SLOVENSKI STANDARD
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Stroji za gradnjo predorov - Zračne zapore - Varnostne zahteve

Tunnelling machines - Air locks - Safety requirements

Tunnelbaumaschinen - Druckluftschleusen - Sicherheitstechnische Anforderungen

Machines pour la construction de tunnels - Sas de transfert - Prescriptions de sécurité

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91.220	Gradbena oprema	Construction equipment
93.060	Gradnja predorov	Tunnel construction

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English Version

Tunnelling machines - Air locks - Safety requirements

Machines pour la construction de tunnels - Sas de transfert - Prescriptions de sécurité

Tunnelbaumaschinen - Druckluftschleusen - Sicherheitstechnische Anforderungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 151.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (prEN 12110:2010) 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 document is currently submitted to the CEN Enquiry.

This document will supersede EN 12110:2002+A1:2008.

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.

Introduction

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

The machinery and equipment 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.

1 Scope

This European Standard applies to the design, construction, equipping, marking and testing of air locks as defined in 3.3 and pressure bulkheads as defined in 3.4, which are to be used in tunnelling work.

An oxygen breathing system used to provide the breathing supply necessary to conduct a safe decompression is also covered by this standard.

NOTE When an air lock is designed for the use of non air breathing mixtures (e.g. Heliox) a specific risk assessment is required. This standard deals with all significant hazards, hazardous situations and events relevant to air locks and pressure bulkheads, when they are used as intended and under the conditions foreseen by the manufacturer as listed in Clause 4. This standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards.

This document is not applicable to machinery and equipment which is manufactured before the date of publication of this document by CEN.

This European Standard does not cover the supply of services to the air lock.

Vibration, noise and EMC (Electromagnetic compatibility) hazards are not significant hazards for air locks.

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 250:2000, *Respiratory equipment — Open-circuit self-contained compressed air diving apparatus — Requirements, testing, marking*

EN 562:2003, *Gas welding equipment — Pressure gauges used in welding, cutting and allied processes*

EN 12021:1998, *Respiratory protective devices — Compressed air for breathing apparatus*

EN 12464-1:2002, *Light and lighting — Lighting of work places — Part 1: Indoor work places*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

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

EN 61310-1:2008, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

EN ISO 3411:2007, *Earth-moving machinery - Physical dimensions of operators and minimum operator space envelope (ISO 3411:2007)*

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)*

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 14113:2008, *Gas welding equipment - Rubber and plastics hose and hose assemblies for use with industrial gases up to 450 bar (45 MPa) (ISO 14113:2007)*

IEC 60364-7-706:2005, *Low-voltage electrical installations — Part 7-706: Requirements for special installations or locations — Conducting locations with restricted movement*

IEC/TR 60877:1999, *Procedures for ensuring the cleanliness of industrial-process measurement and control equipment in oxygen service*

IEC 61000-6-1:2007, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-2:2005, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments*

IEC 61000-6-3:2007, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4:2007, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2003 and the following apply.

3.1
compressed air
air with a pressure of more than 0,1 bar, above atmospheric

NOTE All pressures to be measured above atmospheric pressure.

3.2
working chamber
space in which work in compressed air is carried out

3.3
air lock
pressure vessel with one or more compartments that permits passage between areas of different pressure

NOTE The pressure vessel is equipped with access doors, which can be sealed and the vessel can be pressurised. It includes equipment for its safe operation.

3.3.1
material lock
air lock for the passage of material or equipment only

3.3.2
personnel lock
air lock for the passage of persons only

3.3.3
combined lock
air lock for the passage of persons and material or equipment

3.4
pressure bulkhead
structure which separates spaces with different pressure levels as part of an air lock

3.5
maximum working pressure
highest pressure to which a pressure chamber may be subjected in normal use

3.6
design pressure
DP
maximum pressure for which the equipment is designed as specified by the manufacturer

NOTE The design pressure is the maximum allowable pressure as derived from the EC directive 97/23/EC concerning Pressure Equipment (PED).

3.7
test pressure
TP
pressure to which the equipment is tested

3.8
oxygen breathing system
plant, pipework and ancillary equipment used to provide oxygen supply necessary for a safe decompression procedure

3.9
breathing unit
part of the oxygen breathing system comprising a mask and regulator combination

3.10
main chamber
compartment of a personnel lock in which decompression is normally carried out

3.11
entrance chamber
compartment of a personnel lock which allows passage from atmospheric pressure to the main chamber

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 standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

Table 1 — List of significant hazards

Significant Hazards	Hazardous Situation	Safety Requirements and/or Measures	Reference (Verification)
4.1 Mechanical hazards:	4.1.1 Impact hazard / Squeezing	No sharp edges, bumpers, warning signs, squeezing protection etc.	5.1 (D,V) 5.2.10 (D,V) 5.2.11 (D,V) 7.4 (V)
	4.1.2 Ejection of parts (of machinery and processed material/work pieces)	n/a	n/a
	4.1.3 Uncontrolled change of pressure	Design and construction of pressure vessels, piping and pressure housings. Marking and labelling. Control equipment and instrumentation Design and construction of bulkheads	5.2.1 (D) 5.2.2 (D,T,V) 5.2.3 (D,T,V) 5.2.5 (D,T,V) 5.3.5 (D,V) 5.3.6.2 (V) 5.3.6.3 (V) 5.3.9.2 (D,V) 5.4 (V) 5.6.1 (D,T) 7.4 (V)
	4.1.4 Hazards resulting from the suction by differential pressure between the pressurised environment and atmospheric pressure	Mesh grills for inlets of exhaust pipes	5.2.12 (D,V)
4.2 Electrical hazards:	4.2.1 Electrical contact, direct or indirect	EN 60204-1 and IEC 60364-7-706	5.2.5 (D,T,V)
	4.2.2 External influences on electrical equipment	IEC 61000-6-1 to - 4	5.2.6 (D)
4.3 Thermal hazards:	4.3.1 Burns and scalds, by a possible contact of persons, by flames or explosions and also by the radiation of heat sources	Flame retardant materials. Fire extinguishing system. Temperature limit for heating system	5.2.4 (D) 5.2.4 (D,T,V) 5.3.6.3 (M,V)
	4.3.2 Health-damaging effects by hot or cold work environment	Thermometer	5.3.6.2 (V)
4.4 Noise hazards:	4.4.1 Hearing losses (deafness), other physiological disorders (e.g. loss of balance, loss of awareness, etc.)	Silencers	5.3.6.4 (M,V)
	4.4.2 Interference with speech communication, acoustic signals, etc.	Suitable communication network Silencers	5.2.9 (D,T,V) 5.3.6.4 (T)

Table 1 — List of significant hazards *(continued)*

Significant Hazards	Hazardous Situation	Safety Requirements and/or Measures	Reference (Verification)
4.5 Hazards generated by materials and substances processed, used or exhausted by machinery:	4.5.1 Hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	Fire emergency provisions at the control panel Gas sampling lines / Oxygen monitoring Ventilation Sufficient breathing units	5.2.4 (V) 5.3.6.3 (V) / 5.3.9.5 (T,V) 5.3.7 (M) 5.3.9.4 (D,V)
	4.5.2 Fire or explosion hazards especially under increased pressure	Water spray system Emergency relief valve Oxygen compatible materials	5.2.4 (D,T,V) 5.3.9.2 (D,V) 5.3.9.2
	4.5.3 Use of oxygen	Cleaning of oxygen system Gas sampling lines Distribution network Suitable breathing units	5.2.11 (V) 5.3.6.3 (V) 5.3.9.3 (D,V) 5.3.9.4 (D,V)
4.6 Hazards generated by neglecting ergonomic principles in machine design (mismatch of machinery with human characteristics and abilities):	4.6.1 Unhealthy postures or excessive efforts	Dimensions	5.3.2 (D,M) 5.3.3 (D,M,V)
	4.6.2 Inadequate consideration of human anatomy	Dimensions	5.3.2 (D,M) 5.3.4 (D,M)
	4.6.3 Inadequate local lighting	Interior Illumination acc. to EN 12464-1	5.3.6.4 (V,M)
	4.6.4 Unhealthy insufficient dimensions and upholstery of the seats	Dimensions and Insulation	5.3.3 (D,M,V)
4.7 Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders:	4.7.1 Failure of energy supply (of energy and/or control circuits)	Emergency Power Supply Emergency lighting	5.2.7 (D,T,V) 5.2.7 (D,M,T,V)
	4.7.2 Errors of fitting	Leak test of pressure systems	5.2.11 (T) 5.3.9.2 (V) 5.3.9.3 (V)
	4.7.3 Uncontrolled decompression of working	Protection against inlet line	5.3.5 (D,V)