

TECHNICAL SPECIFICATION

Safety of machinery – Electrical equipment of machines –
Part 34: Requirements for machine tools

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IEC TS 60204-34:2016

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF MACHINERY –
ELECTRICAL EQUIPMENT OF MACHINES –****Part 34 : Requirements for machine tools**

FOREWORD

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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 60204-34, which is a technical specification, has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
44/735/DTS	44/748/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part of IEC 60204 is intended to be used in conjunction with IEC 60204-1:—1.

This part supplements or modifies the corresponding clauses in IEC 60204-1.

The numbering system is based on IEC 60204-31:2013. Where a particular clause or subclause of Part 1 is not mentioned in this Part 34, that clause or subclause applies as far as is reasonable. Where this part states "addition", "modification" or "replacement", the relevant text, notes, figures, and tables in Part 1 are to be adapted accordingly.

Annexes which are additional to those in part 1 are lettered AA, BB, CC, DD, EE and FF.

A list of all parts in the IEC 60204 series, published under the general title *Safety of machinery – Electrical equipment of machines*, can be found on the IEC website.

A bilingual version of this publication may be issued at a later date.

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¹ Stage at the time of publication: IEC/FDIS 60204-1:2016.

SAFETY OF MACHINERY – ELECTRICAL EQUIPMENT OF MACHINES –

Part 34 : Requirements for machine tools

1 Scope

This clause of IEC 60204-1 is applicable except as follows:

Replacement:

This part of IEC 60204 applies to electrical, electronic and programmable electronic equipment and systems of machine tools not portable by hand while working, including a group of machines working together in a co-ordinated manner.

In this part of IEC 60204, machine tools means all machines for the working of metal, wood, plastics and stone, operating by forming or removal of material. The following list includes examples of machine tools but not limited to:

- Turning machines (i.e. manually controlled turning machines without numerical control, manually controlled turning machines with limited numerically controlled capability, numerically controlled turning machines and turning centres, single- or multi-spindle automatic turning machines);
- Milling machines (including boring machines);
- Machining centres;
- Planing machines;
- Drilling machines;
- Grinding machines;
- Laser processing machines;
- Electro Discharge Machines (EDM) (except their power circuit for discharge);
- Sawing machines for cold metal;
- Guillotine shears;
- Hydraulic press brakes;
- Mechanical (or hydraulic, pneumatic) presses.

Power circuits where electrical energy is directly used as a working tool are excluded from this part of IEC 60204.

In addition to this document, the applicable C-standard for the machines listed in the examples can be referred for more information.

2 Normative references

This clause of IEC 60204-1 is applicable except as follows:

Additional references:

IEC 60204-1:—, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60825-4, *Safety of laser products – Part 4: Laser guards*

ISO 14119, *Safety of machinery – Interlocking devices associated with guards – Principles for design and selection*

3 Terms and definitions

This clause of IEC 60204-1 is applicable except as follows:

Additional definitions:

3.101

machine tool

MT

machine, not portable as a whole during its operation, driven by an external electrical energy source and intended to work material in the solid state, with material removal (cutting processes as turning, milling, grinding, drilling, machining...) or without material removal (forming processes such as bending, forging, etc.)

Note 1 to entry: The machine tool is normally equipped with a power supply, an electrical and electronic assembly for power and control and one or more power drive systems for the movement of elements or parts.

[SOURCE: EN 50370-1:2005, 3.1, modified — “typically metal products” has been changed to “work material”. The last sentence (has been changed to NOTE 1 to entry.)

3.102

numerical control

NC

automatic control of process performed by a device that makes use of numerical data introduced while the operation is in progress

[SOURCE: ISO 2806:1994, 2.1.1]

3.103

computerized numerical control

CNC

realization of NC(3.102) using a computer to control the machine functions

[SOURCE: ISO 2806:1994, 2.1.2]

3.104

safety integrity level

SIL

discrete level (one out of a possible three), corresponding to a range of safety integrity values, where safety integrity level 3 has the highest level of safety integrity and safety integrity level 1 has the lowest

[SOURCE: IEC 61508-4:2010, 3.5.6, modified — The words "one out of a possible four" have been replaced by "one out of a possible three" and the words "safety integrity level 4" have been replaced by "safety integrity level 3".]

3.105

type test

test made on one or more equipment representative of the production in order to confirm that the design fulfils certain specifications

[SOURCE: IEC 60050-151:2001, 151-16-16, modified — The word "conformity" has been removed before "test made...", the word "items" has been replaced by "equipment" and the text from "in order to" has been added.]

3.106 performance level PL

discrete level used to specify the ability of safety-related parts of control systems to perform a safety function under foreseeable conditions

[SOURCE: ISO 13849-1:2015, 3.1.23]

3.1000 Abbreviated terms

This subclause of IEC 60204-1 is applicable except as follows:

The abbreviations listed in Table 1 below are used in this Technical Specification.

Table 1 – List of terms and abbreviations

AC	Alternating Current
CNC	Computerized Numerical Control
CPU	Central Processing Unit
DC	Direct Current
EDM	Electro Discharge Machines
EMC	Electromagnetic Compatibility
ESPE	Electro-Sensitive Protective Equipment
I/O	Input / Output
IP	Ingress Protection
LED	Light-Emitting Diode
MT	Machine Tool
NC	Numerical Control
PELV	Protective Extra-Low Voltage
PL	Performance Level
PWB	Printed Wiring Board
RAM	Random Access Memory
RCD	Residual Current Device
SELV	safety Extra-Low Voltage
SIL	Safety Integrity Level

4 General requirements

This clause of IEC 60204-1 is applicable except as follows:

4.4.2 Electromagnetic compatibility (EMC)

Addition:

NOTE 2 Additional guidance can be found in Annex AA.

4.4.3 Ambient air temperature

Addition:

Manufacturer of machine tools could specify a lower minimum and/or a higher maximum ambient air temperatures according to application of the equipment of machine tools.

4.4.5 Altitude

Addition:

NOTE More information about the insulation coordination at the altitudes more than 1 000 m can be found in IEC 60664-1.

4.4.7 Ionizing and non-ionizing radiation

Addition:

Laser processing machines can generate laser radiation. Laser class according to IEC 60825-1 shall be stated and laser hazard label which correspond to the laser class need to be affixed, and laser hazards shall be minimised according to IEC 60825-1 and IEC 60825-4. IEC 60825-4 specifies requirements for laser guards.

NOTE Further requirements on industrial laser equipment can be found in IEC 60519-12. Further information can be found in ISO 11553-1.

5 Incoming supply conductor terminations and devices for disconnecting and switching off

This clause of IEC 60204-1 is applicable except as follows:

5.1 Incoming supply conductor terminations

Addition:

Add after the first sentence of the first paragraph:

When a machine tool needs to use several electrical cabinets, it is recommended that the main power supply is connected to the main power switch of one single electrical cabinet. If other cabinets need a power supply, it is recommended that they connect to the main power switch of this one single electrical cabinet.

For machinery, where two or more incoming supplies are provided, see Clause 5 of IEC 60204-1:—.

6 Protection against electric shock

This clause of IEC 60204-1 is applicable

7 Protection of equipment

This clause of IEC 60204-1 is applicable

8 Equipotential bonding

This clause of IEC 60204-1 is applicable except as follows:

8.2.3 Continuity of the protective bonding circuit

Addition:

It shall be assured that the bed and the electrical cabinet of a machine tool have continuity to the protective bonding circuit.

9 Control circuits and control functions

Addition:

See Annex BB for numerical control system of machine tools.

9.1.2 Control circuit voltages

Addition:

Add after the final paragraph:

It is recommended that the control circuit voltage be one of the following but not limited to:

- 6/24/48/100/110/120/200/220/230 V (AC);
- 5/6/12/24/48/110/220 V (DC);

9.2.3.5 Operating modes

Addition:

Add after the final paragraph: standards.iteh.ai/catalog/standards/sist/5e5f661f-32f9-4dce-b18d-9c0aa304eeff/iec-ts-60204-34-2016

Numerical control machine tools usually have many operating modes, for example manual mode, automatic mode, setting mode, service mode, etc.

Mode selector shall ensure that only one mode is active at anytime. The parts of the control system provided for mode selector shall be assigned to a suitable PL of ISO 13849-1 or SIL of IEC 62061. Required PL or SIL should be selected by risk assessment or in accordance with relevant type-C standards, e.g. ISO 23125.

9.3 Protective interlocks

Addition:

Add a new subclause:

9.3.7 Interlocking guards with guard locking

If hazardous situations still exist after removal of power, an interlocking guard with guard locking (see also ISO 14119) shall be provided, fulfilling a suitable PL of ISO 13849-1 or SIL of IEC 62061. Required PL or SIL should be selected by risk assessment or in accordance with relevant type-C standards, e.g. ISO 23125.

9.4 Control functions in the event of failure

Addition:

Add a new subclause:

9.4.4 Levels of functional safety

Functional safety is part of the overall safety that depends on a system or equipment operating correctly in response to its inputs.

For the purposes of ISO 13849, the ability of safety-related parts to perform a safety function is expressed through the determination of the performance level (PL).

According to IEC 62061 and IEC 61508, the ability of safety-related control systems to perform a safety function is given through a SIL. Table 2 displays the relationship between the two concepts (PLs and SILs). See Annex A of ISO 13849-1:2006 for determination of required performance level (PLs); a SIL example of a methodology is given in Annex A of IEC 62061:2005, IEC 62061:2005/AMD1:2012 and IEC 62061:2005/AMD2:2015.

Detailed information to implement functional safety is given in ISO 13849-1, IEC 62061, IEC 61508, IEC 61131-6.

Table 2 – SIL and PL

Safety integrity level SIL (IEC 61508-1 or IEC 62061, for information), continuous mode of operation	Probability of dangerous failures per hour (i/h)	Performance level PL
–	$\geq 10^{-5}$ to $< 10^{-4}$	a
SIL1	$\geq 3 \times 10^{-6}$ to $< 10^{-5}$	b
SIL1	$\geq 10^{-6}$ to $< 3 \times 10^{-6}$	c
SIL2	$\geq 10^{-7}$ to $< 10^{-6}$	d
SIL3	$\geq 10^{-8}$ to $< 10^{-7}$	e

NOTE Table 2 is based on ISO 13849-1, IEC 61508-1 and IEC 62061.

10 Operator interface and machine-mounted control devices

This clause of IEC 60204-1 is applicable except as follows:

10.3.2 Colours

Modification:

Add an example in the last line, last column of Table 4, as follows:

Table 4 – Colours for indicator lights and their meanings with respect to the condition of the machine

Colour	Meaning	Explanation	Action by operator
RED	Emergency	Hazardous condition	Immediate action to deal with hazardous condition (for example switching off the machine supply, being alert to the hazardous condition and staying clear of the machine)
YELLOW	Abnormal	Abnormal condition Impending critical condition	Monitoring and/or intervention (for example by re-establishing the intended function)
BLUE	Mandatory	Indication of a condition that requires action by the operator	Mandatory action
GREEN	Normal	Normal condition	Optional
WHITE	Neutral	Other conditions; may be used whenever doubt exists about the application of RED, YELLOW, GREEN, BLUE	Monitoring (e.g. power indicating)

10.6 Start devices

Addition:

For example, the start pushbutton can be of the recessed or flush type or protected by a cover.

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11 Controlgear: location, mounting, and enclosures

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This clause of IEC 60204-1 is applicable except as follows:

11.2.3 Heating effects

Addition:

Where heat dissipation of the housing of the enclosure is not sufficient to keep the temperature inside under the limits of the components, means for temperature control shall be provided, for example:

- Forced circulation of the air inside the enclosure
- Forced ventilation
- Forced ventilation with air conditioning
- Local cooling (coolant circulation, peltier element, etc.)

Where the risk of condensation of water exists, heating elements should be provided.

11.3 Degrees of protection

Replacement:

Replace the third indent of NOTE 2 as follows:

- Enclosure used to endure the environment with water and/or dust invasion from all directions IP54
- Enclosure used to endure the environment with water invasion from above IP43

– Enclosure used to endure the environment without water droplets

IP32

11.4 Enclosures, doors and openings

Addition:

Add after the final dashed indent of the last paragraph:

A pocket to accommodate electrical drawing and/or manuals should be attached where practicable.

12 Conductors and cables

This clause of IEC 60204-1 is applicable

13 Wiring practices

This clause of IEC 60204-1 is applicable

14 Electric motors and associated equipment

This clause of IEC 60204-1 is applicable

15 Socket-outlets and lighting

This clause of IEC 60204-1 is applicable

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16 Marking, warning signs and reference designations

This clause of IEC 60204-1 is applicable

17 Technical documentation

This clause of IEC 60204-1 is applicable except as follows:

17.1 General

Addition:

Add after the first paragraph:

See Annex CC for Graphical symbols for machine tools.

See Annex DD for reference designations for electrical diagrams of machine tools.

See Annex EE for electrical diagrams for machine tools.

17.2 Information related to the electrical equipment

Addition:

Add after the first indent of 17.2 e):