SLOVENSKI STANDARD
SIST EN 15654-1:2018

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Železniške naprave - Meritve vertikalnih kolesnih in osnih obremenitev - 1. del: Meritve na železniških vozilih med vožnjo

Railway applications - Measurement of vertical forces on wheels and wheelsets - Part 1: On-track measurement sites for vehicles in service

Bahnanwendungen - Messung von vertikalen Rad- und Radsatzkräften - Teil 1: Interoperable gleisseitige Messeinrichtungen für fahrende Fahrzeuge

Applications ferroviaires - Mesurage des forces verticales à la roue et à l'essieu - Partie 1 : Sites de mesure en voie interopérables des véhicules en service

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ICS:

45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN STANDARD
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English Version

Railway applications - Measurement of vertical forces on wheels and wheelsets - Part 1: On-track measurement sites for vehicles in service

Applications ferroviaires - Mesurage des forces verticales à la roue et à l'essieu - Partie 1 : Sites de mesure en voie des véhicules en service

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 15654-1:2018) 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of an identical text or by endorsement, at the latest by July 2018, and conflicting national standards shall be withdrawn at the latest by July 2018.

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

This document 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.

This document is the first part of a three part series collectively referred to as “*Railway applications — Measurement of vertical forces on wheels and wheelsets*”. The series consists of:

— *Part 1: On-track measurement sites for vehicles in service*

— *Part 2: Test in workshop for new, modified and maintained vehicles*

— *Part 3: Approval and verification of on track measurement sites for vehicles in service* (CEN/TR)

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard has been developed to provide a common procedure for determining the axle load, wheel force and the mass of rail vehicles operating (in-service) in Europe.

This standard also details the evaluation of derived quantities such as asymmetric loading, overloading, vehicle mass and train mass. These quantities are obtained while the train is in-service and in motion.

1 Scope

The scope of this European Standard is restricted to the measurement of vertical wheel forces and calculation of derived quantities on vehicles in service. Measurements of a train in motion are used to estimate the static forces.

Derived quantities can be:

— axle loads;

— side to side load differences of a wheel set, bogie, vehicle;

— overall mass of vehicle or train set;

— mean axle load of a vehicle or train set.

This standard is not concerned with the evaluation of:

— dynamic wheel force or derived quantities;

— wheel condition (i.e. shape, profile, flats);

— lateral wheel force;

— combination of lateral and vertical wheel forces.

The standard defines accuracy classes for measurements to be made at any speed greater than 5 km/h within the calibrated range, which may be up to line speed.

The aim of this standard is to obtain measurement results that give representative values for the distribution of vertical wheel forces of a running vehicle, which under ideal conditions will be similar to those that can be obtained from a standing vehicle.

This standard does not impose any restrictions on the types of vehicles that can be monitored, or on which networks or lines the measuring system can be installed.

The standard lays down minimum technical requirements and the metrological characteristics of a system for measuring and evaluating a range of vehicle loading parameters. Also defined are accuracy classes for the parameters measured and the procedure for verifying the calibration.

The measuring system proposed in this standard should not be considered as safety critical. If the measuring system is connected to a train traffic command and control system then requirements that are not part of this standard may apply.

Measuring systems complying with this standard have the potential to enhance safety in the railway sector. However, the current operating and maintenance procedures rather than this standard are mandatory for ensuring safety levels in European rail networks.

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 50121-4, *Railway applications — Electromagnetic compatibility — Part 4: Emission and immunity of the signalling and telecommunications apparatus*

EN 50121-5, *Railway applications — Electromagnetic compatibility — Part 5: Emission and immunity of fixed power supply installations and apparatus*

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

EN 50122-2, *Railway applications — Fixed installations — Electrical safety, earthing and the return circuit - Part 2: Provisions against the effects of stray currents caused by d.c. traction systems*

EN 50124-1, *Railway applications — Insulation coordination — Part 1: Basic requirements — Clearances and creepage distances for all electrical and electronic equipment*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 15273-3, *Railway applications - Gauges - Part 3: Infrastructure gauge*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE They are listed in the order in which they appear in the standard.

3.1.1
static vertical wheel force
$Q_{F0,j,k}$
representation of the vertical part of the static wheel force vector obtained from the dynamic measurement process of a vehicle in motion

Note 1 to entry: Where the symbol Q_{F0jk} is used, j is the axle number and k is the vehicle side, $k = R$ denotes the right hand side in the direction of travel and $k = L$ denotes the left hand side in the direction of travel.

3.1.2
axle load
sum of the static vertical wheel forces exerted on the track through a wheelset or a pair of independent wheels divided by acceleration of gravity

3.1.3
quantity
property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference

[SOURCE: ISO/IEC GUIDE 99]

3.1.4
derived quantity
quantity, in a system of quantities, that is calculated from one or more measured parameters

3.1.5
measuring system
aggregation of parts that serve to determine the wheel force and which may also be used to derive other quantities

3.1.6
load sensor
element of a measuring system that is intended to receive the load and which realizes a change in the output signal when a load is placed upon it

3.1.7
maximum permissible error
extreme value of measurement error, with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system

[SOURCE: ISO/IEC GUIDE 99]

3.1.8
accuracy class
class of measuring instruments or measuring systems that meet stated metrological requirements that are intended to keep measurement errors or instrumental measurement uncertainties within specified limits under specified operation conditions

[SOURCE: ISO/IEC GUIDE 99]

Note 1 to entry: A measuring system can have different accuracy classes for different quantities and/or different operation conditions.

3.1.9
running gear
bogie, or (on non-bogied vehicles) the wheelset including suspension

3.1.10
in service
in operation and not under maintenance or manufacture

3.1.11
line speed
maximum speed at which vehicles are allowed to run on a line or branch, or on sections of a line or branch

3.1.12
speed band
range of speeds pertaining to a particular accuracy class

3.1.13
instrumented track
section of track where the wheel forces are measured

3.1.14
lead-on track
section of track that precedes the instrumented track

3.1.15
lead-off track
section of track that follows the instrumented track

3.1.16
approach track
section of track that precedes the lead-on track

3.1.17
exit track
section of track that follows the lead-off track

3.1.18
measurement site
section of track that contains the instrumented track, the lead-on/lead-off tracks and the approach/exit tracks

Note 1 to entry: A measurement site is shown in Figure B.1.

3.1.19
cross level
difference in height of the adjacent running surfaces

Note 1 to entry: Refer to EN 13848-1.

3.1.20
gradient
ratio of the difference in height, of the running surface along the rail, at two successive points, to the distance between the points

3.1.21
vertical track deflection
amount by which the track deflects under a defined axle load

3.1.22
track twist
algebraic difference between two cross levels divided by the distance between the two points of measurement

Note 1 to entry: Refer to EN 13848-1.

Note 2 to entry: Twist is usually expressed as a ratio with the units ‰ or mm/m.

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

CEN European Committee for Standardization

EN European Standard

ERA European Railway Agency

ISO International Organization for Standardization

TSI Technical Specification for Interoperability

UIC HRMS Harmonisation of Running Behaviour and noise measurement sites project from UIC (Union internationale des chemins de fer)

3.3 Symbols, quantity and dimension

For the purposes of this document the following symbols apply.

Q_F	vertical wheel force	kN
Q	wheel load	t
P_F	vertical wheelset force	kN
P	axle load	t
m	gross mass	t
Θ	imbalance	
Δ	relative deviation	
g	acceleration due to gravity, minimum accuracy of 2 decimal places	(m/s^2)
j	wheelset index	(1, 2, 3, …)
i	running gear index	(1, 2, 3, …)
k	vehicle side R for the right hand side in the direction of travel L for the left hand side in the direction of travel	
n	total number of vehicles in the train	
n_{trn}	total number of wheelsets of the train	
n_{veh}	total number of wheelsets of individual vehicle	
n_{rg}	total number of running gear of individual vehicle	
z	number of wheelsets per running gear i	
x	number of first wheelset in running gear i	

4 Measured and derived quantities

4.1 Measured quantities

The static vertical wheel force $Q_{F0,j,k}$ is the basic measured quantity for all derived quantities.

4.2 Mandatory derived quantities

The following Table 1 defines mandatory derived quantities.

Table 1 — Mandatory derived quantities

Quantity	Dimension	Formula	Comment
Vertical static wheel load	t	$Q_{0,j,k} = \frac{Q_{F0,j,k}}{g}$	EN 15528 uses Q
Individual wheelset force	kN	$P_{F0,j} = Q_{F0,j,L} + Q_{F0,j,R}$	EN 14363:2005 uses $2Q_{0j}$ P_{F0}
Individual axle load	t	$P_{0,j} = \frac{Q_{0,j,L} + Q_{0,j,R}}{g}$	EN 15528 uses P
Train gross mass	t	$m_{trn} = \sum_j P_{0,j}$ where j addresses each wheelset of the train	

4.3 Optional derived quantities

The following Table 2 defines optional derived quantities.

Similar formulae should be used for other axle configurations, where applicable.