# Novel Test Equipment for Higher Continuous Discharge of up to 150A

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## Abstract

*A simple high current discharge equipment was designed with coil type of nickrome wires. Test current between 50 to 150 Ampere can be passed continuously. The wire is cooled in water. The system is safe and useful especially for EV batteries. This new simple device is inexpensive for various high rate discharge tests for forklift batteries and construction batteries of 48 or 96 volt with 500 to 750 Ah capacities.*

## Keywords

*high current discharge, nickrome wire*

## 1. INTRODUCTION

*Testing of high current discharge is significant for manufacturing and on-site operation. It is often necessary to test the performance of batteries by higher current. The testing of batteries requires a large carbon plate resistor with varying pressures on plate or a water resistor based on two lead electrodes immersed in dilute sulfuric acid with varying distance between the lead acid batteries. This paper introduce an inexpensive method for high current discharge method of up to 150 A. The test device is based on the use of a nichrome wire immersed in cold running water. The constant resistance in the nichrome wire gives a constant current for a battery discharge. This proposed system for different experimental set up is shown. The experiment is made using a small insulated tank containing running water. During a testing of 300AH forklift battery at intense 150 ampere discharge, the temporal change of the voltage drop of around 80 % to 70 %. During the experiment, the temperature is kept in constant. It means that the discharge condition is almost constant during the experiment. It make possible to judge which battery cell should be replaced. When the discharge is started, no notable spark arcing is found. Usually during the disconnection of the switch, it is often found the big spark for such intense current. This testing method does not show any significant arcing because the switch is also immersed in the water contained chamber. Even a large alligator chip in the water can be used as the switch.*

## 2. STRUCTURE OF THE TEST EQUIPMENT

Figure 1 and Figure 2 shows schematic drawings of the novel test equipment. Figure 3 shows connections to change current from 40A to 160A. Figure 4 shows a switch in water.

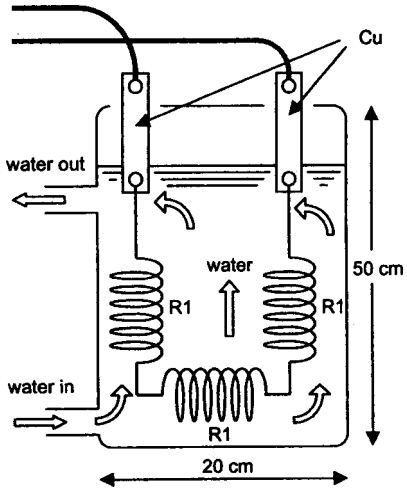



**Fig. 1** Plastic container having 3.5 mm diameter nichrome resistance (R1), water in from bottom and polyethylene case. Cu: Copper terminal (Thickness: 2 mm, width: 10 mm, length: 25 cm)

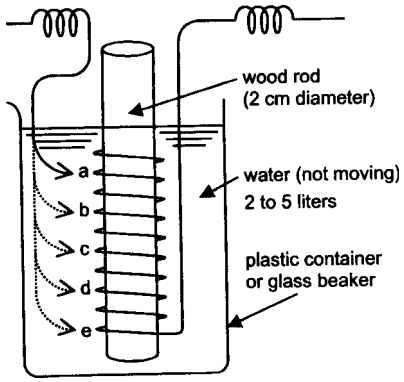
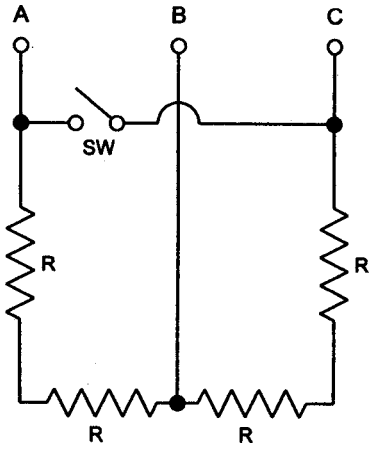



**Fig. 2** 2 to 10 ampere (Adjust the current by moving alligator clip from a, b, c, d and e)




(1) A-C (SW is open): 40A discharge
(2) A-B (SW is open): 80A discharge
(3) A-B (SW is closed): 160A discharge

**Fig. 3** Design for 3 large current selector

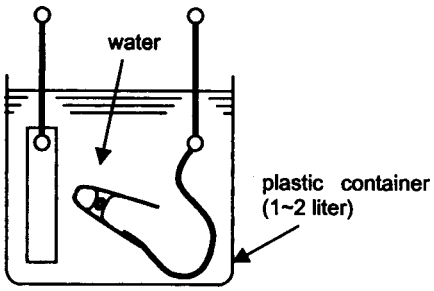



**Fig. 4** Switch in water for 100 to 150 A units

## 3. RESULTS

Since lead acid batteries have a constant open circuit voltage of 2.1 volts/cell, the discharge current remains steady without much effort.

During testing of 300 Ah forklift battery at 150 ampere discharge, the cell voltage was 1.8 volts for about 80% of the discharge. The current began to drop from 140 amps to 130 amps, the voltage of each of the 24 cells was checked to find which cell needed to be replaced. In 4 to 8 year old batteries, one or two bad cells were found and needed replacing.

## 4. SAFETY TEST

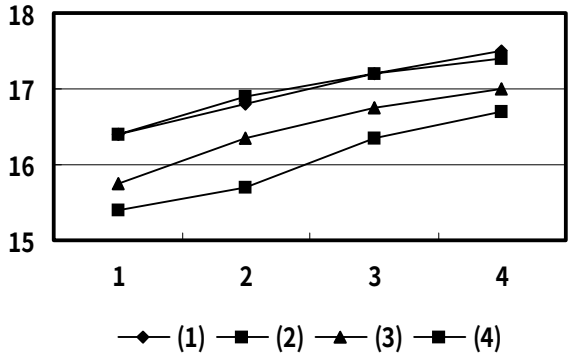
During the use of the equipment with running water, we dipped our finger into the running water in the polyethylene container to see if any electricity enters our body. No effect was noticed with the voltage as high as 65 volts.

## 5. SWITCH

When the discharge is started at 100 or 150 amps, the spark on switch closure is small. However, when the switch is opened a large spark is generated. The switch can be operated in under water and no dangerous large spark is generated. A simple large alligator clip can serve as the switch in water as shown in Figure 4.

## 6. UNEXPECTED BENEFIT

When the battery electrolyte contains 1 to 10 ppm of antimony, it is inefficient to charge the battery since water electrolysis occurs [Mori et al., 2003]. When batteries that have high antimony in the electrolyte are discharged at high current (100 to 150 amps) the effect of antimony disappears. This is one benefit of high current discharge testing. Figure 5 shows the effect of 50A discharge to the Sb addition.




(1)New battery as is; (2)Sb of 102 ppm is added to the electrolyte; (3)After one discharge and charge cycle; (4)After additional 2 cycles of discharge and charges. Discharge was done at 50 A to 9.0 V.

**Fig. 5** Current-voltage curves of 40B type battery (28 Ah at 5 h)

## References

Mori, Y., et al., *ITE Letters*, Vol. 4, No. 4, 432, 2003.

(Received November 10, 2003; accepted December 12, 2003)