BS EN 15955-1:2013

BSI Standards Publication

Railway applications — Track — Demountable machines and associated equipment

Part 1: Technical requirements for running and working

raising standards worldwide™

National foreword

This British Standard is the UK implementation of EN 15955-1:2013.

The UK committee draws users' attention to the distinction between normative and informative elements, as defined in Clause 3 of the CEN/CENELEC Internal Regulations, Part 3.

Normative: Requirements conveying criteria to be fulfilled if compliance with the document is to be claimed and from which no deviation is permitted.

Informative: Information intended to assist the understanding or use of the document. Informative annexes do not contain requirements, except as optional requirements, and are not mandatory. For example, a test method may contain requirements, but there is no need to comply with these requirements to claim compliance with the standard.

When rounded values require unit conversion for use in the UK, users are advised to use equivalent values rounded to the nearest whole number. The use of absolute values for converted units should be avoided in these cases. For the values used in this standard:

20 km/h has an equivalent value of 10 mile/h

30 km/h has an equivalent value of 20 mile/h

60 km/h has an equivalent value of 40 mile/h

100 km/h has an equivalent value of 60 mile/h

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 secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2013

ISBN 978 0 580 75071 7

ICS 45.060.20; 45.120

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15955-1

April 2013

ICS 45.060.20; 45.120

English Version

Railway applications - Track - Demountable machines and associated equipment - Part 1: Technical requirements for running and working

Applications ferroviaires - Voie - Machines déraillables et éléments associés - Partie 1 : Prescriptions techniques pour la circulation et le travail

Bahnanwendungen - Oberbau - Ausgleisbare Maschinen und zugehörige Ausstattung - Teil 1: Technische Anforderungen an das Fahren und den Arbeitseinsatz

This European Standard was approved by CEN on 3 August 2012.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 15955-1:2013: E

Contents

Page

Foreword

This document (EN 15955-1:2013) 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 October 2013, and conflicting national standards shall be withdrawn at the latest by October 2013.

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

EN 15955 *Railway applications — Track — Demountable machines and associated equipment* consists of the following parts:

— *Part 1: Technical requirements for running and working* (the present document);

— *Part 2: General safety requirements*.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey 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 European Standard.

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

Demountable machines as specified in 3.1 form the object of this standard.

This standard deals with railway specific risks of the demountable machines defined in Clause 4 when running and working on railway infrastructures.

The safety requirements in relation to the Machinery Directive 2006/42/EC are dealt with in EN 15955-2 of this series of standards.

Deviations or special national conditions are dealt with in Annex A.

The risks 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 European Standard. If necessary, references are made to appropriate standards of this type.

1 Scope

1.1 General

This European Standard specifies the technical requirements to minimise the specific railway hazards of self propelled demountable machines – henceforward referred to as machines – and associated equipment, which can arise during the commissioning, the operation and the maintenance of these machines when carried out in accordance with the specification given by the manufacturer or his authorised representative. These machines are not designed or intended to operate signalling and control systems and are only designed and intended to work and run under special operating conditions specifically designated by the infrastructure manager. Other machines are dealt with in other European Standards; see Annex D.

This part of EN 15955 deals with the technical railway requirements; Part 2 deals with the requirements for the machine to be declared conformant by the manufacturer, except in the case of machines classified in Annex 4 of the Machinery Directive (2006/42/EC) which requires conformity check in conjunction with a notified body.

These demountable machines are not intended to be vehicles as defined in the Interoperability Directive and are not permitted to run on the railway lines open to normal traffic. If this is required, they will need to be authorised or placed into service as set out in the Interoperability Directive 2008/57/EC.

Additional requirements can apply for running on infrastructures with narrow gauge or broad gauge lines, lines of tramways, railways utilising other than adhesion between the rail and rail wheels and underground infrastructures.

This European Standard is also applicable to machines and associated equipment that in working configuration are partly supported on the ballast or the formation.

This European Standard does not apply to the following:

— requirements for quality of the work or performance of the machine;

— specific requirements established by the railway infrastructure operator for the use of machines, which will be the subject of negotiation between the manufacturer and the purchaser;

— separate machines temporarily mounted on demountable machines and associated equipment.

This European Standard does not establish the additional requirements for the following:

— 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. work in tunnels or in cuttings, extreme environmental conditions (below – 20 °C or above + 40 °C), corrosive environments, contaminating environments, strong magnetic fields;

— hazards due to errors in software;

— hazards occurring when used to handle suspended loads which may swing freely.

The intended use of these machines may have operational parameters specified by each infrastructure manager, e.g. the maximum speed allowed for these machines is likely to be limited by the infrastructure manager; compliance with the clauses of this standard does not confer permission for machines to travel at this speed. These machines will not be allowed on a track open to normal railway traffic.

1.2 Validity of this European Standard

This European Standard applies to all machines, which are ordered one year after the publication date by CEN of this standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 286-3, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 3: Steel pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock*

EN 286-4, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 4: Aluminium alloy pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock*

EN 791, *Drill rigs — Safety*

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

EN 13309, *Construction machinery — Electromagnetic compatibility of machines with internal electrical power supply*

EN 13715, *Railway applications — Wheelsets and bogies — Wheels — Tread profile*

EN 14033-1:2011, *Railway applications — Track — Railbound construction and maintenance machines — Part 1: Technical requirements for running*

EN 14033-2:2008+A1:2011, *Railway applications — Track — Railbound construction and maintenance machines — Part 2: Technical requirements for working*

EN 14363:2005, *Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Testing of running behaviour and stationary tests*

EN 14601, *Railway applications — Straight and angled end cocks for brake pipe and main reservoir pipe*

EN 15273-2, *Railway applications — Gauges — Part 2: Rolling stock gauge*

EN 15528, *Railway applications — Line categories for managing the interface between load limits of vehicles and infrastructure*

EN 15954-1:2013, *Railway applications — Track — Trailers and associated equipment — Part 1: Technical requirements for running and working*

EN 15955-2:2013, *Railway applications — Track — Demountable machines and associated equipment — Part 2: General safety requirements*

EN 50121-3-1:2006, *Railway applications — Electromagnetic compatibility — Part 3-1: Rolling stock — Train and complete vehicle*

EN 50121-3-2:2006, *Railway applications — Electromagnetic compatibility — Part 3-2: Rolling stock — Apparatus*

EN 50122-1, *Railway applications — Fixed installations — Electrical safety, earthing and the return circuit — Part 1: Protective provisions against electric shock*

EN 60947 (all parts), *Low-voltage and switchgear and controlgear*

EN ISO 7731, *Ergonomics — Danger signals for public and work areas — Auditory danger signals (ISO 7731)*

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

UIC 541-1, *Brakes — Regulations concerning the design of brake components* [1)]

UIC 577, *Wagon stresses* [1)]

3 Terms and definitions

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

3.1
demountable machine
self propelled machine that can run and work on rail and which is not intended to operate signalling and control systems

Note 1 to entry: Such a machine is designed to get on 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 running on the ground.

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

3.2
road-rail machine
self propelled machine that can run on rails and ground

Note 1 to entry: It is normally a road vehicle adapted for running on rail, but can be a specially designed rail vehicle for running on the ground.

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

3.3
trailer
non-self propelled machine that can be hauled on rail wheels

Note 1 to entry: Trailers are not intended to operate signalling and control systems and are not designed to be transported between work areas on their rail wheels.

Note 2 to entry: This includes attachments with rail wheels.

1) May be purchased from: *Union Internationale de Chemins de fer* (UIC), 14 rue Jean Rey, F-75015 Paris.

3.4
railbound machine
on-track machines
OTM
vehicle specially designed for construction and maintenance of the track and infrastructure, which is used in different modes: working configuration, running configuration as a self-propelling vehicle, running configuration as a hauled vehicle, when:

— it is running on its own rail wheels,

— it is designed to have characteristics necessary for the operation of track based train detection systems

3.5
trolley
equipment for transport along the track of materials, tools and/or various equipment, moving on wheels or runners and operated by human force only, which is designed so that it can be manually placed on or off the track

[SOURCE: EN 14033-1:2011, 3.8, modified]

3.6
portable machine
machine designed or adapted to be worked on the track, transportable by hand with or without trolleys or separate supports for movement on rail(s), and be operated by internal combustion, electrical, mechanical, hydraulic, pneumatic energy sources or from an external supply, but not powered for movement along the track

Note 1 to entry: It is designed so that the machine and/or its separate component parts may be manually placed on or off the track.

3.7
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 at one defined access position and which consists as a minimum of a work platform with controls, an extending structure and a chassis

3.8
host vehicle
basic road vehicle or machine which is converted to run on rails

3.9
manufacturer
body that designs and constructs a demountable machine, or converts the original machine/vehicle to a demountable machine

3.10
running configuration
state of machine when it is on the rail and all movable parts are stowed and secured within the applicable kinematic gauge

Note 1 to entry: For kinematic gauge and acceptable exceedance, see EN 15273-2.

3.11
working configuration
configuration of the machine as soon as any part of the machine or its equipment is away from the running configuration

3.12
on and off tracking configuration
configuration of the machine when it is in a state that enables it to be on or off tracked

3.13
running
moving the machine in running configuration along the track

3.14
stationary
standing on the track with the rail wheels not rotating

3.15
operating track
track which is in an acceptable condition to operate normal trains

3.16
working track
track that is being maintained for which the geometrical parameters may reach the limiting values and for which special operational restrictions may apply

Note 1 to entry: For limiting values, see EN 14033-2:2008+A1:2011, Annex F.

3.17
railway infrastructure
all installations required for the running of railway vehicles

EXAMPLE Tracks, crossings, catenaries, signals.

3.18
operator
person who handles the controls of a machine in order to perform the functions of the machine including towing or controlling a trailer(s)

3.19
driver
person who handles the controls of a machine in order to control the machine in running configuration moving along the track including towing or controlling a trailer(s)

Note 1 to entry: The driver and operator can be the same person.

3.20
train
self-propelled vehicle/machine or assembly of vehicles/machines attached by couplings conforming to the relevant regulations of the authorised body and/or infrastructure manager

3.21
working limit contour
limit in which a machine can work without interfering with the kinematic gauge of trains on adjacent tracks

Note 1 to entry: For the kinematic gauge, see EN 14033-2:2008+A1:2011, Annex D.

3.22
rated load
maximum load that the lifting equipment has been designed for normal operation and the manufacturer states can be lifted in any specified position

3.23
authorised body
body in a state that, in accordance with the laws and prescriptions in force in that state, is competent to approve rail vehicles for the use on the rail network

3.24
type testing
examination of the first machine, of a new type, for build conformity to the requirements of this standard

3.25
type conformity
examination of the conformity of each machine to the all the safety requirements of this standard before delivery of the machine

3.26
type examination certificate
document issued after the checking of documents and/or testing of machines in which the agreement of the use of the machine in the railway infrastructure is confirmed

3.27
type conformance certificate
document which states that the machine conforms to the design of the first machine of the type that has been approved

3.28
railway undertaking
private or public undertaking whose main business is to provide rail transport services for goods and/or passengers

3.29
infrastructure manager
public body or undertaking responsible for establishing and maintaining railway infrastructure as well as for operating the railway control and safety systems

3.30
working authorisation
authorisation given by an infrastructure manager which permits a machine to work on that railway infrastructure

3.31
methods of examination
visual checks, measurements, functional tests, load test(s), specific verification/measurements and other controls

Note 1 to entry: For methods of examination, see Table B.1.

3.32
visual check
check that establishes whether all elements on the machine, system or component, e.g. protective devices, visual warning device, marking, are present and that documents and drawings correspond to the requirements

3.33
measurement test
test that establishes whether the stated measurable parameters have met the requirements of this standard

Note 1 to entry: Measureable parameters include geometric dimensions, safety distances, insulation resistance of electric circuits, noise and vibration.

3.34
functional test
test that establishes whether, in unloaded working condition the machine, including all safety devices, works as intended and all functions comply with the requirements and with the technical documentation

3.35
load test
test that establishes whether the strength and stability of the equipment under load together with all safety devices and adjustments meets the requirements of this standard

3.36
specific verification/measurements
verification/measurements that establish whether the stated requirements of this standard have been met

Note 1 to entry: Requirements include calculations, technical documentation and specific documents of this standard.

4 Machine categorisation

The application of all requirements of this European Standard is not possible in every case because of the differences in the design of machines. The machines are therefore divided into three types as shown in Table 1 and the requirements are worded for the different types of machines, where necessary.

Table 1 — Types of machine

Cannot be incorporated into a train	**Type A**	**Type B**	**Type C**
Self-propelled machine running speed *v* km/h	> 60	30 to 60	< 30

5 Railway specific safety requirements and/or measures

5.1 General

Machines shall comply with the safety requirements and/or protective measures in accordance with Clauses 5 and 6, and supplied with information in accordance with Clause 7. Machines shall be designed to work on working track within the geometric limits, see EN 14033-2:2008+A1:2011, Annex F, and shall be designed to work on operating track.

Machines that can only work on operating tracks shall display in each driving cab and on the identification plate an indication of that restriction.

5.2 Gauge

5.2.1 Running gauge

5.2.1.1 General

Except as shown in 5.2.1.2, machines in running configuration shall meet the dimensional requirements of EN 15273-2. The critical points near the limits of the permissible kinematic gauge, see EN 14033-1:2011, Annex C, shall be recorded in the technical documentation detailed in Clause 7.

5.2.1.2 Special case for restrictive gauges

Machines intended to travel on infrastructures with more restrictive gauges shall conform to the specific rules of those infrastructures and the corresponding restrictions shall be indicated on their operating permits.

5.2.2 Demountable machine in running configuration

5.2.2.1 Stowing of moveable machine parts in running configuration

— When the machine is in the running configuration, any movable equipment which has the capacity to go outside the gauge shall be capable of being stowed in a manner which prevents inadvertent or unintended movement out of the gauge. All such moveable parts and assemblies forming part of the machine that are unpacked in order to allow the machine to work in rail and non-rail configuration shall, in their stowed state, be secured by devices capable of resisting the foreseeable forces encountered during running, which shall not rely upon a power source to retain the locking function. Moveable parts shall be held by efficient locks. The visible positive locking components in running configuration shall be painted in red. If the locking mechanism is powered, the control of locking should preferably be possible from inside the machine gauge.

Or:

— Check valves on hydraulic systems which shall prevent movement and fail safe.

It shall be obvious to anyone checking the machine that these parts of the machine are locked in their stowed position. Furthermore, for locking devices operable from the cab, either a red warning light shall illuminate on the driver's desk to indicate if any moveable part of the machine is not locked or a green light shall indicate on the driver's desk that all moveable parts of the machine are locked.

5.2.2.2 Operating controls in running configuration

When in running configuration, all operating controls not related to running, including locking devices, shall be deactivated automatically.

5.2.3 Working limit

5.2.3.1 Interference of gauge

Machines and their moveable component parts shall be designed and built to work without unintentional interference with the kinematic gauge necessary for the running of machines permitted by the infrastructure manager without running restrictions on the operating track. For the different zones of work and the zone limit between the working track and the adjacent operating track in service, see EN 14033-2:2008+A1:2011, 5.3.

Where the clearance, under worst operating conditions, between the underside of a revolving superstructure and rail level, is less than 1 300 mm this shall be recorded in the instruction handbook together with the actual height above rail level of the underside of the rotating superstructure; see Clause 7, list entry a) 3) ii).

NOTE The clearance of 1 300 mm is required to enable the superstructure to slew over adjacent track side structures, e.g. platforms. Other distances may be required by some infrastructure managers.

Where a machine has powered moveable components capable of exceeding the kinematic gauge, e.g. a MEWP basket (Mobile Elevating Work Platform basket), there shall be a means of direct communication between the operating position on the mobile component and the driving position of the machine.

5.2.3.2 Movement limiting devices

5.2.3.2.1 General

Where operation of the machine exceeds the working limit according to 5.2.3.1, the accidental intrusion into the kinematic gauge of the line open to traffic shall be made impossible by means of lateral and height limiting devices. The limiting devices are to provide protection against exceedance of the gauge shown in 5.2.1.

Operation of movement limiting devices shall be by key switch or equivalent lock. The key switch shall be positioned outside the danger zone.

The movement limiting devices shall be described with indication of their type and their configuration of operation in the instruction handbook; see Clause 7.

5.2.3.2.2 Design of movement limiting devices

5.2.3.2.2.1 General

Movement limiting devices shall permit the height and rotation limit to be variable to suit each location. The movement limiting device shall stop the movement when height and lateral limits are reached, or prevent movement commencing in an unsafe direction if the machine is stopped at its limit. All movement limiting devices shall comply with 5.2.3.2.2.2 or 5.2.3.2.2.3 or 5.2.3.2.2.4, as appropriate.

5.2.3.2.2.2 Mechanical limiting devices

These devices shall be capable of resisting the foreseeable forces encountered.

NOTE This includes resisting static forces (start-up force of the motion) where they are in the form of a lock, and dynamic forces where they are in the form of a stop, e.g. attachment point or latching.

5.2.3.2.2.3 Electric limiting devices

The design shall be such that there shall be no predictable credible single point failure that would cause the system to fail unsafe, i.e. allow the corresponding movement to continue. Any fault, including unacceptable differences in signals, shall cause the system to fail to a safe condition.

Safety switches acting as information-giving components shall fulfil the requirements as specified in the EN 60947 series, or, as an alternative, to these safety switches, sensors or switches may be used under the following conditions, shown in order of preference:

a) using sensors or other types of switch duplicated: they shall either be self-verifying at start-up or shall have continuous monitoring of the signals from the sensors or switches for out-of-range; or

b) using an arrangement of a single sensor or switch, provided there is a permanent monitoring of the plausibility of its signals by means of other sensors or switches not of the same safety device.

5.2.3.2.2.4 Hydraulic limiting devices

Hydraulic limiting devices shall be designed and installed to provide safety levels equivalent to those for electrical safety devices.

Any credible hydraulic fault shall cause the system to fail to a safe condition, i.e. stop the corresponding movement.

Pilot-operated control valves in these devices or systems shall be so designed and installed that they fail to safety, i.e. stop the corresponding movement, in the event of power failure.

5.2.3.2.2.5 Operation of movement limiting devices

When the working demands necessitate an exceedance of the working limit, it shall only be made possible by means of a deliberate manual action, e.g. actuating an additional switch or releasing a lock. When the machine is brought back within its permitted working limit, the design shall be such that the device will need to be operated again to exceed the permitted working limit.

In the case of exceeding the working limit, an acoustic warning and a flashing red light at the driver’s position and working positions shall indicate this dangerous situation.

5.2.3.2.2.6 Lateral limiting devices

This device shall be continuously adjustable or adjustable in steps.

5.2.3.2.2.7 Height limiting device

When required, a height limiting device shall be fitted to prevent any part of the machine going higher than a set limit and the height shall be indicated visually to the operator.

5.2.4 Determination of lateral limit of exceedance allowed on curves in working configuration

If traffic is to be allowed on adjacent track for the calculation of the limiting width in accordance with local conditions, see EN 14033-2:2008+A1:2011, D.4, and shall be recorded in the technical information; see Clause 7.

5.2.5 Limits in lower area in working and running configuration

Machines shall be designed and built so as not to damage or interfere with the fixed infrastructure during work, e.g. axle counters, hot axle box detectors, switch heaters or dragging brake detector and signalling devices.

A machine or its constituent parts shall not be nearer than a specified safety distance from the electrified parts of the conductor rail system given in Table 2.

Table 2 — Minimum safety distance

Voltage V (DC)	**Minimum safety distance between machine parts and the conductor rail** mm
750	75

This distance shall be taken with the worst case wheel wear and suspension condition.

Machines are permitted to move over live conductor rails providing that they meet the requirements of the minimum safety distance given in Table 2.

Machines not meeting these clearances are not permitted to move over live conductor rail and the type examination certificate shall indicate this restriction.

5.2.6 Working limit in the upper area

5.2.6.1 General

All metallic parts of the machine shall be equipotential bonded to rail according to EN 15955-2:2013, 5.16.7.

5.2.6.2 Protection for the operator

All work positions at a height greater than that shown in Annex A (line 9 of table) shall be protected such that it is not possible to make contact with live electric traction equipment.

This requirement shall be achieved by either:

a) the provision of an earthed metallic roof without open holes: where open holes in a metallic roof are necessary they shall be a maximum 25 mm aperture and covered by a conducting structure. It is

permissible for non-conducting material to be used providing that the frame provides an earth path in the event of fallen catenary;

or

b) the machine shall be accepted for use with the restriction that it may only be operated under isolated and earthed catenaries (this means the electrical power switched off and the contact cable connected to ground potential). This restriction shall be written in the instruction handbook, see Clause 7, list entry a) 3) i), and a notice provided on the side of the machine.

A warning notice shall be placed on MEWPs which do not have a roof, which states that use under live overhead wires is prohibited; see EN 50122-1.

All places on the machine which allow access to either platforms or working areas without roofs in accordance with a) above shall be marked with a warning pictogram; see EN 14033-2:2008+A1:2011, Figure G.1.

5.2.6.3 Prevention of machine contact with the catenary

Requirements for prevention of machine contact with the catenary are given in EN 15955-2:2013, 5.16.6.

5.3 Interaction with the infrastructure

5.3.1 General

The wheels, supports and working tools shall not generate harmful stresses in the infrastructure components, e.g. rail, fastenings, sleepers, ballast and formation.

Furthermore, it is required to take into consideration the maximum rail load, the permissible bending of the rail, the transverse forces on the sleeper fastenings, the surface pressure on the ballast as well as the load carrying ability of the formation. The manufacturer shall state the line category according to EN 15528 of the machine and record in the instruction handbook; see Clause 7.

For the parameters of calculations, see EN 14033-2:2008+A1:2011, Annex K.

If the machine contains devices for levelling and/or lining of the track, the maximum stresses generated by these devices in the rail shall be stated in the instruction handbook; see Clause 7.

5.3.2 Main wheels

The wheels referred to in this clause are the wheels used for the running configuration of the machine.

If the configuration of these wheels in working configuration of the machine is different from the running configuration, then the changes shall not cause derailment over the full range of the machine’s operational conditions.

The load from the main wheels in working configuration shall not generate stresses in the rail higher than the values shown in Table 3.

Table 3 — Tensile limit in the rails

Bending stress	Measure points	Ultimate tensile strength of the rail %
a) Maximum permissible tensile bending stress	Centre line of the top of the head and bottom of the foot of the rail	45
	At the corner of the head of the rail	50
	At the foot of the rail	60
b) Maximum permissible compressive bending stress	Head and foot of the rail	65

The values above allow for safety in particular conditions, e.g. track joints, non-standard sleeper spacing, residual stresses in the rails.

5.3.3 Auxiliary wheels, auxiliary guides and working parts

The auxiliary wheels and guides according to this clause are for the support and guidance of assemblies associated with on and off tracking and/or the working configuration of the machine.

The construction and positioning of any auxiliary wheels and/ or guides shall provide satisfactory guidance on rails and shall not cause damage to the rail or any associated part of the railway infrastructure.

The limits a) and b) given in Table 3 shall be followed for any tool associated with the working configuration but may be exceeded when guiding or placing rails. If the rail is subject to other external stresses, for example thermal stress, this shall be taken into consideration.

The limits a) and b) given in Table 3 can be exceeded in machines specifically designed for straightening or bending rails.

Any additional supporting elements necessary to ensure stability or assist the work process shall also comply with the above requirements.

5.3.4 Loads applied to the ballast

Where the surface pressure applied directly to the ballast by any part of the machine exceeds 0,3 MN/m^2, the manufacturer shall state the maximum value in each working configuration in the instruction handbook.

Machines that apply loads to the ballast by means of a tracked device shall have the surface pressure calculated according to the requirements of EN 791.

5.3.5 Loads applied to the formation

Where the surface pressure applied directly to the formation by any part of the machine exceeds 0,1 MN/m^2, the manufacturer shall state the maximum value in each working configuration in the instruction handbook.

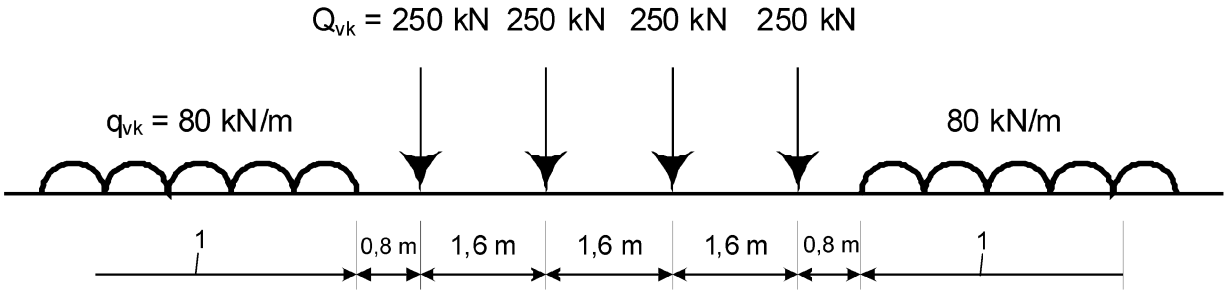
NOTE The value of 0,1 MN/m^2 can be too high for some areas. It is expected that the infrastructure manager will be aware of these areas and specially control machines in these areas.

Machines that apply loads to the formation by means of a tracked device shall have the surface pressure calculated according to the requirements of EN 791.

5.3.6 Forces on structures as a function of axle load configurations

The stresses generated by machines in their various working configurations, in bridges and at the approaches to bridges, should not exceed those resulting from the axle load model given in Figure 1 (relating to point loads only without taking into consideration the cases of distributed loads).

If the loads are in excess of the load model, an analysis shall be carried out for each load configuration. This is particularly necessary for work on bridges or lines having axle load restrictions.



Key

1 no limitation

Figure 1 — Load model

The loading situations to be taken into consideration for each working condition are to be indicated in technical documentation; see Clause 7, list entry b) 6) v).

5.4 Running safety equipment

The infrastructure manager mandates special fixed and/ or portable equipment specific for running safety on their infrastructure. Machines shall be fitted with the equipment detailed in Annex A before access on the specified infrastructure. Where required, the controls for this equipment shall be located in each driving position.

5.5 Running safety and prevention of derailment

5.5.1 General

The aim of the following requirements is to provide the same level of confidence for safety against derailment on the operating track as given by the acceptance procedures defined in EN 14363:2005, 4.1 and Clause 5. In addition, the operating conditions on the working track are covered by 5.5.3.

5.5.2 Running safety for demountable machines running at a speed of 60 km/h < *v* ≤ 100 km/h

First of class machines shall follow the acceptance procedure according to EN 14363:2005:

— 4.1: the most adversely loaded condition when moving along the track in running configuration and where applicable in working condition shall be investigated;

— Clause 5 in running configuration: when using EN 14363:2005, the machine is described as a "special vehicle" due to the low numbers of these machines. In some cases, EN 14363 does not have specific requirements for "special vehicles"; in such cases the machines shall be assigned to a vehicle type most applicable to their design.

The running characteristics of a machine or a machine type are permitted to be determined by running tests or by reference to a similar type approved machine.

A "similar type approved machine" is a machine with similar configuration and running under similar conditions, which can be used as a reference for the test exemption of a new machine, according to the requirements of EN 14363 and the corresponding Table 1, Annex B of EN 14363:2005.

Where machines are designed for use on working track, they shall additionally comply, in the most adversely loaded condition when moving along the track in working configuration, with 5.5.3. Where a machine is not designed for use on working track, the limitation shall be detailed in the instruction handbook; see Clause 7.

5.5.3 Running safety for demountable machines running at a speed of < 60 km/ h

First of class machines that have single axles, or freely rotating bogie (where wheels are a maximum 600 mm diameter and spaced a maximum 1 800 mm apart) at either end of the machine at a maximum of 10 m apart, shall have $\Delta Q/Q$ tests. A static test rig shall be used to determine the $\Delta Q/Q$ values in both the running configuration and the most adversely loaded condition when moving along the track in working configuration. 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. The worst case combination of track conditions permitted by the manufacturer should be simulated. As a minimum these shall be:

— for the frame of the trailer and bogies g_{lim} = 10 ‰ if $2a \leq 2{,}86$;

— for the frame of the trailer and bogies $g_{lim} = (20/2a + 3)$ ‰ if $2a > 2{,}86$;

— for cant = 200 mm;

— for gradient = 40 ‰;

where:

g_{lim} is the track twist in ‰;

$2a$ is the longitudinal base in m.

The vertical load on any rail wheel shall not reduce by more than 50 % (or 60 % for bogie machines) – including wheel load differences between wheels across axle on a flat track – when the machine is placed on simulated track conditions.

For machines which have a three point suspension when moving along the track, which have a minimum of 25 mm free travel on each wheel above the maximum required by the combination of conditions shown above, it is permissible for the $\Delta Q/Q$ tests to be proven by calculation rather than actual testing.

For all other machines, and machines which cannot meet the criteria shown above, proof of safety against derailment for the first of class design in the most adversely loaded condition when moving along the track in both the running configuration and the working configuration shall be proven in accordance with EN 14363:2005, 4.1 considering track conditions given in EN 14363:2005, 4.1.2.2.3 (normal track). If the machine is required to operate on working track, the following also apply:

— for the bogies g_{lim} = 10 ‰ if $2a \leq 2{,}86$;

— for the bogies $g_{lim} = (20/2a^{+} + 3)$ ‰ if $2a > 2{,}86$;

— for the frame of the machine $g_{lim} = (20/2a^{*} + 3)$ ‰.

5.5.4 Track test for all machines

After the tests shown above have been successfully undertaken, the first of class of machine shall have actual track tests undertaken in the most adversely loaded condition in both the running mode and working mode

when moving along the track at its maximum speed. These tests shall be deemed to be successful if on representative track:

a) the suspension is not detrimentally excited by a representative range of track conditions;

b) the machine is able to safely run through switches and crossings;

c) the machine does not derail whilst going through switches, crossings and curves.

5.5.5 Lifeguards

Type A and B machines shall be equipped with lifeguards as described in EN 15955-2:2013, 5.10.2.

5.6 Stability and prevention of overturning

Requirements for prevention of overturning and stability are given in EN 15955-2:2013, 5.11.

5.7 Machine frame and structure

5.7.1 Design of the machine frame

The machine frame of machines shall be constructed to meet the foreseen forces during designed use. Additionally for type A and type B, the following applies:

Type A machines: the machine frame shall be able to withstand the following forces without any permanent deformation; they shall be constructed to meet the requirements of the load cases 6.1 to 6.5 of category F-II of EN 12663-1:2010 with the following deviations:

— 6.5.2, Table 15, vertical load during lifting of the machine frame with the bogie to 20 m/s^2;

— EN 12663-1:2010, Table 13 to read acceleration in the x direction $\pm$ 30 m/s^2; and

— machines are permitted to be constructed to withstand towing and impact forces satisfying the simplified force assumption of UIC 577 and shall withstand a force of 0,8 MN.

Type B machines shall be constructed to meet the requirements of the load cases 4.1 to 4.5 of category P-III of EN 12663-1:2010 with the following deviations:

— 6.5.2, Table 15, vertical load during lifting of the machine frame with the bogie to 20 m/s^2; and

— EN 12663-1:2010, Table 13 to read acceleration in the x direction $\pm$ 30 m/s^2.

5.7.2 Lifting and jacking points

All machines shall either:

a) be fitted with lifting handles to manually lift the machine on and off the track. Where fitted, handles used for handling shall be sufficient for the weight of the machine and allow removal of the machine from the track. Handles for lifting are to be positioned to ensure reasonable sharing of the weight. The weight permitted per person shall not exceed 20 kg or 25 kg for a single person lift. If more than one person is recommended for putting the machine on or off the track, the number of people necessary shall be indicated on the machine; or

b) be capable of lifting themselves onto and off the track; or

c) be fitted with lifting and jacking points to facilitate on and off tracking, by which the whole machine is capable of being safely lifted or jacked. The load cases specified in EN 12663-1:2010, 6.3.2 shall apply for lifting and jacking under workshop and servicing operations.

Each lifting point complying with c) shall be clearly marked by the appropriate symbol, chosen from those shown in Figure 2, adjacent to each lifting/jacking point.

Dimensions in millimetres

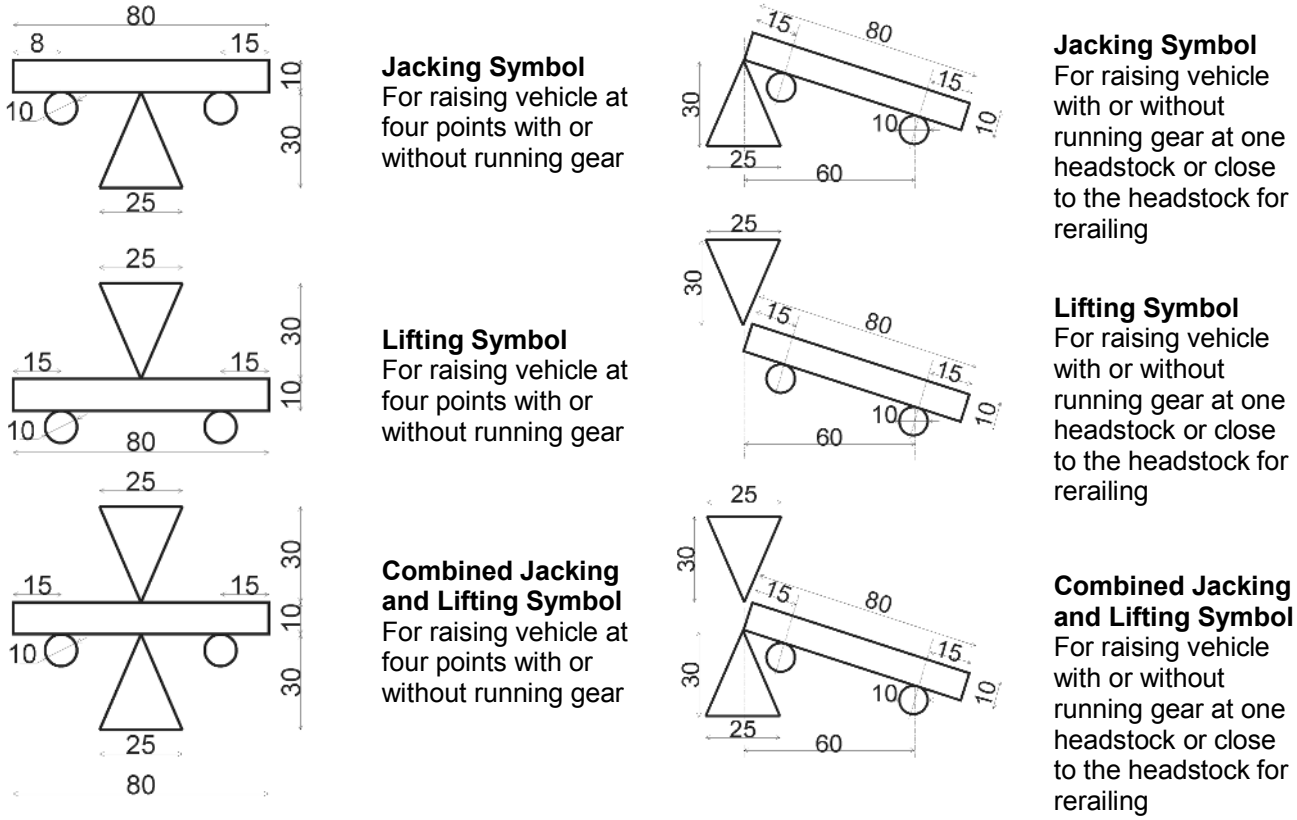


Figure 2 — Symbols to be used to indicate lifting and jacking points

The size of the label is permitted to be reduced to suit the space where it is located.

The location (and any restrictions of use) of the lifting and jacking points where fitted shall be detailed in the user information; see Clause 7.

5.8 Inter machine couplings

The detailed design of coupling systems on machines and their associated trailers shall be capable of withstanding, without permanent deformation, loads that will be encountered in service. Any limitations on machine movement, arising from the use of the coupling system, shall be identified and listed on the type approval documentation.

Machines that are intended to be coupled together in normal operation shall have coupling systems which are mechanically compatible and compliant with the following:

— The coupling system shall be designed to transmit, safely and without suffering damage, all the forces that arise between machines during their normal operation, including those due to traction, buffing, curving, braking, working, coupling and uncoupling.

— The coupling system, with the exception of buffers (if fitted), shall engage positively with the coupling system of any rail machine/vehicle (including trailers) to which it is intended to couple.

— Coupling and uncoupling shall be possible on the range of track features defined for the particular machines.

— The coupling and uncoupling shall either be possible without assistance by personnel, or the mechanism necessary for coupling and uncoupling shall be suitable for manhandling, see 5.7.2, list entry a), and be possible to operate in a safe manner.

— The coupling system, with the exception of buffers (if fitted), shall remain positively engaged during all normal operations of the machines over the track features that they are required to negotiate.

— Any system that controls the operation of the coupling/uncoupling shall be protected from reasonably foreseeable interference that could result in the system's inadvertent operation.

— It shall be possible to determine that the coupling systems are positively engaged. It shall be permissible to achieve this directly or by another suitable system of indication.

If the coupling system carries the connections that provide the continuous element of the automatic braking system, these shall be in accordance with EN 14601.

The preferred coupling systems are detailed in EN 15954-1:2013, Annex A.

5.9 Running gear

5.9.1 General

The running gear structures shall be designed to ensure that no significant permanent deformation or fatigue fracture occurs under all intended load cases.

The supplier shall either:

a) verify that the stress levels in each component of the running gear are acceptable and that due account has been taken of the dynamic stresses produced by running and working on the rails; or

b) provide evidence of the stress levels in the running gear demonstrating via the safety record of machines having a comparable design and loading, that the stress levels in the running gear are acceptable.

5.9.2 Distribution of the wheelset forces in running configuration

The weight of the machine in running configuration, including attachments intended to be used, should be as evenly distributed among the wheelsets of the rail wheels as possible.

5.9.3 Machine rail wheel base

The machine wheelsets and bogie centres shall be positioned to ensure dynamic stability, as verified in 5.5, at the range of speeds the machine is permitted to run.

Experience has shown that for machines with a permitted maximum speed ≤ 20 km/h, the rail wheel base should not be shorter than the track gauge. For machines with a permitted speed 20 km/h to 30 km/h, the rail wheelbase should be ≥ 4 000 mm. For machines with a permitted maximum speed > 30 km/h the rail wheelbase should be ≥ 4 500 mm. The designs, which utilise bogies or a bogie and a wheelset, normally do not need to follow the recommendation for the 4 000 mm spacing.

5.9.4 Rail wheel, wheel profile

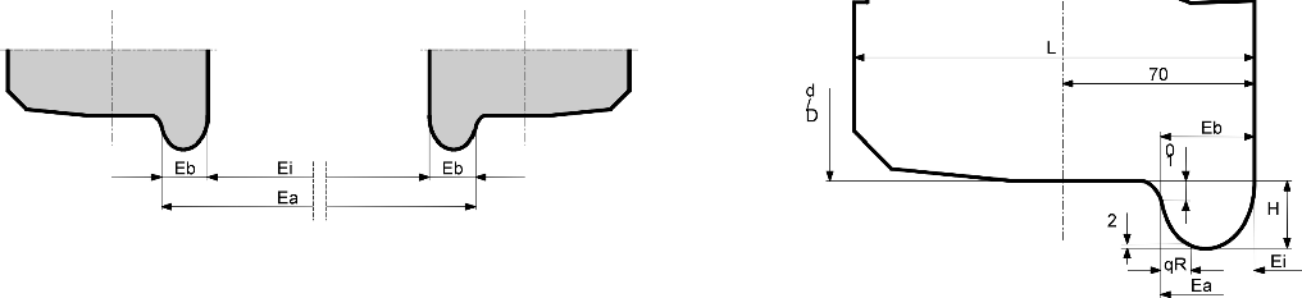
The significant dimensions of the wheel profile, applicable to all permissible wheel sizes, are given in Table 4 and shown in Figure 3.

Table 4 — Wheel profile dimensions

Dimensions in millimetres

		Manufacturing/Reprofiled	In Service
Profile		see EN 13715	
Difference in diameters of wheels on one wheelset		≤ 0,5	
QR		see EN 13715	> 6,5
Wheel width	*L*	maximum 150	
Flange height	*H*	see EN 13715	≤ 36
Flange thickness	*Eb*	see EN 13715	> 22 for *D* = 1 000 to *d* = 840 > 27,5 for *D* = 840 to *d* =330
Between active faces	*Ea*	see EN 13715	
Back to back measurement	*Ei*	1 361 ± 2	1 360 ± 3
D = nominal diameter *d* = minimum worn diameter			

Dimensions in millimetres



Key

D nominal diameter
d minimum diameter specified by manufacturer
Ea distance between active faces
Eb flange thickness
Ei back to back measurement

Figure 3 — Details of wheel profiles

The back-to-back wheel distance *Ei* of the rail wheels shall be measured at bottom of wheel at three points around the diameter of the wheel, with the machine in maximum loaded and unloaded condition standing on the track. All values shall be within the dimensions given in Table 4. The manufacturer should detail the method of taking these measurements in the maintenance documentation.

The wheel profile shall comply with the requirements of EN 13715 or another profile if satisfactory riding as required in 5.5 can be achieved.

5.9.5 Rail wheel arrangements

The rail wheels shall be mounted in such a way as to give the machine safe rail guidance.

This shall be achieved by any one of the following:

a) single rail wheels with 330 mm minimum diameter;

b) single rail wheels with diameters less than 330 mm provided that the ability to safely negotiate switches and crossings is demonstrated for the permitted operational speed range of the machine, wheels less than 330 mm may be prohibited by certain infrastructure managers;

c) design incorporating two bogies, classified as a bogie design;

d) design incorporating a bogie at one end and a single axle at the other end.

NOTE Other minimum wheel diameters than those set out above could be required by some infrastructure managers.

5.9.6 Load on rail wheels

The maximum static load per wheel in the working and running condition is given in Table 5.

Table 5 — Load on rail wheels

	Running configuration Load per rail wheel	**Working configuration Load per rail wheel**			
Wheel diameter		**No load control**		**With load control**	
d	**Static**	**Rail with σ_B = 880 N/mm^2 [a]**	**Rail with σ_B = 680 N/mm^2 [b]**	**Rail with σ_B = 880 N/mm^2 [a]**	**Rail with σ_B = 680 N/mm^2 [b]**
mm	t	t	t	t	t
∅ ≥ 920	11,25	24,8	14,8	31,6	18,9
920 > ∅ ≥ 840	11,25	22,6	13,5	28,8	17,3
840 > ∅ ≥ 760	10,0	20,5	12,2	26,1	15,6
760 > ∅ ≥ 680	9,25	18,3	10,9	23,3	14,0
680 > ∅ ≥ 630	8,5	17,0	10,1	21,6	13,0
630 > ∅ ≥ 550	7,25	14,8	8,8	18,9	11,3
550 > ∅ ≥ 470	6,25	12,7	7,6	16,1	9,7
470 > ∅ ≥ 390	5,25	10,5	6,3	13,4	8,0
390 > ∅ ≥ 330	4, 5	8,9	5,3	11,3	6,8
330 > ∅ ≥ 270	3,5	7,3	4,3	9,3	5,6
270 > ∅ ≥ 210	1,5	5,7	3,4	7,2	4,3
210 > ∅ ≥ 130	1,0	3,5	2,1	4,5	2,7

d = worn rail wheel diameter limit (mm)

σ_B = minimum resistance of the rail to tensile failure (N/mm^2)

[a] corresponds to rails, e.g. 60E1 (UIC 60), 54E1 (S54) (880 N/mm^2)

[b] corresponds to rails, e.g. 49E1 (S49) (680 N/mm^2)

5.9.7 Load on rail wheels in working condition — Maximum rail wheel loads

5.9.7.1 Machines without rail wheel load control devices

In working configuration, the maximum wheel loads (Q_{max}) of the rail wheels or auxiliary wheels in relation to the diameter of the rail wheel and the rail material are to be fixed by the following formula:

$$Q_{max} = 8{,}257 \times 10^{-7} \times \frac{d}{2}\left(\frac{\sigma_B}{\nu_{head}}\right)^2 \text{[kN]} \quad (1)$$

where

ν_{head} is 1,1;

d is the worn rail wheel diameter limit (mm);

σ_B is the minimum resistance to tensile failure (N/mm^2).

The calculation of the vertical loads applied to the rail wheels shall take into account all the factors that can produce variations, e.g:

— due to the machine:

  — eccentricity of the centre of gravity;

  — hysteresis of the suspension;

  — eccentric load;

  — application of an eccentric force.

— due to the track:

  — maximum cant;

  — maximum twist.

The maximum loads as a function of rail wheel diameter are given in Table 5, Columns 3, 4, 5 and 6.

If, in working configuration, the maximum static rail wheel load exceeds the limit values for rails with σ = 680 N/mm^2, it shall be stated in the instruction handbook; see Clause 7.

5.9.7.2 Machines with rail wheel load control devices

Where the loads of rail wheels are controlled in different work configurations by means of a device, e.g. device for limiting of overturning moment, then the wheel loads shall be calculated using the following formula:

$$Q_{max} = 10{,}52 \times 10^{-7} \times \frac{d}{2}\left(\frac{\sigma_B}{\nu_{head}}\right)^2 \text{[kN]} \quad (2)$$

where

ν_{head} is 1,1;

d is the worn rail wheel diameter limit (mm);

σ_B is the minimum resistance to tensile failure (N/mm^2).

Reductions of the maximum load shall be applied when the working conditions are imprecise or difficult to determine, such as:

— lifting of the load from underneath;

— swinging movements of the load;

— indeterminate load caused by ground forces;

— overload due to unequal distribution of the load within the lifting tackle;

— oblique lifting of the load;

— the load swinging to an unacceptable height.

The maximum loads, as a function of rail wheel diameter, calculated for the following types of rail, are given in Table 5, columns 3, 4, 5 and 6.

If, in working configuration, the maximum static rail wheel load exceeds the limit values for rails with σ_B = 680 N/mm^2 it shall be stated in the instruction handbook; see Clause 7.

5.9.8 Operation of spring loaded points

Where the axle load is less than 5 t (wheel load of 2,5 t), the machine cannot be expected to operate spring loaded points, etc. These limitations shall be specified in the instruction handbook; see Clause 7.

5.10 Rail wheel suspension

5.10.1 Rail wheel suspension systems

The rail wheels shall be suitably loaded to provide good rail guidance at all times. This may be achieved by positively locking the wheels down or by an active suspension system.

5.10.2 Active suspension

The active suspension system shall be designed such that, following a sudden loss in pressure of the active medium, the machine can be brought to rest safely, without leaving the rails, when running at all speeds on the maximum track twist defined in EN 14033-2:2008+A1:2011, Annex F. The system shall incorporate an emergency stop that may be initiated by the operator, following an alarm indication being given, or automatically.

Where an active suspension system is used, the support forces on the front and rear wheelsets of the rail equipment shall be continually displayed and visible to the operator during movement along the track. A decrease in support force of 10 % shall trigger an audible and visible warning; see EN 15955-2:2013, Table 4.

If the hydraulic pressure that maintains the support force on the rail wheels is monitored by means of an electronic apparatus, that is, if compensation is made automatically in case of a drop in pressure, the requirement for continual display can be eliminated. However, provision shall be made for easy connection of the necessary measuring equipment to check the monitoring system.

5.10.3 Positively locked suspension

Rail wheels shall be positively locked down in both the running and working configurations as required. This may be achieved by mechanical, hydraulic or pneumatic locks or by an over-centre arrangement or similar. The locked state shall be maintained in the event of failure of the operating system. There shall be an indication to the operator of the correct functioning of the system.

5.10.4 All suspension systems

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

5.11 Braking

5.11.1 General braking requirements

Requirements for braking system are as given in EN 15955-2:2013, 5.24.

Additionally to the operating and parking brake requirements given in EN 15955-2:2013, 5.24.1 and 5.24.2, some infrastructure managers, see Annex A, may permit higher unbraked trailing loads at lower values of gradient. In this case, the manufacturer should produce a matrix to be presented in the instruction handbook detailing the total unbraked trailing load permitted on a particular gradient. In all cases the parking brake should hold the machine and specified trailing load using the coefficients of friction quoted in EN 15955-2:2013, 5.24.2.

5.11.2 Specific requirements for continuous air brake system

Where the continuous service brake is designed to be a through air brake compatible with conventional railway vehicles, the requirements of this clause apply.

Compressor capacity and air storage shall be dimensioned so that the release time for 12 axles of a completely empty air system of the wagons does not exceed 4 min. The air production capacity shall match the intended number of trailed axles as given in Table 6. These values given should be considered as minimum values.

Table 6 — Minimum values for train braking equipment

	12 axles	**24 axles**	**40 axles**	**52 axles**
Compressor capacity at 7,2 bar (l/min)	200	300	540	540
Air storage (l)	80	170	240	360
Reservoir pressure (bar)	8,0	8,0	8,0	10,0
Main air hose internal diameter (inches)	¾	¾	¾	1

The basic equipment of the train brake system consists of the following components:

— air compressor conforming to the through air train brakes, given in Table 6;

— pressure regulator for compressor conforming to the required reservoir pressure, given in Table 6;

— non return valve between compressor and storage tank blocking flow to compressor; alternatively pressure regulator with integrated non return valve;

— safety valve conforming to the reservoir pressure; alternatively pressure regulator with integrated safety valve;

— air tank according to EN 286-3 or EN 286-4 with total capacity, given in Table 6;

— manual condensing drain valve or single chamber air dryer;

— air filter with condensing drain;

— non return valve between air tank and pressure reduction valve blocking flow toward air tank;

— pressure reduction valve to reduce reservoir pressure to brake pipe pressure of 5 bar;

— pressure gauges for main brake pipe pressure and main reservoir pressure, with a diameter of 80 mm or digital displays of "class 1" quality;

— emergency brake valve which vents the main airline directly and completely and also acting on the machine;

— brake hoses in accordance with EN 14601;

— cut-off valve for depressurising the prescribed main line diameter in accordance with EN 14601;

— brake connector head in accordance with EN 14601;

— brake connector holder for holding uncoupled connector heads.

Generally, seamless steel pipes in accordance with UIC 541-1 shall be used for air lines. Hose connections shall only be used where an elastic element is unavoidable.

The dimensions of the brake hose connections and their mountings on the machine are as defined in EN 14601.

The main airline of the train braking system shall have no cut-off valves other than those located at the ends of the machine. The cut-off valves shall allow the full flow of the main air line, have locked end positions and a self venting system for the hoses.

Labels at suitable locations shall identify all braking equipment.

The air tanks shall be installed in machines in such a way that the tank labels are readily legible. The tank labels shall not be painted over.

For the air brake system there shall be a driver's brake controller and an emergency control accessible to the driver and/or operator and emergency brake control at each personnel position.

If the emergency brake air line diameter required for direct and complete evacuation of the main air line (¾ ") cannot be brought up to the emergency brake control for structural reasons, e.g. slew drive on excavator equipment, the emergency brake valve shall be installed between the cut-off valve and the slew drive, etc. and be operated by means of a fail safe solenoid valve.

5.12 Driving and working cabs and places

Type A and B machines shall have at least one cab with a minimum of two firmly installed seats.

Type C machines are permitted to have no cab and only one seat.

Cabs and work places, shall also comply with EN 15955-2:2013, 5.2 to 5.9.

5.13 Controls

In addition to the requirements for controls given in EN 15955-2:2013, 5.14 for type A and B machines, there shall be fitted a means of data recording, as a minimum time and speed.

NOTE A tachograph fulfils this requirement.

5.14 Visibility and audibility of the machine

5.14.1 Lighting in running configuration – Marker lights

Machines, when in running configuration, shall, as a minimum, be fitted with two white marker lights. Where the design of machine permits, there shall be three white marker lights fitted in a triangular formation with two lights at a lower level than the top light at each end. In addition, there shall be two red tail lights at each end. The machine shall always display the white marker lights in the direction of travel and two red lights at the opposite end. It shall not be possible to display both red and white lights at one end of the machine at the same time. The marker lights shall have a changeover device to allow a changeover from white to red light.

The light intensity shall conform to the values given in Table 7.

Table 7 — Light intensity

Operating configuration	Upper marker light where fitted (white)	Lower marker lights (white)	Lower marker lights (red)
Operating configuration marker light			
- on the centre line	from 150 cd to 350 cd	from 300 cd to 700 cd	> 15 cd
- at 45° angle	from 20 cd to 40 cd	from 20 cd to 80 cd	> 15 cd
Operating configuration head light			
- on the centre line		from 12 000 cd to 18 000 0 cd	
- at 45° angle		< 400 cd	

5.14.2 Light switching arrangements

The changeover devices for the marker lights shall either be automatic corresponding to the direction selected or shall be manually controlled with switch placed on each driver's panel. It shall be possible to manually switch to display two red lights at both ends for use when stabled.

The marker lights in their various configurations of operation and any fitted working lights shall be separately controlled and the controls shall be clearly identified.

The working lights shall have the ability to be switched off when running.

Any additional warning equipment required for specific infrastructures shall be controlled separately from the previously defined marker lights.

5.14.3 Tail lamps

Where machines are fitted with fixed electric tail lamps, the centre line of the tail lamp shall be less than 1 800 mm above rail level.

5.14.4 Power capacity

The marker and tail light system shall be capable of operation even with failed engine and independent of the ignition switch for a minimum of 2 h.

5.14.5 Lamp brackets

All machines shall be equipped with lamp brackets at each end.

The tail lamp bracket shall have a fixing slot, as shown in Figure 4.

At the machine ends, the tail lamp brackets shall be arranged in such a way that:

— they are placed, wherever possible, between the buffers and the corners of the machines;

— they are spaced more than 1 300 mm apart;

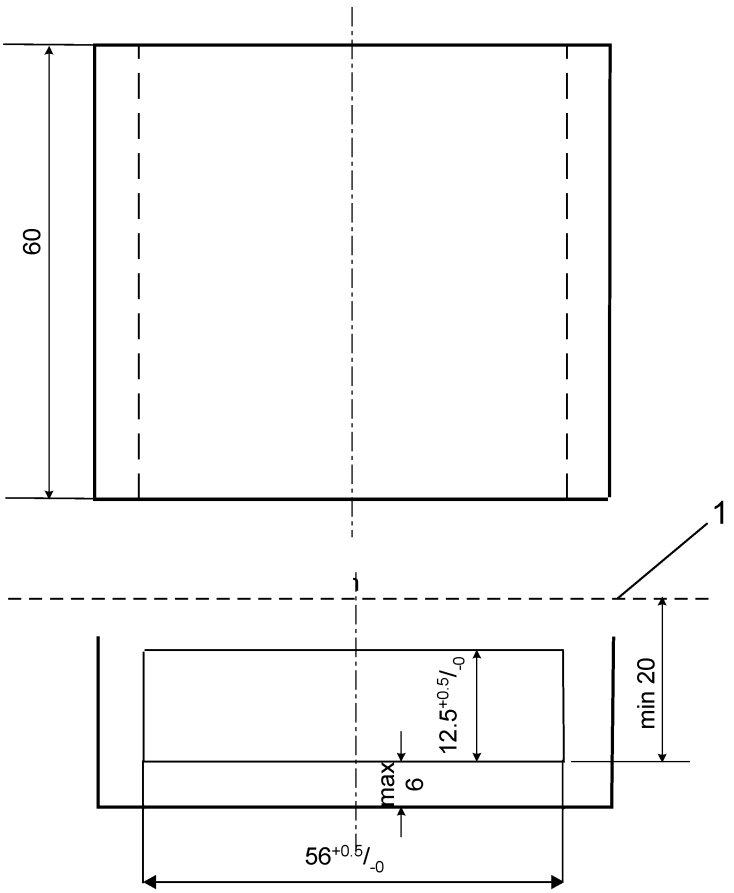
— the main centre line of the slot is perpendicular to the main centre line of the machine;

— the upper side of the tail lamp bracket is less than 1 600 mm above rail level;

— the overall gauge of the tail lamp shown in Figure 5, is complied with.

The tail lamp brackets shall be located in such a position that the lamp, when fitted, is not obscured and is easily accessible.

Dimensions in millimetres

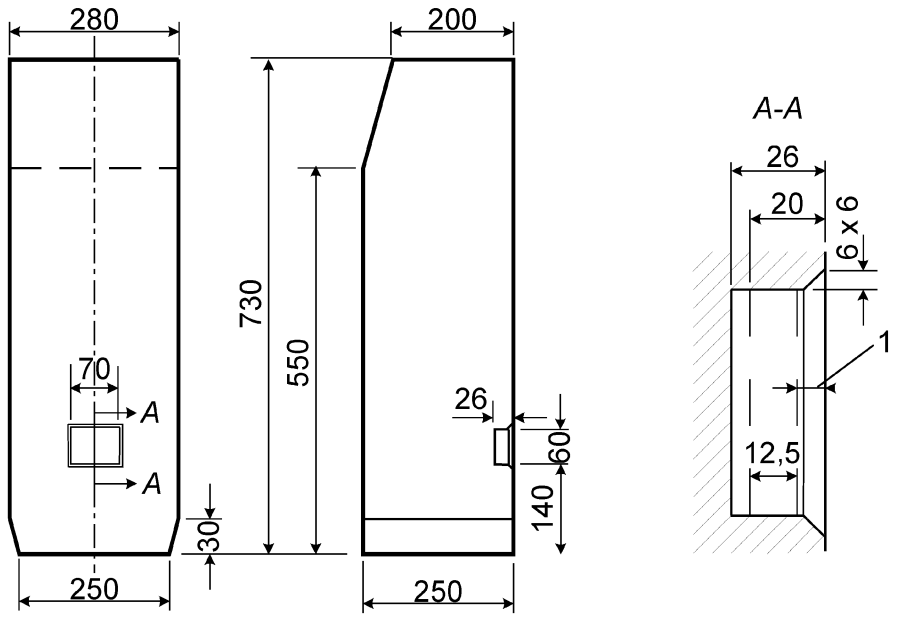


Key

1 external plane of machine wall

Figure 4 — Tail signal lamp brackets

Dimensions in millimetres



Key

1 signal lamp bracket slot

Figure 5 — Space envelope required for tail signal lamp

5.14.6 Head lights

Machines, when in running configuration, shall be fitted with a headlight of sufficient strength to assist the operator in seeing a sufficient distance to enable the machine to be stopped before an obstruction. It shall not be possible for lighting to be confused with railway signals or to blind the drivers of machines/vehicles on adjacent tracks. With the exception of dipped headlights and tail lights (which may be used to meet the above requirement), all road lighting including flashing beacons, shall be isolated against use when the machine is operated on rail. The light intensity shall conform to the values given in Table 7.

Special national conditions, see Annex A, may amend this requirement.

5.14.7 Lighting in working configuration

Machines, when in working configuration, shall display two white marker lights in the forward direction of travel and two red marker lights to the rear. Special national conditions as given in Annex A could amend this requirement.

5.14.8 Horns in running configuration

Machines shall be fitted with warning horns to warn persons of machine movement. In running configuration, the warning horn shall provide an all round audibility of at least 10 dB(A) greater than the noise produced by the machine, when measured at a distance of 1 m from any point around the periphery of the machine and shall be in any case in excess of 80 dB(A).

5.14.9 Colour of the machine

5.14.9.1 General

Machines that do not have rotating superstructures shall have yellow ends.

All machines that have rotating superstructures shall have a predominantly yellow surface finish.

The colour shall be yellow as specified by any of the following paint colours:

— RAL 1003, RAL 1004, RAL 1018, RAL 1021, or RAL 1023 from the RAL Classic Colour Collection;

— NCS (Natural colour system) target value 1080-Y 10-R or 1475-Y 11R;

— EC 222.69.79 in the Eurocolour table.

Conformance shall be assessed by confirmation that the particular colour has been applied using the manufacturer's specification and applied using the manufacturers approved process only.

Where vinyl and gel coats are used to achieve yellow colour, the colour shall be a reasonable match to the yellow colours listed above. Conformance shall be assessed by visual comparison only.

5.14.9.2 Specific component colours

The components locking the working devices in running configuration, and areas around earthing points and grease nipples shall be painted in red.

5.15 Warning systems for personnel of traffic on adjacent lines in working configuration

5.15.1 General

If required by the intended use, optical and/or acoustic warning devices to warn site workers and the operator of traffic on adjacent lines shall be provided.

The warning devices shall be actuated from at least one place on the machine or by remote control.

If such systems are to be installed they shall be according to 5.15.2 and/or 5.15.3.

NOTE Such warning devices are required by specific railway infrastructures; see Annex A.

5.15.2 Acoustic warning systems

The noise pressure level of acoustic warning devices shall be at least 3 dB(A) higher than the maximum AS-weighted sound pressure level, as set out in EN 15955-2:2013, Annex C, at each working position and everywhere outside the cab at a distance of 1 m around the machine, at a height of 1,7 m above rail level.

The audibility of the warning devices shall be guaranteed when the machine is working.

Electronic warning devices shall be as specified in EN ISO 7731.

5.15.3 Optical warning devices

Optical warning devices shall be installed on both sides of the machine on the outside at each working position and at each access point, e.g. at the exits of working or driving cabs, at operating positions, at climbing points and supervisory points.

The maximum spacing distance along the side of the machine between two warning devices shall not exceed 10 m.

5.15.4 Platform to set up a warning unit

Machines with moveable component parts that are able to interfere with the kinematic gauge shall have a platform to set up a mobile wireless warning unit on the site for warning of personnel of traffic on adjacent lines. The dimensions of the platform shall be a minimum of 400 mm x 300 mm.

To avoid sound insulation of the warning unit, the platform shall have four open sides and shall not be covered above.

To fasten the warning unit, the platform shall have four lash points and an edge with the height of 30 mm on all sides.

5.16 Electrical equipment and earth bonding

5.16.1 Equipotential bonding

Equipotential bonding shall be in accordance with EN 15955-2:2013, 5.16.7.

5.16.2 Antennae

The installation of antennae shall be in accordance with EN 15955-2:2013, 5.16.8.

5.16.3 Pantograph

5.16.3.1 General

Pantographs are permitted to be fitted to machines to:

a) provide a temporary equipotential bond between the contact wire and the rail; or

b) measure the position of the contact wire.

The stowed position of the pantograph shall not foul the gauge shown in 5.2.

5.16.3.2 Requirements for pantograph for temporary equipotential bond

The pantograph shall provide sufficient upward vertical pressure when stationary and during movement along the track to ensure permanent electric connection, without deformation of the current-collector bow.

The pantograph contact strip shall not damage the contact wire.

An aiding device shall be provided to assist the descent of the pantograph if there is a functional problem.

The electric connection to the rail shall be made through the wheels of the machine.

NOTE Infrastructure managers could have additional technical requirements to suit their particular catenary systems or not permit their use at all.

5.16.3.3 Requirements for pantograph for measurement

The pantograph shall not damage the contact wire or any other component of the catenary.

The pantograph shall be electrically insulated from the rest of the machine suitable for the catenary system intended for use.

5.17 Electromagnetic compatibility

5.17.1 Emissions from demountable machines

Except where a host vehicle is already stated to be compliant with 2004/104/EC European Automotive EMC Directive, machines shall meet the requirements of EN 13309 or EN 50121-3-1:2006, Clause 6.

Any electrical component that is added to a machine that has already been tested, and certificate of emissions provided, shall either be assessed as an additional component for its potential to affect railway signals, or the whole machine shall be reassessed.

5.17.2 Immunity of demountable machines from railway environment

Manufacturers shall assess the component parts of machine for their susceptibility and result for immunity to electro-magnetic induced currents. Each electrical or electronic circuit box shall be assessed for the effect they would have if the currents were induced. Any electrical or electronic circuit which the manufacturer considers is vulnerable to EMC shall comply with the requirements according to EN 50121-3-2:2006, Clause 8, Table 7, Table 8 and Table 9 or equivalent.

5.18 Power supply

The machine is permitted to be powered by internal combustion engines through mechanical, hydraulic, and electrical drives. It is also permitted for electrical drives to be supplied by batteries.

NOTE Some infrastructure managers may restrict the use in tunnels of machines powered by internal combustion.

5.19 Failure recovery

5.19.1 General

There shall be adequate facilities to enable the machine to be moved should a failure occur.

5.19.2 Towing devices

If the machine cannot be manually lifted from the track, the following shall be provided:

a) method of retracting and locking items to within running gauge;

b) towing connections at both ends;

c) where a machine does not have standard drawhook and buffers, the machine shall be supplied with a rigid tow bar (capable of being attached to a standard draw hook) with facilities for carrying it on the machine;

d) safe procedure for towing at a maximum speed defined by manufacturer.

Consideration should be given to the possibility of the machine being in an unbraked position during the recovery, and during the setting into the recovery position. Because this is an emergency condition, it is permissible for the machine to be unbraked, but only if this has been highlighted and the recovery procedure mitigates this.

5.19.3 Emergency device

Devices which are required in the case of emergency shall be kept on the machine as part of the machine tool kit. Restrictions of use, which may be applicable when such devices are used, shall be detailed in the instruction handbook; see Clause 7, list entry a) 3).

5.20 On and off tracking

5.20.1 General

It shall be possible for any equipment used for on and off tracking to be positively locked in the stowed position when the machine is running on rail.

The system used to place the machine on the track or remove it from the track shall be assessed to ensure:

a) that it will not damage the railway infrastructure;

b) that the machine is inherently safe. In particular, there shall be provision, at all times during the on and off tracking operation, for preventing inadvertent movement of the machine.

5.20.2 Use of turntables

If fitted, the turntable arrangement shall be suitable either for cants of up to 200 mm and gradients up to 40 ‰, or the maximum cant and gradient at which it is safe to be used shall be suitably displayed on the machine and recorded as a limitation in the instruction handbook; see Clause 7.

The turntable arrangement shall be designed to:

a) be stable to prevent inadvertent movement;

b) not damage the railway infrastructure;

c) preferably positively locate on the rails;

d) not act upon the sleepers.

5.21 Setting up and packing away

5.21.1 General

Where applicable, the manufacturer shall consider the need to unpack and pack the machine, i.e. change between running and working configuration, whilst staff remain in a position of safety. Due to the use of these machines in a railway environment, the manufacturer shall consider the risks of the packing and unpacking against the possibility for other train movements. This shall be achieved by being able to perform this function from:

a) inside the cab/machine; or

b) outside the machine from either side provided the necessary conditions to ensure personal safety are stated in the type approval documentation.

5.21.2 Emergency recovery of equipment

It shall be possible to achieve running configuration even with failure of the main power source. If this requires more than 0,5 kW then an auxiliary power source for this use shall be provided.

5.22 Mobile elevating work platform (MEWP)

MEWPs shall comply with EN 15955-2:2013, 6.4.

5.23 General and railway specific attachments

5.23.1 General

Where a machine is designed for attachments to be fitted, a note shall be made in the instruction handbook, as shown in Clause 7, list entry a) 2), to reset the movement limiting devices according to 5.2.3.2.2.1.

5.23.2 General attachments for raising and lowering personnel

Attachments or adaptations for raising and lowering personnel shall be treated as MEWPs and shall be in accordance with 5.22.

5.23.3 Railway specific attachments with rail guidance wheels

Attachments with more than two rail guidance wheels that can be separated completely from the machine shall be treated as trailers and comply with EN 15954-1:2013 and EN 15954-2:2013.

5.24 Exhaust

Exhaust gases shall be directed clear of the zone of air supplies of cabs and clear of the catenary and the work areas. For machines which have no raised working positions, the exhaust outlet shall be directed towards the top of the machine.

Machines shall be equipped to minimise the emissions of internal combustion engines.

NOTE Limits for exhaust emissions are set out in Directive 97/68/EC, amended by Directive 2004/26/EC.

6 Marking and numbering of the machine

6.1 Warning signs and pictograms

For details of warning signs and pictograms, see EN 15955-2:2013, 8.3 with the addition of the following railway specific signs.

— Appropriate warning signs shall be fixed on the machines indicating dangerous zones, which are not protected by other safety measures including hazards generated by work carried out next to a track open to traffic.

— Where required by 5.2.6.2, list entry b), the machine shall be marked "Not for use under live overhead wires".

6.2 Identification plate

Machines shall carry on each machine side an identification plate meeting the requirements of Annex C of this standard. The plate shall be coloured in RAL 5012 from the RAL Classic Colour Collection.

Each machine shall carry, on each identification plate, the names of the infrastructure where it has the authorisation to work and in each case the corresponding working restrictions.

7 User information

In addition to the user information required in EN 15955-2:2013, 8.2, the manufacturer and/or owner of the machine shall provide technical documentation for type testing and the granting of working authorisation.

This documentation shall be provided in the language accepted by the authorised body. The presentation of drawings and units used shall comply with European Standards and shall contain assumptions for calculations used.

As a minimum, the following documents are to be provided:

a) Instruction handbook – in addition to the requirements of EN 15955-2:2013, 8.2 the following information shall be provided:

   1) Maximum stresses generated by devices for levelling, lining or other operations.

   2) Description of movement limiting devices, as shown in 5.2.3.2.1 and a reminder to reset when using attachments, as shown in 5.23.

   3) Restrictions of use:

      i) not for use under live catenary, as shown in 5.2.6.2;

      ii) clearance dimension of underside of moveable parts, as shown in 5.2.3.1;

      iii) not suitable for use on light rail, as shown in 5.9.7.1 and 5.9.7.2;

      iv) not suitable for operation of spring loaded points, as shown in 5.9.8;

      v) use of turntable, if fitted, as shown in 5.20.2.

   4) Category of line as detailed in 5.3.1.

   5) Emergency device(s) as defined in 5.19.3.

b) Technical information for authorised bodies:

   1) For determining the conformity of a machine with the requirements of this standard, technical documentation shall be given by the manufacturer to the organisation confirming conformity. This documentation shall be presented in one of the three official CEN languages and if specified by contract in the language of the organisation. Drawings and units shall conform to European Standards. Details shall be given of assumptions used for calculations.

   2) The documentation required is as follows:

      i) outline diagram showing principal dimensions and position of the centres of gravity, etc.;

      ii) functional description of the working devices;

      iii) minimum permissible radius of curvature to be negotiated in all configurations;

      iv) total mass in all configurations;

      v) maximum speed in all configurations.

   3) Assembly drawing indicating the following:

      i) principal dimensions, in rail configurations, including the critical points near limit of gauge, as shown in 5.2.1.1;

      ii) position of the centre(s) of gravity;

      iii) position of the powered and un-powered axles marked with the indication of the maximum permissible load;

iv) positions of exhaust outlets;

v) work positions, including those that are beyond the loading gauge;

vi) position of lights;

vii) position of optical and acoustic warning devices;

viii) details of lifting and jacking points, where fitted, as shown in 5.7.2.

4) Detailed drawings indicating the following:

i) maximum distances of working parts beyond the swept envelope;

ii) maximum lateral exceedance allowed on curves, as shown in 5.2.4.

5) Detailed drawings with the following indications:

i) devices that can be in contact with the rails;

ii) tools that may bear on the sleepers;

iii) tools that may bear on the ballast.

6) Technical details:

i) restrictions of gauge applicable to working tools;

ii) position of centre(s) of gravity and their movements during work;

iii) proof of stability (prevention of overturning) of the machine;

iv) proof of prevention of derailment;

v) calculation of the forces exerted on the infrastructure e.g. rails, sleepers and fastenings, on the formation and structures e.g. bridges as shown in 5.3.4, 5.3.5 and 5.3.6;

vi) calculations with regard to brakes, stopping distances when driving in all configurations;

vii) calculations of the parts of the machine supporting the railway axles;

viii) description of hydraulic or pneumatic circuit for the rail wheels suspension and locking system when the machine is in rail configuration;

ix) for machines capable of towing, indicate design of coupling and towing capability;

x) arrangement of the driving position with information on controls and indicators.

7) Possible functions of the working parts:

i) minimum duration of gauge infringement by working tools during different phases of work;

ii) locking devices for working components that can go out of the swept envelope.

8 Verification of the conformity to the requirements and/ or particular safety measures

Verification of compliance to the requirements of Clauses 5, 6 and 7 and/or other safety measures shall be assessed by an authorised body, in accordance with the requirements of Table B.1. This will consist of a type testing for the first machine and of type conformance testing for each subsequent machine.

Annex A
(normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonisation, it forms part of the European Standard or Harmonisation Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Clause	Special national condition
1	**Sweden** A machine for use in Sweden should be designed, manufactured and tested for the conditions and the climate zones where it is likely to be operated and used.
5.2.6.2	**Switzerland** In general the machine should be able to work under current conducting contact wire.
5.2.6.4	**France** Machines which are permitted to run and work under a live catenary should have an electrical continuity between conducting parts and two stretches of rail as required in EN 50153. The leakage currents to be taken into account are: — 12 000 A, AC at 50 Hz (fault cancelled in 150 ms); — 35 000 A, DC (fault cancelled in 25 ms). If it is intended to lead the traction returning current by a machine specified in this standard, the following specification applies: — to guarantee the continuity of the traction returning current a machine should have two independent electrical connections (or be unbreakable by their design) each with an equivalent of 600 mm^2 copper.
5.13	**Germany** A minimum of two seats should always be provided.
5.14.4	**United Kingdom** Lamp brackets should meet requirements of RIS 1530 PLT.

Clause	Special national condition
5.15.1	**Switzerland** In general for warning of personnel of traffic on adjacent lines within SBB network of railroads, the machine should have independent acting optical and acoustic warning devices as described herein later on. These devices should be arranged on the machine for an effectual warning of personnel in the track area. The controls of these devices should be within a quick reach for personnel, especially the safety warden. In case of stationary or only slowly moving machines, warning devices should have an additional remote control. In case of machines demanding a jib range, warning devices should be manageable from outside.
5.15.2	**Switzerland** Optical warning devices should consist of orange revolving warning lamps and/or alternating flashlights and/or flashlights.
5.15.3	**Switzerland** Acoustic warning systems should use the predefined SBB alarm terms and noise pressure levels.
5.15.4	**Netherlands** Red lights are not permitted to be shown in working configuration in the Netherlands (and red reflectors should be covered). One white light should be displayed at front and rear of each machine.

Table A.1 — Special national conditions

	Country Infrastructure	Belgium SNCB	Czech Republic SZDC	Denmark Banedanmarklsen	Germany DB Netz AG	Finland VR	France SNCF	Greece OSE (CH)	Ireland CIE (Irish Rail) NIR	Italy RFI S.p.A.
1	Gauge in mm	1 435	1 435	1 435	1 435	1 524	1 435	–	–	1 435
2	Machine gauge in mm	–	–	–	in some cases G 2 (EBO)	enlarged machine construction gauge	–	–	–	–
3	Smallest horizontal radius to be negotiated in circulation (sidings) in m	90	150 130	150	150 90	90	150	–	–	150
4	Smallest vertical radius to be negotiated in circulation (sidings) in m	500	1 000 300	5 000	900 convex 300 concave 400	500	Principal line 900 Secondary line convex 600, concave 900 other lines concave 300, convex 250	–	–	1 000
5	Maximum cant to be negotiated in mm	–	–	–	180	–	180	–	–	–
6	Maximum gradient for circulation in $^{0}/_{00}$ Maximum gradient for parking brake in $^{0}/_{00}$	40	40	25 (30)	40 (in special case 56 $^{0}/_{00}$) 40 (s=1,4)	25	40	–	–	35
7	Lighting requirements, see 5.14	–	–	2 yellow brake lights at each end	–	–	data recorders	–	–	green light dx and white light sx or red light dx and white light sx
8	Minimum height of contact wire above rail level in mm	4 800	4 950	4 900	4 950 (4 800 in special cases)	5 640	4 600	–	–	4 500
9	Maximum height above rail level of work place without need for protection, see 5.2.6.2 in mm	1 600	1 450	1 250	1 450 (1 350 in special cases)	1 740	1 600	–	–	1 500

Table A.1 *(continued)*

	Country Infrastructure	Luxemburg CFL	Netherlands ProRail	Norway GBV	Austria ÖBB	Portugal REFER	Sweden Trafikverket	Switzerland SBB/CFF/FFS	Spain RENFE	Great Britain Network Rail
1	Gauge in mm	1 435	1 435	1 435	1 435	1 668	1 435	1 435	1 668	1 435
2	Machine gauge in mm	–	EN 15273-2 = G 2 or more NL 1 NL 2 Gc	GBV GD 590	–	CPb	SEa and SEc according to EN 15273-2	–	RENFE 12/85	RIS-1530-PLT
3	Smallest horizontal radius to be negotiated in circulation (sidings) in m	90	150	100	100	150	150	150 90	250 75	80
4	Smallest vertical radius to be negotiated in circulation (sidings) in m	500	2 000	350	500	1 300	300	2 000 250	2 000 300	500
5	Maximum cant to be negotiated in mm	–	–	–	–	200	–	–	–	200
6	Maximum gradient for circulation Maximum gradient for parking brake in $^{0}/_{00}$	40	–	55	40	40	25 40	–	40	40
7	Lighting requirements, see 5.14	2 white rotating lights	–	–	rotating orange-yellow warning signal according to EN 468	–	–	white/red 3 x at each end	–	RIS-1530-PLT
8	Minimum height of contact wire above rail level in mm	4 640	4 800	4 800	4 950	4 820	4 800	4 800	4 480	4 165
9	Maximum height above rail level of work place without need for protection, see 5.2.6.2 in mm	1 640	–	–	1 450	–	1 500	1 300	–	1 400

Table A.1 *(continued)*

	Country Infrastructure	Estonia	Hungary	Latvia	Lithuania	Poland	Slovakia	Slovenia
1	Gauge in mm	–	–	–	–	1 435	–	–
2	Machine gauge in mm	–	–	–	–	in some cases PN-K-02056:1970	–	–
3	Smallest horizontal radius to be negotiated in circulation (sidings) in m	–	–	–	–	150 70	–	–
4	Smallest vertical radius to be negotiated in circulation (sidings) in m	–	–	–	–	2 000 500	–	–
5	Maximum cant to be negotiated in mm	–	–	–	–	150	–	–
6	Maximum gradient for circulation Maximum gradient for parking brake in $^{0}/_{00}$	–	–	–	–	30	–	–
7	Lighting requirements, see 5.14	–	–	–	–	–	–	–
8	Minimum height of contact wire in mm	–	–	v	–	4 900 (4 850*) *Special cases in engineering objects	–	–
9	Maximum height above rail level of work place without need for protection, see 5.2.6.2 in mm	–	–	–	–	1 400	–	–

Annex B
(normative)

Check list for conformity

Table B.1 — Determination of safety requirements and/or safety measures

Method of examination Clause number	Type of verification to be effected				
	Visual check Clause 3.32	Measurements Clause 3.33	Functional test Clause 3.34	Load test Clause 3.35	Specific Verification / Measurements Clause 3.36
5.2 Gauge					
5.2.1.1	○	☐			☐
5.2.1.2	○	☐			☐
5.2.2.1	☐○		☐○		☐
5.2.2.2			☐		☐
5.2.3.1	☐○	☐			☐
5.2.3.2.1			☐○		☐
5.2.3.2.2.1	○			☐	☐
5.2.3.2.2.2	○			☐	☐
5.2.3.2.2.3			☐○		☐
5.2.3.2.2.4			☐○		☐
5.2.3.2.2.5			☐○		☐
5.2.3.2.2.6			☐○		☐
5.2.3.2.2.7			☐○		☐
5.2.4					☐
5.2.5		☐			☐
5.2.6.1		☐○			☐
5.2.6.2	☐○				☐
5.2.6.3			☐○		☐
5.3 Interaction with the infrastructure					
5.3.1		☐			☐
5.3.2					☐
5.3.3	○	☐			☐
5.3.4					☐
☐ = 1st machine of a type					
○ = Successive machines of the same type					

Table B.1 *(continued)*

Method of examination Clause number	Type of verification to be effected				
	Visual check Clause 3.32	Measurements Clause 3.33	Functional test Clause 3.34	Load test Clause 3.35	Specific Verification / Measurements Clause 3.36
5.3.5					☐
5.3.6					☐
5.4 Running safety equipment					
5.4	☐○				☐
5.5 Running safety and prevention of derailment					
5.5.1	☐○	☐		☐	☐
5.5.2		☐		☐	☐
5.5.3		☐		☐	☐
5.5.4		☐		☐	☐
5.5.5	○	☐			
5.6 Stability and prevention of overturning					
5.6	☐○		☐○	☐	☐
5.7 Machine frame and structure					
5.7.1					☐
5.7.2	☐○				☐
5.8 Inter machine couplings					
5.8	☐○			☐	☐
5.9 Running gear					
5.9.1					☐
5.9.2				☐○	☐
5.9.3		☐○			☐
5.9.4		☐○			☐
5.9.5				☐	☐
5.9.6				☐	☐
5.9.7.1					☐
5.9.7.2					☐
5.9.8			☐		☐
5.10 Rail wheel suspension					
5.10.1			☐○		☐
5.10.2			☐○		☐
5.10.3			☐○		☐
5.10.4				☐○	☐
☐ = 1st machine of a type					
○ = Successive machines of the same type					

Table B.1 *(continued)*

Method of examination Clause number	Type of verification to be effected				
	Visual check Clause 3.32	Measurements Clause 3.33	Functional test Clause 3.34	Load test Clause 3.35	Specific Verification / Measurements Clause 3.36
5.11 Braking					
5.11.1			○	□	□
5.11.2			○	□	□
5.12 Driving and working cabs and places					
5.12	□○	□	□		□
5.13 Controls					
5.13	□○		□○		□
5.14 Visibility and audibility of the machine					
5.14.1			□○		□
5.14.2	□○				
5.14.3	○	□	□○		□
5.14.4			□○		□
5.14.5	○	□			□
5.14.6	○	□			□
5.14.7		□	□○		□
5.14.8	□○				
5.14.9.1		□	□○		□
5.14.9.2	□○				
5.15 Warning systems for personnel of traffic on adjacent lines in working configuration					
5.15.1			□○		□
5.15.2		□	□○		□
5.15.3			□○		□
5.15.4	□				
5.16 Electrical equipment and earth bonding					
5.16.1		□○			□
5.16.2	□○			□	□
5.16.3.1		□○			□
5.16.3.2	□○			□	□
5.16.3.3	□○			□	□
5.17 Electro-magnetic compatibility					
5.17.1		□			□
5.17.2		□			□
□ = 1st machine of a type					
○ = Successive machines of the same type					

Table B.1 *(continued)*

Method of examination Clause number	Type of verification to be effected				
	Visual check **Clause 3.32**	**Measurements** **Clause 3.33**	**Functional test** **Clause 3.34**	**Load test** **Clause 3.35**	**Specific Verification / Measurements** **Clause 3.36**
5.18 Power supply					
5.18	○		☐		☐
5.19 Failure recovery					
5.19.1	○		☐		☐
5.19.2	○		☐		☐
5.19.3					
5.20 On and off tracking					
5.20.1	☐○		☐○		☐
5.20.2	☐○		☐○		☐
5.21 Setting up and packing away					
5.21.1	○		☐		☐
5.21.2	○	☐	☐		☐
5.22 Mobile elevating work platform (MEWP) and excavator/loaders used as MEWPs					
5.22		☐			☐
5.23 General and railway specific attachments					
5.23.1					☐
5.23.2					☐
5.23.3					☐
5.24 Exhaust					
5.24	☐○				☐
6 Marking and numbering of the machine					
6.1 Warning signs and pictograms					
6.1	☐○				☐
6.2 Identification plate					
6.2	☐○				☐
7 User information					
7	☐○				☐○
☐ = 1st machine of a type					
○ = Successive machines of the same type					

NOTE The user of this form is allowed to copy this present form.

Annex C
(informative)

Machine identification plate

XXX XXX Identification no. No.immatriculation Fahrzeugnr.					
				Last inspection / Dernier contrôle / Letzte Untersuchung **yyyy-mm-dd**	
Owner / Propriétaire / Fahrzeughalter Xxxxxxxxxxxxxxxxx **Telephone no / Numéro de téléphone Telefonnummer**				Next inspection / Prochain contrôle / nächste Untersuchung **yyyy-mm-dd**	
Maximum running speed / Vitesse de circulation max. / maximale Geschwindigkeit in Transportstellung **XX** km/h	Maximum working speed / Vitesse de travail max. / maximale Geschwindigkeit in Arbeitsstellung **XX** km/h				
Only allowed on track with special operating conditions Autorisée uniquement sur voie dans des conditions d'exploitation particulières Einsatz nur auf Gleisen unter besonderen betrieblichen Bedingungen					
Maximum towed speed Vitesse remorquée max. Maximale Geschwindigkeit: gezogen	**XX** km/h	Maximum on/off track gradient Pente max. pour mise en ou hors voie Maximale Längsneigung bei Auf-/ Ausgleisen	**XX** $^{0}/_{00}$		
Maximum working cant Dévers max. en travail Maximale Überhöhung in Arbeitsstellung	**XX** mm	Maximum on/off track cant Dévers max. pour mise en ou hors voie Maximale Überhöhung beim Auf-/ und Ausgleisen	**XX** mm		
Maximum working gradient Pente max. en travail Maximale Längsneigung in Arbeitsstellung	**XX** $^{0}/_{00}$	May be used under live overhead lines Peut être utilisée en présence de caténaire sous tension Darf bei eingeschalteter Oberleitung eingesetzt werden	**YES** or **NO**		
Allowed for shunting Autorisée à la manœuvre Darf abgestoßen werden	**YES** or **NO**	May be used adjacent to line open to traffic (with minimum distance shown below) Peut être utilisée à proximité de lignes ouvertes au trafic (avec les distances minimales données ci-dessous) Darf bei Betrieb im Nachbargleis eingesetzt werden (minimaler Abstand siehe unten)	**YES** or **NO**		
		Minimum distance between track centres Entre-voie minimum (de centre à centre) Minimaler Gleisachsabstand	**X XXX** mm		
Fitted with continuous automatic brake Equipée de frein automatique Ausgestattet mit durchgehender selbsttätiger Bremse	**YES** or **NO**	Maximum unbraked trailing load Charge de remorquage non freinée max. Maximale ungebremste Anhängelast	**XX XXX** kg		

Figure C.1 — Machine identification plate

Annex D
(informative)

Structure of European Standards for track construction and maintenance machines

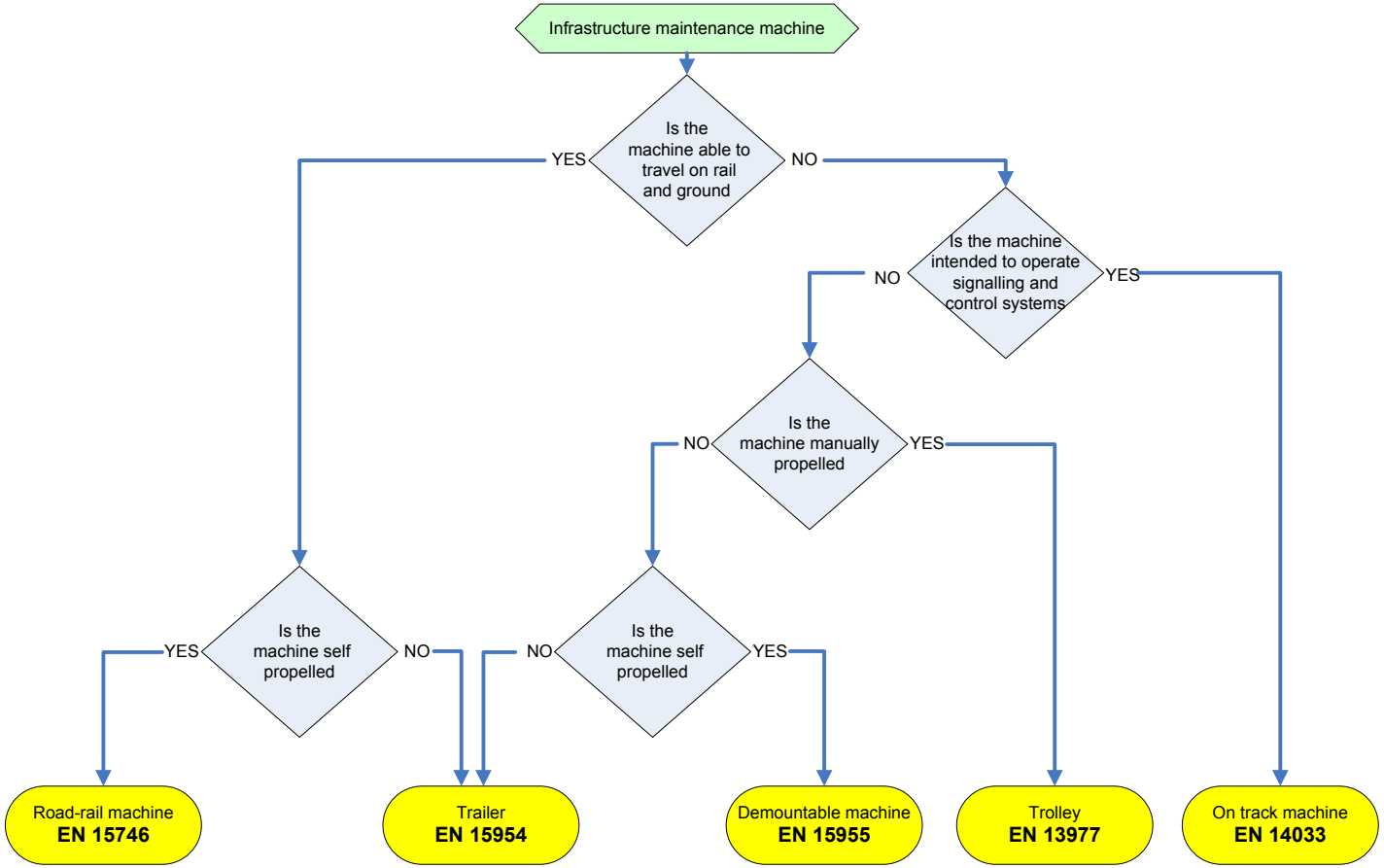


Figure D.1 — Flowchart of European Standards for track construction and maintenance machines

Table D.1 — Structure of European Standards for track construction and maintenance machines

Specifications	European Standards						
	Railbound machines **EN 14033-1:2011** **EN 14033-2:2008+A1:2011** **EN 14033-3:2009**		**Road-rail machines** **EN 15746-1:2010** **EN 15746-2:2010**		**Demountable machines** **EN 15955-1:2013** **EN 15955-2:2013**	**Trailers** **EN 15954-1:2013** **EN 15954-2:2013**	**Portable machines and trolleys** **EN 13977:2011**
Designed for rail or road	rail only		rail and road		rail only	rail only or rail and road	rail only
Designed for operating train control / signalling systems	yes		yes[c]	no[d]	no	no	no
Method of propulsion on the rails	self-propelled [a]	towed [b]	self-propelled		self-propelled	towed	manual

a Category 1, 2, 4 and 6 machines

b Category 3, 5 and 7 machines

c Category 8 machines as well as Category 9 machines designed to operate signalling and control systems

d Category 9 machines

Bibliography

[1] DIN 6164-1:1980-02, *DIN Farbenkarte, System der DIN-Farbenkarte für den 2 — Normalbeobachter* [2)]

[2] DIN 6164-2:1980-02, *DIN Farbenkarte, Festlegung der Farbmuster* [2)]

[3] *NSC — Natural Color System according to Swedish standard* SS 019100/01/02/03 [3)]

[4] *Eurocolor-System auf der farbmetrischen Grundlage des CIELAB-Systems*

[5] NF F 58-002:1991, *Approval of railway track construction and maintenance plant for operation on UIC gauge tracks* [4)]

[6] 2004/26/EC, *Non-Road Mobile Machinery Directive* [5)]

[7] 95/54/EC, *Automotive EMC Directive* [6)]

[8] EN 13977:2011, *Railway applications — Track — Safety requirements for portable machines and trolleys for construction and maintenance*

[9] EN 15746-1:2010, *Railway applications — Track — Road-rail machines and associated equipment — Part 1: Technical requirements for running and working*

[10] EN 15746-2:2010, *Railway applications — Track — Road-rail machines and associated equipment — Part 2: General safety requirements*

[11] EN 14033-3:2009, *Railway applications — Track — Railbound construction and maintenance machines — Part 3: General safety requirements*

[12] EN ISO 17491-4, *Protective clothing — Test methods for clothing providing protection against chemicals — Part 4: Determination of resistance to penetration by a spray of liquid (spray test) (ISO 17491-4)*

[13] EN 50153, *Railway applications — Rolling stock — Protective provisions relating to electrical hazards*

[14] Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC [7)]

[15] Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community [8)]

---

2) May be purchased from: Deutsches Institut für Normung (DIN), Beuth-Verlag GmbH, D-10772 Berlin.

3) May be purchased from: SKANDINAVISKA FÄRGINSTITUTET AB; SCANDINAVIAN COLOUR INSTITUTE AB; Igeldammsgaten 30, S-10028 Strockholm Schweden or Europäisches Color Centrum GmbH, Burggrafenstraße 2A, D-10787 Berlin.

4) May be purchased from: Association Française de Normalisation (AFNOR), 11 av. Francis de Pressensé, F-93571 Saint-Denis La Plaine CEDEX.

5) Official Journal of the European Communities No L 146/1 of 30.04.2004.

6) Official Journal of the European Communities No L 266 of 08.11.1995.

7) Official Journal of the European Communities No L 157 of 9.6.2006.

8) Official Journal of the European Communities No L 191 of 18.7.2008.

[16] Directive 2004/104/EC of 14 October 2004 adapting to technical progress Council Directive 72/245/EEC relating to the radio interference (electromagnetic compatibility) of vehicles and amending Directive 70/156/EEC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers [9)]

[17] Directive 97/68/EC of the European Parliament and of the Council of 16 December 1997 on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machine [10)]

9) Official Journal of the European Communities No L 337 of 13.11.2004 / Official Journal of the European Communities No L 183M of 5.7.2006.

10) Official Journal of the European Communities No L 59, 27.2.1998.

This page deliberately left blank

British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards and other standards-related publications, information and services. It presents the UK view on standards in Europe and at the international level.

BSI is incorporated by Royal Charter. British Standards and other standardisation products are published by BSI Standards Limited.

Revisions

British Standards and PASs are periodically updated by amendment or revision. Users of British Standards and PASs should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using British Standards would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Similary for PASs, please notify BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

BSI offers BSI Subscribing Members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of British Standards and PASs.

Tel: +44 (0)20 8996 7669 Fax: +44 (0)20 8996 7001
Email: plus@bsigroup.com

Buying standards

You may buy PDF and hard copy versions of standards directly using a credit card from the BSI Shop on the website **www.bsigroup.com/shop.** In addition all orders for BSI, international and foreign standards publications can be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001
Email: orders@bsigroup.com

In response to orders for international standards, BSI will supply the British Standard implementation of the relevant international standard, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Knowledge Centre.

Tel: +44 (0)20 8996 7004 Fax: +44 (0)20 8996 7005
Email: knowledgecentre@bsigroup.com

BSI Subscribing Members are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001
Email: membership@bsigroup.com

Information regarding online access to British Standards and PASs via British Standards Online can be found at **www.bsigroup.com/BSOL**

Further information about British Standards is available on the BSI website at **www.bsi-group.com/standards**

Copyright

BSI

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/standards

raising standards worldwide™