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Interested committees:

Title: Draft BS EN 14033-3 BS Railway applications - Infrastructure - Railbound construction and maintenance machines. Part 3: General safety requirements.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

English Version

**Railway applications - Infrastructure - Railbound
construction and maintenance machines - Part 3: General
safety requirements**

Applications ferroviaires - Voie - Machines de
construction et de maintenance empruntant
exclusivement les voies ferrées - Partie 3 :
Prescriptions générales pour la sécurité

Bahnanwendungen - Oberbau - Schienengebundene
Bau- und Instandhaltungsmaschinen - Teil 3:
Allgemeine Sicherheitsanforderungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 14033-3:2024) has been prepared by Technical Committee CEN/TC 256 “Railway Applications”, the secretariat of which is held by DIN.

This document is currently submitted to CEN Enquiry.

This document will supersede EN 14033-3:2017.

Amended clauses compared to EN 14033-3:2017 are detailed in informative Annex I.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For relationship with EU Directive 2006/42/EC, see informative Annex ZA, which is an integral part of this document. For relationship with EU Directive 2023/1230, see informative Annex ZB, which is an integral part of this document.

This series of standards EN 14033 “*Railway applications — Track — Railbound construction and maintenance machines*” consists of the following parts:

- *Part 1: Technical requirements for running*
- *Part 2: Technical requirements for travelling and working*
- *Part 3: General safety requirements*
- *Part 4: Technical requirements for running, travelling and working on urban rail*

Introduction

This document is a type C standard as stated in EN ISO 12100:2010.

This document is the third of a series of three parts of the European Standard: Railway applications — Track — Railbound construction and maintenance machines:

- Part 1 covers the safety and technical requirements for the machines in running mode;;
- Part 2 covers the railway specific requirements for the machines in working and travelling modes;
- Part 3 covers the safety requirements for the machines in working and travelling modes; this is a harmonized standard with the European Machinery Directive 2006/42/EC;
- Part 4 covers the technical requirements for the machines intended to have working, travelling and/or running mode on urban rail systems, giving the amendments to parts 1 – 3 to suit urban rail operation.

The machinery concerned and the extent to which hazards, hazardous situations and hazardous 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 B standards, the provisions of this type C standard take precedence over the provisions of the other standards.

The hazards which exist in all mechanical, electrical, hydraulic, pneumatic and other components of machines and which are dealt with in the relevant European Standards are not within the scope of this document. Where necessary, references are made to appropriate standards of this type.

1 Scope

This document applies to railbound machines and other vehicles - referred to as machines - working exclusively on the railway (utilizing friction adhesion between the rail and rail wheels) but including machines that in working position are partly supported on the ballast or the formation and used for construction, maintenance and inspection of track, structures, infrastructure and fixed electric traction equipment. This document applies to machines that are intended to operate signalling and control systems.

NOTE 1 Other rail mounted railway maintenance and infrastructure inspection machines are dealt with in other European Standards, see Technical Report CEN/TR 17498:2020.

This document specifies the significant hazards, hazardous situations and events common to rail bound machines and arising due their use on railways when they are used as intended or under conditions of misuse which are reasonably foreseeable, see Clause 4.

This document specifies the common hazards, in normal circumstances, during running, assembly and installation, commissioning, use (including setting, programming, and process changeover), operation, cleaning, fault finding, maintenance and de-commissioning of the machines. Additional safety measures can be required by exceptional circumstances, such as extreme ambient temperatures highly corrosive or contaminating environment; e.g. due to the presence of chemicals, and potentially explosive atmospheres.

NOTE 2 This document covers the essential health and safety requirements connected to the use of railbound machines as outlined in the Machinery Directive.

This document does not apply to the following:

- requirements for quality of the work or performance of the machine;
- use of separate equipment temporarily mounted on machines;
- operation subject to special rules, e.g. potentially explosive atmospheres;
- hazards due to natural causes, e.g. earthquake, lightning, flooding;
- working methods;
- operation in severe working conditions requiring special measures, e.g. corrosive environments, contaminating environments, strong magnetic fields;
- hazards occurring when used to handle suspended loads which may swing freely;
- autonomous mobile machines.

NOTE 3 Autonomous mobile machines are referred to as 'autonomous mobile machinery' in the Machinery Regulations 3.1.1 c).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2:1992, *Classification of fires*

EN 3-7:2004+A1:2007, *Portable fire extinguishers - Part 7: Characteristics, performance requirements and test methods*

EN 280-1:2022, *Mobile elevating work platforms - Part 1: Design calculations - Stability criteria - Construction - Safety - Examinations and tests*

EN 280-2:2022, *Mobile elevating work platforms - Part 2: Additional safety requirements for load lifting appliances on the extending lifting structure and work platform*

EN 402:2003, *Respiratory protective devices - Lung governed demand self-contained open-circuit compressed air breathing apparatus with full face mask or mouthpiece assembly for escape - Requirements, testing, marking*

EN 403:2004, *Respiratory protective devices for self-rescue - Filtering devices with hood for escape from fire - Requirements, testing, marking*

EN 474-1:2022, *Earth-moving machinery - Safety - Part 1: General requirements*

EN 547-1:1996+A1:2008, *Safety of machinery - Human body measurements - Part 1: Principles for determining the dimensions required for openings for whole body access into machinery*

EN 547-2:1996+A1:2008, *Safety of machinery - Human body measurements - Part 2: Principles for determining the dimensions required for access openings*

EN 547-3:1996+A1:2008, *Safety of machinery - Human body measurements - Part 3: Anthropometric data*

EN 614-1:2006+A1:2009, *Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles*

EN 614-2:2000+A1:2008, *Safety of machinery - Ergonomic design principles - Part 2: Interactions between the design of machinery and work tasks*

EN 618:2002+A1:2010, *Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of bulk materials except fixed belt conveyors*

EN 619:2022, *Continuous handling equipment and systems - Safety requirements for equipment for mechanical handling of unit loads*

EN 620:2021, *Continuous handling equipment and systems - Safety requirements for fixed belt conveyors for bulk materials*

EN 842:1996+A1:2008, *Safety of machinery - Visual danger signals - General requirements, design and testing*

EN 894-1:1997+A1:2008, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 1: General principles for human interactions with displays and control actuators*

EN 894-2:1997+A1:2008, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 2: Displays*

EN 894-3:2000+A1:2008, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 3: Control actuators*

EN 894-4:2010, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 4: Location and arrangement of displays and control actuators*

- EN 981:1996+A1:2008, *Safety of machinery - System of auditory and visual danger and information signals*
- EN 1032:2003+A1:2008, *Mechanical vibration - Testing of mobile machinery in order to determine the vibration emission value*
- EN 1837:2020, *Safety of machinery - Integral lighting of machines*
- EN 12077-2:1998+A1:2008, *Cranes safety - Requirements for health and safety - Part 2: Limiting and indicating devices*
- EN 12096:1997, *Mechanical vibration - Declaration and verification of vibration emission values*
- EN 12999:2020, *Cranes - Loader cranes*
- EN 13000:2010+A1:2014, *Cranes - Mobile cranes*
- EN 13135:2013+A1:2018, *Cranes - Safety - Design - Requirements for equipment*
- prEN 14033-1:2024, *Railway applications — Track — Railbound construction and maintenance machines — Part 1: Technical requirements for running*
- prEN 14033-2:2024, *Railway applications — Track — Railbound construction and maintenance machines — Part 2: Technical requirements for travelling and working*
- EN 14813-1:2006+A1:2010, *Railway applications - Air conditioning for driving cabs - Part 1: Comfort parameters*
- EN 15153-2:2020, *Railway applications - External visible and audible warning devices - Part 2: Warning horns for heavy rail*
- EN 15877-1:2012+A1:2018, *Railway applications - Marking on railway vehicles - Part 1: Freight wagons*
- EN 16507:2014, *Railway applications - Ground based service - Diesel refuelling equipment*
- EN 16704-2-1:2016, *Railway applications - Track - Safety protection on the track during work - Part 2-1: Common solutions and technologies - Technical requirements for Track Warning Systems (TWS)*
- EN 45545-2:2020+A1:2023, *Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behaviour of materials and components*
- EN 50121-3-2:2016,¹ *Railway applications - Electromagnetic compatibility – Part 3-2: Rolling stock - Apparatus*
- EN 50153:2014,² *Railway applications - Rolling stock - Protective provisions relating to electrical hazards*
- EN 50155:2021, *Railway applications - Rolling stock - Electronic equipment*
- EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*
- EN 60204-32:2008, *Safety of machinery - Electrical equipment of machines - Part 32: Requirements for hoisting machines*

¹ As impacted by EN 50121-3-2:2016/A1:2019.

² As impacted by EN 50153:2014/A1:2017 and EN 50153:2014/A2:2020.

EN 60529:1991,³ *Degrees of protection provided by enclosures (IP Code)*

EN 60825-1:2014,⁴ *Safety of laser products - Part 1: Equipment classification and requirements*

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 61310-2:2008, *Safety of machinery - Indication, marking and actuation - Part 2: Requirements for marking (IEC 61310-2)*

EN 61310-3:2008, *Safety of machinery - Indication, marking and actuation - Part 3: Requirements for the location and operation of actuators (IEC 61310-3)*

EN 61373:2010, *Railway applications - Rolling stock equipment - Shock and vibration tests*

EN IEC 61496-1:2020, *Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests*

EN 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements*

EN 62262:2002,⁵ *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

EN ISO 2860:2008, *Earth-moving machinery - Minimum access dimensions (ISO 2860:1992)*

EN ISO 2867:2011, *Earth-moving machinery - Access systems (ISO 2867:2011)*

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

EN ISO 3449:2008, *Earth-moving machinery - Falling-object protective structures - Laboratory tests and performance requirements (ISO 3449:2005)*

EN ISO 3471:2008, *Earth-moving machinery - Roll-over protective structures - Laboratory tests and performance requirements (ISO 3471:2008)*

EN ISO 3744:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*

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)*

³ As impacted by EN 60529:1991/A1:2000, EN 60529:1991/A2:2013, EN 60529:1991/corrigendum May 1993, EN 60529:1991/AC:2016-12 and EN 60529:1991/A2:2013/AC:2019-02.

⁴ As impacted by EN 60825-1:2014/A11:2021, EN 60825-1:2014/A11:2021/AC:2022-03 and EN 60825-1:2014/AC:2017-06.

⁵ As impacted by EN 62262-2:2002/A1:2021.

EN ISO 4871:2009, *Acoustics - Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 6682:2008, *Earth-moving machinery - Zones of comfort and reach for controls (ISO 6682:1986, including Amd 1:1989)*

EN ISO 6683:2008, *Earth-moving machinery - Seat belts and seat belt anchorages - Performance requirements and tests (ISO 6683:2005)*

EN ISO 7096:2020, *Earth-moving machinery - Laboratory evaluation of operator seat vibration (ISO 7096:2020)*

EN ISO 7731:2008, *Ergonomics - Danger signals for public and work areas - Auditory danger signals (ISO 7731:2003)*

EN ISO 11201:2010, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

EN ISO 11688-1:2009, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1:1995)*

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

EN ISO 13732-1:2008, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13849-1:2023, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2023)*

EN ISO 13849-2:2012, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)*

EN ISO 13850:2015, *Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)*

EN ISO 13854:2019, *Safety of machinery - Minimum gaps to avoid crushing of parts of the human body (ISO 13854:2017)*

EN ISO 13855:2010, *Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)*

EN ISO 13857:2019, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)*

EN ISO 14118:2018, *Safety of machinery - Prevention of unexpected start-up (ISO 14118:2017)*

EN ISO 14119:2013, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection (ISO 14119:2013)*

EN ISO 14120:2015, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)*

EN ISO 14122-2:2016, *Safety of machinery - Permanent means of access to machinery - Part 2: Working platforms and walkways (ISO 14122-2:2016)*

EN ISO 14122-3:2016, *Safety of machinery - Permanent means of access to machinery - Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2016)*

EN ISO 16001:2017, *Earth-moving machinery - Object detection systems and visibility aids - Performance requirements and tests (ISO 16001:2017)*

EN ISO 20643:2008,⁶ *Mechanical vibration— Hand-held and hand-guided machinery — Principles for evaluation of vibration emission*

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 5353:1998, *Earth-moving machinery, and tractors and machinery for agriculture and forestry - Seat index point (ISO 5353:1995)*

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

ISO 3864-1:2011, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 5006:2017, *Earth-moving machinery — Operator's field of view — Test method and performance criteria*

ISO 6011:2023, *Earth-moving machinery — Visual display of machine operation*

ISO 6405-1:2017,⁷ *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 7000:2019, *Graphical symbols for use on equipment — Registered symbols*

ISO 7010:2019,⁸ *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 8434-2:2007, *Metallic tube connections for fluid power and general use — Part 2: 37 degree flared connectors*

ISO 10263-2:2009, *Earth-moving machinery — Operator enclosure environment — Part 2: Air filter element test method*

ISO 10263-3:2009, *Earth-moving machinery — Operator enclosure environment — Part 3: Pressurization test method*

ISO 10263-4:2009, *Earth-moving machinery — Operator enclosure environment — Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance*

ISO 10263-5:2009, *Earth-moving machinery — Operator enclosure environment — Part 5: Windscreen defrosting system test method*

⁶ As impacted by EN ISO 20643:2008/A1:2012.

⁷ As impacted by ISO 6405-1:2017/Amd1:2022.

⁸ As impacted by ISO 7010:2019/A1:2020, ISO 7010:2019/A2:2020, ISO 7010:2019/A3:2021, ISO 7010:2019/A4:2021, ISO 7010:2019/A5:2022, ISO 7010:2019/A6:2022, ISO 7010:2019/A7:2023 and ISO 7010:2019/A8:2024.

ISO 10264:1990, *Earth-moving machinery — Key-locked starting systems*

ISO 11926-1:1995, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 1: Ports with O-ring seal in truncated housing*

ISO 11926-2:1995, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 2: Heavy-duty (S series) stud ends*

ISO 11926-3:1995, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 3: Light-duty (L series) stud ends*

ISO 11112:1995,⁹ *Earth-moving machinery — Operator's seat — Dimensions and requirements*

ISO 12117-2:2008,¹⁰ *Earth-moving machinery — Laboratory tests and performance requirements for protective structures of excavators — Part 2: Roll-over protective structures (ROPS) for excavators of over 6 t*

ISO 12508:1994, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

ISO 15817:2012, *Earth-moving machinery — Safety requirements for remote operator control systems*

ISO 21815-1:2022, *Earth-moving machinery — Collision warning and avoidance — Part 1: General requirements*

ISO 22241-1:2019,¹¹ *Diesel engines — NOx reduction agent AUS 32 — Part 1: Quality requirements*

⁹ As impacted by ISO 11112:1995/Amd1:2001.

¹⁰ As impacted by ISO 12117-2:2008/Amd1:2016.

¹¹ As impacted by ISO 22241-1:2019/Amd1:2019.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

work place

working cabs, combined working and driving cabs, operator's places situated outside cabs, welfare areas, locations where authorized personnel are permitted on the machine and places situated at control or maintenance locations

3.2

travelling mode

configuration of a machine when it allows movement along the working track, all moveable parts stowed (but not secured) within the applicable gauge, and when the machine does not require interaction with the signalling and control systems (in this condition there is no need to ensure operation of signalling systems or for cab based signalling equipment)

Note 1 to entry: A machine in travelling mode does not need to meet the operational requirements for the movement of trains on the railway network.

3.3

working mode

mode when the machine is used to perform any of its permitted designed working tasks

3.4

running mode

configuration of a machine which allows movement along the track, all moveable parts stowed within the applicable gauge, with the machine interacting with the signalling and control systems

Note 1 to entry: A machine in running mode meets all the applicable requirements of EN 14033-1.

3.5

obstacle detection system (ODS)

active devices to detect persons/obstacles immediately ahead of the machine in the direction of movement

3.6

guard-rail

barrier used to demark edge of platform or assistance on steps,

Note to entry: see prEN14033-1:2024, Figure E.2.

4 List of significant hazards

Table A.1 shows all the significant hazards, hazardous situations and events, as far as they are dealt with in this document, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

The common hazards specified include the general hazards presented by the machines, and also the hazards presented by the following specific machine functions, common to two or more machine types:

- ballast tamping, ballast cleaning, ballast regulating, ballast consolidating;
- excavation;
- track renewal;
- rail maintenance;
- craning;
- inspection, measurement and maintenance of the components of the infrastructure;
- tunnel cleaning and ventilation;
- shunting;
- emergency rescue and recovery

during commissioning, use, maintenance and servicing.

5 General safety requirements and/or protective measures

5.1 General

Machines shall comply with the safety requirements and/or protective measures in accordance with Clauses 5 and 6. In addition, the machine shall be designed in accordance with the principles of EN ISO 12100:2010 for relevant hazards, which are not dealt with by this document. Compliance with this document and the assessment with EN ISO 12100:2010 principles, in combination, enables coverage of machine safety, related to its use on rail. A list of significant hazards dealt with by this document is provided in Annex A.

The intended use excludes passenger or freight transport, and this shall be shown as a restriction in the documentation, see 8.4, Table 6, line a), ie not the commercial transportation of public or goods. The intended use of the machine shall be described in the documentation, see 8.2, Table 4, line a).

5.2 Ergonomics

Machines shall be designed in accordance with the principles of EN 614-1:2006+A1:2009 and EN 614-2:2000+A1:2008.

5.3 Machine profile

When the machine is in travelling mode any moveable component which has the capacity to go outside the machine gauge set out in prEN 14033-1:2024, 5.1 shall be capable of being stowed in a manner which prevents accidental or unintended movement out of the gauge. All such moveable components and assemblies forming part of the machine shall have the capability to be stowed and remain stowed under the foreseeable forces encountered during travelling. It shall be visually possible when checking the machine that these parts of the machine are in their stowed position, or detection provided with

indication at the control position. Where a moveable component is capable of exceeding the machine gauge and is not visible from the operating position there shall be detection provided with indication at the control position.

NOTE Moveable components, in their stowed state, will not necessarily require any form of locking or other means of retention in travelling mode if the possible movement will not create a hazard.

Movement limiting devices that control the movement of components out of the gauge shall comply with 5.40.

Loss of power on the machine shall not create a hazard (e.g. check valves on hydraulic systems shall prevent movement and fail safe).

5.4 Machine mass

In addition to the mass measured in accordance with prEN 14033-1:2024 7.7 the distribution of the masses and the maximum wheel load in the different foreseen machine travelling and working configurations shall be stated in the documentation, see 8.2 Table 4, Line b). It is permitted for these masses to be measured or calculated.

5.5 Protection from the risks of lasers

Laser devices shall comply with EN 60825-1:2014⁴.

Rotating lasers shall not continue illumination if the rotation ceases in any failure mode.

Each laser shall have a laser isolation device adjacent to it. The isolation device shall be capable of being locked in the isolate position. This isolation device shall be clearly marked, as set out in 8.6.2 i) with what it applies to and shall not be coloured red. It is permissible for lasers of classes 1 and 2 to not have local isolation devices.

5.6 Safety against derailments

When moving along the track in travelling mode no rail wheel shall be completely unloaded. A means of verifying this is shown in prEN 14033-2:2024, 5.2.2.

When moving along the track in working mode, under all operating and track conditions, no rail wheel shall leave the rail. A means of verifying this is shown in prEN 14033-2:2024, 5.2.3.

5.7 Prevention of overturning

5.7.1 General

Machines that have moveable components that can cause asymmetric loading of the wheels shall not have any rail wheel completely unloaded. A means of verifying this is shown in prEN 14033-2:2024, 5.2.1.

5.7.2 Load moment control and display device

5.7.2.1 General - rated capacity indicator/limiter (RCI/RCL)

Machines that lift loads shall be fitted with appropriate load limiting devices. Simple cantilever or knuckle boom cranes shall, as minimum, be fitted with a rated capacity limiter conforming to the requirements of EN 12077-2:1998+A1:2008 where no combination of load and radius will cause instability. The maximum safe working load shall be displayed next to each load lifting point, see 8.6.2 j).

All other lifting equipment shall be fitted with a rated capacity indicator/rated capacity limiter (RCI/RCL), which will indicate to the operator the rated load that can be lifted in the current machine position (cant and gradient) and mode of the machine. The device shall be in accordance with EN 12077-2:1998+A1:2008, 5.3 and 5.5. The RCI function shall be in accordance with

EN 13000:2010+A1:2014, 4.2.6.2.4 and the RCL function shall be in accordance with EN 13000:2010+A1:2014, 4.2.6.2.2 and 4.2.6.2.3.

Where the RCI/RCL is capable of being overridden, for example during set-up or recovery, the status of the RCI/RCL shall be recorded on the data recorder. After the specific activity the RCI/RCL shall automatically return to normal operation. There shall be a means to prevent the unintentional overriding of the RCI/RCL (for example a key switch or electronic device prevents the unintentional activation). The specific arrangements for using the override shall be described in the documentation, see 8.3 Table 5, line a).

NOTE There are more specific requirements for cranes shown in EN 13000.

5.7.2.2 Warning of overload and limit of load moment

When a machine is used as a crane or lifting machine there shall be an audible and visual warning to the operator of overload. This shall commence when the load reaches 90 % to 97,5 % of the rated load and shall continue until the load is below this range. In addition, there shall be a function that the machine shall cease to continue lifting or increasing the load moment, before the load reaches 100 % to 110 % of the rated load. Where the 100 % to 110 % has been reached the machine shall still be capable of reducing the load moment.

The 90 % to 97,5 % warning and 100 % to 110 % movement lock shall operate for all movements, e.g. boom movements and turret rotation and shall consider the current operational conditions (cant, gradient, rail running gear, use of stabilizer).

The audible overload warning shall be 3 dB(A) above the ambient noise of the machine at a distance of the working range of the machine.

NOTE 1 Virtual wall functions like height limiter and slew limiter can be integrated in the RCI/RCL. The virtual wall mode acts independently from the RCI/RCL.

NOTE 2 Tandem lift functions are permitted to be integrated in the RCI/RCL.

5.7.2.3 Data recording

The RCI/RCL device shall be provided with a data logging system which shall be capable of recording as a minimum the following information:

- a) the date and time of any occurrences shown below;
- b) overload occurrences during lifting operations;
- c) each incidence of the operation of the emergency control / override systems for recovery of equipment. This does not apply to:
 - 1) hand-pumps on hydraulic circuits;
 - 2) cases of complete electrical failure;
- d) activation of RCI override systems (as set out in 5.7.2.1), where fitted.

In addition the data logging system is permitted to be capable of recording the following information:

- e) malfunction of any electronic load monitoring system;
- f) values where displayed on the RCI in the event of activation shown above:
 - 1) duty in use;

- 2) load on hook;
- 3) load radius;
- 4) load height;
- 5) slew angle;
- 6) cant;
- 7) gradient;
- 8) speed (where RCI is displaying speed).

The data logger shall be robust in design and mitigate against the effects of foreseeable derailment and collision incidents. It shall be located in a secure area, capable of being downloaded when required, either remotely or via an accessible link *in situ*. Instructions for downloading shall be included in the documentation, see 8.3, Table 5, line b).

There shall be a visual indication at the operator position to show that the system is operational.

Data loggers shall record data as a minimum, throughout each occurrence shown above at 1 s intervals, for any change of the value of the exceedance occurrence and shall store a minimum of 1 000 events. The occurrence of each overload shall be recorded.

The data logger shall be designed such that in the event of a host machine power failure all data currently stored on the data logger is retained. Data shall be protected against unauthorized amendment, deletion or corruption.

5.7.3 Roll over protective structure (ROPS)

Machines that do not operate with asymmetric loads or machines fitted with an RCI/RCL that are not capable of isolation, see 5.7.2.1, are not required to fit ROPS.

Machines that are intended to operate with asymmetric loads (e.g. diggers and cranes with RCI/RCL that can be isolated), shall be fitted with a roll over protective structure (ROPS) to protect the machine operator and other persons

- a) in the cab
- b) on additional seats fitted in compliance with 5.15.2.

The ROPS shall as a minimum comply with EN ISO 3471:2008 or ISO 12117-2:2008¹¹.

5.8 Machine frame and structure

In addition to the requirements of prEN 14033-1:2024, 6.1 and prEN 14033-1:2024, 6.2 the machine frame shall be designed and constructed to meet the foreseen forces generated additionally during travelling and working.

For machines that generate vibrations during the working mode, the predicted fatigue life of the machine structures (frame, bogie and running gear) and attached equipment, shall be declared in the documentation, see 8.2, Table 4, line a) and 8.5, Table 7, line a). This is permitted to be assessed by a comparison with existing machines of the same type.

5.9 Inter-machine couplings

In addition to the requirements of prEN14033-1:2024, Clause 10, the inter-machine couplings shall be designed and constructed to meet the foreseen forces generated additionally during travelling and working. This is permitted to be assessed by a comparison with existing machines of the same type.

5.10 Rail gear

In addition to the requirements of prEN 14033-1:2024, 7.6 and prEN 14033-2:2024, 5.1.3 all rail wheels shall be designed and constructed to meet the foreseen forces generated additionally during travelling and working. This is permitted to be assessed by a comparison with existing machines of the same type.

5.11 Rail wheel suspension

The rail wheels shall be suitably loaded to provide reliable rail guidance at all times, as set out in 5.6.

Any failure of the suspension system shall not make the machine unstable while operating at the limits of its rated load and/or reach.

5.12 Braking systems

5.12.1 Running mode brake

Requirements for braking systems shall be in accordance with 5.24 and prEN 14033-1:2024, Clause 9.

5.12.2 Travelling and working mode brakes

Requirements for braking systems shall be in accordance with 5.24 and prEN 14033-2:2024, 5.12.

5.12.3 Remote application of brakes

Where there is a designated area for personnel to ride on the machine in an area remote from the driving position they shall have access to a means of applying the brake by an emergency stopping device, with the ability to release the brake following communication with the driver, as set out in 5.13.12.

5.13 Requirements for working cabs and enclosed personnel areas

5.13.1 General requirements for working cabs

Cabs used for driving the machine in running mode shall comply with prEN 14033-1:2024, Clause 14. All other cabs shall comply with 5.13. Cabs used for driving the machine in running mode and in travelling and working modes shall comply with prEN 14033-1:2024 and this document.

5.13.2 Emergency exit

For cabs used for driving in running mode an emergency exit is provided in accordance with prEN 14033-1:2024, 14.2.3.2.

In all other cabs and enclosed personnel areas an alternative opening shall be provided on a side other than that of the primary opening. The dimensions shall comply with EN ISO 2867:2011, Clause 5. A window panel or another door is acceptable if they are easy to open or remove without the use of keys or tools. Latches may be used if they can be opened from the inside without the use of keys or tools. Breaking of a suitable size of glass pane is considered equivalent to an alternative opening. In such a case the necessary pane hammer, immediately accessible to the operator, shall be provided and stored in the cab.

When the window panel is used as an emergency exit it shall bear a pictogram indicating that purpose.

5.13.3 Visibility from operating position

5.13.3.1 General

From work places in working cabs and cabs combined for work, travel or use for driving in running mode, as well as from permanent work places outside of cabs, operators shall have a direct or indirect view of working tools or working areas. The working tools and working area shall be in visibility sector A as far as technically possible and otherwise in visibility sectors B and C in accordance with ISO 5006:2017, Table 1.

If a monitor is used to achieve an indirect view it shall comply with the requirements of Annex D of this document.

5.13.3.2 Movement along track in travelling mode

If the movement along the track is controlled from a cab used for driving in running mode, the visibility requirements are in accordance with prEN 14033-1:2024, 14.6.

If the movement along the track is controlled from a cab used for movements in travelling mode there shall be sufficient forward visibility to see obstacles on the track in front of the machine, and far forward enough to stop the machine on straight track at maximum travelling speed shown in the documentation, see 8.3 Table 5, line c). It is permitted to stand up and move around to achieve the required visibility provided that contact with relevant controls can be maintained. Category 3, 5 and 7 machines that are self-propelled in travelling mode shall have headlamps fitted compliant with prEN 14033-1:2024, 13.2.

For machines that are self-propelled in travelling mode, assuming total darkness and level straight track, the manufacturer shall state the maximum night-time travelling speed in the documentation, see 8.3 Table 5, line q). The maximum speed shall be calculated from the distance ahead of the machine that the headlight will illuminate and the stopping distance capability assuming a coefficient of friction of 0,15.

5.13.3.3 Movement along track in working mode

If the movement along the track is controlled from a working cab one of the following shall apply:

- the track shall be in the visibility sector A in accordance with ISO 5006:2017, Table 1; the manufacturer shall state in the documentation the maximum movement speed when working for daytime and darkness, see 8.3 Table 5, line c);

or

- a work place shall be provided for an assistant (provided with controls at that position that stop the movement of the machine and sound a warning) who has sufficient forward visibility by direct line of sight to be able to stop clear of any track obstruction when moving along the track at maximum working mode speed;

or

- with using remote control, with the speed limited to 5 km/h;

or

- closed circuit television (CCTV) shall be provided in the working cab with field of view both in the immediate vicinity around the machine and into the distance along the track sufficient to be able to stop clear of any track obstruction when moving along the track at maximum working mode speed specified by the manufacturer for the work to be performed, where the camera-monitoring system with the monitor placed in the view of the operator meeting the requirements of Annex D.

Where the operator is unable to continuously observe the monitor or the speed required to operate the machine is greater than 5 km/h then, additional to the camera monitoring system, an obstacle detection

system shall be fitted. This shall be placed at the machine end where the direct or indirect visibility is insufficient, to warn the operator and sound an external warning horn, if persons or obstacles in the movement area are detected. Obstacle detection systems shall meet the requirements of Annex E.

5.13.4 Minimum dimensions in working cabs

Except under the conditions of the following paragraph the minimum space available to the operator shall be as specified in EN ISO 3411:2007.

For working cabs with limited headroom measured from the seat index point to the roof, which shall be as specified in EN ISO 5353:1998 caused by technical requirements, e.g. working cabs for laying of sleepers or ballast chains underneath the frame of the machine as well as cabs of portal cranes, the minimum space envelope height (dimension R1 as specified in EN ISO 3411:2007, Figure 4) may be reduced to 920 mm.

The minimum space and location of the controls at the operator's station shall meet the requirements as specified in EN ISO 6682:2008.

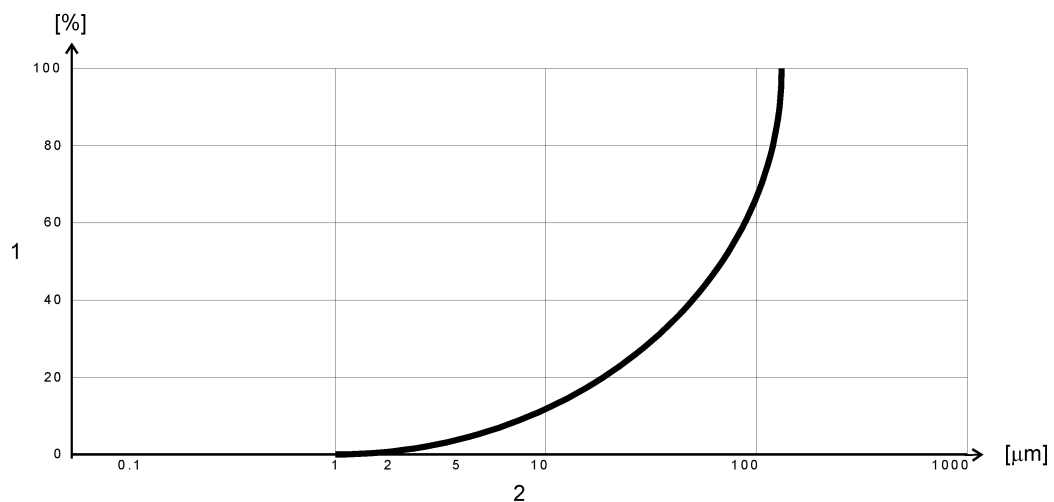
5.13.5 Working cab floors

The floor of working cabs and personnel areas shall be constructed in conformance with the requirements of EN ISO 14122-2:2016.

5.13.6 Protection from dust

Cabs and personnel areas shall be designed and constructed to prevent the ingress of dust, e.g. provision of particle filters.

Where the intended use of the machine causes dust ingress to the cab, particle filters shall be provided to prevent at least 95 % of the dust from entering the cab via the ventilation system. The position of the particle filter shall permit the routine inspection and changing of the filter. The composition of the dust used for calculation of particle filter selection shall be in accordance with Figure 1. This particle filter shall be tested in accordance with ISO 10263-2:2009.



Key

- 1 percentage by weight
- 2 particle diameter

Figure 1 — Composition of dust for calculation particle filter selection

For rail grinding machines particle filters suitable for metallic dust shall be used.

The ventilation system shall be capable of providing the cab with filtered fresh air at the minimum of 60 m³ per person per hour.

Where a cab is provided with a pressurization system, the system shall be tested in accordance with ISO 10263-3:2009 and shall provide an interior positive pressure of at least 50 Pa.

5.13.7 Enclosed climatic conditions

Working cabs and enclosed personnel areas shall protect the personnel against foreseeable adverse climatic conditions. The doors and windows shall protect against rain, exhaust gases wind, snow and ice. Where fitted, pipes, cable ducting, and valves shall not compromise this requirement.

Working cabs and enclosed personnel areas shall be thermally insulated and shall be equipped with an adjustable heating, cooling and ventilation system in accordance with the requirements of ISO 10263-4:2009 or EN 14813-1:2006+A1:2010. It is permitted for the demonstration of ability of the heating, cooling and ventilation system to provide the cab temperature by calculation. Areas intended for intermittent use, such as workshop areas, are permitted to be excluded from this requirement.

If the heating system is insufficient to defrost windows, working cabs and combined working and driving cabs shall be equipped with a system for defrosting the windows used for the observation of work tools. Where systems for defrosting of windows are fitted they shall be tested in accordance with the requirements of ISO 10263-5:2009.

The area of the windscreen to be defrosted shall be determined in accordance with the requirements of 5.13.3.1.

5.13.8 Windows

All windows shall be in accordance with prEN 14033-1:2024, 14.3.5.

For windows used for observation of the work tools, obscurity caused by dust, rain, frost, snow or ice shall be prevented by devices in accordance with prEN 14033-1:2024, 14.3.4.

5.13.9 Storage for instruction handbook and equipment

A space intended for the safekeeping of the instruction handbook shall be provided in at least one of the working cabs.

Machines with welfare areas shall have storage space sufficient for clothing for the number of personnel permitted. Personnel areas of greater than 5 people shall have space provided for a first aid kit and a defibrillator.

5.13.10 Falling object protection structures (FOPS)

Seated operator positions shall be fitted with falling objection protection structures in accordance with EN ISO 3449:2008. It is permitted to demonstrate compliance by calculation.

5.13.11 Noise

In addition to the requirements shown in 5.25, cabs shall be designed to minimize noise with specific attention to soundproof insulation of doors and windows.

According to the current state of the art, the value for the A-weighted emission sound pressure level (LpA) concerning the noise within an enclosed cab should not exceed 78 dB(A) when measured at the position of the operator's ear.

5.13.12 Communications between work positions

Working cabs and cabs combined for work, travel and/or running as well as permanent work places outside of cabs shall have a means of voice communication with each other, e.g. intercom.

The communication system shall not be dependent on the engine running. The communication system shall keep running without interruption when the drive is switched between different power supplies.

Headsets for communication between permanent work places outside of cabs by radio, where this is part of the machine, or by cable shall ensure that the operators hear during normal conversation:

- a) the warning signals given by vehicles / machines on the adjacent track with the sound criteria defined in EN 15153-2:2020;

and

- b) the warning signals for approaching railway vehicles on the adjacent track given by a track warning system with the sound criteria defined in EN 16704-2-1:2016, Annex A.

5.14 Work place

5.14.1 Egress from work places

Egress from work places shall prevent unintended egress onto railway lines open to traffic. A means of achieving this is given in prEN 14033-2:2024, 5.5.

Doors for working cabs should be at least 2 000 mm high and shall either comply with prEN 14033-1:2024, 14.2.3 or where compliance with these is not possible for technical reasons the minimum dimensions of the access to working cabs shall comply with the requirements of EN ISO 2867:2011, Clause 5, Table 1.

5.14.2 Access to work places

The access to work places and places for control and routine maintenance outside of cabs, shall either comply with prEN 14033-1:2024, 14.2 and prEN 14033-2:2024, 5.5 or where this is not possible for technical reasons, they shall comply with EN ISO 2867:2011, Clauses 6 to 9.

5.14.3 Work platforms and walkways on the machine

Working platforms and walkways on the machine shall be in accordance with the requirements of EN ISO 14122-2:2016.

Walkways used for infrequent maintenance activities only, for example less than 20 days per year and less than one hour per day, are permitted to be reduced to a minimum width of 370 mm.

Guard-rails shall be provided in accordance with EN ISO 14122-3:2016, Clauses 7 and 8.

5.15 Seats

5.15.1 Operator's seats

Machines with provision for a seated operator shall be fitted with adjustable seats that support the operator in a position that allows the operator to control the machine under intended operating conditions.

The seat dimensions shall be in accordance with ISO 11112:1995⁹. Where fixed seats are positioned outside of driver's cabs and closed work areas, for example located in working areas where the operator's task requires direct interaction with the track infrastructure, or the available space is limited by the clearance gauge it is permitted to provide seating with reduced dimensions, with a time limit for use of the seat by one person displayed beside the seat, and shown in the documentation, see 8.4, Table 6, Line g).

All adjustments to accommodate the operator's size shall be in accordance with ISO 11112:1995⁹, Table 1 and shall be adjustable without the use of any tool. It is permitted in exceptional cases for the seat angles

α_1 and α_3 in ISO 11112::1995+A1:2001, Table 1 to be reduced to 0°, for example to maintain an escape route.

The operator's seat shall meet the requirements of EN ISO 7096:2020 with regard to its ability to reduce the vibration transmitted to the operator.

5.15.2 Additional seats

Except as shown below, all personnel riding on the machine shall have a fixed seat. Additional seats shall be firmly secured. Where it is intended for the seat to be used for prolonged periods (occupied for ≥ 4 h of a working shift), for example, where used by an assistant, the seat shall meet the requirements of 5.15.1.

Where the machine is in motion in working mode and personnel are intended to stand, the standing area shall be clearly designated and protected as a minimum by guard-rails compliant with the requirements of EN ISO 14122-3:2016, 7 and 8. The vibration in this area shall be measured as set out in 5.27.

When the machine is intended to use for the transport of additional personnel in travelling mode, the area shall be clearly designated and shall be enclosed, as a minimum protected by guard-rails compliant with the requirements of EN ISO 14122-3:2016, 7 and 8 and a fixed roof.

Labels indicating the maximum permitted number of persons allowed in travelling mode shall be displayed in every area authorized for riding on the machine, see 8.6.2 h).

5.15.3 Seat belts

All seat positions fitted outside of enclosed areas shall be fitted with seat belts.

All machines fitted with ROPS, see 5.7.3, shall be fitted with seat belts compliant with EN ISO 6683:2008. On these machines when the seat is in use, the machine shall provide an audible and visible warning at the operating position unless the seat belt is in use.

5.16 Hazards associated with high work places and their access

5.16.1 Electrical risk from overhead contact line system

High work places and places for observers and their access shall provide protection from hazards including contact with a live overhead contact line in accordance with prEN 14033-2:2024, 5.8.

5.16.2 Risk of falling

Standing work places on the machine used for operation, observation or for routine maintenance shall have minimum dimensions of length 500 mm and width 350 mm. Standing places shall be fitted with:

- guard-rails compliant with the requirements of EN ISO 14122-3:2016, Clause 7 and 8;

or

- if it is not possible to fit guard-rails, restraint anchor points in accordance with EN 280-1:2022, 4.6.14 shall be provided for the use of personal protective equipment to prevent falls.

Work places shall include all areas where it is reasonably foreseeable that routine maintenance or intervention work will be undertaken, for example in the area of conveyors, hoppers, etc.

Standing places used for the conveyance of personnel shall meet the requirements of 5.15.2.

5.17 Edges and corners

The radii of edges and corners in work places, gangways, walkways, places for operation, observation and frequent maintenance outside of all cabs shall be in accordance with ISO 12508:1994.

5.18 Pressurized systems

Hydraulic systems shall be in accordance with the requirements of EN ISO 4413:2010, additionally threads compliant to EN ISO 228-1:2003, ISO 8434-2:2007, ISO 11926-1:1995, ISO 11926-2:1995 and ISO 11926-3:1995 shall be permitted. Pneumatic systems shall be in accordance with the requirements of EN ISO 4414:2010.

Pipes and hoses in working cabs and other permanent work places outside of cabs should be avoided. If hoses at these places are closer than 1 m to the operator and contain fluids at a nominal pressure greater than 5 MPa or a temperature exceeding 60 °C, and where, in the event of a defect, a jet of fluid may strike the operator at the operator's position, non-mesh hose guards shall be provided. Guards, including flexible hose covers, shall have sufficient strength to stop or deflect a jet of liquid to avoid direct contact with the operator.

NOTE See also EN ISO 3457:2008, 9.1.

5.19 Operator's controls and indicators

5.19.1 General

No single-point failure shall result in the unintentional movement of the machine.

Operator's controls and indicators for working devices shall be in accordance with the requirements of EN 474-1:2022, 4.5.1, EN 894-1:1997+A1:2008, EN 894-2:1997+A1:2008, EN 894-3:2000+A1:2008, EN 894-4:2010 and EN 61310-3:2008.

Where controls are located on the outside of the machine, unauthorised use of the controls shall be preventable by locking of the operating levers or disabling the function.

Where movement of the machine can be initiated from more than one control position, these shall be designed to ensure only one control is operative at a time. This shall be achieved by a lockable key selector switch and / or interlocking.

The controls shall be functionally grouped in a manner which minimizes the risk of unintended operation or confusion. Except for emergency stops, emergency brakes, warning devices and emergency recovery controls (see 5.26), where duplicate control positions are provided, only one control position shall be active.

Those controls which are most frequently operated shall be arranged in areas that have optimum access.

Controls which need to be operated quickly in a dangerous situation shall be arranged in such a way that they can be operated correctly, even in the dark. The controls shall be indicated as to their use, preferably by pictograms, in accordance with ISO 7000:2019, EN 61310-2:2008 and ISO 6405-1:2017⁷, if applicable.

As design guidance, to avoid sensorial saturation of the operator, the number of indication lamps and audible signals in the cab should be limited.

If the machine contains some functions utilizing indicator lamps, these functions shall comply with the requirements of EN 61310-1:2008.

If the machine contains some functions utilizing audible signals, these signals shall comply with EN ISO 7731:2008 and/or EN 981:1996+A1:2008, and be clearly distinguishable from each other, the ambient noise and other warning signals.

More than one message can be shown via the same indicator providing that the colour can be distinguished clearly.

If visual indications are visible from outside the cab, they shall be installed such that they are not mistaken by a passing train driver for a railway signal or cause glare to the passing driver.

5.19.2 Starting/stopping systems

The starting/stopping system of work devices, driving and combined movements for working and driving shall be provided with a starting/stopping device (e.g. key) or have a similar protection against unauthorized use that at least complies with ISO 10264:1990.

Machines shall be so designed that hazardous movement of the machine or its working equipment and/or attachment shall not be possible without action on the controls whilst starting/stopping the engine.

Stop controls shall also comply with EN 60204-1:2018, 9.2.3.3.

5.19.3 Inadvertent activation

Controls, which can cause a hazard due to inadvertent activation, shall be designed in a way to minimize the risk by:

- arrangement of controls,
- protective casing or guarding,
- deactivation of control.

The deactivation device shall either be self-acting or acting by compulsory actuation of the relevant device.

Where a stop command does not isolate power to the applicable motion, the stop condition shall be monitored by control systems, see 5.24.

5.19.4 Pedals

Pedals shall have an appropriate size, shape and be adequately spaced, to prevent inadvertent or simultaneous activation by one foot. The pedals shall have a slip resistant surface and be easy to clean.

5.19.5 Protection against uncontrolled motion in working mode

Movements of machine and equipment from a stationary position, other than by actuation of the controls by the operator, due to creep, e.g. by leaking, or when power supply stops, or loss of connection to communication network, shall be limited to the extent that they cannot create a hazard to persons.

Controls for working devices shall be one of the following as appropriate;

- hold-to-run as specified in EN ISO 12100:2010, 3.28.3,
- continually or automatically controlled,
- have a function that has a detent position.

If a control has a detent position there shall be a device to detect that the operator remains in position as long as the movement takes place and which stops the endangering movement if the seat is vacated, e.g. seat contact switch.

Where the detection device has detected that the operator has left his operating position and then returned to it, it shall be necessary for an additional action before the continuation of further movement.

5.19.6 Control panels and indicators

The operator shall be able to see from the operator's station, in both daylight and darkness, the necessary indicators to check the proper function of the machine. Glare shall be minimized.

Control indicators for safe and proper operation of the machine, shall follow the safety colours and safety signs/requirements according to ISO 6011:2023.

5.19.7 Remote controls

5.19.7.1 General

The machine is permitted to be moved and the working equipment operated by means of remote controls, provided additional safety measures are provided. As a minimum this shall include:

- deactivation of controls on the machine itself;
- remote controls that are carried shall be fail-safe (stop machine) when dropped, the operator falls over, or the machine moves out of range;
- remote controls for working equipment shall not affect safe operation of any function of the working equipment, including the unintended exceedance of movement limiting devices;
- overriding limiting devices shall not be permitted from the remote control. The status of limiting devices that can be switched off shall be indicated on the remote control.

A remote control includes both wireless devices and control boxes on wander lead / umbilical cords.

In the event of unintended disconnection of the wander lead/umbilical cord the machine shall cease all movements and apply brakes.

Wireless remote controls shall comply with EN ISO 12100:2010, 6.2.11.8 h) and EN 60204-1:2018, 9.2.4 or ISO 15817:2012.

5.19.7.2 Moving the machine along the track by remote control

During remote control operation:

- if the operator is travelling with the machine, the speed shall be limited by engineering means to a maximum of 25 km/h;

or

- if the remote control is operated by a pedestrian the speed shall be limited by engineering means to a maximum of 5 km/h.

For the application of the stop control shown in EN 60204 1:2018, 9.2.4.7 the machine shall be brought to a standstill, without damage to the infrastructure, within the distances shown in prEN 14033-2:2024, 5.12 Table 9.

5.19.8 Movement controls along the track

Except as detailed in 5.19.7, machine movement along the track shall be controlled from operating positions where the visibility complies with 5.13.3.

Control of movement along the track shall be from one location at a time, any attempt to use controls at any other position shall disable the movement along the track function.

5.19.9 Movement controls in travelling mode

Machine's working components that are capable of movement outside of the machine gauge, see 5.3, shall be interlocked to prevent machine movement along the track if a component is not in the stowed position in travelling mode. Doors and inspection hatches do not need interlocking.

5.19.10 Marking of controls and indicators

All controls and indicators shall be marked preferably by pictograms in accordance with ISO 7000:2019, if applicable, or otherwise by a short, precise wording intelligible to the authorized personnel operating the controls, see 8.6.2 d).

5.20 Visibility of the machine

5.20.1 Marker lights

Category 1, 2, 4 and 6 machines shall be equipped at the leading end with fixed electrical marker lights as specified in prEN 14033-1:2024, 13.3.2.

Category 3, 5 and 7 machines which are intended to be marshalled at the head of a formation and/or is self-propelled in travelling mode shall be equipped at the leading end with electrical marker lights as specified in prEN 14033-1:2024, 13.3.2.

5.20.2 Personnel protection

At least the front part of the machines above buffer level shall be coloured yellow and shall be free of non-safety related information.

NOTE This colour corresponds, for example, to:

- RAL 1004;
- or to the NCS (Natural Colour System) target value 1080-Y10 R;
- or to the NCS exact value 1475-Y 11R;
- or to EC 222.69.79 in the Eurocolour table.

The following colours are also acceptable RAL 1003, 1018, 1021 and 1023.

5.21 Warning systems

5.21.1 General

In running mode warning systems shall be in accordance with prEN 14033-1:2024, Clause 13.

5.21.2 System for warning personnel of machine movement or travelling movement or working movement

Where necessary a machine shall be provided with an acoustic warning system in accordance with EN 981:1996+A1:2008 and EN ISO 7731:2008 to warn of any machine movement. It shall be possible for the operator to activate the warning system from all points from which it is possible to initiate and/or control working movements or start the work equipment e.g. indicating an intention to move.

The signal for start of machine or tools shall be clearly audible. The effective masking threshold shall be distinctly exceeded. The A-weighted sound-pressure level of the danger signal shall not be lower than 65 dB(A) at any position in the working area. The A-weighted sound-pressure levels of the signal shall be a minimum of 3 dB(A) higher than the noise when the machine is in operation at all positions in the work area.

NOTE For track-workers the ability to hear warning signals is checked by medical fitness examinations or an occupational preventive medical check-up by their employer as set out in EN 16704-3:2016+A1:2021. This ensures that the probability of hearing loss is low for the population exposed to the warning signal.

If systems with visual danger signals are provided, they shall be in accordance with the requirements of EN 842:1996+A1:2008.

5.22 Electrical hazards

5.22.1 Electrical equipment

The electrical equipment shall be in accordance with all applicable clauses of EN 60204-1:2018 or EN 60204-32:2008 as appropriate (see also 5.22.7).

Electrical equipment, except the starter motor for internal combustion engines, shall be protected with an over-current device as specified in EN 60204 1:2018, 7.2.9.

5.22.2 Disconnection devices

All machines with an electrical supply shall be fitted with a supply disconnecting device in accordance with EN 60204-1:2018, 5.3. Each major electrical system shall also be fitted with a supply disconnection device.

5.22.3 Protection devices

Functionally separate subsystems shall have an overcurrent protection device with discrimination to provide priority isolation and on AC supplies a residual current device (RCD) where appropriate.

5.22.4 Conductors, cables and wiring practices

Electric wires/cables shall be protected in accordance with EN 60204-1:2018, Clauses 12 and 13.

Incorrect connections shall either be avoided by the design of the connectors or if this is not possible electric wires and cables, used to connect components in electric circuits, shall be marked and identified in accordance with EN 60204-1:2018, 13.2.

NOTE ISO 9247 gives guidance for marking and identification of electrical wires and cables.

Electric wires/cables shall be arranged to avoid the vicinity of inflammable materials including pipes and hoses containing inflammable liquids, or additional fire protection shall be provided.

5.22.5 Batteries

Batteries shall be firmly secured in a ventilated space. The location shall have an easy access and where necessary the batteries shall be mounted on a sliding carriage. Batteries shall be easily removable. The batteries shall be provided with grips where necessary to facilitate manual handling. Batteries and/or battery locations shall be designed or covered to minimize any hazard caused by acid vapours in areas occupied by operators or by ejection of battery electrolyte.

The pole not connected to the machinery frame and associated connectors shall be covered with insulation material.

It shall be possible to disconnect batteries by an easily accessible and identifiable device, e.g. a quick coupling or an isolator switch and a label fitted, see 8.6.2 b), adjacent to each breaker/isolator, stating, "battery isolation switch" shall be installed. As an exception, certain circuits may remain connected to their battery in order, for example, to protect information, to light interiors, etc. In these situations, there shall be a separate circuit breaker or fuse for each circuit and information detailed in the documentation, see 8.3 Table 5, line d) and a label shall be fitted in accordance with 8.6.2 c).

Where lithium batteries are used on machines see the requirements of UN Manual of Tests and Criteria, Part III, Clause 38.3 (UN/DOT 38.3).

5.22.6 Overhead contact line system

All work places shall be protected such that it is not possible to make contact with live electric traction equipment.