SLOVENSKI STANDARD
SIST-TP CEN/TR 15654-3:2019

01-julij-2019

Železniške naprave - Meritve vertikalnih kolesnih in osnih obremenitev - 3. del: Odobritev in preverjanje meritev na železniških vozilih med vožnjo

Railway applications - Measurement of vertical forces on wheels and wheelsets - Part 3: Approval and verification of on track measurement sites for vehicles in service

Bahnanwendungen - Messung von vertikalen Rad- und Radsazkräften - Teil 3: Zulassung und Prüfung von gleisseitigen Messeinrichtungen für Fahrzeuge im betrieblichen Einsatz

Applications ferroviaires - Mesurage des forces verticales à la roue et à l'essieu - Partie 3 : Approbation et vérification des sites de mesure en voie des véhicules en service

Ta slovenski standard je istoveten z: CEN/TR 15654-3:2019

<u>**ICS:**</u>

45.060.01	Železniška vozila na splošno	Railway rolling stock in general

SIST-TP CEN/TR 15654-3:2019 **en,fr,de**

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 15654-3

May 2019

ICS 45.060.01

English Version

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This Technical Report was approved by CEN on 15 April 2019. It has been drawn up by the Technical Committee CEN/TC 256.

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (CEN/TR 15654-3:2019) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

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 is the third part of the EN 15654 series, *Railway applications — Measurement of vertical forces on wheels and wheelsets*, which consists of the following parts:

— *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* [this CEN/TR].

This document describes the acceptance and verification of devices defined in Part 1.

Introduction

This document has been developed to provide approval and verification procedures to ensure that measurement systems according to EN 15654-1 meet the functional and metrological characteristics. The goal is to achieve metrologically traceable and reproducible measurement results.

1 Scope

This document is related to EN 15654-1, *Railway applications — Measurement of vertical forces on wheels and wheelsets — Part 1: On-track measurement sites for vehicles in service*, which lays down minimum technical requirements and the metrological characteristics of a system for measuring and evaluating a range of vehicle loading parameters during operation in service.

The aim of this document is to describe approval and verification procedures to validate the functional and metrological characteristics of measurement systems and confirm them over time.

The goal is to obtain the comparability and reproducibility of measurement results under different boundary conditions. To minimize the number of tests, the approval and verification procedures are divided into:

— type approval,

— initial verification,

— in-service verification.

The accuracy class of a measurement system depends on the measurement device, vehicle and track characteristics. Test procedures covering these influences are described to ensure reproducibility in all networks.

The procedures described in this document do not impose any restrictions on the design of measurement sites, on the types of vehicles that can be monitored, or on which networks or lines the measuring system can be installed.

The annexes include examples for test procedures, calculation of maximum permissible errors and statistical test methods.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15654-1:2018, *Railway applications — Measurement of vertical forces on wheels and wheelsets — Part 1: On-track measurement sites for vehicles in service*

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
calibration
operation that establishes a relationship between the reference value and the indicated measurement result from the device under test

Note 1 to entry: The reference value is a quantity value with known uncertainties provided by measurement standards.

Note 2 to entry: The indicated measurement result is the quantity with associated measurement uncertainties.

Note 3 to entry: A calibration may be expressed by a statement, calibration function, calibration diagram, calibration curve, or calibration table. In some cases, it may consist of an additive or multiplicative correction of the indication with associated measurement uncertainty.

Note 4 to entry: Calibration should not be confused with adjustment of a measuring system, often mistakenly called “self-calibration”, nor with verification of calibration (see [2]).

Note 5 to entry: Often, the first step alone in the above definition is perceived as being calibration.

Note 6 to entry: Calibration in general involves comparison against a known standard to determine how closely measurement system output matches the reference over the expected range of operation [based on GUIDE TO METEOROLOGICAL INSTRUMENTS AND METHODS OF OBSERVATION (WMO-No. 8), Part III, Chapter 4].

[SOURCE: OIML V 2-200:2012, 2.39]

3.2
adjustment
process carried out on a measuring instrument in order to provide indications corresponding to given values of the quantity

3.3
verification
conformation through provision of objective evidence that specified requirements have been fulfilled

3.4
approval
formal conformation of compliancy with the requirements of the present standard

3.5
reference value
reading from a measurement device with known measurement uncertainty and metrological traceability

3.6
measurement uncertainity
non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

[SOURCE: ISO/IEC Guide 99:2007, 2.26]

4 Overview

To minimize the number of necessary tests, the approval and verification procedures are divided into:

— type approval test,

— initial verification,

— in-service verification.

Figure 1 gives an overview of the approval and verification tests, test coverage and actions if verficiation is outside accuracy class.

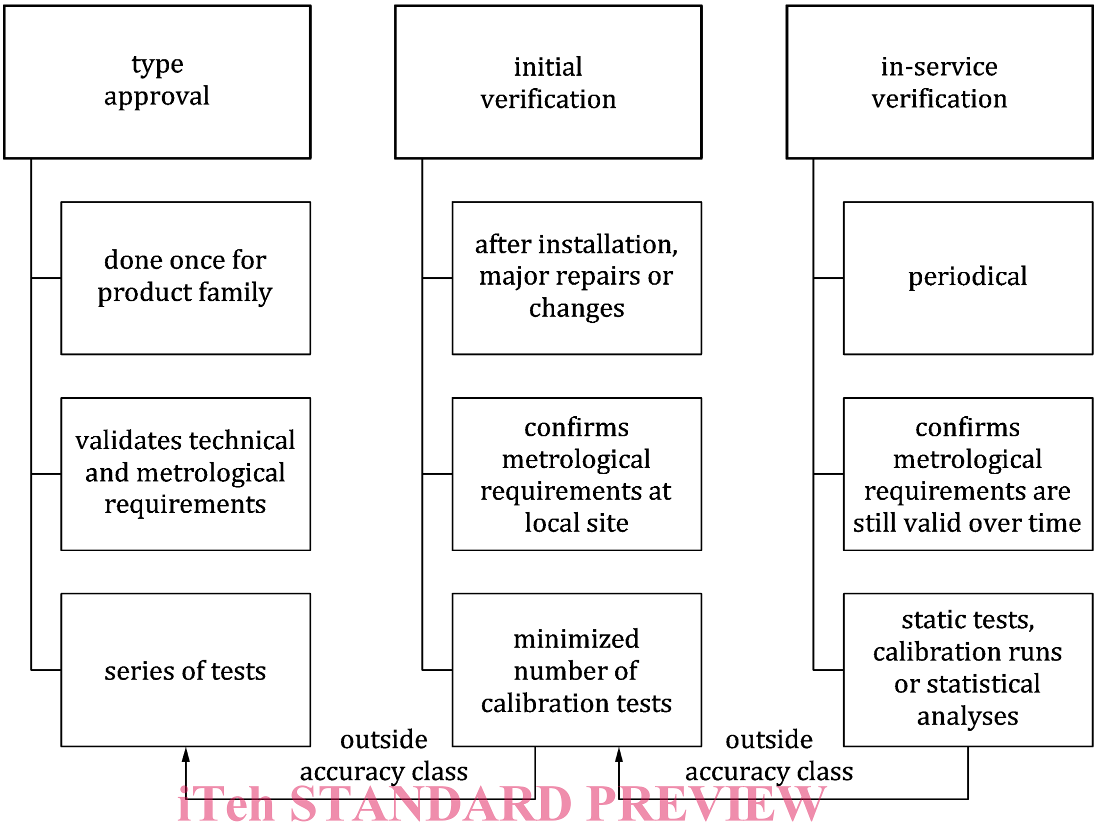

Figure 1 — Overview of approval and verification tests and actions verficiation is outside accuracy class

The purpose of the type approval is to validate the technical requirements and metrological performance characteristics (e.g. accuracy classes) under a variety of operating conditions. It is carried out once for a product family and consists of a series of lab and on-site tests.

The initial verification is performed on site after installation, after major repairs to the measuring system, after track maintenance that can influence the metrological characteristics.

It is carried out to confirm that, after initial setup, the measuring system is functioning within the defined metrological characteristics.

The in-service verification is performed periodically to confirm that the measuring system is functioning within the defined metrological characteristics. This can be achieved by static mass or force, by dynamic test runs or by statistical analysis of vehicle groups which are regularly operated on the site.

If the calibration results from in-service verification or initial verification are outside the accuracy class, corrective actions (e.g. tamping of the track) should be taken (see Annex A). If after the corrective actions, the results are still outside the accuracy class then suitable tests adopted from the type approval procedure should be carried out to determine the real on-site accuracy class for the data to be reported.

Running speed typically influences the accuracy classes. It is difficult to run at constant and defined speeds. In general, a tolerance of ±5 km/h to the required test speed is acceptable.

Speed variation above a certain level due to acceleration or deceleration can affect results. The device should be able to recognize when these levels have been exceeded during operation of the site and set the accuracy class on the digital output (XML) to “0” to indicate that the results are outsite the tested metrological characteristics.

5 Type approval

5.1 General

The type approval confirms device specifications according to EN 15654-1. The type approval may be separated into laboratory and on-site tests. The laboratory tests can cover individual components and system functionality, but cannot completely replace on-site tests. The on-site test confirms that the device operates correctly and achieves its accuracy classes under real track conditions and train operational conditions.

5.2 Tested metrological characteristics and technical requirements

The tests should be designed to reveal the effects of influences on the measurement results and to determine the accuracy class (for more information see B.4 and B.5) for each measured or derived quantity.

Type approval tests should cover at least following parameters:

— maximum measuring speed (km/h);

— minimum measuring speed (km/h);

— maximum axle load for which the accuracy classes are valid (t);

— minimum axle load for which the accuracy classes are valid (t);

— environmental condition (e.g. temperature, humidity, snow, wind, air pressure).

The following test influence quantities should be described as boundary conditions (if applicable):

— track quality and geometry;

— speed change limits;

— ambiguous name of the vehicle type, for example codes in compliance with the European Register of Authorized Types of Vehicles (ERATV);

— running behaviour, wagon condition and suspension;

— loading;

— wheel quality;

— power supply.

5.3 Laboratory and site tests

The type approval should consist of laboratory and on-site tests. The laboratory tests can be carried out for individual components or partial parts of the system, in order to test properties that are necessary to fulfil the requirements on the descriptive markings.

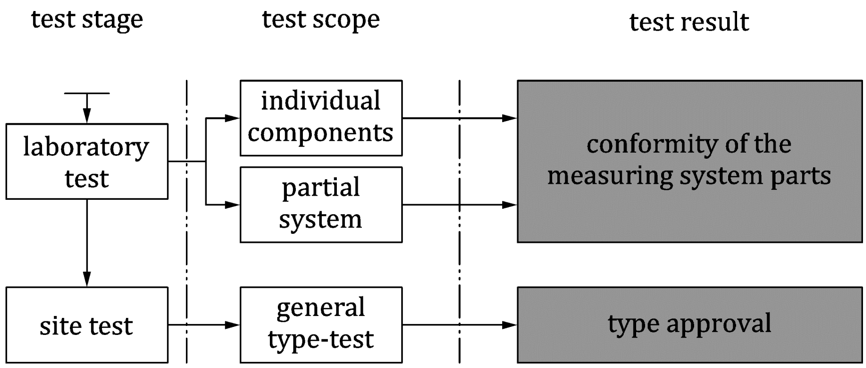

Figure 2 — Structure of the type approval test

The components listed in Table 1 should be verfied to ensure that the measuring device can fullfil its technical and enviromental requirements and metrological characteristics. The parameters to be verified are determined by the system design. Table 1 lists typical parameters to be verified.

Table 1 — Components and verified parameters

Component	Verified parameters
load sensors	measurement range, linearity, repeatability, humidity, temperature, vibration, EMC
cabling, junction boxes and connections	humidity, temperature, vibration, EMC
data acquisition device	humidity, temperature, vibration, EMC, sampling frequency
computing device, network components, power supply (AC/DC converter, UPS)	humidity, temperature, vibration, EMC
software	data exchange interface output safeguard against unauthorized adjustment self-diagnostic functions

The type approval tests should primarily be carried out on site. Laboratory tests should be used for tests that cannot be performed on site.

NOTE 1 For example, axle load typically limits testing. Depending on track and vehicle it is e.g. limited to 22,5 t at a specific site. For loads above this value laboratory tests are necessary in order to confirm linearity, repeatability and accuracy of the device. Other examples are temperature range, vibration and EMC.

Static laboratory tests should be carried out to prove the accuracy of the sensing element (partial test) at:

a) the reference temperature of 20 °C;

b) the specified high temperature;

c) the specified low temperature;

d) a temperature of 5 °C, if the specified low temperature is less than or equal to 0 °C.

NOTE 2 These laboratory tests do not take into account changes in track stiffness that may influence the measurement error depending on the design of the device.

A type approval test requires a certain number of test runs with a reference train (for more information see Annex B). The effect of scheduling test runs with regular traffic should be considered when selecting the test site.

Device behaviour can change over time. Retesting the key parameters (e.g. vehicle weight results) on site after 3 months is recommended. The uncertainty should be within the in-service inspection accuracy class.

5.4 Type approval test train

The tests can be carried out with any reference vehicles. These are vehicles whose parameters are determined on a metrologically traceable device (e.g. vehicle mass on a legal for trade weighbridge or indivual wheel forces or wheelset forces as for example described in EN 15654-2). For more information see B.2 and B.3. Vehicles can also change over the test period.

The test train should consist of at least three different representative vehicle types used on the site. Two axle and four axle vehicles are recommended.

Train composition may influence test results (e.g. train with fully loaded vehicles vs. empty vehicles vs. every second vehicle empty/full). Ideally, the system should be tested with trains that are representative for the device usage.

For freight vehicles the train should comprise of a mixture of fully loaded and empty vehicles for each vehicle type. In addition, partially loaded vehicles are recommended.

NOTE For example, a typical train composition consists of a locomotive, three two-axle vehicles (full/partial/empty), three four-axle vehicles (full/partial/empty).

If special vehicle types (e.g. rolling road) are to be measured by the device under test they should be part of the test train, fully loaded and empty. For measuring accuracy classes at speeds exceeding normal freight speeds it is recommended to use locomotives or empty passenger vehicles as reference vehicles.

Acceleration and deceleration (braking) can influence the measurement results. The maximum acceleration and deceleration, for which the accuracy class is still valid, should be defined.

The test runs should be carried out under known controlled conditions that are typical for standard operation.

Depending on the vehicle type and loading, rain, snow, humidity or cargo loss can lead to a change of the reference quantities of the vehicles over time. The test process should be planned to minimize these changes.

The loading of the reference vehicles and composition of the reference train should meet the relevant standards for safe operation of trains. Apply e.g. the imbalance load tests (left/right and front/rear imbalance load) only where it is safe to do.

5.5 Type approval test runs

The test runs should be carried out in each direction shown on the descriptive markings.

For type approval the following speeds should be tested at least twice for each accuracy class:

- at the minimum speed of the accuracy class;
- at the maximum speed of the accuracy class;
- and in between in steps, the maximum interval between test speeds in one accuracy class should not exceed:
  - 20 km/h: for speeds up to 120 km/h;
  - 40 km/h: for speeds greater 120 km/h.