Eskom	Standard	Technology

Title: **DC & AUXILIARY SUPPLIES PHILOSOPHY**

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Content

1. Introduction

This document sets out the fundamental principles upon which DC & Auxiliary supply systems shall be planned and designed.

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

To specify the fundamental principles upon which DC and Auxiliary supply systems shall be planned and designed in Eskom. This document shall be adhered to by resources responsible for planning/scoping of project solutions, designing the infrastructure and operating and maintaining such infrastructure.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001 Quality Management Systems.

[2] GCR 9 - National Energy Regulator, The South African Grid Code - The Network Code, Rev. 8.0, July 2010.

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Definition	Description
Auxiliary Supplies	The AC power supply system (primary or secondary) at site including the AC distribution system.
DC System	The power electronic converter (rectifier, DC-DC converter) and the energy storage device (battery, ultracapacitor, etc.) including the DC distribution boards.
Essential loads	AC and DC powered load equipment that are critical for the effective operation of the site and need to be powered for as long as practically possible.
Non-essential loads	Loads that are not critical for the effective operation of the site.
Primary power supply	This is referred to as the normal power supply at site. At a substation this would be the auxiliary transformer or power voltage transformer (VT) whereas at a renewable site it could a wind turbine or solar panels.

Definition	Description
Secondary power supply	This is referred to as the emergency / standby power supply at site. In most cases this will be an energy storage device such as a battery or diesel generator.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
DC	Direct Current
UPS	Uninterruptible Power Supply

2.5 Roles and responsibilities

Stakeholders involved with the design of DC & Auxiliary supply systems shall ensure that the fundamental principles of this document are adhered to.

2.6 Process for monitoring

Compliance with the requirements of this document will be ensured by conducting audits within the different Divisional Design departments.

2.7 Related/supporting documents

Not applicable

3. Requirements

3.1 General

The DC & auxiliary supply system refers to the electrical system/s designed to supply DC and AC power to the different load equipment at site. The voltage level is low voltage (≤ 1000V) and includes both the primary power supply and secondary power supply from an energy storage device.

Each site has load equipment that can be divided into essential and non-essential loads. Essential loads are the most important loads at site and are always powered from a standby power system which is either switched in when required or permanently connected.

3.2 Standby power system philosophy

The standby power system shall provide uninterrupted power to connected load equipment whenever the primary power source is available and for a finite period (standby time) when the primary power source is not available.

3.2.1 Purpose of Standby power system

Standby power systems are required to ensure the following:

3.2.1.1 Allow safe shut down of the plant if primary power supplies are interrupted and unavailable

3.2.1.2 Maintain communication, control, instrumentation and protection facilities for specified periods following normal primary power supply interruptions and unavailability

3.2.1.3 Provide power for essential emergency lighting, even during plant maintenance interventions

3.2.1.4 Keep plant in a state of readiness, where practicable, for rapid re-start when the primary power supplies are restored

3.2.1.5 Prevent unnecessary tripping of plant in the event of temporary primary power supply interruptions

3.2.1.6 Restoration of the national grid from a power generating plant perspective

3.2.1.7 Uninterrupted power supply through sufficient redundancy in design for the stated power supply standby period

3.2.2 Design objectives

The system shall be designed in such a manner to ensure the following:

3.2.2.1 All circuits are effectively protected against overload and short-circuit conditions

3.2.2.2 All protective devices are selected to provide effective discrimination

3.2.2.3 Effective protection against overvoltages due to lightning strikes and switching surges

3.2.2.4 Optimal configuration of different sub-systems to render the expected total system reliability and availability

3.2.2.5 Optimal maintainability to ensure the ability to safely isolate and connect/reconfigure sections of the system for maintenance purposes without affecting the connected load equipment

3.2.2.6 The reliability and availability of the selected system configurations shall be commensurate with the importance of the supported plant / equipment as viewed from a network perspective i.e. the ability to generate and supply electricity. Therefore the selected standby power system configuration shall be dictated by the criticality of the connected load equipment and the impact the loss of power to this equipment may have on the operation of the electricity network or in more general terms the value of the investment being protected

3.2.2.7 That the design base criteria in terms of standby time (autonomy), reliability, availability and maintainability is met

3.2.2.8 Essential loads shall always be powered from both primary and secondary power supplies. Any means necessary shall be exploited to keep essential loads operational for long as practically possible

3.2.2.9 The cables shall be optimally sized to ensure that the voltage drops are within acceptable limits

3.2.2.10 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 series connection of power conversion equipment to obtain the necessary supply voltages shall always be kept to a minimum to render the optimal reliability by limiting the effect of equipment failure to a minimum. Where this is an absolute necessity, the required reliability and availability levels shall be obtained by introducing redundant components / sub-systems.

3.2.3 Load equipment

Load equipment shall as far as possible be powered directly from the DC bus provided that the DC bus output voltage window is within the input voltage window of the connected load equipment. In cases where this requirement is not met, load voltage regulation equipment is necessary which can be a dropping diode circuit or a DC-DC converter.

In cases where AC powered load equipment is connected, an inverter (DC-AC converter) shall be installed to provide the required AC power. In this case the inverter is seen as the DC bus connected load and the DC bus operating voltages must be in line with the input voltage window of the inverter. Uninterruptible Power Supply systems are usually used for this function / purpose.

When running off the secondary power source, as a last resort, it might be necessary for the less-critical essential load equipment to be disconnected in order to conserve power for the most critical loads. This is referred to as load shedding and it is essential that a load shedding schedule be compiled in conjunction with all stakeholders.

3.2.4 Voltage Immunity

The voltage immunity levels of standby power supplies shall ensure availability and normal operation during supply disturbances as stipulated in the National Grid Code GCR 9.

4. Authorization

This document has been seen and accepted by:

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5. Revisions

Date	Rev	Compiler	Remarks
Jan 2016	1	T Jacobs	Original document.

6. Development team

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

- Thomas Jacobs – Power Delivery Engineering
- Manie van Staden – Production Engineering Integration Coal

7. Acknowledgements

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