

TC 61

INTERNATIONAL STANDARD



3605

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Textile glass reinforced plastics — Composites in the form of rods made from textile glass rovings — Determination of compressive strength

Plastiques renforcés au verre textile — Composites sous forme de joncs à base de stratifils — Détermination de la résistance à la compression

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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 3605 was developed by Technical Committee ISO/TC 61, *Plastics*, and was circulated to the member bodies in January 1975.

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

Austria	India	Romania
Belgium	Iran	South Africa, Rep. of
Brazil	Israel	Sweden
Canada	Japan	Switzerland
Czechoslovakia	Mexico	Turkey
Finland	New Zealand	United Kingdom
Germany	Netherlands	U.S.A.
Hungary	Poland	U.S.S.R.

No member body expressed disapproval of the document.

Textile glass reinforced plastics — Composites in the form of rods made from textile glass rovings — Determination of compressive strength

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the compressive strength of textile glass reinforced resin composite rods of circular cross-section, made from rovings.

2 REFERENCES

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

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

3 APPARATUS AND MATERIAL

3.1 Mould, in the form of a straight rigid cylinder, having a minimum length of 400 mm and a standard internal diameter of $6 \pm 0,1$ mm; if other diameters are chosen, these shall be selected upon agreement between the interested parties from the range of 4 to 10 mm (with tolerances of $\pm 0,1$ mm).

The mould may be constructed of glass, polytetrafluoroethylene, or any other suitable material.

3.2 Resin.

Not all resin systems are necessarily suitable and the system to be used shall be at the discretion of the roving supplier. In the event of dispute, the system used shall be declared and shall form the basis for the test, subject to an agreement between the interested parties. The selected resin system shall be mixed in accordance with the resin manufacturer's detailed instructions.

3.3 Suitable wire, for pulling the roving through the mould (3.1).

3.4 Oven with air circulation, for curing and/or postcuring the resin at the recommended temperature.

3.5 Suitable compression testing machine, capable of maintaining a constant speed of 1 mm/min.

3.6 Two test jigs, as shown, for example, in figure 1, each consisting of

- a base plate X;
- an elastic compressive pad Y (for example of polyamide);
- an anti-burst ring Z.

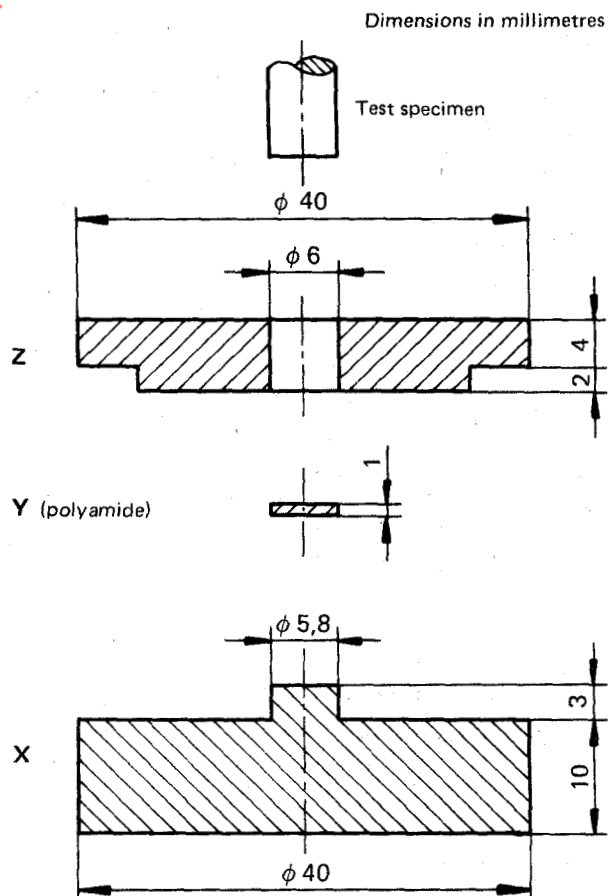


FIGURE 1 — Example of a jig for testing textile glass fibre reinforced plastic rods of 6 mm diameter

4 CONDITIONING AND TESTING ATMOSPHERES

The hank of rovings shall be conditioned for at least 16 h in one of the standard laboratory atmospheres defined in ISO 291.

The atmosphere during the test shall be one of those defined in ISO 291.

5 PROCEDURE

5.1 Preparation of the rovings

Take a parallel assembly of rovings, 1 m long and of the correct mass (approximately 15 g) to give a glass content in the moulded rod of $62 \pm 3 \%$ (m/m).

5.2 Preparation of reinforced rods

Fold the roving assembly about its midpoint and secure the hank at this point to a length of the wire (3.3). Condition for at least 16 h in one of the standard laboratory atmospheres defined in ISO 291. Take care to minimize contamination of the roving during handling.

Impregnate the hank by immersion in a trough containing the catalysed resin (3.2) or by any other suitable means. When the hank is completely impregnated, draw it vertically into the mould (3.1) by means of the wire. Draw the lower end of the hank a few millimetres into the mould and seal the opening of the mould with a plastic or cork stopper to prevent run-out of resin.

Prepare three rods in this way.

5.3 Curing of the rods

Cure the rods in a vertical position, while still in the mould, in the oven (3.4). Curing and post-curing conditions shall be in accordance with the resin system used. The curing conditions shall be mentioned in the test report.

5.4 Preparation and conditioning of test specimens

5.4.1 Cut twelve test specimens, of length $22,5 \pm 0,5$ mm for 6 mm diameter rods, from each of the three rods (see figure 2) by means of a water-cooled diamond-tipped saw. When test specimens other than 6 mm diameter have been chosen (see 3.1), the ratio of length to cross-sectional area shall be equivalent to that of a length of 22,5 mm to an area having a diameter of 6 mm. Assemble two sets (A and B) of fifteen test specimens by taking, for each set, five from each rod. Assemble three sets (C) of two test specimens from the remainder (see figure 2).

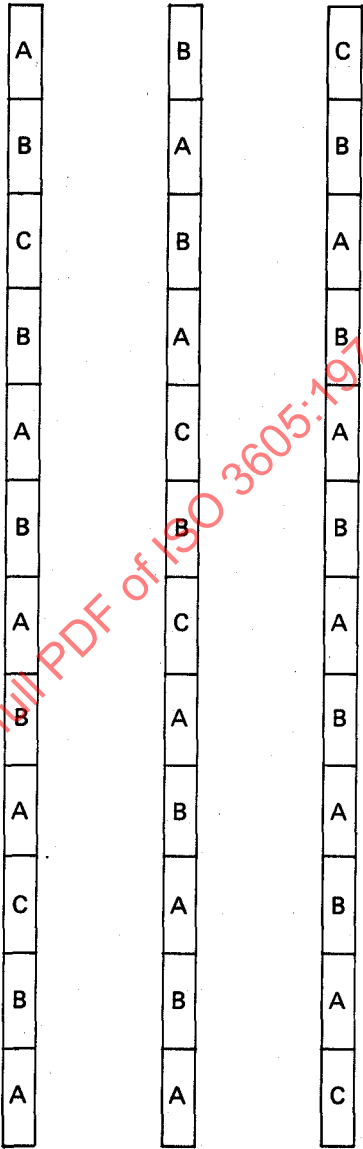


FIGURE 2 — Selection of sets of tests specimens from rods made from rovings

NOTE — Ensure that the end faces of each test specimen are smooth and perpendicular to its axis, and are free from any visible defects. The end faces shall be left untreated.

5.4.2 Condition the test specimens for at least 16 h in one of the standard laboratory atmospheres defined in ISO 291.

Keep one set (A) of fifteen test specimens for testing in the dry state.

Submit the other set (B) of fifteen test specimens to boiling in distilled water, for at least 2 h for polyester rods and for at least 16 h for epoxy rods; after cooling in water to room temperature, these specimens shall be tested wet within 6 h.

Keep the three sets (C) of two test specimens for the determination of the glass content of each rod, in accordance with ISO 1172.

5.5 Determination of compressive strength

5.5.1 Determine the glass content of each test specimen of the three sets (C) of two specimens according to ISO 1172, to verify that the glass content is $62 \pm 3\%$ (m/m). If the glass content is outside the permitted tolerance, prepare new rods for testing.

5.5.2 Before carrying out the compressive strength test, measure two perpendicular diameters to the nearest 0,01 mm at the centre of each test specimen. Use the average of these measurements in the calculation.

5.5.3 Conduct the compressive test in the same standard laboratory atmosphere as used for conditioning. Assemble the test specimen with a test jig (3.6) at each end. Place the assembly between the platens of the testing machine (3.5). Compress the test specimen at a speed of 1 mm/min. Record the force at which the specimen fails.

6 EXPRESSION OF RESULTS

For each test specimen, the compressive strength σ_c is given, in megapascals, by the formula

$$\sigma_c = \frac{4 F}{\pi d^2}$$

where

F is the force, in newtons, at which the specimen fails;

d is the diameter, in millimetres.

For each set of test conditions ("dry" or "after boiling"), calculate the average of all results which lie within 50 % of the average, ignoring those outside that range. At least five results are required in order to report their average as the compressive strength of the material.

7 TEST REPORT

The test report shall include the following particulars :

- a) reference to this International Standard;
- b) complete identification of the roving tested;
- c) complete identification of the type of resin used;
- d) curing and postcuring conditions;
- e) testing atmosphere;
- f) the chosen diameter of the rods tested, when different from the standard (6 mm);
- g) length of the test specimens, when different from the standard (22,5 mm);
- h) compressive strength of the material in the dry state and individual results;
- i) type of water, if different from that specified;
- j) time of immersion in boiling water;
- k) compressive strength of the material after boiling, and individual results;
- l) glass content of each rod.

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