INTERNATIONAL STANDARD

ISO 13007-4

Third edition
2013-10-15

Ceramic tiles — Grouts and adhesives —

Part 4: Test methods for grouts

Carreaux céramiques — Mortiers de joints et colles —

Partie 4: Méthodes d'essai pour les mortiers de joints

Reference number
ISO 13007-4:2013(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 189, *Ceramic tile*.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: http://www.iso.org/iso/home/standards_development/resources-for-technical-work/foreword.htm

This third edition cancels and replaces the second edition (ISO 13007-4:2010), of which it constitutes a minor revision.

ISO 13007 consists of the following parts, under the general title *Ceramic tiles — Grouts and adhesives*:

— *Part 1: Terms, definitions and specifications for adhesives*

— *Part 2: Test methods for adhesives*

— *Part 3: Terms, definitions and specifications for grouts*

— *Part 4: Test methods for grouts*

Ceramic tiles — Grouts and adhesives —

Part 4: Test methods for grouts

1 Scope

This part of ISO 13007 describes methods for determining characteristics for grouts used in the installation of ceramic tiles. The following test methods are described:

— determination of flexural and compressive strength (4.1);

— determination of water absorption (4.2);

— determination of shrinkage (4.3);

— determination of resistance to abrasion (4.4);

— determination of transverse deformation (4.5);

— determination of chemical resistance (4.6).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10545-6, *Ceramic tiles — Part 6: Determination of resistance to deep abrasion for unglazed tiles*

ISO 13007-2, *Ceramic tiles — Grouts and adhesives — Part 2: Test methods for adhesives*

3 General test conditions and procedures

3.1 Sampling

A representative sample of at least 2 kg shall be used.

3.2 Test conditions

Standard conditions shall be (23 ± 2) °C and (50 ± 5) % relative humidity (RH) and a circulation of air in the testing area less than 0,2 m/s. Other test conditions may be specified in Clause 4. The tolerance in the time of conditioning for all test specimens shall be as follows in Table 1.

Table 1 — Allowed tolerance window for testing time for all samples after conditioning

Sample conditioning time	Allowed tolerance for testing
24 h	±0,5 h
7 d	±3 h
14 d	±6 h
21 d	±9 h
28 d	±12 h

3.3 Test materials

Condition all test materials including water for at least 24 h under standard conditions. The grout to be tested shall be within its shelf life, where this is specified.

3.4 Mixing procedures

3.4.1 Cementitious grouts (CG)

The amount of water and/or liquid admix required for preparing the grout shall be as stated by the manufacturer in parts by weight, i.e. liquid to dry powder (in the case where a range of values is given, the average shall be used). Prepare a minimum quantity of 2 kg of the powder and the necessary liquid using a mixer of the planetary type (see ISO 13007-2, Figure 1 and Figure 2) running at the slow speed settings (140 ± 5) rotation per min and (62 ± 5) rotation per min planetary movement.

Carry out the following procedure.

1) Pour the liquid into the pan.

2) Scatter the dry powder over the liquid.

3) Mix for 30 s.

4) Take out the mixing paddle.

5) Scrape down the paddle and pan within 1 min.

6) replace the paddle and mix for 1 min

If required by the grout manufacturer's instructions, let the grout mature as specified and then mix for an additional 15 s.

3.4.2 Reaction resin grouts (RG)

Where reaction resin grouts are to be used, the manufacturer's instructions shall be followed.

3.5 Test report

3.5.1 General

The information listed below shall be provided:

a) a reference to this part of ISO 13007 (ISO 13007-4:2013);

b) the date of test;

c) the type of grout, commercial designation and manufacturer's name;

d) the source, date obtained, and complete identification of test sample;

e) the handling and storage of samples before testing;

f) the test conditions;

g) the amount of water or liquid used for preparing grout;

h) any other factor that could have affected the result.

3.5.2 Test results

The information listed below shall be provided:

a) Flexural and compressive strength

b) Water absorption

c) Shrinkage

d) Abrasion

4 Test methods

4.1 Determination of flexural and compressive strength

Flexural and compressive strength shall be tested following the general test conditions and procedures given in Clause 3 and the specific instructions which follow.

4.1.1 Apparatus

4.1.1.1 Gang mould, three gang moulds used to prepare prismatic specimens (40 ± 0,1) mm × (40 ± 0,1) mm × (160 ± 0,4) mm, with ground surfaces, made of steel. [See Figure A.1 a)]

4.1.1.2 Jolting apparatus, or jolting table used for the settlement of 10 mm × 40 mm × 160 mm grout specimen in accordance with Figure A.2.

4.1.1.3 Testing machine, flexural strength testing machine shall be capable of applying the load with suitable capacity and sensitivity for the test. The machine shall be provided with a flexure device in accordance with Figure A.3.

4.1.1.4 Testing jig, the test requires the use of a jig in accordance with Figure A.4 to be incorporated in the lower platen; the upper platen receives the load from the compressive strength testing machine through an intermediate spherical seating.

4.1.2 Preparation of test units

Mould the specimens immediately after the mixing of the grout, with the mould firmly clamped to the jolting table. Introduce, using a suitable scoop, the first of two layers of grout into each of the compartments, directly from the mixing bowl. Spread the layer uniformly, then compact using 60 jolts. Introduce the second layer of grout, level, and compact with a further 60 jolts. Lift the mould gently from the jolting table, strike off excess of material, and smooth the surface with a flat trowel. Wipe off the grout left on the perimeter of the mould. Place a 210 mm × 185 mm plate glass sheet of 6 mm thickness on the mould. A plate of steel or other impermeable material of similar size can be used. Place the mould, suitably identified, on a horizontal base in standard conditions, (23 ± 2) °C and (50 ± 5) % RH. After 24 h, carefully remove the specimen from the mould. Prepare three specimens for each grout. For fast-setting grout, demould the specimen immediately before the test.

4.1.3 Flexural strength under standard conditions

Keep the demoulded prism in standard conditions for 27 d leaving a clearance between prisms of at least 25 mm. After conditioning has been completed, place the prism in the testing machine (4.1.1.3) with one side face on the supporting rollers and with the longitudinal axis normal to the support. Apply the load vertically by means of the loading roller to the opposite side face of the prism and increase it smoothly at the rate of (50 ± 10) N/s until fracture. Keep the prism halves in standard conditions until tested in compression.

4.1.4 Compressive strength under standard conditions

Test the prism halves broken in flexion, by means of the equipment specified in 4.1.1.4. Center the prism halves laterally to the platens of the machine within ±0,5 mm, and longitudinally such that the end face of the prism overhangs the platens or auxiliary plates by about 10 mm. Increase the load smoothly at the rate of (2400 ± 200) N/s over the entire load application until fracture.

4.1.5 Flexural and compressive strength after freeze-thaw cycles

Prepare the test units in accordance with 4.1.2. Condition the test units for 6 d in standard conditions and then immerse in water for 21 d before carrying out 25 freeze-thaw cycles following the procedure given in ISO 13007-2, 4.4.4.5. Condition the test units for 3 d in standard conditions after the last cycle and prior to test, examine them and record a brief description of surface appearance of the specimen. Determine the flexural strength in accordance with 4.1.3 and the compressive strength in accordance with 4.1.4.

4.1.6 Evaluation of results

4.1.6.1 Flexural strength

The flexural strength (R_f) is calculated from:

$$R_f = \frac{(1{,}5\,F_f)(L)}{b^3}\ \text{N/mm}^2 \qquad (1)$$

where

b is the length of the side of the square section of the prism, in mm;

F_f is the load applied to the middle of the prism at fracture, in N;

L is the distance between the supports, in mm.

Calculate the mean of the three determinations to the nearest 0,1 N/mm2.

4.1.6.2 Compressive strength

The compressive strength (R_c) is calculated from:

$$R_c = \frac{F_c}{1\,600}\ \text{N/mm}^2 \qquad (2)$$

where

F_c is the maximum load at fracture, in N;

1 600 = 40 mm × 40 mm is the area of the platens or auxiliary plates, in mm2.

Calculate the mean of the six results obtained from the test to the nearest 0,1 N/mm2.

4.1.7 Test report

The information listed in 3.5.1, items a) to h), plus the following:

— 3.5.2, item a): results of visual inspection of each specimen before and after flexural and compressive strength testing with test results (individual and mean values) for each condition in N/mm^2.

4.2 Determination of water absorption

Water absorption shall be tested following the general test conditions and procedures given in Clause 3 and the specific instructions which follow.

4.2.1 Apparatus

4.2.1.1 Gang mould, three prism gang moulds as described in 4.1.1.1.

4.2.1.2 Inserts, three, 1 mm thick of rigid plastic (e.g. PTFE) or HDPE with no release agent.

4.2.1.3 Jolting apparatus, or jolting table as described in 4.1.1.2.

4.2.1.4 Tray, with a flat base large enough to contain three test specimens.

4.2.2 Preparation of test samples

Place the inserts approximately in the middle of the mould, parallel to the smaller faces. Following the procedure described in 4.1.2, prepare six specimens of each grout. After demoulding, condition the samples for 20 d in standard conditions. Seal the four sides with dimensions 40 mm × 80 mm by means of a neutral curing silicone sealant so as to be water impermeable. Then condition the samples for an additional 7 d.

4.2.3 Test procedure

28 d after mixing, weigh each test sample to the nearest 0,1 g and then place them vertically in the tray, with the unsealed surface down on round or triangular spacers with dimensions 40 mm × 40 mm, immersed in water, 5 mm to 10 mm deep, taking care to prevent the prism faces from coming in contact with each other. Maintain the water level constant by adding water when necessary. After 30 min, remove the test samples from water, quickly dry them by blotting with a dampened cloth, and immediately weigh. Replace in the tray and repeat the procedure after an additional 210 min.

4.2.4 Evaluation and expression of results

Calculate the water absorption (W_{mt}), in grams, of each sample using the following formula:

$$W_{mt} = m_t - m_d \tag{3}$$

where

m_d is the mass of the dry specimen, in g;

m_t is the mass of the specimen after immersion, in g.

Calculate the mean of at least three test samples.

4.2.5 Test report

The information listed in 3.5.1, items a) to h), plus the following:

— 3.5.2, item b): test results for water absorption expressed as individual and mean values after 30 min and 240 min.

4.3 Determination of shrinkage

Shrinkage shall be tested following the general test conditions and procedures given in Clause 3 and the specific instructions which follow.

4.3.1 Apparatus

4.3.1.1 Gang mould, three gang moulds used to prepare prismatic specimens (10 ± 0,1) mm × (40 ± 0,1) mm × (160 ± 0,4) mm, with ground surfaces, made of steel. [See Figure A.1 b).] Suitable pins and holders [see Figures A.1 b) and A.1 c)] are used to provide measurement reference points.

4.3.1.2 Jolting apparatus, as described in Figure A.2.

4.3.1.3 Measuring apparatus, shall consist of a measurement attachment and a base with adjustment screws. The measurement attachment shall be formed by a dial gauge, which reads accurately to 0,01 mm, rigidly mounted in a measuring frame (see Figures A.5, A.6, and A.7).

4.3.1.4 Calibration rod, or reference rod shall be used as a standard length against which gauge readings can be tested. The rod shall be made of material having a negligible coefficient of expansion (e.g. Invar).

4.3.2 Preparation of test samples

Assemble suitable mould to prepare samples. Mould the specimens immediately after the mixing of the grout, with the mould firmly clamped to the jolting table. Introduce, using a suitable scoop, the first of two layers of grout into each of the compartments, directly from the mixing bowl. Spread the layer uniformly, then compact using 60 jolts. Introduce the second layer of grout, level, and compact with a further 60 jolts. Lift the mould gently from the jolting table, strike off excess material, and smooth the surface with a flat trowel. Wipe off the grout left on the perimeter of the mould. Cover with a glass plate according to 4.1.2. Place the mould, suitably identified, on a horizontal base in standard conditions, (23 ± 2) °C and (50 ± 5) % RH. After 24 h, carefully remove the specimens from the mould. Prepare three specimens for each grout.

4.3.3 Test procedure

Immediately after demoulding, determine the length of the test samples (initial reading) using the measuring apparatus (see 4.3.1.4). Keep the demoulded prisms on a 10 mm dimension under standard conditions leaving a clearance of at least 25 mm between specimens. Take a reading of each specimen after 27 d ± 12 h from the initial reading.

4.3.4 Evaluation of results

The linear shrinkage is reported in mm/m as the mean of three values based on the initial measurement.

4.3.5 Test report

The information listed in 3.5.1, items a) to h), shall be provided plus the following:

— 3.5.2, item c): test results for shrinkage (individual and mean values) in mm/m.

4.4 Determination of resistance to abrasion

Resistance to abrasion shall be tested following the general test conditions and procedures given in Clause 3 and the specific instructions which follow.

4.4.1 Apparatus

4.4.1.1 Abrasion apparatus, see Figure A.8, consisting essentially of a rotating disc, a storage hopper with a dispensing device for the abrasive material, a test specimen support, and a counterweight. The disc is made of E 235 A (Fe 360 A) in accordance with ISO 10545-6, with a diameter of (200 ± 0,2) mm and thickness at the edge of (10 ± 0,1) mm, and with a revolution rate of 75 r/min. The pressure with which the test specimens are held against the steel disc is determined by calibrating the apparatus against transparent fused silica. The pressure is adjusted such that, after 150 revolutions using white fused aluminium oxide of grain size 80 (see ISO 10545-6) abrasive, a chord of (24 ± 0,5) mm is produced. Transparent fused silica shall be used as a primary standard. A secondary standard of float glass or other products can be used. When the diameter has worn by 0,5 % of the initial diameter, the steel disc shall be replaced.

4.4.1.2 Abrasive material, white fused aluminium oxide of grain size 80 in accordance with ISO 10545-6.

4.4.1.3 Measuring gauge, accurate to 0,1 mm.

4.4.1.4 Template, a smooth, square, rigid, non-absorbent frame (e.g. in polyethylene or PTFE), with internal dimensions of (100 ± 1) mm × (100 ± 1) mm and thickness of (10 ± 1) mm.

4.4.2 Preparation of test samples

The grout shall be prepared as described in Clause 3. Place the template over a polyethylene film. Trowel sufficient quantity of grout across the template and then screed clean so as to neatly and completely fill the hole in the template. Cover with a glass plate in accordance with 4.1.2. After 24 h, carefully remove the template. Condition the units according to the test requirements. Prepare two specimens for each grout sample.

4.4.3 Test procedure

Place a test specimen in the apparatus (4.4.1.1) with the trowelled face against the disc so that it is tangential against the rotating disc. Ensure that abrasive material (4.4.1.2) is fed uniformly into the grinding zone at a rate of (200 ± 10) g per 100 r. Rotate the steel disc for 50 r. Remove the test specimen from the apparatus and measure the chord length (L) of the groove to the nearest 0,5 mm. Test each test specimen in at least two places at right angles to each other. Do not reuse the abrasive material.

4.4.4 Expression of results

The resistance to deep abrasion is expressed as the volume (V), in cubic millimetres, of material removed, and is calculated from the chord length (L) of the groove using the formulae:

$$V = \left(\frac{\pi\alpha}{180} - \sin\alpha \right) \frac{hd^2}{8} \tag{4}$$

and

$$\sin\left(0{,}5\alpha\right) = \frac{L}{d} \tag{5}$$

where

α is the angle, in degrees, subtended at the centre of the rotating disc by the chord (see Figure A.6);

h is the thickness, in millimetres, of the rotating disc;

d is the diameter, in millimetres, of the rotating disc;

L is the length, in millimetres, of the chord.

Some equivalent values of L and V are given in Table 1.

4.4.5 Test report

The information listed in 3.5.1, item a) to h), shall be provided plus the following:

— 3.5.2, item d): test results for abrasion resistance which include, the chord length (L) of each groove to the nearest 0,5 mm, the volume (V), in cubic millimetres, for each individual groove, and the average volume (V_m) in cubic millimetres.

4.5 Determination of transverse deformation

Transverse deformation shall be tested and reported by following the procedures given in ISO 13007-2, 4.5.

4.6 Determination of chemical resistance

Chemical resistance shall be tested and reported by following the procedures given in ISO 13007-2, 4.6.

Annex A
(informative)

Test apparatus

A.1 Jolting apparatus

The jolting apparatus (a typical design is shown in Figure A.2) shall comply with the following requirements.

The apparatus consists essentially of a rectangular table rigidly connected by two light arms to a pivot at 800 mm from the centre of the table. The table shall incorporate at the centre of its lower face a projecting lug with a rounded face. Beneath the projecting lug shall be a small stop with a plane upper surface. In the rest position, the common normal through the point of contact of the lug and the stop shall be vertical. When the projecting lug rests on the stop, the top face of the table shall be horizontal so that the level of any of the four corners does not deviate from the mean level by more than 1,0 mm. The table shall have dimensions equal to or greater than those of the mould baseplate and a plane-machined upper surface. Clamps shall be provided for firm attachment of the mould to the table.

The combined mass of the table, including arms, empty mould, hopper, and clamps, shall be (20,0 ± 0,5) kg.

The arms connecting the table assembly to the pivot shall be rigid and constructed of round tubing with an outside diameter lying in the range 17 mm to 22 mm selected from tube sizes given in ISO 4200. The total mass of the two arms, including any cross bracing, shall be (2,25 ± 0,25) kg. The pivot bearings shall be of the ball or roller type and protected from ingress of grit or dust. The horizontal displacement of the centre of the table as caused by the play of the pivot shall not exceed 1,0 mm.

The lug and the stop shall be made of hardened steel of at least HV 500 Vickers hardness value. The curvature of the lug shall be about 0,01 mm.

In operation, the table is raised by a cam and allowed to fall freely from a height of (15,0 ± 0,3) mm before the lug strikes the stop.

The cam shall be made of steel of at least HV 400 Vickers hardness value and its shaft shall be mounted in ball bearings of such construction that the free drop requirement of (15,0 ± 0,3) mm is always satisfied. The cam follower shall be of a construction which ensures least wear of the cam. The cam shall be driven by an electric motor of about 250 W through a reduction gear at a uniform speed of 1 r/s. A control mechanism and a counter shall be provided which ensures that one period of jolting comprises exactly 60 jolts.

The position of the mould on the table shall be such that the longitudinal dimension of the compartments is in line with the direction of the arms and perpendicular to the axis of rotation of the cam. Suitable reference marks shall be provided to facilitate the positioning of the mould in such a way that the centre of the central compartment is directly above the point of impact.

The apparatus shall be firmly mounted on a concrete block of mass of about 600 kg and volume of about 0,25 m^3 and of dimensions giving a suitable working height for the mould. The entire base of the concrete block shall stand on an elastic pad, e.g. natural rubber, having a suitable isolation efficiency preventing external vibrations from affecting the compaction.

The base of the apparatus shall be fixed level to the concrete base by anchor bolts and a thin layer of mortar shall be placed between the base of the apparatus and the concrete base to ensure overall and vibration-free contact.

A.2 Flexural strength testing machine

The testing machine for the determination of flexural strength shall be capable of applying loads up to 10 kN, with an accuracy of ±1,0 % of the recorded load in the upper four-fifths of the range being used, at a rate of loading of (50 ± 10) N/s. The machine shall be provided with a flexure device incorporating two steel supporting rollers of (10,0 ± 0,5) mm diameter, spaced (100,0 ± 0,5) mm apart, and a third steel loading roller of the same diameter placed centrally between the other two. The length of these rollers shall be between 45 mm and 50 mm. The loading arrangement is shown in Figure A.3.

The three vertical planes through the axes of the three rollers shall be parallel and remain parallel, equidistant, and normal to the direction of the specimen under test. One of the supporting rollers and the loading roller shall be capable of tilting slightly to allow a uniform distribution of the load over the width of the specimen without subjecting it to any torsional stresses.

NOTE The determination of flexural strength can be carried out in a compressive strength testing machine. In this case, a device complying with the specification in this subclause shall be used.

A.3 Compressive strength testing machine

The testing machine for the determination of compressive strength shall be of suitable capacity for the test (see Note 1). It shall have an accuracy of ±1,0 % of the recorded load in the upper four-fifths of the range being used and it shall provide a rate of loading of (2 400 ± 200) N/s. It shall be fitted with an indicating device which shall be so constructed that the value indicated at failure of the specimen remains indicated after the testing machine is unloaded. This can be achieved by the use of a maximum indicator on a pressure gauge or a memory on a digital display. Manually operated testing machines shall be fitted with a pacing device to facilitate the control of the load increase.

The vertical axis of the ram shall coincide with the vertical axis of the machine and during loading, the direction of movement of the ram shall be along the vertical axis of the machine. Furthermore, the resultant of the forces shall pass through the centre of the specimen. The surface of the lower machine platen shall be normal to the axis of the machine and remain normal during loading.

The centre of the upper platen spherical seating shall be at the point of intersection of the vertical machine axis with the plane of the lower surface of the upper machine platen with a tolerance of ±1 mm. The upper platen shall be free to align as contact is made with the specimen, but during loading the relative attitude of the upper and lower platens shall remain fixed.

The testing machine shall be provided with platens made of hardened steel, with a Vickers hardness of at least HV 600, or preferably of tungsten carbide. These platens shall be at least 10 mm thick, (40,0 ± 0,1) mm wide, and at least (40,0 ± 0,1) mm long. The flatness tolerance, according to ISO 1101, 14.2, over the entire contact surface with the specimen shall be 0,01 mm. The surface texture, according to ISO 1302, shall be not smoother than N3 and not rougher than N6.

Alternatively, two auxiliary plates of hardened steel, or preferably of tungsten carbide, at least 10 mm thick and complying with the requirements for the platens, may be provided. Provision shall be made for centering the auxiliary plates with respect to the axis of the loading system with an accuracy of ±0,5 mm.

Where there is no spherical seating in the testing machine or where the spherical seating is blocked, or where the diameter of the spherical seating is greater than 120 mm, a jig according to A.4 shall be used.

NOTE 1 The testing machine can be provided with two or more load ranges. The highest value of the lower range should be approximately 1/5 of the highest value of the next higher range.

NOTE 2 It is considered advisable for the machine to be provided with an automatic method for adjusting the rate of loading and with equipment for recording the results.

NOTE 3 The spherical seating of the machine can be lubricated to facilitate adjustment on contact with the specimen but only to such an extent that movement of the platen cannot take place under load during the test. Lubricants which are effective under high pressure are not suitable.

NOTE 4 The terms “vertical”, “lower”, and “upper” refer to conventional testing machines. However, machines whose axis is not vertical are also permitted provided that they satisfy an acceptance testing procedure and that the other requirements of A.3 are fulfilled.

A.4 Jig for compressive strength testing machine

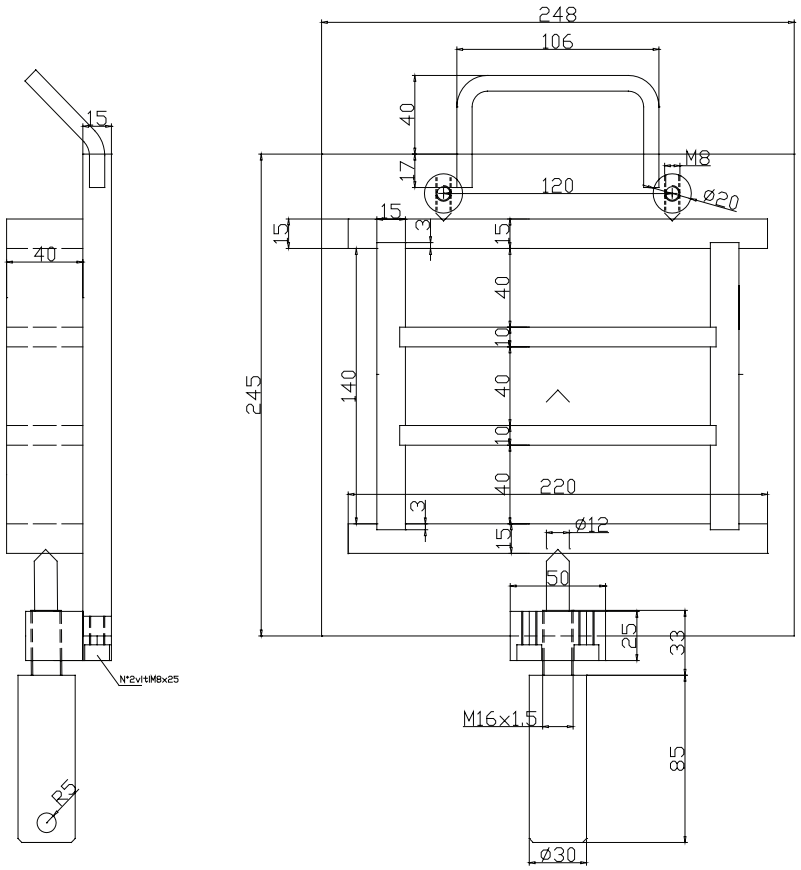
When A.3 requires the use of a jig (see Figure A.4), it shall be placed between the platens of the machine to transmit the load of the machine to the compression surfaces of the mortar specimen.

A lower plate shall be used in this jig and it can be incorporated in the lower platen. The upper platen receives the load from the upper platen of the machine through an intermediate spherical seating. This seating forms part of an assembly, which shall be able to slide vertically without appreciable friction in the jig guiding its movement. The jig shall be kept clean and the spherical seating shall be free to rotate in such a way that the platen will accommodate itself initially to the shape of the specimen and then remain fixed during the test. All requirements stated in A.3 apply equally when a jig is used.

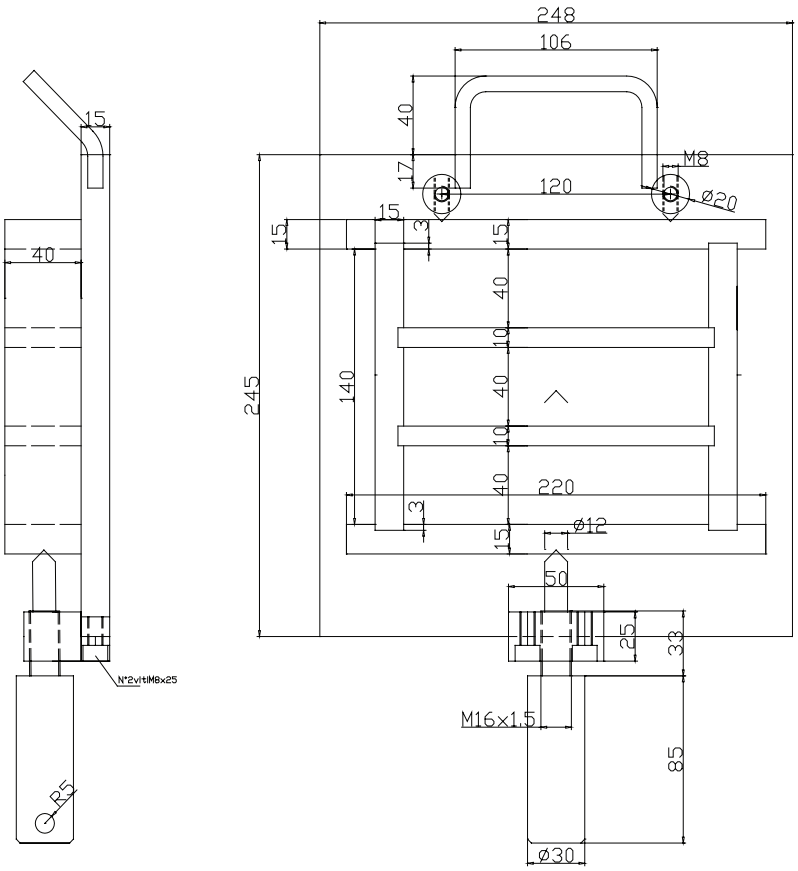
NOTE 1 The spherical seating of the jig can be lubricated but only to such an extent that movement of the platen cannot take place under load during the test. Lubricants which are effective under high pressure are not suitable.

NOTE 2 It is desirable that the assembly should return automatically to its initial position after crushing the specimen.

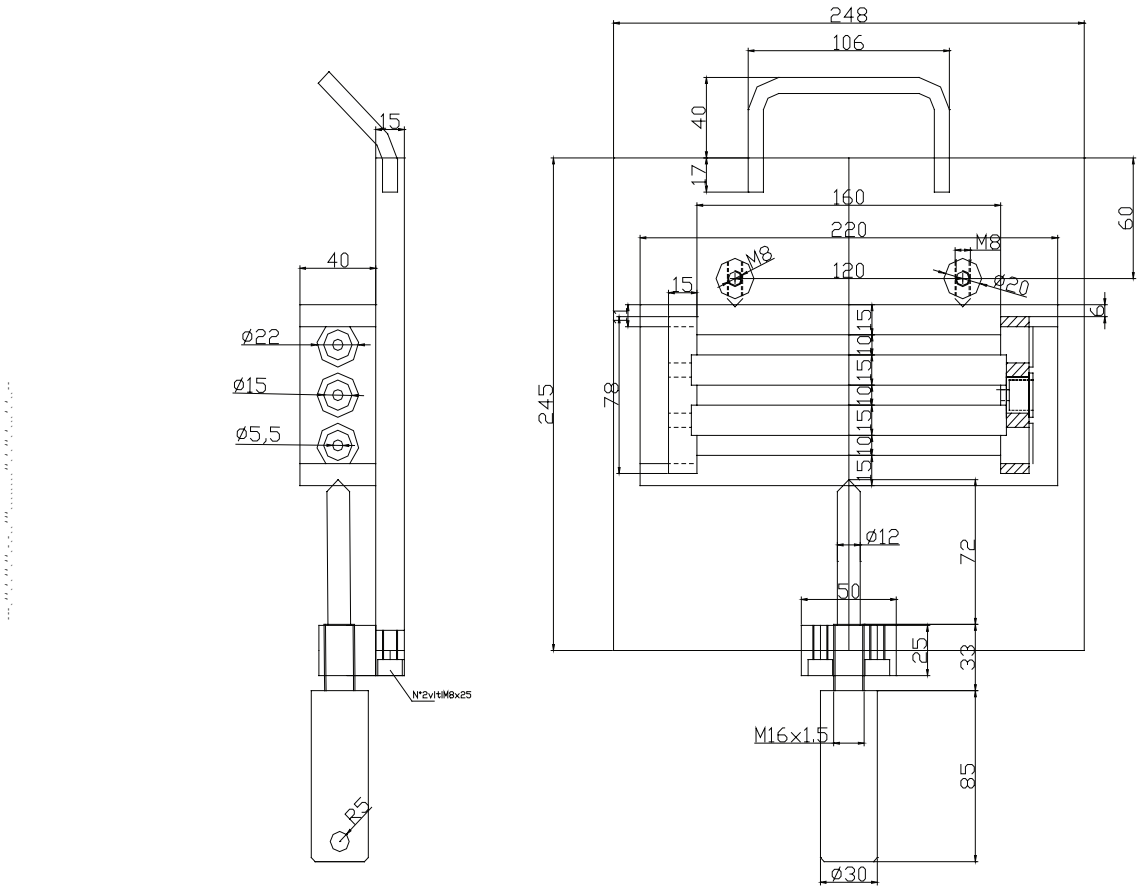
Dimensions in millimetres



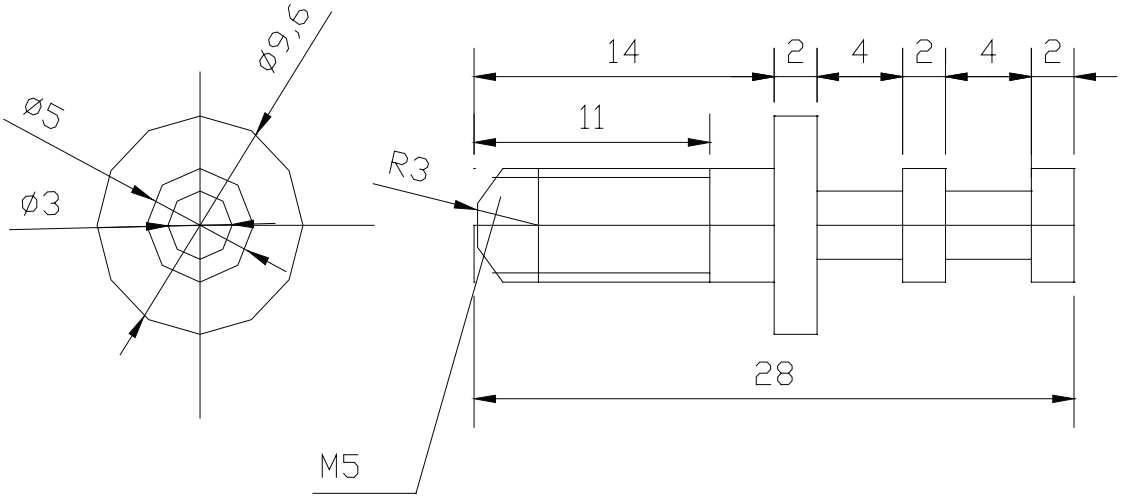
a) Example of a mould used to prepare prismatic specimens (40 ± 0,1) mm × (40 ± 0,1) mm × (160 × 0,4) mm



b) Example of a mould used to prepare prismatic specimens (10 ± 0,1) mm × (40 ± 0,1) mm × (160 ± 0,4) mm for shrinkage testing

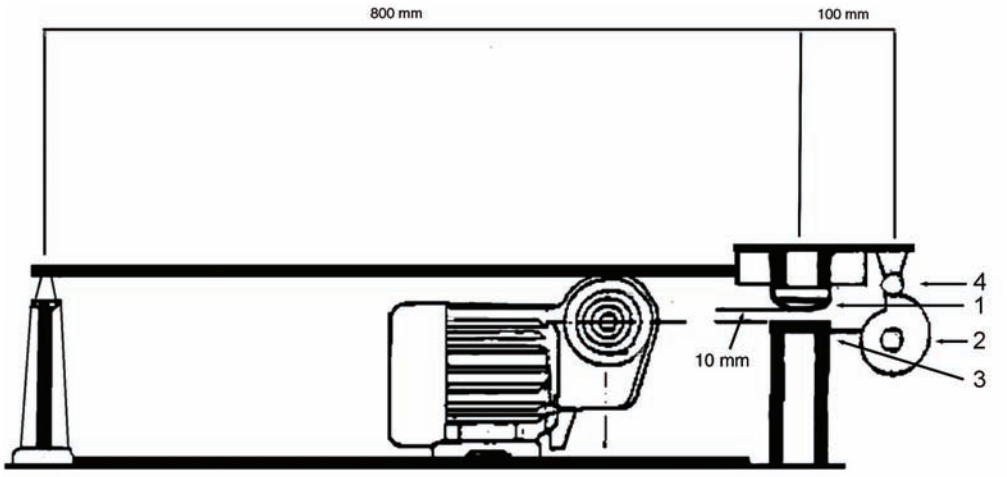


c) Example of a pin inserted into a grout specimen for shrinkage testing, used with mould shown in Figure A.1 b)



d) Example of a holder for use with a pin from Figure A.1 c) inserted into a grout specimen for shrinkage testing

Figure A.1 — Mould examples

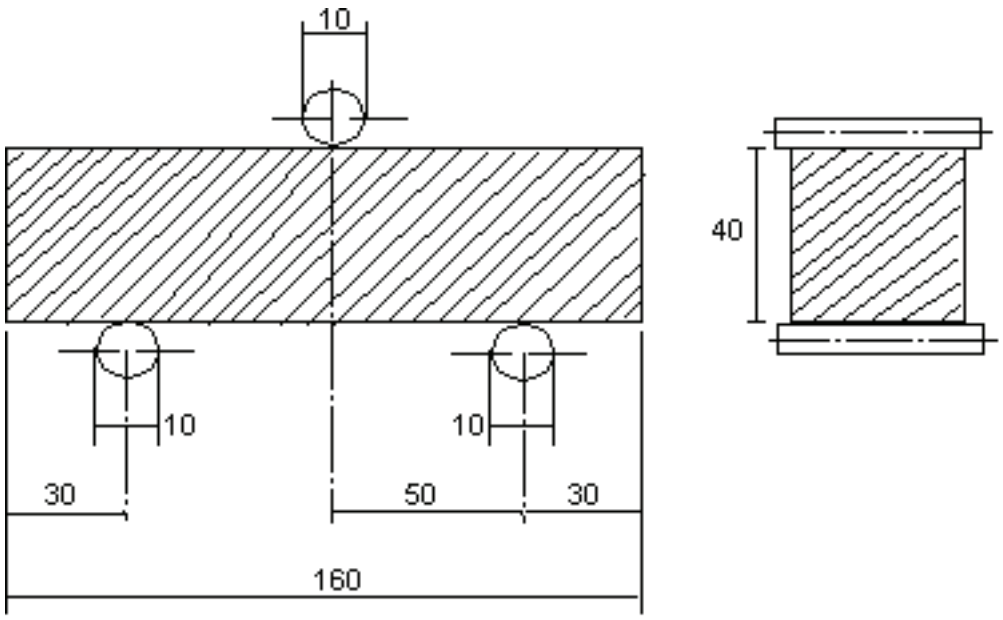


Key

1 lug
2 cam
3 stop
4 cam follower

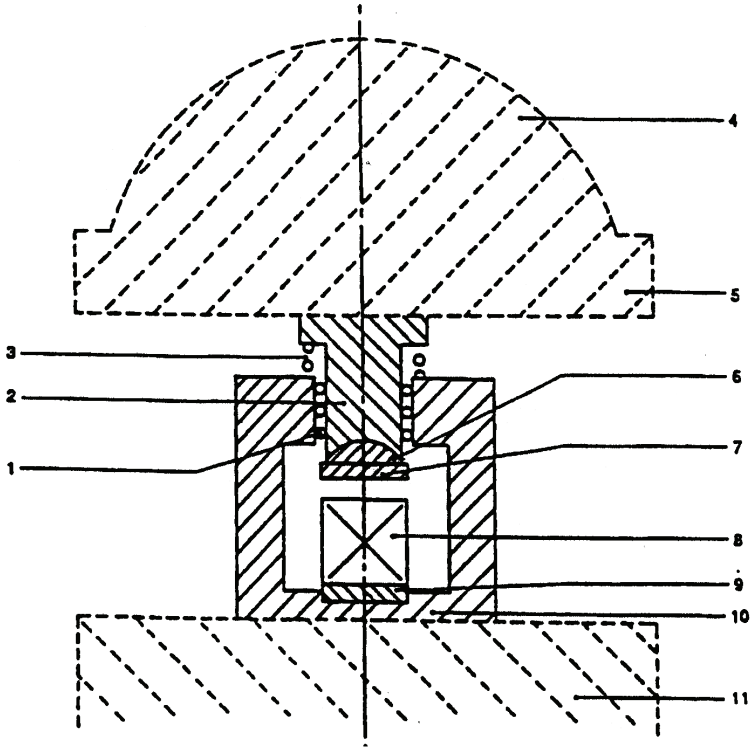
Figure A.2 — Typical jolting apparatus

Dimensions in millimetres



NOTE Moulds and jolting tables from different manufacturers can have unrelated external dimensions and masses, so their compatibility needs to be ensured by the purchaser.

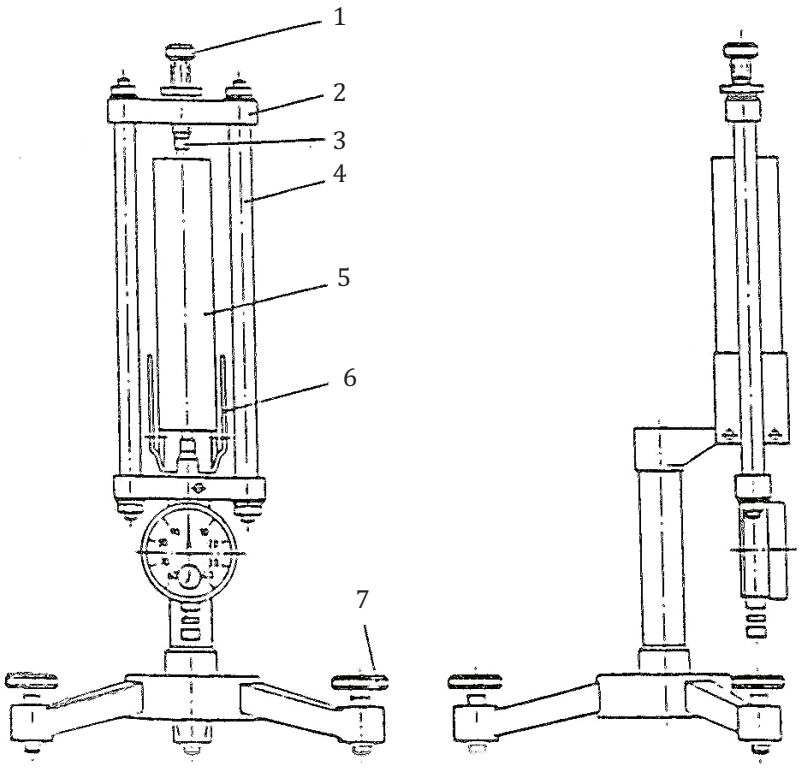
Figure A.3 — Arrangement of loading for determination of flexural strength



Key

1 ball bearings
2 sliding assembly
3 return spring
4 spherical seating of machine
5 Upper platen of machine
6 spherical seating of the jig
7 Upper platen of the jig
8 specimen
9 lower plate
10 lower platen of the jig
11 lower platen of the machine

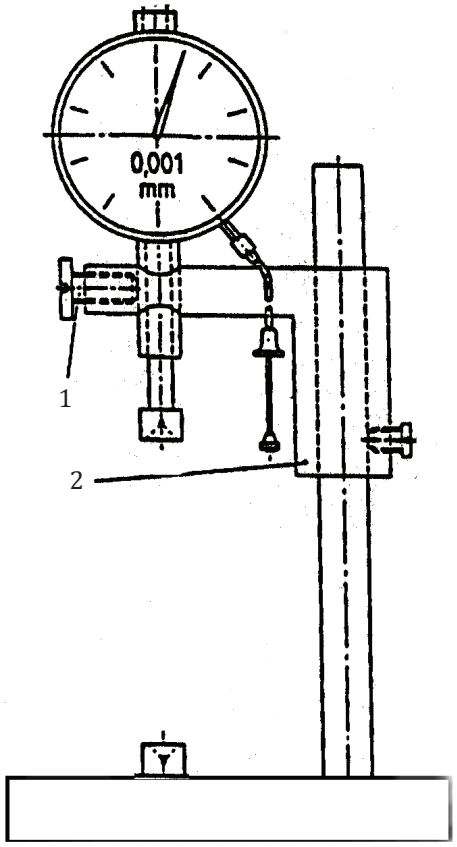
Figure A.4 — Typical jig for compressive stress testing



Key

1 adjustment screw
2 frame
3 measurement stud
4 side rod
5 specimen
6 holder
7 adjustment screw

Figure A.5 — Measuring apparatus (Type A)

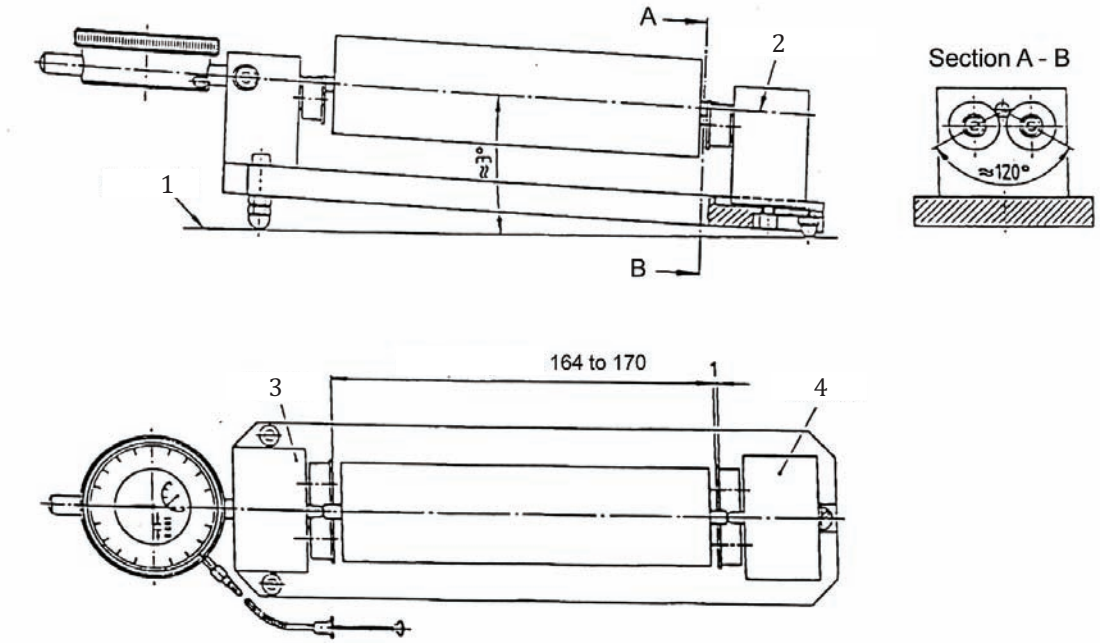


Key

1 stop device

2 holder

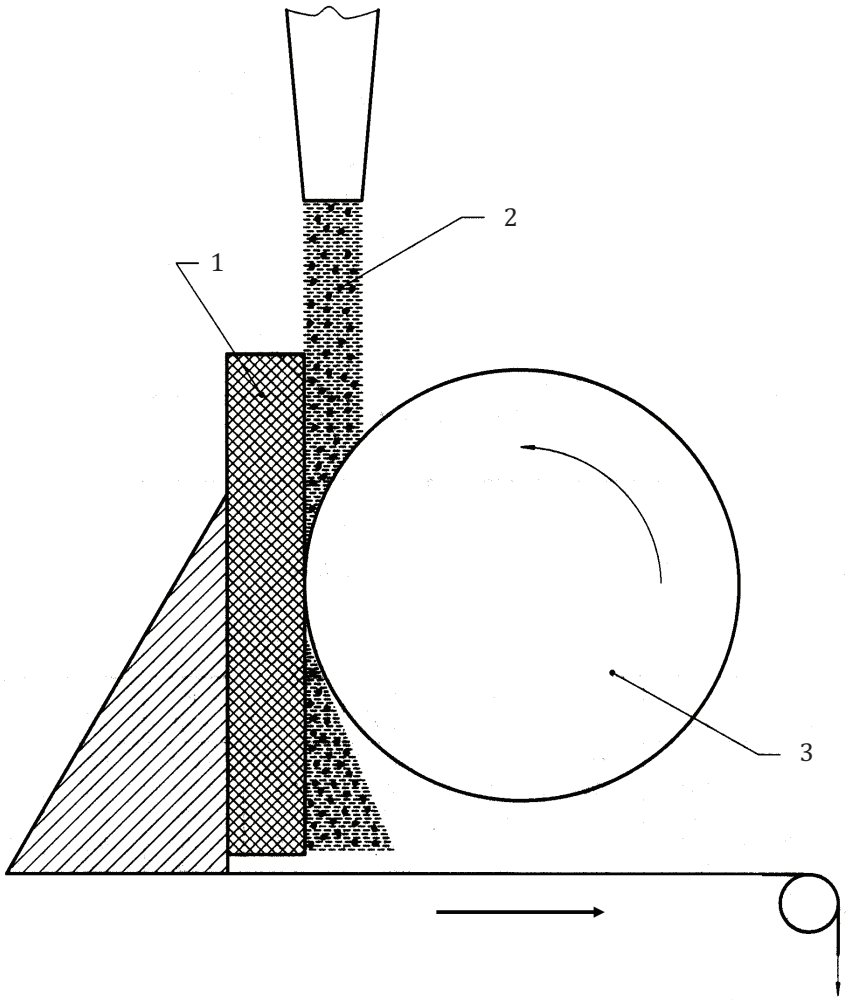
Figure A.6 — Measuring apparatus (Type B)



Key

1 horizontal
2 measuring axis
3 stand 1
4 stand 2

Figure A.7 — Measuring apparatus (Type C)



Key

1 sample
2 alumina grit
3 steel wheel

Figure A.8 — Schematic diagram of deep abrasion equipment

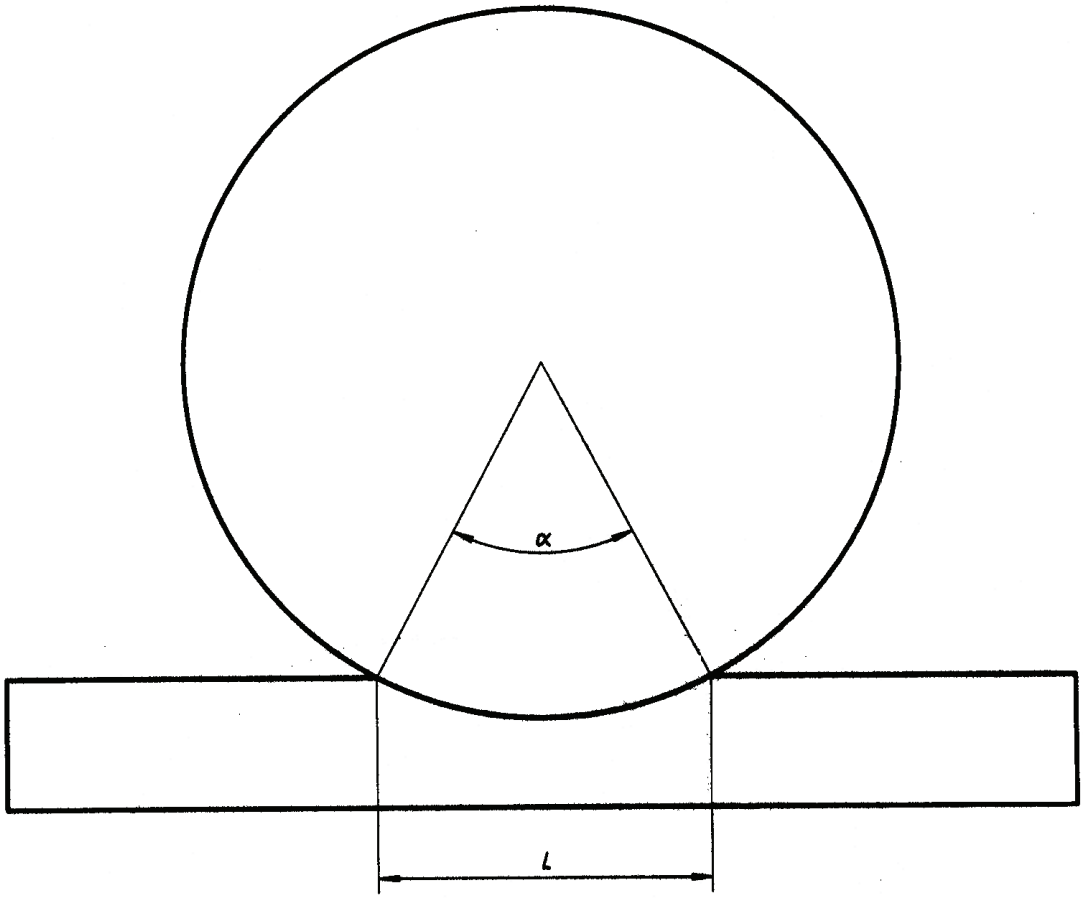


Figure A.9 — Definition of the chord

Table A.1 — Equivalent values

L mm	**V** mm^3	**L** mm	**V** mm^3	**L** mm	**V** mm^3	**L** mm	**V** mm^3	**L** mm	**V** mm^3
20	67	30	224	40	540	50	1 062	60	1 851
20,5	72	30,5	238	40,5	561	50,5	1 094	60,5	1 899
21	77	31	250	41	582	51	1 128	61	1 947
21,5	83	31,5	262	41,5	603	51,5	1 162	61,5	1 996
22	89	32	275	42	626	52	1 196	62	2 046
22,5	95	32,5	288	42,5	649	52,5	1 232	62,5	2 097
23	102	33	302	43	672	53	1 268	63	2 149
23,5	109	33,5	316	43,5	696	53,5	1 305	63,5	2 202
24	116	34	330	44	720	54	1 342	64	2 256
24,5	123	34,5	345	44,5	746	54,5	1 380	64,5	2 310
25	131	35	361	45	771	55	1 419	65	2 365
25,5	139	35,5	376	45,5	798	55,5	1 459	65,5	2 422
26	147	36	393	46	824	56	1 499	66	2 479
26,5	156	36,5	409	46,5	852	56,5	1 541	66,5	2 537
27	165	37	427	47	880	57	1 583	67	2 596
27,5	174	37,5	444	47,5	909	57,5	1 625	67,5	2 656
28	184	38	462	48	938	58	1 689	68	2 717
28,5	194	38,5	481	48,5	968	58,5	1 713	68,5	2 779
29	205	39	500	49	999	59	1 758	69	2 842
29,5	215	39,5	520	49,5	1 030	59,5	1 804	69,5	2 906

Bibliography

[1] ISO 13006, *Ceramic tiles — Definitions, classification, characteristics and marking*

[2] ISO 13007-1, *Ceramic tiles — Grouts and adhesives — Part 1: Terms, definitions and specifications for adhesives*

[3] ISO 13007-3, *Ceramic tiles — Grouts and adhesives — Part 3: Terms, definitions and specifications for grouts*

ICS 91.100.10;91.100.23

Price based on 22 pages