

Machine safety in special environments

Explosion protection and plant safety: a two-fold challenge

Machine safety in explosive zones: switchgear required for this field must comply with two complex sets of regulations. Although this is a "niche within a niche", different options are still available when selecting safety switches and sensors. This is true for heavy-duty applications, but also for machines performing duties such as processing or packaging dust-explosive foodstuffs.

For both machine safety and explosion protection, comprehensive sets of standards exist which in Europe are documented in the machine directive and the ATEX directive. There are also international regulations (e.g. IECEx) to be taken into account, as well as – for both areas – national standards and stipulations (UL/CSA, Inmetro, Ex CCC, EAC...). Last but not least, an "update" of the machine directive is currently under discussion which will better include new developments, such as digitalisation and connectivity.

The demands made on switchgear for monitoring the position of guard doors on machines in Ex zones are correspondingly complex because here both sets of regulations apply equally – and sometimes

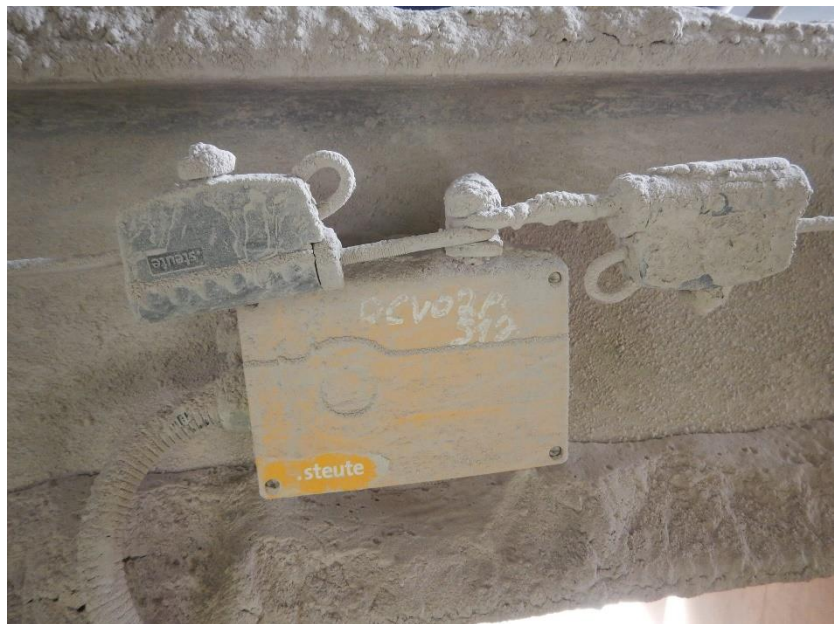


Fig. 1 Emergency pull-wire switches must work reliably – as shown by this application example – even in adverse environmental conditions.

even more than two, depending on the application.

Heavy-duty use in conveyor and extraction engineering

A typical application for safety switchgear in Ex zones is conveyor and extraction engineering. Here the entire equipment



Figs. 2 a and 2 b The ZS 92 S/SR series – containing emergency pull-wire and belt alignment switches – was developed especially for extreme environments.

must also be mechanically robust and suitable for use in areas with high levels of dust, as well as a wide temperature range (Fig. 1). These requirements are met by e.g. the emergency pull-wire switches in the Ex ZS 92 S series, providing an emergency stop function for conveyor belts over lengths of up to 2 x 100 m (Fig. 2 a). This series also includes an (equally robust) belt alignment switch (Fig. 2 b).

Applications: Shipbuilding and oil/gas exploration

In other application fields, such as shipbuilding or oil/gas exploration, safety switches need to meet the requirements of gas explosion protection, while also being anti-corrosive. In addition, additional industry-specific approvals, such as DNV or Lloyd's Register, must be adhered to, and possibly also works standards specified by the customer. And all with very good reason: the risk of explosion on e.g. oil rigs or tankers is omnipresent; and the physical work is hard and likely to cause accidents.

The safety measures need to be correspondingly effective.

Series like the Ex AZ 16 (Fig. 3) have been especially developed for such niche applications: a safety switch with a separate actuator, three contacts and a separate terminal compartment which can be used in gas Ex zones 1 and 21 (as well as dust Ex zone 22). If required, the Ex AZ 16 can also be supplied with a cable assembly.

A sought-after combination of features in general mechanical engineering

Within the large industrial switchgear market, this is definitely a niche area, and yet Ex safety switches are also needed in general mechanical engineering for many different reasons. For example, if the positions of guard doors and maintenance flaps on processing, filling and packaging machines for powdered foodstuffs (flour, sugar, coffee, ready mixes...) require monitoring, dust explosion protection requirements usually apply. Organic dusts

are always flammable and can ignite if they come into contact with air.

Position switches with safety function: a choice of options

In addition to the Ex AZ 16, engineers can choose between two series of steute Ex position switches which are also suitable for functional safety applications. The approved switches (EN 50047 and 50041) in the Ex 97 and Ex 99 series (Fig. 4) can be used in gas Ex zones 1 and 2, as well as dust Ex zones 21 and 22. They are additionally suited to temperatures down to $-60\text{ }^{\circ}\text{C}$, making high demands on the construction and sealing of the enclosures.

Users who prefer their gas Ex and dust Ex safety position switches to be housed in metal can opt for the Ex 98 series featuring a robust, anti-corrosive aluminium enclosure with a stainless steel cover, high protection classes and standardised dimensions to DIN EN 50041.

From electromechanical to non-contact

As an alternative to electromechanical switchgear, mechanical engineers can opt for non-contact safety sensors – for example the Ex HS Si 4 series, which can monitor the position of guard doors in combination with an actuator. Its high-level shock resistance and compact design make it easy to integrate in the surrounding construction of a guard door (Fig. 5). Also possible is the use of safety sensors from the Ex RC Si M 30 series, featuring a cylindrical design and a separate actuator. They are also available in an Extreme version with protection class IP 69K and a stainless steel enclosure.



Fig. 3 Safety in Ex zones is provided by the Ex AZ 16, for example, a safety switch with a separate actuator and a separate terminal compartment.

Solenoid interlock: the alternative with extra benefits

If a solenoid interlock is required, e.g. due to a dangerous overrun of the machine in question, several series are available which have all been approved for use in explosive zones. The Ex STM 295 for Ex zones 1 and 21 is just one example (Fig. 6). Increasingly popular, this option improves not only machine safety, but also process reliability: operators cannot interrupt processes by opening a guard door. Instead, the machine comes to a stop in a controlled manner, and only then can the door be opened – e.g. for repairs or maintenance. This has considerable benefits, especially for interlinked machines.

Ex solenoid interlocks are rarely found in industrial switchgear ranges. But here, too, the steute "Extreme" range serves this niche requirement with multiple options.



Fig. 4 Impact and shock-resistant, thoroughly sealed and suitable for subzero temperatures down to -60°C : the Ex 99 series of Ex position switches with safety function.



Fig. 5 Non-contact alternative for guard door monitoring in Ex zones: the Ex HS Si 4 series of safety sensors.

Conclusion: a broad selection, even in niche areas

This overview has shown: even for complex niche applications such as the combination of (gas or dust) explosion protection and functional safety, engineers and plant operators have multiple options when selecting switchgear. This is even true when additional requirements come into play, such as a heavy-duty design, corrosion protection or subzero temperature compatibility.

Fig. 6 Ex solenoid interlocks round off the steute range of Ex switchgear.



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