

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Short-circuit temperature limits of electric cables with rated voltages above
30 kV ($U_m = 36$ kV)**

**Limites de température de court-circuit des câbles électriques de tension
assignée supérieure à 30 kV ($U_m = 36$ kV)**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SHORT-CIRCUIT TEMPERATURE LIMITS OF ELECTRIC CABLES
WITH RATED VOLTAGES ABOVE 30 kV ($U_m = 36$ kV)**

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International Standard IEC 61443 has been prepared by subcommittee 20A: High-voltage cables, of IEC technical committee 20: Electric cables.

This consolidated version of IEC 61443 consists of the first edition (1999) [documents 20A/409/FDIS and 20A/411/RVD] and its amendment 1 (2008) [documents 20/953/FDIS and 20/976/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 1.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

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- withdrawn,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

INTRODUCTION

The following four aspects may be applicable when selecting the short-circuit rating of a cable system.

- a) The permissible maximum temperature limits for cable components (e.g. conductor, insulation, screen or metallic sheath, bedding, armour and oversheath). For the range of voltages covered by this standard, dielectric integrity is the major limitation. For practical uses, the energy producing the temperature rise is usually expressed by an equivalent (I^2t) value so that the permitted maximum duration for a given short-circuit current can be calculated.
- b) The maximum value of current which will not cause mechanical failure (such as bursting) due to electromagnetic forces. Irrespective of any temperature limitations, this determines a maximum current which should not be exceeded.
- c) The thermal performance of joints and terminations at the limits of current and duration specified for the associated cable. Accessories should also withstand the thermo-mechanical and electromagnetic forces produced by the short-circuit current in the cable.
- d) The influence of installation conditions on the above three aspects.

Aspect a) is dealt with in detail, and the limits given are based on a consideration of the cable only. A single short-circuit application is not expected to produce any significant damage to the cable, but repeated short-circuits may cause cumulative damage. Guidance is given, where appropriate, on aspects c) and d) mainly as they concern thermo-mechanical forces in the conductors and metallic sheath. Aspect b) is not covered in this standard.

The limits recommended in this standard should be used for guidance only. There is little scientific evidence available on the behaviour of actual cables under short-circuit conditions, most of the information being based on tests on the constituent materials themselves. It has been necessary to exercise considerable judgement in setting these recommended limits, and, in general, especially for the dielectric, the best average of present usage has been suggested.

It is not possible to provide complete limits for joints and terminations because their construction is not standardized and performance varies. Where the full short-circuit capability of the cable is needed, the accessories should be designed appropriately, but this is not always economically justified and the short-circuit capability of a cable system may be determined by the performance of its joints and terminations. Where possible, guidance has been included on the performance of accessories when they are installed on cables subject to the short-circuit limits given in this standard.

SHORT-CIRCUIT TEMPERATURE LIMITS OF ELECTRIC CABLES WITH RATED VOLTAGES ABOVE 30 kV ($U_m = 36$ kV)

1 Scope

This International Standard gives guidance on the short-circuit maximum temperature limits of electric cables having rated voltages above 30 kV ($U_m = 36$ kV) up to the voltage limits given in IEC 60141 and IEC 62067, with regard to the following:

- insulating materials;
- oversheath and bedding materials;
- conductor and metallic sheath materials and methods of connection.

The design of accessories and the influence of the installation conditions on the temperature limits are taken into consideration.

The calculation of the permissible short-circuit current in the current-carrying components of the cable should be carried out in accordance with IEC 60949.

2 Normative references

The following referenced documents are indispensable for the application 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 60141 (all parts), *Tests on oil-filled and gas-pressure cables and their accessories*

IEC 60840:1999, *Power cables with extruded insulation and their accessories for rated voltages above 30 kV ($U_m = 36$ kV) up to 150 kV ($U_m = 170$ kV) – Test methods and requirements*

IEC 60949:1988, *Calculation of thermally permissible short-circuit currents, taking into account the non-adiabatic heating effects*

IEC 62067, *Power cables with extruded insulation and their accessories for rated voltages above 150 kV ($U_m = 170$ kV) up to 500 kV ($U_m = 550$ kV) – Test methods and requirements*

3 Factors governing the application of the temperature limits

3.1 General

The short-circuit temperatures given in clause 4 are the actual temperatures of the current-carrying component as limited by the adjacent material in the cable and are valid for short-circuit durations of up to 5 s. When calculating the allowable short-circuit current, these temperatures will be obtained if heat loss into the insulation during the short circuit is taken into account (non-adiabatic heating). If heat loss during the short-circuit is neglected (adiabatic heating), the calculations give short-circuit currents that are on the safe side.

NOTE The temperature limits given in clause 4 should also not be exceeded with repeated short-circuits occurring in a short time.