

# SLOVENSKI STANDARD

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**Nevezane in hidravlično vezane zmesi - 4. del: Preskusne metode za laboratorijsko referenčno gostoto in vsebnost vode - Vibracijsko kladivo**

Unbound and hydraulically bound mixtures - Part 4: Test methods for laboratory reference density and water content - Vibrating hammer

Ungebundene und hydraulisch gebundene Gemische - Teil 4: Laborprüfverfahren für die Trockendichte und den Wassergehalt - Vibrationshammer

Mélanges traités et mélanges non traités aux liants hydrauliques - Partie 4: Méthode d'essai de détermination en laboratoire de la masse volumique apparente sèche de référence et de la teneur en eau - Marteau vibrant

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

EN 13286-4

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ICS 93.080.20

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English Version

## Unbound and hydraulically bound mixtures - Part 4: Test methods for laboratory reference density and water content - Vibrating hammer

Mélanges traités et mélanges non traités aux liants hydrauliques - Partie 4: Méthode d'essai de détermination en laboratoire de la masse volumique apparente sèche de référence et de la teneur en eau - Marteau vibrant

Ungebundene und hydraulisch gebundene Gemische - Teil 4: Laborprüfverfahren für die Trockendichte und den Wassergehalt - Vibrationshammer

This European Standard was approved by CEN on 5 July 2021.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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## European foreword

This document (EN 13286-4:2021) has been prepared by Technical Committee CEN/TC 227 “Road Materials”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by May 2022, and conflicting national standards shall be withdrawn at the latest by May 2022.

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

This document supersedes EN 13286-4:2003.

In comparison with the previous edition, the following technical modifications have been made:

- editorial changes;
- removal of the particle size requirement at 20mm which was considered unnecessary and contrary to current usage;
- advice on the use of the test method with absorbent aggregates, soils and hydraulically bound mixtures;
- the inclusion of text relating to the possible types of compaction curves and definition/selection of the resulting optimum water content;
- removal of the Annex: Compactibility test for graded aggregates, which was deemed unnecessary.

This document is one of a series of standards as follows:

- EN 13286-1, *Unbound and hydraulically bound mixtures – Part 1: Test methods for laboratory reference density and water content – Introduction, general requirements and sampling*
- EN 13286-2, *Unbound and hydraulically bound mixtures – Part 2: Test methods for laboratory reference density and water content – Proctor compaction*
- EN 13286-3, *Unbound and hydraulically bound mixtures – Part 3: Test methods for laboratory reference density and water content – Vibrocompression with controlled parameters*
- EN 13286-4, *Unbound and hydraulically bound mixtures – Part 4: Test methods for laboratory reference density and water content – Vibrating hammer*
- EN 13286-5, *Unbound and hydraulically bound mixtures – Part 5: Test methods for laboratory reference density and water content – Vibrating table*
- EN 13286-7, *Unbound and hydraulically bound mixtures – Part 7: Cyclic load triaxial test for unbound mixtures*
- EN 13286-40, *Unbound and hydraulically bound mixtures – Part 40: Test method for the determination of the direct tensile strength of hydraulically bound mixtures*
- EN 13286-41, *Unbound and hydraulically bound mixtures – Part 41: Test method for the determination of the compressive strength of hydraulically bound mixtures*

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- EN 13286-42, *Unbound and hydraulically bound mixtures – Part 42: Test method for the determination of the indirect tensile strength of hydraulically bound mixtures*
- EN 13286-43, *Unbound and hydraulically bound mixtures – Part 43: Test method for the determination of the modulus of elasticity of hydraulically bound mixtures*
- EN 13286-44, *Unbound and hydraulically bound mixtures – Part 44: Test method for the determination of the alpha coefficient of vitrified blastfurnace slag*
- EN 13286-45, *Unbound and hydraulically bound mixtures – Part 45: Test method for the determination of the workability period of hydraulically bound mixtures*
- EN 13286-46, *Unbound and hydraulically bound mixtures – Part 46: Test method for the determination of the moisture condition value*
- EN 13286-47, *Unbound and hydraulically bound mixtures – Part 47: Test method for the determination of California bearing ratio, immediate bearing index and linear swelling*
- EN 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: Test method for the determination of the accelerated swelling of 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: Method for the manufacture of test specimens of hydraulically bound mixtures using axial compression*
- CEN/TS 13286-54, *Unbound and hydraulically bound mixtures – Part 54: Test method for the determination of frost susceptibility – Resistance to freezing and thawing of hydraulically bound mixtures*

Annex A is normative.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

## 1 Scope

This document specifies a method for the determination of the relationship between the dry density and water content of a mixture using vibrating hammer compaction.

This document applies to mixtures which contain no more than 10 % by mass of the mixture retained on the 40 mm test sieve.

This document also describes the procedure for calculating and plotting the curves corresponding to 0 %, 5 % and 10 % air voids.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 932-2, *Tests for general properties of aggregates - Part 2: Methods for reducing laboratory samples*

EN 933-1, *Tests for geometrical properties of aggregates - Part 1: Determination of particle size distribution - Sieving method*

EN 1097-5, *Tests for mechanical and physical properties of aggregates - Part 5: Determination of the water content by drying in a ventilated oven*

EN 13286-1, *Unbound and hydraulically bound mixtures - Part 1: Test methods for laboratory reference density and water content - Introduction, general requirements and sampling*

## 3 Terms and definitions

SIST EN 13286-4:2022

<https://standards.iteh.ai/catalog/standards/sist/4ecb37bb-48dc-4c3e-adfe-442570100000/en-13286-4-2021>

For the purposes of this document, the terms and definitions given in EN 13286-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

## 4 Principle

The mixture is compacted into a cylindrical mould using an electrically powered vibrating hammer over a range of water contents. The range includes the optimum water content at which the maximum dry density for the specified degree of compaction is obtained. The relationship between dry density and water content is described in EN 13286-1.

## 5 Apparatus

**5.1 Cylindrical, corrosion resistant, Proctor mould B in accordance with EN 13286-2 (see also Figure 1).** The internal faces shall be smooth, clean and dry before use.

**5.2 Detachable baseplate and removable extension piece,** to fit the mould (see Figure 1).

**5.3 Electrically powered vibrating hammer,** conforming to the performance check in Annex A.

NOTE A vibrating hammer with a power consumption of at least 600 W, an operating frequency between 25 Hz and 60 Hz, and fitted with a suitable safety circuit breaker would be suitable.

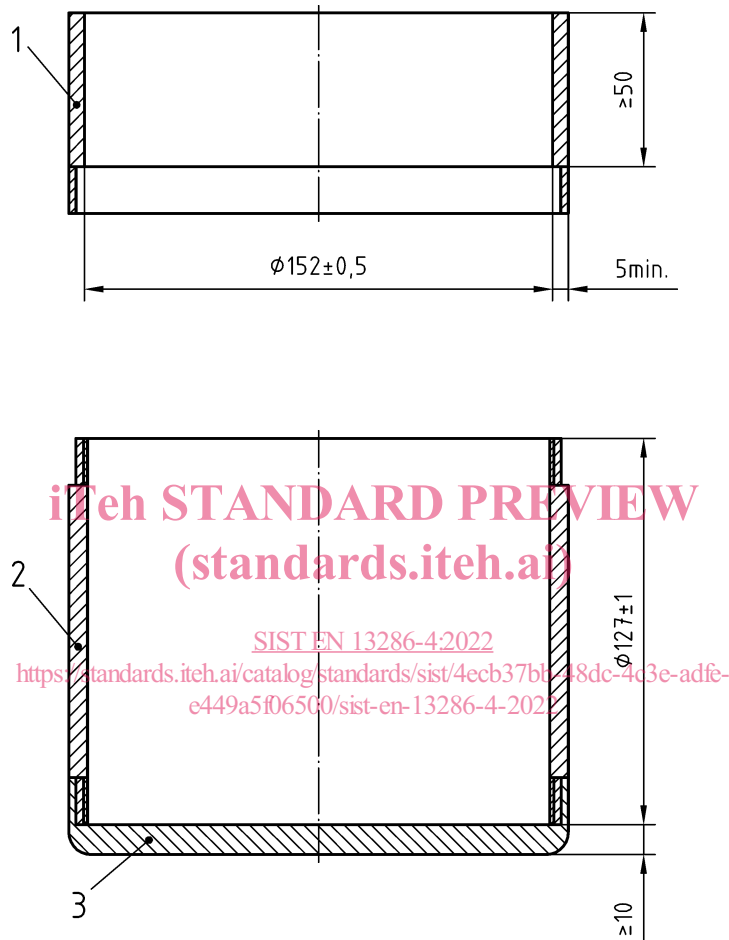
## prEN 13286-4:2020 (E)

**5.4 Steel tamper attachment**, for the vibrating hammer with a flat bottom face of diameter  $(145,0 \pm 2,0)$  mm, a base thickness of at least 10,0 mm and a total mass of not more than 3,0 kg.

**5.5 Supporting guide frame for the hammer** (optional).

**5.6 Depth gauge or steel rule**, readable to 0,5 mm.

Dimensions in millimetres



**Key**

- 1 Wall, min. 5 mm
- 2 Good finish on bore
- 3 Detachable baseplate

**Figure 1 — Cylindrical mould and collar extension**

**5.7 Balance**, of suitable capacity to weigh the mould, test specimen and baseplate, and readable to 5 g.

**5.8 Steel straightedge**, at least 200 mm long.

**5.9 Test sieves**, aperture sizes 40 mm and 20 mm, and a suitable receiver, for use in preparation of the test sample.



**5.10 Metal or plastic trays.**

**5.11 Suitable scoop.**

**5.12 Stopclock or similar timer**, readable to 1 s.

**5.13 Apparatus for extracting the sample from the mould.**

## **6 Preparation**

### **6.1 Preparation of the sample for test**

NOTE 1 Care needs to be taken with aggregates and soils that absorb water. If supplied dry, such materials need to be pre-treated with sufficient water beforehand and for sufficient time to allow full absorption to take place.

NOTE 2 HBM include treating agents that depending on their nature either quickly or slowly commence reaction and setting in contact with water and, in the case of quick lime, slake when coming into contact with water. What follows therefore needs to recognize this and ensure that testing is completed before any setting commences.

Weigh and record the mass of the sample. The sample shall have a mass of at least 50 kg.

Determine the water content of the sample using the procedures described in EN 932-2 and EN 1097-5.

Remove all of the particles retained on the 40 mm test sieve from the remainder of the sample. Use the sieving procedures described in EN 933-1, without first washing and drying the sample. If necessary, sieve in parts to ensure that the test sieve is not overloaded.

Weigh and record the mass of the particles retained on the 40 mm sieve.

If the sample contains 5 % or less, by mass, of particles retained on the 40 mm test sieve, the resulting modified sample shall be considered as the test portion.

If the sample contains more than 5 % but less than 10 %, by mass, of particles retained on the 40 mm test sieve, further modify the sample by adding an equal mass of similar material which passes the 40 mm test sieve but is retained on the 20 mm test sieve.

### **6.2 Preparation of the test portions**

Subdivide the sample or modified sample into five or more test portions, each of about 6 kg, using the procedures described in EN 932-2.

Water shall be added to each of the test portions to give a range of water contents.

The range of nominal water contents selected shall be such that at least two values lie either side of the value at which the laboratory dry density is expected to occur.

NOTE Increments of 1 % to 2 % are typically suitable.

The added water shall be thoroughly mixed with the sample.

**prEN 13286-4:2020 (E)****7 Procedure****7.1 Compaction**

Weigh the mould with the baseplate and extension attached. Record the mass  $m_1$  to the nearest 5 g. Measure and record the height  $H$  of the extended mould, to nearest 0,5 mm.

Place the assembly on a heavy solid base with a mass of not less than 50 kg.

NOTE A concrete floor or concrete plinth is suitable.

Place some of the first test portion into the mould such that, when compacted, it occupies about one third of the height of the mould body. Place the foot of the tamper attachment on the material and compact with the vibrating hammer for  $(60 \pm 2)$  s.

During compaction, apply a steady downward force on the hammer so that the tamper attachment does not bounce on the compacted material and the total downward force on the material, including the mass of the hammer, is between 300 N and 400 N.

The application of the necessary pressure to achieve the required downward force should be checked by the operator before the test starts. Push the hammer – without vibration – against the load pan of a suitable platform balance until a mass of 30 kg to 40 kg is indicated.

Place a second similar volume of the test portion into the mould and repeat the compaction stage. Add a third volume of the test portion so as to fill the mould after compaction and compact again.

**7.2 Measurement**

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Remove any loose material lying on the surface of the test specimen around the side of the mould. Lay the straightedge across the top of the extended mould. Measure down from the straightedge to the compacted surface of the test specimen, to the nearest 0,5 mm.

Take readings at four points spaced evenly over the surface of the test specimen, at least 15 mm from the side of the mould. Using the previously measured internal height of the extended mould  $H$  calculate the mean height  $h$  of the test specimen, to the nearest millimetre.

Weigh the mould, compacted test specimen, extension collar and base plate. Record the mass  $m_2$  to the nearest 5 g.

Remove the compacted test portion from the mould and determine its water content using the procedures described in EN 1097-5. Discard any of the test portion which remains.

**7.3 Further test portions**

Repeat the procedures described in 7.1 and 7.2 for the remainder of the test portions ensuring that in the case of hydraulically bound mixtures, compaction is completed before commencement of setting of the treating agent.