



International
Standard

ISO 19014-1

**Earth-moving machinery —
Functional safety —**

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

Engins de terrassement — Sécurité fonctionnelle —

*Partie 1: Méthodologie pour la détermination des parties du
système de commande relatives à la sécurité et les exigences de
performance*

**Second edition
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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 document 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).

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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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 151, *Construction equipment and building material machines - Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 19014-1:2018), which has been technically revised.

The main changes are as follows:

- clarification of “quality measure” in [subclause 6.6](#);
- revision of wording covering controllability when multiple actions are required to avoid a hazard ([subclause 6.5](#));
- addition of the terms “machine abuse”, “idle factor”, and “work cycle” in [Clause 3](#);
- revision of the machine control system safety analysis (MCSSA) process;
- addition of requirements covering information for use, in accordance with ISO Guide 78.

A list of all parts in the ISO 19014 series can be found on the ISO website.

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 (basic 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 12100:2010.

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

- machine and component manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved in accordance with this document:

- machine users and employers (small, medium and large enterprises);
- machine users and employees (e.g. trade unions, organizations for people with special needs);
- service providers, e. g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

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

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

When the requirements of this type-C standard differ from those 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.

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Earth-moving machinery — Functional safety —

Part 1:

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

1 Scope

This document specifies a methodology for the determination of performance levels required for earth-moving machinery as defined in ISO 6165:2022

NOTE 1 For controls determined to be safety-related, the characteristics for architecture, hardware, software, environmental requirements, and performance are covered by other parts in the ISO 19014 series.

NOTE 2 The ISO 19014 series covers the significant hazards caused by the failure of a safety control system and excludes hazards arising from the equipment itself (for example, electric shock or fire).

To cover all the relevant safety requirements for the products in its scope, this document is used in combination with ISO 19014-2:2026, ISO 19014-3:2026, ISO 19014-4:2026, and ISO 19014-5:2026.

This document does not apply to other controls that are not safety control systems (SCS) and 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).

NOTE 3 A list of safety control systems is included in [Annex B](#).

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

This document is not applicable to earth-moving machinery manufactured before the date of its publication.

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 6165:2022, *Earth-moving machinery — Basic types — Identification and vocabulary*

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

ISO 19014-2:2026, *Earth-moving machinery — Functional safety — Part 2: Design and evaluation of hardware and architecture requirements for safety-related parts of the control system*

ISO 19014-3:2026, *Earth-moving machinery — Functional safety — Part 3: Environmental performance and test requirements of electronic and electrical components used in safety-related parts of the control system*

ISO 19014-4:2026, *Earth-moving machinery — Functional safety — Part 4: Design and evaluation of software and data transmission for safety-related parts of the control system*

ISO 19014-5:2026, *Earth-moving machinery — Functional safety — Part 5: Tables of performance levels*