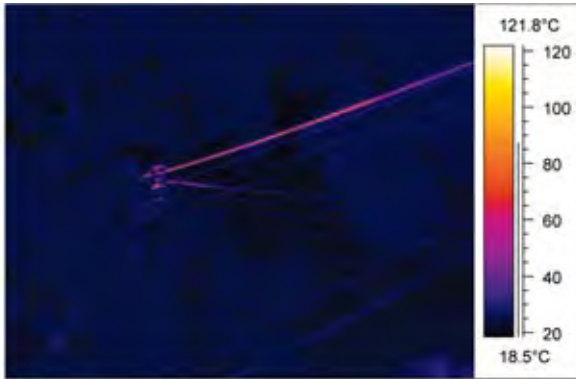
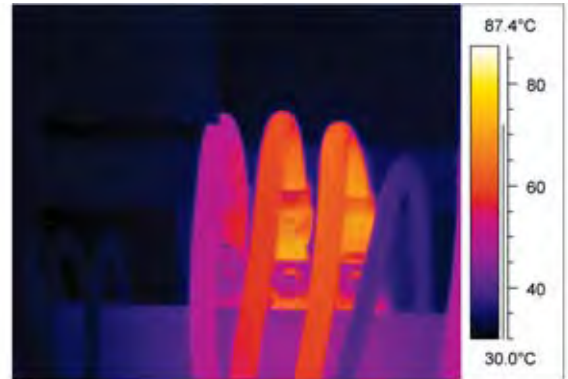


INFRARED INSPECTION ON ELECTRICAL INSTALLATIONS AT HOSPITALS

By Mohd Azmi and Mohd Dani, Faber Medi-Serve Sdn Bhd



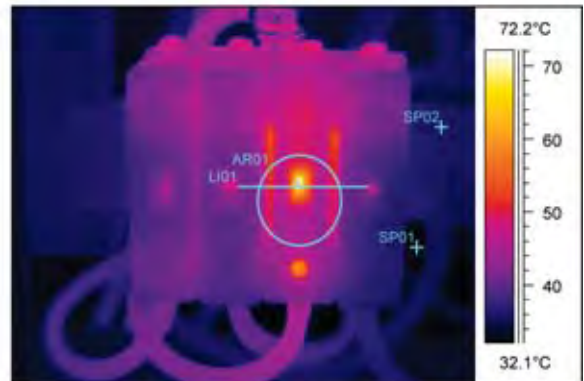
Overhead lines: Insulation deteriorated



Main Switchboard: Unbalanced load



Distribution Board: Loose cable connection



Distribution Board: Overload at Fuse

Figure 1: Examples of electrical distribution images at our hospitals

Infrared (IR) thermography is one of the most valuable diagnostic tools for predictive maintenance. It is a cost-effective solution available in varying capabilities, depending on how many technological options one can afford. IR systems can run the gamut from simple thermal sensors, to sophisticated thermal imagers with built-in color cameras complete with reporting software.

With an infrared camera, it only takes minutes to look at systems and equipment to evaluate their current condition based on thermal patterns. Infrared thermography provides a non-contact, online or real-time evaluation of systems and equipment. For electrical systems, IR thermography can identify problems such as overheated components, poor

connections, overloading, unbalanced loads and overheating breakers which, if left unattended, could lead to major breakdowns.

INTRODUCTION

Based on historical infrared inspection data we have collected and archived on electrical systems in hospitals, we have found that poor or loose connections are the most frequent findings we detect.

CASE HISTORIES

The infrared thermograms above show some sample IR images of electrical installations at some of our hospitals.

The infrared image and thermal profile in Figure 2 shows a hot spot (at tem-

perature 108.8 deg Celsius) on a cable connection at the distribution board. The overheating was caused by a loose or improper cable connection.

After corrective measures have been executed, the infrared image (Figure 3) shows no hot spots and the thermal profile shows normal operating temperature under working conditions.

The infrared image and thermal profile (Figure 4) shows hot spot (at temperature 125.9 deg Celsius) on the cable connection at the main switchboard. The overheating was caused due to deteriorated cable insulation. Arrows show where the red and yellow phase cable insulation has deteriorated.

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Power over Ethernet

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rack-mount units. There is no need to incorporate MPS boxes into the industrial environment as existing non-PoE switches can be re-deployed to other areas of the network

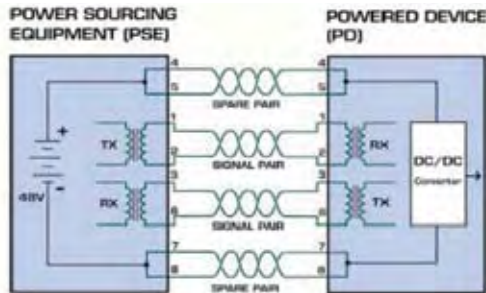


Figure 3a

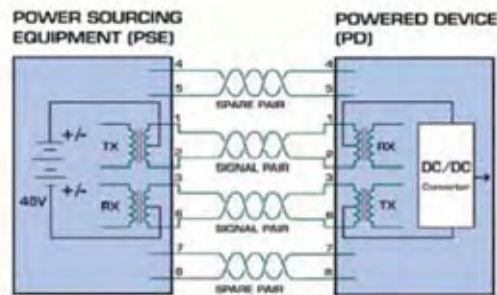


Figure 3b

Figure 3a diagrams use of the spare pairs in a CAT5 cable, where Figure 3b demonstrates use of the data pairs. Source: PowerOverEthernet.com

The 802.3af standard ensures the safety of PDs by prescribing a 25k ohm resistor in the PD. Power is applied only when a “discovery process” running from the PSE detects the resistor. If an 802.3af-compliant device is detached from the network, or if a proprietary PoE or non-PoE device is attached, no power is transmitted by the PSE. In addition, the PoE standard calls for over-current protection, under-current detection, and fault protection for further protection of PDs from shorts, power fluctuation or failure.

Under the PoE standard, features such as remote power-down or remote reset can be implemented using a system management package, such as the Simple Network Management Protocol (SNMP). Such niceties provide additional flexibility in deploying PDs at the edge of the industrial network.

SUMMARY

With the introduction of PoE, industrial Ethernet suppliers – and users – have a beneficial new technology for heavy-duty environments such as utility substations, mines and quarries, transportation systems, factory facilities, and warehouses. In large industrial campuses or factories where configurations change on a frequent basis, the ability to decouple expensive electrical rewiring from the placement of PDs is highly advantageous. In an environment where budgets are tight and demand for increased productivity is constant, the simplicity of PoE makes it a strong candidate for high acceptance in system upgrades.

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After repairs to the cable, the infrared image reveals no hot spots and the thermal profile shows normal operating temperatures under working conditions.

SUMMARY

The situation outlined in this article, if not corrected, would have either led to fire, a short circuit or tripping of the circuit due to excessive heat on the cable, thus leading to serious downtime in critical areas. By employing infrared thermal imaging techniques, we can actually predict the problem beforehand, thereby enabling us to rectify it, and the infrared images taken after corrective action shows them to be effective.

It is very difficult to place a monetary value on

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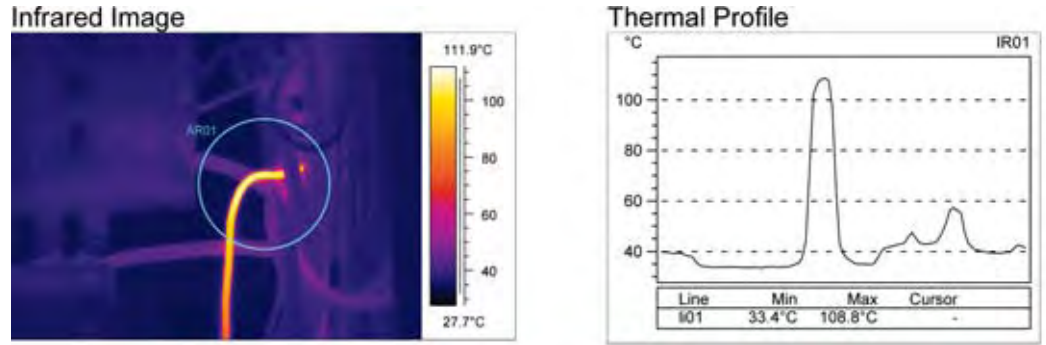


Figure 2: Pre-repairs: loose connection creates excessive heat on cable end, thus producing a spike in the thermal pattern

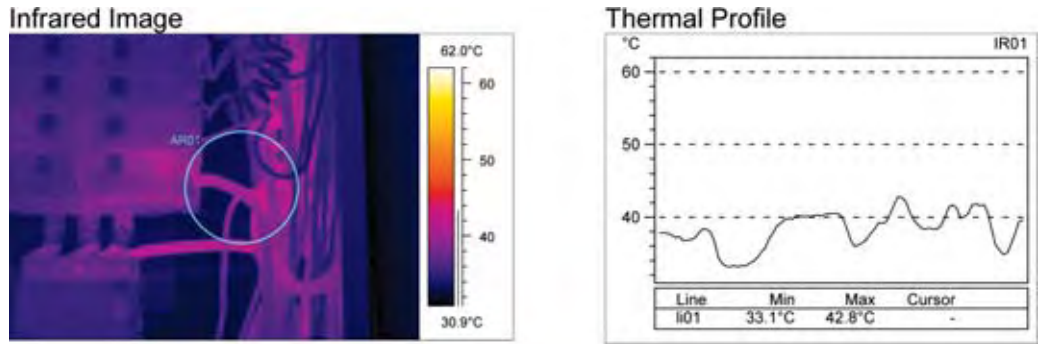


Figure 3: Post-repairs: The thermal pattern is uniform

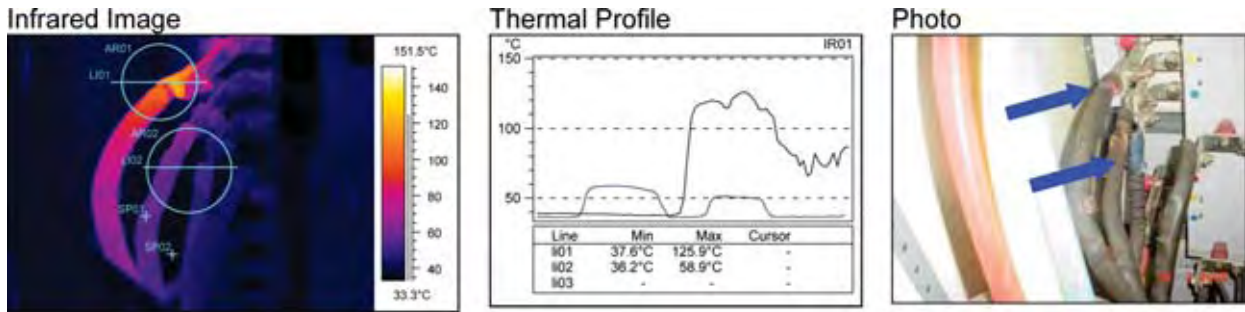


Figure 4: Pre-repairs: High temperatures on cable were detected.

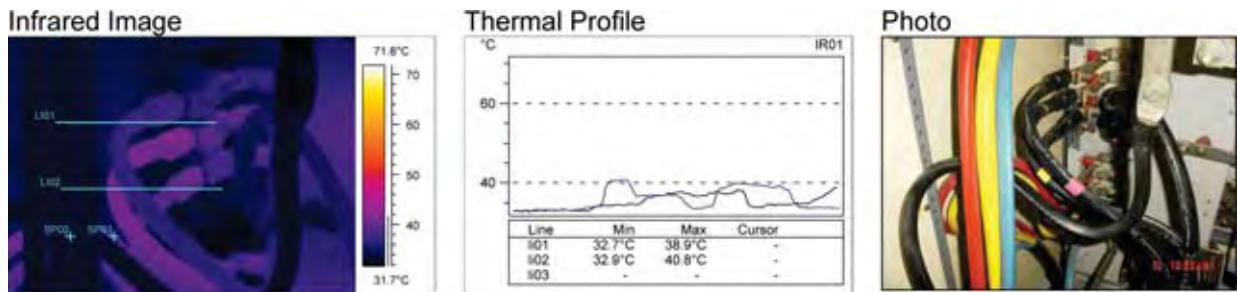
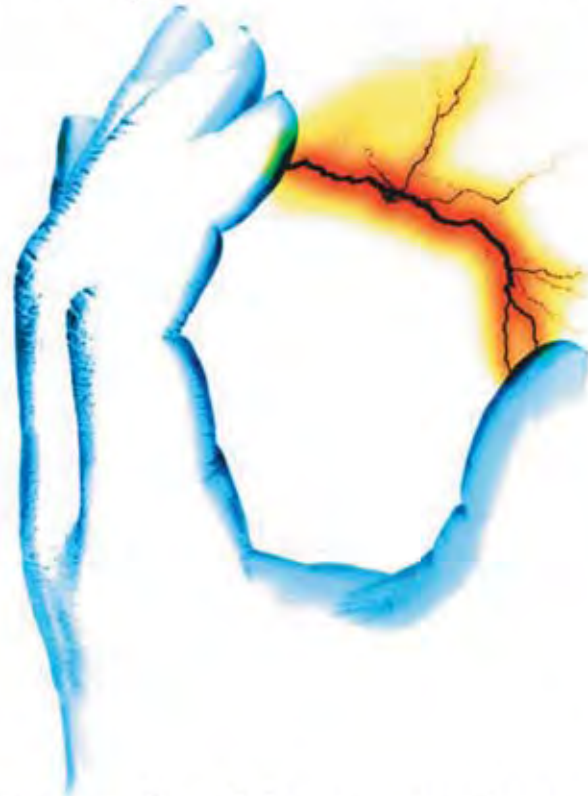


Figure 5: Post-repairs: The thermal pattern is uniform

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Photo



Photo



Photo



Figure 6: Photos show the damaged cable after installation of a new one

the benefits realized from an infrared inspection program because the faults are found and repaired before failure occurs. The failure could be from a simple circuit tripping to a major fire due to excessive heat. By establishing a proper IR inspection program, the benefits are easily realized, as the reliability and safety of electrical installations are ensured. At Faber Medi-Serve (FMS), we think of our infrared program as one of our key implementations.

ACKNOWLEDGEMENTS

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