SLOVENSKI STANDARD
SIST EN 791:2000+A1:2009

01-maj-2009

Vrtalna oprema - Varnost

Drill rigs - Safety

Bohrgeräte - Sicherheit

Appareils de forage - Sécurité

Ta slovenski standard je istoveten z: **EN 791:1995+A1:2009**

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25.080.40	Vrtalniki	Drilling machines
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English Version

Drill rigs - Safety

Appareils de forage - Sécurité

Bohrgeräte - Sicherheit

This European Standard was approved by CEN on 1 July 1995 and includes Amendment 1 approved by CEN on 20 December 2008.

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Foreword

This document (EN 791:1995+A1:2009) has been prepared by 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of an identical text or by endorsement, at the latest by August 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

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

This document includes Amendment 1, approved by CEN on 2008-12-20.

This document supersedes EN 791:1995.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

⟨A1⟩ For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. ⟨A1⟩

This standard is a type C-standard in the structure of A-/B-/C-standards as defined in EN 292.

The Annex A is normative and contains "Measurement of noise and vibration", the Annex B is normative and contains "Instructions for the examination and checking of blocks, wire ropes and chains", the Annex C is normative and contains "Brake test for drill rigs excluding truck and tractor mounted drill rigs", the Annex D is normative and contains "Hazards related to operation modes of drill rigs", the Annex D is normative and contains "Hazards related to operation modes of drill rigs", the Annex E is informative and contains "Symbols and signs" and the Annex F is informative and contains "Bibliography".

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, 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 United Kingdom.

Introduction

The extent to which hazards are covered is indicated in the scope of this standard.

In addition, machinery should comply as appropriate with EN 292 for hazards which are not covered by this standard.

Those hazards that are relevant for all mechanical, electrical, hydraulic, pneumatic and other equipment of machinery and that are dealt with in standards for common use are not covered by this standard.

Reference to pertinent standards of this kind is made where such standards are applicable and so far as is necessary.

1 Scope

1.1 The general term "Drill Rig" covers several differing types of machines for use in the construction industry, water well drilling industry, mining and quarrying, for use above ground as well as underground and for tunnel construction. The differing tasks determine the choice of drilling method and type of machine. For this reason there are many possible ways to separate drill rigs into different groups, e.g. in accordance with:

— The task;

— The drilling method used;

— The cutting removal method;

— The type of construction work.

The methods used for drilling can be basically differentiated in percussive and rotary drilling principles.

Percussive drilling is a method by which the hole is produced by crushing the ground or rock at the bottom of the drill-hole by striking it with the drilling tool and removing the cuttings out of the bore-hole.

Rotary drilling is a method in which the drilling tool at the bottom of the borehole is rotated and at the same time, a feed force is applied by a feed system or drill collar. The ground or rock at the bottom of the borehole is crushed or cut by pressure, shear or tensile stress produced by the different drilling tools. The cuttings are periodically or continuously removed out of the bore hole.

Rotary percussive drilling is performed by a piston striking directly on the bit (down the hole hammer drills) or by percussive energy transmitted via a drill string to the bit. The piston is powered by either hydraulic fluid or compressed air.

At the same time the drill bit is rotated either continuously or intermittently.

The cuttings are continuously removed out of the borehole by a flushing medium, air or fluid which is carried to the drilling tool.

Typical examples of drill rigs covered by this standard are:

— Cable tool drill rig;

— Pile drill rigs;

— Pile top drill rig;

— Raise borer;

— Reverse circulation drill rig;

— Rotary and percussive drill rig for underground drilling;

— Rotary and percussive drill rig for surface drilling;

— Rotary drill rig with power swivel;

— Rotary spindle rig;

— Rotary drill rig for underground use.

A casing or a drilling fluid may be used to stabilize the bore hole.

Drill rigs are stationary during drilling. They may move from one place of work to another, under their own power. Self propelled drill rigs may include those mounted on lorries, wheeled chassis, tractors, crawlers, skid bases (pulled by winch). When drill rigs are mounted on lorries, tractors and trailers, or are wheeled based, transportation may be carried out at higher speeds and on public roads. When designing and constructing these units attention is drawn to regulations covering both the drill rig and traffic regulations.

The questions of safety and ergonomic criteria in this standard mainly refer to the principal work, e.g. when the machine is stationary and drilling. In many cases the driver is also the operator of the drill rig.

1.2 This standard deals with the significant hazards pertinent to mechanized drill rigs, when used as intended and under the conditions foreseen by the manufacturer. It specifies requirements of safety concerning the design, construction, operation and maintenance. This standard applies to drill rigs for surface and underground drilling in the tunnelling, mining, construction and water well drilling industries. Casing units are also covered by this standard.

If the base of a drill rig consists of an excavator, crane, etc. it shall be covered by its own standards to the extent the requirements of this standard are not applicable.

NOTE 1 If a drill rig operates with attachments other than those for drilling according to this standard, e.g. pile driving, the safety standards applying to such machines shall also be complied with.

For drill rigs to be used in an explosive atmosphere (coal mining etc.) the relevant standards apply additionally.

NOTE 2 CEN/TC 196 is preparing complementary standards for machines to be used in explosive atmospheres.

Oil and gas industry drill rigs are not covered by this standard.

2 Normative references

This European Standard incorporates, by dated or undated references, 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.

EN 3:1975, *Portable fire extinguishers.*

EN 292-1:1991, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*

EN 292-2:1991, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications.*

EN 294:1992, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs.*

EN 418:1992, *Safety of machinery — Emergency stop equipment, functional aspects — Principles for design.*

prEN 563, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces.*

prEN 953, *Safety of machinery — General requirements for the design and construction of guards (fixed, movable).*

prEN 954-1, *Safety of machinery — Safety related parts of control systems — Part 1: General principles for design.*

prEN 982, *Safety requirements for fluid power systems and components — Hydraulics*

prEN 983, *Safety requirements for fluid power systems and components — Pneumatics*

prEN 1037, *Safety of machinery — Isolation and energy dissipation — Prevention of unexpected start-up.*

ENV 1070:1993, *Safety of machinery — Terminology.*

EN 22860:1985, *Earth-moving machinery — Minimum access dimensions.*

EN 23164:1985, *Earth-moving machinery — Laboratory evaluations of roll-over and falling-object protective structures – Specifications for the deflection-limiting volume.*

EN 23411:1988, *Earth-moving machinery – Human physical dimensions of operators and minimum operator space envelope.*

EN 50081-2:1993, *Electromagnetic compatibility — Generic emission standard — Part 2: Industrial environment.*

EN 50082-2:1994, *Electromagnetic compatibility — Generic immunity standard — Part 2: Industrial environment.*

EN 60204-1:1992, *Electrical equipment of industrial machines — Part 1: General requirements.*

ISO 2631-1:1985, *Evaluation of human exposure to whole-body vibration — Part 1: General requirements.*

ISO 2867:1989, *Earth-moving machinery — Access systems.*

ISO 3449:1992, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements.*

ISO 3450:1985, *Earth-moving machinery — Wheeled machines — Performance requirements and test procedures for braking systems.*

ISO 3457:1986, *Earth-moving machinery — Guards and shields — Definitions and specifications.*

ISO 3471-1:1986, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements — Part 1: Crawler, wheel loaders and tractors, backhoe loaders, graders, tractor scrapers, articulated steel dumpers.*

ISO 3795:1989, *Road vehicles and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials.*

ISO 4302:1981, *Cranes, wind load assessment.*

ISO 4309:1990, *Cranes — Wire ropes — Code of practice for examination and discard.*

ISO 4872:1978, *Acoustics — Measurement of airborne noise emitted by construction equipment intended for outdoor use — Method for determining compliance with noise limits.*

ISO 6682:1986, *Earth-moving machinery — Zones of comfort and reach for controls.*

ISO 10570:1992, *Earth-moving machinery — Articulated frame lock — Performance requirements.*

ISO/DIS 11201:1993, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at the workstation and at other specified positions — Engineering method in an essentially free field over a reflecting plane.*

IEC 651:1979, *Sound level meters.*

IEC 804:1985, *Integrating-averaging sound level meters.*

3 Definitions

For the purposes of this standard, the definitions of ENV 1070:1993 apply. Additional definitions, specifically needed for drill rigs, are added below.

3.1
danger zone
any zone within and/or around a drill rig in which a person is exposed to risk of injury or damage to health

NOTE For a drill rig this means the area in which a person can be reached by an operational movement of the drill rig, its working devices, its auxiliary equipment or swinging or falling equipment

3.2
working area
an area near a machine in which its tools are moved in order to carry out work.

3.3
exposed person
a person wholly or partially in the danger zone

3.4
operator
a person operating the drill rig while drilling. He may also be the driver of the rig.

3.5
driver
a person responsible for the movement of the drill rig.

NOTE The driver may be transported on the drill rig, may be on foot (pedestrian driver) or he may control the drill rig by remote control.

3.6
hook load
the actual load carried by the hook of the bottom block, including the weight of the bottom block and of the running ropes.

NOTE A distinction shall be made between the normal operating case and the exceptional operating case as defined in 3.7 and 3.8.

3.7
normal operating case
operating conditions that are normal or usual such as those occurring mainly during the sinking and clearing out of bore holes.

NOTE The maximum permissible hook load under those conditions is designated as the normal hook load.

3.8
exceptional operating case
operating conditions, which do not arise frequently or are of limited duration and during which, the normal hook load may be exceeded. The maximum permissible hook load under these conditions is designated as the exceptional hook load.

NOTE Examples are fishing jobs and certain casing operations.

3.9
stability angle
the angle between the vertical plane, passing through the tipping line and the plane passing through the centre of gravity, displaced as defined in 5.5.2 and the tipping line. The stability angle thus defines the tilt angle to overturning.

3.10
tipping lines

a) or drill rigs, crawler and wheel mounted:

   1) in the direction of travel, the lines connecting the lowest support points of contact of the idlers, rollers or the drives of the tracks or the front wheels, see figures 2 to 6;

   2) in sideward direction (perpendicular to the direction of travel), the lines passing through the centres of the support contact areas on each side of the chassis. See figures 2 to 6.

b) For drill rigs on support legs:

The lines connecting the centres of the support legs/jacks on each side of the chassis see figures 2 and 5.

3.11
total vertical resultant force
the sum of the total weight force of the drill rig and all other working forces in the vertical direction.

NOTE Resultant horizontal forces (wind forces etc.) have an influence only on the position of the total vertical resultant force.

3.12
tramming
short movements of a drill rig in drilling condition on site.

3.13
sweep radius
a special term for drill rigs with booms, being the outer radius, R, of the turning circle for a drill rig in tramming, see figure 1.

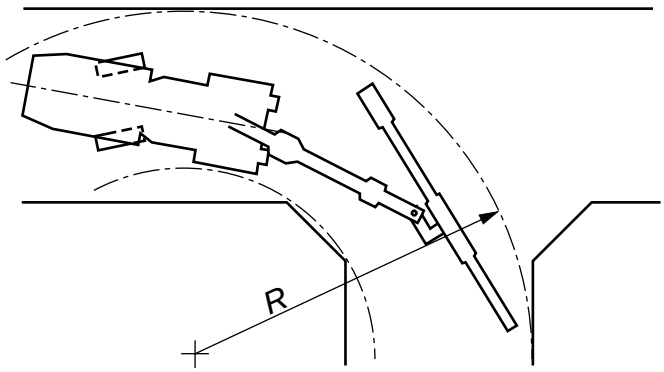

Figure 1 — Sweep radius

3.14
safety factor of rope
the ratio between the minimum breaking load of a rope guaranteed by the manufacturer, and maximum pulling force of a rope on the first layer of a winch.

3.15
examination
a periodic thorough visual inspection by a competent person to determine faults or damage, of all components important to safety, and functional tests including all necessary measurements.

3.16
check
a frequent inspection of components by the operator or the maintenance personnel to detect obvious damages or faults, and to determine, by means of spot checks, their ability to function normally.

3.17
personnel lift for operational work
a list used only for personnel transport and consisting of a guided platform on the mast.

NOTE The vertical movement is commonly winch operated.

3.18
movable platforms for maintenance and repair
a platform attached to parts of the drilling equipment, e.g. the drill head, which can be moved along the drill mast. The attachment can be temporary or permanent.

NOTE Personnel and material can be moved on this platform and personnel can work from it.

4 List of hazards

This clause contains all hazards, as far as they are treated in this standard, identified by risk assessments significant for drill rigs and which require action to eliminate or reduce risk.

		Clause
4.1	**Mechanical hazards**	
	Drawing in or trapping	5.4.2.2; 7.4.3; 7.4.5
	High pressure fluid ejection	5.1.5
	Ejection of parts	5.2.2; 5.3.4; 5.7.4
	Falling objects	5.2.2; 5.2.3
	Loss of stability	5.5; 5.15
	Slip, trip and fall	5.1.8; 5.17
4.2	**Electrical hazards**	
	Electrical contact directly or indirectly	5.1.9; 5.8
4.3	**Thermal hazards**	
	Hot and cold surfaces	5.1.3
4.4	**Hazards generated by noise**	5.2.2; 5.13.1; 5.13.2
4.5	**Hazards generated by vibrations**	5.13.3
4.6	**Hazards generated by materials and substances processed, used or exhausted**	
	Harmful dust and exhaust emissions	5.14
	Ejection of material from auger	7.4.2
	Fire risk	5.12
4.7	**Hazards generated by neglecting ergonomic principles**	5.1.2; 5.2.1; 5.2.2; 5.4.1
	Lighting	5.11
	Visibility	5.2.4
4.8	**Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders**	
	Failure of energy supply	5.3.4; 5.1.9
	Failure of control systems	5.3.5
	Unexpected loss of machine stability	5.2.1; 5.15.3
	Failures of brakes	5.6
	Failures of roller and leaf chains	5.16

4.9 Hazards caused by missing and incorrectly positioned safety-related measures and means

All kinds of guards	5.1.3; 5.1.4; 5.1.5; 5.2.2; 5.2.3; 5.4.2.3; 5.7.1; 5.7.2; 5.7.3
Safety-related devices	5.17.1; 5.17.2; 5.17.3; 5.17.4; 5.17.5; 5.17.6
Start and stop devices	5.3.1; 5.3.2; 5.3.3; 5.3.4; 5.3.5
Safety signs and tags	5.19; 7.2; Annex E
All kinds of information	5.7.3.4; 7
Energy supply disconnecting devices	5.1.9; 5.3.1
Emergency stops and safety devices	5.3.3; 5.4.2
Feeding and take off means for workpieces	5.7.3

See also Annex D for hazards in the various modes of operation of the drill rigs.

5 Safety requirements and measures

5.1 General safety requirements

5.1.1 Intended use of the drill rig

When developing and designing a drill rig its intended use shall be considered as well as uses which can be reasonably expected in accordance with 5 of EN 292-1:1991.

5.1.2 Ergonomics

The drill rig shall be designed according to ergonomic principles to avoid fatigue and stress on the operator. Consideration shall be given to the fact that operators may wear heavy gloves, footwear and other personal protection equipment. For guidance, see EN 23411:1988 and ISO 6682:1986.

5.1.3 Hot and cold surfaces and sharp edges

Where there is a risk of human contact with hot or cold surfaces, such surfaces shall be protected by guards or covers in accordance with 4.8 of ISO 3457:1986 and prEN 563. Surfaces and edges shall fulfil the requirements of 3.1 of EN 292-2:1991.

5.1.4 Ventilating ports

The mechanical ventilation and the cooling ports shall be provided with grills or similar devices to prevent fingers and limbs from reaching the moving components, in accordance with EN 294:1992.

5.1.5 Hoses, pipes and fittings under pressure

Pipes, hoses and fittings shall be able to withstand the stresses from the pressure. The hoses shall be marked with the rated working pressure. The requirements of prEN 982 and prEN 983 shall be complied with.

Where there is a risk that a rupture of a hose or pipe at the operator's position could cause hazard to the operator, the hoses and pipes in this area shall be provided with protective guards in accordance with 4.9 of ISO 3457:1986.

Flushing hoses, such as air, grout and mud hoses, shall be secured against freeing themselves, by means of adequate restraints.

5.1.6 Materials

Materials used in drill rigs shall be chosen so that they do not cause any danger to an exposed person's health or safety. The materials shall be suitable for the foreseen ambient temperatures. The manufacturer shall indicate in the operator's instructions the temperature range for which the drill rig is designed.

5.1.7 Handling of the drill rig and its parts

There shall be defined lifting points or devices for lifting the whole drill rig or parts of it. They may also be used for holding and securing the machine during transport. Lifting points shall be clearly marked.

On articulated carriers there shall be a mechanical locking device for locking the articulated joint during lifting and transport. The articulated frame lock shall be as specified in ISO 10570:1992.

Components and parts of a drill rig which require to be manually handled shall be designed in such a way as to allow safe manual handling.