

Standards and Regulations for Batteries and Battery Plants

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14.1 SIGNIFICANCE OF STANDARDS

Standards are appointments and may become enforceable by jurisdictional law and administrative regulations through signed contracts (for instance a sales contract) and can be understood to be “approved technology rules”.

The general features of standards are, in short:

- Standards are a service for technology.
- Standards are an economic and a technical form of cooperation (see also DIN 820 Part 1).
- Standards are planned unifications of material and immaterial objects to serve everybody.
- Standards may not lead to exceptional economic advantages for any party.
- Standards may not affect the progress of technology and innovations.
- Standards shall help to cut down trade barriers.

14.2 NATIONAL GERMAN STANDARDS AND REGULATIONS

The Deutsche Elektrotechnische Kommission (DKE) is in charge of designing standards and regulations for the electrotechnical sector for Germany. The three institutes for this job are the DIN (Deutsches Institut für Normung; German Institute for Standardization), the DKE (Deutsche Kommission für Elektrotechnik; German Electrotechnical Commission), and the VDE (Verein Deutscher Elektro-

techniker; German member of IEEE). Results of their work are the Deutsche Normen, or German standards (DIN, DIN EN, and DIN IEC*), and the Bestimmungen, or regulations (VDE and DIN).

Federal and state laws are superior to these standards. For example:

- Explosion regulations (Ex V).
- Regulations on working environments (Arb. Staett. V).
- Building regulations (Elt Bau V).
- Regulations for assembly halls (V Staett V).
- Regulations for office buildings (Gh V).

For the European Community the EU directives and regulations are of the same importance and also gain law status through regulations.

Supporters and cosupporters of standards and regulations can also be corporate bodies, e.g. producer unions, associations, and institutes.

National carriers are also existent, for instance in Russia and France. France has a Ministry of Technology that issues these standards. In these countries standards are so-to-speak laws.

The following committees are in charge of standardization of batteries, that is secondary batteries (accumulators) and primary batteries (dry batteries) at the DKE:

K 371	Secondary rechargeable batteries (accumulators)
AK 371.0.2	Stationary lead accumulators
AK 371.0.3	Traction lead batteries
AK 371.0.4	Starter batteries
AK 371.0.5	Small valve-regulated lead-acid batteries
UK 371.1	Secondary alkaline batteries
UK 371.2	Regulations
K 372	Galvanic primary elements and batteries

Above this, further standardization work is accomplished by the following committees:

UK 351.4	Electric road vehicles
K 223	Emergency appliances and plants in buildings for public assemblies, etc.

14.2.1 How Standards Come into Being

Producers, branch associations (e.g. German Battery Manufacturers Association, member of ZVEI (Manufacturers Association of the Electronic and the Electro-technical Industry)), and authorities can propose or request a standard at the DKE. In case the committee in charge accepts the proposal, a team is put in charge of forming the standards' layout (draft), which in turn must pass the committee. Then this layout is made public allowing for public opinion within a period of 4 months.

Any national drafted standard is automatically transformed to a European draft under the responsibility of Comité Européen de Normalisation Electrotechnique (CENELEC). The CENELEC members are asked to decide whether they want to create based upon the national proposal a European standard or let it pass as a national standard only in the country which made the proposal.

After reconciliation of the objections by the CENELEC committees and possible changes, the final vote and passing by the national committees follows. In case of approval all member states of the European Union have to take the layout of the final version to edit it as an EN Standard. In the case only a national standard has to be published the procedure is shown in Figure 14.1. Here only national objections have to be regarded by the German National Committee; after reconciliation of the objections and possible changes the final vote follows and the layout is then printed as German National Standard (DIN).

Other general rules that have to be considered due to the cooperation between CENELEC and IEC are not treated here, but can be referred to in special publications on the subject.

14.3 INTERNATIONAL STANDARDS

14.3.1 International Electrotechnical Commission

The IEC (International Electrotechnical Commission) features the following commissions in charge of standardization of batteries:

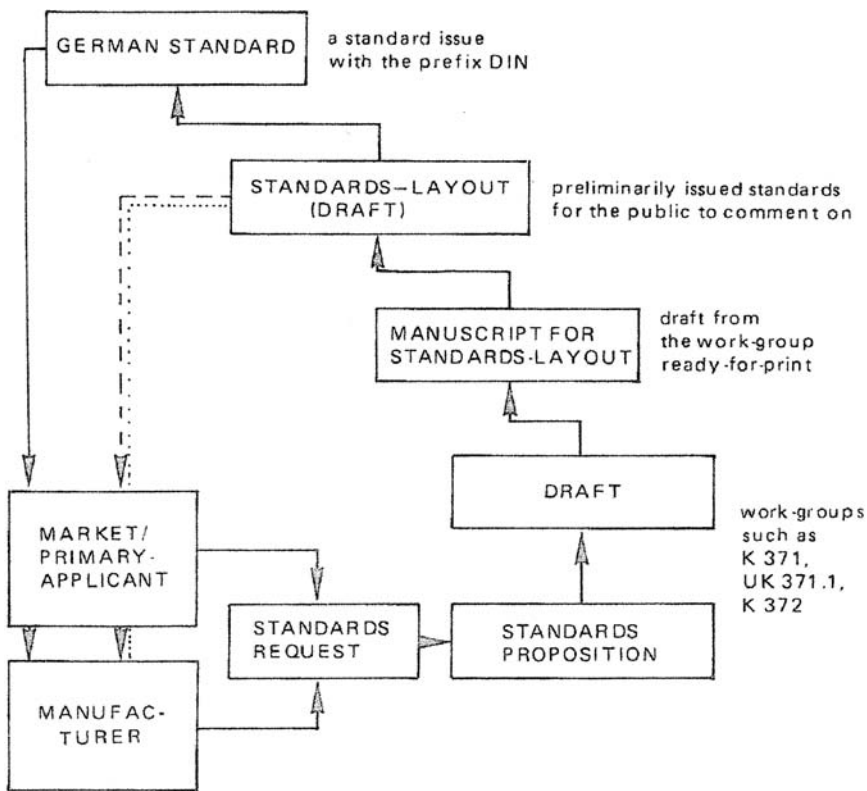


Figure 14.1 Schematic of the standardization process from the standard's request to the final standard. (From DIN 820.)

- TC 21 Secondary rechargeable batteries (accumulators)
- SC 21 A Secondary rechargeable alkaline batteries
- TC 35 Dry batteries

Germany is a member of the IEC; the “reflecting committees” send their delegates to the IEC committees as German delegations represented by a speaker; this is usually the chairman of the corresponding German committee (called also “mirror-committee”).

Consultations on standards’ submissions are also made by working groups resulting in IEC standards. The first step toward a new standard is the distribution of draft documents to all member countries by the IEC’s Central Office (CO) in Geneva.

The Central Office documents are subjected to a 2- or 6-month period of time for the members (national committees) to vote on. In case of a sufficient majority of votes, the CO document becomes an IEC standard, e.g. IEC Standard 60 254-1, Lead-Acid Traction Batteries (3). Sometimes the margins between the IEC and the ISO (International Standards Organization) are not clearly perceivable and may pose problems. All drafts of IEC standards run in parallel as CENELEC drafts under vote with aim to take over the IEC standard as EN Standard.

14.3.2 En Standards (CENELEC)

The CENELEC features “reflective committees” similar to the IEC, but these are activated only to a small extent to prevent work to be done twice, so there are only very few committees and working groups established.

Every IEC document (CO) or standard is followed by a questionnaire in CENELEC countries whether or not to start a standardization process on the same subject resulting in an EN standard. Depending on the result of the inquiry a halt of all national standardization activities follows in order to attain accordance with the international standards. The simplest way to do this is to make the IEC standard a national standard, partially or as a whole with the same significance. Details on the subject are referred to by special publications.

Obstacles for a fast integration into national standards are, for example:

- Established dimensions.
- Established safety-standards (Ex-directives VDE 0165, 0170, 0171).
- Different levels of technology.

Guideline for the work of all European National Standard Committees is to

Make proposals for international standards, not national standards and transfer international standards to national standards.

Figure 14.2 shows in a very rough manner the way to a standard, worldwide, on the European level, and on the national level. Cooperating partners of the standardization organizations are associations such as worldwide-operating BCI (Battery Council International, International Association of Battery Manufacturers). In Europe this function has EUROBAT (Federation of European Manufacturers of Batteries). A treaty allowing EUROBAT to propose directly to CENELEC standardization work links European battery manufacturers and CENELEC, avoiding the way via the national committees. In Germany the German

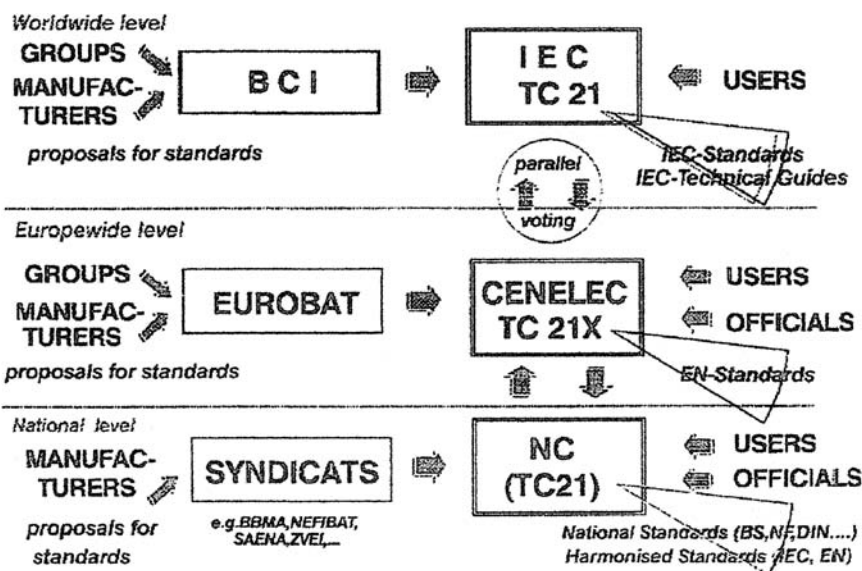


Figure 14.2 The way to standards: worldwide, Europewide, and nationwide.

Federation of Battery Manufacturers (member of ZVEI) cooperates with the DIN organization.

14.4 PRODUCT STANDARDS, TESTING STANDARDS, AND SAFETY STANDARDS

Standards can mainly be divided into these three main groups (6).

Product standards comprise main overall dimensions, weights, and electric data on production series or on single parts. Example: DIN 43 595, titled “Lead-acid accumulators; tubular plate-type cells for water- and land-bound vehicles, low maintenance type. Nominal capacities; main dimensions.”

Testing standards include testing methods for type and acceptance tests. Example: DIN 43539, part 3 titled “Lead-acid accumulators; test methods, traction cells and batteries.”

Combinations of dimensional and testing standards are also common.

Safety standards (or directives) comprise basic rules for the application of a product ranging from installation to employment. Example: DIN 57 510 (VDE 0510), titled “VDE Directives for Accumulators and Battery Plants.”

14.5 STANDARDS FOR DRY BATTERIES (SELECTION)

- DIN IEC 86-1, Primary batteries. Part 1: General.
- DIN IEC 86-2, Primary batteries. Part 2: Standard sheets.

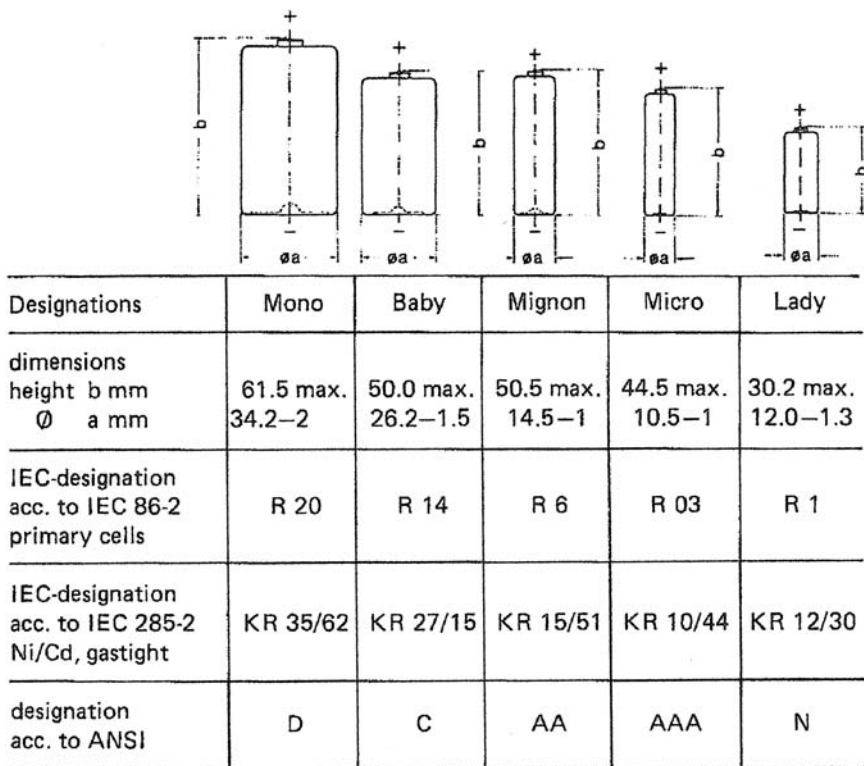


Figure 14.3 Survey on the most important standardized cylindrical (round) cells.

Dry batteries are employed in countless applications, for original equipment as well as for replacement. They are manufactured all over the world, making the need for standardization of dimensions, voltages, and connecting techniques understandable. Who has not heard of the classic sizes MONO, BABY, MIGNON, LADY, or A, AA, AAA, and AAAA? Figure 14.3 describes the most important standardized cylindrical cells. Figure 14.4 shows a survey on the most important standardized button-type cells.

14.6 STANDARDS FOR STARTER BATTERIES (SELECTION)

14.6.1 Existing German National Standards (Selection)

- DIN 72 310, Parts 1 and 2: Lead-acid accumulators; starter batteries. Series numbers, construction.
- DIN 72 311: Lead-acid accumulators; starter batteries (several parts).
- DIN 72 311, Part 1: Lead-acid accumulators; starter batteries for cranking lighting and ignition purposes, test methods.
- DIN 72 331, Parts 1 and 2: Lead-acid accumulators; starter batteries, battery poles for starter batteries.

							
dimensions height b mm Ø a mm	6,2 16,0	5,4 11,6	4,2 11,6	3,6 11,6	3,6 9,5	5,4 7,9	3,6 7,9
IEC-types	R 9 MR 9 LR 9 NR 9	MR 44 SR 44 (NR 44)	MR 43 SR 43	MR 42 SR 42	MR 45 (SR 45)	MR 48 SR 48	MR 41 SR 41
IEC-designation for comparable gastight NiCd-cells	KBL 16/7	KBL 12/E				KBL 8/E	

- R = Manganese dioxide = 1,50 V
- MR = Mercuric oxide = 1,35 V
- SR = Silveroxide = 1,55 V
- LR = Manganese dioxide, alkaline = 1,45 V
- NR = Mercuric oxide/Manganese dioxide = 1,40 V

Figure 14.4 Survey on the most important standardized button-type cells.

- DIN 72 332, Part 1: Lead-acid accumulators; starter batteries, battery terminals for starter batteries.
- DIN 72 333, Parts 1–4: Lead-acid accumulators; starter batteries, battery terminals for starter batteries, clamp fittings, terminal fittings with ground straps, ground connectors, light clamp fittings.
- DIN 43 539, Part 2: Lead-acid accumulators; test methods, starter batteries 12 V. Harmonized (see EN 60 095-1).

14.6.2 IEC and EN Standards (Selection)

- IEC 60 095-1, EN 60 095-1: Lead-acid starter batteries; general requirements and test methods.
- IEC 60 095-2, EN 60 095-2: Lead-acid starter batteries: Dimensions of batteries.
- IEC 60 095-3, EN 60 095-3: Lead-acid starter batteries: Dimensions and markings of terminals.

14.7 STANDARDS FOR TRACTION BATTERIES (SELECTION)

14.7.1 Existing German National Standards (Selection)

- DIN 43 531: Lead-acid accumulators; traction batteries, 48 V for industrial trucks: Dimensions, weights, electrical data.
- DIN 43 535: Lead-acid accumulators; traction batteries, 24 V for industrial trucks: Dimensions, weights, electrical data.

- DIN 43 536: Lead-acid accumulators; traction batteries, 80 V for industrial trucks: Dimensions, weights, electrical data.
- DIN 43 537: Lead-acid accumulators; traction batteries for road-bound electric vehicles, cells of low maintenance type: Nominal capacities, main dimensions.
- DIN 43 538: Lead-acid accumulators; traction batteries for road-bound electric vehicles; monobloc batteries of low maintenance type: Nominal capacities, main dimensions.
- DIN 43 539, Part 3: Lead-acid accumulators: Test methods, traction cells and batteries. Harmonized (see EN 60 254-1).
- DIN 43 595: Lead-acid accumulators; tubular-plate type cells for land- and water-bound vehicles, low maintenance type: Nominal capacities, main dimensions. Harmonized (see EN 60 254-2).

14.7.2 IEC and EN Standards (Selection)

- IEC 60 254-1, EN 60 254-1, Part 1: Lead-acid traction batteries: General requirements and methods of test.
- IEC 60 254-2, EN 60 254-2, Part 2: Lead-acid traction batteries: Dimensions of traction battery cells.

14.8 STANDARDS FOR STATIONARY LEAD-ACID BATTERIES (SELECTION)

14.8.1 Existing German National Standards (Selection)

- DIN 40 734: Lead-acid accumulators; stationary battery cells with positive grid-type plates: Capacities, main dimensions
- DIN 40 736, Parts 1 and 2: Lead-acid accumulators; stationary battery cells with positive tubular plates: Capacities, main dimensions, weights.
- DIN 40738: Lead-acid accumulators; stationary battery cells with Planté plates, high-performance construction: Capacities, main dimensions, weights.
- DIN 43 539, Part 4: Lead-acid accumulators; test methods, stationary battery cells and batteries. Harmonized (see EN 60 8961 and EN 60 896-2).

14.8.2 IEC and EN Standards (Selection)

- IEC 60 896-1, EN 60 896-1, Part 1: Stationary lead-acid batteries; vented types: General requirements and methods of test.
- IEC 60 896-2, EN 60 896-2, Part 2: Stationary lead-acid batteries, valve-regulated types (VRLA): General requirements and methods of test.

14.9 STANDARDS FOR PORTABLE MAINTENANCE-FREE, VALVE-REGULATED LEAD-ACID (VRLA) CELLS

14.9.1 Existing German National Standards (Selection)

All are harmonized.

14.9.2 IEC and EN Standards (Selection)

- IEC 60 056-1, EN 60 056-1, Part 1: Portable lead-acid cells and batteries: General requirements, functional characteristics, methods of test.
- IEC 60 056-2, EN 60 056-2, Part 2: Portable lead-acid cells and batteries: Dimensions, terminals, marking.
- IEC 60 056-3, EN 60 056-3, Part 3: Portable lead-acid cells and batteries: Safety recommendations for use in electric appliances.

14.10 STANDARDS FOR ALKALINE ACCUMULATORS (SELECTION)

14.10.1 Existing German National Standards (Selection)

All are harmonized.

14.10.2 IEC and EN Standards (Selection)

- IEC 60 285, EN 60 285: Alkaline secondary cells and batteries; sealed nickel/cadmium cylindrical rechargeable single cells.
- IEC 60 509, EN 60 609: Alkaline secondary cells and batteries; sealed nickel/cadmium button rechargeable single cells.
- IEC 60 622, EN 60 622: Alkaline secondary cells and batteries; Sealed nickel/cadmium prismatic rechargeable single cells.
- IEC 60 623, EN 60 623: Alkaline secondary cells and batteries; vented nickel/cadmium prismatic rechargeable cells.
- IEC 61 150, EN 61 150: Alkaline secondary cells and batteries; sealed nickel/cadmium rechargeable monobloc batteries in button cell design.
- IEC 61 438, EN 61 438: Possible safety and health hazards in the use of alkaline secondary cells and batteries: Guide to equipment manufacturers and users.

14.11 VDE REGULATIONS (SELECTION)

- VDE 0510: Regulation for accumulators and battery plants.
- VDE 0170: Regulation for mounting electric devices in medical facilities.
- VDE 0108: Regulation for mounting and operating emergency electric equipment in public assembly buildings.
- VDE 0122: Regulation for electric equipment of road-bound electric vehicles.

The German National Committee has proposed to transfer the revision of VDE 0510 in all parts into EN and IEC standards. This work is in progress with the relevant CENELEC working groups.

14.12 OTHER GERMAN STANDARDS AND GUIDELINES

- VG (military defense equipment).
- LN (aeronautical standards).
- BN (railway standards).
- VDI Guidelines

14.13 OTHER INTERNATIONAL STANDARDS AND COMMITTEES

- ANSI American National Standards Institute (formerly AESC, ASA, USASI)
- AQAP Allied Quality Assurance Publication (NATO demands and standards)
- ASTM American Society for Testing and Materials
- MIL Military Standards and Specifications
- MS Military Standards
- NEMA National Electric Manufacturers Association (United States)
- SAE Society of Automotive Engineers (United States)

14.14 SIGNIFICANCE OF STANDARDS AND REGULATIONS REGARDING MANUFACTURER LIABILITY

Manufacturer and product liability, both concerning the same issue, is not a new concept. The BGB (federal German law book) has commented the subject since 1915. Protection of the consumer has, similar to environmental protection, recently been more publicly discussed. The regulating law in this regard in Germany is paragraph 823 of the BGB, with a principle of indebtedness independent of liability (delict liability). According to this the fact that production techniques are state of the art is not sufficient. Observation of the DIN standards is not an excuse for the manufacturers, but is a first step toward lowering risks, as DIN standards have been included in many decrees.

The manufacturer is liable for:

- Development errors.
- Construction deficiencies.
- Manufacturing faults.

This implies the necessity for the manufacturer to survey the quality of its products and to check for compatibility of its product with other products.

Laws on the subject are not internationally uniform. In Germany manufacturing deficiencies are not generally followed by the manufacturer's liability, if the manufacturing company, apart from the faulty product, turns out products that correspond with standards and directions and the company disposes of a quality

supervision system that operates flawlessly, so these manufacturing faults are taken as “uncontrollable drop-outs”.

(See EU Directive titled “Assimilation of the laws and directives of the member-states of the European Community on liability for faulty products”).)

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