ISO 26262 compliance

Addressing the compliance complexity of safety-relevant E/E systems.

White paper

Abstract

An increasing number of high profile recalls have proved that even industry leaders in automotive technology are not immune to functional safety issues. ISO 26262 provides an automotive safety lifecycle that covers management, development, production, operation, service and decommissioning. Automotive Original Equipment Manufacturers (OEMs) and their suppliers risk losing their competitive advantage if they fail to implement the requirements of ISO 26262. They also often approach functional safety as an afterthought following product development, rather than as an integral part of the design process, spending millions of dollars rectifying issues, rather than avoiding them from the start.

This whitepaper gives an overview of how the automotive industry can address this challenge to help minimise the risks of product liability and ensure continued profitability.

Introduction

ISO 26262 was published in 2011 to address the increasing complexity of safety-relevant electrical and electronic systems, and is now recognised as the state-of-the-art functional safety requirement. The standard covers safety-related systems that are installed in series production passenger cars, and include one or more electrical and/or electronic (E/E) system.

While ISO 26262 is a complex standard, it will help OEMs to improve the safety of their product, minimise risks of product liability and help them remain competitive.

The ISO 26262 framework deals with product related requirements that define properties which can be observed as specific safety-features in the final product, as well as process related requirements that reduce the probability of systematic faults (but cannot directly be observed as a feature of the product).

Following a number of functional safety related issues that have put lives at risk and cost the industry dear, few automotive OEMs and suppliers will dispute the importance of the standard. However, while the necessity to improve functional safety in the automotive industry has become widely accepted, many will agree ISO 26262 is a challenging standard to interpret and implement due to its complexity and the lack of functional safety experts within the industry.

While ISO 26262 is a complex standard, it will help OEMs to improve the safety of their product, minimise risks of product liability and help them remain competitive. It will also enhance a business's reputation as a premium quality manufacturer with a commitment to safety, thereby improving attractiveness to both consumer and corporate customers.

ISO 26262 contains 10 sections, which provide a system of stages to manage the development process:

THE 10 SECTIONS OF ISO 26262:

1. Vocabulary – a glossary of terms and abbreviations for application across all parts of the standard
2. Management of functional safety – outlines organisational aspects of functional safety management
3. Concept phase – a risk evaluation and safety concept
4. Product development at the system level – safety aspects of the system development
5. Product development at the hardware level – safety aspects of hardware development
6. Product development at the software Level – safety aspects of software development
7. Production and operation – safety aspects after Start of Production (SOP)
8. Supporting processes – quality ensuring processes
9. ASIL-oriented and safety oriented analyses – safety analysis
10. Guidelines on ISO 26262

Overview of ISO 26262

- Provides an automotive safety lifecycle (management, development, production, operation, service, decommissioning) and supports tailoring the necessary activities during these lifecycle phases.
- Provides an automotive specific risk-based approach for determining risk classes (Automotive Safety Integrity Levels, ASILs).
- Uses ASILs for specifying the item's necessary safety requirements for achieving an acceptable residual risk.
- Provides requirements for validation, verification and confirmation measures to ensure a sufficient and acceptable level of safety being achieved.

Figure 1 shows a useful diagrammatic representation of the various elements required to achieve compliance.

While it is not demanded by the standard, it would be best practice to initially perform a gap analysis. This is an assessment of your existing processes and products against the requirements of the standard.

Typically the process involves the internal and independent third-party functional safety experts investigating key issues of the development process and/or technical product or system. These processes are outlined within ISO 26262 and include documentation, management processes, technical functions and risk analysis. In TÜV SÜD's experience, this can usually be accomplished over a week long workshop.

Stages within the ISO 26262 safety life cycle identify and assess hazards (safety risks), establish specific safety requirements to reduce those risks to acceptable levels, and manage and track those safety requirements.

The definition of the item is the first of these stages, which means identifying when it is necessary to achieve functional safety and what the required safety functions are. A risk assessment process, carried out according to accepted principles of risk assessment, is the best way of achieving this. This approach, for example, defines which actions of a product are defined as safety-relevant and which are not safety-relevant.

A safety goal can then be determined for every hazard identified. For example if one of the safety requirements identified is an airbag, a potential hazard may be the airbag initiating unintentionally and the safety goal would be to prevent this.

The result of the risk assessment is the Automotive Safety Integrity Level (ASIL), which is a measure of the potential risk and determines the activities and methods required to address the risk in an appropriate manner.The ASIL is defined by the level of risk based on a combination of the probability of exposure, the possible controllability by a driver, and the possible severity if a critical event occurs.

The ASIL is defined in four steps, from ASIL A (the lowest amount of risk reduction) to ASIL D (the highest amount of risk reduction), with the standard detailing the minimum requirements according to the assigned ASIL. This is a key component for ISO 26262 compliance, as the ASIL, and therefore the hazard level, is determined at the beginning of the development process, and the intended functions of the safety system are then analysed with respect to those possible hazards (Figure 2).

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FIGURE 1: OVERVIEW OF THE STRUCTURE OF ISO 26262

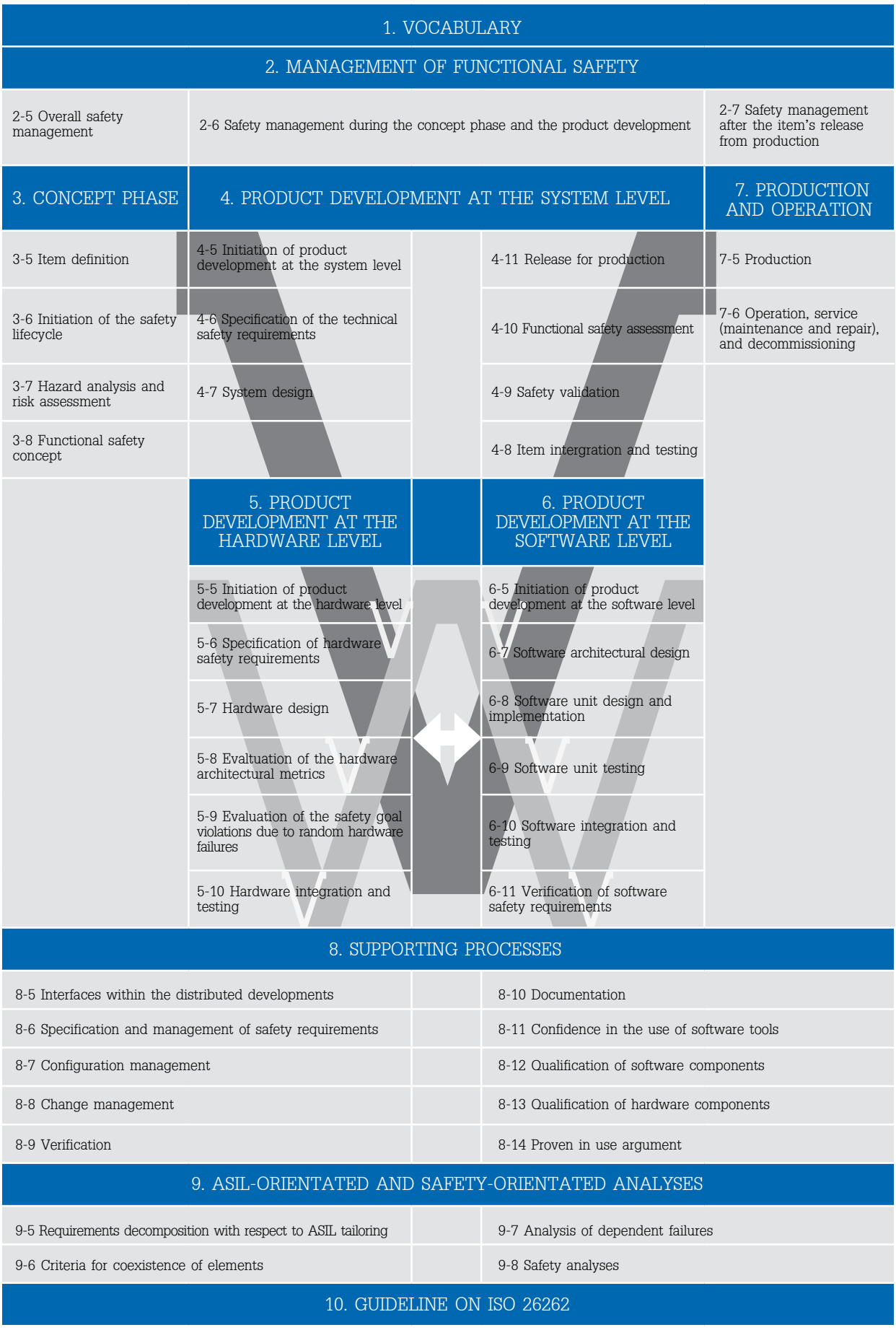
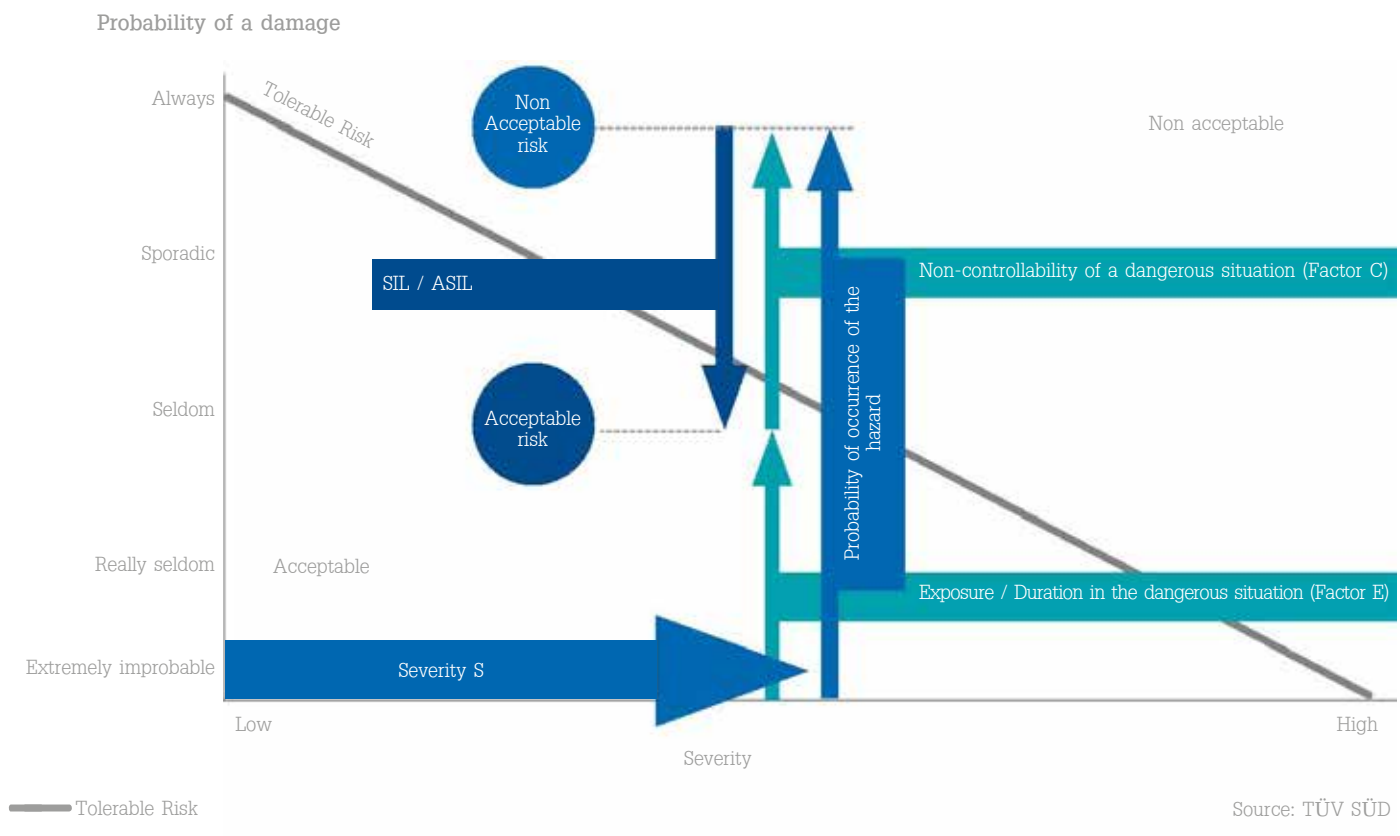


FIGURE 2: APPROACH TO HAZARD ANALYSIS



The next stage is to ensure that the defined safety requirement performs as its design intended, which must include accounting for failures of the underlying hardware and the prevention of systematic faults. The identified safety goals, which define the safety requirements, must also be implemented as specified by the appropriate ASIL, with suitable processes and methods implemented.

This is achieved by defining a functional safety concept, with the technical aspects detailed in a technical safety concept, together with a safety design (or safety architecture), that determines the hardware and software safety requirements. Using the airbag example, a safety architecture could be defined that stops the airbag inflating unintentionally, but ensures it protects the driver in a crash.

It is also necessary to formulate a plan that closes any conformity gaps. Should, for example, the hardware layout of a safety relevant electronic system leave a high risk of malfunction when there is a short circuit, the plan would outline how the layout (design) needs to be changed to prevent this. It would also describe how the design will be technically modified, the still safe interaction of the modification with other systems and the supporting documentation required. This will ensure all activity is documented correctly so, if there is an incident, it can be re-assessed at a later date. This is also required even if no change to the layout or concept was necessary. It is crucial for such measures to be taken early in the process as changes become more costly and time-consuming in later stages.

Verification that the system meets the assigned ASIL is also a vital stage. This is achieved by a specialist, either in-house or

a qualified third-party, running appropriate tests and analysis to determine the safety function's mean time between failures.

Many that have experienced the implementation of ISO 26262 fully understand the value of obtaining an external assessment, as well as certification. This final step involves attaining a technical report or certificate from an independent assessor as a proof of conformity to the latest standard. For example, TV SD provides testing based on your development documentation and on-site assessments. The result is a technical report that evaluates your systems, hardware, software and tools, which is especially important for suppliers as leading automotive manufacturers in markets such as France, Germany, Japan, Korea and the United States will often only accept reports or certificates endorsed by reputable third parties.

Staff competence

While ISO 26262 sets out the complex 'functional' steps that must be taken towards compliance, you must first ensure that your business has the expertise required to understand how ISO 26262 relates to your products and, if required, how to implement any changes towards conformity. This can either be achieved through training existing staff, hiring functional safety specialists to become part of your staff, or outsourcing the work to an independent third-party.

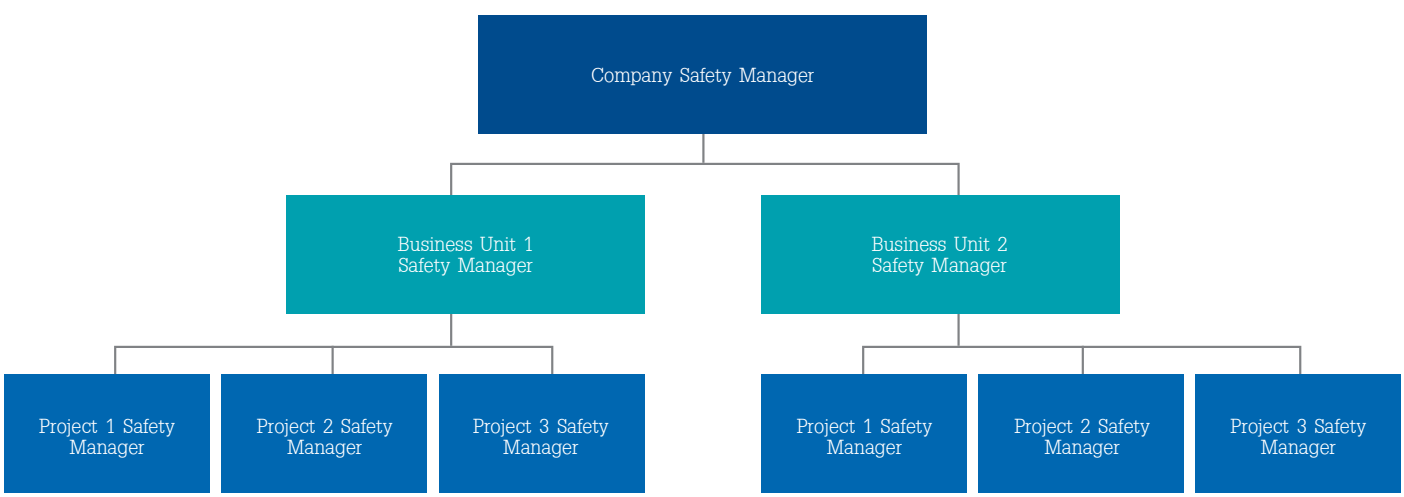
It is vital that relevant staff fully understand the content of ISO 26262, the required documentation and the key issues in each of its ten sections.

Within larger organisations there are often three key task personnel profiles that could support successful functional safety management within the organisation:

1. Company Safety Manager
2. Business Unit Safety Manager
3. Project Safety Manager - the only role required by the standard

This hierarchy is shown in Figure 3.

FIGURE 3: THREE KEY TASK PROFILES FOR SUCCESSFUL FUNCTIONAL SAFETY MANAGEMENT



Source: TÜV SÜD

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The Company Safety Manager is the custodian of an organisation's safety culture, ensuring consistent communication amongst all staff, the company's management team and external service providers. They are also responsible for the further development of functional safety within the business, ensuring that company specific guidelines and staff training are updated according to compliance changes.

They should also instigate regular audits of departments to ensure consistent compliance with company-wide guidelines for functional safety, including regular adjustment meetings with the safety managers of each separate business unit.

The Business Unit Safety Manager is not a role specified within the standard, but is common within larger organisations. They are the central point of contact within the business unit for all questions relating to functional safety, and should also be responsible for the maintenance of basic data and ensure the appropriate training of staff.

The Project Safety Manager is the most important role, and the only one that is required by the standard. They work with the Business Unit Safety Manager to coordinate specific functional safety projects. The Project Safety Manager typically has the responsibility for the creation and maintenance of a project safety plan, which includes the execution of assessments, the application of measures to avoid systematic faults, as well as the execution of verification and validation measures. They also have responsibility for the coordination of all internal and external interfaces (business units, suppliers, customers etc.).

Creating a culture of functional safety

Achieving functional safety requires more than just an understanding of the technical requirements of ISO 26262. For successful implementation there must be a culture where employees at all levels 'live and breathe' its mantra.

Functional safety is an extension of quality management that can only work if all employees adhere to high standards.

For example, a major safety issue can be caused if just one out of the hundreds of engineers involved in the development process misses an activity or uses the wrong method.

To help OEMs and suppliers achieve this cultural consistency, appropriate management processes must be in place, including the strict execution of safety rules and tools.

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Conclusion

While ISO 26262 is complex, it is imperative for OEMs and suppliers as it helps them to improve product safety and minimise liability risks. However, not only does ISO 26262 help to ensure vehicles, systems and components are safe, it will also enhance your reputation as a premium quality OEM or supplier, improving the appeal of your products and helping you to remain competitive.

TÜV SÜD has a global network of automotive functional safety experts with extensive industry experience who are ready to support your business with ISO 26262 activities. As an internationally accredited ISO 26262 testing body, TÜV SÜD is one of the world's leading experts on functional safety and a founding participant in the establishment of the ISO 26262 standard. We can provide a comprehensive range of knowledge services, functional safety assessment, testing, certification and training services throughout the entire automotive value chain.

Find out more about TÜV SÜD's automotive solutions:

www.tuv-sud.com/automotive