



SLOVENSKI STANDARD

SIST EN 60310:2001

01-februar-2001

Železniške naprave – Transformatorji vlečnih tokokrogov in dušilke na vlečnih sredstvih

Railway applications - Traction transformers and inductors on rolling stock

Bahnanwendungen - Transformatoren und Drosselspulen auf Bahnfahrzeugen

Applications ferroviaires - Transformateurs de traction et inductances du matériel roulant

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Ta slovenski standard je istoveten z: EN 60310:1996

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ICS:

29.180	Transformatorji. Dušilke	Transformers. Reactors
29.280	Električna vlečna oprema	Electric traction equipment

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en

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60310

May 1996

ICS 29.180; 29.280

Descriptors: Electric traction, rail vehicle, transformer, inductor, definition, classification, limit of temperature rise, test, electrical tolerance, rating plate

English version

**Railway applications - Traction transformers and
inductors on rolling stock
(IEC 310:1991, modified)**

Applications ferroviaires
Transformateurs de traction et
inductances du matériel roulant
(CEI 310:1991, modifiée)

Bahnanwendungen - Transformatoren
und Drosselspulen auf
Schienenfahrzeugen
(IEC 310:1991, modifiziert)

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This European Standard was approved by CENELEC on 1995-11-28. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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 310:1991, prepared by IEC TC 9, Electric traction equipment, together with common modifications prepared by SC 9XB, Electromechanical material on board of rolling stock, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways, was submitted to the formal vote and was approved by CENELEC as EN 60310 on 1995-11-28.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 1996-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1996-12-01

For products which have complied with the relevant national standard before 1996-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2001-12-01.

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Endorsement notice

The text of the International Standard IEC 310:1991 was approved by CENELEC as a European Standard with agreed common modifications as given below:

COMMON MODIFICATIONS

Title **Replace** the title by:

Railway applications - Traction transformers and inductors on rolling stock

1 Scope

Replace the first three lines of this clause by:

This European Standard EN 60310 applies to traction transformers installed on board rolling stock and to the various type of inductors inserted in the power and auxiliary circuits of electric vehicles.

The term "inductor" is used in this Standard with the same meaning as the term "reactor" mentioned in IEC Publications 50(421), 50(811) and 289 (EN 60289) and is considered equivalent.

NOTE: This decision is valid up to a clarification of the matter by IEC/TC1. The decision taken will be automatically applied as editorial improvement to EN 60310.

The inductors mentioned in the first paragraph may be:

- 1.3 **Replace** this subclause by: [SIST EN 60310:2001](https://standards.iteh.ai/catalog/standards/sist/a0424345-1427-4708-b502-f6fcac764af4/sist-en-60310-2001)
- 1.3 *Normative references*

This European Standard 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 thereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- EN 50124-1*) Railway applications - Insulation co-ordination
Part 1: Basic requirements - clearances and creepages
- EN 50125-1*) Railway applications - Environmental conditions for equipment
Part 1: Equipment on board rolling stock
- EN 50163 Railway applications - Supply voltages of traction systems
- EN 50207*) Railway applications - Electronic power converters for rolling stock
- EN 50215 Railway applications - Rolling stock - Tests after completion of construction and before entry into service
- EN 60289 Reactors (IEC 289, mod)

*) Under consideration

HD 398	Power transformers (IEC 76, mod - series)
HD 398.5	Part 5: Ability to withstand short circuit (IEC 76-5:1976 + A1:1979)
HD 566	Thermal evaluation and classification of electrical insulation (IEC 85)
IEC 349	Electric traction - Rotating electrical machines for rail and road vehicles

2 Service conditions

2.1 Replace this subclause by:

2.1 *Normal service conditions*

Service conditions are specified in EN 50125-1.

NOTE: Pending the approval of said document, service conditions of IEC 310:1991 apply.

If external ambient air is heated or cooled before entering the transformer (or inductor) heat exchanger, this information and the temperature of the entering air shall be given to the manufacturer.

Chapter II, Section 1 – Definitions for transformers

Replace in the note "IEC 76" by "HD 398".

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5 Rated voltages of transformer windings

5.1 Replace in the note "IEC 850" by "EN "50163".

6 Rated power

Replace the second paragraph by:

The rated power is referred to a continuous duty.

Chapter II Section 2 – Definitions for inductors

Add at the beginning of the section:

The definitions given in EN 60289 apply. For better clarification, the following additional definitions may apply:

8 Definitions of inductance

8.3 Replace the title of 8.3 by "Incremental inductance".

In the footnote, delete ", in accordance with IEC 411,".

10 Identification of transformers and inductors according to cooling method**10.1 Add at the end of this subclause:**

The characteristics of the construction arrangement and of the material involved are given in the Standards of the TC 14 of CENELEC and of TC 10 of IEC, the latter as endorsed by CENELEC.

11 Classification of insulating materials

Replace in the first paragraph "IEC 85" by "HD 566".

12 Limits of temperature rise

Replace this clause by:

The temperature rises above the ambient air of the components of transformers and inductors submitted to temperature-rise tests shall not exceed the values given in table 3.

Table 3 - Limits of temperature rise

Part of the apparatus	Thermal class of windings	Temperature rises		Limit temperatures °C
		duty class 1 K	duty class 2 K	
Windings	A	80	80	120
	B	95	95	135
	C	105	105	170
	D	130	130	195
	E	155	160	220
	H	180	180	240
	200	200	200	260
	220	220	230	290
	250	250		
O liquid	-	65		105
K liquid	-	150		190

For directed oil flow, the temperature rises in windings may be increased by 5 K.

Higher limits may be adopted by agreement between user and manufacturer when certain insulating materials are used (moisture repellent stabilized paper, thermally stabilized paper, special insulating liquids, etc.).

Temperature-rise limits for gas filled units both in gas and in the associated windings are to be defined by agreement between user and manufacturer, taking into account the characteristics of the gas used. For the windings, the limits shall not exceed the values indicated in the table.

Two different alternatives are given for temperature rises, corresponding to duty classes 1 (normal duty) and 2 (heavy duty). Class 2 of duty corresponds to operating cycles where the transformers or inductors are at full load for extended periods in their life span and the reference ambient temperature is taken, as for conventional stationary units, equal to 40 °C.

The temperature rises given for Class 1 of duty take into account that on board traction equipment are not continuously loaded and have considerable periods at reduced load or no load. This reduces the ageing of the insulation materials taken into account in HD 566. Moreover, for Class 1 of duty for on board traction equipment it is considered correct to base the temperature rises on the maximum daily average of ambient temperatures, which is assumed to be + 25 °C for all normal ambient Classes, having the maximum ambient temperature of up to + 50 °C.

For ambient temperatures up to 50 °C no correction shall be made on duty Class 1 temperature rises because an allowance of +10 K is admitted. For higher maximum ambient temperatures, in both duties, the temperature rises shall be reduced by the difference in excess to the maximum values indicated (40 °C for Class 2 and 50 °C for Class 1 respectively). "Ambient" in this context shall mean the ambient from which the cooling air is taken.

Limit temperatures in table 3 are given for guidance only. Temperature rises are the ruling limits.

The rated power for the equipment is intended for continuous duty. It should be related to the Joule integral of the load current according the actual duty. Should it not correspond, the actual rated power on which the temperature test shall be based may be fixed by agreement between user and manufacturer.

Thermal Class A is admissible only for the liquids type O. For liquids type K the limit temperature rise for both the winding and the liquid is the lower tabled for either.

Temperature rises resulting from table 3 apply to temperatures measured:

- by the method of variation of resistance for the windings;
- by thermometer (bulb or electric) for parts other than windings.

The temperature rise of the cores and other parts of transformers or inductors shall in no case reach a value that may damage these parts or adjacent ones.

In case of K liquids, the type of the liquid shall be subject to approval by the purchaser.

16 General - List of tests

Replace in the last paragraph, before the note, "IEC 411" by "EN 50207".

Replace in the note "IEC 165" by "EN 50215".

18 Preliminary checkes (routine test)

Add "voltage vector relationship (for three-phase transformers)," after the word "markings,".

19 Measurement of winding resistance (type and routine tests)

Replace in the first paragraph "IEC 76" by "HD 398".

21 Measurement of no-load primary current and losses (type and routine tests)

Replace in the second paragraph "IEC 76" by "HD 398".

22 Measurement of impedance voltage (type and routine tests)

Replace in the second paragraph "IEC 76" by "HD 398".

23 Measurement of load losses (type and routine tests)

23.1 Replace in the fourth paragraph "IEC 411" by "EN 50207".

24 Determination of total losses (type test)

Replace table 6 by:

Table 6 - Reference temperatures

Thermal class	Reference temperature °C
A E	85
B	130
F H	150
200 220 250	

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25 Temperature-rise test (type test)

Replace "IEC 76" by "HD 398" (twice).

Replace the text from the 6th paragraph ("Temperature-rise tests ...") to the end of the clause by:

Direct loading method and back-to-back method are of common use in this type of transformers, mainly when of limited rating. Details on such methods are subject to agreement between user and manufacturer.

Short-circuit method shall be carried out in accordance with HD 398.

For the temperature tests on transformers forming part of a static convertor, and specially for the determination of thermally equivalent currents in their windings, it is recommended to make reference also to EN 50207. The final values of the temperature rise of the various parts of the transformer shall not exceed the limits indicated in table 3.

26 Dielectric tests (type and routine tests)

Replace the fourth paragraph ("For induced ...") and tables 7 and 8 by:

Dielectric test levels are specified in EN 50124-1.