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Cellular plastics, rigid — Test methods for self-skinned, high-density materials

Plastiques alvéolaires rigides — Méthodes d'essai pour les produits à peau intégrée et à haute densité

Reference number
ISO 9054:1990(E)

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 9054 was prepared by Technical Committee ISO/TC 61, *Plastics*.

Annex A forms an integral part of this International Standard.

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Cellular plastics, rigid — Test methods for self-skinned, high-density materials

1 Scope

This International Standard specifies the basic test procedures for the determination of the physical properties of self-skinned, high-density (typically having an overall density in excess of 100 kg/m^3) rigid cellular plastic materials.

This standard also specifies the primary methods to be used for comparison of materials similar to self-skinned, high-density materials as defined in clause 3, based upon ISO test methods and using a standard test specimen thickness. It likewise permits the use of the same test methods, when found to be suitable, for the assessment of the properties of products of different thickness, when agreed upon by the supplier and the purchaser.

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

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

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

ISO 845:1988, *Cellular plastics and rubbers — Determination of apparent (bulk) density.*

ISO 868:1985, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness).*

ISO 1922:1981, *Cellular plastics — Determination of shear strength of rigid materials.*

ISO 1923:1981, *Cellular plastics and rubbers — Determination of linear dimensions.*

ISO 1926:1979, *Cellular plastics — Determination of tensile properties of rigid materials.*

ISO 4897:1985, *Cellular plastics — Determination of the coefficient of linear thermal expansion of rigid materials at sub-ambient temperatures.*

ISO 6603-1:1985, *Plastics — Determination of multiaxial impact behaviour of rigid plastics — Part 1: Falling dart method.*

ISO 6603-2:1989, *Plastics — Determination of multiaxial impact behaviour of rigid plastics — Part 2: Instrumented puncture test.*

ISO 8301:—[1], *Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus.*

ISO 8302:—[1], *Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus.*

IEC 243:1967, *Recommended methods of test for electric strength of solid insulating materials at power frequencies.*

1) To be published.

3 Definition

For the purposes of this International Standard, the following definition applies.

self-skinned, high-density material; integral-skin foam; structural foam: A rigid cellular material, with an integral surface skin formed during manufacture, which has either:

a) one or more surface zones with an apparent density substantially greater than that of the core material;

or

b) a relatively uniform density.

4 Test specimens

Where the form and thickness of the finished product are known, the thickness of the specimen shall be "as produced". In those instances where the final form and shape of the product are unknown, or where the thickness of the part is variable, the test thickness shall be as agreed upon by the purchaser and supplier. When a test specimen is moulded expressly for test purposes, the identical conditions, as specified by the material supplier for use in the production of the finished product, shall be used insofar as is practical.

When test specimens are cut from a finished part or a part moulded expressly for test purposes, no specimen is to be cut from within an area closer to any edge than 20 mm.

Test specimens may be cut from finished parts whose thickness is at least 10 mm. All test specimens shall be machined in such a manner that no irregularities are produced at the cut edges.

Test specimens shall not be cut from any part until at least 72 h have elapsed from the time of production of the test part.

5 Conditioning and testing

5.1 Conditioning

All test specimens shall be conditioned for a minimum of 16 h after cutting (preparation) in an atmosphere as set forth in ISO 291. The preferred conditions are 23 °C ± 2 °C and 50 % ± 5 % R.H. For tropical climates, the conditions are 27 °C ± 2 °C and 65 % ± 5 % R.H. Other conditioning atmospheres may be used as agreed between the purchaser and supplier.

5.2 Testing

The testing of the specimens shall be performed under the same conditions as used for conditioning the test specimens.

6 Test methods

All tests for material properties shall be as agreed upon between purchaser and supplier. These tests will vary from material to material depending upon the ultimate use of the finished material. It should be recognized that properties are influenced by the variation of the density in the direction of the thickness.

Where ISO test methods are unavailable or cannot be used for determining the property values as set forth in these clauses, national practice shall be the guiding factor.

6.1 Apparent density

See ISO 845.

The linear dimensions shall be measured with an accuracy of 0,01 mm (in accordance with ISO 1923) and the mass to an accuracy of 0,1 g.

6.2 Bending strength

See ISO 178, which determines the bending stress and deflection at break or at 10 mm and 20 mm deflection.

If the specimen does not break (rupture) before reaching 20 mm deflection, stop the test and calculate the bending stress at 10 mm and 20 mm deflection.

If the specimen breaks between 10 mm and 20 mm, report the bending stress at 10 mm as well as the deflection at break.

6.3 Impact strength

The impact strength shall be determined by a falling dart test method (see ISO 6603-1).

Preferably, an instrumented falling dart apparatus should be used (see ISO 6603-2).

6.4 Tensile test

See ISO 1926.

The specimens shall be tested in the thickness as produced and with skins intact.

6.5 Shear test

The procedure used shall be that described in ISO 1922, except that the specimens shall be tested in the thickness as produced and with the skins intact. The specimen shall have a length not less than 12 times its thickness and a width not less than twice its thickness.

6.6 Screw retention

See annex A.

6.7 Surface hardness

See ISO 868.

6.8 Thermal conductance

See ISO 8301 or ISO 8302.

6.9 Burning behaviour

As required by national practice.

6.10 Dielectric strength

See IEC 243.

6.11 Linear thermal expansion

See ISO 4897.

6.12 Deflection under constant load and increasing temperature

See ISO 75.

7 Test results

The report shall include the following information:

a) a reference to this International Standard;

b) a complete identification of the tested material:

- material supplier,
- material designation,
- source of samples,
- lot or run number,
- type of part,
- date of production;

c) the type of manufacturing process and the set-up conditions used in producing the test part: extrusion, injection moulding, reaction injection moulding (RIM), casting, etc.;

d) the dimensions of the test specimen (length, width, thickness);

e) the conditioning temperature and time;

f) the distance between the supports (for the bending test in accordance with ISO 178);

g) the mean results of each test performed and the standard deviation;

h) details of any and all deviations from the normal test parameters;

i) any peculiarities observed during the test;

j) the date of the test.

Annex A
(normative)

Direct screw withdrawal test

A.1 General

Screw-holding tests shall be made on screws threaded into a board to measure the resistance to withdrawal in a plane normal to the face. For numerous applications, the withdrawal resistance of screws from the edge of the board is desired. When that value is required, the screw withdrawal resistance in the plane parallel to the face shall be determined. When general information for comparing the screw withdrawal resistance of a board with that of another board or material is required, a 25 mm No. 10 wood screw shall be used. For special applications, however, this procedure is adaptable to other sizes and types of screw, such as the 25 mm No. 10 type A sheet-metal screw.

A.2 Test specimens

A.2.1 Withdrawal perpendicular to the plane of the board

Each test specimen shall be 76 mm in width and 152 mm in length. The thickness of the specimen shall be at least 25 mm, unless other considerations make it desirable to test with the thickness as manufactured, because local bending of the board at withdrawal may affect test results. If necessary, glue up two or more thicknesses of the board to arrive at the minimum thickness. A 25 mm No. 10 wood screw shall be threaded 17 mm into the specimen at midwidth, at least 50 mm from the end of the specimen. A lead hole shall be predrilled using a drill 2,8 mm in diameter.

A.2.2 Withdrawal from the edge of the board

Each test specimen shall be 63 mm in width and 114 mm in length and the thickness of the specimen shall be the thickness of the board as manufactured. In some applications where several thicknesses of thinner board are laminated together, it may be desirable to obtain the edge withdrawal resistance of a laminated board. When this is done, the specimen shall be laminated from an odd number of thicknesses and the screw shall be located at the midthickness of the centre laminate.

One half of the test specimens shall be prepared with the long dimension parallel and the other half with the long dimension perpendicular to the long dimension of the board in order to evaluate directional properties. A 25 mm No. 10 wood screw shall be threaded 17 mm into the edge of the board at midthickness, using a lead hole predrilled using a drill 2,8 mm in diameter. It is recognized that some other lead hole diameter may give higher withdrawal resistance values for some densities and kinds of board. Departures from this size of lead hole are nevertheless permitted, but the diameter used shall be reported.

A.3 Specimens tested in the dry condition

When tests are made in the dry state, the withdrawals shall be made immediately after the screws have been embedded.

A.4 Specimens tested soaked before test

If specimens are to be tested in the soaked condition, the screws shall be embedded before the specimens are soaked.

A.5 Method of loading

Attach the specimen-holding fixture (see figure A.1) to the lower platen of the test machine. Insert a specimen in the fixture with the head of the screw up.

Engage the head of the screw in the load-applying fixture (see figure A.1), which is equipped with a slot for easy attachment. Attach this load-applying fixture to the upper platen of the testing machine. Apply a load by separation of the platens of the test machine.

A.6 Speed of testing

Apply the load to the specimen by moving the movable head of the test machine at a uniform rate of 1,5 mm/min throughout the test.

A.7 Test report

The test report shall include the following information:

a) the maximum load required to withdraw the screw;

b) the diameter of lead hole actually used, and the type and size of screw;

c) the direction of withdrawal, i.e. surface (withdrawal perpendicular to the plane of the board) or edge (withdrawal parallel to the plane of the board);

d) the thickness of the board tested;

e) if a screw breaks rather than being withdrawn, this shall be noted and the test value shall not be reported as a withdrawal load.

Dimensions in millimetres

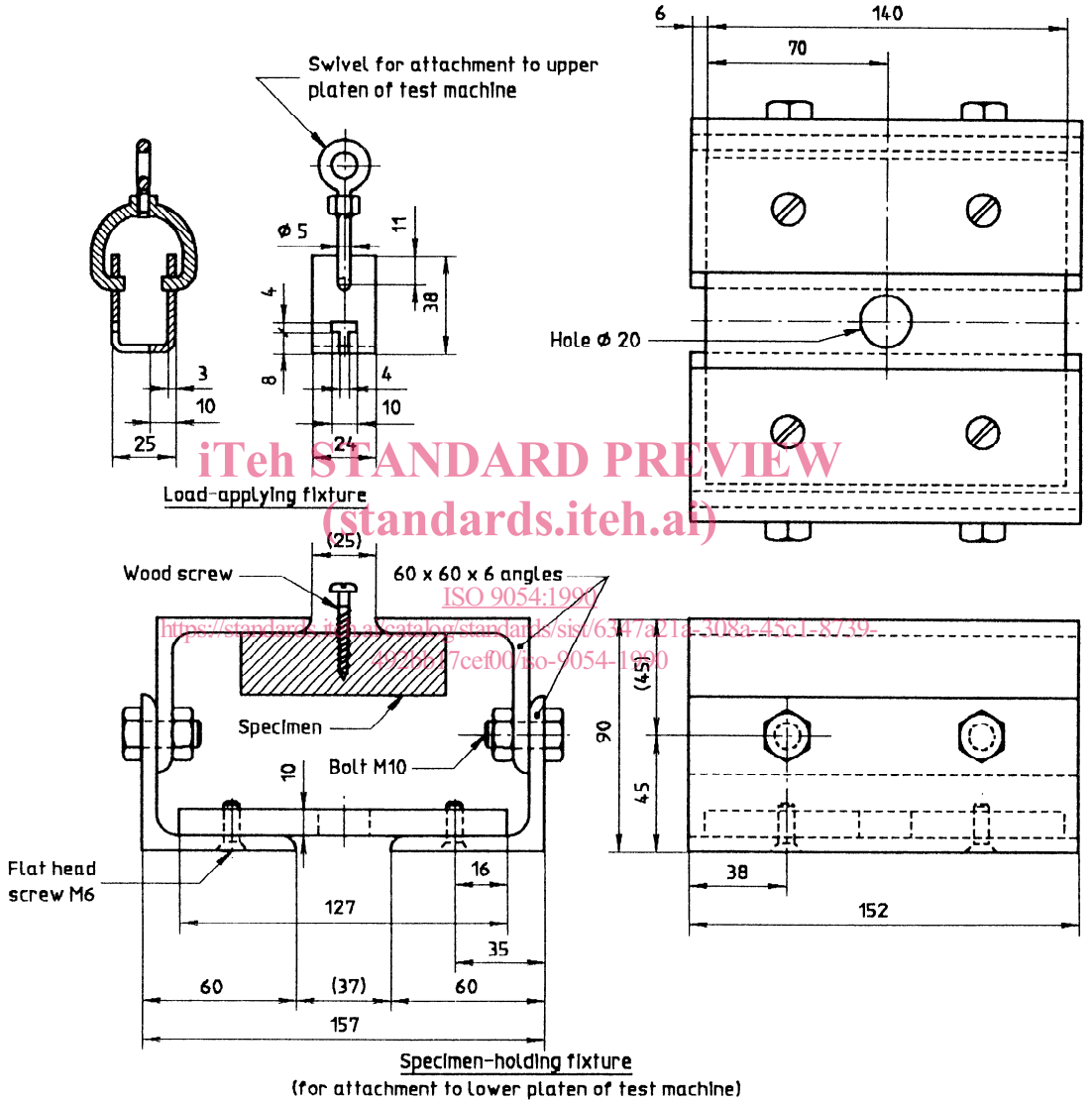

Figure A.1 — Specimen-holding fixture and load-applying fixture for screw withdrawal test

UDC [678.5/.8].077-405.8:620.17

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