



Application of DC load in the fuse blowing test

With the promotion of automotive safety, environmental protection, energy saving and comfort, more and more electronics are been used in automobiles. Various types of new connectors and fuses are continuously designed, with higher fuse-breaking capability. By now, the fuses used in the power battery of new energy vehicles are mostly bolt-type fuses, and the nominal current can reach 500A, of which the typical types are SF30 and SF51. Next, we will introduce one way to test the fuse's fuse-time by using ITECH high-power power supply and electronic load.

The fuse is used as a component that permanently disconnects the circuit under abnormal conditions (when the current overloads), and thus plays a vital role in the safety of the vehicle. Therefore, the fuse timing test is a must-test item. In the international standard of road vehicle fuse ISO8820-5_2007 and ISO8820-1_2005, the parameters definition and criteria of the fuse are described in detail.

The complete fuse-related test consists of break-over voltage drop test, fuse time test, step current, and segmentation capability tests. This article will introduce the test of the fuse time of SF30 and SF51.

- 150A – 200A SF30 Fuse
- 300A – 500A SF51 Fuse

**Fusing time test requirements:**

The following figure is taken from the ISO 8820-1_2007 international standard for the SF30 and SF51 fuse test, the fuse time needs to be tested with the overload current from $1.1I_R \sim 6.0I_R$ range, when the overload current is higher, the faster the fuse time. With a 500A fuse, $6I_R$ means the overload current is 3000A, and the fuse time is measured under this condition.

Figure 5 Fusing time

Test currents	Operating times s							
	SF 30				SF 51			
	30 A ... 125 A		150 A ... 200 A		80 A ... 250 A		300 A ... 500 A	
	min.	max.	min.	max.	min.	max.	min.	max.
$0,75 I_R$	— ^b	—	360 000	∞	—	—	14 400	∞
I_R	360 000	∞	—	—	14 400	∞	—	—
$1,1 I_R$	14 400	∞	—	—	—	—	—	—
$1,35 I_R$	—	—	—	—	120	1 800	—	—
$1,5 I_R$	90	3 600	—	—	—	—	—	—
$2,0 I_R$	3	100	1	15	1	15	1	15
$3,0 I_R$	0,3	3	—	—	—	—	—	—
$3,5 I_R$	—	—	0,3	5	0,3	5	0,5	5
$5,0 I_R$	0,1	1	—	—	—	—	—	—
$6,0 I_R$ ^a	—	—	0,1	1	0,1	1	0,1	1

^a Not for ≥ 350 A.
^b Not specified, where noted with "—".

 Remarks a Do not apply to ≥ 350 A

b No definition, means '—'

Fusing time test solution:

For the test of the melting time of 3000A, the most advanced electronic load matching power supply solution can form the basic test framework. However, there are still some difficulties that need to be conquered, such as: (1) Fusing time testing requires an additional oscilloscope, which is expensive, and cost a lot more if the fall time of current other than voltage needs to be tested according to the standard. (2) In the aspect of hardware, there are not many professional instrument manufacturers that can meet both power supply and electronic load at 3000A, many manufacturers use adjustable resistors to realize, but the operation will be very cumbersome. (3) Lack of professional testing software. (4) In the premise of 3000A power supply and load, and feasible plan, whether or not the size of the instruments is particularly bulky, this is a concern for any laboratory staff.

In view of the above difficulties, ITECH be backed by powerful hardware and firmware functions, had already made breakthroughs and provided 3000A fusing time system to lots of famous fuse manufacturer's laboratories.

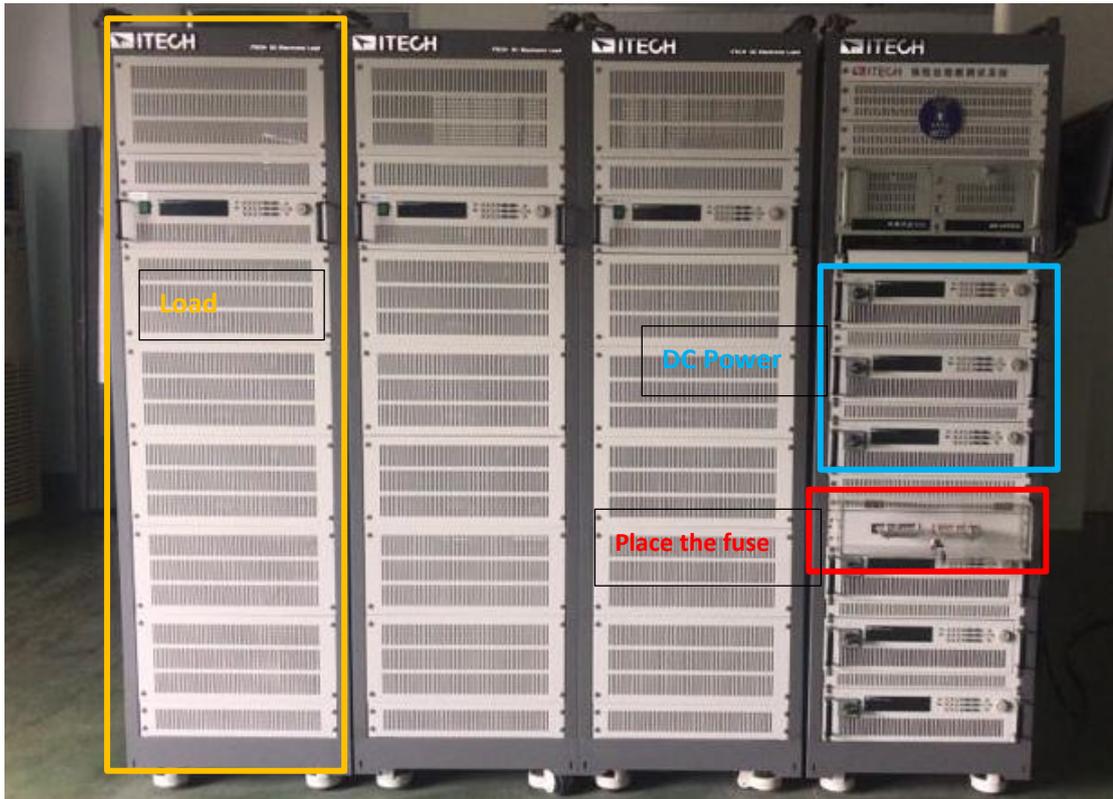


Fig 1. Fusing Time Test System

Advantages of ITECH fusing time test system:

- (1) Fig 2. Shows the waveform of current, the fusing time is the duration of the current dropping from C to E point (Positive pulse width time), and time measurement accuracy can be comparable to a high-accuracy oscilloscope.

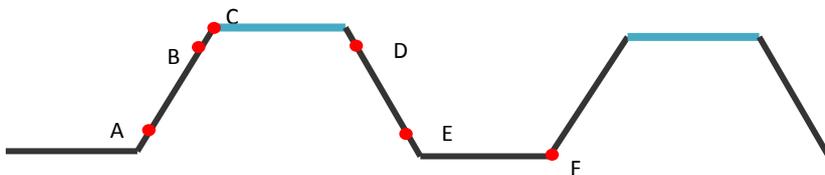


Fig 2. Waveforms of Voltage or Current

Time measurement should be fulfilled by sending commands. For example, testing the rising and falling time of voltage from 1V to 8V and the current from 1A to 5A, the following commands can be sent:

SYSTEM: REMote

FUNCTION CURRENT

CURRent 6

SENSe: TIME: VOLTage1 1

SENSe: TIME: VOLTage2 8

SENSe: TIME: CURRent1 1

SENSe: TIME: CURRent2 5

INPut 1

SENSe: TIME: VOLTage: UP?

SENSe: TIME: VOLTage: DOWN?

SENSe: TIME: CURRent: UP?

SENSe: TIME: CURRent: DOWN?

IT8900A/E series load comes with time measurement function, with accuracy comparable with oscilloscope.



Fig 3. Time Measurement Comparison between IT8900A and oscilloscope

- (2) In the fusing test solution, the maximum power of electronic load IT8900A can reach up to 384 kW and the power supply IT6000 series is only 3U high with 15 kW output, greatly reducing the size of the entire system.
- (3) Professional PC software, which can measure and record the fusing time under different current rates, can help draw the fusing waveform.

Fuse Test

This test item mainly tests the fuse blown time at different rate currents.

Configuration parameters



In general, ITECH has already possessed a reliable and accurate fusing time measurement system in the field of new energy. Moreover, ITECH also has on-board charger test system and battery test system, AC, DC charging station simulation system, etc.

For more information, please visit official website: <http://www.itechate.com/en>