

INTERNATIONAL STANDARD

**Ferrite cores – Guidelines on dimensions and the limits of surface
irregularities –
Part 5: EP-cores and associated parts for use in inductors and transformers**

IECNORM.COM : Click to view the full PDF of IEC 63093-5:2018



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IECNORM.COM : Click to view the full PDF of IEC 60393-5:2018

INTERNATIONAL STANDARD

**Ferrite cores – Guidelines on dimensions and the limits of surface irregularities –
Part 5: EP-cores and associated parts for use in inductors and transformers**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.100.10

ISBN 978-2-8322-5833-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	5
3 Terms and definitions	5
4 Primary dimensions	6
4.1 General.....	6
4.2 Dimensions of EP-cores.....	6
4.2.1 Principal dimensions.....	6
4.2.2 Effective parameter and $A_{\min}$ values	6
4.3 Dimensional limits for coil formers.....	7
4.4 Pin locations and base outlines.....	8
5 Limits of surface irregularities.....	9
5.1 General.....	9
5.2 Examples of surface irregularities	9
5.3 Chips and ragged edges	10
5.3.1 General	10
5.3.2 Chips and ragged edges on the mating surfaces.....	10
5.3.3 Chips and ragged edges on the other surfaces	10
5.4 Cracks	13
5.5 Flash	13
5.6 Pull-outs	13
5.7 Crystallites.....	14
5.8 Pores	15
Annex A (normative) EP-core design	16
A.1 General.....	16
A.2 Pin location and base outlines	16
Bibliography.....	17
Figure 1 – Principal dimensions of EP-cores	6
Figure 2 – Main dimensions of coil formers for EP-cores.....	7
Figure 3 – Pin locations (SMD type) viewed from the upper side of the board	8
Figure 4 – Pin locations (PTH type) viewed from the underside of the board	9
Figure 5 – Examples of surface irregularities	10
Figure 6 – Chip location for EP-cores.....	11
Figure 7 – Crack and pull-out locations for EP-cores.....	13
Figure 8 – Crystallite location for EP-cores	14
Figure 9 – Pore location for EP-cores	15
Table 1 – Principal dimensions of EP-cores	6
Table 2 – Effective parameter and $A_{\min}$ values.....	7
Table 3 – Dimensional limits for coil formers for EP-cores.....	7
Table 4 – Area and length reference for visual inspection	12
Table 5 – Limits for cracks	14

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FERRITE CORES – GUIDELINES ON DIMENSIONS
AND THE LIMITS OF SURFACE IRREGULARITIES –****Part 5: EP-cores and associated parts for use
in inductors and transformers**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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.
- 2) The formal decisions or agreements of 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 63093-5 has been prepared by IEC technical committee 51: Magnetic components, ferrite and magnetic powder materials.

This first edition cancels and replaces the first edition of IEC 62317-5 published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 62317-5:2015:

- a) addition of the limits of surface irregularities.

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

CDV	Report on voting
51/1212/CDV	51/1233/RVC

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 63093 series, published under the general title *Ferrite cores – Guidelines on dimensions and the limits of surface irregularities*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

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

IECNORM.COM : Click to view the full PDF of IEC 63093-5:2018

FERRITE CORES – GUIDELINES ON DIMENSIONS AND THE LIMITS OF SURFACE IRREGULARITIES –

Part 5: EP-cores and associated parts for use in inductors and transformers

1 Scope

This part of IEC 63093 specifies the dimensions that are of importance for mechanical interchangeability for a preferred range of EP-cores made of ferrite, the essential dimensions of coil formers to be used with them and the locations of their terminal pins on a 2,50 mm printed wiring grid in relation to the base outlines of the cores and the effective parameter values to be used in calculations involving them. It also gives guidelines on allowable limits of surface irregularities applicable to EP-cores.

The specifications contained in this document are useful in negotiations between ferrite core manufacturers and users about surface irregularities.

The general considerations upon which the design of this range of cores is based are as given in Annex A.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 60401-1, *Terms and nomenclature for cores made of magnetically soft ferrites – Part 1: Terms used for physical irregularities*

IEC 60424-1, *Ferrite cores – Guidelines on the limits of surface irregularities – Part 1: General specification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60401-1 and IEC 60424-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Primary dimensions

4.1 General

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

4.2 Dimensions of EP-cores

4.2.1 Principal dimensions

The principal dimensions of EP-cores shall be those given in Figure 1 and Table 1.

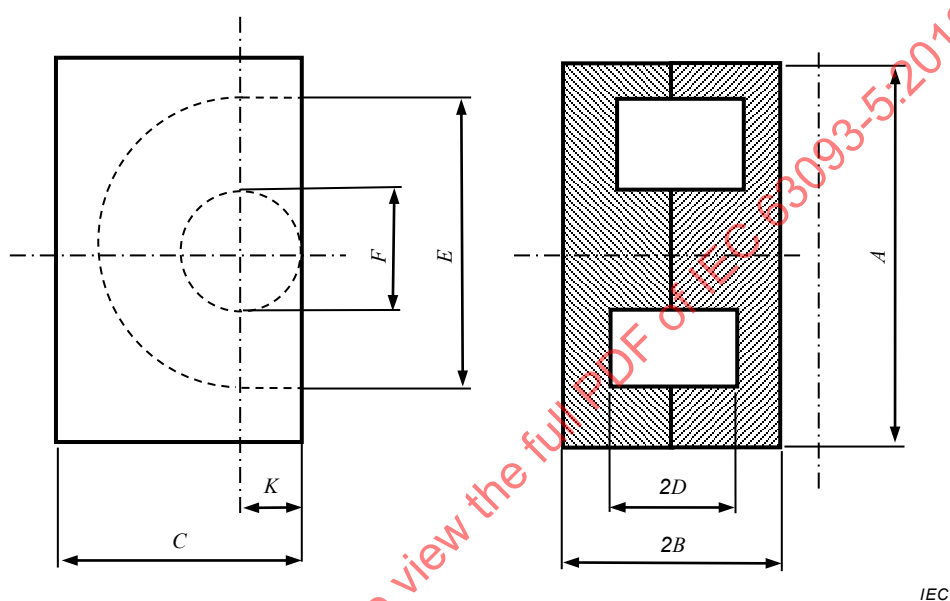


Figure 1 – Principal dimensions of EP-cores

Table 1 – Principal dimensions of EP-cores

Size	A mm		C mm		K mm	E mm		F mm		2B mm		2D mm	
	Min.	Max.	Min.	Max.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
EP5	5,85	6,15	3,70	3,90	1,00	4,25	4,55	1,60	1,80	5,50	5,70	3,80	4,20
EP7	9,00	9,40	6,20	6,50	1,80	7,20	7,60	3,20	3,40	7,30	7,50	5,00	5,40
EP10	11,2	11,8	7,45	7,85	1,95	9,20	9,60	3,15	3,45	10,0	10,4	7,20	7,60
EP13	12,2	12,8	8,60	9,00	2,50	9,70	10,3	4,20	4,50	12,7	13,0	9,00	9,40
EP17	17,6	18,4	10,75	11,25	3,45	11,6	12,4	5,50	5,85	16,6	17,0	11,0	11,6
EP20	23,5	24,5	14,6	15,3	4,70	16,1	16,9	8,50	9,00	21,2	21,6	14,0	14,6
EP30	30,5	31,5	22,6	23,6	7,85	23,6	24,4	14,5	15,0	29,7	30,0	23,0	23,8

4.2.2 Effective parameter and $A_{\min}$ values

The effective parameter values of a pair of cores having the dimensions given in 4.2.1 are as shown in Table 2. For the definitions of these parameters and their calculations, reference shall be made to IEC 60205.

Table 2 – Effective parameter and $A_{\min}$ values

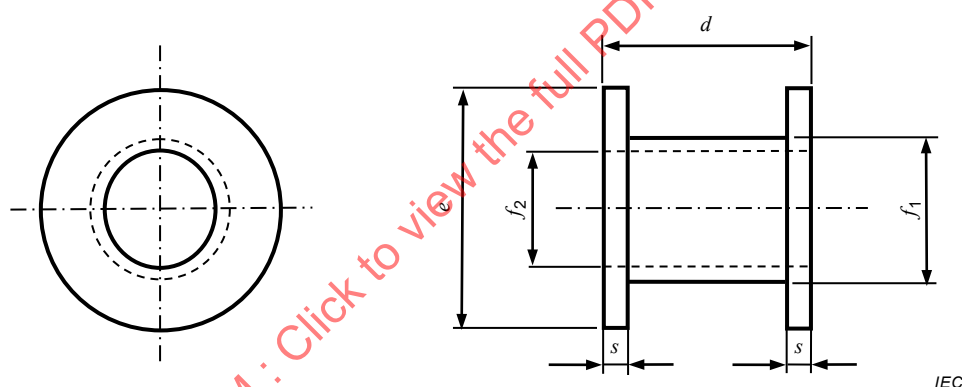
Size	C_1 mm ⁻¹	C_2 mm ⁻³	l_e mm	A_e mm ²	V_e mm ³	$A_{\min}^a$ mm ²
EP5	3,255 8	$1\,080,4 \times 10^{-3}$	9,81	3,01	29,6	2,27
EP7	1,479 9	$138,76 \times 10^{-3}$	15,8	10,7	168	8,55
EP10	1,726 5	$152,21 \times 10^{-3}$	19,6	11,3	222	8,55
EP13	1,264 2	$64,783 \times 10^{-3}$	24,7	19,5	481	14,9
EP17	0,854 96	$25,187 \times 10^{-3}$	29,0	33,9	985	25,3
EP20	0,518 14	$6,603\,8 \times 10^{-3}$	40,7	78,5	3 190	60,1
EP30	0,353 76	$1,990\,1 \times 10^{-3}$	62,9	178	11 200	128

NOTE The above values have been calculated using the method given in IEC 60205.

^a $A_{\min}$ is selected as the smallest value among A_1, A_2, A_3, A_4 and A_5 using the mean value of each dimension.

4.3 Dimensional limits for coil formers

The main dimensions of coil formers suitable for use with a pair of EP-cores shall be as given in Figure 2 and Table 3.

**Figure 2 – Main dimensions of coil formers for EP-cores****Table 3 – Dimensional limits for coil formers for EP-cores**

Size	e mm		f_1 mm		f_2 mm		d mm		s mm	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
EP5	4,00	4,20	2,65	2,85	1,85	2,05	3,50	3,70	0,30	0,50
EP7	6,70	7,00	4,30	4,70	3,60	3,80	4,45	4,75	0,60	0,80
EP10	8,60	9,00	4,65	4,95	3,60	3,80	6,70	7,00	0,50	0,70
EP13	9,30	9,60	5,55	5,85	4,60	4,80	8,60	8,90	0,45	0,65
EP17	11,1	11,4	7,05	7,35	6,00	6,30	10,6	10,9	0,55	0,75
EP20	15,6	15,9	10,0	10,3	9,10	9,40	13,5	13,9	0,55	0,75
EP30	23,1	23,5	16,7	17,0	15,1	15,4	22,5	22,9	0,80	1,00

4.4 Pin locations and base outlines

Pin locations and base outlines shall be as shown in Figure 3, in which the base is viewed in the mounting direction, i.e. from the upper side of the printed wiring board, and in Figure 4, in which the base is viewed from the pin side, i.e. from the underside of the printed wiring board.

Dimensions in millimetre

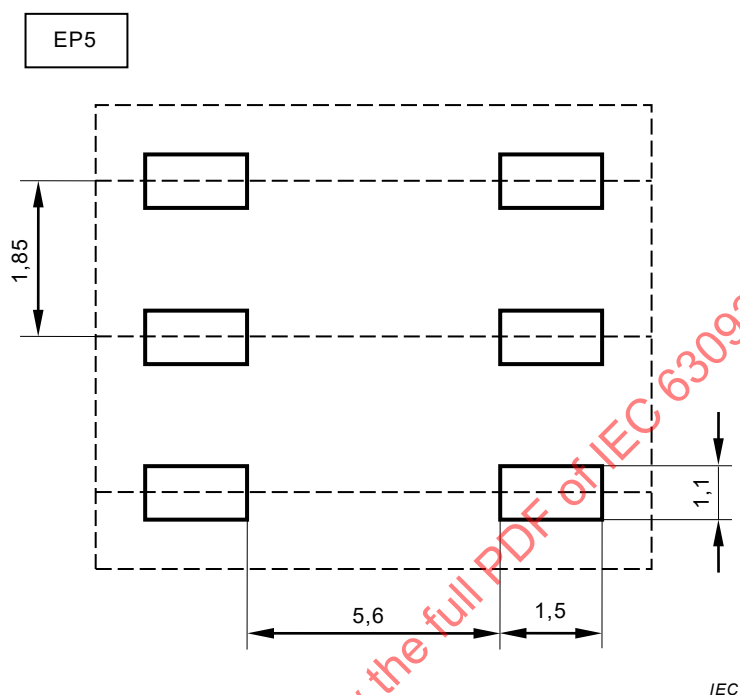
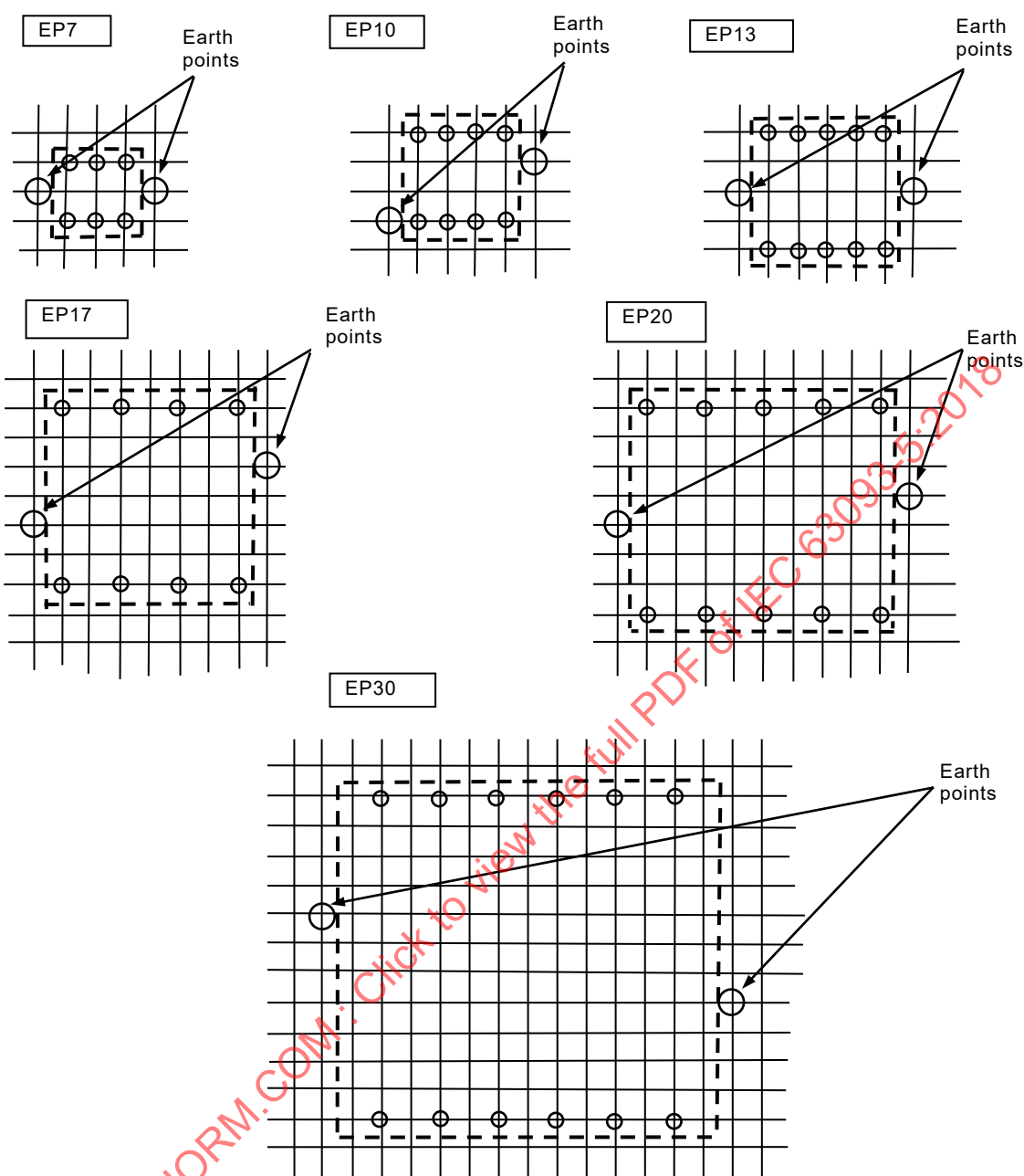


Figure 3 – Pin locations (SMD type) viewed from the upper side of the board



NOTE 2,50 mm grids.

Figure 4 – Pin locations (PTH type) viewed from the underside of the board

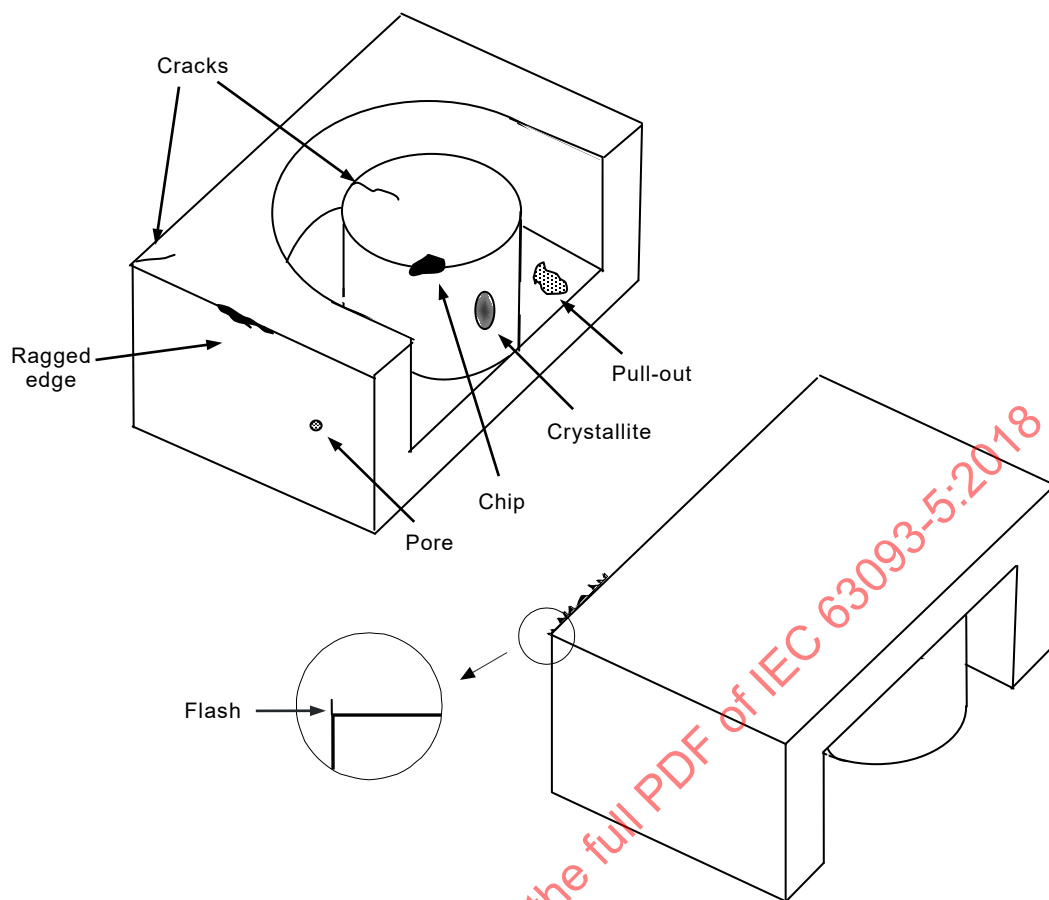
5 Limits of surface irregularities

5.1 General

Surface irregularities are defined in IEC 60424-1.

5.2 Examples of surface irregularities

Figure 5 shows different examples of surface irregularities of an EP-core.



IEC

Figure 5 – Examples of surface irregularities

5.3 Chips and ragged edges

5.3.1 General

The minimum area is taken as 0,5 mm², to be distinguishable to the naked eye.

5.3.2 Chips and ragged edges on the mating surfaces

The areas of the chips located on the mating surfaces (chip 1 and chip 1' irregularities in Figure 6) shall not exceed the following limits:

- the cumulative area of the chips shall be less than 4 % of the relevant mating surface. The mating surface of ring and centre pole are considered separately;
- the total length of the ragged edges shall be less than 25 % of the perimeter of the relevant surface.

5.3.3 Chips and ragged edges on the other surfaces

The allowable areas of chips on the other surfaces are doubled as compared to the limits for the mating surface of the ring (outer leg); see Figure 6. The rule for ragged edges is the same as that for the mating surface.

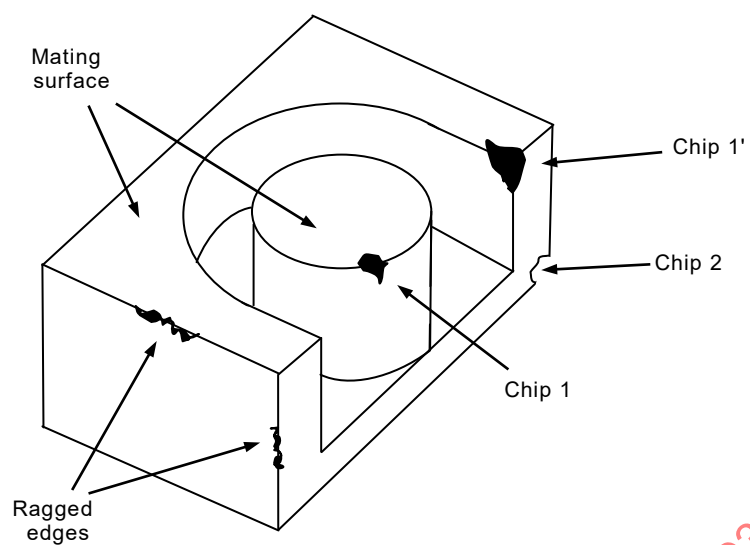


Figure 6 – Chip location for EP-cores

IECNORM.COM : Click to view the full PDF of IEC 63093-5:2018

Area and length reference for visual inspection is given in Table 4.

Table 4 – Area and length reference for visual inspection

Area	A	B	C	D	E	Area	A	B	C	D	E
0,5 mm ²	•	■	▬	▬	▴	12,5 mm ²	●	■	▬	▬	▴
1,0 mm ²	•	■	▬	▬	▴	15,0 mm ²	●	■	▬	▬	▴
1,5 mm ²	•	■	▬	▬	▴	17,5 mm ²	●	■	▬	▬	▴
2,0 mm ²	•	■	▬	▬	▴	20,0 mm ²	●	■	▬	▬	▴
2,5 mm ²	•	■	▬	▬	▴	25,0 mm ²	●	■	▬	▬	▴
3,0 mm ²	•	■	▬	▬	▴	30,0 mm ²	●	■	▬	▬	▴
3,5 mm ²	•	■	▬	▬	▴	35,0 mm ²	●	■	▬	▬	▴
4,0 mm ²	•	■	▬	▬	▴	40,0 mm ²	●	■	▬	▬	▴
4,5 mm ²	•	■	▬	▬	▴	45,0 mm ²	●	■	▬	▬	▴
5,0 mm ²	•	■	▬	▬	▴	50,0 mm ²	●	■	▬	▬	▴
6,0 mm ²	•	■	▬	▬	▴						
7,0 mm ²	•	■	▬	▬	▴						
8,0 mm ²	•	■	▬	▬	▴						
9,0 mm ²	•	■	▬	▬	▴						
10,0 mm ²	•	■	▬	▬	▴						
Scale 1:1 1 mm – 2 mm – 3 mm – 4 mm – 5 mm – 7,5 mm – 10 mm –											

5.4 Cracks

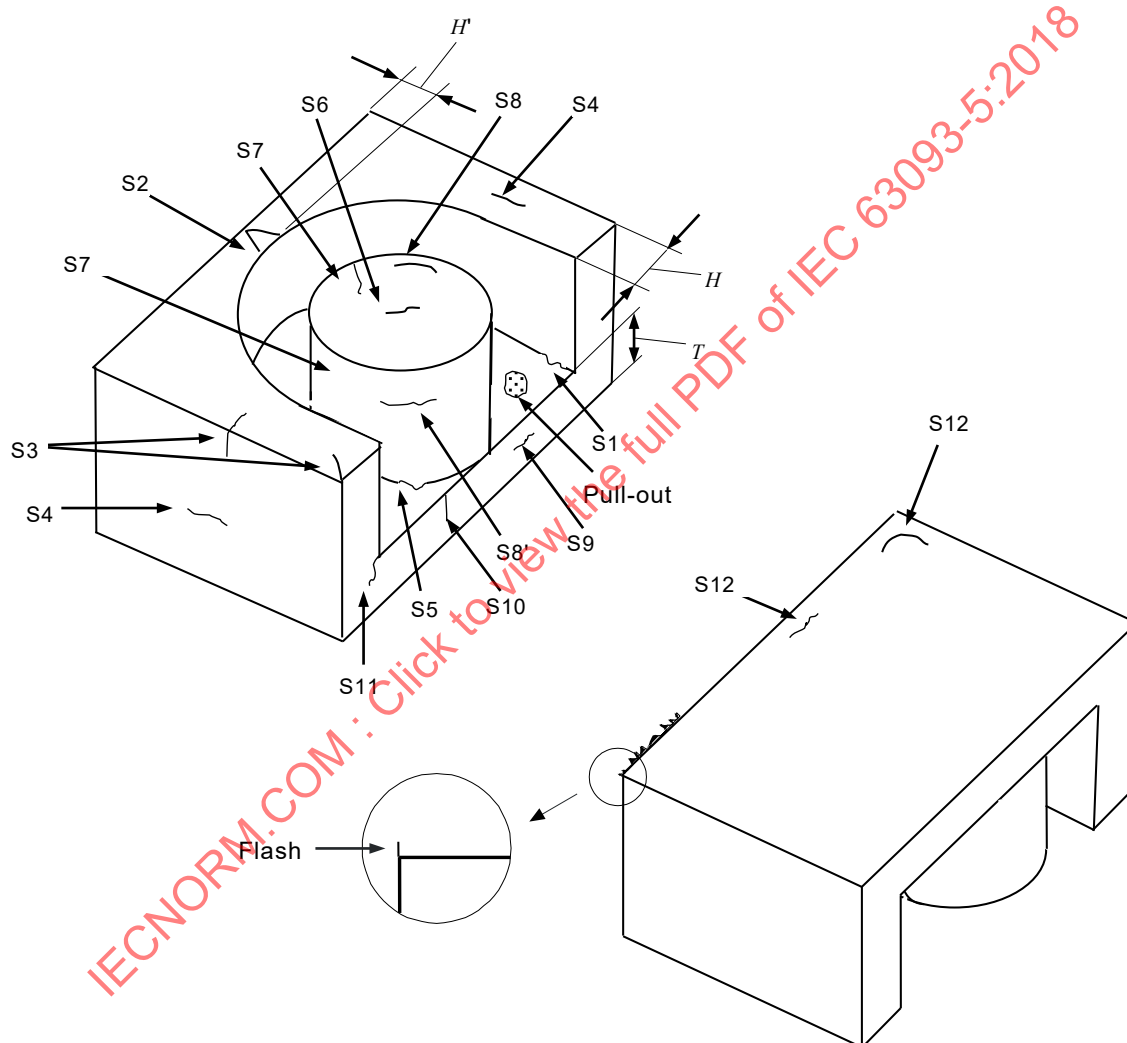
The limits for cracks at various locations shown in Figure 7 are given in Table 5.

5.5 Flash

There shall be no flash extending from the core into the wire slot (see Figure 7).

5.6 Pull-outs

For EP-cores, the cumulative area of pull-outs of the core shall be less than 25 % of the total respective surface area (see Figure 7).



IEC

Figure 7 – Crack and pull-out locations for EP-cores

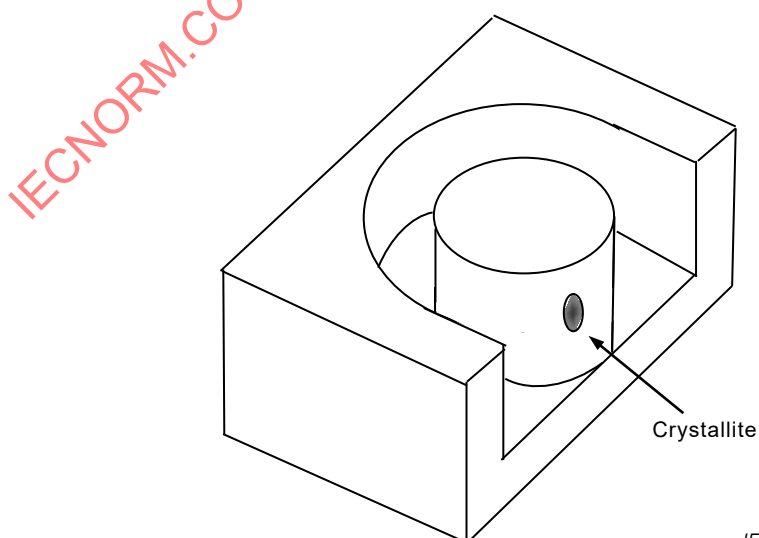
Table 5 – Limits for cracks

Type	Location	Limits for single crack	Limits for multiple cracks
S1	Bottom corner of ring and back wall	10 % of the length of bottom corner of ring (outer leg) and back wall	20 % of the length of bottom corner of ring (outer leg) and back wall
S2	Mating surface of ring, angle shape	50 % of minimum thickness of ring (outer leg)	Minimum thickness of ring (outer leg)
S3	Vertical against ring	50 % of minimum thickness of ring (outer leg)	Minimum thickness of ring (outer leg)
S4	Parallel with ring	Minimum thickness of ring (outer leg)	2 × minimum thickness of ring (outer leg)
S5	Bottom corner of centre pole and back wall	10 % of the length of bottom corner of centre pole and back wall	20 % of the length of bottom corner of centre pole and back wall
S6, S7 and S8	Mating surface of centre pole	20 % of diameter of centre pole	40 % of diameter of centre pole
S8'	Side wall of centre pole, parallel with mating surface	20 % of diameter of centre pole	40 % of diameter of centre pole
S9	Back wall	50 % of dimension T	Dimension T
S10 and S11	Back wall	50 % of dimension T	Dimension T
S12	Back surface	Dimension T	2 × dimension T

5.7 Crystallites

Figure 8 shows an example of crystallite location on EP-cores:

- a single area of the crystallites located on any surface shall be less than 2 % of the respective surface area;
- the cumulative area of the crystallites located on any surface shall be less than 4 % of the respective surface area.



IEC

Figure 8 – Crystallite location for EP-cores

5.8 Pores

Figure 9 shows an example of pore location on EP-cores:

- the number of pores located on the same surface shall not exceed two; the total number of pores located on all surfaces shall not exceed five;
- a hole with an area larger than 1 mm^2 on any surface is not acceptable.

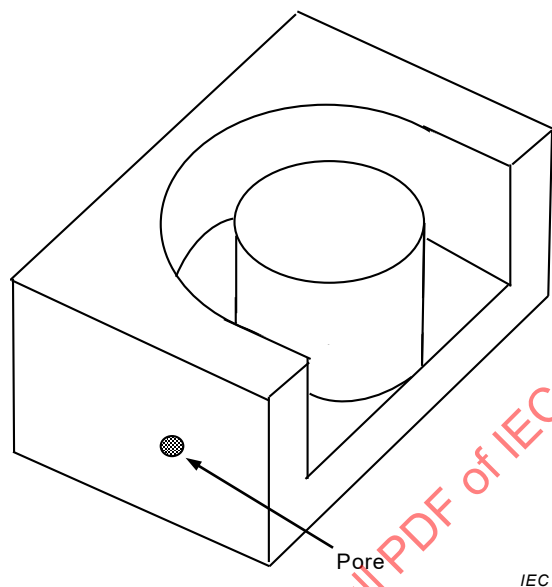


Figure 9 – Pore location for EP-cores