



# SLOVENSKI STANDARD

## SIST EN 16228-6:2014

01-oktober-2014

Nadomešča:

SIST EN 791:2000+A1:2009

SIST EN 996:2000+A3:2009

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**Oprema za vrtanje in temeljenje - Varnost - 6. del: Oprema za vpihanje, nanašanje malte in vbrizgavanje**

Drilling and foundation equipment - Safety - Part 6: Jetting, grouting and injection equipment

Geräte für Bohr- und Gründungsarbeiten - Sicherheit - Teil 6: Geräte für Injektionsarbeiten

Machines de forage et de fondation - Sécurité - Partie 6: Machines de réalisation par jet de structure de sol ciment, de cimentation et d'injection

**Ta slovenski standard je istoveten z: EN 16228-6:2014**

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**ICS:**

53.100	Stroji za zemeljska dela	Earth-moving machinery
93.020	Zemeljska dela. Izkopavanja.	Earthworks. Excavations.
	Gradnja temeljev. Dela pod zemljo	Foundation construction. Underground works

**SIST EN 16228-6:2014**

**en,fr**

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EUROPEAN STANDARD

EN 16228-6

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2014

ICS 93.020

Supersedes EN 791:1995+A1:2009, EN  
996:1995+A3:2009

English Version

## Drilling and foundation equipment - Safety - Part 6: Jetting, grouting and injection equipment

Machines de forage et de fondation - Sécurité - Partie 6:  
Machines pour traitement des sols par injection et machines  
pour injection des sols par jet

Geräte für Bohr- und Gründungsarbeiten - Sicherheit - Teil  
6: Geräte für Injektionsarbeiten

This European Standard was approved by CEN on 6 March 2014.

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.

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

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## Foreword

This document (EN 16228-6:2014) has been prepared by Technical Committee CEN/TC 151 "Construction equipment and building material machines - Safety", 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 November 2014 and conflicting national standards shall be withdrawn at the latest by November 2014.

This document supersedes EN 791:1995+A1:2009, EN 996:1995+A3:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This European Standard is divided into several parts and covers drilling and foundation equipment.

Part 1 contains requirements that are/may be common to all drilling and foundation equipment. Other parts contain additional requirements for specific machines that supplement or modify the requirements of part 1. Compliance with the clauses of part 1 together with those of a relevant specific part of this standard giving requirements for a particular machine provides one means of conforming with the essential health and safety requirements of the Directive concerned.

When a relevant specific part does not exist, part 1 can help to establish the requirements for the machine, but will not by itself provide a means of conforming to the relevant essential health and safety requirements of the Directive.

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This European Standard, EN 16228, *Drilling and foundation equipment – Safety*, consists of the following parts:

- *Part 1: Common requirements*
- *Part 2: Mobile drill rigs for civil and geotechnical engineering, quarrying and mining*
- *Part 3: Horizontal directional drilling equipment (HDD)*
- *Part 4: Foundation equipment*
- *Part 5: Diaphragm walling equipment*
- *Part 6: Jetting, grouting and injection equipment*
- *Part 7: Interchangeable auxiliary equipment*

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, 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.

**EN 16228-6:2014 (E)****Introduction**

This document is a type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards are covered are indicated in the scope of this standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for drilling and foundation equipment that have been designed and built according to the provisions of this type C standard.

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## 1 Scope

This European Standard, together with part 1, deals with all significant hazards for jetting, grouting and injection equipment when they are used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer associated with the whole life time of the machine (see Clause 4).

The requirements of this part are complementary to the common requirements formulated in EN 16228-1:2014

This document does not repeat the requirements from EN 16228-1:2014, but adds or replaces the requirements for application for jetting, grouting and injection equipment.

Rigs for drilling, vibrating, pile driving, to be used for preparing holes for these applications are covered by EN 16228-2:2014 and/or EN 16228-4:2014.

Jetting, grouting and injection equipment is used in the preparation, transfer and application of grouting materials used for either:

- the improvement of ground condition; or
- the filling of voids e.g. around piles or ground anchors.

Jetting, grouting and injection equipment are constituted by all equipment and installations, operated by hand or electrically, pneumatically, mechanically or hydraulically powered, necessary for the following:

- mixing, storing, measuring and pumping of substances (cement suspension, mortar or chemical liquids/mixtures);
- jetting, grouting and injection processes (of/into subsoil) with low, medium or high pressure or vacuum systems;
- all types of pressure and wear resistant grout hoses, fittings, quick release coupling with thread or hose connection, ball valves and flexible pipes;
- all control systems, electrical or mechanical pressure and flow recorders, for monitoring the grouting;
- all jetting, grouting and injection accessories, such as: special tools, lances, rods, sockets, packers, retention clamps and swivel hooks.

## 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 809:1998+A1:2009, *Pumps and pump units for liquids — Common safety requirements*

prEN 853:2013, *Rubber hoses and hose assemblies — Wire braid reinforced hydraulic type — Specification*

prEN 854:2013, *Rubber hoses and hose assemblies — Textile reinforced hydraulic type — Specification*

prEN 855:2011, *Plastics hoses and hose assemblies — Thermoplastics textile reinforced hydraulic type — Specification*

prEN 856:2011, *Rubber hoses and hose assemblies — Rubber-covered spiral wire reinforced hydraulic type — Specification*

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prEN 857:2013, *Rubber hoses and hose assemblies — Wire braid reinforced compact type for hydraulic applications — Specification*

EN 12001:2012, *Conveying, spraying and placing machines for concrete and mortar — Safety requirements*

EN 12151:2007, *Machinery and plants for the preparation of concrete and mortar — Safety requirements*

EN 16228-1:2014, *Drilling and foundation equipment — Safety — Part 1: General requirements*

EN ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414:2010)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

**3 Terms and definitions**

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN 16228-1:2014 and the following apply.

**3.1****grouting**

method for filling boreholes voids

Note 1 to entry: The pressure of the grout pump is up to 0,3 Mpa.

**3.2****injection**

method for grouting liquid mixtures or resins into voids/pores or for injecting of ground anchors or micro piles

Note 1 to entry: Two different methods can be distinguished: the injection of solid matter in a liquid mixture, like cement or bentonite and the injection of chemicals, like water glass and hardener.

Note 2 to entry: The pressure of the injection pump is up to 11 Mpa.

**3.3****jetting or jet-grouting**

method for producing concrete part in soil, which is normally used for the underpinning of foundations of existing buildings, to produce a dense pit or to densify the pit floor, to stabilize the soil while tunnelling or to erect a dense screen for dams

Note 1 to entry: The pressure of the jetting or high pressure pump is up to 60 MPa, which creates an exit velocity of the jet from the nozzle of more than 100 m/s.

**3.4****safety burst hose**

special hose with a lower burst strength than the normally used hoses, which is intended to burst first, when exceptional load cases or pressure peaks occur

Note 1 to entry: By using this special hose, the bursting of this hose should prevent the other hoses in the line being damaged and to dissipate the unintended overpressure.



## 4 List of additional significant hazards

Clause 4 of EN 16228-1:2014 applies with the following additional Table 1.

Table 1 of EN 16228-1:2014 and the additional Table 1 in this document contain all hazards, (hazardous situations and events), identified by risk assessments as significant for jetting, grouting and injection equipment and which require action to eliminate or reduce risk.

Hazards generally occur under the following conditions:

- a) in transportation to and from the work site;
- b) in rigging and dismantling on the work site;
- c) in service on the work site;
- d) when moving between pile positions on the work site;
- e) out of service on the work site;
- f) in storage at the plant depot or on the work site;
- g) during remote control of the pump, especially if the pump is out of sight of the drill rig operator;
- h) during maintenance.

**Table 1 — List of additional significant hazards and associated requirements**

No.	Hazard	Relevant clause(s) in this standard
1	Mechanical hazards	
1.1	Fluids under pressure	5.2.1, 5.2.2, 5.2.5, 5.2.7, 5.2.8, 5.2.9, 7.1
1.2	High pressure fluid injection or ejection hazard	5.2.2, 5.2.6, 5.2.9, 7.1
2	Hazards generated by noise, resulting in:	
2.1	Hearing losses and physiological disorders	Annex A
2.2	Accidents due to interference with speech communication and warning signals	Annex A
3	Processed materials and substances, used materials, fuels	
3.1	Hazards from contact with harmful fluids, gases, mists, fumes and dusts	5.2.3, 5.3

## 5 Safety requirements and/or protective measures

### 5.1 General

Jetting, grouting and injection equipment shall comply with the requirements of EN 16228-1:2014 except as modified or replaced by the requirements of this document.

In addition, the equipment shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards, which are not dealt with by this document.