

The background image shows two men in a control room. The man on the left is wearing a white shirt and holding a tablet, gesturing towards the equipment. The man on the right is wearing a blue checkered shirt and glasses, holding a stack of papers. They are standing in front of a large rack of industrial control panels with various buttons and screens.

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Ingenuity for life

IEC 60204-1 6th edition

Updates on Power Drive Systems

White Paper - October 2017

The safety standard IEC 60204-1 "Safety of machinery - Electrical equipment of machines - Part 1: General requirements for electrical equipment on machines" is an important reference to promote safety international uniformity in electrical equipment.

The Edition 6.0 of the IEC 60204-1 has been prepared by the IEC technical committee and published at the end of 2016 in order to substitute the 2005 version.

This white paper is aimed to highlight the changes that might affect Power Drive Systems and their safety operation.

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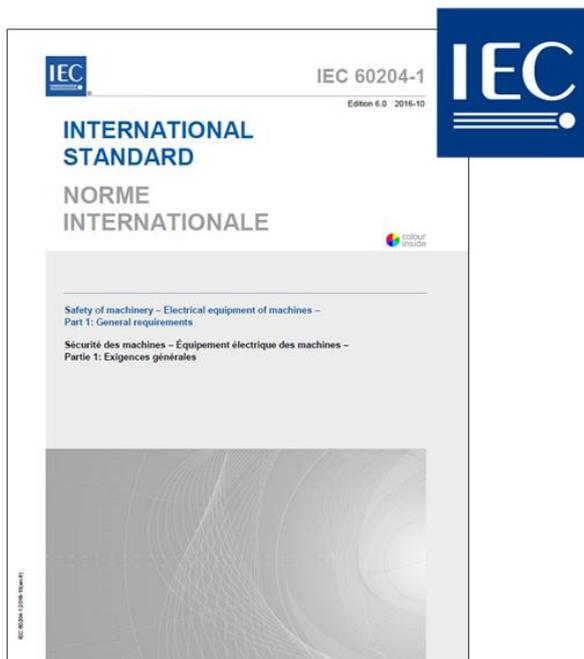
Introduction

Edition 6.0 comes into effect

On October 2016, IEC released the 6th edition of the IEC 60204-1 standard, which is the reference for electrical safety of machine manufacturers.

This standard means to provide requirements and recommendations involving electrical equipment, as well as to promote:

- Safety of persons and property.
- Consistency of control response.
- Ease of operation and maintenance.



Target group

The IEC 60204-1 is aimed at the electrical equipment of machine design, project and manufacture.

Scope

The IEC 60204-1 is intended to be used in the following range of application:

- Within electric, electronic and programmable equipment and systems for machines.
- Equipment starting at the point of connection of the supply to the electrical equipment of the machine.
- Control cabinets with rated voltages up to 1000 V for alternating current (AC) and up to 1500 V for direct current (DC).
- Does not take into account all requirements that are necessary or are required by other standards or regulations to protect persons from risks other than electrical hazards.

Some important changes

This edition includes among other significant technical changes the following topics with respect to the 5th version:

- Applications with Power Drive Systems (PDS).
- Electromagnetic compatibility (EMC).
- Short-circuit current rating of electrical equipment.
- Overcurrent protection and protective bonding circuit.
- Control circuits and control functions.
- Icons for actuators and control devices.
- Requirements for the technical documentation.
- National requirements, normative specifications, and literature references.

Nonetheless, the safety applications within PDS will be the focus of this publication.

Timetable:

Since when should the Edition 6.0 be adopted?

This sixth edition constitutes a technical revision and cancels and replaces with some transition time the fifth edition published in 2005.

The adoption in the Official Journal of the European Union is expected on fall, 2017.

Changes in the IEC 60204-1 Regarding Power Drive Systems

Overview

Over the last decade, power drive systems have grown widely inside the industrial automation, and so its regulation.

For these reasons, this publication intention is to clarify part of the changes affecting the requirements of PDS.

Among these changes are featured: the safe standstill of the drives (safe torque off), and the updates regarding overcurrent and overload protection against electric shock, which include new terminology such as the concept of short-circuit current rating.

In addition, Edition 6.0 includes updates regarding new error loop measurement for protection using automatic switch-off; regulatory requirements for equipotential bonding; and clarified methods of protection against indirect contact.

Up next, further information about two of the most important changes within PDS is given.

Updates concerning Safe Torque Off (STO)

The STO function is a drive safety function that ensures that no torque-generating energy can continue to act upon a motor and prevents unintentional starting.

In accordance with 60204-1 section 5.4, the Safe Torque Off function safely clears the pulses of the drive making it reliably torque-free.

Additionally, Edition 6.0 contains in section 5.3 a clarification regarding the incoming supply conductor terminations and devices for disconnecting and switching off, which confirms that no isolation from the network is necessary for PDS with STO used to prevent unexpected start-ups. Nonetheless, in order to work on the electrical equipment, an isolating device still must be provided.



Family of SINAMICS power drives

Updates regarding protection against electric shock in case of indirect contact

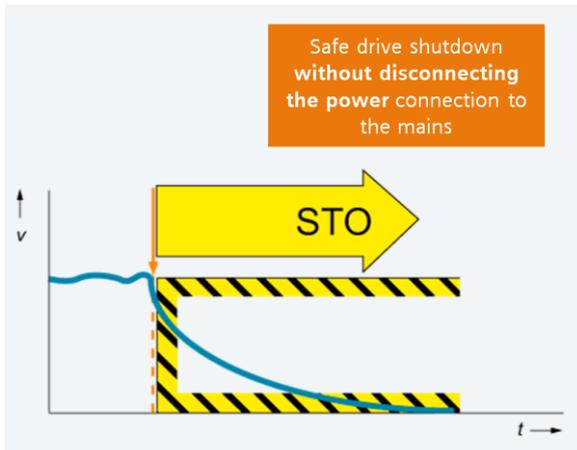
The protection against electric shock is intended to prevent dangerous situations by enabling basic and fault protection against direct or indirect contact with conductive parts. Nonetheless, Edition 6.0 contains only changes regarding indirect contact.

The updated section 6.3.3 clarifies that converters shall provide an output protection that automatically disconnects supplied circuits (motors, motor cables, motor chokes) in case of insulation faults, so that the duration of the touch voltage is sufficiently short.

As appears in the standard 60204-1, manufacturers of converters that do not provide output protection are required to provide instructions on additional protection measures.

Siemens drive technology

Application examples



Safe Torque Off (STO)

Our SINAMICS drives benefit from integrated STO function. The STO has the immediate effect that the drive cannot supply any torque-generating energy.

There is an increased risk of injury to personnel and damage to machines wherever there are rotating units. Therefore, in compliance with 602204-1, STO can be used in many applications to bring the drive to a standstill in a sufficiently short time by the load torque or friction.

STO also enables safe working when the protective door is open (restart interlock) and has a wide range of use in machines/ systems with moving axes, e.g. handling, conveyor technology.

Integrated protection functions

All SINAMICS drives provide integrated protection against electric shock for the supplied circuits by automatic disconnection of the supply as shown in the standard 60204-1 section 6.3.3.

Furthermore, the drives provide integrated protection functions for the equipment connected to the converter output:

- Overcurrent protection as per section 7.2
- Overload protection as per section 7.3.2

Short-circuit protective devices are required on the line side of the drive system. For the SINAMICS drives a choice of validated protective devices is available. Some of them usually included are:

- Siemens 3NA LV fuses
- Siemens SIRIUS 3RV2 motor starter protectors
- Siemens SENTRON 3VA1 circuit breakers

In compliance with 60204-1, our safety technology starting from the Safety Integrated input terminals of the SINAMICS components (control unit, motor module), and all the way through our cable routing methods, cable insulation, shielding and installation standards satisfy all requirements.

Customer benefits:

- **Powerful safety** concepts with short response times
- **High degree of flexibility:** safety and operating concept can be implemented in-line with those required in practice
- **Increased cost-effectiveness:** lower hardware and installation costs
- **Higher availability:** electromechanical switching elements sensitive to disturbances are eliminated



Safety integrated functions



Increased availability



Normative compliant



Lower costs



Reduced number of components

Systems with Safety Integrated

Simply safe – twice the efficiency

SINAMICS safety integrated reacts more quickly

Safety Integrated (SI) is the safety concept that reliably masters specific dangerous situations, such as wherever there are rotating units (e.g. saws, rolls and spindles).

It has a significantly faster response time and a higher degree of functionality with generally unchanged and occasionally even increased productivity.

Lower costs, increased safety

While conventional safety technology always requires additional contactors, safety relays and interlocking circuits, for the integrated safety technology from Siemens, all of these additional electromechanical components are eliminated from the very start.

A solution for safety

For any application Safety Integrated from Siemens offers the right solution according to IEC 60204-1. The Safety Integrated portfolio contains SIMATIC, SIRIUS and SINAMICS components which work perfectly together.

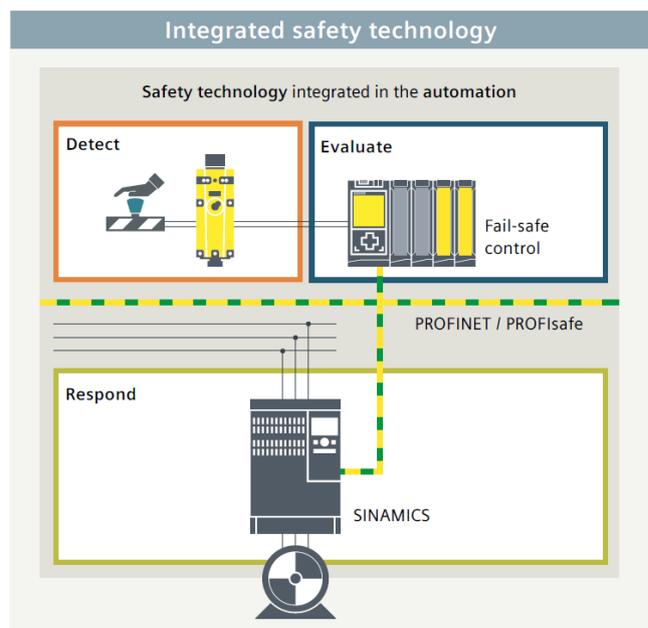
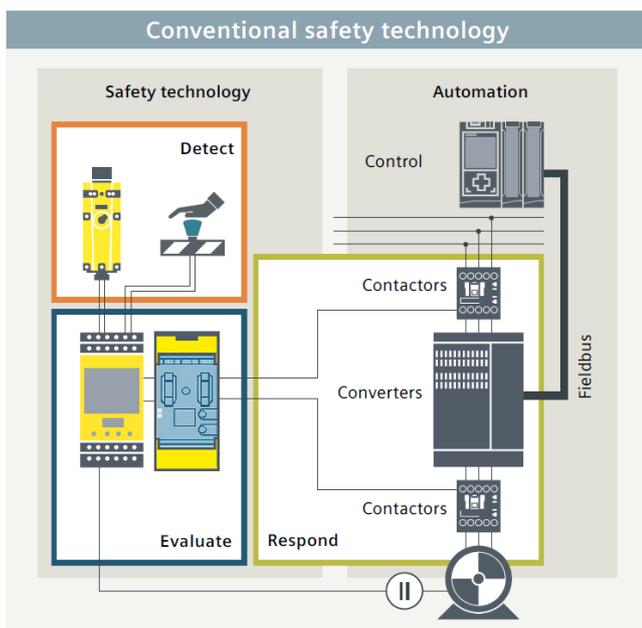
And even more..

As the safety-relevant signals can be transferred via standard fieldbuses, the complexity and therefore wiring costs are reduced. As a consequence, the high requirements of the safety standards can be far more simply implemented. And not only this, as a result of the lower number of components, machine availability is increased.



For further information visit:

www.siemens.com/safety-drives



Abbreviations

AC	Alternating current
DC	Direct current
EMC	Electro-Magnetic Compatibility
IEC	International Electro-technical Commission
PDS	Power Drive System
SI	Safety Integrated
STO	Safe Torque Off

Further information from Siemens

Siemens keeps you up-to-date.

Whether you are looking for reference works, web-based training courses, helpful engineering tools or useful information on panel building, you will find comprehensive information on "expert know-how", "tools and data for digitalization in engineering" and "aligned product and system portfolio" on our market portal for panel building:

usa.siemens.com/controlpanels

Still have questions or need additional support?

Siemens supports panel builders with free consulting and training on standards. Get in contact with one of our experts by sending us an email to:

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