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High-voltage switchgear and controlgear -
Part 322: The use of digital technologies

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High-voltage switchgear and controlgear - Part 322: The use of digital technologies

FOREWORD

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IEC TR 62271-322 has been prepared by IEC technical committee 17: High-voltage switchgear and controlgear. It is a Technical Report.

This first edition cancels and replaces the first edition of IEC TR 62063 published in 1999. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) IEC numbering has been modified;
b) title has been modified;
c) updates in the field of digital technologies, like Internet of Things, cloud and edge computing, digital twins, artificial intelligence and cybersecurity have been added; in accordance with the IEC strategy themes and goals;

d) synchronization and updates in the context of the latest standards of TC 17: IEC 62271-1 and IEC 62271-3;

e) Bibliography has been added.

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

Draft	Report on voting
17/1190/DTR	17/1197/RVDTR

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 Technical Report 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.

A list of all parts in the IEC 62271 series, published under the general title *High-voltage switchgear and controlgear*, can be found on the IEC website.

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

– reconfirmed,

– withdrawn, or

– revised.

1 Scope

Digital technologies, intelligently combined with switchgear and controlgear in electrical grids, can be enablers of reliable, sustainable, and affordable energy systems and an all-electric society. This document gives guidance for network operators, manufacturers and all parties driving the energy and electrical grid transition through the application of digital technologies. Relevant references and definitions of state-of-the-art digital technologies, like the Internet of Things (IOT), Industrial Internet of Things (IIOT), cloud and edge computing, digital twins, artificial intelligence, and cybersecurity are listed. Trends and examples in the use of network operation, service and asset management are described and examples of transition roadmaps of network operators given. Trends and the integration of adequate state-of-the-art digital technologies and application examples are described. Finally, guidance based on experiences for the identification, specification, qualification, and integration of digital technologies is given.

High-voltage switchgear and controlgear can be considered in terms of its two sub-parts:

– switching devices and equipment, i.e. the high-voltage part of the switchgear and controlgear, dedicated to high-voltage functions, e.g. current flow, insulation and switching;
– associated control and auxiliary devices and equipment, i.e. the low voltage part of the switchgear and controlgear, dedicated to the control, measuring, protective, regulating, and monitoring functions of the switching devices and equipment.

The boundary of switchgear and controlgear is then easily identified as being generally the cable connections for the switching devices and equipment and the terminal block for the auxiliary equipment.

Introducing electronic and digital technologies results in significant changes on several points:

– The location of the auxiliary equipment is not necessarily confined to the related switchgear and controlgear, but can be distributed at any location, at the local control cubicle of the switchgear and controlgear or the control room of the substation or directly at the switchgear and controlgear device with local intelligence (edge computing technology) or physically disconnected of the substation (cloud computing technology).
– Different components of the auxiliary equipment might be supplied by different manufacturers and integrated into the switchgear and controlgear independently of the manufacturer of the switchgear and controlgear equipment.
– Electronic and digital technologies using distributed architectures, microprocessor-based components, and digital communications induce new concepts in dependability. That results in modifications of maintenance policies, and asset management as well as user operation of the switchgear and controlgear.

This document describes trends and the state-of-the-art of digital technologies enabling their use in switchgear and controlgear along their life cycle. The report is a guidance for the IEC TC17 and supported by use cases or by emerging technologies, able to be implemented in power grids. The report can be used by designers, asset managers and any stakeholder dealing with interoperable and digital technologies for a switchgear and controlgear over their whole life cycle. The document consists of three main parts.

Clause 4 describes the trends in user exploitation of digital technologies within the switchgear and controlgear. Clause 5 focuses on trends regarding technology and consequences for system architectures. Clause 6 gives guidance for use of new technologies in substations.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Terms and definitions related to switchgear and controlgear

3.1.1
switchgear and controlgear
general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures

[SOURCE: IEC 60050-441:1984 [82], 441-11-01]

3.1.2
equipment
single apparatus or set of devices or apparatuses, or the set of main devices of an installation, or all devices necessary to perform a specific task

Note 1 to entry: Examples of equipment are a power transformer, the equipment of a substation, measuring equipment

[SOURCE: IEC 60050-151:2001 [83], 151-11-25]

3.1.3
device
material element or assembly of such elements intended to perform a required function

Note 1 to entry: A device may form part of a larger device

[SOURCE: IEC 60050-151:2001, [83] 151-11-20]

3.1.4
(signal) transducer
device for transforming a physical quantity representing information into a physical quantity of different kind representing the same information, one of the two quantities being electric

[SOURCE: IEC 60050-151:2001 [83], 151-13-37]

3.1.5
sensor
measuring element
part of a measuring instrument, or measuring chain, which is directly affected by the measurand and which generates a signal related to the value of the measurand

[SOURCE: IEC 60050-311:2001 [84], 311-05-01]