Purge, Pressurize, Protect: Keeping Your Plant, & Your Product, Safe

By Bill Fleming

Over the past few years, Congress, the media and grass-roots security groups have been increasingly scrutinizing the chemical industry. That's why chemical facilities are more than ever actively engaged in managing risks to guarantee safety. Most of these efforts focus on safely operating facilities on a day-to-day basis using well designed equipment, preventive maintenance, up-to-date operating procedures and a well trained staff.

In spite of the hazards associated with working with chemicals, various safety measures have resulted in lower injury and illness rates for some segments of the industry. In 2006, the chemical industry reported 2.9 cases of work-related injury or illness per 100 workers in contrast to an average of six for all manufacturing industries, according to the U.S. Department of Labor.

Per a 2002 U.S. Chemical Safety Board study, equipment maintenance was one of the most frequently reported management deficiencies. And as U.S. chemical companies turn their attention to dedicating more resources to competing in the global market, some of the most commonplace plant equipment—operator interface system enclosures, for example—are likely to be overlooked.

It can be explosive to overlook operator interface systems in areas where combustible liquids, gases or vapors exist. A component failure enclosed in an inadequately equipped or poorly maintained operator interface system can ignite arcs and sparks that cause explosions when they interact with chemical materials.

Proper operator interface system management is relatively simple, however, if you know the facts. It comes down to purging and pressurizing—and knowing your hazardous environment.

Understanding Your Hazardous Environment

Selecting the right operator interface system for your environment begins with understanding the environment’s hazards. There are two classes of hazardous environments, each characterized by the type of hazardous substances present. Class I signifies an area where ignitable concentrations of flammable gases or liquid vapors are present. Class II areas include locations with ignitable concentrations of combustible dusts, such as grain dust.

Each class is further separated into divisions, which are defined by the level of hazardous substance concentration. Division I classifications apply when hazardous

substances are present during normal operation. Division II classification (the most common) pertains to hazardous substances are present only during abnormal conditions, such as leaks.

The following groups further characterize the hazardous substances present in the environment. Class I substances consist of:

- Group A—acetylene.
- Group B—hydrogen.
- Group C—ethylene.
- Group D—methane.

Class II substances are made up of:
Group E—conductive dust.
Group F—carbonaceous dust.
Group G—agricultural dust.

Some North American standards that apply to hazardous environments include:
NFPA 70—National Electrical Code, Article 500.
NFPA 496—Purged and Pressurized Enclosures for Electrical Equipment, 1996 edition.
ISA 12.4-1996—Pressurized Enclosures.
UL 698—Industrial Control Equipment for use in Hazardous Locations, Class I, Groups A, B, C & D, and Class II, Groups E, F & G.

Purge/Pressurization Essentials

Purge and pressurization systems use clean or inert gas to maintain a higher pressure inside the operator interface system, preventing chemical byproducts and other environmental hazards from entering the enclosure. This enables electrical equipment to be safely operated inside. The purge and pressurization system is set up before the enclosed electrical components are activated. If pressure is lost at any time during operation, power to the enclosure equipment may be disabled depending on the type of purge or pressurization used.

There are three types of purge and pressurization systems:

- Type X, which reduces the enclosure area classification from Division I to a non-hazardous or general-purpose rating.
- Type Y, which reduces the enclosure area classification from Division I to II.
- Type Z, which reduces the area classification from Division II to general purpose.

In types Y and Z purge and pressurization applications, removal of power to the enclosure is not required upon the loss of pressure; however, there must be an audible or visible alarm. For an X-type purge system, there must be a timer to

prevent the start-up of electrical equipment within the control cabinet. In these cases, four complete volume changes of the entire control enclosure must occur before power is energized.

While purge systems utilize an external airflow source to maintain internal pressure of the enclosure, it is typically insufficient for cooling. However, heat-pipe exchangers can cool the system by circulating cooler external air alongside the hotter interior air without intermingling. External air never enters the enclosure and is circulated by an external fan. Some times external air is supplied via a compressed-air hose, eliminating the need for a fan and possible sparking.

Maintaining Cleanliness

Operator interface systems with purge and pressurization technology are necessities in potentially volatile chemical environments. Purge and pressurization, however, are not the only features that you should consider when making your purchase.

Cleanability is also a concern. Systems intended for chemical environments should feature the fewest possible crevices and ledges to reduce particulate accumulation and permit easy cleaning. They should also meet NEMA 4X standards, which require interior component protection from splashing water, water seepage, hose-directed water, falling water or severe exterior condensation. Ideal for washdown environments, NEMA 4X systems incorporate stainless steel construction for extra corrosion resistance, as well as doors and seals to prevent water from entering the enclosure.

Selecting The Right System

In addition to protecting against potential explosion and contamination hazards, your operator interface investment should be designed with your plant floor—and workers—in mind. To avoid retrofitting or frequent investments in new systems, search for a durable system that maximizes your existing space. Also look for ergonomically friendly systems; they increase productivity and minimize user errors by optimizing comfort.

Popular operator interface design options include:

- Vertically adjustable systems to provide up to 30 in. of counterbalanced vertical repositioning with additional rotational articulation.
- Low-height console systems for improved process visibility.
- In-wall stations to fit in the confines of a shallow wall.
- On-wall stations for direct mounting via tabs or holes in the enclosure.
- Mobile systems so that you can bring the operator interface to the process, eliminating the need for multiple fixed stations.

Vertically adjustable systems are best for process control applications, particularly when the operator is required to spend long periods of time at the interface system. As most ergonomically diverse, it allows for easy adjustment between operators and precise display positioning. Vertically adjustable systems also let operators use the display for setup and subsequent repositioning during processing.

Thanks to a variety of new operator interface system designs, engineers can choose customized solutions that are not only outfitted with UL- or FM-approved technology, but are also designed to meet their specific space requirements. Customization permits you to strategically place an easily accessible operator interface system anywhere in your environment and still meet safety requirements.

By including operator interface systems as part of your overall safety plans, you can ensure that your products, workers and future business plans remain safe—and don’t go up in smoke.

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