



SLOVENSKI STANDARD

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Nadomešča:
SIST EN 13309:2000

Gradbeni stroji - Elektromagnetna združljivost strojev z notranjim električnim napajanjem

Construction machinery - Electromagnetic compatibility of machines with internal power supply

Baumaschinen - Elektromagnetische Verträglichkeit von Maschinen mit internem elektrischen Bordnetz

Machines de génie civil - Compatibilité électromagnétique des machines équipées d'électricité de distribution interne

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Construction machinery - Electromagnetic compatibility of machines with internal power supply

Machines de génie civil - Compatibilité électromagnétique des machines équipées de réseau électrique de distribution interne

Baumaschinen - Elektromagnetische Verträglichkeit von Maschinen mit internem elektrischen Bordnetz

This European Standard was approved by CEN on 19 June 2010.

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Foreword

This document (EN 13309:2010) has been prepared by 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of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

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

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.

This document supersedes EN 13309:2000.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

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

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

Electrostatic discharges are relevant to construction machinery because control elements can be positioned outside the operator's station and potential differences can emerge at contact points. Conducted transients in power supply wiring have to be taken into account because construction machinery often represents open systems and several devices and/or components of construction equipment are combined with one another.

While there are many existing standards for a variety of products and systems, the test method presented in this European Standard provides for the specific test conditions of construction machinery and the "electrical/electronic sub-assemblies or separate technical units" of construction machinery. The test method recognises that because of the size and usage of construction machinery, the arrangement of the construction machinery in the test facility needs to be responsive to the operating characteristics of these types of construction machinery. This European Standard provides test methods and criteria which are acceptable for construction machinery considering the unique characteristics and operating parameters of construction machinery.

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Because construction machinery has a number of systems that consist of components that may be used on a number of different construction machinery the approach of defining "electrical/electronic sub-assemblies or separate technical units" 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 the effects of the wiring systems used to connect the sub-assemblies into the construction machinery. The tests can also be conducted on the construction machinery.

EN 13309:2010 (E)**1 Scope**

This European Standard provides test methods and acceptance criteria for the evaluation of the electromagnetic compatibility of construction machinery with respect to free trade of goods in the European Union. It deals with functional EMC requirements under typical EMC environmental conditions.

This European Standard does not deal with safety requirements.

Electrical and/or electronic component(s) or separate technical unit(s) intended to be fitted in construction machinery are also dealt with in this European Standard. The following electromagnetic disturbance phenomena are evaluated:

- broadband and narrowband electromagnetic interference;
- electromagnetic field immunity test;
- broadband and narrowband interference of electrical/electronic sub-assemblies;
- electromagnetic field immunity test of electrical/electronic sub-assemblies;
- electrostatic discharge;
- conducted transients.

Construction machinery can have DC and/or AC internal electrical power supply systems.

Machines that are designed to be supplied by the "Public Mains Network" are specifically excluded.

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2 Normative references

The following referenced documents are indispensable for the application 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.

EN 55016-1-1:2007, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1-1: Radio disturbance and immunity measuring apparatus — Measuring apparatus (CISPR 16-1-1:2006)*

EN 55025:2008, *Vehicles, boats and internal combustion engines — Radio disturbance characteristics — Limits and methods of measurement for the protection of on-board receivers (CISPR 25:2008)*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

ISO 7637-1:2002, *Road vehicles — Electrical disturbances from conduction and coupling — Part 1: Definitions and general considerations*

ISO 7637-2:2004, *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 11451-1:2005, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology (including ISO 11451-1:2005/Amd 1:2008)*

ISO 11451-2:2005, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 2: Off-vehicle radiation sources*

ISO 11452-1:2005, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology* (including ISO 11452-1:2005/Amd 1:2008)

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

ISO 11452-3:2001, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 3: Transverse electromagnetic mode (TEM) cell*

ISO 11452-4:2005, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 4: Bulk current injection (BCI)* (including ISO 11452-4:2005/Cor 1:2009)

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

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 16-1-4:2007+Amd1:2008, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1-4: Radio disturbance and immunity measuring apparatus — Ancillary equipment — Radiated disturbances*

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3 Terms and definitions

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For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

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3.1

internal electrical power supply

is to be understood which is absolutely independent from outside sources (mains supply) and the connection to mains is not intended during operation

3.2

electromagnetic compatibility

EMC

ability of construction machinery or component(s) or separate technical unit(s) to function satisfactorily in its electromagnetic environment, without introducing intolerable electromagnetic disturbances to anything in that environment

NOTE See IEC 60050-161:1990 with amendments 1997 and 1998.

3.3

electromagnetic disturbance

electromagnetic phenomenon which may degrade the performance of construction machinery or component(s) or separate technical unit(s)

NOTE An electromagnetic disturbance can be electromagnetic noise, an unwanted signal or a change in the propagation medium itself (see IEC 60050-161:1990).

3.4

electromagnetic immunity

ability of construction machinery or components(s) or separate technical unit(s) to perform in the presence of specific electromagnetic disturbances without degradation of performance

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NOTE See IEC 60050-161:1990.

3.5
electromagnetic environment

totality of electromagnetic phenomena existing at a given location

NOTE See IEC 60050-161:1990.

3.6
reference limit

limit value with which the production has to conform

3.7
reference antenna

<frequency range of 30 MHz to 80 MHz> shortened balanced dipole which is a half-wave resonant dipole at 80 MHz

<frequency range above 80 MHz> balanced half wave resonant dipole tuned to the measurement frequency

NOTE See CISPR 16-1-4:2007+Amd1:2008.

3.8
broadband emission

emission which has a bandwidth greater than that of a particular measuring apparatus or receiver

NOTE See IEC 60050-161:1990.

3.9
narrowband emission

emission which has a bandwidth less than that of a particular measuring apparatus or receiver

NOTE See IEC 60050-161:1990. standards.iteh.ai/catalog/standards/sist/cb330057-48df-4b1c-8d8c-08b2d6e4e191/sist-en-13309-2010

3.10
out-of-band emission

emission on a frequency or frequencies immediately outside the necessary bandwidth of radio frequency equipment which results from the modulation process, but excluding spurious emissions

[Article 1, No 1144 of the radio regulations]

3.11
necessary bandwidth

for a given class of emission of radio-frequency-equipment, width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

NOTE See Article 1, No 1152 of the ITU radio regulations.

3.12
spurious emission

emission on a frequency or frequencies which are outside the necessary RF-bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

NOTE 1 In every modulation process of radio-frequency-equipment additional undesired signals exist. They are summarised under the expression "spurious emissions".

NOTE 2 Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions (see Article 1 No 1145 of the ITU radio regulations).

3.13**electrical/electronic system**

electrical and/or electronic component(s) or set of components intended to be part of construction machinery, together with any electrical connections

3.14**electrical/electronic sub-assembly****ESA**

electrical and/or electronic component(s) or set of components intended to be part of construction machinery, together with any associated electrical connections and wiring, which performs one or more specialised functions

3.15**electrostatic discharge****ESD**

transfer of electrostatic charge between bodies of different electrostatic potential in proximity or through direct contact

NOTE See IEC 60050-161:1990.

3.16**conducted transients**

transient voltage or current distributed in the power supply wiring of construction machinery or component or separate technical unit via conductor between the source of the transient and the drain

3.17**construction machinery type**

construction machinery which does not differ in such essential respects as:

- the structural shape;
- the general arrangement of the electrical and/or electronic components and the general wiring arrangement;
- the primary material of which the design of the construction machinery consists (for example steel, aluminium or fibreglass covering parts)

3.18**ESA type**

ESAs which do not differ in such essential respects as:

- the function performed by the ESA;
- the arrangement of the electrical and/or electronic components, if applicable;
- the primary material of the casing

3.19**operator's control**

is exercised by means of, for example, steering, braking, or propulsion control. This also concerns movements of parts of the machine and modifications of the state of function, which may generate uncommanded, random or unresponsive machine operation (i.e. hazardous machine behaviour)

EN 13309:2010 (E)**4 Requirements****4.1 General requirements****4.1.1 Fulfilment of the requirements**

The requirements of this European Standard are met by construction machinery, and the electrical/electronic sub-assemblies when the requirements in 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8 and 4.9, as applicable, are fulfilled. The user of this European Standard may choose either the clauses pertaining to the complete construction machinery, or those clauses pertaining to the electrical/electronic sub-assemblies. When the clauses pertaining to the electrical/electronic sub-assemblies are chosen, to fulfil the requirements of this European Standard, the electrical/electronic sub-assemblies shall be installed on the construction machinery in conformity with relevant provisions which have been considered in determining that the electrical/electronic sub-assemblies meet the requirements of the appropriate clauses of this European Standard.

The requirements of this European Standard are also deemed to be fulfilled when the construction machinery has no such equipment for which an immunity or interference test is required. In this case no tests are necessary (see Clause 5).

4.1.2 Test specimen

The test specimen may be chosen in accordance with the definitions given in 3.17 and/or 3.18.

Because the test of a single test specimen is to be used to judge the performance of a population of like construction machinery, the reference limits for emissions and immunity shall be made more restrictive by a 20 % reduction for emissions limits and a 25 % increase for immunity limits so as to account for variability of emission and immunity due to manufacturing variations of construction machinery, or ESA types and testing factors.

For a subsequent test on a like test specimen, conformity to the reference limits shall be accepted as fulfilment of the requirements of this European Standard.

For electrostatic discharge and conducted transients, the reference limits are valid for all testing of the test specimen.

4.1.3 Additional requirements for immunity tests

When a test specimen is subjected to the immunity requirements, operator controls, and any automatic controls for the construction machinery and any attachments or machinery shall remain functional so as to provide continued control of the construction machinery. This also applies to secondary or shut-down systems which are intended to be operated when the primary control has failed.

4.2 Specifications concerning broadband electromagnetic emission radiated from construction machinery**4.2.1 Method of measurement**

The electromagnetic radiation shall be measured using the method described in Annex B at either of the defined antenna distances. The choice shall be made by the user of the standard.

4.2.2 Broadband reference limits

If measurements are made using the method described in Annex B using a construction machinery-to-antenna spacing of $(10,0 \pm 0,2)$ m, the emission reference limits shall be 34 dB ($\mu\text{V/m}$) ($50 \mu\text{V/m}$) in the 30 MHz to 75 MHz frequency band and 34 dB ($\mu\text{V/m}$) to 45 dB ($\mu\text{V/m}$) ($50 \mu\text{V/m}$ to $180 \mu\text{V/m}$) in the 75 MHz to 400 MHz frequency band, this limit increasing logarithmically (linearly) with frequencies above 75 MHz as

shown in Figure A.1. In the 400 MHz to 1 000 MHz frequency band the limit remains constant at 45 dB ($\mu\text{V}/\text{m}$) ($180 \mu\text{V}/\text{m}$).

If measurements are made using the method described in Annex B using a construction machinery-to-antenna spacing of $(3,0 \pm 0,05) \text{ m}$, the emission reference limits shall be 44 dB ($\mu\text{V}/\text{m}$) ($160 \mu\text{V}/\text{m}$) in the 30 MHz to 75 MHz frequency band and 44 dB ($\mu\text{V}/\text{m}$) to 55 dB ($\mu\text{V}/\text{m}$) ($160 \mu\text{V}/\text{m}$ to $562 \mu\text{V}/\text{m}$) in the 75 MHz to 400 MHz frequency band, this limit increasing logarithmically (linearly) with frequencies above 75 MHz as shown in Figure A.2. In the 400 MHz to 1 000 MHz frequency band the limit remains constant at 55 dB ($\mu\text{V}/\text{m}$) ($562 \mu\text{V}/\text{m}$).

On a single test specimen, the measured values, expressed in dB ($\mu\text{V}/\text{m}$) or ($\mu\text{V}/\text{m}$) shall be at least 2,0 dB or (20 %) below the reference limits.

4.3 Specifications concerning narrowband electromagnetic emission radiated from construction machinery

4.3.1 Method of measurement

The electromagnetic emission shall be measured using the method described in Annex C at either of the defined antenna distances. The choice shall be made by the user of the standard.

4.3.2 Narrowband reference limits

If measurements are made using the method described in Annex C using a construction machinery-to-antenna spacing of $(10,0 \pm 0,2) \text{ m}$, the emission reference limits shall be 24 dB ($\mu\text{V}/\text{m}$) ($16 \mu\text{V}/\text{m}$) in the 30 MHz to 75 MHz frequency band and 24 dB ($\mu\text{V}/\text{m}$) to 35 dB ($\mu\text{V}/\text{m}$) ($16 \mu\text{V}/\text{m}$ to $56 \mu\text{V}/\text{m}$) in the 75 MHz to 400 MHz frequency band, this limit increasing logarithmically (linearly) with frequencies above 75 MHz as shown in Figure A.3. In the 400 MHz to 1 000 MHz frequency band the limit remains constant at 35 dB ($\mu\text{V}/\text{m}$) ($56 \mu\text{V}/\text{m}$).

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If measurements are made using the method described in Annex C using a construction machinery-to-antenna spacing of $(3,0 \pm 0,05) \text{ m}$, the emission reference limits shall be 34 dB ($\mu\text{V}/\text{m}$) ($50 \mu\text{V}/\text{m}$) in the 30 MHz to 75 MHz frequency and 34 dB ($\mu\text{V}/\text{m}$) to 45 dB ($\mu\text{V}/\text{m}$) ($50 \mu\text{V}/\text{m}$ to $180 \mu\text{V}/\text{m}$) in the 75 MHz to 400 MHz frequency band, this limit increasing logarithmically (linearly) with frequencies above 75 MHz as shown in Figure A.4. In the 400 MHz to 1 000 MHz frequency band the limit remains constant at 45 dB ($\mu\text{V}/\text{m}$) ($180 \mu\text{V}/\text{m}$).

On a single test specimen, the measured values, expressed in dB ($\mu\text{V}/\text{m}$) or ($\mu\text{V}/\text{m}$), shall be at least 2,0 dB or (20 %) below the reference limits.

4.4 Specifications concerning the immunity of construction machinery to electromagnetic radiation

4.4.1 Test method

The immunity to electromagnetic radiation of the construction machinery shall be tested according to ISO 11451-1 and ISO 11451-2 with horizontal and vertical polarisation. The determination of the reference points and the operating modes shall be machine specific and noted in the test report. Immunity testing should be conducted as outlined in ISO 11451-1 except forward power may be used as the control regardless of the standing wave ratio of the system. The test report shall note which control method was used. The substitution method and the 80 % amplitude modulation (AM) with sinusoidal wave of 1 kHz is determined as a test method in the frequency band of 20 MHz to 800 MHz (see ISO 11451-1). Pulse Modulation (PM) with t_{on} 577 μs , period 4 600 μs is determined as test method in the frequency band of 800 MHz to 2 000 MHz (see ISO 11451-1).

NOTE 1 In the frequency range from 800 MHz to 1 000 MHz the amplitude modulation may alternatively be applied.