SLOVENSKI STANDARD
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Železniške naprave - Profili - 3. del: Infrastrukturni profil

Railway applications - Gauges - Part 3: Infrastructure gauge

Bahnanwendungen - Begrenzungslinien - Teil 3: Infrastrukturbegrenzungslinien

Applications ferroviaires - Gabarits - Partie 3 : Gabarit de l'infrastructure

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Bahnanwendungen - Begrenzungslinien - Teil 3: Infrastruktur

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (prEN 15273-3:2018) 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 will supersede EN 15273-3:2013.

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 European standard is one of the series prEN 15273, *Railway applications — Gauges* as listed below:

— prEN 15273-1: *Generic explanations and methods of gauging* gives the general explanations of gauging and defines the sharing of the space between rolling stock and infrastructure;

— prEN 15273-2: *Rolling stock* gives the rules for dimensioning vehicles;

— prEN 15273-3: *Infrastructure* gives the rules for positioning the infrastructure;

— prEN 15273-4: *Catalogue of gauges and associated rules* includes a non-exhaustive list of reference profiles and parameters to be used by infrastructure and rolling stock;

— prCEN/TR 15273-5: *Background, explanation and worked examples*.

Introduction

The aim of this standard is to define the rules for the calculation and verification of the dimensions of rolling stock and infrastructure from a gauging perspective.

This standard describes gauging processes taking into account the relative movements between rolling stock and infrastructure as well as the necessary margins or clearances.

This part of the series EN 15273 covers rolling stock gauges and is used in conjunction with the following parts:

— *Part 1*: *Generic explanations and methods of gauging*;

— *Part 2: Rolling stock;*

— *Part 4: Catalogue of gauges and associated rules*;

— *Part 5*: *Background, explanation and worked examples.*

1 Scope

This document:

— defines the various profiles needed to install, verify and maintain the various infrastructures near the infrastructure gauge,

— lists the various phenomena to be taken into account to determine the infrastructure gauge,

— defines a methodology that may be used to calculate the various profiles from these phenomena,

— lists the rules to determine the distance between the track centres,

— lists the rules to be complied with when building the platforms,

— lists the rules to determine the pantograph gauge,

— lists the formulae needed to calculate the infrastructure gauge,

and is applicable for various track gauges.

This document defines the gauge as an agreement between infrastructure and rolling stock, and defines the responsibilities of the following parties:

a) for the infrastructure:

   1) gauge clearance;

   2) maintenance;

   3) infrastructure monitoring.

b) for the rolling stock:

   1) compliance of the operating rolling stock with the gauge concerned;

   2) maintenance of this compliance over time.

For a given defined gauge, the application of the rules contain in this part 3, associated with useful elements contained in prEN 15273-4, makes it possible to determine the minimum dimensions of an infrastructure. Therefore, this infrastructure is compatible with vehicle gauge having the same designation, and obtained according to rules defined in prEN 15273-2.

Other networks such as urban and suburban may apply the gauging rules defined in this standard but are outside of its scope.

For absolute and comparative gauging, the application of the rules contained within prEN 15273-3, combined with vehicle data defined in prEN 15273-2 in accordance with make it possible to determine the dimensions of infrastructure.

NOTE The rules given in this standard are not applicable to the gauges “S” and “T” referred to in 4.2.3.1. (7) & (8) for track gauge 1 520 mm of the merged TSI Loc and Pass (Commission Regulation N° 1302/2014 of 18 November 2014).

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 13232 (series), *Railway applications — Track — Switches and crossings*

prEN 15273-1:2018, *Railway applications - Gauges - Part 1: General - Common rules for infrastructure and rolling stock*

prEN 15273-2:2018, *Railway Applications - Gauges - Part 2: Rolling stock*

prEN 15273-4:2018, *Railway Applications - Gauges - Part 4: Catalogue of gauges and associated rules*

prCEN/TR 15273-5, *Railway applications - Gauges - Part 5: Background, explanation and worked examples*

EN 50119, *Railway applications - Fixed installations - Electric traction overhead contact lines*

EN 50367, *Railway applications - Current collection systems - Technical criteria for the interaction between pantograph and overhead line (to achieve free access)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 15273-1 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

4 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations given prEN 15273-1 apply.

5 Defined gauging

5.1 General

5.1.1 Introduction

For defined gauging, the infrastructure is defined on the basis of a reference profile and its associated rules (see prEN 15273-1, prEN 15273-4 and 5.2.1) that form an agreement between the infrastructure and the rolling stock and are therefore inseparable.

This agreement dictates how the various possible displacement of a vehicle on the track are distributed and taken into account.

5.1.2 Gauging methods

There are various calculation methods; more details are given in prEN 15273-1. It is essential to specify the method used:

— the kinematic method;

— the dynamic method;

— the static method.

5.1.3 Infrastructure gauge types

For each reference profile, listed in prEN 15273-4, there are different infrastructure gauge types depending on the required application:

— the infrastructure verification limit gauge only takes into account widening and mandatory allowances that allow safety of operations during control with parameters measured on site;

— the infrastructure installation limit gauge takes into account the infrastructure verification limit gauge and all the displacements and wear that may occur between two maintenance periods by means of an infrastructure maintenance allowance. Fitting this gauge means that clearance is maintained between the various maintenance and checking operations;

— the infrastructure installation nominal gauge, takes into account the infrastructure installation limit gauge and additional infrastructure allowances. This gauge means that clearance is maintained in practically all conditions and allows more possible uses.

5.1.4 Uniform gauge

When the infrastructure manager has sufficient space available, he can define a non-variable gauge with a design that permits easier management for the infrastructure managers and may allow the passage of exceptional consignments. This gauge, which generally incorporates additional allowances, is a nominal type infrastructure gauge called a uniform gauge.

Uniform gauges are often used in Europe by several networks. Their application rules may differ according to the networks.

This approach creates an additional allowance compared to the infrastructure installation nominal gauge used and is only possible if adequate space is available on site.

The infrastructure manager shall always check the conditions on which this gauge is based and shall always return to the infrastructure installation nominal gauge when these conditions are not met any longer.

It is necessary, therefore, not to forget the choice of gauge used and the conditions it has been based on.

The passage of exceptional consignments shall be agreed with the infrastructure manager.

5.1.5 Choice of gauge

5.1.5.1 Introduction

The gauge choice is up to the infrastructure managers. For this, the infrastructure manager may need to consider

— the technical specifications for interoperability in force,

— the bilateral or multilateral agreements,

— international technical specifications in force,

— the space available on the lines concerned,

— the specific restrictions imposed by the infrastructure.

The infrastructure manager is responsible for the maintenance of the chosen gauge over time.

The calculation method is strongly linked to the gauge choice.

5.1.5.2 Infrastructure gauge type choice

When constructing new lines, the infrastructure installation nominal gauge should be applied. In exceptional circumstances it is permitted for the infrastructure manager to apply the infrastructure installation limit gauge.

For all other new installations on existing lines, renewal, upgrading, etc., it is recommended to apply the infrastructure installation nominal gauge. It is permissible for the infrastructure manager to apply the infrastructure installation limit gauge.

NOTE 1 The aim will always be to clear the infrastructure installation nominal gauge.

An infrastructure verification limit gauge may need to be defined when the infrastructure manager wants to verify the free running of vehicles on a track in a degraded situation.

NOTE 2 Once selected a particular type of infrastructure gauge for the line or section of a line, it does not imply necessarily that the same gauge type should also be considered in the calculation of the distance between tracks, platforms and pantograph gauge.

5.1.6 Taking account of allowances

5.1.6.1 Infrastructure installation limit gauges

The phenomena to be considered and the calculation method for the sums of the allowances Σ_1 and Σ_2 are defined later in the standard.

The calculation method is often similar for the infrastructure verification limit gauge and for the infrastructure installation limit gauge.

Whereas the phenomena to be considered are always clearly defined in this standard, their determination remains the responsibility of the infrastructure managers.

5.1.6.2 Infrastructure installation nominal gauge

There is no common methodology to allow the Infrastructure installation nominal gauge to be determined in view of the different allowances to be included or not according to the choices of the infrastructure manager. The Infrastructure installation nominal gauge should be determined following a feasibility study based on the objectives laid down and the resulting technical and economic consequences.

One way to obtain a larger safety allowance whose only aim is to facilitate the management of structures approaching the infrastructure gauge is to total all the random allowances together arithmetically instead of by a root mean square and added with a *Supl*. This *Supl* is a choice of the infrastructure manager and takes into account different phenomena (aerodynamic effects, margin for exceptional consignment, etc.).

5.2 General information on all the gauging methods

5.2.1 The reference profile and its associated rules

Generally added to this profile is widening according to the line (radius, cant) and speed (cant deficiency) and certain allowances to cover random phenomena and to ensure track maintenance. These are called the associated rules.

All types of infrastructure gauges are determined by enlarging the reference profile in the lateral and vertical directions, which are often dealt with separately.

This widening corresponds to the displacements of the reference vehicles that are the basis for defining the gauge considered.

5.2.2 Lateral widening

5.2.2.1 General

Depending on the gauge method, some or all the following parameters need to be taken into account.

5.2.2.2 Lateral infrastructure gauge variations depending on the local situation

5.2.2.2.1 General

The gauge variations depend on the calculation method used and particularly on the gauge used.

5.2.2.2.2 Lateral projection ($S_{i/a}$)

The lateral projection defines the sum of the following phenomena:

— the geometric effect in the curve of the reference vehicles (S_R);

— the effect of the track widening (S_l);

— F value for static calculation method (see prEN 15273-1).

The general formulations are set forth in prEN 15273-1. The specific formulae to be used for calculating each gauge are given in EN 15273-4.

5.2.2.2.3 Quasi-static effect ($qs_{i/a}$)

The quasi-static effect gives the reference vehicle body roll in a curve for the upper parts

— outside of the curve, under the cant deficiency effect, which becomes maximum at maximum authorized speed,

— inside of the curve, under the cant effect, which becomes maximum when the vehicle is stationary.

It should be noted that, for the kinematic calculation method, the rolling stock already takes a part into account up to values I_0 and D_0; the infrastructure only takes the addition into account.

In the static calculation method, the complete D or I needs to be taken into account by the infrastructure manager.

NOTE Other methods exist for taking this phenomenon into account. For example, in the case of the dynamic calculation method, this phenomenon is taken into account by the rolling stock.

The general formulations are given in prEN 15273-1. The specific formulae to be applied for the gauge used are given in 5.3.2.1 for the kinematic gauging method.

For the lower parts (see Annex B), this phenomenon is taken into account by the rolling stock.

5.2.2.3 Lateral random phenomena

5.2.2.3.1 General

Random phenomena to be considered depend on the gauge method used.

The following phenomena are considered as the responsibility of the infrastructure manager.

5.2.2.3.2 Vehicle oscillations generated by track irregularities (T_{osc})

Irregularities of the track are one of the causes of vehicle oscillations. The amplitude depends mainly on the track condition and suspension characteristics. These phenomena are taken into account by the infrastructure by the value T_{osc} Depending on the flexibility of the vehicle, they are located at the base of an inclination around the roll centre and thus the following widening:

$$\Delta b_1 = \frac{s_0}{L} \cdot T_{osc} \cdot (h - h_{c0}) \quad (1)$$

NOTE Other methods exist for taking this phenomenon into account. For example, in the case of the dynamic calculation method, this phenomenon is taken into account by the rolling stock.

In straight track, the value of $T_{osc,a}$ shall be taken into account.

5.2.2.3.3 Track displacement (T_{voie})

T_{voie} is a lateral margin that takes into account the lateral movement of the track. The track position is likely to change between two track maintenances and/or obstacle verifications owing to the traffic loads and to the track maintenance.

When the track design does not allow any movement in relation to the structure, this allowance may be disregarded.

5.2.2.3.4 Cross level variation (T_D)

T_D is a value for the variation of cross level. The cross level of the track can vary in relation to its nominal value due to the maintenance tolerances and to the traffic. This cross level variation T_D has a double effect:

— the reference profile rotates around the track centreline at an angle corresponding to the maximum variation, $\frac{T_D}{L}$ which causes the following widening:

$$\Delta b_2 = \frac{T_D}{L} \cdot h \quad (2)$$

— the vehicle will tend to turn around the roll centre, affected by the flexibility of its suspension, which will cause an additional widening of parts located above the roll centre:

$$\Delta b_3 = \frac{s_0}{L} \cdot T_{\mathrm{D}} \cdot (h - h_{\mathrm{c0}})_{>0} \tag{3}$$

It shall be noted that the two phenomena are always present simultaneously and are therefore not independent.

NOTE Other methods exist for taking this phenomenon into account. For example, in the case of the dynamic calculation method, only the geometrical effect is taken into account by the infrastructure manager, the dynamic effect is taken into account by the rolling stock.

5.2.2.3.5 Dissymmetry ($\eta_{0,\mathrm{r}}$)

A vehicle will never be perfectly symmetrical; the main reasons for this are as follows:

— poor suspension adjustment resulting in a body roll (T_{susp})

— loading dissymmetry which makes the vehicle body roll in its suspension gear and which results similarly in a rotation of the vehicle (T_{charge}).

In both cases, the vehicle body rotates around its roll centre C_0 The sum of the two angles corresponds to the agreed reference angle $\eta_{0,\mathrm{r}}$:

$$\eta_{0,\mathrm{r}} = T_{\mathrm{charge}} + T_{\mathrm{susp}} \tag{4}$$

This will cause additional widenings, both considered at the same time:

$$\Delta b_4 = \tan(T_{\mathrm{charge}}) \cdot (h - h_{\mathrm{c0}})_{>0} \tag{5}$$

and

$$\Delta b_5 = \tan(T_{\mathrm{susp}}) \cdot (h - h_{\mathrm{c0}})_{>0} \tag{6}$$

NOTE Other methods exist for taking this phenomenon into account. For example, in the case of the dynamic calculation method, this phenomenon is taken into account by the rolling stock.

5.2.3 Vertical adjustment

5.2.3.1 General

According to the point on the reference profile and the gauge method, some or all the following parameters need to be taken into account, either upward or downward.