EUROPEAN
COMMISSION

Brussels, XXX
ENE
[…](2022) XXX draft

ANNEX 4

ANNEX

to the

Commission implementing Regulation

amending Commission Regulations: (EU) No 321/2013, No 1299/2014, No 1300/2014, No 1301/2014, No 1302/2014, No 1304/2014 and Commission Implementing Regulation (EU) 2019/777

ANNEX IV

The Annex to Regulation (EU) No 1301/2014 is amended as follows:

(1) in point 2.1(2), point (a) is replaced by the following:

"(a) substations: connected on the primary side to the high-voltage grid, with transformation of the high-voltage to a voltage and/or conversion to a traction power supply system suitable for the trains. On the secondary side, substations are connected to the railway contact line system;";

(2) point 2.1.1 is replaced by the following:

"2.1.1Traction power supply

(1) The objective of the traction power supply system is to supply every train with power in order to meet the planned timetable.

(2) Basic parameters for traction power supply system are set out in point 4.2.";

(3) in point 2.1.2, point (1) is replaced by the following:

"(1) The objective is to ensure reliable and continuous power transfer from the traction power supply system to the rolling stock. The interaction between the overhead contact line and the pantograph is an important aspect of interoperability.";

(4) in Chapter 3, the Table, rows 4.2.4 and 4.2.5 are replaced by the following:

"

4.2.4	Traction power supply performance	—	—	—	—	1.5 2.2.3	—
4.2.5	Current at standstill	—	—	—	—	1.5 2.2.3	—

";

(5) point 4.2.1 is replaced by the following:

"4.2.1 (not used)";

(6) point 4.2.2.1 is replaced by the following:

"4.2.2.1 Traction power supply system:

(a) Voltage and frequency (4.2.3);

(b) Parameters relating to traction power supply system performance (4.2.4);

(c) Current at standstill (4.2.5);

(d) Regenerative braking (4.2.6);

(e) Electrical protection coordination arrangements (4.2.7);

(f) Harmonics and dynamic effects for AC traction power supply systems (4.2.8).";

(7) point 4.2.3 is replaced by the following:

"4.2.3Voltage and frequency

The nominal voltage and nominal frequency of the traction power supply system shall be one of the four systems:

(a) AC 25 kV, 50 Hz;

(b) AC 15 kV, 16,7 Hz;

(c) DC 3 kV;

(d) DC 1,5 kV.

For new lines with speed greater than 250 km/h, implementation rules are specified in point 7.1.1.";

(8) point 4.2.4 is replaced by the following:

"4.2.4 Traction power supply system performance

For newly built subsystems, or in the case the traction power supply system is changed (e.g. migration from DC to AC), the quality index for the subsystem shall comply with the specification referenced in Appendix E, Index [1] in order to enable trains to meet the design timetable.";

(9) point 4.2.5 is replaced by the following:

"4.2.5Current at standstill

The OCL shall be designed to sustain at least the values of current at standstill per pantograph, in accordance with the specification referenced in Appendix E, Index [2].";

(10) in point 4.2.6, point (1) is replaced by the following:

"(1) The electric traction power supply systems shall be designed to allow the use of regenerative braking according to the specification referenced in Appendix E, Index [1].";

(11) point 4.2.7 is replaced by the following:

"4.2.7Electrical protection coordination arrangements

Electrical protection coordination design of the energy subsystem shall comply with the requirements detailed in the specification referenced in Appendix E, Index [1].";

(12) in point 4.2.8, point (2) is replaced by the following:

"(2) In order to avoid instability and achieve electrical system compatibility, harmonic overvoltages shall be limited below critical values in accordance with the specification referenced in Appendix E, Index [1].";

(13) point 4.2.9 is amended as follows:

(a) in point (1), "7.2.3" is replaced by "7.1.2";

(b) point (2) is replaced by the following:

"(2) The contact wire height and the lateral deviation of the contact wire under the action of a crosswind are factors which govern the interoperability of the rail network.";

(14) in point 4.2.9.1, points (1), (2) and (3) are replaced by the following:

"(1) The permissible data for contact wire height is given in Table 4.2.9.1.

Table 4.2.9.1		
Contact wire height		
Description	v ≥ 250 [km/h]	v < 250 [km/h]
Nominal contact wire height [mm]	Between 5080 and 5300	Between 5000 and 5750
Minimum design contact wire height [mm]	5080	In accordance with the specification referenced in Appendix E, Index [3] depending on the chosen gauge
Maximum design contact wire height [mm]	5300	6200([1])
([1]) Taking into account tolerances and uplift in accordance with the specification referenced in Appendix E, Index [3], the maximum contact wire height shall not be greater than 6500 mm.		

(2) For the relation between the contact wire heights and pantograph working heights see the specification referenced in Appendix E, Index [3].

(3) At level crossings, the contact wire height shall be specified by national rules or in the absence of national rules, in accordance with the specification referenced in Appendix E, Index [4].";

(15) point 4.2.9.2 is amended as follows:

(a) point (1) is replaced by the following:

"(1) The maximum lateral deviation of the contact wire in relation to the track centre line under action of crosswind shall be in accordance with the specification referenced in Appendix E, Index [2].";

(b) point (3) is replaced by the following:

"(3) Track gauge system 1 520 mm:

For Member States applying the pantograph profile in accordance with point 4.2.8.2.9.2.3 of the Annex to Regulation (EU) No 1302/2014 (LOC&PAS TSI) the maximum lateral deviation of the contact wire in relation to the pantograph centre under action of a cross wind shall be 500 mm.";

(16) point 4.2.10 is replaced by the following:

" 4.2.10. Pantograph gauge

(1) Track gauge system other than 1520 mm:

The mechanical kinematic pantograph gauge shall be specified using the method given in the specification referenced in Appendix E, Index [2] to this Annex and the pantograph profiles defined in LOC&PAS TSI, clauses 4.2.8.2.9.2.1 and 4.2.8.2.9.2.2.

(2) Track gauge system 1520 mm:

For Member States applying the pantograph profile in accordance with LOC&PAS TSI, clause 4.2.8.2.9.2.3, the static gauge available for pantograph is defined in Appendix D to this Annex.

(3) No part of the energy sub-system shall enter the pantograph gauge as stated in points (1) and (2), except for the contact wire and steady arm.";

(17) in point 4.2.11, points (2) and (3) are replaced by the following:

"(2) The ranges of F_m for each of the traction power supply systems are defined in the specification referenced in Appendix E, Index [2].

(3) The overhead contact lines shall be designed to be capable to sustain the upper design limit of F_m given in the specification referenced in Appendix E, Index [2].";

(18) in point 4.2.12, points (2) and (3) are replaced by the following:

"(2) S_0 is the simulated or measured uplift of the contact wire at a steady arm, with a minimum of two pantographs operating simultaneously with the upper limit of F_m at the OCL design speed. When the uplift of the steady arm is physically limited due to the overhead contact line design, it is permissible for the necessary space to be reduced to $1{,}5S_0$ (refer to the specification referenced in Appendix E, Index [3]).

(3) Maximum force (F_{max}) is usually within the range of F_m plus three standard deviations σ_{max}; higher values may occur at particular locations and are given in the specification referenced in Appendix E, Index [3]. For rigid components such as section insulators in overhead contact line systems, the contact force can increase up to a maximum of 350 N.";

(19) point 4.2.13 is replaced by the following:

"4.2.13. Pantograph spacing for overhead contact line design

The overhead contact line shall be designed for trains with two pantographs operating simultaneously. The design spacing of the two pantograph heads, centre line to centre line, shall be equal or lower than values set out in the specification referenced in Appendix E, Index [2].";

(20) in point 4.2.14, point (3) is replaced by the following:

"(3) Permissible materials for contact wires are copper and copper-alloy. The contact wire shall comply with the requirements of the specification referenced in Appendix E, Index [5].";

(21) point 4.2.15 is replaced by the following:

"4.2.15 Phase separation sections

4.2.15.1 General

(1) The design of phase separation sections shall ensure that trains can move from one section to an adjacent one without bridging the two phases. Power exchange between the OCL and the unit shall be brought to zero, by switching off the circuit breaker or other equivalent means, before entering the phase separation section. Adequate means (except for the short separation section) shall be provided to allow a train that is stopped within the phase separation section to be restarted.

(2) The overall length D of neutral sections is defined in the specification referenced in Appendix E, Index [2]. For the calculation of D, clearances in

accordance to the specification referenced in Appendix E, Index [3] and an uplift of S_0 shall be taken into account.

4.2.15.2 Lines with speed v ≥ 250 km/h

Two types of design of phase separation sections may be adopted:

(a) a phase separation design where all the pantographs of the longest TSI compliant trains are within the neutral section. The overall length of the neutral section shall be at least 402 m.

For detailed requirements see the specification referenced in Appendix E, Index [2];

(b) a shorter phase separation with three insulated overlaps as shown in the specification referenced in Appendix E, Index [2]. The overall length of the neutral section is less than 142 m including clearances and tolerances.

4.2.15.3 Lines with speed v < 250 km/h

The design of separation sections shall normally adopt solutions as described in the specification referenced in Appendix E, Index [2]. Where an alternative solution is proposed, it shall be demonstrated that the alternative is at least as reliable.";

(22) point 4.2.16.1 is amended as follows:

(a) in point (1), the first sentence is replaced by:

"The design of system separation sections shall ensure that trains can move from one traction power supply system to an adjacent different traction power supply system without bridging the two systems.";

(b) point (3) is replaced by the following:

"(3) The overall length D of neutral sections is defined in the specification referenced in Appendix E, Index [2]. For the calculation of D clearances, the specification referenced in Appendix E, Index [3] and an uplift of S_0 shall be taken into account.";

(23) point 4.2.16.2 is amended as follows:

(a) point (1) is replaced by the following:

"(1) Power exchange between the OCL and the unit shall be brought to zero by switching off the circuit breaker or other equivalent means, before entering the system separation section.";

(b) in point (2), points (b) and (c) are replaced by the following:

"(b) provision shall be made in the energy subsystem to avoid bridging of both adjacent traction power supply systems should the opening of the on-board circuit breaker(s) fail;

(c) variation in contact wire height along the entire separation section shall fulfil requirements set in the specification referenced in Appendix E, Index [3].";

(24) in point 4.2.16.3, point (2) is replaced by the following:

"(2) If a system separation section is traversed with pantographs lowered, it shall be designed so as to avoid the electrical connection of the two traction power supply systems by an unintentionally raised pantograph.";

(25) in point 4.2.17, points (2) and (3) are replaced by the following:

"(2) The on-ground energy Data Collecting System (DCS) shall receive, store and export CEBD without corrupting it, in accordance with the specification referenced in Appendix E, Index [6].

(3) The on-ground energy DCS shall support all the data exchange requirements as defined in point 4.2.8.2.8.4 of the LOC&PAS TSI and requirements set out in the specification referenced in Appendix E, Index [7].";

(26) point 4.2.18 is replaced by the following:

"4.2.18 Protective provisions against electric shock

Electrical safety of the overhead contact line system and protection against electric shock shall be achieved by compliance with the specification referenced in Appendix E, Index [4] and, regarding AC voltage limits for the safety of persons and DC voltage limits, by compliance with the specification referenced in Appendix E, Index [4].";

(27) in point 4.3.2, the table is amended as follows:

(a) the second and third rows are replaced by the following:

"

Traction power supply performance	4.2.4	Max current from OCL Power factor	4.2.8.2.4 4.2.8.2.6
Current at standstill	4.2.5	Maximum current at standstill	4.2.8.2.5

";

(b) the sixth row is replaced by the following:

"

Harmonics and dynamic effects for AC traction power supply systems	4.2.8	Harmonics and dynamic effects for AC systems	4.2.8.2.7

";

(28) in point 4.3.4, points (2) and (3) are replaced by the following:

"(2) However, the information is transmitted between the ETCS trackside and the ETCS on-board sub-systems as well as between the ETCS on-board and the vehicle power system. Consequently, the transmission interface is specified in the Annex to *[PO please insert recast of Commission Regulation (EU) 2016/919* (CCS TSI*)] and the LOC & PAS TSI.

(3) The relevant information to perform the switching off of the circuit breaker, the change of maximum train current, the change of the traction power supply system and the pantograph management shall be transmitted via ETCS when the line is equipped with ETCS and those trackside functionalities are implemented.

_____

* Commission Regulation (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union (OJ L 158, 15.6.2016, p. 1).";

(29) in point 4.3.5, the table, the first row is replaced by the following:

"

Traction power supply performance	4.2.4	Train composition Preparation of the Route Book	4.2.2.5 4.2.1.2.2.1

";

(30) point 5.2.1.6 is replaced by the following:

"5.2.1.6 Current at standstill

The overhead contact line shall be designed for the requirements set out in point 4.2.5.";

(31) point 6.1.4.1 is amended as follows:

(a) in point (1), point (d) is replaced by the following:

"(d) The design of an overhead contact line shall be assessed with a simulation tool validated in accordance with the specification referenced in Appendix E, Index [8] and by measurement in accordance with the specification referenced in Appendix E, Index [9].

For OCL with a design speed up to and including 100 km/h, simulation and measurement of the dynamic behaviour are not required.";

(b) point (3), point (f) is replaced by the following:

"(f) The uplift of at least two steady arms shall be measured.";

(32) point 6.1.4.2 is replaced by the following:

" 6.1.4.2. Assessment of current at standstill (DC systems only)

The conformity assessment for DC systems shall be carried out in accordance with the specification referenced in Appendix E, Index [2].";

(33) in point 6.1.5, the introductory phrase is replaced by the following:

"In accordance with Article 9(2) of Directive (EU) 2016/797, the EC declaration of conformity shall be accompanied by statement setting out the condition of use:";

(34) point 6.2.4.1 is replaced by the following:

"6.2.4.1 Assessment of voltage and frequency

(1) The applicant shall declare in the technical file which nominal voltage is chosen for the traction power supply only in the following cases:

(a) a new energy subsystem is built;

(b) the traction power supply system is changed (e.g. migration from DC to AC).

(2) The selected traction power supply system shall be assessed by a document review in the design phase. An assessment is required only in the following cases:

(a) a new sub-systems is built;

(b) the traction power supply system is changed (e.g. migration from DC to AC).";

(35) the following point 6.2.4.1a is inserted:

"6.2.4.1a. *Assessment of traction power supply performance*

(1) The applicant shall declare:

(a) a quality index as defined in the point 4.2.4 for the subsystem;

(b) that the output of the design study complies with the specification referenced in Appendix E, Index [1].

(2) The assessment shall be carried out by verifying only the existence of the declaration.";

(36) point 6.2.4.2 is replaced by the following:

"6.2.4.2. Assessment of regenerative braking

(1) The assessment for AC traction power supply fixed installations shall be demonstrated in accordance with the specification referenced in Appendix E, Index [1].

(2) The assessment for DC traction power supply shall be demonstrated by a design review.";

(37) points 6.2.4.3 and 6.2.4.4 are replaced by the following:

"6.2.4.3. Assessment of electrical protection coordination arrangements

The assessment shall be demonstrated for design and operation of substations in accordance with the specification referenced in Appendix E, Index [1].

6.2.4.4. Assessment of harmonics and dynamic effects for AC traction power supply systems

(1) A compatibility study shall be carried out in accordance with the specification referenced in Appendix E, Index [1].

(2) That study shall be carried out only in the case of introducing converters with active semi-conductors in the traction power supply system.

(3) The notified body shall assess if criteria of the specification referenced in Appendix E, Index [1] are fulfilled.";

(38) in point 6.2.4.5, point (2) is replaced by the following:

"(2) Measurements of the interaction parameters shall be carried out in accordance with the specification referenced in Appendix E, Index [9].";

(39) in point 6.3.1(1), the introductory phrase is replaced by the following:

"Until the list of interoperability constituents listed in Chapter 5 of this TSI is revised, a notified body is allowed to issue an EC certificate of verification for a subsystem, even if some of the interoperability constituents incorporated within the subsystem are not covered by the relevant EC declarations of conformity and/or suitability for use according to this TSI, if the following criteria are complied with:";

(40) in Chapter 7, the first paragraph is deleted;

(41) points 7.1 to 7.3 are replaced by the following:

"7.1 National implementation plan

(a) Member States shall develop a national plan for the implementation of this TSI, considering the coherence of the entire rail system of the Union. That plan shall include all projects regarding new, renewal and upgrading of energy subsystem and shall ensure a gradual migration within a reasonable timescale onwards an interoperable target energy subsystem fully compliant with this TSI.

(b) Member States shall ensure that an on-ground energy data collecting system capable to exchange compiled energy billing data in accordance with point 4.2.17 of this TSI is implemented.

7.1.1 Implementation rules for voltage and frequency

New lines with speed greater than 250 km/h shall be supplied with one of the AC systems listed in point 4.2.3.

7.1.2. Implementation rules for OCL geometry

7.1.2.1. Implementation rules for 1435 mm track gauge system

The OCL shall be designed taking into account the following rules:

(a) New energy subsystems with speed greater than 250 km/h shall accommodate both pantographs as specified in points 4.2.8.2.9.2.1 (1600 mm) and 4.2.8.2.9.2.2 (1950 mm) of the LOC & PAS TSI.

If this is not possible, the OCL shall be designed for use by at least a pantograph with the head geometry specified in point 4.2.8.2.9.2.1 (1600 mm) of the LOC & PAS TSI.

(b) Renewed or upgraded energy subsystems with speed greater than 250 km/h shall accommodate at least a pantograph with the head geometry specified in point 4.2.8.2.9.2.1 (1600 mm) of the LOC & PAS TSI.

(c) Other cases: the OCL shall be designed for use by at least one of the pantographs with the head geometry specified in points 4.2.8.2.9.2.1 (1600 mm) or 4.2.8.2.9.2.2 (1950 mm) of the LOC & PAS TSI.

7.1.2.2. Track gauge systems different than 1435mm

The OCL shall be designed for use by at least one of the pantographs with the head geometry specified in point 4.2.8.2.9.2 of the LOC & PAS TSI.

7.2. Application of this TSI to a new energy subsystem

(1) For a new energy subsystem, the application of this TSI shall be compulsory.

(2) For the purpose of this TSI, a 'new energy subsystem' means an energy subsystem placed into service after [Publications Office: Please insert the date of entry into force of this amending act], which is or will be created where no traction power supply and OCL previously existed.

Any other energy subsystem shall be considered as an 'existing energy subsystem'.

(3) At least the following situations are considered as upgrading and not as the placing into service of new energy subsystems:

(a) the realignment of part of an existing route;

(b) the creation of a bypass;

(c) the addition of one or more tracks on an existing route, regardless of the distance between the original tracks and the additional tracks.

7.3 Application of this TSI to an existing energy subsystem

7.3.1. Performance criteria of the subsystem

In addition to the cases referred to in point 7.2.(3), "upgrading" is a major modification work of an existing energy subsystem resulting in an increase of the line speed of more than 30km/h.

7.3.2. Application of the TSI

(1) The conformity with this TSI is mandatory for a subsystem or part(s) of it which are upgraded or renewed. However, this TSI recognizes that due to the characteristics of the inherited railway system, compliance of existing energy subsystem with this TSI may be achieved through a gradual improvement of interoperability.

(2) For the upgraded energy subsystem, the application of this TSI shall be compulsory and applied to the upgraded subsystem within the geographical coverage of the upgrading. The geographical coverage of the upgrading shall be identified in relation to locations on tracks based on km references and shall result in the compliance of all basic parameters of the energy subsystem associated with the tracks that will benefit from the upgrading of the energy subsystem.

(3) In the event of a change other than an upgrading of the energy subsystem, the application of this TSI for each of the basic parameters (established in point 4.2.2) affected by the change shall be compulsory when the change requires carrying out a new 'EC' verification procedure in accordance with Commission Implementing Regulation (EU) 2019/250*. Provisions defined in Articles 6 and 7 of Implementing Regulation (EU) 2019/250 shall apply.
In the event of a change other than an upgrading of the energy subsystem and for those basic parameters that are not affected by the change, or when a change does not require a new 'EC' verification, the demonstration of the level of compliance with this TSI is voluntary.

(4) 'Substitution in the framework of maintenance' means any replacement of components by parts of identical function and performance in the framework of preventive or corrective maintenance, as defined in Article 2, point (17), of Directive (EU) 2016/797 of the European Parliament and of the Council**.

(5) For a substitution in the framework of maintenance no 'EC' verification is required.

(6) In the framework of a 'renewal', as defined in Article 3, point (15), of Directive (EU) 2016/797, non TSI-compliant parts of the subsystem shall be replaced with TSI-compliant ones.

(7) Other substitutions in the framework of maintenance shall be made in accordance with the requirements of this TSI, whenever reasonably and economically feasible.

(8) For the existing energy subsystem, in any event other than an upgrading, for the maximum lateral deviation of the OCL, it is permitted to deviate from the requirement in point 4.2.9.2. as long as it has been proven that any TSI

compliant rolling stock with a TSI compliant pantograph (as described in point 7.1.2.1 of this TSI) has already operated under the same OCL design installed in the network without occurring any incident.

7.3.3. Existing lines that are not subject to a renewal or upgrading project

Where an infrastructure manager wishes to demonstrate the level of compliance of an existing line with the basic parameters of this TSI, it shall apply the procedure described in in Commission Recommendation 2014/881/EU***.

7.3.4 Route compatibility checks before the use of authorised vehicles

The 'route compatibility check' procedure to be applied and the parameters of the energy subsystem to be used are laid down in point 4.2.2.5 and Appendix D1 of the Annex to Commission Implementing Regulation (EU) 2019/773**** (OPE TSI).

_____

* Commission Implementing Regulation (EU) 2019/250 of 12 February 2019 on the templates for 'EC' declarations and certificates for railway interoperability constituents and subsystems, on the model of declaration of conformity to an authorised railway vehicle type and on the 'EC' verification procedures for subsystems in accordance with Directive (EU) 2016/797 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 201/2011 (OJ L 42, 13.2.2019, p. 9).

** Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union (OJ L 138, 26.5.2016, p. 44).

*** Commission Recommendation 2014/881/EU of 18 November 2014 on the procedure for demonstrating the level of compliance of existing railway lines with the basic parameters of the technical specifications for interoperability (OJ L 356, 12.12.2014, p. 520).

**** Commission Implementing Regulation (EU) 2019/773 of 16 May 2019 on the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system within the European Union and repealing Decision 2012/757/EU (OJ L 139I, 27.5.2019, p. 5).";

(42) Point 7.4.2.2.1 is replaced by the following:
"7.4.2.2.1 (not used)";

(43) Point 7.4.2.7.1 is replaced by the following:
"7.4.2.7.1 (not used)";

(44) point 7.4.2.8 is replaced by the following:

"7.4.2.8 (not used)";

(45) point 7.4.2.9 is replaced by the following:

"7.4.2.9 (not used)";

(46) in Appendix A, Table A.1, row "Current at standstill — 5.2.1.6", fourth column, "X" is replaced by "X (only for DC systems)";

(47) in Appendix B, Table B.1, first column, the second and third rows are replaced by the following:

"

Traction power supply performance — 4.2.4
DC systems only: Current at standstill — 4.2.5

”;

(48) Appendix C is replaced by the following:

“Appendix C (not used)”;

(49) Appendix D is amended as follows:

(a) the title is replaced by the following:

“Specification of the static pantograph gauge (track gauge system 1520mm)”;

(b) point D.1 is deleted;

(c) the title of point D.2 is deleted;

(50) Appendix E is replaced by the following:

“Appendix E

List of referenced standards

Table E.1

List of referenced standards

Index	**Parameter**	**TSI Point**	**Standard Point**
[1]	**EN 50388-1:2022** **Railway Applications - Fixed installations and rolling stock - Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - Part 1: General**		
[1.1]	Traction power supply performance	4.2.4	8.2
[1.2]	Regenerative braking	4.2.6	12.2.2
[1.3]	Electrical protection coordination arrangements	4.2.7	11.2 and 11.3 point 2 and 3
[1.4]	Harmonics and dynamic effects for AC traction power supply systems	4.2.8 (2)	10.3 – Table 6
[1.5]	Assessment of traction power supply performance	6.2.4.1a	8.4
[1.6]	Assessment of regenerative braking	6.2.4.2 (1)	15.6.2
[1.7]	Assessment of electrical protection coordination arrangements	6.2.4.3	15.5.1.2 and 15.5.2.1

Index	Parameter	TSI Point	Standard Point
[1.8]	Assessment of harmonics and dynamic effects for AC traction power supply systems	6.2.4.4 (1)	10.3
[1.9]	Assessment of harmonics and dynamic effects for AC traction power supply systems	6.2.4.4 (3)	10.3
[2]	**EN 50367: 2020+A1:2022** **Railway Applications - Fixed installations and rolling stock - Criteria to achieve technical compatibility between pantographs and overhead contact line**		
[2.1]	Current at standstill	4.2.5	7.2, Table 5
[2.2]	Maximum lateral deviation	4.2.9.2 (1)	5.2.5
[2.3]	Mechanical kinematic pantograph gauge	4.2.10 (1)	5.2.2
[2.4]	Mean contact force	4.2.11 (2) and (3)	Table 6
[2.5]	Pantograph spacing for overhead contact line design	4.2.13	Table 9
[2.6]	Phase separation sections - General - length D of neutral section	4.2.15.1 (2)	4
[2.7]	Lines with speed v ≥ 250 km/h	4.2.15.2 (a)	Annex A.1.2
[2.8]	Lines with speed v ≥ 250 km/h	4.2.15.2 (b)	Annex A.1.4
[2.9]	Lines with speed v < 250 km/h	4.2.15.3	Annex A.1
[2.10]	System separation sections - General - length D of neutral section	4.2.16.1 (3)	4
[2.11]	Assessment of current at standstill (DC systems only)	6.1.4.2	Annex A.3
[3]	**EN 50119:2020** **Railway Applications - Fixed installations – Electric traction overhead contact lines**		
[3.1]	Minimum design contact wire height	4.2.9.1 (1)	5.10.4
[3.2]	Maximum design contact wire height	4.2.9.1 (1) Note ([1])	figure 3

Index	Parameter	TSI Point	Standard Point
[3.3]	Relation with pantograph working height	4.2.9.1 (2)	figure 3
[3.4]	Dynamic behaviour and quality of current collection	4.2.12 (2)	5.10.2
[3.5]	Dynamic behaviour and quality of current collection	4.2.12 (3)	5.2.5.2, Table 4
[3.6]	Phase separation sections - calculation of D, clearances	4.2.15.1 (2)	5.1.3
[3.7]	System separation sections – General - calculation of D, clearances	4.2.16.1 (3)	5.1.3
[3.8]	System separation sections - pantographs raised	4.2.16.2 (2)	5.10.3
[4]	**EN 50122-1** 2011+A1:2011 +AC:2012+A2:2016+A3:2016+A4:2017 **Railway Applications - Fixed installations – Electrical safety, earthing and the return circuit – Part 1: Protective provisions against electric shock**		
[4.1]	Contact wire height	4.2.9.1 (3)	5.2.4 and 5.2.5
[4.2]	Protective provisions against electric shock	4.2.18	5.2.1 (only for public areas), 5.3.1, 5.3.2, 6.1, 6.2 (excluding requirements for connections for track circuits)
[4.3]	AC voltage limits	4.2.18	9.2.2.1 and 9.2.2.2
[4.4]	DC voltage limits	4.2.18	9.3.2.1 and 9.3.2.2
[5]	**EN 50149:2012** **Railway Applications - Fixed installations – Electric traction – Copper and copper alloy grooved contact wire**		
[5.1]	Contact wire material	4.2.14 (3)	4.2 (excluding the reference to annex B of the standard), 4.3 and 4.6 to 4.8
[6]	**EN 50463-3:2017**		

Index	Parameter	TSI Point	Standard Point
	Railway Applications – Energy measurement on board trains – Part 3: Data handling		
[6.1]	On-ground energy data collecting system	4.2.17 (2)	4.12
[7]	**EN 50463-4:2017Railway Applications – Energy measurement on board trains – Part 4: Communication**		
[7.1]	On-ground energy data collecting system	4.2.17 (3)	4.3.6 and 4.3.7
[8]	**EN 50318:2018+A1:2022** **Railway Applications – current collection systems – Validation of simulation of the dynamic interaction between pantograph and overhead contact line**		
[8.1]	Assessment of dynamic behaviour and quality of current collection – Simulation tool	6.1.4.1 (1)	5, 6, 7, 8 , 9, 10, 11
[9]	**EN 50317:2012+A1:2022** **Railway Applications – current collection systems – Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line**		
[9.1]	Assessment of dynamic behaviour and quality of current collection - Measurement	6.1.4.1 (1)	5, 6, 7, 8, 9
[9.2]	Assessment of dynamic behaviour and quality of current collection (integration into a subsystem)	6.2.4.5 (2)	5, 6, 7, 8, 9

”;

(51) in Appendix G, Table G.1, the rows “Mean useful voltage train” and “Mean useful voltage zone” are deleted.