



SLOVENSKI STANDARD

SIST EN 12699:2015

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Nadomešča:
SIST EN 12699:2002

Izvedba posebnih geotehničnih del - Vtisnjeni piloti

Execution of special geotechnical work - Displacement piles

Ausführung spezieller geotechnischer Arbeiten (Spezialtiefbau) - Verdrängungspfähle

Exécution des travaux géotechniques spéciaux - Pieux avec refoulement de sol
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Ta slovenski standard je istoveten z: ~~SIST EN 12699:2015~~ EN 12699:2015

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EUROPEAN STANDARD

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ICS 93.020

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Execution of special geotechnical works - Displacement piles

Exécution des travaux géotechniques spéciaux - Pieux
avec refoulement du solAusführung von Arbeiten im Spezialtiefbau -
Verdrängungspfähle

This European Standard was approved by CEN on 12 March 2015.

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Contents

	Page
Foreword.....	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	7
4 Information needed for the execution of the work	16
4.1 General.....	16
4.2 Special features	17
5 Geotechnical investigation	18
5.1 General.....	18
5.2 Specific requirements	18
6 Materials and products	19
6.1 General.....	19
6.2 Prefabricated displacement piles.....	19
6.2.1 Concrete piles	19
6.2.2 Steel piles	19
6.2.3 Cast iron piles	20
6.2.4 Timber piles	20
6.3 Cast <i>in situ</i> displacement piles	20
6.3.1 Mortar and concrete	20
6.3.2 Grout	22
6.3.3 Reinforcement.....	22
6.4 Coatings and corrosion protection compounds	23
7 Considerations related to design.....	23
7.1 General.....	23
7.2 Geometrical construction tolerances	23
7.3 Sequence of installation	23
7.4 Protection of piles.....	24
7.5 Needs for driving assistance.....	24
7.6 Design for impact driving of prefabricated piles.....	24
7.6.1 General.....	24
7.6.2 Prefabricated concrete piles.....	25
7.6.3 Steel piles	25
7.6.4 Timber piles	25
7.7 Specific design related considerations	26
7.7.1 General.....	26
7.7.2 Reinforcement of cast <i>in situ</i> piles	26
7.7.3 Pile shoe	28
7.7.4 Pile joint	28
7.7.5 Pile enlargement	28
7.7.6 Spacing of piles	28
7.7.7 Combined piles	29
7.7.8 Screw piles	29
8 Execution	29
8.1 General.....	29
8.2 Construction tolerances	29
8.3 Site preparation.....	30
8.4 Sequence of installation	30

8.5	Equipment and Methods.....	30
8.5.1	General	30
8.5.2	Impact hammer	30
8.5.3	Vibrating hammer	30
8.5.4	Equipment for screw piles	31
8.5.5	Equipment for jacked piles	31
8.5.6	Auxiliary equipment	31
8.5.7	Drive tube	31
8.6	Prefabricated piles	31
8.6.1	General	31
8.6.2	Prefabricated concrete piles	31
8.6.3	Steel piles	32
8.6.4	Timber piles	33
8.6.5	Combined piles	33
8.7	Cast <i>in situ</i> piles	33
8.7.1	General	33
8.7.2	Temporary cased piles.....	34
8.7.3	Permanently cased piles.....	36
8.8	Grouted piles	36
8.8.1	Grouting during driving	36
8.8.2	Grouting after driving.....	37
8.9	Trimming of concrete piles.....	37
8.10	Driving assistance methods.....	37
8.11	Ground movement limiting methods.....	38
8.12	Cast <i>in situ</i> base enlargements	38
9	Supervision, monitoring and testing.....	38
9.1	Supervision	38
9.2	Monitoring of pile construction	39
9.3	Pile testing	40
9.3.1	General	40
9.3.2	Pile load tests	41
9.3.3	Integrity tests	41
10	Records	41
11	Special requirements	44
	Annex A (informative) Classification and examples.....	46
	Annex B (informative) Guidance on minimum cover (in mm) for bearing element of low strength steel for cast <i>in situ</i> displacement piles	61
	Annex C (informative) Degree of obligation of the provisions	62
	Bibliography.....	69

EN 12699:2015 (E)**Foreword**

This document (EN 12699:2015) 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 October 2015, and conflicting national standards shall be withdrawn at the latest by October 2015.

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 12699:2000.

The technical changes in comparison to EN 12699:2000 are:

- driven piles independent of dimension are included;
- sections describing concrete and testing have been minimised.

The document has been prepared to stand alongside EN 1997 (all parts), *Eurocode 7: Geotechnical design*. Clause 7 covers design aspects of piles.

Annex A and Annex B are informative.

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.

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1 Scope

1.1 This European Standard establishes general principles for the execution of displacement piles, that means piles which are installed in the ground without excavation or removal of material from the ground except for limiting heave and/or limiting vibration as well as removal of obstructions or to assist penetration.

Piles are driven into the ground using impact, vibration, pressing, screwing or a combination of these methods.

1.2 The material of displacement piles covered by this European Standard can be:

- steel;
- cast iron;
- concrete, mortar;
- timber;
- grout;
- combination of above.

1.3 This European Standard covers prefabricated, cast *in situ*, or a combination of these methods to form displacement piles of regular shape.

Examples are given in Figure A.2 and Figure A.3.

1.4 Displacement piles may be installed in soils enhanced by ground improvement techniques. The ground improvement can be executed before, at the same time or after installation of the piles.

1.5 Other than practical considerations there are for the purpose of this European Standard no limitations regarding cross section dimensions, shaft or base enlargements, length or rake.

1.6 The provisions of this European Standard apply to:

- single piles;
- pile groups;
- concrete sheet piles.

1.7 Columns constructed by ground improvement techniques (such as mixed *in situ* columns, jet grouting, compaction grouting, vibro flotation, stone columns) are not covered by this European Standard. Bored piles are covered in EN 1536. Steel and timber sheet pile walls are covered in EN 12063. Micropiles are covered in EN 14199.

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 206:2013, *Concrete - Specification, performance, production and conformity*

EN 12699:2015 (E)

EN 1090-2, *Execution of steel structures and aluminium structures — Part 2: Technical requirements for steel structures*

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 1995 (all parts), *Eurocode 5: Design of timber structures*

EN 1996 (all parts), *Eurocode 6 — Design of masonry 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 1999 (all parts), *Eurocode 9 — Design of aluminium structures*

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

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

EN 10083-1, *Steels for quenching and tempering - Part 1: General technical delivery conditions*

EN 10083-2, *Steels for quenching and tempering - Part 2: Technical delivery conditions for non alloy steels*

EN 10083-3, *Steels for quenching and tempering - Part 3: Technical delivery conditions for alloy steels*

EN 10210 (all parts), *Hot finished structural hollow sections of non-alloy and fine grain structural 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 12794, *Precast concrete products — Foundation piles*

EN 13670, *Execution of concrete structures*

EN 16228 (all parts), *Drilling and foundation equipment — Safety*

EN ISO 2560, *Welding consumables - Covered electrodes for manual metal arc welding of non-alloy and fine grain steels - Classification (ISO 2560)*

EN ISO 4063, *Welding and allied processes - Nomenclature of processes and reference numbers (ISO 4063)*

EN ISO 5817, *Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817)*

EN ISO 9606-1, *Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1)*

EN ISO 9692-1, *Welding and allied processes - Types of joint preparation - Part 1: Manual metal arc welding, gas-shielded metal arc welding, gas welding, TIG welding and beam welding of steels (ISO 9692-1)*

EN ISO 9692-2, *Welding and allied processes - Joint preparation - Part 2: Submerged arc welding of steels (ISO 9692-2)*

EN ISO 11960, *Petroleum and natural gas industries - Steel pipes for use as casing or tubing for wells (ISO 11960)*

EN ISO 14341, *Welding consumables - Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels - Classification (ISO 14341)*

EN ISO 17660-1, *Welding - Welding of reinforcing steel - Part 1: Load-bearing welded joints (ISO 17660-1)*

EN ISO 18276, *Welding consumables - Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high-strength steels - Classification (ISO 18276)*

prEN ISO 22477-1:2006, *Geotechnical investigation and testing — Testing of geotechnical structures — Part 1: Pile load test by static axially loaded compression (ISO/DIS 22477-1:2005)*

prEN ISO 22477-10:2014, *Geotechnical investigation and testing — Testing of geotechnical structures — Part 10: Testing of piles: rapid load testing (ISO/DIS 22477-10:2014)*

3 Terms and definitions

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

3.1

displacement pile

fr: pieu avec refoulement du sol

de: Verdrängungspfahl

pile which is installed in the ground without excavation or removal of material from the ground except for limiting heave and/or limiting vibration as well as removal of obstructions or to assist penetration

3.2

prefabricated pile

fr: pieu préfabriqué

de: Fertigpfahl

pile or pile element which is manufactured in a single unit or in pile segments before installation

3.3

cast in situ displacement pile

fr: pieu exécuté en place

de: Ortbetonverdrängungspfahl

pile installed by driving a closed ended concrete shell or permanent or temporary casing, and filling the hole so formed with plain or reinforced concrete, grout or mortar

3.4

combined pile

fr: pieu mixte

de: zusammengesetzter Pfahl

pile made up of two or more types or sizes of piles joined together

Note 1 to entry: The connection between the components is designed to transmit axial load and bending and to prevent separation during and after construction. See Figure A.8.

EN 12699:2015 (E)**3.5****screw pile****fr:** pieu vissé**de:** Schraubpfahl

pile in which the pile or pile tube comprises a limited number of helices at its base and which is installed under the combined action of a torque and a vertical thrust

Note 1 to entry: By the screwing-in and/or by the screwing-out, the ground is essentially laterally displaced and virtually no soil is removed. See Figure A.10.

3.6**jacked pile****fr:** pieu vériné**de:** eingepresster Pfahl

pile pressed into soil by means of static force

3.7**grouted pile****fr:** pieu injecté**de:** verpresster Pfahl

pile fitted with an enlarged shoe to create along a part or the full length of the pile a space which is filled or grouted during driving with grout, mortar or a mixture of grout and soil

Note 1 to entry: See Figure A.11.

3.8**post grouted pile****fr :** pieu post-injecté**de:** nachverpresster Pfahl

pile where shaft and/or base grouting is performed after installation through pipes fixed along or incorporated in the pile

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Note 1 to entry: See Figure A.12.

3.9**casing****fr:** tubage**de:** Verrohrung

steel tube used temporarily or permanently

Note 1 to entry: The temporary casing supports the soil surrounding the wall of the pile shaft during construction and is withdrawn on completion of concreting or grouting. In permanent situation the casing can act as a protective or load bearing unit.

3.10**drive tube****fr:** tube de fonçage**de:** Vortreibrohr

closed ended steel tube used to displace the ground during the formation of a driven cast in situ pile

Note 1 to entry: Drive tube is withdrawn during or after casting.

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3.11**liner, lining****fr: gaine, chemise****de: Hülse**

tube, generally of thin steel plate, forming part of the shaft of a pile

Note 1 to entry: For example, they can be used for the protection of pile shafts in soft or aggressive grounds or to reduce negative skin friction.

3.12**pile joint****fr: raccord****de: Pfahlkupplung**

means of joining lengths of pile elements either by welding or by mechanical or other jointing systems

Note 1 to entry: For examples, see Figure A.7, Figure A.8 and Figure A.9.

3.13**pile shoe****fr: sabot****de: Pfahlschuh**

shoe or point fitted to the base of a pile or drive tube to form the toe

Note 1 to entry: For examples, see Figure A.4.

3.14**wings****fr: ailes****de: Flügel**

shaft enlargements to steel piles formed by welding steel sections to the pile

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Note 1 to entry: See example in Figure A.2j.

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3.15**leader****fr: mât****de: Mäkler**

steel sections used for guiding driving equipment and/or pile during driving

Note 1 to entry: See Figure A.6.

3.16**impact hammer****fr: mouton, marteau****de: Rammbär**

tool of construction equipment for driving or extracting piles or drive tubes by impact (striking or falling mass)

3.17**vibrator (vibrating hammer)****fr: vibreur****de: Vibrationsbär**

tool of construction equipment for driving or extracting piles, drive tubes or casing by the application of vibratory forces

EN 12699:2015 (E)**3.18****helmet****fr:** casque**de:** Schlaghaube

device, usually steel, placed between the base of the impact hammer and the pile or drive tube so as to uniformly distribute the hammer impact to the top of the pile

Note 1 to entry: See Figure A.6.

3.19**hammer cushion****fr:** martyr du marteau**de:** Haubenfutter

device or material placed between the impact hammer and the helmet to protect the hammer and the pile head from destructive direct impact

Note 1 to entry: The hammer cushion material shall have enough stiffness to transmit hammer energy efficiently into the pile. See Figure A.6.

3.20**pile cushion****fr:** martyr du casque**de:** Pfahlfutter

material, commonly softwood, placed between the helmet and the top of a precast concrete pile

Note 1 to entry: See Figure A.6.

3.21**follower****fr:** faux-pieu**de:** Rammjungfer

temporary extension, used during driving, that permits the driving of the pile top below ground surface, water surface, or below the lowest point to which the driving equipment can reach without disengagement from the leaders

3.22**mandrel****fr:** mandrin**de:** Dorn

steel core for driving that is inserted into a closed-end tubular pile

Note 1 to entry: After installation the mandrel is withdrawn.

3.23**driving****fr:** fonçage**de:** Einbringen

method used to install the piles or drive tubes or casings into the ground, such as hammering, vibrating, pressing, screwing or by a combination of these methods

3.24**driven pile****fr:** pieu foncé**de:** Ramppfahl

pile which is forced into the soil by driving, the soil being displaced by the pile or drive tube

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3.25**driving assistance****fr: aide au fonçage****de: Einbringhilfe**

method used to assist a pile to penetrate the ground

3.26**coring****fr: carottage****de: Kernbohren**

removal of soil by core sampler (e.g. to mitigate the effects of heave by pile driving)

Note 1 to entry: Removal can also be done by preboring, see 3.28.

3.27**jetting****fr: lançage****de: Spülen**

use of pressurized water to facilitate the driving of a pile by means of hydraulic displacement of parts of the soil

3.28**preboring (pre-augering, pre-drilling)****fr: préforage****de: Vorbohren**

boring through obstructions or materials too dense to penetrate with the planned pile type and driving equipment to avoid deviation and/or facilitate driving

Note 1 to entry: Removal can also be done by coring, see 3.26.

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pumping of grout or mortar with a pressure which is higher than the hydrostatic pressure

3.30**restrike****fr: surbattage****de: Nachrammen**

additional series of hammer blows used to drive the prefabricated pile or casing to verify the driving criteria and/or bearing capacity

3.31**redrive****fr: refonçage****de: Ausrammen**

method used to form an enlarged shaft or base on a temporarily cased driven cast in situ pile

3.32**probe pile****fr: pieu initial****de: Anfangspfahl**

first working pile on construction site

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3.33

test pile**fr: pieu d'essai****de: Probepfahl (zur Ermittlung der Tragfähigkeit)**

pile to which a load is applied to determine the resistance deformation characteristics of the pile and surrounding ground

3.34

trial pile**fr: pieu de faisabilité****de: Probepfahl (zum Herstellungsversuch)**

pile installed to assess the practicability and suitability of the construction method for a particular application

Note 1 to entry: A trial pile can also be used as a test pile.

3.35

preliminary pile**fr: pieu préliminaire****de: Vorversuchspfahl**

pile installed before the commencement of the main piling works or section of the works for the purpose of establishing the suitability of the chosen type of pile, driving equipment and/or for confirming the design, dimensions and bearing capacity

3.36

driving criteria**fr: critères de fonçage****de: Einbringkriterien**

driving parameters used to be fulfilled when driving a pile

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3.37

set**fr: refus****de: Eindringung**

mean permanent penetration of a pile in the ground per blow measured by a series of blows

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3.38

monitoring**fr: contrôle, monitoring****de: Überwachung**

passive role of checking and observing the technical quality of the piling process

3.39

supervision**fr: surveillance****de: Bauaufsicht**

active role of overseeing or directing the piling operations

3.40

recording**fr: enregistrement****de: Dokumentation, Aufzeichnung**

making of a permanent record of the facts relating to the piling operations and aspects monitored

3.41**static pile load test****fr: essai de chargement statique****de: statische Pfahlprobelastung**

loading test where a pile is subjected to chosen static axial and/or lateral actions at the pile head for the analysis of its capacity

3.42**maintained load pile test****fr: essai de chargement par palier****de: lastgesteuerte Pfahlprobelastung**

static loading test in which a test pile has loads applied in incremental stages, each of which is held constant for a certain period or until pile motion has virtually ceased or has reached a prescribed limit (ML - test)

3.43**constant rate of penetration pile load test****fr: essai de chargement à vitesse d'enfoncement constante****de: weggesteuerte Pfahlprobelastung**

static loading test in which a test pile is forced into the ground at a constant rate and the force is measured (CRP - test)

3.44**dynamic pile load test****fr: essai de chargement dynamique****de: dynamische Pfahlprobelastung**

loading test where a pile is subjected at the pile head to a dynamic force and measurements of strain and acceleration are made for analysis of its load bearing capacity

3.45**rapid pile load test****fr: essai de chargement dynamique****de: schnelle Pfahlprobelastung**

loading test where a pile is subjected to a particular axial rapid load at the pile head for the analysis of the bearing capacity

Note 1 to entry: See prEN ISO 22477-10:2014, Testing of piles: rapid load testing.

3.46**integrity test****fr: essai d'intégrité****de: Integritätsprüfung**

test carried out on an installed pile for the verification of soundness of materials and/or of the pile geometry

EXAMPLE low strain integrity test, sonic test and coring test

3.47**grout****fr: coulis****de: Verpressmörtel**

homogenous mixture of cement and water to which admixtures, additions, filler or sand can be added

3.48**mortar****fr: mortier****de: Zementmörtel/Feinkornbeton**

concrete with an aggregate size of 4 mm or less