



THE 61508 ASSOCIATION
Guidance in Compliance

An Introduction to the Maintenance and Proof Testing of Safety Instrumented Systems (SIS)

Guidance for end user companies with
respect to BS EN 61508 and its associated
standards

First of a Series of Presentations



Purpose of this document

1. To highlight the requirements and responsibilities of end user companies for SIS maintenance.
2. Increase the understanding, whilst emphasising the importance of maintenance, proof testing and how they comprise key parts of process safety.
3. Target audience are process sector companies with Safety Instrumented Functions (SIF's) trying to understand what are their maintenance responsibilities.

An Analogy



<p>An M.O.T. is a mandatory legal requirement and applies to everyone in the UK (no exceptions)</p>	<p>A proof test of a SIF is a mandatory requirement of IEC61511 and IEC61508</p>
<p>An M.O.T. has its frequency mandated as every year.</p>	<p>A proof test has its frequency set by the designer of the SIF and mandated.</p>
<p>An M.O.T. has its basic content and test requirement mandated but since every car is different the designer also has a part to play knowing that the M.O.T. is required.</p>	<p>A proof test has its basic content and test requirement mandated but since every SIF is different the designer also has a part to play knowing that the proof test is required.</p>
<p>Every car is different and designed differently even though the M.O.T. is a mandatory legal requirement in the UK.</p>	<p>Every SIF is different and designed differently even though the proof test is a mandatory requirement of IEC61511</p>
<p>If you are late getting an M.O.T. completed and recorded then the matter is taken very seriously</p>	<p>If you are late getting a proof test completed and recorded then the matter is taken very seriously</p>

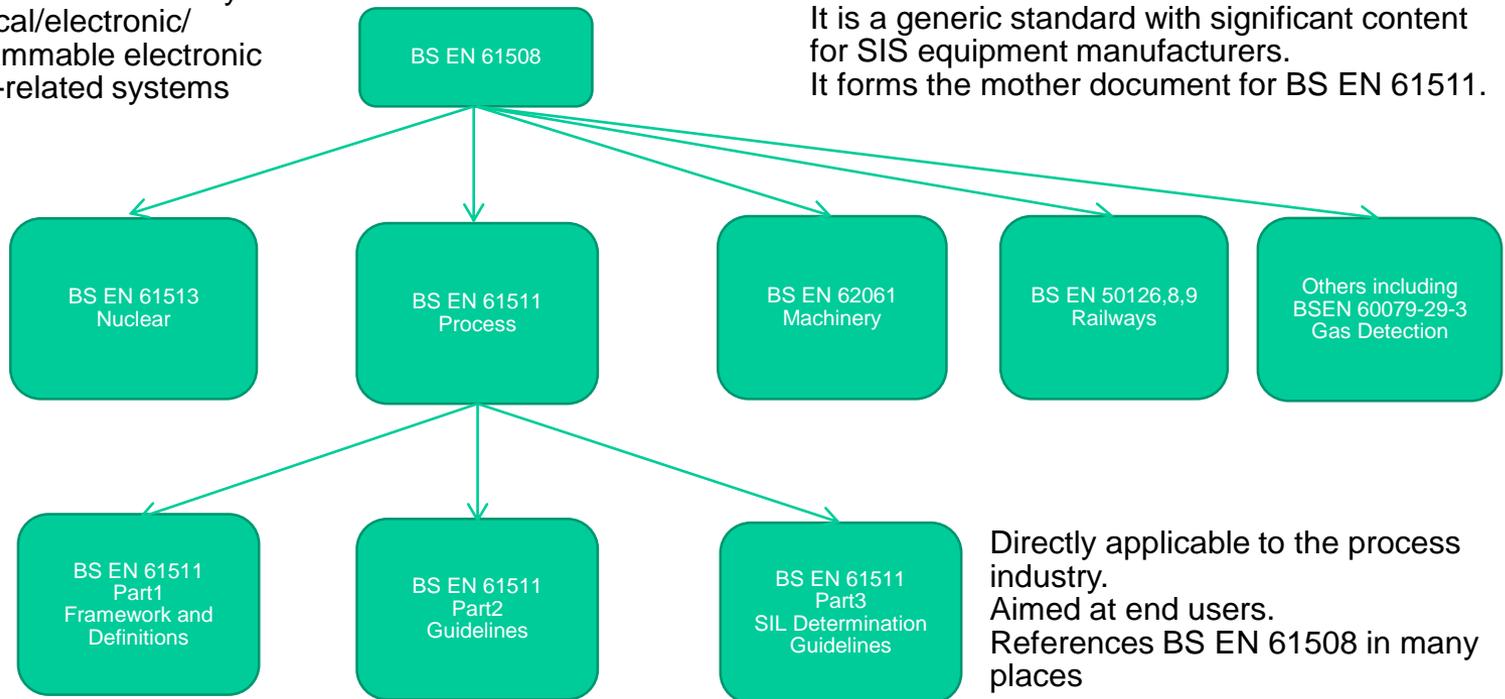
A car also needs to be maintained to ensure that it will pass its MOT. This is the same for a SIF, it needs maintaining to ensure it operates correctly so it will pass its proof test.



BS EN 61508 and its “Children”

Title:- Functional safety of
electrical/electronic/
programmable electronic
safety-related systems

It is a generic standard with significant content
for SIS equipment manufacturers.
It forms the mother document for BS EN 61511.



Directly applicable to the process
industry.
Aimed at end users.
References BS EN 61508 in many
places

Title:- Functional safety – Safety Instrumented
systems for the process industry sector



Objective of BS EN 61511 Clause 16. SIS Operation and Maintenance

- To ensure that the required Safety Integrity Level (SIL) of each safety instrumented function is maintained during operation and maintenance.
- To operate and maintain the SIS so that the designed functional safety is maintained.



Why do we maintain?

- To ensure that employees, public and the environment remain protected from harm
- To prevent damage to business assets and reputation
- Ensure the demand rate does not change with time (due to deterioration of other layers of protection)
- Protection of the investment in the SIS itself.
- Lastly – to comply with the standard.



Why do we Proof Test ?

- To ensure that employees, public and the environment remain protected from harm
- To prevent damage to business assets and reputation
- Periodic testing to discover hidden faults
- Lastly – to comply with the standard.



Where is maintenance and Proof testing needed ?

- On any process plant that has SIS's installed to protect people, assets and the environment.
- For operating companies with process plants that want to comply with BS EN 61511.



When should maintenance be done?

- Throughout the operational phase of the lifecycle in accordance with defined maintenance schedules.
- It consists of two types
 - Preventative – Planned refurbishment of Sensors, Final Elements – don't forget the Logic Solver .
 - Reactive – Repair, or like for like replacement.



When should proof testing be done?

- After commissioning as part of a validation test
- Part of schedule periodic testing
- After any maintenance
- Prior to planned preventative maintenance *(This is not a requirement of the standard but is a tip for good practice to ensure that it is known any failure that may be repaired by the maintenance is discovered)*



What activities comprise Maintenance and Proof testing

Maintenance

- Maintenance of Hardware and supporting systems
- Visual inspection
- Calibration of Sensors
- Service of valves
- Don't forget the logic solver

Proof Testing

- Complete system Functional testing
- Partial testing
- End to End testing
- Calibration check of Sensors

Competence

(A definition)

For a person to be competent, they need qualifications, experience, and qualities **appropriate to their duties**.

These include such training as would ensure acquisition of the necessary knowledge of the tasks that they are required to perform

- adequate knowledge of the hazards and failures of the equipment for which they are responsible
- knowledge and understanding of the working practices used in the organisation for which they work
- the ability to communicate effectively with their peers, with any staff working under their supervision, and with their supervisors
- an appreciation of their own limitations and constraints, whether of knowledge, experience, facilities, resources, etc., and a willingness to point these out.

Who should undertake testing. (Things to consider)

Competence - Is everyone competent?

- Installation contractors
 - How do you know that the SIF is installed correctly
- Validation test engineers
 - Are they competent and trained on the SIS
- Maintenance Technicians
 - Can you prove they are competent
- Operators
 - End to End proof tests, Demand and fault reporting
- Equipment Service Providers
 - Have you audited them, do they understand your system.
- Maintainers of other plant systems
 - ATEX Inspections (Induced faults and conflicts)



How to undertake maintenance and testing

- Schedule & Planning (Plan)
 - For Preventative Maintenance and Proof testing
 - Manual scheduling can suffice
 - Computerised Maintenance Management Systems (CMMS) if available
 - Plan for reactive maintenance
 - Spares holdings (Are they actually like for like)
 - Mean time to restore (MTTR)
 - Conflicting testing regimes (eg ATEX)
- Maintenance and proof test procedures (Do)
 - Written instruction for maintenance **and** proof tests
 - Involve end user (Techs/Ops) in preparation of procedures
 - Critical tasks – Independent checks for selected activities
- Checking and recording (Check)
 - Fault reporting during operation and at proof test
 - Test results recording and analysis (must be reviewed)
- Auditing (Review)
 - Auditing plan
 - Is all the above still working and achievable

Who is responsible ?

Clause 5.2.2 of IEC61511 states that:

Persons, departments, organisations or other units which are responsible for carrying out and reviewing each of the SIS safety life-cycle phases **shall** be identified and be informed of the responsibilities assigned to them.

Persons, departments, organisations involved in the SIS safety life-cycle activities **shall** be competent to carry out the activities for which they are accountable.

In essence this means that if you are involved in any SIS activity then **YOU** are responsible for your activities.

In the UK, the system owner would be considered to have overall responsibility and would assign to different parties their responsibility according to safety planning, management, and national regulations.



Further Reading

- The 61508 Maintenance Engineers Hymn Sheet
- Principles for proof testing of safety instrumented systems in the chemical industry – ABB
- HSE document SPC/Technical/General/48 (Proof testing of Safety Instrumented Systems in the on shore Chemical/Specialist Industry).
- HSE Document SPC/Technical/General/51 (Management of instrument systems providing safety functions of low/Undefined safety integrity).