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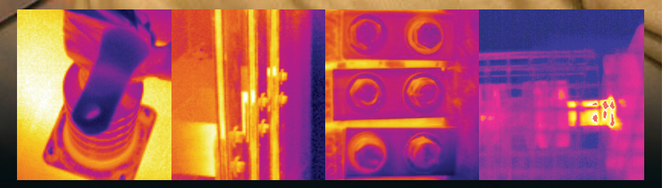
INFRARED EVOLVED

Are You Ready for CSA Z462?

An analysis of electrical thermography and compliance with CSA Z462 and NFPA70E safety standards



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Are You Ready for CSA Z462?

Your power distribution system is the heart of your plant's operation. This distribution system feeds all of your processes with the critical electricity needed to produce your end products.

Any operational failure can be catastrophic to your bottom line-not to mention a life-threatening hazard to your workers! That much, we all know. But how do you detect the early onset of major electrical faults without exposing infrared inspection staff to potentially dangerous conditions-while complying fully with the proposed CSA Z462 Standard for Workplace Electrical Safety for Canada?

Thermography staff are faced with huge issues, and even greater risks, in that they are frequently unable to detect all impending electrical faults without open the enclosure covers that house electrical connections.

Thermal cameras simply cannot 'see' through glass, plastics or metal enclosure covers.

In the name of health and safety, the new CSA Z462 (2008) parallelling its new standard to U.S. Electrical Safety Standard NFPA 70E (2004) regulations do not allow thermographers or qualified electricians to open up such enclosures without stringent arc-flash analysis, training and properly selected and maintained PPE. So how can these potentially fatal and costly faults be detected and dealt with in a safe and cost-effective manner?

Infrared Thermography: Intelligent Testing

The answer is simple… Hawk IR has developed advanced, specialist solutions to help you do precisely that. Its unique series of fully-tested infrared Sightglass products facilitates the safe inspection of internal electrical components, without having to remove any enclosure covers.

The broad range of Hawk IR Sightglasses offers a high-tech solution to electrical testing requirements, reducing labor costs and inspection time and dramatically improving safety. Your predictive maintenance program will no longer require removing doors and covers and exposing your personnel to potentially fatal dangers in order to thermally test your operation's critical equipment.

Infrared Thermography: Intelligent Testing

In the ongoing pursuit of ensuring functional design and safe electrical equipment, particularly in line with the latest regulations such as CSA Z462 (2008) and Canadian Electric Code (Rule 2-306), infrared thermography is crucial to the maintenance and growth of any responsible, standards driven organization. It is also imperative that future requirements for the upkeep and predictive testing of electrical systems are anticipated well in advance so as to avoid the unscheduled cost resulting from major electrical failure or from significant changes to the regulations.

But let's start at the beginning. In essence infrared thermography is a diagnostic technique in which an infrared camera is used to measure temperature and, more importantly, locate 'hot-spots' in power distribution systems. This technology is used to find failure points that would otherwise go unnoticed and lead to major damage and downtime. Once located, these potential hazards can be addressed during a scheduled repair, and lost production and expensive capital equipment replacement costs can be avoided.

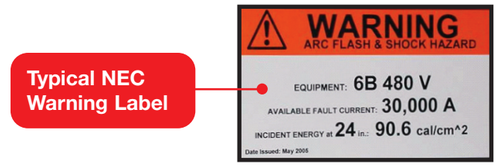
Infrared thermography has been used for the detection of electrical problems in equipment such as electrical switchgear, motor terminal cabinets, transformer terminals, MCC and other high-voltage components for many years. A conscientious and comprehensive thermal survey of electrical equipment is chiefly addressed by recognizing the thermal indications of faults and taking temperature measurements as direct as possible. It requires specialized testing equipment that must be impeccable, continuously accurate and thoroughly-tested in line with legal and regulatory specifications of the highest order.

Danger Zone: Cover Up

A major issue with the use of infrared equipment to date has been the fact that you cannot obtain adequate or reliable information with an infrared camera without opening the enclosure and looking at the actual electrical components. Plus, the equipment needs to be live for a correct thermal analysis to take place. Infrared cameras require a system to be live and on at least 40% rated load (NFPA70B) for there to be enough energy to make satisfactory detection.

Serious problems can exist without a corresponding significant temperature rise on the cover of the enclosure.

Opening such covers to scan electrical equipment introduces severe and, indeed possible fatal risks, such as the increased potential exposure to arc-flash and electrocution.



Typical NEC Warning Label

What Is An Arc-Flash?

Although the arc-flash phenomenon has been present since the concept of electricity first came to fruition, it has not been until recent years that electrical safety-related work practices have been brought to the forefront. Changes made in the 2004 edition of the NFPA 70E electrical safety standard have escalated this issue considerably. Subsequently, this document has been adopted as a 'Recognized Industry Practice'.

Firstly, an arc-flash is the consequence of an arc-fault, which in turn, is a phase-to-phase or phase-to-ground short circuit through air, caused by a reduction in the insulating clearances to such an extent that the potential difference applied can no longer be withstood by the system.

The resultant arc-flash consists of a plasma arc between the shorted components which, once established, has a virtually unlimited current carrying capacity. In addition to the plasma-arc itself, an enormous amount of concentrated radiant energy explodes outwards from the electrical equipment creating pressure waves capable of damaging a person's ear-drums. A high-intensity flash can damage eyesight and produce a superheated ball of gas that can severely burn human skin and melt metal. Arc-flash temperatures are capable of reaching over 4000 degrees Fahrenheit in less than one second!

The pressure waves can also send loose material-typically, pieces of equipment damaged as the result of the arc-fault, as well as tools and other such objects - flying through the air, causing untold damage and danger to surrounding objects and work personnel.

Arc-flash incidents typically occur in any applications above 120 volts and can occur when electrical equipment is being serviced or inspected. Some incidents may occur from a piece of equipment.

Most instances of arc-flash are due to the reduction of insulation and isolation distance between energized components, as commonly caused by:

- Tools left behind or dropped into a breaker or service area
- Other elements accidentally left behind
- Failure to ensure that the equipment has been properly de-energized
- Insulating material degradation due to age
- Racking in breakers believed to be in the 'open' position
- Overall or partial equipment failure

Damage and Downtime

An arc-flash event can cause serious equipment damage and render the equipment no longer usable, causing severe disruption to a facility's ongoing operation and production. The explosion can also bend and distort nearby pieces of equipment leaving that equipment unsuitable for service and in need of repair or complete replacement. Again, heralding untold cost and effort.

There are essentially two types of faults in electrical distribution systems - a bolted fault and an arc-fault. A bolted fault consists of a low impedance short circuit between two separate phases or between phase and ground. Because of the low impedance path, the short circuit current present is very high compared to an arc-fault in a similar system. Generally speaking, the bolted fault current a system is capable of sustaining is roughly twice that of an arc-fault in a similar system.

Traditionally, electrical equipment was designed to withstand high bolted-fault current. However, a bolted fault rarely results in the devastating explosion associated with an arc-fault and as such, electrical equipment that has only been type tested for resistance to a bolted fault will most probably not maintain their integrity under are-fault conditions.

The majority of low voltage (480/440/415V) systems are not designed for resistance to arc-fault and will fail under such conditions. What's more, the inherent dangers of arc-flash are more pronounced in lower voltage systems.

Standards and Regulations

Industry standards are now in place to assist the prevention of arc-flash explosions and to provide protection of those workers employed to monitor electrical equipment that can cause arc-flash explosions. The NFPA 70E (2004) and CEC (Rule 2-306), and CSA Z462 (2008) regulations demand as much.

It should be emphasized at this point that it is the sole responsibility of the employer to ensure that these regulations and confirmed procedures are adhered to correctly and in their entirety.

NFPA 70E: Code of Practice

Quite literally defining electrical safety in the workplace, NFPA 70E (2004) is an accepted 'Industry Standard' in the United States. It is, in essence, a set of guidelines written by a panel of third party experts to advise and direct organizations in the appropriate manner.

A senior Administrator for Occupational Safety and Health (OSHA), US Department of Labor, has stated, in response to an inquiry on OSHA's stand on arc-flash hazard:

"Though OSHA does not, per se, enforce the NFPA standard, 2000 Edition, OSHA considers NFPA standard as a recognized industry practice.
The employer is required to conduct assessment in accordance with CFR 1910. 132 (d) (1). If an arc-flash hazard is present, or likely to be present, then the employer must select and require employees to use the protective apparel.

Employers who conduct the hazard/risk assessment, and select and require their employees to use protective clothing and other PPE appropriate for the task, as stated in the NFPA 70E standard, 2000 Edition, are deemed in compliance with the Hazard Assessment and Equipment Selection OSHA standard."

Though NFPA 70E will act as a "seed document" for the new CSA Z462 standard, we suspect this code to be adopted by provincial governments and enacted into law that will mandate Canadian companies comply with the work practices now mandated by OSHA in the U.S.

The NFPA 70E guidelines define a series of boundaries related to electrical safety when working on energized equipment.

The flash protection boundaries define the safe working distances in which any tradesman can operate in front of an energized component. Thermographers must be fully compliant with these regulations, as it may occasionally be required to remove covers to allow access for the completion of an inspection.

The established rulings on protection boundary parameters, as defined by the OSHA in strict accordance with NFPA 70E guidelines, are as follows:

Flash Protection Boundary	
Up to 750V	3 Feet
750V to 2kV	4 Feet
2kV to 15kV	16 Feet
15kV to 36kv	19 Feet
Over 36kV	Must be Calculated.

Personal Protective Equipment (PPE)

PPE must be selected to comply with the potential calorie level of radiated energy the thermographer may be exposed to and is quantified in terms of cal/cm^2.

Again, it is crucial to note here that it is not the responsibility of the thermographer to select the appropriate PPE equipment; their role is only to recognize its requirement. The ultimate responsibility of selection falls to the employer.

Complex hazard analysis calculations must be performed to compute the potential radiant energy at each point in the electrical system. As such the thermographer needs to understand the basic potential risk and then request appropriate arc-flash PPE from the employer.

KEEP IT SAFE

1 Did you know…
There are on average 5-10 industrial arc-flash explosions each day in the United States alone?

2 Did you know…
That each explosion costs an average of $1.5m to US Industry?

3 Did you know…
There are government safety requirements that prevent the removal of switchgear covers whilst live?

You can see the detail of the OSHA regulations and the vast dangers that can occur by anyone neglecting to comply with them. The legal implications and costs to company revenue in both the short and long term pose a series of difficult conundrums to the majority of modern-day Canadian businesses. The dire consequences of NOT having the correct procedures and testing equipment in place can bring a business, quite literally, to its knees.

Thankfully, there is an answer…

ARC-FLASH

An Advanced Solution

Businesses rely on consistently robust electrical systems from the ground up. Making sure all such installations and equipment components are safe, efficient and compliant at all times with CEC Rule 2-306 and CSA Z462 (2008) can be a costly and time-consuming task-not to mention a hazardous one, if the appropriate industry standard procedures and specifications are not fully adhered to. That said, it is the responsibility of all commercial-oriented operations that demands due consideration and planning.

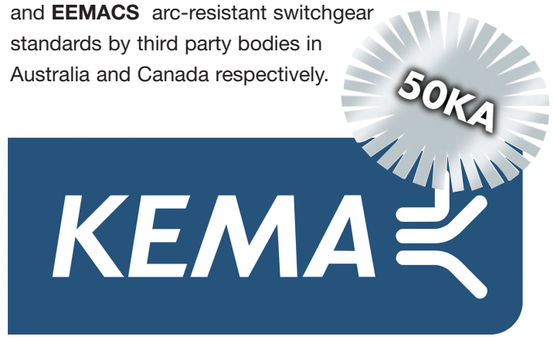
Hawk IR's impressive and unique Sightglass range allows you cover every base in your quest for maintaining safe and reliable electrical distribution systems in your workplace.

Hawk IR Sightglasses allow thermographers to clearly recognize thermal signature of problems during predictive maintenance without the need to open any enclosure.

The New Regulations

Industry standard regulations for operating and inspecting electrical equipment have been comprehensively reviewed and revamped in recent times. Guidelines for arc-flash protection have been particularly dominant in this area, with CEC Rule 2-306 and CSA Z462(2008) requirements calling for dramatic changes when it comes to the widespread practice of testing electrical distribution systems.

That's why HAWK IR has developed high-end engineering techniques and rigorous, universally-recognized testing procedures to develop its range of Sightglasses in compliance with all current industry regulations. Hawk IR is currently the only company in the world to have completed all regulatory arc-flash testing, having passed the Level 4 Arc-Flash Test with its C-Range IR Sightglass in December 2006. Hawk IR Sightglasses have been tested to both IEEE and **EEMACS** arc-resistant switchgear standards by third party bodies in Australia and Canada respectively.



Ground-Breaking Technology

The product of extensive high-tech innovation, research and development, the Hawk IR Sightglass range is revolutionizing the world of industrial electrical testing in Canada. It gives thermographers resilient, reliable tools with which to check electrical equipment and it gives businesses the assurance of knowing their key installations can be tested complete safety.

Simple, Long-Term Solutions

Hawk IR Sightglass devices are permanently fitted onto switchgear, transformer panels, motor lead boxes and MCC cell doors. This allows thermographers to clearly recognize thermal signature of problems during maintenance routines without the need to open any enclosure and expose themselves to severe and potentially fatal hazards.

Hawk IR Sightglasses are designed for installation in low to medium voltage switchgear and MCC, transformer air terminal chambers, motor lead boxes bus duct and other electrical equipment.

Sightglasses for All

Leaders in infrared sightglass technology, Hawk IR provides the most comprehensive product range available on the market today, making sure your entire portfolio of operational equipment can be continuously monitored to the highest level of inspection.

C-Range: Crystal Optic

The C-Range of Sightglasses is designed for long or shortwave infrared thermography. It is designed for installation in power systems operating at any voltage, either indoor or outdoor (NEMA 1, 3, and 12).
The Hawk IR Sightglass C-Range product line utilizes a broadband infrared transparent crystal that operates effectively with both long wave and shortwave camera systems, CLIRVU coated for longevity and prevention of water absorption.

Save Time, Save Money

The ease of use and installation simplicity of Hawk IR Sightglasses affords preventive inspection of critical areas (connecting bus bars, cable terminations, breakers, etc) without interrupting or disturbing the ongoing business operation.

Moreover, it removes the cost and time spent having to arrange for qualified persons to remove and replace enclosure doors or panels, thereby dramatically reducing the time- and money- spent on inspections, while offering a significantly safer working environment.

Stop! Look! Listen!

The dangers or arc-flash can be understood. There is no way of predicting to what extent a breach of CSA Z462 safety guidelines will cause injury, death and unprecedented devastation to your power distribution system. However, fully tested IR Sightglasses are now available, designed to facilitate compliance with recognized safety standards and greatly reduce the inherent dangers related to electrical thermography inspections.

The question remains: Are you ready for CSA Z462? We sincerely hope so. And if not…contact Hawk IR to discuss your options to bring your system to code.

EEMACS 14-1 ARC-RESISTANT

- Upto 50kA Arc-Resistant
- Flexible Broadband Optic
- Visual Inspection Capability
- Fusion Ready
- CSA, UL/cUL Recognised
- Type 3/12 Equipment

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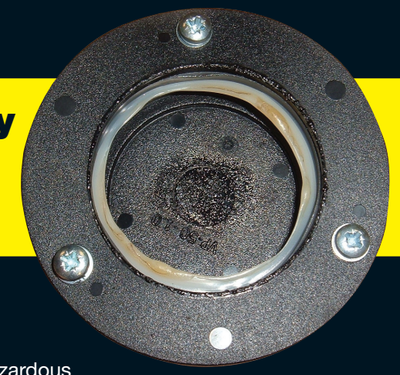
Warning!

Potentially Hazardous Infrared Windows

Hawk IR Warns Of Potentially Hazardous Polymer Type Infrared Windows



Recently, so called “low cost” synthetic polymer type Infrared windows have been released into industry. These potentially hazardous products have not been subjected to internal arc fault testing and are manufactured from thin film polymer material microns in thickness, posing severe melt burn risks.

Although these products hold basic certification, Hawk IR have commissioned third party validation testing with the following results;

Fareham, UK, October 3rd, 2005- TUV Test GM Tech Polymer Infrared window.

“The clear centre plastic (the polymeric insert) and the complete unit incorporating the clear centre plastic cannot be classified as both 5VA and 5VB in accordance with the criteria indicated in table 1 of IEC 60695-11-20 (IEC 60695-11-20 is an international standard that the UL94 standard has been harmonized to i.e. UL94 5VA is equivalent to IEC 60695-11-20 5VA)”.

Northbrook, IL, October 10th, 2005-UL Remove IRISS VPF and VPR Range.

“The plastic optic IR view ports Model ‘IRISS’ Cat nos. VPF and VPR are currently not a (UL) recognised construction and have been removed from the (UL) website as of today”.