



BSI Standards Publication

Railway applications -Infrastructure — Demountable machines, trailers and associated equipment

Part 2: General safety requirements

National foreword

This British Standard is the UK implementation of EN 15955-2:2025. It supersedes BS EN 15955-2:2013 and BS EN 15954-2:2013, which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RAE/2, Railway Applications - Track.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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© The British Standards Institution 2025
Published by BSI Standards Limited 2025

ISBN 978 0 539 18226 2

ICS 45.060.20; 45.120

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2025.

Amendments/corrigenda issued since publication

Date

Text affected

English Version

**Railway applications - Infrastructure - Demountable
machines, trailers and associated equipment - Part 2:
General safety requirements**

Applications ferroviaires - Infrastructure - Machines
déraillables, remorques et éléments associés - Partie 2 :
Prescriptions générales pour la sécurité

Bahnanwendungen - Infrastruktur - Ausgleisbare
Maschinen, Anhänger und zugehörige Ausstattung -Teil
2: Allgemeine Sicherheitsanforderungen

This European Standard was approved by CEN on 7 March 2025.

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European foreword

This document (EN 15955-2:2025) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, 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of an identical text or by endorsement, at the latest by November 2025, and conflicting national standards shall be withdrawn at the latest by November 2025.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15954-2:2013 and EN 15955-2:2013.

Principal amended clauses compared to EN 15954-2:2013 and EN 15955-2:2013:

- General: all references updated to latest issue;
- 4.3: attachments with rail wheels clarified to be a trailer;
- Clause 5: all of Part 5 renumbered and each clause revised;
- 6.4: additional clause added for machines that profile rails;
- Clause 7: requirements for machine marking revised (was previously 8.3 and 8.4);
- Clause 8: documentation requirements completely revised (was previously called ‘Information for Use’);
- Annex A: revised to suit new format and numbering;
- Annex B: revised to suit new format and numbering;
- Annex C: revised and updated;
- Annex: new Annexes D to H added.

EN 15955, *Railway applications — Infrastructure — Demountable machines, trailers and associated equipment*, is currently composed with the following parts:

- *Part 1: Technical requirements for travelling and working;*
- *Part 2: General safety requirements.*

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 the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

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

This document is the second of a series of two parts of the European standard: *Railway applications — Track — Demountable machines, trailers and associated equipment*, dealing with railway specific risks of the demountable machines and trailers when travelling and working on railway infrastructures:

- Part 1 covers the safety and technical requirements for the machines in travelling and working modes, and is applicable for all machines, including those in operation on urban rail;
- Part 2 covers the safety requirements for the machines in travelling and working modes; this is a document harmonized with the European Machinery Directive 2006/42/EC.

Part 1 specifies requirements for approval of the machine for use on the railway. Depending on the decision of the Infrastructure Manager, Urban Rail Manager or the requirements in National rules the assessment of conformance could be undertaken by the Infrastructure/Urban Rail Manager concerned, by a third party assessor or by the manufacturer as a declaration of conformity.

Part 2 specifies requirements for the machine to be declared conformant by the manufacturer, except in the case of machines classified under Annex 4 of the Machinery Directive, which require a conformity check in conjunction with a notified body.

This document was prepared to meet the basic requirements of EU Directives to facilitate an open market for goods and services.

This document deals with railway specific risks of the demountable machines and trailers as defined in 3.1, 3.2 and 3.3 when travelling and working on railway infrastructures.

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

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, for machines that have been designed and built in accordance with the provisions of this type C standard.

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.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

1 Scope

This document specifies the general safety requirements for demountable machines and trailers, including road-rail trailers – henceforward referred to as ‘machines’, for use when travelling and working on railway track.

NOTE 1 Trailers, including road-rail trailers, are considered as machines because they are moved along the track by powered machines.

This document specifies the requirements to deal with the common hazards presented by their use on the railway during transport, assembly and installation, commissioning, travelling and working on track, use including setting, programming, and process changeover, operation, cleaning, fault finding, maintenance and de-commissioning of the machines and associated equipment when they are used as intended and under conditions of misuse which are reasonably foreseeable.

These machines will not run on railway lines open to normal traffic.

NOTE 2 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 is also applicable to machines and associated equipment that in working mode are partly supported on the ballast or the formation.

The requirements in this document are based on the assumption that the machines are used, operated and maintained by skilled person(s).

This document does not include requirements for:

- quality of the work or performance of the machine;
- use of separate equipment temporarily mounted on machines;
- machines that utilize external power supplies such as the overhead contact line system for traction purposes or as a power source;
- hazards due to air pressure caused by the passing of high-speed trains at more than 200 km/h;
- 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.

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 2:1992,¹ *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*

¹ As impacted by EN 2:1992/A1:2004.

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 12077-2:2024, *Cranes safety - Requirements for health and safety - Part 2: Limiting and indicating devices*

EN 12663-1:2010+A2:2023, *Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)*

EN 12999:2020, *Cranes - Loader cranes*

EN 13000:2010+A1:2014, *Cranes - Mobile cranes*

EN 13001-1:2015, *Cranes - General design - Part 1: General principles and requirements*

EN 13135:2013+A1:2018, *Cranes - Safety - Design - Requirements for equipment*

EN 14033-1:2017, *Railway applications - Track - Railbound construction and maintenance machines - Part 1: Technical requirements for running*

EN 14033-2:2017, *Railway applications - Track - Railbound construction and maintenance machines - Part 2: Technical requirements for travelling and working*

EN 14363:2016+A2:2022, *Railway applications - Testing and Simulation for the acceptance of running characteristics of railway vehicles - Running Behaviour and stationary tests*

EN 15566:2022, *Railway applications - Railway rolling stock - Draw gear and screw coupling*

EN 15746-1:2020, *Railway applications - Track - Road-rail machines and associated equipment - Part 1: Technical requirements for travelling and working*

EN 15877-1:2024, *Railway applications - Markings of railway vehicles - Part 1: Freight wagons*

EN 15955-1:2025, *Railway applications - Infrastructure - Demountable machines, trailers and associated equipment — Part 1: Technical requirements for travelling and working*

EN 45545-2:2020+A1:2023, *Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behaviour of materials and components*

EN 50121-3-1:2017,² *Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock - Train and complete vehicle*

EN 50121-3-2:2016,³ *Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus*

EN 50153:2014,⁴ *Railway applications - Rolling stock - Protective provisions relating to electrical hazards*

EN 50155:2021, *Railway applications - Rolling stock - Electronic equipment*

EN 50206-1:2010, *Railway applications - Rolling stock - Pantographs: Characteristics and tests - Part 1: Pantographs for main line vehicles*

EN 50206-2:2010, *Railway applications - Rolling stock - Pantographs: Characteristics and tests - Part 2: Pantographs for metros and light rail vehicles*

EN 50317:2012,⁵ *Railway applications - Current collection systems - Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line*

EN 50318:2018,⁶ *Railway applications - Current collection systems - Validation of simulation of the dynamic interaction between pantograph and overhead contact line*

EN 50367:2020,⁷ *Railway applications - Fixed installations and rolling stock - Criteria to achieve technical compatibility between pantographs and overhead contact line*

EN 50405:2015,⁸ *Railway applications - Current collection systems - Pantographs, testing methods for contact strips*

EN 60529:1991,⁹ *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2016, modified)*

EN 60204-32:2008, *Safety of machinery - Electrical equipment of machines - Part 32: Requirements for hoisting machines (IEC 60204-32:2008)*

² As impacted by EN 50121-3-1:2017/A1:2019.

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

⁴ As impacted by EN 50153:2014/A1:2017 and EN 50153:2014/A2:2020.

⁵ As impacted by EN 50317:2012/A1:2022.

⁶ As impacted by EN 50318:2018/A1:2022.

⁷ As impacted by EN 50367:2020/A1:2022.

⁸ As impacted by EN 50405:2015/A1:2016.

⁹ As impacted by EN 60529:1992/corrigendum May 1993, EN 60529:1992/A1:2000, EN 60529:1992/A2:2013, EN 60529:1992/A2:2013/AC:2019-02 and EN 60529:1992/AC:2016-02.

EN 60825-1:2014,¹⁰ *Safety of laser products - Part 1: Equipment classification and requirements (IEC 60825-1:2014)*

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 61310-2:2007)*

EN 61310-3:2008, *Safety of machinery - Indication, marking and actuation - Part 3: Requirements for the location and operation of actuators (IEC 61310-3:2007)*

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

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

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)*

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

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

¹⁰ 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.

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 12001:2009, *Acoustics - Noise emitted by machinery and equipment - Rules for drafting and presentation of a noise test code (ISO 12001:2009)*

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 20643:2008,¹¹ *Mechanical vibration - Hand-held and hand-guided machinery - Principles for evaluation of vibration emission (ISO 20643:2005)*

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

ISO 3864-2:2016, *Graphical symbols - Safety colours and safety signs - Part 2 Design principles for product safety labels*

ISO 3864-3:2012, *Graphical symbols - Safety colours and safety signs - Part 3 Design principles for graphical symbols for use in safety signs*

ISO 3864-4:2011, *Graphical symbols - Safety colours and safety signs - Part 4 Colorimetric and photometric properties of safety sign material*

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

ISO 4305:2014,¹² *Mobile cranes - Determination of stability*

ISO 4310:2009, *Cranes - Test code and procedures*

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

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

ISO 7000:2019, *Guide to graphical symbols for use on equipment*

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

ISO 8434-2:2007, *Metallic tube connectors for fluid power and general use - Part 2: 37° 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*

¹¹ As impacted by EN ISO 20643:2008/A1:2012.

¹² As impacted by ISO 4305:2014/AMD 1:2016.

ISO 11112:1995,¹³ *Earth-moving machinery - Operator's seat - Dimensions and requirements*

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 12117-2:2008,¹⁴ *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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. ISO and IEC maintain terminological 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

demountable machine

self-propelled machine that can travel and work on rail only, and is not intended to operate signalling and control systems

Note 1 to entry: Such a machine is designed to move onto and off track by its own means or with other lifting equipment. In the case of demounting by its own means, these are not intended for general movement on the ground.

Note 2 to entry: Such a machine is permitted to work and travel on the railway only under special operating conditions granted by the infrastructure manager.

3.2

trailer

non-self-propelled machine that can be hauled on rail wheels and is not intended to operate signalling and control systems

¹³ As impacted by ISO 11112:1995/AMD 1:2001.

¹⁴ As impacted by ISO 12117-2:2008/COR 1:2010 and ISO 12117-2:2008/AMD 1:2016.

3.3**road-rail trailer**

trailer that can be towed on rails and on the ground

Note 1 to entry: Towed also includes when the trailer is being pushed in front of a powered machine.

Note 2 to entry: It does not imply that the trailer is suitable for use on the public road.

3.4**mobile elevating work platform****MEWP**

mobile machine that is intended to move persons to working positions where they are carrying out work from the work platform with the intention that persons are getting on and off the work platform only at access positions at ground level or on the chassis and which consists as a minimum of a work platform with controls, an extending structure and a chassis

3.5**host vehicle**

basic road vehicle or item of machinery which is converted to operate additionally on rails; this vehicle is either EU road permissible or CE marked

3.6**manufacturer**

entity that designs, constructs or converts the original item of machinery/vehicle to a demountable machine or trailer

3.7**operator**

person who handles the controls of a machine in order to perform the functions of the machine in travelling and working mode

3.8**working place**

driving cab, working cab, combined working and driving cab, operator position situated outside a cab, platform or place situated at a control or maintenance location including an area for conveyance of personnel

3.9**travelling mode**

machine configuration that allows movement along the track (including shunting), where all parts are stowed with everything within the applicable gauge, and the machine does not require to interrelate 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.

Note 2 to entry: The mode only relates to the technical configuration of the machine independent of the operational mode (e.g. movements during shunting and regular train running).

3.10**working mode**

mode in which the machine is used to perform any of its permitted intended tasks; as soon as any part of the machine is un-stowed it is in working mode

3.11

rail configuration

state of the machine when it is in place on the rails ready to work or travel along the track

Note 1 to entry: Rail configuration does not include the transient state during getting on and off the track.

3.12

operating track

track corresponding to the criteria of the Infrastructure Manager on which vehicles may run under normal signalling arrangements (with or without a speed limit)

3.13

working track

track not open for normal traffic

3.14

degraded working track

track being maintained for which the geometrical parameters may reach the limiting values and for which special operational restrictions may apply

Note 1 to entry: The limiting values as specified in EN 14033-2:2017, Annex F.

3.15

railway infrastructure

all installations required for the running of railway vehicles

EXAMPLE Tracks, overhead contact line system, signals.

3.16

rail level

datum point corresponding to the top of the rail

3.17

continuous brake

brake on all connected machines used in dynamic conditions, for which the brake force can be varied by the operator using a control to simultaneously apply brakes

3.18

infrastructure manager

entity responsible for establishing and maintaining railway infrastructure as well as for operating the railway control and safety systems, including the Urban Rail Manager (as defined in EN 15746-4:2020, 3.2)

3.19

skilled person

person with relevant training, education and experience to enable them to perceive risks and to avoid hazards associated with the machine

Note 1 to entry: several years of practice in the relevant technical field may be taken into consideration in assessment of professional training

[SOURCE: ISO 14990-1:2016, 3.5.4, modified “electricity” replaced by “machine”]

4 Hazards and categories

4.1 List of significant hazards

Table A.1 contains 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 dealt with include the general hazards presented by the machines, as well as the hazards presented by the following specific machine functions:

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

4.2 Examples of demountable machines and trailers

Examples of common demountable machines and trailers are discussed and illustrated in Technical Report CEN/TR 17498:2020.

4.3 Attachments with rail wheels

Attachments with rail wheels are considered as trailers and shall meet the requirements in this document.

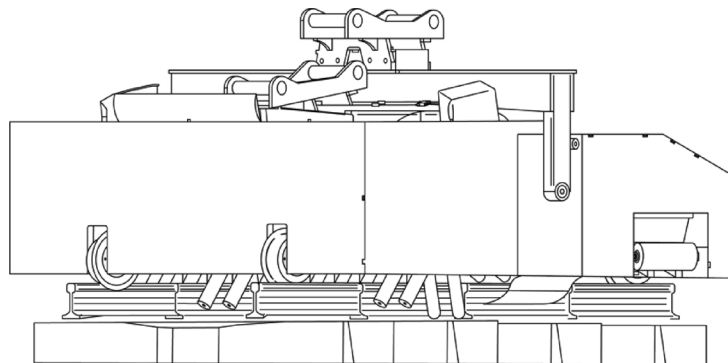


Figure 1 — Example of railway specific attachment with rail wheels (ballast brush)

5 Safety requirements and/or measures

5.1 General

Machines shall be designed to deal with the common hazards set out in this document, during transport, assembly and installation, commissioning, travelling and working on track, use including setting, programming, and process changeover, operation, cleaning, fault finding, maintenance and de-commissioning of the machines and associated equipment when they are used as intended and under conditions of misuse which are reasonably foreseeable.

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.

Components where the actual orientation is specified by the manufacturer as important to the component function, shall be designed to prevent incorrect assembly, or the orientation is displayed clearly on the component.

5.3 Machine profile

When the machine is in travelling mode, any moveable component which has the capacity to go outside the gauge set out in EN 15955-1:2025, 5.2.1 shall be capable of being stowed in a manner which prevents accidental or unintended movement out of the gauge. All such moveable parts 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 possible to check visually that these parts of the machine are in their stowed position, or detection provided with indication at the control position. Where a moveable part 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

The total mass of the machine, the rail wheel loads and the longitudinal spacing of these wheels shall be stated in the technical documentation, see 8.2, Table 10, lines c), d) and e). Where these parameters are different in travelling and working modes, the wheel loads/spacing shall be stated for each condition.

Measurement of wheel load shall be made in accordance with EN 14033-1:2017, 7.7.5.

5.5 Protection from the risks of lasers

Laser devices shall comply with EN 60825-1:2014.

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

Each laser shall have an laser isolation button adjacent to it. The isolation button shall be capable of being locked in the isolate position. It is permissible for lasers of classes 1 and 2 to not have local isolation buttons. The colour of the laser isolation button shall not be red.

5.6 Safety against derailment

5.6.1 General

The aim of the following requirements is to provide the same level of confidence for safety against derailment on the working track that is suitable for train operation, as given by the acceptance procedures specified in EN 14363:2016+A2:2022, 6.1. In addition, the operating conditions on the degraded working track are covered by 5.6.3.2.

5.6.2 Safety against derailment for machines with a maximum travelling speed of $v > 60$ km/h

The machine shall comply with EN 14033-1:2017, 8.1. This shall be verified for the first of type machine. The demonstration of conformity of subsequent machines is permitted to exclude this verification if they are confirmed to be the same design as the first of type machine.

NOTE First of type is a machine that does not have a similar configuration of an existing accepted machine.

5.6.3 Safety against derailment for machines with a maximum travelling speed of $v \leq 60$ km/h

5.6.3.1 Known machine types

First of class machines that have:

- a) single axles (including stub axles) and/or
- b) at either end of the machine a freely rotating bogie
 - 1) where wheels are at a maximum of 600 mm diameter and
 - 2) have a wheel base less than or equal to 1 800 mm
- c) and where the bogie/bogie, axle/axle or axle/bogie distance is at a maximum of 10 m

shall be tested for safety against derailment on twisted tracks by $\Delta Q/Q$ tests.

The tests are done in a static test rig to determine the $\Delta Q/Q$ values in the travelling configuration.

Q is defined as the mean wheel load of the axle in the load case where the investigation is done and ΔQ is defined as the maximum wheel unloading due to the test track conditions applied.

For each considered load case:

$$Q = (Q_1 + Q_2) / 2$$

where

- Q_1 is the heaviest wheel load on an axle on level track;
- Q_2 is the lightest wheel load on the same axle on level track.

For each track test condition:

$$\Delta Q = Q - Q_L$$

where

- Q_L is the lightest wheel load on an axle for a track condition.

The track conditions shall be simulated by vertically raising and/or lowering wheels of the static machine as necessary. The loads on all rail wheels shall be monitored simultaneously.

For machines allowed to work on degraded working track the simulated track conditions are:

- for the bogies $g_{+lim} = 10 \text{ ‰}$ if $2a^+ \leq 2,5$;
- for the bogies $g_{+lim} = (20/2a^+ + 2) \text{ ‰}$ if $2a^+ > 2,5$;
- for the frame of the machine $g^*_{lim} = (20/2a^* + 2) \text{ ‰}$;
- cant = 160 mm;
- gradient = 40 ‰.

where

- g_{lim} is the track twist in ‰;
- $2a$ is the longitudinal base in metres.

The maximum values of cant, gradient and track twist shall be simulated simultaneously. Where a maximum permitted cant and/or gradient is stated by the manufacturer and an alarming device warns the driver when this limited cant and/or gradient is exceeded, this may be taken into account to specify the simulated track conditions.

One of the following acceptance criteria shall be fulfilled:

- 1) $\Delta Q/Q$ shall not exceed 50 % (or 60 % for wheels in a bogie) when the machine is placed on simulated track conditions;
- 2) for machines which have a three point suspension when moving along the track, which have a minimum of 25 mm free vertical clearance on each wheel above the maximum required by the combination of conditions shown above, it is permissible for the $\Delta Q/Q$ and ΔQ tests to be proven by calculation rather than actual testing;
- 3) for machines equipped with bogies with rigid frames, typically four independent, primary unsprung wheels in one frame which has no torsional flexibility at all and provided the longitudinal distance between external axles is not larger than 1 500 mm in such a rigid frame. In such frames it is allowed to treat the frame as one axle, i.e. without applying any bogie twist on the frame.

5.6.3.2 Other machine types

For machines not complying with 5.6.3.1, including machines which cannot meet the criteria shown above, safety against derailment for the first of class design in the most adversely loaded condition when moving along the track in both the travelling configuration and the working configuration shall be proven in accordance with EN 14363:2016+A2:2022, 6.1 considering track conditions given in EN 14363:2016+A2:2022, 6.1.5 (normal track). If the machine is required to operate on degraded working track additionally the following apply:

- for the bogies $g_{+lim} = 10 \text{ ‰}$ if $2a^+ \leq 2,86$;
- for the bogies $g_{+lim} = (20/2a^+ + 2) \text{ ‰}$ if $2a^+ > 2,86$;
- for the frame of the machine $g^*_{lim} = (20/2a^* + 2) \text{ ‰}$.

5.6.4 Safety against derailment for machines in working mode with an admissible speed $v \leq 60 \text{ km/h}$

5.6.4.1 Machines with static or symmetrical load

Where the suspension is different in working and travelling modes, the tests set out in 5.6.3.1 shall be repeated in a static test rig to determine the $\Delta Q/Q$ values in the most adversely loaded condition when moving along the track in working configuration. When determining the most adversely loaded condition it is allowed to take devices to control the load position, such as position gauges and angle gauges to control the position of a moveable load, into account. The limit values shall be as shown in 5.6.3.1.

5.6.4.2 Machines with moveable or asymmetrical load

For the load condition with the load moved into the most adverse position, without any outriggers or similar supports applied, the following procedure and acceptance criteria may be applied as an alternative to the method set out in 5.6.3.1:

- 1) position the moving load in the most unfavourable position, taking limitation from the Rated Capacity Limiter (RCL) or similar devices into consideration;
- 2) apply the worst case asymmetric load;
- 3) the safe working load is defined as 67 % of the load that causes any rail wheel unloading to zero;
- 4) Reduce the working load to 67 % of the working load causing zero wheel load.
- 5) if the remaining wheel load is at least 500 kg or 50 % of the wheel load at maximum operating mass (whichever is the least), then the safe working load is 67 % of the working load causing zero wheel load;
- 6) if the remaining load on the wheel is lower than 500 kg or 50 % of the wheel load at maximum operating mass (whichever is the least), continue to reduce the working load until the remaining load is greater than or equal to 500 kg or 50 %. This working load is the permitted safe working load.

When assessing the variation of moveable load the unloading of any wheel due to a reduction in working load or equipment position (causing backward instability) shall not be permitted to be less than 500 kg.

5.6.5 Dynamic tests on track for all machines

After the tests shown in 5.6.3 and 5.6.4 have been successfully undertaken, the first of class of machine shall either have actual dynamic tests on track undertaken in the most adversely loaded condition in travelling modes when moving along the track at its maximum speed, or be verified by calculation. Where the use of the machine has a speed limitation on specific track conditions, this shall be recorded in the documentation, see 8.4, Table 12, line b) and detailed on the identification plate (see Annex E for example). These tests shall be carried out to show:

- a) the suspension is not detrimentally excited by a representative range of track conditions;
- b) the machine does not derail while going through switches, crossings and curves.

NOTE One possible method to prove safety against derailment in switches and crossings for machines with small wheels is given in EN 14363:2016+A2:2022, Annex E.

This shall be verified for the first of type machine. The demonstration of conformity of subsequent machines is permitted to exclude this verification if they are confirmed to be the same design as the first of type machine.

Where the use of the machine has a speed limitation on specific track geometry, this shall be shown as a restriction in the documentation, see 8.4, Table 12, line b) and be displayed on the side of the machine (see Annex E for an example).

In addition, trailers shall be dynamically tested, as shown above, whilst being towed and also being pushed by a self-propelled machine. The test should be repeated with any alternative towing bar/coupling arrangement intended by the manufacturer. Where a trailer has limitation in maximum speed, or total prohibition, whilst being pushed, this shall be clearly marked on the side of the trailer (see Annex E for an example) and shown as a restriction in the documentation – see 8.4, Table 12, line c).

5.6.6 Railhead clearing devices

Self-propelled machines shall be fitted with railhead clearing devices, in front of the leading rail wheels, in either direction of movement of the machine, to brush aside small obstacles from the rail head. The device shall be designed such that it does not increase the risk of derailment of the machine.

NOTE 1 This means the design to avoid risk of derailment includes deformation caused by striking an object.

NOTE 2 A similar requirement for clearing obstacles is given in EN 280-1:2022, 4.3.1.18.

It is permissible for machines which are not self-propelled to have railhead clearing device fitted.

5.7 Stability and prevention of overturning

5.7.1 General

If a machine has a structure that can move and cause wheel load variation, it shall be assessed to ensure that, in the worst case of track condition and component position, any rail wheel does not leave the rail. In considering the stability of a machine, the tests and/or calculations shall be considered with respect to the assembled machine in working mode and not to any individual component or sub-assembly of the machine. Stability shall be provided under all intended operating conditions, as specified in the documentation, see 8.2, Table 10, line a).

Proof of stability shall be by testing and/or calculation as set out below.

Machines that are permitted to be used as cranes or lifting machines shall have a rated capacity indicator / limiter (RCI/RCL) fitted in accordance with 5.7.4. Machines that are permitted to be used as cranes or lifting machines shall have load holding valves for all hydraulic systems which are involved in stabilizing the machine as well as their components during lifting the load and holding the lifted load. Machines that are permitted to dig as well as lift loads shall have an RCI/RCL fitted.

For all machines, calculations and testing for overturning stability and prevention of derailment shall assume that all tanks containing consumable fluids are in their least favourable condition, and all moveable components are in their least favourable position.

5.7.2 Stationary stability

5.7.2.1 Conditions for stationary stability

Stationary in this context means that the machine is working but not moving along the track and the rail wheels are braked. A machine is considered stable if, in the most unfavourable structural position, loading and track conditions, all the wheels remain in contact with the rails, except where the machine operation is specifically designed to lift the wheel(s). The stability of a machine shall not depend on any devices attaching to the rail.

5.7.2.2 Load cases for calculating stationary stability

The calculations shall be made with the machine on the worst case combination of track cant, twist and gradient, as specified in EN 14033-2:2017, Annex F. Where it is intended for the machine to be used on

more favourable track conditions only, these track conditions shall be stated in the documentation, see 8.4, Table 12, line a), and used in the calculations and tests in 5.7. Such limitation shall be displayed on a notice at the operating position.

The calculations shall be made in accordance with:

- EN 280-1:2022 for mobile elevating work platform for machines built to that standard;
- EN 12999:2020 for loader crane for machines built to that standard;
- EN 13000:2010+A1:2014 for crane for machines built to that standard.

Stability for all other machines shall be calculated using the overturning loads given in Table 1. Tests shall be as specified in ISO 4305:2014.

Table 1 — Load cases for calculating stability (machines used for lifting)

Load case	Use of machine	Overturning load	Unloaded side
With stabilizers	On track	$1,25 P + 0,1 F$	> 15 % machine weight
Free on wheels	On track	$1,33 P + 0,1 F$	
Backward stability	On track, no load on hook and loose lifting equipment, including pulley block on ground		
P = Maximum allowed load including lifting tackle in accordance with ISO 4305:2014 ¹² and ISO 4310:2009.			
F = Equivalent mass of jib, lifting ropes and pulley block as set out in ISO 4310:2009. For excavators used for lifting, a boom and dipper shall be taken to mean jib and fly jib.			

5.7.2.3 Rail clamps and stabilizers

Clamps onto the rail are not allowed and thus overturning stability shall be achieved without consideration of any clamping of the machine to the track. The machine shall be designed such that any stabilizers (if part of the design) can be used without coming into contact with the sleepers or rails.

5.7.2.4 Requirement for testing

If the calculated safety factor (ratio of stabilizing moment to overturning moment) is ≥ 2 for all positions of machine on the worst case track conditions, it is not necessary to prove stability by testing. If the safety factor is < 2 , testing shall be carried out in accordance with 5.7.2.5.

5.7.2.5 Proof of stability by test

5.7.2.5.1 General

Except as specified in 5.7.2.4, testing is required. All the possibilities of movement and unfavourable positions of the machine and load, and worst combination of track cant, gradient and twist shall be considered, as specified in EN 14033-2:2017, Annex F. Where the manufacturer intends the use of the machine on more favourable track conditions only, these shall be stated in the documentation, see 8.4, Table 12, line a), and used in the calculations and tests in 5.7. Such limitation shall be displayed on a notice at the operating position.

The machine shall lift an increasing load or pull against a fixed object (for machines where this is permitted), until any one (or possibly two during testing for static stability) of the rail wheels starts to lift from the track. The testing shall be made in accordance with:

- EN 280-1:2022 for mobile elevating work platforms for machines built to that standard;
- EN 12999:2020 for loader cranes for machines built to that standard;
- EN 13000:2010+A1:2014 for mobile cranes for machines built to that standard;
- EN 13001-1:2015 for cranes for machines built to that standard.

All other machines shall either be proof load tested or absolute load tested as shown in 5.7.2.5.2 or 5.7.2.5.3.

5.7.2.5.2 Proof load testing

Machines shall be tested in accordance with ISO 4310:2009, by load testing in accordance with Table 2.

Table 2 — Load cases for testing prevention of overturning

Working mode	Load conditions	Standard	Test load
Proof load with or without stabilizers	Static	ISO 4310:2009	1,25 <i>P</i>
<i>P</i> = Maximum allowed load including lifting accessory in accordance with ISO 4305:2014 and ISO 4310:2009.			

If the test load given in Table 2 cannot be achieved on the worst case track conditions, it is permitted to use more favourable values of track cant and gradient, however, in this case a notice shall be displayed on the machine indicating the maximum cant and gradient on which the machine is permitted to be used. Such limitations that need to be placed on the operation of the machine to ensure safety and stability shall be clearly specified in the documentation, see 8.4, Table 12, line a).

5.7.2.5.3 Absolute load testing

Stability shall be proved by tests. All the possibilities of movement and unfavourable positions of the machine and load, and the worst combination of track cant, twist and gradient shall be considered. The machine shall lift an increasing load or pull against a fixed object until the rail wheels start to lift from the track. The rated load in each position is the lower of 90 % of the load that causes the first rail wheel to leave rail or 75 % of the load that causes the second rail wheel to leave track.

Sufficient tests shall be carried out to develop a rated lift capacity chart taking into account the radius and, when appropriate, the height of the load.

5.7.3 Proof of stability when moving along the track in working mode

5.7.3.1 General

When moving along the track in working mode, a machine used for lifting or having a structure that can move and cause wheel load variation, shall have all rail wheels loaded sufficiently to avoid derailment.

5.7.3.2 Verification of prevention of derailment

5.7.3.2.1 General

In addition to the testing set out in 5.6, a machine shall be subject to an additional verification as specified in either 5.7.3.2.2 or 5.7.3.2.3.

5.7.3.2.2 Machines with only one suspension arrangement when stationary and moving along the track

The safety against derailment in the foreseen working conditions is deemed to be proven when the following conditions are observed simultaneously:

- on a level track without superelevation, the load of the guiding wheel of the machine is $\geq 80\%$ of the normal wheel load;
- the height of the centre of gravity of the machine from the head of the rail is $\leq 2,20$ m;
- the suspension is not blocked out, or the machine has a three-point suspension where at least one of the three support points can turn freely and absorb the twist, or the machine including the wheelsets is flexible enough to absorb the track twist;
- there is no rigid connection between several connected machine parts that would obstruct the turning freedom or the free movement in vertical and cross-wise direction within the freedom of movement necessary for the threshold parameters between the machine parts.

If any of these conditions is not met, the proof of derailment safety shall be achieved by stationary tests according to 5.7.3.3.

5.7.3.2.3 Machines with different axle and suspension arrangement when stationary and moving along the track

For machines which have different axle or suspension configurations when stationary and when moving along the track, the proof of derailment safety shall be achieved by stationary tests taking into account the work modes according to 5.7.3.3.

If the machine has a different axle or suspension configuration when stationary and when moving along the track, it shall not be possible to change from one configuration to the other if this would cause the load moment to reach or exceed 90 % of the rated load for the new configuration.

5.7.3.3 Load cases for prevention of derailment of lifting machines during moving along the track in working mode

For cranes, cranes fixed to the machine, and other types of machines which may have their centre of gravity displaced, wheel unloading shall be proven by stationary tests. With all the possible unfavourable positions of the machine and load, and the worst combination of track cant, gradient and twist, as specified in EN 14033-2:2017, Annex F, no rail wheel shall leave the rail when the maximum load given in Table 3 is applied. Where the manufacturer intends the use of the machine on more favourable track conditions only, these shall be stated in the documentation, see 8.4, Table 12, line a), and used in the calculations and tests. Such limitation shall be displayed on a notice at the operating position.