

General Rolling Stock Requirements and Approval Process

Supporting Document 6.1

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1 Introduction

This document is issued by the State and defines the requirements and provides information for Rolling Stock that is to be used on HSL-Zuid Infrastructure in the Netherlands. It also provides information about Rolling Stock requirements for operation in Belgium and France.

The Rolling Stock that is part of the bid shall be compliant with the requirements as stated in sections 2.1. Before the start of the operation of the HSL-Zuid train services the TOC shall have demonstrate compliance with the requirements, to the State, or nominated representatives of the State. The TOC shall bear all costs associated with demonstrating compliance with the specifications and standards required by this specification.

Capitalised terms used in this document shall, unless the context otherwise requires, be defined in the Glossary.

Reference documents referred to in this document are held in the Data Room. Any deviations from the referenced documents shall be agreed with the State.

2 Overview of the Rolling Stock Requirements

2.1 Overview of the Rolling Stock requirements for operation in the Netherlands

Four groups of Rolling Stock requirements can be distinguished.

1. Rolling Stock shall comply with the EU Council Directive 96/48. This results in compliance with the Technical Specifications of Interoperability (TSIs). The relevant TSIs are listed in section 3.1.
2. The Rolling Stock must be designed and built to operate within the design requirements of the High-Speed Infrastructure. Section 3.2 provides the requirements and discusses means to show compliance.
3. All Rolling Stock must be approved for use on the Conventional Infrastructure. A more detailed overview of the applicable requirements and the approval process is given in section 3.3.
4. Rolling Stock shall comply with the binding safety case requirements as defined in section 2.2 of Supporting Document 5 HSL-Zuid Safety Specification. In addition, section 3.3 of Supporting Document 5 HSL-Zuid Safety Specification contains Rolling Stock related safety guidelines.

Any conflicts between the requirements will be addressed on a case by case basis.

Additional infrastructure information for the design of Rolling Stock is given in Chapter 4. This chapter contains information about pressure waves in tunnels during the passage of trains and the climatic conditions under which the high-speed infrastructure will be operational.

2.2 Rolling Stock requirements for operation on Belgian and French Infrastructure

Rolling Stock used for operation on the Belgian infrastructure needs to comply with the Belgian Rolling Stock requirements and needs to be accepted by the Belgian authorities. The Belgian specification, "Reglement van de beheerder van de spoorweginfrastructuur" can be found in the Data Room. Note that this specification is for guidance only, and the State is not responsible for any errors or omissions.

Rolling Stock used for operation on the French Infrastructure needs to comply with the French Rolling Stock requirements and needs to be accepted by the French authorities.

The French specification, EQUT001006A, can be found in the Data Room. Note that this specification is for guidance only, and the State is not responsible for any errors or omissions.

A comparison of the Rolling Stock infrastructure interface for the Netherlands, Belgium and France has been made and can be found in the Data Room in document: "Rolling Stock Infrastructure interface comparison for the Dutch, Belgian and French Infrastructure". Note that this document is for guidance only, and the State is not responsible for any errors or omissions.

3 Rolling Stock Requirements

3.1 EU Council Directive 96/48

Requirements

RS1 In accordance with EU Council Directive 96/48, the Rolling Stock shall comply with the following TSIs, (Technical Specifications for Interoperability):

- TSI Rolling Stock¹;
- TSI Maintenance;
- TSI Control-command and Signalling;
- TSI Operation;
- TSI Energy.

RS2 In exception of RS1 Rolling Stock with a maximum operating speed of 220kph may deviate from the TSIs at the following aspects²:

- Service speed;
- Traction performance;
- Axle load.

The minimum requirements for these aspects are clarified in Supporting Document 6.2 High-speed Infrastructure Interface Requirements.

Demonstrating Compliance

RS3 The State requires Certificates of Conformity to demonstrate compliance with the TSIs.

RS4 The TOC shall appoint a Notified Body, as defined in EU Council Directive 96/48, which will provide the relevant Certificates of Conformity to the State.

3.2 High-speed Infrastructure Interface

Requirements

RS5 Rolling Stock shall be suitable for use on the High-speed Infrastructure. This will be achieved by compliance with high-speed infrastructure interface requirements as defined in Supporting Document 6.2 High-speed Infrastructure Interface Requirements.

Demonstrating Compliance

¹ The latest version of the TSI Rolling Stock contains a fire containment requirement. The state is willing to support the development of compliance methods through the input of fire expertise.

² Additional exemptions might be given for requirements with a high impact on Rolling Stock used for Domestic operation.

- RS6 The TOC shall appoint a Notified Body, as defined in EU Council Directive 96/48, who will confirm, by the issue of appropriate certification to the State, that the high-speed infrastructure interface requirements have been satisfied.
- RS7 The identity of the Notified Body shall be agreed, at the commencement of the Contract, with the State. Any subsequent alteration to the identity of the Notified Body must be agreed in advance with the State.

3.3 Conventional Infrastructure

Requirements

- RS8 The Rolling Stock shall be suitable for use on the Conventional Infrastructure in the Netherlands. This will be achieved by completion of the Railed Rolling Stock acceptance process.
- RS9 Rolling Stock shall comply with the requirements of Chapter One of Railed Standard M-001^E, "Railway Safety Admission Requirements Rolling Stock".
- RS10 Rolling Stock shall comply with the requirements of Chapter Two of Railed Standard M-001^E, "Railway Safety Admission Requirements Rolling Stock", including all applicable Category A, B and C issues.
- RS11 The specific Dutch requirements outlined in Chapter Two of Railed Standard M-001^E include, amongst others:
- An On Train Data Recorder, as outlined in Railed Standard M-002.
 - Passenger Door Requirements, as outlined in Railed Standard M-003.
 - The requirement for an Automatic Vigilance Device from zero speed.
- RS12 Rolling Stock shall be equipped with GSM-R voice and data communication systems. GSM-R will replace the existing Dutch railways communication system, Telerail, before the HSL services start.

Demonstrating Compliance

- RS13 Notified Bodies demonstrating compliance for the Conventional Infrastructure requirements need to be accepted by Railed³.
- RS14 When the Rolling Stock is to be operated under Dutch authority, the TOC's maintenance procedures must be assessed in accordance with Railed Standard M-004.

³ A number of Dutch Notified Bodies are accepted as providers of statements of compliance for the Conventional Infrastructure.

- RS15 The TOC is responsible for gaining the admission of the Rolling Stock onto the Dutch Infrastructure. The procedure for this is outlined in Rained standard M-005.
- RS16 The TOC is responsible for gaining the "Declaration of No Objection" from Rained to enable testing of the Rolling Stock to commence.
- RS17 The TOC is responsible for gaining approval to operate the Rolling Stock, including the completion of the "Put-in-service notification", as defined in Rained standard M-006.

4 Infrastructure Information

4.1 Description of the Infrastructure

A description of the HSL-Zuid Infrastructure can be found in Supporting Document 2.1 Description of Rail Infrastructure. It includes a description of the High-speed infrastructure, the Conventional Infrastructure and the Belgian and French infrastructure, over which it is expected that the Rolling Stock may operate.

4.2 HSL Tunnel Design Principles

TOC's should note that consideration has been given to ensure that pressure changes arising from the passage of a Train at high speed through tunnels does not cause discomfort to passengers or crew. For this purpose the HSL has defined two comfort levels for pressure changes that should be achievable. Figure 1 shows the comfort level for a single train passage through a tunnel and Figure 2 shows the comfort level for 2 passing trains in a single tunnel tube.

These levels of comfort are achievable if the Rolling Stock is equivalent to the rolling stock specified in "HSL richtlijn 606D, Maatregelen ter beperking van de invloed van drukgolven in tunnels" (HSL Guide line, precautions for the reduction of effects of pressure waves in tunnels).

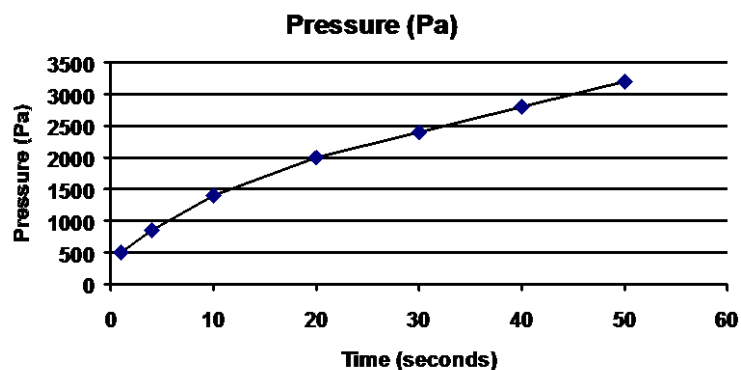


Figure 1 High pressure-comfort

This high pressure-comfort level has been applied for dimensioning the tunnel sections for a single train passage on the High-speed Infrastructure.

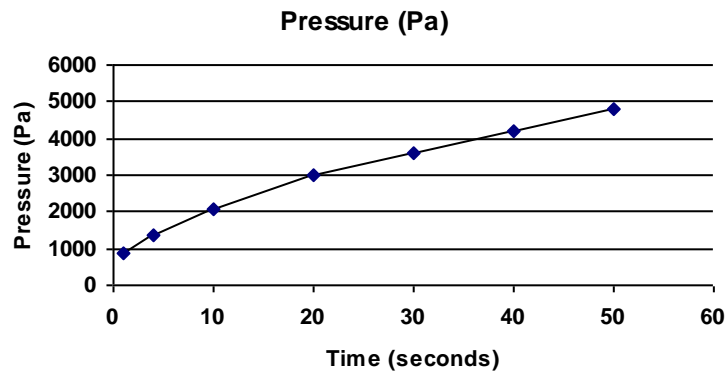


Figure 2 Normal pressure comfort

This normal pressure-comfort level has been applied for dimensioning the tunnel sections for two passing trains in a single tunnel tube on the High-speed Infrastructure.

4.3 Climatic Conditions

The High-speed Infrastructure will be designed and constructed to perform in accordance within the environmental conditions listed in the sections below.

Temperature

Tunnel located systems:	-10°C to +30°C
Trackside outdoor systems:	-20°C to +40°C
systems in tunnel cuttings:	-20°C to +45°C

Humidity

Tunnel located systems:	15% to 100% relative (condensing) 0.02 g/m ³ to 30 g/m ³ (absolute)
Trackside outdoor systems:	15% to 100% relative (condensing) 0.02 g/m ³ to 25 g/m ³ (absolute)

Wind

Wind speed of 1 m/s to determine thermal load of overhead wire catenary

Wind speed of 35 m/s for structures and mechanical load

Wind gusts up to 50 m/s for a duration of 1 second

Other wind conditions as described in NEN 1060 "Bovengrondse Hoogspanningslijnen" (Overhead High Voltage Lines).

Solar Radiation

Solar radiation of 1120 W/m².

Rainfall

Rainfall up to and including rainfall in accordance with the van Braak curve for a 1 in 100 year rainfall event.

Hail

Hailstones up to a maximum diameter of 20 mm.

Snow and Ice

Any snow, ice and freezing rain conditions which occur in The Netherlands.

Lightning

Lightning conditions referenced in NEN 1014 "Bliksembeveiliging" (Lightning Protection) with a 5% chance of being exceeded.

Glossary

Certificate of Conformity	A certificate issued by a Notified Body which confirms compliance with the TSIs.
Conventional Infrastructure	Infrastructure for train operations, including all necessary systems not being part of the train, at speeds up to 160 kph. The systems are: i.a. track, command, control and communication system, traction power system.
ERTMS	European Railway Traffic Management System.
ETCS	European Train Control System.
Data Room	A room located at the offices of the Project organisation HSL-Zuid in Utrecht, containing information relating to the HSL South Transport Contracts.
GSM-R	System for mobile communications applicable to railways.
High-Speed Infrastructure	Infrastructure for train operations, including all necessary systems not being part of the train, at a minimum Service Speed of 200 kph. The systems are: i.a. track, command, control and communication system, traction power system.
HSL-Zuid Infrastructure	All the infrastructure required for HSL-Zuid operations including High-Speed Infrastructure, Conventional Infrastructure and diversion routes.
Infrastructure Provider	The party responsible for design, built and maintenance of the High-Speed Infrastructure and adjacent parts of Conventional Infrastructure in the Netherlands.
Notified Body	A body recognised by the State in accordance with the requirements of EU Directive.
Rolling Stock	Vehicles, able to drive on rail infrastructure, which use the bearing and guiding functions of the track.
Safety Case	A document that demonstrates that, if complied with, the relevant system will meet its safety and health

requirement.

Service Speed

Maximum speed at which Trains can run during operation.

TEL

Transient Exposure Level.

The State

The State of the Netherlands.

Telerail

The existing communications system on the Dutch railways.

Train

Rolling Stock or a combination of Rolling Stock intended to drive as a unit on the rail infrastructure.

TSI

Technical Specification for Interoperability.

Rolling Stock High-speed Infrastructure Interface Requirements

Supporting Document 6.2

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5 Introduction

This specification describes the Rolling Stock interface requirements with the High-Speed Infrastructure in the Netherlands. These requirements are derived from the characteristics of the High-Speed Infrastructure. Additional information about the High-Speed Infrastructure can be found in the ITDN Infraprovider part 4 Schedule 5.1 through schedule 5.10 in the Data Room Infraprovider.

The document is issued by the State and contains requirements for Rolling Stock. The requirements are numbered, the other paragraphs are for information only. The Rolling Stock that is part of the bid shall be compliant with the requirement as stated in this document. The information provided may be used for the design of the Rolling Stock.

Reference documents referred to in this document are available in the Data Room.

Capitalised terms used in this document shall, unless the context otherwise requires, be defined in the Glossary.

6 General Requirements

- IS1 The Rolling Stock shall be designed and constructed to meet the requirements of the Council of the European Union's Directive 96/48/EC of 23 July 1996 concerning the interoperability of the trans-European high-speed rail system.

The High-Speed Infrastructure will be designed and constructed based on Rolling Stock with general characteristics as described in UIC 660 unless otherwise described within this document.

7 Command, Control and Communications System

7.1 General

IS2 Rolling Stock shall at a minimum comply with the TSI Command-Control and Signalling.

IS3 Rolling Stock shall support GSM-R data and voice communication equipment that complies with the EIRENE standards.

IS4 Rolling Stock command and control system shall support both train protection and traffic management functions as described in "ERTMS/ETCS Class 1 Specifications".

IS5 Rolling Stock command and control system shall support ETCS level 2 or 3. Co-ordination with the Infrastructure Provider will be required in the implementation phase.

7.2 Command and control transitions

IS6 The Rolling Stock command and control systems shall provide a transition between the High-Speed Infrastructure and the Conventional Infrastructure and between the High-Speed Infrastructure and the Belgian infrastructure.

7.3 Maximum train length

IS7 The maximum Train length under normal operating conditions shall not exceed 400 m.

The Train length may be doubled in exceptional circumstances, for example for Train recovery by another Train.

7.4 Acceleration and braking characteristics

IS8 The Rolling Stock shall be capable of braking under normal service braking conditions with a minimum deceleration of 0.35 m/s^2 down to a speed of 230 kph and a minimum deceleration of 0.6 m/s^2 down to a speed of 0 kph.

IS9 For emergency braking the Rolling Stock is allowed to brake with a maximum deceleration of 2.5 m/s^2 .

IS10 All Rolling Stock shall have acceleration characteristics better than defined in table IS1a.

TRAIN SPEED	[KPH]	40	80	160	220
Maximum distance from stand-still to accelerate to given speed	[m]	206	833	4943	22614
Maximum time to accelerate from stand-still to given speed	[sec.]	45	83	199	518

Table IS1a: Minimum acceleration characteristics of Rolling Stock

Acceleration in excess of values presented in table IS1b may be limited by the control and command system.

TRAIN SPEED	[KPH]	40	80	160	220	300
Distance to accelerate from stand-still to given speed	[m]	102	434	2186	4804	13419
Time to accelerate from stand-still to given speed	[sec.]	18	38	90	139	256

Table IS1b: Maximum acceleration characteristics of Rolling Stock

7.5 Train Detection

IS11 Resistance between two wheels, on the same axle, of the Rolling Stock shall be in accordance with UIC leaflets 512 and 533. In the case of independent wheelsets (i.e. wheels parallel but free to rotate independently) the wheels shall be electrically connected so as to conform to these requirements.

7.6 Train Speed

IS12 The maximum permissible Service Speed on the High-Speed Infrastructure of HSL-Zuid is 300 kph.

IS13 Rolling Stock shall have a Service Speed of at least 220 kph on the High-Speed Infrastructure except on the Southern parts between Breda and The Netherlands – Belgium border.
Rolling Stock shall have a Service Speed of at least 200 kph on the High-Speed Infrastructure between Breda and The Netherlands – Belgium border.

IS14 With regard to safety, all systems of the Trains shall function correctly up to a speed of 10% faster than the Service Speed.

8 Track System

8.1 Derailment Safety

IS15 The derailment safety of Rolling Stock on track distortions shall meet the requirements in ERRI report B55 Rp 8.

8.2 Design Loads

8.2.1 Static Load

IS16 The maximum load per axle shall not exceed the values shown in table IS2.

MAXIMUM SERVICE SPEED OF ROLLING STOCK (KPH)	MAXIMUM AXLE LOAD (TONNES)
Up to and including 300	17
Up to and including 250	18
Up to and including 220	22.5

Table IS2: Rolling Stock Axle Loads

IS17 The wheelbase shall be in accordance with UIC leaflet 511.

The infrastructure will be designed and constructed according to “Belastingen en Vervormingen bouwconstructies HSL-Richtlijn 600”, Version E, 29 October 1999. Rolling Stock with axle distribution that differs significantly from existing Rolling Stock (TGV PBKA, ICE 3M) might not be acceptable for the High-Speed Infrastructure. This shall be taken into account in the Rolling Stock design.

The ride comfort might be negatively influenced when passing the bridge over Hollandsch Diep due to dynamic behaviour of that bridge. The Hollandsch Diep bridge consists of 10 approximately 100 m long bridge sections which due to deflection might cause an increased oscillation of the Rolling Stock. The bridge is designed based on Rolling Stock with an oscillation frequency between of 0.8 Hz and 1.2 Hz and a damping of 0.1.

8.2.2 Total Load

IS18 In extreme conditions of load, speed, and cant deficiency, the maximum combined static and dynamic load shall not exceed:

- 170 kN per wheel for Rolling Stock with a Service Speed of 300 kph;
- 180 kN per wheel for Rolling Stock with a Service Speed of 250 kph;
- 200 kN per wheel for Rolling Stock with a Service Speed of 220 kph.

IS19 The Rolling Stock shall minimise damage to the infrastructure through, amongst others, the following measures:

- good condition of the wheels;
- prevention of slipping or sliding wheels.

IS20 The Rolling Stock shall meet the wheel unloading characteristics of ERRI reports C138 Rp9 and B55 Rp8.

8.2.3 Wheel Profile

IS21 The wheel profile shall be in accordance with those described in UIC leaflet 510-2.

9 Traction Power System

9.1 Traction Power Distribution

IS22 Rolling Stock shall comply with the TSI Energy.

IS23 The maximum continuous current per Train shall not exceed 1,000 Amps at 25 kV AC 50 Hz and 4,000 Amps at 1500 V DC.

9.2 Pantograph

IS24 Rolling Stock shall use pantographs to collect traction power from the overhead catenary system.

IS25 Pantographs shall be between 1450 mm and 1950 mm wide.

IS26 The pantographs used on the Rolling Stock shall comply with the requirements of UIC leaflets 608 and 794.

The overhead contact wire will be 5.30 m above rail level.

The overhead contact wire shall comply with the requirements of UIC leaflets 794 and 608.

The overhead contact wire will incorporate stagger either side of the track centreline to provide even wear to the Rolling Stock pantograph.

The overhead wire will be staggered so that the pantograph wear shall be evenly distributed over 80% of the area of the minimum size of pantograph.

IS27 The distance between pantographs and maximum number of pantographs per train shall be as described in table IS3.

REQUIREMENT	220 KPH MAXIMUM OPERATING SPEEDPH	PH300 KPH MAXIMUM OPERATING SPEED
Minimum Distance between active Pantographs	80 metres	152 metres
Maximum Distance between active Pantographs	400 metres	400 metres
Maximum Number of Pantographs per Train	5	2

Table IS3: Rolling Stock Pantographs

9.3 Transition Zones

9.3.1 Traction Voltage Changeover System

IS28 The normal operating condition shall be for the Rolling Stock not to draw power and for the pantographs to be lowered for the transition across the traction voltage changeover system.

IS29 The pantographs shall be automatically lowered for the transition across the traction voltage changeover system.

IS30 The Train driver shall be able to manually lower the pantographs.

The traction voltage changeover system will be designed for abnormal operation of Rolling Stock (Rolling Stock not working according to requirement IS28).

9.3.2 Traction Power Phase Lock

IS31 The normal operating condition shall be for the Rolling Stock not to draw power and to have the pantographs left raised (with no electrical connection between the pantographs) for the transition across a traction power phase lock.

The traction power phase lock system will be designed for abnormal operation of Rolling Stock (Rolling Stock not working according to requirement IS31)

9.4 Electrical Braking

9.4.1 Regenerative Braking

The Rolling Stock may use regenerative braking on the High-speed Infrastructure.

9.4.2 Eddy Current Braking

The Rolling Stock may use eddy current braking on the High-Speed Infrastructure.

IS32 The characteristics of eddy current brakes used shall be equivalent to those of the Knorr-Bremse EWB154R eddy current brake.

IS33 There shall be a maximum of 16 bogies per train equipped with eddy current brakes.

9.5 Electromagnetic Compatibility

IS34 The Rolling Stock shall comply with CENELEC EN 50121-3 and CENELEC EN 50155.

10 Gauge

10.1 Rolling Stock Outline

IS35 Rolling Stock shall be constructed within the UIC-GC profile. This shall be demonstrated by means of calculations in accordance with UIC leaflets 505 and 506.

For the Conventional Infrastructure, the Rolling Stock shall comply with the requirements of Appendix 4 of UIC leaflet 505-1. This means that the requirement for the Conventional Infrastructure limits the Rolling Stock outline.

11 Environment

11.1 Exterior Noise

IS36 Noise emission of Rolling Stock shall not exceed the values specified in table IS4 for speeds up to Service Speed. For Service Speeds other than tabulated noise values shall be linearly interpolated.

VELOCITY [KPH]	TEL [dB(A)]
300	88
250	85
200	82

Table IS4: Maximum Noise emission Rolling Stock

Transient Exposure Level (TEL) shall be measured in accordance with prEN ISO 3095 (April 1999) at 25 m from the centreline of the track and at a height of 3.5 m above rail level with full load condition and in the minimal possible operational configuration for normal service.

11.2 Pressure Waves

IS37 Pressure waves produced by Rolling Stock shall allow the achievement of the pressure comfort level in passing trains as described in "Maatregelen ter beperking van de invloed van drukgolven in tunnels, HSL-Richtlijnen 606", Version D, 7 October 1999.

11.3 Particle Emission

IS38 The design of the pantograph shall minimise the emission of metals (e.g. copper).

Glossary

Conventional Infrastructure	Infrastructure for train operations, including all necessary systems not being part of the train, at speeds up to 160 kph. The systems are: i.a. track, command, control and communication system, traction power system.
ERTMS	European Railway Traffic Management System.
ETCS	European Train Control System.
Data Room	A room located at the offices of the Projectorganisation HSL-Zuid in Utrecht, containing information relating to the HSL South Transport Contracts.
GSM-R	System for mobile communications applicable to railways.
High-Speed Infrastructure	Infrastructure for train operations, including all necessary systems not being part of the train, at a minimum Service Speed of 200 kph. The systems are: i.a. track, command, control and communication system, traction power system.
Infrastructure Provider	The party responsible for design, built and maintenance of the High-Speed Infrastructure and adjacent parts of Conventional Infrastructure in The Netherlands.
Rolling Stock	Vehicles, able to drive on rail infrastructure, which use the bearing and guiding functions of the track.
Service Speed	Maximum speed at which Trains can run during operation.
TEL	Transient Exposure Level.
Train	Rolling Stock or a combination of Rolling Stock intended to drive as a unit on the rail infrastructure.
TSI	Technical Specification for Interoperability.