

**GEOTEHNILISTE ERITÖÖDE TEGEMINE.  
PINNASEANKRUD**

**Execution of special geotechnical work - Ground  
anchors**

**EESTI STANDARDI EESSÕNA****NATIONAL FOREWORD**

See Eesti standard EVS-EN 1537:2013 sisaldab Euroopa standardi EN 1537:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 1537:2013 consists of the English text of the European standard EN 1537:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 10.07.2013.	Date of Availability of the European standard is 10.07.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 93.020

**Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele**

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Aru 10, 10317 Tallinn, Eesti; koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

**The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation**

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Aru 10, 10317 Tallinn, Estonia; homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

## Execution of special geotechnical works - Ground anchors

Exécution des travaux géotechniques spéciaux - Tirants  
d'ancrage

Ausführung von Arbeiten im Spezialtiefbau - Verpressanker

This European Standard was approved by CEN on 8 May 2013.

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 CEN-CENELEC Management Centre or to any CEN member.

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.

CEN members are the national standards bodies of 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 United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

**Contents**

Page

Foreword.....	4
<b>1 Scope .....</b>	<b>5</b>
<b>2 Normative references .....</b>	<b>7</b>
<b>3 Terms, definitions and symbols.....</b>	<b>7</b>
3.1 Terms and definitions .....	7
3.2 Symbols .....	10
<b>4 Information needed for the execution of the work .....</b>	<b>11</b>
4.1 General.....	11
4.2 Special features .....	11
<b>5 Geotechnical investigation .....</b>	<b>12</b>
5.1 General.....	12
5.2 Specific requirements .....	12
<b>6 Materials and products .....</b>	<b>13</b>
6.1 General.....	13
<b>6.2 Anchor components subject to corrosion protection .....</b>	<b>13</b>
6.2.1 Tendon .....	13
6.2.2 Anchor head.....	14
6.2.3 Coupler .....	14
6.2.4 Tendon bond length .....	14
6.2.5 Components in the borehole .....	14
6.2.6 Compression element of a compression type anchor.....	15
<b>6.3 Corrosion protection of steel tendon and stressed steel components .....</b>	<b>15</b>
6.3.1 General.....	15
6.3.2 Temporary ground anchor .....	15
6.3.3 Permanent ground anchor .....	16
<b>6.4 Grouts for corrosion protection and load transfer.....</b>	<b>16</b>
6.4.1 Cement grout for temporary anchors.....	16
6.4.2 Cement grout for permanent anchors inside encapsulations .....	17
6.4.3 Cement grout for permanent anchors outside encapsulations.....	17
6.4.4 Resin Grout .....	17
<b>6.5 Other components and materials for corrosion protection barriers.....</b>	<b>18</b>
6.5.1 Plastic sheaths and ducts.....	18
6.5.2 Heat shrink sleeves .....	19
6.5.3 Seals.....	19
6.5.4 Corrosion protection compounds based on petroleum, waxes or greases .....	19
6.5.5 Sacrificial metallic coating.....	19
6.5.6 Other coatings on steel parts .....	20
6.5.7 Steel tubes and caps .....	20
<b>6.6 Application of corrosion protection.....</b>	<b>20</b>
6.6.1 General.....	20
6.6.2 Tendon free and bond lengths .....	20
6.6.3 Anchor head.....	21
<b>6.7 Corrosion protection system.....</b>	<b>22</b>
<b>7 Considerations related to design.....</b>	<b>23</b>
<b>8 Execution.....</b>	<b>23</b>
8.1 Drilling of holes.....	23

8.1.1	Drilling Methods .....	23
8.1.2	Tolerances.....	24
8.2	Manufacturing, transport, handling and installation.....	25
8.2.1	Manufacture .....	25
8.2.2	Transport, handling and installation .....	25
8.3	Grouting .....	26
8.3.1	General .....	26
8.3.2	Borehole testing .....	26
8.3.3	Pre-grouting .....	27
8.3.4	Anchor grouting .....	27
8.3.5	Post-grouting .....	28
8.4	Stressing .....	29
8.4.1	General .....	29
8.4.2	Equipment .....	29
8.4.3	Stressing procedure.....	29
8.4.4	Lock off of anchor .....	30
8.4.5	Stressing of anchors with staggered free lengths.....	30
9	Supervision, testing and monitoring.....	30
9.1	General .....	30
9.2	Measurement requirements .....	31
9.3	Datum load .....	31
9.4	Test methods .....	31
9.5	Investigation test .....	31
9.6	Suitability test .....	32
9.7	Acceptance test .....	32
9.8	Evaluation of the apparent tendon free length.....	32
9.9	Supervision of construction and testing .....	33
9.10	Monitoring .....	33
10	Records .....	33
11	Special requirements .....	34
Annex A	(informative) Examples of testing corrosion protection .....	36
Annex B	(informative) Guidelines for acceptance criteria for viscous corrosion protection compounds and examples of standards for the testing of material properties .....	38
Annex C	(informative) Corrosion protection systems for temporary and permanent anchors and typical details for permanent anchor heads .....	39
Annex D	(informative) Example of record sheet.....	45
Annex E	(informative) Obligation of the provisions .....	47
Bibliography	.....	52

## Foreword

This document (EN 1537:2013) has been prepared by Technical Committee CEN/TC 288 "Execution of special geotechnical works", 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 January 2014, and conflicting national standards shall be withdrawn at the latest by January 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 1537:1999.

The remit of CEN/TC 288 is the standardisation of the execution procedures for geotechnical works (including testing and control methods) and of the required material properties. CEN/TC 288/WG 14 has been charged with the revision of EN 1537:1999 in the subject area of ground anchors, which includes all anchors that are bonded to the ground by grout and are stressed and tested.

This standard has been prepared to stand alongside EN 1997-1, *Eurocode 7: Geotechnical design — Part 1: General rules*, and prEN ISO 22477-5, *Geotechnical investigation and testing — Testing of geotechnical structures — Part 5*. Design, safety aspects and testing, which were included as the informative Annexes D and E in the previous issue of this standard (EN 1537:1999), were consequently taken out of this present issue. Clause 7, "Considerations related to design" of this standard deals only with those design matters that should be taken into account during the execution stage of ground anchors so that the design of the anchor system may be fulfilled. In addition, this standard provides full coverage of the construction and supervision requirements.

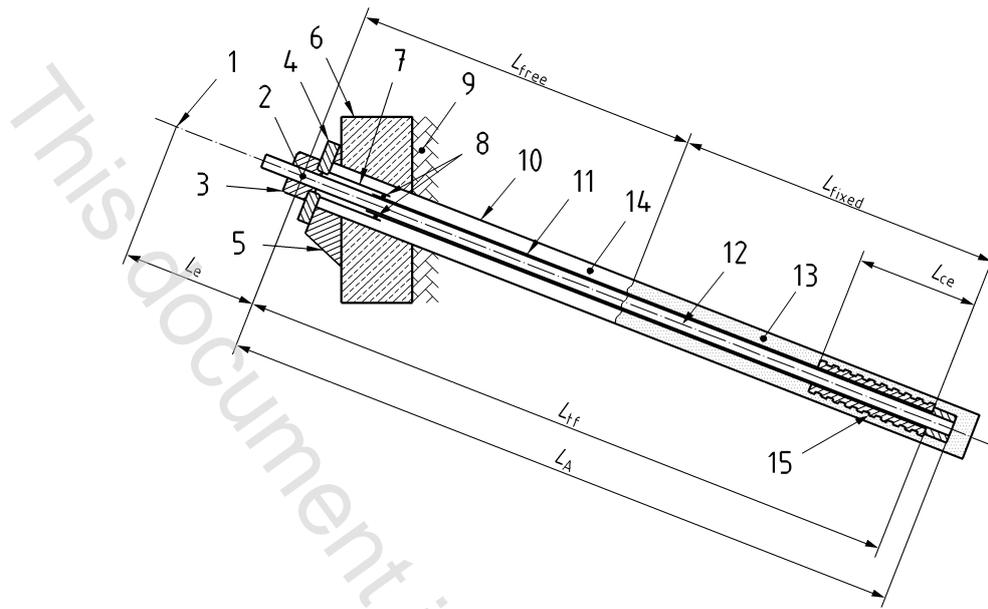
The revision of this standard was effected by a working group comprising of delegates from ten countries and the comments of these countries have been taken into account. The main amendments are:

- definitions and terminology brought into accordance with the definitions and terminology of EN 1997-1:2004, *Eurocode 7*, in particular with Section 8;
- alignment of this European Standard with prEN ISO 22477-5;
- structural revisions to match the structure of this standard with that of other standards for special geotechnical works, e.g. EN 1536, *Execution of special geotechnical work — Bored piles* and EN 1538, *Execution of special geotechnical work — Diaphragm walls*;
- general revision in accordance with comments received during the CEN Enquiry, 2010;
- update of references.

As long as EN ISO 22477-5 is not available, national solutions should be implemented for the testing of anchors.

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, 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.





**Key**

- 1 anchorage point at jack during stressing
- 2 anchorage point at anchor head in service
- 3 tensioning element at anchor head
- 4 bearing plate
- 5 load transfer block
- 6 structural element
- 7 trumpet or anchor head tube
- 8 O - Ring
- 9 soil/rock
- 10 borehole
- 11 debonding sleeve
- 12 tendon
- 13 fixed length grout body
- 14 free length filling where appropriate
- 15 compression element

**Figure 2 — Sketch of a compression type ground anchor — Details of anchor head and head protection omitted**

## 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.

EN 206-1, *Concrete — Part 1: Specification, performance, production and conformity*

EN 447, *Grout for prestressing tendons — Basic requirements*

EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling*

EN 1992-1-1, *Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings*

EN 1997-1:2004, *Eurocode 7: Geotechnical design — Part 1: General rules*

EN 1997-2, *Eurocode 7 — Geotechnical design — Part 2: Ground investigation and testing*

EN 10025 (all parts), *Hot-rolled products of structural steels*

EN 10080, *Steel for the reinforcement of concrete — Weldable reinforcing steel — General*

prEN 10138-1, *Prestressing steel — Part 1: General requirements*

EN 10210-1, *Hot finished structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions*

EN 10219-1, *Cold formed welded structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions*

EN 10219-2, *Cold formed welded structural hollow sections of non-alloy and fine grain steels — Part 2: Tolerances, dimensions and sectional properties*

EN ISO 12944-5, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems (ISO 12944-5)*

prEN ISO 22477-5, *Geotechnical investigation and testing — Testing of geotechnical structures — Part 5: Testing of anchorages (ISO/DIS 22477-5)<sup>1)</sup>*

ETAG 013, *Post-tensioning kits for prestressing of structures*

## 3 Terms, definitions and symbols

### 3.1 Terms and definitions

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

#### 3.1.1

##### **anchor head**

**fr:** tête d'ancrage

**de:** Ankerkopf

element of a ground anchor which transmits the tensile load from the tendon to the bearing plate or the structure

---

1) In preparation.