

JIS

JAPANESE INDUSTRIAL STANDARD

General rules for ferrite cores

JIS C 2560—1992

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.



JAPANESE INDUSTRIAL STANDARD

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General rules for ferrite cores

C 2560-1992

1. Scope This Japanese Industrial Standard specifies basis to determine performances, styles, materials, etc. of ferrite cores mainly for use in electronic components with inductance (hereafter referred to as "cores") and to symbolize such data.

Remarks: The following Standard is cited in this Standard:

JIS C 2561 Measuring Methods for Fundamental Properties of Soft Ferrites

2. Definitions Principal definitions for use in this Standard and relevant detail specification shall be as given in Annex 1.

3. Type designation

3.1 Structure of type designation The type designation shall be arranged as follows:

[Symbol denoting core]	[Symbol denoting style]	[Symbol denoting dimension]	...	[Symbol denoting dimension]	[Symbol denoting con- struction]	[Symbol denoting per- formance]	[Symbol denoting material]
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Example 1:

F OR -19 -10 -10 -XY10

Example 2:

F EE -16.0 -14.4 -4.80 -100 -XY10

Example 3:

F PP 9 X5 -2 -100 -XY10

Remarks: In general a mark "-" or "X" shall be inserted between individual symbols. However, this mark shall not be used between the symbol denoting core and the symbol denoting style.

If there is no risk of confusion this mark may be omitted.

3.2 Symbol

- (1) Core The symbol denoting core shall be an English capital letter F.
- (2) Style The symbol denoting style shall consist of one to three English capital letters. The first letter shall be as specified in Table 3, and the second and third letters shall be as specified in the detail specification.
- (3) Dimension The symbol denoting dimension shall consist of numerals as specified in the detail specification.

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- (4) Construction The symbol denoting construction shall consist of English capital letters or numerals as specified in the detail specification.
- (5) Performance The symbol denoting performance shall consist of numerals as specified in the detail specification.
- (6) Material The symbol denoting material is subject to agreement between the parties concerned with acceptance.

4. Performances

4.1 Performance relation to material The performance items related to material shall be chosen from Table 1.

The numerical values which represent the performances shall be as specified in the detail specification.

Table 1. Performance items related to material

Item	Symbol	Unit	Corresponding number in Annex 1
Saturation magnetization	M_s	A/m	2
Saturation magnetic flux density	B_s	T	3
Remanent flux density	B_r	T	5
Coercive force	H_c	A/m	10
Initial permeability ⁽¹⁾	μ_i	—	20
Relative loss factor	$\frac{\tan \delta}{\mu_i}$	—	40
Hysteresis material constant	η_b	1/T	42
Temperature coefficient of initial permeability ⁽¹⁾	$\alpha_{\mu i}$	1/°C	51
Temperature factor of initial permeability ⁽¹⁾	$\alpha_{\mu tr}$	—	58
Complex permeability ⁽¹⁾	$\underline{\mu}$	—	25
Curie temperature	T_c	°C	59
Disaccommodation factor	D_r	—	61
Electrical resistivity	ρ_v	$\Omega \cdot m$	62
Apparent density	d_b	kg/m ³	70
Squareness ratio	B_r/B_s	—	15
Core loss volume density	P_{cv}	W/m ³	45

Table 1 (Continued)

Item	Symbol	Unit	Corresponding number in Annex 1
Core loss mass density	P_{cm}	W/kg	46
Amplitude permeability ⁽¹⁾	μ_a	-	19
Q	Q	-	47
Saturation magnetostriction	λ_s	-	73
Coefficient of linear thermal expansion	α_{T1-T2}	1/°C	74
Thermal conductivity	κ	W/(m·°C)	75
Bending strength	σ_{bs}	N/m ²	77

Note (1) This permeability shall be expressed in relative permeability.

Remarks: The "-" in the column of unit means a dimensionless number.

4.2 Performance related to style The performance items related to style shall be chosen from Table 2.

The numerical values which represent the performances shall be as specified in the detail specification.

Table 2. Performance items related to style is practical service

Item	Symbol	Unit	Corresponding number in Annex 1
Incremental permeability ⁽¹⁾	μ_{Δ}	—	22
Effective permeability ⁽¹⁾	μ_e	—	30
Effective pulse permeability ⁽¹⁾	μ_p	—	31
Apparent permeability ⁽¹⁾	μ_{app}	—	32
Inductance factor	A_L	H	33
Effective quality factor	Q_e	—	49
Temperature coefficient of effective permeability ⁽¹⁾	$\alpha_{\mu e}$	1/°C	52
Temperature coefficient of apparent permeability ⁽¹⁾	$\alpha_{\mu app}$	1/°C	53
Temperature coefficient of effective pulse permeability ⁽¹⁾	$\alpha_{\mu p}$	1/°C	54
Temperature coefficient of effective quality factor	α_{Qe}	1/°C	56
Surface electrical resistance	R_s	Ω	63
Mechanical strength	—	—	79
Characteristics at environmental condition	—	—	80
Inductance for d.c. superposed	L_{Δ}	H	34
Core factor	C_1 C_2	m^{-1} m^{-3}	83
Effective cross-sectional area	A_e	m^2	84
Effective magnetic path length	l_e	m	85
Effective volume	V_e	m^3	86

Remarks: The "—" in the column of unit means a dimensionless number.

5. Classification of styles The classification of core style shall be as given in Table 3.

The examples of styles are shown in Attached Fig. 1.

Table 3. Classification of core styles

Classification	Symbol (First letter)	Style
Bar type ferrite core	I	A bar type core whose cross section is circle, square, rectangular or approximate figure thereof and whose length is larger than the maximum outside dimension of the cross section
Square type ferrite core	S	A core of square plate shape
Disk type ferrite core	R	A core of round plate shape
Drum type ferrite core	D	A core of drum shape
Cup type ferrite core	C	A core which has external leg of sleeve shape for magnetic shielding and a longitudinal cross section of almost U-shape
Screw type ferrite core	T	A core of headless screw shape
Multi-hole type ferrite core	M	A core which has more than one through holes
Cylinder type ferrite core	B	A core of cylinder shape or approximately similar shape
Frame type ferrite core	K	A core of rectangular window frame shape
Ring type ferrite core	O	A core of ring shape
Pot type ferrite core	P	A core which has basically an outside leg of sleeve shape around the center leg for magnetic shielding and a longitudinal cross section of almost E-shape
E-type ferrite core	E	A core which is fundamentally used as a combination and the shape of one or both of the pair is almost E
U-type ferrite core	U	A core which is fundamentally used as a combination and the shape of one or both of the pair is almost U
Funnel type ferrite core	Y	A core of funnel shape

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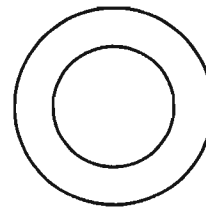
- Remarks 1. In the classification, small holes, grooves, etc. which do not affect the magnetic characteristics of core are neglected.
2. Classification into disk type, ring type, cylinder type and bar type (circular) is made as follows:

When $d_2 > 0$

Disk type: $h < \frac{d_1 - d_2}{4}$

Ring type: $\frac{d_1 - d_2}{4} \leq h \leq d_1 - d_2$

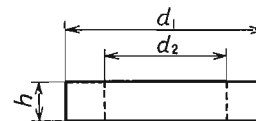
Cylinder type: $h > d_1 - d_2$



When $d_2 = 0$

Disk type: $h \leq d_1$

Bar type (circular): $h > d_1$



where, d_1 : outside diameter

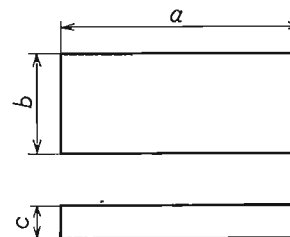
d_2 : inside diameter

h : height

3. Classification into square type and bar type (square), referring to the shape in the following figure where $a \geq b \geq c$ holds, is as follows:

Square type: $\frac{b}{c} > 4$

Bar type (square): $\frac{b}{c} \leq 4$



4. For antenna cores in bar type or square type ferrite cores, symbol A may be used.
5. For such a core in pot type ferrite cores that only a core of one side is used as a high frequency coil, symbol C may be used.

6. Dimensions The dimensions of cores shall be specified in detail specifications.

7. Materials Materials for cores are classified into spinel system ferrite and hexagonal system ferrite according to their crystal structure.

- (1) Spinel system ferrite Spinel system ferrites are classified according to principal metal components other than iron. Principal spinel system ferrites are shown in Table 4.

Table 4. Classification of spinel system ferrites

Classification	Definition
Mn - Zn ferrite	Core material mainly consisting of oxides of iron, manganese and zinc
Ni - Zn ferrite	Core material mainly consisting of oxides of iron, nickel and zinc
Mg - Zn ferrite	Core material mainly consisting of iron, magnesium and zinc

- (2) Hexagonal system ferrite Hexagonal system ferrites are classified according to the main components and structure. Principal hexagonal system ferrites are shown in Table 5.

Table 5. Classification of hexagonal system ferrites

Classification	Definition
Me - W ferrite	Core material expressed by chemical formula of $\text{BaMe}_2\text{Fe}_{16}\text{O}_{27}$
Me - Y ferrite	Core material expressed by chemical formula of $\text{Ba}_2\text{Me}_2\text{Fe}_{12}\text{O}_{22}$
Me - Z ferrite	Core material expressed by chemical formula of $\text{Ba}_3\text{Me}_2\text{Fe}_{24}\text{O}_{41}$

Remarks: The Me means such divalent elements as Mn, Ni, Fe, Co, Mg, Cu and Zn and the combinations thereof.

Example: When the chemical formula is $\text{Ba}_3\text{Co}_{1.2}\text{Zn}_{0.8}\text{Fe}_{24}\text{O}_{41}$, the ferrite is expressed as CoZn - Z ferrite.

8. Test methods The test methods shall comply with JIS C 2561 and the detail specifications.

9. Marking

9.1 Marking on product The items prescribed below shall be marked on an easily visible position of each core. If the marking is difficult, it may be omitted subject to agreement.

- (1) Type designation
- (2) Production lot number
- (3) Manufacturer's name or abbreviation

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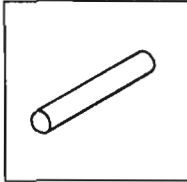
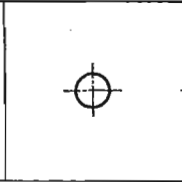
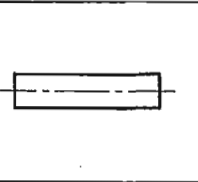
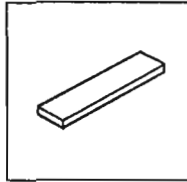
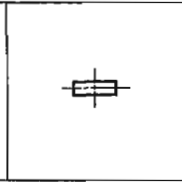
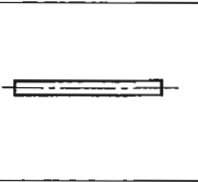
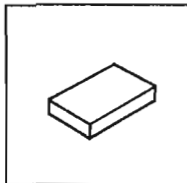
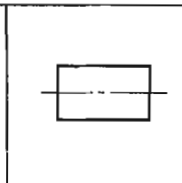
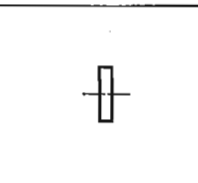
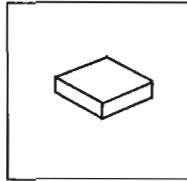
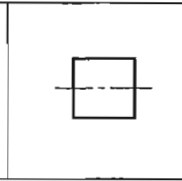
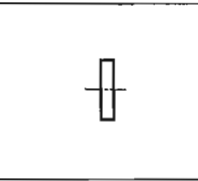
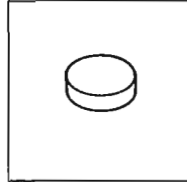
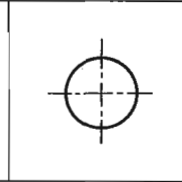
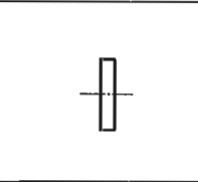
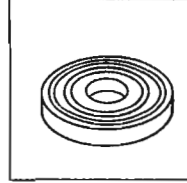
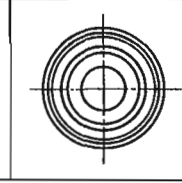
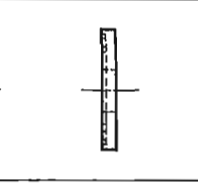
9.2 Marking on package The items prescribed below shall be indelibly marked on each package. If requested by the user marking which shows that the core means a set or one of a set shall be added.

- (1) Type designation
- (2) Date of manufacture or year and week of manufacture; or their abbreviation
- (3) Production lot number
- (4) Manufacturer's name or abbreviation
- (5) Quantity

Related Standard:

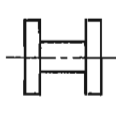
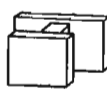
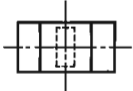
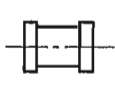
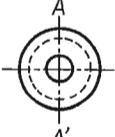
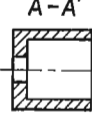
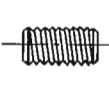
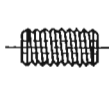
IEC 50(221) International Electrotechnical Vocabulary Chapter 221:
Magnetic materials and components

Attached Fig. 1. Examples of representative style

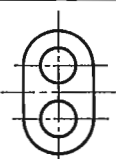
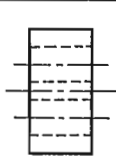
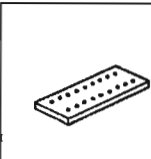
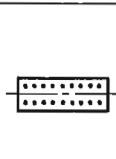
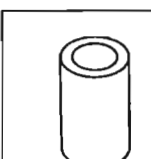
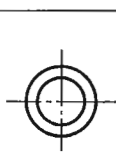
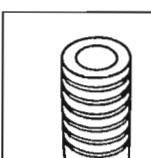
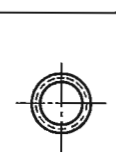
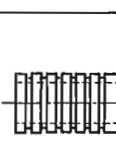
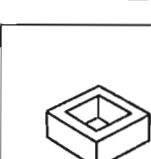
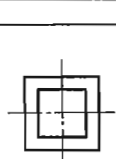
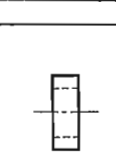
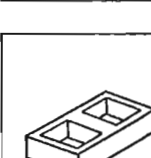
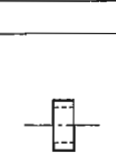
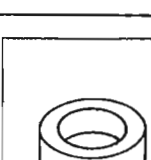
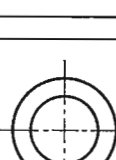
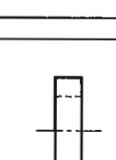
Classi- fication	Symbol (First letter)	Example of style	Principal use
Bar type ferrite core	I	     	Inductor, antenna
Square type ferrite core	S	     	Electro- magnetic induction coil
Disk type ferrite core	R	     	Rotary transformer

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Attached Fig. 1 (Continued)

Classi- fication	Symbol (First letter)	Example of style	Principal use
Drum type ferrite core	D	     	High- frequency coil
Cup type ferrite core	C	     	High- frequency coil
Screw type ferrite core	T	     	High- frequency coil

Attached Fig. 1 (Continued)

Classi- fication	Symbol (First letter)	Example of style	Principal use
Multi-hole type ferrite core	M	     	Balun transformer, noise suppressor
Cylinder type ferrite core	B	     	Bead core, rotary transformer
Frame type ferrite core	K	     	Common- mode choke
Ring type ferrite core	O	  	Transformer, inductor