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Earth-moving machinery — Functional safety

Part 1: Methodology to determine safety-related parts of the control system and performance requirements

AS ISO 19014.1:2020

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Construction and Mining Equipment Industry Group
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Earth-moving machinery – Functional safety

Part 1: Methodology to determine safety-related parts of the control system and performance requirements

First published as AS ISO 19014.1:2020.

Preface

This Standard was prepared by the Standards Australia Committee ME-063, Earthmoving Equipment.

The objective of this document is to provide a methodology for the determination of performance levels required for earth moving machinery (EMM) as defined in ISO 6165.

This document covers the hazards caused by the failure of a safety control system and excludes hazards arising from the equipment itself (for example, electric shock, fire, etc.).

This document does not apply to other controls that are not safety control systems (SCS), that do not mitigate a hazard or perform a control function and where the operator would be aware of a failure (e.g. windscreen wipers, head lights, cab light, etc.).

This document is identical with, and has been reproduced from, ISO 19014-1:2018, *Earth-moving machinery — Functional safety — Part 1: Methodology to determine safety-related parts of the control system and performance requirements*.

As this document has been reproduced from an International Standard, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms "normative" and "informative" are used in Standards to define the application of the appendices or annexes to which they apply. A "normative" appendix or annex is an integral part of a Standard, whereas an "informative" appendix or annex is only for information and guidance.

Contents

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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*.

This first edition of ISO 19014-1, together with ISO 19014-2, ISO 19014-3, ISO 19014-4 and ISO/TS 19014-5, cancels and replaces ISO 15998 and ISO/TS 15998-2 which have been technically revised.

The main changes compared to the previous documents are as follows:

— method for determination of performance levels and machine control system safety analysis,

— additional requirements for mobile machines,

— environmental test requirements for components of safety controls systems, and

— requirements for software validation and verification of machine performance levels.

This corrected version of ISO 19014-1:2018 incorporates the following corrections:

— in 4.2 c) 2), 4.2 d) 1), 6.1 and Annex C, the cross-references to the steps defined in 4.2 have been corrected.

A list of all parts in the ISO 19014-series can be found on the ISO website. At the time of publication of this document, Part 2, *Design and evaluation of safety-related machine control systems*, Part 4, *Design and evaluation of software and transmission for safety related parts of the control system*, and Part 5, *Tables of performance levels*, are under development.

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.

Introduction

This document addresses systems of all energy types used for functional safety in earth-moving machinery.

The structure of safety standards in the field of machinery is as follows.

Type-A standards (basis standards) give basic concepts, principles for design and general aspects that can be applied to machinery.

Type-B standards (generic safety standards) deal with one or more safety aspects, or one or more types of safeguards that can be used across a wide range of machinery:

— type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);

— type-B2 standards on safeguards (e.g. two-hands controls, interlocking devices, pressure sensitive devices, guards).

Type-C standards (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines.

This document is a type C standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e. g. for maintenance (small, medium and large enterprises);

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

NOTES

Australian Standard®

Earth-moving machinery — Functional safety

Part 1: Methodology to determine safety—related parts of the control system and performance requirements

1 Scope

This document provides a methodology for the determination of performance levels required for earth moving machinery (EMM) as defined in ISO 6165.

A Machine Control System Safety Analysis (MCSSA) determines the amount of risk reduction of hazards associated with control systems, required for Safety Control Systems (SCS). This reduction is quantified by the Machine Performance Level (MPL), the hazards are identified using the risk assessment principles as defined in ISO 12100 or by other means.

NOTE 1 Step 2 as shown in Annex A demonstrates the relationship between ISO 12100 and ISO 19014 as a complementary protective measure.

NOTE 2 ISO 19014 can also be used to assess the functional safety requirements of other off-road mobile machinery.

For those controls determined to be safety-related, the characteristics for architecture, hardware, software environmental requirements and performance are covered by other parts in ISO 19014.

ISO 19014 covers the hazards caused by the failure of a safety control system and excludes hazards arising from the equipment itself (for example, electric shock, fire, etc.).

Other controls that are not safety control systems (SCS), that do not mitigate a hazard or perform a control function and where the operator would be aware of a failure, are excluded from this standard (e.g. windscreen wipers, head lights, cab light, etc.).

NOTE 3 A list of safety control systems is included in Annex D.

NOTE 4 Audible warnings are excluded for the requirements of diagnostic coverage.

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 6165, *Earth-moving machinery — Basic types — Identification and terms and definitions*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6165 and ISO 12100 and the following 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 http://www.iso.org/obp