Custom Solutions for High Arc Flash Incident Energy and Interlocked Electrical Enclosures

By Mark Bowling, Level II Thermographer, IRISS Inc. & Rick Miner, Level III Thermographer, Thermal Techniques

Overview:

Many facilities have embraced the safety requirements of NFPA 70E and the safety-by-design features now available from most electrical switchgear manufacturers. Many times in the past, however, failure to initially design for maintenance safety has made infrared inspections impossible for many critical and valuable distribution assets. Rightfully, safety has become the priority but that does not mean we have to compromise infrared imaging and electrical maintenance best practices.

Case Study

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Much has been written about the need and use of infrared windows in high arc flash and interlocked electrical cabinets. Proper selection and retrofit placement of infrared viewing windows can result in finding thermal issues that could have gone undetected until sudden equipment failure resulted in loss of power or an even more catastrophic thermal event. The NFPA estimates that 25% of fires in businesses and institutions are linked to a malfunction of electrical equipment, wiring, or both. Recognizing this, many fire insurance providers are now making annual infrared inspection of their client's electrical infrastructure mandatory. Many of these insurer's employ infrared surveying specialists to perform this work.

Recently, an insurance company advised their client, a large US based bank's main data center facility, that they were unable to perform their mandatory infrared inspection on the thirty (30) medium voltage (12,470 V) main electrical enclosures and that a thorough thermographic inspection was therefore not possible to complete. The insurance company recommended that infrared windows and ultrasonic ports be installed to detect possible overheating and identify partial discharge issues.

The facilities engineering and maintenance department were given the task of implementing a solution to become compliant with the insurer's requirements. It seemed simple enough. Just knock out a few round holes and install some infrared viewing ports. However, further thinking and investigation revealed that this was not going to be quite so simple.

- A power outage would need to be scheduled. Shutting down the entire facility was not an option and data center operation could not be impacted. Only ten of the medium voltage switchgear sections could be deenergized at one time.
- Installation had to be simple, quick and efficient to minimize the shut down time.
- Panels and doors would likely need to be removed from the equipment enclosures and window holes cut in a remote area to avoid contaminating the equipment with metal filings that could cause secondary issues.
- To accurately view all of the infrared targets (lugs, disconnect points and fuse attachments), placement of the infrared windows needed to be precise.
- The installation must look professional and not impact structural integrity of the equipment with excessive holes and penetrations.

Suppliers of infrared windows were contacted for pricing and suggestions. Thermal Techniques of Charlotte, North Carolina, an experience certified Level III thermographer and distributor of IRISS Inc. infrared windows, volunteered to visit the site and discuss the application in more detail. The facility had a spare switch that was not in service. The interlocked door could be opened and the entire switch was examined to determine the best location of the new windows based on window field of view and distance to targets.

The existing switches had a large Plexiglass viewport (See Figure 1) in the upper portion of the cabinet and arc flash barriers between the fuses at the bottom of the cabinet. The Plexiglass window provided a direct line of site of incoming lugs, disconnect switch, and the top of the fuses.

Figure 1 existing plexiglass window

Plexiglass material does not allow infrared radiation to pass through it and be seen with a thermal imaging camera. The Plexiglass window was held in place by eight (8) easily removable mounting bolts. Measurements of the opening and bolt hole locations were made. This data was provided to IRISS who made a template of the opening. The template was made and sent to the site. The opening and bolt hole locations were fine-tuned so that an exact Flex IR custom replacement could be installed using the same mounting as the original Plexiglass (See Figure 2).

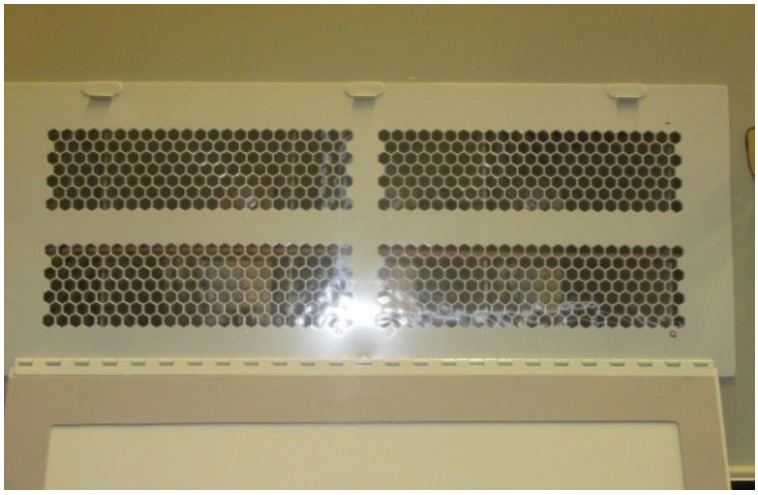

Figure 2 Flex IR custom designed IRISS 24” high x 8” wide polymer infrared window replacement

The arc flash shields between the fuses limited the available field of view for the fuse clips. By placing 4” round windows centered on the arc shields it was possible to view the top and bottom of two of the phases at one time for good comparison. Two 4” round windows were required to view all of the fuses.

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By installing a polymer window to replace the Plexiglas window and two 4” round window for the fuses all components within the cabinets could be inspected with a thermal camera. The installation of an ultrasound port enabled the site to comply with the request of the insurance carrier.

Figure 3

All the goals of the project were met:

- High voltage switch gear was de-energized IR windows were installed and returned to service without incident
- All electrical components can now be viewed during the scheduled annual infrared testing, while equipment is energized.
- The switches can be inspected at any time in compliance of NFPA 70E and safety standards.
- Installation was accomplished in 8 hours, well within the allocated maintenance time.
- The finished product is professional looking and well-engineered (Figure 3)

Shortly after completion of the installation a complete infrared inspection was performed. For the first time since the building was placed in service, the medium voltage interlocked cabinets could accurately be inspected. One of the fuse clip holders was identified as operating at an elevated temperature with a high resistance connection, and repairs were subsequently scheduled. (See Figure 4)

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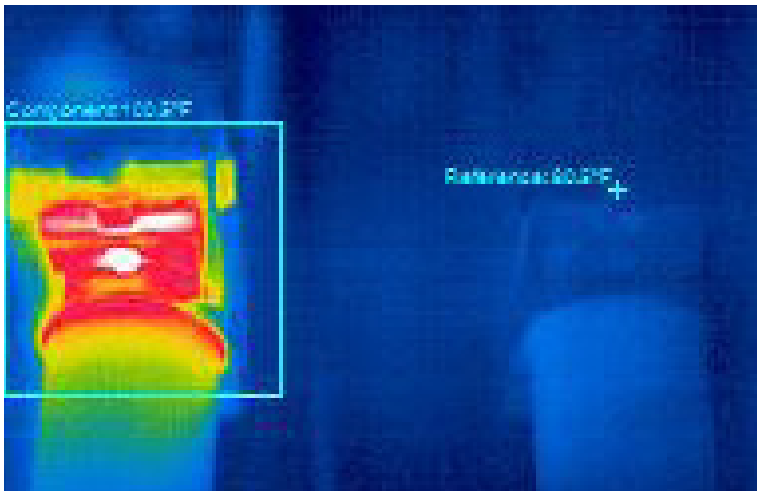

Figure 4

The expertise of Thermal Techniques and Flex IR custom retrofit solutions from IRISS Inc. reflects the state-of-the-art in Maintenance Inspection Solutions available. Contact us today for help implementing a safer way to perform Condition Based Maintenance tasks at your facility.

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