BATTERY CAPACITY ANALYZER BEST PRACTICES

Application Note

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Battery Capacity Analyzer Best Practices

This article is intended for new users of B&K Precision's 600B and 601B battery capacity analyzers who are looking for a simple and practical approach for evaluating the readings in real world applications. The common 12-volt sealed lead acid (SLA) battery is used in the examples presented.

Battery Capacity Characteristics

The 600B and 601B provide useful information about the battery in less than 5 seconds. This snapshot includes voltage and remaining capacity expressed as a percentage. To effectively use the battery capacity analyzer, an understanding of the battery's discharge characteristics is important.

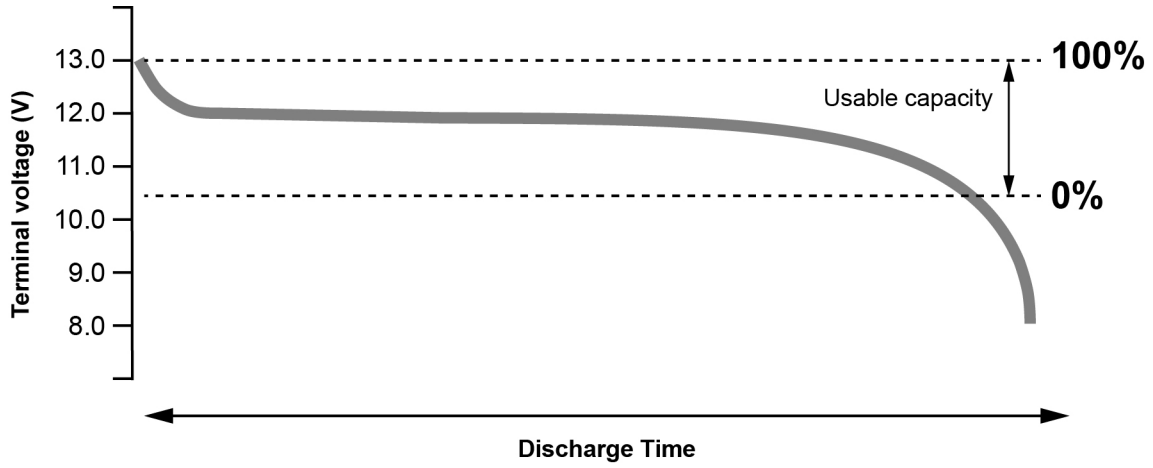

Figure 1.

A fresh newly-charged 12-volt battery under a normal load will typically start at just over 13 V (point A as shown in Figure 1). The voltage will have a small initial drop at the beginning of its discharge and flatten out over an extended period of service. At some point, a sharp decline in terminal voltage can be expected. The fully discharged point is identified as point B. Most SLA battery manufacturers consider a 12-volt battery fully discharged at 10.1 V.

The battery discharge rate has an effect on the remaining capacity. Figure 2 below shows typical discharge curves based on different current rates. Notice how the battery drops to 10.1 V faster if the current rate on the battery is higher. The higher the discharging current, the faster the battery will discharge.

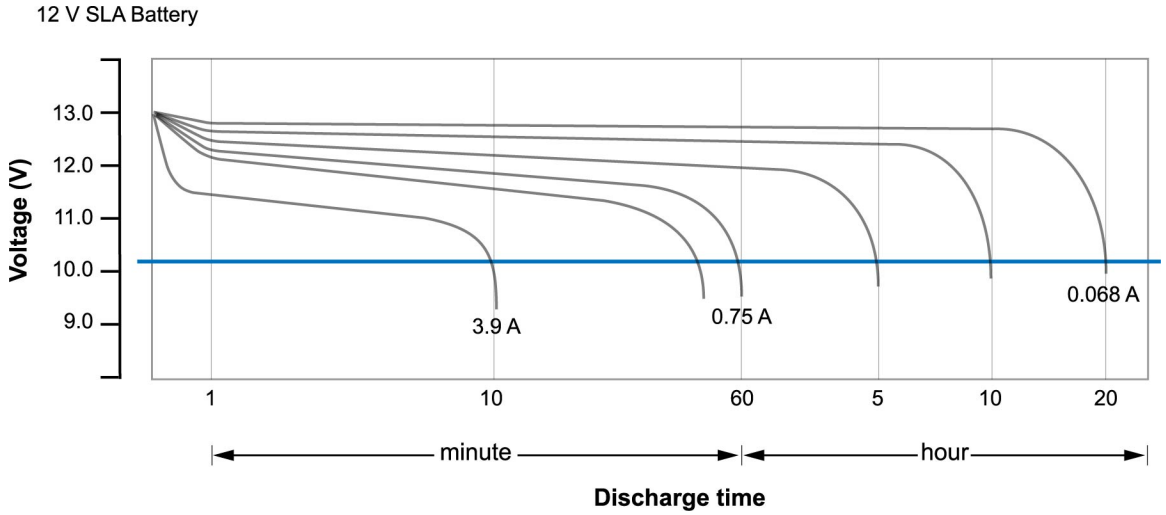

Figure 2.

The battery's age has an adverse effect on its capacity. As the battery ages, the discharge curve changes in several ways as shown in Figure 3. The initial voltage after a fresh charge is lower, the ramp down is steeper, and dropping to 10.1 V happens much sooner. The capacity degradation will continue until the battery no longer holds a charge or totally fails with an open circuit.

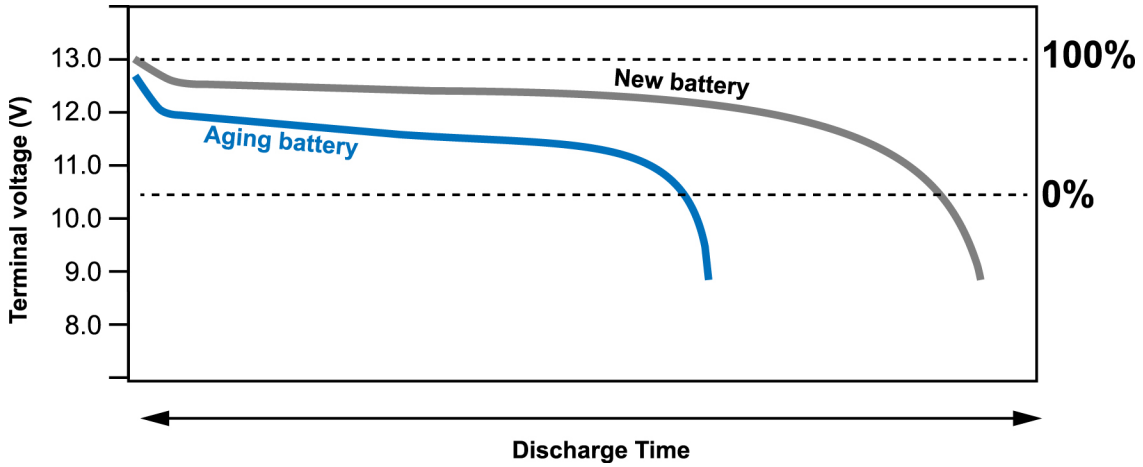

Figure 3.

Capacity degradation is caused by several factors including charge and discharge cycles, load demands, operating temperatures, internal physical changes like plate erosion, degradation of connecting parts, and electrolyte changes.

Battery Discharge Regions

In this section, we divide the discharge curve into three regions: A, B, and C. These three regions provide a framework for evaluating the measured readings from B&K Precision's 600B and 601B battery capacity analyzers. A battery discharge region is a theoretical portion of the battery discharge curve. For this section, we will use a common 12-volt 7 AH SLA battery and assume the battery is new, freshly charged, and working per the manufacturer's specifications.

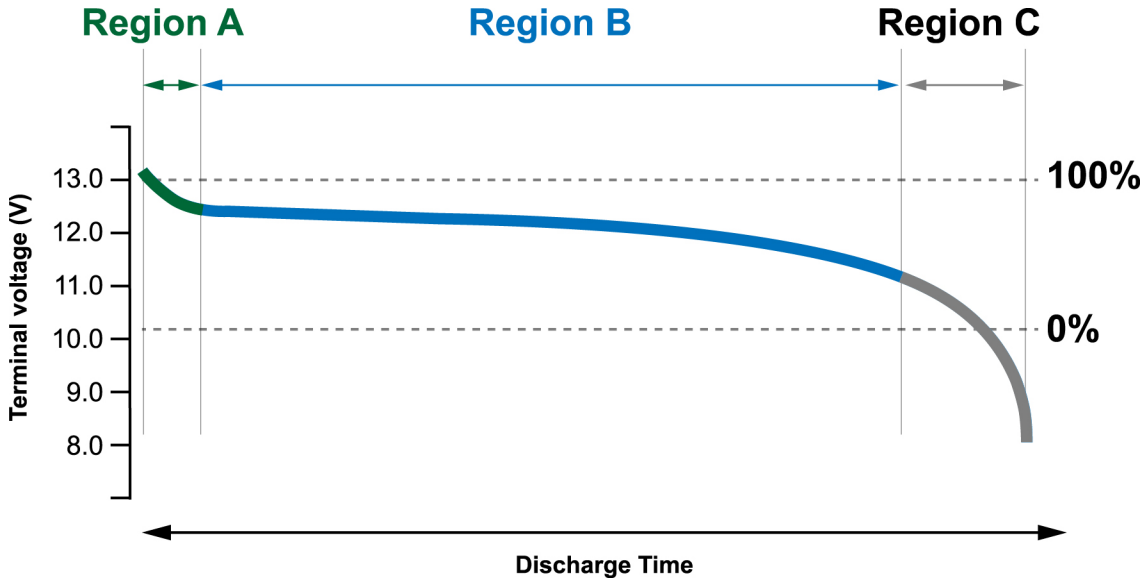

Figure 4.

Region A depicts a high percentage capacity in the 90 to 100% range and a voltage just over 13 V. If the battery were put into service without a maintenance charging circuit, it would start to discharge based on demand requirements of the load (device powered by the battery).

Starting in Region A, the voltage drops sharply as it discharges and levels off at approximately 12.4 V where it enters Region B. The battery will continue to discharge until Region C where the voltage falls sharply again to 10.1 V, the fully discharged area.

Interpreting the Readings

Before starting the battery test, it is helpful to ask yourself, "Which region do I expect the battery to be in? Will it be Region A, B, or C?" When using the battery capacity analyzer, consider all the items that can adversely affect battery capacity. This includes knowing

whether the battery was on a maintenance charging system and if the charging system is working correctly. In the following evaluation examples, refer to Figure 4 to view the different regions.

Region A Evaluation

Testing a new battery that has completed a normal charge cycle, the battery capacity analyzer should show around 13 V and 98% capacity. As expected, the battery is in Region A and the battery seems to be in good condition. If the battery shows less than 11.9 V or less than 90% capacity, refer to the battery manufacturer's charging data and make sure your charger supports the requirements. If the battery charger is correct, then the battery is suspect.

Region B Evaluation

Understanding batteries in Region B will require user application knowledge and history of the battery. Let's consider a hypothetical example where the battery is removed from service and tested. The battery capacity analyzer shows 58% capacity and around 12.5 V. These results would indicate the battery has discharged into Region B. Is this battery good and operating within its normally specified range or is it a defective battery that should be replaced? If this is a newer battery (i.e. a month old) and used in a security control panel, most users would consider the battery or the charging circuit suspect. If this battery was used in a children's ride-on toy or other non-critical application, the user would most likely recharge the battery and return the battery to service.

Region C Evaluation

Let's consider another example where the battery was removed from service just after a normal discharge event. The battery was discharged to Region C. The battery capacity analyzer indicates a very low capacity and voltage as expected. If the user is unaware of the recent discharge event, the battery could be mistakenly replaced when all that was required was a normal recharge cycle. If the same battery completes a normal recharge cycle and still indicates low capacity and voltage readings upon retest, then the battery is suspect.

Conclusion

When a user has a good understanding of the operating environment, application, and battery history, battery capacity analyzers can provide very useful information. Evaluating the battery's discharge curve regions during testing can also help to determine whether a battery is suspect or not.