

Moving Europe towards a sustainable and
safe railway system without frontiers.

Guide for the application of the ENE TSI

*In accordance with Article 19(3) of Regulation (EU) 2016/796 of
the European Parliament and of the Council of 11 May 2016*

Released by European Union Agency for Railways

*This guide does not contain any legally binding advice. It may serve as a clarification tool
without however dictating in any manner compulsory procedures to be followed and without
establishing any legally binding practice. The guide provides explanations on the provisions
contained in the TSIs and should be helpful for understanding the approaches and rules
described therein. However, it does not substitute for them.*

*The guide is publicly available and it will be regularly updated to reflect progress with
European standards and changes to the TSIs.*

*The reader should refer to the website of the European Union Agency for Railways for
information about its latest available edition.*

Document History

<i>Version</i>	<i>Date</i>	<i>Comments</i>
1.0	26 Aug 2011	First publication
2.0	16 Oct 2014	Second publication following the revision of the (existing) ENE TSIs in force (merged and extended scope)
3.0	20 Dec 2023	Third publication - Version 2023 updated based on the Commission Implementing Regulation (EU) 2023/1694 of 10 August 2023

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1. SCOPE OF THIS GUIDE

1.1. Scope

This document is an Annex to the “Guide for the Application of TSIs”. It provides information on the application of **Commission Regulation (EU) No 1301/2014 of 18 November 2014 on the technical specifications for interoperability relating to the ‘energy’ subsystem of the rail system in the Union (ENE TSI)**.

This version 2023 of the guide is updated based on the **Commission Implementing Regulation (EU) 2023/1694 of 10 August 2023 amending Regulations (EU) No 321/2013, (EU) No 1299/2014, (EU) No 1300/2014, (EU) No 1301/2014, (EU) No 1302/2014, (EU) No 1304/2014 and Implementing Regulation (EU) 2019/777**.

The guide needs to be read and used only in conjunction with the ENE TSI. It is intended to facilitate its application, but it does not substitute for it.

The general part of the “Guide for the Application of TSIs” has also to be considered.

1.2. Content of the guide

In chapter 2 of this document, extracts of the original text of the ENE TSI are provided, shown in a shaded text box and these are followed by a text that gives guidance.

Guidance is not provided for every clause where the original ENE TSI requires no further explanation.

Guidance is of voluntary application. It does not mandate any requirement in addition to those set out in the ENE TSI.

1.3. Reference documents

Reference documents are indicated as a footnote in Commission Regulation and in its annexes (TSI ENE), and in the general part of the “Guide for the Application of TSIs”.

1.4. Definitions, abbreviations and acronyms

Definitions, abbreviations and acronyms are given in Appendix G of the ENE TSI, and in the general part of the “Guide for the Application of TSIs”.

2. GUIDANCE ON THE APPLICATION OF THE ENE TSI

2.1. Foreword

The geographical scope of the ENE TSI is the network of the whole Union rail system, as defined in article 2 of the Regulation.

As a general comment, it must be emphasised that TSI should not be considered as a design manual. Neither is it a complete list of assessments which should be done to start the operation of the subsystem. The process of putting in service any fixed installations is a subject to national construction law and commissioning processes which cover all elements including those not in the scope of the TSI.

The requirements set out in the TSI include only those elements which are important from the interoperability point of view, for the compatibility of the energy subsystem (as defined in the interoperability directive) with a TSI-compliant rail vehicle.

On existing lines, it is intended that as work is done, it will move towards achieving full compliance with the ENE TSI. This work can be done as stated in clause 7.3.2.

2.2. Essential requirements

The essential requirements cover:

- safety,
- reliability and availability,
- health,
- environmental protection,
- technical compatibility,
- accessibility

and are addressed in chapter 3 of the TSI.

2.3. Characteristics of the subsystem

The following clauses refer to respective points of the TSI.

2.3.1. Voltage and frequency (point 4.2.3)

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

- AC 25 kV, 50 Hz;
- AC 15 kV, 16.7 Hz;
- DC 3 kV, or
- DC 1.5 kV

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

The wide extent of existing traction current supply systems and the fact that vehicles designed for operation on more than one traction system are the current state of the art, could make the migration to one system not economically viable.

Therefore, the application of AC 25 kV, 50 Hz; AC 15 kV, 16.7 Hz; DC 3 kV or DC 1.5 kV is permitted for new, upgraded or renewed subsystems taking into account the provisions set out in section 7 of the TSI.

Section 6.2.4.1a of TSI ENE refers to point 8.4 of EN 50388-1:2022 which refers to EN50163:2004 indicating that the voltage limits defined in EN 50163 shall be fulfilled.

On lines with a speed higher than 250 km/h, only AC systems are permitted because of the high power demand of trains (point 7.1.1 Implementation rules for voltage and frequency of ENE TSI).

2.3.2. Traction power supply performance (point 4.2.4)

(1) 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.

To avoid unnecessary energy subsystems costs it was decided that the infrastructure manager will perform a dimensioning study and chose a quality index as defined in clause 8.2 of EN 50388-1:2022. To avoid unnecessary rolling stock costs, it was also decided that the energy subsystem should allow scheduled trains (a combination of rolling stock coupled together) up to 2 MW without *power or current limitations*, according to clause 7.2 (Current limitation according to infrastructure information) and clause 7.3 (Automatic current or power limitation as a function of line voltage) of EN 50388-1:2022

This power limit refers to the maximum power taken from the OCL for a complete train.

The limitations in EN 50388-1:2022 chapter 7.2 (Train set current and power limitation function) apply to all trains regardless of installed power.

An interface with Operation and traffic management subsystem (Train composition and preparation of the Route Book) has been introduced to complete the scope of this parameter (see also 2.4.2 of this guide).

The maximum allowed train current for the specific sections of line is given in the RINF, parameter 1.1.1.2.2.2.

The values and limits of voltage and frequency shall comply with section 6.2.4.1a. Assessment of traction power supply performance of TSI ENE.

2.3.3. Current at standstill (point 4.2.5)

(1) 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].

The purpose of this requirement is to prevent overheating of the pantograph contact strip / contact wire contact point when the train is at standstill and is drawing power, for example for auxiliary equipment.

In line with application of clause 7.2, table 5 of EN 50367:2020 +A1:2022, the requirement is also applicable to AC systems, but assessment is not necessary for AC systems as stated in the Note of mentioned clause 7.2: assessment is not necessary because the current is too low to become a risk for overheating.

Information on which contact strip material is used for the tests has to be indicated in the technical file.

2.3.4. Regenerative braking (point 4.2.6)

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].

Regenerative braking for both AC and DC systems is widely used in modern rolling stock.

Current technologies, during regenerative braking, allow injection of current into the system with a low harmonic content, which reduces the impact on the quality of energy delivered by the energy supplier to other consumers.

2.3.5. Electrical protection coordination arrangements (point 4.2.7)

Electrical protection coordination design of the energy subsystem shall comply with the requirements detailed in the specification referenced in appendix E, index [1].

To coordinate protection, a global view of the whole process and the interfaces between the subsystems LOC&PAS and energy is necessary.

It is important to note that although the EN 50388-1:2022 describes the complete electrical protection coordination arrangements, in the ENE TSI only the requirements for the substations are mandatory.

2.3.6. Harmonic and dynamic effects for AC systems (point 4.2.8)

(1) The interaction of traction power supply system and rolling stock can lead to electrical instabilities in the system.

(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].

These phenomena are related to the harmonic and dynamic characteristics of power supply fixed installations and rolling stock, which can create overvoltages and other instability phenomena in the power supply system.

Particular attention should be paid when introducing a new element into an existing, stable electric environment. The TSI stresses the need for a compatibility study to be carried out in this case, to assess any consequences resulting from the introduction of the new element into the system. The compatibility study is explained in the standard quoted in this clause of the TSI.

The role of the notified body on this issue is only to check if presented study confirms that criteria of EN 50388-1:2022 clause 10.4 (Methodology and acceptance criteria) are fulfilled

2.3.7. Geometry of the overhead contact line (point 4.2.9)

(1) The overhead contact line shall be designed for pantographs with the head geometry specified in the LOC&PAS TSI point 4.2.8.2.9.2 taking into account the rules set out in point 7.1.2 of this TSI.

- *Contact wire height*

Geometry of the overhead contact line is the main interface with the pantograph.

The contact wire height is defined by table 4.2.9.1, including the nominal contact wire height, the minimum design contact wire height and the maximum design contact wire height.

These three values are in relation with the design speed of the line.

Additional information on the minimum and maximum design contact wire heights is given in EN 50119:2020.

These values are given in the RINF, parameters 1.1.1.2.2.5 and 1.1.1.2.2.6.

Those parameters are set out to ensure that the absolute minimum and maximum values are always within the pantograph working range.

Maximum contact wire height is included to fulfil local needs (e.g. washing tracks, workshops, loading areas, etc.) where trains move at low speed, without requirements regarding dynamic behaviour and quality of current collection performance between the pantograph and the OCL.

For the 1520 mm track gauge network, particular requirements for height have been included.

- *Maximum lateral deviation*

The maximum lateral deviation of the contact wire in relation to the track centre line under action of a cross wind shall be in accordance with the specification referenced in appendix E index [2].

The maximum permissible lateral deviation is related to the target profiles of the pantograph head, as defined in the LOC&PAS TSI, point 4.2.8.2.9.2.

Lateral deviation values are adapted in accordance with the pantograph movement and track tolerances taking into account the standard quoted in TSI for this clause.

For the 1520 mm track gauge network, particular values for lateral deviation are set out.

2.3.8. Pantograph gauge (point 4.2.10)

Determination of the mechanical kinematic pantograph gauge.

This point is based on the EN 15273 series relating to detailed calculation of gauge for infrastructure and vehicles, as the standard quoted in TSI clause is referring to EN 15273 series.

This TSI uses the concepts of width and length of the pantograph head as defined in Figure 1 below.

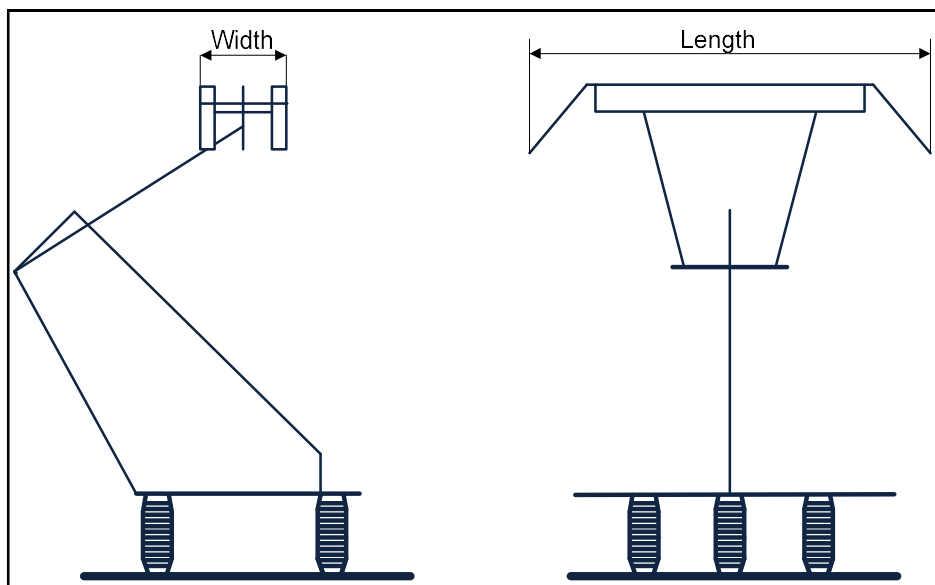


Figure 1 - Pantograph head, width and length (according to Fig. 1 EN 50206-1:2010)

Determination of the static pantograph gauge:

Appendix D contains the requirement for static pantograph gauge for the 1520 mm track gauge network.

2.3.9. Mean contact force (point 4.2.11)

(1) The mean contact force F_m is the statistical mean value of the contact force. F_m is formed by the static, dynamic and aerodynamic components of the pantograph contact force.

(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].

(4) The curves apply to speed up to 360 km/h. For speeds above 360 km/h procedures set out in point 6.1.3 shall apply.

The contact force limits for interaction performance, are defined in the standard quoted in the TSI clause 4.2.11..

The formulas in the standard quoted in the TSI clause 4.2.11 represent the upper design limit of F_m .

Consequently OCL should be designed to accept a vehicle with a pantograph exerting a contact force in the range between $F_{m,min}$ and $F_{m,max}$ as indicated in the standard quoted in the TSI clause 4.2.11.

TSI requires that the overhead contact line is designed to be capable to sustain the upper design limit of F_m given in the standard quoted in the TSI clause 4.2.11.. Therefore, the mean contact force exerted during the measurement for the assessment of the OCL is $F_{m,max}$ or lower. This is necessary because of the fact that F_m cannot be adjusted exactly for the measurement.

2.3.10. Dynamic behaviour and quality of current collection (point 4.2.12)

(1) Depending on the assessment method, the overhead contact line shall achieve the values of dynamic performance and contact wire uplift (at the design speed) set out in Table 4.2.12.

Compared with previous TSIs, requirements for dynamic behaviour and quality of current collection have been separated from assessment methods.

For more details about assessment, see point 2.6 of this guide.

2.3.11. Pantograph spacing (point 4.2.13)

The overhead contact line shall be designed for trains with two pantographs operating simultaneously. The design spacing of the two adjacent 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].

For the design of OCL, it is important to underline that the aim of the values in the standard quoted in the TSI clause 4.2.13:

- to set out that OCLs have to be designed to accept at least two pantographs.
- to set out a classification of OCL design configurations (types A, B or C).
- to set out the maximum distance from centre line to centre line of adjacent pantographs for OCL design.
- to set out a baseline for specifying the OCL limits in the RINF with which the operators need to take into account before placing a train into service on the line. When the operator does not comply with the values given in RINF, additional tests can be performed.

- not to set out the minimum distance from centre line to centre line of adjacent pantographs heads in the context of LOC&PAS IC or subsystem assessment.

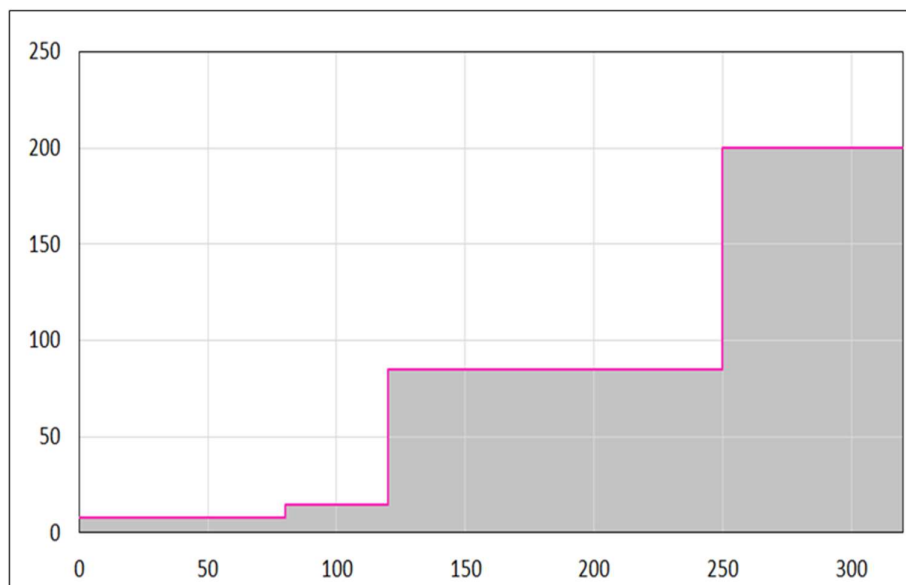


Figure 2 - Design values for AC-OCL of type B (ordinates: distance (m), abscissas: speed (km/h))

The Figure 2 above gives an example for an AC- OCL of type B. The OCL designer is free to move the boundary line further within the grey area. The actual values are given in the RINF. When the values are exactly the values of type B, then the white area gives the allowed values for trains.

Table 4.2.13 - *Pantograph spacing for OCL design* - defines the minimum spacing centre line to centre line of two pantographs operating adjacently.

The columns headed “A”, “B” and “C” are specified as a “benchmark” to define a minimum specification of the performance of the overhead line for the operation of trains with up to two pantographs. This “benchmark” sets an assessable position.

The actual design spacing can be reduced to allow the operation of trains with closer pantographs at a higher speed, or to allow for three or more pantographs in use on a train. In many cases, building to the minima defined by the TSI may be insufficient to deliver the needs of particular train operators – the designer needs to take this into account when designing the overhead line.

Information about the number of pantographs operating on a train and the distances between two consecutive pantographs which can be used on a certain line at a given speed are set in the RINF, parameter 1.1.1.2.3.3.

2.3.12. Separation sections (point 4.2.15 and 4.2.16)

The main goal of the separation sections is to ensure that a vehicle passing through does not bridge two adjacent phases/systems.

In case of lines with speed $v \geq 250$ km /h there are precise requirements related to design. For other lines the TSI gives greater freedom in the design of the separation sections.

Details of the particular separation section are given in the RINF, parameter 1.1.1.2.4.

Further information is given in EN50367:2020+A1:2022 and EN50388-1:2022.

Where necessary to separate two feeding sections of the same system (phase shift occurs without any load), the rules for phase separation sections are applicable as well.

Section length in separation sections has to ensure that overlaps between the sections are considered. The overall length D will ensure that the first passing pantograph will securely leave the first section before the second one enters into it. The definition of D within separation sections using static calculation is not sufficient, dynamic influence has to be taken into account.

2.3.13. On-ground energy data collecting system (point 4.2.17)

(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].

Appendix E, index [6]: clause 4.12 of EN 50463-3:2017 Railway Applications – Energy measurement on board trains – Part 3: Data handling

Appendix E, index [7]: clause of 4.3.6 and 4.3.7 of EN 50463-4:2017 Railway Applications – Energy measurement on board trains – Part 4: Communication

There is no assessment of the on-ground energy data collecting system to be carried out by the notified body in the verification of the energy subsystem.

2.4. Interfaces

The interfaces between energy and other subsystems are covered in point 4.3 of the TSI. In this section only interfaces which need more explanations are developed.

Compared to the previous ENE TSIs the relevance with SRT TSI was removed, because the particular requirements related to the energy subsystem to be considered in tunnels are covered by the new SRT TSI.

2.4.1. Interface with Rolling Stock subsystem.

The complete list of corresponding parameters between ENE and LOC&PAS TSI are given in the table 4.3.2. In the points below particular aspects are highlighted.

2.4.1.1. Contact wire material / Contact strip material

The interface between rolling stock and energy subsystems and related parameters in both TSIs has taken into account the results of the research project (CoStrIM-contact strip material) in the case of acceptance of copper impregnated carbon on AC network. Other materials, approved on particular networks, are indicated in the RINF, clause 1.1.1.2.3.4.

2.4.1.2. On-ground energy data collecting system/on-board energy measurement system

Since Commission Implementing Regulation (EU) 2018/868 entered into force the legal framework is defined. All new, renewed and upgraded vehicles shall have an on-board energy measurement system (EMS). New EMS should be able to send the data to an on-ground energy data collecting system (DCS). Such a DCS is mandatory to be offered by all member states since 1 January 2022. The data is further processed in a settlement system. This settlement system allocates the measured consumptions to the Member States where the consumption took place and distributes it to the settlement systems of these Member states. It also validates the measured consumptions, estimates missing consumptions and allocates them to the correct consumer. It exchanges the data with relevant parties in the energy market. A typical process flow is given in Figure 3.

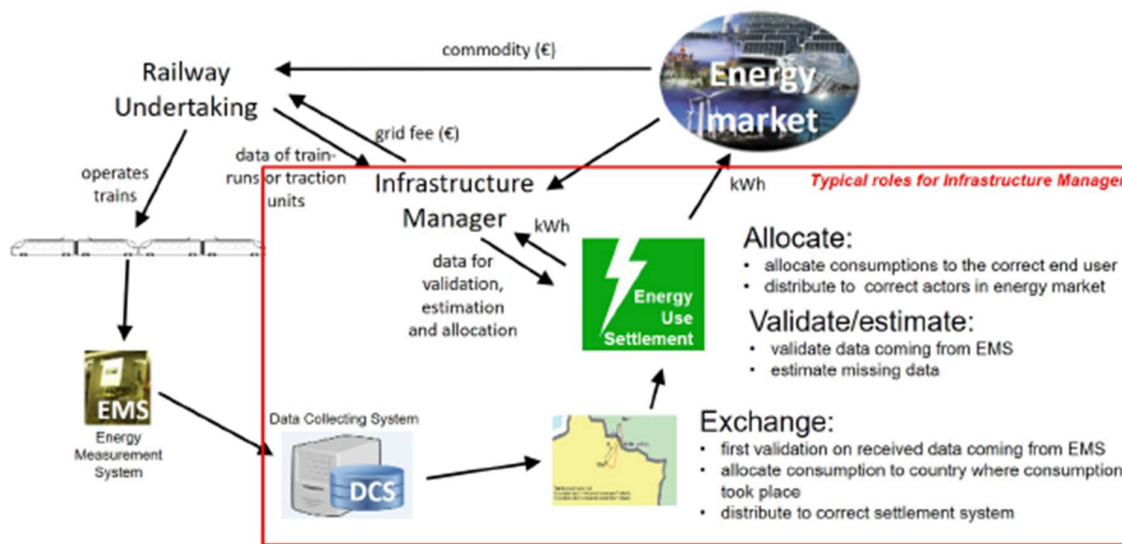


Figure 3– Typical process flow regarding on-board energy measurement, exchange of data, on-ground energy data collecting and energy settlement.

The UIC IRS 90930 gives further guidance and defines a role model and protocols for data exchanges between different actors.

2.4.2. Operation and traffic management

The Energy subsystem has not only interfaces with an individual unit (defined in the LOC&PAS TSI) but also with a train (which can be a composition of units assembled by the RU at the operational level). In this context there are some energy subsystem parameters (see point 4.3.5 of ENE TSI) which have an interface with the operation and traffic management subsystem. Those parameters having impact

on the design of the energy subsystem, and affect the preparation and operation of trains are reflected in the Register of Infrastructure and RU documents (route book).

2.5. Interoperability constituents (ICs)

OCL as IC

The advantages of using OCL as IC are important:

- harmonisation of the different “types” of OCL,
- reduction of the proliferation of different versions of OCL and different assessment stages of the same OCL if applying the procedure of an intermediate statement of verification (ISV),
- OCL can be offered as a “product” on the market,
- reduction in the process of assessment of the subsystem when using an OCL that has already been certified.

2.6. Conformity assessment

2.6.1. General

The conformity assessment is performed on two levels:

- assessment of conformity of the interoperability constituent (the OCL), defined in point 6.1 of the ENE TSI,
- the EC verification of the energy subsystem, defined in point 6.2 of the ENE TSI.

For the assessment of conformity of the interoperability constituent OCL and EC verification of the energy subsystem modules defined in in the Commission Decision 2010/713/EU apply. The choice between modules, for the IC and subsystem is given in chapter 6 of the ENE TSI.

When a particular assessment procedure is needed, the ENE TSI describes it in specific sections (OCL is defined in 6.1.4 and subsystem defined in 6.2.4).

Some aspects of the particular assessment procedure are explained below.

2.6.2. Interoperability constituent – overhead contact line

The goal of the assessment procedure is to verify the design of the OCL against the relevant requirements set out in point 5.2.1 of the ENE TSI.

Table A.1 describes the assessment stages of the OCL as IC.

The assessment of the OCL as an IC is carried out in two phases; a design review, and for some parameters tests are required, in accordance with the particular assessment procedure for the interoperability constituent (see 6.1.4 of the ENE TSI).

Particular attention should be paid to the assessment of existing OCL designs used before the publication of this TSI (see point 2.6.4 of this guide).

2.6.2.1. Particular assessment procedure for the interoperability constituent – overhead contact line

2.6.2.1.1 Assessment of dynamic behaviour and quality of current collection

The dynamic behaviour and quality of current collection describes the relationship between the overhead contact line and pantograph in order to obtain the proper quality of current collection and to avoid excessive wear or damage.

Section 6.1.4.1 is rearranged into 3 parts:

- Methodology (containing general explanations)
- Simulation (design review)
- Measurement (site tests)

In order to facilitate and accelerate the process of assessment, the TSI includes the possibility to perform the simulation with pantograph types that are under the process of IC certification. The EC certificate of conformity for the IC overhead contact line may only be issued when the EC certificates of conformity for the pantographs used in the simulation are available or equivalent demonstration of conformity (i.e assessment results) are available.

The quality of the interaction between overhead contact line and pantograph shall be demonstrated by simulation for each of the speed and pantograph spacing combinations for which the overhead line is to be designed. For EC certification of the OCL design as an IC, the Applicant shall define at least one “speed / pantograph spacing combination” to be object of the NoBo’s assessment. For each one of these combinations, at least one simulation shall be performed. At least the worst case arrangements (spacing / speed) of pantographs derived from the simulation is to be verified by measurement in a field test.

Regarding the uplift measurement, at least two measurement points shall be defined for different types of supports (e.g. push-off and pull-off arrangements).

In site tests with multiple pantographs, a combination of the two pantographs that have been used in the simulation is permitted.

The procedure to assess the dynamic behaviour and current collection of the pantograph as IC is not in the scope of ENE TSI but is defined in LOC&PAS TSI.

When assessing an OCL as an IC, once the design review is completed, in order to avoid additional costs and unnecessary efforts on the assessment process, the OCL production phase can be postponed

if a subsystem certification is on-going. Then, all necessary measurements can be done together for the subsystem and the IC, once a section of the OCL is installed.

2.6.2.1.2 Assessment of current at standstill (DC systems)

For DC systems, additional assessments need to be done to avoid overheating of the contact point at standstill.

The methodology is defined in Annex A.3 (additional tests for DC systems) of EN 50367:2020+A1:2022. For the assessment, the test value within the range of static contact force given in EN 50367:2020+A1:2022 (table 4, point 7.2) should be used.

2.6.3. Energy subsystem

The main concerns in the assessment of energy subsystem refer to the incorporation of the OCL into it.

In general, when the energy subsystem contains an OCL - IC which holds an EC declaration of conformity, the assessment of the design of the OCL is already done and the assessment of the OCL in the subsystem will focus on the integration into subsystem.

If the energy subsystem contains an OCL which does not hold an EC declaration of conformity (as specified in 6.3 of the ENE TSI), the assessment of the energy subsystem will take more effort. In this case the OCL also needs to be assessed against the requirements as defined in Table B.1 of the ENE TSI (indicated by X²).

2.6.3.1. Particular assessment procedures for Energy Subsystem - related to OCL

When the OCL has been certified as an interoperability constituent, it can be used on interoperable lines after the integration into a subsystem.

The Energy Subsystem will either use an OCL which:

- has been certified as an interoperability constituent, or
- does not hold an EC verification yet as it is being certified as an interoperability constituent as part of the EC verification process

2.6.3.1.1 Assessment of dynamic behaviour and quality of current collection (integration into a subsystem) (point 6.2.4.5)

The main aspect of assessment of the dynamic behaviour and quality of current collection of a certified OCL is the identification of allocation design and installation errors.

(3) These measurements shall be carried out with an interoperability constituent pantograph, exhibiting the mean contact force characteristics as required by point 4.2.11 of this TSI for the design speed of the line considering aspects related to minimum speed and siding tracks.

Minimum speed should be understood as the operational speed for any track. When the operational speed is less than the design speed of the IC OCL (e.g. for layout and/or track and/or signalling constraints), the test should be carried out at the maximum operational speed of the track.

Measurements can be performed with a tilting train with the aim to reach a higher speed on the line to be tested. The tested speed will be the maximum operational speed for the ENE subsystem, independently from the type of train used.

The maximum operational speed of the track is included in the 'EC' certificate of verification issued by the notified body in the conditions of validity of the certificate.

Regarding the uplift measurement, at least two measurement points shall be defined for different types of supports (e.g. push-off and pull-off arrangements)..

Once the evaluation is performed at the IC level, the measurements for the evaluation at subsystem level for section 6.2.4.5(4) of TSI ENE, could be performed with only one pantograph.

For speeds up to 120 km/h (AC systems) and for speeds up to 160 km/h (DC systems) significant installation errors are not generally demonstrated by contact force measurement. In this case, alternative methods of identifying construction errors may be used, such as measurement of the contact wire height, stagger, and space for uplift. This approach cannot be adopted for the process of IC certification.

2.6.4. Assessment of existing OCL designs - clarifications

The implementation of ENE TSI for the existing OCL designs creates concerns and questions in relation to the process of assessment, which can be summed up in two groups:

- a) Legal framework for further application of existing OCL designs which are already in use in the particular network (for OCL as IC and for non-certified OCL)

At the beginning it has to be underlined that ENE TSIs did not set any new requirements and generally reflected the current state of the art. In this sense the existing OCLs in use, supported by extensive operational and maintenance records, should fulfil most of the TSI requirements.

For existing OCLs being a subject to conformity assessment the process is performed according to point 6.1.2 of ENE TSI. In this point, for an IC placed on the EU market before entry in force of this TSI, the application of following modules are foreseen: CA – internal production control (without involvement of notified body) or CH – conformity based on full quality management system (with involvement of notified body checking the quality management system of an applicant

For non-certified OCL integrated into ENE subsystem the process described in point 6.3 of ENE TSI can be used, but with limited period of time.

This gives the option of using existing OCL – generally inside the given network – with proven experience (operational and maintenance records).

It is particularly important for upgrading and renewals (see also 2.7.2 of this guide) when the project is in constant development during a period of time on the operational line or extension of existing network. In this case, experiences gained from the fulfilment of ENE TSI subsystem requirements (chapter 4) should be enough for placing in service the subsystem. It is the responsibility of the

applicant to decide whether to also check this OCL against the assessment procedure(s) of point 6.1 of the ENE TSI.

Though an OCL-IC can be offered on other 'markets' as a 'product' but it should be noted that it is a 'particular product' which exists as a design and as a real assembly only when it is incorporated into a subsystem.

In order to cover the risk related to special features (e.g. tunnels, bridges, layout, etc.) when the OCL-IC is integrated into a new subsystem, it is optional for the applicant to decide whether to check also this OCL against the assessment procedure(s) of point 6.1 of the ENE TSI.

- b) Need for dynamic tests in the case of integration into subsystem OCL types for speeds applied in the conventional network.

The issue has been addressed in the point above (see 2.6.3). For speeds up to 120 km/h (AC systems) and for speeds up to 160 km/h (DC systems) significant installation errors are not generally demonstrated by contact force measurement. In this case, alternative methods of identifying construction errors may be used, such as measurement of the contact wire height, stagger and space for uplift. This approach cannot be adopted for the process of IC certification.

2.6.5. Assessment of protective provisions against electric shock (4.2.18)

The intention of subclause 6.2.4.6 in TSI ENE is to check the design against construction rules, based on the requirements given in 4.2.18, in the design phase and against construction errors in the production phase. In the production phase, the check is limited to the identification of deviations against the designed installation.

The notified body should assess the stages of the production phase indicated in Table B.1 only if no other independent body has done so.

An 'independent body' means in this context any assessment entity (body or person) which is competent according to national legislation (such as construction law or railway law) to perform an assessment of the protective provisions against electric shock.

This independent body may be or not an organisation which is also acting as a notified body or designated body within the meaning of Interoperability Directive (EU) 2016/797

To avoid unnecessary the repetition of these tests, the applicant for EC verification in accordance with the ENE TSI should inform the notified body the existence of these tests and provide the relevant certificates and technical documentation.

The notified body should include evidence of the independent body checks in the technical file, and indicate it in the EC certificate.

2.6.6. *Assessment of harmonics and dynamic effects for AC traction power supply systems (6.2.4.4)*

The role of the notified body on this issue is only to check if presented study confirms that criteria of EN 50388-1:2022 Annex I clause 10.4 (Methodology and acceptance criteria) are fulfilled

2.6.7. *Additional clarification of Table A.1 - Conformity assessment of interoperability constituents*

Particular attention should be paid on Table A.1 for Current at standstill - 5.2.1.6: AC systems are excluded from tests. The NoBo would define the conditions of use of the IC in accordance with requirement in clause 7.2, table 5 of EN 50388-1:2022 as in the TSI ENE.

2.6.8. *Additional clarification of Table B.1 - EC verification of the energy subsystem*

For the correct interpretation of the table B.1, for the following parameters, the indication N/A should be understood as that the assessment is generally not performed by NoBo except the situations given below:

- Geometry of the overhead contact line (4.2.9), in the column Assembled, before putting into service, when an alternative assessment method is used as foreseen in point 6.2.4.5. (Assessment of dynamic behaviour and quality of current collection (integration into a subsystem) of the TSI and,
- Dynamic behaviour and quality of current collection (4.2.12), in the column Validation under full operating conditions, when the validation in the phase “Assembly before putting into service” is not possible due to e.g.: operationally limitation of the maximum speed or load need for the stability of the track.

2.7. **Appendixes of the TSI**

2.7.1. *Appendix E – List of referenced standards*

For a general information on Standards please refer to the “Guide for the Application of TSIs”

Table 1 contains the standard referred to in this guide, explanations on the usage of the standard are provided in the core text of the guide.

The application of some standards listed in this table, but not referred to in the ENE TSI, is not meant to be mandatory. In some cases, harmonised standards that cover the basic parameters of the TSIs provide presumption of conformity with certain clauses of the TSIs. In accordance with the spirit of the new approach to technical harmonisation and standardisation, application of these standards remains voluntary, but their references are published on the Official Journal of the European Union (OJEU). These specifications are listed in the TSI application guide in order to facilitate their use by the industry. These specifications remain complementary to TSIs.

Table 1 - List of standards quoted in this application guide

No	Point of the application guide	Standard
1	2.3.2. Traction power supply performance	EN 50388-1:2022
2	2.3.3. Current at standstill	EN 50367:2020 +A1:2022
3	2.3.6 Harmonic and dynamic effects for AC systems (point 4.2.8)	EN 50388-1:2022
4	2.3.8. Pantograph gauge	EN 15273 series
5	2.3.12. Separation sections	EN50367:2020+A1:2022 EN50388-1:2022.
6	2.6.2.1 static contact force	EN50367:2020+A1:2022
7	2.6.4. Assessment of existing OCL	EN 50318:2018+A1:2022