16. Marking, warning signs and reference designations
Defines the requirements for the markings:

- Warning signs against electric shock hazard, hot surfaces hazard, etc.
- Functional identification on the device
- Marking of equipment

Name or trade mark of supplier	Serial number	Certification mark, when required
Type, e.g. ATR 2015		
Rated voltage, e.g. 400 V		
Number of phases, e.g. 3L + N + PE		
Frequency, e.g. 50 Hz		
Full-load current for each supply, e.g. field 1: 250 A, field 2: 400 A		
Number of the diagrams		

Permanent, clearly legible, abrasion-resistant, and appropriate for the physical and chemical environment

- Reference designations

17. Technical documentation
Defines the requirements for the information necessary for installation, operation, and maintenance of the electrical equipment of a machine. The information shall be in an agreed language (see also Annex B). The information provided may vary with the complexity of the electrical equipment supplied.

18. Verification
Defines the requirements for the testing of each electrical equipment. The extent of verification will be given in the dedicated product standard for a particular machine. Where there is no dedicated product standard for the machine, the verifications shall always include the items a), b) and f) and may include one or more of the items c) to e):

a) compliance with the technical documentation
b) protection by automatic disconnection
c) insulation resistance test
d) voltage test
e) protection against residual voltage
f) functional tests

Annex B: Enquiry form for the electrical equipment of machines
It is recommended that the following information be provided by the intended user of the equipment. The following requirements are defined, inter alia:

- IP degrees of protection
- Environment conditions
- Incoming supply voltage tolerance
- Disconnecting the neutral conductor on the supply disconnecting (isolating) device
- Language of the technical documentation, etc.

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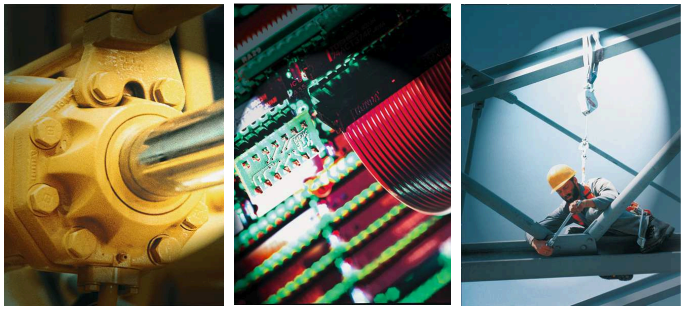

Safety of machinery – the essential points on the electrical equipment of machines

Overview of EN 60204-1

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CERTIFICATION

The Directive 2006/42/CE (Machinery Directive) in Annex I, para. 1.5.1, specifies that all hazards of an electrical nature are or can be prevented. The manufacturer of the electrical equipment of the machinery implements this by meeting the safety objectives of the Directive 2014/35/EU (Low Voltage Directive). The standard EN 60204-1 substantiates the safety objectives of this Directive and applies to the application of electrical, electronic and programmable electronic equipment and systems to machines at the point of connection.

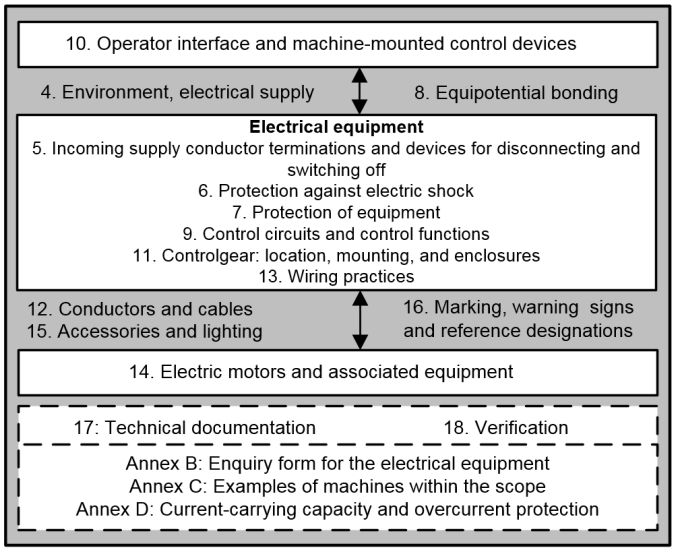
Part 1 of EN 60204 provides general requirements and recommendations relating to the electrical equipment of machines so as to promote:
– safety of persons and property;
– continuation of functionality;
– ease of maintenance.

It is applicable to electrical equipment that operates with nominal supply voltages up to 1000 VAC or up to 1500 VDC.

This document provides an overview of the main aspects of electrical equipment contained in EN 60204-1. It is not a substitute for reading and applying the standard.

Overview of the standard

The electrical equipment consists essentially of the following safeguards / protective measures (*the numbering relates to the section number in the standard*):



Source: Fig. 1 of EN 60204-1

Content of the standard

5. Incoming supply conductor terminations and devices for disconnecting and switching off
Every machine must have devices for:
- Supply disconnecting (isolating)
- Prevention of unexpected start-up
- Disconnecting electrical equipment
- Protection against unauthorized, inadvertent and/or accidental connection

6. Protection against electric shock

Hazards
- Electric shock
- Thermal effects (chapter 12, 13)
  -overload (longer-term)
  -short circuit (short time)
- «Side effects» (chapter 12, 13)
  - ultraviolet rays, bang
  - forces on busbars
  - electrochemical decomposition

Measures
- *Basic protection* (protection against direct contact)
  Protection against electric shock in the absence of a fault
  - barriers and enclosures
  - protection by insulation of live parts
  - protection by obstacles or by placing out of reach
- *Fault protection* (protection against indirect contact)
  Protection against electric shock when an individual fault is present
  - connection of metallic parts to the protective bonding circuit (class I)
  - use of double or reinforced insulation (class II)
  - use of Protective Extra-Low Voltage (PELV) (class III)
- *Additional protection*
  Protection against electric shock, in addition to basic and fault protection
  - automatic disconnection by RCD (Residual Current protective Device)

7. Protection of equipment
Defines the measures to be taken to protect equipment against the effects of:
- overcurrent arising from a short circuit
- overload and/or loss of cooling of motors
- abnormal temperatures
- loss of or reduction in the supply voltage
- overspeed of machines / machine elements
- earth fault / residual current
- incorrect phase sequence
- overvoltage due to lightning and switching surges

8. Equipotential bonding
Defines the requirements for protective bonding (fault protection from indirect contact) and functional bonding (minimizing the consequences of an insulation failure or electrical disturbances to sensitive electrical equipment).

9. Control circuits and control functions
Defines the requirements for control circuits and control functions for:
- Control transformers and control circuit voltage
- Start, stop, emergency stop, operating and special operating modes, cableless controls, etc.
- Interlocks in the case of movable guards
- Behaviour in the event of failure

10. Operator interface and machine-mounted control devices
Defines the requirements for devices mounted outside control enclosures:
- Control elements within easy reach, height ≥ 0.6 m above servicing level
- Safely operable (outside the danger zone)
- Minimal possibility of inadvertent operation (e.g. shrouded start button)
- Required IP protection provided
- Main switch / revision switch, control element correctly identified (black/grey or red/yellow)
- Marking of the control elements with pictograms
- Colour identification in the case of push-buttons

Colour	Meaning	Explanation	Example
RED	Emergency	Actuate in the event of an emergency	Emergency stop
YELLOW	Abnormal	Actuate in the event of an abnormal condition	Measure required
BLUE	Mandatory	Actuate for a condition requiring mandatory action	Reset function
GREEN	Normal	Start operational activity	Possible start button
WHITE	No specific meaning assigned	For general initiation of functions except for emergency stop	START/ON (preferred) STOP/OFF
GREY			START/ON STOP/OFF
BLACK		Recommended pictograms: See EN 60204-1	START/ON STOP/OFF (preferred)

Source: Table 2, 3 from EN 60204-1

11. Controlgear: location, mounting, and enclosures
Defines the requirements for the installation of the electrical components in the control cabinet (above servicing level):
- Terminal and device connections ≥ 0.2 m
- Apparatus that require preventive maintenance or adjustments between 0.4 m - 2 m
- Easy accessibility of the controlgear for operation and preventive maintenance

No electrical apparatus that require preventive maintenance or adjustments shall be placed at a height > 2 m!

12. Conductors and cables
Defines the requirements for conductors and cables. These shall be selected so as to be suitable for the operating conditions and external influences that can exist.
- Current-carrying capacity depending upon method of installation, grouping, conductor and insulation material, ambient temperature, operation site, cable length and cross-section
- Conductor and cable voltage drop

13. Wiring practices
Defines the requirements for the wiring inside and outside of enclosures:
- Installation and connection of conductors and cables
- Marking and identification of conductors and cables

15. Accessories and lighting
Defines the requirements for local lighting and sockets. E.g. the sockets with a nominal current ≤ 20 A shall be equipped with a residual current protective device (RCD) ≤ 30 mA.