

Design guidelines

Technical Specification - Turnout integrated system & rail expansion joints

09-03-2021



Co-financed by the European Union
Connecting Europe Facility

*The sole responsibility of this publication lies with the author.
The European Union is not responsible for any use that may be made of the information contained therein.*

Table of Contents

1.	Scope	4
2.	Reference documents	5
2.1.	Design Guidelines	5
2.2.	TSI	6
2.3.	European Standards.....	6
2.4.	UIC recommendations	7
3.	Terms and definitions.....	8
4.	General requirements	9
4.1.	General requirements for turnouts	9
4.2.	General requirements for expansion joints	10
4.3.	Turnout design parameters.....	11
4.3.1.	Speed of diverging track	11
4.3.2.	Type of crossing	12
4.3.3.	Track alignment design criteria	12
4.4.	Rail expansion joint design parameters	13
4.5.	Scope of supply of turnouts	14
4.6.	Adoption of the supplier specifications	15
5.	Component interface requirements.....	16
5.1.	General	16
5.2.	Interface with signalling design	16
5.3.	Interface with rolling stock	16
5.4.	Interface with civil works.....	16
6.	Turnouts dimensions	17
6.1.	Geometric specifications	17
6.2.	Interface with actuation, locking and detection equipment	18
7.	Material and equipment requirements	19
7.1.	Turnouts components requirements	19
7.1.1.	General	19
7.1.2.	Switch panel	19
7.1.3.	Closure panel	20
7.1.4.	Crossing panel	20
7.2.	Fastening systems and other fittings	21

7.3.	Concrete bearers (sleepers) requirements	21
7.4.	Rail expansion joints	21
8.	Manufacturing.....	22
8.1.	General	22
8.2.	Straightening and bending of rails.....	22
8.3.	Machining and fitting	23
8.4.	Holes.....	23
8.5.	Rail ends	23
9.	Testing & acceptance.....	24
9.1.	Dimensional tolerances	24
9.2.	Inspection.....	24
9.3.	Factory assembly, inspection and acceptance of prototypes.....	24
9.3.1.	General	24
9.4.	Integrated turnout systems acceptance tests.....	25
10.	Submittals	26
10.1.	Design and maintenance manual.....	26
10.2.	Drawings.....	26
10.3.	BIM deliverables.....	27
10.4.	Design conformity documentation and certification	28
10.5.	Certification	28
11.	Quality system inspection	29
11.1.	General	29
11.2.	Certificate of Conformity	29
11.3.	Quality records	29
11.4.	Inspection and audits	29
12.	Additional information requested.....	30

1. Scope

This specification covers the requirements for the design, manufacture testing and supply of turnout integrated system and rail expansion joints for use on the Rail Baltica line.

The specification defines requirements for selection of the most suitable fully functioning turnout integrated system from the life cycle cost perspective (incl. sourcing, installation and maintenance cost).

In the following, “turnout” shall be understood as turnout device alone, whereas “turnout integrated system” means an integrated system including turnout and all necessary elements and subsystems necessary for optimum operation and maintenance of the turnout.

In the following, “turnout” and “switch” have same meaning, and also includes the track crossings.

In the following, “point machine” and “switch machine” have same meaning.

The scope of the specification covers supplier’s responsibilities towards integration of all types of proposed turnouts with track equipment, structure, earthworks, Energy sub-system, Control-Command and Signalling subsystem, including all auxiliary systems required for turnout operation: switch drives, locks, actuators, switch heating, predictive maintenance sensors and devices, etc. Scope of responsibility of supplier covers design, manufacturing, factory testing and commissioning, as well as all necessary instructions, manuals and training material for installation, testing and commissioning, operation, maintenance and dismantlement.

This specification concerns the turnout integrated system for:

- Rail Baltica main line, including passing loops, stations and service tracks necessary to its proper functioning;
- Freight terminals, infrastructure maintenance facilities, rolling stock maintenance facilities, etc.

This specification concerns the rail expansion joints for long structures and other locations.

This specification does not concern:

- The temporary turnouts which might be necessary during construction works.

2. Reference documents

The document hierarchy of precedence in descending order shall be:

- This Specification;
- Design Guidelines;
- TSI specification;
- European Standards;
- UIC leaflets recommendations.

The following standards and specifications are referred to in this specification (when revised or amended, subsequent revisions or amendments to these specifications shall apply).

The supplier shall make reference to the above documents for design, test, manufacture and supply.

2.1. Design Guidelines

The following Design Guidelines shall be applied and/or refer to:

Standard	Title
RBDG-MAN-012	Design Guidelines – General Requirements
RBDG-MAN-014	Design Guidelines – Railway Superstructure – Track
RBDG-MAN-014A	Design Guidelines – Technical Specification – Rails
RBDG-MAN-014B	Design Guidelines – Technical Specification - Sleepers, USPs and Fastenings
RBDG-MAN-018	Design Guidelines – Railway Energy Part 1: traction power system
RBDG-MAN-022	Design Guidelines – Railway Control-Command Signalling system
RBDG-MAN-029	Design Guidelines – Adaptation to climate change
RBDG-MAN-032	Design Guidelines – RAMS Targets

2.2. TSI

Railways used are to be based largely on national regulations and requirements. The purpose of the new European regulations is to standardise subsystems or components in order to reduce the cost of railways and to increase competitiveness, as well as to make it possible for trains to run between different member states without technical obstacles.

The following Technical Specifications for Interoperability (TSI) is based on best available expert knowledge and is related to the infrastructure subsystem of the rail in the European Union:

TSI	Title
Commission Regulation (EU) N° 1299/2014 of 18 November 2014 – Infrastructure TSI	Technical Specifications for Interoperability relating to the infrastructure subsystem of the rail in the European Union.

2.3. European Standards

The relevant European standards used for high speed lines and conventional lines are listed below:

Standard	Title
EN 13232-1	Switches and crossings – Definition
EN 13232-2	Switches and crossings – Requirements for geometric design
EN 13232-3	Switches and crossings – Requirements for wheel/rail interaction
EN 13232-4	Switches and crossings – Actuation, locking and detection
EN 13232-5	Switches and crossings – Switches
EN 13232-6	Switches and crossings – Fixed common and obtuse crossings
EN 13232-7	Switches and crossings – Crossings with moveable parts
EN 13232-8	Switches and crossings – Expansion devices
EN 13232-9	Switches and crossings – Layouts
EN 13481-7	Performance requirements for fastening systems – Special fastening systems for switches and crossings and check rails
EN 13674-1	Vignole railway rails 46kg/m and above
EN 13674-2	Switch and crossing rails used in conjunction with Vignole railway 46kg/m and above

Standard	Title
EN 13674-3	Check rails

2.4. UIC recommendations

The following UIC recommendation should be taken into consideration:

UIC leaflet	Title
UIC 864-2	Technical specification for the supply of steel track bolts
UIC 864-4	Technical specification for the supply of fishplates or sections of fishplates
UIC 866	Technical specification for the supply of cast manganese steel crossings for switch and crossing work

3. Terms and definitions

Terms and definitions used in this specification comply with the ones defined and listed in EN 13232-1.

4. General requirements

Turnout shall be provided as a fully functioning turnout integrated system with all necessary systems required for turnout operation: track, Control-Command and Signalling, point heating, predictive maintenance, etc.

The turnouts shall be designed for the respective speeds on deviated direction stated in Rail Baltica Operation Plan and detailed in Section 4.3 below.

Only components with service proven records for application on track with at least the same or higher speed and axle load, and a minimum of a period of 5 years' service on such conditions, will be considered.

In order to cope with the environmental conditions of the Baltic countries, the integrated turnout solution shall be designed and constructed in accordance with requirements of §8. "Environmental conditions for systems", found in RBDG-MAN-012 (Design Guidelines - "General Requirements"); in particular, all the exposed steel parts from the track shall be protected against corrosion, except for the running rail.

All infrastructure components, including turnouts, switches and expansion joints, shall comply with a design life of 50 years.

For maintainability purposes, each type of turnout integrated systems and expansion joints shall be manufactured from one source of supply and have dimensional tolerances to ensure that each component is interchangeable.

4.1. General requirements for turnouts

Turnout integrated system shall comply with the following minimum requirements:

- a) 1435mm track gauge;
- b) 1/40 inclination;
- c) The turnouts shall allow to be included in the continuous welded rails;
- d) The turnouts shall be designed to be lubrication-free designed, for switch and frog tongue movements;
- e) Electrical resistance of the turnout according to EN 13481-2 Clause 5.6
- f) The turnouts shall be designed to be fully capable of withstanding longitudinal forces induced by the rolling stock when braking with at least 2.5 m/s^2 ;
- g) The turnouts shall be equipped of a switch machine, switch locking and switch heating (Refer to RBDG-MAN-022);
- h) The turnouts shall be equipped with electric heating system, for switch/stock rail and movable crossing but also for rods connecting locking devices to the switch machines;
- i) The turnouts shall be equipped with hollow sleepers in which the locking devices with their rods are integrated and protected;
- j) The locking systems shall be protected against snow;
- k) Rail/wheel interaction compatibility: switches and crossings shall be designed to suit the wheel profile;

- l) All joints shall be welded;
- m) The assembly shall ensure continuous electrical contact for return traction current, for 25kV electrification system;
- n) Switches, swing nose crossing shall be equipped with:
 - a. Locking devices;
 - b. Devices enabling to detect whether movable components lay in correct required position and are correctly locked;
- o) Steel grade shall be not less than R350HT;
- p) Turnouts shall be equipped with monoblock concrete bearers;
- q) The rail fastening system of the turnouts shall provide the same performance as the rail fastening system in plain track;
- r) The turnout shall ensure continuous electrical contact for return traction current, for 25kV electrification system.
- s) Turnouts shall be compatible with the use of magnetic braking systems for emergency braking;
- t) Turnouts shall be non-trailable type;
- u) The movement of turnouts shall be possible in local control mode;
- v) Turnouts shall be equipped of devices for local switching;
- w) Turnouts components (rails, concrete bearers, fastenings) shall comply with relevant components specifications as described in the following Design Guidelines:
 - a. Technical Specification - Rails (RBDG-MAN-014A);
 - b. Technical Specification - Sleepers, USPs and Fastenings (RBDG-MAN-014B)
- x) Derailing blades (trap points) shall follow the same requirements as turnouts

4.2. General requirements for expansion joints

The expansion joints shall be of durable design and shall be capable of accommodating the longitudinal movements caused by thermal, structural and/or live loads;

The expansion joints shall be designed to accommodate rail movement at least equivalent to the seasonal movement (expansion and contraction) of the structural element which is required to accommodate, or to accommodate the longitudinal movements of the interrupted continuous welded rail, or the combination of both;

Type and opening of expansion rail joints shall be determined in accordance with the rail structure interaction studies for each civil engineering work, bridge or viaduct designed for the Rail Baltica project;

All expansion joints shall be manufactured and tested according to EN 13232-8;

The expansion joints are made from rails profile EN 60E2, grade R350HT steel, as per EN 13674-1;

The assembly shall ensure continuous electrical contact for return traction current, for 25kV electrification system.

4.3. Turnout design parameters

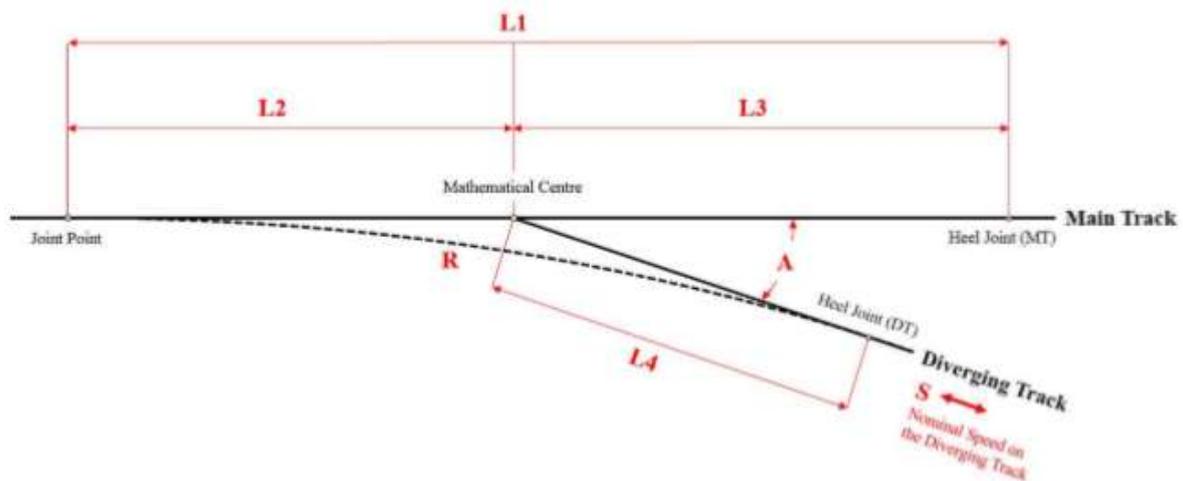
The turnouts shall be designed, tested and manufactured in accordance with the following design parameters:

4.3.1. Speed of diverging track

According to Rail Baltica Operating plan, there shall be (maximum) 11 types of turnouts for the following 7 different diverging track speeds:

- a) 40 km/h;
- b) 50 km/h;
- c) 80 km/h;
- d) 100 km/h;
- e) 130 km/h;
- f) 170 km/h;
- g) 230 km/h.

Proposed dimensions (for design purpose) for the turnouts are the following:



1. FIGURE 1 - PROPOSED DIMENSIONS FOR TURNOUTS

Turnout	Crossing type	L1 (m)	L2 (m)	L3 (m)	L4 (m)	R (m)	A (degree)	S (km/h)	V (km/h)
60E-7350 - 1/65	Swing nose	194.508	64.998	129.510	129.527	7350	0,9290	230	300
60E-3550- 1/46	Swing nose	137.535	45.900	92.635	91,660	3550	1,3128	170	300
60E-2500- 1/26.5	Swing nose	94,306	47,153	47,153	47,153	2500	2,4012	130	300

Turnout	Crossing type	L1 (m)	L2 (m)	L3 (m)	L4 (m)	R (m)	A (degree)	S (km/h)	V (km/h)
60E-2500-1/26,5	Fixed	94,306	47,153	47,153	47,153	2500	2,4012	130	200
60E-1200-1/18,5	Swing nose	64.818	32.409	32.409	32.409	1200	3.0941	100	300
60E-1200-1/18,5	Fixed	64.818	32.409	32.409	32.409	1200	3.0941	100	200
60E-760-1/15	Swing nose	54.216	25.305	28.911	28.911	760	3.8141	80	300
60E-760-1/14	Swing nose	54.216	27.108	27.108	27.108	760	4.0856	80	300
60E-760-1/14	Fixed	54.216	27.108	27.108	27.108	760	4.0856	80	200
60E-300-1/9	Fixed	33.230	16.615	16.615	16.615	300	6.3402	50	160
60E-190-1/9	Fixed	27.138	10.523	16.615	16.615	190	6.3402	40	160

These dimensions are indicative only and are subject to change depending on the supplier's design.

4.3.2. Type of crossing

Use of swing nose crossings

- On straight track where speed is > 200 km/h, turnouts shall be equipped with swing nose crossings;
- On straight track where speed is ≤ 200 km/h turnouts shall be equipped with fixed crossings.

4.3.3. Track alignment design criteria

The following table summarizes the design criteria for track alignment used in Rail Baltica project:

TRACK ALIGNMENT DESIGN CRITERIA	
GENERAL INFORMATION	
Nominal track gauge	1435mm
Rail profile	EN 60 E2
Maximum axle load:	
Until 120 km/h:	25 tons
From 120 km/h until 220 km/h:	22,5 tons
From 220 km/h until 300 km/h:	18 tons

TRACK ALIGNMENT DESIGN CRITERIA	
Annual net tonnage	25 Million gross tons/years
Distance between main line track centerlines	Mixed traffic sections: 4,50m Passenger and light traffic with preferred value of 4,00m
Maximum ruling gradient	Mixed traffic sections: 8‰ (nominal); 12,5‰ (maximum) Passenger and light freight sections: 15‰ (nominal); 25‰ (maximum) Station areas (including track and turnouts up to the external crossover): 0‰ (nominal), 1,5‰ (maximum); 2,5‰ (exceptional)
Minimum radius of curvature (Main Line)	Mixed traffic sections: 4000m (nominal); 3600m (exceptional value); Freight only sections: 900m; Passenger only and light freight sections: 400m Stations areas: 1000m
Maximum cant deficiency	Mixed traffic line: 100mm (exceptional value of 115mm); Passenger only and light freight traffic line: 110mm (exceptional value of 130mm)
Electrified traffic	Yes
Climate conditions	According to Design Guidelines RBDG-MAN-029 and RBDG-MAN-012
TRACK INFORMATION	
Rail inclination	1:40
Depth of ballast (Nominal) – Main Line	Minimum thickness of ballast layer under sleeper bottom: 300mm on embankment and 350mm on structure
SLEEPER DESIGN INFORMATION	
Impact factor	Based on EN 13230-6 and EN 13230-1, 2 and for bearers also EN 13230-4
Sleeper spacing on main tracks	600mm

4.4. Rail expansion joint design parameters

The rail expansion joints shall be designed according to EN 13232-8;

The design and selection of the type of expansion devices will be influenced by capacity guidance, gauge variation due to longitudinal movement and site conditions. Design inputs are the following:

- a) Gross annual tonnage: 25 Million tons

- b) Direction of traffic: both;
- c) Track geometry: according table in 4.3.3;
- d) Expansion capacity of the expansion device and maximum displacement rail/support: to be provided by RB Rail AS, once interaction calculations between track and structure will have been done;
- e) Nominal support spacing: according table in 4.3.3;
- f) Type of support structure: concrete bearer;

Design rules shall respect the following:

- i. Low restraint fastenings: the creep resistance shall be $\leq 5\text{kN}$;
- ii. The slide chairs shall permit movement of rails, with resistance $\leq 5\text{kN}$;

A reference point shall be made at the stock rail, in the vicinity of the tongue tip, in order to check the relative position of both rails. The mean position is used for design, acceptance and installation.

4.5. Scope of supply of turnouts

The scope of supply shall include all components and materials from the underside of the bearers to the rail head comprising:

- a) The switch assembly, comprising the steelwork from the stock joint to the switch heel joint inclusive of all rail, components and any baseplates extending beyond the switch heel;
- b) The frog assembly from the internal to the external heel together with all components and baseplates and any baseplates extending beyond the frog led ends;
- c) Check rails assemblies inclusive of baseplates and baseplates for the running rail opposite the frog;
- d) Baseplates shall include the provision of baseplates bedding pads, rail fastenings, baseplates anchorages (if any) and any other associated components;
- e) The operating mechanism shall include all drive rods and non-driven stretcher bars, the detection and locking system, also position and locking detection devices. Interface with the signalling supplier will be required to provide an in-bearer/motor unit at switch points and swing nose frog that meets the turnouts requirements;
- f) Turnout concrete bearer set including cast-in components;
- g) All running rail after the switch stock rail joints, as closures between the switch and the frog and outside the frog and beyond the switch heel for the full extent of the turnout bearer (sleeper);
- h) Manufacturer shall supply all specific extended and shortened turnout bearers needed for interfacing the turnout with the running rail after the switch.
- i) All rail fastenings inclusive of the rail pads for the direct fastening of the running rails to the concrete bearer;
- j) Switch heating systems (for switch/stock rail and movable crossing but also for rods connecting locking devices to the switch machines) shall also be supplied by the turnout manufacturer.

4.6. Adoption of the supplier specifications

This specification lists the performance requirements for new turnouts and expansion joints to be used on the Rail Baltica project. However, the supplier is encouraged to offer their proprietary specification for the design, testing, manufacture and supply of these turnouts and expansion joints. The supplier's offer must include a tabulated clause-by-clause comparison of the offered specification, and any other information as may be appropriate;

RB Rail AS may consider such offered specification, in particular any improvement in durability constructability, maintainability and whole of life cost, and subject to mutual agreement, may adopt the supplier's specification.

5. Component interface requirements

5.1. General

The Track system (mainly rails / sleepers and fastenings / ballast / turnouts) shall be fully compatible with all systems and equipment provided as part of the overall Rail Baltica Project;

The Track system shall support the transfer of physical loads between the vehicle and the infrastructure.

5.2. Interface with signalling design

Turnouts shall be set up in order to satisfy signaling operation requirements;

Interface between moveable parts and actuation, locking and detection equipment shall comply with EN-13232-4 and are described in Section 6.2;

Turnout integrated system supplier shall liaise with the CCS subsystem supplier to agree on the interface.

An initial prototype of each kind of turnout will be assembled and presented to the CCS subsystem supplier for the purpose of testing to ensure the units meet the interface requirements, as specified in Section 9.3;

Heating systems shall be designed according to turnout type and local climate requirements in each station separately and supplied by the turnout integrated system supplier. Solution shall be coordinated and approved by RB Rail AS before production.

Interface with real time remote monitoring system shall be provided by turnout integrated system supplier for acceptance by RB Rail AS.

5.3. Interface with rolling stock

The specifications of this document are done for Rolling Stock which conform with TSI (to ensure rail/wheel interaction compatibility).

5.4. Interface with civil works

The rail expansion joints, if any, shall be designed to accommodate rail movement at least equivalent to the seasonal movement (expansion and contraction) of the structural element which it is required to accommodate;

The type and opening of the rail expansion joints to be used along the Rail Baltica project will be defined in accordance with the civil works project, once the interaction between rail and structures will be determined.

6. Turnouts dimensions

6.1. Geometric specifications

Technical specifications of turnouts shall comply with the following parameters:

- a) Maximum value of free wheel passage in switches: 1380mm into service;
- b) Maximum value of fixed nose protection: 1392mm into service;
- c) Maximum value of free wheel passage at crossing nose: 1356mm into service;
- d) Maximum value of free wheel passage at check/wing rail entry: 1380mm into service;
- e) Maximum unguided length of fixed obtuse crossings: in accordance with TSI INF 4.2.5.3;
- f) Minimum flangeway width: 38mm into service;
- g) Minimum flangeway depth: 40mm into service;
- h) Excess height of check rail: 70mm into service.

The table below summarizes the main manufacturing dimensions:

Definition	Nominal value (mm)	Construction tolerance (mm)
Track gauge	1435 (1)	+2 -1
Width of wheel flangeway gaps	Nominal value	+0,5 -0,5
Nose protection (space between operative face of check rail and running edge of further rail)	1395	+0,5 -0,5
Free wheel passage at check entry	1355	≤1356
Height of check rail above running rail: H	Turnout: $0 \leq H \leq 60$ Diamond crossing: $45 \leq H \leq 60$	+2 -1
Turnout length (between real nose point and real switch toe)	-	±5mm
Switch position relatively to stock rail position	-	±2mm
Concrete bearers position	-	±10mm

Note (1): Maximum variation between concrete bearer next to each other is 1mm

6.2. Interface with actuation, locking and detection equipment

If not otherwise specified, interfaces between moveable parts and the actuation, locking and detection equipment shall comply with EN 13232-4.

The following criteria shall be taken into account:

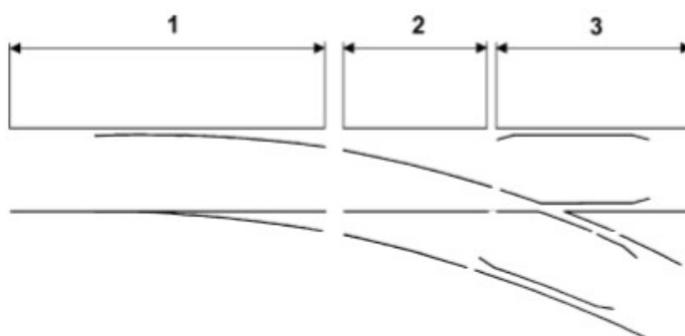
- a) In order to be able to measure the switch toe displacement (differential longitudinal displacement between the switch rail and the corresponding stock rail), a reference point shall be placed on the stock rail;
- b) For swing nose crossing in order to measure the swing nose displacement a reference point will be placed on the wing rail;
- c) Minimum flangeway width: to be calculated by the supplier;
- d) Trailability: not required;
- e) Conceptual dimensions of actuator and locking system, including the drive, locking and detection positions: Supplier to submit for approval to RB Rail;
- f) Actuator capacity F_{cap} : Supplier to submit for approval to RB Rail;
- g) Maximum actuation force applied F_a : Supplier to submit for approval to RB Rail;
- h) Mechanical interfaces of all actuating, locking and detection devices: Supplier to submit for approval to RB Rail;
- i) Toe movement (f_p) or switch opening at drive position (f_d): Supplier to submit for approval to RB Rail;
- j) Maximum gap at switch toe (d_{toe}): 10mm;
- k) Actuator displacement: Supplier to submit for approval to RB Rail;
- l) The machining detail at the point of the switch and the drilling details for the point machine drive/detection/lock rodding shall be specified by the signalling suppliers in the supplied drawings;
- m) Calculations and verifications, specifically for the minimum flangeway, shall be done in accordance with Section 4.2 of EN 13232-4;
- n) For each type of turnout, test methods for switch or crossing panel mounted with the complete actuation, locking and detection system shall be done in accordance with Section 5 of EN 13232-4;
- o) Acceptance tests, standard testing (in case of deliveries of existing designs) and prototype testing, shall be done in accordance with Section 6 of EN 13232-4. For both testing (standard and prototype), the delivery of the turnout shall include the actuator and locking system.

7. Material and equipment requirements

7.1. Turnouts components requirements

Inclination of 1:40, in the turnouts (stock rails, intermediate rails running rails) can be obtained either by inclined rail or with shape of the active part of the rail head being inclined (included the active part of the switch);

7.1.1. General



Key

- 1 Switch panel
- 2 Closure panel
- 3 Crossing panel

2. FIGURE 2 TURNOUT PANELS

7.1.2. Switch panel

Stock rails shall be made of EN 60 E2 profile;

Stock rails shall be one straight stock rail undercut for point details and one curved stock rail undercut for point details;

The switch rails shall be flexible, made of asymmetrical rail profile related to 60E2, with forged heel, in order to be connected with closure rail. There must be no welds within the free length of the switch rail;

The machining detail at the point of the switch and the drilling details for the point machine drive/detection/lock rodding shall be specified by the signalling suppliers in the supplied drawings;

The switch and stock rail design shall incorporate a device or devices for restraining the longitudinal movement of the switch rail relative to the stock rail as a consequence of temperature fluctuation or any variations in longitudinal forces due to the continuous welding of rails in and abutting the turnouts. The design of such devices shall be such that no significant stress raiser is introduced into either the switch rail or the stock rail;

The stops anti-creeping devices shall be made of spheroidal graphite cast iron material, fixed with bolts inside the stock rail, or equivalent “state-of-the-art” 5 years’ service proven technology;

The slide chairs, made of spheroidal graphite cast iron material, shall use Ni-Cr coating system or equivalent “state-of-the-art” 5 years’ service proven technology;

Slide chairs are adapted in order to provide locking and point rail position detection systems and heating devices;

Detecting and locking devices:

- Switches and swing nose crossing shall be equipped with:
 - Locking devices;
 - Devices enabling to detect whether mobile components lay in correct position and are correctly locked;

The supplier is encouraged to offer his proprietary specification as mentioned in Section 4.6.

7.1.3. Closure panel

Rails shall be made of EN 60 E2 profile, laid with 1/40 inclination;

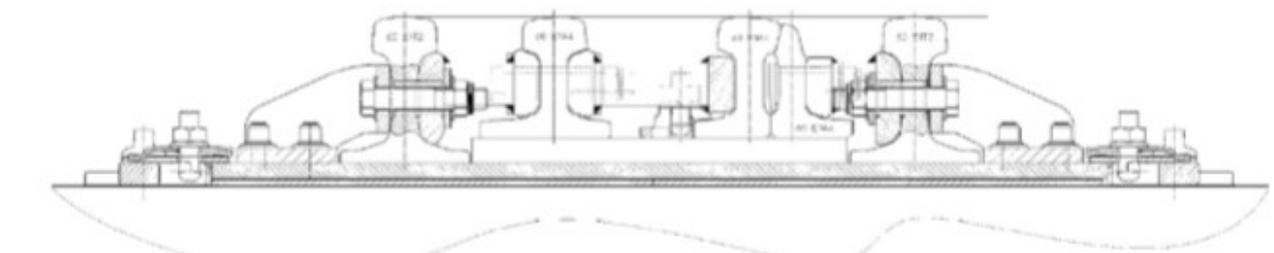
Rails are fixed on elastic fasteners, including resilient pad and cast-iron baseplate laid on monobloc concrete bearers.

7.1.4. Crossing panel

Turnouts crossing part shall be swing nose technology (swing nose frogs) or fixed nose technology (rail-bound manganese steel frogs), according to Section 4.3.2;

Swing nose crossings shall be equipped with forged block with weld-on-rails or bolted switch solutions;

- The following example of swing nose is made of switches rails grade 350HT, jointed together by high strength bolts (the technical drawing below is presented for information only):



For swing nose crossings:

- the wings rail profile shall be 60 E2, or cast manganese cradle;
- the wings rail grade shall be R350HT, or cast manganese cradle;

Fixed nose crossings:

- shall be forged R350HT or bainitic or cast manganese;
- the wing rails grade shall be R350 HT, or cast manganese;

The check rails shall be “elevated check rail”;

The supplier is encouraged to offer his proprietary specification as mentioned in Section 4.6.

7.2. Fastening systems and other fittings

The fastening system requirements of the turnouts can be found in RBDG-MAN-014A

7.3. Concrete bearers (sleepers) requirements

Concrete bearers shall be equipped with under sleeper pads, the requirements for the concrete bearers are part of RBDG-MAN-014B;

The supplier shall also supply details of in bearer rodding design for switch and frog locations.

7.4. Rail expansion joints

Rail inclination shall be 1:40 (rail inclination can be given by inclined active rail head);

Steel grade shall be R350HT;

Stock rail profile shall be EN60 E2;

Rail expansion joints shall be equipped with low longitudinal restraint fastening, according to the Rail Expansion Joint design;

High vertical elasticity of fastening system shall be less than 40 kN/mm;

Rail expansion joints shall be equipped with special designed pre-stressed monoblock sleeper, equipped with under sleeper pads.

8. Manufacturing

8.1. General

The turnout from the toe-end of the stock to the heel-end of the crossing, and including the cant reducing plates if any, shall be mounted on suitable baseplates secured to the prestressed concrete bearers by the fasteners;

The rails on the end infill panel shall be mounted on baseplates which are placed directly onto the concrete bearers and secured by elastic fasteners;

All turnout components and expansion devices shall be plainly marked as indicated below:

- a) Each half-set of switches shall have an identification marking fixed in the switch rail and/or the stock rail with the following:
 - a. Supplier's name;
 - b. Last two digits of year of manufacture;
 - c. Type of switch (radius of switch, main line radius, rail profile and hand of turnout);
 - d. Unique identification number;
- b) Each crossing shall have an identification marking fixed on the crossing with the following:
 - a. Supplier's name;
 - b. Last two digits of year of manufacture;
 - c. Crossing type (rail profile, geometry, left hand, rail hand);
 - d. Unique identification number;
- c) Each half set of expansion device shall have an identification marking fixed on the switch rail and/or stock rail with the following:
 - a. Supplier's name;
 - b. Last two digits of year of manufacture;
 - c. Expansion capacity;
 - d. Unique identification number.

8.2. Straightening and bending of rails

Rails shall be pressed straight and true before commencing fabrication. All bending of rails shall be done without damage using a suitable rail bending machine. Where required, all finished rails shall be absolutely straight, free from kinks and twists and when assembled shall fit together in the positions and at the angles specified without warping and distortion. Where curved rails are required, the rails shall be curved uniformly to arcs and circles.

8.3. Machining and fitting

Machining shall be smooth finished to match the existing rolled surface and any sharp, edges and burrs shall be removed. All mating surfaces shall be machined or ground to provide uniform bearing throughout. Blocks shall be machined to accurately fit the profile of the rail throughout. Rolling brands on rail web shall be removed where interference with blocks and other item is likely;

Switch shall house and fit accurately to the stock rails for the full length required. The supplier shall provide a set of accurate gauges for machining of switches and these shall be made available to RB Rail AS representative on request.

8.4. Holes

According to EN 13674-2 holes shall be drilled perpendicularly to the rail unless otherwise required and true to the diameters and in the positions shown. Hot or cold punching of holes in rails shall not be permitted. Flame cutting or blowing of holes in rails and fishplates shall not be permitted;

All holes shall be finished by machining a 1 mm chamber on each side of the web of the rail.

8.5. Rail ends

Rail ends shall be cut square to the axis of the rail unless otherwise required.

9. Testing & acceptance

Note: testing & acceptance for concrete bearers are described in RBDG-MAN-014B

9.1. Dimensional tolerances

Except otherwise specified in this specification (mainly in Section 6.1), manufacturing tolerances shall respect tables given in Section 6 of EN 13232-5 (for switches), in section 6 of EN 13232-6 (for fixed nose crossings), in section 6 of EN 13232-7 (for crossing with moveable parts) or in Section 5 of EN 13232-8 (for expansion devices).

9.2. Inspection

Inspection of switches and crossings, during manufacture, shall be done in accordance with Section 6.5 of EN 13232-5, Section 6.5 of EN 13232-6 and Section 6.5 of EN 13232-7;

The supplier shall carry out the general nondestructive testing method of components using austenitic manganese steel and/or other special materials and processes. The results of such testing shall be provided to RB Rail AS representative on his/her request;

A weld map is to be prepared for all austenitic manganese steel casting produced. If the casting has no defect, the weld map is to be clearly marked "No Defects";

Inspections of expansion devices shall be done in accordance with Section 5.7 of EN 13232-8.

9.3. Factory assembly, inspection and acceptance of prototypes

9.3.1. General

The prototype of any new turnout shall undergo a full trial assembly arranged to prove the design in respect of geometry, installation tolerance and operation. The prototype assembly shall achieve all measurements and installation tolerances, and shall demonstrate correct powered operation and detection;

The following shall be carried out by the supplier for the first-off supply of each hand of turnout for any geometry:

- a) Pre-assembly of the first of each hand of turnout (to be known as the "proto-type(s)") for the purpose of proving dimensions and operation, and for inspection by RB Rail AS representative, prior to proceeding to deliver the balance of turnouts required under the Contract;
- b) No welding of the prototype turnout will be required for pre-assembly. All pre-assembled turnouts will be secured/clamped to prove dimension and operation, and for inspection by RB Rail AS representative;
- c) Painting of all steelwork components in the prototype turnout(s) with a suitable and approved rust-preventative treatment;
- d) Marking of all components, as per Section 8;
- e) Disassembly of the prototype turnout(s) into transportable sub-assemblies;

- f) The turnout and/or the swing nose crossing motors shall be supplied by the Signalling supplier. The turnout supplier must liaise with the Signalling supplier and test the turnout as applicable with the motors supplied by the Signalling supplier.

9.4. Integrated turnout systems acceptance tests

For each type of integrated turnout system, test methods for switch or crossing panel mounted with the complete actuation, locking and detection system shall be done in accordance with Section 6 of EN 13232-4;

For each type of integrated turnout system, acceptance tests, standard testing (in case of deliveries of existing designs) and prototype testing, shall be done in accordance with Section 6 of EN 13232-4. For both testing (standard and prototype), the delivery of the turnout shall include the actuator and locking system;

For each type of expansion device, testing and acceptance shall be done in accordance with Sections 6 & 7 of EN 13232-8.

10. Submittals

Except otherwise specified below, the supplier shall submit the documentation listed in section 7.5 of EN 13232-9.

10.1. Design and maintenance manual

The supplier shall provide a Design & Maintenance Manual covering the installation, operation and maintenance of all turnouts and expansion joint, inclusive of the operating mechanism;

The manual shall be provided in hard copy and must include all drawings and information required to install and maintain turnouts and expansion joints. Drawings must include sufficient detail to enable the easy identification of all components for the ordering of spares and replacement parts;

The manual shall provide full instruction of the installation, geometry tolerances and adjustment of the operating mechanism, mechanical roller (if any), point motors, check rails, and flange way and inspection and maintenance procedures as applicable.

10.2. Drawings

For the turnouts, the supplier shall provide general arrangement and installation drawings in soft and hard copies. In addition, the supplier must provide a “footprint” drawing for each turnout type, defining track centerline, rail gauge line, and bearer layout (bearer type and layout will be provided by the concrete bearers’ supplier);

For each type of switch, the supplier shall provide drawings containing the following information:

- a) Machining profiles;
- b) Sets, bending details;
- c) Position of the running edge and machining reference plane;
- d) Drillings including the pertinent tolerances;
- e) Surface

For each type of expansion joints, the supplier shall provide drawings containing the following information:

- i. Machining profiles;
- ii. Sets, bending details;
- iii. Detailed geometry plan of expansion switch in accordance to EN 13232-2;
- iv. Position of the running edge and machining reference plane;
- v. Drillings including the pertinent tolerances;
- vi. Surface markings;
- vii. Material;

- viii. As a result of the design the supplier shall prepare the assembly documents in accordance with the information given in EN 13232-9.

10.3. BIM deliverables

For all type of models (each type of turnout and expansion joints) the Supplier shall provide a detailed BIM model.

The BIM Execution Plan (BEP) shall be developed and agreed with the RB Rail AS during the inception phase of the project. BEP template is part of Design Guidelines – RBDG-TPL-013

The BIM models shall correspond to minimum manufacturing level LOD400 (LOG and LOI) and shall follow the requirements in Design Guidelines

- RBDG-MAN-033 BIM Manual
- RBDG-MAN-035 Codification & Data Management
- RBDG-MAN-034 CAD Standards
- RBDG-MAN-030 Building Information Management (BIM) Employers Information Requirements
- RBDG-TPL-013 BIM Execution Plan
- RBDG-TPL-014 Task Information Delivery Plan
- RBDG-TPL-015 Model Information Delivery Plan
- RBDG-TPL-016 Codification Tables
- RBDG-TPL-017 QEX Report Template
- RBDG-TPL-018 QTO Report Template
- RBDG-TPL-019 BIM Objects Attributes Matrix
- RBDG-TPL-020 BIM Delivery Report Template
- RBDG-TPL-021 Data Drop Template
- RBDG-TPL-022 QAQC BIM/CAD Checklist Template
- RBDG-TPL-023 Clash Detection Report
- RBDG-TPL-024 BIM Objects LoG Matrix
- RBDG-TPL-025 CAD Template

RBDG-TPL-024 BIM Objects LoG MatrixThe BIM models shall be delivered in exchange (IFC2x3) formats and native file formats. The native file formats shall be described in BEP.

All the Drawings shall be extracted and created from the BIM models and shall 100% correspond to the geometry and information within the BIM models.

After the installation of the turnouts and expansion joints, the as-built BIM models shall be georeferenced and delivered to the Client in their real geographical locations and contain all the necessary attribute data.

All the required information about each of the elements shall be also added to the Client's Asset Register.

Requirements in «BIM use cases for Construction and handover stage» which are part of the Construction Logistics Study shall be followed.

10.4. Design conformity documentation and certification

Prior to manufacture of any turnout or expansion joint, the supplier shall provide:

- a) An independent design verifier's certificate to verify that the turnout or the expansion joint has been designed in accordance with the requirements of this specifications;
- b) Detail design calculations that demonstrate that the turnout or the expansion joint meets all the requirements of this specification;
- c) The supplier shall also provide the expected life of the turnout or the expansion joint.

10.5. Certification

The supplier shall provide test reports from an independent laboratory approved by RB Rail Representative for all tests as stated in this specification prior to manufacture and/or prior to delivery of turnout or expansion joint.

All materials shall conform to the latest relevant European Standards.

11. Quality system inspection

11.1. General

The Supplier shall be certified under ISO 9001, or institute a Quality Assurance system complying with ISO 9001 and approved by RB Rail AS, and shall ensure that his subcontractors (if any) have similar systems, or work under the Supplier's system;

A Project Quality Plan shall be prepared and be submitted to RB Rail AS for approval as a controlled document within 2 (two) weeks of the date of award of the contract;

11.2. Certificate of Conformity

During production, the Supplier must within 10 days of the month end prepare and issue a Certificate of Conformance to RB Rail AS in an agreed format, certifying the month's production, regarding turnouts, itemizing any failures and actions, and attaching a tabulation of inspection and test results.

11.3. Quality records

The Supplier must retain all primary quality records in accordance with the statutory requirements, contract conditions and company policy and make these available to RB Rail AS at all reasonable times. These must include all the requirements of the approved Project Quality Plan;

If not otherwise required, records must be kept for at least 6 (six) years after the date of issue of the final certificate.

11.4. Inspection and audits

RB Rail AS will arrange inspections or audits to ensure that the Supplier is complying with the Quality system;

RB Rail AS reserves the right to perform inspections, at all times while the work on the contract of the Supplier is being performed, of all parts of the Supplier's work concerning the manufacture of rails ordered. The Supplier must, upon being given reasonable notice, make or arrange to make available all facilities, documentation records, and personnel details, including those of any subcontractors, that are reasonably required for the audit or surveillance to be undertaken;

The Supplier shall afford the inspector, free of charge, all reasonable facilities and necessary assistance to satisfy him that rails are being supplied in accordance with these specifications. Inspections will be conducted so as not to interfere unnecessarily with the operation of the works or disturb normal mill production.

12. Additional information requested

In addition to the mandatory requirements outlined in this specification, RB Rail AS reserves the right to request from the Supplier information pertaining to the performance of their product under similar service conditions, with particular emphasis on rail management aspects which may influence turnouts and expansion devices life-cycle costs, i.e.: rail wear rates, rolling contact fatigue behavior etc.