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~~ISO TC 23/SC 2/WG 10~~

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ISO/TC 23/SC 2

Secretariat: ~~ANSI~~ ANSI

Date: 2025-02-14

Agricultural and forestry machinery — Electromagnetic compatibility —

Part 1: General EMC requirements

Machines agricoles et forestières — Compatibilité électromagnétique —

Partie 1: Exigences CEM générales ~~de CEM~~

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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 documentsdocument 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 drawnISO draws attention to the possibility that some of the elementsimplementation of this document may beinvolve the subjectuse of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. 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).

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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.htmlwww.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 2, *Common tests*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 144, *Agricultural machinery*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 14982-1, together with ISO/FDIS 14982-2,;—[1)] cancels and replaces ISO 14982:1998, which has been technically revised.

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

— the provisions have been brought up to date with technological change;

— normative references have been updated to their latest editions.

A list of all parts in the ISO 14982 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.

[1)] Under development. Stage at the date of publication: ISO/FDIS 14982-2:2025.

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Introduction

0.1 0.1Document type

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 regarding machine safety:

— machine manufacturers;

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

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

— machine users/employers;

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

— service providers, e.g., for maintenance;

— consumers (in case of machines 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 machine concerned and the extent to which hazards, hazardous situations, or hazardous events 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.

0.2 0.2Background

In recent years, an increasing number of electronic devices for controlling, monitoring and displaying a variety of functions have been introduced into machine designs. It is necessary to consider the electrical and electromagnetic environment in which these devices operate.

Electrical and radio-frequency disturbances occur during normal operation of many items of machines. They are generated over a wide frequency range with various electrical characteristics and can be distributed to on-board electronic devices and systems by conduction, radiation, or both. Narrowband signals generated from sources on or off the machine can also be coupled into the electrical or electronic system, affecting the normal performance of electronic devices. Such sources of narrowband electromagnetic disturbances include mobile radios and broadcast transmitters.

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

While there are many existing standards for a variety of products and systems, the test method presented by the ISO 14982 series provides for the specific test conditions of the machine within its scope as well as the

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electrical/electronic sub-assemblies (ESA) or ESA separate from the machine. ~~-~~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 several systems that may consist of components that may be used on a variety of different machine types, the approach of defining "electrical/electronic sub-assemblies" or separate technical units" for these components may be applied for the immunity and emissions test methods. ~~-~~This allows these components to be evaluated by comparable (or alternative) test methods in existing laboratory facilities consisting of specially equipped shielded rooms. ~~–~~When electrical/electronic sub-assembly tests are performed, it is necessary to consider any additional effects imparted by the wiring systems used to connect the sub-assemblies to the machine. ~~-~~The tests can also be conducted on the machinery.

~~Annex A~~Annex A provides guidance for selecting and configuring test specimens.

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Agricultural and forestry machinery — Electromagnetic compatibility —

Part 1: General EMC requirements

1 Scope

This document specifies the test methods and acceptance criteria for evaluating the electromagnetic compatibility of tractors, and all kinds of mobile (including hand-held or battery powered) agricultural and forestry machines, landscaping, and gardening machines [referred to hereafter as machine(s)] as supplied by the machine manufacturer. It is applicable to machines and electrical/electronic sub-assemblies (ESA's) which are manufactured after the date of publication of this document.

This document specifies general EMC requirements under typical EMC environmental conditions. ISO/FDIS 14982-2: deals with EMC requirements specifically related to functional safety.

Electrical/electronic components or sub-assemblies intended for fitting in machines are also within the scope of this document, except regarding immunity for those parts whose functions are not involved in the direct control and modification of the state of the functions of the machine. The following electromagnetic phenomena are to be evaluated:

— radiated electromagnetic emissions;

— electromagnetic field immunity;

— electrostatic discharge;

— conducted transients.

This document is not applicable to machines directly supplied with current from public electrical mains. Exceptions to machines or electrical/electronic systems or ESA's that ~~may~~might not require testing in accordance with this document are given in ~~Clause 12.~~Clause 12.

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

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

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

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

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

ISO 11452-12:2019, *Road vehicles — Electrical — Component test methods for electrical disturbances byfrom narrowband radiated electromagnetic energy — Component test methods — Part 1: General and definitions 2: Absorber-lined shielded enclosure*

ISO 11452-23:2016, *Road vehicles — Electrical disturbances by narrowband radiated electromagnetic energy — Component test methods — Part 2: Absorber-lined chamber*

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

ISO 11452-4:2020, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 4: Harness excitation methods*

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

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

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

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

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

CISPR 32 Ed. 2.1:2019, Electromagnetic compatibility of multimedia equipment — Emissions requirements

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obphttps://www.iso.org/obp;

— IEC Electropedia: available at http://www.electropedia.orghttp://www.electropedia.org

3.1 3.1
absorber lined shielded enclosure
ALSE
shielded enclosure/screened room with radio-frequency-absorbing material on its internal ceiling and walls

3.2 3.2
amplitude modulation
AM
modulation in which the amplitude of a periodic carrier is a given function generally linear, of the instantaneous values of the modulating signal.

Note 1 to entry: Sine wave amplitude modulated (AM) by 1 kHz sine wave at 80 % (modulation index m = 0,8)

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3.3 ~~3.3~~
artificial network
AN
network inserted in the supply lead or signal/load lead of apparatus to be tested which provides, in a given frequency range, a specified load impedance for the measurement of disturbance voltages and which can isolate the apparatus from the supply or signal sources/loads in that frequency range

~~given frequency range, a specified load impedance for the measurement of disturbance voltages and which can isolate the apparatus from the supply or signal sources/loads in that frequency range.~~

Note 1 to entry: This network is inserted in the DC power lines of the vehicle in charging mode and provides, in a given frequency range, a specified load impedance and which isolates the vehicle from the DC power supply in that frequency range.

3.4 ~~3.4~~
average detector
detector, the output voltage of which is the average value of the envelope of an applied signal

~~signal.~~

Note 1 to entry: The average value ~~must~~shall be taken over a specified time interval.

[~~Source:~~ SOURCE; IEC 60050-161:1990, 161-04-26]

3.5 ~~3.5~~
broadband emission
emission which has a bandwidth greater than that of a particular measuring apparatus or receiver

3.6 ~~3.6~~
bulk current
total amount of common mode current in a harness

3.7 ~~3.7~~
conducted transients
transient voltage or current distributed in the power supply wiring of a machine or component or separate technical unit via a conductor between the source of the transient and the drain

3.8 ~~3.8~~
degradation of performance
undesired departure in the operational performance of any device, equipment, or system from its intended performance

Note 1 to entry: The term “degradation” also applies to temporary or permanent failure.

[~~Source~~SOURCE: IEC 60050-161:1990]

3.9 ~~3.9~~
electrical/electronic sub-assembly

ESA
electrical and/or electronic component or set of components intended to be part of a machine, together with any associated electrical connections and wiring, which performs one or more specialised functions.

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3.10 ~~3.10~~
electrical/electronic system
electrical and/or electronic component or set of components intended to be part of a machine, together with any associated electrical connections.

3.11 ~~3.11~~
electromagnetic compatibility
EMC
ability of equipment or system to function satisfactorily in its *electromagnetic environment* ~~(3.13)~~(3.13) without introducing intolerable *electromagnetic disturbance* (3.12) to anything in that environment

[SOURCE: IEC 60050-161 ~~Ed. 1.0 t~~:1990]

3.12 ~~3.12~~
electromagnetic disturbance
any electromagnetic phenomenon which may degrade the performance of a machine or component or separate technical unit~~.~~

Note 1 to entry: An electromagnetic disturbance may be an electromagnetic noise, an unwanted signal, or a change in the propagation medium itself.

3.13 ~~3.13~~
electromagnetic environment
totality of electromagnetic phenomena existing at a given location

3.14 ~~3.14~~
electrostatic discharge

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

3.15 ~~3.15~~
ESA type
ESA which does 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~~.~~

3.16 ~~3.16~~
immunity related functions
functions related to operator control, and to the direct control or operation of the machine by affecting visibility, or which, when disturbed, cause confusion to the operator or others nearby or to machine statutory data, and functions related to machine data bus functionality

Note 1 to entry: Examples of immunity related functions may include, but are not limited to:

— unexpected machine movement;

— changes in engine speed, wheel speed or wheel angle;

— driving lights, windscreen wipers, demisting systems, direction indicators, stop lamps, marker lamps, rear position lamp, emergency light bars;

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— wrong information from warning indicators, lamps, or displays related to the functions of operator control;

— acoustical disturbances from incorrect operation of anti-theft alarms, horns, reverse movement alarm;

— functions which can affect machine statutory data such as hour meters and odometers;

— machine data bus functions which can block data transmission on machine data bus system used to transmit data related to the correct functioning of other immunity related functions;

— unexpected activation of safety restraint systems;

— unexpected movement of driver's seat or steering wheel position.

3.17 ~~3.17~~
machine type
machines which do 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 machine consists of (for example a steel, aluminium or fibreglass covering parts).

3.18 ~~3.18~~
narrowband
emission which has a bandwidth less than that of a particular measuring apparatus or receiver

~~[Source~~[SOURCE: IEC 60050-161:1990]

3.19 ~~3.19~~
non-immunity related functions
functions which are not related to direct operator control or operation of the machine

3.20 ~~3.20~~
peak detector
detector, the output voltage of which is the peak value of an applied signal

[~~Source~~SOURCE: IEC 60050-161:1990, 161-04-24]

3.21 ~~3.21~~
pulse modulation type 1
PM type 1
pulse modulation similar to GSM, with t_{on} = 577 µs and a period = 4 600 µs

3.22 ~~3.22~~
pulse modulation type 2
PM type 2
pulse modulation similar to radar, with t_{on} = 3 µs and a period = 3 333 µs

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3.23 ~~3.23~~
quasi-peak detector
detector having specified *electrical time constants* which, when regularly repeated identical *pulses* are applied to it, delivers an output voltage which is a fraction of the peak value of the pulses, the fraction increasing towards unity as the pulse repetition rate is increased

~~*pulses* are applied to it, delivers an output voltage which is a fraction of the peak value of the pulses, the fraction increasing towards unity as the pulse repetition rate is increased~~

~~[Source~~[SOURCE: IEC 60050-161:1990, 161-04-24]

3.24 ~~3.24~~
reference limit
limit value with which the production conforms to

4 Requirements

4.1 Fulfilment of requirements

The requirements of this document shall be met by a machine (and its electrical/electronic installation or its ESA's) operating in accordance with its final purpose.

If the entire machine is not tested, then the use of options b) and c) shall require a combination of the testing described, and sufficient analysis of the combined machine(s) and ESA(s) to ensure proper performance to this document when combined.

a) The requirements of this document are deemed to be fulfilled for a complete machine when the requirements identified in ~~Clauses 5, 6~~Clauses 5, 6, and ~~9~~9 as applicable, are fulfilled. No routine tests of the electrical/electronic systems or ESA's are required.

b) The requirements of this document are deemed to be fulfilled if it is confirmed by the machine manufacturer that all electrical/electronic systems or ESA's fulfil the requirements identified in ~~Clauses 7, 8, 9, 10, and 11~~Clauses 7, 8, 9, 10, and 11 and has been installed taking into account the recommended requirements of the ESA manufacturer and risk assessment by the machine manufacturer.

c) The requirements of this document are deemed to be fulfilled for a machine meeting the requirements of ~~Clauses 5, 6, 9~~Clauses 5, 6, 9, and in which an electrical/electronic system, ESA, tractor/towed implement, or other types of implement combinations, which also complies with ~~Clauses 7, 8, 9, 10~~Clauses 7, 8, 9, 10, and ~~11~~11 and has been installed taking into account the recommended requirements of the ESA manufacturer and risk assessment by the system integrator.

d) The requirements of this document are also deemed to be fulfilled when the machine has no such equipment for which an immunity or interference test is required. In this case, no tests are necessary (see exceptions in ~~Clause 12~~Clause 12).

4.2 Test specimen

The test specimen may be of an ESA type or machine type as specified in ~~3.15~~3.15 and ~~3.17.~~3.17.

For a subsequent test on a similarly configured machine or ESA, conformity to the reference limits shall be accepted as fulfilment of the requirements of this document.

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

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