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
Международная Электротехническая Комиссия

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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.
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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- withdrawn;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);

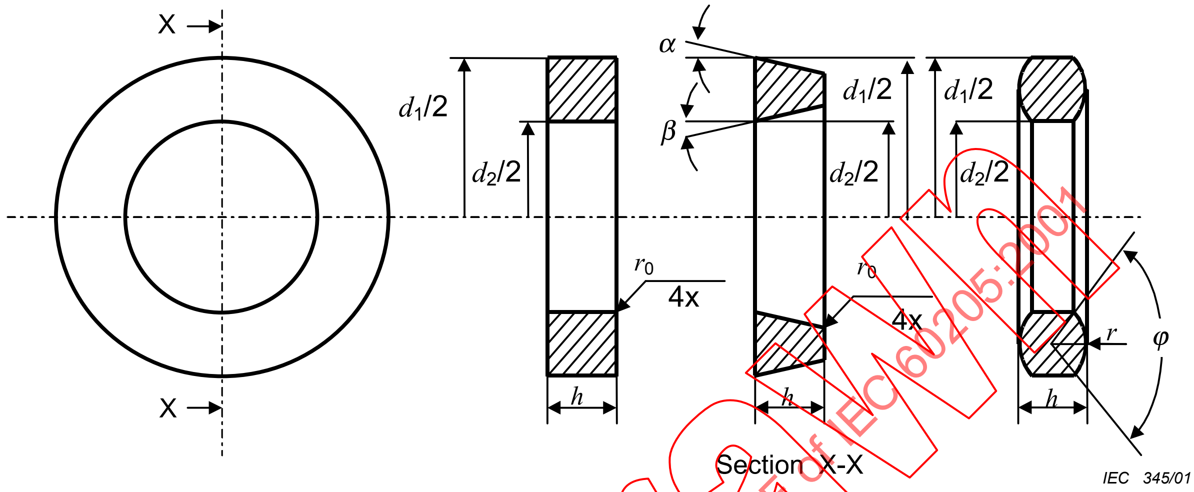
V_e is the effective volume (mm^3);

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



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

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

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

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

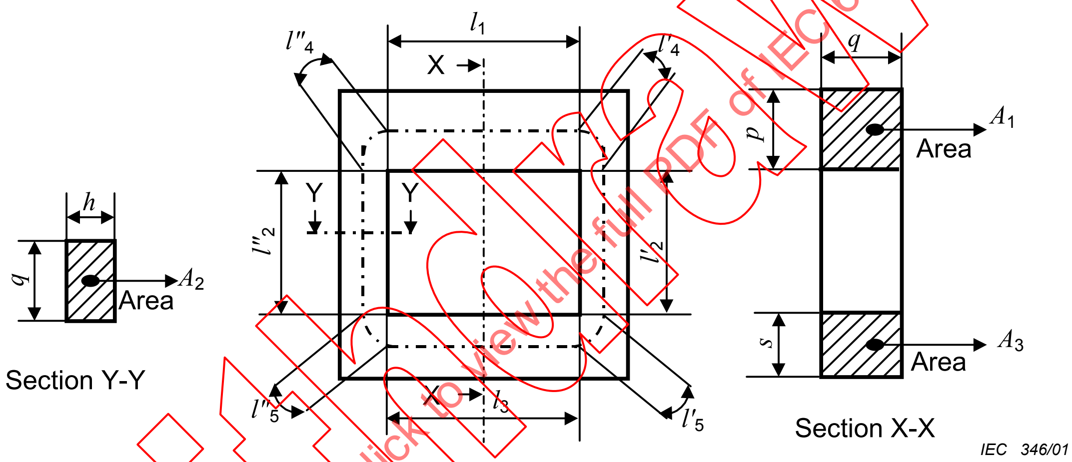
$$\varphi = 2\arcsin\frac{d_1 - d_2}{4r};$$

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



Length of flux path associated with area A_2:

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

Mean length of flux paths at corners:

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

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

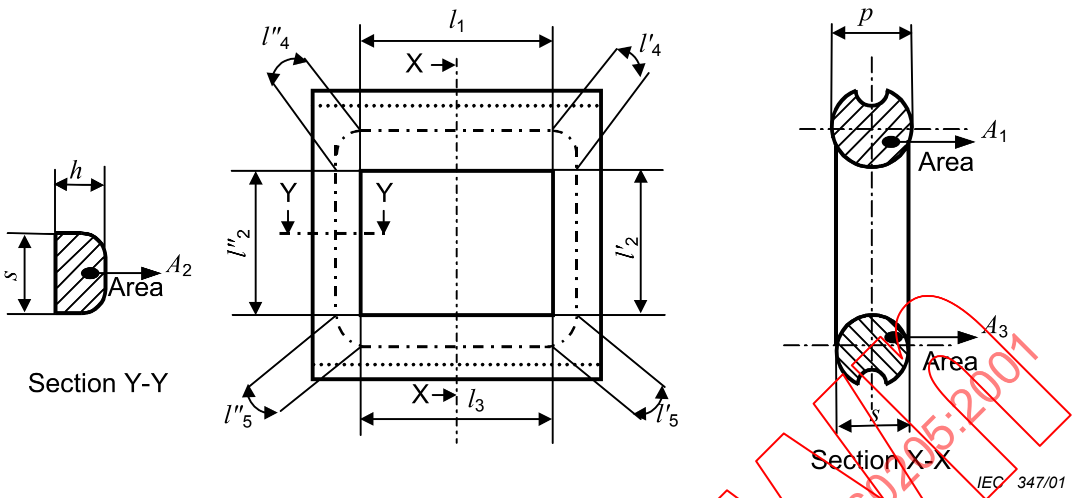
Mean areas associated with l_4 and l_5:

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

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

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

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:

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

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

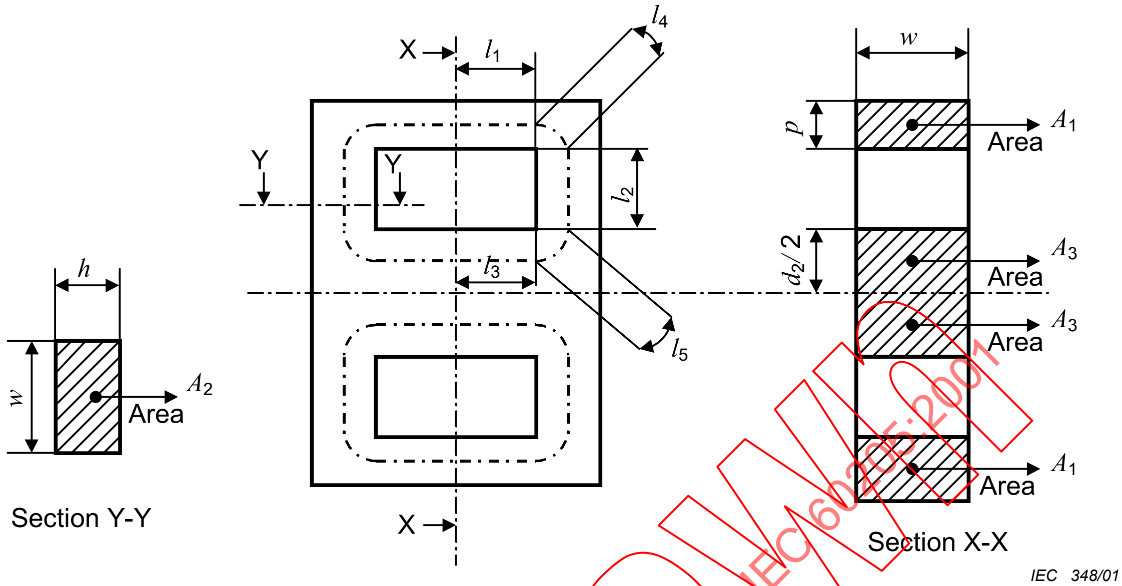
Mean areas associated with l_4 and l_5:

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

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

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

3.4 Pair of E-cores of rectangular section



Area of half the centre limb: A_3

Mean length of flux paths at corners:

$$l_4 = \frac{\pi}{8}(p + h)$$

$$l_5 = \frac{\pi}{8}\left(\frac{d_2}{2} + h\right)$$

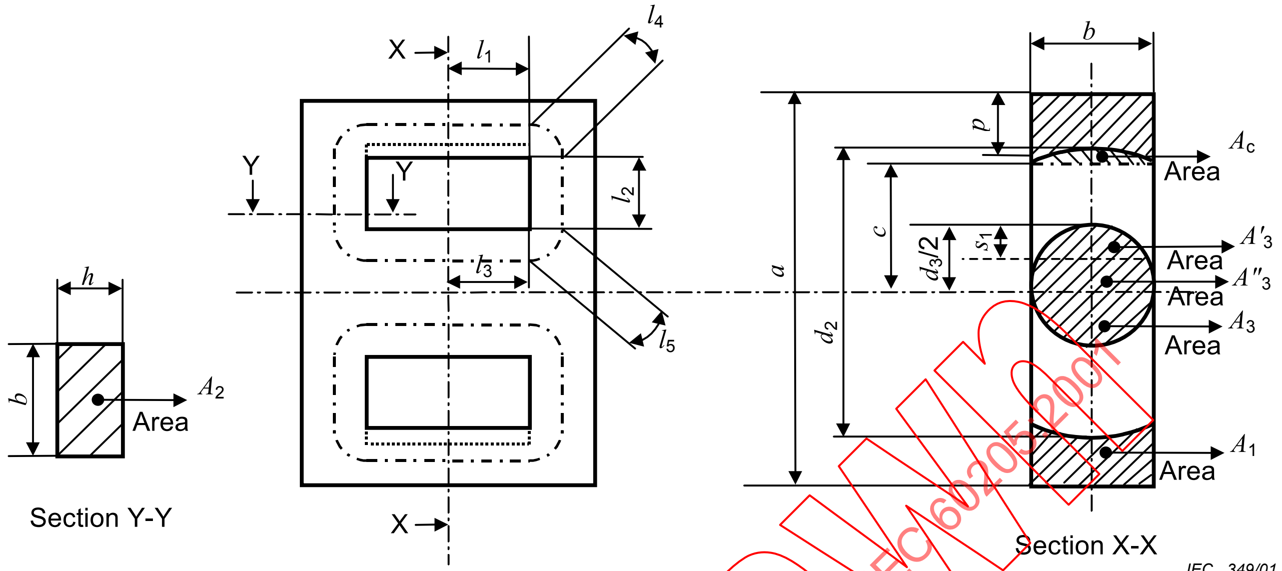
Mean areas associated with l_4 and l_5:

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

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

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

3.5 Pair of ETD-cores



A_1 is equal to the rectangle $b\left(\frac{1}{2}a - c\right)$ less the cap or segment A_c

$$A_c = \frac{1}{4}d_2^2 \arcsin\left(\frac{b}{d_2}\right) - \frac{1}{4}b\sqrt{d_2^2 - b^2}$$

$$A_1 = \frac{1}{2}ab - \frac{1}{4}b\sqrt{d_2^2 - b^2} - \frac{1}{4}d_2^2 \arcsin\left(\frac{b}{d_2}\right)$$

Mean length of flux path at back walls:

$$l_2 = \frac{1}{4}\left(d_2 + \sqrt{d_2^2 - b^2}\right) - \frac{d_3}{2}$$

NOTE l_2 is taken from the mean value of $\frac{1}{2}(d_2 - d_3)$ and $(c - d_3/2)$.

Area of half the centre limb:

$$A_3 = A'_3 + A''_3$$

The condition to obtain $A'_3 = A''_3$ is

$$S_1 = 0{,}2980\ d_3$$

Mean length of flux path at corners:

$$l_4 = \frac{\pi}{8}(p + h)$$

where $p = \frac{a}{2} - l_2 - \frac{d_3}{2}$

$$l_5 = \frac{\pi}{8}(2S_1 + h)$$

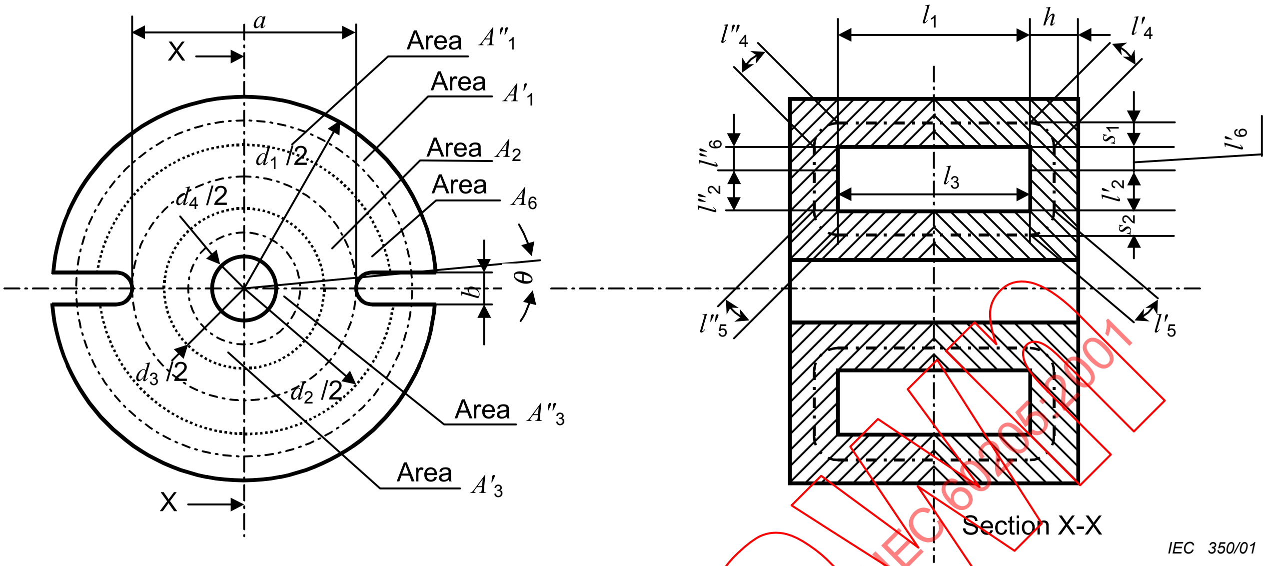
Mean areas associated with l_4 and l_5:

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

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

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

3.6 Pair of pot-cores



Area of outer ring:

$$A_1 = A'_1 + A''_1$$

The condition to obtain $A'_1 = A''_1$ is

$$S_2 = -\frac{d_2}{2} + \sqrt{\frac{1}{8}\left(d_1^2 + d_2^2\right)}$$

Area of centre limb:

$$A_3 = A'_3 + A''_3$$

The condition to obtain $A'_3 = A''_3$ is:

$$S_1 = \frac{d_3}{2} - \sqrt{\frac{1}{8}\left(d_3^2 + d_4^2\right)}$$

Area of ring:

$$A_1 = \frac{1}{4}(\pi - n\theta)\left(d_1^2 - d_2^2\right) \qquad \theta = \arcsin \frac{2b}{d_1 + d_2}$$

b: slot width

n: number of slots

Core factors associated with l_2:

$$\frac{l_2}{A_2} = \frac{1}{\pi h} \ln \frac{a}{d_3}$$

$$\frac{l_2}{A_2} = \frac{a - d_3}{\pi^2 a d_3 h^2}$$

Area of centre limb:

$$A_3 = \frac{\pi}{4}\left(d_3{}^2 - d_4{}^2\right)$$

Mean length of flux paths at corners:

$$l_4 = l'_4 + l''_4 = \frac{\pi}{4}(2S_2 + h)$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}(2S_1 + h)$$

Areas associated with l_4 and l_5:

$$A_4 = \frac{1}{8}(\pi - 2\theta)\left(d_1{}^2 - d_2{}^2\right) + \frac{\pi}{2} d_2 h$$

$$A_5 = \frac{\pi}{8}\left(d_3{}^2 - d_4{}^2 + 4 d_3 h\right)$$

Core factors associated with l_6:

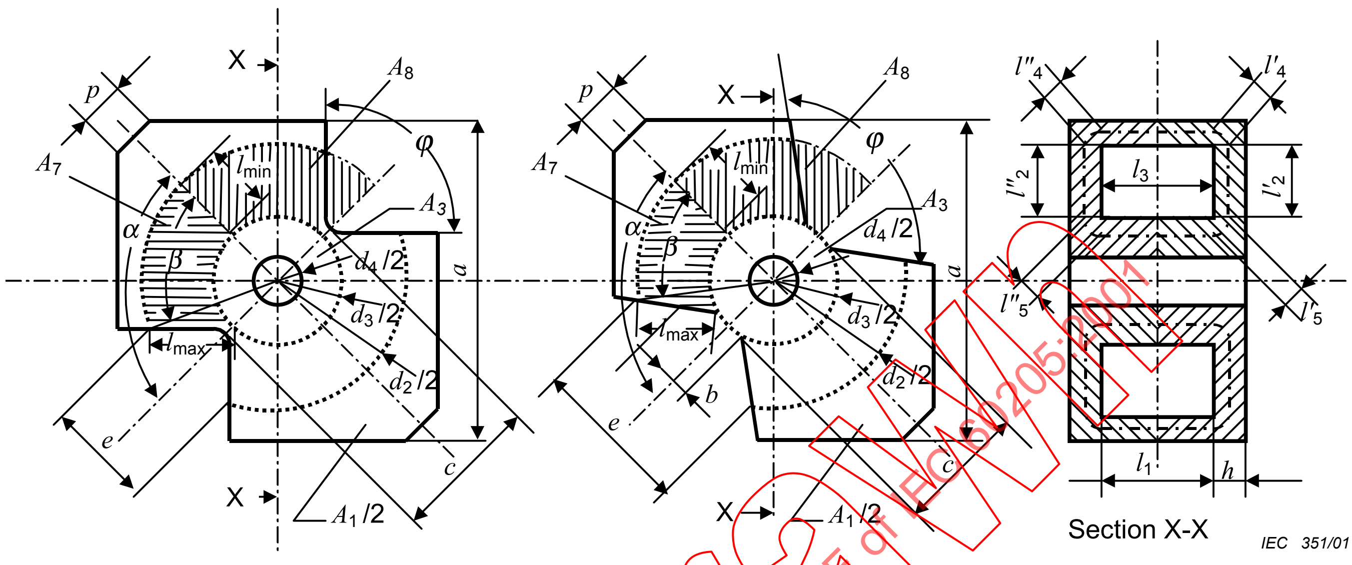
$$\frac{l_6}{A_6} = \frac{1}{(\pi - n\theta)h} \ln \frac{d_2}{a}$$

$$\frac{l_6}{A_6} = \frac{d_2 - a}{a d_2 (\pi - n\theta)^2 h^2}$$

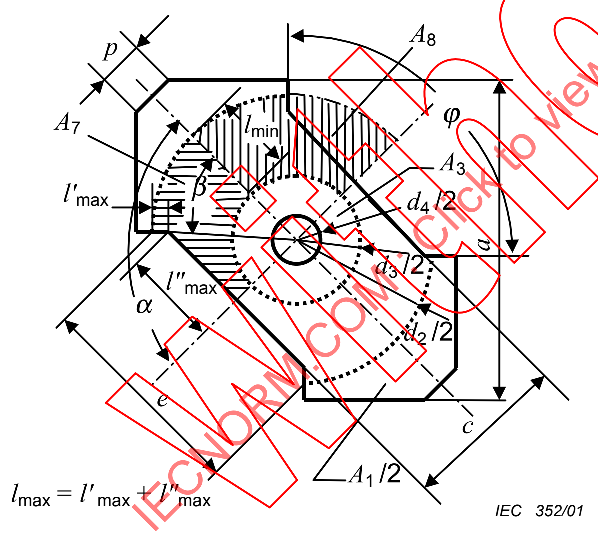
$$C_1 = \sum_1^6 \frac{l_i}{A_i} \qquad C_2 = \sum_1^6 \frac{l_i}{A_i{}^2}$$

3.7 Pair of square cores (RM-cores)

Type 1 – RM6-S, RM6-R Type 2 – RM7



Type 3 – RM4, RM5, RM8, RM10, RM12, RM14



NOTE This calculation is also applicable to the core type without hole.

Total area of the leg:

$$A_1 = \frac{1}{2} a^2 \{1 + \tan(\beta - 45)\} - \frac{\beta\pi}{360} d_2{}^2 - \frac{1}{2} p^2$$

where $\beta = \alpha - \arcsin \dfrac{e}{d_2}$.

Core factors associated with l_2:

$$\frac{l_2}{A_2} = \frac{\ln \dfrac{d_2}{d_3} f}{D\pi h}$$

where $f = \dfrac{l_{\text{min}} + l_{\text{max}}}{2 l_{\text{min}}}$ $\qquad D = \dfrac{A_7}{A_8}$

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

Type 1:

$$l_{\text{max}} = \sqrt{\frac{1}{4}\left(d_2{}^2 + d_3{}^2\right) - \frac{1}{2} d_2 d_3 \cos(\alpha - \beta)}$$

Type 2:

$$l_{\text{max}} = \sqrt{\frac{1}{4}\left(d_2{}^2 + d_3{}^2\right) - \frac{1}{2} d_2 d_3 \cos(\alpha - \beta)} - \frac{b}{2 \sin \dfrac{\varphi}{2}}$$

Type 3:

$$l_{\text{max}} = \frac{e}{2} + \frac{1}{2}\left(1 - \sin \frac{\varphi}{2}\right)(d_2 - c)$$

$$\frac{l_2}{A_2{}^2} = \frac{(1/d_3 - 1/d_2) f}{(D\pi h)^2}$$

Type 1: RM 6-S:

$$A_7 = \frac{1}{4}\left\{\frac{\beta\pi}{360} d_2{}^2 + \frac{1}{2} e^2 \tan\beta - \frac{1}{2} e^2 \tan\left(\alpha - \frac{\varphi}{2}\right) - \frac{\pi}{4} d_3{}^2\right\}$$

Type 1: RM 6-R:

$$A_7 = \frac{1}{4}\left\{\frac{\beta\pi}{360} d_2{}^2 + \frac{1}{2} d_2 d_3 \sin(\alpha - \beta) + \frac{1}{2}(c - d_3)^2 \tan \frac{\varphi}{2} - \frac{\pi}{4} d_3{}^2\right\}$$

Type 2:

$$A_7 = \frac{1}{4}\left\{\frac{\beta\pi}{360}d_2{}^2 - \frac{\pi}{4}d_3{}^2 + \frac{1}{2}\left(b^2 - e^2\right)\tan\left(\alpha - \frac{\varphi}{2}\right) + \frac{1}{2}e^2\tan\beta\right\}$$

Type 3:

$$A_7 = \frac{1}{4}\left\{\frac{\beta\pi}{360}d_2{}^2 - \frac{\pi}{4}d_3{}^2 + \frac{1}{2}c^2\tan(\alpha - \beta)\right\}$$

$$A_8 = \frac{\alpha\pi}{1440}\left(d_2{}^2 - d_3{}^2\right)$$

Area of centre limb:

$$A_3 = \frac{\pi}{4}\left(d_3{}^2 - d_4{}^2\right)$$

Mean length of flux paths at corners and mean areas associated with these:

$$l_4 = l'_4 + l''_4 = \frac{\pi}{4}\left(h + \frac{1}{2}a + \frac{1}{2}d_2\right)$$

$$A_4 = \frac{1}{2}\left(A_1 + \frac{\beta\pi}{90}d_2 h\right)$$

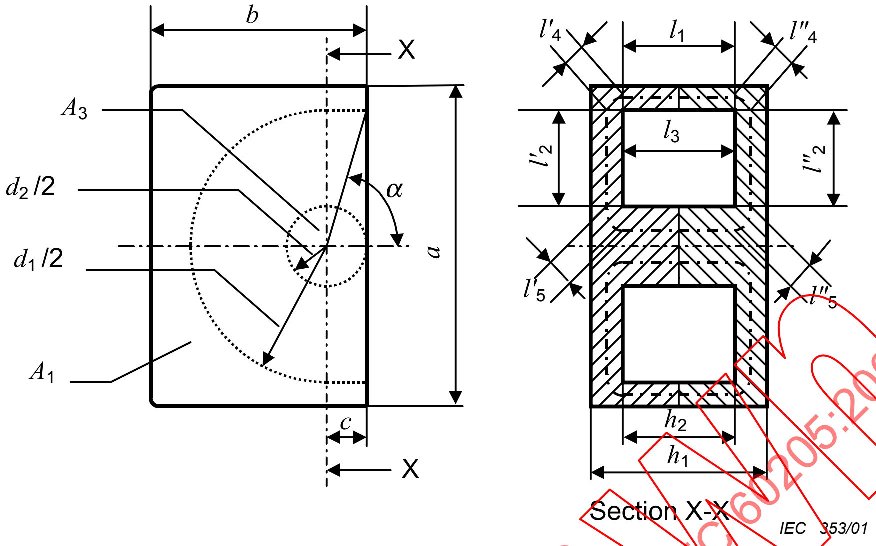
$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}\left\{d_3 + h - \sqrt{\frac{1}{2}\left(d_3{}^2 + d_4{}^2\right)}\right\}$$

$$A_5 = \frac{1}{2}\left\{\frac{\pi}{4}\left(d_3{}^2 - d_4{}^2\right) + \frac{\alpha\pi}{90}d_3 h\right\}$$

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

NOTE This calculation ignores the effect of spring recesses and stud recesses. These may have some influence on the outcome of the calculation, especially for smaller cores.

3.8 Pair of EP-cores



As a pair:

$$\frac{l_1}{A_1} = \frac{h_2}{ab - \frac{\pi d_1^2}{8} - \frac{d_1 d_2}{2}}$$

$$\frac{l_1}{A_1^2} = \frac{h_2}{\left(ab - \frac{\pi d_1^2}{8} - \frac{d_1 d_2}{2}\right)^2}$$

$$\frac{l_2}{A_2} = \frac{2}{(\pi - \theta)(h_1 - h_2)} \ln \frac{d_1}{d_2}$$

$$\frac{l_2}{A_2^2} = \frac{4(d_1 - d_2)}{(\pi - \theta)^2 (h_1 - h_2)^2 d_1 d_2}$$

where $\theta = \frac{\pi\alpha}{180}$

$$\frac{l_3}{A_3} = \frac{4h_2}{\pi d_2^2}$$

$$\frac{l_3}{A_3^2} = \frac{16h_2}{\pi^2 d_2^4}$$

Areas associated with l_4 and l_5:

$$l_4 = l'_4 + l''_4 = \frac{\pi}{2}\left(\gamma - \frac{d_1}{2} + \frac{h_1 - h_2}{4}\right)$$

$$\gamma = \sqrt{\frac{(\pi - \theta) d_1^2 + 2\left(ab - \frac{\pi}{8} d_1^2 - \frac{d_1 d_2}{2}\right)}{4(\pi - \theta)}}$$

where γ is a hypothetical radius bisecting the cross-sectional area of the ring.

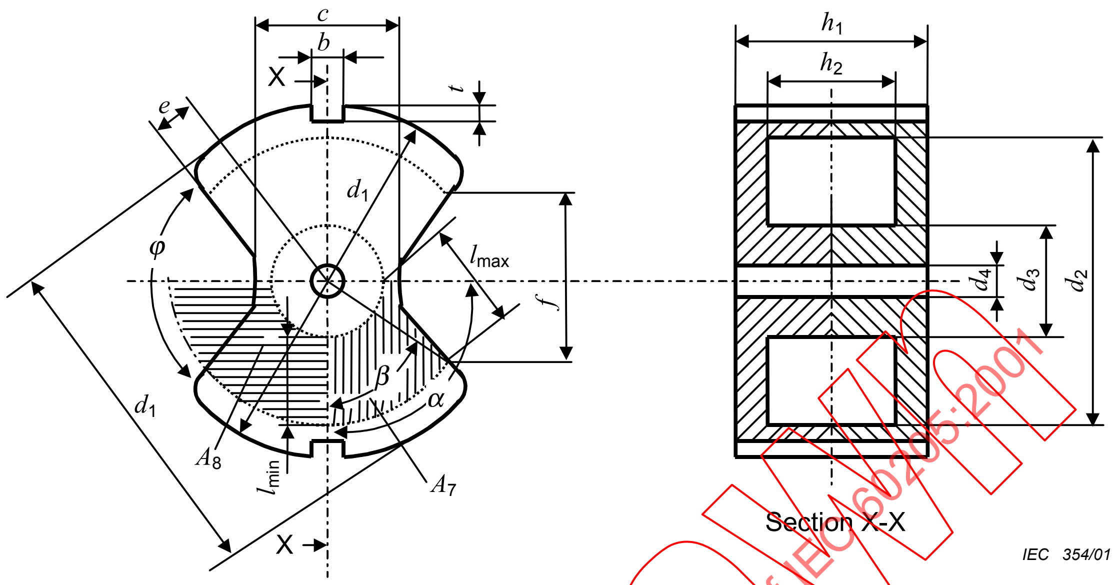
$$A_4 = \frac{1}{2}\left\{ab - \frac{\pi}{8} d_1^2 - \frac{d_1 d_2}{2} + (\pi - \theta) d_1 \left(\frac{h_1}{2} - \frac{h_2}{2}\right)\right\}$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{2}\left(0{,}292\,89 \frac{d_2}{2} + \frac{h_1 - h_2}{4}\right)$$

$$A_5 = \frac{\pi}{2}\left\{\frac{d_2^2}{4} + \frac{d_2}{2}(h_1 - h_2)\right\}$$

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

3.9 Pair of PM-cores



Total area of the leg:

$$A_1 = \frac{\beta}{2}\left(d_1^2 - d_2^2\right) - 2bt$$

Core factors associated with l_2:

$$\frac{l_2}{A_2} = \frac{\ln\frac{d_2}{d_3}\,g}{D\pi(h_1 - h_2)}$$

where $g = \dfrac{l_{min} + l_{max}}{2l_{min}}$

$$D = \frac{A_7}{A_8}$$

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

$$l_{max} = \sqrt{\frac{1}{4}\left(d_2^2 + d_3^2\right) - \frac{1}{2}d_2 d_3 \cos(\alpha - \beta)}$$

where $\beta = \alpha - \arcsin\dfrac{f}{d_2}$

$$\frac{l_2}{A_2^2} = \frac{(1/d_3 - 1/d_2)g}{\{D\pi(h_1 - h_2)/2\}^2}$$

$$A_7 = \frac{\beta\pi}{1440}d_2^2 + \frac{1}{8}f^2\tan\beta - \frac{1}{8}f^2\tan\left(\alpha - \frac{\varphi}{2}\right) - \frac{\pi}{16}d_3^2$$

$$A_8 = \frac{\beta\pi}{1440}\left(d_2{}^2 - d_3{}^2\right)$$

Area of centre limb:

$$A_3 = \frac{\pi}{4}\left(d_3{}^2 - d_4{}^2\right)$$

Mean length of flux paths at corners and mean areas associated with these:

$$l_4 = l'_4 + l''_4 = \frac{\pi}{8}\left(h_1 - h_2 + d_1 - d_2\right)$$

$$A_4 = \frac{1}{2}\left\{A_1 + \pi d_2\left(h_1 - h_2\right)\frac{\beta}{90}\right\}$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}\left\{d_3 + h_1 - h_2 - \sqrt{\frac{1}{2}\left(d_3{}^2 + d_4{}^2\right)}\right\}$$

$$A_5 = \frac{\pi}{8}\left(d_3{}^2 - d_4{}^2\right) + \frac{\alpha\pi}{180}d_3\left(h_1 - h_2\right)$$

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

Annex A
(informative)

Purpose of revision and how to deal with new effective parameters

The purpose of this revision is to provide formulae by which everybody can reach the same effective parameter values. First, it is necessary to have a sufficient number of significant figures when figures are rounded off in the process of calculation. Additionally, some of the calculation formulae have been changed to get closer to the actual shape. The calculation formulae for the A_c portion of ETD-cores and the slots of pot-cores have been changed and slots are also taken into account in the disc. A formula for RM-cores has been changed to reach the same value since IEC 60205 B (second supplement, 1974) does not lead to one value. A formula for PM-cores has been newly formulated. Calculation formulae for E-cores with round centre leg and X-cores, for which demand is decreasing, are deleted.

In this revision, the basic idea of calculation has not been changed. Recently, analysis of the magnetic field in the core has been considerably improved, so that on the basis of these ideas, development of new approaches and formulae can be expected.

Effective calculated parameter values will be different since formulae have been changed. For example, the C_1 value of P9/5 in IEC 60133 is 1,25. It is 1,2643 when calculated by the formula in IEC 60205 (1st edition, 1966), and it is 1,2032 by IEC 60205 (2nd edition [this standard]). It is still not possible to explain the first difference, and the second difference is due to a difference in the calculation formulae for slots in the disc.

Many users have been using this value of 1,25 in their catalogues and specifications, and many magnetic parameters have been calculated using it. Therefore, continuity of these documents will be affected if the values are changed. It is expected to use new effective parameters in the future, but users will be responsible for when they will use the new ones.

Effective parameter values calculated using the different formulae are listed in tables A.1 to A.4 for users' convenience.

Table A.1 – Comparison of the effective parameter values of pot-cores (two slots)

Size	Pub. No.[a]	C_1 mm^{-1}	C_2 $X10^{-3}$ mm^{-3}	l_e mm	A_e mm^2	V_e mm^3
P9/5	IEC 60133	1,25	125	12,5	10,0	125
	IEC 60205 (Ed. 1)	1,264 3	128,69	12,4	9,82	122
	IEC 60205 (Ed. 2)	1,203 2	118,12	12,3	10,2	125
P11/7	IEC 60133	1,00	63	15,9	15,9	252
	IEC 60205 (Ed. 1)	0,970 7	60,989	15,5	15,9	246
	IEC 60205 (Ed. 2)	0,933 53	56,727	15,4	16,5	253
P14/8	IEC 60133	0,80	32,0	20,0	25,0	500
	IEC 60205 (Ed. 1)	0,791 13	31,797	19,7	24,9	490
	IEC 60205 (Ed. 2)	0,758 42	29,579	19,5	25,6	499
P18/11	IEC 60133	0,60	13,9	25,9	43	1 120
	IEC 60205 (Ed. 1)	0,598 21	13,888	25,8	43,1	1 110
	IEC 60205 (Ed. 2)	0,573 82	12,863	25,6	44,6	1 140
P22/13	IEC 60133	0,50	7,9	31,6	63	2 000
	IEC 60205 (Ed. 1)	0,496 09	7,829 2	31,4	63,4	1 990
	IEC 60205 (Ed. 2)	0,480 78	7,418 5	31,2	64,8	2 020
P26/16	IEC 60133	0,40	4,3	37,2	93	3 460
	IEC 60205 (Ed. 1)	0,399 81	4,248 9	37,6	94,1	3 540
	IEC 60205 (Ed. 2)	0,389 23	4,060 5	37,3	95,9	3 580
P30/19	IEC 60133	0,33	2,43	45	136	6 100
	IEC 60205 (Ed. 1)	0,332 57	2,453 6	45,1	136	6 110
	IEC 60205 (Ed. 2)	0,323 43	2,332 1	44,9	139	6 119
P36/22	IEC 60133	0,26	1,29	52	202	10 600
	IEC 60205 (Ed. 1)	0,263 37	1,309 7	53,0	201	10 600
	IEC 60205 (Ed. 2)	0,256 66	1,249 2	52,7	205	10 800
P42/29	IEC 60133	0,26	0,98	69	265	18 300
	IEC 60205 (Ed. 1)	0,256 79	0,963 16	68,4	267	18 200
	IEC 60205 (Ed. 2)	0,251 57	0,932 49	67,9	270	18 300

[a] 1st line in column: effective parameter values listed in IEC 60133.
2nd line in column: effective parameter values calculated by IEC 60205 (1st edition, 1966).
3rd line in column: effective parameter values of IEC 60205 (2nd edition [this standard]) calculated by the new formulae.

Table A.2 – Comparison of the effective parameter values of ETD-cores

Size	Pub. No.[a]	C_1 mm^{-1}	C_2 $X10^{-3}$ mm^{-3}	l_e mm	A_e mm^2	V_e mm^3
ETD34	IEC 61185	0,814 1	8,379	79	97	7 700
	IEC 60205 (Ed. 2)	0,814 49	8,387 9	79,1	97,1	7 680
ETD39	IEC 61185	0,741 6	5,933	93	125	11 600
	IEC 60205 (Ed. 2)	0,742 00	5,940 1	92,7	125	11 600
ETD44	IEC 61185	0,598 8	3,458	104	173	18 000
	IEC 60205 (Ed. 2)	0,599 18	3,462 8	104	173	17 900
ETD49	IEC 61185	0,542 1	2,566	115	211	24 200
	IEC 60205 (Ed. 2)	0,542 45	2,569 2	115	211	24 200

NOTE Effective parameter values of other sizes in IEC 61185, Amendment 1 are the same as those calculated by IEC 60205 (2nd edition [this standard]).

[a] 1st line in column: effective parameter values listed in IEC 61185.

2nd line in column: effective parameter values of IEC 60205 (2nd edition [this standard]) calculated by the new formulae.

Table A.3 – Comparison of the effective parameter values of PM-cores

Size	Pub. No.[a]	C_1 mm^{-1}	C_2 $X10^{-3}$ mm^{-3}	l_e mm	A_e mm^2	V_e mm^3
PM50/39	IEC 61247	0,226 69	0,613 75	84,0	369	30 900
	IEC 60205 (Ed. 2)	0,249 64	0,715 48	87,1	349	30 400
PM62/49	IEC 61247	0,190 09	0,330 93	109	570	63 000
	IEC 60205 (Ed. 2)	0,195 90	0,346 73	111	565	62 500
PM74/59	IEC 61247	0,162 22	0,205 50	128	790	101 000
	IEC 60205 (Ed. 2)	0,168 95	0,215 46	132	784	104 000
PM87/70	IEC 61247	0,160 54	0,177 01	146	910	132 000
	IEC 60205 (Ed. 2)	0,161 20	0,173 02	150	932	140 000
PM114/93	IEC 61247	0,116 29	0,067 692	200	1 720	343 000
	IEC 60205 (Ed. 2)	0,116 68	0,066 429	205	1 760	360 000

[a] 1st line in column: effective parameter values listed in IEC 61247.

2nd line in column: effective parameter values of IEC 60205 (2nd edition [this standard]) calculated by the new formulae.