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Plastics — Acrylonitrile-butadiene-styrene (ABS) moulding and extrusion materials — Part I : Designation

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Plastiques — Plastiques à base d'acrylonitrile-butadiène-styrène (ABS), pour moulage et extrusion — Partie I : Désignation

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2580/I was developed by Technical Committee ISO/TC 61, *Plastics*, and was circulated to the member bodies in July 1976.

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It has been approved by the member bodies of the following countries :

Australia	India	Portugal
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The member bodies of the following countries expressed disapproval of the document on technical grounds :

Italy
South Africa, Rep. of

This International Standard cancels and replaces ISO 2580-1974, of which it constitutes a technical revision.

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Plastics – Acrylonitrile-butadiene-styrene (ABS) moulding and extrusion materials – Part I : Designation

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard establishes a system of designation for the classification of impact-modified styrene/acrylonitrile (or substituted styrene) thermoplastic materials which are differentiated from each other by appropriate levels of at least one of five chosen properties. The values given in this International Standard are not intended for design purposes.

The designation is applicable to materials ready for normal use, for example those containing colorants and additives for normal processing. However, the presence of other colorants and additives can change the classification of the material.

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1.2 This International Standard does not apply to

a) materials containing less than 10 % acrylonitrile in the continuous phase;

b) materials with an Izod impact strength less than 30 J/m (equivalent to a notched Charpy impact strength of 3 kJ/m^2);

c) materials containing more than 5 % of another comonomer or polymer in the continuous phase;

d) materials containing fibres;

e) materials containing less than 40 % (*m/m*) of butadiene units in the elastomer of the elastomeric phase.

2 REFERENCES

ISO 178, *Plastics – Determination of flexural properties of rigid plastics.*

ISO/R 179, *Plastics – Determination of the Charpy impact resistance of rigid plastics (Charpy impact flexural test).*

ISO/R 180, *Plastics – Determination of the Izod impact resistance of rigid plastics (Izod impact flexural test).*

ISO 291, *Plastics – Standard atmospheres for conditioning and testing.*

ISO 306, *Plastics – Determination of the Vicat softening temperature of thermoplastics.*

ISO 1133, *Plastics – Determination of the melt flow rate of thermoplastics.*[1]

ISO 1656, *Raw natural rubber and natural rubber latex – Determination of nitrogen.*

ISO 2557, *Plastics – Amorphous thermoplastic moulding materials – Preparation of test specimens with a defined level of shrinkage.*

3 DEFINITION

ABS plastics : Two-phase systems in which the continuous phase consists of copolymers of styrene and/or substituted styrene and acrylonitrile, and the dispersed elastomeric phase is based on a polymer or copolymer of butadiene as the impact modifier.

4 SYSTEM OF DESIGNATION

4.1 The properties chosen to designate ABS plastics are

a) acrylonitrile content in the continuous phase;

b) Vicat softening temperature;

c) melt flow rate;

d) Izod or notched Charpy impact strength;

e) flexural modulus.

These properties are chosen as being the most suitable for the identification and designation of the various types of ABS plastics.

The types are identified by a five-digit numerical designation; for example, the first digit refers to acrylonitrile content, the number indicating which of the cells in the table includes the average value for that type. Thus, for example, an ABS plastic having an acrylonitrile content of 25 %, a Vicat softening point of 95 °C, a melt

1) At present at the stage of draft. (Revision of ISO/R 1133-1969.)

flow rate of 0,5, an Izod impact strength of 250 J/m (or a notched Charpy impact strength of 15 kJ/m^2), and a flexural modulus of 2,6 GPa, would be designated ABS 1213(I)3 or ABS 1213(C)3 (see the table). If the values of properties fall on the borderline between two cells, the materials is to be classified by the manufacturer.

Not all possible combinations of the values for the five properties used to designate ABS plastics are provided by currently available ABS plastics.

4.2 The properties selected for this method of designation are not necessarily adequate for predicting the behaviour of a material in use. Therefore, other properties are or may be necessary to specify materials for particular purposes. General properties of ABS plastics which may be useful in this regard are shown in ISO 2580/II.[1)]

4.3 This designation does not imply that different materials are always compatible with each other if they have the same designation.

5 GENERAL REQUIREMENTS

5.1 The table shows the requirements that define ABS plastics, and lists the physical properties used to classify these materials, together with the appropriate test methods.

5.2 Other characteristic general properties of ABS plastics are shown in ISO 2580/II.

5.3 Average results of tests shall conform to the tabulated requirements of the table. Only those tests which define type shall be used to establish conformity of a material to type. Other properties needed for a particular purpose may be identified, with the method for determination, for example by selection from ISO 2580/II, and agreed between the interested parties.

6 DETAILED REQUIREMENTS

6.1 Test specimens

Most mechanical properties of moulded specimens are affected by residual stresses and orientations; it is important that these be controlled.

Moulding conditions for specimens in the basic state shall be adjusted so that the partial shrinkage of the specimens at 170 °C, 15 min, is not greater than 5 % when determined in accordance with ISO 2557, using a 30 mm test length cut from the central part of the moulded specimen. Other convenient test lengths may be used by agreement, but then different criteria of suitability must also be agreed.

NOTE — A partial shrinkage of 5 % at 170 °C, 15 min, corresponds to 2 to 3 % at VST/B (ISO 306) + 40 °C, 30 min.

6.2 Preparation of test specimens

Specimens shall be prepared by thermal relaxation of injection moulded specimens conforming to the requirements of ISO 2557.

Alternatively, specimens of suitable dimensions may be machined from items such as sheet, provided it is in the basic state.

Material shall be pre-dried as recommended by the manufacturer.

6.3 Conditioning

Moulded test specimens shall be allowed to cool to 23 ± 2 °C in a desiccator after moulding. In case of dispute, specimens and granular materials shall be placed for 4 h in an oven at 80 °C and afterwards cooled to 23 ± 2 °C in a desiccator and left there until tested.

6.4 Test conditions

The stated tests shall be conducted in a standard laboratory atmosphere according to ISO 291. The limits in the table are based on tests conducted at 23 °C and 50 % relative humidity.

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1) At present at the stage of draft.

TABLE — **Characteristics of type**

Designation number	Property	Test method	Specimen size mm	Units	Limits			
					1	2	3	4
1	Acrylonitrile content in the continuous phase	Kjeldahl (see the annex)	–	%	10 to 30	> 30	*	*
2	Vicat softening temperature at 49,05 N load	ISO 306	as specified	°C	< 90	90 to 100	> 100 to 110	> 110
3	Melt flow rate	ISO 1133** but at 220 °C and 10 kg load	–	g/10 min	< 5	5 to 10	> 10 to 20	> 20
4	Izod impact (I) or notched Charpy impact (C)	ISO/R 180 ISO/R 179	63,5 × 12,7 × 6,35 50 × 6 × 4	J/m kJ/m²	30 to 100 3 to 8	> 100 to 200 > 8 to 12	> 200 to 300 > 12 to 18	> 300 > 18
5	Flexural modulus	ISO 178	80 × 10 × 4 or 20 *h* × 2,5 *h* × *h*	GPa	< 1,8	1,8 to 2,3	> 2,3 to 2,8	> 2,8

NOTE — The values shown in lines 2, 4 and 5 are based on specimens moulded according to clause 6.

* *These spaces are left open for future use.*

** Die diameter : 2,090 to 2,100 mm.

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ANNEX

EVALUATION OF THE ACRYLONITRILE CONTENT IN THE CONTINUOUS PHASE OF ABS POLYMERS

A.1 PRINCIPLE

Separation of the non-grafted resin from the ABS polymer, determination of the nitrogen content of this resin and calculation of the acrylonitrile content of the continuous phase of the ABS polymer.

A.2 PROCEDURE

A.2.1 Pre-extraction with *n*-hexane

Extract the dried granules (of dimensions approximately 3 mm × 3 mm × 3 mm) of the ABS with *n*-hexane for about 80 h in a Soxhlet apparatus. During this time, additives such as anti-oxidants and lubricants will be removed. Dry the residue under vacuum at 60 °C.

A.2.2 Extraction with acetone

Extract 1,2 g of the ABS residue (A.2.1) with 50 ml of acetone, with occasional stirring, for 24 h at room temperature. Centrifuge the dispersion to separate a clear solution of the resin from the insoluble residue; for example centrifuging at a rotational frequency of 20 000 min^{-1} for 40 min is satisfactory. Extract the residue several times with acetone and separate the solution by centrifuging. The combined acetone solution contains quantitatively the non-grafted resin, which can be precipitated by pouring it into ten times its volume of methanol at − 10 °C. Dry the precipitated resin under vacuum at 60 °C.

A.2.3 Acrylonitrile content

Determine the acrylonitrile content of the precipitated resin (A.2.2) by the Kjeldahl analysis of nitrogen (see ISO 1656).

The percentage of nitrogen multiplied by the factor 3,79 gives the percentage of acrylonitrile.

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