The batteries that radar UPS systems depend on need regular testing to ensure that the skies stay safe

Introduction

The safety of aircraft around the globe depends on the work of air traffic controllers – work that they can only carry out with the aid of input from complex radar installations. If those installations stop working, the air traffic controllers are instantly deprived of the information that they need to guide flights safely, and the consequences can be disastrous. It's no surprise, therefore, that the radar systems used in air traffic control applications feature a high level of redundancy and that they are invariably fed from sophisticated uninterruptible power supply (UPS) systems. The performance of even the most sophisticated UPS, however, is no better than that of the batteries upon which it depends.

Modern storage batteries are, of course, very reliable but there is still only one way to make sure that when they are called upon to deliver power, they are ready and able to do so. And that is by testing them regularly. Naturally, in an application as critical as air traffic control, that testing has to be carried out to the highest standards.

It is well known that the most dependable and revealing method of checking the performance of a battery installation is to carry out a full discharge test. In air traffic control applications however, this method has several drawbacks.

The first of these is that, as the name suggests, the battery has to be taken out of service and discharged, during the test. Therefore, unless elaborate and usually costly measures are in place to provide an alternative back-up supply if the mains supply should fail at the point during the test when the battery is fully discharged the UPS will be unable to operate, and the radar system will go off line. It is worth noting that some discharge test sets, notably those in the Megger Torkel range, provide an option where the batteries can remain in service and are only discharged down to 20% of their capacity during the test, rather than being fully discharged. It has been found that this has very little effect on the accuracy of the results provided by the test. Nevertheless, a battery that is called to go on line with only 20% of its charge remaining will be exhausted very quickly, which is usually unacceptable in air traffic control applications. Discharge testing also has another critical drawback – it is very time consuming. Testing a large battery installation may take many hours or even days. This not only makes the testing inconvenient but also costly to perform. There is, however, an alternative to discharge testing in the form of battery impedance testing. For this type of test, an AC voltage is applied to the battery and the resulting current flow measured so that the battery impedance can be calculated.

While impedance measurements do not provide a direct measure of battery capacity in the same way that discharge testing does, extensive research confirmed by practical experience has shown that there is a very good correlation between battery impedance and capacity. The battery capacity is to a very good approximation, inversely proportional to its impedance.

It must however be stressed that the correlation between impedance and capacity is not 100% - the only way to determine battery capacity with 100% certainty is, as has already been suggested, to carry out a full discharge test. Nevertheless, impedance testing is a very useful way of performing routine periodic tests on batteries, and of locating weak cells. The advantages of impedance testing are clear. Testing can be carried out without taking the battery out of service and even with large battery banks, the time required for testing is unlikely to be much longer than 30 minutes when a modern test set such as the Megger BITE3 is used. In addition this type of testing does not affect the charge held by the battery.

In the case of batteries used in critical applications like air

traffic control, the recommended approach to testing and condition monitoring is to perform a discharge test once per year as, despite the inconvenience involved, this provides an excellent baseline. Between discharge tests, the battery performance can be checked regularly by impedance testing.

This combination of test techniques provides the best possible assurance that the battery remains healthy at all times. It is worth noting however, that loss of capacity is not the only problem that can affect a battery installation. In practice, faults are just as likely to relate to poor connections and, in particular, inter-cell straps that have been loosened by the heating and cooling cycles that occur during charging and discharging. This type of problem can however, be located relatively easily using a low-resistance ohmmeter. Often less easy to locate are earth faults on floating battery strings. Typically resulting from either water ingress or the spillage of electrolyte, these faults can be very hard to localise using ordinary resistance measurements. For this reason, dedicated instruments have been developed that work by injecting an AC signal into the battery installation, which can then be tracked using a clamp-type probe on the battery feeder cables. Since the amplitude of the signal seen by the probe is inversely proportional to the fault impedance on the feeder, this arrangement allows earth faults to be located quickly and easily.

Batteries play a crucial role in ensuring that air traffic control systems around the world can continue to operate reliably and safely even if there is a failure of the mains supply at the radar stations on which they rely. It is imperative, therefore, that those batteries should be maintained in good condition, with potential problems detected and remedied before they can develop into outright failures.

The key to effective routine and preventative maintenance is to test the batteries regularly and, as has been discussed in this article, modern instruments and test techniques are making this testing easier and more convenient than ever to perform. It's no exaggeration to say that the latest battery testers are helping to ensure that we always have the power to keep our skies safe!

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