

Testing Alkaline Batteries using the MBT-1/Mini-MBT

Summary

By screening batteries prior to installation, it is possible to reduce the likelihood of a shade prematurely hibernating due to battery quality. It is also possible to use this battery testing methodology to diagnose latent battery failures, which is useful in determining why a shade has stopped responding to commands.

1 Recommended Equipment: ZTS® Pulse-Load® Multi-Battery Testers MBT-1 and Mini-MBT

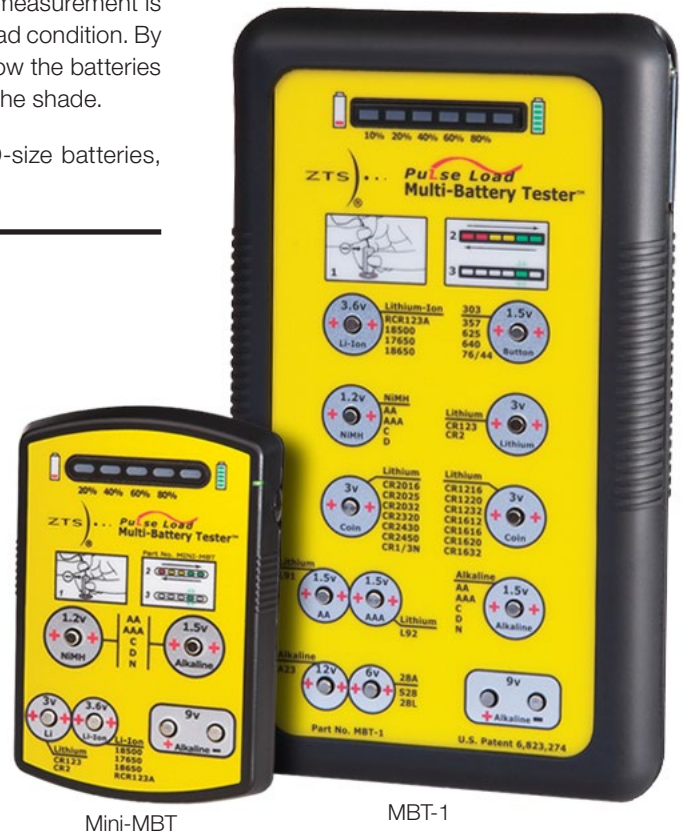
The MBT-1 and Mini-MBT are tools designed to measure the “state of charge” of a battery, which is an indicator of the remaining energy capacity. This measurement is made by reading the voltage at the battery terminals under a known load condition. By measuring batteries under load, you get a better understanding of how the batteries will perform in, and be seen by, the battery management circuitry in the shade.

NOTE: Both the MBT-1 and Mini-MBT have support for alkaline D-size batteries, however only the MBT-1 has support for lithium AAs.

2 Theory and Intent

Battery quality can be measured by a number of different metrics, the most important of which for the life expectancy of a shade is the Energy Capacity. This measurement varies between brands, chemistries, and by the age of the battery. Furthermore, when batteries are used together “in series”, as in the case of Serena/QS Triathlon shades, the quality of one battery can adversely affect the operation of another. For this reason, it only takes a single “bad” battery in a set in order to limit the battery life in a shade. This shade behavior is intentional, and meant to prevent the dead battery from over-discharging, which can result in leakage.

As a result, it’s important that all the batteries installed in a shade are similarly new & undamaged, such that they’re likely to be of similar capacity. A state-of-charge measurement on the MBT-1 or Mini-MBT is a good way of confirming this, and removing any potentially defective or damaged batteries prior to installation. The same measurement can be taken on a set of discharged batteries to determine if the quality of one or a few batteries limited the life of a shade.



Mini-MBT

MBT-1

3 Battery Screening

To use the MBT-1 or Mini-MBT, simply apply the positive end (side with raised bump) of the battery to the appropriate terminal on the front end of the device. See figure 3.1.

Then, continuing to hold the positive end of the battery on this terminal, apply the negative terminal (black wire) of the MBT-1 or Mini-MBT to the negative end (flat side) of the battery.

There are 6 LEDs on the bar graph at the top of the MBT-1 (5 on the Mini-MBT), which indicate the measured remaining capacity in 20% increments. When testing new batteries out of the package, ensure that all batteries installed in the shade measure 100%.

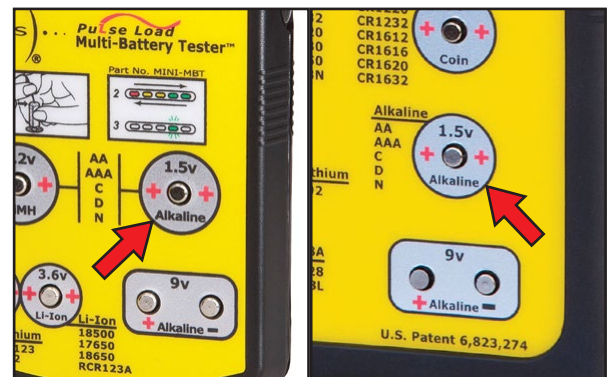


Figure 3.1 - 1.5 V Alkaline Battery terminals on the Mini-MBT (left) and MBT-1 (right)

4 Diagnosis

The technique described in section 3 can also be used to diagnose battery failures in shades. Once a shade provides battery related feedback (moving at half speed, slow **RED** blink, solid **RED** light), evaluate each of the batteries in the manner above. If one or more batteries is at a lower reading than the others, they were likely limiting the life of the stack. When replacing these batteries, be sure to use all brand new batteries from the same manufacturer, preferably from the same package. See figures 4.1 below for common examples you can expect to see when measuring batteries on the MBT-1 or Mini-MBT (MBT-1 6-LED graph shown).



Figure 4.1 - MBT-1 readings representing various battery conditions

4 Diagnosis *(continued)*

If monitoring battery quality in a shade over time with this tool, note that readings of 80% shortly after installation are not uncommon. Due to the nature of the alkaline chemistry in the battery, it will have a sharp voltage drop while first being used. Symptoms of defective or low-quality batteries are unusually low readings (20% - 40%) shortly into life, readings that tend to change erratically, or readings that increase over time.

Also note that readings of 20% after a shade has started providing Low Battery feedback are normal and expected. The remaining energy is reserved by the shade to hibernate, so that it's able to provide feedback, listen for radio commands, and prevent leakage until batteries are replaced.

Conclusion

The MBT-1 and Mini-MBT are useful tools for measuring the state-of-charge, or remaining energy capacity, of a battery. This measurement provides a way both to cull out defective or damaged batteries prior to installation, as well as a way to determine if battery quality limited the life of a shade once the batteries have died.

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