SLOVENSKI STANDARD

SIST EN 60205:2006

oct 2006

Izračun efektivnih parametrov magnetnih sestavnih delov (IEC 60205:2006)

Calculation of the effective parameters of magnetic piece parts (IEC 60205:2006)

ICS 29.100.10

Referenčna številka
SIST EN 60205:2006(en)

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60205

July 2006

ICS 29.100.10

Supersedes EN 60205:2001

English version

Calculation of the effective parameters of magnetic piece parts
(IEC 60205:2006)

Calcul des paramètres effectifs
des pièces ferromagnétiques
(CEI 60205:2006)

Berechnung der effektiven Kernparameter
magnetischer Formteile
(IEC 60205:2006)

This European Standard was approved by CENELEC on 2006-05-01. 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 two official versions (English and 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, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the 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

Ref. No. EN 60205:2006 E

Foreword

The text of document 51/848/FDIS, future edition 3 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 2006-05-01.

This European Standard supersedes EN 60205:2001.

This European Standard includes the following significant technical changes with respect to EN 60205:2001:

a) unit of angles through the text are described by using “radian”;

b) new words are added in 2.1 “All angles are in radians”;

c) replacement, in 3.9, of the equation $\frac{l_2}{A_2} = \frac{\ln d_2 g / d_3}{D\pi(h_1 - h_2)}$ by $\frac{l_2}{A_2} = \frac{\ln d_2 g / d_3}{D\pi(h_1 - h_2)/2}$;

d) new cores “EL, ER, PQ, EFD and E planar” are added in this edition.

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)	2007-02-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2009-05-01

Endorsement notice

The text of the International Standard IEC 60205:2006 was approved by CENELEC as a European Standard without any modification.

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INTERNATIONAL STANDARD

IEC 60205

Third edition
2006-04

Calculation of the effective parameters of magnetic piece parts

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PRICE CODE U

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CALCULATION OF THE EFFECTIVE PARAMETERS OF MAGNETIC PIECE PARTS

FOREWORD

1) The International Electrotechnical Commission (IEC) 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60205 has been prepared by IEC technical committee 51: Magnetic components and ferrite materials.

This third edition cancels and replaces the second edition published in 2001, corrigendum 1 (2001). This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) unit of angles through the text are described by using "radian";
b) new words are added in 2.1 "All angles are in radians";
c) replacement, Clause 3.9, of the equation $\frac{l_2}{A_2} = \frac{\ln d_2 g / d_3}{D\pi(h_1 - h_2)}$ by $\frac{l_2}{A_2} = \frac{\ln d_2 g / d_3}{D\pi(h_1 - h_2)/2}$;
d) new cores "EL, ER, PQ, EFD and E planar" are added in this edition.

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

FDIS	Report on voting
51/848/FDIS	51/857/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 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. 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, 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. All angles are in radians.

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);

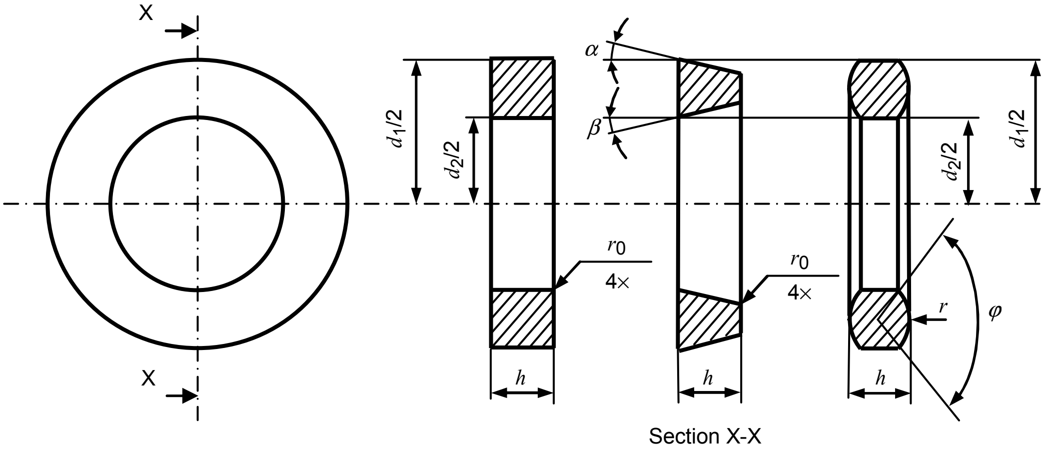
V_e is the effective volume (mm^3);

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



IEC 584/06

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

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

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

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

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

$$h_e = h(1 - k_2) \quad k_2 = \frac{h(\tan\alpha + \tan\beta)}{d_1 - d_2}$$

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

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

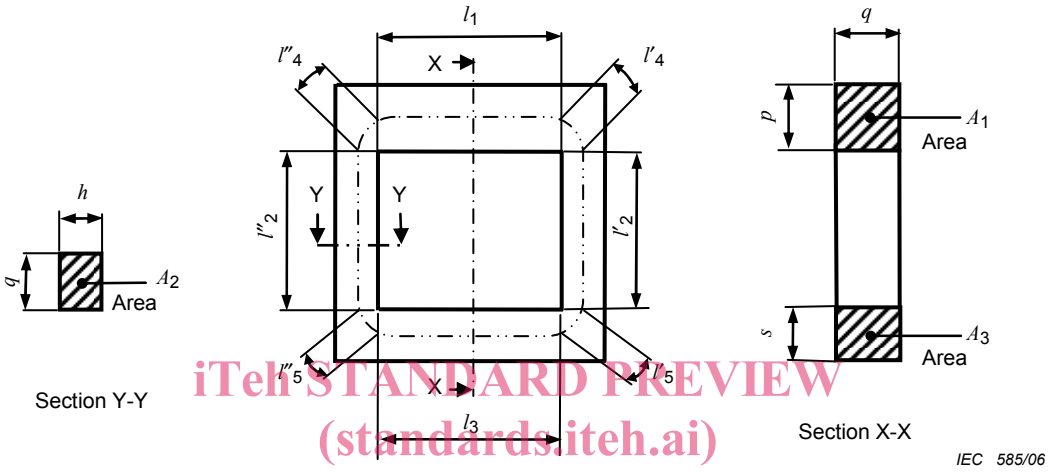
$$\varphi = 2\arcsin\frac{d_1 - d_2}{4r}.$$

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

NOTE U + PLT (Plate)-cores use U core formulas



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:

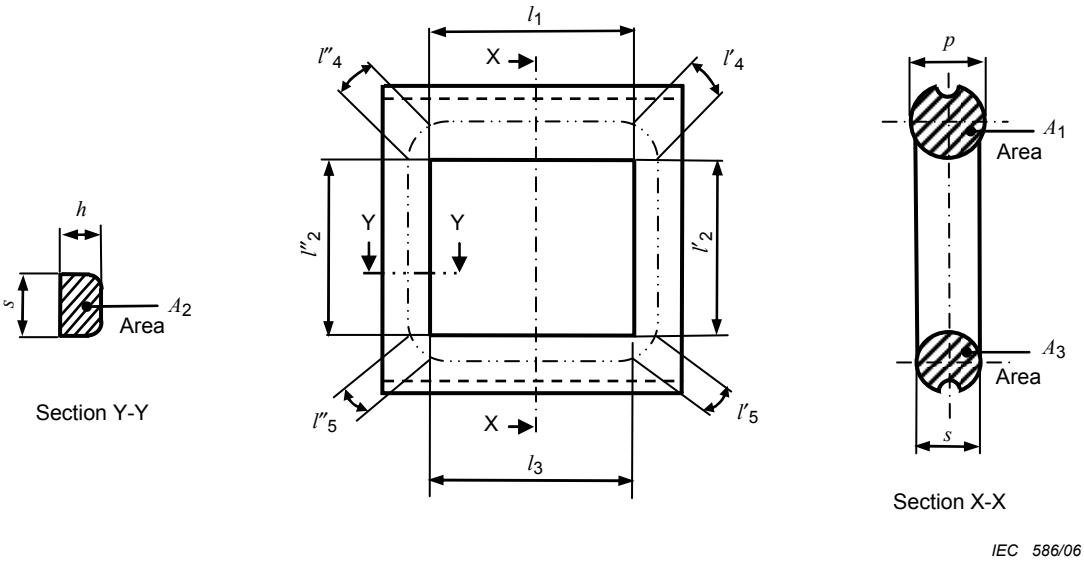
$$A_4 = \frac{A_1 + A_2}{2}$$

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

$$C_1 = \sum_{i=1}^{5}\frac{l_i}{A_i} \qquad C_2 = \sum_{i=1}^{5}\frac{l_i}{A_i^2}$$

3.3 Pair of U-cores of rounded section

NOTE U + PLT (Plate)-cores use U core formulas.



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:

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

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

$$C_1 = \sum_{i=1}^{5} \frac{l_i}{A_i} \qquad C_2 = \sum_{i=1}^{5} \frac{l_i}{A_i^2}$$