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PROFESSIONAL GUIDE			
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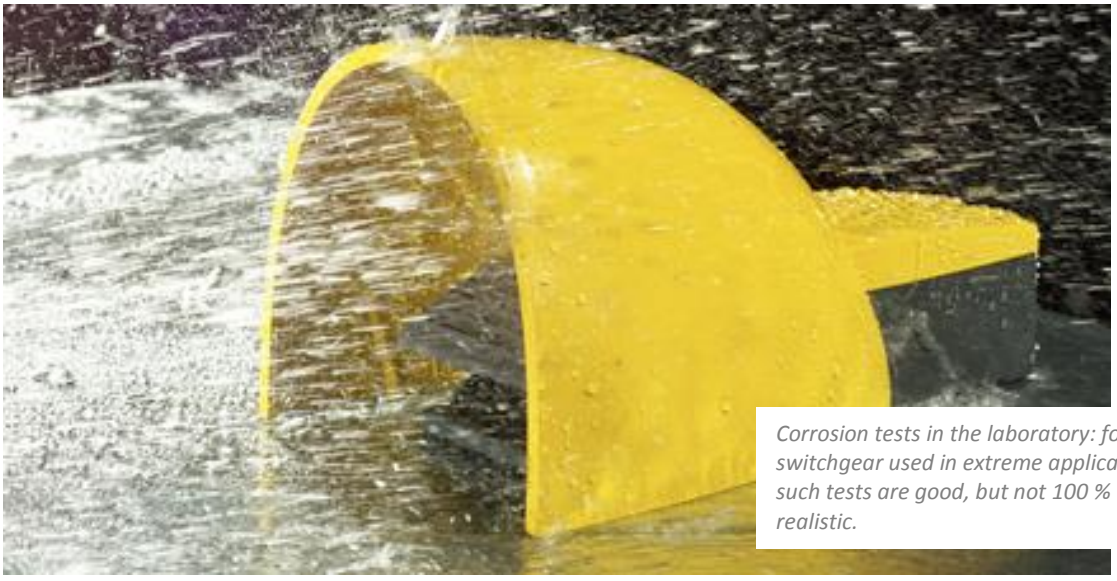
DECISION MAKERS – FACTS
For operators • Loading systems for oil and gas require reliable switchgear for tasks such as the position monitoring of loading arms. In addition to explosion protection, systems which are installed in ports or offshore also require high resistance levels. • The devices in the series described here are designed for very high and very low temperatures, are Ex-protected and are seawater-resistant in the long term.

Position monitoring on loading systems

Switchgear for extreme applications

In casting and forming plants, a foot control is an important element of the human-machine interface – also and especially regarding the triggering of safety-related functions. Now wireless safety foot controls are available for this task, providing users with improved ergonomic comfort and greater freedom of movement.

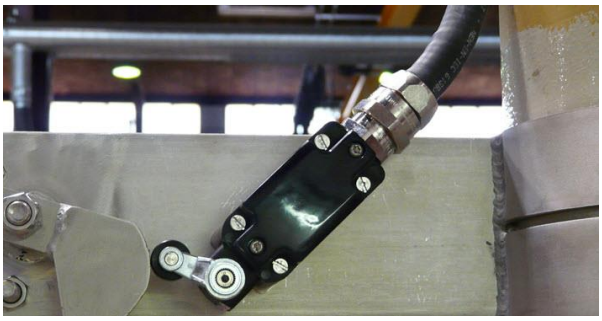
Petrol, natural gas and liquid gas are typical products handled using loading systems manufactured by Emco Wheaton. These loading systems are frequently to be found at the end of a process chain, at production sites or logistics stations like



Corrosion tests in the laboratory: for switchgear used in extreme applications, such tests are good, but not 100 % realistic.

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

The key components of these handling systems include the swivel joints of the loading arms, which are tightly sealed to prevent both gas and liquid leakage.



The position of the loading arm is monitored using a position switch which must be suitable for extreme environments.

fuel depots or, in "ship to shore" applications, at ports. Emco Wheaton has two main business areas which together cover the entire range of products. One area manufactures large-scale loading systems for ships, similar to crane systems. The second area develops and produces onshore loading systems with moving arms which can reach into e.g. rail cars in order to fill them with liquids or gas, or to remove liquids or gas by suction.

The system engineers favour an extensive vertical range of manufacture and individual project planning in close cooperation with the operator. The design process starts with the selection of materials – which differ depending on what needs loading – and the dimensions of the loading arms, as well as how they should be balanced. For the onshore loading systems, hydraulic, pneumatic and electric drives, as well as manual systems, e.g. with spring cylinders or counterweights, are all optionally available. A key component produced in the Emco Wheaton factory is the

PRACTICAL EXAMPLE

Large-scale plant for loading of liquid gas

A loading system for liquefied petroleum gas (LPG) in a current project from Emco Wheaton comprises 108 individual stations and 216 loading arms. It enables a complete train with multiple rail cars to be loaded and unloaded at a terminal in Central Asia very quickly and without having to shunt the train. The LPG must be kept at a pressure level of 170 to 180 bar if it is to remain liquid and thus transportable. This means that the pressure level must also be maintained during the loading process. For these requirements the plant engineers have developed special components for both the swivel joints of the loading arms and the sealing of the couplings to the rail cars.

Three steute Extreme series Ex 99 position switches are installed at each station. Two of them are responsible for safe signalling when one of the two end positions of the loading arm is reached. The third switch communicates to the central control unit the position of the foldable ladder granting operators access to the top of the rail car. This guarantees that all safety-relevant movements at each individual station within the terminal are monitored with a high degree of reliability – in an explosive environment and in subzero temperatures.

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Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

The steute Ex position switches in series Ex 97/ Ex 99 and Ex magnetic sensors Ex RC M20 KST are suitable for subzero temperatures of down to -60 °C.

More realistic than laboratory tests: in a one-year outdoor exposure test, "oil & gas" switches were tested on the North Sea island of Helgoland, some of them in tidal water. The photo shows the condition of selected switches at "half time".

loading arm itself. It will typically have four swivel joints, making it mobile enough to swing over and into a manhole. These joints are crucial for reliable and leak-free loading and must fulfil very high sealing standards.

Hot and cold: position switches for Ex applications

When designing the loading arms and systems, the temperature of the media loaded and of the ambient air both play a role, as does the pressure required. And nearly every project also has to take explosion protection regulations into account. These criteria all impact the choice of position monitoring switchgear for the loading arms. Either the switches monitor the start and end positions of the arm, or a mechanical cam switch is used to cover a predetermined range. Because position monitoring is a safety function, switches with NC contacts are used. Here the system manufacturer uses position switches from the steute Ex 98 series. These switches are Atex certified for gas Ex applications in zone 1, meet comparable international Ex regulations and can be used for safety applications. In addition, they are suitable for temperatures of up to +70 °C. Such high temperatures can be reached when liquid bitumen or other hot media are loaded.

More and more frequently, engineers are having to design systems for extremely low temperatures. This could be for exploration in polar regions, for example. For such applications, the switchgear manufacturer has developed its Ex 99 Ex position switch series. It can be used in temperatures of down to -60 °C and also in corrosive environments. The actuators are roller levers made out of brass.

Test site quay wall

The requirements for switchgear in oil and gas applications include not only explosion protection, but often also corrosion resistance, for example in maritime or port handling. Standardised test procedures are already available for this area, but they do not necessarily reflect reality. Scientists at

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32584 Löhne, Germany
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Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

the Fraunhofer Institute for Manufacturing Technology and Advanced Materials (IFAM) in Bremen have stated, for example, that the results of standard salt spray tests "do not always sufficiently reflect the failure behaviour of coatings". The scientists believe one of the reasons for this to be the fact that corrosion tests take place in constant conditions, whereas in practice conditions can change enormously through temperature, humidity, current, saltwater impact and other factors. What would be desirable, because far more realistic, would be corrosion tests under – defined – real-life conditions. IFAM can do just this at its external field test site on the North Sea island of Helgoland. Here components can be tested in conditions such as those which actually predominate in ports. These conditions include the dynamic, particularly weather-induced environment, but also additional factors such as fouling through algae.

In order to test the suitability of steute Extreme switchgear for such application environments, the manufacturer commissioned IFAM in Bremen to conduct a 1-year outdoor weather test. Several samples each from selected switchgear series were fixed to the South mole at splashwater level and in an exposed position for 1 year. Some additional devices were installed in tidal water, in other words at changing water levels, in order to investigate the limitations of these devices when facing the movements of the North Sea.

Proven seawater-resistant

The appearance of the switching devices after one year in the salt spray atmosphere, as well as the functional tests conducted, revealed that the devices from the various series are all seawater-resistant. The devices made out of reinforced plastic were in a particularly good condition. Here the switchgear manufacturer uses outdoor-compatible plastic combinations of polyester and polyamide to UL 746C, footnote "f1". The coating system for the devices with metal housings also proved itself suitable for maritime applications. This system involves multiple mixed powder coats which are applied to previously passivated aluminium surfaces.

For the housing sealing and cable glands, the chosen silicone material proved much more resistant than rubber. In addition, the tests provided comprehensive information for users, for example about how best to mount the devices in order to avoid contact corrosion, and which connection cables and screwed cable glands are best suited to maritime applications. This information will be passed on by steute to engineers and users in the oil and gas industry.

Author:

Rainer Lumme
Product Manager Extreme
steute Technologies

Images: steute Technologies GmbH & Co. KG, Emco Wheaton

steute Schaltgeräte GmbH & Co. KG
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