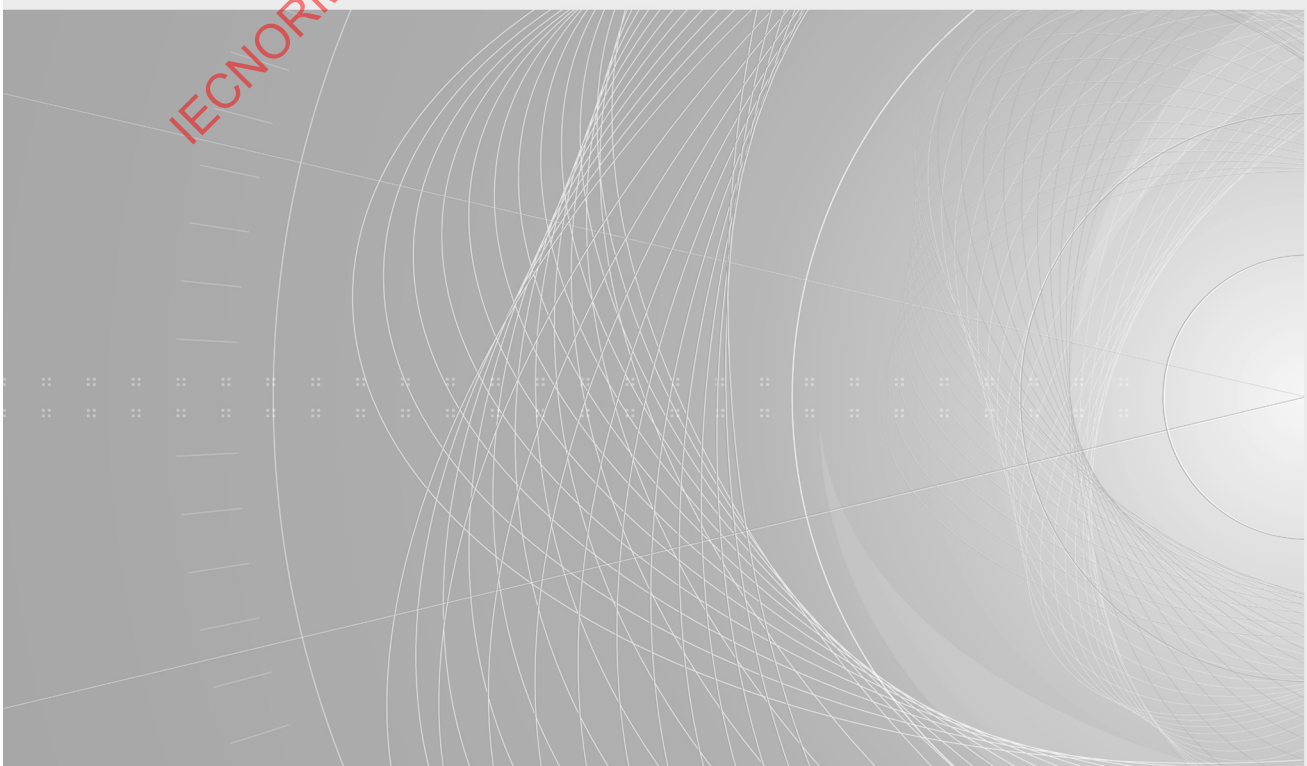
IEC 63093-6

Edition 1.0 2018-06

INTERNATIONAL STANDARD

Ferrite cores – Guidelines on dimensions and the limits of surface irregularities –
Part 6: ETD-cores for use in power supplies



IEC 63093-6:2018-06(en)

IEC Central Office
3, rue de Varembé
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 It also gives information on projects, replaced and withdrawn publications.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.

IEC 63093-6

Edition 1.0 2018-06

INTERNATIONAL STANDARD

Ferrite cores – Guidelines on dimensions and the limits of surface irregularities – Part 6: ETD-cores for use in power supplies

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 29.100.10

ISBN 978-2-8322-5834-7

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

Part 6: ETD-cores for use in power supplies

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 63093-6 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 62317-6 published in 2015 and the second edition of IEC 60424-3 published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 62317-6:2015 and IEC 60424-3:2015:

a) This document integrates IEC 62317-6:2015 and IEC 60424-3:2015;
b) Table 1 – Allowable areas of chips for ETD-cores, of IEC 60424-3:2015, has been moved to Annex C (informative) of this document.

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

CDV	Report on voting
51/1215/CDV	51/1234/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.

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

Part 6: ETD-cores for use in power supplies

1 Scope

This part of IEC 63093 specifies the dimensions that are of importance for mechanical interchangeability for a preferred range of ETD-cores made of ferrite and the essential dimensions of coil formers to be used with them, as well the effective parameter values to be used in calculations involving them. It also gives guidelines on allowable limits of surface irregularities applicable to ETD-cores.

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

The use of derived standards which give more detailed specifications of component parts while still permitting compliance with this document is discussed 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 purpose 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 the mechanical interchangeability of complete assemblies and coil formers.

4.2 Dimensions of ETD-cores

4.2.1 Principal dimensions

The principal dimensions of ETD-cores shall be those given in Figure 1 and Table 1. The dimensions of the cores can be checked by means of gauges. By way of example, possible dimensions for these gauges are given in Annex B. In order to facilitate production, it can be necessary to use gauges with dimensions that differ from those given in Annex B, although no relaxation of the requirements for the dimensions of the cores given in Table 1 is permitted. The dimensions specified in Table 1 are illustrated in Figure 1.

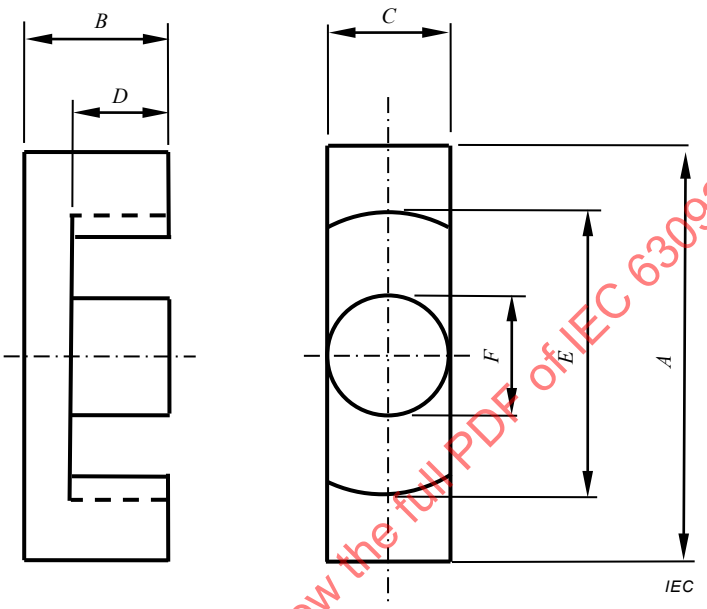


Figure 1 – Dimensions of ETD-cores

Table 1 – Dimensions of ETD-cores

Size	*A* mm		*B* mm		*C* mm		*D* mm		*E* mm		*F* mm	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
ETD 19	19,1	20,1	13,5	13,8	7,2	7,6	9,2	9,6	14,4	15,4	7,2	7,6
ETD 24	23,8	25,0	14,3	14,6	8,2	8,8	9,9	10,3	18,0	19,2	8,2	8,8
ETD 29	29,0	30,6	15,6	16,0	9,2	9,8	10,7	11,3	22,0	23,4	9,2	9,8
ETD 34	33,4	35,0	17,1	17,5	10,5	11,1	11,8	12,4	25,6	27,0	10,5	11,1
ETD 39	38,2	40,0	19,6	20,0	12,2	12,8	14,2	15,0	29,3	30,9	12,2	12,8
ETD 44	43,0	45,0	22,1	22,5	14,4	15,2	16,1	16,9	32,5	34,1	14,4	15,2
ETD 49	47,6	49,8	24,5	24,9	15,9	16,7	17,7	18,5	36,1	37,9	15,9	16,7
ETD 54	53,2	55,8	27,4	27,8	18,5	19,3	19,8	20,6	40,1	42,3	18,5	19,3
ETD 59	58,4	61,2	30,8	31,2	21,2	22,1	22,0	22,9	43,6	45,8	21,2	22,1

4.2.2 Effective parameter and A_{min} values

The effective parameter values of a pair of cores whose dimensions comply with 4.2.1 shall be as given 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
ETD 19	1,253 9	28,412 × 10^{-3}	55,3	44,1	2 440	39,5
ETD 24	1,053 7	17,811 × 10^{-3}	62,3	59,2	3 690	55,0
ETD 29	0,927 07	12,139 × 10^{-3}	70,8	76,4	5 410	70,9
ETD 34	0,814 49	8,387 9 × 10^{-3}	79,1	97,1	7 680	91,6
ETD 39	0,742 00	5,940 1 × 10^{-3}	92,7	125	11 600	123
ETD 44	0,599 18	3,462 8 × 10^{-3}	104	173	17 900	172
ETD 49	0,542 45	2,569 2 × 10^{-3}	115	211	24 200	209
ETD 54	0,455 01	1,625 1 × 10^{-3}	127	280	35 700	280
ETD 59	0,382 24	1,038 9 × 10^{-3}	141	368	51 700	366

NOTE 1 Manufacturers can indicate more precise values in their catalogues than those given in Table 2.

NOTE 2 The above values have been calculated using the method given in IEC 60205.

[a] IEC 60205 shall be referred to for the definition of A_{min}.

4.3 Dimensional limits for coil formers

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

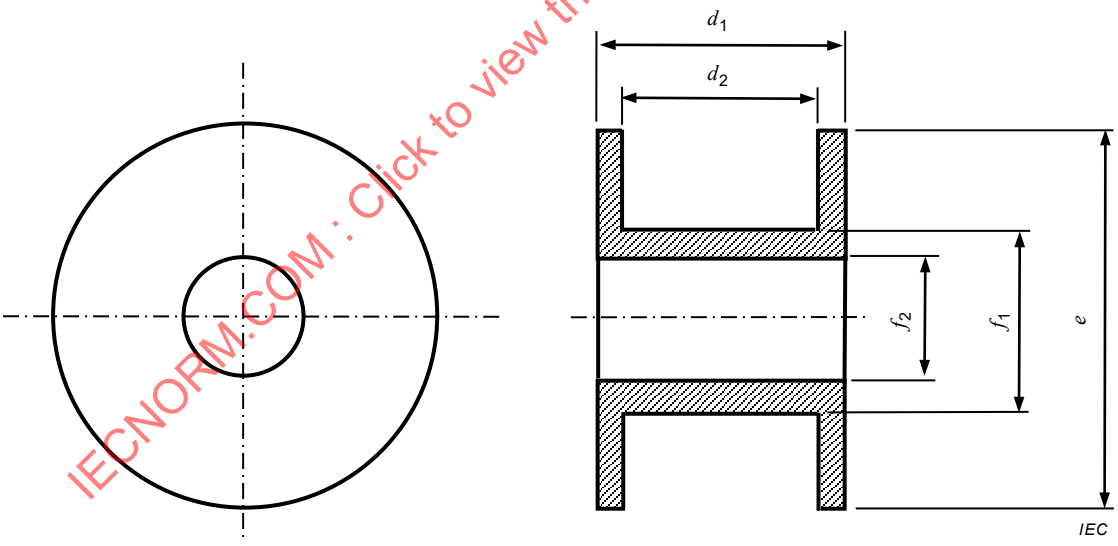


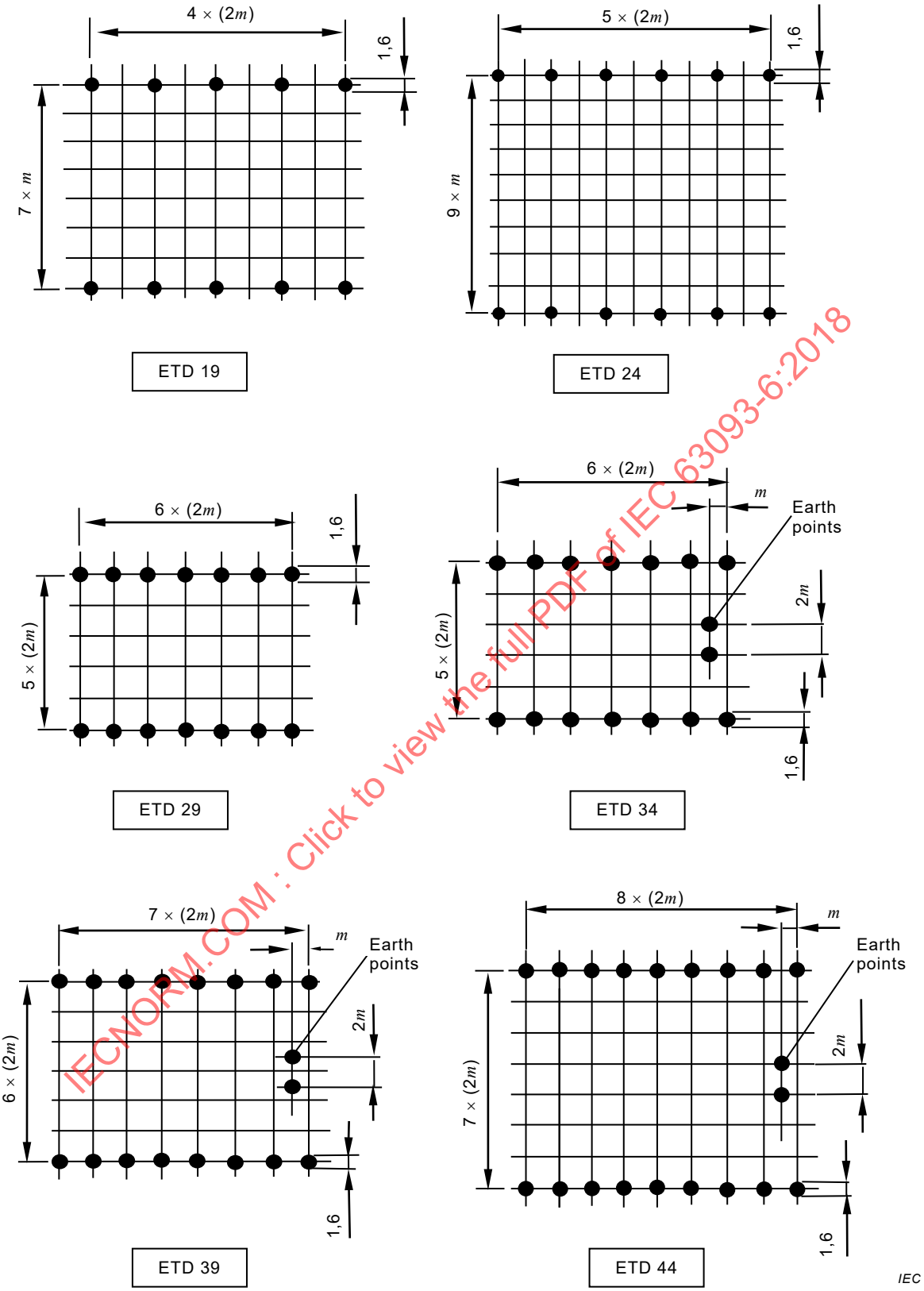
Figure 2 – Essential dimensions of coil formers

Table 3 – Dimensional limits for coil formers

Size	e mm	f_1 mm	f_2 mm	d_1 mm	d_2 mm
	Max.	Max.	Min.	Max.	Min.
ETD 19	14,1	9,8	7,8	18,2	15,9
ETD 24	17,6	11,0	9,0	19,6	17,1
ETD 29	21,6	12,0	10,0	21,2	18,7
ETD 34	25,2	13,6	11,3	23,4	20,9
ETD 39	28,8	15,3	13,0	28,2	25,7
ETD 44	32,0	17,7	15,4	32,0	29,5
ETD 49	35,5	19,5	17,0	35,2	32,2
ETD 54	39,5	22,1	19,6	39,3	36,3
ETD 59	43,0	24,9	22,4	43,7	40,7

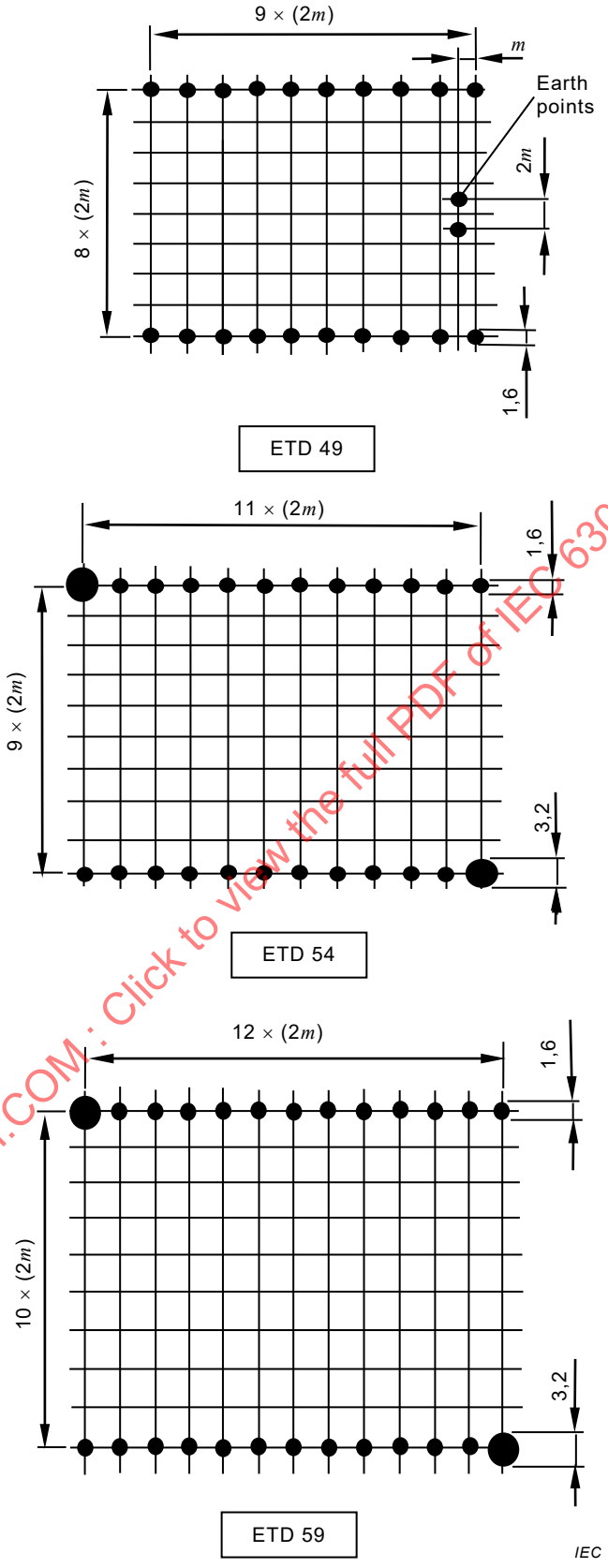
4.4 Pin locations and base outlines

These 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.



The module, designated as m, as shown in the grid plan, may be 2,50 mm or 2,54 mm.

Figure 3 – Pin locations and base outlines viewed from the upper-side of the board *(1 of 2)*



The module, designated as m, as shown in the grid plan, may be 2,50 mm or 2,54 mm.

Figure 3 *(2 of 2)*

4.5 Pin diameter

Coil former terminations (pins) shall be accepted by a gauge with 1,2 mm holes on a true position.

5 Marking

Where a coil former is fitted with termination pins conforming to a 2,50 mm module, it shall be clearly and indelibly marked with the letter m, in such a position that it can be readily seen in the completed component.

6 Mounting

According to their sizes and respective weights, it is recommended that two of the largest cores (ETD 54 and ETD 59) be fixed on the printed board by means of screws located at two opposite sides of their coil formers.

Concerning smaller sizes such as ETD 19 and ETD 24, no mounting assemblies are defined. It is recommended that the two cores be fixed by glue or adhesive tape.

7 Limits of surface irregularities

7.1 General

Surface irregularities are defined in IEC 60424-1.

7.2 Examples of surface irregularities

Figure 4 shows different examples of surface irregularities of an ETD-core.

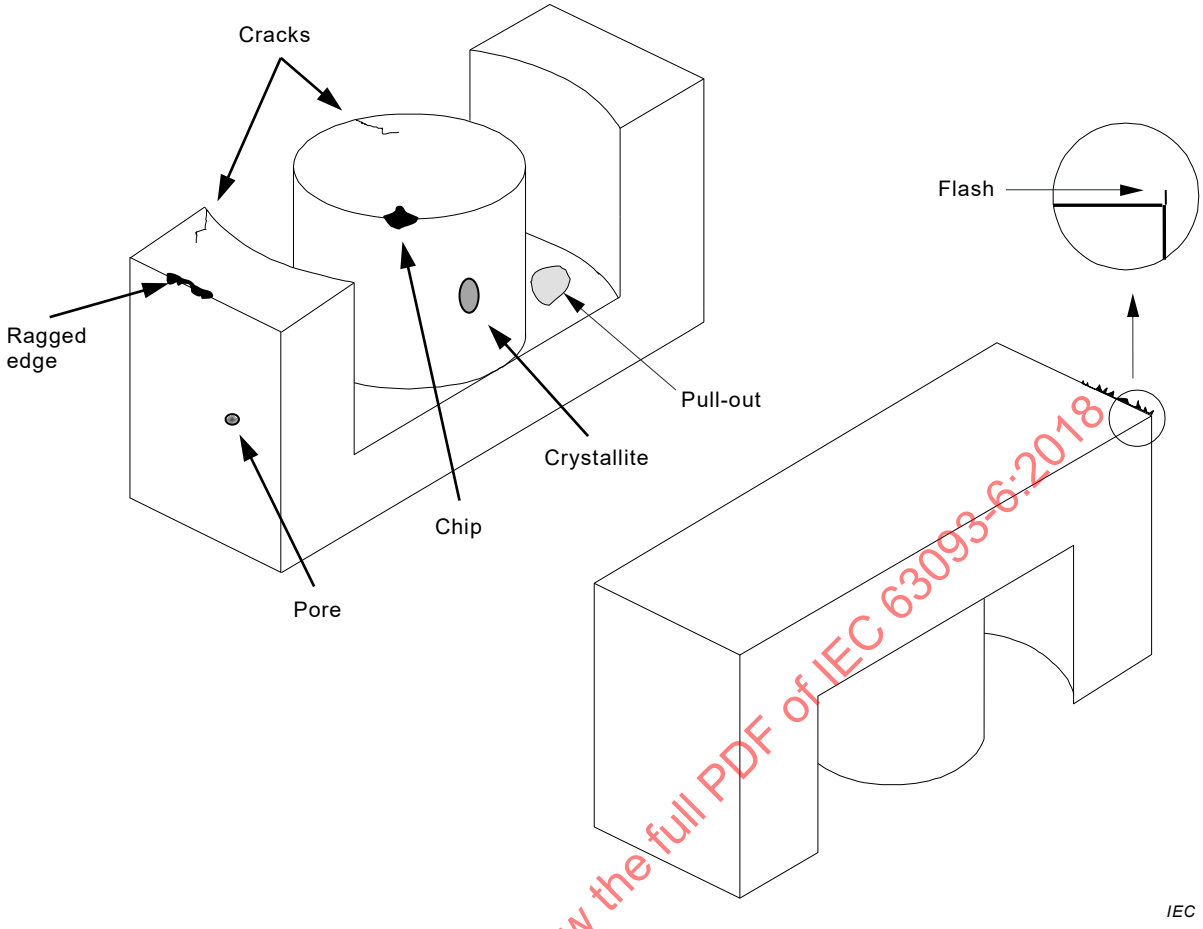


Figure 4 – Examples of surface irregularities

7.3 Chips and ragged edges

7.3.1 General

The minimum area is taken as 0,5 mm^2, to be distinguishable to the naked eye.

Examples of allowable areas of chips are given in Annex C.

7.3.2 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 5) shall not exceed the following limits:

- the cumulative area of the chips shall be less than 6 % of the mating surface (whether gapped or ungapped) of the centre pole;
- the total length of the ragged edges shall be less than 25 % of the perimeter of the relevant surface.

7.3.3 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 (see Figure 5).

The rule for ragged edges is the same as that for the mating surface.

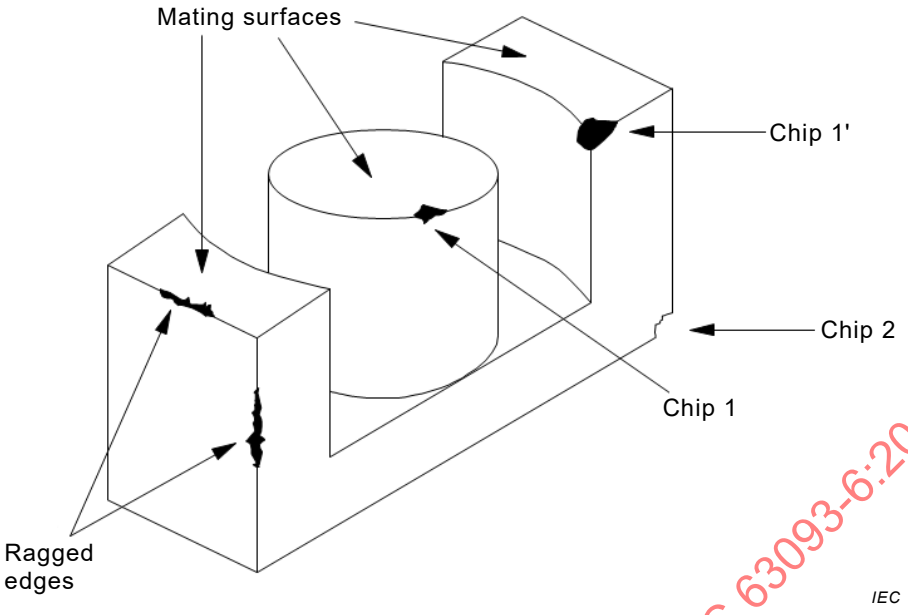
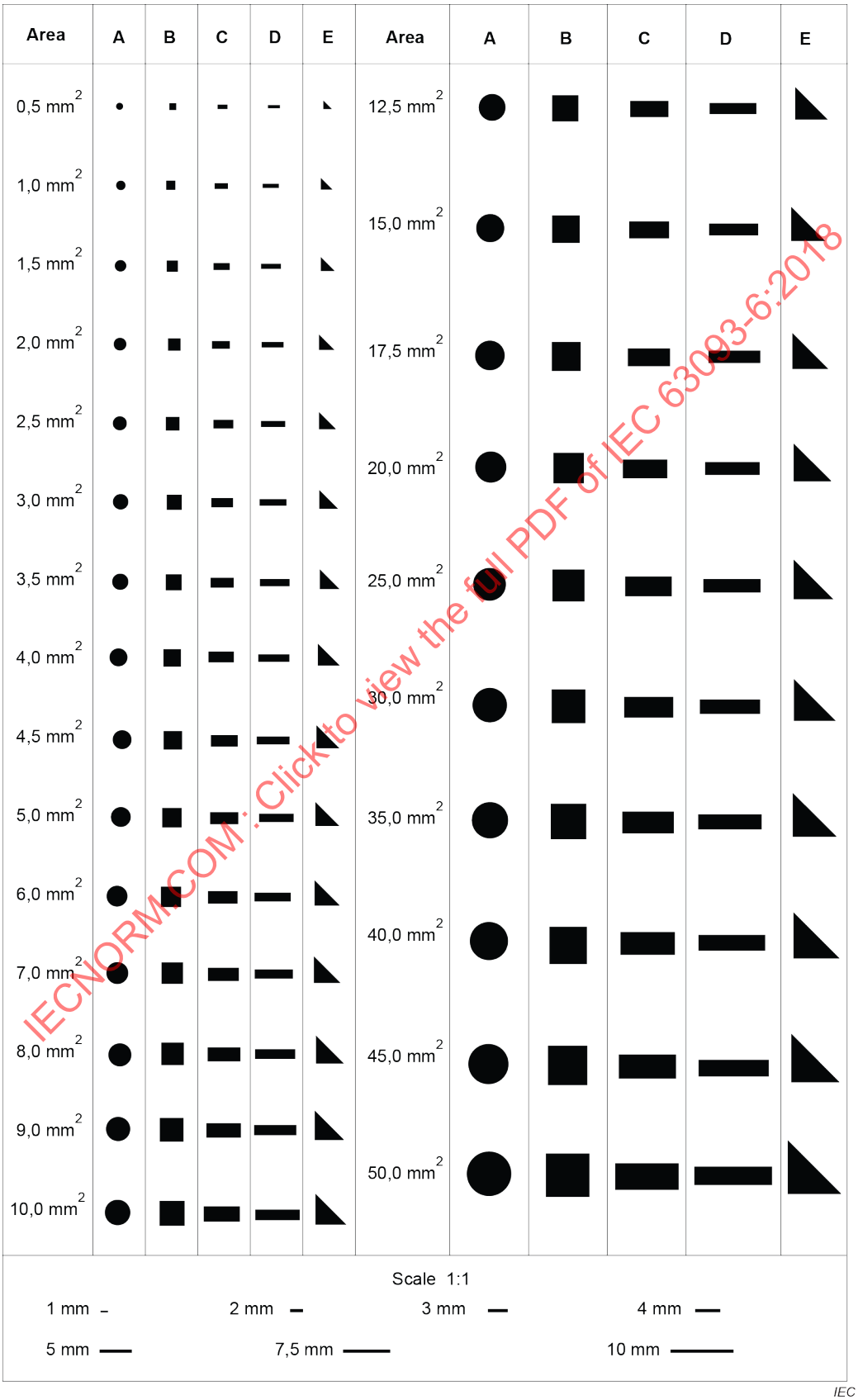


Figure 5 – Chip location for ETD-cores

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

Table 4 – Area and length reference for visual inspection



IEC

7.4 Cracks

The limits for cracks at various locations shown in Figure 6 are given in Table 5.

7.5 Flash

There shall be no flash extending from the core into the wire slot (see Figure 6).

7.6 Pull-outs

For ETD-cores, the cumulative area of pull-outs of the core shall be less than 25 % of the total respective surface area (see Figure 6).

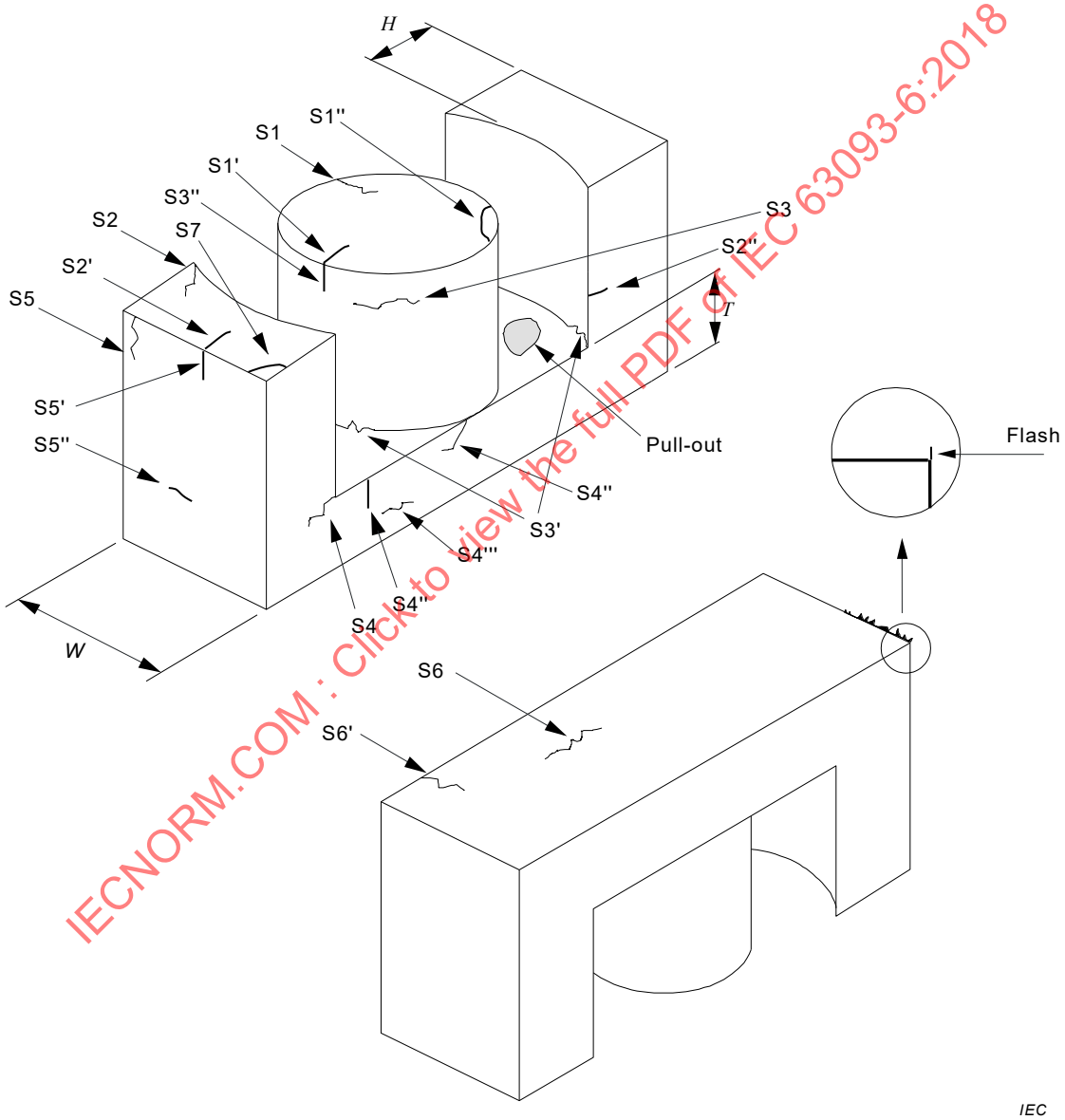


Figure 6 – Crack and pull-out locations for ETD-cores

Table 5 – Limits for cracks

Type	Location	Limits for single crack	Limits for multiple cracks
S1 and S1'	Mating surface of centre pole	< 25 % of dimension W	< 50 % of dimension W
S1"	Corner of centre pole	Not acceptable	Not acceptable
S2 and S2'	Mating surface of outer leg	< 25 % of dimension H	< 25 % of dimension H
S2"	Side of outer leg	< 25 % of dimension H	< 25 % of dimension H
S3 and S3"	Centre pole	< 25 % of dimension W	< 25 % of dimension W
S3'	Bottom corner of centre pole / back wall and outer leg/back wall	< 25 % of dimension W	< 25 % of dimension W
S4	Bottom corner of outer leg / back wall	< 25 % of dimension T	< 25 % of dimension T
S4' and S4"	Back wall	< 25 % of dimension T	< 25 % of dimension T
S4"'	Back wall	< 50 % of dimension W	< 100 % of dimension W
S5 and S5' and S5"	Outer leg	< 50 % of dimension W	< 100 % of dimension W
S6	Back surface	< 50 % of dimension W	< 100 % of dimension W
S6'	Back surface	< 25 % of dimension W	< 25 % of dimension W
S7	Corner of outer leg	Not acceptable	Not acceptable

7.7 Crystallites

Figure 7 shows an example of crystallite location on ETD-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 (see Figure 7).

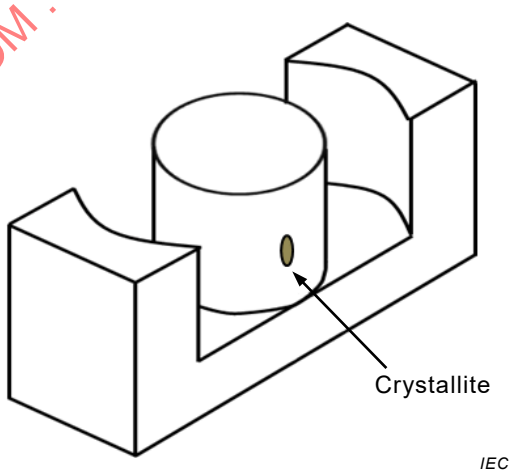


Figure 7 – Crystallite location for ETD-cores

7.8 Pores

Figure 8 shows an example of pore location on ETD-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.

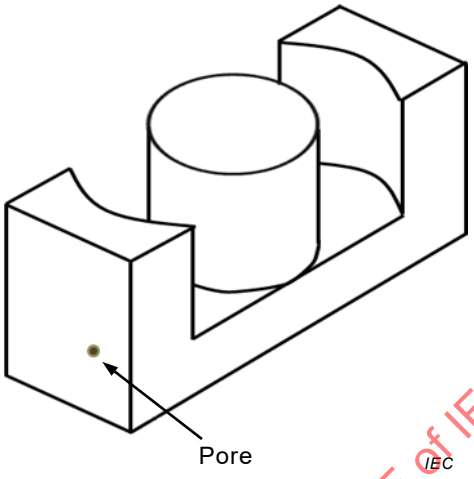


Figure 8 – Pore location for ETD-cores

Annex A
(normative)

Derived standards

Clauses 4 to 5 of this document establish the values for the principal dimensions of core assemblies and wound coil formers and enable full interchangeability for components complying with this document to be achieved.

Parties interested in making or using ETD-cores may find it desirable to lay down local standards for everyday use that show the dimensions and tolerances in greater detail than those in Clause 4 and 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 ETD-core meeting the requirements in this document that would also satisfy the performance specification valid for a specific case.

It should be noted that, even if a component complies with a derived standard and with the requirements of Clause 4 of this document, therefore permitting core assemblies and coil formers to be freely interchanged, its constituent parts may not necessarily be interchangeable.

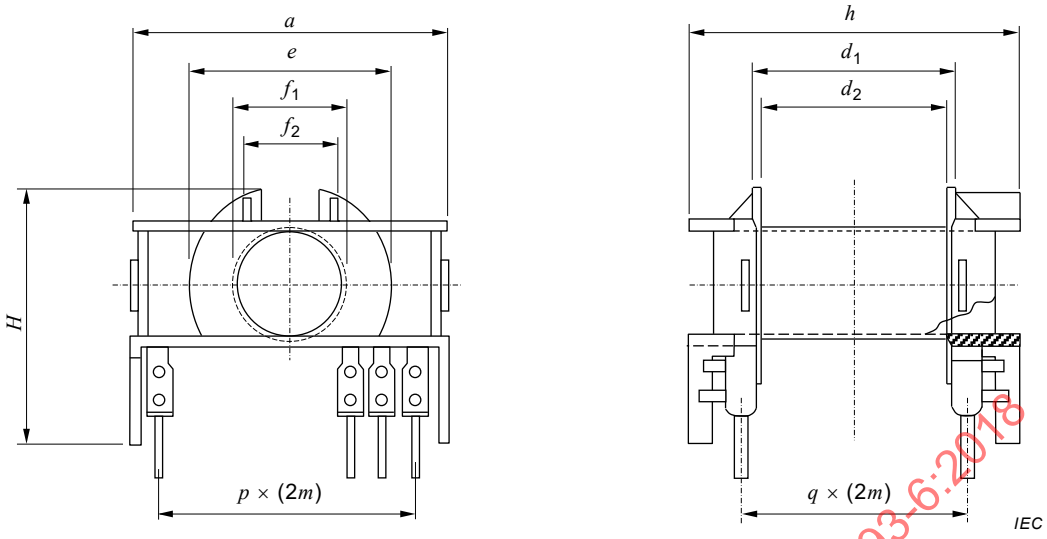
When requirements lead to the establishment of a national standard, the relevant national standardization body is strongly requested to insert a note in such a national standard stating that:

a) the national standard is in accordance with the dimensional requirements of IEC 63093-6, but that more details are given in order to promote the practical use of the standard;

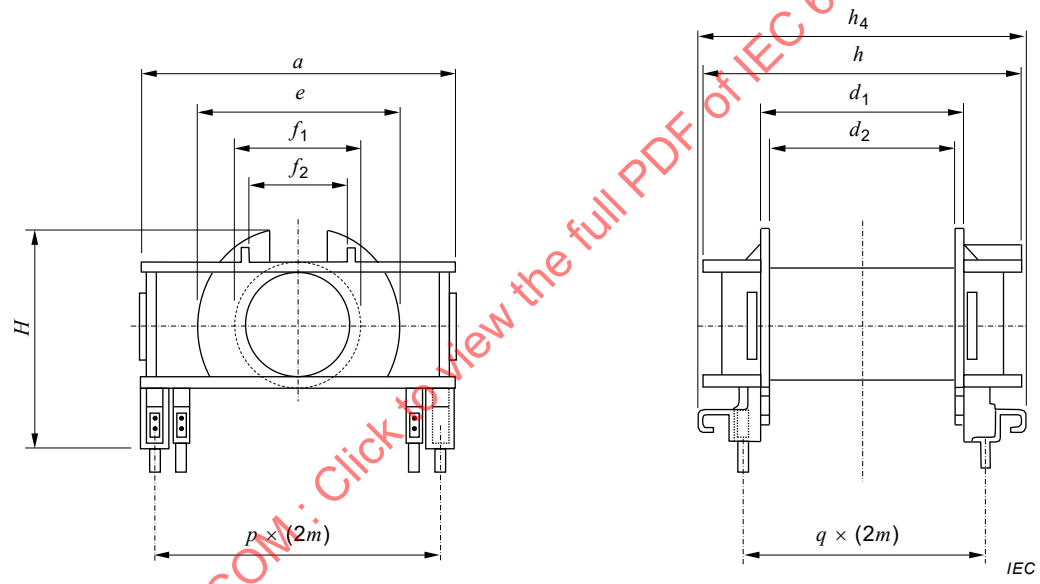
b) other solutions are possible within the framework of IEC 63093-6, and should not be excluded if the resulting cores and coil formers are functionally interchangeable with those in accordance with the national standard.

By way of example, a possible derived standard for coil formers is given in Figure A.1.

An example of a standard for the main dimensions of coil formers for ETD-cores meeting the requirements of this document is given in Figure A.1 and Table A.1.



a) ETD-cores ETD 29, ETD 34, ETD 39, ETD 44 and ETD 49



b) ETD-cores ETD 54 and ETD 59

The module, designated as m, may be 2,50 mm or 2,54 mm.

Figure A.1 – Main dimensions of coil formers