BS EN 13279-2:2014

BSI Standards Publication

Gypsum binders and gypsum plasters

Part 2: Test methods

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National foreword

This British Standard is the UK implementation of EN 13279-2:2014. It supersedes BS EN 13279-2:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/544, Plastering, rendering, dry lining.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

This document (EN 13279-2:2014) has been prepared by Technical Committee CEN/TC 241 “Gypsum and gypsum based products”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by July 2014, and conflicting national standards shall be withdrawn at the latest by July 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13279-2:2004.

This document on gypsum binders and gypsum plasters, EN 13279, *Gypsum binders and gypsum plasters*, consists of two parts:

— *Part 1: Definitions and requirements;*

— *Part 2: Test methods.*

This document for gypsum binders and gypsum plasters uses European standardized test methods as far as possible and where this was not applicable other appropriate proven test methods have been used.

This document includes an informative Annex A concerning water retention.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Figure 1 shows the family of gypsum binders and gypsum plasters

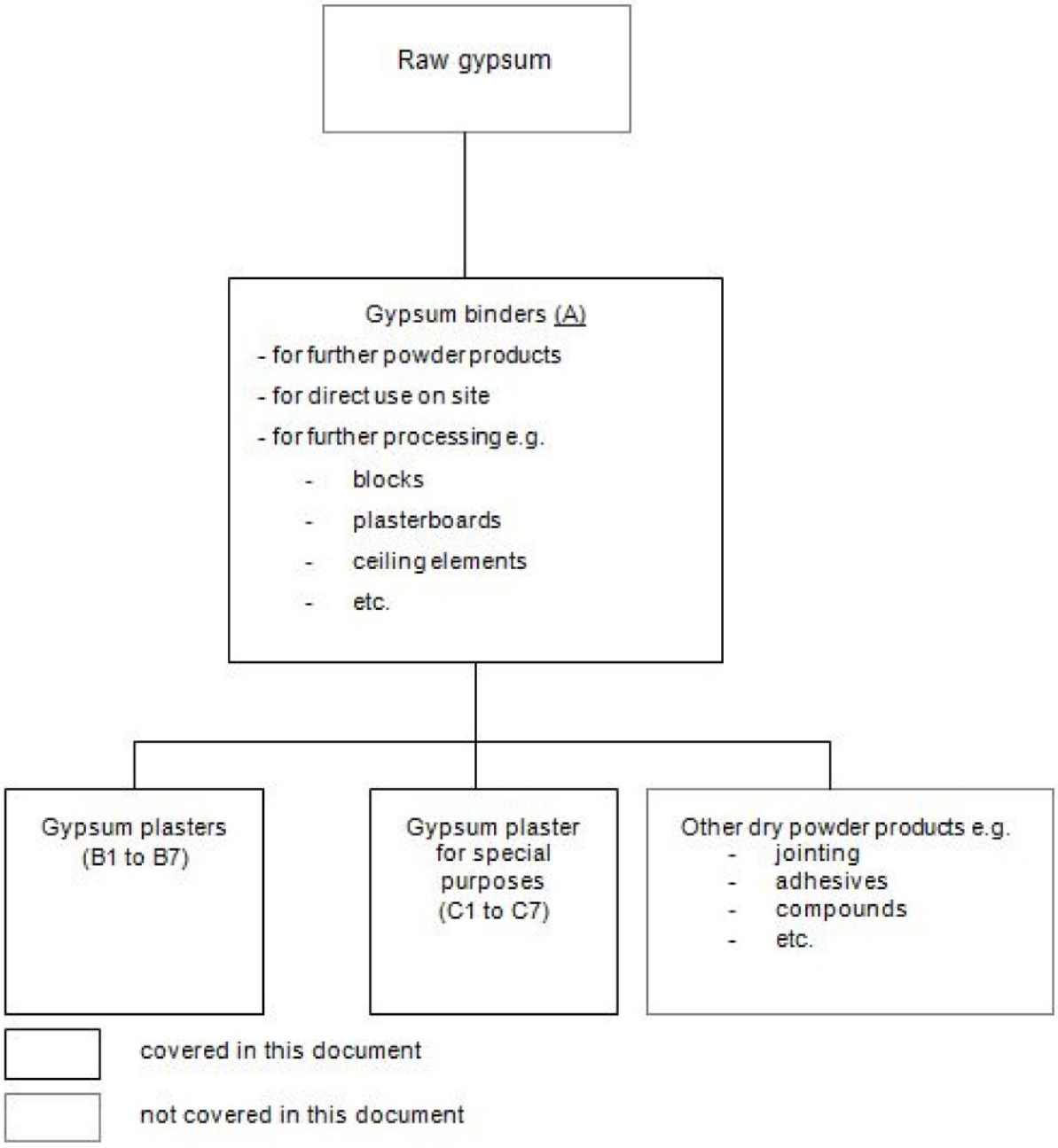


Figure 1 — Family of gypsum biners and gypsum plasters

1 Scope

This European Standard describes the reference test methods for all gypsum binders and gypsum plasters covered by EN 13279-1.

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 referenced, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 196-1:2005, *Methods of testing cement - Part 1: Determination of strength*

EN 196-7, *Methods of testing cement - Part 7: Methods of taking and preparing samples of cement*

EN 459-2:2010, *Building lime - Part 2: Test methods*

EN 932-1, *Tests for general properties of aggregates - Part 1: Methods for sampling*

ISO 565, *Test sieves - Metal wire cloth, perforated metal plate and electroformed sheet - Nominal sizes of openings*

3 Test conditions and sampling

3.1 Test atmosphere (reference test)

Temperature of the test room, the equipment and the materials (plaster, water): (23 ± 2) °C

Relative humidity of the air: (50 ± 5) %

3.2 Sampling

Sampling shall be carried out in accordance with EN 196-7.

Sample granular material in accordance with the procedures given in EN 932-1 for aggregates taking into account the need to minimise moisture and carbon dioxide absorption.

The spot sample size shall be (8 ± 3) kg.

The test sample prior to testing shall be kept in hermetically sealed containers.

3.3 Preparation of the sample

Before carrying out tests, the mass of the sample shall be homogenised.

Before carrying out chemical analyses, a representative sample of (50 ± 5) g shall be taken and be ground to a particle size of ≤ 0,1 mm.

3.4 Water

The water used for reference tests and chemical analyses shall be distilled or deionised.

3.5 Appliances and apparatus

The apparatus used for gauging and the moulds used for preparing the test pieces, shall be free from leaks and shall be manufactured from a water resistant material which is non reactive to calcium sulphate (e.g. glass, brass, stainless steel, hardened steel, hard rubber and plastics). Soft plastic and rubber materials shall not be used.

Since the characteristics of plasters are strongly influenced by the presence of particles of calcium sulphate dihydrate which can influence the setting time, all the equipment used in the tests shall be kept in a perfect state of cleanliness.

4 Test methods for gypsum binders and gypsum plasters (including special purposes)

4.1 Sieve analysis (Fineness)

4.1.1 Apparatus

a) Control sieves conforming to ISO 565:

   1) 5 000 µm, only for gypsum bricklaying plaster (C2);

   2) 200 µm and 100 µm for fibrous gypsum plaster elements (C1, C7);

   3) 1 500 µm for fibrous plaster works and thin coat plaster (C1, C6);

b) wooden or plastic spatula;

c) balance accurate to ± 0,1 g;

d) desiccator.

4.1.2 Determination of particles retained on 5 000 µm sieves (see 4.1.1 a))

4.1.2.1 Procedure

From the hermetically sealed laboratory sample weigh 500 g ± 25 g and pass through a 5 000 µm sieve (see 4.1.1 a)), crushing any soft lumps with a spatula. Weigh the residue and examine any hard particles retained on the sieve.

Repeat the procedure on a second sample.

Expression of results

Express the mass retained on the sieve as a percentage of the total sample. Take the mean of the two results and record it in the test report.

4.1.3 Determination of particles retained on 200 µm and 100 µm sieves

4.1.3.1 Procedure

Take approximately 200 g from the hermetically sealed sample and dry it to constant mass[1)] at (40 ± 2) °C. Cool in a desiccator to room temperature. Weigh 50 g ± 5 % and transfer to the test sieve.

Hold the sieve in one hand, slightly tilted, and shake it, allowing it to strike the other hand on each movement at a rate of approximately 125 times per minute, so that the plaster always spreads out evenly.

Every 25 movements turn the sieve through 90 degrees. After 1 min weigh the residue and return to the sieve. Continue sieving until the mass of plaster passing the sieve in 1 min does not exceed 0,4 g.

After sieving for 3 min, brush any fine material adhering to the inner surface of the sieve frame onto the wire screen. Sieving is continued until the plaster passing the sieve in 1 min does not exceed 0,2 g. The underside of the wire screen surface is then brushed, and the brushings rejected, before the residue retained on the sieve is weighed. For the 100 µm sieve the test is carried out in the same way and with the same limits as for the 200 µm sieve.

Repeat the procedure on a second sample.

4.1.3.2 Expression of results

Express the mass retained on the sieve as a percentage of the total sample. Take the mean of the two results for each of the sieve sizes and compare with the requirements.

4.2 Determination of sulphur trioxide content and calculation of equivalent calcium sulfate

NOTE This test method applies to all types of plasters.

4.2.1 Principle

The calcium sulfate is decomposed by digestion with hydrochloric acid solution. Insoluble constituents are removed by filtration. The sulfate in the filtrate is determined gravimetrically as barium sulfate.

4.2.2 Apparatus

a) Sieve 0,1 mm mesh;

b) 250 ml and 400 ml beakers;

c) rapid filtration funnels;

d) muffle furnace;

e) vitreosil ignition crucible, porosity 4 or porous porcelain or silica crucible;

f) filter paper capable of retaining particles greater than 2,5 µm;

g) balance to an accuracy of 0,001 g;

h) desiccator.

[1)] Constant mass is defined as two successive weighings 24 h apart, differing by less than 0,1 %.

4.2.3 Reagents

a) Hydrochloric acid solution: 2 mol/l HCl;

b) barium chloride: (10 % solution).

4.2.4 Procedure

The sample is ground until it passes through a sieve with a mesh of 0,1 mm.

0,5 g of the sample dried at 40 °C shall be boiled with 30 ml HCl 1:1 and 150 ml distilled H_2O for 15 min to 20 min in a 250 ml beaker. Then it shall be filtered through a quantitative filter (red band) into a 400 ml beaker and washed with hot deionised water. The solution shall be boiled, and while stirring it SO_3 shall be precipitated with 25 ml 10 % barium chloride, brought to the boil, and then allowed to stand for at least 12 h.

The solution shall be filtered through a quantitative filter (red band) and washed using hot deionised water, until it is free of chloride. The filter residue shall be left to incinerate slowly in the crucible and ignited at 800 °C until constant weight is achieved, then be cooled in a desiccator and weighed.

The test shall be repeated.

4.2.5 Expression of results

4.2.5.1 Calculation of SO_3

The sulfate content expressed as SO_3 is calculated in percent from the Formula (1):

$$SO_3 = \frac{BaSO_4 \times 0{,}343 \times 100}{m_p} \quad (1)$$

where

$BaSO_4$ is the mass of the barium sulfate $BaSO_4$, in g;

m_p is the mass of the sample, in g.

4.2.5.2 Calculation of equivalent calcium-sulfate

The equivalent calcium-sulfate is calculated in percent from the Formula (2):

$$SO_3 \text{ x } 1{,}7 = CaSO_4 \quad (2)$$

4.3 Determination of the water/plaster ratio

NOTE There are no corresponding requirements in EN 13279–1.

4.3.1 Sprinkling method

This method is used for gypsum binders.

4.3.1.1 Principle

Determination of the mass of the gypsum binder in grams which can be saturated when it is sprinkled into 100 g of water.

4.3.1.2 Apparatus

a) Cylindrical glass container with 66 mm internal diameter and 66 mm height and with markings at a height of 16 mm and 32 mm above the inner surface of the base;

b) chronometer;

c) balance, accurate to ± 0,1 g.

4.3.1.3 Procedure

Pour 100 g of water into the glass container, while taking care not to wet the upper part of the cylindrical wall. Determine the mass m_0 within ± 0,5 g. The total time for the following procedure shall be (120 ± 5) s. First sprinkle the plaster evenly over the surface of the water in such a way, that after 30 s the gypsum paste has reached the first marking and has reached the second marking after 60 s. Continue the sprinkling until the gypsum paste has reached approximately 2 mm below the surface of the water after (90 ± 10) s. During the following 20 s to 40 s, sufficient binder is sprinkled on to the surface of the water and the rim of the glass container that the water surface disappears. Any small dry islands of binder, which appear during the operation should be saturated at the end of 3 s to 5 s.

In the case of binder which tends to settle slowly, the level marks may not be reached within the required time. In this case, the binder shall be sprinkled so that it falls only on to those areas of the water, which are free from binder and not on to binder which has already been sprinkled. The sprinkling time is to be stated.

Before weighing remove surplus plaster from the rim of the glass container. Determine the mass m_1, within ± 0,5 g. The test method is repeated at least twice. Calculate the mean sprinkled quantity.

4.3.1.4 Expression of results

The water/plaster ratio R is given by Formula (3):

$$R = \frac{100}{m_1 - m_0} \tag{3}$$

where

m_0 is mass of glass container + mass of water, in g;

m_1 is mass of glass container + mass of water + mass of plaster, in g.

4.3.2 Dispersal method

4.3.2.1 General

This method is used for gypsum binders and gypsum plasters with fluid consistency by measuring the flow of the mixture when a mould filled with the mixture is removed.

4.3.2.2 Principle

Determination of the mass of the gypsum binder or gypsum plaster (in grams) that will produce a mixture of given consistency.

4.3.2.3 Apparatus

a) A bowl for mixing, together with a mixing spatula made from a non-reactive material;

b) Vicat ring: 40 mm in height, upper internal diameter 65 mm, lower internal diameter 75 mm;

c) flat plate made from glass: the plate shall be smooth, clean and dry;

d) chronometer;

e) caliper gauge, measuring tape.

4.3.2.4 Procedure

Add a quantity of plaster determined by preliminary test expected to provide a spread diameter of 150 mm to 210 mm into the mixing bowl containing 500 g of water. Start the chronometer when the plaster is added to the water. The mixture shall be prepared as follows:

— sprinkling for a period of 30 s;

— allow the mixture to stand for 60 s;

— stir by hand for 30 s, describing 30 times a Figure 8;

— allow the mixture to stand for 30 s;

— stir by hand for 30 s in the same way.

Pour the mixture into the truncated mould, which is resting on the glass plate. Strike off the excess mixture. Raise the mould vertically 3 min and 15 s after start of the mixing procedure enabling the mixture to flow over the plate.

Measure the diameter of the pat formed in two places at right angles to each other and calculate the mean value. Where this value falls outside the range of 150 mm to 210 mm, repeat the test from the beginning using a larger or smaller quantity of plaster as appropriate. When the quantity of plaster that gives a flow within the range 150 mm to 210 mm has been found, record this quantity m_2 in grams.

4.3.2.5 Expression of the results

The water/plaster ratio R is given by Formula (4):

$$R = \frac{500}{m_2} \tag{4}$$

where

m_2 is the mass of plaster, in g.

4.3.3 Flow table method

4.3.3.1 General

This method is used for premixed gypsum plasters. The water/plaster ratio is determined by the trial and error method until a pat of a specified diameter is formed, when a truncated cone, filled with the slurry, is removed and jolted in the manner described.

4.3.3.2 Principle

The water/plaster ratio for premixed gypsum plaster is defined by a given consistency.

The required consistency is achieved, when the empirically determined diameter of the pat of plaster is (160 ± 5) mm or (165 ± 5) mm.

4.3.3.3 Apparatus

a) Mixer, mixing bowl and paddle (see EN 196-1:2005);

b) flow table and slump cone (see EN 459-2:2010, 6.8.2.1.2);

c) spatula;

d) caliper gauge, measuring tape;

e) chronometer.

4.3.3.4 Procedure

1,2 dm^3 to 1,5 dm^3 of the gypsum plaster shall be weighed to 1 g (m_4). The quantity of water (m_3) determined by preliminary tests is weighed into the dry mixing bowl. The gypsum plaster shall be folded into the water and premixed with the spatula and the paddle by hand for about 1 min. The plaster shall then be mixed with the mixer and the paddle for 1 min at low speed (140 ± 5) min^{-1} rotation or (62 ± 5) min^{-1} planetary motion.

The slump cone shall be placed at the centre of the glass plate of the flow table and held firmly in position with one hand. An excess of plaster shall be poured into the cone. The excess shall be removed with a spatula.

After 10 s to 15 s the slump cone shall be vertically withdrawn. Any plaster adhering to the cone shall be added to the plaster. Fifteen vertical blows shall then be applied to the flow table at a constant speed of 1 revolution per second.

The diameter of the resulting pat shall then be measured to 1 mm in two directions at right angles to each other. The mean diameter of the pat of hand-applied plaster shall be (165 ± 5) mm, the mean diameter of the pat of machine-applied plaster shall be (160 ± 5) mm.

Where the slump differs from that specified for the product, the test shall be repeated from the beginning using larger or smaller quantities of water.

If the setting time is such, that the water/plaster ratio cannot be carried out satisfactorily, a small amount of retarder may be added to the gauging water. In this case, the test report will state the nature and dosage of the admixture used.

4.3.3.5 Expression of results

The water/plaster ratio R is given by Formula (5):

$$R = \frac{m_3}{m_4} \tag{5}$$

where

m_3 is the mass of mixing water, in g;

m_4 is the mass of gypsum plaster, in g.

4.4 Determination of the setting time

4.4.1 Knife method

4.4.1.1 General

The method is used for gypsum binders.

4.4.1.2 Principle

The initial setting time is the time in minutes after which the edges of a cut, made with a knife through the gypsum paste, cease to flow together.

4.4.1.3 Apparatus

a) Knife with a cutting blade about 100 mm long, 16 mm wide and a thickness of the upper edge of 1 mm with wedge-shaped cross-section;

b) spatula;

c) smooth glass plates (minimum of 400 mm long and 200 mm wide);

d) chronometer;

e) bowl for mixing, made from non-reactive material.

4.4.1.4 Procedure

a) Production of the gypsum pats:

The gypsum binder or gypsum plaster shall be mixed and prepared with the amount of water determined to 4.3.1 (sprinkling method) or 4.3.2 (dispersal method) depending on the kind of gypsum. The time at which the gypsum binder or gypsum plaster is first added to the water shall be noted (t_0).The gypsum paste shall then be poured on to the glass plate, with constant stirring, to form three pats about 100 mm to 120 mm in diameter and about 5 mm thick.

b) Determination of the initial setting time T_i:

The initial setting time shall be determined by making cuts in the pat. The knife shall be cleaned and dried after each cut. Cuts shall be made at intervals not greater than 1/20 of expected setting time. Two pats are for trial cuts, one pat is for the test cut.

The initial setting T_i is achieved when the edges of a cut made at time t_1 cease to flow together.

4.4.1.5 Expression of results

The initial setting time T_i is given by Formula (6):

$$T_i = t_1 - t_0 \quad (6)$$

where

T_i is the initial setting time, in minutes;

t_0 is the time at which the plaster is first added to the water, in minutes;

t_1 is the time at which the edge of a cut made with a knife through the plaster, cease to flow together, in minutes.

4.4.2 Vicat cone method

4.4.2.1 General

This method is the standard method for all premixed gypsum plasters which incorporate additives and/or retarders.

If other methods are used (for instance ultrasonic methods or Vicat machines) these methods have to be aligned with the Vicat cone method at least 1/month.

4.4.2.2 Principle

The depth of penetration of the conical penetrator (cone) into a plaster/water paste as the set progresses. This principle is used to determine the initial setting time.

4.4.2.3 Apparatus

a) Vicat apparatus: see Figures 2 and 3;

b) conical penetrator (cone): see Figure 4;

c) glass plate: about 150 mm long and 150 mm wide;

d) Vicat ring: see item b) in 4.3.2.3;

e) straight edge:140 mm length;

f) chronometer;

g) mixer and paddle: see EN 196-1:2005, 4.4.

4.4.2.4 Procedure

The Vicat ring shall be placed on the glass plate with the larger opening in contact with the glass plate. The gypsum plaster shall be mixed with the amount of water determined according to 4.3.3 or 4.3.2. The time at which the plaster is first added to the water is noted t_0. An excess of plaster shall be transferred to the ring. Using a sawing motion the vertically held straight edge is used to strike off the excess material. Lower the cone to the surface of the plaster using the spring plate of the release mechanism.

The guide bar shall be opened for testing using the release mechanism. The time between the cone penetration should be not greater than 1/20th of the initial setting time. The cone shall be cleaned and dried between each penetration and there should be at least 12 mm between each penetration mark. The time at which the depth of penetration achieved (22 ± 2) mm above the glass plate, t_1, shall be noted.

4.4.2.5 Expression of results

The initial setting T_i is given by Formula (7):

$$T_i = t_1 - t_0 \quad (7)$$

where

t_1 is the time at which the depth of penetration (22 ± 2) mm above the glass plate is achieved, in minutes;

t_0 is the time at which the plaster is first added to the water, in minutes.

4.5 Determination of mechanical properties

4.5.1 Apparatus

a) Mixer and paddle: see EN 196-1:2005, 4.4;

b) spatula;

c) moulds with base: see EN 196-1:2005, 4.5;

d) scraper;

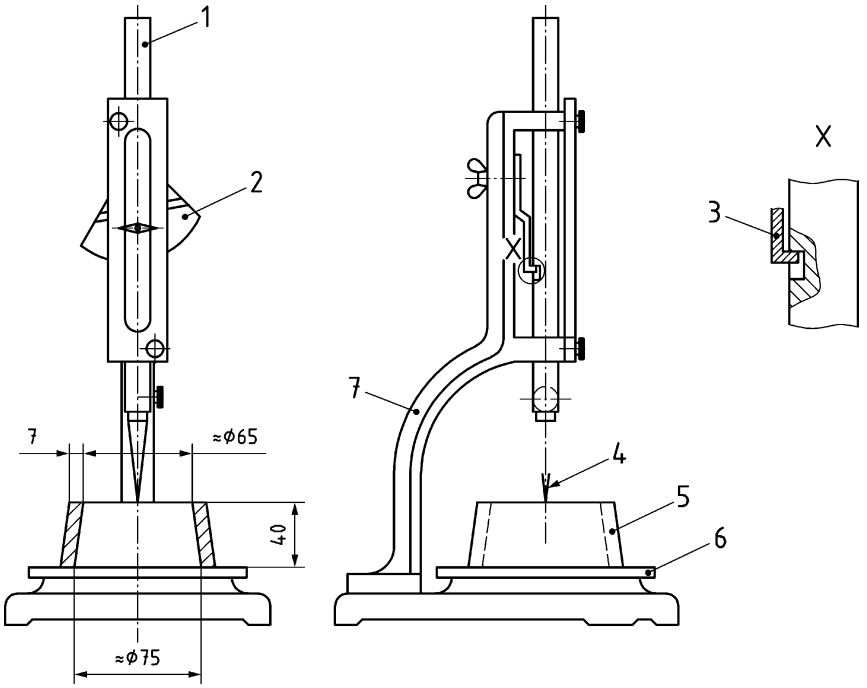
e) desiccator;

f) compression machine: capable of a loading rate of 1 N/mm^2 per s, see EN 196-1:2005, 4.7 and 4.8;

g) bending device: see f);

h) hardness device.

Dimensions in millimetres

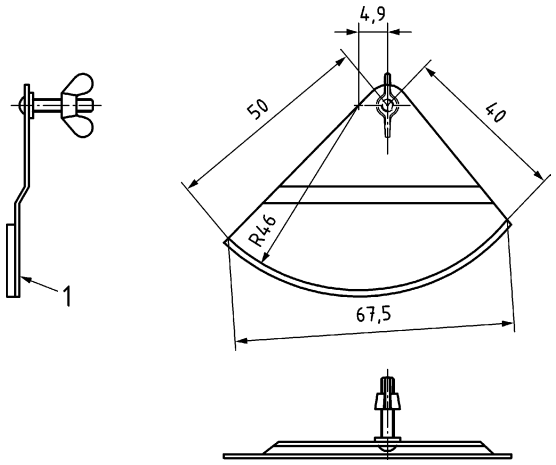


Key

1 guide bar
2 release mechanism
3 spring plate
4 conical penetrometer (cone)
5 vicat ring
6 glass plate
7 stand

Figure 2 — Typical Vicat apparatus with needle and release mechanism

Dimensions in millimetres

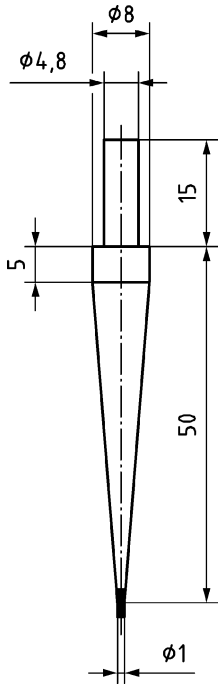


Key

1 spring plate

Figure 3 — Typical release mechanism for the Vicat apparatus

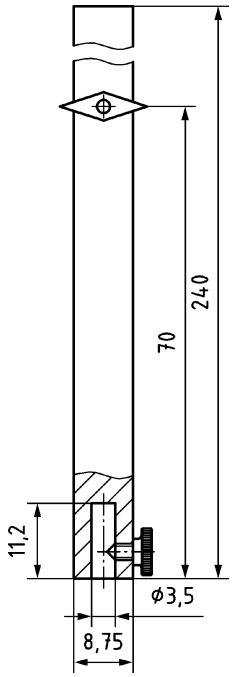
Dimensions in millimetres



Key

Material: high grade steel

Figure 4 — Conical penetrometer (cone)



Key

Material: aluminium

NOTE Figure for guidance (length depends on the combined mass of the cone and guide bar, total mass = 100 g).

Figure 5 — Guide bar

4.5.2 Preparation of the test specimen

The plaster under test shall be mixed according to the procedure given in 4.3.3 using the water/plaster ratio determined according to the procedures given in 4.3.1, 4.3.2 or 4.3.3, depending on the type of gypsum plaster.

Immediately after being prepared, the plaster paste shall be transferred using a spatula to press into the sides and corners of the mould which has previously been lightly oiled or greased. To eliminate any air bubble the mould shall then be raised 10 mm by its end and allowed to fall.

This shall be repeated 5 times at each end. The moulds shall be filled not later than 10 min after the start of mixing, and the surface may not be smoothed. After setting is complete the surplus paste shall be scraped off with a sawing motion of the knife or steel rule. At least three prisms shall be prepared in this way.

When an adequate degree of strength has been reached, the prisms shall obtain identifying marks and removed from moulds. The prisms shall be stored for 7 days in the standard atmosphere described in 3.1. Then, they shall be dried to constant mass at (40 ± 2) °C. After drying, the samples shall be cooled to room temperature.

4.5.3 Determination of hardness

4.5.3.1 Principle

The indentation produced by a known force on a test specimen is measured.

4.5.3.2 Apparatus

Device which allows a hardened steel ball of 10 mm diameter to be applied to a fixed point on the surface of the test specimen and a fixed load to be applied to the ball perpendicular to the surface of the test specimen.

Comparator, integral with the ball carrier, which can be used to measure the depth of the impression.

4.5.3.3 Procedure

Carry out the determination on the two longitudinal faces of the specimen (e.g. the lateral faces in contact with the mould).

Apply the force at right angles to the face being tested, in the plane passing through the lateral axis, and at three points, the distance between them being the quarter of the length. However, the extreme points shall be situated at least 20 mm from the ends.

Apply a load of 10 N, then in 2 s increase the load to 200 N ± 10 N. Maintain it for 15 s; then measure the depth of the impression.

4.5.3.4 Expression of results

The hardness *H*, in newtons per square millimetre, is given by Formula (8):

$$H = \frac{F}{\pi \times D \times t} = \frac{20 \times 1000}{\pi \times 1 \times t} = \frac{6366}{t} \quad (8)$$

where

F is the load, in N;

D is the diameter of the ball, in mm;

t is the mean depth, of the impressions in µm.

Record in the test report, in groups of three, corresponding to each face tested, the depth of the 18 impressions. Calculate the arithmetic mean t and indicate the number of results between 0,9 t and 1,1 t. Exclude values for impressions showing obvious pores.

4.5.4 Determination of flexural strength

4.5.4.1 Principle

The force required to break a plaster prism 160 mm x 40 mm x 40 mm supported at 100 mm centres is determined.

4.5.4.2 Procedure

The test specimen shall be placed on the supporting rollers of the bending device and the loading roller shall be applied using the test machine after the start of loading. Record the maximum load in Newton supported by the test specimen.

4.5.4.3 Expression of results

The flexural strength P_F is given by Formula (9):

$$P_F = 0{,}00234 \times P \tag{9}$$

where

P_F is the flexural strength, in N/mm^2;

P is the average breaking load in N of at least three obtained values.

4.5.5 Determination of compressive strength

4.5.5.1 Principle

The test specimen is compressed until it fails.

4.5.5.2 Procedure

Compressive strength shall be determined by applying a load to the broken part of the test specimen used for the determination of flexural strength.

New test specimen may be made following procedure 4.5.2. If there is a delay between the determination of flexural strength and compressive strength the parts of the prism to be tested should be stored in a desiccator. Place the test pieces between the steel platens so that the sides of the prism which were in contact with the sides of the moulds are in contact with the platens over a section of 40 mm x 40 mm.

The upper platen is allowed to tilt so that perfect contact is made between the test piece and the platen. The axis of rotation of the upper platen passes through the centre of the surfaces which are being compressed. The test specimen shall be loaded until rupture of the test specimen occurs.

4.5.5.3 Expression of results

The mean value of the 6 test values shall be calculated and expressed in N/mm^2. The compressive strength R_c load is calculated by Formula (10):

$$R_c = \frac{F_c}{1600} \quad (10)$$

where

R_c is the compressive strength, in N/mm^2;

F_c is the maximum load at fracture, in N;

1600 40 mm x 40 mm is the area of the platens in mm^2.

4.6 Determination of adhesion

4.6.1 Principle

The adhesion of a plaster to a specific background is measured as the maximum load supported when a metal disc fixed to the plaster is pulled perpendicular to the surface.

4.6.2 Apparatus

a) Metal plates 50 mm in diameter and not less than 10 mm in thickness, with central connection for traction purposes;

b) resin-based adhesives, such as epoxy resin or methylmethacrylate resin;

c) core cutter, to produce samples 50 mm ± 0,5 mm in diameter in the hardened plaster;

d) traction device permitting a tensile force to be applied to the steel plates without subjecting the assembly to a flexural stress. The indicating device shall permit the test force to be read with an accuracy of measurement of ± 5 % of the maximum recorded load.

4.6.3 Procedure

Background surfaces shall be prepared in accordance with good practice or the appropriate code of application.

The plaster shall be mixed with water and applied to the substrate in accordance with the manufacturers recommendations. When the plaster has set, the specimens shall be stored for seven days in the test atmosphere. Using the core cutter circular test areas shall be isolated from the surrounding plaster. The cut shall be made to a depth of approximately 5 mm into the background. Glue the pull-heads to the isolated area of plaster with the adhesive, taking care to position the pull-heads centrally over the area and making sure that the adhesive does not bridge the gap between the isolated area and its surrounds. Apply the tensile load perpendicular to the test area using the testing machine. The load shall be applied at a uniform rate within the range 0,003 N/mm^2 to 0,1 N/mm^2 per s.

For loading rate see Table 1.

Table 1 − Loading rate

Test area A = 1,963 mm^2 (ø 50 mm)

Expected adhesive strength	Loading rate	
(N/mm^2)	(N/s)	(N/mm^2.s)
< 0,2	5	0,003
0,2 to 0,5	25	0,013
0,5 to 1,0	100	0,050
> 1,0	200	0,100

4.6.4 Expression of results

4.6.4.1 Adhesive strength

The individual adhesive strength is calculated by Formula (11):

$$R_u = \frac{F_u}{A} \tag{11}$$

where

R_u is the adhesive strength in N/mm^2;

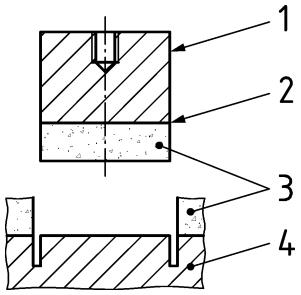
F_u is the failure load in N;

A is the test area of the cylindrical specimen, in mm^2.

Calculate the adhesive strength as the mean value from the individual values of the specimen to the nearest 0,01 N/mm^2.

4.6.4.2 Fracture pattern

In some cases rupture may not occur at the interface between mortar and substrate, but in the plaster itself or in the background or the adhesive resin at the pull-head. In these cases the adhesive strength will be higher than the measured value. These values shall therefore be neglected when calculating the mean value. The fracture pattern shall however in each case be reported according to Figure 6 to Figure 9.



Key

1 test plate

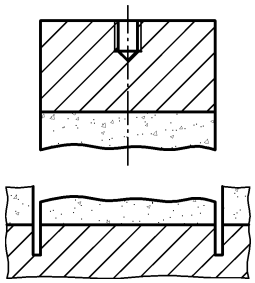
2 adhesive layer

3 plaster

4 background

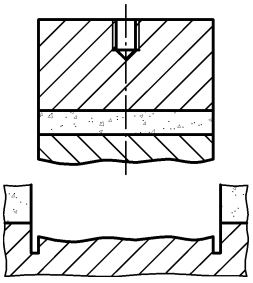
(Fracture at the interface between plaster and background; Test value equals the adhesive strength)

Figure 6 — Fracture pattern a - Adhesion fracture



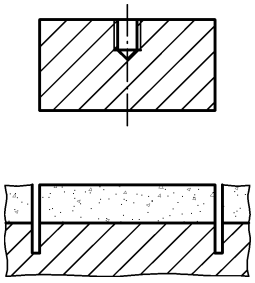
(Fracture in the plaster itself, the adhesive strength is greater than the test value).

Figure 7 — Fracture pattern b - Cohesion fracture



(Fracture in the background material; the adhesive strength is greater than the test value.)

Figure 8 — Fracture pattern c - Cohesion fracture



(Fracture in the adhesive layer due to a failure produced by glueing; if this fracture pattern occurs the test shall be repeated.)

Figure 9 — Fracture pattern d

If different fracture patterns occur (e.g. a fracture may be partly in the background and partly in the plaster), this shall be described stating the estimated percentage failure in each.

Annex A
(informative)

Water retention

The determination of water retention is done according to the method given in 6.9 of EN 459-2:2010.

Bibliography

[1] EN 13279-1, *Gypsum binders and gypsum plasters - Part 1: Definitions and requirements*

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