

Frequent Infrared Inspections of Electrical Cabinets Made Easy and Inexpensive with Newly Approved UL-Device

Is the cause of your next production stoppage behind door No. 1, door No. 2, or door No. 3? If you're a plant manager concerned about the condition of electrical hardware, that can be a frustrating question. Today's higher equipment utilization rates call for an aggressive infrared inspection program for electrical panels to head off disaster, but that's traditionally been a tough goal. One graphic example of how frequent infrared inspections can save significant expense occurred recently at a gas enrichment plant in the western U.S. Using a new lens and port technology that facilitates closed-door infrared inspections, the plant's maintenance team discovered overheated, failing connection leads to two 4,500-hp, methane compressor motors, critical to the 24/7 operation. A similar electrical connection problem at the plant previously had caused an unscheduled outage that resulted in \$1 million in lost production. The timely finding enabled plant managers to correct the problems on a controlled basis, avoiding costly unscheduled downtime and damaged equipment.

Two Inspection Options, Neither Appealing

Up to now, the methods and options for performing a safe infrared scan have not been appealing. Removing or opening electrical panels always poses a risk when high energy is involved. Human error – particularly for an inspector suited up in heavy personal protective equipment (PPE) – equipment failure and other factors can transform stable conditions in the cabinet into a dangerous environment for the inspector and anyone nearby. Preferably, an arc flash assessment per NFPA 70E will be done first to determine safe boundaries. Certainly the correct level of personal protective equipment should be worn. Regrettably, the heavy protective suits, gloves, hoods and face shields that are sometimes required make this an arduous task, even in a cool environment, discouraging frequent inspections.

Closed-door inspection is safer and a better use of manpower, allowing the thermographer to work without the help of an electrician, and with a greatly reduced level of PPE. Traditionally, this has required installation of costly and fragile IR-transparent windows (or sight glasses) which allow a small portion of a cabinet interior to be viewed through a camera. Metal mesh ports are also available.

From a thermographer's standpoint, IR-transparent windows transmit only varying percentages of IR in different wavelengths, depending on the material. The resulting temperature measurements cannot be considered accurate.

IR-transparent windows used in "sight glasses" for electrical cabinets are neither glass nor acrylic, but crystalline materials that allow light in the wavelength of 8-14 microns to pass through. Typically made of calcium fluoride, germanium or zinc selenide, IR-transparent materials are expensive – hundreds or thousands of dollars for just a few square inches. Worse, they're extremely fragile and subject to vandalism by disgruntled employees. Most are highly susceptible to scratching and damage from UV light

or corrosive fumes, and require some type of overlay or coating to protect against breakage and degradation. Unlike glass or acrylic, IR windows shatter easily when pressure is applied. The most common material, calcium fluoride, is also hygroscopic, and has a reputation for dissolving in humid environments, leaving open holes in cabinet doors.

Because only a limited area of the cabinet interior can be viewed through a sight glass even with a wide angle lens, it may take four or more sight glasses (at a cost of about \$200-300) to make the interior of a typical panel viewable from outside. Sight glasses also require a relatively large hole in the cabinet door which can be a safety hazard if the window breaks.

Metal screens can compromise safety if they fall into the cabinet or become bent or broken. They easily skew thermography by acting as both reflectors and emitters of IR radiation, while obstructing an unknown percentage of radiation from the target of interest.

UL-Approved Device For Closed-Door Inspections

Another alternative has recently been developed for closed-door inspections that requires no IR-transparent window or metal mesh. It allows a thermographer to scan a panel looking through a tiny 0.5" opening in the door. This new system combines a viewport with a fisheye lens, known as a SpyGlass™. The cone-shaped tip of the lens "docks" in the socket-shaped opening of the viewport to maintain a comfortable, steady position for the camera to reduce operator fatigue.

This combination of window-free port and fisheye lens makes company-wide standardization feasible and affordable, because the <\$50 cost of the ports comes down as quantity goes up. Industry leaders such as GE, Exxon Mobil, Boeing, Dupont and Cargill already have thousands of these ports installed. The patented viewports



Maintenance monitoring of high-voltage electrical connections, looking through a 0.5" viewport with SpyGlass™ equipped IR camera.



Application Note

have received UL approval (number NITW2.E228318 in the U.S. and NITW8.E228318 in Canada), leading to a high level of confidence by early adopters.

The fisheye/viewport system enables closed-door thermal inspections of connected electrical switch gear, while maintaining the original safety rating of the cabinet. This applies to cabinets energized with 480 volts and up, as well as motor junction boxes with 4160V



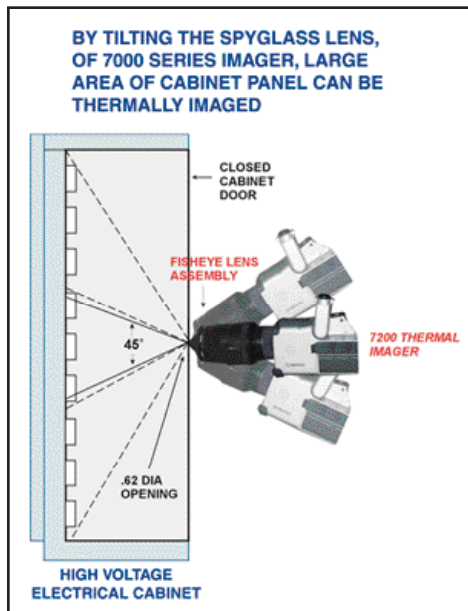
No IR Attenuation or Obstruction

The fisheye lens and viewport provide the clearest possible view and most accurate temperature measurement of electrical switch gear under load because the tiny port opening requires no IR-transparent window or metal mesh.

The viewport uses only a 0.5" aperture that is covered by a sealed, screw-on cap to maintain the integrity and safety rating of the cabinet when not in use. To prevent unauthorized access to the cabinet, a locking device for the viewport cap is available as well. Allowing an unobstructed view of a cabinet's entire interior, the viewport is unaffected by moisture, dirt, UV and corrosive environments that can degrade IR windows or penetrate metal mesh covers. It never needs cleaning or replacement.

The viewport is designed to "dock" with the cone-shaped tip of the lens barrel. The plastic-tipped barrel protects the lens elements from contact with the port or cabinet, and provides a layer of insulation to eliminate "path to ground" hazards. By contrast, a camera lens with a metal rim in contact with an IR window can damage the window easily.

In addition to the lens' wide field of view, its tip works with the viewport like a ball-and-socket joint, allowing the camera to be rocked at different angles to look up, down and to the sides, as well as straight ahead.

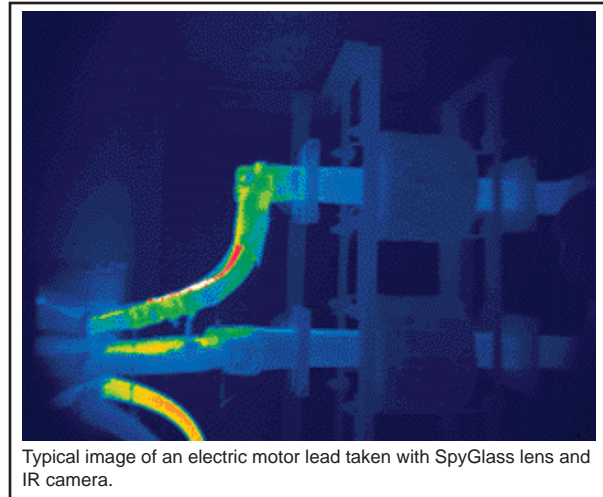


The viewport is UL approved. It also meets NEMA Type 1, 2, 3, 3R, 4, 5, 12, 12K and 13 specifications. Suitable for both low- and high-voltage applications, it can be installed on cabinets indoors or outdoors, in either vertical or horizontal position.

A Broad Field of View

The fisheye lens, with its wide field of view (53° horizontal by 40° vertical, or 66° diagonal), allows easy scanning of the interior of the electrical cabinet through the viewport, while providing a temperature measurement accuracy of $\pm 3^{\circ}\text{C}$.

Focusing from 3" to infinity (100 mm to infinity) and providing



great depth of field, the fisheye lens reduces the need to re-focus for different electrical cabinet depths. It's worthwhile to note that it could easily take up to four IR sight glasses to cover this same area for inspection with a typical wide angle lens.

20-Minute Installation

The viewport can be installed by one person in 20 minutes or less. The electrical equipment should be de-energized before installation. To install, simply open or remove the cabinet door, use a Greenlee punch to create the aperture, drill the screw mounting holes, affix the viewport and reinstall the door.

Versatile Applications

The viewport can be installed on any application where an expansive and unobstructed view behind a panel or door is desired, including mechanical rooms. Motor control centers, transformer terminal boxes, air circuit breakers, motor lead boxes and a wide range of mechanical equipment can be outfitted with viewports.

Three styles of viewport are available: with a screw-on cap, with a locking cap, and with an IR window and locking cap.

Mikron Infrared, Inc.

Thermal Imaging Division

1101 Elevation Street, Suite 3
Hancock, MI 49930

Tel: (906) 487-6060

Fax: (906) 487-6066

E-Mail: jon@mikroninfrared.com

Internet: www.mikroninfrared.com

For More Information Call:

1-888-506-3900

