IEC 60893-3-1

Edition 3.0 2012-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Insulating materials – Industrial rigid laminated sheets based on thermosetting resins for electrical purposes –
Part 3-1: Specifications for individual materials – Types of industrial rigid laminated sheets

Matériaux isolants – Stratifiés industriels rigides en planches à base de résines thermodurcissables à usages électriques –
Partie 3-1: Spécifications pour matériaux particuliers – Types de stratifiés industriels rigides en planches

IEC 60893-3-1:2012

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX K

ICS 29.035.01

ISBN 978-2-83220-216-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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International Standard IEC 60893-3-1 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This third edition cancels and replaces the second edition, published in 2003 and constitutes a technical revision. This edition includes the following significant technical change with respect to the previous edition:

a) addition of new material types according to the third edition of IEC 60893-3-2 (in preparation).

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

CDV	Report on voting
15/606/CDV	15/641/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

A list of all the parts in the IEC 60893 series, under the general title *Insulating materials – Industrial rigid laminated sheets based on thermosetting resins for electrical purposes,* can be found on the IEC website.

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

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- withdrawn,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

INTRODUCTION

This part of IEC 60893 is one of a series which deals with industrial rigid laminated sheets based on thermosetting resins for electrical purposes.

The series consists of four parts:

– Part 1: Definitions, designations and general requirements (IEC 60893-1)
– Part 2: Methods of test (IEC 60893-2)
– Part 3: Specifications for individual materials (IEC 60893-3)
– Part 4: Typical values (IEC 60893-4)

IEC 60893-3-1 contains one of the sheets comprising Part 3, as follows:

Sheet 1: Types of industrial rigid laminated sheets.

INSULATING MATERIALS – INDUSTRIAL RIGID LAMINATED SHEETS BASED ON THERMOSETTING RESINS FOR ELECTRICAL PURPOSES –

Part 3-1: Specifications for individual materials – Types of industrial rigid laminated sheets

1 Scope

This part of IEC 60893 provides requirements for various materials. Their properties are given in subsequent Part 3 specification sheets.

Materials which conform to this specification meet established levels of performance. However, the selection of a material by a user for a specific application should be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

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.

IEC 60893-3-2, *Insulating materials – Industrial rigid laminated sheets based on thermosetting resins for electrical purposes – Part 3-2: Specifications for individual materials – Requirements for rigid laminated sheets based on epoxy resins*

3 Abbreviations

Type of resin		*Type of reinforcement*	
EP	Epoxy (epoxide)	CC	Woven cotton cloth
MF	Melamine	CP	Cellulosic paper
PF	Phenolic	GC	Woven glass cloth
UP	Unsaturated polyester	GM	Glass mat
SI	Silicone	PC	Woven polyester fibre cloth
PI	Polyimide	WV	Wood veneers
		CR	Combination reinforcement

NOTE Designation CR (combination reinforcement) is used for those laminates containing more than one type of reinforcement. The actual composition is given in the appropriate Part 3 specification.

4 Types

The types of industrial rigid laminated sheets are given in Table 1.

Table 1 – Types of industrial rigid laminated sheets

Laminate type			Application and distinguishing characteristics[b]
Resin	Reinforcement	Serial number[a]	
EP	CC	301	Mechanical and electrical applications. Good resistance to electrical tracking, good wear and chemical resistance (fine weave[c]).
	CP	201	Electronic applications. Good stability of electrical properties in high humidity. Low flammability.
	GC	201	Mechanical, electrical and electronic applications. Extremely high mechanical strength at moderate temperature. Very good stability of electrical properties in high humidity.
		202	Similar to type EP GC 201. Low flammability.
		203	Similar to type EP GC 201. High mechanical strength at elevated temperature.
		204	Similar to type EP GC 203. Low flammability.
		205	Similar to type EP GC 203, but with roving cloth.
		306	Similar to type EP GC 203, but with improved tracking indices.
		307	Similar to type EP GC 205, but with improved tracking indices.
		308	Similar to type EP GC 203, but with improved thermal endurance properties.
		309	Similar to EP GC 201, but with defined mechanical strength at elevated temperature.
		310	Similar to EP GC 202, but with halogen free compound[d].
		311	Similar to EP GC 204, but with halogen free compound[d].
	GM	201	Mechanical and electrical applications. Extremely high mechanical strength at moderate temperature. Very good electrical properties in high humidity.
		202	Similar to type EP GM 201. Low flammability.
		203	Similar to type EP GM 201. High mechanical strength at elevated temperature.
		204	Similar to type EP GM 203. Low flammability.
		305	Similar to type EP GM 203, but with improved thermal endurance properties.
		306	Similar to type EP GM 305, but with improved tracking indices.
	PC	301	Electrical and mechanical applications. Good resistance to SF_6 (coarse weave[c]).
MF	CC	201	Mechanical and electrical applications. Arc and tracking resistant (coarse weave[c]).
	GC	201	Mechanical and electrical applications. High mechanical strength. Arc and tracking resistant. Low flammability.

Table 1 *(continued)*

Laminate type			Application and distinguishing characteristics[b]
Resin	**Reinforcement**	**Serial number[a]**	
PF	CC	201	Mechanical applications. Better mechanical properties and poorer electrical properties than type PF CC 202 (coarse weave[c]).
		202	Mechanical and electrical applications (coarse weave[c]).
		203	Mechanical applications. Recommended for small parts. Better mechanical properties but poorer electrical properties than type PF CC 204 (fine weave[c]).
		204	Mechanical and electrical applications. Recommended for small parts (fine weave[c]).
		305	Mechanical and electrical applications. For close tolerance machining applications (very fine weave[c]).
	CP	201	Mechanical applications. Mechanical properties better than other PF CP types. Poor electrical properties in normal humidity. Also available in hot-punching versions.
		202	High-voltage applications at power frequencies. High electric strength in oil. Good electric strength in air in normal humidity.
		203	Mechanical and electrical applications. Good electrical properties in normal humidity. Also available in hot-punching versions.
		204	Electrical and electronic applications. Good stability of electrical properties in high humidity. Also available in cold or hot punching versions.
		205	Similar to type PF CP 204, but low flammability.
		206	Mechanical and electrical applications. Good electrical properties in high humidity. Also available in hot-punching versions.
		207	Similar to type PF CP 201, but with improved punching characteristics at lower temperature.
		308	Similar to type PF CP 206, but low flammability.
	GC	201	Mechanical and electrical applications. High mechanical strength and good electrical properties in normal humidity. Heat resistant.
	WV	201	Mechanical applications. Cross-plied. Good mechanical properties.
		202	Mechanical and electrical applications. Cross-plied. Good electrical properties in normal humidity.
		303	Mechanical applications. Parallel plied. Good mechanical properties.
		304	Mechanical and electrical applications. Parallel plied.

Table 1 *(continued)*

Laminate type			Application and distinguishing characteristics[b]
Resin	**Reinforcement**	**Serial number[a]**	
UP	GM	201	Mechanical and electrical applications. Good stability of electrical properties in high humidity. Good mechanical properties at moderate temperature.
		202	Mechanical and electrical applications. Similar to type UP GM 201. Low flammability.
		203	Mechanical and electrical applications. Similar to type UP GM 202, but with improved resistance to arcing and tracking.
		204	Mechanical and electrical applications. Very good mechanical properties at ambient temperature. Good mechanical properties at elevated temperature.
		205	Mechanical and electrical applications. Similar to type UP GM 204. Low flammability.
SI	GC	201	Electrical and electronic applications. Extremely good electrical properties in dry conditions. Good electrical properties in humid conditions.
		202	Mechanical and electrical applications at elevated temperature. Good heat resistance.
PI	GC	301	Electrical and mechanical applications. Very good mechanical and electrical properties at high temperature.

[a] This specification was originally based on ISO 1642[1][1], which is now obsolete. Consequently, the type designations of the 200 series types came from ISO 1642 and those of the 300 series were added later.

[b] It should not be inferred from the contents of Table 1 that laminates of any particular type are necessarily unsuitable for applications other than those listed for them, or that specific laminates will be suitable for all applications within the wide description given.

[c] Fabric weaves of type PC and CC reinforcements

	Mass per unit area g/m^2	*Thread count* cm^{-1}
Coarse weave	>130	≤30
Fine weave	≤130	>30
Very fine weave	≤125	>38

These values are only for information. They are not to be considered as specification values. In general, the finer weave materials have better machining characteristics.

[d] The definition of halogen free epoxy laminated sheet is given in IEC 60893-3-2.

1 The figure in square brackets refers to the bibliography.