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When enhancing safety and operational efficiency, glass manufacturers today must evaluate installation risks, including environmental and economic factors. Here, as GLASS SERVICE can attest, is where the EN ISO 13577-4:2022 standard now redefines risk assessment as it replaces EN 746-2 for industrial furnaces – integrating functional safety standards while ensuring both IEC 61508 and IEC 61511 compliance.

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he EN ISO 13577 series of standards, particularly EN ISO 13577-4, provides essential guidelines for assessing risks associated with industrial furnaces and associated processing equipment. This aspect of the standard will focus on risk assessment processes, which are crucial for ensuring safety and operational efficiency in high-temperature environments.

EN ISO 13577-4 outlines a systematic approach to both identifying hazards and evaluating risks in the operation of furnaces. It emphasizes the importance of a structured risk assessment process, which helps organizations understand potential dangers while implementing the necessary safety measures. The standard is particularly relevant for industries that deal with high-temperature processes, including metallurgy, ceramics and heat treatment.

By the following, the EN ISO 13577-4 redefines the designed criteria for equipment in a protective system:

- Electrical installations and equipment will be compliant with IEC 60204-1:2016;
- Devices and protective systems



will withstand environmental conditions according to IEC 60204-1:2016 - fulfilling their intended function;

• Sensors used in the protective system will operate independently of the process control system.

In particular, the functional safety requirement identified in the 13577 series will accord with IEC 61508:2010, IEC 61511:2016, IEC 62061:2021 and ISO 13849-1 respectively.

REPLACEMENT ROADMAP

At the end of 2010 a general review of EN 746-2 was planned to include some EN ISO 13577-2 prescriptions together with a project that was started to define a new EN 746-11.

However, this standard remains illusory, even if it is possible to buy a preview of EN 746-11 and a draft of EN 746-2:2020. That said, neither of these standards is recommended as both projects were aborted.

The plan is now to replace the

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binding EN 746-2 with the new EN ISO 13577-4:2022 and 13577-2:2024.

The new EN ISO 13577-4 reviews and readapts two methods listed in the preexistent EN 746 by a set of three methods - all identified to achieve full compliance for the new furnace equipment project as follows:

- Method A: shall be a wired system in which all devices comply with the product standard. ISO 61508:2010, 61511:2016, IEC 62061:2021 and 13849-1 are not applicable;
- Method BC: shall be a combination of devices meeting the relevant product standard and/ or SIL/PL for which no product standard exists PLC is optional. Using PLC, a safety function software shall be verified and validated SIL 3 and Devices (timer

PLC, etc.) which are not covered by product standards;

 Method D: shall be in accordance with the full requirements of functional safety standards IEC 61508:2010, IEC 61511:2016, IEC 62061:2021 and ISO 13849-1.

Any of above mentioned methods, or a combination of all three, shall be used to implement a protective system for the safety functions requirements.

Compared with the standard EN 746-2, the EN ISO 13577-2 involves few modifications compared, as the additional prescription for IN LINE BURNERS.

On the other hand, the EN ISO 13577-4 shows many differences - especially with par 5.7 of EN 746-2: the standard includes at the same time, the classical approach to furnace safety, together with functional security.

ENHANCING INDUSTRIAL SAFETY SYSTEMS

In industrial safety, ensuring the proper functioning of safety systems is critical to mitigating risks and protecting people, the environment and assets. The EN ISO 13577-4:2022 and IEC 61511-3:2016 are two important standards that provide a structured approach to risk assessment and evaluation of Safety Integrity Levels (SIL) in industrial processes. These standards guide organizations in designing, evaluating and maintaining safety systems to meet operational and safety requirements. This article will explore the significance of EN ISO 13577-4:2022 and how it integrates with IEC 61511-3:2016 for effective risk management and SIL evaluation.

The standard provides methods for determining whether the identified risks fall within acceptable



1. Hazard Identification

The first step involves identifying all possible hazards associated with furnace operations. This includes mechanical failures, human errors, environmental conditions, and operational anomalies.

2. Risk Analysis

This involves evaluating the likelihood of occurrence and the potential consequences of each hazard. Quantitative and qualitative methods can be used to assess risk

3. Risk Evaluation

Organizations must evaluate them against predefined criteria to determine their acceptability. Risks that exceed acceptable levels must be addressed through mitigation strategies.

4. Mitigation Measures

Implementation of appropriate measures to reduce risks to acceptable levels. This may include engineering controls, administrative controls, and personal protective equipment (PPE).

5. Documentation and Review

Maintaining thorough documentation of the risk assessment process is crucial. Regular reviews and updates ensure that the assessment remains relevant as processes or conditions change. thresholds based on industry practices, regulatory requirements and safety norms.

SIL Evaluation: After assessing the risks, EN ISO 13577-4:2022 helps determine the Safety Integrity Level (SIL) required to reduce the identified risks to an acceptable level. The SIL is a measure of the reliability of a safety function, which is critical in ensuring that safety systems perform their intended role in preventing hazardous events.

RISK ASSESSMENT METHODOLOGY: IEC 61511-3

While EN ISO 13577-4:2022 offers detailed methodologies for hazard identification and risk estimation, which align with the risk assessment principles outlined in IEC 61511-3:2016, one of the primary goals of IEC 61511-3 is to define the necessary SIL for each safety function based on risk levels. The standard uses risk matrices and failure rates to calculate the probability of failure on demand (PFD) and determine the required level of safety integrity.

- Lifecycle Approach: IEC 61511-3 stresses the importance of maintaining safety integrity throughout the entire lifecycle of a safety system, from design and installation to operation, maintenance and eventual decommissioning.
- Continuous Risk Management: The standard also advocates for ongoing monitoring and reassessment of risks, ensuring that the safety system remains effective as the operational environment changes or as new risks emerge.
- Risk Reduction Measures: Once the SIL is determined, both EN ISO 13577-4:2022 and IEC 61511-3:2016 emphasize implementing the necessary safety functions to reduce risks to acceptable levels. These measures include redundancy, diagnostics and failsafe mechanisms that are designed to meet the specified SIL.

Integrating EN ISO 13577-4:2022 with IEC 61511-3:2016 for Effective Risk Management.

FACTORS TO BE CONSIDERED FOR EFFECTIVE RISK EVALUATION

• Equipment producer:

The evaluation should have to consider the full layout of supplied equipment, by integration of evaluations made on a single device (machine or almost-machine). The evaluation should consider only some factor complying with pertinent legislation.

• Organization (glass manufacturer): For what concern the Organization, the Risk Assessment factors to be considered to perform an effective Risk Evaluation, should involve not only the Human injury and the Environmental Impact (as per pollution prevention), but also the Economic losses in the context of the Installation, considering all the potential interference Risks,



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by the consequences of installation of a furnace in Industrial Context where other machines, structures and process are operating together.

IMPLICATION OF NEW APPROACH OF RENEWED EN ISO 13577-4

Implementation of EN ISO 13577-4 is implemented as binding legislation, some severe consequences of described Risk assessment will have impact as a must for both equipment suppliers and glass manufacturers - especially concerning environmental and health factors.

Example 1: The equipment installation is placed in a region affected by severe seismic risk. The Risk Analysis should consider this factor and as consequences must provide the installation of a 'Seismic Valve' to shut off gas feeding at certain value of horizontal acceleration.

Example 2: The equipment installation is located in a zone of the factory which should be considered 'Closed Space'. Eventual gas leakage could create an accumulation of gas which can generate an explosive atmosphere. The Risk Analysis should consider this factor and must therefore provide the installation of a 'Gas Leak Detector' to prevent human access to the area and thereby reduce ignition Risk.

The equipment installation is located in a zone of factory where the environmental temperature should have peaked over the certified maximum temperature range of Installed equipment. The Risk Analysis should consider this factor and must therefore effect mitigation.

CONCLUSIONS

Strengthening Industrial Safety with EN ISO 13577-4:2022 and



IEC 61511-3:2016. The combination of EN ISO 13577-4:2022 and IEC 61511-3:2016 ultimately offers a powerful risk approach with the integration of EN ISO 13577-4:2022 with IEC 61511-3:2016, which creates a unified framework for achieving functional safety in complex industrial environments.

This ensures that safety systems are properly designed, maintained and continuously evaluated to meet the everevolving challenges of industrial risk management.

Here, implications that are hardly negligible will end up impacting the supply chain, involving the equipment supplier on the one hand and the glass manufacturer (directly) on the other - the latter of whom will be specifically involved in Risk Assessment not only in terms of the equipment supplied but also how the equipment gets integrated into the technological environment of the facility which, in turn, takes into account not only Risk factors deriving from health and environment protection but also those on the properties of the whole plants insofar as potential economic loss is concerned.

Based upon its long decades of know-how, Glass Service can support customers in the full process to obtain an effective Risk Assessment in compliance with the new EN ISO 13577-4 : 2022 requirements.





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