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Railway applications - Track - Road-rail machines and associated equipment - Part 3: Technical requirements for running

Bahnanwendungen - Oberbau - Zwei-Wege Maschinen und zugehörige Ausstattung - Teil 3: Technische Anforderungen an das Fahren

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (prEN 15746-3:2015) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

EN 15746, *Railway applications — Track — Road-rail machines and associated equipment*, is currently composed with the following parts:

— *Part 1: Technical requirements for running and working*;

— *Part 2: General safety requirements*;

— *Part 3: Technical requirements for running* [currently at Enquiry stage];

— *Part 4: Technical requirements for running, travelling and working on urban rail* [currently at Enquiry stage].

Introduction

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

This document is the third of a series of four parts of the European Standard: Railway applications — Track — Road-rail machines and associated equipment, dealing with railway specific risks of the road-rail machines when running, travelling and working on railway infrastructures:

— Part 1 covers the technical requirements for the machines in working and travelling modes, and is applicable for all machines.

— Part 2 covers the safety requirements for the machines in working and travelling modes; this is a harmonized standard with the European Machinery Directive 2006/42/EC.

— Part 3 covers the essential requirements for the machines that have a running mode and run on tracks within the scope of the Railway Directive 2007/58/EC; this is a harmonized standard with the Railway Interoperability Directive 2008/57/EC and its associated Technical Specifications for Interoperability (TSI).

— Part 4 covers the technical requirements for the machines that have a running mode on urban rail and/or for machines intended to have working and travelling modes on urban rail.

Part 1 defines requirements for approval of the machine for use on the railway, depending on the decision of the Infrastructure Manager or National rules the assessment of conformance could be by the Infrastructure Manager concerned, by a third party assessor or declaration of conformity by the manufacturer.

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

Part 3 defines requirements for running on the European railway network, assessment of conformity is by a notified body as prescribed in the Railway Interoperability Directive.

Part 4 of defines requirements for approval of the machine for use on urban rail, depending on the decision of the controller of the network or National rules the assessment of conformance could be by the urban rail controller concerned, by a third party assessor or declaration of conformity by the manufacturer.

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. Where necessary, references are made to appropriate standards of this type.

1 Scope

1.1 General

This European Standard deals with the technical requirements to minimize the specific railway hazards of self-propelled road-rail machines as defined in prEN 15746-1:2015, 3.5, henceforward referred to as machines – when designed and intended for running on European railways within the scope of European Directive 2007/58/EC.

The running mode is an option designed by the manufacturer which permits the use of the machine on a specified railway infrastructure without the need for special operational rules.

NOTE The use of special track safety equipment (i.e. part of automatic train protection systems) does not necessarily infer that the machine has a running mode, some infrastructure managers use such equipment as means of protection for machines in travelling and/or working modes.

This European Standard does not apply to the following:

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

— travelling and working both on and off rails;

— running on urban rail.

For a road-rail machine it is assumed that an EU road permissible host vehicle will offer an accepted safety level for its designed basic functions before conversion. Unless explicitly stated otherwise in a particular clause this specific aspect is not dealt with in this European Standard.

1.2 Validity of this European Standard

This European Standard applies to all machines which are within the scope of the Commission Regulation (EU) No 1302/2014 for locomotives and passenger rolling stock.

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 12663-1:2010+A1:2014, *Railway applications — Structural requirements of railway vehicle bodies — Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)*

EN 12663-2:2010, *Railway applications — Structural requirements of railway vehicle bodies — Part 2: Freight wagons*

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 15153-1:2013, *Railway applications — External visible and audible warning devices for trains — Part 1: Head, marker and tail lamps*

EN 15273-2:2013, *Railway applications — Gauges — Part 2: Rolling stock gauge*

EN 15437 (all parts), *Railway applications — Axlebox condition monitoring — Interface and design requirements*

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

prEN 15746-1:2015, *Railway applications — Track — Road-rail machines and associated equipment — Part 1: Technical requirements for travelling and working*

prEN 15746-2:2015, *Railway applications — Track — Road-rail machines and associated equipment — Part 2: General safety requirements*

EN 45545-2, *Railway applications — Fire protection on railway vehicles — Part 2: Requirements for fire behavior of materials and components*

EN 50238-1:2003, *Railway applications — Compatibility between rolling stock and train detection systems — Part 1: General*

EN 62625-1:2013, *Electronic railway equipment — On board driving data recording system — Part 1: System specification (IEC 62625-1:2013)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, prEN 15746-1:2015 and prEN 15746-2:2015 apply.

4 Machine categorization

4.1 Categories

The machines are divided into four categories as shown in prEN 15746-1:2015, Clause 4.

4.2 Type qualification for being in a train

4.2.1 Mode of machine Category 8

Machines of Category 8 may be part of a train, but only under the conditions prescribed by the railway undertaking of such a train and/or by the infrastructure manager.

4.2.2 Mode of machine Category 9

The machine has a running mode and shall be designed and intended to operate signalling and control systems, and shall comply with this standard

NOTE 1 The acceptance procedure for access to the railway infrastructure is likely to be different for running mode than for travelling and working modes.

NOTE 2 A compatibility assessment will need to be undertaken to ensure the signalling command and control system fitted on the machine is compatible with the line to be run upon.

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 prEN 15746-1:2015, Clauses 5 and 6, and this standard.

5.2 Rolling stock gauge

5.2.1 Running gauge

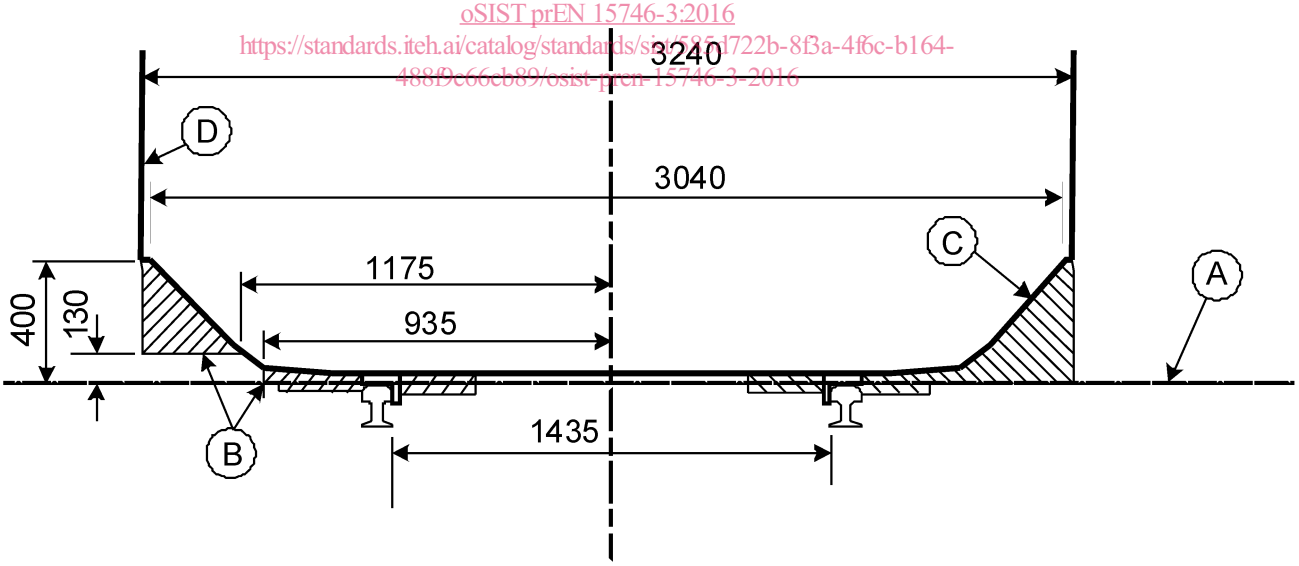
Except in the lower area, machines in running mode shall meet the dimensional requirements of EN 15273-2. The critical points near the limits of the permissible kinematic gauge, see EN 14033-1:2011, Annex C, shall be recorded in the technical documentation as shown in Clause 7, b), 3), i).

In the lower area deviations are permitted for machines according to Category 9 B and Category 9 C and equivalent machines belonging to Category 8 to accommodate road wheels, as shown in Figure 1. The requirement is that the machine does not damage the infrastructure.

NOTE 1 The G1 Profile in EN 15273–2:2013, Figure A.4 meets the cross acceptance gauging requirements for the majority of mainland European countries.

NOTE 2 National conditions may apply to this exceedance amount, see Annex A.

Dimensions in millimetres



Key

A rail level

B exceedance of gauge permitted for road-rail machines

C additional exceedance of gauge permitted for Category 9 C machines

D gauge according to EN 15273-2

Figure 1 — Limits in lower area

Machines intended to run on infrastructures with more restrictive gauges shall conform to the specific rules of those infrastructures and the corresponding restrictions shall be indicated in the instruction handbook.

No metallic part of the vehicle shall be permitted, under any circumstance of predictable use and wear, to encroach into the area outside the lower vehicle gauge shown in EN 15273-2:2013, Figure A.6.

5.2.2 Road-rail machine in running mode

5.2.2.1 Stowing of moveable machine parts in running mode

When the machine is in the running mode 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 mode 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 either:

— efficient locks. The visible positive locking components in running mode 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 be 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 mode

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

5.2.3 Limits in lower area in running mode

5.2.3.1 Working limit in the lower area

Road-rail 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, 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 prEN 15746-1:2015, Table 2.

5.2.3.2 Running limit in lower area

Category 9 B and 9 C machines are permitted to exceed the lower gauge area, see EN 14033-2:2008+A1:2011, Annex D. When this is the case there shall be an operating restriction stated on the type approval certificate prohibiting the passing of track mounted obstructions, e.g. railway signalling and safety devices such as PZB magnets, hot box detectors.

The restriction for passing over tracks with such obstructions may be relieved if damage to the obstructions by the machines' road wheels can reliably be prevented by use of road wheels of an appropriate maximum width according to Figure 1.

NOTE Special national conditions may permit alternative arrangements, such as a lifting system mounted on the machine as described in Annex A.

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 the load carrying ability of the formation. The manufacturer shall state the line Category according to EN 15528 of the machine, as shown in 5.8.2 of this standard, and record in the instruction handbook, see Clause 7, a), 4).

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

NOTE Some infrastructure managers could require seeing these calculations.

If the machines contain 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, a), 1).

5.3.2 Stress induced into rail by main wheels

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

If the configuration of these wheels in working and travelling modes of the machine is different from the running mode, 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 mode shall not generate stresses in the rail higher than the values in Table 1.

Table 1 — Stress 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

NOTE 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 Running safety equipment

5.3.3.1 Indication equipment

Machines with a running mode shall be fitted with special equipment specific for running safety on specific infrastructures, see EN 14033-1:2011, Annex J.

The controls for this equipment shall be located in each driving cab.

5.3.3.2 Data recorder

Machines with a running mode shall carry at least one data recorder compliant with EN 62625-1:2013, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.3.1.3, 4.3.1.4 and 4.3.1.6, where required by the specific national safety authority; see Annex A.

5.4 Safety against derailment

5.4.1 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 5.6.3.

5.4.2 Safety against derailment for machines

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

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

— Clause 5 in running mode: when using EN 14363 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 case 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 of EN 14363:2005, Annex B.

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 mode, with 5.6.3. Where a machine is not designed for use on working track the limitation shall be detailed in the instruction handbook, see Clause 7, a), 3), vii).

When running tests are required, they should be carried out by an authorized body or by the manufacturer of the machine, if the manufacturer is recognized as a testing body by the accreditation body.

5.4.3 Dynamic tests on track for all machines

After the tests shown in 5.4.2 have been successfully undertaken the first of class of machine shall have actual dynamic tests on track undertaken in the most adversely loaded condition in the running, travelling and working modes when moving along the track at its maximum speed. Where the maximum speed is limited for specific track conditions this shall be recorded in the instruction handbook, see Clause 7, a), 3), viii) to x) and detailed on the identification plate (Annex F). These tests shall be carried out on track shown in a) to d):

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 is able to run over raised check rails (as detailed in 5.3);

d) the machine does not derail while going through switches, crossings and curves.

These tests should be carried out by an authorized body or by the manufacturer of the machine if the manufacturer is recognized as a testing body by the authorized body.

When doing $\Delta Q/Q$ test the Q is the mean wheel load of the axle and the ΔQ is the maximum wheel unloading due to the test conditions applied.

5.4.4 Railhead clearing devices

Machines shall be equipped with devices as described in prEN 15746-2:2015, 5.10.2 and/or 5.10.3.

5.5 Stability and prevention of overturning

Requirements for prevention of overturning and stability are shown in prEN 15746-2:2015, 5.11.

5.6 Machine frame and structure

5.6.1 Design of the machine frame

5.6.1.1 Requirements for Category 9 machines

The machine frame shall meet the requirements of prEN 15746-1:2015, 5.7.1.1.

5.6.1.2 Requirements for Category 8 machines

Category 8 machines, machine frame shall be able to withstand the following forces without any permanent deformation when running in a train:

a) machines not permitted to be loose shunted or hump shunted shall be constructed to meet the requirements of the load cases 4.1 to 4.5 of Category FII of EN 12663-1 or EN 12663-2 with the following deviations:

   1) Item 4.5, c) vertical load during lifting of the machine frame with the bogie to 2 g;

   2) EN 12663-1:2010+A1:2014, Table 13 or EN 12663-2:2010, Table 10 to read acceleration in the x direction ± 3 g;

   3) machines which are restricted to be positioned only at the front or rear of a train are permitted to be constructed to withstand towing and impact forces of 0,8 MN.

All other Category 8 machines shall be constructed to meet the requirements of the load cases 4.1 to 4.5 of Category FI of EN 12663-1 or EN 12663-2 with the following deviations:

b) Item 4.5, c) vertical load during lifting of the machine frame with the bogie to 2 g; and

c) EN 12663:2000, Table 12 to read acceleration in the x direction ± 3 g.

5.6.2 Lifting and jacking points

Lifting and jacking points shall be fitted capable of safely supporting the whole machine while being lifted or jacked. It shall also be possible to lift or jack one end of the machine (including its running gear) with the other end resting on the remaining running gear. The locations (and any restrictions of use) of lifting and jacking points, where fitted, shall be detailed in the technical information, see Clause 7, b), 3), viii).

In addition for Category 8 machines the following requirements apply: