Rupture discs have become an increasingly popular method of pressure relief in modern process plants, thanks to their ability to withstand a range of pressure and process conditions. But with ever-increasing safety standards and environmental considerations having to be satisfied in a particularly challenging economic climate, the need for reliable yet cost-effective detection systems – to indicate when a disc has functioned - has become a pressing requirement. This has led disc manufacturers and customers alike to seek increasingly advanced systems that provide reliable detection without stretching budgets.

Plant engineers have long relied upon rupture discs as a safety measure to manage a variety of pressure conditions. The last 50 years have seen a complete overhaul of risk and hazard management, with most companies adopting a safety culture. Environmental concerns and the drive to reach zero emissions have changed the way many plants are run, particularly as unregulated leakages have implications beyond simply the environment: fines, sanctions and proposed government taxes on emissions could all have considerable financial repercussions. As a result, the need for burst detection alongside rupture discs is vital, as plants need to quickly identify when a disc has burst.

However, due to the time and expense of change-outs, wiring and associated labour costs, detection is often perceived as an optional extra, something that may be helpful but not a necessity; some even assume that they will simply hear a disc bursting.

**Membrane detection**

Traditionally, detection systems featured a simple membrane design, complete with an insulated, electrically conductive path mounted between supportive rings. Following the functioning of the rupture disc, fluid flow would cause the membrane, and in turn the conductive path, to break, producing an open circuit signal and...
notification that the disc had functioned and needed to be replaced. This method of detection is useful in many ways, being suitable for a number of applications and a low-cost option. However, the sensitive nature of the membrane design means it is vulnerable to sudden process changes and corrosive atmospheres, making it liable to give false signals.

General maintenance inspections require the disassembly of the disc and holder installation, causing avoidable downtime. Another notable disadvantage is that the membrane is very easily damaged during installation and needs to be replaced, along with the disc. This can lead to expensive stock ordering and holding, while the potential for spurious failures or damage can result in unnecessary plant downtime while a replacement is ordered.

As a result of these disadvantages, a non-consumable means of detection that is non-invasive to the process became desirable. Other popular methods of detection, such as break wires, pneumatic switches and resettable switches, are reusable, but are invasive to the process and sensitive to damage through repeated use, as well as general wear and tear over time.

Reusable, non-invasive detection
Recent innovations have led to the development of detection systems which offer greater performance and reliability in a reusable design, offering both a higher level of protection and a cost-effective alternative to traditional methods of rupture detection. These products operate on simple reed switch and magnet technology, the sensor fitting directly into the disc holder. The disc itself is provided complete with a small magnet. As the disc bursts, the magnet is pulled away from the sensor, giving an open circuit signal.

Only the disc itself has to be replaced after it functions, eliminating the need to hold stock of detectors or order excessive spares. Unlike membrane systems, this method of reed switch and magnet detection is non-invasive to the process and so is not susceptible to process change and false signals, and therefore does not affect the performance of the disc.

Since the sensor is non-invasive to the process, it is suitable for use in corrosive environments and can also be used in explosive atmospheres, in process temperatures ranging from -55°C to 250°C. Such detection is therefore Zone 0 compatible, meeting ATEX and IECEx approvals, with all components featuring a minimum IP66 rating.

The sensor can be tested in situ without interrupting the process, making maintenance checks more efficient and simple. The fail-safe design only operates when a disc has ruptured, eliminating false alarms and limiting downtime in the event of a rupture disc functioning. Being reusable, the detector only needs to be wired once, which cuts costs - particularly as the cost of wiring often exceeds that of the detector - and saves on downtime.

Reed and magnet-based detection systems can also be used in wireless networks, allowing for the continuous monitoring of rupture discs through wireless technology, using radio waves instead of physical wiring. The detection system is simply fitted with a transmitter, allowing data to be sent to a repeater and receiver. Such systems benefit the most hazardous of process environments, where continuous monitoring is particularly important but where traditional detection is unsuitable.

The oil and gas, and chemical and pharmaceutical, industries have seen the advantage of replacing traditional detection systems with their non-invasive counterparts. When upgrading their pressure relief devices and associated detection, companies in these sectors have witnessed an end to the spurious alarms and subsequent downtime previously caused by unreliable or easily-damaged membrane-type detectors. Such lost production can often run into tens of thousands of pounds.

About the author:

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