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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Lead-acid starter batteries –
Part 7: General requirements and methods of test for motorcycle batteries

Batteries d'accumulateurs de démarrage au plomb –
Partie 7: Exigences générales et méthodes d'essais pour les batteries de motocycles

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LEAD-ACID STARTER BATTERIES –

Part 7: General requirements and methods of test for motorcycle batteries

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
21/1014/FDIS	21/1019/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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A list of all parts in the IEC 60095 series, published under the general title *Lead-acid starter batteries*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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LEAD-ACID STARTER BATTERIES –

Part 7: General requirements and methods of test for motorcycle batteries

1 Scope

This part of IEC 60095 is applicable to lead-acid batteries used primarily as a power source for the starting of internal combustion engines, lighting and ignition (SLI) of motorcycles and other power sport vehicles. The nominal voltage is 12 V or 6 V.

Test definitions and criteria in this document are for batteries with a nominal voltage of 12 V only. For batteries with a nominal voltage of 6 V, all voltages have to be divided by two.

The other power sports vehicles covered in this document are snowmobiles, personal water crafts and all-terrain vehicles.

This document is not applicable to batteries for other purposes, such as the back-up power sources, auxiliary equipment of internal combustion engine vehicles and e-bikes.

This document specifies:

- general requirements;
- size, essential functional characteristics, relevant test methods and results required.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-482, *International Electrotechnical Vocabulary (IEV) – Part 482: Primary and secondary cells and batteries*

IEC 60095-1:2018, *Lead-acid starter batteries – Part 1: General requirements and methods of test*

IEC 60417, *Graphical symbols for use on equipment* (available at http://www.graphical-symbols.info/equipment)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-482 apply.

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4 Designation of starter batteries

4.1 Battery designation of starter batteries

For VRLA batteries, flooded batteries, dry charged batteries (or conserved charge batteries), AGM batteries, and gel batteries, refer to IEC 60095-1.

4.2 Electrolyte density and open circuit voltage

For electrolyte density and open circuit voltage, refer to IEC 60095-1.

4.3 Terminal

The standard terminal shall be manufactured using lead alloy, and for a battery having a bolt and nut, the terminal shall be mounted. However, for a battery whose outside dimensions are small, a lead wire type may be used instead of a terminal. As regards this lead wire, an electric wire, and as a wire covering colour, red shall be used for the positive polarity side and black for the negative polarity one.

4.4 Size

As regards the size, the outside dimensions shown in Table 1 for VRLA batteries and Tables A.4 and A.5 for flooded batteries (see Annex A), shall be measured using a length meter.

The designation of the position in which the outside dimensions are measured is shown in Figure 1.

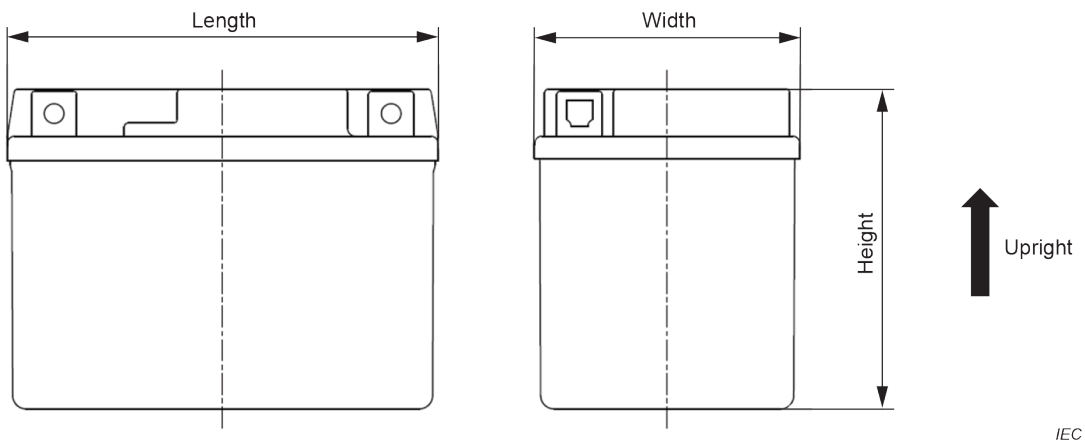

Figure 1 – Designation of the position for measurement

5 Condition on delivery

5.1 VRLA battery

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

The battery may be supplied in a dry-charged (or charge-conserved) state not filled with electrolyte. These batteries shall be supplied, by the manufacturer, with a bottle of electrolyte of specific strength and volume. The density of the acid to fill these batteries before use (unless otherwise recommended by the manufacturer) shall be: 1,32 kg/l ± 0,01 kg/l at 25 °C for valve regulated batteries.

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5.2 Flooded battery

The battery may be supplied:

- in a state ready for use
- in a dry-charged (or charge-conserved) state not filled with electrolyte. The density of the acid to fill these batteries before use (unless otherwise recommended by the manufacturer) shall be:
  - 1,28 kg/l ± 0,01 kg/l at 25 °C.

Any other manufacturer instruction for handling after filling and before first usage shall be considered.

6 General requirements

6.1 Identification and labelling

6.1.1 General

Batteries according to this document shall bear the characteristics described from 6.1.2 to 6.1.8 on at least one of their sides or on the top surface.

6.1.2 The identification of manufacturer or supplier

The name of the manufacturer or supplier shall be indicated.

6.1.3 Nominal voltage: 12 V or 6 V

The nominal voltage of 6 V or 12 V shall be indicated.

6.1.4 Capacity $C_{10,e}$ (Ah) and nominal cranking current I_{cc} (A) at −18 °C (see 7.1)

Label size: The capacity $C_{10,e}$ (Ah) and the cold cranking current I_{cc} (A) shall be displayed on a separate label or as text on a combined label (e.g. together with additional information of the producer or type mark). The size of the label shall be at least 3 % of the largest side of the battery. The height of the characters should be at least 3 mm. The label shall be fixed on one of the four sides or on the lid. A multiple labelling is allowed.

Instead of labels, silk printing or similar methods for marking can be used as well. Designated marking areas with corresponding sizes should be realized.

The battery designed for lighting application only is not required to be marked with the value of nominal cranking current.

6.1.5 Production date code

Subclause 6.1.5 of IEC 60095-1:2018 is applicable.

6.1.6 Safety labelling

Subclause 6.1.6 of IEC 60095-1:2018 is applicable.

6.1.7 Recycling labelling

Subclause 6.1.7 of IEC 60095-1:2018 is applicable.

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6.1.8 Valve-regulated batteries

Subclause 6.1.8 of IEC 60095-1:2018 is applicable.

6.2 Marking of the polarity

The batteries shall be marked with signs for both polarities that have to be positioned near the terminals.

The marking of the positive terminals shall take the form of the symbol "+". It shall be in accordance with IEC 60417-5005:2002-10.

The negative terminal shall take the form of the symbol "−". It shall be in accordance with IEC 60417-5006:2002-10.

7 Functional characteristics

7.1 Electrical characteristics

7.1.1 The 10 h capacity of a starter battery is defined for a temperature of 25 °C ± 2 °C.

The 10 h nominal capacity C_n may be indicated by the manufacturer.

The 10 h nominal capacity C_n is the electric charge in ampere hours (Ah) that a battery can supply with a current:

$$I_n = C_n / 10\ \text{h (A)}$$

until the terminal voltage falls to U_f = 10,50 V.

The effective 10 h capacity $C_{10,e}$ shall be determined by discharging a battery with constant current I_n to U_f = 10,50 V (see 9.1). The resultant discharge time, in hours, is used for the verification of C_n.

7.1.2 The cranking performance is the discharge current I_{cc} as indicated by the manufacturer, which a battery can supply (see 9.2).

7.1.3 The charge acceptance is expressed as the current I_{ca} which a partially discharged battery accepts at 0 °C and a constant voltage of 14,40 V (see 9.3).

7.1.4 The charge retention is defined as the cold cranking performance of the charged and filled battery after storage on open circuit under defined conditions of temperature and time (see 9.4).

7.1.5 The endurance test represents the ability of a battery to perform repeated discharge and 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 9.5).

7.1.6 Water consumption: maintenance-free service of a battery requires a low rate of water decomposition through overcharge (see 9.6).

VRLA batteries have a very low water consumption and are not intended to receive additional water.

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7.2 Mechanical characteristics

Vibration resistance represents the ability of a battery to maintain service under periodic or irregular acceleration forces. Minimum requirements shall be verified by a test (see 9.7).

8 General test conditions

8.1 Sampling of batteries

Regarding the sampling of batteries, refer to 8.1 of IEC 60095-1:2018.

8.2 Charging of batteries

Batteries shall be considered as fully charged if they have undergone the charging procedures. Prior to the first capacity test, the battery charge shall be limited to 16 h.

If not specified differently by the battery manufacturer, the batteries that will be tested according to this document shall be charged according to Table 1.

Table 1 – Charging method

Battery type	Voltage U_c	Current	Time	Remarks
VRLA batteries	14,80 V ± 0,05 V	2,5 I_{10}	24 h (16 h)[a)]	
Flooded batteries	16,00 V ± 0,05 V	2,5 I_{10}	24 h (16 h)[a)]	
[a)] After cranking performance test and prior to first capacity check				

If necessary, the environmental control system shall be used instead of the water bath.

8.3 Test equipment

8.3.1 Measuring instruments

Regarding the measuring instruments, refer to 8.3.1 of IEC 60095-1:2018.

8.3.2 Water bath

Regarding the water bath, refer to 8.3.2 of IEC 60095-1:2018.

8.3.3 Environmental chamber

Regarding the environmental chamber, refer to 8.3.3 of IEC 60095-1:2018.

8.4 Test sequence

8.4.1 Batteries filled and charged

a) Initially, the batteries are subjected to the following series of tests:
   - first $C_{10,e}$ check;
   - first cranking performance test;
   - second $C_{10,e}$ check;
   - second cranking performance test;
   - third $C_{10,e}$ check;
   - third cranking performance test.

b) It is not necessary to complete the sequence if the specified values are achieved on the first or second test.

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The tests according to Table 2 shall be carried out only if the batteries have complied with the tests mentioned in a), and no more than one week after completion of the said tests.

Table 2 – Test sequence

Step	Test		Battery				
		Reference	1	2	3	4	5
0	Cranking performance for dry-charged batteries	8.4.2, 9.8	✓	✓	✓	✓	✓
1	Initial charge prior to test	8.2	✓	✓	✓	✓	✓
2	1st 10 h capacity	9.1	✓	✓	✓	✓	✓
3	1st cranking performance	9.2	✓	✓	✓	✓	✓
4	2nd 10 h capacity	9.1	✓	(✓)	(✓)	(✓)	(✓)
5	2nd cranking performance	9.2	(✓)	(✓)	(✓)	(✓)	(✓)
6	3rd 10 h capacity	9.1	✓	(✓)	(✓)	(✓)	(✓)
7	3rd cranking performance	9.2	(✓)	(✓)	(✓)	(✓)	(✓)
8	Charge acceptance	9.3	✓				
9	Charge retention	9.4		✓			
10	Endurance tests	9.5			✓		
11	Water consumption	9.6				✓	
12	Vibration resistance	9.7					✓
Key							
✓	test to be fulfilled.						
(✓)	test to be fulfilled only if the previous identical test carried out failed.						

For batteries used only for lighting with no cranking performance required, the cranking performance test shall be replaced by a discharge at the current of 10 I_{10} in the test sequence step 9, 10 and 12 of Table 2.

8.4.2 Dry-charged or conserved-charge batteries

a) Initially, the batteries are subjected to the initial cranking performance test after being filled with electrolyte (see 9.8).

b) The tests according to Table 2 shall be carried out only if the batteries have complied with the test mentioned in a) and no more than one week after that test.

9 Tests methods

9.1 10 h capacity check $C_{10,e}$

Throughout the duration of the tests, the battery shall be placed in a water bath at a temperature of 25 °C ± 2 °C, according to 8.3.2. If necessary, the environmental control system (refer to 8.3.3) shall be used instead of the water bath.

The battery shall be discharged with the current I_n (calculated according to 7.1.1) kept constant at ±2 % of the nominal value until the terminal voltage falls to 10,50 V ± 0,05 V. The duration t (h) of the discharge shall be recorded. The beginning of the discharge shall take place between 1 h to 5 h after the completion of charging according to 8.2.

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The capacity $C_{10,e}$ is as follows:

$$C_{10,e} = t \times I_n \quad \text{(Ah)}.$$

9.2 Cranking performance test

The tests shall be carried out as follows:

Step 1: After a rest period of up to 24 h after preparation according to 8.2, the battery shall be placed in a cooling environmental chamber with (forced) air circulation at a temperature of −18 °C ± 1 °C until the temperature in one of the middle cells has reached −18 °C ± 1 °C.

NOTE It is generally accepted that the required temperature is achieved after a minimum period of 16 h in the environmental chamber.

Step 2: The battery shall then be discharged within 2 min after the cooling with nominal cold cranking current I_{CC} (see 7.1.2) for 30 s. This current shall be kept constant to within I_{CC} ± 0,5 % during the discharge.

Step 3: After 30 s discharge, the terminal voltage $U_{30\ s}$ shall also be recorded and the current shall be cut off.

9.3 Charge acceptance test

The tests shall be carried out on fully charged batteries in accordance with 8.2, as follows:

Step 1: The battery shall be placed in a water bath at a temperature of 25 °C ± 2 °C, according to 8.3.2. If necessary, the environmental control system (refer to 8.3.3) shall be used instead of the water bath.

Step 2: The battery shall be discharged at a current I_0:

$$I_0 = C_{10,e} / 10\ \text{h (A) for 5 h.}$$

The value $C_{10,e}$ shall be taken as the maximum value $C_{10,e}$ of the three previous discharges according to 9.1.

Step 3: Immediately after the discharge, the battery shall be cooled at a temperature of 0 °C ± 1 °C for a minimum of 20 h.

Step 4: At this temperature of 0 °C ± 1 °C, the battery shall be charged at a constant voltage of 14,40 V ± 0,10 V.

After 10 min, the charging current I_{ca} shall be recorded.

9.4 Charge retention test

The tests shall be carried out on fully charged batteries in accordance with 8.2, as follows.

Step 1: Cell plugs shall be closed but any venting system shall be open.

Step 2: The battery shall be placed in a water bath (refer to 8.3.2) or an environmental chamber (refer to 8.3.3) at 40 °C ± 2 °C for 49 days on open circuit. No connecting clamps or cables shall be connected to the terminals.

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