HTC™

Battery System Tester

User Manual

BM-36

Contents

1. Overview

The instrument is used to analyze and test the performance of 12V/24V lead-acid battery. It can test and analyze the performance of the battery during the vehicle starting process, the generator charging process and the static state.

The instrument is well designed, easy to operate and fully functional. It adopts large-screen LCD display, and the test process and results are displayed in one screen. Precision circuits and powerful digital processing units are used inside the meter. After a series of complex data acquisition and calculation is completed by the four-wire Kelvin test connection method, each test result is obtained. In addition, the input protection is strengthened inside the instrument, which has the advantages of preventing polarity reversal, overvoltage access, and poor contact of the test collet, making it more safe, convenient and accurate in the process of use.

The instrument can be used in the production and sales of batteries, auto parts maintenance and other kinds of equipment using lead-acid batteries. It is an analysis and detection tool for the performance of lead-acid batteries.

2. Safety Rules and Precautions

This manual includes instrument instructions and safe operation warnings. Incorrect use may damage the instrument.

The instrument is designed and produced in strict accordance with the safety requirements for electronic measuring instruments of GB4793.1 and safety standards of IEC/EN61010-1.

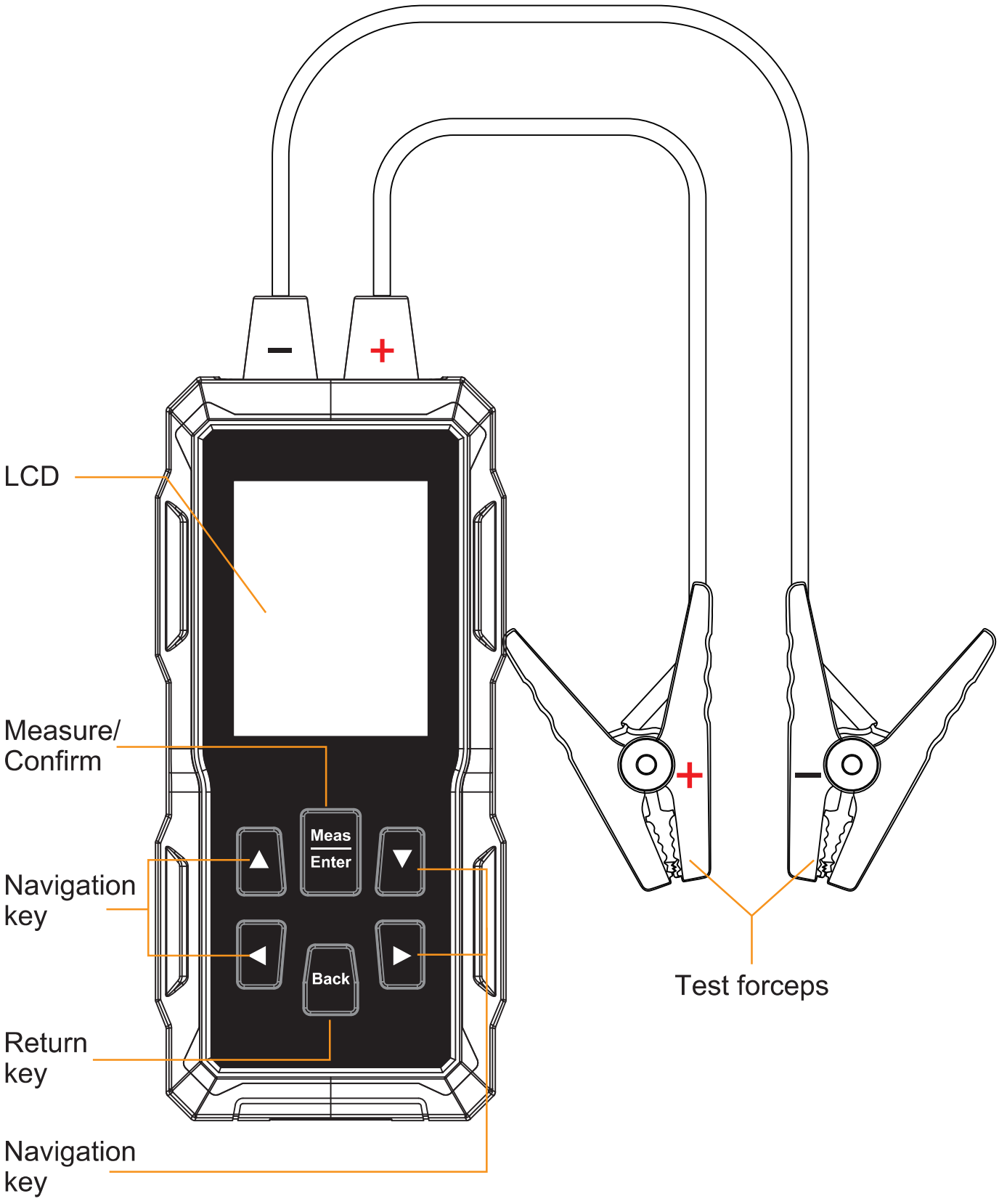
(1) Applicable to the detection and analysis of 12V/24V batteries.
(2) The working voltage range is DC9V~35V.
(3) When the battery is saturated after charging, the battery voltage (surface voltage) will be slightly higher than the normal value. Please turn on the headlamp for 2 to 3 minutes, and then test the battery after clearing the surface voltage.

(4) Before use, check whether the insulation layer of the test clamp is in good condition, that is, the insulation layer is not damaged.
(5) Do not use or store the instrument in high temperature, high humidity, flammable, explosive environment and strong electromagnetic field.
(6) Do not arbitrarily change the internal circuit of the instrument to avoid damage it.
(7) Wear an eye mask when testing car batteries to prevent foreign objects from flying into your eyes from the engine.
(8) Please run and maintain the vehicle in a well-ventilated environment to prevent the inhalation of toxic gases.
(9) If the engine is running, do not place instruments and accessories near the engine or exhaust pipe to avoid heat damage.
(10) Pay attention to the manufacturer's warnings, precautions, and repair procedures when repairing the vehicle.
(11) Optional 12V battery standards:
CCA: 100~2000 IEC: 100~1000 EN: 100~1700
DIN: 100~1000 JIS: Check the table to compare CCA
Capacity: 3Ah~200Ah

3. International Electrical Symbol

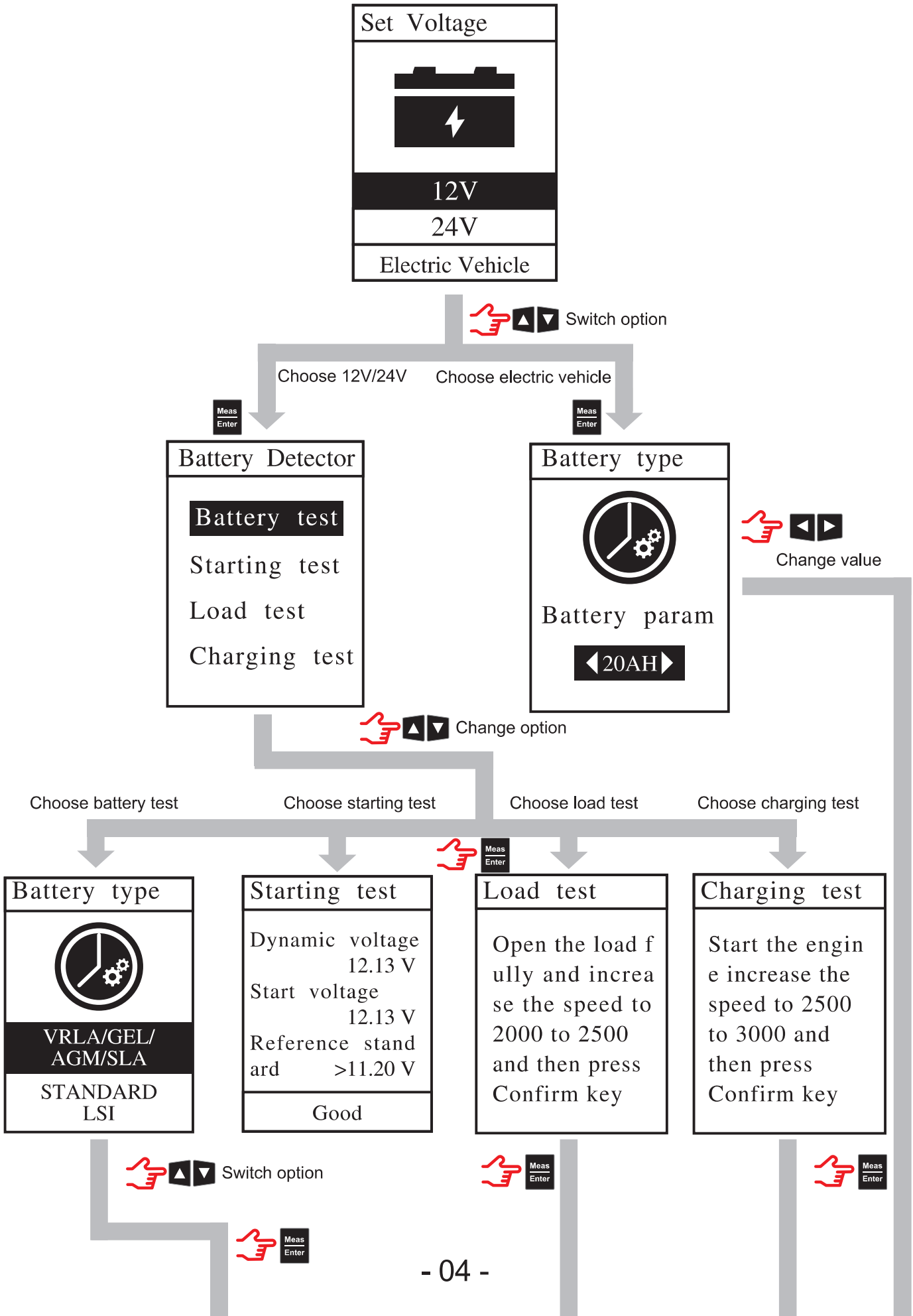
	Direct current
	Alternating current
	Direct/Alternating current
	Warning/Caution/Safety sign
	Dangerous voltage (shock hazard)
	Ground connection
	Double insulator/ high insulation
	Fuse wire
	Battery

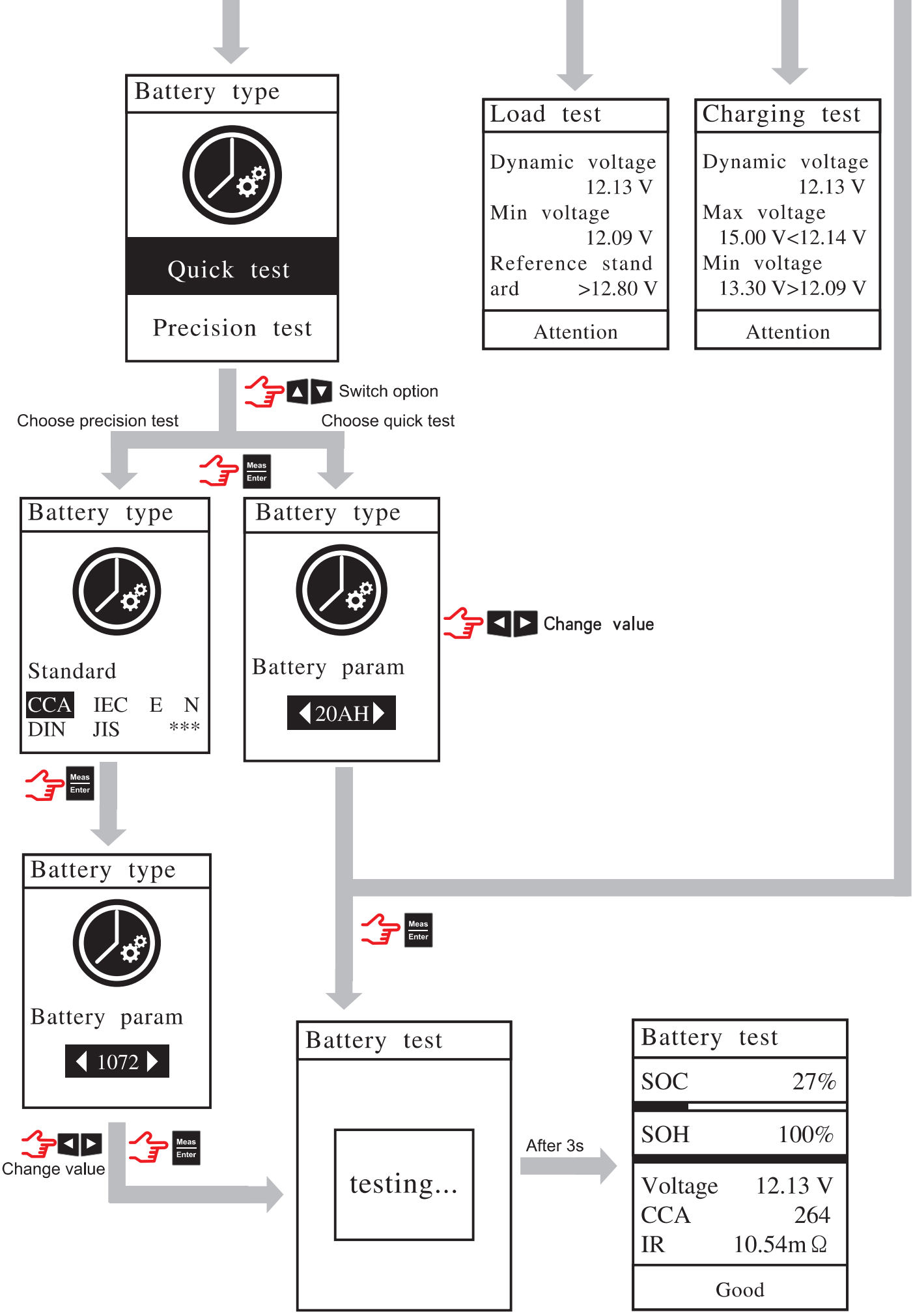
4. Product Structure



5. Function Description

5.1 Operating Instruction





Note: Please select the setting value correctly, as it will be associated with the test results.

5.2 Terms Note

5.2.1 Setting Options Description

Options	Setting Content	Description
Battery voltage setting	12V	12V battery, generally used for gasoline vehicles
	24V	24V batteries are commonly used in diesel vehicles
	Electric vehicle	Generally used to test electric vehicles. Only one battery pack can be tested (multiple battery packs are prohibited)
Standard choice	Unknown	Choose this option when the battery standard and capacity cannot be determined *1
	CCA	CCA standard: Cold starting current
	IEC	IEC Standard: International Electronic Technology Association
	EN	EN standard: European industrial standard
	DIN	DIN: German industrial standard
	JIS#	JIS# : Japanese industrial standard
VRLA/GEL/AGM/SLA		Lead-acid storage batteries for vehicles
STANDARD LSI		Automotive battery

*1. Can only measure the current power, not the life.

5.2.2 Setting Options Description

- Battery test: Measure the battery life
- Starting test: Measure the discharge performance of the battery
- Load test: Measure the performance of the generator
- Charging test: Test the charging system of the generator

5.3 Battery Test

Note: For UPS batteries/motorcycle batteries, only the internal resistance/charge/voltage can be measured, not the battery life.

5.3.1 Standard Choice

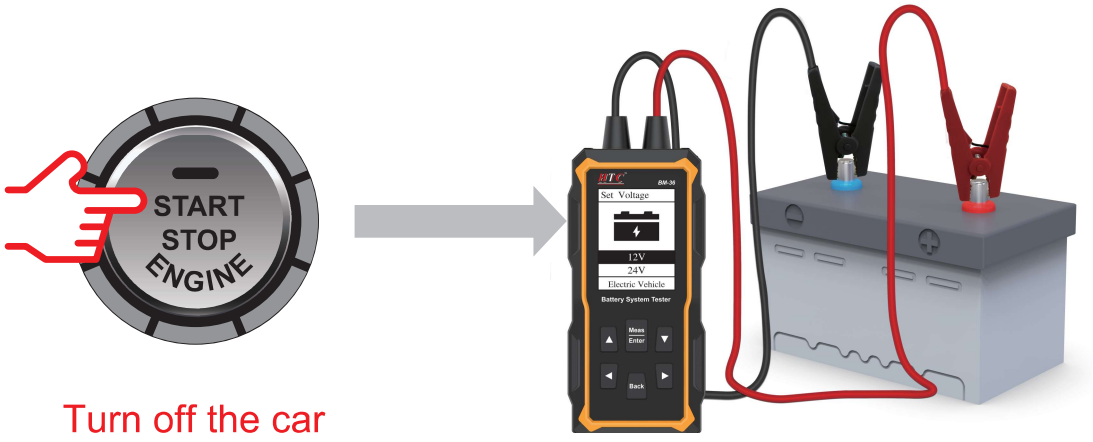
Battery Label	Standard Selection	Battery Parameter	Note
12V/60Ah/CCA 500A	CCA	500	12V battery, 60Ah capacity, cold starting current 500A
300A EN	EN	300	EN standard value: 300A
12V 250A 60Ah DIN	DIN	250	12V battery, 60Ah capacity, DIN standard value: 250A
26A19R 12V 60Ah	JIS#	200	12V battery, 60Ah capacity, check JS code conversion table 26A19R: the corresponding CCA is 200
26A19RMF 12V 60Ah	JIS#	220	12V battery, capacity 60Ah, check JS code conversion table 26A19R: corresponding CCA for MF is 220
12V 60Ah	Capacity	60Ah	Estimate the CCA value based on the battery capacity. This method is used when no standard can be found

Note: Users can also estimate CCA value based on vehicle displacement

Vehicle Displacement	Reference Value of CCA
1200~1600 CC	350
1600~2000 CC	500
2000~3000 CC	650
>3000 CC	750

5.3.2 Test Results for Automotive/Electric Vehicle Battery

Please turn off the car first, turn the key to the OFF position, and turn off other electrical equipment.



Turn off the car

After preparations are complete, choose Batteries Test according to 5.1 . Test results are as follows:

SOC	Current battery level
SOH	Battery life
Voltage	Current voltage
CCA	Cold starting current
Resistance	Internal resistance of battery

Note:

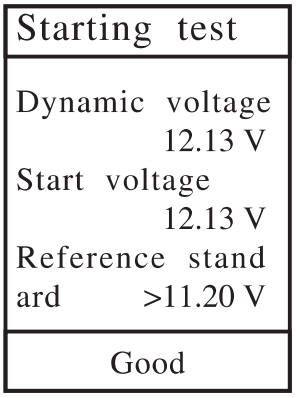
* After driving a vehicle for some time, its battery voltage will be slightly higher. Place it for a period of time or turn on the headlamp for 3 minutes, and then measure the battery when the voltage drops back to the normal value.
* The standard of internal resistance will vary due to different plate materials used by different manufacturers, so there is no fixed standard. But the same manufacturer of the same model battery, its factory resistance value won't be much different.

Description of test results:

Replacement	Battery life<45%
Attention	Battery life≥45%
Average	Battery life≥60%
Good	Battery life≥80%
Need to charge	Battery voltage <12.30V, charge the battery (for 24V systems <25.6V)
Retest after charging	If the voltage is less than 12.0V, the measurement results are invalid. Retest the battery after charging (for 24V system <24.0V)

5.4 Starting Test

Please turn off the car and turn the key to the OFF position. Start the test mode according to 5.1. Start the car, when completing, the test will be completed.



Display minimum voltage, dynamic voltage and standard;

Description of test results:

Good	Starting voltage >10.2V
Average	Starting voltage 9.6~10.2V
Attention	Starting voltage <9.6V

Note: For 24V system, the evaluation standard of voltage is multiplied by 2 times. For example, the performance is good when the starting voltage is above 10.2V; For 24V system, the performance is good when the starting voltage is above 20.4V.

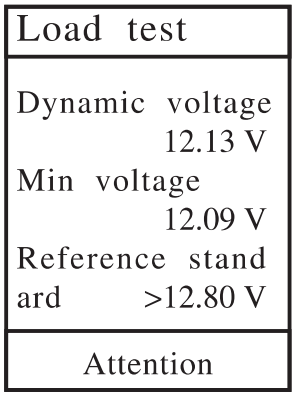
The principle of starting test is to judge the current starting performance by detecting the lowest starting voltage of the car, which is closely related to the current state of the car and the battery power. You are advised to follow the manual when:

1. Generally, the wiring of a car that is used several years will age. The greater the contact resistance, the greater the starting current, even if the battery is replaced, its starting voltage will be low. Therefore, it is necessary to check whether the line is aging and corrosive.

2. If the power of the new battery is insufficient, it will also cause low starting voltage, which needs to be fully charged and tested again.
3. If the voltage of the new battery is sufficient, but its storage time is long after leaving the factory, it will also cause low starting voltage. Then, you need to charge the battery to activate the chemical activity, and then test.
4. When the vehicle has not been run for a long time, the starting current required under the condition of cold car is much larger than the normal one, resulting in a very low starting voltage. It is recommended to drive the car for 2-3 kilometers or start the car for 2-3 times to retest.

5.5 Load Test

Start the car first and select the load test mode according to 5.1. According to the instrument prompt, increase the speed to 2000-2500, and then press Meas Enter to obtain the measurement results.



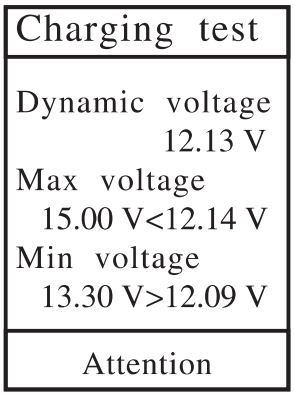
Display minimum voltage, dynamic voltage and standard;

Description of test results:

Good	Minimum voltage >13.4V (24V system >26.8V)
Average	Minimum voltage >12.8V(24V system >25.6V)
Attention	Minimum voltage >12.8V(24V system >25.6V). Check the generator belt for wear, and the wire for short circuits

5.6 Charging Test

Start the car first and select the load test mode according to 5.1. According to the instrument prompt, increase the speed to 2000-3000, and then press Meas Enter to obtain the measurement results.



Display minimum voltage, maximum voltage, dynamic voltage;

Description of test results:

Good	Minimum voltage >13.3V (24V system >26.6 V) Maximum voltage <15.0V(24V system <30.0 V)
Attention	Minimum voltage <13.3V (24V system <26.6 V) Maximum voltage >15.0V(24V system >30.0 V)

6. Common Problems

6.1 Test Principles

With the increase of time, the battery will gradually age. The main reason is that the surface of the battery plate is vulcanized, so that it can no longer carry out effective chemical reactions, which is the main reason that most batteries can no longer be used.

The International Institute of Electrical and Electronic Engineers (IEEE) has formally adopted the conductance test method as one of the testing standards for lead-acid batteries. It is clearly stipulated in IEEES standard 1118-1996: "The measurement of battery conductivity is to add AC signals of known frequency and amplitude to both ends of the battery, and then measure the generated AC current. The AC conductivity value is the ratio of the AC current signal in phase with the AC voltage to the AC voltage." This product was developed based on such judgment.

6.2 The Inverter Will Affect the Result or Not

All inverters will affect the test results of the instrument. Therefore, before measuring, please remove the inverters to ensure the correctness of the test.

6.3 Can Accurately Predict Battery Failure Time or Not

The internal resistance of sealed lead-acid battery is complex, which includes the ohm internal resistance of battery, the internal resistance of concentration difference polarization, the internal resistance of electrochemical reaction and the interference effect of double layer capacitor charging. Different test methods and internal resistance values measured at different time contain different components and relative content, so the measured internal resistance values are different. There is no strict mathematical relationship between the internal resistance (or conductance) of a sealed lead-acid battery and the capacity of the battery, so it is impossible to predict the service life of a battery based on the internal resistance (or conductance) value of a single battery. However, the sudden increase of the internal resistance of the battery or the sudden decrease of the "CCA" indicates that the battery life is about to end.

6.4 Are the Measured CCA Values Accurate or Not

CCA is a control standard for battery production. The accumulated results show that the CCA of the new battery is 10 to 15 percent higher than the indicated value. During the use of the battery, the value will slowly approach the indicated value, and then fall below the indicated value.

6.5 Difference between Test Method and Load Test Method

▲Load test method:
According to the physical formula R=V/I, the test device forces a large constant DC current (40A~80A current is generally used at present) to pass the battery for a short period of time (usually 2-3 seconds). Measure the voltage at both ends of the battery and calculate the current internal resistance of the battery according to the formula.

Shortcomings:
(1) Only large-capacity batteries or accumulators can be measured. Small-capacity batteries cannot load 40A to 80A current within 2 to 3 seconds.
(2) When a large current passes through the battery, the electrode inside the battery will be polarized, resulting in internal resistance of polarization. Therefore, the measurement time must be very short, otherwise the error of the measured internal resistance value is very large.
(3) The electrode inside the battery will be damaged by the heavy current passing through the battery.

▲Product measurement method:
The battery is actually equivalent to an active resistance, so we give the battery a test signal of fixed frequency and fixed current (small current). Then Sample its voltage. After a series of processing such as rectification and filtering, calculate the internal resistance of the battery through the calculation circuit.

Advantages:
(1) This method can measure almost all batteries, including small capacity batteries.
(2) This method will not do much damage to the battery itself.

7. Battery Specification Table

(The following tables are for reference, the actual value is subject to the factory data)

7-1. JIS Code Conversion Table

Specifications		Cold Starting Current CCA			Specifications		Cold Starting Current CCA		
JIS(new)	JIS(old)		MF	CMF	JIS(new)	JIS(old)		MF	CMF
26A17R		200			55B24RS	NT80-S6S	430	420	500
26A17L		200			55B24LS	NT80-S6LS	430	420	500
26A19R	12N24-4	200	220	264	55D26R	N50Z	350	440	525
26A19L	12N24-3	200	220	264	55D26L	N50ZL	350	440	525
28A19R	NT50-N24	250			60D23R		520		
28A19L	NT50-N24L	250			60D23L		520		
32A19R	NX60-N24	270	295		65D23R		420	540	580
32A19L	NX60-N24L	270	295		65D23L		420	540	580
26B17R		200			65D26R	NS70	415	520	625
26B17L		200			65D26L	NS70L	415	520	625
28B17R		245			65D31R	N70	390	520	630
28B17L		245			65D31L	N70L	390	520	630
28B19R	NS40S	245			70D23R	35-60	490	540	580
28B19L	NS40LS	245			70D23L	25-60	490	540	580
32B20R	NS40	270			75D23R		500	520	580
32B20L	NS40L	270			75D23L		500	520	580
32C24R	N40	240	325	400	75D26R	F100-5	490		
32C24L	N40L	240	325	400	75D26L	F100-5L	490		
34B17R		280			75D31R	N70Z	450	540	735
34B17L		280			75D31L	N70ZL	450	540	735
34B19R	NS40ZA	270	325	400	80D23R		580		
34B19L	NS40ZAL	270	325	400	80D26L		580		
36B20R	NS40Z	275	300	360	85B60K				500
36B20L	NS40ZL	275	300	360	85BR60K				500
36B20RS	NS40ZS	275	300	360	95D31R	NX120-7	620	660	850
36B20LS	NS40ZLS	275	300	360	95D31L	NX120-7L	620	660	850
38B20R	NX60-N24	330	340	410	95E41R	N100	515	640	770
38B20RS	NT60-N24S	330	340	410	95E41L	N100L	515	640	770
38B20L	NX60-24L	330	340	410	105E41R	N100Z	580	720	880

Continued table

Specifications		Cold Starting Current CCA			Specifications		Cold Starting Current CCA		
JIS(new)	JIS(old)		MF	CMF	JIS(new)	JIS(old)		MF	CMF
38B20LS	NX60-24LS	330	340	410	105E41L	N100ZL	580	720	880
40B20L		330			105F51R	N100Z	580		
40B20R		330			105F51L	N100ZL	580		
42B20R		330			115E41R	NS120	650	800	960
42B20L		330			115E41L	NS120L	650	800	960
42B20RS		330			115F51R	N120	650	800	960
42B20LS		330			115F51L	N120L	650	800	960
46B24R	NS60	325	360	420	130E41R	NX200-10	800		
46B24L	NS60L	325	360	420	130E41L	NX200-10L	800		
46B24RS	NS60S	325	360	420	130F51R			800	
46B24LS	NS60LS	325	360	420	130F51L			800	
46B26R		360			145F51R	NS150	780	920	
46B26L		360			145F51L	NS150L	780	920	
46B26RS		360			145G51R	N150	780	900	1100
34B19RS	NS40ZAS	270	325	400	80D26R	NX110-5	580	580	630
34B19LS	NS40ZALS	270	325	400	80D26L	NX110-5L	580	580	630
46B26LS		360			145G51L	N150L	780	900	1100
48D26R	N50	280	360	420	150F51R	NT200-12	640		
48D26L	N50L	280	360	420	150F51L	NT200-12L	640		
50D20R		310	380	480	165G51R	NS200	935	980	
50D20L		310	380	480	165G51L	NS200L	935	980	
50D23R	85BR60K	500			170F51R	NX250-12	1045		
50D23L	85B60K	500			170F51L	NX250-12L	1045		
50B24R	NT80-S6	390			180G51R	NT250-15	1090		
50B24L	NT80-S6L	390			180G51L	NT250-15L	1090		
50D26R	50D20R		370		195G51R	NX300-51	1145		
50D26L	50D20L		370		195G51L	NX300-51L	1145		
55D23R		355	480	500	190H52R	N200	925	1100	1300
55D23L		355	480	500	190H52L	N200L	925	1100	1300
55B24R	NX100-S6	435	420	500	245H52R	NX400-20	1530	1250	
55B24L	NX100-S6L	435	420	500	245H52L	NX400-20L	1530	1250	

7-2. DIN and EN Model Comparison Table

Model	Same Model	DIN	EN	Model	Same Model	DIN	EN
52805	52815	180	240	56420	56322 88066	300	510
53517		175	300	56530	56618 56638	300	510
53520	53521 53522	150	240	56618	56619 56620	300	510
53625	53638 53836	175	300	56633	56647 56641	300	510
53646	53621 88038	175	300	56820	56821 56828	315	540
53653	53624 53890	175	300	57024	57029	315	540
54038	54039	175	300	57113	57539	400	680
54232		175	300	57114	56821 88074	400	680
54313	54324 54464	220	330	57218	57219	420	720
54317	54312 88146	210	360	57220	57217	420	720
54437	54466 54459L	210	360	57230		380	640
54459	54434 88046	210	360	57412	57413 57412L	400	680
54469	54449 54465	210	360	57512	57513 57531	350	570
54519	54533 54612	210	360	58515	58424	450	760
54523	54524	220	300	58521	58513	320	540
54537	54545 54801	190	300	58522	58514	320	540
54551	54580	220	300	58815	58821	395	640
54533	54577 54579	220	300	58820	58515 58527	395	640
54584	54578	220	300	58827		400	640
54590		210	330	58838	58833 88092	400	680
54827		240	360	59040	59017 59018	360	600
55040	88056	265	450	59218	59219	290	480
55041	55042	220	360	59226	59215	450	760
55044	55414 88056	265	450	59514		320	540
55046		300	510	59518	59519	395	640
55056		320	540	59615	59616	360	600
55057	54827 88156	320	540	60018	60019	250	410
55068	55069 55548	220	390	60026	58811	440	720
55218		255	420	60044	60038	500	760
55414	55415 55421	265	450	60527	60528	410	680
55422	55566 55040	265	450	61017	61018	400	680
55428	55423 55427	300	510	61023	62529	450	760

Continued table

Model	Same Model	DIN	EN	Model	Same Model	DIN	EN
55457		265	450	61047	61048	450	760
55529		220	360	62034	62038 62045	420	680
55531	55545 55559L	255	420	63013		470	680
55559	55530 88056	255	420	63545	63549	420	680
55564	55552 55563	255	420	64202	64317 64318	325	550
55564	55565 55548	255	420	64028	64035	520	760
55570	55567 55565L	255	420	64036		460	760
56012		230	390	64317	64318 64323	540	900
56048	56068 56069	250	390	65513		540	900
56049	56069 56073	250	390	65514	65515	570	900
56077	56030	300	510	67043	67045	600	1000
56091	55811	360	540	68032	68034	600	1000
56111	55048	300	540	70029	70038 70027	630	1050
56218	56092	300	510	70036	68040 68021	570	950
56219	56216	300	510	71014	71015	700	1150
56220		280	510	72512		680	1150
56225	56323	300	510	73011		740	1200
56318	56312 56311	300	510				

7-3. Yuasa Battery Specification Table

Yuasa Battery Model	CCA Value	Specifications	Cold Starting Current CCA
GT50L-MF	356CCA	75A-72	630CCA
GTH55DL-MF	356CCA	78A-72	670CCA
GTH60DL-MF	325CCA	34-610MF	610CCA
GTH75DL-MF	520CCA	75-6MF	615CCA
CTH40S	275CCA	58-6MF	530CCA
CTH40L	276CCA	34-6MF	500CCA
CTH40	277CCA	24-500	500CCA
CTH60L	325CCA	34-710	710CCA
GTH75DL-MF(Athletic Version)	520CCA	41-580	580CCA
GTH75DR-MF(Athletic Version)	521CCA	58-530	530CCA
55D23R-MF	522CCA	65-730	730CCA
34-60	525CCA	75-660	660CCA
58-60	525CCA	78-710	710CCA
65-70	700CCA	GR40R-MF	700CCA
74-60	525CCA	GR40R-CMF	820CCA
75-72	500CCA	GR96R-MF	500CCA
35-580	580CCA	GR96R-CMF	580CCA
65-900	850CCA		

8. Knowledge about Car Battery

8.1 Different Types of Batteries Have Different Internal Resistances

Batteries of the same type have different internal resistance due to inconsistent internal chemical characteristics. The internal resistance of a battery is so small that it is generally defined in milliohm units. Internal resistance is an important technical index to measure battery performance. Normally, a battery with a small internal resistance has a strong discharge capacity, while a battery with a large internal resistance has a weak discharge capacity.

8.2 The Amount of Energy of a Battery Cannot Be Measured by Feeling

A hydrometer can be used to measure the working state of the battery. The electrolyte is based on the specific gravity of distilled water and pure sulfuric acid at 1.26g/cm³ at 20℃. For a new battery, if the amount of electrolyte (battery acid) is in the normal range and the acidity is fixed, the electrolyte (battery acid) is not enough. At this time, distilled water needs to be added, which can maintain a certain amount of water, but also can maintain PH value. If the battery works normally, then in addition to the fixed PH, its specific gravity value will also be in a certain range.

Batteries for Small Cars			
Voltage(V)	Battery level(%)	Specific Gravity	Note
>12.7	100%	1.26~1.28	Full charge
>12.6	90%	1.24	Normal state
12.40	70%	1.22	Need to charge
12.30	60%	1.20	Immediate charge
12.1	50%	1.16	Immediate charge
<11.7	20%	<1.10	Immediate charge

After full charging, if the specific gravity value of the electrolyte can not reach 1.26~1.28, and the measured voltage can not reach 12.7V above, then it represents the storage capacity of the battery has declined. At this time, if the specific gravity value of electrolyte is deliberately adjusted to 1.26 (increase the proportion of sulfuric acid), this will not only be unable to revive the battery, but also let the battery life loss faster.

8.3 Meaning of Common Battery Parameter Abbreviations

▲ RC- Reserve Capacity (standard of International Battery Association)
When the battery is operating at 27°C(80°F), the average power load can reach 25 amps per minute and maintain a minimum voltage of 10.5V.

▲ CCA- Cold Cranking Ampere (standard of International Battery Association)
The lowest voltage of a fully charged battery can be 7.2V after 30 seconds of load discharge output at -18℃(O°F). In terms of the SAE standard,CCA is the standard that factory tests battery, which measures the discharge load capacity of the battery. After 30 seconds of load discharge at -18°C(O°F) (500CCA that is, 500A continuous discharge on the load), the voltage of each battery should be above 1.2V and all batteries should be above 7.2V. This is the minimum standard required for this battery.

▲ CA- Cranking Amperes
The meaning is similar to that of CCA, and the unit is also amperes. The only difference from CCA is the temperature of measurement. CCA is the result at -18°C(O°F) and CA is the result at 0°C. If both CCA and CA are marked on the same battery, CCA will have a lower value than CA, because the lower the temperature, the worse the battery will perform.

▲ AH- Amp/Hour (20 hour ratio)
This is a standard formulated by Japanese Industrial Standards (JIS). In short, a battery can be maintained above 10.5V by discharging at a constant amperage, so a fixed amperage multiplied by hours is amperage per hour. For example, a fixed 5 amperes discharge for 20 hours results in a battery of 100 ampere/hour.

▲ DIN- German standard of verification
A 100DIN battery is discharged at 100A at -18°C(0°F) and maintains a minimum voltage above 9.0V for 30 seconds and above 8.0V for 150 seconds.

▲ IEC- International Electronic Technology Association
With average current output at -18°C(0° F), the minimum voltage is maintained above 8.4V for 60 seconds.

▲ BSR- British standard of verification
With average current output at -18°C(0° F), the minimum voltage is maintained above 6.0V for 180 seconds.

8.4 Glossary

MF(Maintenance-Free) --- Maintenance-free battery
CMF(Closed Maintenance-Free) --- Sealed maintenance-free battery

According to the alloy composition: Maintenance-free battery is lead-calcium alloy; Conventional batteries are lead-antimony alloys.

In use, the proportion of self-discharge and water loss of maintenance-free battery is very low, so it saves effort in daily inspection and maintenance. And it does not need to add water, does not leak acid, so it will not corrode the car body and pollute the environment, is a relatively environmentally friendly battery.

In 1981, a modified MF battery was introduced in response to the shortcomings of traditional batteries, which often require water to be added for maintenance. In order to further enter the age of free maintenance, CMF series was introduced successively in 1985.

Vulcanization of Batteries

The characteristics of lead-acid batteries are that there will be vulcanizationphenomenon under normal use conditions, but when the battery voltage is lower than 10.5V, the vulcanization phenomenon will be accelerated. Therefore, avoid voltage below 10.5V or deep discharge during storage.

Web:www.hazari.com