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High-voltage switchgear and controlgear – Part 320: Environmental aspects and life cycle assessment rules for high-voltage switchgear and controlgear

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CONTENTS

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IEC TS 62271-320 has been prepared by IEC technical committee 17: High-voltage switchgear and controlgear. It is a Technical Specification.

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

Draft	Report on voting
17/1161/DTS	17/1169/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 Technical Specification 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- withdrawn, or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.

INTRODUCTION

Increasingly there is a focus on preserving the natural environment for the good of future generations. For this to be achieved, efficient use of energy and materials throughout the life cycle of every product when used in a system and process to conserve the world's finite natural resources is essential. In addition, it is essential that the release of substances and materials that might be harmful for the environment or induce climatic changes be avoided or minimized. From concept to end-of-life of a product, the environmental impact of all the relevant processes should be considered, including the circularities of materials for their future life such as how materials are disposed of or recovered.

In order to contribute to conserving natural resources, manufacturers of high-voltage switchgear and controlgear and their assemblies should ensure an environmentally conscious design (ECD) involving:

a) phasing-out or minimizing the use of hazardous substances or materials;

b) efficient use of energy and materials in the manufacture of products;

c) ensuring the lowest practical energy consumption by the products while they are in use;

d) ensuring a dependability performance consideration in relation to the reference service life and associated conditions;

e) at the end-of-product life, as far as practical, the design should enable recovery of materials for future use and sorting hazardous components requiring a specific treatment.

As this approach considers the use of high-voltage switchgear and controlgear in systems, this document contributes to conserving natural resources by users.

Declarations and ECD are increasingly required. This document recommends type III environmental declarations in accordance with ISO 14025 and material declarations (MD) in accordance with IEC 62474. In some businesses, green public procurement (GPP) is applicable and/or ECD is part of the ISO 14001 certification. Some countries and regions are also actively pushing for environmental conservation, for example, the European Union through its Ecodesign for Sustainable product regulations (ESPR, Regulation EU 2024/1781) and China through Ecodesign and life cycle assessment initiatives. Systematic demands for ECD will be required by most, if not all customers, in the medium term.

Assessing the environmental impact of high-voltage switchgear and controlgear and their assemblies is part of an ECD process. ECD requires the identification, measurement and reporting of particular impacts. IEC 62430 describes the basic principles of ECD, with the goal of reducing the potential environmental impacts of products.

Stakeholders met along the life cycle of the switchgear and controlgear (suppliers, manufacturers, carriers, contractors, users, recyclers) are continuing their efforts to reduce their environmental footprint and to assess it as targeted by this document. A simplified means of estimating the environmental impacts is essential together with readily available data to make the stakeholder's, i.e., manufacturer's, contractor's, installer's, end user's and recycler's, task of assessing environmental impacts at system level easier.

Product specific rules (PSR) for assessing the environmental impacts and providing appropriate data for high-voltage switchgear and controlgear and their assemblies are among the purposes of this document. These rules establish a common evaluation scheme of their environmental impacts in terms of characterized impact indicators (e.g. carbon dioxide equivalents, ozone depletion, etc.) over their whole life cycle.

The informative references are mentioned in bibliography. They are referred to in the text in such a way that some or all of their content constitutes the most useful references for this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 320: Environmental aspects and life cycle assessment rules for high-voltage switchgear and controlgear

1 Scope

This part of IEC 62271 provides guidance to suppliers, manufacturers, users, and waste operators of high-voltage switchgear and controlgear as well as their assemblies having a rated voltage above 1 kV AC and 1,5 kV DC, together with their associated auxiliary equipment, on environmentally conscious design, and on assessing environmental impacts when used in systems. This document also gives guidance on effective communication of environmental information throughout the entire life cycle.

This document provides guidance on the process and general aspects to select UN sustainable development goals (UN sustainable development goals (SDG)), especially those dealing with health and environmental impacts and their assessments, represented respectively by:

- SDG 3-Good Health and Well-being;
- SDG 6-Clean Water and Sanitation;
- SDG 7-Affordable and Clean Energy;
- SDG 12-Responsible Consumption and Production;
- SDG 13-Climate Action;
- SDG 14-Life Below Water;
- SDG 15-Life on Land.

This document gives guidance on the process and general aspects to implement environmentally conscious product design (ECD) principles, as given in IEC 62430, essential for high-voltage electrical power equipment and power control equipment.

This document gives guidance on executing the life cycle assessment (LCA) based on product category rules (PCR) in accordance with IEC 63366, ISO 14040 and ISO 14044 and on applying the Type III environmental declaration in accordance with ISO 14025, both for high-voltage switchgear and controlgear. This guidance provides standardized product specific rules (PSR) summarized as follows:

1) Common rules for the LCA process describing functional units, system boundaries, life cycle inventory analysis, scenarios, environmental impact categories;
2) Common rules for communicating information about the presence of regulated substances and the materials contained in the product, according to IEC 62474;
3) Common rules for communicating information about the end-of-life treatment of the product including material efficiency.

This document does not address the environmental declaration programme, however it can be used by program operators.

This document focuses on describing the LCA process referring to the functional unit, system boundary, scenarios, etc.

Owing to variability of influencing factors, such as flows, allocations, not balanced and time-stable energy mix under different programmes, equipment customization, durability related to environmental conditions, it is not possible to compare two similar high-voltage switchgear and controlgear analysed in different contexts.

This document does not address by-products from arcing which are generated in sufficiently small quantities such that their environmental impact can be neglected. Any by-product generated by arcing during the use of equipment is strongly dependent on operating conditions and cannot a priori be qualified nor quantified. However, they are not expected to be released in air and will be managed at end-of-life by a dedicated process.

EXAMPLE

During the use of high-voltage switchgear and controlgear the handlings of normally arced gas are covered by IEC 62271-4. When the volume of gaseous by-product is below 1 % of normally arced gas, it is not considered compared to the cut-off rules specified in this document. The scenarios related to the system boundary do not take into account leakages from failures except if an agreement is reached on this between user and manufacturer (see Table 7, item h).

Power transformers, low-voltage switchgear and controlgear, and the interconnections with such equipment are not covered by this document. Therefore, assemblies according to IEC 62271-202 or IEC 62271-212 comprising any of the above equipment are not within the scope of this document.

This document supports material efficiency for circular economy. However, one of the major issues related to remanufacturing is the consideration of used parts and product(s) while regulatory requirements are applicable to new product. For high voltage switchgear and controlgear and for this document remanufacturing is not considered avoiding any misalignment for life cycle assessment.

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 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

IEC 62271-4:2022, *High-voltage switchgear and controlgear – Part 4: Handling procedures for gases for insulation and/or switching*