

Section 1: General Information

0. Identification of the type

0.1 0.2 0.4 Type ID: 13-093-0001-8-001-004
0.3 Date of record: 2021-12-02

1. General Information

1.1 Type name: ETR521 S1
1.2 Alternative type name: ETR521 S1

1.3 Manufacturer:

1.3.1 Manufacturer identification data:

1.3.1.1 Name of organisation: Hitachi Rail STS S.p.A.
1.3.1.2 Registered business number: 01371160662
1.3.1.3 Organisation code:

1.3.2 Manufacturer contact data:

1.3.2.1 Address of organisation, street and number: Via Paolo Mantovani, 3/5
1.3.2.2 Town: Genova, Italy
1.3.2.3 Country code: IT
1.3.2.4 Post code: 16151
1.3.2.5 E-mail address: info.hri@hitachirail.com

Registration Method: New Version of a registered Type Directive 2008/57/EC
Registered Vehicle Type: 13-093-0001-8-001
1.4 Category: Traction vehicles
1.5 Subcategory: Self-propelled passenger trainset (incl. railbusses)
1.6 Platform: Caravaggio

Section 2: Conformity with TSI

2.1 Conformity with TSI and Sections not complied with:

1435mm / DC 3kV / BACC

CCS TSI (Regulation (EU) N° 2016/919)
CCS TSI (Regulation (EU) N° 2016/919)
amended by Reg.(EU)2019/776
CCS TSI (Regulation (EU) N° 2016/919)
amended by Reg.(EU)2019/776 amended by
Reg.(EU)2020/387
LOC & PAS (Regulation (EU) No 1302/2014)
amended by Reg.(EU)2016/919 amended by
Reg.(EU)2018/868 amended by Reg.(EU)
2019/776 amended by Reg.(EU) 2020/387)
PRM (Regulation (EU) No 1300/2014
amended by Regulation (EU) 2019/772)
SRT (Regulation (EU) No 1303/2014)
amended by Reg.(EU) 2016/912) amended by
Reg.(EU) 2019/776
Noise (Regulation (EU) No 1304/2014
amended by Regulation (EU) 2019/774)

1435mm / DC 3kV / RSDD/SCMT

CCS TSI (Regulation (EU) N° 2016/919)
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CCS TSI (Regulation (EU) N° 2016/919)
amended by Reg.(EU)2019/776 amended by
Reg.(EU)2020/387
LOC & PAS (Regulation (EU) No 1302/2014)
amended by Reg.(EU)2016/919 amended by
Reg.(EU)2018/868 amended by Reg.(EU)
2019/776 amended by Reg.(EU) 2020/387)
PRM (Regulation (EU) No 1300/2014
amended by Regulation (EU) 2019/772)
SRT (Regulation (EU) No 1303/2014)
amended by Reg.(EU) 2016/912) amended by
Reg.(EU) 2019/776
Noise (Regulation (EU) No 1304/2014
amended by Regulation (EU) 2019/774)

2.3 Applicable specific cases (specific cases conformity with which has been assessed)

2.2 Reference of 'EC type examination certificates'

Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2019/RST/IT EN/020.06
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2020/RST/ITEN/170/V01
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2020/RST/ITEN/234/V01
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2021/RST/ITEN/041/V01
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2021/RST/ITEN/193/V01

Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2021/RST/ITEN/228/V01
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2020/CCO/IT EN/026
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2020/CCO/ITEN/167/V01
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2021/CCO/ITEN/196/V01
Reference of 'EC type examination certificates' - if module SB applied - and/or 'design verification certificate' - if module SH1 applied	1960/1/SB/2021/CCO/ITEN/225/V01

Section 3: Authorisations

Italy

3.0 Area Of Use:	IT(Rete Ferroviaria Italiana (RFI))
3.1.1 Member state of authorisation:	Italy(IT)
3.1.2.1 Status:	Valid
3.1.2.2 Validity of Authorisation (until):	
3.1.2.3 Coded conditions for use and other restrictions:	<p>1435mm / DC 3kV / BACC</p> <p>1 Technical restriction related to construction</p> <p>1.1 Minimum curve radius in meters: 100 mt in deposito / 150 mt in linea</p> <p>1.3 Speed restrictions in Km/h: 160</p> <p>1.4 Use in multiple operation (maximum number of trainsets authorised to be coupled together to operate as a single train): Single operation</p> <p>2 Geographical restriction</p> <p>2.1 Kinematic gauge (coding WAG TSI): GB/G12</p> <p>2.2 Wheelset gauge: 2.2.4 Gauge 1435</p> <p>2.7 Noise category: 2.7.1 Can be used in all quieter routes- TSI Noise compliant- Silent - retrofitted without testing</p> <p>3 Environmental restrictions</p> <p>3.1 Climatic zone: 3.1.3 T3</p> <p>4 Restrictions on use</p> <p>4.1 Time based: True</p> <p>4.2 Condition based (distance travelled, wear, etc.): True</p>

5 On-board equipment

5.1 Recording device: 5.1.01 "Registratore cronologico d'eventi computerizzato" (RCEC) according to specification RFI/DTC/CSI/SR/OR/10/002/B of 11/02/2008

1435mm / DC 3kV / RSDD/SCMT

1 Technical restriction related to construction

1.1 Minimum curve radius in meters: 100 mt in deposito / 150 mt in linea

1.3 Speed restrictions in Km/h: 160

1.4 Use in multiple operation (maximum number of trainsets authorised to be coupled together to operate as a single train): Single operation

2 Geographical restriction

2.1 Kinematic gauge (coding WAG TSI): GB/G12

2.2 Wheelset gauge: 2.2.4 Gauge 1435

2.7 Noise category: 2.7.1 Can be used in all quieter routes- TSI Noise compliant- Silent - retrofitted without testing

3 Environmental restrictions

3.1 Climatic zone: 3.1.3 T3

4 Restrictions on use

4.1 Time based: True

4.2 Condition based (distance travelled, wear, etc.): True

5 On-board equipment

5.1 Recording device: 5.1.01 "Registratore cronologico d'eventi computerizzato" (RCEC) according to specification RFI/DTC/CSI/SR/OR/10/002/B of 11/02/2008

3.1.2.4 Non-coded conditions for use and other restrictions:

1435mm / DC 3kV / BACC

Per la circolazione su linee la cui velocità massima al rango più elevato sia superiore a 200 km/h, verificare preventivamente l'idoneità del veicolo e la sussistenza delle condizioni di sicurezza in coerenza con i principi della circolazione ferroviaria di cui al Decreto ANSF 4/2012 del 09.08.2012, tenendo conto delle caratteristiche del fissaggio dei dispositivi alla struttura della cassa, con particolare riferimento alla solidità delle porte esterne e dei relativi sistemi di attacco, essendo previsti i seguenti valori limiti al carico aerodinamico: statico: ± 4000 Pa / affaticante: ± 2500 Pa

Sottosistema MR: Requisito 1.4 Requisito nazionale per le prove - divieto di utilizzo in composizione multipla. Requisito 2.1.5 Fissaggio dei dispositivi alla struttura della cassa - carico aerodinamico sui fissaggi dei dispositivi alla struttura della cassa: • statico ± 4000 Pa; • affaticante ± 2500 Pa.

Requisito 3.1 - Sagoma del rotabile - idoneo a circolare su linee che ammettono la sagoma con profilo di riferimento GB di cui alla EN 15273-2:2013/FprA1:2016; - divieto di circolazione in presenza di freni posti sul binario e di altri dispositivi di manovra e di arresto in posizione attiva; - divieto di passaggio sulle navi traghetto.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia e 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario - in modalità normale: $V_{adm} = 160$ km/h, $c_{dadm} = 153$ mm; - nelle varie situazioni di degrado le condizioni di esercizio del veicolo con i relativi limiti accettabili sono definite dal Richiedente nel documento DD02P023113B rev.06.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia, 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario, 3.2.2 - Conicità equivalente e 3.2.3 - Profilo della ruota e limiti - profilo ruota: S1002; - massima conicità equivalente ammessa in servizio in conformità a quanto previsto al par. 5.4.3.3 della EN 14363:2005: • $t_{gge} = 0,435$ per le sale dei carrelli motore degli elementi DM1e DM2 • $t_{gge} = 0,33$ per le sale dei carrelli portanti degli elementi TA, TX, TB

Requisito 3.2.5 - Raggio minimo di curvatura orizzontale, raggio di curvatura concavo verticale, raggio di curvatura convesso - esercizio in composizione singola (condizione di veicolo non accoppiato); - raggio minimo di curvatura: • orizzontale in linea pari a 150 m • orizzontale in deposito pari a 100 m • verticale concava pari a 500 m • verticale convessa pari a 500 m.

Requisito 3.3.6 - Cuscinetti sulla sala montata - monitoraggio e verifica in esercizio dei cuscinetti del veicolo in accordo al piano definito dal Richiedente nel par. 4 del documento DD02P021447B; al completamento di ogni step ed al termine del monitoraggio previsto, il Richiedente, sulla base della valutazione degli esiti dei controlli effettuati, deve definire le eventuali azioni di controllo e monitoraggio da mettere in atto durante l'esercizio del veicolo.

Requisito 4.2 - Requisiti di sicurezza della frenatura a livello del treno - devono essere prese in carico e rispettate da parte dell'Impresa Ferroviaria le condizioni applicative riportate nel doc. QB060011996 rev. 00 del 13.09.2021 "ETR 521 S1- Stima esplicita del rischio": • SRAC_SE_IF_001 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_003 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_004 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_007 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_008 in carico all'Impresa Ferroviaria; • SRAC_SE_ECM_001 da parte del Soggetto Responsabile della Manutenzione.

Requisito 4.7 - Produzione della forza di frenatura - sul veicolo

Sottosistema CCS: [ITCF_ETR521S1_CCS_01] Le condizioni applicative definite nel documento QB100012041 rev. 00 devono essere prese in carico e rispettate dall'Impresa Ferroviaria e dal Soggetto Responsabile della Manutenzione.

1435mm / DC 3kV / RSDD/SCMT

Per la circolazione su linee la cui velocità massima al rango più elevato sia superiore a 200 km/h, verificare preventivamente l'idoneità del veicolo e la sussistenza delle condizioni di sicurezza in coerenza con i principi della circolazione ferroviaria di cui al Decreto ANSF 4/2012 del 09.08.2012, tenendo conto delle caratteristiche del fissaggio dei dispositivi alla struttura della cassa, con particolare riferimento alla solidità delle porte esterne e dei relativi sistemi di attacco, essendo previsti i seguenti valori limiti al carico aerodinamico: statico: ± 4000 Pa / affaticante: ± 2500 Pa

Sottosistema MR: Requisito 1.4 Requisito nazionale per le prove - divieto di utilizzo in composizione multipla. Requisito 2.1.5 Fissaggio dei dispositivi alla struttura della cassa - carico aerodinamico sui fissaggi dei dispositivi alla struttura della cassa: • statico ± 4000 Pa; • affaticante ± 2500 Pa.

Requisito 3.1 - Sagoma del rotabile - idoneo a circolare su linee che ammettono la sagoma con profilo di riferimento GB di cui alla EN 15273-2:2013/FprA1:2016; - divieto di circolazione in presenza di freni posti sul binario e di altri dispositivi di manovra e di arresto in posizione attiva; - divieto di passaggio sulle navi traghetto.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia e 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario - in modalità normale: $V_{adm} = 160$ km/h, $c_{dadm} = 153$ mm; - nelle varie situazioni di degrado le condizioni di esercizio del veicolo con i relativi limiti accettabili sono definite dal Richiedente nel documento DD02P023113B rev.06.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia, 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario, 3.2.2 - Conicità equivalente e 3.2.3 - Profilo della ruota e limiti - profilo ruota: S1002; - massima conicità equivalente ammessa in servizio in conformità a quanto previsto al par. 5.4.3.3 della EN 14363:2005: • $t_{gge} = 0,435$ per le sale dei carrelli motore degli elementi DM1e DM2 • $t_{gge} = 0,33$ per le sale dei carrelli portanti degli elementi TA, TX, TB

Requisito 3.2.5 - Raggio minimo di curvatura orizzontale, raggio di curvatura concavo verticale, raggio di curvatura convesso - esercizio in composizione singola (condizione di veicolo non accoppiato); - raggio minimo di curvatura: • orizzontale in linea pari a 150 m • orizzontale in deposito pari a 100 m • verticale concava pari a 500 m • verticale convessa pari a 500 m.

Requisito 3.3.6 - Cuscinetti sulla sala montata - monitoraggio e verifica in esercizio dei cuscinetti del veicolo in accordo al piano definito dal Richiedente nel par. 4 del documento DD02P021447B; al completamento di ogni step ed al termine del monitoraggio previsto, il Richiedente, sulla base della valutazione degli esiti dei controlli effettuati, deve definire le eventuali azioni di controllo e monitoraggio da mettere in atto durante l'esercizio del veicolo.

Requisito 4.2 - Requisiti di sicurezza della frenatura a livello del treno - devono essere prese in carico e rispettate da parte dell'Impresa Ferroviaria le condizioni applicative riportate nel doc. QB060011996 rev. 00 del 13.09.2021 "ETR 521 S1- Stima esplicita del rischio": • SRAC_SE_IF_001 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_003 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_004 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_007 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_008 in carico all'Impresa Ferroviaria; • SRAC_SE_ECM_001 da parte del Soggetto Responsabile della Manutenzione.

Requisito 4.7 - Produzione della forza di frenatura - sul veicolo

Sottosistema CCS: [ITCF_ETR521S1_CCS_01] Le condizioni applicative definite nel documento QB100012041 rev. 00 devono essere prese in carico e rispettate dall'Impresa Ferroviaria e dal Soggetto Responsabile della Manutenzione.

3.1.3.1.1 Date of the original authorisation: 2019-11-29

3.1.3.1.2 Authorisation holder:

3.1.3.1.2.1 Authorisation holder identification data:

3.1.3.1.2.1.1 Name of organisation: Hitachi Rail STS S.p.A.

3.1.3.1.2.1.2 Registered business number: 01371160662

3.1.3.1.2.1.3 Organisation code:

3.1.3.1.2.2 Authorisation holder contact data:

3.1.3.1.2.2.1 Address of organisation, street and number: Via Argine, 425

3.1.3.1.2.2.2 Town: Napoli

3.1.3.1.2.2.3 Country code: NA

3.1.3.1.2.2.4 Post code: 80147

3.1.3.1.2.2.5 E-mail address: hitachirailsts@legalmail.it

3.1.3.1.3 Authorisation document reference: IT5920191014

3.1.3.1.4 Certificate of verification : Reference of type examination or design examination type:

IT/02/2013/1/SB/2019/RST/IT EN/022.07

IT/02/2013/1
/SB/2020/RST
/ITEN/159/V0
1

IT/02/2013/1
/SB/2020/RST
/ITEN/230/V0
1

IT/02/2013/1
/SB/2021/RST
/ITEN/038/V0
1

IT/02/2013/1
/SB/2021/RST
/ITEN/225/V0
1

IT/02/2013/1
/SB/2021/RST
/ITEN/266/V0
1

IT/02/2013/1/SB/2019/CCO/IT EN/019.06

IT/02/2013/1
/SB/2020/CCO
/ITEN/152/V0
1

IT/02/2013/1
/SB/2021/CCO
/ITEN/222/V0
1

IT/02/2013/1
/SB/2021/CCO
/ITEN/263/V0
1

3.1.3.1.5 Parameters for which conformity to applicable national rules has been assessed:

1435mm / DC 3kV / BACC
2015/2299/EU

1.1 General documentation

1.2 Maintenance instructions and requirements

1.2.1 Maintenance instructions

1.2.2 The maintenance design justification file

1.3 Instructions and documentation for operation

1.3.1 Instructions for operation in normal and degraded modes of the vehicle

1.4 National requirement for testing

2.1 Vehicle structure

2.1.1 Strength and integrity

2.1.2 Load capability

2.1.2.1 Load conditions and weighed mass

2.1.2.2 Axle load and wheel load

2.1.3 Joining technology

2.1.4 Lifting and jacking

2.1.5 Fixing of devices to car body structure

2.1.6 Connections used between different parts of the vehicle

2.2 Couplers / coupling systems

2.2.1 Automatic coupling

2.2.2 Characteristics of rescue coupling

2.2.3 Conventional screw coupling and other non-automatic coupling systems

2.2.5 Gangways

2.3 Passive safety

3.1 Vehicle gauge

3.2 Vehicle dynamics

- 3.2.1 Running safety and dynamics
- 3.2.2 Equivalent conicity
- 3.2.3 Wheel profile and limits
- 3.2.4 Track loading compatibility parameters
- 3.2.5 Minimum horizontal curve radius, vertical concave curve radius, convex curve radius
- 3.3 Bogies / running gear
 - 3.3.1 Bogies
 - 3.3.2 Wheelset (complete)
 - 3.3.3 Wheel
 - 3.3.4 Wheel/rail interaction influencing systems
 - 3.3.5 Sanding system
 - 3.3.6 Bearings on the wheelset
 - 3.3.7 Axle shaft
- 3.4 Limit of maximum longitudinal positive and negative acceleration
- 4.1 Functional requirements for braking at train level
- 4.2 Safety requirements for braking at train level
 - 4.2.1 Reliability of main brake system functionality
 - 4.2.2 Reliability of traction/braking interlocking
 - 4.2.3 Reliability of stopping distance
 - 4.2.4 Reliability of parking brake
- 4.3 Brake system - Recognised architecture and associated standards
- 4.4 Brake command
 - 4.4.1 Emergency braking command
 - 4.4.2 Service braking command
 - 4.4.3 Direct braking command
 - 4.4.4 Dynamic braking command
 - 4.4.5 Parking braking command
- 4.5 Brake performance
 - 4.5.1 Emergency braking performance
 - 4.5.2 Service braking performance
 - 4.5.3 Calculations related to thermal capacity
 - 4.5.4 Parking brake performance
 - 4.5.5 Brake performance calculation
- 4.6 Braking adhesion management
 - 4.6.1 Limit of wheel rail adhesion profile
 - 4.6.2 Wheel slide protection system ("WSP")

- 4.7 Braking force production
 - 4.7.1 Friction brake components
 - 4.7.1.2 Brake discs
 - 4.7.1.3 Brake pads
 - 4.7.2 Dynamic brake linked to traction
 - 4.7.5 Parking brake
- 4.8 Brake state and fault indication
- 4.9 Brake requirements for rescue purposes
- 5.1 Access
 - 5.1.1 Exterior doors
 - 5.1.2 Boarding aids
- 5.2 Interior
 - 5.2.3 Clearways
 - 5.2.4 Floor height changes
 - 5.2.5 Interior lighting
- 5.3 Handrails
- 5.4 Windows
- 5.5 Toilets
- 5.6 Heating, ventilation and air conditioning systems
- 5.7 Passenger information
 - 5.7.1 Public address system
 - 5.7.2 Signs and information
- 6.1 Impact of the environment on the vehicle
 - 6.1.1 Environmental conditions impacting on the vehicle
 - 6.1.1.1 Altitude
 - 6.1.1.2 Temperature
 - 6.1.1.3 Humidity
 - 6.1.1.4 Rain
 - 6.1.1.5 Snow, ice and hail
 - 6.1.1.6 Solar radiation
 - 6.1.1.7 Resistance to pollution
 - 6.1.2 Aerodynamic effects on the vehicle
 - 6.1.2.1 Crosswind effects
 - 6.1.2.2 Maximum pressure variation in tunnels
- 6.2 Impact of the vehicle on the environment
 - 6.2.1 External emissions
 - 6.2.1.1 Toilet emissions
 - 6.2.1.3 Chemical and particulate emission

- 6.2.2 Limits for noise emissions
 - 6.2.2.1 Stationary noise impact
 - 6.2.2.2 Starting noise impact
 - 6.2.2.3 Pass-by noise impact
- 7.1 Integrity of software employed for safety related functions
- 7.2 Visual and audible vehicle identification and warning functions
 - 7.2.1 Vehicle marking
 - 7.2.2 External lights
 - 7.2.2.1 Headlights
 - 7.2.2.2 Marker lights
 - 7.2.2.3 End-of-train signal
 - 7.2.2.4 Lamp controls
 - 7.2.3 Audible signal systems
 - 7.2.4 Brackets
- 8.1 Traction performance requirements
- 8.2 Functional and technical specification related to the interface between the vehicle and the energy subsystem
 - 8.2.1 Functional and technical specification related to the electric power supply
 - 8.2.1.1 Specific requirements for power supply
 - 8.2.1.2 Voltage and frequency of overhead contact line power supply
 - 8.2.1.3 Regenerative braking
 - 8.2.1.4 Maximum power and maximum train current that is permissible to draw from the overhead contact line
 - 8.2.2 Pantograph functional and design parameters
 - 8.2.2.1 Pantograph overall design
 - 8.2.2.2 Pantograph head geometry
 - 8.2.2.3 Pantograph contact force (including static contact force, dynamic behaviour and aerodynamic effects)
 - 8.2.2.4 Working range of pantographs
 - 8.2.2.5 Current capacity of pantograph including contact strip
 - 8.2.2.6 Arrangement of pantographs
 - 8.2.2.7 Insulation of pantograph from the vehicle
 - 8.2.2.8 Pantograph lowering
 - 8.2.2.9 Running through phase or system separation sections

- 8.2.3 Contact strip functional and design parameters
 - 8.2.3.1 Contact strip geometry
 - 8.2.3.2 Contact strip material
 - 8.2.3.3 Contact strip assessment
 - 8.2.3.4 Detection of contact strip breakage
- 8.3 Electrical power supply and traction system
 - 8.3.1 Energy consumption measurement
 - 8.3.2 Requirements for electrical installations on-board of a railway vehicle
 - 8.3.3 High voltage components
 - 8.3.4 Earthing
- 8.4 Electromagnetic Compatibility ("EMC")
 - 8.4.1 EMC within the vehicle
 - 8.4.2 EMC between the vehicle and the railway system
 - 8.4.2.1 Maximum currents
 - 8.4.2.1.1 Rail return current
 - 8.4.2.1.2 Heating cable interference current
 - 8.4.2.1.3 Interference current under the vehicle
 - 8.4.2.1.4 Harmonic characteristics and related overvoltages on the overhead contact line
 - 8.4.2.1.5 Effects of DC content in AC supply
 - 8.4.2.2 Maximum electro-magnetic fields/Induced voltages
 - 8.4.2.2.1 Electro-magnetic fields/Induced voltages in the track/under the vehicle
 - 8.4.2.2.2 Electro-magnetic fields/Induced voltages outside the track
 - 8.4.2.3 Vehicle entrance impedance
 - 8.4.2.5 Transverse voltage limits for compatibility voice/data circuits
 - 8.4.3 EMC between the vehicle and the environment
 - 8.4.3.1 Maximum electro-magnetic fields
 - 8.4.3.2 Induced interference current/voltage
- 8.5 Protection against electrical hazards
- 8.7 Systems requiring special monitoring and protection measures
 - 8.7.2 Pressure vessel systems/pressure equipment
 - 8.7.4 Technical systems in potentially explosive atmospheres

8.7.5 Hydraulic/pneumatic supply and control systems

9.1 Driver's cab design

9.1.1 Interior layout

9.1.2 Access to driver's cab

9.1.2.1 Access, egress and doors

9.1.2.2 Driver's cab emergency exits

9.1.3 Windscreen in driver's cab

9.1.3.1 Mechanical characteristics

9.1.3.2 Optical characteristics

9.1.3.3 Equipment to the windscreen

9.1.3.4 Front visibility / visibility field

9.1.4 Desk ergonomics

9.1.5 Driver's seat

9.2 Health and safety

9.2.1 Environmental conditions

9.2.1.1 Heating, ventilation and air-conditioning systems in driver's cab

9.2.1.2 Noise in driver's cab

9.2.1.3 Lighting in driver's cab

9.2.2 Other health and safety requirements

9.3 Driver/machine interface

9.3.1 Speed indication

9.3.2 Driver display unit and screens

9.3.3 Controls and indicators

9.3.4 Driver supervision

9.3.5 Rear and side view

9.4 Marking and labelling in driver's cab

9.5 Equipment and other facilities on-board for staff

9.5.1 Facilities on-board for staff

9.5.1.1 Staff access for coupling/uncoupling

9.5.1.2 External steps and handrails for shunting staff

9.5.1.3 Storage facilities for use by staff

9.5.2 Staff and freight access doors

9.5.3 On-board tools and portable equipment

9.5.4 Audible communication system

9.6 Recording device

10.1 Fire protection concept and protection measures

10.2 Emergency

10.2.1 Passenger evacuation concept

10.2.2 Rescue services' information, equipment and access

10.2.3 Passenger alarm

10.2.4 Emergency lighting

10.3 Emergency running capabilities

11.1 Train cleaning facilities

11.2.1 Waste water disposal systems

11.2.2 Water supply system

11.2.3 Further supply facilities

12.1 On-board radio system

12.1.2 GSM-R compliant radio system

12.1.2.1 Use of hand portables as cab mobile radio

12.1.2.2 Other GSM-R requirements

12.2 On-board signalling

12.2.1 National on-board signalling systems

12.2.2 STM requirements

12.2.3 Transitions

12.2.4 Compatibility of rolling stock with CCS Trackside

12.2.4.1 Minimum axle distance

12.2.4.2 Minimum wheel diameter

12.2.4.3 Metal and inductive components-free space between wheels

12.2.4.4 Metal mass of a vehicle

12.2.4.5 Compatibility with fixed installations of CCS

13.1 Specific items to place on-board

1435mm / DC 3kV / RSDD/SCMT

2015/2299/EU

1.1 General documentation

1.2 Maintenance instructions and requirements

1.2.1 Maintenance instructions

1.2.2 The maintenance design justification file

1.3 Instructions and documentation for operation

1.3.1 Instructions for operation in normal and degraded modes of the vehicle

1.4 National requirement for testing

2.1 Vehicle structure

2.1.1 Strength and integrity

- 2.1.2 Load capability
 - 2.1.2.1 Load conditions and weighed mass
 - 2.1.2.2 Axle load and wheel load
- 2.1.3 Joining technology
- 2.1.4 Lifting and jacking
- 2.1.5 Fixing of devices to car body structure
- 2.1.6 Connections used between different parts of the vehicle
- 2.2 Couplers / coupling systems
 - 2.2.1 Automatic coupling
 - 2.2.2 Characteristics of rescue coupling
 - 2.2.3 Conventional screw coupling and other non-automatic coupling systems
 - 2.2.5 Gangways
- 2.3 Passive safety
- 3.1 Vehicle gauge
- 3.2 Vehicle dynamics
 - 3.2.1 Running safety and dynamics
 - 3.2.2 Equivalent conicity
 - 3.2.3 Wheel profile and limits
 - 3.2.4 Track loading compatibility parameters
 - 3.2.5 Minimum horizontal curve radius, vertical concave curve radius, convex curve radius
- 3.3 Bogies / running gear
 - 3.3.1 Bogies
 - 3.3.2 Wheelset (complete)
 - 3.3.3 Wheel
 - 3.3.4 Wheel/rail interaction influencing systems
 - 3.3.5 Sanding system
 - 3.3.6 Bearings on the wheelset
 - 3.3.7 Axle shaft
- 3.4 Limit of maximum longitudinal positive and negative acceleration
- 4.1 Functional requirements for braking at train level
- 4.2 Safety requirements for braking at train level
 - 4.2.1 Reliability of main brake system functionality
 - 4.2.2 Reliability of traction/braking interlocking
 - 4.2.3 Reliability of stopping distance
 - 4.2.4 Reliability of parking brake

- 4.3 Brake system - Recognised architecture and associated standards
- 4.4 Brake command
 - 4.4.1 Emergency braking command
 - 4.4.2 Service braking command
 - 4.4.3 Direct braking command
 - 4.4.4 Dynamic braking command
 - 4.4.5 Parking braking command
- 4.5 Brake performance
 - 4.5.1 Emergency braking performance
 - 4.5.2 Service braking performance
 - 4.5.3 Calculations related to thermal capacity
 - 4.5.4 Parking brake performance
 - 4.5.5 Brake performance calculation
- 4.6 Braking adhesion management
 - 4.6.1 Limit of wheel rail adhesion profile
 - 4.6.2 Wheel slide protection system ("WSP")
- 4.7 Braking force production
 - 4.7.1 Friction brake components
 - 4.7.1.2 Brake discs
 - 4.7.1.3 Brake pads
 - 4.7.2 Dynamic brake linked to traction
 - 4.7.5 Parking brake
- 4.8 Brake state and fault indication
- 4.9 Brake requirements for rescue purposes
- 5.1 Access
 - 5.1.1 Exterior doors
 - 5.1.2 Boarding aids
- 5.2 Interior
 - 5.2.3 Clearways
 - 5.2.4 Floor height changes
 - 5.2.5 Interior lighting
- 5.3 Handrails
- 5.4 Windows
- 5.5 Toilets
- 5.6 Heating, ventilation and air conditioning systems
- 5.7 Passenger information
 - 5.7.1 Public address system
 - 5.7.2 Signs and information

- 6.1 Impact of the environment on the vehicle
 - 6.1.1 Environmental conditions impacting on the vehicle
 - 6.1.1.1 Altitude
 - 6.1.1.2 Temperature
 - 6.1.1.3 Humidity
 - 6.1.1.4 Rain
 - 6.1.1.5 Snow, ice and hail
 - 6.1.1.6 Solar radiation
 - 6.1.1.7 Resistance to pollution
 - 6.1.2 Aerodynamic effects on the vehicle
 - 6.1.2.1 Crosswind effects
 - 6.1.2.2 Maximum pressure variation in tunnels
- 6.2 Impact of the vehicle on the environment
 - 6.2.1 External emissions
 - 6.2.1.1 Toilet emissions
 - 6.2.1.3 Chemical and particulate emission
 - 6.2.2 Limits for noise emissions
 - 6.2.2.1 Stationary noise impact
 - 6.2.2.2 Starting noise impact
 - 6.2.2.3 Pass-by noise impact
- 7.1 Integrity of software employed for safety related functions
- 7.2 Visual and audible vehicle identification and warning functions
 - 7.2.1 Vehicle marking
 - 7.2.2 External lights
 - 7.2.2.1 Headlights
 - 7.2.2.2 Marker lights
 - 7.2.2.3 End-of-train signal
 - 7.2.2.4 Lamp controls
 - 7.2.3 Audible signal systems
 - 7.2.4 Brackets
- 8.1 Traction performance requirements
- 8.2 Functional and technical specification related to the interface between the vehicle and the energy subsystem
 - 8.2.1 Functional and technical specification related to the electric power supply
 - 8.2.1.1 Specific requirements for power supply

8.2.1.2 Voltage and frequency of overhead contact line power supply

8.2.1.3 Regenerative braking

8.2.1.4 Maximum power and maximum train current that is permissible to draw from the overhead contact line

8.2.2 Pantograph functional and design parameters

8.2.2.1 Pantograph overall design

8.2.2.2 Pantograph head geometry

8.2.2.3 Pantograph contact force (including static contact force, dynamic behaviour and aerodynamic effects)

8.2.2.4 Working range of pantographs

8.2.2.5 Current capacity of pantograph including contact strip

8.2.2.6 Arrangement of pantographs

8.2.2.7 Insulation of pantograph from the vehicle

8.2.2.8 Pantograph lowering

8.2.2.9 Running through phase or system separation sections

8.2.3 Contact strip functional and design parameters

8.2.3.1 Contact strip geometry

8.2.3.2 Contact strip material

8.2.3.3 Contact strip assessment

8.2.3.4 Detection of contact strip breakage

8.3 Electrical power supply and traction system

8.3.1 Energy consumption measurement

8.3.2 Requirements for electrical installations on-board of a railway vehicle

8.3.3 High voltage components

8.3.4 Earthing

8.4 Electromagnetic Compatibility ("EMC")

8.4.1 EMC within the vehicle

8.4.2 EMC between the vehicle and the railway system

8.4.2.1 Maximum currents

8.4.2.1.1 Rail return current

8.4.2.1.2 Heating cable interference current

8.4.2.1.3 Interference current under the vehicle

8.4.2.1.4 Harmonic characteristics and related overvoltages on the overhead contact line

- 8.4.2.1.5 Effects of DC content in AC supply
- 8.4.2.2 Maximum electro-magnetic fields/Induced voltages
 - 8.4.2.2.1 Electro-magnetic fields/Induced voltages in the track/under the vehicle
 - 8.4.2.2.2 Electro-magnetic fields/Induced voltages outside the track
- 8.4.2.3 Vehicle entrance impedance
- 8.4.2.5 Transverse voltage limits for compatibility voice/data circuits
- 8.4.3 EMC between the vehicle and the environment
 - 8.4.3.1 Maximum electro-magnetic fields
 - 8.4.3.2 Induced interference current/voltage
- 8.5 Protection against electrical hazards
- 8.7 Systems requiring special monitoring and protection measures
 - 8.7.2 Pressure vessel systems/pressure equipment
 - 8.7.4 Technical systems in potentially explosive atmospheres
 - 8.7.5 Hydraulic/pneumatic supply and control systems
- 9.1 Driver's cab design
 - 9.1.1 Interior layout
 - 9.1.2 Access to driver's cab
 - 9.1.2.1 Access, egress and doors
 - 9.1.2.2 Driver's cab emergency exits
 - 9.1.3 Windscreen in driver's cab
 - 9.1.3.1 Mechanical characteristics
 - 9.1.3.2 Optical characteristics
 - 9.1.3.3 Equipment to the windscreen
 - 9.1.3.4 Front visibility / visibility field
 - 9.1.4 Desk ergonomics
 - 9.1.5 Driver's seat
- 9.2 Health and safety
 - 9.2.1 Environmental conditions
 - 9.2.1.1 Heating, ventilation and air-conditioning systems in driver's cab
 - 9.2.1.2 Noise in driver's cab
 - 9.2.1.3 Lighting in driver's cab
 - 9.2.2 Other health and safety requirements
- 9.3 Driver/machine interface

- 9.3.1 Speed indication
- 9.3.2 Driver display unit and screens
- 9.3.3 Controls and indicators
- 9.3.4 Driver supervision
- 9.3.5 Rear and side view
- 9.4 Marking and labelling in driver's cab
- 9.5 Equipment and other facilities on-board for staff
 - 9.5.1 Facilities on-board for staff
 - 9.5.1.1 Staff access for coupling/uncoupling
 - 9.5.1.2 External steps and handrails for shunting staff
 - 9.5.1.3 Storage facilities for use by staff
 - 9.5.2 Staff and freight access doors
 - 9.5.3 On-board tools and portable equipment
 - 9.5.4 Audible communication system
- 9.6 Recording device
- 10.1 Fire protection concept and protection measures
- 10.2 Emergency
 - 10.2.1 Passenger evacuation concept
 - 10.2.2 Rescue services' information, equipment and access
 - 10.2.3 Passenger alarm
 - 10.2.4 Emergency lighting
- 10.3 Emergency running capabilities
- 11.2 Train refuelling facilities
 - 11.2.1 Waste water disposal systems
 - 11.2.2 Water supply system
 - 11.2.3 Further supply facilities
- 12.1 On-board radio system
 - 12.1.2 GSM-R compliant radio system
 - 12.1.2.1 Use of hand portables as cab mobile radio
 - 12.1.2.2 Other GSM-R requirements
- 13.1 Specific items to place on-board

L'ETR521 S1 è una versione del veicolo tipo di riferimento ETR521 che allo stato attuale è autorizzato nella sua configurazione denominata BL4. Tenuto conto delle differenze tra i 2 veicoli, per quanto riguarda le modifiche apportate al freno di stazionamento, per cui è stato incrementato il numero di freni di parcheggio, esse hanno determinato un aumento delle prestazioni di tale tipologia di freno con impatto sulle caratteristiche essenziali di progettazione riferite nella 2019/776/UE. Pertanto le modifiche apportate possano essere considerate come di tipo c), ai sensi del Regolamento UE 2018/545, articolo 15 comma 1 ed hanno generato quindi una versione del Tipo di veicolo ETR 521.

3.1.3.1.6 Comments:

3.1.3.1.7 Reference to the written declaration by the proposer referred to in Article 3(11) of Regulation (EU) 402/2013:

CB03P021893B_09 del 30.11.2020

3.1.3.1 Initial Registration

3.1.2.3 Coded conditions for use and other restrictions:

1435mm / DC 3kV / BACC

1 Technical restriction related to construction

1.1 Minimum curve radius in meters: 100 mt in deposito / 150 mt in linea

1.3 Speed restrictions in Km/h: 160

1.4 Use in multiple operation (maximum number of trainsets authorised to be coupled together to operate as a single train): Single operation

2 Geographical restriction

2.1 Kinematic gauge (coding WAG TSI): GB/G12

2.2 Wheelset gauge: 2.2.4 Gauge 1435

2.7 Noise category: 2.7.1 Can be used in all quieter routes- TSI Noise compliant- Silent - retrofitted without testing

3 Environmental restrictions

3.1 Climatic zone: 3.1.3 T3

4 Restrictions on use

4.1 Time based: True

4.2 Condition based (distance travelled, wear, etc.): True

5 On-board equipment

5.1 Recording device: 5.1.01 "Registratore cronologico d'eventi computerizzato" (RCEC) according to specification RFI/DTC/CSI/SR/OR/10/002/B of 11/02/2008

1435mm / DC 3kV / RSDD/SCMT

1 Technical restriction related to construction

1.1 Minimum curve radius in meters: 100 mt in deposito / 150 mt in linea

1.3 Speed restrictions in Km/h: 160

1.4 Use in multiple operation (maximum number of trainsets authorised to be coupled together to operate as a single train): Single operation

2 Geographical restriction

2.1 Kinematic gauge (coding WAG TSI): GB/G12

2.2 Wheelset gauge: 2.2.4 Gauge 1435

2.7 Noise category: 2.7.1 Can be used in all quieter routes- TSI Noise compliant- Silent - retrofitted without testing

3 Environmental restrictions

3.1 Climatic zone: 3.1.3 T3

4 Restrictions on use

4.1 Time based: True

4.2 Condition based (distance travelled, wear, etc.): True

5 On-board equipment

5.1 Recording device: 5.1.01 "Registratore cronologico d'eventi computerizzato" (RCEC) according to specification RFI/DTC/CSI/SR/OR/10/002/B of 11/02/2008

3.1.2.4 Non-coded conditions for use and other restrictions:

1435mm / DC 3kV / BACC

Per la circolazione su linee la cui velocità massima al rango più elevato sia superiore a 200 km/h, verificare preventivamente l'idoneità del veicolo e la sussistenza delle condizioni di sicurezza in coerenza con i principi della circolazione ferroviaria di cui al Decreto ANSF 4/2012 del 09.08.2012, tenendo conto delle caratteristiche del fissaggio dei dispositivi alla struttura della cassa, con particolare riferimento alla solidità delle porte esterne e dei relativi sistemi di attacco, essendo previsti i seguenti valori limiti al carico aerodinamico: statico: ± 4000 Pa / affaticante: ± 2500 Pa

Sottosistema MR: Requisito 1.4 Requisito nazionale per le prove - divieto di utilizzo in composizione multipla. Requisito 2.1.5 Fissaggio dei dispositivi alla struttura della cassa - carico aerodinamico sui fissaggi dei dispositivi alla struttura della cassa: • statico ± 4000 Pa; • affaticante ± 2500 Pa.

Requisito 3.1 - Sagoma del rotabile - idoneo a circolare su linee che ammettono la sagoma con profilo di riferimento GB di cui alla EN 15273-2:2013/FprA1:2016; - divieto di circolazione in presenza di freni posti sul binario e di altri dispositivi di manovra e di arresto in posizione attiva; - divieto di passaggio sulle navi traghetto.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia e 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario - in modalità normale: $V_{adm} = 160$ km/h, $c_{dadm} = 153$ mm; - nelle varie situazioni di degrado le condizioni di esercizio del veicolo con i relativi limiti accettabili sono definite dal Richiedente nel documento DD02P023113B rev.06.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia, 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario, 3.2.2 - Conicità equivalente e 3.2.3 - Profilo della ruota e limiti - profilo ruota: S1002; - massima conicità equivalente ammessa in servizio in conformità a quanto previsto al par. 5.4.3.3 della EN 14363:2005: • $t_{gge} = 0,435$ per le sale dei carrelli motore degli elementi DM1e DM2 • $t_{gge} = 0,33$ per le sale dei carrelli portanti degli elementi TA, TX, TB

Requisito 3.2.5 - Raggio minimo di curvatura orizzontale, raggio di curvatura concavo verticale, raggio di curvatura convesso - esercizio in composizione singola (condizione di veicolo non accoppiato); - raggio minimo di curvatura: • orizzontale in linea pari a 150 m • orizzontale in deposito pari a 100 m • verticale concava pari a 500 m • verticale convessa pari a 500 m.

Requisito 3.3.6 - Cuscinetti sulla sala montata - monitoraggio e verifica in esercizio dei cuscinetti del veicolo in accordo al piano definito dal Richiedente nel par. 4 del documento DD02P021447B; al completamento di ogni step ed al termine del monitoraggio previsto, il Richiedente, sulla base della valutazione degli esiti dei controlli effettuati, deve definire le eventuali azioni di controllo e monitoraggio da mettere in atto durante l'esercizio del veicolo.

Requisito 4.2 - Requisiti di sicurezza della frenatura a livello del treno - devono essere prese in carico e rispettate da parte dell'Impresa Ferroviaria le condizioni applicative riportate nel doc. QB060011996 rev. 00 del 13.09.2021 "ETR 521 S1- Stima esplicita del rischio": • SRAC_SE_IF_001 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_003 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_004 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_007 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_008 in carico all'Impresa Ferroviaria; • SRAC_SE_ECM_001 da parte del Soggetto Responsabile della Manutenzione.

Requisito 4.7 - Produzione della forza di frenatura - sul veicolo

Sottosistema CCS: [ITCF_ETR521S1_CCS_01] Le condizioni applicative definite nel documento QB100012041 rev. 00 devono essere prese in carico e rispettate dall'Impresa Ferroviaria e dal Soggetto Responsabile della Manutenzione.

1435mm / DC 3kV / RSDD/SCMT

Per la circolazione su linee la cui velocità massima al rango più elevato sia superiore a 200 km/h, verificare preventivamente l' idoneità del veicolo e la sussistenza delle condizioni di sicurezza in coerenza con i principi della circolazione ferroviaria di cui al Decreto ANSF 4/2012 del 09.08.2012, tenendo conto delle caratteristiche del fissaggio dei dispositivi alla struttura della cassa, con particolare riferimento alla solidità delle porte esterne e dei relativi sistemi di attacco, essendo previsti i seguenti valori limiti al carico aerodinamico: statico: ± 4000 Pa / affaticante: ± 2500 Pa

Sottosistema MR: Requisito 1.4 Requisito nazionale per le prove - divieto di utilizzo in composizione multipla. Requisito 2.1.5 Fissaggio dei dispositivi alla struttura della cassa - carico aerodinamico sui fissaggi dei dispositivi alla struttura della cassa: • statico ± 4000 Pa; • affaticante ± 2500 Pa.

Requisito 3.1 - Sagoma del rotabile - idoneo a circolare su linee che ammettono la sagoma con profilo di riferimento GB di cui alla EN 15273-2:2013/FprA1:2016; - divieto di circolazione in presenza di freni posti sul binario e di altri dispositivi di manovra e di arresto in posizione attiva; - divieto di passaggio sulle navi traghetto.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia e 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario - in modalità normale: $V_{adm} = 160$ km/h, $c_{dadm} = 153$ mm; - nelle varie situazioni di degrado le condizioni di esercizio del veicolo con i relativi limiti accettabili sono definite dal Richiedente nel documento DD02P023113B rev.06.

Requisiti 3.2.1 - Sicurezza e dinamica di marcia, 3.2.4 - Parametri di compatibilità delle sollecitazioni esercitate sul binario, 3.2.2 - Conicità equivalente e 3.2.3 - Profilo della ruota e limiti - profilo ruota: S1002; - massima conicità equivalente ammessa in servizio in conformità a quanto previsto al par. 5.4.3.3 della EN 14363:2005: • $t_{gge} = 0,435$ per le sale dei carrelli motore degli elementi DM1e DM2 • $t_{gge} = 0,33$ per le sale dei carrelli portanti degli elementi TA, TX, TB

Requisito 3.2.5 - Raggio minimo di curvatura orizzontale, raggio di curvatura concavo verticale, raggio di curvatura convesso - esercizio in composizione singola (condizione di veicolo non accoppiato); - raggio minimo di curvatura: • orizzontale in linea pari a 150 m • orizzontale in deposito pari a 100 m • verticale concava pari a 500 m • verticale convessa pari a 500 m.

Requisito 3.3.6 - Cuscinetti sulla sala montata - monitoraggio e verifica in esercizio dei cuscinetti del veicolo in accordo al piano definito dal Richiedente nel par. 4 del documento DD02P021447B; al completamento di ogni step ed al termine del monitoraggio previsto, il Richiedente, sulla base della valutazione degli esiti dei controlli effettuati, deve definire le eventuali azioni di controllo e monitoraggio da mettere in atto durante l'esercizio del veicolo.

Requisito 4.2 - Requisiti di sicurezza della frenatura a livello del treno - devono essere prese in carico e rispettate da parte dell'Impresa Ferroviaria le condizioni applicative riportate nel doc. QB060011996 rev. 00 del 13.09.2021 "ETR 521 S1- Stima esplicita del rischio": • SRAC_SE_IF_001 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_003 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_004 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_007 da parte dell'Impresa Ferroviaria; • SRAC_SE_IF_008 in carico all'Impresa Ferroviaria; • SRAC_SE_ECM_001 da parte del Soggetto Responsabile della Manutenzione.

Requisito 4.7 - Produzione della forza di frenatura - sul veicolo

Sottosistema CCS: [ITCF_ETR521S1_CCS_01] Le condizioni applicative definite nel documento QB100012041 rev. 00 devono essere prese in carico e rispettate dall'Impresa Ferroviaria e dal Soggetto Responsabile della Manutenzione.

3.1.3.1.1 Date of the original authorisation: 2019-11-29

3.1.3.1.2 Authorisation holder:

3.1.3.1.2.1 Authorisation holder identification data:

3.1.3.1.2.1.1 Name of organisation: Hitachi Rail STS S.p.A.

3.1.3.1.2.1.2 Registered business number: 01371160662

3.1.3.1.2.1.3 Organisation code:

3.1.3.1.2.2 Authorisation holder contact data:

3.1.3.1.2.2.1 Address of organisation, street and number: Via Argine, 425

3.1.3.1.2.2.2 Town: Napoli

3.1.3.1.2.2.3 Country code: NA

3.1.3.1.2.2.4 Post code: 80147

3.1.3.1.2.2.5 E-mail address: hitachirailsts@legalmail.it

3.1.3.1.3 Authorisation document reference: IT5920191014

3.1.3.1.4 Certificate of verification : Reference of type examination or design examination type:

IT/02/2013/1/SB/2019/RST/IT EN/022.07

IT/02/2013/1
/SB/2020/RST
/ITEN/159/V0
1

IT/02/2013/1
/SB/2020/RST
/ITEN/230/V0
1

IT/02/2013/1
/SB/2021/RST
/ITEN/038/V0
1

IT/02/2013/1
/SB/2021/RST
/ITEN/225/V0
1

IT/02/2013/1
/SB/2021/RST
/ITEN/266/V0
1

IT/02/2013/1/SB/2019/CCO/IT EN/019.06

IT/02/2013/1
/SB/2020/CCO
/ITEN/152/V0
1

IT/02/2013/1
/SB/2021/CCO
/ITEN/222/V0
1

IT/02/2013/1
/SB/2021/CCO
/ITEN/263/V0
1

3.1.3.1.5 Parameters for which conformity to applicable national rules has been assessed:

1435mm / DC 3kV / BACC

1.1 General documentation

1.2 Maintenance instructions and requirements

1.2.1 Maintenance instructions

1.2.2 The maintenance design justification file

1.3 Instructions and documentation for operation

1.3.1 Instructions for operation in normal and degraded modes of the vehicle

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2.1 Vehicle structure

2.1.1 Strength and integrity

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2.1.2.1 Load conditions and weighed mass

2.1.2.2 Axle load and wheel load

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2.2.1 Automatic coupling

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 - 3.3.1 Bogies
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 - 3.3.3 Wheel
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 - 3.3.5 Sanding system
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 - 3.3.7 Axle shaft
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 - 6.1.1 Environmental conditions impacting on the vehicle
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 - 6.1.2 Aerodynamic effects on the vehicle
 - 6.1.2.1 Crosswind effects
 - 6.1.2.2 Maximum pressure variation in tunnels
- 6.2 Impact of the vehicle on the environment
 - 6.2.1 External emissions
 - 6.2.1.1 Toilet emissions
 - 6.2.1.3 Chemical and particulate emission
 - 6.2.2 Limits for noise emissions

6.2.2.1 Stationary noise impact

6.2.2.2 Starting noise impact

6.2.2.3 Pass-by noise impact

7.1 Integrity of software employed for safety related functions

7.2 Visual and audible vehicle identification and warning functions

7.2.1 Vehicle marking

7.2.2 External lights

7.2.2.1 Headlights

7.2.2.2 Marker lights

7.2.2.3 End-of-train signal

7.2.2.4 Lamp controls

7.2.3 Audible signal systems

7.2.4 Brackets

8.1 Traction performance requirements

8.2 Functional and technical specification related to the interface between the vehicle and the energy subsystem

8.2.1 Functional and technical specification related to the electric power supply

8.2.1.1 Specific requirements for power supply

8.2.1.2 Voltage and frequency of overhead contact line power supply

8.2.1.3 Regenerative braking

8.2.1.4 Maximum power and maximum train current that is permissible to draw from the overhead contact line

8.2.2 Pantograph functional and design parameters

8.2.2.1 Pantograph overall design

8.2.2.2 Pantograph head geometry

8.2.2.3 Pantograph contact force (including static contact force, dynamic behaviour and aerodynamic effects)

8.2.2.4 Working range of pantographs

8.2.2.5 Current capacity of pantograph including contact strip

8.2.2.6 Arrangement of pantographs

8.2.2.7 Insulation of pantograph from the vehicle

8.2.2.8 Pantograph lowering

8.2.2.9 Running through phase or system separation sections

- 8.2.3 Contact strip functional and design parameters
 - 8.2.3.1 Contact strip geometry
 - 8.2.3.2 Contact strip material
 - 8.2.3.3 Contact strip assessment
 - 8.2.3.4 Detection of contact strip breakage
- 8.3 Electrical power supply and traction system
 - 8.3.1 Energy consumption measurement
 - 8.3.2 Requirements for electrical installations on-board of a railway vehicle
 - 8.3.3 High voltage components
 - 8.3.4 Earthing
- 8.4 Electromagnetic Compatibility ("EMC")
 - 8.4.1 EMC within the vehicle
 - 8.4.2 EMC between the vehicle and the railway system
 - 8.4.2.1 Maximum currents
 - 8.4.2.1.1 Rail return current
 - 8.4.2.1.2 Heating cable interference current
 - 8.4.2.1.3 Interference current under the vehicle
 - 8.4.2.1.4 Harmonic characteristics and related overvoltages on the overhead contact line
 - 8.4.2.1.5 Effects of DC content in AC supply
 - 8.4.2.2 Maximum electro-magnetic fields/Induced voltages
 - 8.4.2.2.1 Electro-magnetic fields/Induced voltages in the track/under the vehicle
 - 8.4.2.2.2 Electro-magnetic fields/Induced voltages outside the track
 - 8.4.2.3 Vehicle entrance impedance
 - 8.4.2.5 Transverse voltage limits for compatibility voice/data circuits
 - 8.4.3 EMC between the vehicle and the environment
 - 8.4.3.1 Maximum electro-magnetic fields
 - 8.4.3.2 Induced interference current/voltage
- 8.5 Protection against electrical hazards
- 8.7 Systems requiring special monitoring and protection measures
 - 8.7.2 Pressure vessel systems/pressure equipment
 - 8.7.4 Technical systems in potentially explosive atmospheres

8.7.5 Hydraulic/pneumatic supply and control systems

9.1 Driver's cab design

9.1.1 Interior layout

9.1.2 Access to driver's cab

9.1.2.1 Access, egress and doors

9.1.2.2 Driver's cab emergency exits

9.1.3 Windscreen in driver's cab

9.1.3.1 Mechanical characteristics

9.1.3.2 Optical characteristics

9.1.3.3 Equipment to the windscreen

9.1.3.4 Front visibility / visibility field

9.1.4 Desk ergonomics

9.1.5 Driver's seat

9.2 Health and safety

9.2.1 Environmental conditions

9.2.1.1 Heating, ventilation and air-conditioning systems in driver's cab

9.2.1.2 Noise in driver's cab

9.2.1.3 Lighting in driver's cab

9.2.2 Other health and safety requirements

9.3 Driver/machine interface

9.3.1 Speed indication

9.3.2 Driver display unit and screens

9.3.3 Controls and indicators

9.3.4 Driver supervision

9.3.5 Rear and side view

9.4 Marking and labelling in driver's cab

9.5 Equipment and other facilities on-board for staff

9.5.1 Facilities on-board for staff

9.5.1.1 Staff access for coupling/uncoupling

9.5.1.2 External steps and handrails for shunting staff

9.5.1.3 Storage facilities for use by staff

9.5.2 Staff and freight access doors

9.5.3 On-board tools and portable equipment

9.5.4 Audible communication system

9.6 Recording device

10.1 Fire protection concept and protection measures

10.2 Emergency

10.2.1 Passenger evacuation concept

10.2.2 Rescue services' information, equipment and access

10.2.3 Passenger alarm

10.2.4 Emergency lighting

10.3 Emergency running capabilities

11.1 Train cleaning facilities

11.2.1 Waste water disposal systems

11.2.2 Water supply system

11.2.3 Further supply facilities

12.1 On-board radio system

12.1.2 GSM-R compliant radio system

12.1.2.1 Use of hand portables as cab mobile radio

12.1.2.2 Other GSM-R requirements

12.2 On-board signalling

12.2.1 National on-board signalling systems

12.2.2 STM requirements

12.2.3 Transitions

12.2.4 Compatibility of rolling stock with CCS Trackside

12.2.4.1 Minimum axle distance

12.2.4.2 Minimum wheel diameter

12.2.4.3 Metal and inductive components-free space between wheels

12.2.4.4 Metal mass of a vehicle

12.2.4.5 Compatibility with fixed installations of CCS

13.1 Specific items to place on-board

1435mm / DC 3kV / RSDD/SCMT

1.1 General documentation

1.2 Maintenance instructions and requirements

1.2.1 Maintenance instructions

1.2.2 The maintenance design justification file

1.3 Instructions and documentation for operation

1.3.1 Instructions for operation in normal and degraded modes of the vehicle

1.4 National requirement for testing

2.1 Vehicle structure

2.1.1 Strength and integrity

2.1.2 Load capability

- 2.1.2.1 Load conditions and weighed mass
- 2.1.2.2 Axle load and wheel load
- 2.1.3 Joining technology
- 2.1.4 Lifting and jacking
- 2.1.5 Fixing of devices to car body structure
- 2.1.6 Connections used between different parts of the vehicle
- 2.2 Couplers / coupling systems
 - 2.2.1 Automatic coupling
 - 2.2.2 Characteristics of rescue coupling
 - 2.2.3 Conventional screw coupling and other non-automatic coupling systems
 - 2.2.5 Gangways
- 2.3 Passive safety
- 3.1 Vehicle gauge
- 3.2 Vehicle dynamics
 - 3.2.1 Running safety and dynamics
 - 3.2.2 Equivalent conicity
 - 3.2.3 Wheel profile and limits
 - 3.2.4 Track loading compatibility parameters
 - 3.2.5 Minimum horizontal curve radius, vertical concave curve radius, convex curve radius
- 3.3 Bogies / running gear
 - 3.3.1 Bogies
 - 3.3.2 Wheelset (complete)
 - 3.3.3 Wheel
 - 3.3.4 Wheel/rail interaction influencing systems
 - 3.3.5 Sanding system
 - 3.3.6 Bearings on the wheelset
 - 3.3.7 Axle shaft
- 3.4 Limit of maximum longitudinal positive and negative acceleration
- 4.1 Functional requirements for braking at train level
- 4.2 Safety requirements for braking at train level
 - 4.2.1 Reliability of main brake system functionality
 - 4.2.2 Reliability of traction/braking interlocking
 - 4.2.3 Reliability of stopping distance
 - 4.2.4 Reliability of parking brake
- 4.3 Brake system - Recognised architecture and associated standards

- 4.4 Brake command
 - 4.4.1 Emergency braking command
 - 4.4.2 Service braking command
 - 4.4.3 Direct braking command
 - 4.4.4 Dynamic braking command
 - 4.4.5 Parking braking command
- 4.5 Brake performance
 - 4.5.1 Emergency braking performance
 - 4.5.2 Service braking performance
 - 4.5.3 Calculations related to thermal capacity
 - 4.5.4 Parking brake performance
 - 4.5.5 Brake performance calculation
- 4.6 Braking adhesion management
 - 4.6.1 Limit of wheel rail adhesion profile
 - 4.6.2 Wheel slide protection system ("WSP")
- 4.7 Braking force production
 - 4.7.1 Friction brake components
 - 4.7.1.2 Brake discs
 - 4.7.1.3 Brake pads
 - 4.7.2 Dynamic brake linked to traction
 - 4.7.5 Parking brake
- 4.8 Brake state and fault indication
- 4.9 Brake requirements for rescue purposes
- 5.1 Access
 - 5.1.1 Exterior doors
 - 5.1.2 Boarding aids
- 5.2 Interior
 - 5.2.3 Clearways
 - 5.2.4 Floor height changes
 - 5.2.5 Interior lighting
- 5.3 Handrails
- 5.4 Windows
- 5.5 Toilets
- 5.6 Heating, ventilation and air conditioning systems
- 5.7 Passenger information
 - 5.7.1 Public address system
 - 5.7.2 Signs and information
- 6.1 Impact of the environment on the vehicle

6.1.1 Environmental conditions impacting on the vehicle

6.1.1.1 Altitude

6.1.1.2 Temperature

6.1.1.3 Humidity

6.1.1.4 Rain

6.1.1.5 Snow, ice and hail

6.1.1.6 Solar radiation

6.1.1.7 Resistance to pollution

6.1.2 Aerodynamic effects on the vehicle

6.1.2.1 Crosswind effects

6.1.2.2 Maximum pressure variation in tunnels

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6.2.1.3 Chemical and particulate emission

6.2.2 Limits for noise emissions

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 - 8.2.2.4 Working range of pantographs
 - 8.2.2.5 Current capacity of pantograph including contact strip
 - 8.2.2.6 Arrangement of pantographs
 - 8.2.2.7 Insulation of pantograph from the vehicle
 - 8.2.2.8 Pantograph lowering
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 - 8.4.2.1.4 Harmonic characteristics and related overvoltages on the overhead contact line
 - 8.4.2.1.5 Effects of DC content in AC supply

8.4.2.2 Maximum electro-magnetic fields/Induced voltages

8.4.2.2.1 Electro-magnetic fields/Induced voltages in the track/under the vehicle

8.4.2.2.2 Electro-magnetic fields/Induced voltages outside the track

8.4.2.3 Vehicle entrance impedance

8.4.2.5 Transverse voltage limits for compatibility voice/data circuits

8.4.3 EMC between the vehicle and the environment

8.4.3.1 Maximum electro-magnetic fields

8.4.3.2 Induced interference current/voltage

8.5 Protection against electrical hazards

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9.1.2.2 Driver's cab emergency exits

9.1.3 Windscreen in driver's cab

9.1.3.1 Mechanical characteristics

9.1.3.2 Optical characteristics

9.1.3.3 Equipment to the windscreen

9.1.3.4 Front visibility / visibility field

9.1.4 Desk ergonomics

9.1.5 Driver's seat

9.2 Health and safety

9.2.1 Environmental conditions

9.2.1.1 Heating, ventilation and air-conditioning systems in driver's cab

9.2.1.2 Noise in driver's cab

9.2.1.3 Lighting in driver's cab

9.2.2 Other health and safety requirements

9.3 Driver/machine interface

9.3.1 Speed indication

- 9.3.2 Driver display unit and screens
- 9.3.3 Controls and indicators
- 9.3.4 Driver supervision
- 9.3.5 Rear and side view
- 9.4 Marking and labelling in driver's cab
- 9.5 Equipment and other facilities on-board for staff
 - 9.5.1 Facilities on-board for staff
 - 9.5.1.1 Staff access for coupling/uncoupling
 - 9.5.1.2 External steps and handrails for shunting staff
 - 9.5.1.3 Storage facilities for use by staff
 - 9.5.2 Staff and freight access doors
 - 9.5.3 On-board tools and portable equipment
 - 9.5.4 Audible communication system
- 9.6 Recording device
- 10.1 Fire protection concept and protection measures
- 10.2 Emergency
 - 10.2.1 Passenger evacuation concept
 - 10.2.2 Rescue services' information, equipment and access
 - 10.2.3 Passenger alarm
 - 10.2.4 Emergency lighting
- 10.3 Emergency running capabilities
- 11.2 Train refuelling facilities
 - 11.2.1 Waste water disposal systems
 - 11.2.2 Water supply system
 - 11.2.3 Further supply facilities
- 12.1 On-board radio system
 - 12.1.2 GSM-R compliant radio system
 - 12.1.2.1 Use of hand portables as cab mobile radio
 - 12.1.2.2 Other GSM-R requirements
- 13.1 Specific items to place on-board

L'ETR521 S1 è una versione del veicolo tipo di riferimento ETR521 che allo stato attuale è autorizzato nella sua configurazione denominata BL4. Tenuto conto delle differenze tra i 2 veicoli, per quanto riguarda le modifiche apportate al freno di stazionamento, per cui è stato incrementato il numero di freni di parcheggio, esse hanno determinato un aumento delle prestazioni di tale tipologia di freno con impatto sulle caratteristiche essenziali di progettazione riferite nella 2019/776/UE. Pertanto le modifiche apportate possano essere considerate come di tipo c), ai sensi del Regolamento UE 2018/545, articolo 15 comma 1 ed hanno generato quindi una versione del Tipo di veicolo ETR 521.

3.1.3.1.6 Comments:

3.1.3.1.7 Reference to the written declaration by the proposer referred to in Article 3(11) of Regulation (EU) 402/2013:

CB03P021893B_09 del 30.11.2020

Section 4: Technical Characteristics

4.1.3 Wheel set gauge RC	1435	mm
4.1.12 Number of vehicles composing the fixed formation (for fixed formation only)	5	
4.13.1 Signalling		
4.13.1.1 ETCS equipment on-board and the set of specifications from CCS TSI Annex A RC	None	
4.13.1.5 Class B or other train protection control and warning systems installed (system and if applicable version) RC	BACC RSDD/SCMT	
4.13.1.8 ETCS System Compatibility	Not applicable	
4.13.2 Radio		
4.13.2.1 GSM-R Radio voice on board and its Baseline RC	Regulation 2016/919 Set_3 (8/16)	
4.13.2.3 Class B or other radio systems installed (system and if applicable version) RC	None	
4.13.2.5 Radio Voice System Compatibility	Not applicable	

4.13.2.6 Voice and operational communication implementation RC							in accordance with standard EIRENE FRS 8.0.0 and EIRENE SRS 16.0.0
4.13.2.7 GSM-R Radio Data communication on board and its Baseline RC							None
4.13.2.8 Radio Data System Compatibility							Not applicable
4.13.2.10 Voice SIM Card GSM-R Home Network							GSM-R I (Italy)
4.13.2.12 Voice SIM Card support of Group ID 555							True
4.10.1 Energy supply system (voltage and frequency) RC							DC 3kV
4.10.4 Maximum current at standstill per pantograph (to be indicated for each DC systems the vehicle is equipped for)	DC 3kV		200			A	
4.10.5 Height of interaction of pantograph with contact wires (over top of rail) (to be indicated for each energy supply system the vehicle is equipped for) RC	DC 3kV		0004.50	m		0006.50	m
4.10.6 Pantograph head geometry (to be indicated for each energy supply system the vehicle is equipped for) RC	DC 3kV		1450 (sc IT)	mm			
4.10.7 Number of pantographs in contact with the overhead contact line (OCL) (to be indicated for each energy supply system the vehicle is equipped for) RC	DC 3kV		1				

4.10.10 Material of pantograph contact strip the vehicle may be equipped with (to be indicated for each energy supply system the vehicle is equipped for) RC	DC 3kV	If permitted by RINF: impregnated carbon with cladded copper are allowed	
4.10.11 Automatic dropping device (ADD) fitted (to be indicated for each energy supply system the vehicle is equipped for) RC	DC 3kV	False	
4.10.14 Electric units equipped with power or current limitation function RC	1435mm / DC 3kV / BACC	True	
	1435mm / DC 3kV / RSDD/SCMT	True	
4.10.15 Mean contact force RC	1435mm / DC 3kV / BACC	105	N
	1435mm / DC 3kV / RSDD/SCMT	105	N
4.1.2 Speed			
4.1.2.1 Maximum design speed	1435mm / DC 3kV / BACC	160	km/h
	1435mm / DC 3kV / RSDD/SCMT	160	km/h
4.1.5 Maximum number of trainsets or locomotives coupled together in multiple operation.	1435mm / DC 3kV / BACC	1	
	1435mm / DC 3kV / RSDD/SCMT	1	
4.2.1 Reference profile RC		GB GI2	
4.3.1 Temperature range		T3 (-25 to +45)	
4.3.3 Snow, ice and hail conditions		Nominal	
4.4.1 Fire safety category RC		B	
4.5.2 Design mass			
4.5.2.1 Design mass in working order		247877	kg
4.5.2.2 Design mass under normal payload		330148	kg
4.5.2.3 Design mass under exceptional payload RC		362317	kg

4.5.3 Static axle load

4.5.3.1 Static axle load in working order		14686	kg		
4.5.3.2 Static axle load under normal payload		18358	kg		
4.5.3.3 Static axle load under exceptional payload RC		19704	kg		
4.5.3.4 Position of the axles along the unit (axle spacing) : a: Distance between axles b: Distance from end axle to the end of the nearest coupling plane c: distance between two inside axles	1435mm / DC 3kV / BACC		a: 0002,65 m b: 0003,51 m c: 0016,45 m		
	1435mm / DC 3kV / RSDD/SCMT		a: 0002,65 m b: 0003,51 m c: 0016,45 m		
			Explanations: Indicazioni fornite in accordo a quanto disposto dalla normativa vigente		
			Explanations: Indicazioni fornite in accordo a quanto disposto dalla normativa vigente		
4.5.5 Total vehicle mass (for each vehicle of the unit)	1435mm / DC 3kV / BACC	247877	kg		
	1435mm / DC 3kV / RSDD/SCMT	247877	kg		
4.5.6 Mass per wheel	1435mm / DC 3kV / BACC	7521	kg		
	1435mm / DC 3kV / RSDD/SCMT	7521	kg		
4.6.4 Combination of maximum speed and maximum cant deficiency for which the vehicle was assessed RC	1435mm / DC 3kV / BACC	0160,00	km/h	0153,00	mm
	1435mm / DC 3kV / RSDD/SCMT	0160,00	km/h	0153,00	mm
4.6.5 Rail inclination RC	1435mm / DC 3kV / BACC		all rail inclinations		
	1435mm / DC 3kV / RSDD/SCMT		all rail inclinations		
4.7.1 Maximum average deceleration		1.51	m/s ²		
4.7.2.1 Brake performance on steep gradients with normal payload					
4.7.2.1.2 Speed (if no reference case is indicated)		80	km/h		
4.7.2.1.3 Gradient (if no reference case is indicated)		21	‰ (mm/m)		
4.7.2.1.4 Distance (if no reference case is indicated)		46	km		

4.7.2.1.6 Maximum brake thermal energy capacity	1435mm / DC 3kV / BACC	470				kJ
	1435mm / DC 3kV / RSDD/SCMT	470				kJ
4.7.3 Parking brake						
4.7.3.3 Maximum gradient on which the unit is kept immobilized by the parking brake alone (if the vehicle is fitted with it)		40				‰ (mm/m)
4.7.4.1 Eddy current brake						
4.7.4.1.1 Eddy current track brake fitted RC		False				
4.7.4.2 Magnetic brake						
4.7.4.2.1 Magnetic track brake fitted RC		False				
4.7.4.3 Regenerative brake (only for vehicles with electrical traction)						
4.7.4.3.1 Regenerative brake fitted RC		True				
4.7.4.3.2 Possibility of preventing the use of the regenerative brake (only if fitted with regenerative brake) RC		True				
4.7.5 Emergency brake : Stopping distance and deceleration profile for each load condition per design maximum speed a: Load condition: working order b: Load condition: normal payload c: Load condition: exceptional payload	1435mm / DC 3kV / BACC	a: 1078,00	m	0001,17		m/s ²
		b: 0000,00	m	0000,00		m/s ²
		c: 0000,00	m	0000,00		m/s ²
	1435mm / DC 3kV / RSDD/SCMT	a: 1078,00	m	0001,17		m/s ²
		b: 0000,00	m	0000,00		m/s ²
		c: 0000,00	m	0000,00		m/s ²
4.7.6 For general operation : Brake weight percentage (lambda) or Braked mass	1435mm / DC 3kV / BACC	140,00		(%) or ,		tonnes
	1435mm / DC 3kV / RSDD/SCMT	140,00		(%) or ,		tonnes

4.7.7 Service brake: At maximum service brake:	1435mm / DC 3kV / BACC	1291,00	m	0000,81	m/s ²
Stopping distance, Maximum deceleration, for the load condition 'design mass under normal payload' at the design maximum speed.	1435mm / DC 3kV / RSDD/SCMT	1291,00	m	0000,81	m/s ²
4.7.8 Wheel slide protection system	1435mm / DC 3kV / BACC	True			
	1435mm / DC 3kV / RSDD/SCMT	True			
4.8.1 Vehicle length		136.84	m		
4.8.2 Minimum in-service wheel diameter RC		850	mm		
4.8.4 Minimum horizontal curve radius capability RC		100	m		
4.8.5 Minimum vertical convex curve radius capability		500	m		
4.8.6 Minimum vertical concave curve radius capability		500	m		
4.9.1 Type of end coupling	Automatic Type 10 / Scharfenberg				
	Tensile force	1000.0000	kN		
	Compressive force	1500.0000	kN		
4.9.2 Axle bearing condition monitoring (hot axles box detection) RC		Detectable by line side			
4.12.3.1 Platform heights for which the vehicle is designed. RC		550	mm		
4.14.1 Type of train detection systems for which the vehicle has been designed and assessed RC		Track circuits Axle counters Loops			