



SLOVENSKI STANDARD

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Tunnelling machines - Air locks - Safety requirements

Tunnelbaumaschinen - Druckluftschleusen - Sicherheitstechnische Anforderungen

Tunneliers - Sas de transfert - Prescriptions de sécurité

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English version

Tunnelling machines - Air locks - Safety requirements

Tunneliers - Sas de transfert - Prescriptions de sécurité

Tunnelbaumaschinen - Druckluftschleusen -
Sicherheitstechnische Anforderungen

This European Standard was approved by CEN on 2 September 2002.

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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 Management Centre has the same status as the official versions.

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Foreword

This document (EN 12110:2002) 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of an identical text or by endorsement, at the latest by April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

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).

For relationship with EC Directives, see informative annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

This document is a type C standard as stated in EN 1070:1998.

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.

1 Scope

1.1 Description of the machine(s)

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

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

1.2 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 (see clause 4). This standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards.

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

2 Normative references

This European Standard incorporates by dated or undated reference, 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 (including amendments).

EN 140:1998, *Respiratory protective devices - Half masks and quarter masks - Requirements, testing, marking*.

EN 292-2:1991, *Safety of machinery - Basic concepts, general principles for design – Part 2: Technical principles* (identical with ISO/DIS 12100 –2:2000) Revision of EN 292-2:1991 and EN 292-2:1991/A1:1995).

EN 1070:1998, *Safety of machinery – Terminology*.

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

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

EN 61310-1:1995, *Safety of machinery - Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals* (IEC 61310-1:1995).

EN ISO 11202:1995, *Acoustics – Noise emitted by machinery and equipment – Measurement of emission sound pressure levels at a work station and at other specific positions – Survey method in situ (ISO 11202:1995)*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1070:1998 together with the following apply.

3.1

compressed air

air with a pressure of more than 0,1 bar, above atmospheric. All pressures to be measured above atmospheric pressure

3.2

pressure chamber

pressure vessel which is intended for accommodating persons above atmospheric pressure

3.3

working chamber

space in which work in compressed air is carried out

3.4

air lock

pressure vessel with one or more chambers with access doors, which can be sealed and pressurised with compressed air

3.5

material lock

air lock through which only material or equipment goes into or out of the working chamber

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3.6

personnel lock

air lock through which only persons go into or out of the working chamber

3.7

combined lock

air lock through which persons, material or equipment go into or out of the working chamber

3.8

pressure bulkhead

equipment which separates spaces with different pressure levels

3.9

maximum working pressure

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

3.10

design pressure

pressure used for calculation not including the safety-factor

3.11

oxygen breathing installation

plant and ancillary equipment used to provide oxygen supply necessary for a safe decompression procedure

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.

4.1 Mechanical hazards

- | | | |
|-------|--|----------------------|
| 4.1.1 | Impact hazard, see: | 5.2.4, 5.2.5 |
| 4.1.2 | Ejection of parts (of machinery and processed material/workpieces) , see: | 5.1.1 |
| 4.1.3 | Uncontrolled change of pressure, see:
5.2.9 | 5.1.1, 5.1.2, 5.2.6, |
| 4.1.4 | Hazards resulting from the suction by differential pressure between the pressurised environment and atmospheric pressure, see: | 5.2.7 |

4.2 Electrical hazards

- | | | |
|-------|---|-------|
| 4.2.1 | Electrical contact, direct or indirect, see: | 5.1.3 |
| 4.2.2 | External influences on electrical equipment, see: | 5.1.3 |

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, see:
SIST EN 12110:2003 | 5.1.3, 5.1.7, 5.2.7, 5.2.10.5, 7.2 |
| 4.3.2 | Health-damaging effects by hot or cold work environment, see:
https://standards.iteh.ai/catalog/standards/sist/6f04961b-1fa3-4da8-a76c-900b00000000/sist-en-12110-2003 | 5.2.6.1, 5.2.7, 5.4 |

4.4 Noise hazards

- | | | |
|-------|--|-----------------|
| 4.4.1 | Hearing losses (deafness), other physiological disorders (e.g. loss of balance, loss of awareness, etc.), see: | 5.2.7, 5.4 |
| 4.4.2 | Interference with speech communication, acoustic signals, etc., see: | 5.2.7, 5.4, 7.2 |

4.5 Hazards generated by materials and substances processed, used or exhausted by machinery, for example:

- | | | |
|-------|--|-----------------------------|
| 4.5.1 | Hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts, see:
5.2.10.1 | 5.1.7, 5.2.6.2, 5.2.8, |
| 4.5.2 | Fire or explosion hazards especially under increased air pressure, see:
5.2.10.1, 5.2.10.2, 5.2.10.3 | 5.1.3, 5.1.4, 5.1.7, 5.2.7, |
| 4.5.3 | Use of oxygen, see clause: | 5.2.10 |

4.6 Hazards generated by neglecting ergonomic principles in machine design (mismatch of machinery with human characteristics and abilities) caused e.g. by:

- | | | |
|-------|---|---------------------|
| 4.6.1 | Unhealthy postures or excessive efforts, see: | 5.1.8, 5.2.2, 5.2.3 |
| 4.6.2 | Inadequate consideration of human anatomy, see: | 5.2.2, 5.2.3, 5.2.4 |

4.6.3 Inadequate local lighting, see: 5.1.4, 5.2.7

4.7 Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders, e.g.:

4.7.1 Failure of energy supply (of energy and/or control circuits), see: 5.1.4, 5.2.7, 7.2

4.7.2 Errors of fitting, see: 5.2.5, 5.5.1, 7.2

4.7.3 Uncontrolled decompression of working chamber or lock, see: 5.1.6, 5.2.5, 5.2.6.1, 5.2.9, 5.2.10.6

4.7.4 Loss of communication, see: 5.1.5

4.8 Hazards caused by (temporarily) missing and/or incorrectly positioned safety related measures/means, e.g.:

4.8.1 All kinds of safety related (protection) devices, see: 5.1.3 5.1.5, 5.2.6.1, 5.2.6.2, 5.3, 5.5.2

4.8.2 Safety signs, see: 5.3, 7.1, 7.2

4.8.3 All kinds of information or warning devices, see: 5.2.6.1, 7

4.8.4 Means of access for emergency personnel into the confined pressurised part of the machine, see: 5.2.1, 5.2.2, 5.2.4, 5.2.5

4.8.5 Emergency devices, in particular means of evacuation of a casualty from the confined pressurised part of the machine, see: 5.2.1, 5.2.2

4.8.6 Essential equipment and accessories for safe adjusting and/or maintaining see: 5.2.6.1, 5.3, 5.4

4.8.7 Equipment for evacuating gases, etc, see: 5.2.6.2, 5.2.8, 5.2.10.3, 5.2.10.6, 5.4

5 Safety requirements and/or protective measures

Machinery shall comply with the safety requirements and/or protective measures of this clause.

Machinery shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of EN 292 for hazards relevant but not significant, which are not dealt with by this document (e.g. sharp edges).

5.1 General requirements

5.1.1 Calculation

The design pressure shall be 1,1 times the maximum working pressure. Where bulkheads cannot be tested the design pressure shall be 1,5 times the maximum working pressure.

The calculation shall be carried out according to the finite elements method. The calculations shall be part of the technical documentation.

5.1.2 Pressure relief valve

Each compartment shall be equipped with a pressure relief valve set at 1,1 times the maximum working pressure and capable of passing the whole air supply to the air lock at that pressure. Once activated the valve shall be able to fully close when pressure is lowered back to the working pressure.

5.1.3 Electrical equipment

Electrical equipment in air locks shall comply with EN 60204-1:1997. For the application of EN 60204-1 the manufacturer shall carry out an adequate risk assessment for the requirements thereof where choice is necessary.

NOTE This specific risk assessment is part of the general risk assessment relating to the hazards not covered by this type C standard.

It shall be suitable for humid and wet spaces and be protected from dust deposits and spraying water to a minimum class of IP 55 of EN 60529:1991, clause 4. Electrical equipment shall be designed to minimise the risk of fire and toxic fumes and shall withstand pressure changes to the maximum working pressure of the air lock.

5.1.4 Control panel

Control equipment and indicating instruments which are outside the air lock shall be assembled in a control panel. They shall be easily readable and so designed, constructed, arranged and marked that function and switching direction can be clearly recognised, in compliance with EN 61310-1:1995. They shall be illuminated with a nominal intensity of at least 100 lux. Emergency lighting shall be available for a duration of 1 hour.

Fire fighting and other emergency provisions shall be considered to enable the lock attendant to remain at the panel until the evacuation of pressurised persons is completed. Those provided shall be detailed in the instruction handbook. See clause 7.

5.1.5 Communication

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A Voice Communication network shall be installed to connect working chamber, personnel locks and control panel.

5.1.6 Doors, closing and sealing

Doors of personnel and material locks shall be self-sealing and kept shut by differential pressure or be fitted with a mechanical interlocking system preventing opening of the door unless the pressures are equalised.

5.1.7 Fire protection

Personnel and material locks shall consist of material and components of low flammability under increased air pressure and of low toxicity when burning.

5.1.8 Handling of heavy items

It is necessary to minimize the physical effort required by personnel while in compressed air. Appropriate devices shall be installed for that purpose when needed.

5.2 Personnel locks

5.2.1 Number of chambers

Personnel locks shall consist of at least two directly interconnected chambers, a main chamber and an entrance chamber accessible from atmospheric pressure, with door openings as specified in 5.2.4.