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Železniške naprave - Zgornji ustroj proge - Kretnice in križišča za Vignolove tirnice - 7. del: Kretniška srca s premičnimi deli

Railway applications - Track - Switches and crossings for Vignole rails - Part 7: Crossings with moveable parts

Bahnanwendungen - Oberbau - Weichen und Kreuzungen für Vignolschienen - Teil 7: Herzstücke mit beweglichen Bauteilen

Applications ferroviaires - Voie - Appareils de voie - Partie 7: Coeurs à parties mobiles

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Foreword

This document (prEN 13232-7:2014) 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 13232-7:2006+A1:2011.

This series of standards “*Railway applications – Track – Switches and crossings for Vignole rails*” covers the design and quality of switches and crossings in flat bottomed rail. The list of Parts is as follows:

— *Part 1: Definitions*

— *Part 2: Requirements for geometric design*

— *Part 3: Requirements for wheel/rail interaction*

— *Part 4: Actuation, locking and detection*

— *Part 5: Switches*

— *Part 6: Fixed common and obtuse crossings*

— *Part 7: Crossings with moveable parts*

— *Part 8: Expansion devices*

— *Part 9 : Layouts*

Part 1 contains terminology used throughout all parts of this series. Parts 2 to 4 contain basic design guides and are applicable to all switch and crossing assemblies. Parts 5 to 8 deal with particular types of equipment including their tolerances. These use Parts 1 to 4 as a basis. Part 9 defines the functional and geometric dimensions and tolerances for layout assembly.

The following terms are used within to define the parties involved in using the EN as the technical basis for a transaction:

Customer the Operator or User of the equipment, or the Purchaser of the equipment on the User's behalf.

Supplier the Body responsible for the use of the EN in response to the Customer's requirements.

Introduction

The requirements of crossings with moveable parts are that they are capable of performing their intended purpose, which is to allow a vehicle to pass the area where the two rails cross with a continuous running edge.

That means the wheels of the vehicle are fully supported and guided in the whole crossing area, either in the facing or trailing direction.

The main criteria for the selection of crossings with moveable parts are:

— improvement of ride comfort;

— reduction of noise and vibration;

— reduction of maintenance;

— mixed traffic conditions (e.g. train/tram);

— security against derailment.

This last point is particularly important (critical) in diamond crossings. Effectively, as the wheel diameter and the obtuse crossing angle decrease, the distance without guidance (EN 13232-3:2003, 4.2.5) increases.

Therefore, to assure the safety of running of the wheel set over the diamond crossing, it is sometimes necessary to design the obtuse crossing as moveable.

Rules and recommendations for security against derailment in diamond crossings are set down in part 9 of this standard.

The crossings with moveable parts shall be designed to withstand all external forces from rolling stock, thermal influences etc.

The customer shall specify the maximum strains or stresses due to external thermal forces that the crossing with moveable parts has to withstand.

Operating, signalling systems, heater systems, load bearing supports, maintainability and safety are all major factors which should be taken into account during the design.

The performance criteria shall be based on information given by the customer.

The design and selection of types of crossings with moveable parts will be influenced by axle loads, frequency of traffic and speed.

1 Scope

The scope of this part is:

— to establish a working terminology for crossings with moveable parts, which means crossings with moveable parts to close the gap of the running edge, and their constituent parts, and identify the main types;

— to list the minimum informative requirements for the manufacture of crossings with moveable parts and/or their constituent parts;

— to formulate codes of practice for inspection and tolerances for crossings with moveable parts and/or their constituent parts;

— to establish the limits and extent of supply;

— to list the method by which crossings with moveable parts and their constructional parts should be identified and traced;

— to list the different and varying ways by which crossings with moveable parts can be described, using the following parameters:

  — geometry of crossings;

  — types of construction;

  — performance requirements;

  — design criteria;

  — tolerances and inspection.

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 13145, *Railway applications – Track – Wood sleepers and bearers*

EN 13146 (all parts), *Railway applications – Track – Test methods for fastening systems*

EN 13230 (all parts), *Railway applications – Track – Concrete sleepers and bearers*

prEN 13232-1:2013, *Railway applications – Track – Switches and crossingsfor for Vignole rails – Part 1: Definitions*

prEN 13232-2:2014, *Railway applications – Track – Switches and crossings for Vignole rails – Part 2: Requirements for geometric design*

prEN 13232-3:2014, *Railway applications – Track – Switches and crossings for Vignole rails – Part 3: Requirements for wheel/rail interaction*

prEN 13232-4:2014, *Railway applications – Track – Switches and crossings for Vignole rails – Part 4: Actuation, locking and detection*

prEN 13232-9:2014, *Railway applications – Track – Switches and crossings for Vignole rails – Part 9: Layouts*

EN 13481 (all parts), *Railway applications – Track – Performance requirements for fastening systems*

EN 13674 (all parts), *Railway applications – Track – Rail*

UIC 866, *Technical specification for the supply of cast manganese steel crossings for switch and crossing work*

3 Types of crossing with moveable parts

3.1 Common crossings with moveable parts

There are two major types of common crossing with moveable parts. These are crossing with moveable point (see Figure 1) and crossing with moveable wing rails (see Figure 2).

In both cases:

The wings and vee support can be:

— saddle (cast, welded, machined);

— assembled (made of different rail profiles, e.g. standard rail, asymmetric low section, symmetric thick web section etc.).

The vee can be:

— monobloc (cast, welded, machined);

— assembled (made of different rail profiles, e.g. standard rail, asymmetric low section, symmetric thick web section etc.).

Rail profiles shall be according to EN 13674-1 and EN 13674-2.

In the case of a crossing with moveable point:

— point may or may not contain a longitudinal sliding area;

— vee of point and splice rail may be coupled by bolting, welding or fabricated out of a monobloc and welded to their respective adjacent legs.

For example see Figures 3, 4 and 5.

In the case of a crossing with moveable wing rails a longitudinal sliding area is not required.

Other types of construction and their requirements shall be agreed between customer and supplier.

3.2 Obtuse crossings with moveable parts

The main type of obtuse crossing with moveable parts is the switch diamond crossing (see Figure 6).

The wing and switches rails support can be:

— saddle (cast, welded, machined);

— assembled (made of different rail profiles, e.g. standard rail, asymmetric low section, symmetric thick web section etc.).

The wing rail can be:

— monobloc (cast, welded, machined);

— assembled (made of different rail profiles, e.g. standard rail, asymmetric low section, symmetric thick web section etc.).

Switch diamond crossings can be used in obtuse crossings with or without single or double slips.

Rail profiles shall be according to EN 13674-1 and EN 13674-2.

3.3 Materials

The materials used shall be defined at least by their respective European Standard or by their mechanical and chemical characteristics in the non-existence of a European Standard.

The grade and specification of rails to be used shall be specified by the customer and shall comply with EN 13674 (all parts). All bolts and other fixing devices shall be minimum grade 5.6. All other blocks and fittings shall be manufactured to minimum grade 200. The use of other materials shall be agreed between customer and supplier.

3.4 Geometry

The geometry of the crossing at the running edges (straight or curved) shall be in accordance with the general layout according to prEN 13232-2:2014 and prEN 13232-9:2014.

3.5 Inclination of the running table

The running table of the crossing may or may not be inclined.

Inclination of any running table in the crossing and location and length of any twist (change of inclination) shall be defined.

3.6 Construction

If a transition from special rail profile to standard rail profile is required, the transition can either be located in the fixed part or in the moveable part. In case of a weld, in the moveable part, the weld shall be secured by fishplating.

3.7 Relationship with the adjacent track

The crossing can be joined to the adjacent track:

— by fishplates;

— by glued fishplates;

— by welding.

4 Terms and definitions

For the purpose of this European Standard the terms and definitions given in prEN 13232-1:2013 and the following apply.

4.1 Common crossing with moveable point (Figure 7)

4.1.1
swing nose (or moveable vee)
part of the crossing which forms the vee. It is moved to form a continuous running edge for either the main or branch lines

4.1.2
saddle (or wing rail)
gives support to the swing nose and also forms the housings when the swing nose is thrown. The saddle (or wing rail) is also used to support the wheel when transferring from the wing rail to the vee

4.1.3
relief ramp (if required)
ramp for false flange on worn wheels

4.1.4
distance blocks (if required)
mechanical device to give strength and support to the crossing. Depending on the design concept, the distance blocks should transfer track forces

4.1.5
left hand wing front rail
rail connected to left hand wing front

4.1.6
right hand wing front rail
rail connected to right hand wing front

4.1.7
spacer blocks (or studs)
blocks to give lateral support to the swing nose

4.1.8
foot relief (if required)
reduction of section of point rail foot at the swing nose heel to facilitate flexing

4.1.9
longitudinal sliding area (if required)
system to permit free movement of the swing nose, it allows for the changes in rail length as the swing nose is operated. The longitudinal sliding area is normally situated on the branch line of the crossing

4.1.10
left hand wing rail
wing rail to the left of the vee when viewed from the vee (swing nose)

4.1.11
right hand wing rail
wing rail to the right of the vee when viewed from the vee (swing nose)

4.1.12
left hand vee rail (monobloc vee)
rail connected to the left hand vee leg between the swing nose and the longitudinal sliding area (as shown for a left hand crossing)

4.1.13
left hand extended vee rail (monoblock vee) (if required)
rail between the longitudinal sliding area and the heel of the crossing (as shown for a left hand crossing)

4.1.14
right hand vee rail (monoblock vee)
rail connected to the right hand vee leg of swing nose (as shown for a left hand crossing)

4.1.15
flangeway blocks
blocks used to maintain the correct flangeway gap between the vee rails and wing rails. Depending on the design concept, the distance blocks should transfer track forces

4.1.16
left hand splice rail (assembled vee)
rail spliced to point rail

— forming the vee and permitting longitudinal movement between point rail and splice rail (see Figure 3),

— forming the vee between the point rail and the extended splice rail and permitting longitudinal movement between splice rail and extended splice rail (see Figure 4) and

— forming the vee and without longitudinal movement between point rail and splice rail

4.1.17
left hand extended splice rail (assembled vee) (if required)
rail between the longitudinal sliding area and the heel of the crossing (as shown for a left hand crossing)

4.1.18
right hand point rail (assembled vee)
rail forming the swing nose situated in the main line from the swing nose to the heel joint (as shown for a left hand crossing in Figures 3 and 4)

4.1.19
point rail toe (PRT)
front physical end of the point rail that contacts the saddle or the wing rail to form a continuous running edge in the closed position (see Figure 10 a))

4.1.20
splice rail toe (SRT) (assembled vee)
front physical end of the splice rail that contacts the point rail (see Figure 10 a))

4.2 Common crossing with moveable wing rails (Figure 8)

4.2.1
left hand vee rail
rail forming the vee situated to the left of the vee when viewed from the nose

4.2.2
right hand vee rail
rail forming the vee situated to the right of the vee when viewed from the nose

4.2.3
relief ramp (if required)
ramp for false flange on worn wheels

4.2.4
vee
part of the crossing forming the shape of a letter '*v*'. The vee is fixed

4.2.5
supporting bar
in the closed position of the wing rail this bar gives lateral support to the wing rail via the wing rail stops

4.2.6
wing rail stops
stops fixed on the wing rails to transfer the lateral forces from the wing rail to the supporting bar (in the closed position of the wing rail)

4.2.7
foot relief
reduction of section of wing rail foot at the wing front to facilitate flexing

4.2.8
left hand moveable wing rail
wing rail to the left of the vee when viewed from the nose. It is moved to form a continuous running edge for the right line as shown in Figure 8

4.2.9
right hand moveable wing rail
wing rail to the right of the vee when viewed from the nose. It is moved to form a continuous running edge for the left line

4.2.10
nose
point at which the vee commences at the level of the gauge reference plane

4.3 Obtuse crossing with moveable parts (Figures 9 & 10)

4.3.1
switch diamond
type of obtuse crossing where both the point rails take the form of movable switch rails presenting fully supported running edges in the route for which they are set. Switch diamonds are used for flat crossing angles, and for crossings with sharp curvature, and consist of two switch rails and a wing rail

4.3.1.1
set of switch diamonds
arrangement forming the centre part of a movable diamond and consisting of two wing rails (W) and four switch rails (S). See Figure 10

4.3.2
right hand switch rail
rail to the right hand side of the switch diamond when viewed from outside the gauge. This rail flexes to either form a continuous running edge for the wheel to pass over when the switch is closed, or flange way clearance for the wheel to pass through when the switch is open

4.3.3
left hand switch rail
as right hand switch rail but opposite hand

4.3.4
right hand back rail (if required)
rail to the right hand side of the switch diamond when viewed from outside the gauge. This rail gives support to the switch rail and also forms the fixed flexing portion at the heel of the switch rail

4.3.5
left hand back rail (if required)
as right hand back rail but opposite hand

4.3.6
heel blocks (if required)
blocks used to form the fixed heel block assembly between the switch rail and respective back rail to limit the moveable length. Depending on the design concept, the distance blocks should transfer track forces

4.3.7
wing rail
part of the crossing with horizontal set forming the running rail support at the switch rail ends

4.3.8
distance blocks (if required)
mechanical device to give strength and support to the crossing assembly. Depending on the design concept, the distance blocks should transfer track forces

4.3.9
knuckle
theoretical intersection of the running edges

4.3.10
spacer blocks (or studs)
blocks to give lateral support to the switch rail

4.3.11
switch toe
physical end of the switch rail that contacts the wing rail to form a continuous running edge in the closed position

4.3.12
moveable length
part of the switch rail which moves in front of the first fixed position when the switch diamond is operated

4.3.13
foot relief
reduction of section of switch rail foot at the switch heel to facilitate flexing

5 Design requirements

5.1 Geometrical data

The following data shall be agreed between the customer and the supplier:

— geometry of the two intersecting running edges (straight, circular, clothoid, etc.);

— tangent at the theoretical intersection point;

— bearer layout at the crossing;

— position of the gauge plate/strut (if required);

— height of the crossing;

— rail profiles;

— rail inclination;

— track gauge;

— check gauge (if non-active check rail is requested by the customer);

— machining profile of nose and wing-rail (see Figures 11 to 13);

— minimum flange way width;

— minimum opening between the wing rails (throat opening);

— opening at the drive position.

And any other interfaces with the turnout deemed to be necessary for the design of the crossing.

Check rail profiles shall be according to EN 13674-3.

5.2 Rolling stock data

5.2.1 Maximum axle load

The customer shall provide the value of the maximum axle load for the line where the crossing is to be installed.

5.2.2 Maximum speed

The customer shall provide the value of the maximum speed for the mainline where the crossing is to be installed.

5.2.3 Wheel profile, diameter, back to back and wheel set dimensions

The customer shall provide the supplier with the wheel profile/profiles, diameter, back to back and wheel set dimensions. The wheel profile/profiles to be used in the design of the crossing may be new ones, with an average wear or maximum wear values. The customer shall indicate which profile/profiles are to be used in the design. Also if special circumstances are to be taken into account, e.g. false flanges in the wheels, etc.

Wheel profile and wheel set geometry determine the geometry of the rolling table of the crossing, the flange way width and the check gauge if non-active checkrails are requested.

5.2.4 Note

For detail requirements, see prEN 13232-2:2014 and prEN 13232-3:2014.

5.3 Supports and fastenings

The relationship of the crossing to the adjacent track and the closure panel, the fastening and supporting systems shall be agreed between supplier and customer. EN 13145, EN 13146 (all parts), EN 13230 (all parts) and EN 13481 (all parts) shall be taken into account.

It shall be specified if the crossing is to be welded to the track or joined by fishplates. In the latter case, the type and details of the fishplates to be used shall be specified by the customer, i.e. section details, length, size and number of holes, bolt centre line height above base of rail and material of fishplates.

The customer shall specify the details of fastenings to be used, direct or indirect.

5.4 Interface between crossing with moveable parts and operating system

Requirements to permit the interface between the crossing with moveable parts and the actuation, locking and detection systems shall be as defined in prEN 13232-4:2014. The type of operating system shall be specified by the customer.

The throwing force shall be agreed between customer and supplier and checked at inspection of prototypes only.

5.5 Transfer of longitudinal track forces

When the crossing is integrated in a continuous welded track, the maximum longitudinal forces to be considered for the design are the maximum thermal forces.

The supplier shall prove the capability of the product to support track forces on customer request.

The customer shall define the method (calculation and/or practical test) to be used.

5.6 Other requirements

The customer shall specify all other requirements that may have an influence on the design of the crossing, and provide all necessary data for them.

Examples are heaters, environmental conditions, electrical insulation, continuously welded rail, insulated and/or glued joints, applied cant, special maintenance requirements.

5.7 Drawings

Individual components shall be illustrated on detailed drawings. These detailed drawings shall contain the following information:

— machining profiles;

— sets;

— bending details;

— position of the running edges and machining reference plane;

— drillings;

— pertinent tolerances and surface finishes.

To assure the safety of running of the wheel set over crossing with moveable parts, the machining profiles of switch rail, point rail, splice rail and wing rail shall respect the prescription given in prEN 13232-3:2014.

See also prEN 13232-3:2014.

6 Tolerances and inspection

6.1 General

The following section describes tolerances of the critical dimensions, which shall be verified. These tolerances are based on workshop temperatures or a predefined temperature specified by the customer.

Any dimensions and tolerances relating to special requirements (e.g. operating systems, welds, insulated joints) shall be verified.

If the customer imposes restrictions on the tolerances given in the following, they shall be stated in the tender documents.

6.2 Tools and instruments

The customer may request drawings/details of tools/measuring instruments and measuring conditions for verification. Drawings/details shall be submitted on request for approval. All tools/instruments shall be made available by the supplier on request.