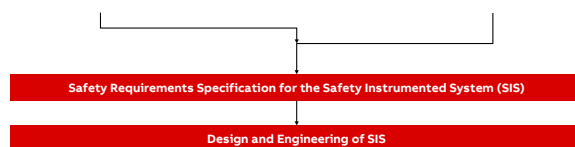


Designing and verifying your SIF



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¹ This is for the vast majority of SIFs in the process sector that operate in demand mode.

Process plant owners and operators have a responsibility to reduce the risk from their potentially hazardous events below a tolerable level. Where instrumentation is used as part of the risk reduction strategy, the international functional safety standard IEC 61511 represents current good practice for the process industry sector.



IEC 61511 organises activities into lifecycle phases; the early phases identify the hazardous events and determine the target SIL that each SIF needs to achieve. The next two phases of the safety lifecycle relate to SIF design - specifying the safety requirements and designing the SIF.

What we offer

ABB have a group of experienced functional safety specialists with both the practical and theoretical knowledge to produce full and pragmatic specifications enabling compliant SIFs to be designed that compliment production and maintenance objectives.

Safety Requirement Specification (SRS)

For many years, cause and effect charts were the main way of defining the requirements for safety instrumented systems. IEC 61511 expects much more effort and detail and lists 27 requirements that may need to be considered and documented for each SIF. The SRS forms the basis of all subsequent safety lifecycle activities and provides the link between the theoretical SIL determination activities and the physical design.

Calculating if your Safety Instrumented Function (SIF) meets its Target Safety Integrity Level (SIL).

If you don't fully define the SIF requirements then:

- You can't create a good, compliant design
- You can't create accurate and detailed factory acceptance and site acceptance test specifications
- You can't demonstrate that the SIF adequately protects against the hazard
- You can't write effective test methods

ABB has extensive experience of writing and reviewing SRSs across all process sectors and apply a pragmatic approach to the level of detail required based upon our operational heritage. This is applicable to new projects and the retrospective definition of legacy systems.

Designing the SIF

ABB can carry out the design for new SIFs, or check that designs completed by others meet the target SIL, or verify that existing SIFs are designed appropriately. The performance of the SIF and the SIL achieved is expressed as the average Probability of Failure on Demand (PFDavg)¹. A compliant SIF needs to meet three criteria:

- Control of random hardware failures (the PFDavg calculation)
- Meets architectural constraints with sufficient Hardware Fault Tolerance (HFT)
- Addresses potential systematic faults

Average probability of failure on demand (PFDavg)	
SIL 1	≥0.01 to <0.1
SIL 2	≥0.001 to <0.01
SIL 3	≥0.0001 to <0.001
SIL 4	≥0.00001 to <0.0001

For basic SIFs, the PFD is a simple function of instrument failure rates and test intervals. However, the operational challenges of more complex processes and the desire for longer intervals between shutdowns have led to higher target SILs and more complex designs being required.

A SIF designer will have to consider a wider range of issues and more advanced techniques to meet the client requirements. These will include:

- Selection of appropriate failure data sources for the process and environmental duty
- Interpretation of manufacturer's certificates
- Using redundant or diverse measurements (1oo2, 2oo3...)
- Common cause / common mode failures (λ factor)
- Use of internal or external diagnostics to reduce the failure rate (diagnostic coverage)
- Action on the detection of failures
- Spurious trip rate requirements
- Use of certified devices with high Safe Failure Fraction (SFF) to reduce HFT requirements
- Partial stroke testing of final elements
- Test coverage

While the application of these advanced design strategies can be complicated, it is quite easy to make the 'numbers' fit the desired result. ABB Consulting have detailed knowledge of all these issues and have sensibly applied them to create IEC 61511 compliant and justifiable designs for clients across all process chemical sectors.

ABB creates SIF designs in their commercially available TRAC software tool. TRAC was developed in conjunction with industry and provides an efficient and consistent methodology for demonstrating that the target SIL and safety requirements have been achieved.

Benefits

- Full and pragmatic SRS' for new and legacy systems
- Provides the required level of risk reduction while minimising installation and maintenance costs
- Reducing production interruption for proof tests
- Meeting regulatory expectations
- Demonstration that required risk reduction is being achieved by the design

Why ABB?

ABB is frequently selected to provide SIF designs for a wide range of companies because:

- We have competent, TÜV certified safety specialists with wide experience across a number of industries and types of processes
- We are leading process safety consultants who regularly contribute to industry journals and conferences
- We run a variety of training activities across the safety lifecycle, including a 2-day SIL design course and the TÜV certified functional safety engineer programme
- Our consultants' mix of operational experience and theoretical knowledge enable workable and justifiable designs to be created for complex situations

