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Road vehicles — Functional safety —

Part 12: Adaptation of ISO 26262 for motorcycles

Véhicules routiers — Sécurité fonctionnelle —

Partie 12: Adaptation de l'ISO 26262 pour les motocycles

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

A list of all parts in the ISO 26262 series can be found on the ISO website.

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Introduction

The ISO 26262 series of standards is the adaptation of IEC 61508 series of standards to address the sector specific needs of electrical and/or electronic (E/E) systems within road vehicles.

This adaptation applies to all activities during the safety lifecycle of safety-related systems comprised of electrical, electronic and software components.

Safety is one of the key issues in the development of road vehicles. Development and integration of automotive functionalities strengthen the need for functional safety and the need to provide evidence that functional safety objectives are satisfied.

With the trend of increasing technological complexity, software content and mechatronic implementation, there are increasing risks from systematic failures and random hardware failures, these being considered within the scope of functional safety. ISO 26262 series of standards includes guidance to mitigate these risks by providing appropriate requirements and processes.

To achieve functional safety, the ISO 26262 series of standards:

a) provides a reference for the automotive safety lifecycle and supports the tailoring of the activities to be performed during the lifecycle phases, i.e., development, production, operation, service and decommissioning;

b) provides an automotive-specific risk-based approach to determine integrity levels [Automotive Safety Integrity Levels (ASILs)];

c) uses ASILs to specify which of the requirements of ISO 26262 are applicable to avoid unreasonable residual risk;

d) provides requirements for functional safety management, design, implementation, verification, validation and confirmation measures; and

e) provides requirements for relations between customers and suppliers.

The ISO 26262 series of standards is concerned with functional safety of E/E systems that is achieved through safety measures including safety mechanisms. It also provides a framework within which safety-related systems based on other technologies (e.g. mechanical, hydraulic and pneumatic) can be considered.

The achievement of functional safety is influenced by the development process (including such activities as requirements specification, design, implementation, integration, verification, validation and configuration), the production and service processes and the management processes.

Safety is intertwined with common function-oriented and quality-oriented activities and work products. The ISO 26262 series of standards addresses the safety-related aspects of these activities and work products.

Figure 1 shows the overall structure of the ISO 26262 series of standards. The ISO 26262 series of standards is based upon a V-model as a reference process model for the different phases of product development. Within the figure:

— the shaded “V”s represent the interconnection among ISO 26262-3, ISO 26262-4, ISO 26262-5, ISO 26262-6 and ISO 26262-7;

— for motorcycles:

  — ISO 26262-12:2018, Clause 8 supports ISO 26262-3;

  — ISO 26262-12:2018, Clauses 9 and 10 support ISO 26262-4;

— the specific clauses are indicated in the following manner: “m-n”, where “m” represents the number of the particular part and “n” indicates the number of the clause within that part.

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EXAMPLE "2-6" represents ISO 26262-2:2018, Clause 6.

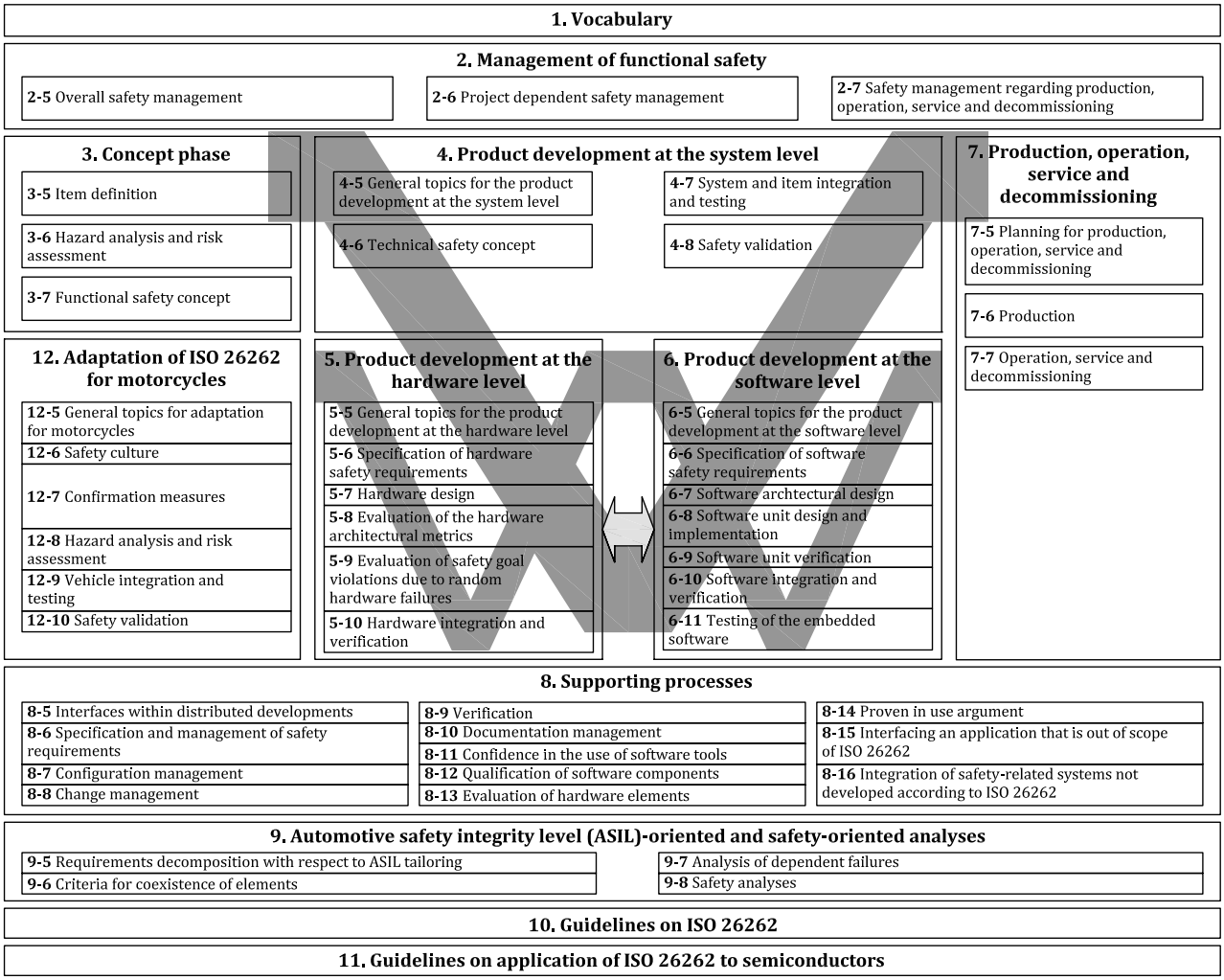

Figure 1 — Overview of the ISO 26262 series of standards

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Road vehicles — Functional safety —

Part 12: Adaptation of ISO 26262 for motorcycles

1 Scope

This document is intended to be applied to safety-related systems that include one or more electrical and/or electronic (E/E) systems and that are installed in series production road vehicles, excluding mopeds. This document does not address unique E/E systems in special vehicles such as E/E systems designed for drivers with disabilities.

NOTE Other dedicated application-specific safety standards exist and can complement the ISO 26262 series of standards or vice versa.

Systems and their components released for production, or systems and their components already under development prior to the publication date of this document, are exempted from the scope of this edition. This document addresses alterations to existing systems and their components released for production prior to the publication of this document by tailoring the safety lifecycle depending on the alteration. This document addresses integration of existing systems not developed according to this document and systems developed according to this document by tailoring the safety lifecycle.

This document addresses possible hazards caused by malfunctioning behaviour of safety-related E/E systems, including interaction of these systems. It does not address hazards related to electric shock, fire, smoke, heat, radiation, toxicity, flammability, reactivity, corrosion, release of energy and similar hazards, unless directly caused by malfunctioning behaviour of safety-related E/E systems.

This document describes a framework for functional safety to assist the development of safety-related E/E systems. This framework is intended to be used to integrate functional safety activities into a company-specific development framework. Some requirements have a clear technical focus to implement functional safety into a product; others address the development process and can therefore be seen as process requirements in order to demonstrate the capability of an organization with respect to functional safety.

This document does not address the nominal performance of E/E systems.

This document specifies the requirements for adaptation for motorcycles, including the following:

— general topics for adaptation for motorcycles;

— safety culture;

— confirmation measures;

— hazard analysis and risk assessment;

— vehicle integration and testing; and

— safety validation.

Annex A provides an overview on objectives, prerequisites and work products of this document.

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 26262-1, *Road vehicles — Functional safety — Part 1: Vocabulary*

ISO 26262-2:2018, *Road vehicles — Functional safety — Part 2: Management of functional safety*

ISO 26262-3:2018, *Road vehicles — Functional safety — Part 3: Concept phase*

ISO 26262-4:2018, *Road vehicles — Functional safety — Part 4: Product development at the system level*

ISO 26262-5:2018, *Road vehicles — Functional safety — Part 5: Product development at the hardware level*

ISO 26262-6:2018, *Road vehicles — Functional safety — Part 6: Product development at the software level*

ISO 26262-7:2018, *Road vehicles — Functional safety — Part 7: Production, operation, service and decommissioning*

ISO 26262-8:2018, *Road vehicles — Functional safety — Part 8: Supporting processes*

ISO 26262-9:2018, *Road vehicles — Functional safety — Part 9: Automotive Safety Integrity Level (ASIL)-oriented and safety-oriented analyses*

3 Terms and definitions

For the purposes of this document, the terms, definitions and abbreviated terms given in ISO 26262-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

4 Requirements for compliance

4.1 Purpose

This clause describes how:

a) to achieve compliance with the ISO 26262 series of standards;

b) to interpret the tables used in the ISO 26262 series of standards; and

c) to interpret the applicability of each clause, depending on the relevant ASIL(s).

4.2 General requirements

When claiming compliance with the ISO 26262 series of standards, each requirement shall be met, unless one of the following applies:

a) tailoring of the safety activities in accordance with ISO 26262-2 has been performed that shows that the requirement does not apply; or

b) a rationale is available that the non-compliance is acceptable and the rationale has been evaluated in accordance with ISO 26262-2.

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Informative content, including notes and examples, is only for guidance in understanding, or for clarification of the associated requirement, and shall not be interpreted as a requirement itself or as complete or exhaustive.

The results of safety activities are given as work products. "Prerequisites" are information which shall be available as work products of a previous phase. Given that certain requirements of a clause are ASIL-dependent or may be tailored, certain work products may not be needed as prerequisites.

"Further supporting information" is information that can be considered, but which in some cases is not required by the ISO 26262 series of standards as a work product of a previous phase and which may be made available by external sources that are different from the persons or organizations responsible for the functional safety activities.

4.3 Interpretations of tables

Tables are normative or informative depending on their context. The different methods listed in a table contribute to the level of confidence in achieving compliance with the corresponding requirement. Each method in a table is either:

a) a consecutive entry (marked by a sequence number in the leftmost column, e.g. 1, 2, 3), or

b) an alternative entry (marked by a number followed by a letter in the leftmost column, e.g. 2a, 2b, 2c).

For consecutive entries, all listed highly recommended and recommended methods in accordance with the ASIL apply. It is allowed to substitute a highly recommended or recommended method by others not listed in the table, in this case, a rationale shall be given describing why these comply with the corresponding requirement. If a rationale can be given to comply with the corresponding requirement without choosing all entries, a further rationale for omitted methods is not necessary.

For alternative entries, an appropriate combination of methods shall be applied in accordance with the ASIL indicated, independent of whether they are listed in the table or not. If methods are listed with different degrees of recommendation for an ASIL, the methods with the higher recommendation should be preferred. A rationale shall be given that the selected combination of methods or even a selected single method complies with the corresponding requirement.

NOTE A rationale based on the methods listed in the table is sufficient. However, this does not imply a bias for or against methods not listed in the table.

For each method, the degree of recommendation to use the corresponding method depends on the ASIL and is categorized as follows:

— "++" indicates that the method is highly recommended for the identified ASIL;

— "+" indicates that the method is recommended for the identified ASIL; and

— "o" indicates that the method has no recommendation for or against its usage for the identified ASIL.

4.4 ASIL-dependent requirements and recommendations

The requirements or recommendations of each sub-clause shall be met for ASIL A, B, C and D, if not stated otherwise. These requirements and recommendations refer to the ASIL of the safety goal. If ASIL decomposition has been performed at an earlier stage of development, in accordance with ISO 26262-9:2018, Clause 5, the ASIL resulting from the decomposition shall be met.

If an ASIL is given in parentheses in the ISO 26262 series of standards, the corresponding sub-clause shall be considered as a recommendation rather than a requirement for this ASIL. This has no link with the parenthesis notation related to ASIL decomposition.

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4.5 Adaptation for motorcycles

For items or elements of motorcycles for which requirements of this document are applicable, the requirements of this document supersede the corresponding requirements in other parts.

4.6 Adaptation for trucks, buses, trailers and semi-trailers

Content that is intended to be unique for trucks, buses, trailers and semi-trailers (T&B) is indicated as such.

5 General topics for adaptation for motorcycles

5.1 Objectives

The objective of this clause is to give an overview of the adaptation of the ISO 26262 series of standards for motorcycles.

5.2 General

In order for E/E systems on motorcycles to comply with the ISO 26262 series of standards, all of the requirements of ISO 26262-2 through ISO 26262-9 shall be met. However, as described in 4.5, some requirements may require a degree of tailoring in order to apply to motorcycles. In such cases, these tailored requirements supersede the corresponding requirements of the ISO 26262 series of standards.

The specific requirements for motorcycles described in this document correspond to requirements of ISO 26262-2:2018, 5.4.2, requirements in ISO 26262-2:2018, 6.4.9, requirements in ISO 26262-3:2018, Clause 6, ISO 26262-3:2018, Annex B, requirements in ISO 26262-4:2018, 7.4.4, and requirement in ISO 26262-4:2018, Clause 8.

NOTE The following definitions and abbreviations are specific for motorcycles and are used in this document. These are described in ISO 26262-1:

— expert rider;

— motorcycle;

— Motorcycle Safety Integrity Level (MSIL); and

— Controllability Classification Panel (CCP).

Annex A provides the overview of and work flow for motorcycles to implement ISO 26262-2:2018, ISO 26262-3:2018 and ISO 26262-4:2018.

Annex B gives a general explanation of the hazard analysis and risk assessment.

Annex C provides examples of controllability evaluation techniques considering motorcycle dynamics in the context of conventional product development.

Figure 2 shows the relation of this document and the other parts of ISO 26262.

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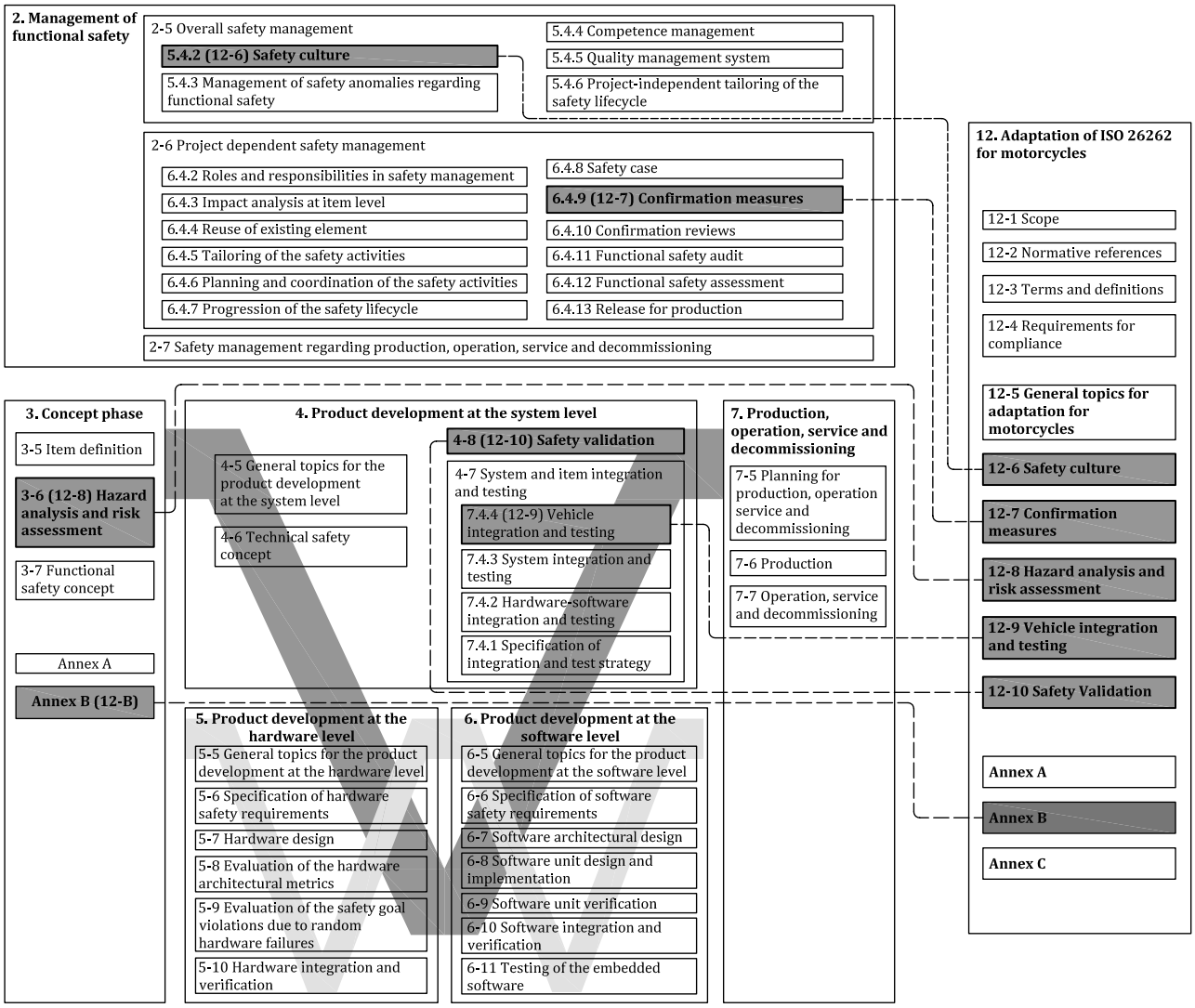

Figure 2 — Overview of this document and the relation to the other parts

6 Safety culture

6.1 Objective

To provide a tailoring of ISO 26262-2:2018, 5.4.2 for motorcycles.

6.2 Requirements and recommendations

6.2.1 The organization shall create, foster, and sustain a safety culture that supports and encourages the effective achievement of functional safety for motorcycles.

NOTE ISO 26262-2:2018, Annex B provides more details of what can constitute a safety culture.

6.2.2 The organization shall institute, execute and maintain organization-specific rules and processes to achieve and maintain functional safety and to comply with the requirements of the ISO 26262 series of standards.

NOTE Such organization-specific rules and processes can include the creation and maintenance of generic plans (e.g. a generic safety plan) or generic process descriptions.

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6.2.3 The organization shall institute and maintain effective communication channels between functional safety, cybersecurity, and other potentially interacting disciplines that are related to the achievement of functional safety, if applicable.

EXAMPLE 1 Communication channels between functional safety and cybersecurity in order to exchange relevant information (e.g. in the case it is identified that a cybersecurity issue might violate a safety goal or a safety requirement, or in the case a cybersecurity requirement might compete with a safety requirement).

EXAMPLE 2 Communication channels between functional safety and quality.

NOTE Guidance on potential interaction of functional safety with cybersecurity is given in ISO 26262-2:2018, Annex E.

6.2.4 During the execution of the safety lifecycle, the organization shall perform the required safety activities, including the creation and management of the associated documentation in accordance with ISO 26262-8:2018, Clause 10.

6.2.5 The organization shall provide the resources required for the achievement of functional safety.

NOTE Resources include human resources, tools, databases, guidelines and work instructions.

6.2.6 The organization shall institute, execute and maintain a continuous improvement process, based on:

— learning from the experiences gained during the execution of the safety lifecycle of other items, including field experience; and

— derived improvements for application on subsequent items.

6.2.7 The organization shall ensure that the persons responsible for achieving or maintaining functional safety, or for performing or supporting the safety activities, are given sufficient authority to fulfil their responsibilities.

7 Confirmation measures

7.1 Objective

The objective of this clause is to define the independency requirements of confirmation measures associated with ASIL.

7.2 Requirements and recommendations

7.2.1 The functional safety of the item and its elements shall be confirmed, based on:

a) confirmation reviews to judge whether the key work products, i.e. those included in Table 1, provide sufficient and convincing evidence of their contribution to the achievement of functional safety, considering the corresponding objectives and requirements of the ISO 26262 series of standards, in accordance with Table 1 and ISO 26262-2:2018, 6.4.10;

NOTE 1 For motorcycles, Table 1 of this document replaces ISO 26262-2:2018, Table 1.

NOTE 2 The confirmation reviews are performed for those work products that are specified in Table 1 and required by the safety plan.

b) a functional safety audit to judge the implementation of the processes required for functional safety, in accordance with Table 1 and ISO 26262-2:2018, 6.4.11; and

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NOTE 3 The reference processes required for functional safety are defined in the ISO 26262 series of standards. The processes pertaining to an item or element are defined through the activities referenced or specified in the safety plan.

c) a functional safety assessment to judge the achieved functional safety of the item, or the contribution to the achievement of functional safety by the developed elements, in accordance with Table 1 and ISO 26262-2:2018, 6.4.12.

NOTE 4 The aim of the independence defined in Table 1 is to ensure an objective, unbiased viewpoint and to avoid conflict of interest. The use of the term independence in this document relates to organizational independence.

NOTE 5 Guidance for the confirmation measure is given in ISO 26262-2:2018, Annex C.

NOTE 6 A report that is a result of a confirmation measure includes the name and revision number of the work products or process documents analysed (see ISO 26262-8:2018, Clause 10).

NOTE 7 If the item changes subsequent to the completion of confirmation measures, then the pertinent confirmation measures will be repeated or supplemented (see ISO 26262-8:2018, 8.4.5.2).

NOTE 8 Confirmation measures such as confirmation reviews and functional safety audits can be merged and combined with the functional safety assessment to support the handling of comparable variants of an item.

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Table 1 — Required confirmation measures, including the required level of independence

Confirmation measures	Level of independence[a] applies to				Scope
	QM	ASIL A	ASIL B	ASIL C	
Confirmation review of the impact analysis at item level (see ISO 26262-2:2018, 6.5.1) Independence with regard to those creating the work product	I3	I3	I3	I3	Judgement of whether the impact analysis in accordance with ISO 26262-2:2018, 6.4.3 correctly identified the item as being a new item, a modification of an existing item or an existing item with a modified environment. Judgement of whether the impact analysis in accordance with ISO 26262-2:2018, 6.4.3 adequately identified the implications on functional safety caused by the modification(s); and the safety activities to be performed.
Confirmation review of the hazard analysis and risk assessment (see Clause 8) Independence with regard to those creating the work product	I3	I3	I3	I3	Judgement of whether the selection of the operational situations pertinent to the hazardous events and the definitions of the hazardous events are appropriate. Judgement of whether the determined ASILs, quality management ("QM") ratings of the identified hazardous events for the item and the parameters resulting in no ASIL e.g. C0/S0/E0 are correct. Judgement of whether the specified safety goals cover the identified hazardous events.
Confirmation review of the safety plan (see ISO 26262-2:2018, 6.5.3) Independence with regard to those creating the work product NOTE 1 A confirmation review of the safety plan includes a review of the impact analyses at element level performed due to the reuse of existing elements (see ISO 26262-2:2018, 6.5.2). NOTE 2 The safety plan includes the proven in use arguments (analysis, data and credit) of the proven in use candidates and the corresponding tailoring, if applicable (see ISO 26262-2:2018, 6.4.6 and ISO 26262-8:2018, Clause 14). NOTE 3 The safety plan includes tailoring due to the use of software tools, if applicable (see ISO 26262-2:2018, 6.4.6 and ISO 26262-8:2018, Clause 11).	—	I1	I1	I2	Applies to the highest ASIL among the safety requirements

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