

INTERNATIONAL
STANDARD

ISO
3597-3

First edition
1993-11-15

**Textile-glass-reinforced plastics —
Determination of mechanical properties on
rods made of roving-reinforced resin —**

Part 3:

Determination of compressive strength

*Plastiques renforcés verre textile — Détermination des propriétés
mécaniques sur joncs de stratifils —*

Partie 3: Détermination de la résistance en compression



Reference number
ISO 3597-3:1993(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 3597-3 was prepared by Technical Committee ISO/TC 61, *Plastics*, Sub-Committee SC 13, *Composites and reinforcement fibres*.

This first edition, together with the other parts of ISO 3597, cancels and replaces ISO 3597:1977, which has been technically revised.

ISO 3597 consists of the following parts, under the general title *Textile-glass-reinforced plastics — Determination of mechanical properties on rods made of roving-reinforced resin*:

- Part 1: *General considerations and preparation of rods*
- Part 2: *Determination of flexural strength*
- Part 3: *Determination of compressive strength*
- Part 4: *Determination of apparent interlaminar shear strength*

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Textile-glass-reinforced plastics — Determination of mechanical properties on rods made of roving-reinforced resin —

Part 3: Determination of compressive strength

1 Scope

This part of ISO 3597 specifies a test method for determining the compressive strength of composite rods of circular cross-section made of roving-reinforced resin.

This test may be carried out on as-made rods, or on rods that have been pretreated by immersion in boiling water for a specified time.

This test is intended for inspection and quality control of rovings. The results obtained are not intended for the generation of design data.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 3597. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 3597 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 291:1977, *Plastics — Standard atmospheres for conditioning and testing*.

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

ISO 3597-1:1993, *Textile-glass-reinforced plastics — Determination of mechanical properties on rods made of roving-reinforced resin — Part 1: General considerations and preparation of rods*.

3 Apparatus

3.1 Compression testing machine, capable of maintaining a constant compression speed of 1 mm/min.

3.2 Two test jigs, as for example in figure 1, each consisting of:

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

Parts X and Z of the top jig can be bolted together (see figure 2 for example).

The use of an aligning sleeve is recommended to align correctly the test jigs while the specimen is inserted. The inside diameter of such a sleeve shall be chosen so that the sleeve does not alter the force measured.

3.3 Micrometer.

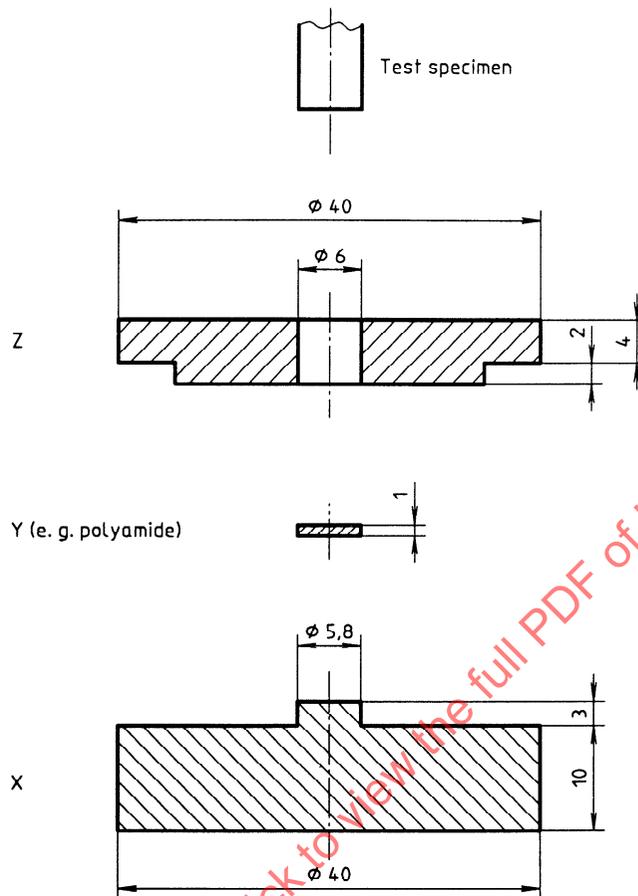


Figure 1 — Example of a jig for testing textile-glass-reinforced plastic rods of 6 mm diameter

4 Preparation and conditioning of specimens

The procedure specified hereafter is suitable for rods of 6 mm diameter to be tested as-made and, if required, pretreated. For each test condition (as-made or pretreated), the required number of specimens is 15. When the test is required in both conditions, three rods shall be prepared as specified in ISO 3597-1 and cut into specimens whose locations are designated as in figure 3. The set A of 15 specimens is intended

for the as-made (dry) test, set B of 15 specimens for the test after pretreatment. The C specimens are tested for glass content (see 5.1).

Care shall be taken to assure the cut ends of the specimens are parallel.

When rods of diameter other than 6 mm are chosen, the ratio of rod length to rod diameter shall satisfy the following equation:

$$L = 0,625d^2$$

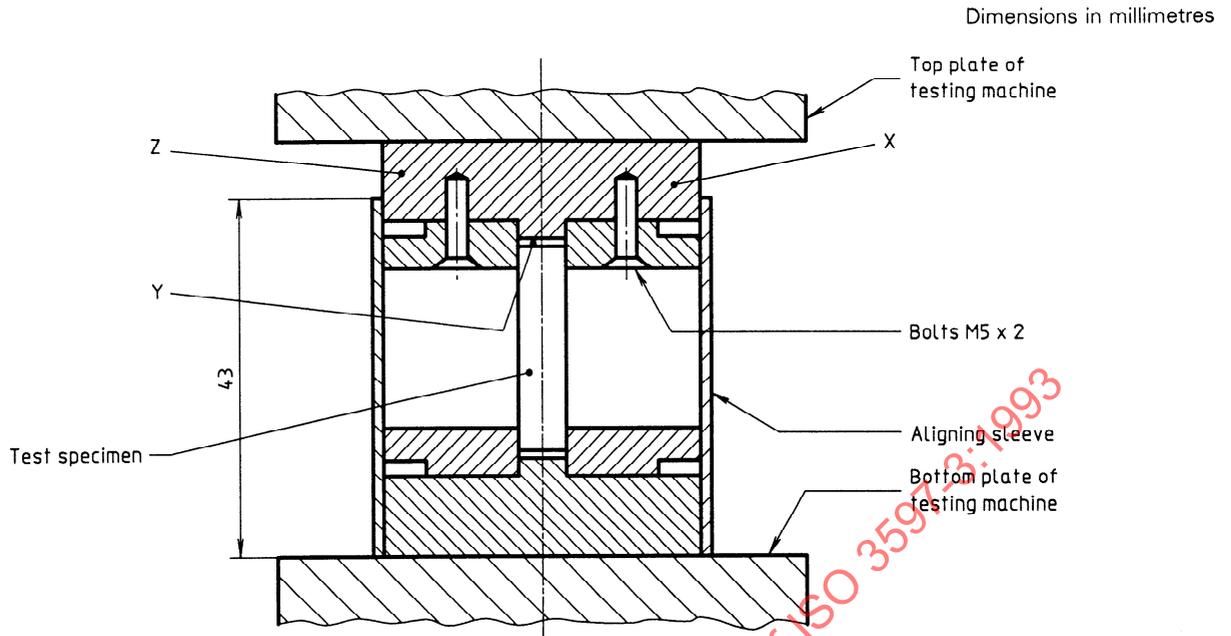
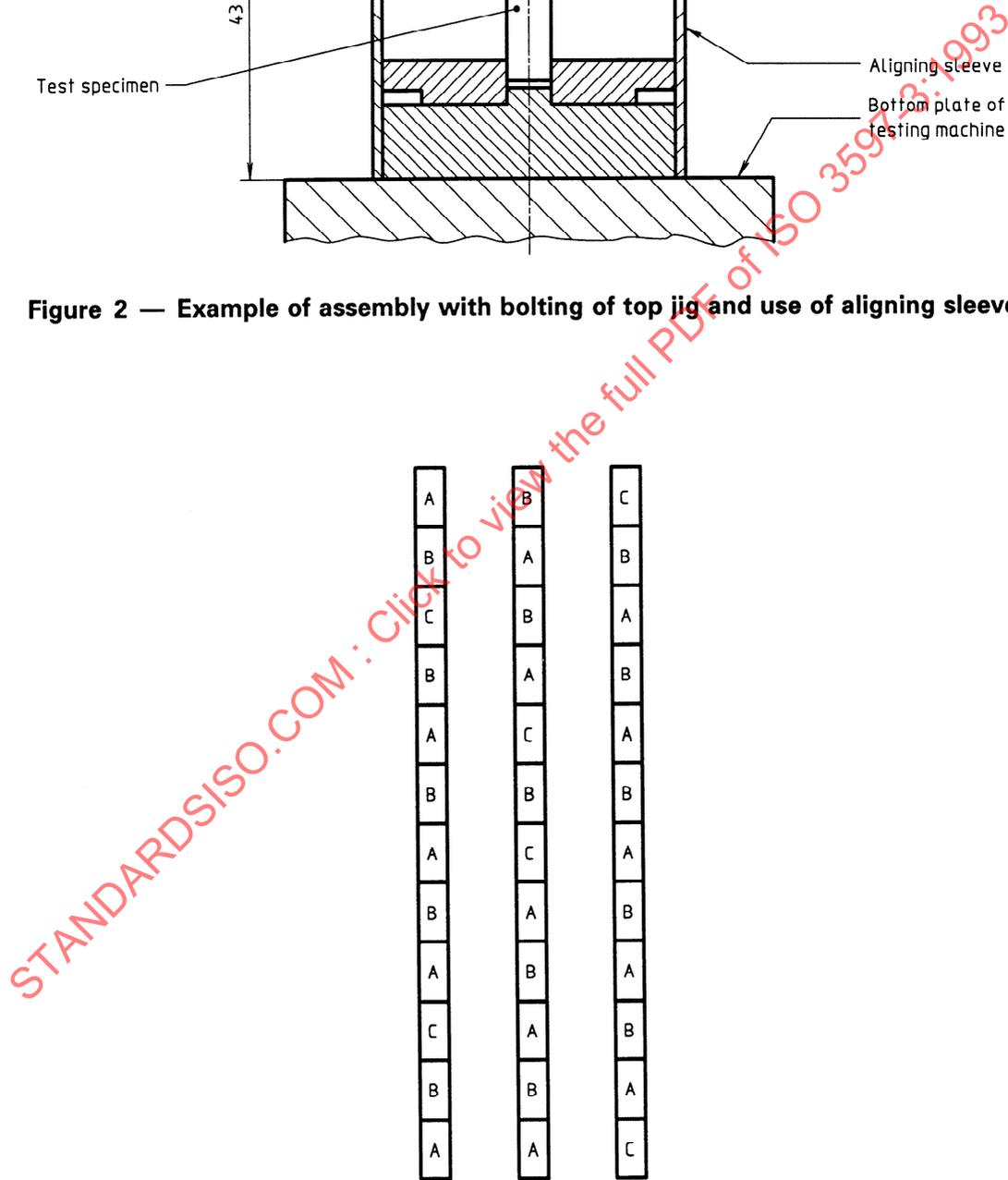


Figure 2 — Example of assembly with bolting of top jig and use of aligning sleeve



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 ends of the test specimens shall be left untreated.

Figure 3 — Location of individual specimens for preparing sets of test specimens for as-made (A), pretreated (B) and glass content (C) testing

5 Test procedure

5.1 Determine the glass content of the three sets of two C specimens each, in accordance with ISO 1172, to verify that the glass content meets the requirement of 65 % (m/m) ± 3 % (m/m). If the glass content is outside the permitted tolerance, prepare new rods for testing.

NOTE 1 The two C specimens from each rod are tested together for loss on ignition.

5.2 Before carrying out the compressive strength test, with the micrometer (3.3) measure, to the nearest 0,01 mm, the diameter at two points located 90° apart around the rod circumference at the centre of each test specimen. Use the average of these measurements in the calculation of results.

5.3 Conduct the compressive test in the same standard laboratory atmosphere used for conditioning (see ISO 291). Assemble the test specimen with a test jig (3.2) at each end. Place the assembly between the platens of the testing machine (3.1). Compress the test specimen at a speed of 1 mm/min. Record the force at which the specimen fails.

5.4 Observe the specimen and note the type of failure, e.g. crushing, longitudinal splitting or buckling.

6 Expression of results

For each test specimen, calculate the compressive strength σ_c , expressed in megapascals, using the equation

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

where

- F is the force, in newtons, at which the specimen fails;
- d is the diameter, in millimetres, of the test rod.

For each set of test conditions (rods as-made or pretreated), calculate the average of the results obtained on each specimen, discarding those results which do not fall within 50 % of this average. Report the resulting value as the compressive strength of the material.

If less than five results are available for this calculation, a further set of test specimens shall be prepared and tested, exercising more precise control in order to reduce the range of test results obtained. If this second set results in similar difficulties, record this situation in the test report.

7 Precision of the method

The precision of this test method is not known because interlaboratory data are not available. When such data are obtained, a precision statement will be added at the next revision of this part of ISO 3597.

8 Test report

The test report shall include the following information:

- a) reference to this part of ISO 3597;
- b) complete identification of the roving tested;
- c) complete identification of the type of resin used;
- d) curing and postcuring conditions;
- e) test atmosphere;
- f) diameter of the rods tested, if different from the preferred diameter (6 mm);
- g) length of the test specimens, if different from the standard length (22,5 mm);
- h) glass content of each set of C specimens;
- i) compressive strength of the as-made rods: individual results, including those discarded, and average value;
- j) if testing was also required after pretreatment:
 - type of water used,
 - duration of boiling water pretreatment,
 - compressive strength after pretreatment: individual results, including those discarded, and average value;
- k) type of failure observed (crushing, longitudinal splitting or buckling of surface fibres).