The future is with hydrogen

Every two months, Dr. Martin Thedens, Chair of IEC TC 31 "Equipment for explosive atmospheres", will offer his perspective on the latest developments in the world of standards.

The 'all electric society' is an essential requirement for a carbon neutral future, but it will not work without hydrogen. You can agree with these two statements, or not – but the future of our world with hydrogen can no longer be stopped.

The big advantages of hydrogen and its derivatives are that they can be used to easily store and transport energy, enabling greater flexibility in energy supply. We as explosion protection experts know a lot about hydrogen and its properties. The standards issued by IEC TC 31 and its SCs can be used for the safe use of hydrogen. And by the way: we don't care what colour the hydrogen is. Green, blue or brown are all the same for IEC TC 31.

Here are some topics where the IEC TC 31 standards can support hydrogen technology:

Classification of flammable substances
IEC SC 31M provides Ex-related requirements for the classification and characterisation of hydrogen, such as equipment grouping, temperature class, auto-ignition temperature, lower and upper explosion limits, etc. Such characteristics are given in ISO/IEC 80079-20-1.

Hazardous areas
IEC SC 31J provides requirements for a classification of the hazardous area. This concept of the Zones is independent of the type of flammable substance. It's related to the probability of occurrence of a flammable substance. Such requirements for the use of hydrogen are given in IEC 60079-10-1.

Ex Equipment
IEC TC 31, SC 31G and SC 31M provide specific ex-related constructional requirements and provide guidance to avoid an ignition, so that explosion protected equipment (Ex Equipment) can be used within a hazardous area where a Group IIC and a temperature class T1 is required.

For example, general requirements for the design, construction and testing of Ex Equipment to be used in an explosive atmosphere with hydrogen are given in IEC 60079-0 for electrical equipment and in ISO 80079-36 for mechanical equipment. Requirements for the design, construction and testing of Ex Equipment Assemblies to be used in an explosive atmosphere with hydrogen are given in IEC TS 60079-46.

Use of Ex Equipment
IEC SC 31J provides specific ex-related requirements for installation, use and maintenance of Ex Equipment for hazardous areas.

For example, requirements for the installation of electrical Ex Equipment in a hazardous area for the use of hydrogen are given in IEC 60079-14. Furthermore, the use of hydrogen requires technical measures to avoid an explosive atmosphere such as closed systems with (permanently) technically sealed solutions.

Additionally, IEC TC 31 documents can be used as well. Requirements for the safety, performance and function of gas detectors for hydrogen can be found in the IEC 60079-29 series. Guidance about equipment, product and process properties necessary to avoid ignition and electrostatic shock hazards arising from static electricity is given in IEC TS 60079-32-1.

The IECEx International Hydrogen Conference 2024 was held at the end of May in Singapore. It was a great event with all key players of hydrogen technology such as the Chairpersons of ISO TC 197 "Hydrogen Technologies", SC 1 of ISO TC 197 responsible for "hydrogen dispensers", IEC TC 105 "fuel cells" and of course IEC TC 31 and IECEx as well as speakers from IRENA and the Hydrogen Council.

The conference was opened by the IEC President Jo Cops. Beside of all future needs, one point was clear: we do not need to re-invent the wheel! Most requirements and technical solutions are available. The same is for the organisational structure within ISO, IEC and IECEx. But for sure, some future tasks for IEC TC 31 and its SCs were identified, for example:

- Explosion characteristics and methods must be developed above and below atmospheric conditions as well as for mixtures of hydrogen with other gases or for hybrid mixtures.
- The use of LOHC (liquid-organic hydrogen carrier) is not directly addressed by our standards.
- The existing requirements for Ex Equipment must be checked and extended for special applications, such as requirements for flame arrestors for hydrogen or the use of oxide electrolyser cells (SOEC) as the operating temperature is between 500 °C and 850 °C.

IEC TC 31 has recently formed AG 59 "Hydrogen Advisory Group" recognizing the growth in this field to help with developments and coordination. AG 59 can support other groups related to explosion protection and give guidance for the use of hydrogen. We all have to be aware of an overlap with other TCs/SCs of IEC and ISO. The aim is that duplicated work and conflicting requirements shall be avoided. We all share the same future, and the future is with hydrogen! ■

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Image: Moore Industries

SIS Logic Solvers – more choices needed

Industrial processing and manufacturing industries are not new to the concept of safety processes, methods, and designs. In fact, since the Industrial Revolution, layers of security have been developed to safeguard workers in factories and mining regions. Over several decades, more effective safety regulations emerged, and the accessibility of safety-related equipment significantly increased. IEC 61511 Functional Safety - Safety Instrumented Systems for the Process Industry Sector appears to have recently gained acceptance across all significant manufacturing and processing sectors.

At the heart of the IEC 61511 standard is the SIS or Safety Instrumented System which is implemented to mitigate and prevent unacceptable risk by an organization to protect its personnel, facility and/or surrounding community and environment. Each SIS is made up of one or more SIFs, or Safety Instrumented Functions that bring a process or loop to a desired safe state. The basic elements of a SIF are the sensor, logic solver and final element. The sensor monitors the process and transmits that information to a logic solver where in turn that data is compared against predetermined settings to determine whether the final element should be adjusted, activated or engaged.

Since Logic Solvers are at the epicenter of every SIS decision, this article will primarily focus on logic solver capabilities and considerations. Currently, several vendors are offering Functional Safety logic solvers, but there can be a large price and functionality gap that exists between single-loop logic solvers and larger safety systems.

The key considerations, capabilities and features that should be part of the decision process in selecting a suitable logic solver for your Functional Safety application will be discussed and reviewed in the following sections. In addition, we will introduce the concept of the multichannel and multiloop logic solver that effectively fills the large price and functionality gap between single-loop logic solvers and safety PLCs or larger safety systems.

The logic solver gap

Of the three main components typically contained in the SIF, the logic solver is the most critical. The logic solver is responsible for determining whether dangerous conditions have been met and is responsible for the final element's ultimate effect on the mitigation function or strategy.