

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1642

PLASTICS

BASIS FOR SPECIFICATION FOR INDUSTRIAL LAMINATED SHEETS
BASED ON THERMOSETTING RESINS

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 1642, *Plastics – Basis for specification for industrial laminated sheets based on thermosetting resins*, was drawn up by Technical Committee ISO/TC 61, *Plastics*, the Secretariat of which is held by the American National Standards Institute (ANSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1642, which was circulated to all the ISO Member Bodies for enquiry in August 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Belgium	Israel	Spain
Brazil	Italy	Sweden
Canada	Japan	Switzerland
Czechoslovakia	Korea, Rep. of	Turkey
France	Netherlands	U.A.R.
Germany	New Zealand	United Kingdom
Greece	Poland	U.S.A.
Hungary	Portugal	U.S.S.R.
India	Romania	
Iran	South Africa, Rep. of	

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

FOREWORD

This ISO Recommendation does not contain limits for properties. These will be inserted as soon as the necessary methods of test have been given in ISO and IEC Recommendations and data arising from experience of these methods become available.

PLASTICS

BASIS FOR SPECIFICATION FOR INDUSTRIAL LAMINATED SHEETS BASED ON THERMOSETTING RESINS

1. SCOPE

This ISO Recommendation gives a basis for specification covering industrial laminated sheets made with any one of the following resins as the binder : epoxy (epoxide), melamine, phenolic, (unsaturated) polyester and silicone. The sheets covered are flat and are those of the nominal thicknesses listed in Table 2.

2. CLASSIFICATION

The sheets covered by this specification are classified in types which differ in the resin and reinforcement employed and the distinguishing properties.

2.1 Abbreviations

Resins	Abbreviation	Reinforcements	Abbreviation
Epoxy (epoxide)	EP	Cellulose paper	CP
Melamine	MF	Woven cotton fabric	CC
Phenolic	PF	Wood veneer	WV
Polyester	UP	Asbestos paper	AP
Silicone	SI	Woven asbestos fabric	AC
		Asbestos felt (mat)	AM
		Woven glass fabric	GC
		Glass mat	GM

2.2 Types

The following list shows the combinations of resins and reinforcements which constitute the types covered by the specification, together with applications and distinguishing properties.

Type			Applications and distinguishing properties
Resin	Reinforcement	Number	
EP	CP	1	Electronic application. Good stability of electrical properties under high humidity, flame resistant.
	GC	1	Mechanical and electrical applications. Extremely high mechanical strength at moderate temperature. Very good stability of electrical properties under high humidity.
	GC	2	Similar to Type EP GC 1, flame resistant.
	GC	3	Similar to Type EP GC 1, extremely high mechanical strength at elevated temperature.
	GC	4	Similar to Type EP GC 3, flame resistant.
MF	GC	1	Mechanical and electrical applications. High mechanical strength, flame, arc, and tracking resistant.
PF	CP	1	Mechanical application. Mechanical properties better than other PF CP types. Poor electrical properties under normal humidity.
	CP	2	High voltage application at power frequencies. High electric strength under oil. Good electric strength in air under normal humidity.
	CP	3	Electrical and mechanical applications, good electrical properties under normal humidity.
	CP	4	Electrical and electronic applications, good stability of electrical properties under high humidity.
	CC	1	Mechanical application (coarse weave*). Good mechanical properties.
	CC	2	Mechanical and electrical applications (coarse weave*).
	CC	3	Mechanical application (fine weave*), recommended for small parts.
	CC	4	Mechanical and electrical applications (fine weave*), recommended for small parts.
	WV	1	Mechanical application. Good mechanical properties.
	WV	2	High voltage applications at power frequencies. Properties and other applications under consideration.
	WV	3	Mechanical and electrical applications, good electrical properties under normal humidity.
	AP	1	Mechanical application, heat and flame resistant.

* Characteristics of the base material

Mass per unit area, g/m²

Coarse weave > 130

Fine weave ≤ 130

Thread count per cm

< 30

≥ 30

These values are given for information only; they are not to be considered specification values.

Type			Applications and distinguishing properties
Resin	Reinforcement	Number	
PF	AC	1	Mechanical application. Mechanically better than PF AP 1, heat and flame resistant.
	AM	1	Mechanical application, heat and flame resistant.
	GC	1	Mechanical and electrical applications. High mechanical strength and good electrical properties under normal humidity, heat and flame resistant.
UP	GM	1	Mechanical, electrical and electronic applications. Good stability of electrical properties under high humidity.
	GM	2	Mechanical, electrical and electronic applications. Similar to UP GM 1, flame resistant.
SI	GC	1	Electronic and other electrical applications. Extremely good dielectric properties under dry conditions, still good properties under humidity.
	GC	2	Mechanical and electrical applications at elevated temperature, good heat resistance.

NOTE. — It must not be inferred from the above 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 descriptions given.

3. DEFINITIONS

For the purpose of this ISO Recommendation, the following definitions apply :

- 3.1 *Laminates*. Products made by bonding together two or more layers of material or materials. Industrial laminated sheets consist of superimposed layers of paper, fabric, veneer or felt (mat) that have been substantially impregnated with a thermosetting or curable resin and bonded together under pressure, with or without heat, to form a single piece. Other ingredients, for example, colouring matter, may be incorporated.
- 3.2 *Epoxy (Epoxide) resin*. Synthetic resin containing epoxide groups and capable of cross-linking.
- 3.3 *Melamine resin*. An amino resin made by polycondensation of melamine with formaldehyde or a compound that is capable of providing methylene bridges.
- 3.4 *Phenolic resin*. Generically a class of resins made by the polycondensation of phenol, its homologues and/or derivatives, with aldehydes or ketones.
- 3.5 *Polyester resin*. A polymer in which the repeated structural unit in the chain is of the ester type.
- 3.6 *Silicone resin*. Resin in which the main polymer chain consists of alternating silicon and oxygen atoms, with carbon-containing side groups.

4. APPEARANCE

Sheets shall be free from blisters, wrinkles and cracks and reasonably free from other defects, for example, scratches, dents and discolouration. A small amount of mottle is permissible.

5. FLATNESS

When any sheet of nominal thickness 3 mm or more is placed without restraint, concave side up, on a flat surface, the departure at any point of the upper surface of the sheet from a light straight-edge laid in any direction upon it shall not exceed the appropriate value given in Table 1.

TABLE 1 — Maximum permissible departure of surface of sheet from straight-edge

Material	Thickness	Length of straight-edge	
		100 cm	50 cm
Values for various materials and thicknesses are to be inserted later.			

6. TOLERANCES IN THICKNESS

The deviation from nominal thickness of a sheet at any point shall not exceed the value shown in Table 2 for the appropriate type and thickness. The diameter of the anvil of the measuring device shall be 6 to 8 mm.

TABLE 2 — Tolerances in thickness ($\pm$ mm)

Nominal thickness (mm)	EP		MF	PF							UP	SI
	CP	GC	GC	CP	CC	WV	AP	AC	AM	GC	GM	GC
	1	1 — 2 — 3 — 4	1	1 — 2 — 3 — 4	1 — 2 — 3 — 4	1 — 2 — 3	1	1	1	1	1 — 2	1 — 2
Values for various materials and thicknesses are to be inserted later.												

7. PHYSICAL PROPERTIES

When determined by the appropriate test methods, the physical properties shall be as given in Table 3.