Safety Integrity Level (SIL)

Reducing the risk of unacceptable process conditions

BUSINESS CHALLENGE

Electrical, electronic, or programmable electronic (E/E/PE) safety-related systems are designed to implement the required safety functions and execute the necessary integrity to achieve or maintain a secure state for the equipment under control. The ANSI/ISA S84.01 standard and the IEC 61508 standard requires the operating companies to assign a target SIL for all safety instrumented system applications. One main principle is to separate random failures from systematic failures. Random failures occur at random times, which result from the possible deterioration of one or more mechanisms in the hardware. Systematic failures are determined by certain causes, which can only be eliminated by modifications in the design of the manufacturing processes, operational procedures, documentation or other relevant factors. The challenge is to utilize a method that can detect the safety integrity of a device or system.

SOLUTION

What is Safety Integrity Level (SIL)?

The ANSI/ISA S84.01 and the IEC 61508 standards suggest that the effects of the random failures must be evaluated in a quantitative way by utilizing Safety Integrity Levels (SIL). SIL is a statistical representation of the availability of a required safety instrumented function. There are 4 SIL designations provided in ANSI/ISA S84.01 and IEC 61508; SIL 4 has the highest level of safety integrity and SIL 1 has the lowest.

The diagram below displays the target failure frequency for an operating safety function and its safety integrity level. Bureau Veritas has technical staff dedicated to helping clients comply with the ANSI/ISA S84.01 standard and IEC 61508 to demonstrate their safety management systems and to build strong justifications.

Target failure frequency

<table>
<thead>
<tr>
<th>SIL</th>
<th>Low demand mode of operation (Average probability of failure to perform its design function on demand PFD)</th>
<th>High demand or continuous mode of operation (Probability of a dangerous failure per hour PFH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$10^{-2} &lt; \text{PFD} &lt; 10^{-1}$</td>
<td>$10^{-6} &lt; \text{PFH} &lt; 10^{-5}$</td>
</tr>
<tr>
<td>2</td>
<td>$10^{-3} &lt; \text{PFD} &lt; 10^{-2}$</td>
<td>$10^{-7} &lt; \text{PFH} &lt; 10^{-6}$</td>
</tr>
<tr>
<td>3</td>
<td>$10^{-4} &lt; \text{PFD} &lt; 10^{-3}$</td>
<td>$10^{-8} &lt; \text{PFH} &lt; 10^{-7}$</td>
</tr>
<tr>
<td>4</td>
<td>$10^{-5} &lt; \text{PFD} &lt; 10^{-4}$</td>
<td>$10^{-9} &lt; \text{PFH} &lt; 10^{-8}$</td>
</tr>
</tbody>
</table>
OUR APPROACH

Bureau Veritas performs SIL Assessments for operating facilities by means of a two step approach;

(i) SIL Classification and  
(ii) SIL Verification.

Note: IEC 61511 gives normative references to SIL Assessments for process industries.

We use a risk based approach to determine the safety integrity requirements of E/E/PE safety-related systems. This approach is comprised of multiple examples demonstrating its execution. An overall safety lifecycle model may be utilized as part of the technical framework of activities necessary to ensure functional safety is achieved by these systems.

Our focus is to encompass all aspects of the system and corresponding subsystems that carry out the safety function. This may include hardware, software and failure mechanisms [random hardware and systematic]. Our methods contain requirements for preventing failures [by avoiding the introduction of faults] and for controlling failures [ensuring safety even when faults are present]. These techniques and measures are necessary to achieve the required safety integrity for our client’s products.

Bureau Veritas offers services for various safety lifecycle activities including the initial concept; hazard analysis and risk assessment; development of safety requirements; specification; design and implementation; operation and maintenance; modification; and final decommissioning and/or disposal.

FAQ

We manufacture components used in safety functions for the process industry. Are SIL assessments required? Is Bureau Veritas capable of performing laboratory tests?

Yes. SIL certified products are an essential business need for many manufacturers. We conduct assessments of the product design and analyze field experience data to then certify your product (E/E/PE systems) to its SIL level. If required, laboratory tests are carried out by our partner company (LCIE).

Do you combine HAZOP and SIL Classification workshops?

Yes, we have an experienced technical staff capable of carrying out combined HAZOP and SIL Classification sessions for our clients.

RELATED SERVICES

Bureau Veritas offers a wide range of related services:

- 4-day Training on SIL Assessments and Safety Management Systems
- Hazard and Operability Study (HAZOP)
- Layer of Protection Analysis (LOPA)
- Fault Tree Analysis (FTA)
- Quantitative Risk Assessment (QRA)
- Reliability and Availability studies

CONTACT

Chicago Office  
630.795.3200  
weldingexpert@us.bureauveritas.com

Houston Office  
281.986.1300  
tc.houston@us.bureauveritas.com

www.us.bureauveritas.com/asset