



SLOVENSKI STANDARD

SIST HD 528 S2:1999

01-julij-1999

A method of temperature-rise assessment by extrapolation for partially type-tested assemblies (PTTA) of low-voltage switchgear and controlgear (IEC 60890:1987+corrigendum Mar.1988+A1:1995)

A method of temperature-rise assessment by extrapolation for partially type-tested assemblies (PTTA) of low-voltage switchgear and controlgear

Verfahren zur Ermittlung der Erwärmung von partiell typgeprüften Niederspannung-Schaltgerätekombinationen (PTSK) durch Extrapolation

Méthode de détermination par extrapolation des échauffements pour les ensembles d'appareillage à basse tension dérivés de séries (EDS)

Ta slovenski standard je istoveten z: HD 528 S2:1997

ICS:

29.130.20	Niskonapetostne stikalne in krmilne naprave	Low voltage switchgear and controlgear
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en

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HARMONIZATION DOCUMENT
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HD 528 S2

January 1997

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Descriptors: Method, extrapolation, temperature rise, partially type-tested assemblies (PTTA) of low-voltage switchgear and controlgear

English version

**A method of temperature-rise assessment by extrapolation
for partially type-tested assemblies (PTTA) of low-voltage
switchgear and controlgear
(IEC 890:1987 + corrigendum 1988 + A1:1995)**

Méthode de détermination par
extrapolation des échauffements pour
les ensembles d'appareillage à basse
tension dérivés de séries (EDS)
(CEI 890:1987 + corrigendum 1988 +
A1:1995)

Verfahren zur Ermittlung der Erwärmung
von partiell typgeprüften
Niederspannung-Schaltgeräte-
kombinationen (PTSK) durch
Extrapolation
(IEC 890:1987 + Corrigendum 1988 +
A1:1995)

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This Harmonization Document was approved by CENELEC on 1996-12-09. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

Up-to-date lists and bibliographical references concerning such national implementation may be obtained on application to the Central Secretariat or to any CENELEC member.

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 890:1987, with its corrigendum March 1988 and its amendment 1:1995, prepared by SC 17D, Low-voltage switchgear and controlgear assemblies, of IEC TC 17, Switchgear and controlgear, was submitted to the formal vote and was approved by CENELEC as HD 528 S2 on 1996-12-09 without any modification.

The following dates were fixed:

- latest date by which the existence of the HD has to be announced at national level (doa) 1997-06-01
- latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement (dop) 1997-12-01
- latest date by which the national standards conflicting with the HD have to be withdrawn (dow) 1997-12-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A and B are informative.
Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 890:1987, with its corrigendum March 1988 and its amendment 1:1995, was approved by CENELEC as a Harmonization Document without any modification.



Annex ZA (normative)**Normative references to international publications
with their corresponding European publications**

This Harmonization document incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Harmonization document only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 439-1 (mod)	1985	Low-voltage switchgear and controlgear assemblies Part 1: Requirements for type-tested and partially type-tested assemblies	EN 60439-1 ¹⁾	1990

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1) EN 60439-1 is superseded by EN 60439-1:1994, which is based on IEC 439-1:1992, and its corrigenda August 1994 and February 1995.

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RAPPORT DE LA CEI IEC REPORT

CEI
IEC
890

Première édition
First edition
1987



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

**Méthode de détermination par extrapolation
des échauffements pour les ensembles d'appareillage
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**A method of temperature-rise assessment by extrapolation
for partially type-tested assemblies (PTTA) of low-voltage
switchgear and controlgear**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

A METHOD OF TEMPERATURE-RISE ASSESSMENT
BY EXTRAPOLATION
FOR PARTIALLY TYPE-TESTED ASSEMBLIES (PTTA)
OF LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR

FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.
- 4) The IEC has not laid down any procedure concerning marking as an indication of approval and has no responsibility when an item of equipment is declared to comply with one of its recommendations.

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PREFACE

This report has been prepared by Sub-Committee 17D: Low-voltage Switchgear and Controlgear Assemblies, of IEC Technical Committee No. 17: Switchgear and Controlgear.

The text of this report is based on the following documents:

Six Months' Rule	Report on Voting
17D(CO)31	17D(CO)32

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

The following IEC publication is quoted in this report:

Publication No: 439-1 (1985): Low-voltage Switchgear and Controlgear Assemblies, Part 1: Requirements for Type-tested and Partially Type-tested Assemblies.

A METHOD OF TEMPERATURE-RISE ASSESSMENT BY EXTRAPOLATION FOR PARTIALLY TYPE-TESTED ASSEMBLIES (PTTA) OF LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR

1. Introduction

In IEC Publication 439-1, in the series of type tests, a temperature-rise test is specified. However, for certain types of assemblies for which the performance of a temperature-rise test is either not feasible or economically not justifiable a calculation of the temperature rise in the form of extrapolation from data found by tests on other assemblies may be made instead. Such assemblies are then called partially type-tested assemblies (PTTA).

Various methods of calculation can be conceived and are acceptable. The factors and coefficients set out in this report have been derived from measurements on numerous assemblies and the method has been verified by comparison with test results. The method described in this report is therefore one possible method and may for partially type-tested assemblies be used to prove compliance with the requirements of Sub-clause 8.2.1 of IEC Publication 439-1. This report applies to PTTAs only.

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2. Scope

The following method is applicable to enclosed PTTA or partitioned sections of PTTA without forced ventilation. [SIST HD 528 S2:1999](https://standards.iteh.ai/catalog/standards/sist/ada0d9d0-94a5-4d8c-baff-40b311b33e3d/sist-528-s2-1999)

Notes 1. — The influence of the materials and wall thicknesses usually used for enclosures are negligible on the steady state temperatures. The method is therefore applicable to enclosures made of sheet steel, sheet aluminium, cast iron, insulating material and the like.

2. — For open-type and dead-front PTTA, no temperature-rise assessment is needed if it is obvious that no excessive air temperatures are likely to arise.

3. Object

The proposed method is intended to determine the temperature rise of the air inside the enclosure.

Note. — The air temperature within the enclosure is equal to the ambient air temperature outside the enclosure plus the temperature rise of the air inside the enclosure caused by the power losses of the installed equipment.

Unless otherwise specified, the ambient air temperature outside the PTTA is the air temperature indicated for indoor installation of the PTTA (average value over 24 h) of 35°C. If the ambient air temperature outside the PTTA at the place of use exceeds 35°C, this higher temperature is deemed to be the ambient air temperature of the PTTA.

4. Conditions for application

This method of calculation is only applicable if the following conditions are fulfilled:

- there is an approximately even distribution of power losses inside the enclosure;
- the installed equipment is so arranged that air circulation is but little impeded;
- the equipment installed is designed for direct current or alternating current up to and including 60 Hz with the total of supply currents not exceeding 3 150 A;

- conductors carrying high currents and structural parts are so arranged that eddy-current losses are negligible;
- for enclosures with ventilating openings, the cross-section of the air outlet openings is at least 1.1 times the cross-section of the air inlet openings;
- there are no more than three horizontal partitions in the PTTA or a section of it;
- where enclosures with external ventilating openings have compartments, the surface of the ventilating openings in each horizontal partition shall be at least 50% of the horizontal cross-section of the compartment.

5. Calculation

5.1 Necessary information

The following data are needed to calculate the temperature rise of the air inside an enclosure:

- dimensions of the enclosure: height/width/depth;
- the type of installation of the enclosure according to Figure 4, page 25;
- design of enclosure, i.e. with or without ventilation openings;
- number of internal horizontal partitions;
- effective power loss of equipment installed in the enclosure.

Note. — The effective power losses of the equipment installed in the circuits of the PTTA used for this calculation are the power losses at the rated currents of the various circuits to be taken from information provided by the manufacturer. The power losses of the conductors are determined by calculation.

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5.2 Calculation procedure

For the enclosures specified in columns 4 and 5 of Table I, the calculation of the temperature rise of the air inside the enclosures is carried out using the formulae laid down in columns 1 to 3 of Table I.

The pertinent factors and exponents (characteristics) are obtained from columns 6 to 10 of Table I.

The symbols, units and designations are to be taken from Table II.

For enclosures having more than one section with vertical partitions the temperature rise of the air inside the enclosure shall be determined separately for each section.

Where enclosures without vertical partitions or individual sections have an effective cooling surface greater than 11.5 m² or a width greater than about 1.5 m, they should be divided for the calculation into fictitious sections, whose dimensions approximate to the foregoing values.

Note. — The form shown on page 35 may be used as a calculation aid.

5.2.1 Determination of the effective cooling surface A_e of the enclosure

The calculation is carried out according to formula (1) in column 1 of Table I.

The effective cooling surface A_e of an enclosure is the sum of the individual surfaces A_o multiplied by the surface factor b . This factor takes into account the heat dissipation of the individual surfaces according to the type of installation of the enclosure.

5.2.2 Determination of the internal temperature rise $\Delta t_{0,5}$ of the air at mid-height of the enclosure

The calculation is carried out according to formula (2) in column 2 of Table I.

In formula (2) the enclosure constant k allows for the size of the effective cooling surface for enclosures without ventilation openings and, in addition, for the cross-section of the air inlet openings for enclosures with ventilating openings.

The dependence of the temperature rises occurring in the enclosure on the effective power loss P is expressed by the exponent x .

The factor d allows for the dependence of the temperature rise on the number of internal horizontal partitions.

5.2.3 Determination of the internal temperature rise $\Delta t_{1,0}$ of air at the top of the enclosure

The calculation is made according to formula (3) in column 3 of Table I.

Factor c allows for the temperature distribution inside an enclosure. Its determination varies with the design and installation of the assembly as follows:

- a) For enclosures without ventilation openings and with an effective cooling surface:

$$A_e > 1.25 \text{ m}^2$$

The factor c from Figure 4, page 25, depends on the type of installation and the height/base factor f , where:

$$f = \frac{h^{1.35}}{A_b}$$

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- b) For enclosures with ventilation openings and with an effective cooling surface:

$$A_e > 1.25 \text{ m}^2$$

The factor c from Figure 6, page 29, depends on the cross-section of air inlet openings and the height/base factor f , where:

$$f = \frac{h^{1.35}}{A_b}$$

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- c) For enclosures without ventilation openings and with an effective cooling surface:

$$A_e \leq 1.25 \text{ m}^2$$

The factor c from Figure 8, page 33, depends on the height/width factor g , where:

$$g = \frac{h}{w}$$

where:

h is the enclosure height, in metres

A_b is the surface area of the enclosure base, in square metres

w is the enclosure width, in metres

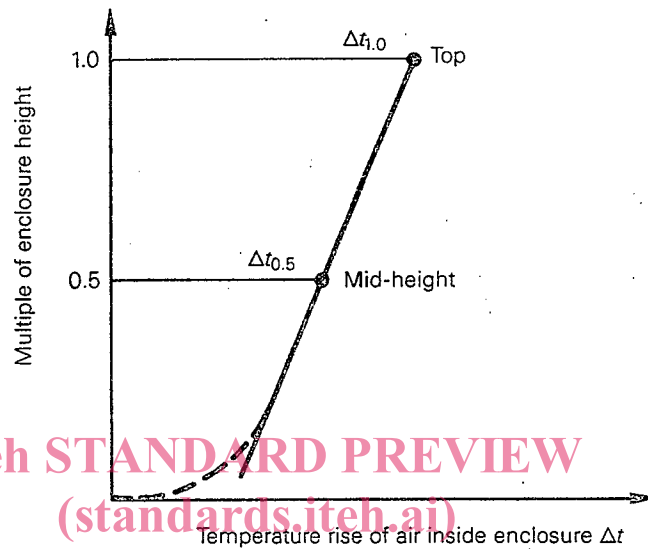
5.2.4 Characteristic curve for temperature rise of air inside enclosure

To evaluate the design according to Clause 6, it is necessary to apply the calculated results of Sub-Clauses 5.2.2 and 5.2.3 with the proper characteristic curve for temperature rise of air inside the enclosure as a function of the enclosure height. The air temperatures within horizontal levels are practically constant.

5.2.4.1 *Temperature-rise characteristic curve for enclosures with an effective cooling surface A_e exceeding 1.25 m^2*

As a general rule, the characteristic curve of temperature rise is adequately well defined by a straight line which runs through the points $\Delta t_{1,0}$ and $\Delta t_{0,5}$ (see Figure 1).

The internal air temperature rise at the bottom of the enclosure is close to zero, i.e. the characteristic curve flattens out towards zero. (In practice, the dotted part of the characteristic curve is of secondary importance.)



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FIG. 1. — <http://www.standards.iteh.ai/> Temperature-rise characteristic curve for enclosures with A_e exceeding 1.25 m^2 .
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