
**Glf c ʹ nU [fUXb ʹ c ʹ dfYXcfcj ʹ ! ʹ NUy]lb] glfc ʹ ždchgb] j fHJb] ʹ glfc ʹ]b ʹ j fHJb] ʹ glfc ʹ g
gj YXf] ʹ hf ʹ cdfYa UnUdc ʹ U ʹ Ub ʹ Y ʹ cV ʹ c [ʹ ! ʹ J UfbcglbYnU hfj Y**

Tunnelling machines - Shield machines, thrust boring machines, auger boring machines,
lining erection equipment - Safety requirements

Tunnelbaumaschinen - Schildmaschinen, Pressbohrmaschinen,
Schneckenbohrmaschinen, Geräte für die Errichtung der Tunnelauskleidung -
Sicherheitstechnische Anforderungen

Tunneliers - Boucliers, machines de fonçage, matériel de mise en place de revêtement -
Prescriptions de sécurité

Ta slovenski standard je istoveten z: EN 12336:2005+A1:2008

ICS:

91.220	Gradbena oprema	Construction equipment
93.060	Gradnja predorov	Tunnel construction

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NORME EUROPÉENNE
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Tunnelling machines - Shield machines, thrust boring machines, auger boring machines, lining erection equipment - Safety requirements

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This European Standard was approved by CEN on 21 February 2005 and includes Amendment 1 approved by CEN on 9 September 2008.

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EN 12336:2005+A1:2008 (E)**Foreword**

This European Standard (EN 12336:2005+A1:2008) 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of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-09-09.

This document supersedes EN 12336:2005.

The start and finish of text introduced or altered by amendment is indicated in the text by tags $\boxed{A_1}$ $\boxed{A_1}$.

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 EC Directive(s).

$\boxed{A_1}$ For relationship with EC Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. $\boxed{A_1}$

This European Standard includes a 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.

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Introduction

This European Standard is a type C standard as stated in EN ISO 12100-1:2003.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

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 machines that have been designed and built according to the provisions of this type C standard.

In this European Standard it is assumed that:

- only competent persons operate the machine;
- components without specific requirements are:
 - a) designed in accordance with the usual engineering practice and calculation codes, including all failure modes;
 - b) of sound mechanical and electrical construction according to the state of the art;
 - c) made of materials with adequate strength and of suitable quality;
 - d) made of no harmful materials, such as asbestos;
- components are kept in good repair and working order, so that the required characteristics remain despite wear;
- the installation allows a safe use of the machine;
- negotiation occurs between the manufacturer and the user/purchaser concerning particular conditions of use and the places (e. g. ground and local safety conditions) of use of the machinery.

NOTE "Manufacturer" is understood within the European Union as intended in the Machinery Directive.

EN 12336:2005+A1:2008 (E)**1 Scope****1.1 Description of the machines**

This European Standard is applicable to all types of shield machines and associated back up equipment, thrust boring machines, auger boring machines and lining erection equipment. It specifies the essential safety requirements for the design, installation, maintenance, and information for use of such machines.

Shield machines and associated back up equipment include:

- open shields for both manual and mechanical excavation;
- shielded tunnel boring machines;
- micro tunnelling machines;
- towed or stationary back up equipment;
- pipe jacking equipment.

All shield machines provide lateral and radial ground support. In addition they may provide various types of face support and ground water control (see Clause 3).

Certain associated matters are not included in the scope of the standard:

- additional equipment which may form an integral part of a shield machine or back up equipment and is used for compressed air (hyperbaric/plenum) working (see EN 12110:2002);
- use under hyperbaric conditions;
- the supply of electricity up to the machine;
- ancillary tools and equipment used for, at or on the machine;
- electromagnetic compatibility;
- loading and transport equipment which is not an integral part of the machine, e.g. rolling stock, man riders, grout cars, segment cars, muck cars.

NOTE Within the European Union Directive 94/9/EC concerning equipment and protective systems intended for use in potentially explosive atmospheres can be applicable to the type of machine or equipment covered by this European Standard. The present document is not intended to provide means of complying with the essential health and safety requirements of Directive 94/9/EC.

1.2 Hazards

This European Standard deals with significant hazards, hazardous situations and events relevant to shield machines and associated back up equipment, thrust boring machines and auger boring machines when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4).

1.3 Validity

This European Standard is not applicable to machines which are manufactured before the date of publication of this European Standard by CEN.

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 3-7:2004, *Portable fire extinguishers - Part 7: Characteristics, performance requirements and test methods*

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

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

EN 563:1994, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces*

EN 620:2002, *Continuous handling equipment and systems — Safety and EMC requirements for fixed belt conveyors for bulk materials*

EN 894-3:2000, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 954-1:1996, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

EN 981:1996, *Safety of machinery — System of auditory and visual danger and information signals*

EN 982:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 983:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*

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EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1837:1999, *Safety of machinery — Integral lighting of machines*

EN 12094-1:2003, *Fixed firefighting systems — Components for gas extinguishing systems — Part 1: Requirements and test methods for electrical automatic control and delay devices*

EN 13627:2000, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements (ISO 3449:1992 modified)*

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997)*

EN 60204-11:2000, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV (IEC 60204-11:2000)*

EN 60439-1:1999, *Low-voltage switchgear and controlgear assemblies — Part 1: Type-tested and partially type-tested assemblies (IEC 60439-1:1999)*

EN 60439-2:2000, *Low-voltage switchgear and controlgear assemblies — Part 2: Particular requirements for bus-bar trunking systems (busways) (IEC 60439-2:2000)*

EN 60439-3:1991, *Low-voltage switchgear and controlgear assemblies — Part 3: Particular requirements for low-voltage switchgear and controlgear intended to be installed in places where unskilled persons have access for their use — Distribution boards (IEC 60439-3:1991, modified)*

EN 60439-4:2004, *Low-voltage switchgear and controlgear assemblies — Part 4: Particular requirements for assemblies for construction sites (ACS) (IEC 60439-4:2004)*

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EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60825-1:1994, *Safety of laser products — Part 1: Equipment classification, requirements and user's guide (IEC 60825-1:1993)*

EN 60947-1:2004, *Low-voltage switchgear and controlgear — Part 1: General rules (IEC 60947-1:2004)*

EN ISO 2860:1999, *Earth-moving machinery — Minimum access dimensions (ISO 2860:1992)*

EN ISO 3411:1999, *Earth-moving machinery — Human physical dimensions of operators and minimum operator space envelope (ISO 3411:1995)*

EN ISO 3457:2003, *Earth moving machinery — Guards — Definitions and requirements (ISO 3457:2003)*

EN ISO 11202:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a workstation and at other specified positions — Survey method in situ (ISO 11202:1995)*

EN ISO 11688-1:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

EN ISO 11688-2:2000, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design (ISO/TR 11688-2:1998)*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

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

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ISO 3864-1:2002, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

ISO 7745:1989, *Hydraulic fluid power — Fire-resistant (FR) fluids — Guidelines for use*

3 Terms, definitions symbols and abbreviated terms

For the purposes of this European Standard, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

3.1

shield machine

steerable protective structure within which tunnel excavation takes place by manual, mechanical or hydraulic means. Erection of tunnel support may take place within the shield machine. Examples of shield machines are given in Annex A (informative)

3.1.1

shield

shield machine in which an open or partial face is excavated by manual or independent mechanical means

3.1.2

shielded tunnel boring machine (TBM)

shield machine for full face excavation, having one or more rotating cutting heads in which the cutter head(s) may be separated from the rest of the shield by a bulkhead. Passage of material through the bulkhead may be controlled

3.1.3

micro tunnelling machine

shield machine designed for non man entry (except for maintenance purposes when out of service) which is remotely controlled by an operator from outside the tunnel

3.2

associated back up equipment

3.2.1

towed back up equipment

steel construction normally towed behind or attached and moving with the machine which accommodates equipment, to provide the machine with services for its operation and its crew with facilities for their work and comfort

3.2.2

stationary back up equipment

equipment for operation or control of pipe jacking and micro tunnelling equipment, thrust boring and auger boring machines which is installed at the bottom of an access shaft or on the surface adjacent thereto

3.2.3

pipe jacking equipment

3.2.3.1

pipe jacking rig

hydraulic jacking equipment at main jacking station, used to drive a pipe string through the ground to form a tunnel lining

3.2.3.2

intermediate jacking station

structure having the same external dimensions as the pipe and containing a number of hydraulic jacks used to drive a section of pipe string through the ground. Intermediate jacking stations subdivide a long pipe string into sections

3.3

thrust boring machine

machine for constructing pipelines by displacement

3.4

auger boring machine

non-steerable machine for constructing pipelines using continuous flight augers for excavation and spoil removal

3.5

lining erection equipment (Erector)

handling and erecting equipment which is situated within or immediately behind a shield machine which is used to install tunnel linings

3.6

control station

any location on a shield machine or back up equipment from where one or more functions of the shield machine, back up equipment or their separate working units are controlled by an operator

3.7

main control station

control station from where the boring operation and the advance of the shield machine is controlled

3.8

walkway

part of the access system that permits walking or crawling between locations on a shield machine or back up equipment

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- 3.9**
walkway surface
footpath within the walkway
- 3.10**
servicing point
any location on a shield machine or back up equipment where maintenance or servicing is normally carried out
- 3.11**
working area
area on or in a machine, where an operator assists in the function of the machine

4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this European Standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

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Hazards	See clause
4.1 Mechanical hazards	
a) Crushing hazard	5.2.4, 5.2.7, 5.2.8, 5.5.4.3, 5.17.2
b) Friction or abrasive hazard	5.2.1
c) High pressure fluid injection hazard	5.2.3, 5.3.1
d) Loss of stability and structural collapse	5.2.6, 5.2.7
e) Slip, trip and fall hazards	5.2.8
4.2 Electrical hazards	
a) Electrical contact, direct or indirect	5.10, 5.11
b) External influences on electrical equipment	5.10.3, 5.10.4, 5.10.6, 5.10.7
4.3 Thermal hazards	5.2.2
4.4 Hazards generated by noise	
a) Hearing damage (deafness)	5.3.1, 5.9
b) Accidents due to interference with speech communication and acoustical signals	5.5.4.3
4.5 Hazards generated by radiation	
a) Laser	5.7
b) Radon	5.8.3.2
4.6 Hazards generated by materials and substances	
a) Materials processed, used or exhausted by machinery	5.8.2
b) Dust and gas	5.3.1, 5.8, 5.10.3, 5.13.1
c) Fire or explosion	5.8.3, 5.13
d) Falling objects, face collapse and flood	5.2.9
4.7 Hazards generated by neglect of ergonomic principles	
a) Unhealthy posture or excessive efforts	5.2.5, 5.3.2
b) Inadequate local lighting	5.10.8
4.8 Hazards caused by failure of energy supply	
a) Failure of energy system	5.5.6, 5.12
b) Failure of control system	5.5.2
4.9 Hazards caused by missing and/or incorrectly positioned safety related measures	
a) All kinds of guards	5.2.8, 5.4
b) All kinds of safety related devices	5.4, 5.5, 5.6
c) Starting and stopping devices	5.2.6, 5.5.2, 5.5.4
d) Safety signs and tags	5.4.1, 5.7, 5.16
e) All kinds of information or warning devices	5.4, 5.5, 5.6, 5.8.3.2, 5.8.3.4, 5.10.2, 5.16
f) Energy supply disconnecting devices	5.10.2
g) Emergency stopping devices	5.5.5
h) Safe handling of machinery and parts, loading and unloading operations	5.2.5
i) Essential equipment and accessories for safe adjustment and/or maintenance	5.17
j) Equipment evacuating gases	5.8