



**SLOVENSKI STANDARD**  
**SIST EN 447:1998**  
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Grout for prestressing tendons - Specification for common grout

Grout for prestressing tendons - Specification for common grout

Einpreßmörtel für Spannglieder - Anforderungen für üblichen Einpreßmörtel

Coulis pour câble de précontrainte - Prescriptions pour les coulis courants

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EUROPEAN STANDARD

EN 447

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English version

## Grout for prestressing tendons - Specification for common grout

Coulis pour câble de précontrainte -  
Prescriptions pour les coulis courants

Einpreßmörtel für Spannglieder - Anforderungen  
für üblichen Einpreßmörtel

This European Standard was approved by CEN on 1994-10-28. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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**CEN**

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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### Foreword

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

This European Standard shall be given the status of a National Standard, either by publication of an identical text or by endorsement, at the latest by September 1996, and conflicting national standards shall be withdrawn at the latest by September 1996.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

### Introduction

In post-tensioned prestressed concrete construction, grouting of tendons is an important operation. The intention of this European Standard is to provide a specification for grouts, compliance with which will satisfy the recommendations in ENV 1992-1-1.

The main functions of the grout are:

- to protect the tendons against corrosion and
- to provide bond between the tendons and the sheaths.

### 1 Scope

This European Standard covers the materials which may be used in the manufacture of commonly produced grouts and are defined herein as "common grouts". Other more specialised grouts may require additional specification to that given herein and are defined herein as "special grouts".

### 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.



ENV 197-1 : 1989	Cement - Composition, specifications and conformity criteria - Part 1: Common cements
EN 445	Grout for prestressing tendons - Methods of test <sup>1)</sup>
EN 446	Grout for prestressing tendons - Grouting procedures <sup>1)</sup>
EN 934-4	Admixtures for concrete, mortar and grout - Part 4: Admixtures for grout - Definitions, specifications and conformity criteria <sup>1)</sup>
EN 1008	Mixing water for concrete <sup>1)</sup>
ENV 1992-1-1 : 1992	Eurocode 2: Design of concrete structures - Part 1: General rules and rules for buildings

### 3 Definitions

#### 3.1 Common grout

Homogeneous mixture of Portland cement, water and admixtures.

#### 3.2 Special grout

Grout consisting of a homogeneous mixture of cement, water, admixture and additions and possessing characteristics distinct from those of common grout.

NOTE 1: This grout is not covered by this standard.

### 4 Materials

#### 4.1 General

Grout shall consist of Portland cement, water and admixtures. The materials used shall be such that the chloride content of the grout shall not exceed 0,1 %  $\text{Cl}^-$  mass of the cement. This value is the summation of the chlorides occurring as permitted impurities in the constituent materials. The deliberate addition of chlorides is not permitted.

#### 4.2 Cement

Cement shall comply with type CEM I according to ENV 197-1 (see also clause 4 of EN 446).

NOTE 2: In some member countries it is allowed to use cements with a total content of up to 20 % of granulated blast furnace slag or fly ash. This may furthermore apply when it is in conformity with national standards or provisions valid in the place of the concrete structure.

#### 4.3 Water

Water shall comply with EN 1008.

#### 4.4 Admixtures

Admixtures shall comply with EN 934-4. It shall be permissible to use admixtures singly or in combination.

### 5 Properties of grout

#### 5.1 General

Grout shall comply with the requirements given in 5.2 to 5.5 for:

- fluidity and bleeding in the plastic condition,
- volume change when hardening,
- strength when hardened.

#### 5.2 Fluidity

The fluidity of the grout during the injection period shall be sufficiently high for it to be pumped effectively and adequately to fill the sheath, but sufficiently low to expel the air and any water in the sheath. When tested by the methods given in 3.2.1 or 3.2.2 of EN 445 the grout shall have the values given in table 1.

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<sup>1)</sup> At present at the draft stage.

Table 1: Fluidity test requirements

Test method given in EN 445	Immediately after mixing Time (in s)	30 min after mixing <sup>1)</sup> or at end of injection period Time (in s)	At duct outlet Time (in s)
Immersion Cone	$\geq 30$ $\leq 25 (50)^2$	$\leq 80 (200)^2$ $\leq 25 (50)^2$	$\geq 30$ $\geq 10$
<sup>1)</sup> Mixing time shall be measured from the time when all of the materials are in the mixer. <sup>2)</sup> For grouts prepared in some mixers which have a high shear mixing action, the upper limits given in table 1 may be increased to 200 s for the immersions test and 50 s for the Cone test. The mixer and these limits shall be subject to the approval of the competent authority.			

NOTE 3: In some countries there are requirements for the variation in fluidity between duct inlets and outlets.

### 5.3 Bleeding

The bleeding of the grout shall be sufficiently low to prevent excessive segregation and settlement of the grout materials. When tested by one of the methods given in 3.4 of EN 445 the bleeding shall be less than 2 % of the initial volume of the grout after 3 h.

### 5.4 Volume change

The volume change assessed may be either increase or decrease. When tested in accordance with the methods given in 3.4.2 or 3.4.3 of EN 445 the volume change of the grout shall be within the range - 1 % and + 5 %. For grouts with expanding agents there shall be no decrease in volume.

### 5.5 Strength

The compressive strength of grout may be assessed using either of the specimen shapes and sizes given in table 2 and using the corresponding procedure given in the table. In either case the compressive strength shall be not less than 30 MPa at 28 days, or 27 MPa at 7 days if it is proposed to estimate the likely 28 day strength at 7 days.

Table 2: Compressive strength specimens

Specimen shape	Specimen dimensions mm	Test procedure as specified in EN 445
Prism	40 x 40 x 160	clause 3.7
Cylinder <sup>1)</sup>	100 diam x 80 height	clause 3.8
<sup>1)</sup> In some countries cubes are used to establish compressive strength. Where cubes are used, the dimension shall not exceed 100 mm and the procedure describes in clause 3.6 of EN 445 shall be appropriately adapted for such testing. The permission of the competent authority shall be obtained for the use of cubes.		

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## 6 Batching and mixing of grout

All materials shall be batched by mass except the mixing water which may be batched by mass or volume. The accuracy of batching shall be:

- ± 2 % for cement and admixture
- ± 1 % for water

of the quantities specified.

The maximum water/cement (w/c) ratio shall be 0,44.

Mixing shall be carried out mechanically to obtain a homogeneous and stable grout with the plastic properties given in clause 5.

Depending upon environmental or material influences (e. g. temperature, configuration of the tendon and the properties of the cement used), the w/c ratio shall be kept as low as possible having regard to the required plastic properties of the grout.

A sufficient amount of material shall be batched to ensure complete grouting of a duct making due allowance for overflow. The grout shall be mixed in a machine capable of producing a homogeneous grout and, after mixing, keeping the grout in slow continuous agitation, until it is ready to be pumped into the sheath. Water shall be added to the mixer first, followed by the cement and admixtures. The batch quantities of cement and admixtures may be added as a whole or in part in sequence until the total quantities are added.

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