هيئة التقييس لدول مجلس التعاون لدول الخليج العربية
STANDARDIZATION ORGANIZATION FOR G.C.C (GSO)

GSO 34/2007

بطاريات الرصاص الحمضية المستعملة في السيارات
لبدء حركة المحركات ذات الاحتراق الداخلي
LEAD-ACID STARTER BATTERIES USED FOR MOTOR VEHICLES AND INTERNAL COMBUSTION ENGINES

ICS: 43.040.00

LEAD-ACID STARTER BATTERIES USED FOR MOTOR VEHICLES AND INTERNAL COMBUSTION ENGINES

Date of GSO Board of Directors' Approval : 19-5-1428H (5-6-2007)
Issuing Status : Technical Regulation

Foreword

GCC Standardization Organization (GSO) is a regional Organization which consists of the National Standards Bodies of GCC member States. One of GSO main functions is to issue Gulf Standards /Technical regulations through specialized technical committees (TCs).

GSO through the technical program of committee TC No(3) " Gulf technical committee for Electrical and Electronic Products Specifications Sector " has updated the GSO Standard No: GSO 34/1997 " Lead-acid starter batteries used for motor cars & internal combustion engines" The Draft Standard has been prepared by (Kingdom of Saudi Arabia).

This standard has been approved as a Gulf Technical Regulation by GSO Board of Directors in its meeting No. (6) ,held on 19/5/1458H , 5/6/2007G. The approved standard will replace and supersede the GSO standard No. GSO 34/1997.

CONTENTS

CLAUSE

1 SCOPE AND FIELD OF APPLICATION

2 COMPLEMENTARY REFERENCES

3 DEFINITIONS

4 MATERIALS, DESIGN AND CONSTRUCTION

5 DIMENSIONS OF BATTERIES AND MATERIALS, DIMENSIONS AND MARKING OF TERMINALS

6 ELECTRICAL PERFORMANCE

7 MECHANICAL CHARACTERISTICS

8 PACKING

9 TESTING

10 RULES OF ACCEPTANCE AND REJECTION

11 MARKING

TABLES

1 CLASSIFICATION AND DIMENSIONS OF TERMINALS

2 CONDITIONS AND REQUIREMENTS OF RAPID DISCHARGE OF A DRY CHARGED BATTERY AFTER ELECTROLYTE FILLING ....

3 CONDITIONS AND REQUIREMENTS OF RAPID DISCHARGE AT LOW TEMPERATURE

4 SAMPLE SIZE AND CONFORMITY LIMITS

5 TYPE TESTS FOR STANDARD BATTERIES

6 TYPE TESTS FOR MAINTENANCE FREE (MF) BATTERIES

7 TYPE TESTS FOR HEAVY DUTY BATTERIES

LEAD-ACID STARTER BATTERIES USED FOR MOTOR VEHICLES AND INTERNAL COMBUSTION ENGINES

1- SCOPE AND FIELD OF APPLICATION

This standard is concerned with 6 V and 12 V lead-acid batteries, used primarily as a power source for starting, lighting auxiliary equipment and ignition current of internal combustion engine used in vehicles. These batteries are commonly called "Starter Batteries" or "SLI (Starting, Lighting and Ignition) Batteries".

It covers both the standard batteries ,the maintenance free (MF) batteries and the low maintenance free (LMF) batteries.

It is not applicable to batteries for other purposes such as the starting of railcar internal combustion engines or the lighting of omnibuses.

2- COMPLEMENTARY REFERENCES

2.1 GSO 35/2007 "Methods of Test for Lead-Acid Starter Batteries Used for Motor Vehicles and Internal Combustion Engines".

2.2 GS 686/1997 "Water for Lead-Acid Batteries".

2.3 GS 479/1994 "Sulphuric Acid".

3- DEFINITIONS

3.1 Secondary battery: Voltaic cells which after discharge, can be brought back to its initial (charged) chemical condition by passing a current through it in a reverse direction to that of discharge.

3.2 Lead-acid battery: A secondary battery in which the electrodes are made mainly from lead compound and the electrolyte is a sulphuric acid solution.

For the SLI lead acid battery, this battery is provided with plates that contain the following active materials:

3.2.1 Positive electrode : Lead dioxide.

3.2.2 Negative electrode: Lead (Spongy lead).

3.2.3 Electrolyte : Diluted sulphuric acid.

3.3 Standard battery: A secondary battery is considered as being standard when it complies with the requirements of Table 5.

3.4 Maintenance free (MF) battery: A secondary battery which during its service needs no addition of water, known as "topping up", provided specified operating conditions are fulfilled. It shall comply with the requirements of Table 6.

3.5 Dry charged battery: A secondary battery containing charged plates, but no electrolyte, that may be activated by the addition of suitable electrolyte.

3.6 Heavy duty battery: A secondary battery is considered as being heavy duty battery if it complies with the more severe requirements of life cycle and vibration resistance as described in Table 7.

3.7 Sealed battery: A secondary battery that has no provision for "topping up" of water, but only allows the escape of gases generated in the battery.

3.8 Electrolyte: A solution of sulphuric acid that acts as a medium for ion movement and electric conduction between positive and negative electrodes.

3.9 Plate: A unit that (singly or in groups) is submerged in the electrolyte so that its surface forms the whole or part of one of the electrodes of the cell.

3.10 Active material: The portion of plate in which chemical changes occur by the passage of an electric current through it.

3.11 Separator: A sheet of porous and/or microporous insulating materials placed between the positive and negative plates to prevent shorting and to support the active materials.

3.12 Vent plug: A removable plug, in the standard battery, closing the filling hole, which is also employed to permit the free escape of gas from the cell, the plug shall be provided with a barrier whereby electrolyte spray is arrested.

3.13 Terminal post (Top terminal): A lead alloy post which projects above the lid of the end cell of a battery and from which connection is made to the external circuit or to the end terminal post of another battery.

3.14 Side terminal: A lead alloy terminal allocated at the side of the battery. These terminals have threaded "hard" metal inserts for connection of cables.

3.15 Capacity: The quantity of electricity in ampere-hours that may be taken from a cell or a battery at a given rate of discharge under specified conditions of voltage and temperature.

3.16 Reserve capacity: T The minimum number of minutes that a fully charged battery at $25\pm2^{o}C$ can be continuously discharged at 25±1 A to terminal voltage equal to o 1.75 V per cell.

3.17 Activation performance: The cranking performance of a dry charged battery after activating it, with the specified electrolyte.

3.18 Charge acceptance: The charge acceptance is a measure of the rechargeability of a partially discharged battery.

3.19 Charging: The passing of an electric current through the cell so as to bring it to a chemical condition in which it is capable of supplying electricity to an external circuit. The quantity of electricity used for this purpose is called a "charge", and it is measured in ampere-hours.

3.20 Cranking performance: The amount of time at a given temperature during which the battery can continuously deliver high enough current to crank an engine before falling to a specified cut-off voltage.

3.21 Discharging: The connection of a cell to an external circuit in such a way that electric current flows from the cell into the external circuit, the quantity of

electricity taken by this method is called a "discharge". Discharging is measured in:

Ah (Ampere hours) for C_{20} (20 hours capacity);

min (Minutes) for RC (Reserve capacity).

3.22 Life cycle: The life of a battery expressed as the number of charge and discharge cycles it can undergo before falling below a specified percentage of its capacity.

3.23 Overcharging: Charging a battery after it has attained 100% charge.

3.24 Self discharge: Loss in capacity over time due to a chemical reaction dependent on the temperature, specific gravity of electrolyte and impurities.

3.25 Vibration test: The ability of a battery to withstand specified physical permanent strains in laboratory tests.

3.26 Water consumption: The loss of water in a battery during overcharge at specified temperature and voltage.

3.27 Head space: The vertical distance between upper level of the inner top surface of the battery lid and the electrolyte level.

3.28 Type tests: Tests carried out to prove conformity with the requirements of this standard. These are intended to prove the general quality and design of a given type of battery.

3.29 Acceptance tests: Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot.

3.30 Lot: All batteries of the same type, design and rating, manufactured by the same factory during the same period, using the same process and materials and offered for inspection at a time, shall constitute a lot.

3.31 Routine tests: Tests carried out on every battery.

3.32 Low Maintenance free battery : A secondary battery type standard battery which shall comply with the requirements of Table 5 .

4- MATERIALS, DESIGN AND CONSTRUCTION

Details of the design and construction of cells and complete battery are left to the manufacturer, upon his option, provided that the following shall be fulfilled in the battery and its different components:

4.1 Materials

4.1.1 The battery shall be manufactured from materials such that it will withstand use under the various prevailing operating conditions. It shall be free from any apparent defects.

4.1.2 Materials used in the construction of a battery shall be such that the battery will comply with the requirements of this standard.

4.2 Design and construction

4.2.1 The battery shall be assembled in a mono-block container and each cell (of a standard battery) fitted with a removable vent plug for the purpose of filling or, alternatively, the battery shall have a venting system whereby electrolyte spray is arrested without impeding the free escape of gases.

4.2.2 Each cell shall be sealed within the container so as to prevent any leakage of electrolyte.

4.3 Container

The container shall be strong enough to allow handling of the battery in a safe manner. It shall be free from cracks and other mechanical defects, and made of a material not affected by acids.

4.4 Electrolyte

4.4.1 New cells shall be filled with diluted sulphuric acid prepared from a sulphuric acid conforming to the standard mentioned in Sub-clause 2.3, diluted with water conforming to the standard mentioned in Sub-clause 2.2, to a specific gravity of 1.28.

4.4.2 The specific gravity of the electrolyte in a fully charged battery when put in a normal test shall be 1.28 ± 0.01 corrected to 27°C. Batteries that have no provisions for electrolyte access (sealed battery) shall be tested with the electrolyte as supplied by the manufacturer.

4.4.3 In standard battery the manufacturer shall mark the height of the electrolyte above the plates level so as to permit enough head space.

4.4.4 The specific gravity of electrolyte measured by means of the hydrometer shall be corrected as follows:

For each 1°C above 27°C, add 0.0007 to the hydrometer reading;

For each 1°C below 27°C, deduct 0.0007 from the hydrometer reading.

4.4.5 For sealed battery designs, electrolyte specific gravity and temperature shall be measured by carefully drilling a hole in the top of the battery, per the manufacturer's directions, to gain access to the electrolyte. This hole shall be blocked with a rubber stopper during all test times.

4.5 Flame arrestor

A porous material which will allow for the flow of gases generated in the battery, but will not allow an external spark or flame to propagate through it into the battery or cell.

4.6 Lid (cover)

The lid shall be of a material not affected by acid, strong enough to allow handling of the battery in a safe manner and sealed to the container so as not to allow electrolyte leak.

4.7 Handles

Batteries having a weight, in excess of 25 kg including electrolyte shall be provided with a lifting means (e.g. handle). The choice of the quality and shape of the handles are left to the manufacturer provided that handling of the battery by means of this handles will be safe and will not exceed the normal height of the battery. The handles shall also be capable of being folded, removed or flexible so as not to interfere with the other dimensions.

4.8 Sealing and electrolyte retention

4.8.1 The sealing shall be acid-resistant, well adhere the parts and no leakage of air or electrolyte shall occur when the pressure inside a dry battery is raised by 2 N/cm^2 above the atmospheric pressure for 15 s.

4.8.2 The sealing shall withstand temperature variation without cracking or changing shape when a filled battery is subjected to temperature range from -10°C to 60°C. No leakage shall occur through the sealing.

4.8.3 Electrolyte retention

The battery shall retain the liquid electrolyte and no liquid shall be visible on the vent plugs when it is tilted through 45° from the vertical during a maximum period of 1 s and maintained at this position for 3 s on each of its two wide sides alternatively at an intervals of not less than 30 s between each tilting.

4.9 Connection

The connection between cells shall be made of lead or lead alloys and shall have enough cross-sectional area to ensure specified high rate discharge characteristics.

4.10 Condition on delivery

New batteries may be supplied in any of the following two states:

- ready for use, filled with the appropriate electrolyte to the maximum level. After an initial charge, the specific gravity of the electrolyte shall be as specified in Sub-clause 4.4.2,
- dry-and-charged state not filled with electrolyte. The specific gravity of the electrolyte to fill these batteries before use shall be as specified in Sub-clause 4.4.1.

4.11 Fastening of the battery

4.11.1 To secure correct positioning of the battery on the support, suitable provision shall be provided in the battery. If batteries are to be fastened to the vehicle by means of integral parts (e.g. bottom ledges), these shall be so designed as to withstand acceleration in crash conditions as specified by vehicle manufacturers.

4.11.2 Batteries for fastening by the upper part of the container shall be designed so that the cover provides appropriate support of the hold down device, for instance a metal frame.

4.11.3 Fastening by the base of the container is effected by providing ledges on the lower part (bottom hold down) for fastening over the length of the long sides and notches to prevent movement of the battery lengthwise.

4.11.4 Fastening by the container, on the short sides, is effected by fixing lugs with notches to prevent movement of the battery crosswise.

4.12 Ratings

The battery shall be rated for "C_{20}" - capacity in Ampere hours (Ah) or reserve capacity "RC" in minutes (min.) to satisfy the requirement of Sub-clause 6.2 or Sub-clause 6.4 respectively and for high rate discharge current at low temperature in Ampere (A) to satisfy the requirement of Sub-clause 6.3.

4.13 Charging

A battery may be fully charged using constant current or constant voltage. For recombination batteries containing electrolyte in gel form or absorbed in separator, the battery manufacturer shall specify the charging parameters.

One of the following charging methods shall be followed and has to be applied at an ambient temperature of (27 ± 5)°C.

4.13.1 Charging at constant current

The battery is charged with 2 I_{20} until a voltage of 2.4 V/cell is achieved. Then the charging is carried out with 2 I_{20} for additional 5 h.

After a rapid discharge capacity test at low temperature, the same charge is applied, however the residual charging time after reading 2.4 V/cell will be only 3 h with 2 I_{20}.

4.13.2 Charging at constant voltage

The battery is charged at 2.667 V/cell ± 0.1 V for a period of 22 to 30 h, the current intensity being limited to 5 I_{20} or as specified by the manufacturer.

A reduction of total charging time to 16 h is admissible after a rapid discharge capacity test at low temperature.

4.14 Condition of full charge

4.14.1 For charging at constant current

Two basic criteria may be used to recognize when the battery is fully charged:

4.14.1.1 When the temerature corrected specific gravity of the electrolyte is constant within ± 0.005 over three successive hourly intervals, or

4.14.1.2 When the on charge terminal voltage at the constant current does not change by more than 0.008 volts per cell per hour over three successive hourly intervals.

The readings must be corrected to 27°C (=80°F) to eliminate the effects of changing temperatures.

4.14.2 For charging at constant voltage

Two basic criteria may be used to recognize when the battery is fully charged:

4.14.2.1 When the specific gravity of the electrolyte is constant within ± 0.005 over three successive hourly intervals, or

4.14.2.2 When a constant current (± 1%) is observed over three successive hourly intervals at a constant terminal voltage.

4.15 Arrangement of the cells of the battery

4.15.1 It is recommended that the cells in the 6 V and 12 V batteries for light vehicles are so arranged as shown in Figures 1 and 2 respectively.

4.15.2 It is recommended that the cells in the 12 V batteries for heavy vehicles are so arranged as shown in Figure 3 (either of the two arrangements given).

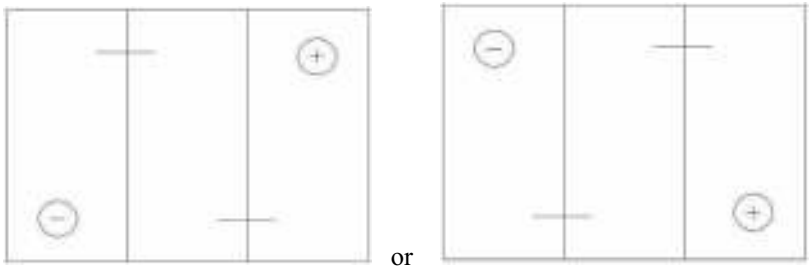


FIGURE 1

ARRANGEMENT OF CELLS IN A 6 V BATTERY FOR LIGHT VEHICLES

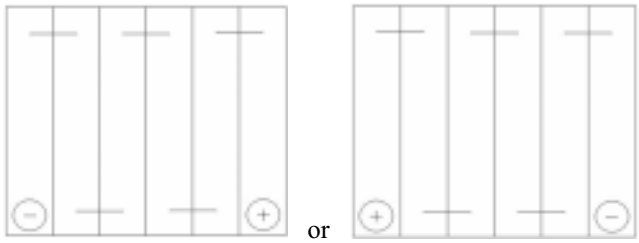


FIGURE 2

ARRANGEMENT OF CELLS IN A 12 V BATTERY FOR LIGHT VEHICLES

FIGURE 3

ARRANGEMENT OF CELLS IN A 12 V BATTERY FOR HEAVY VEHICLES

5- DIMENSIONS OF BATTERIES AND MATERIALS, DIMENSIONS AND MARKING OF TERMINALS

5.1 Dimensions of batteries

It is recommended, as far as practicable, that the external dimensions of the batteries are in accordance with that given in the standard mentioned in Sub-clause 2.4.

5.2 Materials, dimensions and marking of terminals

5.2.1 The terminals shall be made of lead alloy and of the dimensions specified in Table 1.

5.2.2 The dimensions and marking of the terminals shall be in accordance with that given in the standard mentioned in Sub-clause 2.4, provided that the following shall be fulfilled:

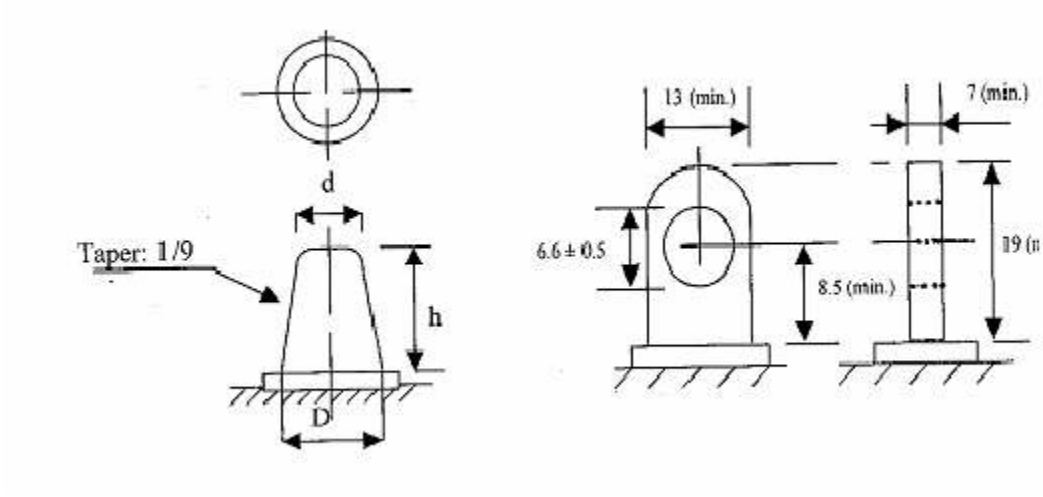
5.2.2.1 Classes A (T_1) and B (T_2) shall be the tapered terminal of the shape and dimensions shown in Figure 4 and Table 1.

5.2.2.2 Classes C (T_3) and D (T_4) shall be the bolt and nut terminal of the shape and dimension shown in Figure 4.

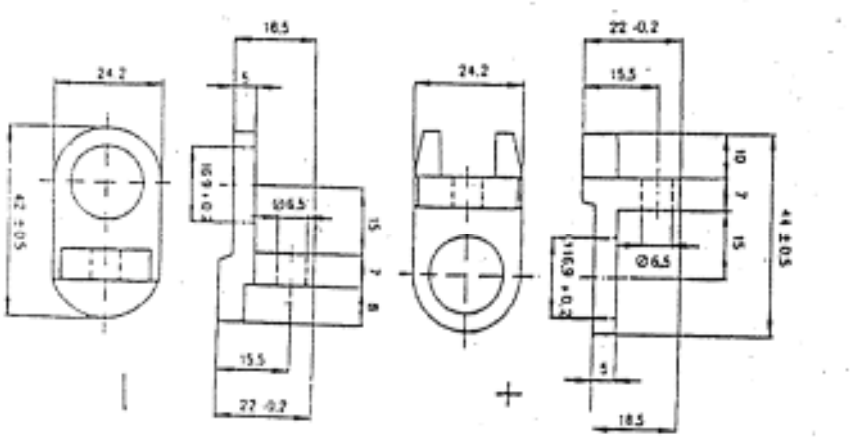
TABLE 1

CLASSIFICATION AND DIMENSIONS OF TERMINALS

Classification of terminals	**Dimensions (mm)**				
	D		**d**		**h**
	+ (P) Pole	**- (N) Pole**	**+ (P) Pole**	**- (N) Pole**	**+ (P) & - (N)**
A (T_1)	$19.5^{+0}_{-0.3}$	$17.9^{+0}_{-0.3}$	—	—	17^{+3}_{-0}
B (T_2)	$14.7^{+0}_{-0.3}$	$13.0^{+0}_{-0.3}$	—	—	17^{+3}_{-0}



Classes A (T_1) and B (T_2) **Class D (T_4)**



Flat Terminal – C (T_3)

All dimensions in millimetres

FIGURE 4

TERMINAL DIMENSIONS

6- ELECTRICAL PERFORMANCE

Batteries shall be so designed as to fulfil the following requirements:

6.1 Rapid discharge capacity of a dry charged battery at normal temperature (Activation test)

The conditions and requirements of this test shall be as stated in Table 2.

TABLE 2

CONDITIONS & REQUIREMENTS OF RAPID DISCHARGE OF A DRY CHARGED BATTERY AFTER ELECTROLYTE FILLING

Initial temperature of the electrolyte	Discharge current	Minimum discharge time		Voltage at battery terminals after discharge of 5 to 7 seconds		Final voltage at battery terminals	
				6 V battery	12 V battery	6 V battery	12 V battery
°C	A	min	s	V	V	V	V
27 ± 2	3 $C_{20}/_{3.75}$ C_5	2	30	4	8	3	6

6.2 Rated capacity "C_{20}" (slow discharge rate capacity)

Batteries placed in service in accordance with the manufacturer's instructions shall reach at least 90% of the rated capacity "C_{20}" declared by the manufacturer at least once during the course of the first three cycles of discharge.

6.3 Rapid discharge capacity at low temperature

6.3.1 The conditions and the requirements of this test shall be as stated in Table 3. Batteries placed in service in accordance with the manufacturer's instruction shall reach the specified values at least once during the course of the first three cycles of rapid discharge at low temperature.

TABLE 3

CONDITIONS AND REQUIREMENTS OF RAPID DISCHARGE AT LOW TEMPERATURE

Initial temperature of the electrolyte	Discharge current	Minimum discharge time	30s voltage at battery terminals	
			6 V battery	12 V battery
°C	A	s	V	V
-18 ± 1	Rated current	30	3.6	7.2

6.3.2 The rapid discharge capacity test at low temperature shall be carried out after the C_{20} checking of the rated capacity or reserve capacity test, as indicated in point 6 of Tables 5, 6 & 7.

6.4 Reserve capacity "RC" (= C_{RC})

Batteries placed in service in accordance with the manufacturer's instructions shall reach the rated reserve capacity "RC" declared by the manufacturer at least once during the course of the first three cycles of discharge.

6.5 Charge acceptance

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, the recorded charging current I_{ca} shall fulfil the following formula:

The ratio $i_{ca} = \frac{I_{ca}}{\frac{C_e}{20}}$ shall be ≥ 2.

Where C_e is defined as in Sub-clause 13.1 of the standard mentioned in Sub-clause 2.1.

6.6 Conservation of charge (self discharge - loss of capacity during storage)

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, the voltage after 30 s for maintenance free batteries shall be not less than 1.333 V per cell and that for the standard batteries shall be not less than 1.200 V per cell.

6.7 Battery life (Endurance)

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, the following shall be fulfilled:

6.7.1 Battery life for standard and maintenance free batteries

The standard and maintenance free batteries shall give a minimum of four endurance test units.

6.7.2 Battery life for heavy duty batteries

The heavy duty batteries shall give a minimum of seven endurance test units.

6.8 Water consumption

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, the water consumption of maintenance-free and low maintenance free batteries shall not be higher than 3 g/Ah or 2 g/min of effective capacity "C_e".

6.9 Leakage of air

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, there shall not be any pressure drop at the end of 15 seconds.

6.10 Leakage of electrolyte (Heat endurance)

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, there shall not be any leakage of electrolyte or liquefaction of the sealing compound.

7- MECHANICAL CHARACTERISTICS

Batteries shall be so designed as to fulfil the following requirements:

7.1 Vibration resistance

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, the following shall be fulfilled:

7.1.1 Batteries shall be able to maintain service under periodic or irregular acceleration forces.

7.1.2 The battery terminal 30 s voltage after vibration resistance test may not decrease by more than 0.25 V/cell.

7.2 Electrolyte retention

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, batteries shall retain the liquid electrolyte under the specified mechanical conditions.

7.3 Strength of terminals

When the batteries are tested in accordance with the relevant test given in the standard mentioned in Sub-clause 2.1, the terminal of the battery shall have adequate strength so as to withstand the specified torque during the test.

8- PACKING

8.1 Batteries shall be packed in a suitable means so as to protect it from damage and deterioration during transportation and handling.

8.2 The package shall be marked with the necessary information.

9- TESTING

9.1 Sampling

9.1.1 For type tests

The samples shall be withdrawn at random from stock or routine factory production by the testing authority. Five sample units from each type of battery shall be subjected to the type tests mentioned in Sub-clause 9.3.1.

9.1.2 For acceptance (conformity or sample) tests

9.1.2.1 The supplied batteries consignment shall be divided into lots, each of which shall constitute all the batteries of the same type, design and rating, manufactured by the same factory, during the same period.

9.1.2.2 From each lot (N) a sample of batteries (n), in accordance with Table 4, shall be withdrawn at random and subjected to the acceptance tests mentioned in 9.3.2.

9.1.2.3 If repeating of tests is required, a further sample of the same size as taken in the first stage shall be withdrawn at random and tested.

TABLE 4

SAMPLE SIZE AND CONFORMITY LIMITS

Lot size N	First sample n	Second sample n	2n	C_1	C_2	C_3
Up to 50	2	2	4	0	1	1
51 to 300	3	3	6	0	1	1
301 to 500	5	5	10	0	2	2
501 to 1000	8	8	16	0	2	2
1001 and above	13	13	26	0	3	4

9.2 Methods of test

Tests shall be carried out in accordance with GS ..... "Methods of Test for Lead-Acid Starter Batteries Used for Motor Vehicles and Internal Combustion Engines".

9.3 Tests

9.3.1 Type tests

9.3.1.1 The tests given in Tables 5, 6 & 7 shall constitute the type tests for standard batteries, maintenance free (MF) batteries and heavy duty batteries respectively, and shall be carried out on the sample units withdrawn according to Sub-clause 9.1.1.

9.3.1.2 The sequence of the tests shall be as given in Tables 5, 6 & 7, as applicable.

TABLE 5

TYPE TESTS FOR STANDARD & LMF BATTERIES

No.	Name of the Test	Sample Unit No.					Clause No. of the Test in GS ...*
		1	2	3	4	5	
1	Visual Inspection	x	x	x	x	x	5
2	Checking of Materials, Construction, Packing and Marking	x	x	x	x	x	6
3	Checking of Dimensions	x	x	x	x	x	7
4	Leakage of Air** or Electrolyte	-	-	-	-	x	16 or 20
5	Rapid Discharge Capacity of a Dry Charged Battery at Normal Temperature After Filling (Activation Test)**	x	x	x	x	-	10
6	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	x	x	x	x	9 12
7	Rapid Discharge Capacity at Low Temperature	x	x	x	x	x	11
8	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	#	#	#	#	9 12
9	Rapid Discharge Capacity at Low Temperature	x	#	#	#	#	11
10	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	#	#	#	#	9 12
11	Rapid Discharge Capacity at Low Temperature	x	#	#	#	#	11
12	Charge Acceptance	x	-	-	-	-	13
13	Conservation of Charge (Self Discharge - Loss of Capacity During Storage)	-	x	-	-	-	14
14	Battery Life (Endurance Test)	-	-	-	-	x	15
15	Water Consumption	(x)	-	-	-	-	17
16	Vibration Resistance	-	-	x	-	-	18
17	Electrolyte Retention	-	-	-	x	-	19
18	Heat Endurance (Leak Testing)	-	-	-	x	-	20
19	Strength of Terminal	x	-	-	-	-	21

* *The standard mentioned in Sub-clause 2.1.*
X *Test is applicable.*
(x) *Test is applicable only for low maintenance free standard batteries*
** *Test is applicable only for dry batteries*
\# *Test is only necessary if the nominal values have not been achieved.*
\- *Test is not applicable.*

TABLE 6
TYPE TESTS FOR MAINTENANCE FREE (MF) BATTERIES AND LOW MAINTENANCE FREE BATTERY

No.	Name of the Test	Sample Unit No.					Clause No. of the Test in GS ...*
		1	2	3	4	5	
1	Visual Inspection	x	x	x	x	x	5
2	Checking of Materials, Construction, Packing and Marking	x	x	x	x	x	6
3	Checking of Dimensions	x	x	x	x	x	7
4	Leakage of Air** or Electrolyte	-	-	-	-	x	16 or 20
5	Rapid Discharge Capacity of a Dry Charged Battery at Normal Temperature After Filling (Activation Test)**	x	x	x	x	-	10
6	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	x	x	x	x	9 12
7	Rapid Discharge Capacity at Low Temperature	x	x	x	x	x	11
8	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	#	#	#	#	9 12
9	Rapid Discharge Capacity at Low Temperature	x	#	#	#	#	11
10	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	#	#	#	#	9 12
11	Rapid Discharge Capacity at Low Temperature	x	#	#	#	#	11
12	Charge Acceptance	x	-	-	-	-	13
13	Conservation of Charge (Self Discharge - Loss of Capacity During Storage)	-	x	-	-	-	14
14	Battery Life (Endurance Test)	-	-	-	-	x	15
15	Water Consumption	x	-	-	-	-	17
16	Vibration Resistance	-	-	x	-	-	18
17	Electrolyte Retention	-	-	-	x	-	19
18	Heat Endurance (Leak Testing)	-	-	-	x	-	20
19	Strength of Terminal	x	-	-	-	-	21

* *The standard mentioned in Sub-clause 2.1.*
X *Test is applicable.*
** *Test is applicable only for dry batteries*
\# *Test is only necessary if the nominal values have not been achieved.*
\- *Test is not applicable.*

TABLE 7

TYPE TESTS FOR HEAVY DUTY BATTERIES

No.	Name of the Test	Sample Unit No.					Clause No. of the Test in GS ...*
		1	2	3	4	5	
1	Visual Inspection	x	x	x	x	x	5
2	Checking of Materials, Construction, Packing and Marking	x	x	x	x	x	6
3	Checking of Dimensions	x	x	x	x	x	7
4	Leakage of Air** or Electrolyte	-	-	-	-	x	16 or 20
5	Rapid Discharge Capacity of a Dry Charged Battery at Normal Temperature After Filling (Activation Test)**	x	x	x	x	-	10
6	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	x	x	x	x	9 12
7	Rapid Discharge Capacity at Low Temperature	x	x	x	x	x	11
8	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	#	#	#	#	9 12
9	Rapid Discharge Capacity at Low Temperature	x	#	#	#	#	11
10	Rated Capacity, C_{20}, or Reserve Capacity, RC	x	#	#	#	#	9 12
11	Rapid Discharge Capacity at Low Temperature	x	#	#	#	#	11
12	Charge Acceptance	x	-	-	-	-	13
13	Conservation of Charge (Self Discharge - Loss of Capacity During Storage)	-	x	-	-	-	14
14	Battery Life (Endurance Test)	-	-	-	-	x	15
15	Water Consumption	(x)	-	-	-	-	17
16	Vibration Resistance	-	-	x	-	-	18
17	Electrolyte Retention	-	-	-	x	-	19
18	Heat Endurance (Leak Testing)	-	-	-	x	-	20
19	Strength of Terminal	x	-	-	-	-	21

* *The standard mentioned in Sub-clause 2.1.*
X *Test is applicable.*
(x) *Test is applicable only for maintenance free and low maintenance free heavy duty batteries*
** *Test is applicable only for dry batteries.*
\# *Test is only necessary if the nominal values have not been achieved.*
\- *Test is not applicable.*

9.3.2 Acceptance tests

The following tests shall constitute the acceptance tests, which shall be carried out in the same order on the sample units withdrawn according to Sub-clause 9.1.2:

9.3.2.1 Visual inspection.

9.3.2.2 Checking of materials, construction, packing and marking.

9.3.2.3 Checking of dimensions.

9.3.2.4 Test for leakage of air (for a dry charged battery) or electrolyte (for a wet charged battery).

9.3.2.5 Rapid discharge capacity test of a dry charged battery at normal temperature (activation Test).

9.3.2.6 Checking of rated capacity "C_{20}" (slow discharge rate capacity), or Reserve capacity "RC".

9.3.2.7 Rapid discharge capacity test at low temperature.

9.3.3 Routine tests

The following tests shall constitute the routine tests, which shall be carried out on each produced battery by the manufacturer:

9.3.3.1 Visual inspection.

9.3.3.2 Checking of materials, construction, packing and marking.

9.3.3.3 Test for leakage of air (for a dry charged battery) or electrolyte (for a wet charged battery).

10- RULES OF ACCEPTANCE AND REJECTION

10.1 For batteries subjected to type tests (type approval)

The type shall be considered conforming to this standard if all sample units (withdrawn according to Sub-clause 9.1.1) pass all of their relevant type tests mentioned in Sub-clause 9.3.1. If any of the sample units fail in the relevant type test, a new sample double the number of the original one shall be withdrawn and subjected to the test(s) in which failure occurred. The type shall be considered conforming to this standard if all units of the new sample pass the test(s), otherwise it shall be considered non-conforming.

10.2 For lots subjected to acceptance tests (the type of which has been approved)

10.2.1 Each consignment of batteries shall be accompanied with a certificate stating its compliance with this standard.

10.2.2 The lot shall be considered conforming to this standard if all sample units (withdrawn according to Sub-clause 9.1.2) pass all the acceptance tests mentioned in Sub-clause 9.3.2. A battery shall be declared defective if it fails in one or more of the acceptance tests. If the number of defectives is less than or equal to C_1 the lot shall be considered conforming to this standard. If the number of defectives is equal to or greater than C_2 the lot shall be considered not conforming to this standard. If the number of defectives in the first sample

is less than C_2 and greater than C_1, a further sample of the same size as withdrawn in the first stage shall be withdrawn and tested. If the number of defectives in the two samples combined is less than C_3 the lot shall be considered conforming to this standard, otherwise the lot shall be considered not conforming.

11- MARKING

11.1 The following information shall be legibly and indelibly marked on each battery in Arabic and/or English.

11.1.1 Manufacturer's name or trademark.

11.1.2 Country of origin.

11.1.3 A manufacturer's type indication that enables the information to be readily obtained from manufacturer's catalogues or similar publications.

11.1.4 Suitable performance designations rated capacity [in C_{20} (Ah) or RC (min)] and rated current according to this standard. If additional ratings are given according to other standards, then a reference to the standard in question has to be indicated in conjunction with the rated capacity.

EXAMPLE:

Mandatory

	Cold cranking Amps (CCA)	Rated Capacity (C_{20} or RC)
GS	470 A	66 Ah or 90 min

Optional

SAE	470 A	90 min
DIN	350 A	66 Ah
etc.	xxx A	yyy Ah

11.1.5 Number or date of the batch of production.

11.1.6 Upper and lower electrolyte levels in case of transparent containers.

NOTE: A maintenance free battery may also be marked with "Maintenance Free" or "MF" and a low maintenance free battery may also be marked with "low Maintenance Free" or "LMF" according to GS ....." (i.e. this standard) in addition to the Sub-clauses given above (11.1.1 to 11.1.6).

11.2 Safety labelling

11.2.1 Each battery shall be marked with SIX coloured symbols as shown in Figure 5.

FIGURE 5
SIX COLOURED SYMBOLS

11.2.2 The symbols shall have common dimensions as shown in Figure 6 with a minimum dimension of 10 mm.

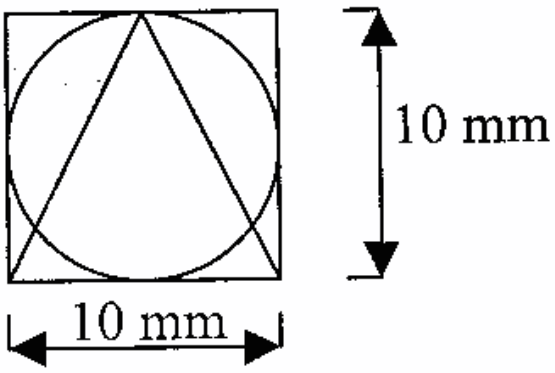


FIGURE 6
COMMON DIMENSIONS OF THE SAFETY SYMBOLS

11.2.3 The symbols shall be located in a group as shown in Figure 5, on the top of the battery.

11.2.4 No text in any language shall be used with the symbols.

11.2.5 In the original equipment market, the meaning of the symbols shall be found in the vehicle booklet in Arabic and English.

11.2.6 In the replacement market, the meaning of the symbols shall be in the booklet supplied with the battery (Sub-clause 11.3).

11.2.7 The meaning of the symbols are:

(RED)	No smoking, no naked flames, no sparks
(BLUE)	Shield eyes
(RED)	Keep away from children
(YELLOW)	Battery acid
(BLUE)	Note operating instructions
(YELLOW)	Explosive gas

11.3 Each battery shall be supplied with a sticker or any other appropriate means containing the following information in Arabic and English:

11.3.1 The information mentioned in Sub-clauses 11.1 and 11.2, where applicable.

11.3.2 Activation instructions for a dry charged battery (i.e. instructions for putting it into service).

11.3.3 Appropriate instructions for precautions to be followed on handling, installation, maintenance, topping up and charging.

11.3.4 Any additional information the manufacturer finds necessary to indicate certain characteristics in his products.

11.4 Polarity

11.4.1 For top terminal batteries, a mark ("+" and "-", "P" and "N" or "POS and NEG") on the top end of each of the battery terminals or on the top cover of the container in close proximity to the terminal indicating its polarity is required.

11.4.2 For side terminal batteries, polarity markings ("+ and -", "P and N" or "POS and NEG") on a label (on the top of a battery) are allowable, however addition non-removable markings must coexist on the battery on the container or cover in close proximity to the terminal.

11.5 Warranty

Each battery shall be provided with a warranty declaration against the manufacturing defects for not less than one year from the date of purchase by the end-user .