

© Copyright SEK. Reproduction in any form without permission is prohibited.

Järnvägstillämpningar – Batterier för hjälpkraftssystem

*Railway applications –
Batteries for auxiliary power supply systems*

Som svensk standard gäller europastandarden EN 50547:2013. Den svenska standarden innehåller den officiella engelska språkversionen av EN 50547:2013.

Nationellt förord

Standarden ska användas tillsammans med SEK TS 50534, utgåva 1, 2013.

ICS 29.220.01; 45.060.01

Denna standard är fastställd av SEK Svensk Elstandard, som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: SEK, Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00. Telefax: 08 - 444 14 30
E-post: sek@elstandard.se. Internet: www.elstandard.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

**Railway applications -
Batteries for auxiliary power supply systems**

Applications ferroviaires -
Batteries pour systèmes d'alimentation
auxiliaire

Bahnanwendungen -
Batterien für
Bordnetzversorgungssysteme

This European Standard was approved by CENELEC on 2013-03-04. 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Contents

Foreword	6
1 Scope	7
2 Normative references	7
3 Terms, definitions and abbreviations	8
3.1 Terms and definitions.....	8
3.2 Abbreviations	10
4 General requirements	11
4.1 Definitions of the components of a battery	11
4.2 Definitions of battery type	12
4.2.1 lead acid batteries.....	12
4.2.2 lead acid batteries with vented technology (liquid electrolyte)	12
4.2.3 lead acid batteries with valve-regulated-lead technology (non-liquid respectively absorbed-liquid electrolyte).....	12
4.2.4 NiCd batteries (all with liquid electrolyte).....	12
4.2.5 NiCd batteries with fibre structure technology	12
4.2.6 NiCd batteries with sintered / PBE technology	12
4.3 Environmental conditions	12
4.4 Voltage / capacity.....	13
4.5 System requirements	14
4.5.1 Charging requirements	14
4.5.2 Discharging requirements	15
4.5.2.1 Load profile	16
4.5.2.2 Long-time discharge	18
4.5.2.3 Low temperature performance (if applicable)	18
4.5.3 Charge retention (self discharge)	18
4.5.4 Requirements for battery capacity design	19
4.6 Shock and vibration.....	19
4.7 Safety and protection requirements	19
4.7.1 Deep discharge of lead acid batteries	20
4.7.2 Necessary conditions after deep discharge of lead acid batteries	20
4.7.3 Deep discharge of NiCd batteries.....	20
4.7.4 Necessary reconditioning after deep discharge of NiCd batteries	20
4.7.5 Temperature compensation	20

4.7.6	Protection against superimposed ripple current	21
4.8	Fire protection	21
4.9	Maintenance.....	21
5	Lead acid batteries	21
5.1	General	21
5.2	Sizes of vented batteries.....	22
5.3	Sizes of GEL batteries	23
5.4	Sizes of AGM batteries	24
5.5	Charging characteristic	24
6	NiCd batteries	26
6.1	General	26
6.2	Preferred tray dimensions and mounting interface	26
6.3	Preconditions for the design of the battery tray	26
6.4	Charging characteristic	28
7	Proposal for mechanical design of Lead Acid and NiCd Batteries	30
7.1	General	30
7.2	Fixing mechanism	30
7.2.1	Fixed solution.....	31
7.2.2	Roll solution	32
7.2.3	Slide solution.....	34
7.3	Accessibility.....	34
7.4	Location of battery.....	34
7.5	Ventilation of battery box	35
8	Electric interface.....	35
8.1	General	35
8.2	Electrical connections	36
9	Marking.....	36
9.1	Safety signs.....	36
9.1.1	Outside the box.....	36
9.1.2	Tray, crate or other places inside the box.....	36
9.1.3	Cells or monoblocs	38
9.2	Nameplate.....	38
9.2.1	Box.....	38
9.2.2	Tray, crate or other nameplates inside the box	38
9.2.3	Cells or monoblocs	38

10	Storage and transportation conditions	38
10.1	Transportation	38
10.2	Storage of batteries.....	38
11	Testing	39
11.1	General	39
11.2	Routine test	39
11.3	Shock and vibration.....	40
Annex A (informative) Load profile verification		41
A.1	General	41
A.2	General methodology.....	41
A.3	Sizing description (calculation, simulation or preliminary tests)	41
A.4	Sizing documentation.....	42
A.5	Operational verification (load profile test)	42
A.6	Test report.....	43
Annex B (informative) Example of functions during load profile.....		44
Annex C (informative) NiCd-battery sizing for specific load profiles		45
Bibliography		47

Figures

Figure 1 - Definition of cell, monobloc battery, crate, tray and box	11
Figure 2 - Typical NiCd H-Type discharging curves at various constant discharging currents (example based on percentage of capacity)	13
Figure 3 - VRLA Typical discharge with various currents (multiples of I ₅) at +20 °C (example based on discharge time))	14
Figure 4 - Interfaces between battery and battery charger system	15
Figure 5 - Example of load profile in emergency operation (standstill of the train)	16
Figure 6 - Example of load profile in driving operation (driving without battery charging)	17
Figure 7 - Example of load profile for high speed train (without starting up segment).....	17
Figure 8 - Example of load profile for regional train / EMU (without starting up segment).....	18
Figure 9 - Typical charging curves for lead acid batteries on rail vehicles over temperature	25
Figure 10 - Typical mounting interface dimensions including fixing interfaces	27
Figure 11 - Typical charging characteristic of NiCd-batteries.....	30
Figure 12 - Example of fixed solution without tray.....	31
Figure 13 - Example of fixed solution with tray.....	31

Figure 14 - Example of roll solution with folding beams	32
Figure 15 - Example of roll solution with roller bearings.....	33
Figure 16 - Example of slide solution	34
Figure 17 - Schematic of a battery system (not all part necessary at all battery systems)	35
Figure 18 – Safety signs outside the battery box	36
Figure 19 – Safety signs inside the battery box	37
Figure C.1 - Envelope of the battery box and battery tray.....	46

Tables

Table 1 - Requirements of the charging characteristic.....	14
Table 2 – Necessary information for the definition of a discharging characteristic	19
Table 3 - Maintenance steps for different battery types	21
Table 4 - Specification of battery sizes of vented single cells / monobloc batteries	22
Table 5 - Specification of battery sizes of GEL single cells / monobloc batteries	23
Table 6 - Specification of battery sizes of AGM single cells / monobloc batteries	24
Table 7 - Typical charging voltages for lead acid batteries on rail vehicles	25
Table 8 - Specification of battery inner tray length (“A” reference in Figure 10)	28
Table 9 - NiCd batteries charging characteristics.....	29
Table 10 - List of tests	39
Table B.1 – Examples of functions during different steps of load profile	44
Table C.1 - Specification of battery tray sizes NiCd-batteries based on given load profiles).....	45

Foreword

This document (EN 50547:2013) has been prepared by Working Group 20 of SC 9XB, Electromechanical material on board of rolling stock, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The following dates are fixed:

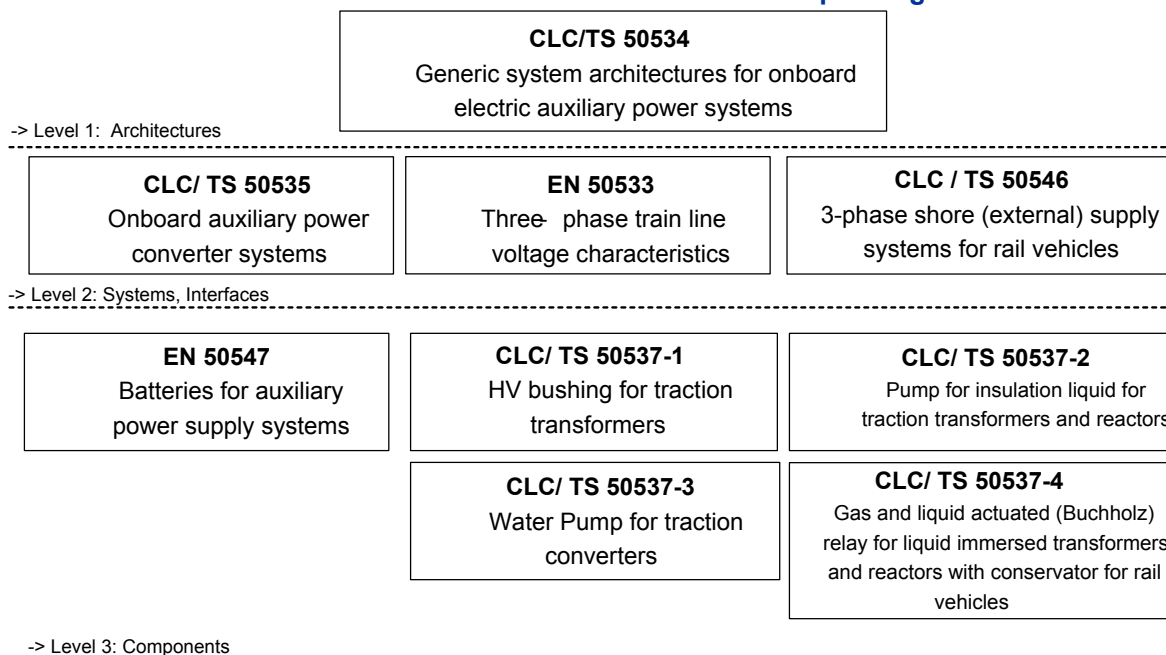
- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-03-04
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2016-03-04

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

EN 50547 shall be read in conjunction with CLC/TS 50534:2010 “*Railway applications - Generic system architectures for onboard electric auxiliary power systems*”.

This standardization project was derived from the EU-funded Research project MODTRAIN (MODPOWER). It is part of a series of standards, referring to each other. The hierarchy of the standards is intended to be as follows:

Overview on the technical framework CLC/TS 50534 defines the basis for other depending standards



1 Scope

This European Standard specifies rechargeable lead acid and NiCd-batteries for 110 V voltage auxiliary power supply system for railway vehicles.

This European Standard may be applied to other rolling stock types (e.g. light rail vehicles, tramways, metros...) if these are not in the scope of another specific standard.

Others technologies like NiMh or Lithium are not covered by this standard at present.

This European Standard focuses on:

- the description of mechanical interfaces: dimensions of the cells or monobloc batteries, main terminals and preferred sizes of the mounting space of the battery systems for lead acid batteries,
- the description of mechanical interfaces: dimensions of the trays and main terminals for NiCd batteries (as they have different characteristics depending on the technology),
- description of electrical interfaces: capacity, voltage and charging characteristic.

This European Standard restricts the variety of different types provided by EN 60254 and EN 60896 for lead acid batteries and defines the use of cells compliant to EN 60623 and EN 62259 for NiCd-Batteries.

The main objective of this standard is to achieve interchangeability of the battery cells and monobloc for lead acid batteries and the interchangeability of the battery trays for NiCd batteries.

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 50125-1:1999	<i>Railway applications - Environmental conditions for equipment - Part 1: Equipment on board rolling stock</i>
EN 50155:2007	<i>Railway applications - Electronic equipment used on rolling stock</i>
EN 50272-2:2001	<i>Safety requirements for secondary batteries and battery installations Part 2: Stationary batteries</i>
EN 50272-3:2002	<i>Safety requirements for secondary batteries and battery installations Part 3: Traction batteries</i>
EN 50467:2011	<i>Railway applications - Rolling stock - Electrical connectors, requirements and test methods</i>
EN 60077-1:2002	<i>Railway applications - Electric equipment for rolling stock - Part 1: General service conditions and general rules (IEC 60077-1:1999, mod.)</i>
EN 60254-1:2005	<i>Lead-acid traction batteries - Part 1: General requirements and methods of test (IEC 60254-1:2005)</i>
EN 60254-2:2008	<i>Lead-acid traction batteries - Part 2: Dimensions of cells and terminals and marking of polarity on cells (IEC 60254-1:2005)</i>
EN 60623:2001	<i>Secondary cells and batteries containing alkaline or other non-acid electrolytes - Vented nickel-cadmium prismatic rechargeable single cells (IEC 60623:2001)</i>

- EN 60896-11:2003 *Stationary lead-acid batteries - Part 11: Vented types; General requirements and methods of test (IEC 60896-11:2002)*
- EN 60896-21:2004 *Stationary lead-acid batteries - Part 21: Valve regulated types - Methods of test (IEC 60896-21:2004)*
- EN 61373:2010 *Railway applications - Rolling stock equipment - Shock and vibration test (IEC 61373:2010)*
- EN 62259:2004 *Secondary cells and batteries containing alkaline or other non-acid electrolytes - Nickel cadmium prismatic secondary single cells with partial gas recombination (IEC 62259:2003)*
- CEN/CLC TS 45545 series *Railway applications - Fire protection on railway vehicles*
- EN ISO 7010:2012 *Graphical symbols - Safety colours and safety signs - Safety signs used in workplaces and public areas (ISO 7010:2011)*
- IEC 60410:1973 *Sampling plans and procedures for inspection by attributes*