



BSI Standards Publication

# **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

This is a preview of "BS EN ISO 13766-1:20...". [Click here to purchase the full version from the ANSI store.](#)

## National foreword

This British Standard is the UK implementation of EN ISO 13766-1:2018. It is identical to ISO 13766-1:2018. Together with BS EN ISO 13766-2:2018, it supersedes BS EN 13309:2010, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/513/1, Earth moving machinery (International).

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2019  
Published by BSI Standards Limited 2019

ISBN 978 0 539 06622 7

ICS 91.220; 33.100.20

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2018.

### Amendments/corrigenda issued since publication

Date	Text affected
30 September 2019	Z Annex added

This is a preview of "BS EN ISO 13766-1:20...". Click here to purchase the full version from the ANSI store.

EUROPÄISCHE NORM

June 2018

ICS 33.100.01; 53.100

Supersedes EN 13309:2010

English Version

## 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 (ISO 13766-1:2018)

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 (ISO  
13766-1:2018)

Baumaschinen - Elektromagnetische Verträglichkeit  
von Maschinen mit internem elektrischen Bordnetz -  
Teil 1: Allgemeine EMV-Anforderungen unter  
typischen EMV-Umgebungsbedingungen (ISO 13766-  
1:2018)

This European Standard was approved by CEN on 8 May 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

This is a preview of "BS EN ISO 13766-1:20...". [Click here to purchase the full version from the ANSI store.](#)

## European foreword

This document (EN ISO 13766-1:2018) has been prepared by Technical Committee ISO/TC 127 "Earth-moving machinery" in collaboration with Technical Committee CEN/TC 151 "Construction equipment and building material machines - Safety" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2018, and conflicting national standards shall be withdrawn at the latest by December 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13309:2010.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Endorsement notice

The text of ISO 13766-1:2018 has been approved by CEN as EN ISO 13766-1:2018 without any modification.

This is a preview of "BS EN ISO 13766-1:20...". [Click here to purchase the full version from the ANSI store.](#)

**Annex ZA**  
(informative)

**Relationship between this European standard and the essential requirements of Directive 2014/30/EU [2014 OJ L96] aimed to be covered**

This European standard has been prepared under the European Commission standardisation request C(2016) 7641 final of 30.11.2016<sup>1</sup>, ('M/552'), as regards harmonised standards in support of Directive 2014/30/EU relating to electromagnetic compatibility, to provide one voluntary means of conforming to essential requirements of Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

**Table ZA.1 – Correspondence between this European standard and the Essential Requirements set out in Directive 2014/30/EU [2014 OJ L96]**

Essential requirements of Directive 2014/30/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
Annex I. 1(a) (electromagnetic disturbances)	4 Requirements. Particularly, 4.2, 4.3, 4.5, 4.6	
Annex I. 1(b) (electromagnetic immunity)	4 Requirements. Particularly, 4.4, 4.7, 4.8, 4.9	

WARNING 1: Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2: Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

<sup>1</sup> COMMISSION IMPLEMENTING DECISION C(2016) 7641 final of 30.11.2016 on a standardisation request to the European Committee for Standardisation, to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards harmonised standards in support of Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility.

This is a preview of "BS EN ISO 13766-1:20...". Click here to purchase the full version from the ANSI store.

## Contents

	Page
<b>Foreword</b> .....	<b>v</b>
<b>Introduction</b> .....	<b>vi</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>2</b>
<b>4 Requirements</b> .....	<b>6</b>
4.1 General requirements.....	6
4.1.1 Fulfilment of requirements.....	6
4.1.2 Test specimen.....	6
4.1.3 Additional requirements for immunity tests.....	7
4.2 Specifications for broadband electromagnetic emission radiated from machinery.....	7
4.2.1 Method of measurement.....	7
4.2.2 Broadband reference limits.....	7
4.3 Specifications concerning narrowband electromagnetic emission radiated from machinery.....	7
4.3.1 Method of measurement.....	7
4.3.2 Narrowband reference limits.....	7
4.4 Specifications concerning the immunity of machinery to electromagnetic radiation.....	8
4.4.1 Test method.....	8
4.4.2 Machinery immunity reference limits.....	8
4.5 Specifications concerning broadband electromagnetic emissions radiated from ESA.....	9
4.5.1 Method of measurement.....	9
4.5.2 ESA broadband reference limits.....	9
4.6 Specifications concerning narrowband electromagnetic emissions radiated from ESA.....	9
4.6.1 Method of measurement.....	9
4.6.2 ESA narrowband reference limits.....	9
4.7 Specifications concerning the immunity of ESA to electromagnetic radiation.....	9
4.7.1 Method of testing.....	9
4.7.2 ESA immunity reference limits.....	10
4.8 Electrostatic discharge (ESD).....	10
4.8.1 Method of testing.....	10
4.8.2 Reference limits.....	10
4.9 Conducted transients.....	11
4.9.1 General.....	11
4.9.2 Method of testing.....	11
4.9.3 Conducted emission — Reference limits.....	11
4.9.4 Conducted immunity — Reference limits and functional status.....	11
<b>5 Exceptions</b> .....	<b>13</b>
<b>6 Test report</b> .....	<b>14</b>
<b>Annex A (normative) Reference limits</b> .....	<b>15</b>
<b>Annex B (normative) Method of measurement of radiated broadband electromagnetic emissions from machinery — Complete machine only</b> .....	<b>21</b>
<b>Annex C (normative) Method of measurement of radiated narrowband electromagnetic emissions from machinery — Complete machine only</b> .....	<b>26</b>
<b>Annex D (normative) Method of measurement of radiated broadband electromagnetic emissions from electrical/electronic sub-assemblies (ESA)</b> .....	<b>30</b>
<b>Annex E (normative) Method of measurement of radiated narrowband electromagnetic emissions from ESA</b> .....	<b>36</b>

This is a preview of "BS EN ISO 13766-1:20...". [Click here to purchase the full version from the ANSI store.](#)

<b>Annex F (informative) Guidance for selecting test specimen configuration and additional considerations</b> .....	<b>39</b>
<b>Bibliography</b> .....	<b>40</b>

This is a preview of "BS EN ISO 13766-1:20...". Click here to purchase the full version from the ANSI store.

## 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](http://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](http://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](http://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.



This is a preview of "BS EN ISO 13766-1:20...". [Click here to purchase the full version from the ANSI store.](#)

## 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

This is a preview of "BS EN ISO 13766-1:20...". [Click here to purchase the full version from the ANSI store.](#)

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.

This is a preview of "BS EN ISO 13766-1:20...". Click here to purchase the full version from the ANSI store.

# 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*