
**Earth-moving and building
construction machinery —
Electromagnetic compatibility (EMC)
of machines with internal electrical
power supply —**

**Part 1:
General EMC requirements
under typical electromagnetic
environmental conditions**

*Engins de terrassement et machines pour la construction des
bâtiments — Compatibilité électromagnétique (CEM) des machines
équipées de réseaux électriques de distribution interne —*

*Partie 1: Exigences CEM générales dans des conditions
électromagnétiques environnementales typiques*



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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 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.

The committee responsible for this document is ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*.

This first edition of ISO 13766-1:2018, together with ISO 13766-2:2018, cancels and replaces ISO 13766:2006, of which it constitutes a technical revision and contains the following changes:

- the scope has been extended to specify building construction machinery as well as earth-moving machinery;
- the provisions have been brought up to date with technological change;
- normative references have been updated to the latest editions;

A list of all parts in the ISO 13766 series can be found on the ISO website.

Introduction

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 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);
- consumers (in case of machinery intended for use by consumers).

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.

With the increasing use of electronic devices in areas where earth-moving and machinery operates, there is a need to ensure that the machinery is provided with adequate immunity to external electromagnetic fields. As more machinery is fitted with electrical and electronic devices, it is necessary to ensure that the emissions of electromagnetic fields from the machinery meet acceptable limits.

Electrical and high frequency disturbances emerge during the normal operation of many parts of machine devices and systems. They are generated within a large frequency range with different electrical characteristics and by conduction or radiation, which can be imparted to other electrical/electronic devices and systems by conduction or radiation. Narrowband signals generated by sources of interference inside or outside the machinery can also be coupled into electrical/electronic systems whereby they can influence the normal function of electrical/electronic devices.

Electrostatic discharges are relevant to the machinery because control elements can be positioned outside the operator station where potential differences could emerge at contact points. Conducted transients in power supply wiring must be considered because the machinery can contain open systems, in which several devices or components can be combined to complement machine functionality.

While there are many existing standards for a variety of products and systems, the test method presented by ISO 13766:2018 provides for the specific test conditions of the machinery within its scope as well as the electrical/electronic sub-assemblies (ESA) or ESA separate from the machinery. The test method recognizes that due to their size and usage, the arrangement of the machines in the test facility needs to be representative of their typical operating characteristics. This document provides test methods and criteria which are acceptable for the machine types it covers, considering their unique characteristics and operating parameters.

Because the machinery has a number of systems that consist of components that can be used on a variety of machine types, the approach of defining ESA or separate ESAs for these components is applied for the immunity and emissions test methods. This allows these components to be evaluated by

the test method in existing laboratory facilities consisting of specially equipped shielded rooms. When electrical/electronic sub-assembly tests are conducted, it is necessary to consider any additional effects imparted by wiring systems used to connect the sub-assemblies into the machinery. The tests can also be conducted on the machinery.

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Earth-moving and building construction machinery — Electromagnetic compatibility (EMC) of machines with internal electrical power supply —

Part 1: General EMC requirements under typical electromagnetic environmental conditions

1 Scope

This document provides test methods and acceptance criteria for the evaluation of the electromagnetic compatibility (EMC) of earth-moving machinery, as defined in ISO 6165:2012, and of the following building construction machinery as defined in ISO/TR 12603:2010:

- drilling and foundation equipment;
- equipment used for the preparation, conveyance and compaction of concrete, mortar and processing reinforcement;
- road construction and maintenance machinery and equipment.

It deals with general EMC requirements under typical electromagnetic environmental conditions. (ISO 13766-2:2018 deals with EMC requirements specifically related to functional safety).

Electrical/electronic subassemblies (ESA) and separate ESA intended to be fitted to the machinery are also dealt with. The following electromagnetic disturbance phenomena are evaluated:

- broadband and narrowband electromagnetic interference;
- electromagnetic field immunity;
- electrostatic discharge;
- conducted transients.

The machinery can have DC or AC or a combination of both as the internal electrical power supply system.

This document is not applicable to machines that are designed to be supplied by an external mains network or to phenomena caused by military applications.

NOTE 1 Grid-connected machines are covered by IEC 61000.

NOTE 2 *Hybrid* machines are covered in UN ECE R10-Rev. 5.

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 6165:2012, *Earth-moving machinery — Basic types — Identification and terms and definitions*

ISO 7637-1:2015, *Road vehicles — Electrical disturbances from conduction and coupling — Part 1: Definitions and general considerations*

ISO 13766-1:2018(E)

ISO 7637-2:2011, *Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only*

ISO 10605:2008, *Road vehicles — Test methods for electrical disturbances from electrostatic discharge*

ISO 11451-1:2015, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology*

ISO 11451-2:2015, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 2: Off-vehicle radiation sources*

ISO 11451-4:2013, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 4: Bulk current injection (BCI)*

ISO 11452-1:2015, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology*

ISO 11452-2:2004, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 2: Absorber-lined shielded enclosure*

ISO 11452-3:2016, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 3: Transverse electromagnetic (TEM) cell*

ISO 11452-4:2011, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 4: Harness excitation methods*

ISO 11452-5:2002, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 5: Stripline*

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

ISO/TR 12603:2010, *Building construction machinery and equipment — Classification*

ISO 16750-1:2006, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 1: General*

ISO 16750-2:2012, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads*

ISO 21848:2005, *Road vehicles — Electrical and electronic equipment for a supply voltage of 42 V - Electrical loads*

CISPR 12:2007+AMD1:2009, *Vehicles, boats and internal combustion engines — Radio disturbance characteristics — Limits and methods of measurement for the protection of off-board receivers*

CISPR 16-1-1:2014, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1-1: Radio disturbance and immunity measuring apparatus — Measuring apparatus*

CISPR 16-1-4:2012, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1-4: Radio disturbance and immunity measuring apparatus — Antennas and test sites for radiated disturbance measurements*

CISPR 25:2008, *Vehicles, boats and internal combustion engines — Radio disturbance characteristics — Limits and methods of measurement for the protection of on-board receivers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6165:2012, ISO/TR 12603:2010 and the following apply.