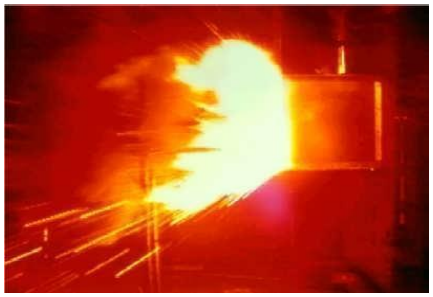
Electrical Maintenance Safety Devices

ADOPT THE EMSD STRATEGY, IT MAKES SOUND BUSINESS SENSE

Martin Robinson, CEO – IRISS Inc.

Every year electrical workers are injured or even killed whilst at work. Thankfully in Ireland and the UK, best practice has ensured that many of these cases are near-misses but that is no cause for complacency.

An arc flash is a short circuit through the air that is equal in force to an explosion caused by several sticks of dynamite. Typical triggers are dropping tools or panels, making contact with energised parts or changing the state of the equipment. As most incidents are triggered by human interaction, the blast occurs close to the worker. Even the most extensive PPE cannot offer 100% protection and burns are the most common injuries.



So keeping personnel away from energized electrical equipment is paramount but that doesn't answer the needs of business. It is vital that productivity is assured by plant and equipment that is running optimally. Any losses are costly both in terms of productivity and company reputation.

Preventative maintenance is a key ingredient in this regard but meaningful quantitative test measurements are best taken when the system is loaded and energised. It's a catch 22. How do you get the best indication of the health of the system without compromising the safety of the maintenance team?

Many safety and trade organisations around the world are actively considering this dilemma. At the core of all electrical safety initiatives that they espouse is a hierarchy of control. Put simply, this concept attempts to control or mitigate risk wherever possible.

Clearly the safest way around the problem is to eliminate the risk completely or opt for a lower risk option. Next in line are engineering controls, such as arc resistant switchgear, safe working practices and the optimal PPE.

Inspecting the 'uninspectable'

For many companies the strategy that is working well is the use of electrical maintenance safety devices (EMSDs) that allow maintenance tasks to be completed while the switchgear enclosure remains closed. Indeed, many are asking for these products to be incorporated by OEMs so the original product or system is 'safer by design'. This is in-line with the recommendations of the IEEE initiative that carries the same name.

So what is classified as an EMSD? Typically they are devices such as ultrasound ports for airborne ultrasound, external voltage detection ports and voltage tap off connections for motor current analysis. Inevitably they also allow the use of online monitoring systems to transmit data to the client via wired or wireless sensor technology.

Thermal imaging is another inspection method that is easily supported by an EMSD strategy. Infrared cameras can only measure what they can see in a direct line of sight and they can't be operated through glass or plastic viewing windows that are commonly fitted in switchgear.

To allow inspections to be completed under load an IR window is an EMSD that allows the thermal imaging camera to see the energised, loaded connections through special lens materials in the IR windows. In this way the switchgear remains closed and in a safe and guarded condition, ensuring the inspector is never exposed to the dangers of arc flash.

Not all infrared windows do the same job. Whilst crystal windows are among the best broadband infrared transmitters and certainly the best choice for operating temperatures above 200°C, they do have limitations. Mechanical stresses can fracture most crystal optics or degrade the crystalline structure, increasing refraction and decreasing transmissance.

These stresses can take the form of jarring drops, exposure to high frequency noise, harmonics or even environmental vibration. Indeed, incompatibility with mechanical stress is the major reason why most crystals are not considered suitable for industrial applications and uncontrolled environments. And the bigger the crystal the more fragile it becomes, unless its thickness is increased. This, however, decreases transmittance of the material and compromises the accuracy of temperature readings.

Polymeric alternative

For this reason IR transmissive polymers have been introduced, providing both resilience and stability. These materials are unaffected by mechanical stress, moisture, humidity, seawater and a broad spectrum of acids and alkalis so are ideally suited to operation in harsh and industrial environments.

When reinforced with specially engineered grills, the polymer optic is capable of resisting a sustained load. As a result, the only long wave compatible IR window optic capable of passing industry standard impact tests is made from reinforced polymer. Consistent transmission is also assured by consistent thickness regardless of window diameter.

Another significant advantage of polymer windows is they can be any size, or indeed, shape. By comparison, the maximum viable diameter of a crystal window is little more than 100mm which means multiple units have to be installed to allow the thermographer to inspect every item in the switchgear cabinet.

An oblong polymer window provides the facility to scan, for example, an entire bus bar in a single pass of the camera. It can also be curved or rainbow shaped to fit around a mechanical guard or a motor housing.

The original polymer windows were opaque but recent developments have included the introduction of a clear polymer. This special material is therefore suitable for UV, visual inspection as well as thermal imaging in all three infrared spectrums.

Tangible benefits

First and foremost EMSDs, such as infrared windows, allow switchgear to remain closed, removing all possible triggers for arc flash. Inspections are under load so the readings are much more valuable and systems that were once considered to be too dangerous can now be regularly inspected.

As no panels have to be removed, inspections require less manpower and lower PPE levels. They can also be conducted quicker and more efficiently.

Additionally, infrared windows enable inspection routes to be standardised. They become data collection points for vital equipment and also ensure that all the inspection parameters are fixed and test measurements regulated so that trend analysis is accurate.

It is fast becoming clear that collectively EMSDs are providing a cost-effective way for companies to comply with all of the established and changing standards for maximum inspection safety whilst minimising commercial risk.

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REG FARRELL
ENGINEERING LTD

For more information please contact a member of our sales team at 01 4659010 or email: **info@rfe.ie** or visit our website **www.rfe.ie**