



DPC: 24 / 30497078 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Part 35: Technical requirements for electrical sheet metal and strip metal used in electrical machines

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Direct tel: **020 8996 7009**
E-mail: csc@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



2/2210/CD

COMMITTEE DRAFT (CD)

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IEC TC 2 : ROTATING MACHINERY		
SECRETARIAT: United Kingdom		SECRETARY: Mr Charles Whitlock
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 68		HORIZONTAL FUNCTION(S):
ASPECTS CONCERNED:		

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TITLE:
Rotating electrical machines - Part 35: Technical requirements for electrical sheet metal and strip metal used in electrical machines

NOTE FROM TC/SC OFFICERS:

CONTENTS

1		
2	CONTENTS	2
3	FOREWORD	4
4	1 Scope	6
5	2 Guidance on the application of the standard	6
6	3 Normative references	6
7	4 Terms and definitions	7
8	4.1 Stator core (Magnetic stator core)	7
9	4.2 Rotor core (Magnetic rotor core)	7
10	4.3 Core stacking method	7
11	4.4 Punching	7
12	4.5 Lasering	7
13	4.6 Specific total loss processing factor P_{SPF} (%)	7
14	4.7 Magnetic field strength processing factor $\hat{H}_{PF}$ (%)	8
15	4.8 Specific total loss P_S (W/kg)	8
16	4.9 Specific Hysteresis power loss P_h (W/kg)	8
17	4.10 Specific Eddy current loss P_e (W/kg)	8
18	4.11 Electric sheet	8
19	4.12 Density ρ (kg/dm ³)	9
20	4.13 Thermal conductivity λ (W/(m*K))	9
21	4.14 Fully- finished	9
22	4.15 Semi- finished	9
23	5 Designation of electrical steel material	9
24	5.1 Order details	10
25	5.2 Radioactive contamination	10
26	6 Quality	10
27	6.1 Strip edges	10
28	6.2 Welding seams	10
29	6.3 Cutting and punching properties	10
30	6.4 Grain size related separation factors G_{SFL} and G_{SFC}	11
31	6.5 Surface quality of sheet material	11
32	6.6 Permissible thickness deviations in the direction of rolling	11
33	6.7 Permissible thickness deviation across the direction of rolling	11
34	6.8 Permissible width deviation	11
35	6.9 Permissible length deviation	11
36	6.10 Edge camber	11
37	7 Permissible shape deviations	11
38	7.1 Internal stress	11
39	7.2 Wave factor	12
40	7.3 Residual Curvature	12
41	8 Magnetic and mechanical properties	12
42	8.1 Magnetic properties	12
43	8.1.1 Magnetic properties including tolerances standard types (A) - losses for	
44	electrical steel and stator core package at $\hat{J}=1,5$ T, 50 Hz, 0,35	
45	mm/ 0,50 mm	12
46	8.1.2 Magnetic properties including tolerances standard types (A) - losses for	
47	electrical steel and stator core package at $\hat{J}= 1,5$ T, 50 Hz; 0,65 mm	13

48	8.1.3	Magnetic properties including tolerances standard types (A) - losses for electrical steel and stator core package at $\hat{J}= 1,5 \text{ T}$, 60 Hz; 0,35 mm/ 0,50 mm.....	14
51	8.1.4	Magnetic properties including tolerances standard types (A) - losses for electrical steel and stator core package at $\hat{J}= 1,5 \text{ T}$, 60 Hz; 0,65 mm.....	15
53	8.1.5	Magnetic properties including tolerances standard types (A) - losses for electrical steel and stator core package at $\hat{J}= 1,5 \text{ T}$, 200 Hz, 0,35 mm/ 0,50 mm	16
56	8.1.6	Magnetic properties including tolerances standard types (A) - losses for electrical steel and stator core package at $\hat{J}= 1,5 \text{ T}$, 200 Hz; 0,65 mm	17
59	8.1.7	Magnetic properties standard types (A)- magnetic field strength $\hat{H}$ at 50 Hz; 0,35 mm/ 0,50 mm/ 0,65 mm	18
61	8.1.8	Magnetic properties including tolerances high permeability types HP - losses for electrical steel and stator core package at $\hat{J}=1,5 \text{ T}$, 50 Hz	19
63	8.1.9	Magnetic properties including tolerances high permeability types HP - losses for electrical steel and stator core package at $\hat{J}=1,5 \text{ T}$, 60 Hz	19
65	8.1.10	Magnetic properties including tolerances high permeability types HP - losses for electrical steel and stator core package at $\hat{J}=1,5 \text{ T}$, 200 Hz	20
67	8.1.11	Magnetic properties high permeability types HP - magnetic field strength $\hat{H}$ at 50 Hz; 0,35 mm/ 0,50 mm/ 0,65 mm	20
69	8.2	Mechanical properties	21
70	8.2.2	Mechanical properties standard types (A)	21
71	8.2.3	Mechanical properties high permeability types (HP).....	21
72	9	Insulation.....	21
73	9.1	General.....	21
74	9.2	Insulation requirements.....	22
75	10	Test certificates and characteristic curves	22
76	10.1	Test methods for electromagnetic assessment.....	22
77	10.1.1	Epstein sample according to IEC 60404-2	22
78	10.1.2	Single sheet testing according to IEC 60404-3.....	23
79	10.2	Test documentation	23
80	11	Type labelling	23
81	12	Terms of delivery	23
82	Annex A (normative)		24
83	A.1	Minimum details for factory certificate for electrical steel	24
84	A.2	Minimum details factory certification for magnetic cores	25
85	A.3	Mechanical properties standard type (A)	26
86	A.4	Mechanical properties high permeability types (HPA).....	27
87	Annex B (informative)		28
88	B.1	Additional information	28
89	B.2	Influence of manufacturer on electromagnetic and mechanical properties	30
90	B.3	Magnetic properties standard types $\hat{H}$ at 50 Hz (1,4 T - 1,7 T)	30
91	B.4	Specific total losses P_s (Epstein)	30
92	B.5	Different stacking methods for stator cores of rotating electric machines	32
93			

Rotating electrical machines – Part 35: Technical requirements for electrical sheet metal and strip metal used in electrical machines

FOREWORD

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- International Standard IEC 60034-35 has been prepared by working group WG12 of IEC technical committee 2: Rotating machinery.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

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.

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.

145

146

147 The National Committees are requested to note that for this document the stability date
148 is 20XX..

149 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED
150 AT THE PUBLICATION STAGE

1 Scope

This document defines specific requirements for materials to be used for the stator and/or rotor core of rotating electrical machines according to the IEC 60034 series. The document applies in addition to IEC 60404- series and is addressed to the suppliers of the raw material (electrical sheet), to producers of magnetic cores (including a possible annealing treatment), to electric motor manufacturers as well as to users of electrical steel.

2 Guidance on the application of the standard.

This standard contains information regarding the requirements for non-grain-oriented electrical sheets for electric machines.

Interesting technical background information related to the electric steels can be found in the informative Appendix B.

The specifications concern, among other details, requirements for the electrical sheets regarding the specific total losses as well as the magnetic field strengths at defined magnetic polarisation values.

These defaults are delimited by defined tolerance bands. The practically existing differences in properties are considered by 3 gradations (Range A, Range B, Range C) of the standardised tolerances. In addition, steel names, standardised thicknesses, specific total losses and magnetic field strengths may be agreed individually. These must be defined between the supplier and the customer.

Specification value tables containing a "Specific total loss processing factor" or a "Magnetic field strength processing factor" apply to the electrical sheet and to the magnetic core. These factors are used to describe any changes in the properties of the electrical steel compared to the finished magnetic core and must be agreed between the supplier and the user of the magnetic core. As a result, the magnetic core can be delivered with consistent, defined electromagnetic properties.

A characterisation of the electrical sheets can also be carried out via the "Grain size related separation factor", which is explained in detail.

3 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 60404-8-4:2022 Magnetic materials - Part 8-4: Specifications for individual materials - Cold-rolled non-oriented electrical steel strip and sheet delivered in the fully- processed state

IEC 60404-1-1:2004 Magnetic materials - Classification of surface insulations of electrical steel sheet, strip and laminations

IEC 60404-9:2018 Magnetic materials - Methods of determination of the geometrical characteristics of electrical steel sheet and strip.

4 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60404-8-4 apply. Deviating terms are defined below.

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>

4.1 Stator core (Magnetic stator core)

Part of an electric machine, composed of high-permeability material and intended to conduct magnetic flux.

Note – The magnetic core is surrounded by the stator winding.

4.2 Rotor core (Magnetic rotor core)

The rotor core of an electric machine is a rotating part of an electric machine.

4.3 Core stacking method

A stacking method is used to join individual electric sheets to form a complete magnetic core. This can be done among other technologies by stacking, welding, riveting, interlocking or gluing. See also B.5 .

4.4 Punching

Punching (shear cutting) is a cutting process for shaping electrical steel sheets.

4.5 Lasering

Laser cutting is a cutting process for shaping electrical sheets.

4.6 Specific total loss processing factor P_{SPF} (%)

The specific total loss processing factor is used to represent the specific total loss deviation determined at the electrical steel (e.g., Epstein test acc. to IEC 60404-2) in relation to the specific total loss at the magnetic core.

$$P_{SPF} = \frac{P_{S2}}{P_{S1}} \times 100$$

where

P_{S2} is specific total loss at the magnetic core;

P_{S1} is specific total loss at the electric steel (For example as a result from the Epstein test method.)

4.7 Magnetic field strength processing factor $\hat{H}_{PF}$ (%)

The Magnetic field strength processing factor is used to represent the magnetic field strength dissipation determined at the electric sheet in relation to the magnetic field strength determined at the magnetic core.

$$\hat{H}_{PF} = \frac{\hat{H}_2}{\hat{H}_1} \times 100$$

where

$\hat{H}_2$ is magnetic field strength at the magnetic core;

$\hat{H}_1$ is magnetic field strength at the electric steel (e.g.as a result from the Epstein test method)

4.8 Specific total loss P_s (W/kg)

The specific total loss P_s (W/kg) is a mass-related power loss which occurs in the electric sheet or in the magnetic core due to the re-magnetization process in the electromagnetic alternating field. The mass-related power loss P_s is composed of the mass-related hysteresis losses P_h (W/kg) and the mass-related eddy current losses P_e (W/kg).

See also B.4.

NOTE: For calculation of P_s , see IEC 60404-2, IEC 60404-3, IEC 60404-6

4.9 Specific Hysteresis power loss P_h (W/kg)

The specific hysteresis power loss results from the frequency-dependent remagnetization of the Weiss domains in the electrical sheet and depends on the structure of the electrical sheet.

NOTE: $P_h = \frac{P_s}{P_e}$; P_h can be calculated or determined indirectly by measurement.

4.10 Specific Eddy current loss P_e (W/kg)

The specific eddy current losses $P_e \left(\frac{W}{kg} \right)$ are caused by closed current paths in the laminated core and depend on the thickness of the laminations.

NOTE: $P_e = \frac{P_s}{P_h}$; P_e can be calculated or determined indirectly by measurement.

4.11 Electric sheet

Electric sheets are single, thin (e.g., 0.5 mm) sheets, made from very low carbon alloys, cold rolled, with soft magnetic behavior and reduced magnetic conductivity (compared to pure iron) which are joined together by a suitable stacking process to form a magnetic core.

4.12 Density ρ (kg/dm³)

at a given point within a three-dimensional domain of quasi-infinitesimal volume dV , scalar quantity equal to the mass dm within the domain divided by the volume dV , thus $\rho = dm/dV$

NOTE 1 Mass density is an intensive quantity describing a local property of a substance.

NOTE 2 The concept of mass density may also be applied to the mass m in a domain D with volume V , leading to the average density $\rho_{av} = \frac{m}{V} = \frac{1}{V} \int_D D \, dV$.

NOTE 3 The coherent SI unit of mass density is kilogram per cubic meter, kg/m³. Other units are tons per cubic meter, t/m³ (1 t/m³ = 1 000 kg/m³ = 1 g/cm³), and kilogram per liter, kg/l (1 kg/l = 1 000 kg/m³).

IEV ref 113-03-07

4.13 Thermal conductivity λ (W/(m·K))

at a point fixed in a medium with a temperature field, scalar quantity λ characterizing the ability of the medium to transmit heat through a surface element containing that point: $\phi = -\lambda \text{ grad } T$, where ϕ is the density of heat flow rate and T is thermodynamic temperature.

NOTE 1 In an anisotropic medium, thermal conductivity is a tensor quantity.

NOTE 2 The coherent SI unit of thermal conductivity is watt per meter kelvin, W/(m·K).

IEV ref 113-04-38

4.14 Fully- finished.

Fully- finished or fully- processed describes an already finally annealed and insulated electrical steel.

4.15 Semi- finished

Semi- finished or semi- processed describes an electrical steel without a finally annealed and insulated electrical steel.

5 Designation of electrical steel material

The following code letters shall be used to identify the designation of electric sheet and strip metal:

A	Standard type, fully- finished based on IEC 60404-8-4
N	Standard types, semi- finished based on IEC 60404-8-3
HP	Hight permeability types
HS	Hight strength electrical types
HF	Hight frequency types

For the time being, the respective values for types of N, HP, HS and HF must be separately agreed.