
**Agricultural machinery and
tractors — Safety of higher voltage
electrical and electronic components
and systems —**

Part 1:
General requirements

*Tracteurs et matériels agricoles — Sécurité des composants et des
systèmes électriques et électroniques haute tension —*

Partie 1: Exigences générales

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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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 3, *Safety and comfort*.

ISO 16230 consists of the following parts, under the general title *Agricultural machinery and tractors — Safety of higher voltage electrical and electronic components and systems*:

— *Part 1: General requirements*

Introduction

Electrification is an enabling technology regarding increased power density and greater flexibility in machine form packaging. Customer benefits are increased fuel economy through efficiency gains and enhanced power delivery options not possible with current mechanical systems.

Agricultural machinery electrical systems have traditionally been in the 12 V DC range. Electrification is introducing significantly higher voltages to the Agricultural machinery and mobile equipment sector (see scope definition) usually observed only in industrial/building applications and other transportation sectors. Increased voltage potential requires special safety considerations in this new environment.

The purpose of this standard is to provide direction on safety of electrical systems as defined in the scope (50 V AC to 1000 V AC and 75 V DC to 1500 V DC) on Agricultural machinery and tractors.

In addition, this part of ISO 16230 defines requirements that can apply to the electrical equipment of agricultural tractors and machines. Example areas include, but are not exclusive to the following:

- protection against electric shock;
- wiring practices;
- marking warning signs — safety symbols;
- operator manual considerations.

Supporting electrical equipment standards like IEC 60204-1 and ISO 6469 were considered. Additional parts of this International Standard are expected to deal with external machine interface (power distribution and communication).

This part of ISO 16230 is a type-C standard as defined in ISO 12100.

When requirements of this type-C standard are different from those stated in type-A or 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

Agricultural machinery and tractors — Safety of higher voltage electrical and electronic components and systems —

Part 1: General requirements

1 Scope

This part of ISO 16230 is applicable to tractors and self-propelled ride-on machines, mounted implements, and towed implements used in agriculture and forestry. This part of ISO 16230 specifies general requirements that relate to the protection and safety of operators and bystanders on machines with on-board voltages in the range of 50 V AC to 1000 V AC and 75 V DC to 1500 V DC. This part of ISO 16230 applies to electrical equipment and parts of the electrical equipment on such machines and includes general requirements related to the protection and safety of operators, bystanders, and first responders.

This part of ISO 16230 deals with significant hazards, hazardous situations, and events, as listed in [Annex A](#), relevant to this agricultural machinery when used as intended and under the conditions of misuse foreseeable by the manufacturer during normal operation and service.

This part of ISO 16230 is not applicable to the following:

- specific design elements of external interfaces (e.g. the interface between a tractor and implement);
- externally powered equipment (e.g. line powered equipment, equipment without on-board power generation);
- purpose built forestry machines;
- stationary electrical generators.

This part of ISO 16230 is not applicable to machines which are manufactured before the date of its publication.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 6469-3:2011, *Electrically propelled road vehicles — Safety specifications — Part 3: Protection of persons against electric shock*

IEC 60204-1:2005 + AMD1:2008, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60364-4-41, *Low-voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles*,

IEC 61140:2009, *Protection against electric shock — Common aspects for installation and equipment*