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COMMISSION DECISION

of 30 November 2009

on the reference document referred to in Article 27(4) of Directive 2008/57/EC of the European Parliament and of the Council on the interoperability of the rail system within the Community

(notified under document C(2009) 8680)

(Text with EEA relevance)

(2009/965/EC)

(OJ L 341, 22.12.2009, p. 1)

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**COMMISSION DECISION****of 30 November 2009****on the reference document referred to in Article 27(4) of Directive 2008/57/EC of the European Parliament and of the Council on the interoperability of the rail system within the Community***(notified under document C(2009) 8680)***(Text with EEA relevance)****(2009/965/EC)**

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community ⁽¹⁾, and in particular, Article 27(4) thereof,

Having regard to the recommendation of the European Railway Agency (No ERA/REC/XA/01-2009) of 17 April 2009,

Whereas:

- (1) Article 27(3) of Directive 2008/57/EC requires the European Railway Agency to draft a reference document cross-referencing all the national rules applied by the Member States for placing vehicles in service. This document must contain the national rules of each Member State for each of the parameters listed in Annex VII to Directive 2008/57/EC and specify the group referred to in Section 2 of that Annex to which these rules belong. These rules must comprise those notified under Article 17(3) of Directive 2008/57/EC, including those notified following adoption of TSIs (specific cases, open points, derogations) and those notified under Article 8 of Directive 2004/49/EC of the European Parliament and of the Council ⁽²⁾. The first version of the reference document is to be presented to the Commission no later than 1 January 2010.
- (2) In order to allow comparison and cross-referencing, in respect of a particular parameter, between the requirements contained within the TSIs and those contained in national rules, the list of parameters to be checked in conjunction with the placing in service of non-TSI conform vehicles, should, on the one hand, preserve compatibility with, and build upon existing agreements based on national rules and, on the other hand, reflect the TSIs. It

⁽¹⁾ OJ L 191, 18.7.2008, p. 1.

⁽²⁾ OJ L 164, 30.4.2004, p. 44.

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is therefore necessary for the list of parameters to be at a level of detail significantly higher than that currently reflected in Section 1 of Annex VII to Directive 2008/57/EC. It is appropriate to adopt the detailed list of parameters set out in the Annex to this Decision as the basis for the reference document referred to in Article 27(4) of Directive 2008/57/EC.

- (3) The measures provided for in this Decision are in accordance with the opinion of the Committee established in accordance with Article 29(1) of Directive 2008/57/EC,

HAS ADOPTED THIS DECISION:

Article 1

The reference document referred to in Article 27(4) of Directive 2008/57/EC shall be drawn up on the basis of the list of parameters set out in the Annex to this Decision.

It shall also contain, for each Member State, some basic information on the national legal framework applicable to placing railway vehicles in service.

Article 2

This Decision is addressed to the Member States and to the European Railway Agency, as represented by its Executive Director.

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ANNEX

List of parameters to be used for classifying national rules in the reference document referred to in Article 27 of Directive 2008/57/EC

| Reference | Parameter | Explanations |
|-----------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Documentation | |
| 1.1 | General documentation | General documentation, technical description of the vehicle, its design and intended use for the kind of traffic (long-distance train, suburban vehicles, commuter services, etc.) inclusive of intended and max design speed, including general plans, diagrams and necessary data for registers, e.g. length of vehicle, axle arrangement, axle spacing, mass per unit, etc. |
| 1.2 | Maintenance instructions and requirements | |
| 1.2.1 | Maintenance instructions | Maintenance manuals and leaflets, including requirements necessary to maintain design safety level of the vehicle. Any appropriate professional qualifications, i.e. skills that are requested for equipment maintenance. |
| 1.2.2 | The maintenance design justification file | The maintenance design justification file explains how maintenance activities are defined and designed in order to ensure that the rolling stock characteristics will be kept within permissible limits of use during its lifetime. |
| 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 | This parameter should address rules (if any) for testing. |
| 2 | Structure and mechanical parts | |

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| Reference | Parameter | Explanations |
|-----------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.1 | Vehicle structure | |
| 2.1.1 | Strength and integrity | Requirements for the mechanical strength of car body, under-frame, suspension systems, track sweeper and snow plough. Mechanical strength of separate items of this list such as bogie/running gear, axle box, suspension, axle shaft, wheel, axle bearings and pantograph will be defined separately. |
| 2.1.2 | Load capability | |
| 2.1.2.1 | Load conditions and weighed mass | Load conditions and weighed mass are mainly an operational issue (referring to the line class). The parameter refers to the understanding of the mass system, to ensure that the same understanding of the mass and load calculations are given. The load capability is an operational matter however maximum load condition shall be consistent with the design of the vehicle (strength of the structure). |
| 2.1.2.2 | Axle load and wheel load | Axle load and wheel load are mainly an operational issue (referring to the line class). The parameter refers to the understanding of the mass system, to ensure that the same understanding of the mass and load calculations are given (e.g. minimum and maximum axle load). Refer to parameter 3.3 for the structural strength of axles and wheels. |
| 2.1.3 | Joining technology | Requirements to the joints and to the joining technologies (welding, gluing, screwing, bolting, etc.). |
| 2.1.4 | Lifting and jacking | Special requirements to the vehicle design for lifting, jacking and re-railing, capacity of the vehicle body to resist lasting deformations, also geometry and location of the lifting points. Not included is the lifting and re-railing instruction; therefor see chapter 1. |
| 2.1.5 | Fixing of devices to car body structure | E.g. for weld-on parts, also for fixed devices inside the passenger areas. |

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| Reference | Parameter | Explanations |
|-----------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.1.6 | Connections used between different parts of the vehicle | E.g. connection/suspension/damping system between, e.g. car body and bogie or between axle box and bogie frame. |
| 2.2 | Couplers/coupling systems | |
| 2.2.1 | Automatic coupling | Requirements and accepted types of automatic coupling systems. It takes into account electrical, mechanical and pneumatic. |
| 2.2.2 | Characteristics of rescue coupling | Requirements to coupling adapters which make different coupling systems compatible; in normal and degraded mode (e.g. rescue coupler). |
| 2.2.3 | Conventional screw coupling and other non-automatic coupling systems | Requirements for conventional screw coupling systems as well as other non-automatic coupling systems (e.g. semi-permanent inner couplings), their components and their interaction. Included: draw gear, draw hook, draw gear suspension. Excluded: buffers and buffing systems (therefore see parameter 2.2.4 'Buffing'), as well as air, brake, energy and control connections. |
| 2.2.4 | Buffing | Requirements for buffers and buffing systems related to vehicle coupling, including buffer marking. |
| 2.2.5 | Gangways | Requirements concerning gangways which allow people (staff or passenger) to interchange between coupled vehicles. |

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| Reference | Parameter | Explanations |
|-----------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.3 | Passive safety | <p>Requirements concerning passive safety of the vehicle in collision with obstacles (e.g. crashworthiness etc.).</p> <p>Including, e.g. obstacle deflector, limiting deceleration, survival space and structural integrity of occupied areas, reducing the risk of derailment and overriding, limiting consequences of hitting a track obstruction, interior fittings for passive safety. Reference to collision scenarios, survival space and structural integrity of the occupied areas, reducing the risk of overriding and derailment, limiting the consequences of hitting a track obstruction.</p> <p>Requirements concerning rail guard for protection of wheels from foreign objects and obstacles on the rails. Refers to: height of the lower end of the rail guard above the plain rail, minimum longitudinal force without permanent deformation. Deals not with snow plough.</p> |
| 3 | Track interaction and gauging | |
| 3.1 | Vehicle gauge | Refers to all requirements connected to vehicle gauge/ vehicle profile. To announce the accepted kinematic vehicle gauge(s) including pantograph gauge. |
| 3.2 | Vehicle dynamics | |
| 3.2.1 | Running safety and dynamics | <p>Requirements to running behaviour and running safety of the vehicle.</p> <p>Included are: tolerance of vehicle to distortion of track, running on curved or twisted tracks, safe running on points and diamond crossings, etc.</p> |
| 3.2.2 | Equivalent conicity | Requirements concerning equivalent conicity values which should be respected. |

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| Reference | Parameter | Explanations |
|-----------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.2.3 | Wheel profile and limits | Requirements for wheel profiles in relation to the relevant track system(s); to announce accepted wheel profiles (e.g. S1002 is widely accepted). |
| 3.2.4 | Track loading compatibility parameters | E.g. dynamic wheel force, wheel forces exerted by a wheel set on the track (quasi static wheel force, maximum total dynamic lateral force, quasi static guiding force) including vertical acceleration. |
| 3.2.5 | Minimum horizontal curve radius, vertical concave curve radius, convex curve radius | The mechanical ability of a vehicle to pass through a horizontal curve of a defined radius. The value of minimum vertical convex curve (hump) and concave curve (bowl) radius of the track to be negotiated by the vehicle shall be announced; conditions (e.g. vehicle coupled/uncoupled). |
| 3.3 | Bogies/running gear | |
| 3.3.1 | Bogies | Requirements concerning bogie frame design and strength as well as bogie overall design. |
| 3.3.2 | Wheelset (complete) | Requirements on joining of the components (axle shaft, wheels, bearings, axle boxes, traction components...), tolerances, impedance between wheels. Not included: requirements on strength and strength calculation of axle shaft, wheels, bearings, traction components and on ability for non-destructive testing. |
| 3.3.3 | Wheel | Requirements on the wheel (e.g. strength, strength calculation, material, manufacturing method, inner mechanical tension state, surface roughness, surface protection/paint coat, marking, ability for non-destructive testing). In case of tyred wheels: requirements on wheel tyre, joining and fixing on wheel body, marking. For wheel profile and limits see 3.2.3. |

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| Reference | Parameter | Explanations |
|-----------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.3.4 | Wheel/rail interaction influencing systems | Requirements to all vehicle mounted systems which have influence to the wheel/rail interaction such as wheel flange lubrication, upper sway/wearing track wheel interactions, requirements deriving from traction, braking, except for sanding system. Compatibility with CCS trackside equipment is covered for EMC by parameter 8.4.2 and for other compatibility requirements by parameters 12.2.4. |
| 3.3.5 | Sanding system | |
| 3.3.6 | Bearings on the wheelset | Requirements on wheelset bearings (e.g. strength, strength calculation, material, manufacturing method). |
| 3.3.7 | Axle shaft | Requirements on the axle shaft (e.g. strength, strength calculation, material, surface roughness, surface protection/paint coat, marking, ability for non-destructive testing). |
| 3.3.8 | Axle bearing condition monitoring | Parameter covers the axle box and hot axle box detection ('HABD') (on-board HABD and interfaces with trackside detectors). |
| 3.4 | Limit of maximum longitudinal positive and negative acceleration | Limit of acceleration due to maximum admissible longitudinal forces in the track. |
| 4 | Braking | |
| 4.1 | Functional requirements for braking at train level | Refers to the availability of basic brake functionalities (usually service braking, emergency braking, a parking brake function) and characteristics of the main brake system (usually automaticity, continuity, inexhaustibility). |
| 4.2 | Safety requirements for braking at train level | |
| 4.2.1 | Reliability of main brake system functionality | Requirement concerning the safe response of the brake system to provide the expected brake force after activation of an emergency brake command. |

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| Reference | Parameter | Explanations |
|-----------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.2.2 | Reliability of traction/braking interlocking | Requirement that tractive effort is safely inhibited after activation of an emergency brake command. |
| 4.2.3 | Reliability of stopping distance | Requirement concerning the compliance with the calculated stopping distance after activation of an emergency brake command. |
| 4.2.4 | Reliability of parking brake | Requirement concerning the safe response of the parking brake system to keep the vehicle stationary under calculated circumstances after activation of a parking brake command. |
| 4.3 | Brake system — Recognised architecture and associated standards | Reference to existing solutions, e.g. UIC ('Union International des Chemins de fer') brake system. |
| 4.4 | Brake command | |
| 4.4.1 | Emergency braking command | Requirements concerning the emergency braking command, e.g. availability of independent emergency brake command devices, specification of appearance of emergency brake command devices, ability of self-locking of the emergency brake command devices, ability of activation of an emergency brake by the control-command and signalling on-board system, specification of the emergency brake after activation. |
| 4.4.2 | Service braking command | Requirements concerning the service braking command, e.g. specifications to the adjustability of the brake force by the service braking command, requirement of only one available service braking command and possibility to isolate the service braking function of the other service braking command(s), automatic cut-off of all tractive effort by the service braking command. |
| 4.4.3 | Direct braking command | Requirements concerning the direct braking command. |

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| Reference | Parameter | Explanations |
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| 4.4.4 | Dynamic braking command | Requirements concerning the dynamic braking command, e.g. possibility of independent and/or combined use of the dynamic brake from/with other brake systems, the possibility to inhibit the application of the regenerative brake. |
| 4.4.5 | Parking braking command | Requirements concerning the parking braking command, e.g. conditions in which the parking braking command has to be able to apply and/or release the parking brake. |
| 4.5 | Brake performance | |
| 4.5.1 | Emergency braking performance | Requirements concerning the emergency braking performance, e.g. response time, deceleration, stopping distance, modes to be considered (normal/degraded). Excluded: exploitation of wheel rail adhesion (see parameter 4.6.1). |
| 4.5.2 | Service braking performance | Requirements concerning the service braking performance, e.g. level and limit the maximum service braking performance. |
| 4.5.3 | Calculations related to thermal capacity | Requirements concerning the calculations related to thermal capacity, both on wheels and brake equipment, e.g. scenarios and load conditions to be applied, sequence of brake applications to be considered, maximum line gradient, associated length and operating speed. |
| 4.5.4 | Parking brake performance | Requirements concerning the parking braking performance, e.g. load condition, ruling track gradient. |
| 4.5.5 | Brake performance calculation | Requirements concerning the brake performance calculation, e.g. applicable wheel diameters, load conditions, friction coefficients, control modes. |
| 4.6 | Braking adhesion management | |

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| Reference | Parameter | Explanations |
|-----------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.6.1 | Limit of wheel rail adhesion profile | Requirements concerning the limitation of the wheel-rail adhesion profile, e.g. target design friction coefficients to limit the exploitation of wheel rail adhesion for wheel slide protection, vehicle configurations to be considered, wheel diameter and load conditions to be considered. |
| 4.6.2 | Wheel slide protection system ('WSP') | Requirements concerning the wheel slide protection (WSP) system, e.g. for which vehicles/vehicle configurations a WSP system is mandatory, requirements on the WSP system performance, safety relevance. |
| 4.7 | Braking force production | |
| 4.7.1 | Friction brake components | |
| 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 | Acceptance and requirements of emergency braking under use of dynamic brake which is linked to the traction system, e.g. requirements to the availability, constraints, etc. |
| 4.7.3 | Magnetic track brake | Requirements on magnetic track brakes, e.g. allowed operation cases, geometrical characteristics of the magnet elements, way of mounting (high/low hanging). |
| 4.7.4 | Eddy current track brake | Requirements on eddy current track brakes, e.g. allowed application cases, limitations to its operation. |
| 4.7.5 | Parking brake | Requirements concerning the brake force production of parking brakes, necessary energy supply to operate it (setting/releasing). |

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| Reference | Parameter | Explanations |
|-----------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.8 | Brake state and fault indication | Requirements concerning the indication of the brake status to the driver/staff, e.g. brake energy availability, brake status of the several brake systems. |
| 4.9 | Brake requirements for rescue purposes | Requirements concerning the ability of brake systems regarding rescue of a train/vehicle, e.g. opportunity to release and isolate all brakes, controllability of the brake system of the rescued train/vehicle from other vehicles, compatibility with other types of brake in degraded mode. For rescue purposes of a train/vehicle usually the opportunity to release and isolate all brakes is necessary. |
| 5 | Passenger-related items | |
| 5.1 | Access | |
| 5.1.1 | Exterior doors | Includes requirements for door locking systems, steps and gaps for vehicle access for exterior passenger doors. |
| 5.1.2 | Boarding aids | Refers to technical specifications of equipment which may be on board to facilitate the access/excess for passengers to/from the vehicle. |
| 5.2 | Interior | |
| 5.2.1 | Interior doors | Requirements concerning the design of interior doors. |
| 5.2.2 | Intercirculation doors | Doors in connection between vehicles which can be at the end of the train. |
| 5.2.3 | Clearways | Clearance (width and height) of space inside in the vehicle for the passenger to have free access to all facilities (also related to passengers with reduced mobility). |
| 5.2.4 | Floor height changes | Requirements concerning floor height changes inside passenger vehicles. Excluded: step height and gap for vehicle access for exterior doors (see 5.1.1). |

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| Reference | Parameter | Explanations |
|-----------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.2.5 | Interior lighting | Requirements concerning passenger related lighting (not technical equipment lighting and signal lights or emergency lighting that is covered by parameter 10.2.4). |
| 5.3 | Handrails | Requirements concerning handrails for passenger use inside/outside of the vehicle (design specifications, where to use). |
| 5.4 | Windows | Requirements concerning windows (windows to the outside of a vehicle), e.g. mechanical characteristics. Items excluded: — windscreen in the cab see parameter 9.1.3; — windows inside the vehicle; — fire safety, evacuation and emergency exits (see parameters 10.2.1). |
| 5.5 | Toilets | Requirements concerning the design and equipment of toilets (also in relation to use by people with reduced mobility). E.g. inside space, access, emergency call, hygienical requirements. Including need and design of staff toilets. Excluded: toilet emissions (see parameter 6.2.1.1). |
| 5.6 | Heating, ventilation and air conditioning systems | E.g. internal air quality, requirement in case of fire (switch off). |
| 5.7 | Passenger information | |
| 5.7.1 | Public address system | The parameter is considered as requirement for a one way communication. For communication from passenger to staff see parameter 10.2.3 'Passenger alarm'. |
| 5.7.2 | Signs and information | Requirements concerning signs, pictograms and displayed text. Including safety instructions to passengers and emergency markings for passengers. |

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| Reference | Parameter | Explanations |
|-----------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 | 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 | Refers to the altitude range to be considered for vehicles. |
| 6.1.1.2 | Temperature | Refers to the temperature range to be considered for vehicles. |
| 6.1.1.3 | Humidity | |
| 6.1.1.4 | Rain | |
| 6.1.1.5 | Snow, ice and hail | Requirements to prevent vehicles from degradation for snow, ice and hail conditions. What 'snow, ice and hail' conditions have to be considered, scenarios like snow-drift, powder snow, snowfall of large quantities of light snow with low water equivalent content, temperature and humidity variation during one single run causing ice build-ups shall be taken into account. To define if capability to remove snow in front of the train is needed. To consider possible consequence of snow/ice on running stability, brake function and brake power supply, needs for windscreen's equipment, providing the driver with acceptable climate for working. |
| 6.1.1.6 | Solar radiation | |
| 6.1.1.7 | Resistance to pollution | Pollution effects to be considered, e.g. by chemically active substances, contaminating fluids, biologically active substances, dust, stones, ballast and other objects, grasses and leaves, pollen, flying insects, fibres, sand and sea spray. |
| 6.1.2 | Aerodynamic effects on the vehicle | |

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| Reference | Parameter | Explanations |
|-----------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.1.2.1 | Crosswind effects | Refers to impact upon vehicle equipment and functions due to crosswinds. Characteristics of wind (e.g. wind speed) to be considered for the design of rolling stock to ensure safety, functionality and integrity. |
| 6.1.2.2 | Maximum pressure variation in tunnels | Impact due to rapid changes in pressure by entering, running in or leaving tunnels. |
| 6.2 | Impact of the vehicle on the environment | |
| 6.2.1 | External emissions | |
| 6.2.1.1 | Toilet emissions | Toilet discharge emissions to the external environment. |
| 6.2.1.2 | Exhaust gas emissions | Exhaust gas emissions to the external environment (see also parameter 8.6). |
| 6.2.1.3 | Chemical and particulate emission | Other emissions/spills from the vehicle like oil and grease leakage, flange lubricant, fuel etc. |
| 6.2.2 | Limits for noise emissions | |
| 6.2.2.1 | Stationary noise impact | Stationary noise impact caused by the vehicle upon the environment external to the railway system. |
| 6.2.2.2 | Starting noise impact | Starting noise impact caused by the vehicle upon the environment external to the railway system. |
| 6.2.2.3 | Pass-by noise impact | Pass-by noise impact caused by the vehicle upon the environment external to the railway system. |
| 6.2.3 | Limits for aerodynamic loads impact | Aerodynamic load impact, e.g. on people on platforms and on the open line. |
| 6.2.3.1 | Head pressure pulses | Effect of pressure pulses caused by the head of the train at the track side. |

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| Reference | Parameter | Explanations |
|-----------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.2.3.2 | Aerodynamic impact on passengers/materials on the platform | Aerodynamic disturbance to passengers/materials on platform including assessment methods and operational loading conditions. |
| 6.2.3.3 | Aerodynamic impact on track workers | Aerodynamic disturbance to track workers. |
| 6.2.3.4 | Ballast pick-up and projection onto neighbouring property | May refer also to ice pick-up. |
| 7 | External warning, signalling, marking functions and software integrity requirements | |
| 7.1 | Integrity of software employed for safety related functions | Requirements concerning the integrity of software related to safety-related functions with impact on the train behaviour, e.g. integrity of software of train bus. |
| 7.2 | Visual and audible vehicle identification and warning functions | |
| 7.2.1 | Vehicle marking | Vehicle marking refers to operational and technical information for railway staff, may be inside and outside the vehicle. |
| 7.2.2 | External lights | |
| 7.2.2.1 | Headlights | ‘Headlights’ refers to the functionality to provide sufficient visibility for the driver in front of the train. This may be ensured by using of the same physical devices as for marker lights or additional devices. |
| 7.2.2.2 | Marker lights | ‘Marker lights’ are lights located at the front of train which have functionality to signal the front of a train. Several signal aspects for signalling the front of a train in different circumstances (e.g. train running on opposite track of the line, train in emergency situation, etc.) are possible. |

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| Reference | Parameter | Explanations |
|-----------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.2.2.3 | End-of-train signal | Requirements concerning equipment which can display a visual end-of-train signal (e.g. red lights). Excluded: brackets for mounting end-of-train signals, see parameter 7.2.4. |
| 7.2.2.4 | Lamp controls | |
| 7.2.3 | Audible signal systems | Requirements concerning vehicle mounted audible signalling systems (e.g. warning horn). Refers to: <ul style="list-style-type: none"> — warning horn tones; — warning horn sound pressure level (outside cab, for internal sound level see parameter 9.2.1.2); — protection of the device; — control of the device; — verification of sound pressure levels. |
| 7.2.4 | Brackets | Requirements for means needed to mount/attach vehicle-external signalling devices (e.g. end-of-train signals, signal lamps, flags). |
| 8 | On-board power supply and control systems | |
| 8.1 | Traction performance requirements | Required traction performance as, e.g. acceleration, traction wheel/rail adhesion control, etc. |
| 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 | Specific requirements for power supply, e.g. power factor, sensitivity of on-board protection system. |
| 8.2.1.2 | Voltage and frequency of overhead contact line power supply | |

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| Reference | Parameter | Explanations |
|-----------|------------------------------------------------------------------------------------------------------|------------------------------------------|
| 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 | Including maximum current at standstill. |
| 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) | Including quality of current collection. |
| 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 | |

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| Reference | Parameter | Explanations |
|-----------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 | Conducted emission and immunity levels to on-board apparatus, magnetic field for human exposure inside rolling stock (e.g. human exposure limits). |
| 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 | Interference current at the point of connection to the railway power supply network — pantograph/shoe gear level. |
| 8.4.2.1.2 | Heating cable interference current | Interference current due to the heating in Diesel traction. |
| 8.4.2.1.3 | Interference current under the vehicle | Interference currents circulating under the vehicle between the axles and mainly produced by on-board equipment. |
| 8.4.2.1.4 | Harmonic characteristics and related overvoltages on the overhead contact line | Vehicle requirements related to the maximum harmonics and the related overvoltages on the overhead contact line. |
| 8.4.2.1.5 | Effects of DC content in AC supply | Vehicle requirements related to the maximum DC component in AC power 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 | The electro-magnetic fields (or induced/interference voltages) at the location of railway equipment (axle counter detectors, ATP ('Automatic Train Protection'), antennas, hot axle box detectors, etc.). |

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| Reference | Parameter | Explanations |
|-----------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8.4.2.2.2 | Electro-magnetic fields/Induced voltages outside the track | The electro-magnetic fields (or induced/interference voltages) with shunting radios, vehicle radio frequency telecommunication systems (e.g. national radio or GSM-R ('Global System for Mobile communications — Railways'), etc. |
| 8.4.2.3 | Vehicle entrance impedance | Entrance impedance for the frequencies of the traction spectrum influencing the track circuits of the network, e.g. the entrance impedance at 50 Hz in the case of 50 Hz track circuits; entrance impedance to limit the inrush current, e.g. for DC track circuits. |
| 8.4.2.4 | Psophometric current | As defined in EN 50121-3-1 Annex A Interference on telecommunication lines — Psophometric currents. |
| 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 | Magnetic field for human exposure outside rolling stock (e.g. human exposure limits). |
| 8.4.3.2 | Induced interference current/voltage | |
| 8.4.3.3 | Psophometric current | As defined in EN 50121-3-1 Annex A Interference on telecommunication lines — Psophometric currents. |
| 8.5 | Protection against electrical hazards | Requirements for earthing are considered by parameter 8.3.4. |
| 8.6 | Diesel and other thermal traction system requirements | For 'Exhaust gas emissions' see parameter 6.2.1.2. |
| 8.7 | Systems requiring special monitoring and protection measures | |
| 8.7.1 | Tanks and pipe systems for flammable liquids | Special requirements for tanks and pipe systems for flammable liquids (including fuel). |
| 8.7.2 | Pressure vessel systems/pressure equipment | |
| 8.7.3 | Steam boiler installations | |

▼ M1

| Reference | Parameter | Explanations |
|-----------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8.7.4 | Technical systems in potentially explosive atmospheres | Special requirements for technical systems in potentially explosive atmospheres (e.g. liquid gas, natural gas and battery-powered systems, including protection of transformer tank). |
| 8.7.5 | Hydraulic/pneumatic supply and control systems | Functional and technical specifications, e.g. compressed air power supply, capacity, type, temperature range, air dryers (towers), dew point indicators, insulation, air intake characteristics, fault indicators, etc. |
| 9 | Staff facilities, interfaces and environment | |
| 9.1 | Driver's cab design | |
| 9.1.1 | Interior layout | General requirements concerning the cab interior layout such as anthropometric measurements of the driver, freedom of movement of personnel in the cab interior, seated and standing driving positions, number of seats (e.g. depending on one or two man operation). |
| 9.1.2 | Access to driver's cab | |
| 9.1.2.1 | Access, egress and doors | Requirements concerning accessibility to the driver's cab and engine room (also external walkways on hood units). Requirements concerning exterior and interior doors, hood access doors, door clearance, footsteps, handrails or opening handles, door locking, prevention from access by non-authorised persons. |
| 9.1.2.2 | Driver's cab emergency exits | Any means for driver's emergency exit or rescue services access to the cab (usually external doors, side windows or emergency hatches); definition of their clearances. |
| 9.1.3 | Windscreen in driver's cab | |

▼ M1

| Reference | Parameter | Explanations |
|-----------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.1.3.1 | Mechanical characteristics | Requirements concerning dimension, location, resist impacts from projectiles of the windscreen. |
| 9.1.3.2 | Optical characteristics | Requirements concerning optical characteristics of the windscreen, e.g. angle between primary and secondary images, permissible optical distortions of vision, material haze, luminous transmittance and chromaticity. |
| 9.1.3.3 | Equipment to the windscreen | E.g. de-icing, de-misting, external cleaning devices, sun protection, etc. |
| 9.1.3.4 | Front visibility/visibility field | Definition of visibility field for the driver to the line in front of him in relation to the driver's positions. Including wiper cleaning field. |
| 9.1.4 | Desk ergonomics | Requirements concerning ergonomics on the driver's desk, e.g. activation direction of levers and switches, ergonomics of emergency systems. |
| 9.1.5 | Driver's seat | Requirements concerning the driver's seat (e.g. anthropometric measurements, seat position in order to meet the reference position of eyes for external visibility, ability to escape in case of emergency, ergonomics and health aspects related to the seat's design, adjustability of the seat to enable standing driving position). |
| 9.2 | Health and safety | |
| 9.2.1 | Environmental conditions | |
| 9.2.1.1 | Heating, ventilation and air-conditioning systems in driver's cab | E.g. allowed CO ₂ concentration in the cab, air flows caused by the ventilation system having an air velocity exceeding the limit value recognised to ensure a proper working environment, temperature ranges, temperatures which have to be reached under certain environmental circumstances. |

▼ **M1**

| Reference | Parameter | Explanations |
|-----------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.2.1.2 | Noise in driver's cab | Maximum noise level allowed in the cab, including horn sound level inside the cab. |
| 9.2.1.3 | Lighting in driver's cab | E.g. luminosity of lighting, independent lighting of the driver's desk reading zone, lighting control, adjustability of luminosity of lighting, allowed light colour. |
| 9.2.2 | Other health and safety requirements | Other requirements than those in the list of parameters for the parameter 9.2 'Health and safety'. |
| 9.3 | Driver/machine interface | |
| 9.3.1 | Speed indication | Requirements concerning the speed indication system (accuracy/tolerances etc.). Excluded: recording of speed covered by parameter 9.6. |
| 9.3.2 | Driver display unit and screens | Functional requirements concerning the information and commands provided in the driver's cab. Excluded: ERTMS ('European Rail Traffic Management System') information and commands, including those provided on a display unit, are specified in chapter 12. |
| 9.3.3 | Controls and indicators | Functional requirements are specified with other requirements applicable to a specific function, in the clause describing that function. |
| 9.3.4 | Driver supervision | Requirements concerning the driver's vigilance, e.g. automatic vigilance safety system/deadman's device. |
| 9.3.5 | Rear and side view | Requirements concerning rear and side view: opening side windows/panel at each side of the cab, (clearance of the opening window/panel), exterior mirrors, camera system. |

▼ M1

| Reference | Parameter | Explanations |
|-----------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.4 | Marking and labelling in driver's cab | Requirements concerning signs, pictograms, labelling and statically displayed text for use of the driver inside the vehicle (cab, engine room, control cabinet). Which information has to be indicated in the driving cabs (usually Vmax, traction vehicle number, location of portable equipment, e.g. self-rescue device, signals, emergency exit). Use of harmonised pictograms. |
| 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 | E.g. Berne rectangle, handrails under the buffers. |
| 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 | This parameter addresses doors for freight use and for use of train crew other than cab doors. E.g. doors equipped with security device for opening only by staff including catering, also doors to engine room. Excluded: doors for passenger use, cab doors (also external walkways on hood units). |

▼ M1

| Reference | Parameter | Explanations |
|-----------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.5.3 | On-board tools and portable equipment | <p>Required on-board tools and portable equipment, e.g. hand-lamp with red and white light, short circuiting equipment for track-circuits, a respirator.</p> <p>Excluded: items for operational reasons such as scotches, coupling adapters, rescue couplers (see chapter 2), fire extinguishing equipment (see chapter 10) and see chapter 13 'Specific operational requirements'.</p> |
| 9.5.4 | Audible communication system | <p>E.g. for communication between: the train crew, or between the train crew (see parameter 10.2.3) and people inside/outside of the train (for passenger alarm see parameter 10.2.3).</p> <p>Excluded: train radio (see chapter 12).</p> |
| 9.6 | Recording device | <p>Recording device for the purpose of monitoring the interaction between train driver and the train as well as the parameters of the train. Requirements concerning the recording device, e.g. which information to be recorded, time increment, ability of event-time correlation, recording technology.</p> |
| 9.7 | Remote control function from the ground | <p>Requirements concerning the remote control function from the ground. Usually radio remote control function for shunting operation, also remote control by other means, excluded: push-pull train control and double head control.</p> |
| 10 | Fire safety and evacuation | |
| 10.1 | Fire protection concept and protection measures | <p>E.g. fire category, classification, protection measures for vehicles and parts of the vehicle (e.g. driver's cab), material properties, fire barriers, fire detectors (including ionisation detectors) and fire extinguishing equipment.</p> |
| 10.2 | Emergency | |
| 10.2.1 | Passenger evacuation concept | <p>Requirements regarding availability and design of passenger emergency exits and their indication, limitation on passengers per vehicle.</p> |

▼ M1

| Reference | Parameter | Explanations |
|-----------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10.2.2 | Rescue services' information, equipment and access | Description of rolling stock provided to the rescue services to permit them to handle emergencies. In particular information provided on how to obtain access to the interior of the rolling stock. |
| 10.2.3 | Passenger alarm | Requirements concerning passenger alarm, e.g. availability of alarm activation devices (location, number), functionality, how to reset, communication link from the passenger to the driver/staff, activation of emergency brake, emergency brake override. |
| 10.2.4 | Emergency lighting | Requirements for the emergency lighting system, e.g. for minimum operating time, lighting level/luminosity. |
| 10.3 | Emergency running capabilities | Measures for running capability of passenger rolling stock with a fire on board. Excluded: emergency brake override handled in parameter 10.2.3. |
| 11 | Servicing | |
| 11.1 | Train cleaning facilities | Train internal and external cleaning, e.g. external cleaning through a washing plant. |
| 11.2 | Train refuelling facilities | |
| 11.2.1 | Waste water disposal systems | Requirements concerning waste water disposal system, including interface to toilet discharge system. Usually definition of evacuation nozzle and the flushing connection for the toilet tank. Excluded: toilet emissions (see parameter 6.2.1.1). |
| 11.2.2 | Water supply system | Conformity to sanitary regulations regarding drinking water supply. Usually ensured by specifications of piping and sealing material and quality. Specification of filling adapters (interoperability constituents). |

▼ **M1**

| Reference | Parameter | Explanations |
|-----------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.2.3 | Further supply facilities | Requirements for any other supplies, e.g. external power supply for vehicles for stabling of trains. |
| 11.2.4 | Interface to refuelling equipment for non-electric rolling stock | Requirements concerning refuelling system for rolling stock using diesel fuel, LPG or other combustibles. |
| 12 | On-board control command and signalling | |
| 12.1 | On-board radio system | |
| 12.1.1 | Non-GSM-R radio system | Requirements for national radio systems if the installation on a vehicle is mandatory for authorisation. |
| 12.1.2 | GSM-R compliant radio system | |
| 12.1.2.1 | Use of hand portables as cab mobile radio | Requirements related to hand portables fulfilling cab radio functions. Indicate here if the 2 Watt hand portable can be used as an option or not and what are the related requirements, restrictions, etc., taking into account Section 7.3.3. 'ERTMS — On-board implementation' of Commission Decision 2012/88/EU ⁽¹⁾ . |
| 12.1.2.2 | Other GSM-R requirements | Other requirements related to GSM-R disturbances, installation of filters, etc., which cannot be categorised under the former points. |
| 12.2 | On-board signalling | |
| 12.2.1 | National on-board signalling systems | Requirement to have national on-board train protection systems installed on-board (such as EBICAB) and corresponding functional requirements. |
| 12.2.2 | STM requirements | Requirements related to STM solutions (separate STM or integrated within ETCS on-board). |
| 12.2.3 | Transitions | Requirements related to transitions between national on-board signalling systems and ETCS; between ETCS and ETCS etc., at the borders of or within the Member State. |

▼ **M1**

| Reference | Parameter | Explanations |
|-----------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12.2.4 | Compatibility of rolling stock with CCS Trackside | Other compatibility requirements than EMC for Rolling Stock with track-side CCS train detection systems, for EMC see 8.4.2. |
| 12.2.4.1 | Minimum axle distance | Requirement related to the functioning of axle counters, for $v > 350$ km/h, see § 3.1.2.3 of the document (ERA/ERTMS/033281): Interfaces between CCS trackside and other subsystems. |
| 12.2.4.2 | Minimum wheel diameter | Requirement related to the functioning of axle counters, for $v > 350$ km/h, see § 3.1.3.2 of the document (ERA/ERTMS/033281): Interfaces between CCS trackside and other subsystems. |
| 12.2.4.3 | Metal and inductive components-free space between wheels | Requirement related to the functioning of axle counters, see § 3.1.3.5 of the document (ERA/ERTMS/033281): Interfaces between CCS trackside and other subsystems. |
| 12.2.4.4 | Metal mass of a vehicle | Requirement related to the functioning of loop detection system. |
| 12.2.4.5 | Compatibility with fixed installations of CCS | Compatibility with fixed installations of CCS, see § 3.1.10 of the document (ERA/ERTMS/033281): Interfaces between CCS trackside and other subsystems. |
| 12.2.5 | ETCS (?) cab signalling system | |
| 12.2.5.1 | Level crossing functionality | Requirements for the set of specifications No 1 in Table A2 of the Annex A to the CCS TSI laid down in Decision 2012/88/EU related to the level crossing functionality for ETCS on-board. |
| 12.2.5.2 | Braking safety margins | Requirements for the set of specifications No 1 in Table A2 of the Annex A to the CCS TSI laid down in Decision 2012/88/EU related to the reliability of the braking curve for the on-board CCS. |
| 12.2.5.3 | Reliability — availability requirements | Minimum reliability/availability requirements shall be specified in order to limit the decrease of the system safety due to the frequent occurrence of degraded situations. |

▼ **M1**

| Reference | Parameter | Explanations |
|-----------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12.2.5.4 | Safety requirements | Safety requirements for ETCS DMI functions for the set of specifications No 1 in Table A2 of the Annex A to the CCS TSI laid down in Decision 2012/88/EU. |
| 12.2.5.5 | Ergonomic aspects of DMI | Ergonomic DMI requirements for the set of specifications No 1 in Table A2 of the Annex A to the CCS TSI laid down in Decision 2012/88/EU. |
| 12.2.5.6 | Interface with service brake | Interface requirements with the service brake for the set of specifications No 1 in Table A2 of the Annex A to the CCS TSI laid down in Decision 2012/88/EU. |
| 12.2.5.7 | Other ETCS requirements (related to existing not interoperable networks) | ETCS requirements related to pre-B2 on-board equipment, compatibility with existing lines where pre-B2 equipment is installed. Or ETCS optional functionalities that may have an impact on the safe movement of the train. |
| 12.2.5.8 | Specification of condition of use where ETCS on-board does not implement all functions, interfaces and performances | Analysis of the impact when not implementing all functions, performances and interfaces specified in CCS TSI by the ETCS on-board subsystem. Useful for additional authorisations. |
| 13 | Specific operational requirements | |
| 13.1 | Specific items to place on-board | To announce specific items to place on-board which are required for operational reasons in normal and degraded mode (e.g. scotches, if the parking brake performance is not sufficient depending on track gradient, coupling adapters, rescue couplers, etc.). Requirements for distribution and availability of the items may be added here. See also parameter 9.5.3. |

▼ **M1**

| Reference | Parameter | Explanations |
|-----------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13.2 | Ferry transport | Requirements concerning the use of ferries by the vehicle, including running gear and vehicle gauge constraints, requirements for securing and fixing. |
| 14 | Freight-related items | Freight-specific requirements. |
| 14.1 | Design, operation and maintenance constraints for the transport of dangerous goods | E.g. requirements derived from RID, national rules or other regulations for the transport of dangerous goods; including facilities specifically required for dangerous goods. |
| 14.2 | Specific facilities for the transport of freight | E.g. securing of freight, air-supply for other purpose than brake, provisions for the hydraulic/pneumatic equipment of freight wagons, requirements for freight loading and unloading, special requirements to the vehicle for vehicle turn dumping. |
| 14.3 | Doors and loading facilities | Requirements concerning freight loading doors and hatches, their closing and locking. |

(¹) Commission Decision 2012/88/EU of 25 January 2012 on the technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system (OJ L 51, 23.2.2012, p. 1), as amended by Commission Decision 2012/696/EU.

(²) See Annex A, Table A2, index No 1 of CCS TSI Decision 2012/88/EU.