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Specification for

Cores made of ferromagnetic oxides for use in high flux density transformers

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The Government department and scientific and industrial organizations marked with an asterisk in the above list, were directly represented on the committee entrusted with the preparation of this British Standard.

This British Standard, having been prepared under the direction of the Telecommunication Industry Standards Committee, was published under the authority of the Executive Board on 30 April 1976

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Foreword

This British Standard has been prepared under the authority of the Telecommunication Industry Standards Committee and is one of a series dealing with magnetic cores intended primarily for use in telecommunication and allied electronic equipment.

Certification. Attention is drawn to the certification facilities described on the inside back cover of this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies the dimensions and electrical properties of U-, E- and I-cores made of ferromagnetic oxides (ferrites) for use in high flux density applications, e.g. television line output transformers, switched-mode power supplies and other high frequency power transformers.

NOTE Complete magnetic circuits may be constructed either from pairs of E- or U-cores, or from combinations of E- or U-cores with I-cores.

2 Object

This British Standard specifies dimensions and tolerances which are essential to ensure dimensional interchangeability, together with effective magnetic dimensions and certain electrical properties.

3 Dimensions and electrical properties

Each type of core shall be designated by the appropriate reference number indicated in Clause 3 and the physical dimensions shall be in accordance with the related drawing. All dimensions are given in millimetres, and first angle projection is used. The geometric tolerances are zero at maximum material conditions unless otherwise stated.

NOTE 1 The flatness of the mating surfaces is mainly determined by the required electrical performance.

NOTE 2 The extent of permissible visual imperfections (e.g. chips, cracks etc.) may be subject to agreement between a supplier and his customer.

The use of a gauge to check the geometric form (e.g. squareness and parallelism) of each type of core is specified. The essential dimensions in millimetres of the necessary form gauges are given in Appendix A.

The minimum inside dimensions of the coil former suitable for use with pairs of each type of core are specified. For cores with legs of round cross-section a minimum inside diameter is specified, whereas for those with legs of rectangular cross-section the minimum inside dimensions of a rectangular coil former are specified.

The effective magnetic dimensions of pairs of each type of core, calculated in accordance with Appendix B, are specified.

The electrical properties of each type of core shall be in accordance with the values specified. The effective flux density specified is the value obtained from the equation

$$\hat{B}_e = \frac{U_{av}}{4fA_eN}$$

where

$\hat{B}_e$ = peak value of effective flux density, T

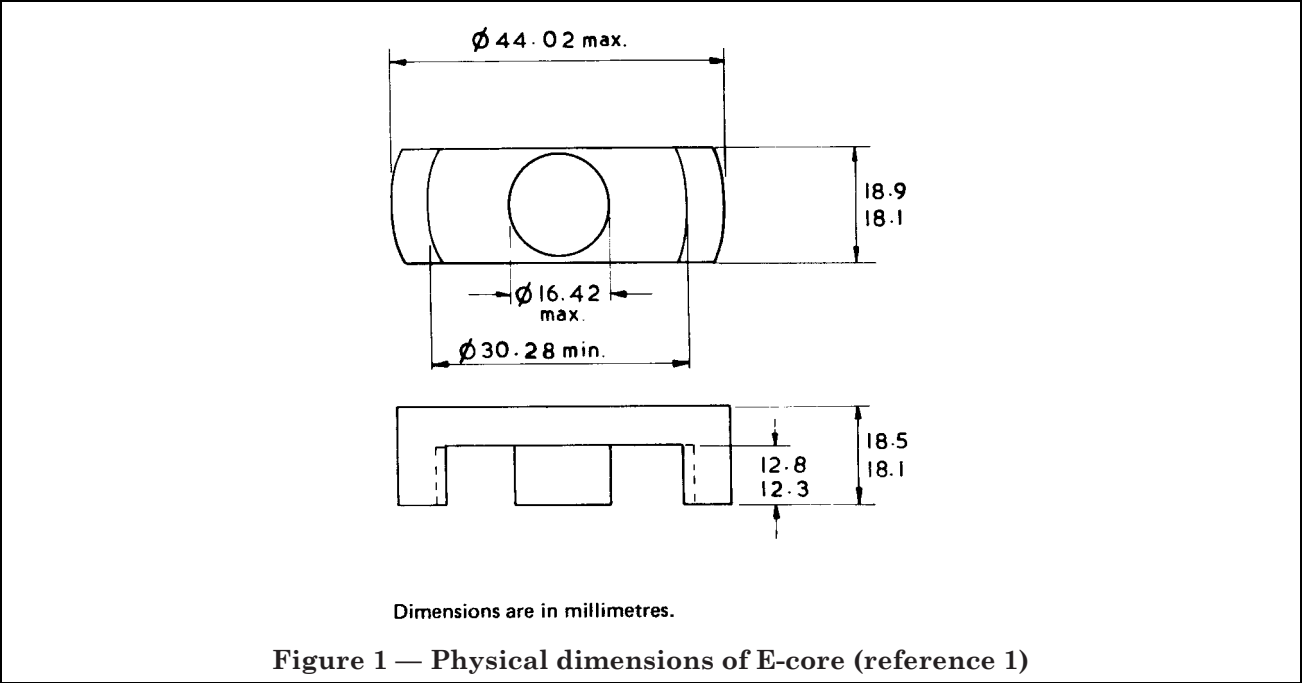
U_{av} = the value of the e.m.f. averaged over half a cycle, V

f = a.c. frequency, Hz

N = number of turns on the test coil

A_e = effective cross-sectional area of magnetic path, m².

3.1 E-core (reference 1)

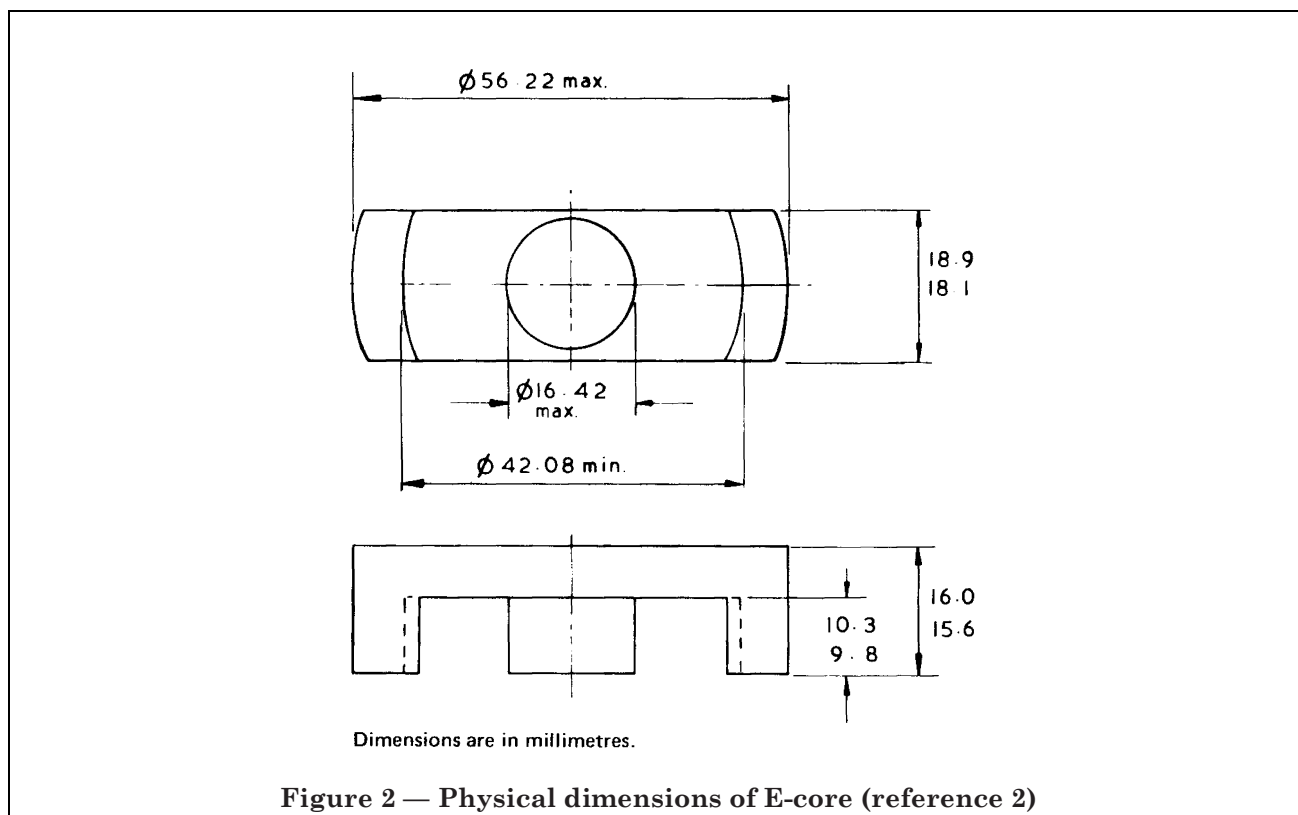


- 3.1.1 Physical dimensions.** The physical dimensions of each E-core (reference 1) shall be as shown in Figure 1.
- 3.1.2 Geometric form.** Each E-core (reference 1) shall have a geometric form such that it can be inserted into a form gauge type A.1.1 (see Appendix A).
- 3.1.3 Coil former dimensions.** The inside diameter of the coil former suitable for use with a pair of E-cores (reference 1) shall not be less than 16.5 mm.
- 3.1.4 Magnetic dimensions.** The effective magnetic dimensions of a pair of E-cores (reference 1), calculated in accordance with B.3.1, are:
- core constant, $\Sigma(I/A)$ $C_1 = 0.394 \text{ mm}^{-1}$
 - effective magnetic length, $l_e = 83.2 \text{ mm}$
 - effective cross-sectional area, $A_e = 211 \text{ mm}^2$
 - effective volume, $V_e = 17\,600 \text{ mm}^3$
- 3.1.5 Electrical properties for a pair of cores.** The electrical properties for a pair of E-cores (reference 1) shall be as specified in Table 1.

Table 1 — Electrical properties for a pair of E-cores (reference 1)

Parameter	Symbol	Temperature	Frequency	Effective flux density	Value
Amplitude permeability	μ_a	25 ± 2 °C	< 100 Hz	420 mT	> 1 000
		85 ± 2 °C		340 mT	> 1 000
Effective total core loss	P	25 ± 2 °C	16 kHz	200 mT	< 2.1 W
		85 ± 2 °C			< 2.0 W

3.2 E-core (reference 2)



3.2.1 Physical dimensions. The physical dimensions of each E-core (reference 2) shall be as shown in Figure 2.

3.2.2 Geometric form. Each E-core (reference 2) shall have a geometric form such that it can be inserted into a form gauge type A.1.2 (see Appendix A).

3.2.3 Coil former dimensions. The inside diameter of the coil former suitable for use with a pair of E-cores (reference 2) shall not be less than 16.5 mm.

3.2.4 Magnetic dimensions. The effective magnetic dimensions of a pair of E-cores (reference 2), calculated in accordance with B.3.1, are:

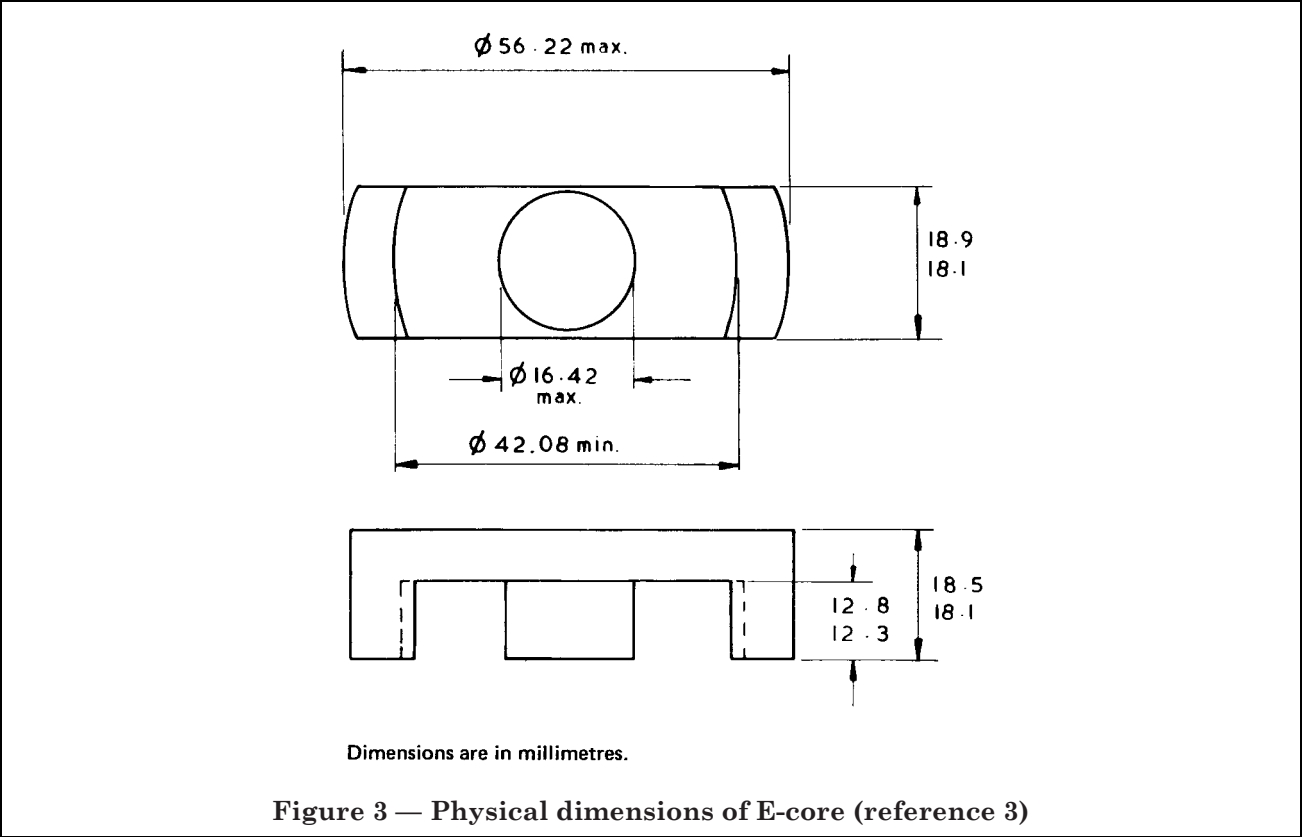
core constant, $\Sigma(I/A)$	$C_1 = 0.408 \text{ mm}^{-1}$
effective magnetic length, l_e	$l_e = 86.2 \text{ mm}$
effective cross-sectional area, A_e	$A_e = 211 \text{ mm}^2$
effective volume, V_e	$V_e = 18\,200 \text{ mm}^3$

3.2.5 Electrical properties for a pair of cores. The electrical properties for a pair of E-cores (reference 2) shall be as specified in Table 2.

Table 2 — Electrical properties for a pair of E-cores (reference 2)

Parameter	Symbol	Temperature	Frequency	Effective flux density	Value
Amplitude permeability	μ_a	$25 \pm 2 \text{ }^\circ\text{C}$	< 100 Hz	400 mT	> 1 000
		$85 \pm 2 \text{ }^\circ\text{C}$		320 mT	> 1 000
Effective total core loss	P	$25 \pm 2 \text{ }^\circ\text{C}$	16 kHz	200 mT	< 3.3 W
		$85 \pm 2 \text{ }^\circ\text{C}$			< 4.0 W

3.3 E-core (reference 3)

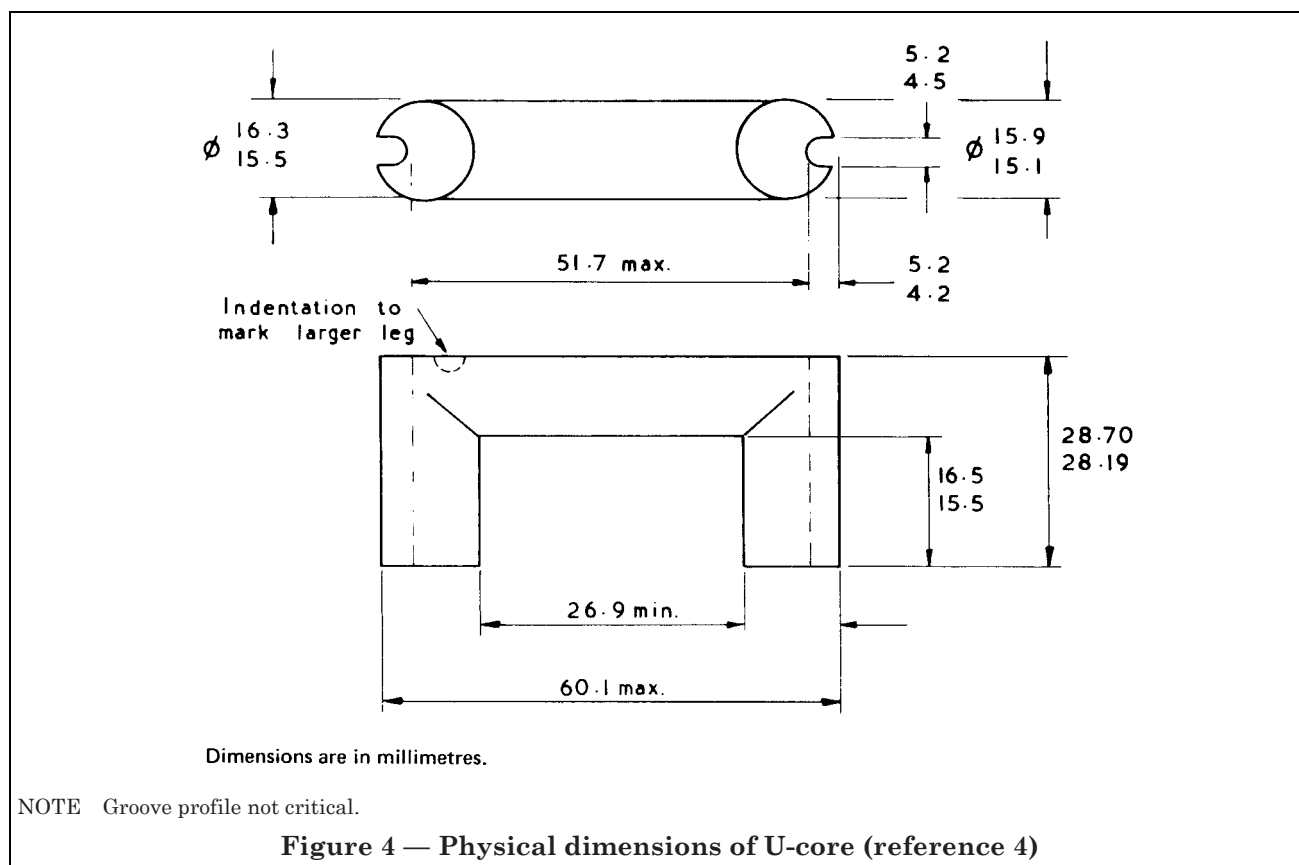


- 3.3.1 Physical dimensions.** The physical dimensions of each E-core (reference 3) shall be as shown in Figure 3.
- 3.3.2 Geometric form.** Each E-core (reference 3) shall have a geometric form such that it can be inserted into a form gauge type A.1.2 (see Appendix A).
- 3.3.3 Coil former dimensions.** The inside diameter of the coil former suitable for use with a pair of E-cores (reference 3) shall not be less than 16.5 mm.
- 3.3.4 Magnetic dimensions.** The effective magnetic dimensions of a pair of E-cores (reference 3), calculated in accordance with B.3.1, are:
- core constant, $\Sigma(I/A)$ $C_1 = 0.455 \text{ mm}^{-1}$
 - effective magnetic length, $l_e = 95.8 \text{ mm}$
 - effective cross-sectional area, $A_e = 211 \text{ mm}^2$
 - effective volume, $V_e = 20\,200 \text{ mm}^3$
- 3.3.5 Electrical properties for a pair of cores.** The electrical properties for a pair of E-cores (reference 3) shall be as specified in Table 3.

Table 3 — Electrical properties for a pair of E-cores (reference 3)

Parameter	Symbol	Temperature	Frequency	Effective flux density	Value
Amplitude permeability	μ_a	25 ± 2 °C	< 100 Hz	420 mT	> 1 000
		85 ± 2 °C		340 mT	> 1 000
Effective total core loss	P	25 ± 2 °C	16 kHz	200 mT	< 2.4 W
		85 ± 2 °C			< 2.2 W

3.4 U-core (reference 4)



3.4.1 Physical dimensions. The physical dimensions of each U-core (reference 4) shall be as shown in Figure 4.

3.4.2 Geometric form. Each U-core (reference 4) shall have a geometric form such that it can be inserted into a form gauge type A.2.1 (see Appendix A).

3.4.3 Coil former dimensions. The inside diameters of the two coil formers suitable for use with a pair of U-cores (reference 4) shall not be less than 16.8 mm and 16.4 mm, respectively.

3.4.4 Magnetic dimensions. The effective magnetic dimensions of a pair of U-cores (reference 4), calculated in accordance with B.3.2, are:

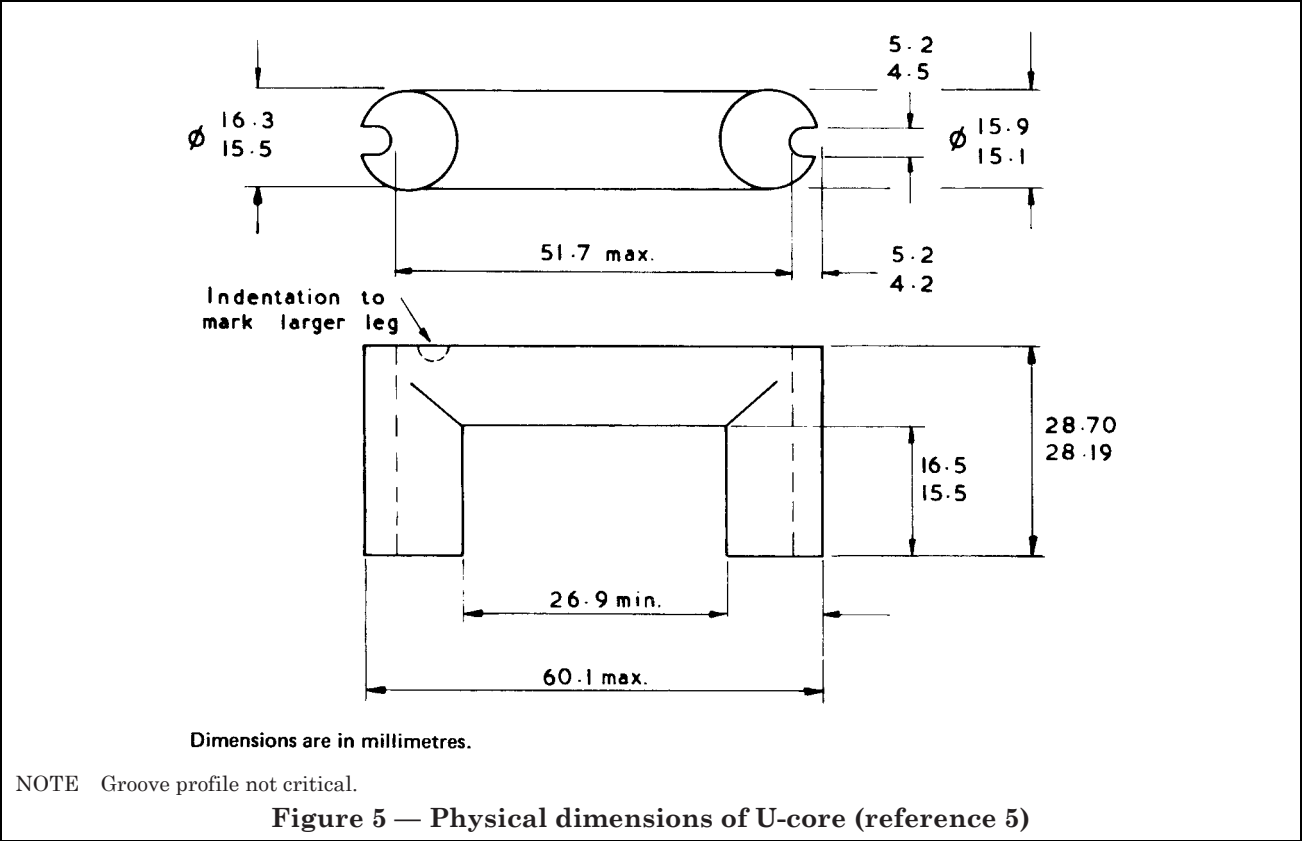
core constant, $\Sigma(I/A)$	$C_1 = 0.957 \text{ mm}^{-1}$
effective magnetic length, l_e	$l_e = 164 \text{ mm}$
effective cross-sectional area A_e	$A_e = 171 \text{ mm}^2$
effective volume, V_e	$V_e = 28\,000 \text{ mm}^3$

3.4.5 Electrical properties for a pair of cores. The electrical properties for a pair of U-cores (reference 4) shall be as specified in Table 4.

Table 4 — Electrical properties for a pair of U-cores (reference 4)

Parameter	Symbol	Temperature	Frequency	Effective flux density	Value
Amplitude permeability	μ_a	$25 \pm 2^\circ\text{C}$	< 100 Hz	400 mT	> 1 000
		$85 \pm 2^\circ\text{C}$		320 mT	> 1 000
Effective total core loss	P	$25 \pm 2^\circ\text{C}$	16 kHz	200 mT	< 5.1 W
		$85 \pm 2^\circ\text{C}$			< 6.2 W

3.5 U-core (reference 5)



3.5.1 Physical dimensions. The physical dimensions of each U-core (reference 5) shall be as shown in Figure 5.

3.5.2 Geometric form. Each U-core (reference 5) shall have a geometric form such that it can be inserted into a form gauge type A.2.1 (see Appendix A).

3.5.3 Coil former dimensions. The inside diameters of the two coil formers suitable for use with a pair of U-cores (reference 5) shall not be less than 16.8 mm and 16.4 mm, respectively.

3.5.4 Magnetic dimensions. The effective magnetic dimensions of a pair of U-cores (reference 5), calculated in accordance with B.3.2, are:

- core constant, $\Sigma(I/A)$ $C_1 = 0.957 \text{ mm}^{-1}$
- effective magnetic length, $l_e = 164 \text{ mm}$
- effective cross-sectional area, $A_e = 171 \text{ mm}^2$
- effective volume, $V_e = 28\,000 \text{ mm}^3$

3.5.5 Electrical properties for a pair of cores. The electrical properties for a pair of U-cores (reference 5) shall be as specified in Table 5.

Table 5 — Electrical properties for a pair of U-cores (reference 5)

Parameter	Symbol	Temperature	Frequency	Effective flux density	Value
Amplitude permeability	μ_a	$25 \pm 2 \text{ }^\circ\text{C}$	< 100 Hz	420 mT	> 1 000
		$85 \pm 2 \text{ }^\circ\text{C}$		340 mT	> 1 000
Effective total core loss	P	$25 \pm 2 \text{ }^\circ\text{C}$	16 kHz	200 mT	< 3.4 W
		$85 \pm 2 \text{ }^\circ\text{C}$			< 3.1 W