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Low-voltage direct current (LVDC) industry applications

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Low-voltage direct current (LVDC) industry applications

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The text of this Systems Reference Deliverable is based on the following documents:

Draft	Report on voting
SyCLVDC/174/DTS	SyCLVDC/182/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Systems Reference Deliverable is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

The electrical distribution in industrial applications has a high number of motor drives and machinery with high peak power demand. More and more production sites integrate photovoltaic (PV) systems and battery storage systems. They reduce the peaks of infeed power which drive the price of electrical energy up. Furthermore, energy storage can be used to increase the availability of electrical energy supply and thus the security of supply within the system. Moving to DC distribution can help to overcome those challenges and is expected to provide new opportunities to increase efficiency. This can be achieved in low-voltage DC (LVDC) because there are lower conversion losses and a cost-effective bidirectional integration of motor drives and batteries is possible. LVDC is already used in many applications in industry, but not all parts are compatible with a LVDC system since they do not have standardized interfaces.

This document harmonizes the system aspects of LVDC distribution systems in the application of industrial production. This document will enable factories to implement an open, vendor-independent industrial LVDC system with renewable sources, electrical energy storage systems, bidirectional motor drives and other applications. It also defines necessary boundaries and interfaces for connected devices or subsystems. As a Systems Reference Deliverable, it is intended to harmonize between the different product standards of all involved technical committees.

LVDC supports the following Sustainable Development Goals of the United Nations [1][1]:

– Goal 7: "Ensure access to affordable, reliable, sustainable and modern energy for all"

  DC grids enable industry to easily integrate solar energy and renewable energy into their production lines and makes the system more and more affordable. The DC nature of electrical energy storage systems such as batteries and capacitors simplifies the integration and increases the reliability of the factory grids.

– Goal 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"

– Goal 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"

  Storage devices like batteries or capacitors help to bridge power outages. This makes production more robust and reduces waste from defective parts because of power failure.

– Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable"

– Goal 12: "Ensure sustainable consumption and production patterns"

  DC systems need fewer resources; less copper, housing materials, electronic equipment, etc. Battery storage also reduces the in-feed power of the production line. This leads to lower investment for transformers and energy distribution within the factory, as well as reduced peak-power electricity rates. In AC the braking energy is dissipated in braking resistors while DC enables the reuse of otherwise wasted energy by other devices.

– Goal 17: "Partnership for the Goals".

This document follows the IEC systems approach from the domain to the gap analysis and gives guidance by describing reference implementation.

[1] Numbers in square brackets refer to the Bibliography.

1 Scope

This document describes certain aspects of standardization of LVDC industrial applications.

These industrial applications apply to the secondary economic sector where the processing of resources applies to the production, distribution and storage of physical goods, typically in a factory or similar areas.

The local LVDC distribution can be connected to the public grid (AC or DC) or can work completely off-grid (intentional islanding).

This document provides a practical guideline for the design and planning of industrial LVDC systems, aiming at interoperability amongst different devices.

IEC use case descriptions of the described industry application are part of this document.

NOTE This document is not intended for following applications: railway, ships, vehicles, aircraft, public distribution. But wherever possible and practicable, compatibility of product requirements is considered favourable.

Included is equipment which is especially designed for and intended for use in industrial areas. This includes everything that is concerned with with the commercial extraction, processing and further processing of raw materials or intermediate products into material goods; in particular, machines, plants, storage facilities and transport systems.

Not included is equipment which is especially designed for and intended for use in ordinary buildings:

– supporting building equipment (e.g. lighting and HVAC) in buildings or parts of buildings in which machines, plants, storage equipment and transport systems are installed;
– building equipment in buildings or parts of buildings in which supporting and administrative production functions are performed (e.g. offices).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60364-4-41, *Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock*

IEC 60364-4-43, *Low-voltage electrical installations - Part 4-43: Protection for safety - Protection against overcurrent*