

Unbound and hydraulically bound mixtures —

Part 53: Methods for the manufacture of
test specimens of hydraulically bound
mixtures using axial compression

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British Standard

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National foreword

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Summary of pages

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English version

**Unbound and hydraulically bound mixtures - Part 53: Methods
for the manufacture of test specimens of hydraulically bound
mixtures using axial compression**

Mélanges traités et mélanges non traités aux liants
hydrauliques - Partie 53: Méthode de confection par
compression axiale des éprouvettes de matériaux traités
aux liants hydrauliques

Ungebundene und hydraulisch gebundene Gemische - Teil
53: Verfahren zur Herstellung von Probekörpern von
hydraulisch gebundenen Gemischen durch axialen Druck

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Foreword

This document (EN 13286-53:2004) has been prepared by Technical Committee CEN/TC 227 "Road materials", 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of an identical text or by endorsement, at the latest by June 2005, and conflicting national standards shall be withdrawn at the latest by June 2005.

This document is one of a series of documents as listed below.

EN 13286-1, <i>Unbound and hydraulically bound mixtures density and water content</i>	<i>Part 1: Test methods for laboratory reference Introduction, general requirements and sampling</i>
EN 13286-2, <i>Unbound and hydraulically bound mixtures laboratory reference density and water content</i>	<i>Part 2: Test methods for the determination of the Proctor compaction</i>
EN 13286-3, <i>Unbound and hydraulically bound mixtures density and water content</i>	<i>Part 3: Test methods for laboratory reference Vibrocompression with controlled parameters</i>
EN 13286-4, <i>Unbound and hydraulically bound mixtures density and water content</i>	<i>Part 4: Test methods for laboratory reference Vibrating hammer</i>
EN 13286-5, <i>Unbound and hydraulically bound mixtures density and water content</i>	<i>Part 5: Test methods for laboratory reference Vibrating table</i>
EN 13286-7, <i>Unbound and hydraulically bound mixtures mixtures</i>	<i>Part 7: Cyclic load triaxial test for unbound mixtures</i>
EN 13286-40, <i>Unbound and hydraulically bound mixtures direct tensile strength of hydraulically bound mixtures</i>	<i>Part 40: Test method for the determination of the</i>
EN 13286-41, <i>Unbound and hydraulically bound mixtures compressive strength of hydraulically bound mixtures</i>	<i>Part 41: Test method for the determination of the</i>
EN 13286-42, <i>Unbound and hydraulically bound mixtures indirect tensile strength of hydraulically bound mixtures</i>	<i>Part 42: Test method for the determination of the</i>
EN 13286-43, <i>Unbound and hydraulically bound mixtures modulus of elasticity of hydraulically bound mixtures</i>	<i>Part 43: Test method for the determination of the</i>
EN 13286-44, <i>Unbound and hydraulically bound mixtures alpha coefficient of vitrified blast furnace slag</i>	<i>Part 44: Test method for the determination of the</i>
EN 13286-45, <i>Unbound and hydraulically bound mixtures workability period of hydraulically bound mixtures</i>	<i>Part 45: Test method for the determination of the</i>
EN 13286-46, <i>Unbound and hydraulically bound mixtures moisture condition value</i>	<i>Part 46: Test method for the determination of the</i>
EN 13286-47, <i>Unbound and hydraulically bound mixtures California bearing ratio, immediate bearing index and linear swelling</i>	<i>Part 47: Test method for the determination of</i>

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prEN 13286-48, *Unbound and hydraulically bound mixtures* *Part 48: Test method for the determination of the degree of pulverisation*

EN 13286-49, *Unbound and hydraulically bound mixtures* *Part 49: Accelerated swelling test for soil treated by lime and/or hydraulic binder*

EN 13286-50, *Unbound and hydraulically bound mixtures* *Part 50: Method for the manufacture of test specimens of hydraulically bound mixtures using Proctor equipment or vibrating table compaction*

EN 13286-51, *Unbound and hydraulically bound mixtures* *Part 51: Method for the manufacture of test specimens of hydraulically bound mixtures using vibrating hammer compaction*

EN 13286-52, *Unbound and hydraulically bound mixtures* *Part 52: Method for the manufacture of test specimens of hydraulically bound mixtures using vibrocompression*

EN 13286-53, *Unbound and hydraulically bound mixtures* *Part 53: Methods for the manufacture of test specimens of hydraulically bound mixtures using axial compression*

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1 Scope

This document specifies a test method for making cylindrical specimens of hydraulically bound mixtures to a predetermined density and moisture content by axial compression. This document applies to mixtures, or that part of a mixture, containing aggregate up to a maximum size of 22,4 mm, and for mixtures that have sufficient fines or cohesion to allow extrusion without damage immediately after compaction.

2 Normative references

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

EN 933-2, *Tests for geometrical properties of aggregates — Part 2: Determination of particle size distribution — Test sieves, nominal size of apertures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

compaction by axial compression

method of manufacture of a laboratory test specimen by compacting a predetermined quantity of mixture into a cylindrical mould of known volume using axial pressure applied through pistons or plugs at both ends of the mould

3.2

slenderness ratio

height to diameter ratio of the specimen

4 Symbols

For the purposes of this document, the following symbols apply.

- d specimen diameter, in millimetres (mm);
- h specimen height, in millimetres (mm);
- e displacement depth of collar, in millimetres (mm);
- m mass of the specimen, in grams (g);
- V volume of the specimen, in cubic millimetres (mm³);
- ρ_d dry density of the specimen, in megagrams per cubic metre (Mg/m³);
- w water content of the mixture expressed as a percentage by dry mass (%).

5 Principle

Cylindrical test specimens of the mixture are made by axial compression. After demoulding, the specimens are stored at a specified temperature and for a specified period of time minimizing loss of moisture until required for testing.

NOTE The method described usually produces specimens with a density gradient such that the density in the central part of the specimen is less than that at the ends.

6 Dimensions of the specimens

Specimens shall conform to the dimensions given in Table 1.

Table 1 — Specimen dimensions

Column	1	2	3
Line	d mm	h mm	Maximum size of particle permitted in the specimen mm
1	50	50 or 100	11,2
2	100	100 or 200	22,4

7 Apparatus

7.1 Moulds, with dimensions conforming to the following (see Figure 1), according to the size of specimen selected from Table 1:

- a) internal diameter (d ± 0,1) mm;
- b) minimum height for cylinder with a slenderness ratio of 2 1,7 h;
- c) minimum height for cylinder with a slenderness ratio of 1 2,4 h;
- d) minimum wall thickness 10 mm.

Each mould shall have flanged pistons (plugs) for each end of the mould with dimensions as follows:

- e) external diameter (d – 0,5 mm) ± 0,1 mm;
- f) minimum height 0,7 d.

The length of the plugs and the moulds shall be such that the free space in the middle part of the mould is (h ± 0,2) mm when the flanges of the 2 plugs are in contact with the barrel of the mould.

7.2 Displacing half-collars conforming to Figure 2, three pairs of which are used between the flanges of the plugs and the barrel of the cylinder during the filling and compaction procedure in order to minimize density gradients within the specimen. The displacement depth of the collars shall conform to Table 2.

Table 2 — Displacement depth of the collars

Pair number	E
1	h/4
2	h/6
3	h/10

7.3 Compaction press or compression testing machine, capable of exerting sufficient force in a controlled manner without vibration to achieve compaction of the specimen.

7.4 11,2 mm and 22,4 mm test sieves, conforming to EN 933-2.

8 Procedure

8.1 Sieve the mixture on the 11,2 mm sieve for 50 mm diameter specimens and on the 22,4 mm sieve for 100 mm diameter specimens and use only the fraction passing the appropriate sieve for the manufacture of the specimens.

8.2 Calculate the mass of the mixture required for moulding using the following formula:

$$m = \frac{V \times \rho_d \left(\frac{100}{100 + w} \right)}{100}$$

where

m is the mass of the mixture to be introduced in the mould, in grams (g);

V volume of the specimen, in cubic millimetres (mm³);

ρ_d is the dry density of the specimen, in megagrams per cubic metre (Mg/m³);

w is the water content of the dry mass of the mixture, in percent (%).

8.3 Introduce pair number 1 of the displacing collars between the flange of the bottom plug and the barrel of the mould.

8.4 Place the total quantity of mixture into the mould. During filling, tamp the material gently and uniformly.

8.5 Insert the upper plug into the mould. Replace pair number 1 of the displacing collars with pair number 2.

8.6 Place the mould between the platens of the press or compression machine. Apply pressure smoothly so the upper plug can be fully inserted at the slowest and most constant speed possible.

8.7 When the flange of the upper plug is in contact with the barrel of the mould, release the pressure and replace pair number 2 of the displacing collars with pair number 3.

8.8 Recommence the compaction so that full penetration of the bottom plug takes at least 10 s.

8.9 Remove pair 3 of the displacing collars. The pressure shall be maintained for at least 10 s after the flanges are in full contact with the mould barrel.

8.10 If the maximum pressure exceeds 3 MPa, the required density or water content of the mixture shall be modified and the process repeated.

NOTE It is also practice to employ apparatus that uses just one pair of displacing collars. Provided the penetration of the 2 plugs is similar during compaction, the above procedure can be modified accordingly.

8.11 Immediately on completion of compaction, carefully remove the plugs and using a plunger, smoothly extrude the specimen from the mould. The speed of this operation shall not exceed 2 mm/s.

8.12 Determine immediately the mass of the specimen to the nearest 5 g and then store as in Clause 9.

9 Storage

Specimens shall be stored

vertically,

preventing loss of moisture,

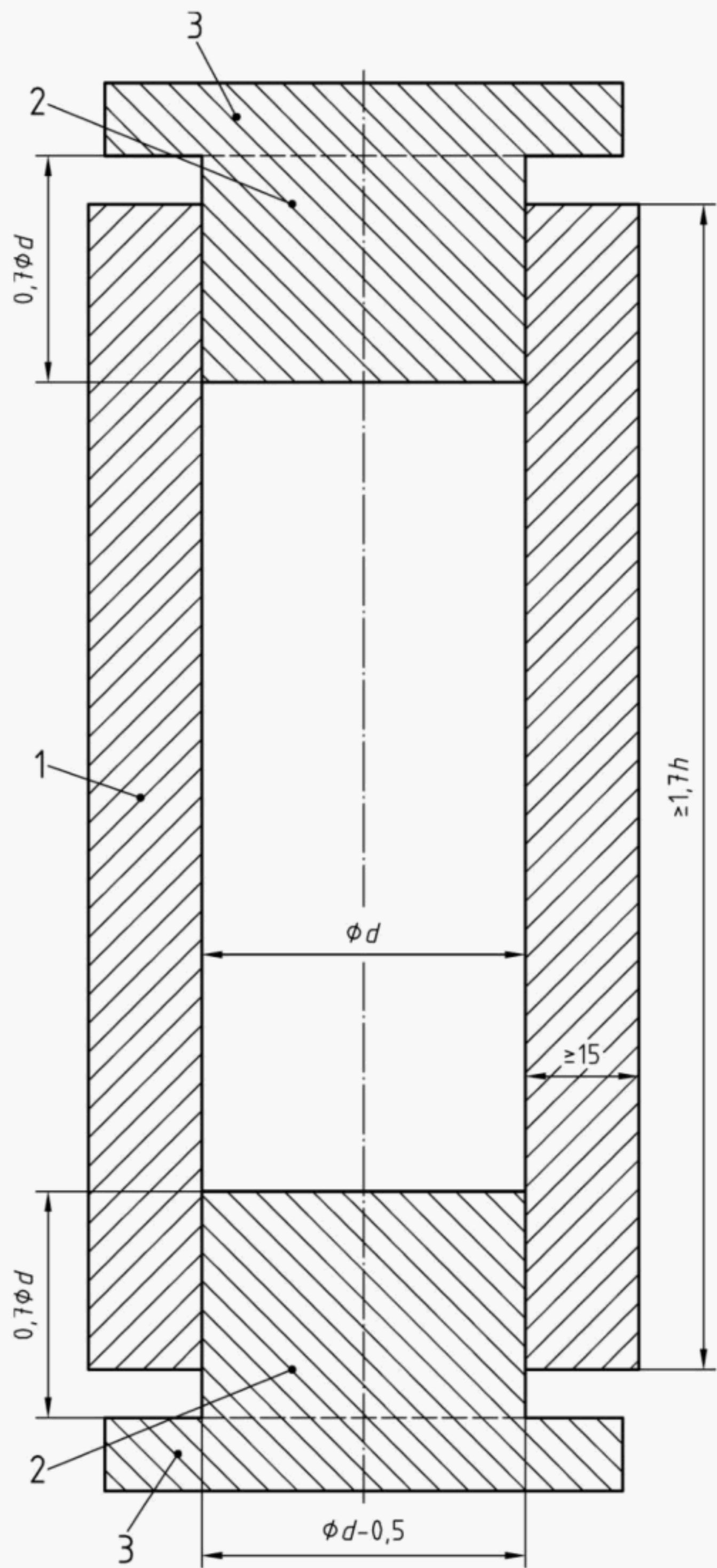
at a temperature within ± 2 °C of the specified temperature,

for the time specified in the relevant mixture document.

10 Test report

The test report shall include the following information:

- a) reference to this document;
- b) type of mixture;
- c) origin of the mixture;
- d) preparation of the mixture where applicable;
- e) percentage by mass of mixture retained on the 11,2 mm or 22,4 mm sieve if any;
- f) mass, water content and dry density of the specimen immediately after compaction;
- g) storage conditions of the specimen;
- h) any deviations from this document as well as any incidents that could have an effect on the result.



- Key**
- 1 mould
 - 2 piston
 - 3 base of the piston

Figure 1 — Mould and piston

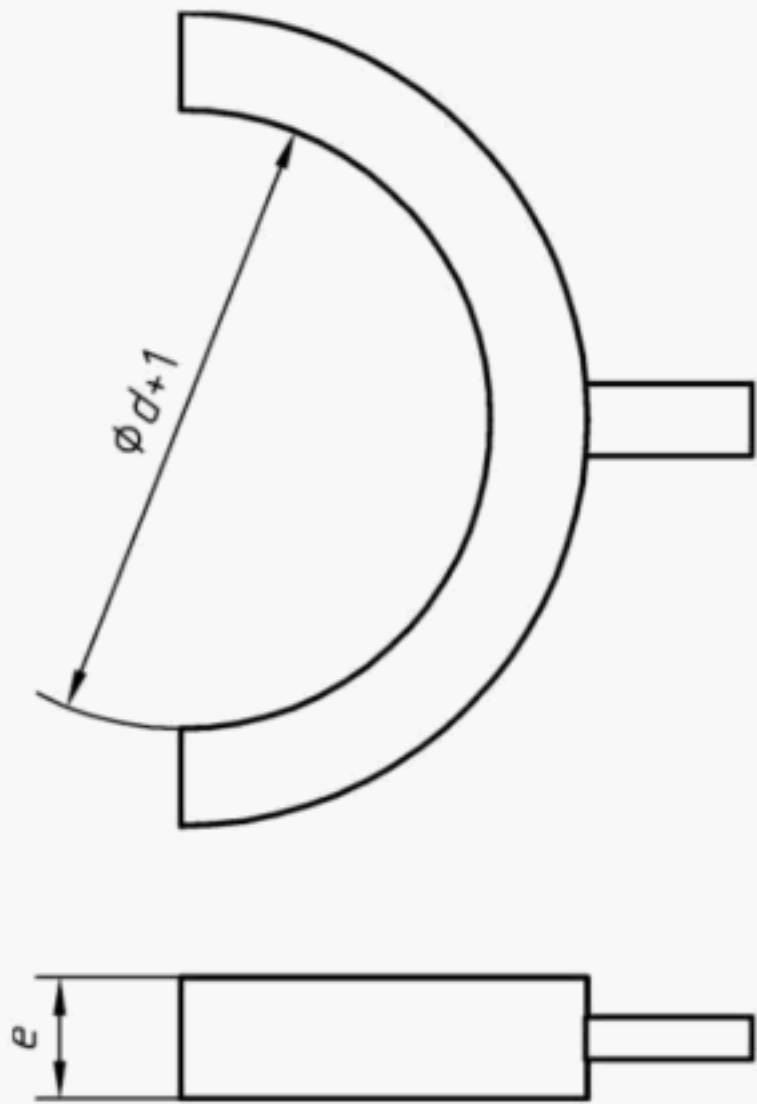


Figure 2 — Displacing collars

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