

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Ferrite cores – Guidelines on the limits of surface irregularities –
Part 4: Ring-cores**

**Noyaux ferrites – Lignes directrices relatives aux limites des irrégularités de
surface –
Partie 4: Noyaux toriques**



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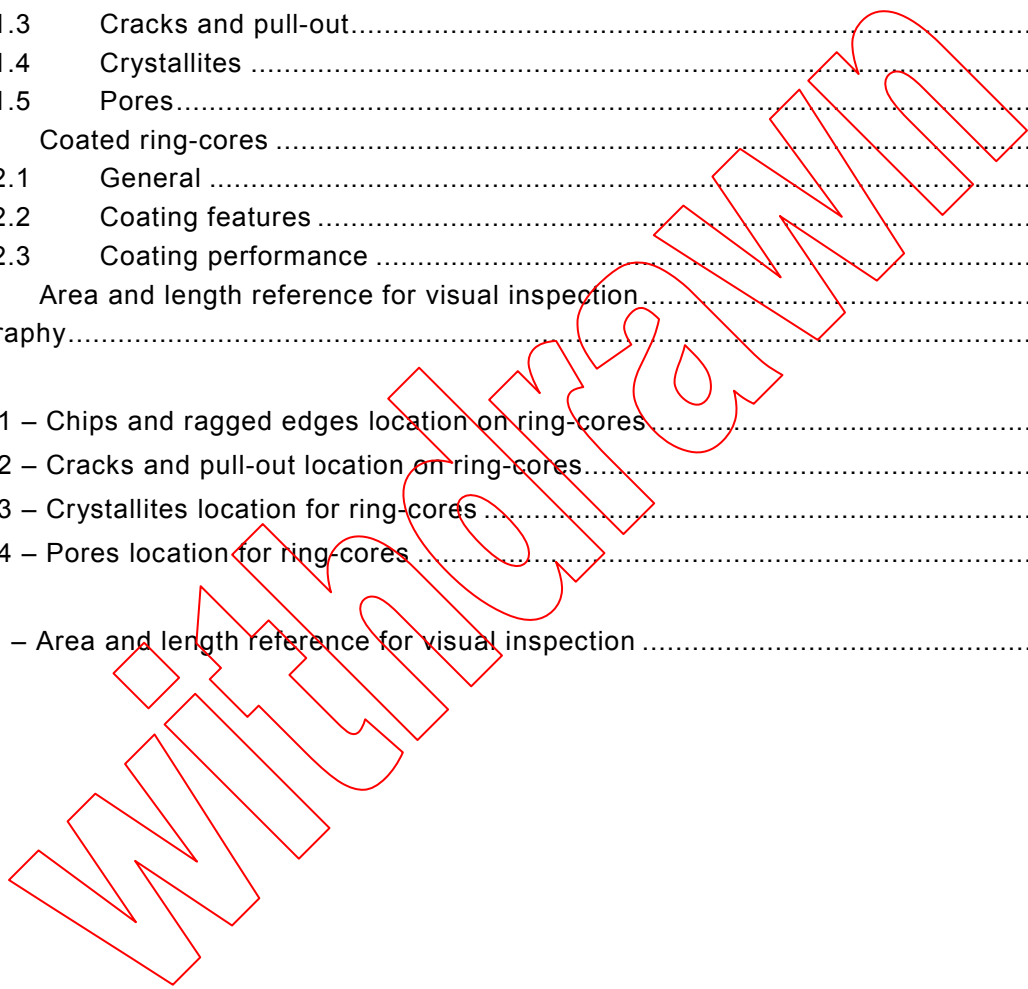
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FERRITE CORES – GUIDELINES ON THE LIMITS
OF SURFACE IRREGULARITIES –****Part 4: Ring-cores**

FOREWORD

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International Standard IEC 60424-4 has been prepared IEC technical committee 51: Magnetic components and ferrite materials.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

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

- a) addition of crystallites in 3.1.3 and of pores in 3.1.4.

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

FDIS	Report on voting
51/1109/FDIS	51/1124/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.

A list of all parts in the IEC 60424 series, published under the general title *Ferrite cores – Guidelines on the limits of surface irregularities*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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

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- withdrawn,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

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FERRITE CORES – GUIDELINES ON THE LIMITS OF SURFACE IRREGULARITIES –

Part 4: Ring-cores

1 Scope

This part of IEC 60424 gives guidance on allowable limits of surface irregularities applicable to ring-cores in accordance with the relevant generic specification defined in IEC 60424-1.

This standard is considered as a sectional specification useful in the negotiations between ferrite core manufacturers and customers about surface irregularities.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Void.

3 Limits of surface irregularities

3.1 Uncoated ring-cores

3.1.1 General

Generally, uncoated ring-cores are smoothed (for example: by tumbling) to remove any significant flash and to add radius to edges that would otherwise be sharp due to tooling angles. Tooling angles exist where the compaction punches meet the interior of the die mold, where a sharp angle in the edge of the piece that is formed is unavoidable. This is also the location inside the ferrite tool set where flashing may occur. The purpose of removing flash and rounding edges is to allow uncoated ring cores to be wound with insulated wire, using typical production winding processes, without damage to the wire.

3.1.2 Chips and ragged edges

Figure 1 shows examples of chips and ragged edges location on ring-cores.

- Ragged edges as defined in IEC 60424-1 are allowed.
- Chips shall not exceed 25 % of the wall thickness either in length or in width, up to a maximum of 2 mm.
- The maximum number of chips shall not exceed 3 on one core edge and a total of 5 on all edges.

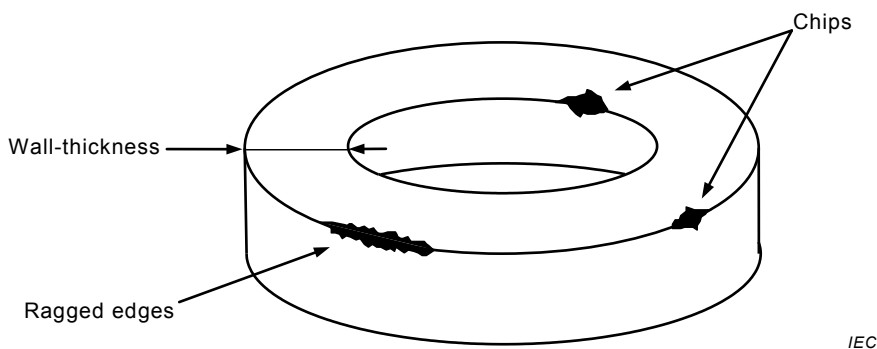


Figure 1 – Chips and ragged edges location on ring-cores

3.1.3 Cracks and pull-out

Figure 2 shows examples of cracks and pull-out location on ring-cores.

Cracks (C1) perpendicular to the magnetic flux path are allowed but shall not exceed 20 % of the wall thickness.

- Cracks (C2) parallel to the magnetic flux are allowed but shall not exceed 12,5 % (1/8) of the relevant core circumference.
- Crazeing (C3) which is a grid-like pattern of superficial cracks (e.g. depth less than 0,5 mm) is allowed.
- Pull-out (C4) is allowed but the relevant cumulative area on each affected core surface shall not exceed 25 % of its area.
- Excess dirt or ferrite debris on the surface or in the window of uncoated ring-cores is not acceptable.

NOTE In any case, cores with surface irregularities will meet relevant electrical specifications.

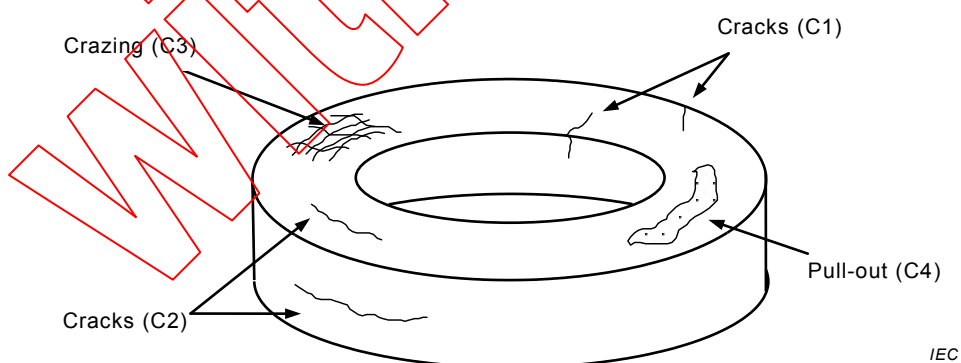


Figure 2 – Cracks and pull-out location on ring-cores

3.1.4 Crystallites

Figure 3 shows examples of crystallites location on ring-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.

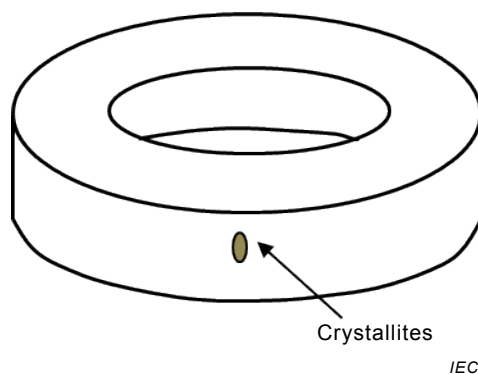


Figure 3 – Crystallites location for ring-cores

3.1.5 Pores

Figure 4 shows examples of pores location on ring-cores

- The number of pores located on the same surface shall not exceed 2. The total number of pores located on all surfaces shall not exceed 5.
- A hole with area larger than 1 mm² on any surface is not acceptable.

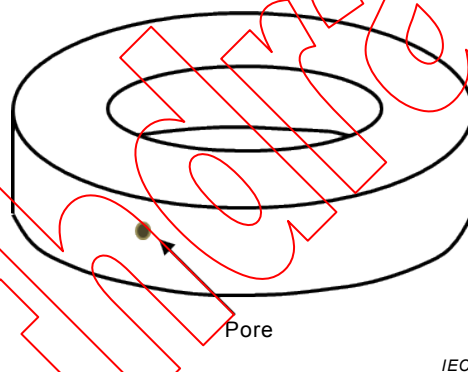


Figure 4 – Pores location for ring-cores

3.2 Coated ring-cores

3.2.1 General

Coated ring-cores are generally smoothed (e.g. by tumbling) before the coating process. A variety of materials are used to provide dielectric protection by coating the surfaces of the ring cores to form a barrier. These include epoxies, polyurethanes, nylons, and paraxylolones.

3.2.2 Coating features

A rough coating surface is acceptable provided that

- 1) dimensional specifications are met, and
- 2) the coating does not exhibit sharp features that would damage insulated wire that is applied using typical winding processes.

Excess dirt or ferrite debris on the surface or in the window of coated ring-cores is not acceptable.

Partial coating exposing bare core is unacceptable. Chips in a layer or layers of coating, exposing other coating, but not the bare core, are acceptable if they do not create sharp edges, and if the voltage breakdown limit is met.

Pin holes in the surface of coated ring cores are acceptable, provided that they meet the relevant voltage breakdown specification. Air bubbles under the coating are not acceptable.

Sharp flashing arising from the method of applying coating is not acceptable.

Paraxylylene coatings may show varying appearance, ranging from transparent to milky white, within individual production batches, and from batch to batch. This is acceptable, provided that the relevant voltage breakdown specification is met.

3.2.3 Coating performance

Coated ring-cores shall withstand the relevant voltage breakdown specifications. Coated ring-cores shall meet their relevant inductance, loss and other electrical performance limits. Manufacturers may publish modified limits for certain coated ring-cores, compared with the same cores not coated, due to characteristic changes resulting from mechanical stress of coating.

3.3 Area and length reference for visual inspection

Irregularities such as chips, cracks and pull-out should be compared to five simple geometries which are shown in Table 1.

Such a table should be used as a reference for evaluation by operators either at the outgoing stage (core manufacturers) or at the incoming inspection (customers).

Other methods than visual inspection can be used, such as computerized optical detection.

NOTE The minimum area and length considered are respectively $0,5 \text{ mm}^2$ and 1 mm.

Recommended resolutions are as follows:

- a) for area
 - $0,5 \text{ mm}^2$ up to 5 mm^2
 - 1 mm^2 from 5 mm^2 to 10 mm^2
 - $2,5 \text{ mm}^2$ from 10 mm^2 to 20 mm^2
 - 5 mm^2 from 20 mm^2 to 50 mm^2
- b) for length
 - 1 mm from 1 mm to 5 mm
 - 2,5 mm from 5 mm to 10 mm