SLOVENSKI STANDARD
SIST EN 50562:2018

01-september-2018

Nadomešča:
SIST-TS CLC/TS 50562:2011

Železniške naprave - Stabilne naprave električne vleke - Postopki, zaščitni ukrepi in prikazovanje varnosti električnih sistemov vleke

Railway applications - Fixed installations - Process, protective measures and demonstration of safety for electric traction systems

Bahnanwendungen - Ortsfeste Anlagen - Prozess, Schutzmaßnahmen und Nachweisführung für die Sicherheit in der Bahnstromversorgung

Applications ferroviaires - Installations fixes - Processus, mesures de prévention et démonstration de la sécurité pour les installations fixes de traction électrique

Ta slovenski standard je istoveten z: **EN 50562:2018**

ICS:

29.280	Električna vlečna oprema	Electric traction equipment

SIST EN 50562:2018 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50562

January 2018

ICS 29.280

Supersedes CLC/TS 50562:2011

English Version

Railway applications - Fixed installations - Process, protective measures and demonstration of safety for electric traction systems

Applications ferroviaires - Installations fixes - Processus, mesures de prévention et démonstration de la sécurité pour les installations fixes de traction électrique

Bahnanwendungen - Ortsfeste Anlagen - Prozess, Schutzmaßnahmen und Nachweisführung für die Sicherheit für elektrische Bahnanlagen

This European Standard was approved by CENELEC on 2017-08-21. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN 50562:2018 E

Contents

Page

European foreword

This document (EN 50562:2018) has been prepared by CLC/SC 9XC “Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations)”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-07-26
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2021-01-26

This document supersedes CLC/TS 50562:2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

Introduction

This European Standard provides a code of practice (CoP) for the process, protective measures and demonstration of safety for the conventional electric traction systems which supports the application of EN 50126. Within this standard “safety” is used with respect to harm to people and environment. Safety in terms of harm to assets is covered in the relevant product and application standards.

This standard includes a systems description for the generic reference system for a conventional electric traction system (refer to Figure 3) and the related subsystems. The interfaces with respect to safety at the system borders and the respective aspects to be coordinated are described. Based on the list of top-level hazards and endangered groups protective measures for risk mitigation and hazard control are derived and indications for the verification and validation procedures are given. The list of standards given in Annex B can serve as a reference.

During the preparation of this European Standard it became obvious, that the risks associated with conventional electric traction systems are broadly accepted. This conclusion is based on long term experience from several European railways. The technical systems used by these European railways in their conventional electric traction systems are equivalent to the generic reference system described in this standard. Confidential field data that were taken into account represent more than 1 200 000 year km operational experience. To exemplify, the equivalent would be a network size of about 80 000 km and the operational experience laid down in traceable field data would cover a period of 15 years of service. No fatality was reported caused by a product property or a failure of a specified function of the conventional electric traction systems.

This standard has been developed specifically to support the realization of EN 50126 within the context of safety for electric traction systems. It provides generic building blocks which assists the fulfilment of the requirements of life cycle steps given in EN 50126. Product and application standards are traditionally applied in fixed installations to ensure safety and performance in terms of e.g. reliability and cost efficiency. Within this standard the link between existing product and application standards, technical specification for interoperability and EN 50126 is given.

This standard complies with the principles of the life cycle modelling according to EN 50126 by tailoring the risk assessment process. This means that this standard encompasses the entire safety process ranging from the system description, hazards identification to the verification and validation of the implemented protective measures according to EN 50126 and it is not just a summation of product and application standards.

This standard has been developed so that it can also be used for assessing risks arising from technical changes within the legal framework of the European Union.

This standard also supports the decision making regarding the assessment of changes, e.g. with respect to the significance of changes in technologies. It includes in particular the risk acceptance principle regarding the application of codes of practice. It also supports the application of the risk acceptance principles similar reference systems and explicit risk estimation for electric traction systems in the framework of EN 50126.

When applying TSIs, e.g. TSI Energy, this standard supports the demonstration of the inherent safety of the conventional electric traction system and supports the safe integration at overall system level.

Amongst others this standard can be used as a code of practice for conventional electric traction systems. This does not exclude consideration of other codes of practice even from other fields of application.

The interrelation between the legal framework, the standards traditionally applied and the set of standards confined to safety is shown in Figure 1.

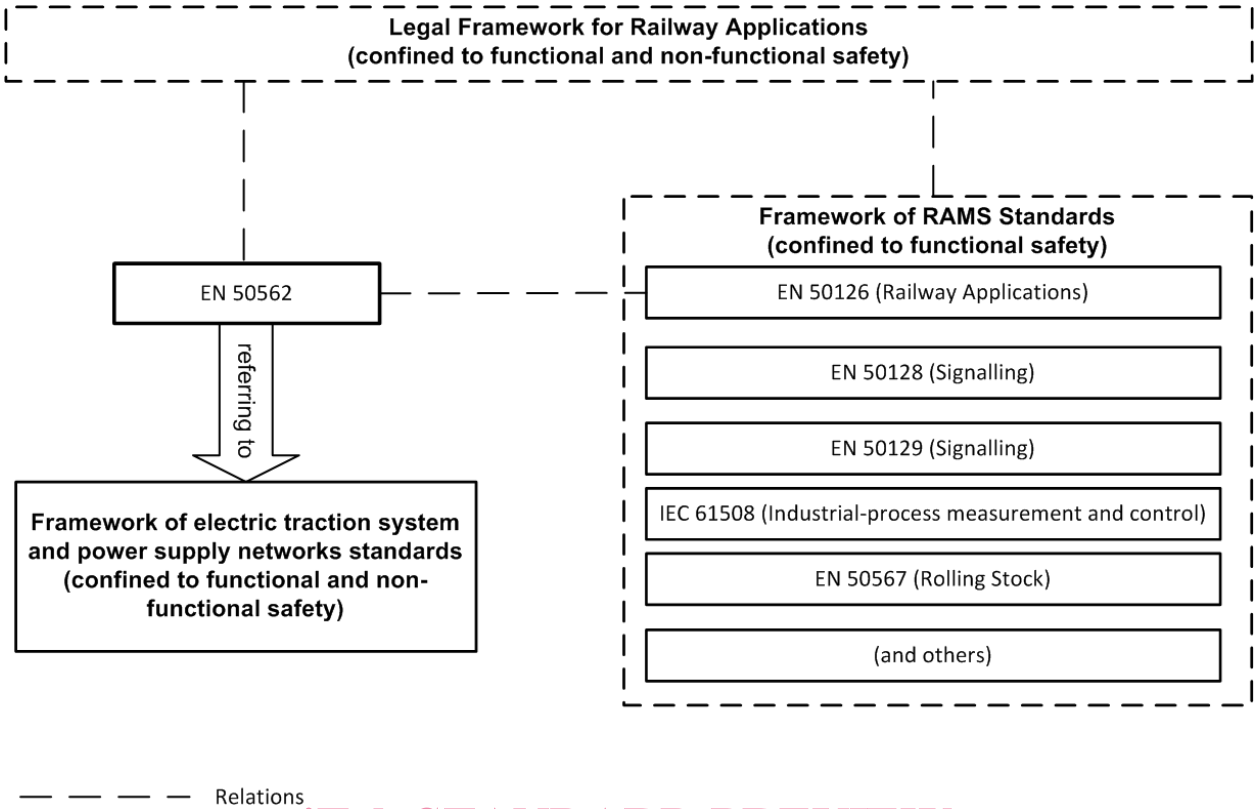

Figure 1 — Interrelationship between standards and the legal framework

1 Scope

This European Standard defines the process, protective measures and demonstration of safety in accordance with EN 50126 for conventional electric traction systems for railways. This standard can also be applied to guided mass transport systems and trolleybus systems. All these systems can be elevated, at-grade and underground.

Other systems including those listed below were not assessed and therefore are outside the scope of this European Standard:

– underground mine traction systems,

– cranes, transportable platforms and similar transportation equipment on rails, temporary structures (e.g. exhibition structures) in so far as these are not supplied directly or via transformers from the contact line system and are not endangered by the traction power supply system,

– suspended cable cars,

– funicular railways,

– magnetic levitated systems,

– railways with inductive power with inductive contactless transmission of the energy from the electric traction power supply system to the electrically powered traction unit,

– railways with buried contact line system that is required to be energised only below the train to ensure safety,

For similar technology and similar hazardous scenarios, the safety considerations of this standard can be used as a guideline. This European Standard applies to conventional electric traction systems, which are new or are undergoing major changes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document including any amendments applies.

EN 50110 (series), *Operation of electrical installations*

EN 50119, *Railway applications - Fixed installations - Electric traction overhead contact lines*

EN 50122 (series), *Railway applications – Fixed installations – Electrical safety, earthing and the return circuit*

EN 50123 (series), *Railway applications – Fixed installations – DC switchgear*

EN 50124 (series), *Railway applications – Insulation coordination*

EN 50126 (series), *Railway applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)*

EN 50152 (series), *Railway applications – Fixed installations – Particular requirements for AC switchgear*

EN 50153, *Railway applications - Rolling stock - Protective provisions relating to electrical hazards*

EN 50163, *Railway applications - Supply voltages of traction systems*

EN 50388, *Railway Applications - Power supply and rolling stock - Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability*

EN 50633, *Railway applications - Fixed installations - Protection principles for AC and DC electric traction systems*

CLC/TR 50488, *Railway applications - Safety measures for the personnel working on or near overhead contact lines*

EN 60255 (series), *Measuring relays and protection equipment (IEC 60255)*

EN 61508 (series), *Functional safety of electrical/electronic/programmable electronic safety-related systems (IEC 61508)*

EN 62305 (series), *Protection against lightning (IEC 62305)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
contact line system
support system and contact line supplying electric energy to vehicles through current collecting equipment

Note 1 to entry: The contact line system can comprise:

- the contact line,

- masts and foundations,

- supports and any components registering the conductors,

- cross-spans or cables,

- tensioners,

- other along track conductors such as feeders, earth wires and return conductors when supported from the same masts as the contact line,

- conductors connected permanently to the contact line for supplying other electrical equipment such as lighting, signal operation, point control and point heating.

[SOURCE: IEC 60050-811:2017, 811-33-59]

3.2
conventional electric traction system
electric traction system constructed, operated and maintained according to relevant standards and common practice

3.3
current collector zone
CCZ
zone whose limits are in general not exceeded by an energized collector no longer in contact with the contact line or broken collector and its fragments

[SOURCE: EN 50122-1:2011, 3.5.10]

3.4
effective touch voltage
U_{te}
voltage between conductive parts when touched simultaneously by a person or an animal

Note 1 to entry: The value of the effective touch voltage can be appreciably influenced by the impedance of the person or the animal in electric contact with these conductive parts.

Note 2 to entry: The conductive path through the body is conventionally from hand to both feet (horizontal distance of 1 m) or from hand to hand.

[SOURCE: IEC 60050-195:1998, 195-05-11, modified - “(effective)” replaced with “effective”, Note 2 to entry has been added.]

3.5
electric safety
freedom from unacceptable risk of harm caused by electrical systems

[SOURCE: EN 50122-1:2011, 3.1.1]

3.6
electric shock
physiological effect resulting from an electric current passing through a human or animal body

[SOURCE: IEC 60050-195:1998, 195-01-04]

3.7
electric traction system
railway electric distribution network used to provide energy for rolling stock

Note 1 to entry: The system includes

– contact line systems,

– return circuit of electric traction systems,

– running rails of non-electric traction systems, which are in the vicinity of, and conductively connected to the running rails of an electric traction system,

– electric installations, which are supplied from contact lines either directly or via a transformer,

– electric installations in power plants and substations, which are utilized solely for generation and distribution of power directly to the contact line,

– electric installations of switching stations.

[SOURCE: IEC 60050-811:2017, 811-36-21]

3.8
hazard
potential source of harm

Note 1 to entry: The In English, the term “hazard” can be qualified in order to define the origin of the hazard or the nature of the expected harm (e.g. “electric shock hazard”, “crushing hazard”, “cutting hazard”, “toxic hazard”, “fire hazard”, “drowning hazard”).

Note 2 to entry: In French, the synonym “risque” is used together with a qualifier or a complement to define the origin of the hazard or the nature of the expected harm (e.g. “risque de choc électrique”, “risque d'écrasement”, “risque de coupure”, “risque toxique”, “risque d'incendie”, “risque de noyade”).

Note 3 to entry: In French, the term “risque” also denotes the combination of the probability of occurrence of harm and the severity of that harm, in English “risk” (see 903–01–07).

[SOURCE: IEC 60050-903:2013, 903-01-02]

3.9
overhead contact line zone
OCLZ
zone whose limits are in general not exceeded by a broken overhead contact line

[SOURCE: EN 50122-1:2011, 3.5.9]

3.10
protection
provisions for detecting faults or other abnormal operating conditions in a power system, for enabling fault clearance, for terminating abnormal operating conditions, and for initiating signals or indications

Note 1 to entry: The term “protection” is a generic term for protection equipment or protection systems.

Note 2 to entry: The term “protection” may be used to describe the protection of a complete power system or the protection of individual plant items in a power system e.g. transformer protection, line protection, generator protection.

Note 3 to entry: Protection does not include items of power system plant provided, for example, to limit overvoltages on the power system. However, it includes items provided to control the power system voltage or frequency deviations such as automatic reactor switching, load-shedding, etc.

[SOURCE: IEC 60050-448:1995, 448-11-01, modified – abnormal condition becomes abnormal operating conditions]

3.11
protective measure
measure intended to achieve adequate risk reduction, implemented:

- by the designer (inherent design, safeguarding and complementary protective measures, information for use) and

- by the user (organization: safe working procedures, supervision, training; permit-to-work systems; provision and use of additional safeguards; use of personal protective equipment)

[SOURCE: IEC 60050-903:2013, 903-01-17]

3.12
return cable
conductor connecting the running rails or other parts of the return circuit to the substation

Note 1 to entry: Similar to IEC 60050-811-35–04.

[EN 50122-1:2011, 3.3.5]

3.13
return circuit
all conductors which form the intended path for the traction return current and the current under fault conditions

Note 1 to entry: The conductors may be for example:

– running rails;

– return conductor rails;

– return conductors;

– return cables.

Note 2 to entry: The definition applies to return currents during operation and fault conditions.

[SOURCE: IEC 60050-811:2017, 811-35-01, modified - Note 2 to entry has been added]

3.14
return conductor
conductor paralleling the track return system and connected to the running rails at periodic intervals

[SOURCE: IEC 60050-811:2017, 811-35-13]

3.15
return conductor rail
conductor rail used instead of the running rail for the traction return currents

[SOURCE: IEC 60050-811:2017, 811-34-10]

3.16
safety
freedom from unacceptable risk

[SOURCE: ISO/IEC Guide 116:2010, 3.16], [SOURCE: IEC 60050-903:2013, 903-01-19]

3.17
switchgear and controlgear
switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy

[SOURCE: IEC 60050-441:2000, 441-11-01]

3.18
system hazard
unintended condition within a technical system which contributes to a top-level hazard

Note 1 to entry: A system hazard can include defects and deficiencies of functions and properties.

3.19
top-level hazard
physical situation that provides a potential source of harm where no further barriers are specified

3.20
track circuit
electrical circuit of which the rails of a track section form a part, with usually a source of current connected at one end and a detection device at the other end for detecting whether this track section is clear or occupied by a vehicle

Note 1 to entry: In a continuous signalling system, the track circuit may be used to transmit information between the ground and the train.

[SOURCE: IEC 60050-821:2017, 821-03-01]

4 Abbreviations

Table 1 — Abbreviations and acronyms

Abbreviation and acronym	Explanation
AC	Alternating Current
ACRC	Automated Connection to the Return Circuit
CCZ	Current Collector Zone
CoP	Code of Practice
CSM RA	Common Safety Methods - Risk Assessment
DC	Direct Current
EMC	Electromagnetic Compatibility
ERE	Explicit Risk Estimation
HD	CEN/CENELEC harmonization document
HMI	Human Machine Interface
O&M	Operation and Maintenance
OCLZ	Overhead Contact Line Zone
OTHERS	Other groups of persons besides PAX, PUB and STAFF, such as trespasser, vandals etc. characteristic: knowing that there are residual risks when entering the vicinity of tracks, power lines and contact line systems
PAX	Passengers of the railway. characteristic: not expecting a risk
PUB	General public, e.g. neighbourhood, passer-by, but not passengers. characteristic: not expecting a risk
SIM	Comparison with a similar reference system
S-SIL	Software Safety Integrity Level
STAFF	Competent persons having the permission for access to and work on railway assets, e.g. railway personnel, civil workers for railway construction, search and rescue etc. Characteristic: knowing that there are residual risks when entering electrical rooms or the vicinity of tracks, power lines and contact line systems
TLH	Top Level Hazard
TSI	Technical Specification for Interoperability
T&C	Testing and Commissioning
WHO	World Health Organization of the United Nations

5 Risk assessment process

5.1 General

Precondition for the application of this European Standard as a code of practice is that the design, construction, operation and maintenance of electric traction systems follow the relevant standards to ensure safety. For applications where no specific standards exist, safety shall be established by the application of the risk acceptance principles 'comparison with a similar reference system' and 'explicit risk estimation'. If explicit risk estimation is applied the safety process shall follow EN 50126 or EN 61508 or equivalent.

NOTE The risk assessment process for application of code of practice or comparison with similar reference system the process is a part of a hazard management process, e.g. with respect to life cycle.

This clause describes how to:

– define the system under consideration and the relevant interfaces,

– apply gap analysis and perform risk assessment,

– apply protective measures,

– demonstrate safety.

Clause 6 of this standard describes an electric traction system that serves as a generic reference system. When using this standard for the risk acceptance principles application of a code of practice and for the comparison with a similar reference system the risk assessment shall be focused on the differences of the reference system and the system under consideration. The reference system can be derived from the generic reference system defined in Clause 6 or from an existing system that is proven in use and has an acceptable safety level within a similar conditions and operational context.

In case the generic reference system is chosen, the protective measures (Clause 7) identified shall be evaluated regarding their applicability for the system under consideration and protective measures for new hazards shall be added. For other reference systems this applies in analogy but based on the protective measures of the generic reference system in clause 6 of this standard.

The risk assessment process for an electric traction system is a process tailored from EN 50126 and consists of the following steps shown in Figure 2.

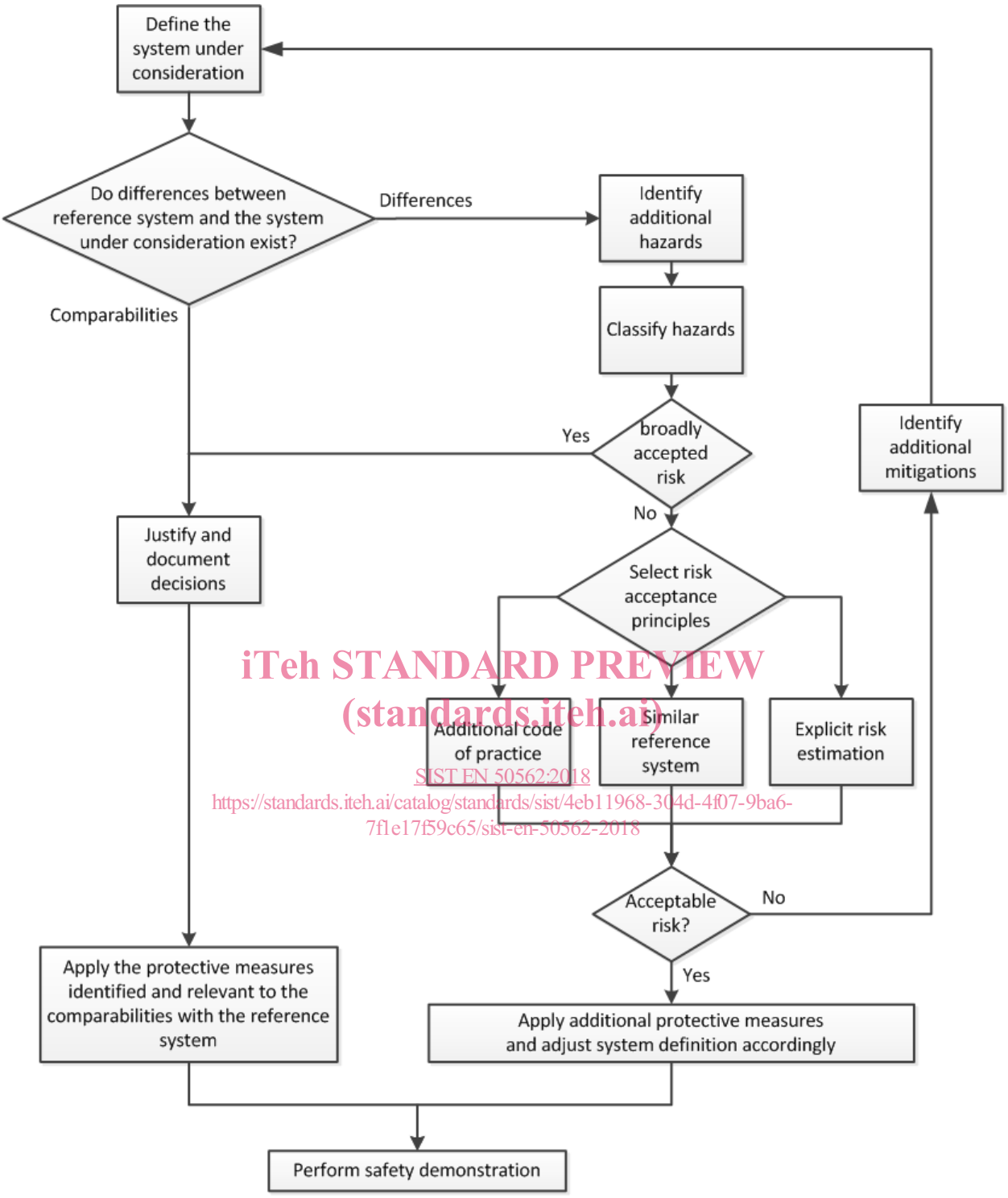

Figure 2 — Risk assessment process for an electric traction system

5.2 System definition

The system under consideration, operational conditions and procedures, environment and its interfaces shall be described in a level of detail that enables the analysis to be undertaken. The system may be structured in subsystems as far as it is necessary. The main functions and components shall be included in the system definition. Application conditions shall be documented and taken into account.

The system definition of the system under consideration shall be comparable to the system definition of the reference system. The reference system serves as a bench mark for the system under consideration