

INTERNATIONAL STANDARD

IEC 60133

Fourth edition
2000-12

Dimensions of pot-cores made of magnetic oxides and associated parts

*Dimensions des circuits magnétiques en pots
en oxydes magnétiques et pièces associées*



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International Electrotechnical Commission
Telefax: +41 22 919 0300

3, rue de Varembe Geneva, Switzerland
e-mail: inmail@iec.ch

IEC web site <http://www.iec.ch>



Commission Electrotechnique Internationale
International Electrotechnical Commission
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DIMENSIONS OF POT-CORES MADE OF MAGNETIC OXIDES AND ASSOCIATED 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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- 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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International Standard IEC 60133 has been prepared by technical committee 51: Magnetic components and ferrite materials.

This edition cancels and replaces the third edition published in 1985, of which it constitutes a technical revision.

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

FDIS	Report on voting
51/570/FDIS	51/580/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.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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- withdrawn;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

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

DIMENSIONS OF POT-CORES MADE OF MAGNETIC OXIDES AND ASSOCIATED PARTS

1 Scope

This standard specifies the dimensions that are of importance for mechanical interchangeability for a preferred range of pot-cores made of magnetic oxides, and the dimensional limits for coil formers to be used with them. The general considerations upon which the design of this range of cores is based are given in annex A.

2 Normative reference

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60205, *Calculation of effective parameters of magnetic piece parts*

3 Primary standards

Compliance with the following requirements ensures mechanical interchangeability of complete assemblies and coil formers.

3.1 Dimensions of pot-cores

3.1.1 Principal dimensions

The principal dimensions of pot-cores shall be as given in table 1.

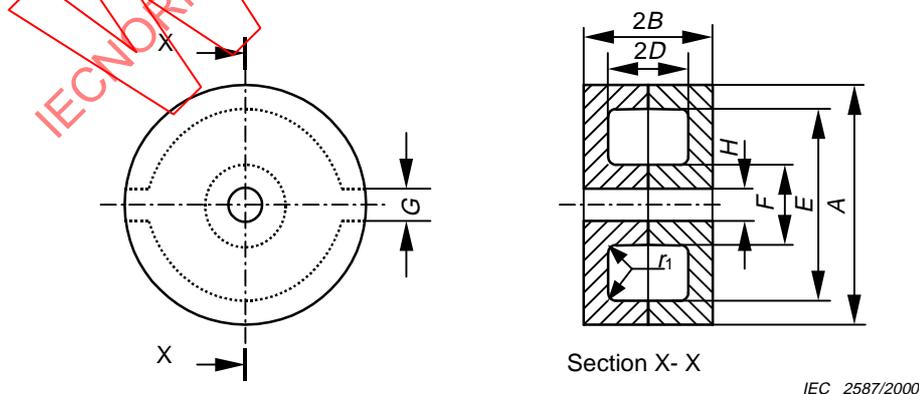


Figure 1 – Principal dimensions of pot-cores without slots

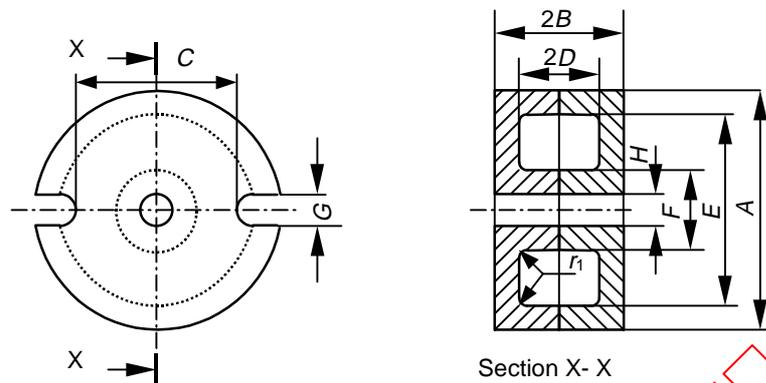


Figure 2 – Principal dimensions of pot-cores with slots

Table 1 – Principal dimensions of pot-cores

Dimensions in millimetres

Size	A		E		F		H		2B		2D		$r_1^{1)}$	Figures
	Min.	Max.	Max.											
P3,3/2,6	3,18	3,30	2,50	2,60	1,30	1,40	–	–	2,50	2,60	1,70	1,90	0,20	1
P4,6/3,1	4,40	4,60	3,50	3,65	1,90	2,00	–	–	3,00	3,10	2,10	2,30	0,20	1
P5,8/3,3	5,65	5,80	4,50	4,60	2,40	2,50	0,95	1,05	3,20	3,30	2,20	2,40	0,20	1
P7,4/4,0	7,15	7,35	5,80	5,95	2,90	3,00	1,05	1,15	4,10	4,20	2,80	3,00	0,20	1
P9/5	9	9,3	7,5	7,75	3,7	3,9	2	2,2	5,1	5,4	3,6	3,9	0,25	2
P11/7	10,9	11,3	9	9,4	4,5	4,7	2	2,2	6,3	6,6	4,4	4,7	0,25	2
P14/8	13,8	14,3	11,6	12	5,8	6	3	3,2	8,2	8,5	5,6	6	0,25	2
P18/11	17,6	18,4	14,9	15,4	7,3	7,6	3	3,2	10,4	10,7	7,2	7,6	0,25	2
P22/13	21,2	22	17,9	18,5	9,1	9,4	4,4	4,7	13,2	13,6	9,2	9,6	0,35	2
P26/16	25	26	21,2	22	11,1	11,5	5,4	5,7	15,9	16,3	11	11,4	0,35	2
P30/19	29,5	30,5	25	25,8	13,1	13,5	5,4	5,7	18,6	19	13	13,4	0,35	2
P36/22	35	36,2	29,9	30,9	15,6	16,2	5,4	5,7	21,4	22	14,6	15	0,35	2

NOTE 1 P3,3/2,6 and P4,6/3,1 cores are without the centre hole shown in figure 1.

NOTE 2 P9/5 and P11/7 cores are without the centre hole shown in figure 2.

NOTE 3 Sharp inner corners of pot-cores are preferable but in practice some rounding may occur, provided that radius r_1 is not exceeded¹⁾.

NOTE 4 The dimensions of the cores may be checked by means of gauges. An example of a possible standard for these gauges is given in annex C.

NOTE 5 In order to facilitate production, it may be necessary to use gauges having dimensions differing from those given in annex C, although no relaxation of the requirements for the dimensions of the cores given in 3.1 is thereby permitted.

Table 2 – Limits for C and G

Dimensions in millimetres

Size	Cores with two slots			
	C		G	
	Min.	Max.	Min.	Max.
P3,3/2,6	–	–	0,8	1,3
P4,6/3,1	–	–	1,1	1,7
P5,8/3,3	–	–	1,4	2,0
P7,4/4,0	–	–	1,6	2,2
P9/5	6,0	7,5	1,6	2,4
P11/7	6,5	8,0	1,8	2,6
P14/8	8,7	10,0	2,3	4,1
P18/11	11,3	14,0	2,7	4,4
P22/13	13,3	16,5	3,0	4,4
P26/16	17,0	20,0	3,0	4,4
P30/19	20,0	23,0	3,5	5,3
P36/22	24,0	27,2	4,0	5,6

NOTE 1 The shape of the slots is not defined, but the width G is indicated in the table.

NOTE 2 It is recommended that any tightening of the tolerance on dimension C should be towards the minimum value and on dimension G towards the maximum value.

3.1.2 Grooves

When grooves are provided corresponding to the slots, their minimum depth shall be as given in table 3.

Table 3 – Minimum groove depth

Dimensions in millimetres

Size	Minimum groove depth
P14/8	0,2
P18/11	0,3
P22/13	0,4
P26/16	0,5
P30/19	0,6
P36/22	0,6

3.1.3 Effective parameter values

The effective parameter values for pot-cores whose dimensions comply with 3.1.1 shall be as given in tables 4 and 5 (for the definitions of these parameters, and their calculation, see IEC 60205).

Table 4 – Effective parameter values pot-cores with a centre hole

Size	C_1 mm ⁻¹	C_2 10 ⁻³ mm ⁻³	A_e mm ²	l_e mm	V_e mm ³	A_{min} mm ²
P5,8/3,3	1,6326	345,47	4,73	7,72	36,5	3,66
P7,4/4,0	1,3588	186,79	7,27	9,88	71,9	5,79
P9/5	1,2032	118,12	10,2	12,3	125	7,88
P11/7	0,933 53	56,727	16,5	15,4	253	13,2
P14/8	0,757 42	29,521	25,7	19,4	499	19,8
P18/11	0,573 83	12,863	44,6	25,6	1 140	36,0
P22/13	0,480 78	7,4185	64,8	31,2	2 020	50,9
P26/16	0,389 23	4,0605	95,9	37,3	3 580	76,1
P30/19	0,323 43	2,3321	139	44,9	6 220	115
P36/22	0,256 66	1,2492	205	52,7	10 800	172

NOTE The manufacturers may indicate in their catalogues more precise values than those given in the above table.

Table 5 – Effective parameter values pot-cores without a centre hole

Size	C_1 mm ⁻¹	C_2 10 ⁻³ mm ⁻³	A_e mm ²	l_e mm	V_e mm ³	A_{min} mm ²
P3,3/2,6	3,1367	1768,4	1,77	5,56	9,87	1,43
P4,6/3,1	2,0887	609,06	3,43	7,16	24,6	2,60
P5,8/3,3	1,5406	295,89	5,21	8,02	41,8	3,66
P7,4/4,0	1,2941	163,38	7,92	10,3	81,2	5,79
P9/5	1,0639	84,640	12,6	13,4	168	8,95
P11/7	0,865 00	46,165	18,7	16,2	304	13,2
P14/8	0,680 99	22,061	30,9	21,0	649	23,6
P18/11	0,540 12	10,923	49,4	26,6	1 320	36,0
P22/13	0,438 12	5,7735	75,9	33,2	2 520	58,1
P26/16	0,355 34	3,1831	112	39,7	4 430	87,0
P30/19	0,304 43	1,9888	153	46,6	7 130	117
P36/22	0,246 93	1,1285	219	54,0	11 800	172

3.2 Main dimensions for coil formers

Main dimensions for coil formers shall be in accordance with table 6.

NOTE The dimensions of table 6 which correspond to similar dimensions in table 1 are labelled with the same letter in upper case, for example, 2d corresponds to 2D in table 1.

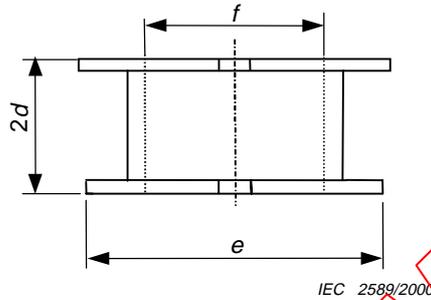


Figure 3 – Main dimensions for coil formers

Table 6 – Main dimensions for coil formers

Dimensions in millimetres

Size	Main dimensions for coil formers		
	<i>e</i>	<i>f</i>	<i>2d</i>
	Max.	Min.	Max.
P3,3/2,6	2,40	1,50	1,60
P4,6/3,1	3,20	2,10	2,00
P5,8/3,3	4,40	2,60	2,10
P7,4/4,0	5,70	3,10	2,70
P9/5	7,40	4,00	3,50
P11/7	8,90	4,80	4,30
P14/8	11,5	6,10	5,50
P18/11	14,8	7,70	7,10
P22/13	17,8	9,50	9,10
P26/16	21,1	11,6	10,9
P30/19	24,9	13,6	12,9
P36/22	29,8	16,3	14,5

Annex A (informative)

Pot-core design

The pot-cores covered by this standard were originally designed for optimum dimensions based upon minimum loss R_{dc}/L . Before optimizing for performance, the following hole diameter ranges were chosen:

0,95 mm to 1,05 mm for P5,8/3,3

1,05 mm to 1,15 mm for P7,4/4,0

2,0 mm to 2,2 mm for P9/5, P11/7

3,0 mm to 3,2 mm for P14/8, P18/11

4,4 mm to 4,7 mm for P22/13

5,4 mm to 5,7 mm for P26/16, P30/19, P36/22

Originally a pot-core 14 mm x 8 mm, with an adjusting device of 3 mm diameter was the smallest that could be produced in quantity.

In accordance with miniaturization of electronic devices, four smaller pot-cores, viz. P7,4/4,0, P5,8/3,3, P4,6/3,1 and P3,3/2,6 have been added as standard pot-cores, and the larger pot-core P42/29 has been deleted.

The ratio of diameter to height of the pot-core, calculated on the above assumption, is fairly constant, as appears from the list below, and $A/2B$ lies between 1,48 and 1,76, except for the smallest type.

Table A.1 – Ratio of diameter to height

Size	A (nom.)	2B (nom.)	A/2B
P3,3/2,6	3,24	2,55	1,27
P4,6/3,1	4,50	3,05	1,48
P5,8/3,3	5,73	3,25	1,76
P7,4/4,0	7,25	4,15	1,75
P9/5	9,15	5,25	1,74
P11/7	11,1	6,5	1,71
P14/8	14,05	8,35	1,68
P18/11	18	10,55	1,71
P22/13	21,6	13,4	1,61
P26/16	25,5	16,15	1,58
P30/19	30	18,8	1,60
P36/22	35,6	21,7	1,64

The steps in the series are such that the ratio of R_{dc}/L of two adjacent pot-cores is about 1,6.

Annex B (informative)

Derived standards

The primary standard given in the main text establishes values for principal dimensions of core assemblies and wound coil formers and enables full interchangeability for components complying with that standard to be achieved.

Parties interested in marking or using pot-cores may find it desirable to lay down local standards for everyday use, which show the dimensions and tolerance in greater detail than clause 3, and which correspond to the state of the art in that area. These are known as derived standards. When doing so, care should be taken not to exclude any other type of pot-core meeting the IEC primary standard, which would also satisfy the performance specification valid for a specific case.

It should be noted that whilst a component complying with a derived standard will comply with the requirements of clause 3 for the primary standard and therefore permit core assemblies and wound coil formers to be freely interchanged, the parts thereof may not necessarily be interchangeable.

NOTE For example, it may not be desirable or even possible for the adjuster, intended to be used with cores complying with one derived standard, to be used with cores complying with another derived standard. This may be due to the tolerances on the central hole being significantly different in the two derived standards but both being within the limits of the primary standard.

When requirements would lead to the establishing of a national standard, the relevant national standardization body is strongly requested to insert a note in such a national standard that

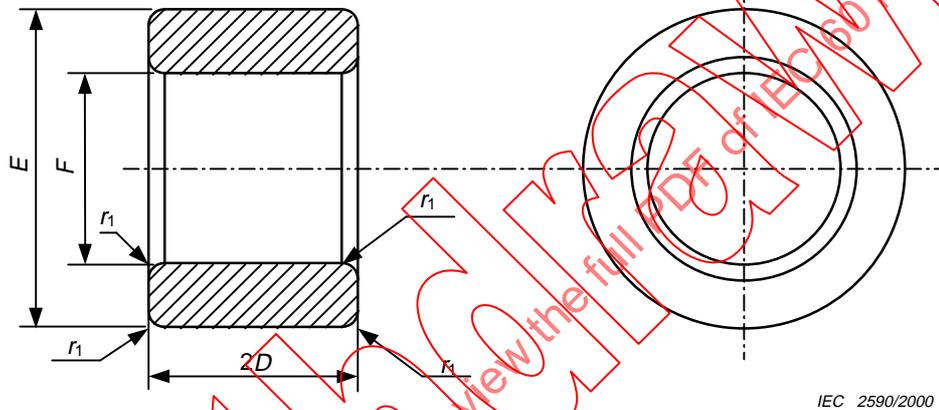
- it is in accordance with the dimensional requirements of this standard IEC 60133, but that more details are given in order to promote its practical use;
- other solutions are possible within the framework of this IEC standard and should not be excluded if the resulting cores and formers are functionally interchangeable with those according to the national standard.

Annex C (informative)

Example of a standard for gauges to check the dimensions of pot-cores meeting the IEC primary standard

C.1 General

The gauges shall be in accordance with tables C.1 and C.2 and their associated figures.



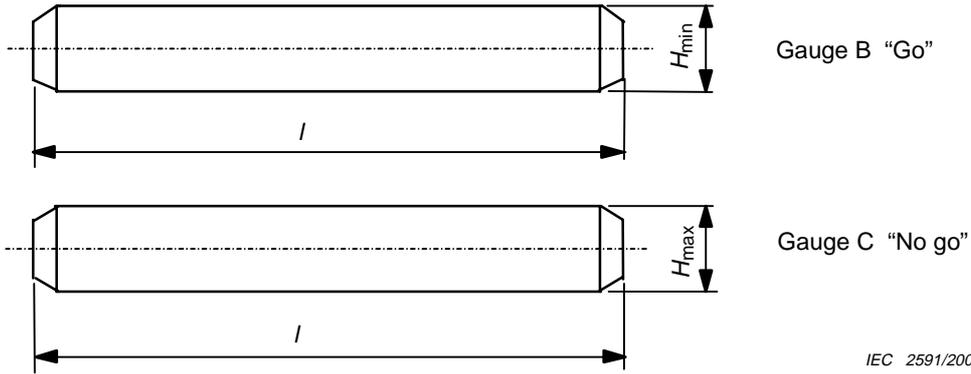
IEC 2590/2000

Figure C.1 – Dimensions of gauge A

Table C.1 – Dimensions of gauge A

Dimensions in millimetres

Size	E			F			2D			r ₁	
	Max.	Min.	Lim.	Max.	Min.	Lim.	Max.	Min.	Lim.	Max.	Min.
P3,3/2,6	2,495	2,480	2,460	1,417	1,405	1,435	1,695	1,683	1,665	0,35	0,25
P4,6/3,1	3,495	3,480	3,460	2,017	2,005	2,035	2,095	2,083	2,065	0,35	0,25
P5,8/3,3	4,495	4,480	4,460	2,517	2,505	2,535	2,195	2,183	2,169	0,35	0,25
P7,4/4,0	5,795	5,780	5,760	3,017	3,005	3,035	2,795	2,783	2,765	0,35	0,25
P9/5	7,495	7,480	7,459	3,917	3,905	3,935	3,595	3,583	3,565	0,35	0,25
P11/7	8,995	8,980	8,959	4,717	4,705	4,735	4,395	4,383	4,365	0,35	0,25
P14/8	11,595	11,577	11,544	6,017	6,005	6,035	5,595	5,583	5,565	0,35	0,25
P18/11	14,895	14,877	14,854	7,620	7,605	7,640	7,195	7,180	7,160	0,35	0,25
P22/13	17,895	17,877	17,854	9,420	9,405	9,440	9,195	9,180	9,160	0,45	0,35
P26/16	21,195	21,174	21,149	11,523	11,505	11,546	10,995	10,977	10,954	0,45	0,35
P30/19	24,995	24,974	24,949	13,523	13,505	13,546	12,995	12,977	12,954	0,45	0,35
P36/22	29,895	29,874	29,849	16,223	16,205	16,246	14,595	14,577	14,554	0,45	0,35



IEC 2591/2000

Figure C.2 – Dimensions of gauges B and C

Table C.2 – Dimensions of gauges B and C

Dimensions in millimetres

Size	l		H_{min}			H_{max}	
	Max.	Min.	Max.	Min.	Lim.	Max.	Min.
P3,3/2,6	–	–	–	–	–	–	–
P4,6/3,1	–	–	–	–	–	–	–
P5,8/3,3	20,5	19,5	0,945	0,936	0,921	1,064	1,055
P7,4/4,0	20,5	19,5	1,045	1,036	1,021	1,164	1,155
P9/5	20,5	19,5	1,995	1,986	1,971	2,214	2,205
P11/7	20,5	19,5	1,995	1,986	1,971	2,214	2,205
P14/8	20,5	19,5	2,995	2,985	2,971	3,214	3,205
P18/11	20,5	19,5	2,995	2,985	2,971	3,214	3,205
P22/13	20,5	19,5	4,395	4,383	4,365	4,717	4,705
P26/16	30,5	29,5	5,395	5,383	5,365	5,717	5,705
P30/19	30,5	29,5	5,395	5,383	5,365	5,717	5,705
P36/22	30,5	29,5	5,395	5,383	5,365	5,717	5,705

NOTE 1 The dimensions indicated as "Min." and "Max." give the manufacturing tolerance; that indicated as "Lim." gives the wear limit permissible for the gauge.

NOTE 2 The dimensions have not been converted by applying the conversion method directly from the corresponding dimensions of the pot-cores on the basis of the difference stated for the millimetres gauges, rounded to four decimal places in the inch system. Therefore, the use of these gauges is restricted to checking only pot-cores manufactured in the same dimensional system, which means that gauges manufactured with millimetre dimensions can only be used for checking pot-cores with millimetre dimensions.

C.2 Procedure and requirements

A pair of pot-core halves is placed around the appropriate gauge A (see figure C.1). For cores with a centre hole, gauge B is inserted with gauge A still in position. These two core halves, when pressed together without forcing, shall meet at the outer ring without an air gap.

Gauge C (see figure C.2) shall not pass through the centre hole of either pot-core half.

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