Execution of special geotechnical work - Bored piles

EESTI STANDARDIKESKUS
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NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 1536:2010 sisaldab Euroopa standardi EN 1536:2010 ingliskeelset teksti.	This Estonian standard EVS-EN 1536:2010 consists of the English text of the European standard EN 1536:2010.
Standard on kinnitatud Eesti Standardikeskuse 31.10.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	This standard is ratified with the order of Estonian Centre for Standardisation dated 31.10.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.
Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 01.09.2010.	Date of Availability of the European standard text 01.09.2010.
Standard on kättesaadav Eesti standardiorganisatsioonist.	The standard is available from Estonian standardisation organisation.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1536

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ICS 93.020

Supersedes EN 1536:1999

English Version

Execution of special geotechnical work - Bored piles

Exécution des travaux géotechniques spéciaux - Pieux forés

Ausführung von Arbeiten im Spezialtiefbau - Bohrpfähle

This European Standard was approved by CEN on 2 July 2010.

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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 Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 1536:2010) 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of an identical text or by endorsement, at the latest by March 2011, and conflicting national standards shall be withdrawn at the latest by March 2011.

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 1536:1999.

The general scope of TC 288 is the standardisation of the execution procedures for geotechnical works (including testing and control methods) and of the required material properties. WG15 has been charged to revise EN 1536:1999, with the subject area of bored piles, including barrettes, but not "micro piles" of diameter less than 0,3 m.

The design, planning and execution of bored piles call for experience and knowledge in this specialised field. The execution phase requires skilled and qualified personnel and the present standard cannot replace the expertise of specialist contractor.

The document has been prepared to complement EN 1997-1, *Eurocode 7: Geotechnical design — Part 1: General rules* and EN 1997-2, *Eurocode 7 — Geotechnical design — Part 2: Ground investigation and testing*. Clause 7 "Considerations related to design" of this European Standard expands on design only where necessary (e.g. the detailing of reinforcement), but provides full coverage of the construction and supervision requirements.

This standard contains additional requirements on concrete complementing the respective provisions of EN 206-1 and of EN 13670. The three standards are not yet fully accorded. It is anticipated that during future revisions several provisions now contained in EN 1536:2010, e.g. in 6.1, 6.3, 8.3 and 8.4 could be transferred to EN 206-1 and EN 13670.

The document has been revised by a working group comprising delegates from eleven European countries and the comments from ten European countries have been received and taken into account.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

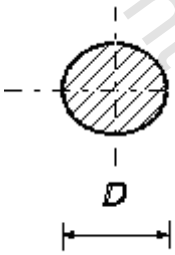
1 Scope

1.1 This European Standard establishes general principles for the execution of bored piles (see 3.2).

NOTE 1 This standard covers piles or barrettes which are formed in the ground by excavation and are structural members used to transfer actions and/or limit deformations.

NOTE 2 This standard covers piles with circular cross-section (see Figures 1 and A.1a)) and barrettes (see 3.3) with rectangular, **T** or **L** or any other similar cross-section (see Figure 2) concreted in a single operation.

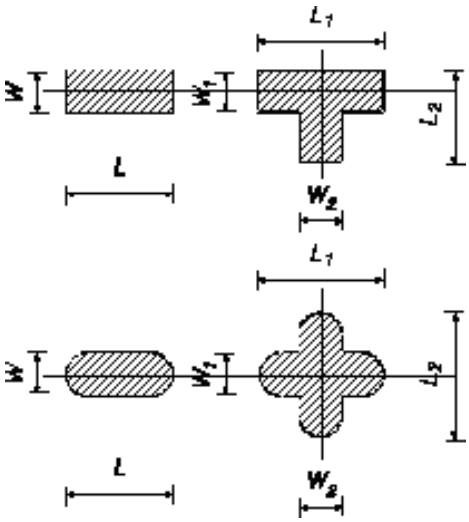
NOTE 3 In the standard the term pile is used for circular cross-section structure and the term barrette for other shapes. Both are bored piles.



Key

D Shaft diameter

Figure 1 — Bored pile with circular cross-section



Key

L Barrette length

W Barrette thickness

A Cross-sectional area of the shaft

Figure 2 — Bored pile with non circular cross-section (barrettes)

1.2 This European Standard applies to bored piles (see Figure 3) with:

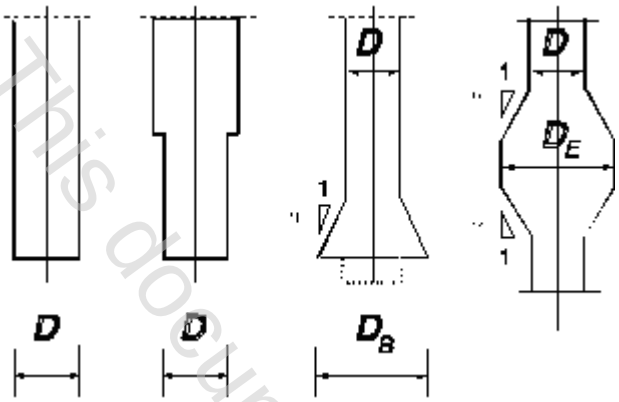
— uniform cross-section (straight shaft);

— telescopically changing shaft dimensions;

— excavated base enlargements; or

— excavated shaft enlargements.

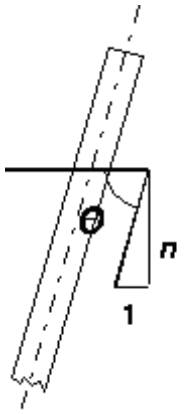
NOTE The shape of a pile base and of an enlargement depends on the tool used for the excavation.



Key

D Shaft diameter
D_B Base enlargement diameter
D_E Shaft enlargement diameter

Figure 3 — Examples for straight shaft piles and piles with shaft and base enlargement



Key

n Rake

Figure 4 — Definition of the rake

1.3 This European Standard applies (see Note) to:

— bored piles with a depth to width ratio ≥ 5;

— piles (see Figures 1 and 3) with a shaft diameter 0,3 m ≤ *D* ≤ 3,0 m;

— barrettes (see Figure 2) with the least dimension $W_i \geq 0{,}4$ m, a ratio L_i / W_i between its largest and its least dimensions ≤ 6 and a cross-sectional area $A \leq 15$ m²;

— piles with circular precast elements used as structural member (see Figure 7) with a least dimension $D_P \geq 0{,}3$ m;

— barrettes with rectangular precast elements used as structural member with a least dimension $W_P \geq 0{,}3$ m.

NOTE The standard covers a large range of diameters. For small diameter bored piles less than 450 mm, the general specification can be adapted to cater for the lack of space (e.g. minimum bars number and spacing).

1.4 This European Standard applies to piles with the following rake (see Figure 4):

— $n \geq 4$ ($\Theta \geq 76°$);

— $n \geq 3$ ($\Theta \geq 72°$) for permanently cased piles.

1.5 This European Standard applies to bored piles with the following dimensions of the shaft or base enlargements (see Figure 3):

a) base enlargements:

1) in non-cohesive ground: $D_B / D \leq 2$;

2) in cohesive ground: $D_B / D \leq 3$;

b) shaft enlargements in any ground: $D_E / D \leq 2$;

c) slope of the enlargement in non-cohesive ground $m \geq 3$;

1) in non-cohesive ground: $m \geq 3$;

2) in cohesive ground: $m \geq 1{,}5$;

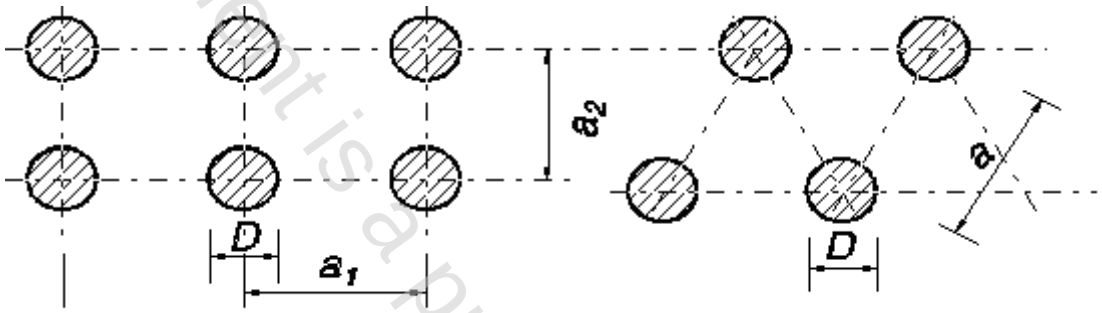
d) base enlargements area of barrettes: $A \leq 15$ m²;

1.6 The provisions of this European Standard apply to:

— single bored piles;

— bored pile groups (see Figure 5);

— walls formed by piles (see Figure 6).

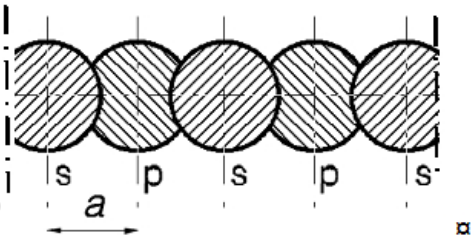


Key

D Shaft diameter

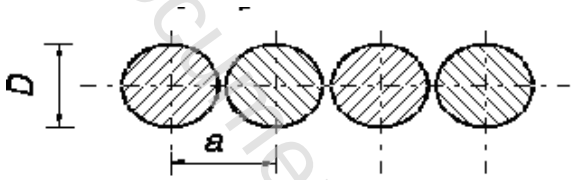
a_i Centre to centre spacing of the piles

Figure 5 — Examples of pile groups



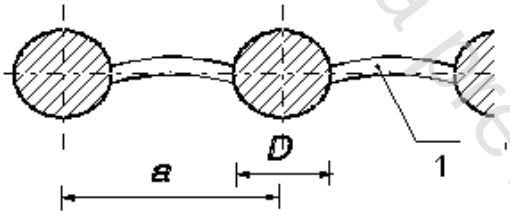
a < *D*
p primary piles
s secondary piles

a) Secant pile wall



a ≅ *D*

b) Contiguous pile wall



a > *D*

c) Widely spaced pile wall

Key

a Centre to centre spacing of the piles
D Shaft diameter
1 Lagging

Figure 6 — Examples of pile walls

1.7 The bored piles which are the subject of this European Standard can be excavated by continuous or discontinuous methods using support methods for stabilizing the excavation walls where required.

1.8 This European Standard applies only to construction methods that allow the designed cross-sections to be produced.

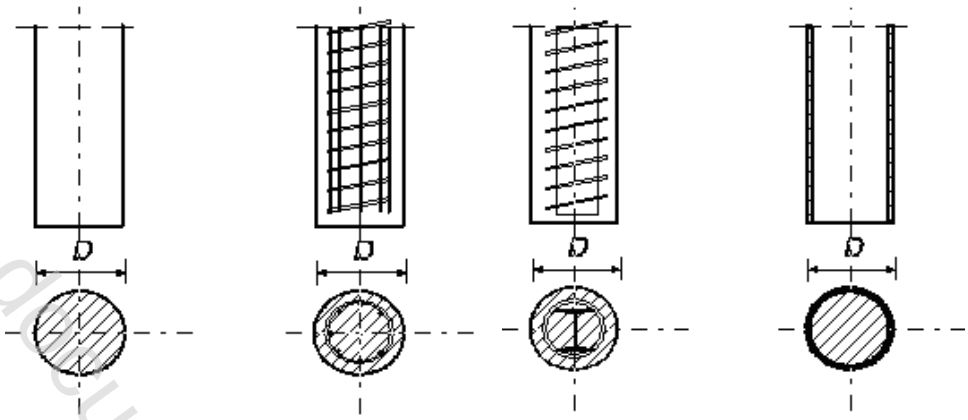
1.9 The provisions apply to bored piles (see Figure 7) constructed of:

— unreinforced (plain) concrete;

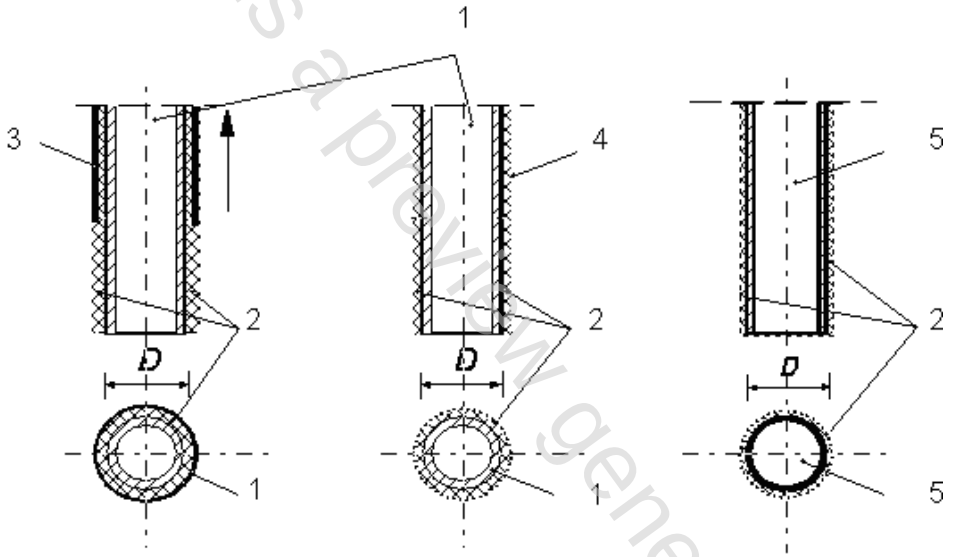
— reinforced concrete;

— concrete reinforced by means of special reinforcement such as steel tubes, steel sections or steel fibres;

— precast concrete (including prestressed concrete) elements or steel tubes where the annular gap between the element or tube and the ground is filled by concrete, cement or cement-bentonite grout.



a) Use of plain concrete **b) Use of concrete with bar reinforcement** **c) Use of special reinforcement (steel section or tube)**



d) Use of precast concrete element as main or supplementary structural member **e) Use of steel tube as main or supplementary structural member**

Key

1 Precast concrete element
2 Grout
3 Temporary casing (extracted)
4 Uncased excavation
5 Unreinforced or reinforced concrete or cement grout
D Shaft diameter

Figure 7 — Examples of bored piles with circular cross-section

1.10 Micropiles, mixed-in-place columns, columns constructed by jet grouting, ground improvement for piling, mixed-in-place pile bases and diaphragm walls are not covered by this European Standard.

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 197-1:2000, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*

EN 206-1:2000, *Concrete — Part 1: Specification, performance, production and conformity*

EN 791, *Drill rigs — Safety*

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

EN 996, *Piling equipment — Safety requirements*

EN 1008, *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

EN 1990, *Eurocode — Basis of structural design*

EN 1991 (all parts), *Eurocode 1: Actions on structures*

EN 1992 (all parts), *Eurocode 2: Design of concrete structures*

EN 1993 (all parts), *Eurocode 3: Design of steel structures*

EN 1994 (all parts), *Eurocode 4: Design of composite steel and concrete structures*

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

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

EN 1998 (all parts), *Eurocode 8: Design of structures for earthquake resistance*

EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

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

EN 10210 (all parts), *Hot finished structural hollow sections of non-alloy and fine grain steels*

EN 10219 (all parts), *Cold formed welded structural hollow sections of non-alloy and fine grain steels*

EN 10248 (all parts), *Hot rolled sheet piling of non alloy steels*

EN 10249 (all parts), *Cold formed sheet piling of non alloy steels*

EN 12620, *Aggregates for concrete*

EN 12794, *Precast concrete products — Foundation piles*

EN 13670, *Execution of concrete structures*

ISO/DIS 22477-1, *Geotechnical investigation and testing — Testing of geotechnical structures — Part 1: Pile load test by static axially loaded compression*