

Products and systems for the protection and repair of concrete structures — Test methods — Determination of tensile strength development for polymers

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British Standard

ICS 91.080.40; 91.100.30

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National foreword

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Summary of pages

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Products and systems for the protection and repair of concrete structures — Test methods — Determination of tensile strength development for polymers

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Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken — Prüfverfahren — Bestimmung der Zugfestigkeitsentwicklung von Polymeren

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 104, Concrete (performance, production, placing and compliance criteria), the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 1998, and conflicting national standards shall be withdrawn at the latest by July 1998.

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1 Scope

This European Standard specifies the method for determining the development of tensile strength during cure of resins, such as epoxy resins.

2 Test principle

The development of tensile strength is determined by measuring the tensile strength of the resin system at various ages of cure, and by interpolation arriving at the time to achieve the strength of 3 N/mm².

This test deals with two component resins for injection.

3 General requirements for testing

3.1 Laboratory

- the laboratory in which these tests will be done shall be equipped with a testing machine (see annex A). A self aligning tensile strength test shall be carried out with a deformation velocity of 0,1 mm/min;
- a conditioning room for resins before testing;
- the testing machine shall be equipped with a temperature controlled cabinet which allows the maintenance of a constant temperature from $(5 \pm 1) ^\circ\text{C}$ to $(21 \pm 2) ^\circ\text{C}$, or other temperatures, providing all parties concerned agree.

3.2 Apparatus

- a) Testing machine (see annex A), by means of a centric tensile test at a deformation rate of 0,1 mm/min;
- b) stopwatch.

The development of strength is measured with the apparatus shown in Figure 1.

The apparatus consists of at least six moulds: cavities and pistons as dimensioned in Figure 1.

The upper fixing device shall be constructed with universal joints in the tensile rod. All parts shall be made of steel.

The mould has a depth of

$2 \begin{smallmatrix} +0,05 \\ 0 \end{smallmatrix}$ mm and a diameter of

$25 \begin{smallmatrix} +0,05 \\ 0 \end{smallmatrix}$ mm (see Figure 2).

The piston shall have a diameter of

$25 \begin{smallmatrix} 0 \\ -0,05 \end{smallmatrix}$ mm (see Figure 3).

3.3 Materials

Two component epoxy resins or other, as specified.

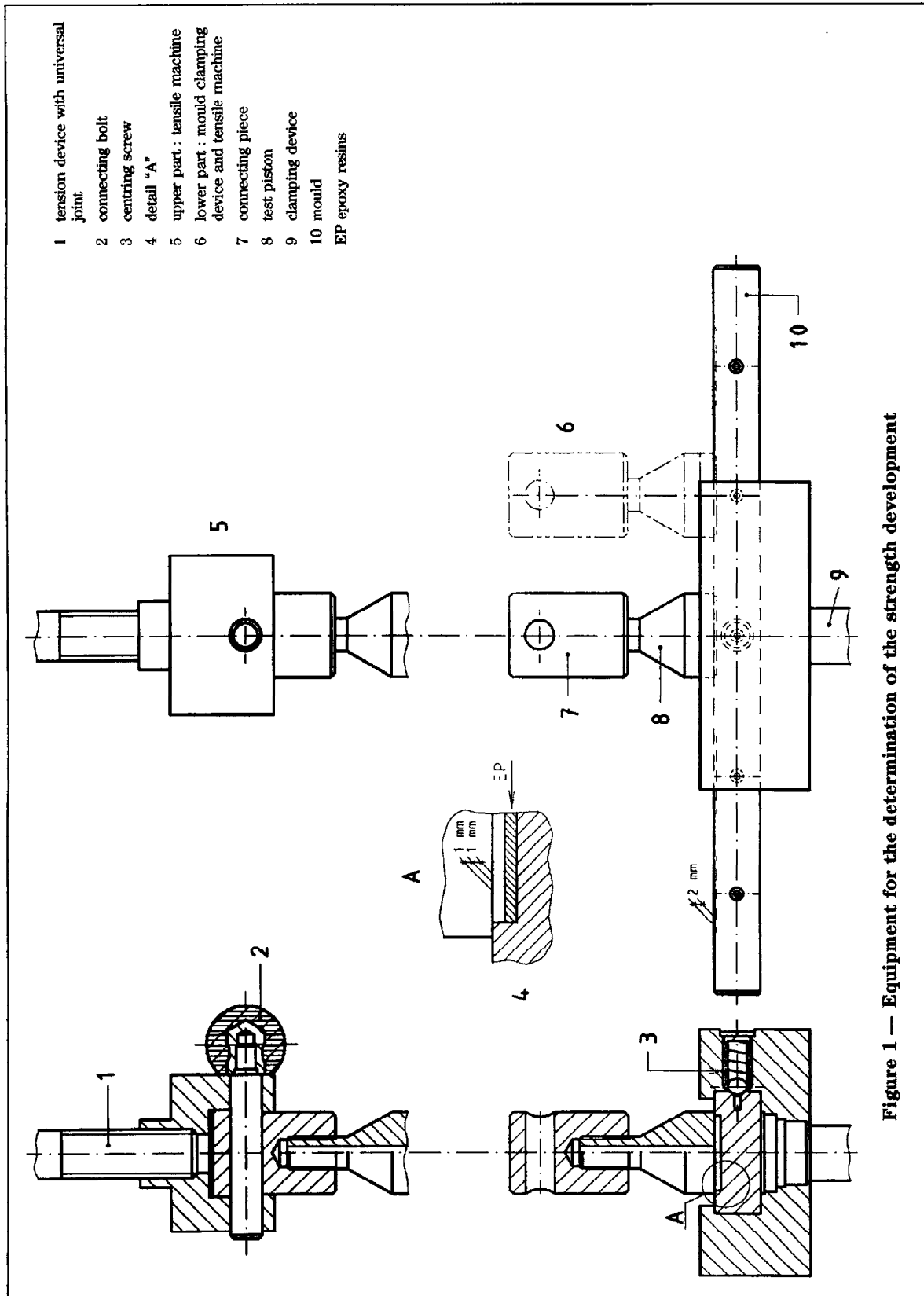


Figure 1 — Equipment for the determination of the strength development

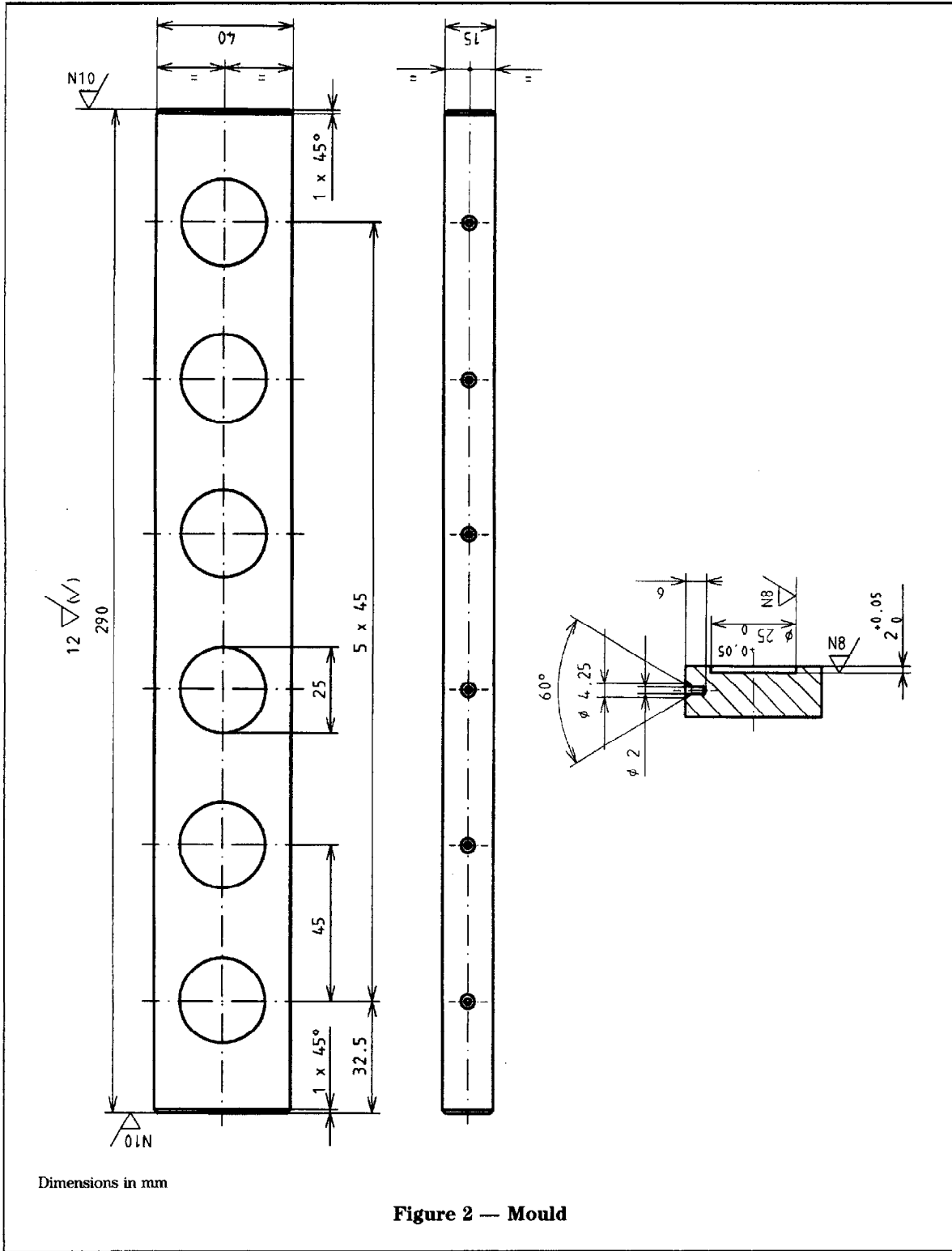
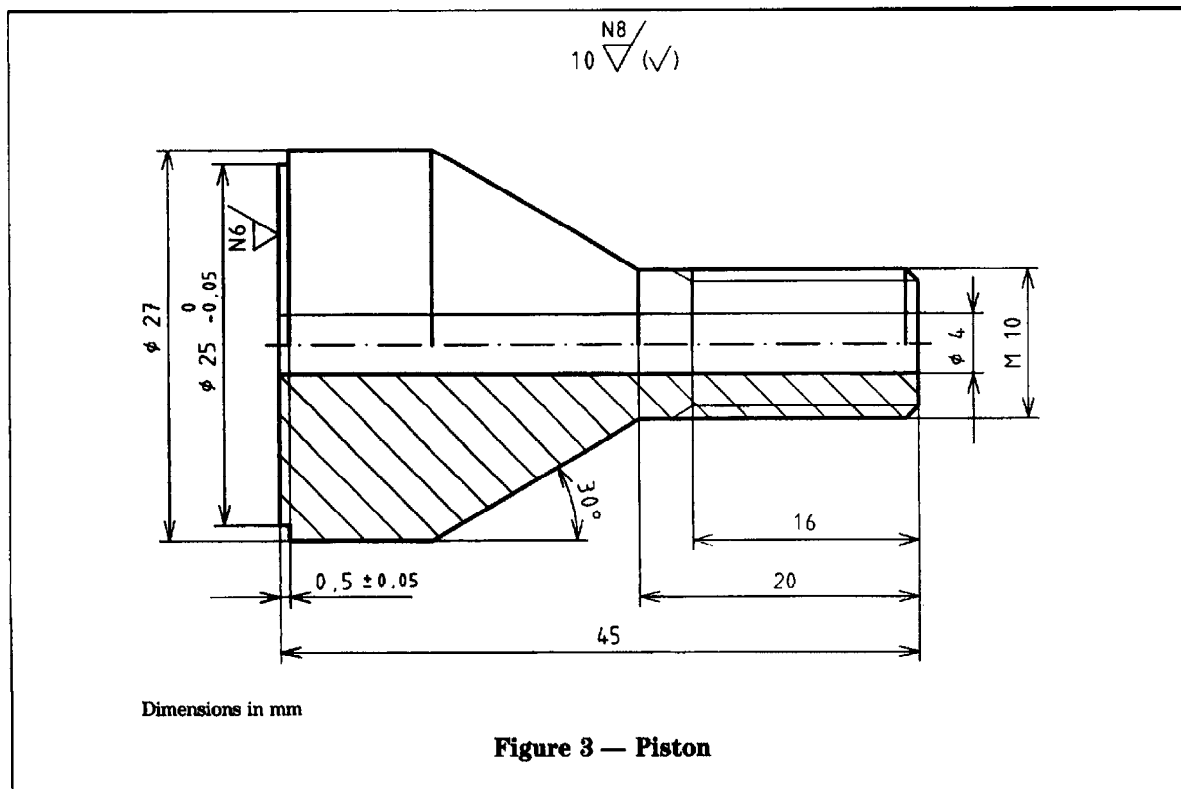


Figure 2 — Mold



4 Test procedure for the determination of the development of strength

4.1 Preparation of the resin

The two components shall be prepared in accordance with the technical data sheet of the manufacturer of the product.

The two component resins and the test apparatus shall be maintained at the selected test temperature for a minimum of 24 h before mixing the resins. The temperatures designated for the tests are $(5 \pm 1)^\circ\text{C}$, $(15 \pm 2)^\circ\text{C}$, $(21 \pm 2)^\circ\text{C}$, but other suitable temperatures may be selected providing all parties concerned agree.

4.2 Mixing

The base and hardener components shall be carefully mixed together, by means of a slowly rotating electric stirrer and paddle, in accordance with the manufacturer's recommendations. To complete the mixing process, the resin shall be poured from one can to another and mixed again for 30 s. Start the stopwatch at the end of the mixing.

4.3 Preparation of the moulds

The cavity of the mould and the faces of the piston shall be abraded to provide a mechanical key. To prevent adhesion of excess of resin, the upper face of the mould plate shall be lightly smeared with a release agent.

4.4 Cleaning of the piston and of the rising main

Remaining resin at the piston shall be removed by solvent (e.g. 70 % dichloromethane, 20 % formic acid, 10% trichlorethylene) or other suitable solvent.

4.5 Filling the moulds

Immediately after mixing, the resin shall be poured into a 2 mm deep, 25 mm diameter recess to fill up about 1 mm.

The piston shall then be carefully lowered into position until its shoulder rests upon the upper face of the mould plate displacing excess resin through the central hole.

Storing and testing of the prepared specimen shall be done at the same temperature as described in 4.1.

5 Measurement of the development of strength

The time of cure shall be measured from the completion of the mixing.

For the validity of the test, it is necessary to get at least six correct results at each temperature.

At various ages of cure, the resin mould and piston shall be fixed to the tensile machine and the tensile strength measured, a tensile load is applied until failure occurs. The velocity of the deformation is 0,1 mm/min.

The maximum value of the tensile force shall be recorded. The tensile strength shall be calculated in relation to the surface area of the piston.

The time interval between tests shall be adjusted to give a spread of at least six results within the range 0 N/mm² to > 5,0 N/mm² (one below 1 N/mm² and one above 5 N/mm²).

6 Calculation

The results shall be plotted as a graph tensile strength against cure time.

The time to reach 3 N/mm² is determined from the graph by interpolation and given to an accuracy of 1 min, this being done for each temperature.

7 Test report

The report shall contain the following informations:

- the identity and source of the product;
- reference to this European Standard;
- the date and place of sampling and testing;
- the temperature of testing;
- the mixing time;
- a plot of tensile strength against cure time for each test temperature;
- the rate of development of strength of 3 N/mm²;
- the diameter and depth of each mould;
- the interpolated cure time in minutes to reach a tensile strength of 3 N/mm².

Annex A (informative)

Bibliography

- [1] *Requirements for machines for tension and compression testing of materials*
(International Organization of Metrology, R 65, 1985)

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