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STANDARD**

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Lead-acid starter batteries - General requirements, methods of test and numbering

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EUROPEAN STANDARD

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English version

## **Lead-acid starter batteries General requirements, methods of test and numbering**

Batteries d'accumulateurs de démarrage  
au plomb  
Prescriptions générales, méthodes  
d'essais et numérotation

Blei-Akkumulatoren  
Starterbatterien  
Allgemeine Anforderungen, Prüfungen  
und Kennzeichnung

### **iTeh STANDARD PREVIEW** **(standards.iteh.ai)**

This European Standard was approved by CENELEC on 2000-08-01. The amendment to the European Standard was approved by CENELEC on 2000-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard and its amendment the status of a national standard without any alteration.

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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 Central Secretariat has the same status as the official versions.

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## **CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 21X, Secondary cells and batteries.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50342 on 2000-08-01.

This European Standard supersedes EN 60095-1:1993 + A2:1995 + A11:1995 + A12:1999 + A13:1997.

A draft for an amendment was submitted to the Unique Acceptance Procedure and was approved as amendment A1 to EN 50342 on 2000-09-01.

In this document, the text of the amendment is indicated by a vertical line in the left margin of the text.

The following dates were fixed :

- latest date by which the EN and the amendment have to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2001-10-01
- latest date by which the national standards conflicting with the EN and the amendment have to be withdrawn (dow) 2003-04-01

Annexes designated "normative" are part of the body of the standard.  
In this standard, annexes A, B, C and D are normative.

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## 1 General

### 1.1 Scope

This standard is applicable to lead-acid batteries with a nominal voltage of 12 V, used primarily as a power source for the starting of internal combustion engines, lighting and also for auxiliary equipment of internal combustion engine vehicles. These batteries are commonly called "starter batteries". Batteries with a nominal voltage of 6 V are also included within the scope of this standard. All referenced voltages have to be divided by two for 6 V batteries.

This standard is applicable to batteries for the following purposes :

- batteries for passenger cars,
- batteries for commercial and industrial vehicles for normal use,
- batteries for commercial and industrial vehicles for severe use.

This standard is not applicable to batteries for other purposes, for example the starting of railcar internal combustion engines.

### 1.2 Object

The object of this standard is to specify :

- general requirements;
- certain essential functional characteristics, the relevant test methods and results required, for several classes and types of starter batteries.

### 1.3 Designation of starter batteries - Electrolyte density and open circuit voltage

1.3.1 Batteries are classified according to their types :

- vented (flooded) battery : a secondary battery having a cover provided with one or more openings through which gaseous products may escape ;
- valve regulated (with gas recombination) battery : a secondary battery which is closed under normal conditions but which has an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value. The battery cannot receive addition to the electrolyte.

In this type of battery, the electrolyte is immobilised.

#### 1.3.2 Electrolyte density and open circuit voltage

The density of the electrolyte in all vented batteries, when fully charged shall be in the range 1,27 kg/l to 1,30 kg/l at 25 °C unless otherwise specified by the manufacturer.

The open circuit voltage (OCV), when fully charged, but after a minimum 24 h stand on open circuit, shall be in the range 12,70 V to 12,90 V for vented batteries and 12,80 V minimum for valve regulated batteries at 25 °C unless otherwise specified by the manufacturer.

Either the manufacturer shall specify the electrolyte density (or OCV) and tolerance, or if such information is not available, vented battery testing shall be carried out with a density of 1,28 kg/l  $\pm$  0,01 kg/l at 25 °C or an OCV of 12,76 V  $\pm$  0,06 V at 25 °C and valve regulated battery testing shall be carried out with a minimum OCV of 12,80 V.

## 1.4 Condition on delivery

New vented batteries may be supplied either :

- in a state ready for use, filled with the appropriate electrolyte to the maximum level. After an initial charge (according to 4.2.1), the electrolyte density or OCV shall be within the ranges specified in 1.3 ;
- in a dry-charged state not filled with electrolyte. The density of the acid to fill such batteries before use shall be in the range 1,27 kg/l to 1,30 kg/l at 25 °C unless otherwise specified by the manufacturer.

Valve regulated batteries are normally supplied in a state ready for use. For these batteries the electrolyte is not accessible and therefore its density cannot be checked.

## 2 General requirements

### 2.1 Identification, labelling

Batteries according to this standard shall bear the following characteristics on at least one of their sides or on the top surface :

- a) the European Type Number (see annex A),
- b) identification of manufacturer or supplier,
- c) the nominal voltage, i.e. 12 V or 6 V,
- d) the capacity:
  - either nominal capacity  $C_n$  (Ah) (see 3.1.2),
  - or nominal reserve capacity  $C_{r,n}$  (min) (see 3.1.2),

The values of  $C_n$  or  $C_{r,n}$  for all batteries shall correspond to the electrolyte density or OCV given in 1.3,

- e) the nominal cranking current  $I_{cc}$  (see 3.1.1),
- f) Safety labelling : batteries shall be marked with six coloured symbols as described in annex B,
- g) the marking for the separate collection and recycling according to EN 61429,
- h) valve regulated batteries shall bear a special indication.

NOTE Batteries may be marked with other information such as the filling and charging date (see 4.1).

### 2.2 Marking of the polarity

According to EN 60095-2 (section 5, clause 14) the positive terminal shall be identified by a + mark on the lid or on the terminal itself.

## 2.3 Additional designation

Vented starter batteries may be designated as "low water loss" according to this European Standard if they comply with the requirements of 5.7.1 and the requirement in 5.5.2.

## 3 Functional characteristics

For general definitions of terms see Chapter 486 of the International Electrotechnical Vocabulary (IEV) (IEC 60050-486)

### 3.1 Electrical characteristics

**3.1.1** The *cranking current* is the discharge current  $I_{cc}$  to be indicated by the manufacturer which a battery can supply at  $-18\text{ °C}$  for 10 s to a minimum voltage  $U_f = 7,50\text{ V}$  and complying with requirements of 5.3.

**3.1.2** The *capacity* of a starter battery is defined for the temperature of  $25\text{ °C} \pm 2\text{ °C}$ .

It may be indicated by the manufacturer either as :

- nominal capacity  $C_n$  (Ah), or as
- nominal reserve capacity  $C_{r,n}$  (min).

The *nominal capacity*  $C_n$  is the electric charge (in Ah) which a battery can supply with a current :

$$I_n = \frac{C_n}{20}$$

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to a final voltage  $U_f = 10,50\text{ V}$ .

The *effective capacity*  $C_e$  shall be determined by discharging a battery with constant current  $I_n$  to  $U_f = 10,50\text{ V}$  (see 5.1).

The *nominal reserve capacity*  $C_{r,n}$  is the period of time (in minutes) for which a battery can maintain a discharge of 25 A to a cut-off voltage  $U_f = 10,50\text{ V}$ .

The *effective reserve capacity*  $C_{r,e}$  shall be determined by discharging a battery with the constant current  $I = 25\text{ A}$  to  $U_f = 10,50\text{ V}$  (see 5.2).

NOTE For the correlation (relationship) of  $C_n$  and  $C_{r,n}$  see annex C.

**3.1.3** The *charge acceptance* is expressed as the current  $I_{ca}$  which a partially discharged battery takes up at  $0\text{ °C}$  and at a constant voltage of 14,4 V (see 5.4).

**3.1.4** *Charge retention* is defined as the cold cranking performance of the charged and filled battery after storage on open circuit under defined conditions (temperature, time - see 5.5).

**3.1.5** *Endurance in cycles* represents the ability of a battery to perform repeated discharge/recharge cycles and long rest periods on open circuit. This ability shall be tested by a series of cycles and rest periods under specified conditions after which the cold cranking performance shall be determined (see 5.6).



**3.1.6** *Water consumption* is defined as g/Ah  $C_e$  or g/min  $C_{r,e}$  (see 3.1.2 and 5.7).

Valve regulated batteries have a very low water consumption and are not intended to receive addition to the electrolyte (see 5.7.2).

**3.1.7** *Dry-charged battery* : A new battery may be designated as dry-charged if it can be activated -ready for service- by filling it with the defined electrolyte (see 1.3 and 1.4) and in accordance with any specific instructions from the manufacturer and if it then conforms to the requirements of 5.10.

## **3.2 Mechanical characteristics**

**3.2.1** *Vibration resistance* represents the ability of a battery to maintain service under acceleration forces. Requirements are verified by the test defined in 5.8.

**3.2.2** *Electrolyte retention* is the ability of a battery to retain electrolyte under specified mechanical conditions (see 5.9). Valve regulated batteries are submitted to a special test (see 5.9.2).

## **4 General test conditions**

### **4.1 Sampling of batteries**

All tests shall be carried out on new battery samples. Samples shall be considered as new not later than :

- 30 days after the acid filling and formation date in the case of filled and charged batteries ;
- 60 days after shipment date of the manufacturer in the case of dry-charged batteries.

### **4.2 Preparation of batteries prior to test - Definition of a fully-charged battery**

All tests -except that in 5.10- shall commence with fully-charged batteries.

Batteries shall be considered as fully-charged if they have undergone the charging procedures of 4.2.1 for vented batteries or 4.2.2 for valve regulated batteries.

#### **4.2.1 Charging of vented batteries**

The battery shall be charged at a voltage of  $16,00 \text{ V} \pm 0,10 \text{ V}$  for 24 h with the maximum current limited to  $5I_n$  (see 3.1.2). The battery temperature shall be maintained in the range  $25 \text{ }^\circ\text{C}$  to  $35 \text{ }^\circ\text{C}$ . If necessary, an appropriate environmental control system shall be used, e.g. a water bath.

In the case of recharging after a test for cranking performance (according to 5.3) the charging time may be limited to 16 h.

#### 4.2.2 Charging of valve regulated batteries

Unless otherwise recommended by the manufacturer, the battery shall be charged :

- at a constant voltage of 14,4 V for 20 h with the maximum current limited to  $5 I_n$  (see 3.1.2) and
- then with a constant current of  $0,5 I_n$  for 4 h.

The temperature shall be maintained in the range 25 °C to 35 °C. If necessary an appropriate environmental control system shall be used e.g. a water bath.

#### 4.3 Activation of dry-charged batteries

Dry-charged batteries shall be filled with the defined electrolyte (according to 1.4) to the maximum level indicated by internal or external marks or according to the manufacturer's activation instructions. Any additional manufacturer's recommended activation instructions shall be complied with.

#### 4.4 Measuring instruments

##### 4.4.1 Electrical measuring instruments

The range of instruments used shall be appropriate for the magnitude of the voltage or current to be measured.

For analogue instruments the readings shall be taken in the top third of the scale.

- Voltage measurement

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The instruments used for measuring voltages shall be voltmeters having an accuracy class of 1 or better. The resistance of the voltmeters shall be at least 300  $\Omega/V$ .

- Current measurement

The instruments used for current measurement shall be ammeters having an accuracy class of 1 or better. The assembly of ammeter, shunt and leads shall have an overall accuracy of class 1 or better.

##### 4.4.2 Temperature measurement

The thermometers used for measuring temperatures shall have an appropriate range, and the value of each scale division shall not be greater than 1 K. The accuracy of the calibration of the instruments shall be not less than 0,5 K.

##### 4.4.3 Density measurement

The density of the electrolyte shall be measured with hydrometers furnished with a graduated scale, the value of each division of which is equal at most to 0,005 kg/l. The accuracy of calibration shall be to 0,005 kg/l or better.

##### 4.4.4 Time measurement

The instruments used for measuring time shall be graduated in hours, minutes, seconds, or in hours and centihours  $ch (= \frac{1}{100} h)$ . They shall have an accuracy of at least  $\pm 1 \%$ .

**4.5 Test sequence**

**4.5.1 Batteries filled and charged**

Initially the batteries are subjected to the following series of tests :

- 1<sup>st</sup> C<sub>e</sub> or C<sub>r,e</sub> check,
- 1<sup>st</sup> Cranking performance test ;
- 2<sup>nd</sup> C<sub>e</sub> or C<sub>r,e</sub> check,
- 2<sup>nd</sup> Cranking performance test ;
- 3<sup>rd</sup> C<sub>e</sub> or C<sub>r,e</sub> check,
- 3<sup>rd</sup> Cranking performance test.

For both C<sub>e</sub> or C<sub>r,e</sub> and the cranking performance the specified values shall be met in at least one of the relevant discharges above.

NOTE It is not necessary to complete the sequence if the specified values are achieved on the first or second test other than for batteries which will subsequently be tested for charge acceptance.

If, and only if, the initial capacity and cranking tests are successful, the batteries shall be tested in accordance with the remainder of the test sequence given in Table 1.

These tests shall commence not later than one week after completion of the initial tests.

**Table 1 – Test sequence**

Battery	Subclause	1	2	3	4	5
1 <sup>st</sup> C <sub>e</sub> or C <sub>r,e</sub>	5.1 or 5.2	X	X	X	X	X
1 <sup>st</sup> Cranking performance test	5.3	X	X	X	X	X
2 <sup>nd</sup> C <sub>e</sub> or C <sub>r,e</sub>	5.1 or 5.2	(X)	(X)	X	(X)	(X)
2 <sup>nd</sup> Cranking performance test	5.3	(X)	(X)	X	(X)	(X)
3 <sup>rd</sup> C <sub>e</sub> or C <sub>r,e</sub>	5.1 or 5.2	(X)	(X)	X	(X)	(X)
3 <sup>rd</sup> Cranking performance test	5.3	(X)	(X)	X	(X)	(X)
Endurance	5.6	X				
Charge retention	5.5		X			
Charge acceptance	5.4			X		
Electrolyte retention	5.9			X		
Vibration resistance	5.8				X	
Water consumption	5.7					X

NOTE The test for water consumption should be applied only to "low water loss" vented batteries according to 2.3 and to valve regulated batteries.