

Specification for

Synthetic resin bonded woven glass fabric laminated sheet

Committees responsible for this British Standard

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- British Paper and Board Industry Federation
- Electrical and Electronic Insulation Association
- Electrical Research Association
- Electronic Engineering Association
- Ministry of Defence
- Rotating Electrical Machines Association
- Society of British Aerospace Companies Limited

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Foreword

This British Standard has been prepared under the direction of the Plastics Standards Policy Committee and is a revision of BS 3953:1976, which is withdrawn.

The glass fabric laminated sheet materials specified are generally more heat-resistant than laminates with a paper or cotton fabric base, and have generally better mechanical properties, particularly impact strength. Most of the glass fabric laminated materials that are specified can be drilled, tapped, sawn or otherwise machined; however, reference should be made to the manufacturer's recommendations.

In drafting this revision, consideration has been given to aligning it with the work of the International Organization for Standardization (ISO), in particular with International Standard ISO 1642. A new polyimide resin bonded type has been introduced in this standard, and two polyester bonded types have been deleted.

Woven glass fabric made from low-alkali "E" glass has been specified.

The types of laminated sheet of woven glass fabric bonded with synthetic resin that are specified in this standard correspond to those specified in BS 3953:1976 (withdrawn) and in ISO 1642, as given in Table 1. Table 1 is only a general guide to the relationship between the types of laminated sheets specified in the three standards. In view of the differences in limiting values, in test methods and in the ranges of properties covered, it should not be assumed that corresponding types are exact equivalents.

Table 1 — Relationship between types of laminated sheet specified in BS 3953:1990 and BS 3953:1976

Types in this standard	Types in BS 3953:1976 (withdrawn)
EP-7	EP-7
MF-3	MF-3
MF-5	MF-5
—	UP-4
UP-5	UP-5
—	UP-6

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, 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 requirements for 13 types of laminated sheet of woven glass fabric bonded with synthetic resin. It does not cover laminated sheets prepared by bonding together previously prepared thinner laminated sheets.

The ranges of thickness covered are as follows:

0.4 mm to 50 mm for types EP-7, MF-3 and MF-5;

0.4 mm to 12 mm for type UP-5.

The nominal density of the classes of material covered by this standard may be taken as 1.6 g/cm³ to 2.1 g/cm³.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1

laminated sheet of woven glass fabric bonded with synthetic resin

sheet or board made from layers of woven glass fabric treated with epoxy, melamine, polyimide, phenolic, silicone or polyester thermosetting resin and bonded together, usually under heat and pressure

2.2

woven glass fabric

a suitably treated or finished fabric woven from glass fibre yarn consisting of strands put together by twisting, the glass containing not more than 1 % of alkali metal oxide expressed as Na₂O ("E" glass)

2.3

flatwise

perpendicular to the plane of lamination

2.4

edgewise

parallel to the plane of lamination

2.5

directions A and B

two directions in the plane of a sheet that are at right angles. They are related to the surface layer of fabric, one of the directions being parallel to the warp threads or the weft threads of the fabric in a surface layer

3 Classification

The classification of the laminated sheets specified in this British Standard is as follows:

a) *Class EP (bonded with epoxy resin)*

Type EP-7 A general purpose type but offering a greater retention of mechanical strength at elevated temperature, after prolonged exposure to elevated temperature.

b) *Class MF (bonded with melamine resin)*

Type MF-3 Having better electrical properties than a general purpose type

Type MF-5 A special type, having a higher resistance to humidity and elevated temperature than type MF-3 and general purpose types.

c) *Class UP (bonded with polyester resin)*

Type UP-5 A general purpose type.

4 Colour

Unless otherwise specified in the material specification, the material shall contain no colour additive.

NOTE Coloured materials are available from most manufacturers if required but it is recommended that the possible deleterious effects of added colouring matter should be discussed and agreed by supplier and purchaser.

5 Appearance

Sheets shall be free from wrinkles, blisters and cracks. Unless otherwise specified by the purchaser, they shall be supplied with trimmed edges.

NOTE Sheets should be of uniform appearance and are normally available free from other small defects, for example, scratches, dents, inclusions and discoloration.

6 Flatness

When any sheet of nominal thickness 3 mm or more is placed without restraint, concave side up on a flat horizontal surface, the departure at any part of the upper surface of the sheet from a light straightedge laid in any direction upon it shall not exceed the values given in Table 2.

NOTE No limit is specified for materials of nominal thickness below 3 mm.

7 Nominal thickness and permissible deviations

The thickness of a sheet at any point shall not deviate from the nominal thickness by more than the appropriate value shown in Table 3. If the nominal thickness is not one of the preferred values, the tolerance of the next higher preferred nominal thickness shall apply.

NOTE 1 The preferred nominal thicknesses are given in Table 3.

NOTE 2 The permissible deviations from nominal thickness listed in Table 3 define upper and lower limits of thickness that are symmetrically disposed about the nominal thickness. By agreement between purchaser and supplier, limits disposed asymmetrically about the nominal thickness may be applied. In such cases the overall tolerance in thickness (i.e. the difference between the agreed upper and lower limiting values) should equal twice the appropriate numerical value given in Table 3.

8 Machinability

When sawn, drilled, turned, routed, milled or punched in accordance with the manufacturer’s recommendations, sheets shall not show any sign of splitting, cracking or delamination.

NOTE Chipping can occur with certain materials and in such instances a purchaser/supplier agreement would be required.

9 Physical and electrical properties

9.1 Basic requirements

When tested by the methods given in Table 4, the limiting values for any single sheet shall be as given in Table 4 and Table 5.

9.2 Optional requirements

NOTE 1 The requirements given in Table 6 are optional. If required these may be specified by the purchaser.

When tested by the methods given in Table 6, the limiting values for any single sheet shall be as given in Table 6 and Table 7.

Special requirements for laminated sheet of type MF-5 are given in Appendix P.

NOTE 2 These types of laminated sheet will satisfy the requirements for British Government Services.

Table 2

Type	Thickness	Departure from straightedge	
		1 m straightedge	0.5 m straightedge
All	mm	mm	mm
	3 up to and including 8	8	2
	Over 8	6	1.5
NOTE No limits are specified for materials of nominal thickness below 3 mm.			