# INTERNATIONAL STANDARD

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# Plastics — Prepregs — Bulk moulding compound (BMC) and dough moulding compound (DMC) — Basis for a specification

*Plastiques — Préimprégnés — Mélanges à mouler en masse BMC et DMC — Base de spécification*

Reference number
ISO 8606:1990(E)

## Contents





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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8606 was prepared by Technical Committee ISO/TC 61, *Plastics.*

INTERNATIONAL STANDARD ISO 8606:1990(E)

# Plastics — Prepregs — Bulk moulding compound (BMC) and dough moulding compound (DMC) — Basis for a specification

## 1 Scope

This International Standard establishes a basis for the specification of the polyester moulding compounds BMC (bulk moulding compound) and DMC (dough moulding compound) with or without thickening agents. BMC and DMC are different types of preimpregnated product used for the production, by moulding, of various parts made of composite materials.

This standard only considers BMC and DMC in which textile glass is the sole (or main) reinforcement.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 62:1980, *Plastics — Determination of water absorption.*

ISO 75:1987, *Plastics and ebonite — Determination of temperature of deflection under load.*

ISO 178:1975, *Plastics — Determination of flexural properties of rigid plastics.*

ISO 179:1982, *Plastics — Determination of Charpy impact strength of rigid materials.*

ISO 180:1982, *Plastics — Determination of Izod impact strength of rigid materials.*

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

ISO 472:1988, *Plastics — Vocabulary.*

ISO 604:1973, *Plastics — Determination of compressive properties.*

ISO 1172:1975, *Textile glass reinforced plastics — Determination of loss on ignition.*

ISO 1183:1987, *Plastics — Methods for determining the density and relative density of non-cellular plastics.*

ISO 1886:1980, *Textile glass — Method of sampling applicable to batches.*

ISO 2577:1984, *Plastics — Thermosetting moulding materials — Determination of shrinkage.*

ISO 3268:1978, *Plastics — Glass reinforced materials — Determination of tensile properties.*

ISO 4585:1989, *Textile glass reinforced plastics — Determination of apparent interlaminar shear properties by short-beam test.*

ISO 4586-2:1988, *Decorative high-pressure laminates (HPL) — Sheets based on thermosetting resins — Part 2: Determination of properties.*

ISO 4589:1984, *Plastics — Determination of flammability by oxygen index.*

ISO 8604:1988, *Plastics — Prepregs — Definitions of terms and symbols for designations.*

IEC 93:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials.*

IEC 112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.*

IEC 243-1:1988, *Methods of test for electric strength of solid insulating materials — Part 1: Tests at power frequencies.*

IEC 250:1969, *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths.*

IEC 695-2-1:1980, *Fire hazard testing — Part 2: Test methods — Glow wire test and guidance.*

## 3 Definitions

For the purposes of this International Standard, the definitions given in ISO 472 and ISO 8604 apply, together with the following:

**3.1 bulk moulding compound (BMC):** A homogeneous mixture of resins and chopped reinforcement fibres with or without fillers, without shape and capable of being moulded under heat and pressure.

NOTE 1 In bulk moulding compound, high viscosity is achieved by the use of chemical thickeners.

**3.2 dough moulding compound (DMC):** A bulk moulding compound, with no chemical thickeners added, capable of being moulded under heat and pressure.

NOTE 2 High viscosity is achieved by increasing the filler content.

## 4 Classification of BMC and DMC

### 4.1 General

A large number of combinations of resin systems, reinforcements, additives and fillers are necessary in order to manufacture a wide variety of different types of moulded part each of which requires a well defined composition to give it its particular

— shape,

— mechanical strength,

— electrical properties,

— colour and

— surface finish.

In view of the large number of possible combinations, two systems of classification are proposed:

— the first one based on the composition,

— the second one based on the shrinkage.

### 4.2 Classification based on composition

#### 4.2.1 Resin (matrix)

Various types of resin can be used, such as:

— unsaturated polyester resin (UP);

— epoxy resin;

— polyurethane resin (PUR);

— vinyl ester resin (VE);

— phenolic resin (P).

For a description of the resin concerned, refer to the relevant International Standard listed in annex B [3][4].

#### 4.2.2 Reinforcement(s)

Although this International Standard covers only textile-glass reinforcements, other types may nevertheless be used together with the main (glass) reinforcement. The reinforcement generally takes the form of chopped strands of length between 3 mm and 25 mm.

BMC and DMC usually contain between 10 % (*m*/*m*) and 35 % (*m*/*m*) of reinforcing material. The proportion of reinforcement is stated after the designation of the type of moulding compound.

#### 4.2.3 Other components

##### 4.2.3.1 Fillers

Fillers are inert, finely divided materials. They are used for the following reasons:

— to reduce the cost of the moulding composition, e.g. calcium carbonate;

— to improve the combustion characteristics, e.g. aluminium trihydrate;

— to improve the surface finish, e.g. clay.

##### 4.2.3.2 Additives

As well as the additives required to manufacture the moulding compound as such [catalyst, releasing agent to facilitate removal of the moulded product from the mould, thickening agent (for BMC)] the following additives may be specified:

— pigments, added in the form of a paste or dispersion;

— low-shrink additives (usually thermoplastics resins) used for very-low-shrink or zero-shrink moulding compounds;

— other additives: fire-retarding agents, UV absorbers, cure retarders (inhibitors), etc.

### 4.3 Classification based on linear shrinkage

#### 4.3.1 General-purpose BMC or DMC

Designates products for which shrinkage during curing is between 0,2 % and 0,5 %.

#### 4.3.2 Low-shrink BMC or DMC

Designates products for which shrinkage during curing is between 0,05 % and 0,2 %.

#### 4.3.3 Very-low-shrink (low profile) BMC or DMC

Designates products for which shrinkage during curing is less than 0,05 %.

#### 4.3.4 Zero-shrink BMC or DMC

Designates products for which shrinkage during curing is zero.

The shrinkage will depend on the orientation and length of the reinforcing fibres. The filler content influences the shrinkage — the more filler the less the shrinkage.

NOTE 3 Shrinkage in moulding compounds is one of the main reasons for the formation of sink marks (hollows) in moulded parts with ribs and bosses. General surface imperfections and warpage may also be caused by shrinkage of the moulding compound.

## 5 Properties

The following list gives properties which may be specified, with tolerances, in the specification for a given bulk moulding or dough moulding compound.

### 5.1 Properties measured on BMC or DMC as received

#### 5.1.1 Physical and chemical properties

See annex A for a list of properties for which ISO standards specifying the methods of test are being prepared.

#### 5.1.2 Defects

The specification shall include all the information required to define the normal visual appearance of the BMC or DMC and to define acceptable defects related to visual appearance.

The following are considered as defects, either of the product itself or of the unit of manufacture:

— patches short of resin (dry spots caused by incomplete impregnation);

— patches with excess resin;

— contamination (foreign matter);

— colour heterogeneity;

— tears, holes or cracks in the boxes or other containers, or in the protective film, in which the product is packed.

The maximum number of each type of defect per unit mass shall be defined in the manufacturer's specification or by agreement between the manufacturer and the purchaser.

### 5.2 Properties measured on moulded specimens

When measuring the undermentioned properties, test specimens may be machined from moulded plates, moulded, or machined from finished parts when possible.

#### 5.2.1 Mechanical properties

— Tensile strength, elongation and tensile modulus of elasticity:

  ISO 3268 — Type II or type III specimens of width equal to or greater than 20 mm;

— Flexural strength and flexural modulus of elasticity:

  ISO 178

— Impact strength (unnotched test specimen):

  ISO 179 (or ISO 180)

— Compression strength:

  ISO 604

— Shear strength:

  ISO 4585

— Temperature of deflection under load:

  ISO 75

#### 5.2.2 Physical properties

— Density:

ISO 1183

— Moulding shrinkage:

ISO 2577

— Loss on ignition:

ISO 1172

— Fire hazard:

IEC 695-2-1

— Oxygen index:

ISO 4589

— Water absorption:

ISO 62 (test temperature 23 °C — method 1)

#### 5.2.3 Electrical properties

— Dielectric strength:

IEC 243

— Dielectric constant (permittivity):

IEC 250

— Surface resistivity:

IEC 93

— Volume resistivity:

IEC 93

— Proof tracking index:

IEC 112

## 6 Sampling

### 6.1 Sampling procedure

A consignment may be made up of one or more batches. Each batch is identified by a number.

NOTE 4 What constitutes a batch may be defined by the manufacturer of the moulding compound and may be an individual mix from a batch mixer, one of a series of numbered mixes from a batch mixer using the same batches of raw materials, or a given output, measured in terms of mass or production time, from a continuous-production unit.

Select the sample (bags or boxes) from each batch in accordance with ISO 1886. The test specimens shall be taken from this sample and prepared as described in the test methods.

Care shall be taken to protect the sample in order to prevent its moulding properties from deteriorating (for example by loss of volatile components such as styrene).

### 6.2 Conditioning of sample

If no specific conditioning is required, the sample shall be sealed in cellophane bags to avoid any loss of styrene and shall be conditioned for at least 6 h in the standard atmosphere 23 °C ± 2 °C, (50 ± 5) % R.H., in accordance with ISO 291.

## 7 Shelf life

The manufacturer shall state the maximum storage life of the material, in its original unopened packaging, under the conditions recommended by him (for example maximum temperature, relative humidity).

## 8 Packaging and marking

### 8.1 Packaging

The contents of each unit package shall be protected by a film of a material, such as cellophane or aluminized kraft paper, which is impermeable to volatile products, for example styrene. The unit packages shall then be palletized or otherwise assembled and protected in such manner that they will not suffer any damage under normal conditions of transport and storage.

If it is known that a consignment will be sampled (by the customs in international trade, for instance), it is recommended that a small, representative sample be included with the consignment, in order to avoid the packages being opened and damage being caused.

### 8.2 Marking

Each unit package shall be identified with the following information:

a) the designation of the product;

b) the classification code for the material and the manufacturer's code;

c) the name and address of the manufacturer;

d) the number of unit packages;

e) the batch number;

f) the colour code for the material;

g) the mass of moulding compound in the package;

h) the date of manufacture;

i) the shelf life and recommended storage conditions.

## Annex A
(informative)

## Physical and chemical properties

Manufacturer and purchaser may include in a materials specification properties for which test methods exist in the literature. At the time of publication of this International Standard, ISO plans to develop test methods in the future for the determination of properties such as:

— Reinforcement and filler content

— Fibre length

— Volatile-matter content

— Reactivity

— Mouldability

## Annex B
(informative)

## Bibliography

[1] ISO 2797:1986, *Textile glass — Rovings — Basis for a specification.*

[2] ISO 3598:1986, *Textile glass — Yarns — Basis for a specification.*

[3] ISO 3672-1:1979, *Plastics — Unsaturated polyester resins — Part 1: Designation.*

[4] ISO 3673-1:1980, *Plastics — Epoxide resins — Part 1: Designation.*

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