Discover®
Innovative Battery Solutions

Why digital testers should not be used to certify a battery's SAE J537 specifications

What is SAE J537?

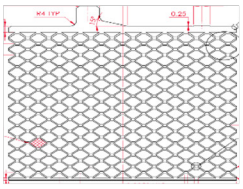
SAE J537 is an SAE International standard titled "Storage Batteries" that defines test procedures and rating requirements for automotive and commercial 12 V lead-acid storage batteries used mainly for starting, lighting, and ignition (SLI) in vehicles with regulated charging systems, and it ensures that battery performance ratings (such as cold cranking, capacity, and life tests) are determined consistently so that at least 90% of subsequent production samples meet the stated ratings when tested according to the standard.

Learn More

Digital testers measure internal resistance, which is influenced by various design and manufacturing choices.

Plate Design

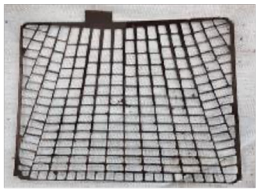
Grid design is influenced by several factors, including manufacturer specifications, production techniques, material thickness, and the geometry of the mesh and frame.



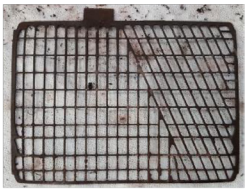
Positive Grid : TBS EX
138(W)*121(H)*0.8(T)

Positive Grid : TBS EX
143(W)*128(H)*0.9(T)

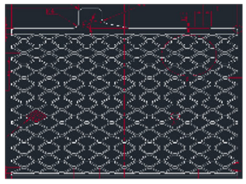
Positive Grid : Punch
138(W)*118(H)*0.9(T)



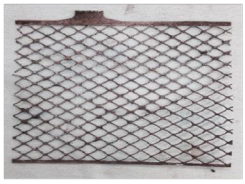
Positive Grid : Punch
145(W)*136(H)*0.9(T)



Positive Grid : Punch
141(W)*120(H)*0.9(T)



Negative Grid : TBS EX
138(W)*121(H)*0.7(T)



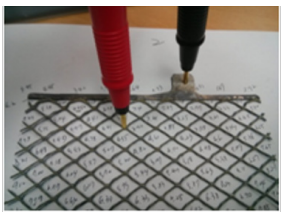
Negative Grid : TBS EX
143(W)*128(H)*0.72(T)

Negative Grid : TBS EX
138(W)*118(H)*0.72(T)

Negative Grid : TBS EX
145(W)*136(H)*0.6(T)

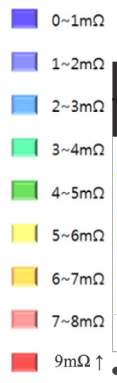
Negative Grid : Concast
141(W)*120(H)*0.8(T)

Grid Design Comparison



Method: Acc. To the Midtronics's (by Dr. Klang)

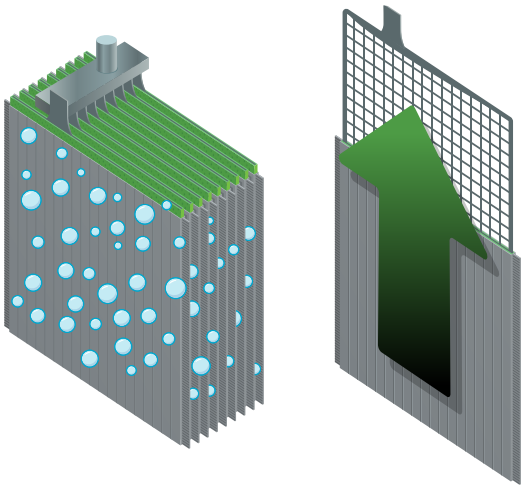
- **Internal resistance tester: HIOKI(Japan)**
- **Check: Grid Lug (Basepoint) vs each Mesh**



Strip Thickness(mm, n=5)		Mesh numbers(ea, n=5)		Frame(n=5)	
0.8(pos)	0.9(pos)	9(neg)	11(neg)	Without (pos)	With (pos)
Avg 4.0mΩ	Avg. 3.6mΩ	Avg. 6.5mΩ	Avg. 6.0mΩ	Avg. 4.0mΩ	Avg. 2.49mΩ

- Resistance shows variable distribution depending on Grid Design (strip thickness, mesh, frame etc.…)

Gassing, Self Discharge & Internal Resistance



Electrolyte with entrapped gas

Separator

- Gassing is one of the leading causes of increased internal resistance within a 12-volt lead acid starting battery.
- The effects of entrapped gas in flooded batteries vary depending on separator type, charging, temperature, rest time after charge and how gently the batteries are handled during testing.
- The presence of gas will reduce performance > than 10% on a conductance test.
- Effects on sustained cranking tests are more dramatic because gas attached to the separators blinds a portion of the plate surface, affecting both ohmic values as well as current density.
- Gas entrapment is recurrent and the cause of the largest variation during high-rate testing in flooded batteries.
- Self discharge impacts gassing, increasing internal resistance.

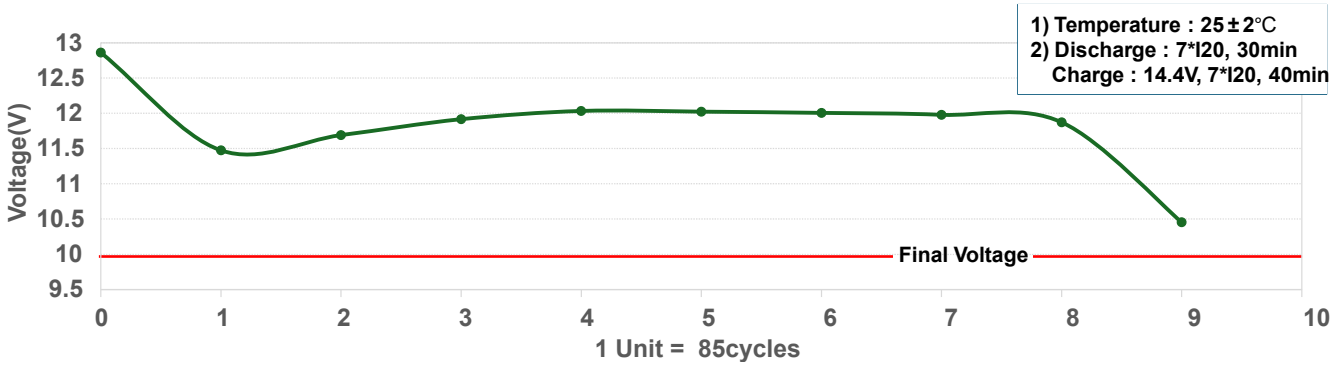
Pasting Paper & Internal Resistance

NWF (Non-Woven Fabric)

Paper (Pulp)

- NWF: Assists with active material retention over the life cycle of a battery. Nominal increase in resistance.
- Paper (Pulp): Melts and disappears during the formation process, nominal decrease in resistance compared to NWF. Resulting in +5 M-CCA increase

Test Result (Endurance Cycle Test DOD 17.5%)



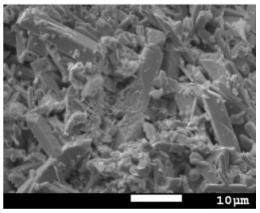
Brand-new lead-acid batteries that have never been used may show a lower Cold Cranking Amps value when measured by an electronic tester.

The main reasons include:

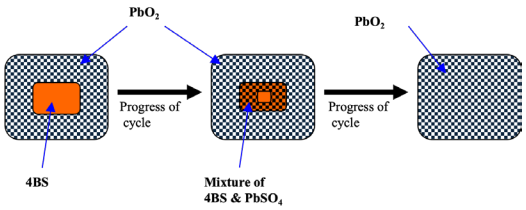
1. **Incomplete plate activation**
   The plates may not be fully formed or stabilized after the factory formation process, resulting in slightly lower conductivity in the initial state.

Theoretical background (explanation)

- Leading flooded battery manufacturers, such as Discover, utilize 4BS curing technology to enhance the adhesion between the calcium (Ca) grid and the active material.
- 4BS offers better life cycle than 3BS. - Contents of PAM: 4BS 75~80%, Crystal size : 10~20㎛
- 4BS is hard to convert to PbO2 during formation. - 4BS (Inside layers) is formed over several cycles.



[Fig1. 4BS crystal]



[Fig2. Schematic of conversion of 4BS crystal to PbO2]

After several cycles in service, residual 4BS is changed into PbO2 decreasing internal resistance.

2. **Minor sulfation during storage**
   To ensure the battery reaches its optimal performance before installation, it is recommended to perform a charge to activate the battery. Sometimes it will take a few charging cycles to reach its optimum performance.

Official DHC Letter regarding testing new batteries with a digital DHC tester.

DHC SPECIALTY CORP.

7FL., NO.83, CHOU TZU ST.,
NEI HU, TAIPEI 114 TAIWAN
TEL:886-2-27995946
FAX:886-2-26595076
EMAIL:service@dhc.com.tw

Why a Brand-New Automotive Lead Acid Battery May Show Lower CCA Than Its Rated Value ?

Even a brand-new lead-acid battery that has never been used may show a lower Cold Cranking Amps (CCA) value when measured by an electronic tester.

The main reasons include:

1. **Incomplete plate activation** – The plates may not be fully formed or stabilized after the factory formation process, resulting in slightly lower conductivity in the initial state.
2. **Minor sulfation during storage** – When stored for a long period, slight lead sulfate crystals may form on the plate surfaces, reducing instantaneous discharge capability.

To ensure the battery reaches its optimal performance before installation, it is recommended to perform a charge to activate the battery.

This process allows the active material on the plates to better convert and the electrolyte to mix more evenly.

Sometimes it will take a few charging cycles to reach its optimum performance.

If the new battery is installed directly into the vehicle, the alternator will gradually activate it during regular driving. It may take weeks or a month of driving(charging) to fully activate the battery, depending on the driving distance/time.