IEC TR 63282

Edition 1.0 2020-11

TECHNICAL REPORT

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LVDC systems – Assessment of standard voltages and power quality requirements

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.020

ISBN 978-2-8322-9078-1

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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IEC TR 63282, which is a Technical Report, has been prepared by IEC technical committee 8: System aspects of electrical energy supply.

The text of this Technical Report is based on the following documents:

Draft TR	Report on voting
8/1549/DTR	8/1556/RVDTR

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

LVDC (Low voltage direct current) distribution systems have recently been recognized by a number of stakeholders as an alternative approach to provide efficient power supply to the consumers. LVDC covers a wide range of power applications from USB-C up to megawatts for aluminium melting. LVDC is now seen not only as a solution for electricity access in developing economies but also as a solution for greener and more sustainable energy in developed economies.

In industrial applications, LVDC is utilized where processing of resources results in the production, distribution and storage of physical goods, especially in a factory or special area of a factory.

The standardization of DC voltages is a key issue, and urgent work is needed. Existing LVAC systems have different standard voltages, depending on the geography and application. LVDC distribution voltages should be optimized to provide a good context for industries that import and export equipment but also for general travellers. Appropriate international LVDC voltage ranges will provide a basis for design and testing of electrical equipment and systems and ease of transition for equipment from AC to DC supply.

LVDC voltages should meet the range of use cases where LVDC systems can make a difference. The list of standard voltages should be as short as possible and allow for cost-effective and safe operation.

The power quality phenomena for the distribution of DC power are not identical to AC phenomena while there are some common issues. Power quality considerations are well studied and standardized on AC power systems, but many power quality phenomena and EMC have not yet been fully evaluated for DC distribution systems.

Power electronic converters/inverters add further demands. Power quality phenomena in LVDC distributed systems can be related to the topology of the entire system, and the operating condition of sources and loads. At the same time, the DC output performance of a single converter and the coordination among several converters can also result in different power quality issues and grid stability.

Requirements for power quality and EMC in LVDC distribution should be established in order to provide a solid basis for the planning and operation of LVDC distribution systems. In addition, the design and configuration of the protection system is to be addressed with the objective to enhance the availability of the source, the reliability, and the lifetime of the system.

Generally, the standardization of voltage level and PQ phenomena of LVDC distribution should greatly stimulate the wide adoption of LVDC.

Besides the main contents concerning voltage level and power quality, the following topics are also presented:

Clause 4 discusses architectures and topologies for LVDC networks.

Clause 7 recommends permissible limits for voltage bands and PQ phenomena.

LVDC SYSTEMS – ASSESSMENT OF STANDARD VOLTAGES AND POWER QUALITY REQUIREMENTS

1 Scope

The purpose of this document is to collect information and report experience in order to make recommendations for the standardization of voltage levels and related aspects (power quality, EMC, measurement …) for LVDC systems (systems with voltage level lower than 1 500 V d.c.).

Rationale for the proposed voltage values are given. Variation of parameters for the voltage (power quality) and recommendation for their boundaries are defined. Nevertheless, some of the technical items are not exhaustively explained in this document and some gaps are identified for future work.

Attention is paid to the definition of DC voltage.

Systems in which a unipolar voltage is interrupted periodically for certain purposes, e.g. pulse voltage, are not considered.

Traction systems are excluded from this document.

2 Normative references

There are no normative references in this document.