SLOVENSKI STANDARD
SIST EN 60205:2002

01-september-2002

Calculation of the effective parameters of magnetic piece parts (IEC 60205:2001)

Calculation of the effective parameters of magnetic piece parts

Berechnung der effektiven Kernparameter magnetischer Formteile

Calcul des paramètres effectifs des pièces ferromagnétiques

Ta slovenski standard je istoveten z: **EN 60205:2001**

ICS:

29.100.10 Magnetne komponente Magnetic components

SIST EN 60205:2002 **en**

EUROPEAN STANDARD **EN 60205**

NORME EUROPÉENNE

EUROPÄISCHE NORM June 2001

ICS 29.100.10

English version

Calculation of the effective parameters of magnetic piece parts
(IEC 60205:2001)

Calcul des paramètres effectifs des pièces ferromagnétiques (CEI 60205:2001)

Berechnung der effektiven Kernparameter magnetischer Formteile (IEC 60205:2001)

This European Standard was approved by CENELEC on 2001-05-01. 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.

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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

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Foreword

The text of document 51/532/FDIS, future edition 2 of IEC 60205, prepared by IEC TC 51, Magnetic components and ferrite materials, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60205 on 2001-05-01.

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) 2002-02-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2004-05-01

Annexes designated "informative" are given for information only.
In this standard, annex A is informative.

Endorsement notice

The text of the International Standard IEC 60205:2001 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60431 NOTE: Harmonized as EN 60431:1997 + A2:1998 (not modified).

IEC 61247 NOTE: Harmonized as EN 61247:1997 (not modified).

INTERNATIONAL STANDARD

IEC 60205

Second edition
2001-04

Calculation of the effective parameters of magnetic piece parts

Calcul des paramètres effectifs des pièces ferromagnétiques

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International Electrotechnical Commission
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CALCULATION OF THE EFFECTIVE PARAMETERS OF MAGNETIC PIECE PARTS

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60205 has been prepared by IEC technical committee 51: Magnetic components and ferrite materials.

This second edition cancels and replaces the first edition published in 1966, amendment 1 (1976), amendment 2 (1981), first supplement (1968) and second supplement (1974). This second edition constitutes a technical revision.

The text of this standard is based on the first edition, amendments 1 and 2, supplements A and B and the following documents:

FDIS	Report on voting
51/582/FDIS	51/594/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

CALCULATION OF THE EFFECTIVE PARAMETERS OF MAGNETIC PIECE PARTS

1 Scope

This International Standard lays down uniform rules for the calculation of the effective parameters of closed circuits of ferromagnetic material.

2 Basic rules

The following basic rules are applicable to this standard.

2.1 All results shall be expressed in units based on the millimetre and shall be accurate to three significant figures, but to derive l_e, A_e, and V_e the values of C_1 and C_2 shall be calculated to five significant figures.

NOTE The purpose of specifying this degree of accuracy is only to ensure that parameters calculated at different establishments are identical, and it is not intended to imply that the parameters are capable of being determined to this accuracy.

2.2 A_{min} is the nominal value of the smallest cross-section. All the dimensions used to calculate A_{min} shall be the mean values between the tolerance limits quoted on the appropriate piece part drawing.

2.3 Calculations are only applicable to the component parts of a closed magnetic circuit.

2.4 All dimensions used for the purpose of calculations shall be the mean value within the tolerance limits quoted on the appropriate piece part drawing.

2.5 All irregularities in the outline of the core, such as small cut-outs, notches, chamfers, etc. shall be ignored unless otherwise described.

2.6 When the calculation involves the sharp corner of a piece part, then the mean length of flux path for that corner shall be taken as the mean circular path joining the centres of area of the two adjacent uniform sections, and the cross-sectional area associated with that length shall be taken as the average area of the two adjacent uniform sections.

Calculation of effective parameters l_e, A_e and V_e

The effective parameters can be defined as

$$l_e = C_1^2/C_2 \qquad A_e = C_1/C_2 \qquad V_e = l_e A_e = C_1^3/C_2^2$$

where

l_e is the effective magnetic length of the core (mm);

A_e is the effective cross-sectional area (mm^2);

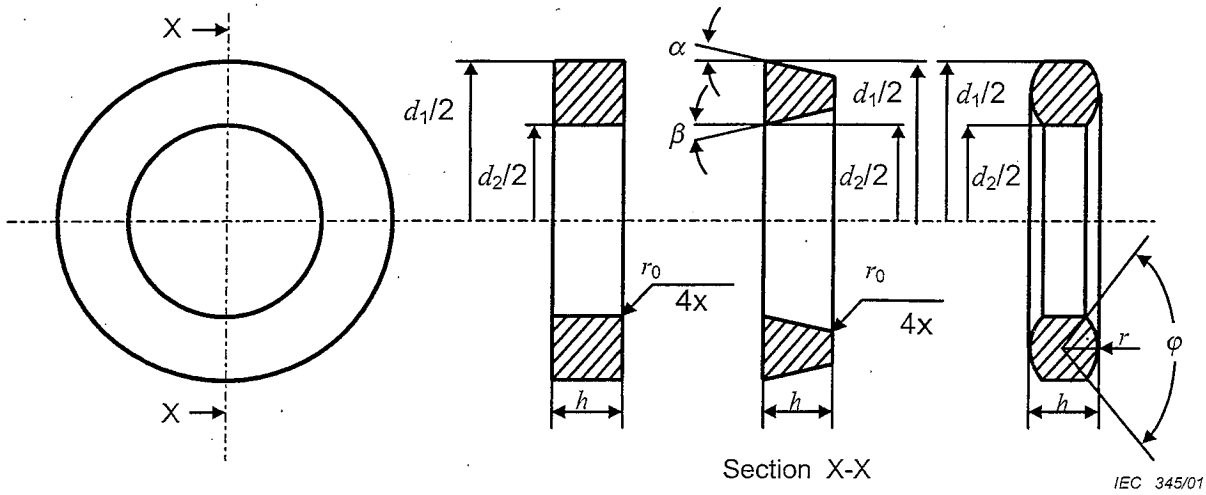
V_e is the effective volume (mm^3);

C_1 is the core constant (mm^{-1});

C_2 is the core constant (mm^{-3}).

3 Formulae for the various types of cores

3.1 Ring cores



$$C_1 = \frac{2\pi}{h_e \ln(d_1/d_2)}$$

$$C_2 = \frac{4\pi(1/d_2 - 1/d_1)}{h_e^2 \ln^3(d_1/d_2)}$$

3.1.1 For ring cores of rectangular cross-section with sharp corners

$$h_e = h$$

3.1.2 For ring cores of rectangular cross-section with an appreciable average rounding radius r_0

$$h_e = h\,(1 - k_1) \qquad k_1 = \frac{1{,}7168\, r_0^{\,2}}{h(d_1 - d_2)}$$

3.1.3 For ring cores of rectangular cross-section with sharp corners

$$h_e = h\,(1 - k_2)$$

$$k_2 = \frac{h\,(\tan\alpha + \tan\beta)}{d_1 - d_2}$$

3.1.4 For ring cores of trapezoidal cross-section with an appreciable average rounding radius r_0

$$h_e = (1 - k_1 - k_2)$$

3.1.5 For ring cores of cross-section with circular arc frontal sides

$$h_e = h - \frac{d_1 - d_2}{4\sin^2\frac{\varphi}{2}}\left(2\sin\frac{\varphi}{2} - \frac{\sin\varphi}{2} - \frac{\varphi}{2}\right)$$

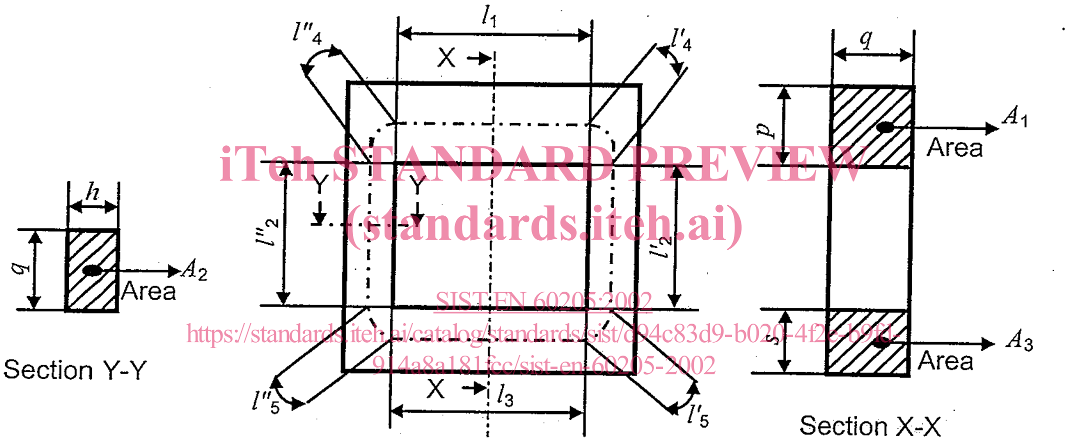
$$\varphi = 2\arcsin\frac{d_1 - d_2}{4r};$$

φ, in radians.

NOTE When the winding is uniformly distributed over a ring core, it may be expected that, at all points inside the ring core, the flux lines will be parallel to its surface.

No leakage flux will therefore leave or enter the ring core. This justifies the use of a theoretically more correct derivation of the effective parameters which does not make use of the assumption that the flux is uniformly distributed over the cross-section.

3.2 Pair of U-cores of rectangular section



IEC 346/01

Length of flux path associated with area A_2:

$$l_2 = l'_2 + l''_2$$

Mean length of flux paths at corners:

$$l_4 = l'_4 + l''_4 = \frac{\pi}{4}(p + h)$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}(s + h)$$

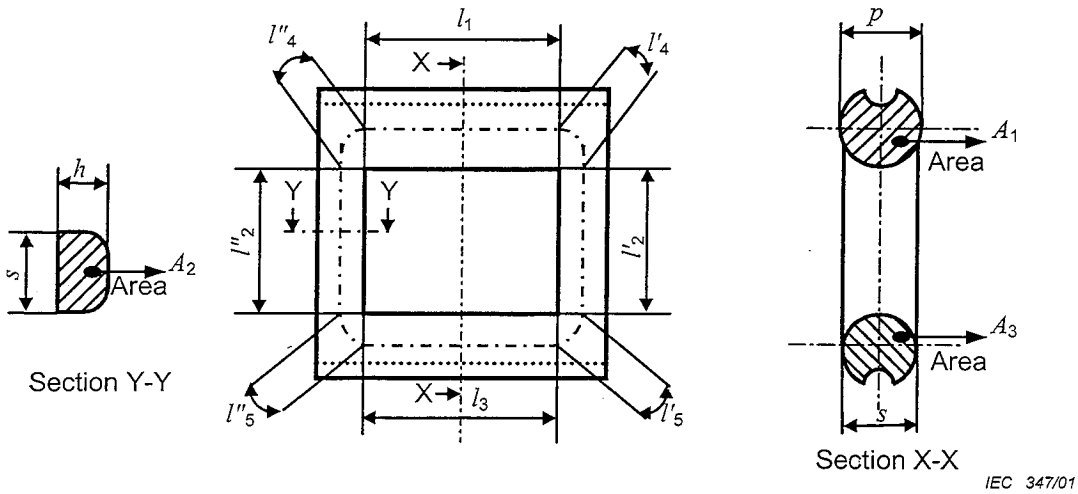
Mean areas associated with l_4 and l_5:

$$A_4 = \frac{A_1 + A_2}{2}$$

$$A_5 = \frac{A_2 + A_3}{2}$$

$$C_1 = \sum_1^5 \frac{l_i}{A_i} \qquad C_2 = \sum_1^5 \frac{l_i}{A_i^2}$$

3.3 Pair of U-cores of rounded section



In calculating A_2, ignore any ridges introduced for the purpose of facilitating manufacture.

Length of flux path associated with area A_2:

$$l_2 = l'_2 + l''_2$$

Mean length of flux path at corners:

$$l_4 = l'_4 + l''_4 = \frac{\pi}{4}(p + h)$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}(s + h)$$

Mean areas associated with l_4 and l_5:

$$A_4 = \frac{A_1 + A_2}{2}$$

$$A_5 = \frac{A_2 + A_3}{2}$$

$$C_1 = \sum_1^5 \frac{l_i}{A_i} \qquad C_2 = \sum_1^5 \frac{l_i}{A_i^2}$$