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Annex I: Amendments to Technical specification for interoperability relating to the subsystem 'Rolling stock – Locomotive and passenger rolling stock' (Annex to Regulation 1302/2014)

1. In chapter 4 'Characterisation of the rolling stock subsystem', point 4.2.2.2.3 (b)(b-2)(1) is replaced by the following:

- (1) The buffers and the screw coupling shall be installed according to clauses 5 and 6 of the specification referenced in Appendix J-1, index 110.

2. In chapter 4 'Characterisation of the rolling stock subsystem':

Point 4.2.2.2.3 (b)(b-2)(2) is replaced by the following:

- (2) The dimensions and layout of brake pipes and hoses, couplings and cocks shall meet the requirements set out in clauses 7 and 8 of the specification referenced in Appendix J-1, index 110.

Point 4.2.2.6 (7) is replaced by the following:

- (7) The geometry of permanent built-in jacking/lifting points shall be compliant with the specification referenced in Appendix J-1, index 9, clause 5.2; the geometry of removable jacking/lifting points shall be compliant with the specification referenced in Appendix J-1, index 9, clause 5.3.

3. In chapter 4 'Characterisation of the rolling stock subsystem', point 4.2.4.8.2 (1) is replaced by the following:

- (1) Requirements on magnetic brakes specified for compatibility with train detection system based on axle counters are referenced in point 4.2.3.3.1.2 (10) of this TSI.

4. In chapter 4 'Characterisation of the rolling stock subsystem', the following point is added below point 4.2.4.8.2 (4):

- (5) The braking performance of the unit specified in clauses 4.2.4.5.2 of this TSI shall be determined with and without the use of magnetic track brakes.

5. In chapter 4 'Characterisation of the rolling stock subsystem', clause 4.2.4.8.3 'Eddy current track brake' is replaced by the following clause:

'4.2.4.8.3 Eddy current track brake

- (1) This clause covers only eddy current track brake developing a brake force between the unit and the rail.

- (2) Requirements on eddy current track brakes specified for compatibility with train detection system based on axle counters, track circuits, wheel detectors and vehicle detectors based on inductive loops are referenced in point 4.2.3.3.1.2 (10) of this TSI.

- (3) If the eddy current track brake requires a displacement of its magnets when the brake is applied, the unobstructed movement of such magnets between the 'brake released' and 'brake applied' positions shall be demonstrated by calculation in accordance with the specification referenced in Appendix J-1, index 14.
 - (4) The maximum distance between the eddy current track brake and the track corresponding to 'brake released' position will be recorded in the technical documentation described in clause 4.2.12 of this TSI.
 - (5) The eddy current track brake shall not operate below a fixed speed threshold.
 - (6) The conditions for use of eddy current track brake for technical compatibility with the track are not harmonised (regarding in particular their effect on rail heating and vertical force). The Register of Infrastructure indicates per track section if their use is allowed, and provides in such case their conditions for use.
 - (7) In order to allow the verification of compatibility of the unit with a network or route, the following technical characteristics of eddy current track brakes shall be recorded in the technical documentation described in clause 4.2.12 of this TSI:
 - The maximum distance between the eddy current track brake and the track corresponding to 'brake released' referred to in point (4)
 - fixed speed threshold referred to in point (5),
 - vertical force as a function of the train speed, for the case of full application of eddy current track brake (emergency braking) and limited application of eddy current brake (service braking)
 - braking force as a function of the train speed, for the case of full application of eddy current track brake (emergency braking) and limited application of eddy current brake (service braking)
 - (8) The braking performance of the unit specified in clauses 4.2.4.5.2 and 4.2.4.5.3 of this TSI shall be determined with and without the use of eddy current track brakes.'
6. In chapter 4 'Characterisation of the rolling stock subsystem', clause 4.2.6.2.5 'Aerodynamic effect on ballasted tracks' is replaced by the following clause:
- '4.2.6.2.5 Aerodynamic effect on ballasted tracks
- (1) This requirement applies to units of maximum design speed higher than 250 km/h.
 - (2) This requirement addresses the aerodynamic effect of trains on ballasted tracks, in order to limit risks induced by the projection of ballast (ballast pick up).
 - (3) This requirement is an open point.

7. In chapter 4 'Characterisation of the rolling stock subsystem', clause 4.2.8.2.8 'On-board energy measurement system' is replaced by the following clause:

'4.2.8.2.8 On-board energy measurement system

4.2.8.2.8.1 General

- (1) The on-board energy measurement system (EMS) is the system for measurement of all active and reactive electric energy taken from or returned (during regenerative braking) to the overhead contact line (OCL) by the electric unit.
- (2) The EMS shall include at least the following functions: Energy measurement function (EMF) as set out in clause 4.2.8.2.8.2, data handling system (DHS) as set out in clause 4.2.8.2.8.3.
- (3) A suitable communication system will send the measured data to an on-ground data collecting system (DCS). The interface protocols and transferred data format between EMS and DCS shall fulfil the requirements set out in point 4.2.8.2.8.4.
- (4) This system is suitable for billing purposes; the data defined in point 4.2.8.2.8.3 (4) provided by this system shall be accepted for billing in all Member States.
- (5) The EMS rated current and voltage shall be matched to the electric unit rated current and voltage; it shall continue to function correctly when changing between several traction energy supply systems.
- (6) Data stored in the EMS shall be protected against loss of the power supply and the EMS shall be protected from non-authorized access.
- (7) An on-board location function providing location data originated from an external source to the DHS shall be provided in networks where such function is necessary for billing purposes only. In any case, the EMS system shall be able to accommodate a compatible location function. If the location function is provided, it shall fulfil the requirements set out in specification referenced in Appendix J-1, index 116.
- (8) The fitment of an EMS, its on-board location function, the description of on-board to ground communication and the metrological control including the accuracy class of the EMF shall be recorded in the technical documentation described in clause 4.2.12.2 of this TSI.
- (9) The maintenance documentation described in clause 4.2.12.3 of this TSI shall include any periodic verification procedure to ensure the required accuracy level of the EMS during its lifetime.

4.2.8.2.8.2 Energy measurement function (EMF)

- (1) The EMF shall ensure the measurement of the voltage and current, calculation of the energy and production of energy data.
- (2) The measured energy values produced by EMF shall have a time reference period of 5 minutes defined by the Universal Time Coordinated (UTC) clock time at the end of each time reference period; originating from the time stamp 00:00:00; It is permitted to use a shorter measuring period if the data can be aggregated on-board into 5 minutes time reference period.

- (3) The accuracy of EMF for active energy measurement shall comply with clauses 4.2.3.1 to 4.2.3.4 of the specification referenced in Appendix J-1, index 117.
- (4) Each device containing one or more functions of EMF shall indicate: metrological control, and its accuracy class, according to the class designations specified in the specification referenced in clauses 4.3.3.4, 4.3.4.3 and 4.4.4.2 of the specification referenced in Appendix J-1, index 117.
- (5) The conformity assessment of the accuracy is set out in clause 6.2.3.19b.

4.2.8.2.8.3 Data handling system (DHS)

- (1) The DHS shall ensure the production of compiled energy billing data sets for energy billing purposes, by merging data from the EMF with time data and, when required, geographical position, and storing it ready to be sent to an on-ground data collecting system (DCS) by a communication system.
- (2) The DHS shall compile the data without corrupting them and shall incorporate data storage with a memory capacity sufficient to store the compiled data of at least 60 days continuous operation. The time reference used shall be the same as in the EMF.
- (3) The DHS shall have a capability to be interrogated locally on-board for audit and data recovery purposes.
- (4) The DHS shall produce compiled energy billing data sets, (CEBD), by merging the following data for each time reference period:
 - unique EMS consumption point identification (CPID) as defined in the specification referenced in Appendix J-1, index 118.
 - end time of each period, defined as year, month, day, hour, minute and second;
 - location data at the end of each period;
 - consumed/regenerated active and reactive (if appropriate) energy in each period, in units of Watthour (active energy) and var-hour (reactive energy) or their decimal-multiples.
- (5) The conformity assessment of compilation and handling of data produced by DHS is set out in clause 6.2.3.19b.

4.2.8.2.8.4 Interface protocols and transferred data format between EMS and DCS

- (1) The data exchange between EMS and DCS shall fulfil the following requirements:
 - The application services (service layer) of the EMS shall comply with clause 4.3.3.1 of the specification referenced in Appendix J-1, index 119.
 - User access rights for these application services shall comply with clause 4.3.3.3 of the specification referenced in Appendix J-1, index 119.
 - The structure (data layer) for these application services shall comply with the XML schema as defined in clause 4.3.4 of the specification referenced in Appendix J-1, index 119.
 - The message mechanism (message layer) for supporting these application services shall comply with the methods and the XML schema in clause 4.3.5 of the specification referenced in Appendix J-1, index 119.
 - The application protocols for supporting the message mechanism shall comply with clause 4.3.6 of the specification referenced in Appendix J-1, index 119.

- The EMS shall use at least one of the communication architectures in clause 4.3.7 of the specification referenced in Appendix J-1, index 119.”
8. In chapter 4 ‘Characterisation of the rolling stock subsystem’, point 4.2.11.6 (4) is replaced by the following:
- (4) ‘Single pole’ power supply line (AC 1 kV, AC/DC 1.5 kV, DC 3 kV), in accordance with the specification referenced in Appendix J-1, index 111.
9. In chapter 4 ‘Characterisation of the rolling stock subsystem’, the following point is added below point 4.2.12.2 (3):
- ‘(3b) For units designed and assessed for general operation, this shall include a description of the electric interfaces between units and of communication protocols, with the reference to the standards or other normative documents that have been applied. Communication protocols (if used) shall comply with the specification referenced in Appendix J-1, index 112.’
10. In chapter 4 ‘Characterisation of the rolling stock subsystem’, the following point is added below point 4.2.12.2 (9):
- ‘(9b) Maximum distance between the eddy current track brake and the track corresponding to ‘brake released’, fixed speed threshold referred to in point, vertical force and braking force as a function of the train speed, for the case of full application of eddy current track brake (emergency braking) and limited application of eddy current brake (service braking), as required in clause 4.2.4.8.3.’
11. In chapter 4 ‘Characterisation of the rolling stock subsystem’, the point 4.2.12.2 (14) is replaced by the following:
- ‘(14) Fitment of an on-board energy measurement system, and of its on-board location function (optional), as required in clause 4.2.8.2.8; Description of on-board to ground communication and the metrological control including the accuracy classes of the voltage measurement, current measurement and energy calculation functions’
12. In chapter 6 ‘Assessment of conformity or suitability for use and ‘EC’ verification’, the following clause is added below the clause 6.2.3.19:

‘6.2.3.19b On-board energy measurement system (clause 4.2.8.2.8)

(1) Energy measurement function (EMF)

The accuracy of the each device containing one or more functions of EMF shall be assessed by testing each function, under reference conditions, using the relevant method as described in clauses 5.4.3.4.1, 5.4.3.4.2 and 5.4.4.3.1 of the specification referenced in Appendix J-1, index 117. The input quantity and power factor range when testing shall correspond to the values set out in Table 3 of the specification referenced in Appendix J-1, index 117.

The effects of temperature on accuracy of the each device containing one or more functions of EMF shall be assessed by testing each function, under reference conditions (except for temperature), using the relevant method as described in clauses 5.4.3.4.3.1, and 5.4.4.3.2.1 of the specification referenced in Appendix J-1, index 117.

The mean temperature coefficient of each device containing one or more functions of EMF shall be assessed by testing each function, under reference conditions (except for temperature), using the relevant method as described in clauses 5.4.3.4.3.2 and 5.4.4.3.2.2 of the specification referenced in Appendix J-1, index 120.

(2) Data handling system (DHS)

The compiling and handling of data within the DHS shall be assessed by testing using the method as described in the specification referenced in Appendix J-1, index 121.

(3) On-board energy measurement system (EMS)

The EMS shall be assessed by testing as described in the specification referenced in the specification referenced in Appendix J-1, index 122.'

13. In chapter 6 'Assessment of conformity or suitability for use and 'EC' verification', the following clause is added below the clause 6.2.7:

'6.2.7a Additional optional requirements for units intended to be used in general operation

- (1) The compliance with the following set of conditions (2) to (9) is optional. If the applicant selects this option, a notified body has to assess the compliance within the EC verification procedure. This shall be reported in the certificate and in the technical documentation.
- (2) The unit shall be fitted with a manual coupling system as defined in clauses 4.2.2.2.3 b) and 5.3.2
- (3) The unit shall be fitted with an EN-UIC braking system as defined in the specification referenced in Appendix J-1, index 22.
- (4) The unit shall meet the requirements of this TSI at least within the temperature range T1 (– 25 °C to + 40 °C; nominal) as defined in clause 4.2.6.1 of this TSI and in the specification referenced in Appendix J-1, index 34.
- (5) The tail lights requested in clause 4.2.7.1 shall be provided by fixed tail lamps.
- (6) If the unit is fitted with a gangway, the gangway shall fulfil the specification referenced in Appendix J-1, index 113.
- (7) Power supply shall be compliant to point 4 of clause 4.2.11.6
- (8) The physical interface between units for the signal transmission shall ensure that the cable and plug of at least one line is compatible with the 18-conductor cable defined in plate 2 of the specification referenced in Appendix J-1, index 114.
- (9) The unit shall be marked at least with the following markings in accordance with the specification referenced in Appendix J-1, index 115:
 - Length over buffers
 - Electric power supply'

14. In Chapter 7, '...', the following clause is added after clause 7.1.1.7:

7.1.1.8 Transitional measure on aerodynamic effect on ballasted tracks

- (1) For units of maximum design speed lower or equal to 300 km/h, this requirement is fulfilled if it is proven that the underside geometry and relevant equipment are the same as those of a train already operated on ballasted tracks of the European network at the same or higher speed before 31st December 2017.
- (2) This transitional measure is applicable until the open point of clause 4.2.6.2.5 is closed

15. In the list 'APPENDICES' below Chapter 7, the text 'Appendix A: Buffer and draw gear' is replaced by 'Appendix A: NOT USED' and the text 'Appendix D: Energy meter' is replaced by 'Appendix D: NOT USED'.

16. The text below Appendix A is replaced by 'NOT USED'. The text below Appendix D is replaced by 'NOT USED'.

17. In the table of appendix H, 'Assessment of the rolling stock subsystem', the row:

Eddy current track brake	4.2.4.8.3	open	Open	Open	Open
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Is replaced by the following:

Eddy current track brake	4.2.4.8.3	X	X	n.a.	–
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18. In the first table of appendix I 'Aspects for which the technical specification is not available (open points)', the following row:

Braking system independent of adhesion conditions	4.2.4.8.3	Eddy current track brake	Equipment not mandatory. Compatibility with concerned network to be checked.
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is replaced by:

Braking system independent of adhesion conditions	4.2.4.8.3	Eddy current track brake	Equipment not mandatory. Electromagnetic compatibility with concerned network.
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19. In the first table of appendix I 'Aspects for which the technical specification is not available (open points)', the following row:

Aerodynamic effect on ballasted track for RST of design speed \geq 190 km/h	4.2.6.2.5	Limit value and conformity assessment in order to limit risks induced by the projection of ballast	Ongoing work within CEN. Open point also in TSI INF.
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is replaced by:

Aerodynamic effect on ballasted track for RST of design speed > 300 km/h	4.2.6.2.5	Limit value and conformity assessment in order to limit risks induced by the projection of ballast	Ongoing work within CEN. Open point also in TSI INF.
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20. In the second table of appendix I 'Aspects for which the technical specification is not available (open points)', the following row is deleted:

On-board energy measurement system	4.2.8.2.8 and Appendix D	On-board to ground communication: specification related to interface protocols and transferred data format	Description of on-board to ground communication shall be provided in the technical documentation. The standard series EN 61375-2-6 should be used.
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21. In appendix J-1 'Standards or normative documents', the following replacements are performed:

- In Index 7, 'Appendix C.C' is replaced by 'Appendix C.1'
- In Index 102, 'Annex C.1' is replaced by 'Appendix C.1'
- EN 15595:2009 is replaced by EN 15595:2009+A1:2011
- 'EN 15153-1:2013' is replaced by 'EN 15153-1:2013+A1:2016'
- 'EN 13260:2009+A1:2010 +A2:2012 ' is replaced by 'EN13260:2009+A1:2010'

22. In appendix J-1, 'Standards or normative documents', the indexes 6, 9, 14, 22, 103, 104 and 105 are replaced by the indexes below:

6	Staff access for coupling and uncoupling — space for shunting staff	4.2.2.2.5	FprEN 16839:2017	4
9	Lifting and jacking - geometry of permanent and removable points	4.2.2.6	EN16404:2016	5.2, 5.3

14	Gauging — method, reference contours	4.2.3.1	EN 15273-2:2013+A1:2016	relevant cl. (1)
	verification of eddy current track brakes	4.2.4.8.3(3)		relevant cl. (1)
	verification of pantograph gauge			A.3.12
22	Braking – type of brake system, UIC brake system	4.2.4.3 6.2.7a	EN 14198:2016	5.4
103	NOT USED			
104	NOT USED			
105	NOT USED			

23. In appendix J-1, 'Standards or normative documents', the indexes below are added:

110	End coupling – Compatibility between units – manual UIC type	4.2.2.2.3	FprEN 16839:2017	5, 6
				7, 8
111	'Single pole' power supply line	4.2.11.6	CLC/TS 50534:2010	Annex A
112	Communication protocols	4.2.12.2	IEC 61375	relevant cl. (1)
113	Gangways-Flange intercommunication connections	6.2.7a	EN 16286-1:2013	Annexes A and B

114	Physical interface between units for the signal transmission	6.2.7a	UIC 558, January 1996	Plate 2
115	Marking: length over buffers and electric power supply	6.2.7a	EN 15877-2:2013	4.5.5.1 4.5.6.3
116	On-board location function- Requirements	4.2.8.2.8.1	EN 50463-3:2017	4.4
117	Accuracy of energy measurement function for active energy measurement: Requirements Class designations Assessment methodology	4.2.8.2.8.2 6.2.3.19b	EN 50463-2:2017	4.2.3.1 and 4.2.3.4 4.3.3.4, 4.3.4.3 and 4.4.4.2 5.4.3.4.1, 5.4.3.4.2, 5.4.4.3.1, Table 3, 5.4.3.4.3.1 and 5.4.4.3.2.1
118	Energy measurement function: consumption point identification - Definition	4.2.8.2.8.3	EN 50463-1:2017	4.2.5.2
119	Interface protocols between on-board energy measurement system (EMS) and on-ground data collection system (DCS) - Requirements	4.2.8.2.8.4	EN 50463-4:2017	4.3.3.1, 4.3.3.3, 4.3.4, 4.3.5, 4.3.6 and 4.3.7

120	Energy measurement function: mean temperature coefficient of each device - Assessment methodology	6.2.3.19b	EN 50463-2:2017	5.4.3.4.3.2 and 5.4.4.3.2.2
121	The compiling and handling of data within the data handing system- Assessment methodology	6.2.3.19b	EN 50463-3:2017	5.4.8.3, 5.4.8.5 and 5.4.8.6
122	On- board energy measurement system- Tests	6.2.3.19b	EN 50463-5:2017	5.3.3 and 5.5.4

