

# PREDICTIVE and PROACTIVE, ELECTRICAL 'UPS' MAINTENANCE. Thermographic Inspections of Uninterruptible Power Supply (UPS) systems, and Battery Banks.

*(Not only faulty Components & Connections, but also Faulty Battery Cells are Detected.)*

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Many Factories, Facilities & Institutions are highly dependant on a secure electricity supply. They almost invariably use a large Uninterruptible Power Supply (UPS) in addition to smaller UPS satellites. These are intended to supply the full load of the essential systems for a period of 15-30 minutes to give the standby generator time to start and stabilise, or in other cases to maintain the service continuity on their own. They rely on banks of batteries to provide this short burst or prolonged power and it is therefore vital that the batteries are kept in good condition and tested regularly. TELECOMMUNICATION-Networks and other Low-Volt DC line equipment users rely on such Battery-Banks on a full time, 24-hours basis to supply their Low Voltage (e.g. 12 to 50 VDC) requirements.

**UPS** systems may range in size from a 250 W unit that supplies a single computer to a 1 MW to supply a HOSPITAL, AIRPORT runway lights, etc. and even larger UPS systems are in use.

The UPS sits quietly supporting essential services unnoticed until it is called upon when the power fails. Most modern UPS systems rely on a battery to supply power through an electronic inverter when the power fails. However, the UPS is not idle; power to essential services is continually routed through the UPS often through the rectifier, inverter and filter that smooth out disturbances and harmonics, so good maintenance is essential. All too often when the power fails the UPS is found wanting. e.g. The battery is not charged. The inverter will or cannot supply the load. Or it will not switch back to the mains when the supply returns, causing a power outage when the Battery Bank becomes discharged. One common problem is that a UPS may see minor voltage variations as failures and switch to the battery supply. If this happens often, batteries discharge, storage capacity is reduced, and inadequate charging and partial cell failure will occur, due to this poor power management.

The normal test procedure is to take the batteries off line and test them on an equivalent dummy load, measuring the length of time that they can supply power at a usable voltage, their "Autonomy Time." Measuring individual battery or string voltage throughout the test provides some information about the condition of individual batteries. (Routine Hydrometer testing of all of the individual cells is rarely viable due to the high number of man-hours that this would entail.)

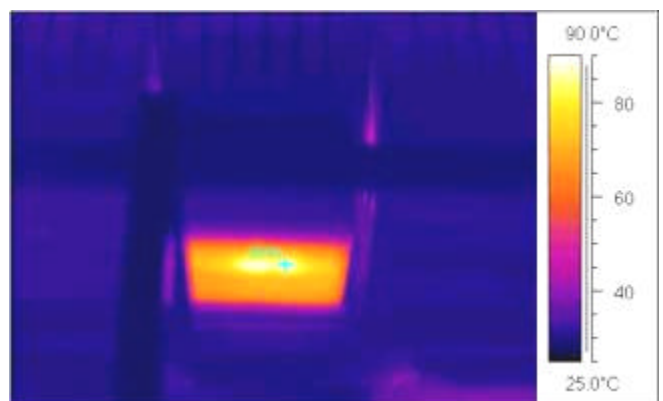
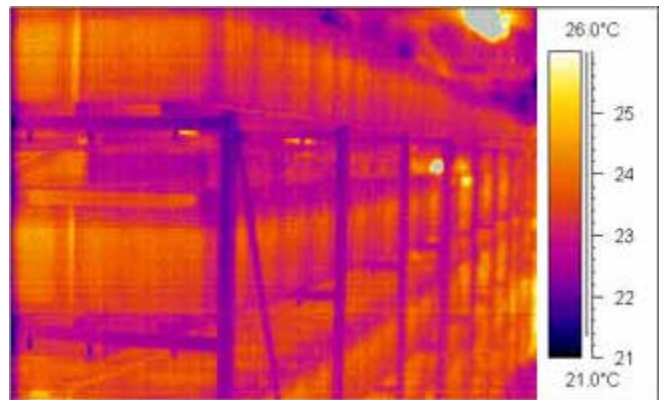
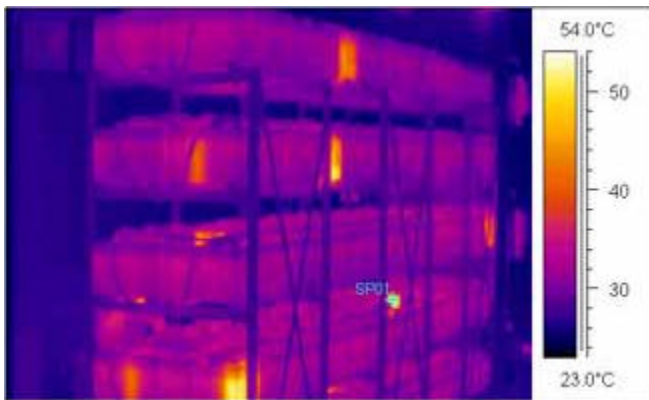
Some larger and/or vital installations such as **HOSPITALS, I.T./Communication Centres** and **AIRPORTS, STOCK MARKETS**, etc., often have spare battery capacity so that one section at a time of the battery bank can be taken off line and tested with a dummy load, without compromising the Uninterruptible Power Supply's integrity.



Thermal Imaging can be used together with or as a replacement for multi-point voltage measurement. A full Thermographic Inspection can be undertaken despite the limited time available to "Run-down," and will detect many insidious, hidden, and incipient faults than cannot be detected by other methods. Thermographic surveys can also be done under normal operating situations and will non-invasively detect individual faulty cells without operative contact, or the need for Hydrometer tests.

The Thermographic scanning of battery banks takes only a very short time. Due to this advantage, "TRUE-USE" and/or "Dummy Load" testing can be carried out without undue inconvenience to the facility's users. To be able to test out a UPS system under an input-power-disconnect, plus batteries-on-line situation, is a great advantage during commissioning and/or if "Dummy Load" testing is not practicable.

Many Thermographic Survey clients find the additional information accumulated over cyclic Thermographic surveys to be of use for predicting when to order replacements, thus assuring battery performance and 100% up-time. The Thermographic survey is used to study cell wall, cable and connection temperatures and integrity before and during the autonomy test, eliminating potential inconveniences or compromises in the power supply's availability. Thermographic surveys are best carried out once or twice a year so as to avoid unpredictable failures and maintain a trending analysis.



Top Left shows one side of a rack with the hot faulty cells clearly visible. Top Right shows the same view after the faulty cells had been replaced.

Note the lower 26C-Max. temperature scale.

The bottom two images are included as examples of the close-ups that would support the report text, and this image to the Right shows a serious overheating (150C) of a Circuit Breaker terminal. >

In this test study to compare Thermography to previous testing methods; after meter-checking, Nine battery blocks had been identified as faulty by their low off-load voltage measurements. However, the Thermographic Surveyor identified these, plus an Additional Six that would fail under load conditions, plus several faulty components and connections, plus a serious "Breaker" fault.

