INTERNATIONAL STANDARD

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Plastics — Aminoplastic moulding materials — Specification

Plastiques — Matières à mouler aminoplastes — Spécification

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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 2112 was prepared by Technical Committee ISO/TC 61, *Plastics*.

This second edition cancels and replaces the first edition (ISO 2112:1977), of which it constitutes a technical revision.

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Plastics — Aminoplastic moulding materials — Specification

1 Scope

1.1 This International Standard establishes a specification applicable to four types of aminoplastic moulding materials, classified according to use, as follows:

Type UF A — General purpose

Example: Urea-formaldehyde resin with cellulose filler.

Type MF B — Hot-water resistant

Example: Melamine-formaldehyde resin with cellulose filler.

Type MF C — Heat resistant and electrical

Example: Melamine-formaldehyde resin with inorganic filler.

Type MF D — Impact resistant

Example: Melamine-formaldehyde resin with chopped cotton-cloth filler.

1.2 These types have been further sub-divided into grades based on property levels and requirements, as follows:

Grade UF A10 **Grade UF A11**	Substantially alpha-cellulose-filled material
Grade UF A20	Substantially woodflour-filled material
Grade MF B10	Substantially alpha-cellulose-filled material
Grade MF B11	Substantially alpha-cellulose-filled material with limited formaldehyde migration
Grade MF B12	Substantially alpha-cellulose-filled material with limited formaldehyde migration for injection-moulding applications
Grade MF B20	Substantially woodflour-filled material

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 171:1980, *Plastics — Determination of bulk factor of moulding materials.*

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 181:1981, *Plastics — Determination of flammability characteristics of rigid plastics in the form of small specimens in contact with an incandescent rod.*

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

ISO 295:1974, *Plastics — Compression moulding test specimens of thermosetting materials.*

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

ISO 2818:1980, *Plastics — Preparation of test specimens by machining.*

ISO 3671:1976, *Plastics — Aminoplastic moulding materials — Determination of volatile matter.*

ISO 4614:1977, *Plastics — Melamine-formaldehyde mouldings — Determination of extractable formaldehyde.*

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

IEC 167:1964, *Methods of test for the determination of the insulation resistance of solid insulating materials.*

IEC 243:1967, *Recommended methods of test for electric strength of solid insulating materials 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 296:1982, *Specification for unused mineral insulating oils for transformers and switchgear.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 aminoplastic moulding material: A thermosetting moulding compound consisting of an amino resin binder that has been intimately combined in the uncured or partially cured condition with fillers, pigments and other chemical agents.

3.2 amino resin: A synthetic resin derived from the reaction of urea, thiourea, melamine or allied compounds with an aldehyde or aldehydes, usually formaldehyde.

4 General requirements

Aminoplastic moulding materials complying with this specification shall meet the appropriate property requirements shown in table 1.

It shall not be inferred from the above that materials of any particular type are necessarily unsuitable for applications other than those indicated, or that specific materials will be suitable for all applications within the wide descriptions given.

5 Test specimens

Bulk factor, flow and volatile-matter content should preferably be determined on the moulding material. The other properties should preferably be determined on moulded test specimens prepared in accordance with ISO 295. It is however permissible to machine test specimens (see ISO 2818) from sheet moulded in accordance with the moulding conditions of ISO 295, as long as it can be shown that the specimens give results that do not differ significantly from those obtained using moulded specimens.

Test specimens to be used for determining the properties given in the lower section of table 1 shall be conditioned under prevailing atmospheric conditions as allowed in ISO 291, unless otherwise stated in the method of test or agreed on between the interested parties.

Tests shall commence not less than 16 h and not more than 72 h after the test specimens have been moulded, unless otherwise specified in the test methods.

When the test specimens have been moulded from powder that has been preheated or dried, then this fact shall be stated in the test report. The conditions of preheating or drying shall also be given.

6 Methods of test

For mechanical tests, it is permissible for the force to be applied in an alternative direction to that specified in the test methods, provided that the results do not differ significantly from those obtained when the force is applied in the specified direction.

6.1 Determination of flexural stress at rupture

See ISO 178. Five test specimens of length not less than 80 mm, of width 10 mm and of thickness 4 mm shall be used.

For both moulded bars and test specimens machined from material moulded in the form of a plate, the load shall be applied parallel to the direction of moulding pressure. The test speed shall be 2 mm/min $\pm$ 0,2 mm/min.

6.2 Determination of Charpy impact strength

See ISO 179. For both moulded bars and test specimens machined from material moulded in the form of a plate, the load shall be applied parallel to the direction of moulding pressure.

Table 1 — Properties of aminoplastic moulding materials

The values specified in this table represent the mean result for the property measured except for extractable formaldehyde, in which case the individual results shall comply with the limit.

Property	Units	Max. or min.	Type UF A			Type MF B				Type MF C	Type MF D	Method of test
			Grade UF A10	Grade UF A11	Grade UF A20	Grade MF B10	Grade MF B11	Grade MF B12	Grade MF B20	Grade MF C10	Grade MF D10	
Properties measured on moulding powder												
Bulk factor	—	max.	X	X	X	X	X	X	X	X	X	ISO 171
Flow	—	—	X	X	X	X	X	X	X	X	X	—1)
Volatile matter	%	max.	X	—	—	—	—	—	—	—	—	ISO 3671
Properties measured on test specimens 2)												
Flexural stress at rupture	MPa	min.	80	70	70	80	80	80	70	50	50	ISO 178
Impact strength3)												
— Charpy, notched	kJ/m²	min.	1,5	1,5	1,3	1,5	1,5	1,5	1,5	2,0	6,0	ISO 179, method 3C
— Charpy, unnotched	kJ/m²	min.	6,5	6,0	5,5	7,0	7,0	7,0	6,0	3,5	6,0	ISO 179, method 3D
— Izod	kJ/m²	min.	1,5	1,5	1,3	1,5	1,5	1,5	1,5	2,0	6,0	ISO 180, method 2A
Temperature of deflection under load	°C	min.	110	110	95	150	150	140	130	140	120	ISO 75, method A
Incandescence resistance		—	X	X	X	X	X	X	X	X	X	ISO 181
Insulation resistance after 24 h in water	Ω	min.	10^{10}	10^{10}	10^{10}	10^{10}	—	10^{10}	10^{8}	10^{8}	10^{8}	IEC 167
Electric strength	MV/m	min.	5,0	3,0	3,0	5,0	—	3,0	5,0	2,0	2,0	IEC 243
Comparative tracking resistance	V	min.	CTI 500	CTI 500	CTI 500	CTI 500	—	CTI 500	CTI 500	CTI 500	CTI 500	IEC 112
Dielectric dissipation factor (tan δ), 1 MHz	—	max.	—	—	—	—	—	—	—	0,30	—	IEC 250
Water absorption — hot	mg	max.	—	—	—	130	130	130	200	100	—	ISO 62, method 4
Water absorption — cold	mg	max.	150	150	200	100	100	100	150	80	120	ISO 62, method 1
Mould shrinkage	%	max.	1,0	1,2	1,0	0,9	0,9	1,1	0,9	0,7	0,8	ISO 2577
Post-moulding shrinkage, 48 h	%	max.	X	X	X	X	X	X	X	X	X	ISO 2577
Extractable formaldehyde — water	4)	max.	—	—	—	—	n	n	—	—	—	ISO 4614
Extractable formaldehyde — acetic acid	4)	max.	—	—	—	—	n	n	—	—	—	ISO 4614
Extractable formaldehyde — alcohol	4)	max.	—	—	—	—	n	n	—	—	—	ISO 4614

X Limits to be agreed on between the interested parties.

n Property shall be measured. Limits will be inserted when these have been agreed on within the Technical Committee.

1) Test method yet to be decided.

2) Details of the method, procedures and specimens to be used are given in clause 6.

3) The Charpy and Izod methods are alternatives, to be used as agreed on between the interested parties.

4) µg/cm² of specimen surface.

6.2.1 Charpy notched impact strength

See ISO 179, method 3C. Five test specimens shall be used.

6.2.2 Charpy unnotched impact strength

See ISO 179, method 3D. Five test specimens shall be used.

6.3 Determination of Izod impact strength

See ISO 180, method 2A. Five test specimens shall be used.

In the case of specimens machined from material moulded in the form of a plate, the load shall be applied perpendicular to the direction of moulding pressure.

6.4 Determination of temperature of deflection under load

See ISO 75, method A. Two test specimens of length not less than 110 mm, of width 10 mm and of thickness 4 mm shall be used.

6.5 Determination of incandescence resistance

See ISO 181.

6.6 Determination of insulation resistance

See IEC 167. Each test specimen shall be in the form of a flat plate moulded to a thickness of 3,0 mm ± 0,25 mm. The taper pin electrodes shall be used. Before carrying out the test, the specimen shall be conditioned (without electrodes) in an oven at 50 °C ± 2 °C for 24 h ± 1 h, and then cooled to room temperature in a desiccator. It shall then be immersed in distilled or de-ionized water at 23 °C ± 2 °C for 24 h ± 1 h. Before testing, the surface water shall be removed with blotting or filter paper, or with a clean, absorbent cloth, and the electrodes fitted. The measurement of insulation resistance shall be made within 5 min after the end of the immersion. At least two specimens shall be used.

6.7 Determination of electric strength at power frequencies

See IEC 243. At least two test specimens shall be used for the determination.[1] Each shall be 3,0 mm ± 0,25 mm thick and not less than 100 mm in diameter. Each test specimen shall be immersed in oil at a temperature of 90 °C ± 2 °C for 15 min to 20 min before the test and during the test. The oil should, preferably, be one complying with the requirements of IEC 296. The 20 s step-by-step method shall be used.

6.8 Determination of tracking resistance under moist conditions

See IEC 112. Test solution A shall be used. For quality-control purposes, the proof test may be used; the numerical value of the applied voltage shall be that of the comparative tracking index given in table 1. Two determinations shall be made.

6.9 Determination of dielectric dissipation factor

See IEC 250. The conditions of test shall be: frequency 1 MHz; temperature 23 °C ± 2 °C; relative humidity (50 ± 5) %; electrodes — metal foil or conductive paint. Two test specimens shall be used.

6.10 Determination of water absorption

See ISO 62. Two test specimens 50 mm ± 1 mm in diameter and 3 mm ± 0,2 mm thick should preferably be used. As an alternative, when agreed between purchaser and supplier, square specimens of side 50 mm ± 1 mm cut from 4 mm ± 0,2 mm thick moulded plates may be used. If this alternative type of test specimen is used, the requirements shall also be the subject of agreement between purchaser and supplier.

6.10.1 Hot-water absorption

See ISO 62. Method 4 shall be used.

6.10.2 Cold-water absorption

See ISO 62. Method 1 shall be used.

6.11 Determination of mould shrinkage

See ISO 2577. Two test specimens shall be used.

For materials intended for injection or transfer moulding, the method of preparation of the test specimens shall be agreed on between purchaser and supplier.

6.12 Determination of post-moulding shrinkage

See ISO 2577. Two test specimens shall be used.

1) It may be necessary to measure the short-time value on an additional test specimen in order to determine the initial voltage to be applied.

For materials intended for injection or transfer moulding, the method of preparation of the test specimens shall be agreed on between purchaser and supplier.

6.13 Determination of extractability of formaldehyde

See ISO 4614. Two test specimens shall be used.

7 Marking

Moulding materials purporting to comply with the requirements of this International Standard shall be supplied in containers marked with the identity of the supplier, the material type and grade, the batch reference number and the number of this International Standard.

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Descriptors: plastics, thermosetting materials, moulding materials, aminoplasts, specifications, tests, marking.

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