SLOVENSKI STANDARD
SIST EN 50152-3-1:2017

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SIST EN 50152-3-1:2004

Železniške naprave - Stabilne naprave električne vleke - Posebne zahteve za stikalne naprave za izmenični tok - 3-1. del: Merilne, krmilne in zaščitne naprave za izključno uporabo v izmeničnih vlečnih sistemih - Naprave

Railway applications - Fixed installations - Particular requirements for a.c. switchgear - Part 3-1: Measurement, control and protection devices for specific use in a.c. traction systems - Devices

Bahnanwendungen - Ortsfeste Anlagen – Besondere Anforderungen an Wechselstrom-Schalteinrichtungen - Teil 3-1: Mess-, Steuerungs- und Schutzeinrichtungen für Wechselstrom-Bahnanlagen - Geräte

Applications ferroviaires - Installations fixes - Exigences particulières pour appareillage à courant alternatif - Partie 3-1: Dispositifs de mesure, de commande et de protection pour usage spécifique dans les systèmes de traction à courant alternatif - Guide d'application

Ta slovenski standard je istoveten z: **EN 50152-3-1:2017**

ICS:

29.130.99	Druge stikalne in krmilne naprave	Other switchgear and controlgear
29.280	Električna vlečna oprema	Electric traction equipment

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EUROPEAN STANDARD

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EN 50152-3-1

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Supersedes EN 50152-3-1:2003

English Version

Railway applications - Fixed installations - Particular requirements for a.c. switchgear - Part 3-1: Measurement, control and protection devices for specific use in a.c. traction systems - Devices

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

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European foreword

This document (EN 50152-3-1:2017) 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 the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-12-26
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2019-12-26

This document supersedes EN 50152-3-1:2003.

EN 50152-3-1:2017 includes the following significant technical changes with respect to EN 50152-3-1:2003:

It was completely reworked to:

— distinguish between requirements, Clauses 4 and 5, and application guides, annexes;

— include requirements on devices e.g. control and protection relays not included before;

— remove parts already included in other standards, e.g. EN 50633 protection principles.

The EN 50152 series is divided as follows:

— *Railway applications — Fixed installations — Particular requirements for alternating current switchgear — Part 1: Circuit-breakers with nominal voltage above 1 kV*;

— *Railway applications — Fixed installations — Particular requirements for alternating current switchgear — Part 2: Disconnectors, earthing switches and switches with nominal voltage above 1 kV*;

— *Railway applications — Fixed installations — Particular requirements for a.c. switchgear — Part 3-1: Measurement, control and protection devices for specific use in a.c. traction systems — Devices*;

— *Railway applications — Fixed installations — Particular requirements for a.c. switchgear — Part 3-2: Measurement, control and protection devices for specific use in a.c. traction systems — Current transformers*;

— *Railway applications — Fixed installations — Particular requirements for a.c. switchgear — Part 3-3: Measurement, control and protection devices for specific use in a.c. traction systems — Voltage transformers*.

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.

Introduction

EN 50152-3-1 is intended for measurement, control and protection devices for specific use in a.c. traction systems other than current and voltage transformers. These are covered by EN 50152-3-2 and EN 50152-3-3 respectively.

This standard covers a large variety of different kinds of equipment used in railway fixed installations which do not have railway specific product standards. It provides clarification on how to select ratings and test values relevant for operation in fixed installations. This standard needs to be read in conjunction with the relevant product standard of the equipment concerned.

Annexes A and B are application guides. Annex A deals with railway specific measurement principles and Annex B provides guidance in the design of control systems for a.c. traction. These application guides identify characteristics of and parameters for procedures and functions used. Guidance in protection principles is given in EN 50633.

The clause numbering of this part is different to that used in all other parts of the series. Clause numbering in the other parts is the same as in the specific referenced product standard

1 Scope

This European Standard is applicable to new low voltage devices for measurement, control and protection which are:

— for indoor or outdoor fixed installations in traction systems, and

— operated in conjunction with high voltage equipment with an a.c. line voltage and frequency as specified in EN 50163.

NOTE EN 50163 specifies the a.c. traction systems 15 kV 16,7 Hz and 25 kV 50 Hz.

This European Standard also applies to measurement, control and protective devices other than low voltage devices and not covered by a specific railway product standard as far as reasonably possible. Requirements of this document prevail.

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 50121-5, *Railway applications — Electromagnetic compatibility — Part 5: Emission and immunity of fixed power supply installations and apparatus*

EN 50124-1, *Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment*

EN 50152-2:2012, *Railway applications - Fixed installations - Particular requirements for alternating current switchgear - Part 2: Disconnectors, earthing switches and switches with nominal voltage above 1 kV*

EN 50152-3-2:2016, *Railway applications - Fixed installations - Particular requirements for a.c. switchgear - Part 3-2: Measurement, control and protection devices for specific use in a.c. traction systems - Current transformers*

EN 50152-3-3:2016, *Railway applications - Fixed installations - Particular requirements for a.c. switchgear - Part 3-3: Measurement, control and protection devices for specific use in a.c. traction systems - Voltage transformers*

EN 50163:2004[1], *Railway applications — Supply voltages of traction systems*

EN 60255-1, *Measuring relays and protection equipment - Part 1: Common requirements (IEC 60255-1)*

EN 61243-5, *Live working - Voltage detectors - Part 5: Voltage detecting systems (VDS) (IEC 61243-5)*

EN 61869 (all parts), *Instrument transformers (IEC 61869, all parts)*

EN 61869-1:2009, *Instrument transformers - Part 1: General requirements (IEC 61869-1:2007, modified)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50152 (all parts) and the following apply.

[1] As impacted by EN 50163:2004/A1:2007, EN 50163:2004/Corrigendum:2010, EN 50163:2004/AC:2013.

3.1
under-voltage
voltage the value of which is lower than a specified limiting value

[SOURCE: IEC 60050-151:2001, 151-15-29]

3.2
under-voltage off
control function which permits a mechanical switching device to open, with or without time-delay, when the voltage of the circuit the mechanical switching device is connected to falls below a predetermined value

Note 1 to entry This term is used when a loss of primary voltage is considered.

Note 2 to entry This function will in most cases require any kind of shunt release.

3.3
under-voltage release
shunt release which permits a mechanical switching device to open or close, with or without time-delay, when the voltage across the terminals of the release falls below a predetermined value

[SOURCE: IEC 60050-441:2000, 441-16-42]

Note 1 to entry This term is used when a loss of an auxiliary voltage is considered

3.4
under-voltage trip
protection function which permits a mechanical switching device to open, with or without time-delay, when the voltage of the circuit the mechanical switching device falls below a predetermined value

Note 1 to entry This term is used when a loss of primary voltage is considered.

Note 2 to entry This function will in most cases require any kind of shunt release.

4 Specific requirements from the traction system

Traction systems due to e.g. their load, voltage and earthing conditions require thorough analysis when defining operational principles and requirements for equipment.

The design of measurement, control and protection circuits, their devices and algorithms shall consider any effect arising from:

— fast fluctuation of traction power demand;

— moving tractions units, providing scenarios with traction currents higher than failure currents;

— the return current system, especially the track, effectively connected to earth;

— fast fluctuation of operating voltages between U_{min2} and U_{max2}, with U_{min2} and U_{max2} as specified in EN 50163;

— high number of switching operations e.g. caused by a high number of short circuits in the contact line systems;

— in 16,7 Hz traction systems the duration of a period of 60 ms in respect to magnetisation, saturation and switching times;

— in auto-transformer systems, a phase shift of 180° resulting in an maximum operating voltage of 2 * U_{max2} but only between phases.

NOTE 1 The return circuit in a.c. traction systems is effectively earthed. Unlike utility networks a displacement of the star point during earth faults resulting in an increase of phase voltages by factor √3 cannot happen.

NOTE 2 Equipment in a 25 kV traction system is subject to a maximum permanent operating voltage phase to earth of 27,5 kV = U_{max1}. Equipment in a 3 phase utility network with a highest system voltage U_m = 36 kV has an average continuous voltage phase to earth during 99 % of its life of 33/√3 kV = 19,1 kV.

If the above values are compared, it becomes clear that the dielectric stress of equipment in traction power supply is significantly higher and therefore the test voltages e.g. during partial discharge testing have assigned higher values in this European Standard.

5 Requirements on measurement, control and protection devices

5.1 General

Measurement, control and protection devices shall be designed, manufactured and tested to their specific product standards. Requirements of railway standards prevail and shall be applied as far as reasonably possible. This especially concerns EN 50124-1 for insulation coordination and EN 50121-5 for electromagnetic compatibility.

5.2 Voltage detection systems

Capacitive voltage detection systems shall comply with EN 61243-5 except for the following requirements:

— voltage absence indication shall be below 50 % of U_{min2},

— voltage presence indication shall be above 90 % of U_{min2} and

— the capacitive voltage detection system shall properly work also up to U_{max2}.

NOTE 1 The thresholds for voltage absence and presence indication are adapted considering the fact that voltages are between contact line and running rail on ground potential and also the tolerances of supply voltages of traction systems.

When selecting voltage detectors manufactured according to EN 61243-1 it may be preferential to use thresholds for voltage absence and presence indication as specified before.

NOTE 2 This portable equipment is only temporarily connected to a supply voltage of the traction system.

NOTE 3 There are national standards available in some countries specifying thresholds for voltage absence and presence indication.

5.3 Devices at supply voltage of a traction system

Devices not covered by a railway specific product standard and being connected to a circuit at supply voltage of a traction system shall comply with the test voltages including partial discharge level as specified in EN 50152-3-3 for this supply voltage. If these devices are connected to provide isolation of feeding systems the test voltages shall be taken for “across the isolating distance” from EN 50152-2:2012, Table 1 e.g. when connected parallel to a disconnector.

Other requirements of EN 50152-3-2 or EN 50152-3-3 or for sensors as given in the EN 61869 series shall apply as far as reasonably possible and shall be agreed upon between supplier and infrastructure manager.

Devices containing electronic parts shall be subject to a function test in the intended operational circuit and under worst case conditions e.g. in its installation position next to a circuit breaker during a short circuit breaking test.

Dielectric type tests shall be applied as specified in EN 61869-1:2009, 7.2.3 with test values as specified in EN 50152-3-3:2016, 7.1. Dielectric routine tests shall be applied as specified in EN 61869-1:2009, 7.3.1 to

7.3.4 with test values as specified in EN 50152-3-3:2016, 7.1 and 7.3. Other tests and their test requirements shall be agreed upon between purchaser and supplier prior to the order.

5.4 Protection devices

Protection devices used in railway applications shall comply with the relevant product standards, particularly EN 60255-1. They shall also comply with the electromagnetic compatibility requirements given in EN 50121-5.

Any protection device shall be specified based on a consideration of the specific requirements from the traction system as given in Clause 4.

Protection devices for contact line protection shall include the following protection functions:

— distance protection with a minimum of two stages and the possibility to use directional settings;

— di/dt or du/dt protection;

— de-icing protection, when specified e.g. by the system designer or infrastructure manager;

— the possibility for blocking or delaying between the functions.

NOTE 1 This kind of protection device will typically use specially adapted algorithms and will therefore be different to devices intended for utility use.

NOTE 2 EN 50633 provides an application guide on protections systems including back scenarios.

Protection devices for 16,7 Hz contact line protection shall include the following protection functions in addition:

— instantaneous overcurrent protection;

— fast acting trip output.

NOTE 3 Instantaneous overcurrent protection in combination with the fast acting trip output are intended to support fault clearance in the first half of the period. 16,7 Hz circuit breakers are typically equipped with a fast tripping device and total time until opening of the breaker is in the range of 20 ms to 25 ms.

NOTE 4 Algorithms for 16,7 Hz contact line protection devices are in many cases different to those of 50 Hz devices. This is due to the aim to achieve similar response times out of a shorter fraction of the period. Hardware modifications are also likely to be required.

Annex A
(informative)

Application guide - Measurement principles

A.1 Introduction

This application guide provides guidance in measurement principles typical to traction systems.

NOTE Many other principles are well known from public power supply systems and are not repeated in this annex.

Line testing has been classified as a measurement principle. Nevertheless it normally only provides a comparison to a threshold and not a measurement value.

A.2 Line testing

A.2.1 General

Overhead contact lines are exposed to a significantly higher number of short circuits compared to other overhead lines. This is due the reduced height of installation above ground and operation together with fast moving pantographs.

Any short circuit provides extra stress to the contact line which is sensitive to over-temperatures. This sensitivity is influenced by many parameters including cross-sections and tensile force. Based on this data and under consideration of traction load, short-circuit current level and protection scheme the withstand-ability of the contact line against e.g. repeated short circuits may be determined.

NOTE 1 A typical value derived from operational experience is 1 short circuit each km of contact line per annum.

NOTE 2 Most sensitive to loss of tensile strength are droppers between messenger and contact wire.

The recommendation is to consider measures reducing the number of short circuits for a contact line. One possibility is to close line circuit breakers only after the ‘short circuit free’ condition of the contact line has been verified. Experience has shown that line testing provides a substantial benefit with short circuit current levels from 20 kA and higher.

NOTE 3 16,7 Hz railways with short circuit current levels of up to 40 kA typically use line testing whereas 50 Hz railways with short-circuit current levels of up to 16 kA typically do not.

NOTE 4 Saturation of current transformers sometimes leads to a delay in tripping of the circuit breaker after switching on to a short circuit. Thermal stress to the contact line is unnecessarily increased in these cases. The current transformer design needs to consider this effect.

All line test principles have in common that the contact line is energised with a voltage in the range of the supply voltage for a predetermined time. The testing source provides a short circuit impedance limiting the failure current in case of a short circuit to a few percent of the rated current. Detection method and related parameters are fixed by the system designers / infrastructure managers for the system.

A.2.2 Line testing methods

A.2.2.1 Line testing based on voltage criterion

This method uses a test resistor limiting the fault current to values below 10 A. The resistor is connected to the feeder cable of the contact line under test and switched on to the feeding system e.g. by a switch-disconnector. The voltage at the contact line is measured and provides the criterion for switching on.