

Section 1: General Information

0. Identification of the type

0.1 0.2 Type ID: 13-031-0001-8-002

0.3 Date of record: 2019-08-12

1. General Information

1.1 Type name: RABe 524 four-parts with ETCS

1.2 Alternative type name: FLIRT TILO FMV mit ETCS

1.3 Manufacturer's name: Stadler Rail

Registration Method: New Version of a registered type

Registered Vehicle Type: 13-031-0001-8-001

1.4 Category: Traction vehicles

1.5 Subcategory: Self-propelled passenger trainset (incl. railbusses)

1.6 Platform: FLIRT

Section 2: Conformity with TSI

2.1 Conformity with TSI and Sections not complied with:

1435mm / AC 15kV-16.7Hz / BACC

1435mm / AC 15kV-16.7Hz / Level 2

1435mm / AC 15kV-16.7Hz / RSDD/SCMT

1435mm / AC 15kV-16.7Hz / ZUB 262

**HS+CR SRT (Dec 2008/163/EC amended by
Dec 2012/464/EU)
Noise (Dec 2011/229/EU amended by Dec
2012/464/EU)**

1435mm / DC 3kV / BACC

1435mm / DC 3kV / Level 2

1435mm / DC 3kV / RSDD/SCMT

1435mm / DC 3kV / ZUB 262

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 0941/5/SD/2014/RST/IT/RC101247-08A

Reference of 'EC type examination certificates' - if
module SB applied - and/or 'design verification
certificate' - if module SH1 applied 0941/5/SD/2014/RST/EN/RC101247-08A

Section 3: Authorisations

Switzerland

3.1.2.1 Status:	Active
3.1.2.2 Validity of Authorisation (until):	2022-06-30
3.1.2.3 Coded Restrictions:	
3.1.2.4 Non Coded Restrictions:	
3.1.3.1.1 Date of the original authorisation:	2017-10-09
3.1.3.1.2 Authorisation holder:	Schweizerische Bundesbahnen SBB Personenverkehr
3.1.3.1.3 Authorisation document reference:	CH5120170407
3.1.3.1.4 National certificate references:	
3.1.3.1.5 Parameters for which conformity to applicable national rules has been assessed:	1435mm / AC 15kV-16.7Hz / Level 2
	1.0 General documentation
	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 Track side tests of the complete vehicle
	2.0 Structure and mechanical parts
	2.1 Vehicle structure
	2.1.1 Strength and integrity
	2.1.2 Load capability
	2.1.2.1 Load conditions and weighted 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 carbody structure
	2.1.6 Connections used between different parts of the vehicle
	2.2 Mechanical interfaces for Endcoupling or Innercoupling
	2.2.1 Automatic coupling
	2.2.2 Characteristics of rescue coupling
	2.2.3 Screw couplings

- 2.2.4 Buffing, intercoupling and draw gear components
- 2.2.5 Buffer marking
- 2.2.6 Draw hook
- 2.2.7 Gangways
- 2.3 Passive safety
- 3.0 Track interaction and gauging
- 3.1 Vehicle gauge
 - 3.1.1 Specific case
- 3.2 Vehicle dynamics
 - 3.2.1 Running safety and dynamics
 - 3.2.2 Equivalent conicity, wheel profile and limits
 - 3.2.3 Track loading
 - 3.2.4 Vertical acceleration
- 3.3 Bogies / running gear
 - 3.3.1 Boogies
 - 3.3.2 Wheelset (Axle + wheels)
 - 3.3.3 Wheel
 - 3.3.4 Wheel/rail interface (including wheel flange lubrication and sanding)
 - 3.3.5 Bearings on the wheelset
 - 3.3.6 Minimum curve radius to be negotiated
 - 3.3.7 Rail guard
- 3.4 Limit of maximum longitudinal positive and negative acceleration
- 4.0 Braking
 - 4.1 Functional Requirements at train level
 - 4.2 Safety requirements for braking at train level
 - 4.2.1 Traction/braking interlocking
 - 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
 - 4.5.2 Service braking

- 4.5.3 Calculations related to thermal capacity
- 4.5.4 Parking brake
- 4.6 Braking adhesion management
 - 4.6.1 Limit of wheel rail adhesion profile
 - 4.6.2 Wheel slide protection system
- 4.7 Braking force production
 - 4.7.1 Friction brake
 - 4.7.1.1 Brake blocks
 - 4.7.1.2 Brake discs
 - 4.7.1.3 Brake pads
 - 4.7.2 Dynamic brake linked to traction
 - 4.7.3 Magnetic track brake
 - 4.7.4 Eddy current track brake
 - 4.7.5 Parking brake
- 4.8 Brake state and fault indication
- 4.9 Brake requirements for rescue purposes
- 5.0 Passenger related items
 - 5.1 Access
 - 5.1.1 Exterior doors
 - 5.1.2 Interior doors
 - 5.1.3 Clearways
 - 5.1.4 Steps and lighting
 - 5.1.5 Floor height changes
 - 5.1.6 Handrails
 - 5.1.7 Boarding aids
 - 5.2 Windows
 - 5.3 Toilets
 - 5.4 Passenger information
 - 5.4.1 Public address system
 - 5.4.2 Signs and information
 - 5.5 Seats and Specific PMR arrangements
 - 5.6 Specific passenger related facilities
 - 5.6.1 Lift systems
 - 5.6.2 Heating, ventilation and Air condition systems
 - 5.6.3 Others
- 6.0 Environmental conditions and aerodynamic effects
 - 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 Chemical and particulate matter
- 6.1.2 Aerodynamic effects
 - 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 Chemical and particulate emissions
 - 6.2.1.1 Toilet emissions
 - 6.2.1.2 Exhaust gas emissions
 - 6.2.2 Limits for noise emissions
 - 6.2.2.1 Exterior noise impact
 - 6.2.2.2 Stationary noise impact
 - 6.2.2.3 Starting noise impact
 - 6.2.2.4 Pass-by noise impact
 - 6.2.3 Limits for Aerodynamic loads impact
 - 6.2.3.1 Head pressure pulses
 - 6.2.3.2 Aerodynamic impact on passengers on platform
 - 6.2.3.3 Aerodynamic impact on track workers
 - 6.2.3.4 Ballast pick up and projection onto neighbouring property
- 7.0 External warning, marking functions and software integrity requirements
- 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 Tail lights
 - 7.2.2.4 Lamp controls
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 - 7.2.3.1 Warning Horn tones
 - 7.2.3.2 Warning horn sound pressure levels

- 7.2.3.3 Warning horns, protection
- 7.2.3.4 Warning horns, control
- 7.2.3.5 Warning horns verification of sound pressure levels
- 7.2.4 Brackets
- 8.0 Onboard power supply and control systems
- 8.1 Traction performance requirements
 - 8.1.1 Residual acceleration at max speed
 - 8.1.2 Residual traction capability in degraded mode
 - 8.1.3 Traction wheel/rail adhesion 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 Power supply
 - 8.2.1.2 Impedance between pantograph and wheels
 - 8.2.1.3 Voltage and frequency of overhead contact line power supply
 - 8.2.1.4 Energy recuperation
 - 8.2.1.5 Maximum power and maximum current that is permissible to draw from the overhead contact line
 - 8.2.1.6 Power factor
 - 8.2.1.7 System energy disturbances
 - 8.2.1.7.1 Harmonic characteristics and related over-voltages on the overhead contact line
 - 8.2.1.7.2 Effects of DC content in AC supply
 - 8.2.1.8 Electrical protection
 - 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 static contact force
 - 8.2.2.4 Pantograph contact force (including dynamic behaviour and aerodynamic effects)
 - 8.2.2.5 Working range of pantographs
 - 8.2.2.6 Current capacity
 - 8.2.2.7 Arrangement of pantographs
 - 8.2.2.8 Insulation of pantograph from the vehicle
 - 8.2.2.9 Pantograph lowering

- 8.2.2.10 Running through phase separation sections
- 8.2.2.11 Running through 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
 - 8.2.3.5 Current capacity
- 8.3 Electrical power supply and traction system
 - 8.3.1 Energy consumption measurement
 - 8.3.2 Main electrical circuit configuration
 - 8.3.3 High voltage components
 - 8.3.4 Earthing
- 8.4 Electromagnetic Compatibility
 - 8.4.1 Electromagnetic compatibility within the onboard electrical power supply and control system
 - 8.4.2 Electromagnetic compatibility with the signalling and telecommunications network
 - 8.4.3 Electromagnetic compatibility with other vehicles and with the trackside part of the railway system
 - 8.4.4 Electromagnetic compatibility with the environment
- 8.5 Protection against electrical hazards
- 8.6 Diesel and other thermal traction system requirements
- 8.7 Systems requiring special monitoring and protection measures
 - 8.7.1 Tanks and pipe systems for flammable liquids
 - 8.7.2 Pressure vessel systems / pressure equipment
 - 8.7.3 Steam boiler installations
 - 8.7.4 Technical systems in potentially explosive atmospheres
 - 8.7.5 Ionisation detectors
 - 8.7.6 Hydraulic/pneumatic control systems
- 9.0 Staff facilities, interfaces and environment
 - 9.1 Driver's cab design
 - 9.1.1 Cab design
 - 9.1.1.1 Interior layout

- 9.1.1.2 Desk ergonomics
- 9.1.1.3 Driver's seat
- 9.1.1.4 Means for the driver to exchange documents
- 9.1.1.5 Other Facilities to control operation of the train
- 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
 - 9.1.3.4 Front visibility
- 9.2 Working conditions
 - 9.2.1 Environmental conditions
 - 9.2.1.1 Heating, Ventilation and Air condition systems in driver cabs
 - 9.2.1.2 Noise in driver cabs
 - 9.2.1.3 Lighting in driver cabs
 - 9.2.2 Others
- 9.3 Driver machine interface
 - 9.3.1 Driver machine interface
 - 9.3.1.1 Speed indication
 - 9.3.1.2 Driver's display unit and screens
 - 9.3.1.3 Controls and indicators
 - 9.3.2 Driver supervision
 - 9.3.3 Rear and side view
- 9.4 Marking and labelling in driver cabs
- 9.5 Equipment and other facilities onboard for staff
 - 9.5.1 Facilities onboard 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
 - 9.5.1.4 Other facilities
 - 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

- 9.7 Remote control function
- 10.0 Fire safety and evacuation
 - 10.1 Fire safety
 - 10.1.1 Fire protection concept
 - 10.1.1.1 Classification of vehicle / Fire categories
 - 10.1.1.2 Fire protection measures
 - 10.1.1.2.1 General protection measures for vehicles
 - 10.1.1.2.2 Fire protection measures for specific kind of vehicles
 - 10.1.1.2.3 Protection of drivers cab
 - 10.1.1.2.4 Fire barriers
 - 10.1.1.2.5 Material properties
 - 10.1.1.2.6 Fire detectors
 - 10.1.1.2.7 Fire extinction equipment
 - 10.2 Emergency
 - 10.2.1 Passenger emergency exits
 - 10.2.2 Rescue service's information, equipment and access
 - 10.2.3 Passenger Alarm
 - 10.2.4 Emergency lighting
 - 10.3 Additional measures
- 11.0 Servicing
 - 11.1 Train cleaning facilities
 - 11.1.1 Train external cleaning facilities
 - 11.1.2 Train internal cleaning
 - 11.2 Train refuelling facilities
 - 11.2.1 Waste water disposal systems
 - 11.2.2 Water supply system
 - 11.2.3 Further supply facilities
 - 11.2.4 Interface to refuelling equipment for non-electric rolling stock
- 12.0 On-board control command and signalling
 - 12.1 On board Radio system
 - 12.1.1 NON GSM-R radio system
 - 12.1.2 GSM-R compliant radio system
 - 12.1.2.1 Text messages
 - 12.1.2.2 Call forwarding
 - 12.1.2.3 Broadcast calls
 - 12.1.2.4 Cab-radio related functions
 - 12.1.2.5 Network selection by external trigger

- 12.1.2.6 General purpose radio related functions
- 12.1.2.7 Primary controller's MMI functionality
- 12.1.2.8 Use of hand portables as cab mobile radio
- 12.1.2.9 Capacity of on board GSM-R
- 12.1.2.10 GSM-R-ETCS interface
- 12.1.2.11 Interconnection and roaming between GSM-R networks
- 12.1.2.12 Border crossing
- 12.1.2.13 GPRS and ASCI
- 12.1.2.14 Interface between Rolling Stock driver's safety device, vigilance device, and GSM-R onboard assembly.
- 12.1.2.15 Test specification for mobile equipment GSM-R
- 12.1.2.16 Directed/automatic network selection
- 12.1.2.17 Registration and deregistration
- 12.1.2.18 GSM-R Version Management
- 12.2 On board signalling
 - 12.2.1 National on board signalling systems
 - 12.2.2 Compatibility of signalling system with the rest of the train
 - 12.2.3 Compatibility of rolling stock with Track infrastructure
 - 12.2.3.1 Relation between axle distance and wheel diameter
 - 12.2.3.2 Metal free space around wheels
 - 12.2.3.3 Metal mass of a vehicle
 - 12.2.4 ETCS cab signalling system
 - 12.2.4.1 Awakening
 - 12.2.4.2 Train categories
 - 12.2.4.3 Performance requirements for on-board GSM-R equipment related to quality of service
 - 12.2.4.4 Use of ETCS modes
 - 12.2.4.5 ETCS requirements when vehicle is driven from outside the cab
 - 12.2.4.6 Level crossing functionality
 - 12.2.4.7 Braking safety margins
 - 12.2.4.8 Reliability — Availability Requirements
 - 12.2.4.9 Marker Boards
 - 12.2.4.10 Ergonomic aspects of the DMI
 - 12.2.4.11 ETCS values of variables controlled outside UNISIG — Manual

- 12.2.4.12 KM Conformance Requirements
- 12.2.4.13 Requirements for pre-fitting ETCS on-board equipment
- 12.2.4.14 ETCS Version Management
- 12.2.4.15 Specification of ETCS variables
- 12.2.4.16 RBC – RBC interface
- 12.2.4.17 Additional requirements on locomotives and multiple units
- 12.2.4.18 Functionality and interfaces of staff protection systems to the signalling system
- 12.2.4.19 Interface with service brake.
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- 6.1.1.5 Snow, ice and hail
- 6.1.1.6 Solar radiation
- 6.1.1.7 Chemical and particulate matter
- 6.1.2 Aerodynamic effects
 - 6.1.2.1 Crosswind effects
 - 6.1.2.2 Maximum pressure variation in tunnels
- 6.2 Impact of the vehicle on the environment
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 - 6.2.1.1 Toilet emissions
 - 6.2.1.2 Exhaust gas emissions
 - 6.2.2 Limits for noise emissions
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 - 6.2.2.3 Starting noise impact
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 - 7.2.3.2 Warning horn sound pressure levels
 - 7.2.3.3 Warning horns, protection
 - 7.2.3.4 Warning horns, control
 - 7.2.3.5 Warning horns verification of sound pressure levels

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8.0 Onboard power supply and control systems

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8.1.2 Residual traction capability in degraded mode

8.1.3 Traction wheel/rail adhesion 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 Power supply

8.2.1.2 Impedance between pantograph and wheels

8.2.1.3 Voltage and frequency of overhead contact line power supply

8.2.1.4 Energy recuperation

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

8.2.1.6 Power factor

8.2.1.7 System energy disturbances

8.2.1.7.1 Harmonic characteristics and related over-voltages on the overhead contact line

8.2.1.7.2 Effects of DC content in AC supply

8.2.1.8 Electrical protection

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8.2.2.4 Pantograph contact force (including dynamic behaviour and aerodynamic effects)

8.2.2.5 Working range of pantographs

8.2.2.6 Current capacity

8.2.2.7 Arrangement of pantographs

8.2.2.8 Insulation of pantograph from the vehicle

8.2.2.9 Pantograph lowering

8.2.2.10 Running through phase separation sections

8.2.2.11 Running through 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
- 8.2.3.5 Current capacity
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 - 8.3.1 Energy consumption measurement
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 - 8.4.2 Electromagnetic compatibility with the signalling and telecommunications network
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 - 8.7.1 Tanks and pipe systems for flammable liquids
 - 8.7.2 Pressure vessel systems / pressure equipment
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 - 8.7.5 Ionisation detectors
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 - 9.1 Driver's cab design
 - 9.1.1 Cab design
 - 9.1.1.1 Interior layout
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 - 9.1.1.3 Driver's seat
 - 9.1.1.4 Means for the driver to exchange documents

- 9.1.1.5 Other Facilities to control operation of the train
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 - 9.1.2.2 Driver's cab emergency exits
- 9.1.3 Windscreen in driver's cab
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 - 9.2.1.2 Noise in driver cabs
 - 9.2.1.3 Lighting in driver cabs
 - 9.2.2 Others
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 - 9.3.1 Driver machine interface
 - 9.3.1.1 Speed indication
 - 9.3.1.2 Driver's display unit and screens
 - 9.3.1.3 Controls and indicators
 - 9.3.2 Driver supervision
 - 9.3.3 Rear and side view
- 9.4 Marking and labelling in driver cabs
- 9.5 Equipment and other facilities onboard for staff
 - 9.5.1 Facilities onboard 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
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- 9.7 Remote control function
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 - 10.1.2.5 Material properties
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 - 11.1.1 Train external cleaning facilities
 - 11.1.2 Train internal cleaning
 - 11.2 Train refuelling facilities
 - 11.2.1 Waste water disposal systems
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3.1.3.1.6 Comments:

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3.1.2.2 Validity of Authorisation (until):	2022-06-30
3.1.2.3 Coded Restrictions:	
3.1.2.4 Non Coded Restrictions:	
3.1.3.1.1 Date of the original authorisation:	2017-10-09
3.1.3.1.2 Authorisation holder:	Schweizerische Bundesbahnen SBB Personenverkehr
3.1.3.1.3 Authorisation document reference:	CH5120170407
3.1.3.1.4 National certificate references:	
3.1.3.1.5 Parameters for which conformity to applicable national rules has been assessed:	1435mm / AC 15kV-16.7Hz / Level 2
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- 9.5.1.4 Other facilities
- 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
- 9.7 Remote control function
- 10.0 Fire safety and evacuation
- 10.1 Fire safety
 - 10.1.1 Fire protection concept
 - 10.1.1.1 Classification of vehicle / Fire categories
 - 10.1.2 Fire protection measures
 - 10.1.2.1 General protection measures for vehicles
 - 10.1.2.2 Fire protection measures for specific kind of vehicles
 - 10.1.2.3 Protection of drivers cab
 - 10.1.2.4 Fire barriers
 - 10.1.2.5 Material properties
 - 10.1.2.6 Fire detectors
 - 10.1.2.7 Fire extinction equipment
- 10.2 Emergency
 - 10.2.1 Passenger emergency exits
 - 10.2.2 Rescue service's information, equipment and access
 - 10.2.3 Passenger Alarm
 - 10.2.4 Emergency lighting
- 10.3 Additional measures
- 11.0 Servicing
 - 11.1 Train cleaning facilities
 - 11.1.1 Train external cleaning facilities
 - 11.1.2 Train internal cleaning
 - 11.2 Train refuelling facilities
 - 11.2.1 Waste water disposal systems
 - 11.2.2 Water supply system
 - 11.2.3 Further supply facilities
 - 11.2.4 Interface to refuelling equipment for non-electric rolling stock
- 12.0 On-board control command and signalling

- 12.1 On board Radio system
 - 12.1.1 NON GSM-R radio system
 - 12.1.2 GSM-R compliant radio system
 - 12.1.2.1 Text messages
 - 12.1.2.2 Call forwarding
 - 12.1.2.3 Broadcast calls
 - 12.1.2.4 Cab-radio related functions
 - 12.1.2.5 Network selection by external trigger
 - 12.1.2.6 General purpose radio related functions
 - 12.1.2.7 Primary controller's MMI functionality
 - 12.1.2.8 Use of hand portables as cab mobile radio
 - 12.1.2.9 Capacity of on board GSM-R
 - 12.1.2.10 GSM-R-ETCS interface
 - 12.1.2.11 Interconnection and roaming between GSM-R networks
 - 12.1.2.12 Border crossing
 - 12.1.2.13 GPRS and ASCI
 - 12.1.2.14 Interface between Rolling Stock driver's safety device, vigilance device, and GSM-R onboard assembly.
 - 12.1.2.15 Test specification for mobile equipment GSM-R
 - 12.1.2.16 Directed/automatic network selection
 - 12.1.2.17 Registration and deregistration
 - 12.1.2.18 GSM-R Version Management
- 12.2 On board signalling
 - 12.2.1 National on board signalling systems
 - 12.2.2 Compatibility of signalling system with the rest of the train
 - 12.2.3 Compatibility of rolling stock with Track infrastructure
 - 12.2.3.1 Relation between axle distance and wheel diameter
 - 12.2.3.2 Metal free space around wheels
 - 12.2.3.3 Metal mass of a vehicle
 - 12.2.4 ETCS cab signalling system
 - 12.2.4.1 Awakening
 - 12.2.4.2 Train categories
 - 12.2.4.3 Performance requirements for on-board GSM-R equipment related to quality of service
 - 12.2.4.4 Use of ETCS modes

- 12.2.4.5 ETCS requirements when vehicle is driven from outside the cab
- 12.2.4.6 Level crossing functionality
- 12.2.4.7 Braking safety margins
- 12.2.4.8 Reliability — Availability Requirements
- 12.2.4.9 Marker Boards
- 12.2.4.10 Ergonomic aspects of the DMI
- 12.2.4.11 ETCS values of variables controlled outside UNISIG — Manual
- 12.2.4.12 KM Conformance Requirements
- 12.2.4.13 Requirements for pre-fitting ETCS on-board equipment
- 12.2.4.14 ETCS Version Management
- 12.2.4.15 Specification of ETCS variables
- 12.2.4.16 RBC – RBC interface
- 12.2.4.17 Additional requirements on locomotives and multiple units
- 12.2.4.18 Functionality and interfaces of staff protection systems to the signalling system
- 12.2.4.19 Interface with service brake.
- 13.0 Specific Operational Requirements
- 13.1 Specific items to place on-board
- 13.2 Occupational health and safety
- 13.3 Lifting diagram and instructions

Section 4: Technical Characteristics

Wheel set gauge

4.1.3 Wheel set gauge	1435	mm
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4.13.1 Signalling

4.13.1.1 ETCS equipment on-board and its level	Level 2
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4.13.1.2 ETCS baseline.version (x.y). If the version is not fully compatible it shall be indicated in brackets	2.0 (2.3.0d)
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4.13.1.3 ETCS on-board equipment for reception of infill-function information via loop or GSM-R	loop GSM-R
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4.13.1.4 ETCS national applications implemented (NID_XUSER of Packet 44)		SBB, Zub 121 migration in Switzerland Siemens		
4.13.1.5 Class B or other train protection control and warning systems installed (system and if applicable version)		BACC ((07.01)) RSDD/SCMT ((07.01)) ZUB 262		
4.13.1.6 Special conditions implemented on-board to switch over between different train protection control and warning systems.		BACC ((07.01)) -> RSDD/SCMT ((07.01)) BACC ((07.01)) -> ZUB 262 RSDD/SCMT ((07.01)) -> ZUB 262		
4.13.2 Radio				
4.13.2.1 GSM-R equipment on board and its version (FRS and SRS)		7/15		
4.13.2.2 Number of GSM-R mobile sets in driving cab for data transmission		2		
4.13.2.3 Class B or other radio systems installed (system and if applicable version)		FS ETACS and GSM ((04.09.03))		
4.13.2.4 Special conditions implemented on-board to switch over between different radio systems.		7/15 -> FS ETACS and GSM ((04.09.03))		
4.10.1 Energy supply system		AC 15kV-16.7Hz DC 3kV		
4.10.2 Maximum power (to be indicated for each energy supply system the vehicle is equipped for)	AC 15kV-16.7Hz DC 3kV	2600 2600		kW kW
4.10.3 Maximum rated current from the catenary (to be indicated for each electrical energy supply system the vehicle is equipped for)	AC 15kV-16.7Hz DC 3kV	200 1000		A A

4.10.4 Maximum current at standstill per pantograph (to be indicated for each DC systems the vehicle is equipped for)	DC 3kV	100	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)	AC 15kV-16.7Hz	0004.28	m	0006.44	m
	DC 3kV	0004.28	m	0006.44	m
4.10.6 Pantograph head (to be indicated for each energy supply system the vehicle is equipped for)	AC 15kV-16.7Hz	1450 (sc SI)	mm		
	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)	AC 15kV-16.7Hz	1			
	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)	AC 15kV-16.7Hz	Plain carbon			
	DC 3kV	Carbon with cladded cooper			
4.10.11 Automatic dropping device (ADD) fitted (to be indicated for each energy supply system the vehicle is equipped for)	AC 15kV-16.7Hz	False			
	DC 3kV	True			
4.10.12 TSI conform energy meter for billing purposes installed on board	AC 15kV-16.7Hz	False			
	DC 3kV	False			

4.1.2 Speed

4.1.2.1 Maximum design speed	1435mm / AC 15kV-16.7Hz / BACC	160	km/h
	1435mm / AC 15kV-16.7Hz / RSDD/SCMT	160	km/h
	1435mm / AC 15kV-16.7Hz / ZUB 262	160	km/h
	1435mm / DC 3kV / BACC	160	km/h
	1435mm / DC 3kV / RSDD/SCMT	160	km/h
	1435mm / DC 3kV / ZUB 262	160	km/h
4.1.4 Conditions of use regarding train formation		Fixed formation	
4.1.5 Maximum number of trainsets or locomotives coupled together in multiple operation.	1435mm / AC 15kV-16.7Hz / BACC	2	
	1435mm / AC 15kV-16.7Hz / RSDD/SCMT	2	
	1435mm / AC 15kV-16.7Hz / ZUB 262	2	
	1435mm / DC 3kV / BACC	2	
	1435mm / DC 3kV / RSDD/SCMT	2	
	1435mm / DC 3kV / ZUB 262	2	
4.1.8 Type meets the requirements necessary for validity of the vehicle authorisation granted by one Member State in other MSs		Not applicable	
4.1.10 Structural category		F-II of EN12663:2000	
4.2.1 Vehicle kinematic gauge (interoperable gauge)		UIC 505-1	
4.3.1 Temperature range		T1 (-25 to +40)	
4.3.2 Altitude range		A2	
4.3.3 Snow ice and hail conditions		nominal	
4.4.1 Fire safety category		B	
4.5.2 Design mass	<hr/>		
4.5.2.1 Design mass in working order		133000	kg

4.5.2.2 Design mass under normal payload		146000	kg
4.5.2.3 Design mass under exceptional payload		164000	kg
4.5.3 Static axle load			
4.5.3.1 Static axle load in working order		18000	kg
4.5.3.2 Static axle load under normal payload/ maximum payload for freight wagons		18700	kg
4.5.3.3 Static axle load under exceptional payload		20000	kg
4.5.4 Quasi-static guiding force (if exceeds the limit defined in TSI or not defined in the TSI)	1435mm	40	kN
4.6.1 Cant deficiency (maximum uncompensated lateral acceleration) for which the vehicle has been assessed	1435mm	153	mm
4.6.2 Vehicle equipped with a cant deficiency compensation system ("tilting vehicle")		False	
4.7.1 Maximum train deceleration		1.4	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)		160	km/h
4.7.2.1.3 Gradient (if no reference case is indicated)		0	‰ (mm/m)
4.7.2.1.4 Distance (if no reference case is indicated)		0.8	km
4.7.3 Parking brake			
4.7.3.2 Parking brake type (if the vehicle is fitted with it)		Automatic	

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)	50	‰ (mm/m)
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4.7.4.1 Eddy current brake

4.7.4.1.1 Eddy current brake fitted	False	
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4.7.4.2 Magnetic brake

4.7.4.2.1 Magnetic brake fitted	True	
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4.7.4.2.2 Possibility of preventing the use of the magnetic brake (only if fitted with magnetic brake)	True	
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4.7.4.3 Regenerative brake (only for vehicles with electrical traction)

4.7.4.3.1 Regenerative brake fitted	True	
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4.7.4.3.2 Possibility of preventing the use of the regenerative brake (only if fitted with regenerative brake)	False	
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4.8.1 Vehicle length	74	m
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4.8.2 Minimum in-service wheel diameter	690	mm
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4.8.4 Minimum horizontal curve radius capability	150	m
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4.8.8 Suitability for transport on ferries	False	
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4.9.1 Type of end coupling (indicating tensile and compressive forces)	Automatic	
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4.9.2 Axle bearing condition monitoring (hot axles box detection)	Detectable by line side	
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4.9.3 Flange lubrication

4.9.3.1 Flange lubrication fitted	True	
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4.9.3.2 Possibility of preventing the use of the lubrication device (only if fitted with flange lubrication)	False	
4.11.1 Pass-by noise level (dB(A))	74	dB(A)
4.11.2 Pass-by noise level was measured under reference conditions	False	
4.11.3 Stationary noise level (dB(A))	57	dB(A)
4.11.4 Starting noise level (dB(A))	70	dB(A)
4.12.1 General passenger related characteristics		
4.12.1.1 Number of fixed seats	From 00169 To 00169	
4.12.1.2 Number of toilets	1	
4.12.1.3 Number of sleeping places	From 00000 To 00000	
4.12.2 PRM related characteristics		
4.12.2.1 Number of priority seats	From 00028 To 00028	
4.12.2.2 Number of wheelchair spaces	From 00002 To 00002	
4.12.2.3 Number of PRM accessible toilets	1	
4.12.2.4 Number of wheelchair accessible sleeping places	From 00000 To 00000	
4.12.3 Passenger access and egress		
4.12.3.1 Platform heights for which the vehicle is designed.	550	mm
4.12.3.2 Description of any integrated boarding aids (if provided)	bridging plates	
4.12.3.3 Description of any portable boarding aids if considered in the design of the vehicle for meeting the PRM TSI requirements	none	

4.14.1 Type of train detection systems for which the vehicle has been designed and assessed

track circuits
axle counters

4.14.2 Detailed vehicle characteristics related to compatibility with train detection systems

4.14.2.1 Maximum distance between consecutive axles	13400	mm		
4.14.2.2 Minimum distance between consecutive axles	2700	mm		
4.14.2.3 Distance between the first and the last axle	66900	mm		
4.14.2.4 Maximum length of the vehicle nose	3589	mm		
4.14.2.5 Minimum wheel rim width	133	mm		
4.14.2.6 Minimum wheel diameter	690	mm		
4.14.2.7 Minimum flange thickness	27.5	mm		
4.14.2.8 Minimum flange height	29.5	mm		
4.14.2.9 Maximum flange height	35	mm		
4.14.2.10 Minimum axle load	10.1	t		
4.14.2.12 Wheel material is ferromagnetic	True			
4.14.2.13 Maximum sanding output	000400.000	g	000030.000	s
4.14.2.14 Possibility of preventing the use of sanding	True			
4.14.2.16 Maximum impedance between opposite wheels of a wheelset	0.01	Ohm		

4.14.2.17 Minimum
vehicle impedance
(between wheels and
pantograph) (only for
vehicles equipped for
1500V or 3000V DC)

AC 15kV-16.7Hz

000000.024000
Ohm per
000019.200000
Hz

000005.024000
Ohm per
000100.000000
Hz

DC 3kV

000000.024000
Ohm per
000019.200000
Hz

000005.326000
Ohm per
000100.000000
Hz