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CONTENTS

TABLES

1. INTRODUCTION

This standard sets out the minimum capacity requirements for essential power supplies that are required for equipment that is essential to the reliable operation of a power station. The standard is applicable to existing and planned equipment installed in Eskom.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 NORMATIVE/INFORMATIVE REFERENCES

2.2.1 Normative

[1] 240-56356401, Eskom Generation Protection Philosophy for Large Fossil Fuel Power Stations with Generator Circuit Breakers.

[2] 240-56176729, Eskom Generation Protection Philosophy for Large Fossil Fuel Power Stations without Generator Circuit Breakers.

[3] 240-56227426, Generation MV and LV Philosophy for Eskom Power Stations.

[4] 240-56356510, Definitions of Terms Applicable to DC Emergency Supplies Standard

[5] 240-53114248, Specification for Thyristor and switch mode chargers, AC/DC to DC/AC converters and inverter/uninterruptible power supplies

[6] 240-56360086, Specification for vented Nickel-Cadmium cells and batteries.

[7] 240-56360034, Specification for vented lead acid cells.

[8] 240-56361454, Undervoltage Protection Standard

[9] 240-56227516, Specification for switchboards and associated equipment for voltages up to and including AC 1000 V and DC 1200 V

[10] 240-56227589, List of Approved Electronic Devices to be used on Eskom Power Stations.

[11] 240-56177186, Acceptance and Commissioning of DC supply equipment

[12] 240-56535959, Management of Emergency AC and DC Supplies at Power Stations Standard

[13] SANS 10108, The Classification of Hazardous Locations and the Selection of Apparatus for use in such locations

[14] SANS 10119, Reduction of Explosion Hazards Presented by Electrical Equipment – Segregation. Ventilation and Pressurization

[15] IEC 61439-1, Low-voltage switchgear and controlgear assemblies –Part 1: General rules

[16] IEC 61439-2, Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies

2.2.2 Informative

None

2.3 DEFINITIONS

Definition	Description
Emergency Stand-By Equipment	Diesel generators,AC or DC, switchgear, batteries, chargers, inverters, converters and UPSs.
Emergency Stand-By Supplies	AC orDC. uninterruptible and interruptible supplies for strategic purposes.
Emergency Stand-By Systems	The various components of an emergency stand-by supply system including all auxiliary equipment.
Essential Power Supplies	Essential power supplies for equipment, the reliable operation of which, is an essential component of power station performance.
Power Station Generation System	The generators, generator transformers, unit transformers, station transformers and associated MV and LV boards, transformers, cables and motors. Diesel generators, batteries and chargers provide stand-by power to essential supplies. Generation is responsible for all equipment up to and including the generator transformer. Generation has control of the EHV circuit-breaker in the HV yard although this is a Transmission asset.
Reliability	The probability of a component or system still working after a given period of time, given certain operating conditions.
Telecommunication System	Includes the radio, PABX, cable, fibre optic systems and radio supervisory equipment
Restoration	Restoration is the process, following a disruption, whereby actions are executed to re-establish operation, production or service delivery to the extent and quality that would be required under normal conditions or to satisfy present demand or to the degree prevalent prior to the disruption.

2.4 DISCLOSURE CLASSIFICATION

Controlled Disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.5 ABBREVIATIONS

Abbreviation	Description
AC	Alternating Current
AGC	Automatic Generation Control System
C&I	Control & Instrumentation
DC	Direct Current
DCS	Distributed Control System
EMDAS	Electrical Metering Data Acquisition System
EMF	Electromotive Force
IED	Intelligent Electronic Device
HMI	Human Machine Interface
LCO	Local Control Officer

Abbreviation	Description
LV	Low Voltage
MUT	Multiple Unit Trip
MV	Medium Voltage
UHF	Ultra High Frequency
UPS	Uninterruptible Power Supply

2.6 ROLES AND RESPONSIBILITIES

a. It is the responsibility of the Power Station and the Centre of Excellence to ensure that this standard philosophy is adhered to, or that the power station migrate towards this standard philosophy whenever opportunities present themselves.

b. The Electrical Engineering Manager shall be responsible for ensuring that all work is carried out in support of this standard in accordance with *240-56535959, Management of Emergency AC & DC Supplies at Power Stations* and *240-56177186, Acceptance and Commissioning of DC Supply Equipment for Generation.*

c. The Electrical and C&I Centre of Excellence Manager is responsible for ensuring that the objectives of this standard philosophy is adhered to.

2.7 PROCESS FOR MONITORING

None

2.8 RELATED/SUPPORTING DOCUMENTS

None

3. CAPACITY OF ESSENTIAL POWER SUPPLIES FOR POWER STATIONS STANDARD

3.1 REQUIREMENTS

3.1.1 Reliability

AC and DC essential power supplies shall be designed to be available and reliable to meet the required:

- standby period (autonomy)
- ensure uninterruptible power for a specified period when normal AC supply is unavailable
- redundancy
- design base criteria.

Power supply system designs shall provide for secure features such as redundancy in primary plant, supply failure detection, automatic changeover of AC supplies, local and remote indication and alarms to achieve the above mentioned requirements.

The power supply source to emergency application will always be the more reliable option, with the objective to limit the impact of equipment failure on the availability of supply. Therefore, the more reliable source of emergency supply is directly from the battery. Applications to rectify UPS AC output to obtain DC supply should be avoided. In applications where this practice is proven to be the more practicable option redundancy must be provided to mitigate the impact of equipment failure on the availability of supply or ensure uninterrupted supply.

Plant design deviations to the conventional plant design shall only be considered if the reliability and plant risk of the new design is proved to better and of lower risk than the conventional plant design in Eskom.

3.1.2 Design Basis

3.1.2.1 The emergency power supplies shall be designed to:

a. Allow safe shut down of the plant if normal power supplies are interrupted and unavailable.
b. Maintain communication, instrumentation and protection facilities for certain periods following normal power supply interruptions and unavailability.
c. Provide essential emergency lighting, even during plant maintenance interventions.
d. Keep plant in a state of readiness, where practicable, for rapid re-start when the normal supplies are restored.
e. Prevent critical instrumentation from tripping plant in the event of temporary power supply interruptions of the normal power supplies.
f. Enable restoration of the national grid from a power generating plant perspective.
g. Ensure uninterrupted power supply through sufficient redundancy in design for the stated power supply standby period.

3.1.2.2 Essential Interruptible Power Supplies

The power generating plant auxiliaries essential for the safe shutdown of the power generating unit will be supplied with power from a 380V switchboard with back-up power generators. The back-up power must be able to return power within 30seconds after total mains supply interruption and only essential auxiliaries will re-start under these conditions. The back-up power generating set must be able to generate power for the time periods of 24 hours. The control supply of these power generating sets shall meet the maximum running time period specified.

3.1.2.3 Essential Uninterruptible Power Supplies

The essential uninterruptible power supplies are used where equipment cannot withstand any interruption in supply. These supplies are provided by uninterruptible power supply units or battery chargers that are backed-up by batteries. The standby time requirements exist for all facilities under worst case scenario without faults. The battery banks are to be maintained to not have a capacity of less than 80% of the stated value at any time. On-line discharge testing is not allowed where redundant battery banks does not exist.

The battery standby times are listed below for the different plant areas at power generating plants.

Table 1: Guideline for battery stand-by times

Back-up Power Generator Sets	Electrochemical Battery Stand-by Time (hours)	
	Redundant diesel generator support	Single diesel generator support
Unit protection	4	6
OSP auxiliary protection	4(1)	6(1)
Switchgear recharge & tripping	4(1)	6(1)
Generator Protection & Remote Backup Protection	6	12
Generator circuit breaker tripping (if not already open)	6	12
Emergency lighting	1	1
Essential lighting	4	6
Audio telecom equipment (phone, PA, radio, siren, etc.)	12	18
Unit C&I and process information systems	4	6
Common plant process information system	4(3)	6(3)
Common plant C&I	4(2,3)	6(2,3)
Chemical Services C&I	2	4
Station control	6	12
Fire detection	12	18

Note:

(1) For non-critical plant, if an alternative AC supply is provided to the charger dedicated to the mechanical design i.e. Charger A to Conveyor A and alternative supply from AC board B, and the plant cannot operate if AC supply to the specific mechanical train is unavailable the required standby time needs to be 1 hour per charger.
(2) If the outside plant system consists of diesel pumps the process information and control system, standby time needs to meet the designed running times of diesel equipment. The control system and I/O for the diesel systems needs to be separated from the normal systems.
(3) Common plant designed with resource reserves and essential to power generation to continue the standby times for all process information and control shall be 6 and 12 hours respectively.

3.1.3 Emergency Standby Supplies

3.1.3.1 Station Board Protection Supplies

The protection power source must be a 220V DC or 110V DC power supply directly from a battery bank.

The protection supplies for the protection systems must meet the requirements of *240-56227426, Generation MV and LV Philosophy for Eskom Power Stations.*

Each independent power source must provide power supply for the intended load after normal power supply unavailability, at the end of the standby time period a sequence of three times two second pulses of 700%, 600% and 700% maximum load current separated by 3 second intervals superimposed before the battery voltage reaches the minimum useful level.

The supplies from the two distribution boards for the protection system Main 1 and Main 2 may not be duplicated feeds from each of the individual boards coupled through diodes or chop-over systems.

3.1.3.2 Power Generating Unit Protection Supplies

The protection power source must be a 220V DC or 110V DC power supply directly from a battery bank in order to ensure availability of supply and limit the impact of earth faults on the availability of supply to the protection devices.

For new build or plant refurbishments, including return to service projects, the protection supplies must be power generating unit specific, duplicated, independent power sources for the protection system Main 1 and Main 2 each backed-up with a dedicated battery bank. A bus-section on a DC system to common the protection distribution boards for Main 1 and Main 2 must be provided for an abnormal plant condition and status must be indicated to electrical control room.

Each independent power source must provide power supply for the intended load after normal power supply unavailability, at the end of the standby time period a sequence of three times two second pulses of 700%, 600% and 700% maximum load current separated by 3 second intervals superimposed before the battery voltage reaches the minimum level required for protection device operation.

The protection supplies for the protection systems must meet the requirements of *240-56227426, Generation MV and LV Philosophy for Eskom Power Stations and 240-56356401, Eskom Generation Protection Philosophy for Large Fossil Fuel Power Stations with Generator Circuit* Breakers or *240-56176729, Eskom Generation Protection Philosophy for Large Fossil Fuel Power Stations without Generator Circuit Breakers.*

The supplies from the two distribution boards for the protection system Main 1 and Main 2 may not be duplicated feeds from each of the individual boards coupled through diodes or chop-over systems.

The protection supply can be utilised to ensure uninterruptable supply to the switchgear control circuitry as an alternative to dip proof inverting, supported by an under-voltage operating philosophy.

3.1.3.3 Power generating Unit Essential Emergency Supply

A 220V DC power source for each power generating unit specific must be provided for heavy power equipment needed for emergency shut-down. Each power source must provide standby power supply for the specified time period and intended load after normal power supply unavailability. At the end of the emergency period a 20% maximum load two second pulse before the battery voltage reaches the minimum level must be included.

As a back-up a loop connection from the adjacent unit must be provided or alternatively a dual redundant charger and battery set. The loop connection is acceptable if the potential impact is limited to the Grid Code governance.

3.1.3.4 Outside and Common Plant Protection Supplies

A 220V DC or 110V DC power supply directly from a battery bank in order to ensure availability of supply and limit the impact of earth faults on the availability of supply to the protection devices will be supplied for the protection system in each substation. Each power source must provide standby power supply for the specified time period and intended load after normal power supply unavailability.

Independent protection power supplies must be provided to each AC reticulation system in the substation.

The protection supply can be utilised to ensure uninterruptable supply to the switchgear control circuitry as an alternative to dip proof inverting, supported by an under-voltage operating philosophy as per *240-56361454, Undervoltage Protection Standard*. The redundancy needs to support the mechanical plant redundancy.

3.1.3.5 Power Generating Unit Control and Instrumentation Supplies

Dual DC power supplies with the specified standby time at maximum load capacity are used for control and instrumentation equipment and alarm systems for the boiler/turbo generator units and other ancillary plant.

The control and instrumentation supplies must be a 24V DC supply, provided by two, battery and charger combinations, in parallel to provide 100% redundancy with the zero volt point earthed (busbar earthed).

On a 24/48V DC supply application, the construction of the supply will be from two battery and charger combinations in series with the common (zero volt) point earthed (busbar earthed). The 24/48 V DC supply must be duplicated to provide 100% redundancy.

Duplicated feeds from each of the DC distribution boards must be provided to each load and are decoupled at each load by means of diodes. Each circuit on the power generating unit DC distribution board must be monitored for individual circuit healthy. The circuit healthy monitoring must also monitor the overload protection of each individual circuit.

Equipment powered from these supplies must be able to accept voltages from 24V ± 20% or a voltage window that allows the battery to be at least float and boost charge without exceeding the equipment maximum operating voltage or that requires a dropping diode with a maximum volt drop, determined by the difference between open circuit voltage of the battery and the minimum load required voltage.

3.1.3.6 Outside and Common Plant Control and Instrumentation Supplies

Dual DC power supplies with the specified standby time at maximum load capacity are used for control and instrumentation equipment and alarm systems. The control and instrumentation supplies must be a 24V DC supply with the common (zero volt) point earthed (busbar earthed), provided by two, battery and charger combinations, in parallel to provide 100% redundancy.

On a 24/48V DC supply application, the construction of the supply will be from two battery and charger combinations in series with the common (zero volt) point earthed (busbar earthed). The 24/48V DC supply must be duplicated to provide 100% redundancy.

Duplicated feeds from the each of DC distribution boards must be provided to each load and are decoupled at each load by means of diodes. Each circuit on the power generating unit DC distribution board must be monitored for individual circuit healthy. The circuit healthy monitoring must also monitor the overload protection of each individual circuit.

Equipment powered from these supplies must be able to accept voltages from 24V ± 20% or a voltage window that allows the battery to be at least float and boost charge without exceeding the equipment maximum operating voltage or that requires a dropping diode with a maximum volt drop, determined by the difference between open circuit voltage of the battery and the minimum load required voltage.

On applications where the main supply is provided from uninterruptible power supplies the following configurations are accepted:

- DC to DC converters from each of the rectifiers on a dual redundant UPS installation to provide two dual DC supplies that is decoupled at the load via blocking diodes.
- Two DC to DC converters from each of the rectifiers on a dual redundant UPS installation supplying two individual DC distribution boards from where dual supplies is provided to each load decoupled with blocking diodes.
- AC to DC converters from each of the two inverter output busses that is not common. Dual DC power supplies must be provided from two independent battery back-up sources with no common

failure equipment on the supply feeds. The duplicated feeds from each of the AC to DC converters supplying the DC control supply to the control panel must be decoupled by means of diodes.

3.1.3.7 Signal and Supervisory Control System Supplies

A dual DC 50 V supply comprising of two batteries and two chargers for:

- Telecommunication equipment
- Signal conditioning equipment
- Supervisory remote control terminals
- Supervisory automatic generation control system (AGC)
- Telemetering equipment

3.1.3.8 Switching and Communication Control Equipment Supplies

A single battery and charger with a stand-by capacity as specified in section 3.1.2.3. for:

- Switching equipment
- Communications control equipment.

Alternatively the Communications Control Equipment can be fed from the Control and Instrumentation inverter system, provided that the system meets the required standby times as specified.

3.1.3.9 Station control, UHF radio voice channel and voice logging system supplies

A single charger or UPS with a stand-by capacity as specified in section 3.1.2.3. for:

- Station control rooms intercom system
- Station UHF radio equipment
- Station voice-logging system.

3.1.3.10 Uninterruptible Power Supplies (Rectifier, Inverter and Converter Supplies)

Uninterruptible Power Supplies can comprise of individual rectifiers, inverters converters and batteries or as an integrated unit. For applications where UPS are utilised for switchgear rewinds or control supply on switchgear the protection loads, C&I or DCS must be protected from back EMF or noise as a result from these applications by the installation of filters or supplied from an segregated UPS system.

Computers and other specialized equipment shall be powered from suitable battery sources to give uninterrupted supplies at all times. Should the mains supply fail, the no-break system will continue to supply the computer or specialized load for the specified period depending on the requirement of the plant.

The output voltage and frequency shall not deviate from the specified limits during this period.

3.1.3.11 Miscellaneous DC Power Supplies

The stand-by capacity of all other DC, power supplies not detailed above, shall be designed to suit the specific needs of associated plant.

3.1.3.12 Back-up Power Generating Sets

Back-up power generator sets configurations shall be a set per power generating unit as well a set for station common supplies and outside plant.

or

A minimum of 100% full dual redundant system common to power generating units to be available at all times. Gas turbines are acceptable provided total reaction is within 30seconds.

The back-up power generating sets of sufficient capacity to allow for the safe shutdown of all units during an extended mains supply interruption while maintaining all other emergency power requirements within the power station.

The emergency back-up power generating sets shall provide sufficient stand-by capacity to allow for a safe shutdown of plant if normal power supplies are unavailable, beside maintaining all other emergency supplies that are needed during an extended normal power interruption. Adequate fuel shall be provided for each backup power generator set to operate over a continuous 24 h period.

Each back-up power generator set shall be capable of supplying the total connected load and starting the largest connected motor. If batteries are used for starting the diesel engines, they shall be the Nickel Cadmium or lead acid Plantè type, that shall be capable of providing at least three starts of 15 seconds duration, each with a break of 10 seconds in between starts.

3.1.4 Emergency Supply Equipment

3.1.4.1 Batteries

The stand-by capacities for lead acid batteries shall be rated at the 10 h rate of discharge while those for Nickel Cadmium batteries shall be rated at the 5 h rate.

All batteries utilised for energy storage including uninterruptible power supply batteries must be vented flooded cells complying to *240-56360086, Stationary Vented Nickel Cadmium Batteries for Power Stations* and *240-56360034, Stationary Vented Lead Acid Batteries.*

3.1.4.2 Battery Chargers

All battery chargers must be of the constant voltage-current type and complies with the Eskom specification *240-53114248, Specification for Thyristor and switch mode chargers, AC/DC to DC/AC converters and inverter/uninterruptible power supplies* and *IEC 61439-1, Low-voltage switchgear and controlgear assemblies –Part 1: General rules, IEC 61439-2, Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies* and *240-56227516, Specification for switchboards and associated equipment for voltages up to and including AC 1000 V and DC 1200 V.*

3.1.4.3 Uninterruptible Power Supplies

All uninterruptible power supplies must comply with the Eskom specification *240-53114248, Specification for Thyristor and switch mode chargers, AC/DC to DC/AC converters and inverter/uninterruptible power supplies* and *IEC 61439-1, Low-voltage switchgear and controlgear assemblies –Part 1: General rules, IEC 61439-2, Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies* and *240-56227516, Specification for switchboards and associated equipment for voltages up to and including AC 1000 V and DC 1200 V.*

3.1.4.4 Battery Rooms and Battery Cabinets

Battery rooms and battery cabinets shall comply with *240-56177186, Design Guide for Power Station Battery Rooms* and *240-53114234, Specification for Battery Cabinets*.

Battery cabinets can be hosted within substations, switchgear rooms and equipment rooms provided the cabinets are ventilated as per *SANS 10108, The Classification of Hazardous Locations and the Selection of Apparatus for use in such locations* and *SANS 10119, Reduction of Explosion Hazards Presented by Electrical Equipment – Segregation. Ventilation and Pressurization, in order to provide a safe environment.* The ventilation of the substation or room must also be considered, alternatively battery cabinet dedicated ventilation can be provided independent from the substation or room.

3.1.4.5 DC to DC Converters

All DC to DC Converters must comply with *240-53114248, Specification for Thyristor and switch mode chargers, AC/DC to DC/AC converters and inverter/uninterruptible power supplies* and *IEC 61439-1, Low-voltage switchgear and controlgear assemblies –Part 1: General rules, IEC 61439-2, Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies* and *240-56227516, Specification for switchboards and associated equipment for voltages up to and including AC 1000 V and DC 1200 V.*

3.1.4.6 Earth Fault Detection

Earth fault detection shall be applied to all circuits as stipulated in *240-56227426, Generation MV and LV Philosophy for Eskom Power Stations.*

On outside plant power supplies earth fault detection must be supplied as an integral function of the charger but a separate device located on the output of the charger.

On control and instrumentation power supplies the DC board busbar must be monitored for earth faults.

3.1.4.7 Contactors

Contactors shall be applied as stipulated in *240-56227426, Generation MV and LV Philosophy for Eskom Power Stations.*

Only tested and approved contactors may be used on the protection power supply system as listed in *240-56227589, List of Approved Electronic Devices to be used on Eskom Power Stations.*

3.1.4.8 Switchgear and Distribution Boards

All switchgear and distribution boards to comply with the Generation specification *240-56227516, Specification for switchboards and associated equipment for voltages up to and including AC 1000 V and DC 1200 V.*

3.1.4.9 Station Protection Boards

Two single busbar boards must be provided, linked by a manual operated bus section load switch. Feedback from the position to the control system must be provided on the bus section load switch and busbar supply circuit to control system. Voltage and current monitoring must be done on the busbars. On new build and refurbishments these signals must be linked to the control system.

The supplies from the two distribution boards for the protection system Main 1 and Main 2 may not be duplicated feeds from each of the individual boards coupled through diodes.

The station protection boards must be equipped with earth fault monitoring, under- and over voltage monitoring on the busbar.

In order to mitigate the risk and impact of a fire on the DC boards cable entry should be from the bottom with no cable racks located directly above the DC boards.

3.1.4.10 Unit Protection Boards

Two single busbar boards must be provided, linked by a manual operated bus section load switch. Feedback from the position to the control system must be provided on the bus-section load switch and busbar supply circuit to control system. Voltage and current monitoring must be done on the busbars. On new build and refurbishments these signals must be linked to the control system.

The supplies from the two distribution boards for the protection system Main 1 and Main 2 may not be duplicated feeds from each of the individual boards coupled through diodes.

The unit protection boards must be equipped with earth fault monitoring, under- and over voltage monitoring on the busbar.

In order to mitigate the risk and impact of a fire on the DC boards cable entry should be from the bottom with no cable racks located above the DC boards.

3.1.4.11 Power Generating Unit Essential Emergency Supply Board

A single busbar board must be provided. Feedback from the position to the control system must be provided on the busbar supply circuit to control system. Voltage and current monitoring must be done on the busbars. On new build and refurbishments these signals must be linked to the control system.

If a unit to unit manual load switch connections is specified as redundancy supply to the board, signals on the position of these connections must be linked to the control system.

The power generating unit essential emergency supply board must be equipped with earth fault monitoring, under- and over voltage monitoring on the busbar.

3.1.4.12 Outside Plant Protection Boards

A single busbar board must be provided. Feedback from the position to the control system must be provided on the busbar supply circuit to control system. Voltage and current monitoring must be done on the busbars. On new build and refurbishments these signals must be linked to the control system.

The outside plant protection boards must be equipped with earth fault monitoring, under- and over voltage monitoring on the busbar.

3.1.4.13 Unit Control and Instrumentation Boards

Two single busbar boards must be provided. The zero volt bus is earthed. Feedback from the position to the control system must be provided on the busbar supply circuit to control system. Voltage and current monitoring must be done on the busbars. On new build and refurbishments these signals must be linked to the control system.

Duplicated feeds from each of DC distribution boards must be provided to each load and are decoupled at each load by means of diodes. Each circuit on the power generating unit DC distribution board must be monitored for individual circuit healthy. The circuit healthy monitoring must also monitor the overload protection of each individual circuit.

3.1.4.14 Outside and Common Plant Control and Instrumentation Boards

Two single busbar boards must be provided. The zero volt bus is earthed. Feedback from the position to the control system must be provided on the busbar supply circuit to control system. Voltage and current monitoring must be done on the busbars. On new build and refurbishments these signals must be linked to the control system.
Duplicated feeds from each of DC distribution boards must be provided to each load and are decoupled at each load by means of diodes. Each circuit on the power generating unit DC distribution board must be monitored for individual circuit healthy. The circuit healthy monitoring must also monitor the overload protection of each individual circuit.

3.2 DOCUMENTATION

All documentation regarding the design basis on which the capacity calculations have been determined shall

4. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
	Document Approved by TDAC ROD 16 July 2013
L Malaza	Electrical Plant Engineering Manager
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5. REVISIONS

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November 2012	0.1	H.J. van Staden Senior Electrical Consultant	Draft document for Review created from GGS 0837 and 36-725
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6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- None

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- None