Electricity Distribution

nationalgrid

Company Directive

POLICY DOCUMENT : SD5/8

Relating to LV System Design

Policy Summary

This document describes the standard requirements for the design of the Low Voltage (LV) system.

Reference is also made to National Engineering Recommendations P2, P28, P29, G5, G59, G99, G74, G83, G98 and to National Grid Electricity Distribution Engineering Directives POL: SD1 and POL: TP5 (as amended).

Author: **Seth Treasure**

Implementation Date: **April 2023**

Approved by

Carl Ketley-Lowe
Engineering Policy Manager

Date: **17th April 2023**

Target Staff Group	**Planners responsible for low voltage design**
Impact of Change	**Green – Minor amendments**
Planned Assurance checks	**None**

IMPLEMENTATION PLAN

Introduction

POL: SD5 specifies the high level requirements for low voltage system design.

Main Changes

Revised maximum impedance statement for main route conductors.

Impact of Changes

Minor – Statement aligns with existing design processes.

Implementation Requirements

None.

Implementation Timescale

Document implemented on issue.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
April 2023	• Clause 2.2, impedance target is now applicable to type of circuit opposed to type of transformer. • Clause 2.4 amended for balance between utilisation and system losses	Seth Treasure
March 2023	• Document rebranded.	Seth Treasure
December 2019	• Page 4, Section 2.1 - ST: AM5C removed and replaced with POL: AM5.	Andy Hood
June 2019	• Maximum impedance of main route conductors added to facilitate the connection of Low Carbon Technologies.	Seth Treasure
September 2018	• References to ENA EREC G98 and ENA EREC G99 have been added to Section 2.3 and Appendix B.	Andy Hood
March 2017	• G59 reference has been updated.	Andy Hood
Sept 2014	The following page amendments have been made: • Links to the Distribution Code and to ENA Engineering Recommendations updated • ENA Engineering Recommendation version / issue numbers removed and replaced with the term “as amended”.	Andy Hood

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1.0 INTRODUCTION

This document describes the standard requirements for the design of the LV system and details the security, supply quality, safety, asset utilisation and capital investment requirements. They shall not be varied without reference to the Engineering Policy Manager.

The practical details of the application of this policy are contained in a range of ST documents with a reference beginning ST: SD5.

2.0 POLICY

The design of the LV system shall satisfy the requirements of the Distribution Code of Licensed Distribution Network Operators of Great Britain, as amended.

2.1 System Security

LV Systems shall be designed to provide a standard level of security not less than that set out in ENA EREC P2, as amended.

Improvements to system reliability will be considered in accordance with POL: AM5 and POL: FI 06/04/01.

2.2 Supply Quality

LV systems will be designed:

- to ensure that voltage levels at customers terminals comply with the limits defined in the Electricity Safety, Quality and Continuity Regulations 2002.

  In order to achieve this requirement the voltage drop across the distribution transformer and low voltage network should not exceed 8% of nominal voltage and the voltage rise should not exceed 1.5% of nominal voltage.

  Guidance on HV regulation, including the requirements for distribution transformers is included in POL:SD4, as amended.

- to facilitate the installation of Low Carbon Technologies with a rating $\leq$ 32A per phase (up to the thermal capacity of the circuit).

  In order to achieve this requirement the maximum phase to neutral loop impedance at the remote end of the LV main route conductor shall be;

  - 0.245 ohms for circuits that include any overhead conductors
  - 0.144 ohms for circuits that entirely consist of underground cables

- to ensure that new connections comply with the voltage unbalance limits contained in ENA EREC P29, as amended.

- to ensure that new connections comply with the voltage fluctuation requirements of ENA EREC P28, as amended.

- to ensure that new connections comply with the limits for harmonics in the UK contained in ENA EREC G5, as amended.

2.3 **Safety**

LV systems will be designed:

- to be protected in accordance with POL: TP5
- to comply with ENA EREC G83, ENA EREC G98, ENA EREC G59 and ENA EREC G99, as applicable
- to take account of the fault level calculation methodology as detailed in ENA EREC G74, as amended
- to operate within equipment design ratings including any appropriate cyclic or short term rating as defined in the appropriate Engineering Instructions and Directives.

2.4 **Asset Utilisation and Capital Investment**

LV systems will be designed:

- using equipment approved by the Engineering Policy Manager.
- using equipment within its nominal capacity.
- with a balance of asset utilisation versus network losses and the consideration of the system security, supply quality and safety criteria.
- for the lowest lifetime cost in accordance with POL: AM5 and POL: FI 06/04/01.

3.0 BACKGROUND INFORMATION

The requirements of this policy have evolved over a period of time and represent tried and tested principles.

Engineering Directive POL: SD1 contains further information on the fundamental aims of system design.

APPENDIX A

SUPERSEDED DOCUMENTATION

This document supersedes POL: SD5/7 dated March 2023 which has now been withdrawn.

APPENDIX B

RECORD OF COMMENT DURING CONSULTATION

No comments received.

APPENDIX C

ANCILLARY DOCUMENTATION

ENA EREC P2, Security of Supply

ENA EREC P29, Planning limits for voltage unbalance in the United Kingdom.

ENA EREC P28, Planning limits for voltage fluctuations caused by Industrial, Commercial and Domestic equipment in the United Kingdom.

ENA EREC G5, Planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission systems and distribution networks in the United Kingdom.

ENA EREC G59, Recommendations for the connection of generating plant to the distribution systems of Licensed Distribution Network Operators.

ENA EREC G99, Recommendations for the connection of generating equipment in parallel with public distribution networks on or after 27th April 2019.

ENA EREC G74, Procedure to meet the requirements of IEC 909 for the calculation of short-circuit currents in three-phase AC power systems.

ENA EREC G83, Recommendations for the connection of type tested small scale embedded generators (up to 16A per phase) in parallel with low-voltage distribution networks.

ENA EREC G98, Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019.

POL: AM5, Technical Appraisal, Approval and Post Investment Appraisal for Network Relating Capital projects.

POL: FI 06/04/01, Capital expenditure and project management - Investment appraisal, financial recommendation, and approval of capital sanctions.

APPENDIX D

KEY WORDS

LV, system, design, security, quantity, imbalance, fluctuation, harmonics, utilisation, regulation.