

PUBLICLY
AVAILABLE
SPECIFICATION

ISO/PAS
19695

First edition
2015-12-01

Motorcycles — Functional safety

Motorcycles — Sécurité fonctionnelle

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Reference number
ISO/PAS 19695:2015(E)

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 38, *Motorcycles and mopeds*.

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Introduction

This Publicly Available Standard is the adaptation of ISO 26262:2011 (all parts) to comply with needs specific to the application sector of electrical and/or electronic (E/E) systems installed in motorcycles, and provides the partial tailoring activities of ISO 26262-2:2011, Clause 6, ISO 26262-3:2011, Clause 7, and ISO 26262-4:2011, Clauses 8 and 9.

ISO 26262:2011 (all parts) is intended to be applied to safety-related systems that include one or more E/E systems and that are installed in series production passenger cars with a maximum gross vehicle mass up to 3 500 kg. ISO 26262:2011 (all parts) does not address unique E/E systems in special purpose vehicles such as vehicles designed for drivers with disabilities.

The motorcycle industry recognizes the need to use appropriate safety-related techniques to avoid unreasonable risk resulting from random or systematic faults of E/E systems.

Many of the requirements specified in ISO 26262:2011 (all parts) are applicable for E/E systems produced for the motorcycle industry and therefore it was accepted by SC 22 (superseded to SC 38) that the E/E systems developed for motorcycles should be within the scope of ISO 26262:2011 (all parts).

However, the adoption of ISO 26262:2011 (all parts) can lead to an inappropriate estimation of motorcycle risk. Therefore, some existing ISO 26262:2011 (all parts) requirements are considered infeasible for the motorcycle industry, e.g. user test under real-life conditions.

Motorcycle Safety Integrity Level (MSIL) is the output of hazard analysis and risk assessment. This is then apportioned between the risk reduction mechanisms and measures assigned to E/E systems using Automotive Safety Integrity Level (ASIL) and the risk reduction taken care of by external measures and/or other technologies [which are outside the scope of ISO 26262:2011 (all parts) and this Publicly Available Standard].

Specifically in the motorcycle industry, a greater proportion of the overall risk reduction is generally apportioned to external measures (for example, riding rules, training/qualification of riders, personal protective equipment, e.g. helmets and infrastructure features).

The worldwide established level of technology (“state-of-the-art”) in the motorcycle industry suggests that ASIL requirements are not appropriate for motorcycles. This is addressed through the alignment between MSIL and ASIL.

It is acknowledged that product development processes and technical solutions within the motorcycle industry are inhomogeneous with those of the automobile industry; therefore, the difference between MSIL and ASIL has been made to accommodate worldwide capability.

It can be necessary to modify certain requirements, methods, and measures of ISO 26262:2011 (all parts) in order to adapt the standards’ best practices to match state-of-the-art practices for motorcycle functional safety.

Other areas of ISO 26262:2011 (all parts) which would be affected by inclusion of motorcycles within the scope of the standard have also been identified and necessary changes recommended. The content of this Publicly Available Standard requires consideration and acceptance by SC 32 in order to facilitate the inclusion of motorcycles within the scope of ISO 26262:2011 (all parts) Edition 2.

[Figure 1](#) shows the structure and relation of this Publicly Available Standard and ISO 26262:2011 (all parts).

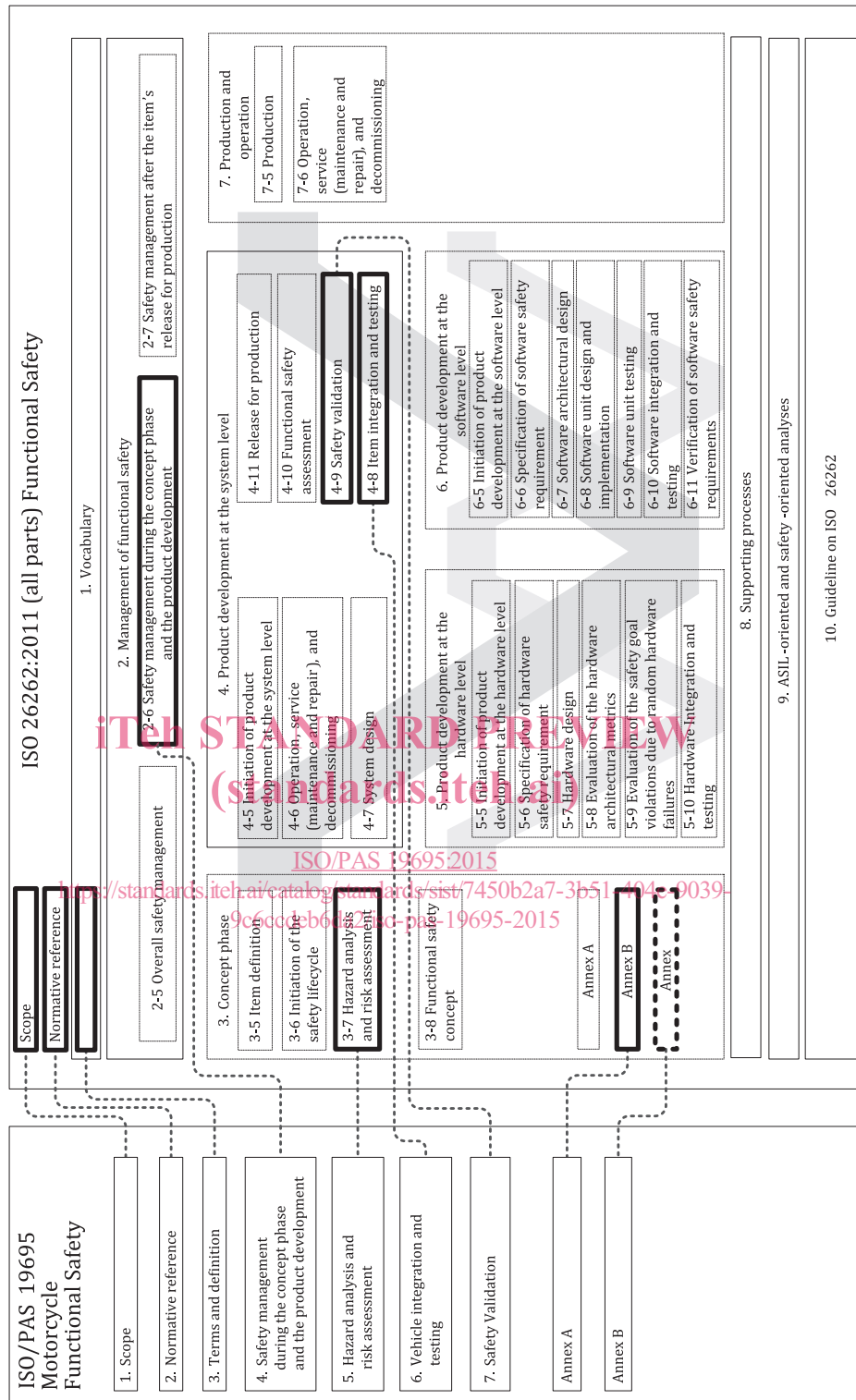


Figure 1 — Overview of this Publicly Available Standard and the relation to ISO 26262:2011 (all parts)

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Motorcycles — Functional safety

1 Scope

This Publicly Available Standard 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 two-wheeled or three-wheeled motorcycles.

This Publicly Available Standard does not address unique E/E systems in special purpose vehicles, such as vehicles designed for competition.

This Publicly Available Standard addresses possible hazards caused by malfunctioning behaviour of E/E safety-related 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 E/E safety-related systems.

This Publicly Available Standard does not address the nominal performance of E/E systems, even if dedicated functional performance standards exist for these systems.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 26262-1:2011, *Road vehicles — Functional safety — Part 1: Vocabulary*

ISO 26262-2:2011, *Road vehicles — Functional safety — Part 2: Management of functional safety*

ISO 26262-3:2011, *Road vehicles — Functional safety — Part 3: Concept phase*

ISO 26262-4:2011, *Road vehicles — Functional safety — Part 4: Product development at the system level*

ISO 26262-5:2011, *Road vehicles — Functional safety — Part 5: Product development at the hardware level*

ISO 26262-6:2011, *Road vehicles — Functional safety — Part 6: Product development at the software level*

ISO 26262-8:2011, *Road vehicles — Functional safety — Part 8: Supporting processes*

ISO 26262-9:2011, *Road vehicles — Functional safety — Part 9: Automotive Safety Integrity Level (ASIL)-oriented and safety-oriented analyses*

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 26262-1:2011 and the following apply

3.1

expert rider

role filled by persons capable of evaluating controllability classifications based on operation of actual motorcycles

Note 1 to entry: An expert rider is a rider who has the

- skill to evaluate controllability,
- capability to conduct the vehicle test, and

- knowledge to evaluate motorcycle controllability characteristics with respect to a representative rider's riding capability.

Note 2 to entry: See Annex B for information relating to the use of expert riders.

3.2

motorcycle safety integrity level

MSIL

one of four levels that specify the item's or element's necessary ISO 26262:2011 (all parts) risk reduction requirements and safety measures to apply for avoiding unreasonable residual risk for items and elements used specifically in motorcycle applications, with D representing the most stringent and A the least stringent level

4 Safety management during the concept phase and the product development

4.1 Objective

The objective of this Clause is to define the independency requirements of confirmation measures associated with ASIL, converted from MSIL.

4.2 General

Safety management includes the responsibility to ensure that the confirmation measures are performed. Depending on the applicable ASIL, some confirmation measures require independence regarding resources, management, and release authority (see 4.4).

Confirmation measures include confirmation reviews, functional safety audits, and functional safety assessments.

- The confirmation reviews are intended to check the compliance of selected work products to the corresponding requirements of ISO 26262 (all parts).
- A functional safety audit evaluates the implementation of the processes required for the functional safety activities.
- A functional safety assessment evaluates the functional safety achieved by the item.

In addition to the confirmation measures, verification reviews are performed. These reviews, which are required in other parts of ISO 26262, are intended to verify that the associated work products fulfil the project requirements, and the technical requirements with respect to use cases and failure modes.

[Table 1](#) lists the required confirmation measures. ISO 26262-2:2011, Annex D lists the reviews concerning verification and refers to the applicable parts of ISO 26262.

4.3 Input to this Clause

4.3.1 Prerequisites

See applicable prerequisites of the relevant phases of the safety lifecycle in which confirmation measures are planned or carried out.

4.3.2 Further supporting information

See applicable further supporting information of the relevant phases of the safety lifecycle in which confirmation measure is planned or carried out.

4.4 Requirements and recommendations

4.4.1 General

The organizations involved in the execution of the safety lifecycle shall comply with 4.4.2 for items that have at least one safety goal with an ASIL A, B, or C, unless stated otherwise.

4.4.2 Confirmation measures: Types, independency, and authority

4.4.2.1 The confirmation measures specified in Table 1 shall be performed, in accordance with the required level of independency as specified in ISO 26262-2:2011, Table 2, 6.4.3.5 i), 6.4.8, and 6.4.9.

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

NOTE 2 A confirmation review includes the checking of correctness with respect to formality, contents, adequacy, and completeness regarding the requirements of ISO 26262:2011 (all parts).

NOTE 3 Table 1 includes the confirmation measures. An overview of the verification reviews is given in ISO 26262-2:2011, Annex D.

NOTE 4 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 26262-8:2011, 10.4.5).

NOTE 5 If the item changes subsequent to the completion of confirmation reviews or functional safety assessments, then these will be repeated or supplemented (see ISO 26262-8:2011, 8.4.5.2).

NOTE 6 The aim of each confirmation measure is given in ISO 26262-2:2011, Annex C.

NOTE 7 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.

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

Confirmation measures	Degree of independency ^a			Scope
	applies to ASIL, converted from MSIL			
	A	B	C	
Confirmation review of the hazard analysis and risk assessment of the item (see Clause 5, ISO 26262-3:2011, Clauses 5, and if applicable, ISO 26262-8:2011, Clause 5) Independence with regard to those generating the work product	I2	I2	I2	The scope of this review shall include the correctness of the determined ASILs and quality management (QM) ratings of the identified hazardous events for the item, and a review of the safety goals
^a The notations are defined as follows: — —: no requirement and no recommendation for or against regarding this confirmation measure; — I0: the confirmation measure should be performed; however, if the confirmation measure is performed, it shall be performed by a different person; — I1: the confirmation measure shall be performed, by a different person; — I2: the confirmation measure shall be performed, by a person from a different team, i.e. not reporting to the same direct superior. ^b A software tool development is outside the item's safety lifecycle whereas the qualification of such a tool is an activity of the safety lifecycle.				

Table 1 (continued)

Confirmation measures	Degree of independency ^a			Scope
	applies to ASIL, converted from MSIL			
	A	B	C	
Confirmation review of the safety plan (see ISO 26262-2:2011, 6.5.1) Independence with regard to those generating the work product	—	I1	I2	Applies to the highest ASIL among the safety goals of the item
Confirmation review of the item integration and testing plan (see ISO 26262-4:2011) Independence with regard to those generating the work product	I0	I1	I2	Applies to the highest ASIL among the safety goals of the item
Confirmation review of the validation plan (see ISO 26262-4:2011) Independence with regard to those generating the work product	I0	I1	I2	Applies to the highest ASIL among the safety goals of the item
Confirmation review of the safety analyses (see ISO 26262-9:2011, Clause 8) Independence with regard to those generating the work product	I1	I1	I2	Applies to the highest ASIL among the safety goals of the item
Confirmation review of the software tool qualification report ^b (see ISO 26262-8:2011, Clause 11) Independence with regard to the persons performing the qualification of the software tool	—	I0	I1	Applies to the highest ASIL of the requirements that can be violated by the use of the tool
Confirmation review of the proven in use arguments (analysis, data, and credit) of the candidates (see ISO 26262-8:2011, Clause 14) Independence with regard to those developing the argument	I0	I1	I2	Applies to the ASIL of the safety goal or requirement related to the considered behaviour, or function, of the candidate
Confirmation review of the completeness of the safety case (see ISO 26262-2:2011, 6.5.3) Independence with regard to those developing the safety case	I0	I1	I2	Applies to the highest ASIL among the safety goals of the item
Functional safety audit in accordance with ISO 26262-2:2011, 6.4.8 Independence with regard to the developers of the item and project management	—	I0	I2	Applies to the highest ASIL among the safety goals of the item

^a The notations are defined as follows:
 — —: no requirement and no recommendation for or against regarding this confirmation measure;
 — I0: the confirmation measure should be performed; however, if the confirmation measure is performed, it shall be performed by a different person;
 — I1: the confirmation measure shall be performed, by a different person;
 — I2: the confirmation measure shall be performed, by a person from a different team, i.e. not reporting to the same direct superior.

^b A software tool development is outside the item’s safety lifecycle whereas the qualification of such a tool is an activity of the safety lifecycle.

Table 1 (continued)

Confirmation measures	Degree of independency ^a			Scope
	applies to ASIL, converted from MSIL			
	A	B	C	
Functional safety assessment in accordance with ISO 26262-2:2011, 6.4.9 Independence with regard to the developers of the item and project management	—	I0	I2	Applies to the highest ASIL among the safety goals of the item
<p>^a The notations are defined as follows:</p> <p>— —: no requirement and no recommendation for or against regarding this confirmation measure;</p> <p>— I0: the confirmation measure should be performed; however, if the confirmation measure is performed, it shall be performed by a different person;</p> <p>— I1: the confirmation measure shall be performed, by a different person;</p> <p>— I2: the confirmation measure shall be performed, by a person from a different team, i.e. not reporting to the same direct superior.</p> <p>^b A software tool development is outside the item's safety lifecycle whereas the qualification of such a tool is an activity of the safety lifecycle.</p>				

4.4.2.2 The persons who carry out a confirmation measure shall have access to, and shall be supported by, the persons and organizational entities that carry out safety activities during the item development.

4.4.2.3 The persons who carry out a confirmation measure shall have access to the relevant information and tools.

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4.5 Work products

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Confirmation measure reports, resulting from [4.4.2](#) and ISO 26262-2:2011, Table 2, 6.4.8 and 6.4.9

5 Hazard analysis and risk assessment

5.1 Objective

This Clause provides a tailoring of ISO 26262-3:2011, Clause 7 for motorcycles.

The objective of the hazard analysis and risk assessment for motorcycles is to identify and to categorize the hazards that malfunctions in the item can trigger and to formulate the safety goals related to the prevention or mitigation of the hazardous events, in order to avoid unreasonable risk.

The objective of this Clause is to specify the necessary requirements that need to be complied with in order to perform a motorcycle specific hazard analysis and risk assessment.

5.2 General

Due to the fact that the dynamic behaviour of motorcycles differs greatly from that of passenger cars, and that controllability of motorcycle specific hazardous events could place more emphasis on the rider, it is recognized that the method of performing risk assessment requires a degree of tailoring to best suit motorcycle specific hazardous events.

Hazard analysis, risk assessment, and MSIL determination are used to determine the safety goals for the item such that an unreasonable risk is avoided. For this, the item is evaluated with regard to its potential hazardous events. Safety goals and their assigned MSIL are determined by a systematic evaluation of hazardous events. The MSIL is determined by considering the estimate of the impact