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Changes in Edition 6.0 of IEC 60204-1

Effects on the electrical equipment of machines

White Paper I July 2017

The basic safety standard IEC 60204-1 "Safety of machinery – Electrical equipment of machines – Part 1: General requirements for electrical equipment of machines" represents an important standard for the electrical equipment of machines. This includes the control panels of machines.
In recent years the International Electrotechnical Commission has worked on a new version of IEC 60204-1, which was published in October 2016. This white paper provides an overview of important changes in the new standard.

A white paper issued by: Siemens.

Content

Introduction

Standards are not laws, but they are an important tool for ensuring a minimum required safety level and for depicting the current state of the art.

A good example of the importance of standards is represented by the conformity assessment procedure in the European Economic Area. Products placed on the market in the European Economic Area (EEA) **must** have the CE mark. With the CE mark the manufacturer confirms that its product meets the requirements of the applicable directive and meets the safety objectives of the directive. This means that compliance with European directives is mandatory in the EEA.

Directives themselves describe basic requirements and contain few technical details. For this reason, directives in the Official Journal of the European Union refer to harmonized standards. Compliance with these harmonized standards leads to the so-called presumption of conformity. In other words, if one or more harmonized standards from the Official Journal are complied with, it is presumed that the safety objectives of the directive applicable to the product are met.

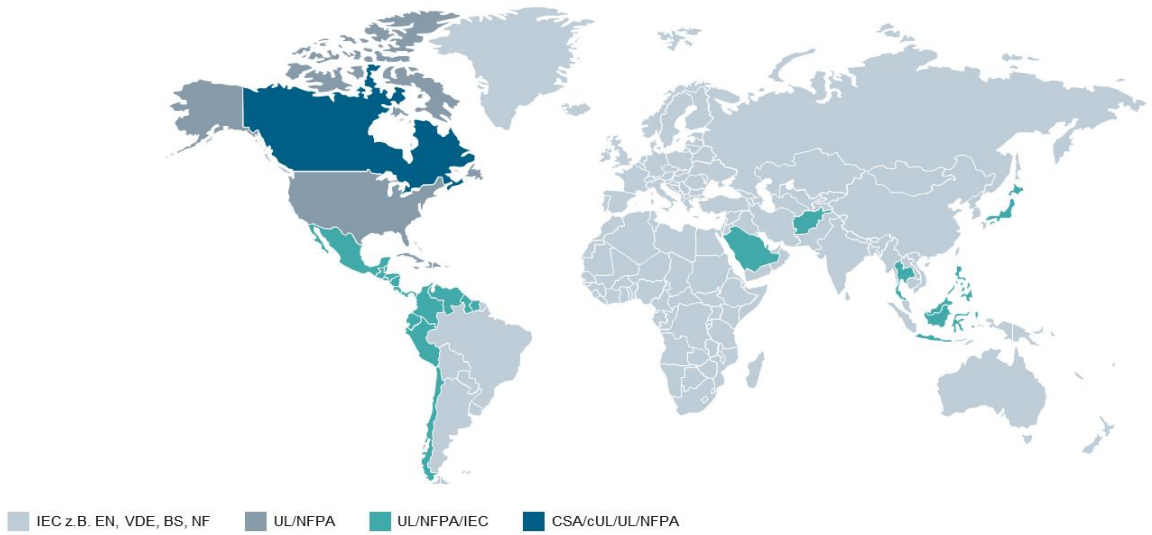
Relevant directives for the electrical equipment of machines include the Low Voltage Directive 2014/35/EU and the Machinery Directive 2006/42/EC. Other directives may also apply depending on the application.

Both the Low Voltage Directive 2014/35/EU and the Machinery Directive 2006/42/EC include "EN 60204-1 Safety of machinery – Electrical equipment of machines – Part 1: General Requirements" as a harmonized standard in their lists of standards in the respective Official Journals. EN 60204-1 is the European version of the international IEC 60204-1.

IEC 60204-1 forms an important basis for compliance with the technical requirements for electrical equipment of machines in Europe.

Compliance with IEC standards is also required directly or indirectly in other markets. The following figure shows the countries in which IEC standards or country-specific versions of IEC standards apply. The German version of IEC 60204-1 valid in Germany is DIN EN 60204-1.

The publication of Edition 6.0 in October 2016 is very important and of great interest to the international control panel and machine building market.



General information on IEC 60204-1

Scope

IEC 60204-1

- applies to electrical, electronic and programmable electronic equipment and systems to machines not portable by hand while working
- commences at the point of connection of the supply to the electrical equipment of the machine
- covers nominal voltages not exceeding 1000 V for alternating current and not exceeding 1500 V for direct current
- does not cover all the requirements that are needed or required by other standards or regulations in order to protect persons from hazards other than electrical hazards. Each type of machine has unique requirements to be accommodated to provide adequate safety.
- does not specify additional and special requirements that can apply to the electrical equipment of machines that, for example:
    - are intended for use in open air
    - use, process or produce potentially explosive material
    - are intended for use in potentially explosive and/or flammable atmospheres
    - have special risks when producing or using certain materials
    - are intended for use in mines
    - are sewing machines, units and systems
    - are hoisting machines
    - are semiconductor fabrication equipment

Target group

IEC 60204-1 targets persons who plan, configure and create electrical equipment of machines.

They are essentially:

- Plant manufacturers
- Industrial control panel builders
- Machine builders
- Electrical system planners

Acceptance in international IEC market

Publication of the international IEC standard is followed by harmonization by the CENELEC standardization organization (European Committee for Electrotechnical Standardization). The goal of this activity is to adopt the IEC standards into the Official Journals of the European Union as EN standards.

The listing of IEC 60204-1 as EN 60204-1 and the publication of the German translation as DIN EN 60204-1 is expected in around in the fall/winter of 2017.

Generally, a transition period for replacement of Edition 5.0 with Edition 6.0 will also be granted. Both editions can be used during the transition period. However, Edition 6.0 will supersede Edition 5.0 in the foreseeable future.

A similar situation is likely to arise in other IEC markets outside the EEA. It will take a while until Edition 6.0 is translated into the respective country versions. However, there is no doubt that Edition 6.0 will become widely disseminated and accepted in the international IEC market over the next few months and years.

Changes in Edition 6.0 of IEC 60204-1

The most important changes at a glance

Some of the topics that have been revised or added include:

- Applications with power drive systems (PDS)
- Electromagnetic compatibility (EMC)
- Short-circuit current rating of electrical equipment
- Overcurrent protection and protective bonding circuit
- Revision of "Control circuits and control functions" chapter
- Mandatory residual current devices (RCDs) for socket outlet circuits up to 20 A nominal current
- Symbols for actuators and control devices
- Requirements for technical documentation
- National requirements, normative specifications, and literature references

Additional details are provided below:

Requirements for technical documentation

The requirements for technical documentation were completely revised in Chapter 17 and reduced to "necessary documents".

Information needed for identification, transport, installation and mounting, use, maintenance, decommissioning and disposal of electrical equipment shall be provided.

Chapter 17.2 "Information related to the electrical equipment" has been made more specific.

Annex I now includes a table that assigns the type of information for the electrical equipment to the recommended standard. Manufacturers and customers can use this table very effectively to agree on the type and scope of technical documentation.

Applications with power drive systems (PDS)

Chapter 18.2 of IEC 60204-1 requires verification of conditions for protection by automatic disconnection of the power supply. This verification consists of two parts:

1. Verification of the continuity of the protective bonding circuit
2. Verification of the fault loop impedance and the suitability of the associated overcurrent protective device

According to Chapter 18.2.3 the fault loop impedance can be calculated or measured.

Edition 5.0 did not describe the fault loop impedance measurement on motors that are supplied by a power drive system (PDS), such as a frequency converter. Because measuring "through" a frequency converter is not possible, this represents a gray area in practice.

Edition 6.0 clearly describes how to handle motors that are supplied by a power drive system, such as a frequency converter. The test device must be applied to the input terminals according to the following figure.

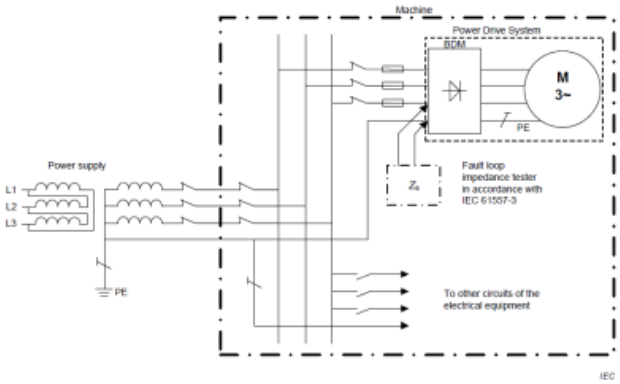


Figure A.2 – Typical arrangement for fault loop impedance (Z_s) measurement for power drive system circuits in TN systems

(Source : IEC 60204-1, Figure A.2)

The specifications of the converter manufacturer must also be observed. If appropriate specifications are not available from the manufacturer, this must be indicated as a deficiency for the test.

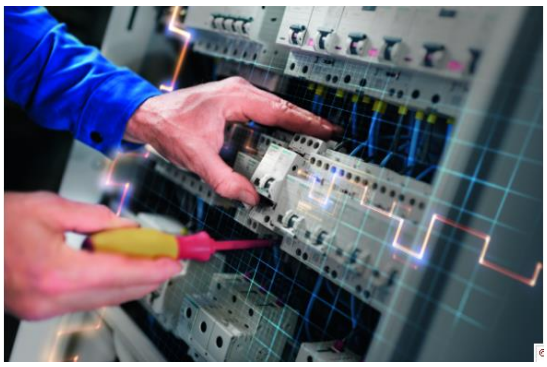
Siemens has the appropriate information available for its frequency converters in Siemens Industry Online Support.

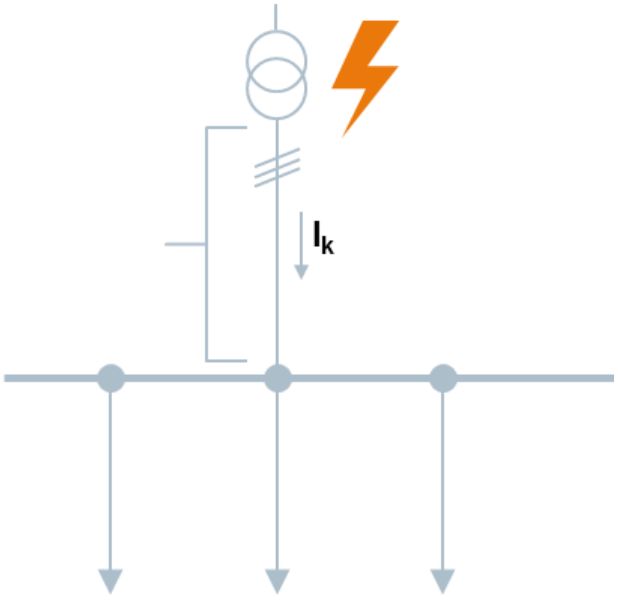
Changes in Edition 6.0 of IEC 60204-1

Residual current devices (RCDs) for socket outlet circuits up to 20 A

Chapter 15.1 of Edition 5.0 describes the use of residual current devices (RCDs) only as an option.
In conjunction with fault protection against electric shock and the required disconnecting times in Table A.1 for handheld Class I equipment (e.g. 0.4 s for U_0 = 230 V), however, residual current devices are used most of the time. They are not mandatory for Class II equipment, for example.

This has been changed in Edition 6.0. In Chapter 15.1, residual current devices (RCDs) with a rated residual current of $I_{\Delta n} \leq 30$ mA are now generally required for socket outlet circuits up to 20 A nominal current.





(Figure: Short-circuit currents at the transformer: In the case of a short-circuit remote from the generator, the initial symmetrical short-circuit current remains virtually constant throughout the duration of the short-circuit and is equal to the steady short-circuit current.)

Short-circuit current rating of electrical equipment

The electrical equipment of a machine must always be designed for the minimum and maximum possible short-circuit at the machine's infeed point. It is not enough to focus only on short-circuit protection in the infeed, e.g. integrated in the supply disconnecting device. All the electrical equipment must be evaluated.

Edition 5.0 does not address this topic. Newly added Chapter 7.10 in Edition 6.0 describes the requirement for measuring the short-circuit current rating of the electrical equipment. The use of design rules, calculations or tests is permitted.

Edition 6.0 does not describe its own procedure, but instead references other standards. Methods according to IEC 61439-1, IEC 60909-0, IEC/TR 60909-1 and IEC/TR 61912-1 are named as possible methods.

Further information from Siemens.

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