Rail Baltica

RBDG-MAN-014D-0102

Design guidelines

Technical Specification - Turnout integrated system & rail expansion joints

04-02-2025

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Table of Contents

1. Scope

This specification covers the requirements for design, tests, product acceptance, manufacture, supply, assembly, functional testing, and commissioning 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 and Rail Expansion Joint system from the life cycle cost perspective (incl. sourcing, installation and maintenance cost).

Scope of the Turnout Integrated System

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 responsibility on the integration of all types of subsystems and elements of the proposed Turnout Integrated System with track equipment, structure, earthworks, Energy sub-system, Control-Command and Signaling subsystem and Rolling stock. All auxiliary systems required for Turnout Integrated System operation are included in the Scope: switch actuators, locks, actuators, detectors, switch heating, condition monitoring sensors and devices, etc.

Scope of responsibility of Supplier covers design, manufacturing, supply, assembly, factory acceptance testing (FAT), delivery, site acceptance testing (SAT), material handling, support during installation, commissioning, as well as supply of all necessary instructions, "as-built" drawings, manuals, and training material for supply, delivery, assembly, installation, testing and commissioning, operation, provision of critical spares and tools, maintenance, and dismantlement of the Turnout Integrated System.

As part of the support during installation, the Supplier shall appoint a responsible competent person who will be present during the unloading and loading activities at the IMF or on the site and during the installation on site (see Section 11.5 for details).

As part of the support during installation of the Turnouts Integrated System, the Supplier shall supervise observe the execution of installation activities, provides clarifications, and warns if incorrect installation is noticed during pre-assembly and installation work.

The supplier shall inform Purchasers about the incidents detected during the unloading, pre-assembly, loading, transportation, unloading and installation on the site activities. The Supplier shall propose the corrective actions.

This specification is applicable to the Turnout Integrated System for:

Rail Baltica main line, including passing loops, stations, service tracks necessary to its proper functioning and any necessary turnout for the proper operation of the Rail Baltica line.

Freight terminals, infrastructure maintenance facilities, rolling stock maintenance facilities, etc.

This specification does not apply to:

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

Scope of the Rail Expansion Joint system

The Supplier shall propose the solution, design, and provide all interfaces to all types of all Rail Expansion Joints with condition monitoring sensors and devices, etc. The number and location of REJs which shall be equipped with condition monitoring sensors will be specified by RB Rail.

This specification concerns the Rail Expansion Joint system for structures and other locations determined by DTD consultant who provides the track design.

Scope of responsibility of Supplier covers design, manufacturing, assembly, factory acceptance testing (FAT), delivery, site acceptance testing (SAT), material handling, support during installation, commissioning, as well as all necessary instructions, "as-built" drawings, manuals, and training material for supply, delivery, assembly, installation (including adjustments), testing and commissioning, operation, provision of critical spares and tools, maintenance, and dismantlement of the Rail Expansion Joints system.

As part of the support during installation, the supplier shall appoint a responsible competent person who will be present during the unloading and loading activities at the IMF or on the site and during the installation on site (see Section 11.5 for details).

As part of the support during installation of the Rail Expansion Joint system, the Supplier shall supervise observe the execution of installation activities, clarifications, and warns if incorrect installation is noticed during pre-assembly and installation work.

The supplier shall inform Purchasers about the incidents detected during the unloading, pre-assembly, loading, transportation, unloading and installation on the site activities. The Supplier shall propose the corrective actions.

2. Reference documents

The document hierarchy of precedence in descending order shall be:

- TSI specification;
- European Standards;
- Design Guidelines;
- This Specification;
- 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-013	Design Guidelines - Railway Alignment
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-030	Building Information Management (BIM) Employer's Information Requirements
RBDG-MAN-032	Design Guidelines – RAMS Targets

Standard	Title
EULYNX	EULYNX specification – the system which standardize interfaces of the signalling systems. The EULYNX system is under development.

2.2. TSI

Technical Specifications for Interoperability (TSI) largely based on national Regulations and requirements, and on best available expert knowledge. They are related to the infrastructure subsystems of the railway in the European Union.
The purpose of the Regulations is to standardize subsystems or components 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 applicable TSIs are listed below:

TSI	Title
ENE TSI	Commission Regulation (EU) No 1301/2014 of 18 November 2014 - Energy TSI
INF TSI	Commission Regulation (EU) No 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union
CSM RA	(EU) No 402/2013 of 30 April 2013 on the common safety method for risk assessment and repealing Regulation (EC) No 352/2009 Commission Implementing Regulation (EU) 2019/776 of 16 May 2019 amending Commission Regulations (EU) No 321/2013, (EU) No 1299/2014, (EU) No 1301/2014, (EU) No 1302/2014, (EU) No 1303/2014 and (EU) 2016/919 and Commission Implementing Decision 2011/665/EU as regards the alignment with Directive (EU) 2016/797 of the European Parliament and of the Council and the implementation of specific objectives set out in Commission Delegated Decision (EU) 2017/1474

2.3. European Standards

The relevant European standards used for high-speed lines, conventional lines and REJs are listed below.
The Supplier shall fully take into account and apply the following standards in the provision of the Services, the in-force standards shall be applied.

Standard	Title
ISO 9001	Quality management systems — Requirements
EN 13146	Railway applications. Track. Test methods for fastening systems
EN 13230	Railway applications. Track. Concrete sleepers and bearers
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 13481-1, 2, 5 and 7	Railway applications. Track. Performance requirements for fastening systems.
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
EN 13674-3	Check rails
EN 13715	Railway applications – Wheelsets and bogies – Wheels – Tread profile
EN 13715	Railway applications - Wheelsets and bogies - Wheels - Tread profile
EN 14363	Railway applications. Testing and Simulation for the acceptance of running characteristics of railway vehicles. Running Behavior and stationary tests.
EN 14587-1	Railway applications - Infrastructure - Flash butt welding of new rails
EN 14587-3	Railway applications. Track. Flash butt welding of rails Welding in association with crossing construction
EN 15273	Railway applications. Gauges
EN 15273-2	Railway applications - Gauges - Part 2: Rolling stock gauge
EN 15302	Railway applications – Method for determining of equivalent conicity
EN 15313	Railway applications. In-service wheelset operation requirements. In-service and off-vehicle wheelset maintenance
ISO 15686-5	Buildings and constructed assets - Service life planning: Part 5, Life-cycle costing
EN 15689	Railway applications. Track. Switches and crossings. Crossing components made of cast austenitic manganese steel
EN 16273	Railway applications. Track. Forged rail transitions
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories
EN 50119	Railway applications - Fixed installations - Electric traction overhead contact lines
EN 50121	Railway applications. Electromagnetic compatibility
EN 50122	Railway applications. Fixed installations. Electrical safety, earthing and the return circuit
EN 50125-3	Railway applications - Environmental conditions for equipment - Part 3: Equipment for signalling and telecommunications
EN 50126	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
EN 50128	Railway applications. Communication, signalling and processing systems.
EN 50129	Railway applications - Communication, signalling and processing systems - Safety related electronic systems for signalling

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 510-2	Trailing stock: wheels and wheelsets. Conditions concerning the use of wheels of various diameters
UIC 713	Design of monobloc concrete sleepers
UIC 716	Maximum permissible wear profiles for switches
UIC 866	Technical specification for the supply of cast manganese steel crossings for switch and crossing work
	UIC state-of-the-art report on Railway noise in Europe

3. Terms and definitions

Terms and definitions used in this specification comply with the ones defined and listed in EN 13232-1 and EN 13232-8.

Abbreviations

Abbreviation	Definition
ALT	Accelerated Life Testing
AMS	Asset Management System
BIM	Building Information Management
CCS	Control, Command and Signalling
CMS	Condition Monitoring System
Crow-AMSAA	Dr. Larry H. Crow - Army Materiel Systems Analysis Activity
CSM RA	Common Safety Method for risk evaluation and assessment
CWR	Continuously welded rail
DTD	Detailed Technical Design
EVA	Ethylene vinyl acetate
EULYNX	The interlocking modular system, which is common for European countries railways.
FAT	Factory Acceptance Test
FMEA	Fault Mode Effect Analysis
FRACAS	A failure reporting, analysis, and corrective action system
FTA	Fault Tree Analysis
HDPE	High-density polyethylene
HMI	Human Machine Interface
IMF	Infrastructure Maintenance Facilities
LCC	Life Cycle Cost
LOD	Level of Design

LRU	Line Replaceable Unit
MDM	Maintenance and Data Management
MRT	Mean Repair Time, does not include logistic.
MTBF	Mean Time Between Failure
MTBSAF	Mean Time Between Service Affecting Failure
MTTF	Mean Time to Failure
NDT	Non-destructive Testing
NTPS	Non-traction power supply
PDF	Probability Density Function
Purchaser	RB Rail AS, Sabiedrība ar ierobežotu atbildību "EIROPAS DZELZCEĻA LĪNIJAS", Osaühing Rail Baltic Estonia, AB "LTG Infra".
RAMS	Reliability Availability, Maintainability and Safety
RBD	Reliability Block Diagram
RBR (and RB Rail)	RB Rail AS
RB Rail tester	RBR certified party to perform the final quality check of Turnout Integrated System and REJ after commissioning.
REJ	Rail Expansion Joint
RTM	Requirement Traceability Matrix
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SCI-P	Standard Communication Interface - Point
SDI-P	Standard Diagnostic Interface - Point
SIL4	Safety integrity level 4
SMI	Standard Maintenance Interface
SSI	Standard Security Interface
SSP	Security Services Platform
Supplier	Original Turnout or REJ Integrated System manufacturer

TOR	Top of Rail
UPS	Uninterruptible Power Supply
USP	Under Sleeper Pad

Terms

Terms	Definition
Asset Management Center	The center which coordinates performance improvement activities of equipment registered in the Asset Management System.
Asset Management System	It is a system that stores all the information related to an asset and its performance.
Dynamic test	Dynamic test is a verification and validation activity that provides final validation of the newly built railway infrastructure through a set of dynamic tests that completes the demonstration of integration between the reference rolling stock and the INF/CCS/ENE subsystems.
Rail Baltica line	Refers to the actual / physical track of the Rail Baltica railway
Rail Baltica railway	A new fast conventional double track electrified European standard gauge (1435mm) railway line on the route from Tallinn through Pärnu – Riga - Panevėžys - Kaunas to Lithuanian - Polish border, with a connection line between Kaunas and Vilnius. Which is part of Rail Baltica Global Project.
Requirement Traceability Matrix	is a matrix containing the necessary information to track individual requirements from their initial identification through design, development, testing, and deployment phases.
Supplier	Original turnout or REJ Integrated System manufacturer
Turnout	Means the same as Turnout Integrated System
Verification and Validation Evidence Catalogue	Catalogue linked to the Requirements Traceability Matrix through Requirements IDs, is a structured document that captures evidence gathered during verification and validation activities and aligns them with specific requirements.

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 period of 5 years in service in such conditions, will be considered. Exceptions may apply to the Turnout Control Unit, detectors and EULYNX electronic interlock interface, subject to approval by RBR.

Design lifetime of all infrastructure components, including turnouts, switches and expansion joints is described in RBDG-MAN-012 (Design Guidelines - "General Requirements"). All infrastructure components, including turnouts, switches, and REJ, shall comply with a design life of 50 years or at least 600 million gross tons, subject to the appropriate maintenance intervention to achieve these targets. The actuators, locks and detectors shall be able to complete 1 million operational cycles without failure affecting train movement (service).

All Turnout Integrated System or REJ system components must be designed in such a way that in the event of a failure the system fails safely.

For maintainability purposes, each type of Turnout Integrated System and REJ system shall be manufactured from one source of supply and have dimensional tolerances to ensure that each component is interchangeable. The design shall be based on standardization of components and reduction of variations. Standardized solutions shall ensure the uniform education and training of maintenance staff, the use of standardized maintenance machinery, tools, and procedures, and simplify the stocking of spare parts.

The Supplier shall collaborate with RBR to implement standardization and interchangeability as much as practically possible throughout all types of the Turnout Integrated System and the Rail Expansion Joints. As well as between the high-speed and conventional versions of the Turnout Integrated Systems, specifically but not limited to track support, track components, switch and stock rails, detection system, Turnout Control Units, Heating Systems and Condition Monitoring System.

To cope with the environmental conditions of the Baltic countries, the Turnout Integrated System and REJ system shall be designed and constructed in accordance with requirements of §8. "Environmental conditions for systems", found in RBDG-MAN-012 (Design Guidelines - "General Requirements").

All concrete bearers shall be equipped with under sleeper pads, the requirements for the concrete bearers are defined in RBDG-MAN-014B "Rail Baltica Technical Specifications for sleepers and bearers with USP's and fastenings" and detailed in the technical specification RBGL-TRA-SPC-R-00002.

The designer shall take characteristics from 4.1.8.1 to 4.1.8.8 into account when designing the rail, baseplate and under sleeper pads to achieve the required design life with the minimum maintenance intervention:

a. common overall construction height for the entire Rail Baltica line

b. quality of the ride

c. operations

d. maintenance

e. CAPEX

f. OPEX

g. including other functional and safety requirements in this specification

h. environmental conditions of Rail Baltica line

Required overall track stiffness is in the range of 70-80kN/mm. In order to reach these values, the Supplier shall offer a suitable set of elastic components for the Turnout Integrated System.

Fault-tolerant functions and redundances shall be considered for all parts of the Turnout Integrated System and REJ system.

Overall construction height of the turnout and REJ shall be consistent with the Overall construction height of plain line.

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/s2;

g) The track shall be designed to be fully capable of transferring lateral, longitudinal and vertical (static and dynamic) forces induced by the rolling stock to track support. In addition, it shall be able to withstand the dynamic load from the wheel flats with occasional wheel impact forces of between 350 to 500kN.

h) The turnouts shall be equipped of a switch machine, switch locking, switch detection and switch heating;

i) The turnouts shall be equipped with electric heating system, for switch/stock rail and movable crossing, but also, if necessary, for rods connecting locking devices to the switch machines;

j) The turnouts shall be equipped with hollow sleepers in which the locking devices with their rods are integrated and protected;

k) The locking systems shall be protected against snow;

l) Rail/wheel interaction compatibility: switches and crossings shall be designed to suit the wheel profile;

m) All joints shall be welded;

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

o) 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;

p) Steel grade shall be not less than R350HT;

q) Turnouts shall be equipped with monoblock concrete bearers;

r) The rail fastening system of the turnouts shall provide the same performance and function as the rail fastening system in plain track;

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

t) Turnouts shall be compatible with the use of magnetic braking systems for emergency braking;

u) Turnouts shall be non-trailable type;

v) The movement of turnouts shall be possible in local control mode;

w) Turnouts shall be equipped of devices for local switching;

x) 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)

y) Derailing blades (trap points) shall follow the same requirements as turnouts

z) Stiffness of the rail pad and baseplate pad, and total vertical stiffness of the track element on turnouts

Parameter	Stiffness of the rail pad and baseplate pad	Total vertical stiffness of the track elements
Turnout on embankment	50 kN/mm ≤ 1/((1/k1) + (1/k3)) ≤ 100 kN/mm	32.6 kN/mm ≤ KT ≤ 55.5 kN/mm
Turnout on structures	30 kN/mm ≤ 1/((1/k1) + (1/k3)) ≤ 50 kN/mm	22.7 kN/mm ≤ KT ≤ 35.7 kN/mm

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.

Stiffness of the rail pad and baseplate pad, and total vertical stiffness of the rail expansion joints:

Parameter	Stiffness of the rail pad and baseplate pad	Total vertical stiffness of the track elements
Rail Expansion Joint	30 kN/mm ≤ 1/((1/k1) + (1/k3)) ≤ 50 kN/mm	22.7 kN/mm ≤ KT ≤ 35.7 kN/mm

4.3. Turnout design parameters

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

Speed of diverging track;

Type of crossing;

Track alignment design criteria.

Track design contains right- and left-hand Turnouts.

High-speed turnouts shall implement a smooth transition curvature on the diverging track. On general basis, the following combination of curvature segments should be integrated: Clothoid (from plain track tangently up to the circular arc segment) - Circular arc segment - Clothoid (from circular arc segment up to the diverted track on toe-end).

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;

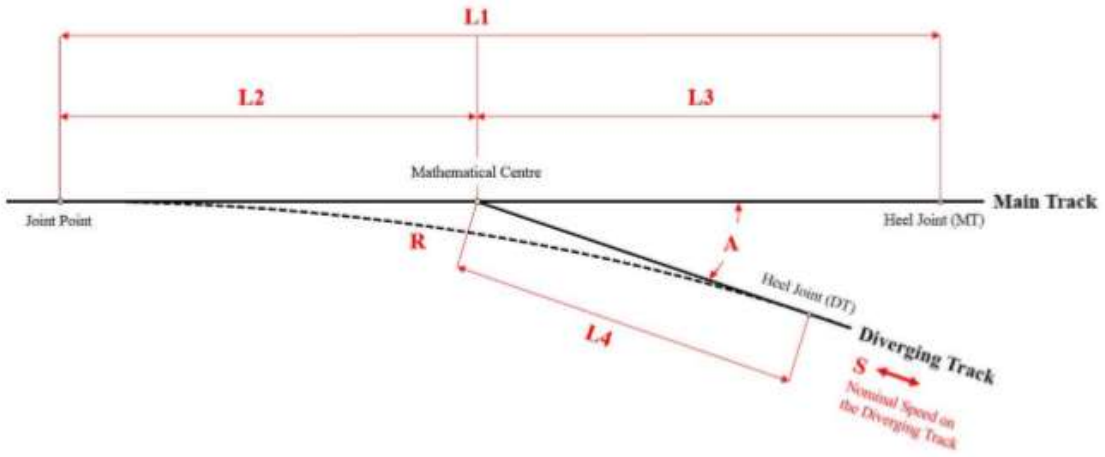
d) 100 km/h;

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
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

a) On straight track where speed is > 200 km/h, turnouts shall be equipped with swing nose crossings;

b) 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
Nominal track gauge tolerances for loaded track, switch, and crossing	+3/-2 mm
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
Annual net tonnage	Maximum: 25 million gross tons/year Mean for the lifetime of 50 years: 12 million gross tons/year
Distance between main line track centerlines	Please refer to RBDG-MAN-013 (Mixed traffic and passenger only and light freight traffic line)
Maximum ruling gradient	Please refer to RBDG-MAN-013 (Mixed traffic and passenger only and light freight traffic line)
Minimum radius of curvature (Main Line)	Please refer to RBDG-MAN-013 (Mixed traffic, sections with only freight traffic. and passenger only and light freight traffic line)
Maximum cant deficiency	Please refer to RBDG-MAN-013 (Mixed traffic and passenger only and light freight traffic line)
Electrified traffic	Yes
Environmental conditions	According to Design Guidelines RBDG-MAN-012 and RBDG-MAN-029
TRACK INFORMATION	
Rail inclination	please refer to RBDG-MAN-014
Switch Minimum flangeway	60 mm

TRACK ALIGNMENT DESIGN CRITERIA	
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	please refer to RBDG-MAN-014

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 to table in 4.3.3;

d) Expansion capacity of the expansion device and maximum displacement rail/support:

- 300 mm (±150mm)
- 600 mm (±300mm)
- 1000 mm (±500mm)
- 1200 mm (±600mm)

e) Nominal support spacing: according to 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 ≤ 5kN;

ii. The slide chairs shall permit movement of rails, with resistance ≤5kN;

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 crossing assembly from the internal to the external heel together with all components and baseplates and any baseplates extending beyond the crossing led ends;

c) Check rails assemblies inclusive of baseplates and baseplates for the running rail opposite the crossing;

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, controls, in-bearer/motor unit at switch points and swing nose crossing that meets the turnouts requirements. Interface with the signalling supplier will be required to ensure integration in to signalling system;

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 crossing and outside the crossing and beyond the switch heel for the full extent of the turnout bearer (sleeper);

h) The 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 control unit 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).

All parts of the Turnout Integrated System and REJ system shall be kept out of the Lower section of kinematic gauge, which is as per Design Guidelines RBDG-MAN-012 clause 4.1.

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 ≤H ≤60 Diamond crossing: 45 ≤H 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 shall be placed on the wing rail;

c) Minimum flangeway width between switch rail and stock rail at the end of planning: 60 mm ;

d) Trailability: not required;

e) Dimensions of actuator and locking system, including the drive, locking and detection positions: Supplier to submit for approval to RB Rail;

f) Actuator capacity Fcap: Supplier to submit for approval to RB Rail;

g) Maximum actuation force applied Fa: 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 (fp) or switch opening at drive position (fd): Supplier to submit for approval to RB Rail;

j) Maximum gap at switch toe (dtoe): 1mm;

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 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;

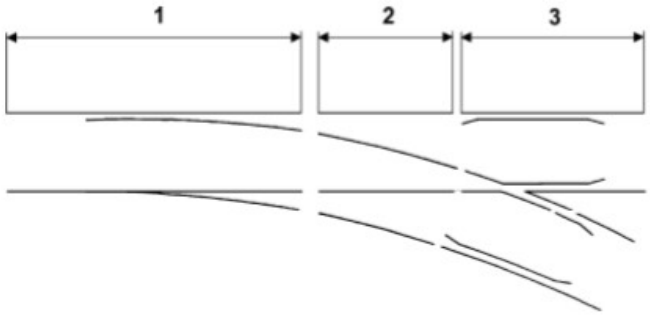
o) Acceptance tests, standard testing (in case of deliveries of existing designs) and prototype testing, shall be done in accordance with Section 6 of EN 13232-4. For both testing (standard and prototype), the delivery of the turnout shall include the actuator and locking system.

7. Material and equipment requirements

7.1. Turnouts components requirements

Rail Inclination of 1:40, shall be achieved by an inclined stock rail and an inclined active part of the switch rail head;

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. For switch rails longer than 50 meters flash-butt welding is allowed in the non-flexible and non-movable part;

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 supplier 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 movable 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 with elastic fasteners, including resilient pad, cast-iron baseplate laid on monobloc concrete bearers or baseplate less bearers.

7.1.4. Crossing panel

Turnouts crossing part shall be swing nose technology or fixed nose technology, according to Section 4.3.2;

Swing nose crossings shall be equipped with cast austenitic manganese monobloc or forged block with weld-on-rails or bolted switch solution made of switches rails grade 350HT, jointed together by high strength bolts.

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:

- The common monobloc cast austenitic manganese crossing shall be used with flash-butt welded wing rails;
- Fabricated fixed crossings shall not be used in CWR track
- 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-014B

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 crossing locations.

7.4. Rail expansion joints

Rail inclination 1:40, shall be achieved by an inclined stock rail and an inclined active part of the switch 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 (or without) 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. Supplie'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 1mm 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 op-eration, 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 integrated system all action (including motors), locking and detection elements shall be supplied by the supplier. The turnout supplier must liaise with the Signalling supplier and test the turnout integrated system to demonstrate and provide evidence of compliance with the specified requirements.

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 and RBR procedures.

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 and RBR procedures. For both testing (standard and prototype), the delivery of the turnout shall include the actuator, locking and detection system.

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

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 integrated system and expansion joint.

The manual shall be provided in hard copy and must include all drawings and information required to install and maintain turnouts integrated system 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 LOD300 (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 Cient 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.