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Purge & pressurization: an overview of proposed changes to IEC standard 60079-2

With multiple protection options for hazardous area equipment that may cause ignition, engineers must determine the most cost-effective method to mitigate the risks, while ensuring compliance with local certification schemes and standards, such as UKEX, ATEX, IEC, and many others.

One of the simplest and most flexible protection methods is Purge and Pressurization (Ex p) which is covered by IEC standard 60079-2, currently in its Edition 6. The 7th edition has been in preparation for some time and is due to be published in January 2024. While there are many changes, this article examines two aspects of the new draft standard where additional flexibility is proposed that could make some Ex p projects more straightforward and, potentially reduce execution cost and time, without compromising safety.

Refresher: what is purge & pressurization?

By installing general-purpose, safe area equipment in a pressurized enclosure, it can be made safe and be certified to use in a hazardous area. Purge & Pressurization requires a supply of clean, dry instrument air, a suitable enclosure and pressurization control system, the characteristics of which are detailed in the standard.

The process comprises two main steps:

Step 1: Purge

The pressurization control system supplies clean, dry instrument air to the pressurized enclosure at a high flow rate for a pre-set time, expelling any potentially flammable atmosphere remaining inside through an outlet valve. Enclosure pressure and purge air flow are monitored. The enclosure contents are not energised.

Step 2: Pressurization

After the purge step is completed, the pressurization control system supplies sufficient air to maintain a constant overpressure inside the pressurized enclosure, compensating for any small leaks, and preventing the ingress of the outside atmosphere. The enclosure pressure is monitored. The enclosure contents can be energised.

Proposed flexibility #1: Use of Cells and Batteries

What are the changes?

a) The first relaxation within the rules refers to small cells or batteries used for memory backup applications. Whereas the current version of the standard, Edition 6, requires a full technical assessment of the cell and its circuitry, Edition 7 enables faster assessment by permitting small cells, used solely for local memory or BIOS power backup, with a total voltage of less than 5V and a total capacity of 2.5 Ah, to be used without further technical assessment, provided they meet some basic requirements within IEC standard 60079-0, General Requirements. External labelling is required outside of the pressurized enclosure "WARNING – CELLS OR BATTERIES ARE LOCATED INSIDE THIS ENCLOSURE. DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT"

b) The second relaxation, albeit for less frequent applications, provides a method for the use of other cells and batteries (not used for memory backup applications), without the laborious technical assessment required by Edition 6, facilitating the installation of most types of cells and batteries within a pressurized enclosure, providing the General Requirements are met. However, a new time limit is introduced that requires the battery to be removed from the enclosure if pressurization is lost for more than twelve hours. The following warning label is required: "WARNING – THIS PRESSURIZED ENCLOSURE CONTAINS A CELL OR BATTERY WHICH REMAINS CONNECTED AFTER THE EXTERNAL POWER HAS BEEN ISOLATED. REMOVAL OF THE CELL OR BATTERY IS REQUIRED IF THE ENCLOSURE IS TO REMAIN UNPROTECTED BY Ex "p" FOR LONGER THAN 12 HOURS. VERIFY THERE IS NO EXPLOSIVE ATMOSPHERE PRIOR TO REMOVING".

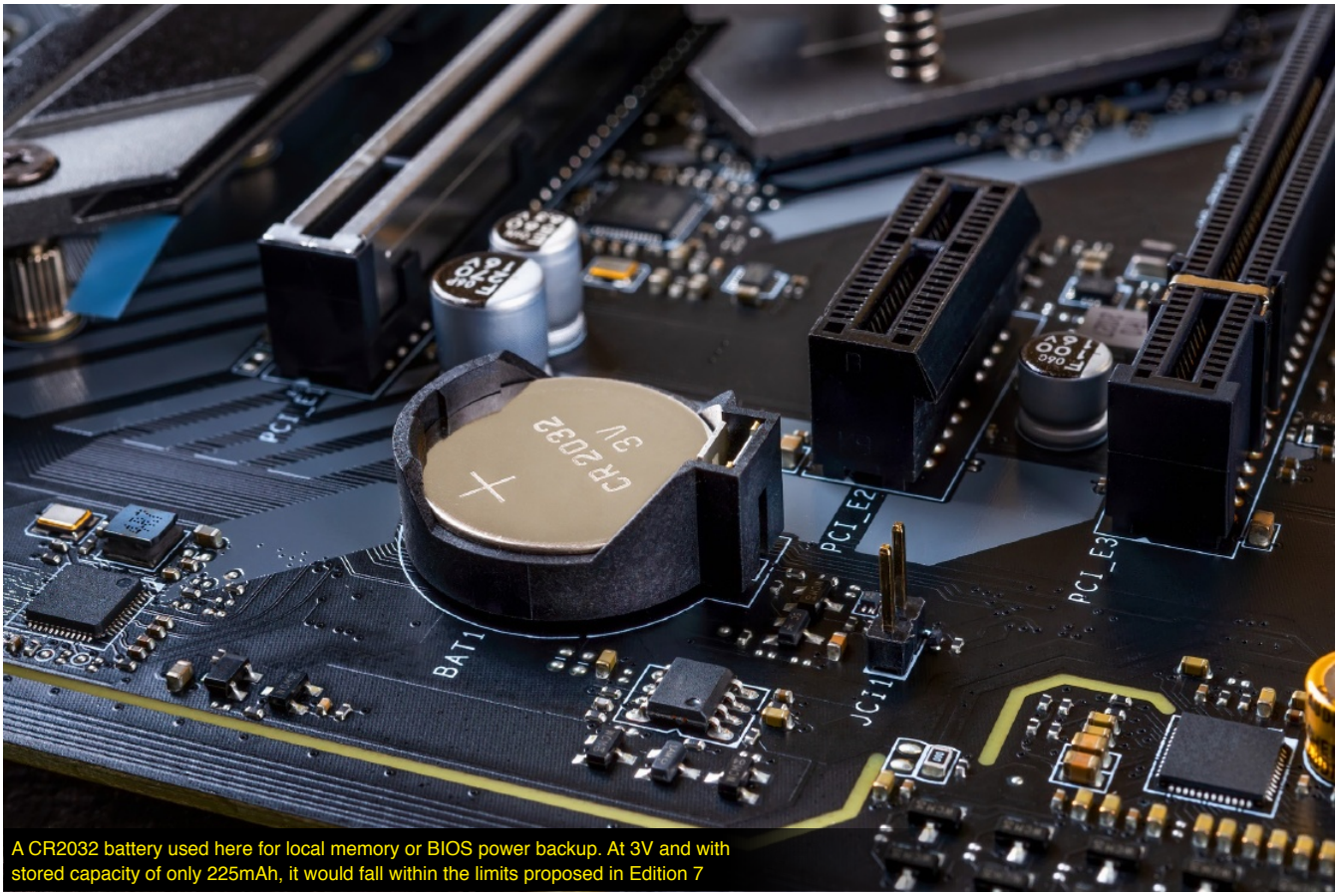
What does this mean for pressurized enclosure projects?

A simple example would be if a standard safe-area computer is to be used within a hazardous area – this is often the case as Ex protected computers are typically expensive. While it is straightforward enough to install the computer inside a pressurized enclosure, the simple fact that a backup battery is installed can lead to complications, either requiring battery testing, or the removal of the battery altogether (potentially with operational consequences) to meet certification requirements.

Under the proposed changes, providing the battery meets the general requirements, and is within the power limits specified, then it does not require further consideration.

Added flexibility #2: Additional mitigation for cases with Internal Source of Release

Firstly, what is an Internal Source of Release (ISOR)? As defined in the standard: "A



A CR2032 battery used here for local memory or BIOS power backup. At 3V and with stored capacity of only 225mAh, it would fall within the limits proposed in Edition 7

point or location from which a flammable substance in the form of a flammable gas or vapour or liquid may be released into the pressurized enclosure such that in the presence of air an explosive gas atmosphere could be formed".

The most frequent application is in the case of gas analysers, where the sample is flammable.

What are the changes?

All safe area electrical equipment that is to be installed in a hazardous area will require certification, using an approved protection method, such as Ex p, and gas analysers are no exception. If the analyser is only measuring non-flammable samples, then the Ex p solution and certification process can be quite straightforward. However, if the sample being piped inside the pressurized enclosure is flammable then it frequently becomes a complex case, that can be time-consuming for Notified/Certification Bodies to assess.

Other protection methods – such as Flameproof (Ex d) – are sometimes used by analyser manufacturers where, due to volume manufacturing, the investment in the design and type approval processes are economically viable. But there remain many applications where sales volume or design considerations call for a flexible solution, such as Ex p.

Of course, mitigation measures currently exist that can assist in finding a certifiable solution – these can include:
- Constructional changes to the sample containment system, using metallic tubing and suitable mechanical fittings in place of plastic
- The separation of the flammable sample from the electrical equipment, potentially via partitioning the enclosure and purging in series, electronics first
- Installation of a flow-limiting device so that the worst-case leak can be characterised and suitable dilution provided, reducing the concentration of flammable material to safe limits
- Maintaining the enclosure pressure at a slightly higher pressure (>50Pa/0.5mbar) than the containment system.

A pressurized enclosure under construction that uses flammable gas detectors. The sensor heads are located inside the enclosure, while the certified transmitter units are eternally mounted and connected to a control system

Edition 7 introduces the possibility of additional mitigation through the use of a gas leak detector that, upon sensing a leak, can provide a control signal to automatically isolate the source of flammable material.

This would allow the containment system (provided it is of metallic construction, as mentioned above) to be classified as "No normal release, limited abnormal release". This is the best classification of the containment system in most practical applications, as the highest classification – "infallible containment system" – is not generally feasible requiring fully welded, metallic, ceramic, or glass construction.

Implementing these measures should not be beyond the capabilities of a typical controls engineer, and could use off-the-shelf components such as a solenoid valve installed outside of the pressurized enclosure in series with the gas sample flow limiting device. Note that, along with the gas leak detector, any components outside of the enclosure, and hence in the hazardous area, will need to be suitably certified in their own right.

Conclusions

At more than 80 pages, the proposed 7th edition of the IEC 60079-2 standard is still a complex document. However, the additional flexibility around the use of batteries has removed a significant area of complication for some of the simplest Ex p projects, such as installing standard safe area computer equipment in hazardous areas.

Additionally, at the more challenging end of Ex p applications, such as flammable gas analysers, additional mitigation measures provide additional scope for a successful assessment and certification process. ■

About the author

Steve Pilgrim, Marketing Manager at Expo Technologies, has wide-ranging experience in developing optimum hazardous area solutions for customers across a wide range of industry sectors and end-uses, with a focus on the application of Purge & Pressurization. Before joining Expo, Steve had a lengthy career in the world of industrial gases and chemicals, including a five-year posting to the Asia Pacific region, working on large semiconductor facility projects. He has a degree in Physics from Loughborough University and an MBA from Rutgers University in the US.