

Checklist report EN 60204-1:2018+A1:2025 Safety of machinery - Electrical equipment of machines Part 1: General requirements	
Report reference No.:	NR.2025.1117B.2
Technical Services Provider & Address:	GZ NIUSAFETE Co., Ltd. Room 2033, Building 1, No.2 Ruifengsan Street, Huangpu, Guangzhou, China
Assessor:	George Chen  
Reviewer:	Kevin Hong 
Date of receipt of assess item:	11-17-2025
Date (s) of performance of assessment:	11-17-2025 to 11-20-2025
Date of issue:	11-20-2025
Total pages:	106
Applicant name & Address:	DONGGUAN THUNDERLASER INDUSTRIAL CO., LTD Room 1101, Building 3, No. 68, Xingzhou Road, Shatian Town, Dongguan, Guangdong, China
Manufacturer name & Address	Same as applicant
Assess item description:	Thunder Laser Systems
Trade Mark:	THUNDER LASER
Model/Type reference:	Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36
Ratings:	230V; 50/60Hz; 1Ph
Location of assessment	Room 1101, Building 3, No. 68, Xingzhou Road, Shatian Town, Dongguan, Guangdong, China
Assess performed (name & clause of assess specification):	Full items of EN 60204-1:2018+A1:2025.

Summary of assessment

All assessment and inspection are performed on the prototype of Bolt Pro 32.

Assessment and inspection were conducted according to EN 60204-1:2018+A1:2025, the items under assess and inspection are IN COMPLIANCE with the requested specifications specified in the standard.

Copy of nameplate

Refer to report NR.2025.1117B.1

General remarks:

The assess results presented in this report relate only to the object assessed.

This report shall not be reproduced, except in full, without the written approval of the technical services provider.

General product information and other remarks:

Machine for labelling.

Possible assess case verdicts:

- subclause does not apply to the assess object: N/A
- assess object does meet the requirement: P (Pass)
- assess object does not meet the requirement: F (Fail)

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
4	General requirements		P
4.1	General		P
	This standard specifies requirements for the electrical equipment of machines. The risks associated with the hazards relevant to the electrical equipment shall be assessed as part of the overall requirements for risk assessment of the machine. This will: – identify the need for risk reduction; and – determine adequate risk reductions; and – determine the necessary protective measures for persons who can be exposed to those hazards, while still maintaining an appropriate performance of the machine and its equipment.	Risk assessment has been done by manufacturer.	P
	Hazardous situations can result from, but are not limited to, the following causes: – failures or faults in the electrical equipment resulting in the possibility of electric shock, arc, or fire; – failures or faults in control circuits (or components and devices associated with those circuits) resulting in the malfunctioning of the machine; – disturbances or disruptions in power sources as well as failures or faults in the power circuits resulting in the malfunctioning of the machine; – loss of continuity of circuits that can result in a failure of a safety function, for example those that depend on sliding or rolling contacts; – electrical disturbances for example, electromagnetic, electrostatic either from outside the electrical equipment or internally generated, resulting in the malfunctioning of the machine; – release of stored energy (either electrical or mechanical) resulting in, for example, electric shock, unexpected movement that can cause injury; – acoustic noise and mechanical vibration at levels that cause health problems to persons; – surface temperatures that can cause injury.	Risk assessment has been done by manufacturer. Relevant hazards have been identified.	P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Safety measures are a combination of the measures incorporated at the design stage and those measures required to be implemented by the user. The design and development process shall identify hazards and the risks arising from them. Where the hazards cannot be removed and/or the risks cannot be sufficiently reduced by inherently safe design measures, protective measures (for example safeguarding) shall be provided to reduce the risk. Additional means (for example, awareness means) shall be provided where further risk reduction is necessary. In addition, working procedures that reduce risk can be necessary. It is recommended that, where the user is known, Annex B be used to facilitate an exchange of information between the user and the supplier(s) on basic conditions and additional user specifications related to the electrical equipment. NOTE Those additional specifications can: – provide additional features that are dependent on the type of machine (or group of machines) and the application; – facilitate maintenance and repair; and – improve the reliability and ease of operation.	Risk assessment has been done by manufacturer. And residual risks are with warning labels, information and warning devices.	P
4.2	Selection of equipment		P
4.2.1	General		P
	Electrical components and devices shall: – be suitable for their intended use; and – conform to relevant IEC standards where such exist; and – be applied in accordance with the supplier's instructions.	Critical electrical components and devices are with EU declaration of conformity. And their intended use has been taken into consideration and all are applied following the manufacturer's instructions.	P
4.2.2	Switchgear		P
	In addition to the requirements of IEC 60204-1, depending upon the machine, its intended use and its electrical equipment, the designer may select parts of the electrical equipment of the machine that are in compliance with relevant parts of the IEC 61439 series (see also Annex F).		N/A
4.3	Electrical supply		P
4.3.1	General		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The electrical equipment shall be designed to operate correctly with the conditions of the supply: – as specified in 4.3.2 or 4.3.3, or – as otherwise specified by the user, or – as specified by the supplier of a special source of supply (see 4.3.4)	As specified in 4.3.2.	P
4.3.2	AC supplies		P
	Voltage Steady state voltage: 0,9 to 1,1 of nominal voltage. Frequency 0,99 to 1,01 of nominal frequency continuously; 0,98 to 1,02 short time. Harmonics Harmonic distortion not exceeding 12 % of the total r.m.s. voltage between live conductors for the sum of the 2nd through to the 30th harmonic. Voltage unbalance Neither the voltage of the negative sequence component nor the voltage of the zero sequence component in three-phase supplies exceeding 2 % of the positive sequence component. Voltage interruption Supply interrupted or at zero voltage for not more than 3 ms at any random time in the supply cycle with more than 1 s between successive interruptions. Voltage dips Voltage dips not exceeding 20 % of the rms voltage of the supply for more than one cycle with more than 1 s between successive dips.		P
4.3.3	DC supplies		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	From batteries: Voltage 0,85 to 1,15 of nominal voltage; 0,7 to 1,2 of nominal voltage in the case of battery-operated vehicles. Voltage interruption Not exceeding 5 ms. From converting equipment: Voltage 0,9 to 1,1 of nominal voltage. Voltage interruption Not exceeding 20 ms with more than 1 s between successive interruptions. NOTE This is a variation to IEC Guide 106 to ensure proper operation of electronic equipment. Ripple (peak-to-peak) Not exceeding 0,15 of nominal voltage.		N/A
4.3.4	Special supply systems		N/A
	For special supply systems (e.g. on-board generators, DC bus, etc.) the limits given in 4.3.2 and 4.3.3 may be exceeded provided that the equipment is designed to operate correctly with those conditions.	No special supply system.	N/A
4.4	Physical environment and operating conditions		P
4.4.1	General		P
	The electrical equipment shall be suitable for the physical environment and operating conditions of its intended use. The requirements of 4.4.2 to 4.4.8 cover the physical environment and operating conditions of the majority of machines covered by this part of IEC 60204. When special conditions apply or the limits specified are exceeded, an exchange of information between user and supplier (see 4.1) can be necessary.		P
4.4.2	Electromagnetic compatibility (EMC)		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The electrical equipment shall not generate electromagnetic disturbances above levels that are appropriate for its intended operating environment. In addition, the electrical equipment shall have a sufficient level of immunity to electromagnetic disturbances so that it can function in its intended environment. A1:2025 Immunity and/or emission tests are required on the electrical equipment unless the following conditions are fulfilled: the incorporated devices and components comply with the EMC requirements for the intended EMC environment specified in the relevant product standard (or generic standard where no product standard exists), and; the electrical installation and wiring are consistent with the instructions provided by the supplier of the devices and components with regard to mutual influences, (cabling, screening, earthing etc.) or with informative Annex H if such instructions are not available from the supplier. NOTE 1 The generic EMC standards IEC 61000-6-1 or IEC 61000-6-2 and IEC 61000-6-3 or IEC 61000-6-4 give general EMC emission and immunity limits. NOTE 2: NOTE 2 Annex H provides examples of measures to reduce the effects of electromagnetic influences.		P
4.4.3	Ambient air temperature		P
	Electrical equipment shall be capable of operating correctly in the intended ambient air temperature. The minimum requirement for all electrical equipment is correct operation in ambient air temperatures outside of enclosures (cabinet or box) between +5 °C and +40 °C.		P
4.4.4	Humidity		P
	The electrical equipment shall be capable of operating correctly when the relative humidity does not exceed 50 % at a maximum temperature of +40 °C. Higher relative humidities are permitted at lower temperatures (for example 90 % at 20 °C). Harmful effects of occasional condensation shall be avoided by design of the equipment or, where necessary, by additional measures (for example built-in heaters, air conditioners, drain holes).		P
4.4.5	Altitude		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Electrical equipment shall be capable of operating correctly at altitudes up to 1 000 m above mean sea level. A1:2025 For equipment to be used at higher altitudes, it is necessary to take into account the reduction of: For equipment to be used at higher altitudes, it is necessary to take into account changes in parameters for example, the reduction of: – the dielectric strength, and; – the switching capability of the devices, and; – the cooling effect of the air. Other parameters of different components can also alter with altitude. It is recommended that the manufacturer is consulted regarding the correction factors to be used where the factors are not specified in product data.		P
4.4.6	Contaminants		P
	Electrical equipment shall be adequately protected against the ingress of solids and liquids (see 11.3). The electrical equipment shall be adequately protected against contaminants (for example dust, acids, corrosive gases, salts) that can be present in the physical environment in which the electrical equipment is to be installed.		P
4.4.7	Ionizing and non-ionizing radiation		N/A
	When equipment is subject to radiation (for example microwave, ultraviolet, lasers, X-rays), additional measures shall be taken to avoid malfunctioning of the equipment and accelerated deterioration of the insulation.		N/A
4.4.8	Vibration, shock, and bump		P
	Undesirable effects of vibration, shock and bump (including those generated by the machine and its associated equipment and those created by the physical environment) shall be avoided by the selection of suitable equipment, by mounting it away from the machine, or by provision of anti-vibration mountings.		N/A
4.5	Transportation and storage		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Electrical equipment shall be designed to withstand, or suitable precautions shall be taken to protect against, the effects of transportation and storage temperatures within a range of -25°C to $+55^{\circ}\text{C}$ and for short periods not exceeding 24 h at up to $+70^{\circ}\text{C}$. Suitable means shall be provided to prevent damage from humidity, vibration, and shock. NOTE Electrical equipment susceptible to damage at low temperatures includes PVC insulated cables.		P
4.6	Provisions for handling		P
	Heavy and bulky electrical equipment that has to be removed from the machine for transport, or that is independent of the machine, shall be provided with suitable means for handling, including where necessary means for handling by cranes or similar equipment.	Provided with suitable means for handling.	P
5	Incoming supply conductor terminations and devices for disconnecting and switching off		P
5.1	Incoming supply conductor terminations		P
	It is recommended that, where practicable, the electrical equipment of a machine is connected to a single incoming supply. Where another supply is necessary for certain parts of the equipment (for example, electronic equipment that operates at a different voltage), that supply should be derived, as far as is practicable, from devices (for example, transformers, converters) forming part of the electrical equipment of the machine. For large complex machinery there can be a need for more than one incoming supply depending upon the site supply arrangements (see 5.3.1).	Single incoming supply	P
	Unless a plug is provided with the machine for the connection to the supply (see 5.3.2 e)), it is recommended that the supply conductors are terminated at the supply disconnecting device.	Terminated at the supply disconnecting device	P
	Where a neutral conductor is used it shall be clearly indicated in the technical documentation of the machine, such as in the installation diagram and in the circuit diagram, and a separate insulated terminal, labelled N in accordance with 16.1, shall be provided for the neutral conductor. The neutral terminal may be provided as part of the supply disconnecting device.	Neutral conductor is not used.	N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	There shall be no connection between the neutral conductor and the protective bonding circuit inside the electrical equipment. Exception: a connection may be made between the neutral terminal and the PE terminal at the point of the connection of the electrical equipment to a TN-C supply system.		N/A
	For machines supplied from parallel sources, the requirements of IEC 60364-1 for multiple source systems apply.	Not supplied from parallel sources.	N/A
	Terminals for the incoming supply connection shall be clearly identified in accordance with IEC 60445. The terminal for the external protective conductor shall be identified in accordance with 5.2.	Terminals for the incoming supply connection are identified with L1, L2, L3 The terminal for the external protective conductor is identified with PE.	P
5.2	Terminal for connection of external protective conductor		P
	For each incoming supply, a terminal shall be provided in the same compartment as the associated line conductor terminals for connection of the machine to the external protective conductor.	In the same compartment.	P
	The terminal shall be of such a size as to enable the connection of an external protective copper conductor with a cross-sectional area determined in relation to the size of the associated line conductors in accordance with Table 1. Where an external protective conductor of a material other than copper is used, the terminal size and type shall be selected accordingly.	Copper is used. PE terminal is with sufficient size to connect external PE conductors.	P
	At each incoming supply point, the terminal for connection of external protective conductor shall be marked or labelled with the letters PE (see IEC 60445).	Labelled with PE.	P
5.3	Supply disconnecting (isolating) device		P
5.3.1	General		P
	A supply disconnecting device shall be provided: – for each incoming supply to (a) machine(s); NOTE The incoming supply can be connected directly to the supply disconnecting device of the machine or to the supply disconnecting device of a feeder system of the machine. Feeder systems of machines can include conductor wires, conductor bars, slip-ring assemblies, flexible cable systems (reeled, festooned) or inductive power supply systems. – for each on-board power supply.	One disconnecting devices.	P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The supply disconnecting device shall disconnect (isolate) the electrical equipment of the machine from the supply when required (for example for work on the machine, including the electrical equipment).	Fulfil such function.	P
	Where two or more supply disconnecting devices are provided, protective interlocks for their correct operation shall also be provided in order to prevent a hazardous situation, including damage to the machine or to the work in progress.	No such scenario.	N/A
5.3.2	Type		P
	The supply disconnecting device shall be one of the following types: a) switch-disconnector, with or without fuses, in accordance with IEC 60947-3, utilization category AC-23B or DC-23B; b) control and protective switching device suitable for isolation, in accordance with IEC 60947-6-2; c) a circuit-breaker suitable for isolation in accordance with IEC 60947-2; d) any other switching device in accordance with an IEC product standard for that device and which meets the isolation requirements and the appropriate utilization category and/or specified endurance requirements defined in the product standard; e) a plug/socket combination for a flexible cable supply.	Type a) is provided.	P
5.3.3	Requirements		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where the supply disconnecting device is one of the types specified in 5.3.2 a) to d) it shall fulfil all of the following requirements: – isolate the electrical equipment from the supply and have one OFF (isolated) and one ON position marked with "O" and "I" (symbols IEC 60417-5008 (2002-10) and IEC 60417-5007 (2002-10), see 10.2.2); – have a visible contact gap or a position indicator which cannot indicate OFF (isolated) until all contacts are actually open and the requirements for the isolating function have been satisfied; – have an operating means (see 5.3.4); – be provided with a means permitting it to be locked in the OFF (isolated) position (for example by padlocks). When so locked, remote as well as local closing shall be prevented; – disconnect all live conductors of its power supply circuit. However, for TN supply systems, the neutral conductor may or may not be disconnected except in countries where disconnection of the neutral conductor (when used) is compulsory; – have a breaking capacity sufficient to interrupt the current of the largest motor when stalled together with the sum of the normal running currents of all other motors and other loads. The calculated breaking capacity may be reduced by the use of a proven diversity factor. Where motor(s) are supplied by converter(s) or similar devices, the calculation should take into account the possible effect on the required breaking capacity.		P
	Where the supply disconnecting device is a plug/socket combination, it shall comply with the requirements of 13.4.5 and shall have the breaking capacity, or be interlocked with a switching device that has a breaking capacity, sufficient to interrupt the current of the largest motor when stalled together with the sum of the normal running currents of all other motors and other loads. The calculated breaking capacity may be reduced by the use of a proven diversity factor. Where the interlocked switching device is electrically operated (for example a contactor) it shall have an appropriate utilisation category. Where motor(s) are supplied by converter(s) or similar devices, the calculation should take into account the possible effect on the required breaking capacity. NOTE A suitably rated plug and socket-outlet, cable coupler, or appliance coupler, in accordance with IEC 60309-1 can fulfil these requirements.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where the supply disconnecting device is a plug/socket combination, a switching device with an appropriate utilisation category shall be provided for switching the machine on and off. This can be achieved by the use of the interlocked switching device described above.		N/A
5.3.4	Operating means of the supply disconnecting device		P
	The operating means (for example, a handle) of the supply disconnecting device shall be external to the enclosure of the electrical equipment. Exception: power-operated switchgear need not be provided with a handle outside the enclosure where other means (e.g. pushbuttons) are provided to open the supply disconnecting device from outside the enclosure.		P
	The operating means of the supply disconnecting device shall be easily accessible and located between 0,6 m and 1,9 m above the servicing level. An upper limit of 1,7 m is recommended. NOTE The direction of operation is given in IEC 61310-3.		P
	Where the external operating means is intended for emergency operation, see 10.7.3 or 10.8.3. Where the external operating means is not intended for emergency operations: – it is recommended that it be coloured BLACK or GREY (see 10.2) – a supplementary cover or door that can be readily opened without the use of a key or tool may be provided, for example for protection against environmental conditions or mechanical damage. Such a cover/door shall clearly show that it provides access to the operating means. This can be achieved, for example, by use of the relevant symbol IEC 60417-6169-1 (2012-08) (Figure 2) or IEC 60417-6169-2 (2012-08), (Figure 3).	Coloured RED.	P
5.3.5	Excepted circuits		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The following circuits need not be disconnected by the supply disconnecting device: – lighting circuits for lighting needed during maintenance or repair; – socket outlets for the exclusive connection of repair or maintenance tools and equipment (for example hand drills, test equipment) (see 15.1); – undervoltage protection circuits that are only provided for automatic tripping in the event of supply failure; – circuits supplying equipment that should normally remain energized for correct operation (for example temperature controlled measuring devices, heaters, program storage devices).	No excepted circuit.	N/A
	It is recommended, however, that such circuits be provided with their own disconnecting device.		N/A
	Control circuits supplied via another supply disconnecting device, regardless of whether that disconnecting device is located in the electrical equipment or in another machine or other electrical equipment, need not be disconnected by the supply disconnecting device of the electrical equipment.		N/A
	Where excepted circuits are not disconnected by the supply disconnecting device: – permanent warning label(s) shall be appropriately placed in proximity to the operating means of the supply disconnecting device to draw attention to the hazard; – a corresponding statement shall be included in the maintenance manual, and one or more of the following shall apply: • the conductors are identified by colour taking into account the recommendation of 13.2.4; • excepted circuits are separated from other circuits; • excepted circuits are identified by permanent warning label(s).		N/A
5.4	Devices for removal of power for prevention of unexpected start-up		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Devices for removal of power for the prevention of unexpected start-up shall be provided where a start-up of the machine or part of the machine can create a hazard (for example during maintenance). Such devices shall be appropriate and convenient for the intended use, be suitably placed, and readily identifiable as to their function and purpose. Where their function and purpose is not otherwise obvious (e.g. by their location) these devices shall be marked to indicate the extent of removal of power. NOTE 1 This part of IEC 60204 does not address all provisions for prevention of unexpected start up. Further information is provided in ISO 14118. NOTE 2 Removal of power means removal of the connection to the source of electrical energy but does not imply isolation.	The supply disconnecting device fulfils such function.	P
	The supply disconnecting device or other devices in accordance with 5.3.2 may be used for prevention of unexpected start-up.	The supply disconnecting device fulfils such function.	P
	Disconnectors, withdrawable fuse links and withdrawable links may be used for protection of unexpected start-up only if they are located in an enclosed electrical operating area (see 3.1.23).	No such application.	N/A
	Devices that do not fulfil the isolation function (for example a contactor switched off by a control circuit, or Power Drive System (PDS) with a Safe Torque Off (STO) function in accordance with IEC 61800-5-2) may only be used for prevention of unexpected start-up during tasks such as: – inspections; – adjustments; – work on the electrical equipment where: • there is no hazard arising from electric shock (see Clause 6) and burn; • the switching off means remains effective throughout the work; • the work is of a minor nature (for example, replacement of plug-in devices without disturbing existing wiring).		N/A
	The selection of a device will be dependent on the risk assessment, taking into account the intended use of the device, and the persons who are intended to operate them.	Risk assessment has been performed by manufacturer to take these into consideration.	P
5.5	Devices for isolating electrical equipment		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Devices shall be provided for isolating (disconnecting) the electrical equipment or part(s) of the electrical equipment to enable work to be carried out when it is de-energised and isolated. Such devices shall be: – appropriate and convenient for the intended use; – suitably placed; – readily identifiable as to which part(s) or circuit(s) of the equipment is served. Where their function and purpose is not otherwise obvious (e.g. by their location) these devices shall be marked to indicate the extent of the equipment that they isolate.	The supply disconnecting device fulfils such function.	P
	The supply disconnecting device (see 5.3) may, in some cases, fulfil that function. However, where it is necessary to work on individual parts of the electrical equipment of a machine, or on one of the machines fed by a common conductor bar, conductor wire or inductive power supply system, a disconnecting device shall be provided for each part, or for each machine, requiring separate isolation.	The supply disconnecting device fulfils such function.	P
	In addition to the supply disconnecting device, the following devices that fulfil the isolation function may be provided for this purpose: – devices described in 5.3.2; – disconnectors, withdrawable fuse links and withdrawable links only if located in an enclosed electrical operating area (see 3.1.23) and relevant information is provided with the electrical equipment (see Clause 17).	No such case.	N/A
5.6	Protection against unauthorized, inadvertent and/or mistaken connection		P
	Where the devices described in 5.4 and 5.5 are located outside an enclosed electrical operating area they shall be equipped with means to secure them in the OFF position (disconnected state), (for example by provisions for padlocking, trapped key interlocking). When so secured, remote as well as local reconnection shall be prevented.	The supply disconnecting device fulfils such function.	P
	Where the devices described in 5.4 and 5.5 are located inside an enclosed electrical operating area other means of protection against reconnection (for example warning labels) can be sufficient.	No such case.	N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	However, when a plug/socket combination according to 5.3.2 e) is so positioned that it can be kept under the immediate supervision of the person carrying out the work, means for securing in the disconnected state need not be provided.		N/A
6	Protection against electric shock		P
6.1	General		P
	The electrical equipment shall provide protection of persons against electric shock by: – basic protection (see 6.2 and 6.4), and; – fault protection (see 6.3 and 6.4).	Both basic and fault protection are provided.	P
	The measures for protection given in 6.2, 6.3, and, for PELV, in 6.4, are a selection from IEC 60364-4-41. Where those measures are not practicable, for example due to the physical or operational conditions, other measures from IEC 60364-4-41 may be used (e.g. SELV).		P
6.2	Basic protection		P
6.2.1	General		P
	For each circuit or part of the electrical equipment, the measures of either 6.2.2 or 6.2.3 and, where applicable, 6.2.4 shall be applied. Exception: where those measures are not appropriate, other measures for basic protection (for example by using barriers, by placing out of reach, using obstacles, using construction or installation techniques that prevent access) as defined in IEC 60364-4-41 may be applied (see also 6.2.5 and 6.2.6).		P
	Where the equipment is located in places open to all persons, which can include children, measures of either 6.2.2 with a minimum degree of protection against contact with live parts corresponding to IP4X or IPXXD (see IEC 60529), or 6.2.3 shall be applied.	Not located in such places.	N/A
6.2.2	Protection by enclosures		P
	Live parts shall be located inside enclosures that provide protection against contact with live parts of at least IP2X or IPXXB (see IEC 60529).		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where the top surfaces of the enclosure are readily accessible, the minimum degree of protection against contact with live parts provided by the top surfaces shall be IP4X or IPXXD.		P
	Opening an enclosure (i.e. opening doors, lids, covers, and the like) shall be possible only under one of the following conditions:		P
	a) The use of a key or tool is necessary for access. NOTE 1 The use of a key or tool is intended to restrict access to skilled or instructed persons (see 17.2 f)). All live parts, (including those on the inside of doors) that are likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected, shall be protected against contact to at least IP2X or IPXXB. Other live parts on the inside of doors shall be protected against unintentional direct contact to at least IP1X or IPXXA.	Key must be used for the control cabinet and tool of screwdriver must be used for other parts.	P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	b) The disconnection of live parts inside the enclosure before the enclosure can be opened. This may be accomplished by interlocking the door with a disconnecting device (for example, the supply disconnecting device) so that the door can only be opened when the disconnecting device is open and so that the disconnecting device can only be closed when the door is closed. Exception: a key or tool as prescribed by the supplier can be used to defeat the interlock provided that the following conditions are met: – it is possible at all times while the interlock is defeated to open the disconnecting device and lock the disconnecting device in the OFF (isolated) position or otherwise prevent unauthorised closure of the disconnecting device; – upon closing the door, the interlock is automatically restored; – all live parts, (including those on the inside of doors) that are likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected, are protected against unintentional contact with live parts to at least IP2X or IPXXB and other live parts on the inside of doors are protected against unintentional contact to at least IP1X or IPXXA; – relevant information about the procedures for the defeat of the interlock is provided with the instructions for use of the electrical equipment (see Clause 17). – means are provided to restrict access to live parts behind doors that are not directly interlocked with the disconnecting means to skilled or instructed persons. (See 17.2 b)). All parts that are still live after switching off the disconnecting device(s) (see 5.3.5) shall be protected against direct contact to at least IP2X or IPXXB (see IEC 60529). Such parts shall be marked with a warning sign in accordance with 16.2.1 (see also 13.2.4 for identification of conductors by colour), except for: – parts that can be live only because of connection to interlocking circuits and that are distinguished by colour as potentially live in accordance with 13.2.4; – the supply terminals of the supply disconnecting device when the latter is mounted alone in a separate enclosure.	Not such measure.	N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	c) Opening without the use of a key or a tool and without disconnection of live parts shall be possible only when all live parts are protected against contact to at least IP2X or IPXXB (see IEC 60529). Where barriers provide this protection, either they shall require a tool for their removal or all live parts protected by them shall be automatically disconnected when the barrier is removed. Where protection against contact is achieved in accordance with 6.2.2 c), and a hazard can be caused by manual actuation of devices (for example manual closing of contactors or relays), such actuation should be prevented by barriers or obstacles that require a tool for their removal.		P
6.2.3	Protection by insulation of live parts		P
	Live parts protected by insulation shall be completely covered with insulation that can only be removed by destruction. Such insulation shall be capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which it can be subjected under normal operating conditions. NOTE Paints, varnishes, lacquers, and similar products alone are generally considered to be inadequate for protection against electric shock under normal operating conditions.		P
6.2.4	Protection against residual voltages		P
	Live parts having a residual voltage greater than 60V when the supply is disconnected shall be discharged to 60 V or less within a time period of 5s provided that this rate of discharge does not interfere with the proper functioning of the equipment. Exempted from this requirement are components having a stored charge of 60μC or less. Where this specified rate of discharge would interfere with the proper functioning of the equipment, a durable warning notice drawing attention to the hazard and stating the delay required before the enclosure may be opened shall be displayed at an easily visible location on or immediately adjacent to the enclosure that contains the live parts.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	In the case of plugs or similar devices, the withdrawal of which results in the exposure of conductors (for example pins), the discharge time to 60 V shall not exceed 1 s, otherwise such conductors shall be protected to at least IP2X or IPXXB. If neither a discharge time of 1 s nor a protection of at least IP2X or IPXXB can be achieved (for example in the case of removable collectors on conductor wires, conductor bars, or slip-ring assemblies, see 12.7.4), additional switching devices or an appropriate warning, for example a warning sign drawing attention to the hazard and stating the delay required shall be provided. When the equipment is located in places open to all persons, which can include children, warnings are not sufficient and therefore a minimum degree of protection against contact with live parts to IP4X or IPXXD is required.	The discharge time to 60 V does not exceed 5 s	P
	NOTE Frequency converters and DC bus supplies could have typically a longer discharge time than 5 s.		N/A
6.2.5	Protection by barriers		N/A
	For protection by barriers, the requirements of IEC 60364-4-41 shall apply.		N/A
6.2.6	Protection by placing out of reach or protection by obstacles		N/A
	For protection by placing out of reach, the requirements of IEC 60364-4-41 shall apply. For protection by obstacles, the requirements of IEC 60364-4-41 shall apply.		N/A
	For conductor wire systems or conductor bar systems with a degree of protection less than IP2X or IPXXB, see 12.7.1.		N/A
6.3	Fault protection		P
6.3.1	General		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Fault protection (3.31) is intended to prevent hazardous situations due to an insulation fault between live parts and exposed conductive parts. For each circuit or part of the electrical equipment, at least one of the measures in accordance with 6.3.2 to 6.3.3 shall be applied: – measures to prevent the occurrence of a touch voltage (6.3.2); or – automatic disconnection of the supply before the time of contact with a touch voltage can become hazardous (6.3.3). A1:2025 NOTE 1 The risk of harmful physiological effects from a touch voltage depends on the value of the touch voltage and the duration of possible exposure. The risk of harmful physiological effects from touch voltages depends upon a number of factors. These include but are not limited to; value of touch voltage, duration of possible exposure, environmental factors, skin condition. NOTE 2 IEC 61140 provides information about classes of equipment and protective provisions.		P
6.3.2	Prevention of the occurrence of a touch voltage		P
6.3.2.1	General		P
	Measures to prevent the occurrence of a touch voltage include the following: – provision of class II equipment or by equivalent insulation; – electrical separation.		P
6.3.2.2	Protection by provision of class II equipment or by equivalent insulation		P
	This measure is intended to prevent the occurrence of touch voltages on the accessible parts through a fault in the basic insulation. This protection is provided by one or more of the following: – class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation in accordance with IEC 61140); – switchgear and controlgear assemblies having total insulation in accordance with IEC 61439-1; – supplementary or reinforced insulation in accordance with IEC 60364-4-41.		P
6.3.2.3	Protection by electrical separation		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Electrical separation of an individual circuit is intended to prevent a touch voltage through contact with exposed conductive parts that can be energized by a fault in the basic insulation of the live parts of that circuit. For this type of protection, the requirements of IEC 60364-4-41 apply.		N/A
6.3.3	Protection by automatic disconnection of supply		P
	Automatic disconnection of the supply of any circuit affected by an insulation fault is intended to prevent a hazardous situation resulting from a touch voltage. This measure consists of the interruption of one or more of the line conductors by the automatic operation of a protective device in case of a fault. This interruption shall occur within a sufficiently short time to limit the duration of a touch voltage to a time within the limits specified in Annex A for TN and TT systems.		P
	This measure necessitates co-ordination between: – the type of supply system, the supply source impedance and the earthing system; – the impedance values of the different elements of the line and of the associated fault current paths through the protective bonding circuit; – the characteristics of the protective devices that detect insulation fault(s). NOTE 1 Details of verification of conditions for protection by automatic disconnection of supply are provided in 18.2.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	This protective measure comprises both: – protective bonding of exposed conductive parts (see 8.2.3), – and one of the following: a) In TN systems, the following protective devices may be used: • overcurrent protective devices; • residual current protective devices (RCDs) and associated overcurrent protective device(s). NOTE 2 The preventive maintenance can be enhanced by use of a residual current monitoring device, RCM, complying with IEC 62020. b) in TT systems, either: • RCDs and associated overcurrent protective device(s) to initiate the automatic disconnection of the supply on detection of an insulation fault from a live part to exposed conductive parts or to earth, or • overcurrent protective devices may be used for fault protection provided a suitably low value of the fault loop impedance Z_s (see A.2.2.3) is permanently and reliably assured; NOTE 3 The preventive maintenance can be enhanced by use of a residual current monitoring device, RCM, complying with IEC 62020. c) In IT systems the relevant requirements of IEC 60364-4-41 shall be fulfilled. During an insulation fault, an acoustic and optical signal shall be sustained. After annunciation, the acoustic signal may then be manually muted. This can require an agreement between the supplier and user regarding the provision of insulation monitoring devices and/or insulation fault location system(s). NOTE 4 In large machines, the provision of an insulation fault location system (IFLS) in accordance with IEC 61557-9 can facilitate maintenance.		P
	Where automatic disconnection is provided in accordance with a), and disconnection within the time specified in A.1.1 cannot be assured, supplementary protective bonding shall be provided as necessary to meet the requirements of A.1.3.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where a power drive system (PDS) is provided, fault protection shall be provided for those circuits of the power drive system that are supplied by the converter. Where this protection is not provided within the converter, the necessary protection measures shall be in accordance with the converter manufacturer's instructions.		P
6.4	Protection by the use of PELV		P
6.4.1	General requirements		P
	The use of PELV (Protective Extra-Low Voltage) is to protect persons against electric shock from indirect contact and limited area direct contact (see 8.2.1). PELV circuits shall satisfy all of the following conditions: a) the nominal voltage shall not exceed: • 25 V AC r.m.s. or 60 V ripple-free DC when the equipment is normally used in dry locations and when large area contact of live parts with the human body is not expected; or • 6 V AC r.m.s. or 15 V ripple-free DC in all other cases; NOTE "Ripple-free" is conventionally defined for a sinusoidal ripple voltage as a ripple content of not more than 10 % r.m.s. b) one side of the circuit or one point of the source of the supply of that circuit shall be connected to the protective bonding circuit; c) live parts of PELV circuits shall be electrically separated from other live circuits. Electrical separation shall be not less than that required between the primary and secondary circuits of a safety isolating transformer (see IEC 61558-1 and IEC 61558-2-6); d) conductors of each PELV circuit shall be physically separated from those of any other circuit. When this requirement is impracticable, the insulation provisions of 13.1.3 shall apply; e) plugs and socket-outlets for a PELV circuit shall conform to the following: • plugs shall not be able to enter socket-outlets of other voltage systems; • socket-outlets shall not admit plugs of other voltage systems.		P
6.4.2	Sources for PELV		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The source for PELV shall be one of the following: – a safety isolating transformer in accordance with IEC 61558-1 and IEC 61558-2-6; – a source of current providing a degree of safety equivalent to that of the safety isolating transformer (for example a motor generator with winding providing equivalent isolation); – an electrochemical source (for example a battery) or another source independent of a higher voltage circuit (for example a diesel-driven generator); – an electronic power supply conforming to appropriate standards specifying measures to be taken to ensure that, even in the case of an internal fault, the voltage at the outgoing terminals cannot exceed the values specified in 6.4.1.	an electronic power supply	P
7	Protection of equipment		P
7.1	General		P
	This Clause 7 details 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 temperature; – 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.		P
7.2	Overcurrent protection		P
7.2.1	General		P
	Overcurrent protection shall be provided where the current in any circuit can exceed either the rating of any component or the current carrying capacity of the conductors, whichever is the lesser value. The ratings or settings to be selected are detailed in 7.2.10.		P
7.2.2	Supply conductors		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Unless otherwise specified by the user, the supplier of the electrical equipment is not responsible for providing the supply conductors and the overcurrent protective device for the supply conductors to the electrical equipment.	Supply conductors and the overcurrent protective device are not supplied by manufacturer.	P
	The supplier of the electrical equipment shall state in the installation documents the data necessary for conductor dimensioning (including the maximum cross-sectional area of the supply conductor that can be connected to the terminals of the electrical equipment) and for selecting the overcurrent protective device (see 7.2.10 and 17).		P
7.2.3	Power circuits		P
	Devices for detection and interruption of overcurrent, selected in accordance with 7.2.10, shall be applied to each live conductor including circuits supplying control circuit transformers.		P
	The following conductors, as applicable, shall not be disconnected without disconnecting all associated live conductors: – the neutral conductor of AC power circuits; – the earthed conductor of DC power circuits; – DC power conductors bonded to exposed conductive parts of mobile machines.		P
	Where the cross-sectional area of the neutral conductor is at least equal to or equivalent to that of the line conductors, it is not necessary to provide overcurrent detection for the neutral conductor nor a disconnecting device for that conductor. For a neutral conductor with a cross-sectional area smaller than that of the associated line conductors, the measures detailed in 524 of IEC 60364-5-52:2009 shall apply.		P
	In IT systems, it is recommended that the neutral conductor is not used. However, where a neutral conductor is used, the measures detailed in 431.2.2 of IEC 60364-4-43:2008 shall apply.		N/A
7.2.4	Control circuits		P
	Conductors of control circuits directly connected to the supply voltage shall be protected against overcurrent in accordance with 7.2.3.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Conductors of control circuits supplied by a transformer or DC supply shall be protected against overcurrent (see also 9.4.3.1.1): – in control circuits connected to the protective bonding circuit, by inserting an overcurrent protective device into the switched conductor; – in control circuits not connected to the protective bonding circuit; • where all control circuits of the equipment have the same current carrying capacity, by inserting an overcurrent protective device into the switched conductor, or; • where different control circuits of the equipment have different current carrying capacity, by inserting an overcurrent protective device into both switched and common conductors of each control circuit. Exception: Where the supply unit provides current limiting below the current carrying capacity of the conductors in a circuit and below the current rating of connected components, no separate overcurrent protective device is required.		P
7.2.5	Socket outlets and their associated conductors		N/A
	Overcurrent protection shall be provided for the circuits feeding the general purpose socket outlets intended primarily for supplying power to maintenance equipment. Overcurrent protective devices shall be provided in the unearthed live conductors of each circuit feeding such socket outlets. See also 15.1.	No socket outlet.	N/A
7.2.6	Lighting circuits		N/A
	All unearthed conductors of circuits supplying lighting shall be protected against the effects of short-circuits by the provision of overcurrent devices separate from those protecting other circuits.		N/A
7.2.7	Transformers		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Transformers shall be protected by an overcurrent protective device having a type and setting in accordance with the transformer manufacturer's instructions. Such protection shall (see also 7.2.10): – avoid nuisance tripping due to transformer magnetizing inrush currents; – avoid a winding temperature rise in excess of the permitted value for the insulation class of transformer when it is subjected to the effects of a short-circuit at its secondary terminals.		N/A
7.2.8	Location of overcurrent protective devices		P
	An overcurrent protective device shall be located at the point where a reduction in the cross-sectional area of the conductors or another change reduces the current-carrying capacity of the conductors, except where all the following conditions are satisfied: – the current carrying capacity of the conductors is at least equal to that of the load; – the part of the conductor(s) between the point of reduction of current-carrying capacity and the position of the overcurrent protective device is no longer than 3 m; – the conductors are installed in such a manner as to reduce the possibility of a short-circuit, for example, protected by an enclosure or duct.		P
7.2.9	Overcurrent protective devices		P
	The rated short-circuit breaking capacity shall be at least equal to the prospective fault current at the point of installation. Where the short-circuit current to an overcurrent protective device can include additional currents other than from the supply (for example from motors, from power factor correction capacitors), those currents shall be taken into consideration. NOTE Information on co-ordination under short-circuit conditions between a circuit-breaker and another short-circuit protective device is provided in Annex A of IEC 60947-2:2006, IEC 60947-2:2006/AMD1:2009 and IEC 60947-2:2006/AMD2:2013. Where fuses are provided as overcurrent protective devices, a type readily available in the country of use shall be selected, or arrangements shall be made for the supply of spare parts.		P
7.2.10	Rating and setting of overcurrent protective devices		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The rated current of fuses or the setting current of other overcurrent protective devices shall be selected as low as possible but adequate for the anticipated overcurrents (for example during starting of motors or energizing of transformers). When selecting those protective devices, consideration shall be given to the protection of switching devices against damage due to overcurrents.		P
	The rated current or setting of an overcurrent protective device for conductors is determined by the current carrying capacity of the conductors to be protected in accordance with 12.4, Clause D.3 and the maximum allowable interrupting time t in accordance with Clause D.4, taking into account the needs of co-ordination with other electrical devices in the protected circuit.		P
7.3	Protection of motors against overheating		P
7.3.1	General		P
	Protection of motors against overheating shall be provided for each motor rated at more than 0,5 kW. Exception: In applications where an automatic interruption of the motor operation is unacceptable (for example fire pumps), the means of detection shall give a warning signal to which the operator can respond.		P
	Protection of motors against overheating can be achieved by: – overload protection (7.3.2), NOTE 1 Overload protective devices detect the time and current relationships ($I t$) in a circuit that are in excess of the rated full load of the circuit and initiate appropriate control responses. – over-temperature protection (7.3.3), or NOTE 2 Temperature detection devices sense over-temperature and initiate appropriate control responses. – current-limiting protection.		P
	Automatic restarting of any motor after the operation of protection against overheating shall be prevented where this can cause a hazardous situation or damage to the machine or to the work in progress.		N/A
7.3.2	Overload protection		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where overload protection is provided, detection of overload(s) shall be provided in each live conductor except for the neutral conductor. However, where the motor overload detection is not used for cable overload protection (see also Clause D.2), detection of overload may be omitted in one of the live conductors. For motors having single-phase or DC power supplies, detection in only one unearthed live conductor is permitted.		P
	Where overload protection is achieved by switching off, the switching device shall switch off all live conductors. The switching of the neutral conductor is not necessary for overload protection.		P
	Where motors with special duty ratings are required to start or to brake frequently (for example, motors for rapid traverse, locking, rapid reversal, sensitive drilling) it can be difficult to provide overload protection with a time constant comparable with that of the winding to be protected. Appropriate protective devices designed to accommodate special duty motors or over-temperature protection (see 7.3.3) can be necessary.		P
	For motors that cannot be overloaded (for example torque motors, motion drives that either are protected by mechanical overload protection devices or are adequately dimensioned), overload protection is not required.		N/A
7.3.3	Over-temperature protection		P
	The provision of motors with over-temperature protection in accordance with IEC 60034-11 is recommended in situations where the cooling can be impaired (for example dusty environments). Depending upon the type of motor, protection under stalled rotor or loss of phase conditions is not always ensured by over-temperature protection, and additional protection should then be provided.		P
	Over-temperature protection is also recommended for motors that cannot be overloaded (for example torque motors, motion drives that are either protected by mechanical overload protection devices or are adequately dimensioned), where the possibility of over-temperature exists (for example due to reduced cooling).		P
7.4	Protection against abnormal temperature		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Equipment shall be protected against abnormal temperatures that can result in a hazardous situation.		P
7.5	Protection against the effects of supply interruption or voltage reduction and subsequent restoration		P
	Where a supply interruption or a voltage reduction can cause a hazardous situation, damage to the machine, or to the work in progress, undervoltage protection shall be provided by, for example, switching off the machine at a predetermined voltage level.		N/A
	Where the operation of the machine can allow for an interruption or a reduction of the voltage for a short time period, delayed undervoltage protection may be provided. The operation of the undervoltage device shall not impair the operation of any stopping control of the machine.		N/A
	Upon restoration of the voltage or upon switching on the incoming supply, automatic or unexpected restarting of the machine shall be prevented where such a restart can cause a hazardous situation.		P
	Where only a part of the machine or of the group of machines working together in a coordinated manner is affected by the voltage reduction or supply interruption, the undervoltage protection shall initiate appropriate control commands to ensure co-ordination.		N/A
7.6	Motor overspeed protection		N/A
	Overspeed protection shall be provided where overspeeding can occur and could possibly cause a hazardous situation taking into account measures in accordance with 9.3.2. Overspeed protection shall initiate appropriate control responses and shall prevent automatic restarting. The overspeed protection should operate in such a manner that the mechanical speed limit of the motor or its load is not exceeded. NOTE This protection can consist, for example, of a centrifugal switch or speed limit monitor.		N/A
7.7	Additional earth fault/residual current protection		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	In addition to providing overcurrent protection for automatic disconnection as described in 6.3, earth fault/residual current protection can be provided to reduce damage to equipment due to earth fault currents less than the detection level of the overcurrent protection.		N/A
	The setting of the devices shall be as low as possible consistent with correct operation of the equipment.		N/A
	If fault currents with DC components are possible, an RCD of type B in accordance with IEC TR 60755 can be required.		N/A
7.8	Phase sequence protection		P
	Where an incorrect phase sequence of the supply voltage can cause a hazardous situation or damage to the machine, protection shall be provided. NOTE Conditions of use that can lead to an incorrect phase sequence include: - a machine transferred from one supply to another; - a mobile machine with a facility for connection to an external power supply.		P
7.9	Protection against overvoltages due to lightning and to switching surges		N/A
	Surge protective devices (SPDs) can be provided to protect against the effects of overvoltages due to lightning or to switching surges. Where provided: – SPDs for the suppression of overvoltages due to lightning shall be connected to the incoming terminals of the supply disconnecting device. – SPDs for the suppression of overvoltages due to switching surges shall be connected as necessary for equipment requiring such protection. NOTE 1 Information about the correct selection and installation of SPDs is given for example in IEC 60364-4-44, IEC 60364-5-53, IEC 61643-12, IEC 62305-1 and IEC 62305-4. NOTE 2 Equipotential bonding of the machine, its electrical equipment and extraneous-conductive-parts to a common bonding network of the building/site can help mitigate electromagnetic interference, including the effects of lightning, on the equipment.		N/A
7.10	Short circuit current rating		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The short-circuit current rating of the electrical equipment shall be determined. This can be done by the application of design rules or by calculation or by test. NOTE The short-circuit current rating may be determined, for example, in accordance with IEC 61439-1, IEC 60909-0, IEC/TR 60909-1, or IEC/TR 61912-1.		P
8	Equipotential bonding		P
8.1	General		P
	This Clause 8 provides requirements for protective bonding and functional bonding. Figure 4 illustrates those concepts. Protective bonding is a basic provision for fault protection to enable protection of persons against electric shock (see 6.3.3 and 8.2).		P
	The objective of functional bonding (see 8.4) is to reduce: – the consequence of an insulation failure which could affect the operation of the machine; – electrical disturbances to sensitive electrical equipment which could affect the operation of the machine; – induced currents from lightning which could damage the electric equipment.		P
	Functional bonding is achieved by connection to the protective bonding circuit, but where the level of electrical disturbances on the protective bonding circuit is not sufficiently low for proper functioning of electrical equipment, it can be necessary to use separate conductors for protective and functional bonding.		P
8.2	Protective bonding circuit		P
8.2.1	General		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The protective bonding circuit consists of the interconnection of: • PE terminal(s) (see 5.2); • the protective conductors (see 3.1.51) in the equipment of the machine including sliding contacts where they are part of the circuit; • the conductive structural parts and exposed conductive parts of the electrical equipment; Exception: see 8.2.5. A1:2025 • conductive structural parts of the machine. those conductive structural parts of the machine used for protective bonding.		P
	All parts of the protective bonding circuit shall be so designed that they are capable of withstanding the highest thermal and mechanical stresses that can be caused by earth-fault currents that could flow in that part of the protective bonding circuit.		P
	The cross-sectional area of every protective conductor which does not form part of a cable or which is not in a common enclosure with the line conductor shall be not less than – 2,5 mm² Cu or 16 mm² Al if protection against mechanical damage is provided, – 4 mm² Cu or 16 mm² Al if protection against mechanical damage is not provided. NOTE The use of steel for a protective conductor is not excluded.		P
	A protective conductor not forming part of a cable is considered to be mechanically protected if it is installed in a conduit, trunking or protected in a similar way. Conductive structural parts of equipment in accordance with 6.3.2.2 need not be connected to the protective bonding circuit. Conductive structural parts of the machine need not be connected to the protective bonding circuit where all the equipment provided is in accordance with 6.3.2.2.		P
	Exposed conductive parts of equipment in accordance with 6.3.2.3 shall not be connected to the protective bonding circuit.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	It is not necessary to connect exposed conductive parts to the protective bonding circuit where those parts are mounted so that they do not constitute a hazard because: – they cannot be touched on large surfaces or grasped with the hand and they are small in size (less than approximately 50 mm × 50 mm); or – they are located so that either contact with live parts, or an insulation failure, is unlikely.		P
	This applies to small parts such as screws, rivets, and nameplates and to parts inside an enclosure, irrespective of their size (for example electromagnets of contactors or relays and mechanical parts of devices).		P
8.2.2	Protective conductors		P
	Protective conductors shall be identified in accordance with 13.2.2.		P
	Copper conductors are preferred. Where a conductor material other than copper is used, its electrical resistance per unit length shall not exceed that of the allowable copper conductor and such conductors shall be not less than 16 mm ² in cross-sectional area for reasons of mechanical durability.		P
	Metal enclosures or frames or mounting plates of electrical equipment, connected to the protective bonding circuit, may be used as protective conductors if they satisfy the following three requirements: • their electrical continuity shall be assured by construction or by suitable connection so as to ensure protection against mechanical, chemical or electrochemical deterioration; • they comply with the requirements of 543.1 of IEC 60364-5-54:2011; • they shall permit the connection of other protective conductors at every predetermined tap-off point.		N/A
	The cross-sectional area of protective conductors shall either be calculated in accordance with 543.1.2 of IEC 60364-5-54:2011, or selected in accordance with Table 1 (see 5.2). See also 8.2.6. and 17.2 (d) of this document.	selected in accordance with Table 1	P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	A1:2025 Each protective conductor shall: • be part of a multicore cable, or; • be in a common enclosure with the line conductor, or; • have a cross sectional area of at least: • 2,5 mm² Cu or 16 mm² Al if protection against mechanical damage is provided; • 4 mm² Cu or 16 mm² Al if protection against mechanical damage is not provided. NOTE 1 The use of steel for a protective conductor is not excluded. Each protective conductor shall: • be part of a multicore cable, or; • be in a common enclosure with the line conductor, or; • have a cross-sectional area of at least: • 2,5 mm² Cu or 16 mm² Al if protection against mechanical damage is provided; • 4 mm² Cu or 16 mm² Al if protection against mechanical damage is not provided. NOTE 1 The use of steel for a protective conductor is not excluded.		P
	A protective conductor not forming part of a cable is considered to be mechanically protected if it is installed in a conduit, trunking or protected in a similar way.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The following parts of the machine and its electrical equipment shall be connected to the protective bonding circuit but shall not be used as protective conductors: A1:2025 • conductive structural parts of the machine; • metal ducts of flexible or rigid construction; • metallic cable sheaths or armouring; • metallic pipes containing flammable materials such as gases, liquids, powder. • flexible or pliable metal conduits; • constructional parts subject to mechanical stress in normal service; • flexible metal parts; support wires; cable trays and cable ladders. NOTE 2 Information on cathodic protection is provided in 542.2.5 and 542.2.6 of IEC 60364-5-54:2011.		P
8.2.3	Continuity of the protective bonding circuit		P
	Where a part is removed for any reason (for example routine maintenance), the protective bonding circuit for the remaining parts shall not be interrupted.		P
	Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and conductors of aluminium or aluminium alloys are used, particular consideration should be given to the possibility of electrolytic corrosion.		P
	Where the electrical equipment is mounted on lids, doors, or cover plates, continuity of the protective bonding circuit shall be ensured and a protective conductor (see 8.2.2) is recommended. Where a protective conductor is not provided, fastenings, hinges or sliding contacts designed to have a low resistance shall be used (see 18.2.2, Test 1).		P
	The continuity of conductors in cables that are exposed to damage (for example flexible trailing cables) shall be ensured by appropriate measures (for example monitoring).		N/A
	For requirements for the continuity of conductors using conductor wires, conductor bars and slip-ring assemblies, see 12.7.2.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The protective bonding circuit shall not incorporate a switching device, an overcurrent protective device (for example switch, fuse), or other means of interruption.		P
	Where the continuity of the protective bonding circuit can be interrupted by means of removable current collectors or plug/socket combinations, the protective bonding circuit shall be interrupted by a first make last break contact. This also applies to removable or withdrawable plug-in units (see also 13.4.5).		P
8.2.4	Protective conductor connecting points		P
	All protective conductors shall be terminated in accordance with 13.1.1. The protective conductor connecting points are not intended, for example, to attach appliances or parts.		P
	Each protective conductor connecting point shall be marked or labelled as such using the symbol IEC 60417-5019:2006-08 as illustrated in Figure 5: or with the letters PE, the graphical symbol being preferred, or by use of the bicolour combination GREEN-AND-YELLOW, or by any combination of these.		P
8.2.5	Mobile machines		N/A
	On mobile machines with on-board power supplies, the protective conductors, the conductive structural parts of the electrical equipment, and those extraneous-conductive-parts which form the structure of the machine shall all be connected to a protective bonding terminal to provide protection against electric shock. Where a mobile machine is also capable of being connected to an external incoming power supply, this protective bonding terminal shall be the connection point for the external protective conductor. NOTE When the supply of electrical energy is self-contained within stationary, mobile, or movable items of equipment, and when there is no external supply connected (for example when an on-board battery charger is not connected), there is no need to connect such equipment to an external protective conductor.		N/A
8.2.6	Additional requirements for electrical equipment having earth leakage currents higher than 10 mA		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where electrical equipment has an earth leakage current that is greater than 10 mA AC or DC in any protective conductor, one or more of the following conditions for the integrity of each section of the associated protective bonding circuit that carries the earth leakage current shall be satisfied: a) the protective conductor is completely enclosed within electrical equipment enclosures or otherwise protected throughout its length against mechanical damage; b) the protective conductor has a cross-sectional area of at least 10 mm² Cu or 16 mm² Al; c) where the protective conductor has a cross-sectional area of less than 10 mm² Cu or 16 mm² Al, a second protective conductor of at least the same cross-sectional area is provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm² Cu or 16 mm² Al. This can require that the electrical equipment has a separate terminal for a second protective conductor. d) the supply is automatically disconnected in case of loss of continuity of the protective conductor; e) where a plug-socket combination is used, an industrial connector in accordance with IEC 60309 series, with adequate strain relief and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable is provided.		P
	A statement shall be given in the instructions for installation that the equipment shall be installed as described in this 8.2.6. NOTE A warning label may also be provided adjacent to the PE terminal to state that the protective conductor current exceeds 10mA.		P
8.3	Measures to restrict the effects of high leakage current		N/A
	The effects of high leakage current can be restricted to the equipment having high leakage current by connection of that equipment to a dedicated supply transformer having separate windings. The protective bonding circuit shall be connected to exposed conductive parts of the equipment and, in addition, to the secondary winding of the transformer. The protective conductor(s) between the equipment and the secondary winding of the transformer shall comply with one or more of the arrangements described in 8.2.6.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
8.4	Functional bonding		P
	Protection against maloperation as a result of insulation failures can be achieved by connecting to a common conductor in accordance with 9.4.3.1.1.		P
	For recommendations regarding functional bonding to avoid maloperation due to electromagnetic disturbances, see 4.4.2 and Annex H.		P
	Functional bonding connecting points should be marked or labelled as such using the symbol IEC 60417-5020:2002-10 (see Figure 6).		P
9	Control circuits and control functions		P
9.1	Control circuits		P
9.1.1	Control circuit supply		P
	Where control circuits are supplied from an AC source, transformers having separate windings shall be used to separate the power supply from the control supply. Examples include: • control transformers having separate windings in accordance with IEC 61558-2-2, • switch mode power supply units in accordance with IEC 61558-2-16 fitted with transformers having separate windings, • low voltage power supplies in accordance with IEC 61204-7 fitted with transformers having separate windings.	switch mode power supply	P
	Where several transformers are used, it is recommended that the windings of those transformers be connected in such a manner that the secondary voltages are in phase.		N/A
	Exception: Transformers or switch mode power supply units fitted with transformers are not mandatory for machines with a single motor starter and/or a maximum of two control devices (for example, interlock device, start/stop control station).		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where DC control circuits derived from an AC supply are connected to the protective bonding circuit (see 8.2.1), they shall be supplied from a separate winding of the AC control circuit transformer or by another control circuit transformer.		P
9.1.2	Control circuit voltages		P
	The nominal value of the control voltage shall be consistent with the correct operation of the control circuit. The nominal voltage of AC control circuits should preferably not exceed – 230 V for circuits with 50 Hz nominal frequency, – 277 V for circuits with 60 Hz nominal frequency. The nominal voltage of DC control circuits should preferably not exceed 220 V.		P
9.1.3	Protection		P
	Control circuits shall be provided with overcurrent protection in accordance with 7.2.4 and 7.2.10.		P
9.2	Control functions		P
9.2.1	General		P
	NOTE Subclause 9.2 does not specify requirements for the devices used to implement control functions. Examples of requirements for devices are given in Clause 10.		
9.2.2	Categories of stop functions		P
	There are three categories of stop functions as follows: – stop category 0: stopping by immediate removal of power to the machine actuators (i.e. an uncontrolled stop – see 3.1.64); – stop category 1: a controlled stop (see 3.1.14) with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved; – stop category 2: a controlled stop with power remaining available to the machine actuators. NOTE For removal of power it can be sufficient to remove the power needed to generate a torque or force. This can be achieved by declutching, disconnecting, switching off, or by electronic means (e.g. a PDS in accordance with IEC 61800 series), etc.		P
9.2.3	Operation		P
9.2.3.1	General		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Safety functions and/or protective measures (for example interlocks (see 9.3)) shall be provided where required to reduce the possibility of hazardous situations.		P
	Where a machine has more than one control station, measures shall be provided to ensure that initiation of commands from different control stations do not lead to a hazardous situation.		P
9.2.3.2	Start		P
	Start functions shall operate by energizing the relevant circuit.		P
	The start of an operation shall be possible only when all relevant safety functions and/or protective measures are in place and are operational, except for conditions as described in 9.3.6.		P
	For those machines (for example mobile machines) where safety functions and/or protective measures cannot be applied for certain operations, starting of such operations shall be by hold-to-run controls, together with enabling devices, as appropriate.		N/A
	A1:2025 The provision of acoustic and/or visual warning signals before the starting of hazardous machine operation should be considered. The provision of acoustic and/or visual warning signals before the starting of hazardous machine operation shall be considered during the risk assessment. Where the risk assessment determines that either or both are required the emission level of these warning signals shall be suitable for the intended environment.		P
	Suitable interlocks shall be provided where necessary for correct sequential starting.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	In the case of machines requiring the use of more than one control station to initiate a start, each of these control stations shall have a separate manually actuated start control device. The conditions to initiate a start shall be: • all required conditions for machine operation shall be met, and • all start control devices shall be in the released (off) position, then • all start control devices shall be actuated concurrently (see 3.1.7).		N/A
9.2.3.3	Stop		P
	Stop category 0 and/or stop category 1 and/or stop category 2 stop functions shall be provided as indicated by the risk assessment and the functional requirements of the machine (see 4.1). NOTE 1 The supply disconnecting device (see 5.3) when operated achieves a stop category 0.		P
	Stop functions shall override related start functions.		P
	Where more than one control station is provided, stop commands from any control station shall be effective when required by the risk assessment of the machine. NOTE 2 When stop functions are initiated, it can be necessary to discontinue machine functions other than motion.		P
9.2.3.4	Emergency operations (emergency stop, emergency switching off)		P
9.2.3.4.1	General		P
	Emergency stop and emergency switching off are complementary protective measures that are not primary means of risk reduction for hazards (for example trapping, entanglement, electric shock or burn) at a machine (see ISO 12100).		P
	This part of IEC 60204 specifies the requirements for the emergency stop and the emergency switching off functions of the emergency operations listed in Annex E, both of which are intended to be initiated by a single human action.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Once active operation of an emergency stop (see 10.7) or emergency switching off (see 10.8) actuator has ceased following a stop or switching off command, the effect of this command shall be sustained until it is reset. This reset shall be possible only by a manual action at the device where the command has been initiated. The reset of the command shall not restart the machinery but only permit restarting.		P
	It shall not be possible to restart the machinery until all emergency stop commands have been reset. It shall not be possible to reenergize the machinery until all emergency switching off commands have been reset.		P
9.2.3.4.2	Emergency stop		P
	Requirements for functional aspects of emergency stop equipment are given in ISO 13850.		P
	The emergency stop shall function either as a stop category 0 or as a stop category 1. The choice of the stop category of the emergency stop depends on the results of a risk assessment of the machine.		P
	Exception: In some cases, to avoid creating additional risks, it can be necessary to perform a controlled stop and maintain the power to machine actuators even after stopping is achieved. The stopped condition shall be monitored and upon detection of failure of the stopped condition, power shall be removed without creating a hazardous situation.		N/A
	In addition to the requirements for stop given in 9.2.3.3, the emergency stop function has the following requirements: • it shall override all other functions and operations in all modes; • it shall stop the hazardous motion as quickly as practicable without creating other hazards; • reset shall not initiate a restart.		P
9.2.3.4.3	Emergency switching off		N/A
	A1:2025 The functional aspects of emergency switching off are given in 536.4 of IEC 60364-5-53:2001 IEC 60364-5-53:2019.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Emergency switching off should be provided where: • basic protection (for example for conductor wires, conductor bars, slip-ring assemblies, controlgear in electrical operating areas) is achieved only by placing out of reach or by obstacles (see 6.2.6); or • there is the possibility of other hazards or damage caused by electricity.		N/A
	Emergency switching off is accomplished by switching off the relevant supply by electromechanical switching devices, effecting a stop category 0 of machine actuators connected to this incoming supply. When a machine cannot tolerate this category 0 stop, it may be necessary to provide other measures, for example basic protection, so that emergency switching off is not necessary.		N/A
9.2.3.5	Operating modes		P
	Each machine can have one or more operating modes (for example manual mode, automatic mode, setting mode, maintenance mode) determined by the type of machine and its application.		P
	Where machinery has been designed and constructed to allow its use in several control or operating modes requiring different protective measures and having a different impact on safety, it shall be fitted with a mode selector which can be locked in each position (for example key operated switch). Each position of the selector shall be clearly identifiable and shall correspond to a single operating or control mode.		N/A
	The selector may be replaced by another selection method which restricts the use of certain functions of the machinery to certain categories of operator (for example access code).		N/A
	Mode selection by itself shall not initiate machine operation. A separate actuation of the start control shall be required.		N/A
	For each specific operating mode, the relevant safety functions and/or protective measures shall be implemented.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Indication of the selected operating mode shall be provided (for example the position of a mode selector, the provision of an indicating light, a visual display indication).		P
9.2.3.6	Monitoring of command actions		P
	Movement or action of a machine or part of a machine that can result in a hazardous situation shall be monitored by providing, for example, overtravel limiters, motor overspeed detection, mechanical overload detection or anti-collision devices. NOTE On some manually controlled machines (for example, manual drilling machine), operators provide monitoring.		P
9.2.3.7	Hold-to-run controls		N/A
	Hold-to-run controls shall require continuous actuation of the control device(s) to achieve operation.		N/A
9.2.3.8	Two-hand control		N/A
	Three types of two-hand control are defined in ISO 13851, the selection of which is determined by the risk assessment. These shall have the following features:		N/A
	Type I: this type requires: - the provision of two control devices and their concurrent actuation by both hands; - continuous concurrent actuation during the hazardous situation; - machine operation shall cease upon the release of either one or both of the control devices when hazardous situations are still present. A Type I two-hand control device is not considered to be suitable for the initiation of hazardous operation.		N/A
	Type II: a Type I control requiring the release of both control devices before machine operation can be reinitiated.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Type III: a Type II control requiring concurrent actuation of the control devices as follows: • it shall be necessary to actuate the control devices within a certain time limit of each other, not exceeding 0,5 s; • where this time limit is exceeded, both control devices shall be released before machine operation can be initiated.		N/A
9.2.3.9	Enabling control		N/A
	Enabling control (see also 10.9) is a manually activated control function interlock that: a) when activated allows a machine operation to be initiated by a separate start control, and b) when de-activated • initiates a stop function, and • prevents initiation of machine operation		N/A
	Enabling control shall be so arranged as to minimize the possibility of defeating, for example by requiring the de-activation of the enabling control device before machine operation may be reinitiated.		N/A
9.2.3.10	Combined start and stop controls		N/A
	Push-buttons and similar control devices that, when operated, alternately initiate and stop motion shall only be provided for functions which cannot result in a hazardous situation.		N/A
9.2.4	Cableless control system (CCS)	No such system	N/A
9.2.4.1	General requirements		N/A
	Subclause 9.2.4 deals with the functional requirements of control systems employing cableless (for example radio, infra-red) techniques for transmitting control signals and data between operator control station(s) and other parts of the control system(s). NOTE 1 Reference to a machine in 9.2.4 is intended to be read as "machine or part(s) of a machine".		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	A1:2025 Transmission reliability requirements can be necessary for safety functions of a CCS that rely on data transmission (for example, safety-related active stop, motion commands). Where a safety function of a CCS relies on data transmission the transmission reliability shall be considered.		N/A
	The CCS shall have functionality and a response time suitable for the application based on the risk assessment. NOTE 2 IEC 61784-3 describes communication failures of communication networks and requirements for safetyrelated data transmission. A1:2025 NOTE 3 Further requirements for cableless control systems are under development by IEC TC 44 in draft IEC 62745. NOTE 3 IEC 62745 deals with cableless control systems for electrical equipment of machinery.		N/A
9.2.4.2	Monitoring the ability of a cableless control system to control a machine		N/A
	The ability of a cableless control system (CCS) to control a machine shall be automatically monitored, either continuously or at suitable intervals. The status of this ability shall be clearly indicated (for example, by an indicating light, a visual display indication, etc.)		N/A
	If the communication signal is degraded in a manner that might lead to the loss of the ability of a CCS to control a machine (e.g., reduced signal level, low battery power) a warning to the operator shall be provided before the ability of the CCS to control a machine is lost.		N/A
	When the ability of a CCS to control a machine has been lost for a time that is determined from a risk assessment of the application, an automatic stop of the machine shall be initiated. NOTE In some cases, for example, in order to avoid this automatic stop generating an unexpected hazardous condition, it can be necessary for the machine to go to a predetermined state before stopping.		N/A
	Restoration of the ability of a CCS to control a machine shall not restart the machine. Restart shall require a deliberate action, for example manual actuation of a start button.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
9.2.4.3	Control limitation		N/A
	Measures shall be taken (e.g. coded transmission) to prevent the machine from responding to signals other than those from the intended cableless operator control station(s).		N/A
	Cableless operator control station(s) shall only control the intended machine(s) and shall affect only the intended machine functions.		N/A
9.2.4.4	Use of multiple cableless operator control stations		N/A
	When more than one cableless operator control station is used to control a machine, then: • only one cableless operator control station shall be enabled at a time except as necessary for the operation of the machine; • transfer of control from one cableless operator control station to another shall require a deliberate manual action at the control station that has control; • during machine operation, transfer of control shall only be possible when both cableless operator control stations are set to the same mode of machine operation and/or function(s) of the machine; • transfer of control shall not change the selected mode of machine operation and/or function(s) of the machine; • each cableless operator control station that has control of the machine shall be provided with an indication that it has control (by for example, the provision of an indicating light, a visual display indication). NOTE Indications at other locations can be necessary as determined by the risk assessment.		N/A
9.2.4.5	Portable cableless operator control stations		N/A
	Portable cableless operator control stations shall be provided with means (for example key operated switch, access code) to prevent unauthorized use.		N/A
	Each machine under cableless control should have an indication when it is under cableless control.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	When a portable cableless operator control station can be connected to one or more of several machines, means shall be provided on the portable cableless operator control station to select which machine(s) is to be connected. Selecting a machine to be connected shall not initiate control commands.		N/A
9.2.4.6	Deliberate disabling of cableless operator control stations		N/A
	Where a cableless operator control station is disabled when under control, the associated machine shall meet the requirements for loss of ability of a CCS to control a machine in 9.2.4.2.		N/A
	Where it is necessary to disable a cableless operator control station without interrupting machine operation, means shall be provided (for example on the cableless operator control station) to transfer control to another fixed or portable control station.		N/A
9.2.4.7	Emergency stop devices on portable cableless operator control stations		N/A
	Emergency stop devices on portable cableless operator control stations shall not be the sole means of initiating the emergency stop function of a machine.		N/A
	Confusion between active and inactive emergency stop devices shall be avoided by appropriate design and information for use. See also ISO 13850.		N/A
9.2.4.8	Emergency stop reset		N/A
	Restarting of cableless control after power loss, disabling and re-enabling, loss of communication, or failure of parts of the CCS shall not result in a reset of an emergency stop condition.		N/A
	The instructions for use shall state that the reset of an emergency stop condition initiated by a portable cableless operator control station shall only be performed when it can be seen that the reason for initiation has been cleared.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	A1:2025 Depending on the risk assessment, in addition to the resetting of the emergency stop actuator on the portable cableless operator control station, one or more supplementary fixed reset devices should be provided. Where the risk assessment shows that resetting of an emergency stop actuator on the portable cableless operator control station is not adequate then one or more supplementary fixed resets shall be provided.		N/A
9.3	Protective interlocks		P
	Reclosing or resetting of an interlocking safeguard		P
	The reclosing or resetting of an interlocking safeguard shall not initiate hazardous machine operation. NOTE Requirements for interlocking guards with a start function (control guards) are specified in 6.3.3.2.5 of ISO 12100:2010.		P
9.3.2	Exceeding operating limits		P
	Where an operating limit (for example speed, pressure, position) can be exceeded leading to a hazardous situation, means shall be provided to detect when a predetermined limit(s) is exceeded and initiate an appropriate control action.		P
9.3.3	Operation of auxiliary functions		P
	The correct operation of auxiliary functions shall be checked by appropriate devices (for example pressure sensors).		P
	Where the non-operation of a motor or device for an auxiliary function (for example lubrication, supply of coolant, swarf removal) can cause a hazardous situation, or cause damage to the machine or to the work in progress, appropriate interlocking shall be provided.		P
9.3.4	Interlocks between different operations and for contrary motions		N/A
	All contactors, relays, and other control devices that control elements of the machine and that can cause a hazardous situation when actuated at the same time (for example those which initiate contrary motion), shall be interlocked against incorrect operation.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Reversing contactors (for example those controlling the direction of rotation of a motor) shall be interlocked in such a way that in normal service no short-circuit can occur when switching.		N/A
	Where, for safety or for continuous operation, certain functions on the machine are required to be interrelated, proper co-ordination shall be ensured by suitable interlocks. For a group of machines working together in a co-ordinated manner and having more than one controller, provision shall be made to co-ordinate the operations of the controllers as necessary.		N/A
	Where a failure of a mechanical brake actuator can result in the brake being applied when the associated machine actuator is energized and a hazardous situation can result, interlocks shall be provided to switch off the machine actuator.		N/A
9.3.5	Reverse current braking		N/A
	Where braking of a motor is accomplished by current reversal, measures shall be provided to prevent the motor starting in the opposite direction at the end of braking where that reversal can cause a hazardous situation or damage to the machine or to the work in progress. For this purpose, a device operating exclusively as a function of time is not permitted.		N/A
	Control circuits shall be so arranged that rotation of a motor shaft, for example by applying a manual force or any other force causing the shaft to rotate after it has stopped, shall not result in a hazardous situation.		N/A
9.3.6	Suspension of safety functions and/or protective measures		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where it is necessary to suspend safety functions and/or protective measures (for example for setting or maintenance purposes), the control or operating mode selector shall simultaneously: • disable all other operating (control) modes; • permit operation only by the use of a hold-to-run device or by a similar control device positioned so as to permit sight of the hazardous elements; • permit operation of the hazardous elements only in reduced risk conditions (e.g. reduced speed, reduced power / force, step-by-step operation, e.g. with a limited movement control device); • prevent any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.		N/A
	If these four conditions cannot be fulfilled simultaneously, the control or operating mode selector shall activate other protective measures designed and constructed to ensure a safe intervention zone. In addition, the operator shall be able to control operation of the parts he is working on from the adjustment point.		N/A
9.4	Control functions in the event of failure		P
9.4.1	General requirements		P
	Where failures or disturbances in the electrical equipment can cause a hazardous situation or damage to the machine or to the work in progress, appropriate measures shall be taken to minimize the probability of the occurrence of such failures or disturbances. The required measures and the extent to which they are implemented, either individually or in combination, depend on the level of risk associated with the respective application (see 4.1).		P
	Examples of such measures that can be appropriate include but are not limited to: • protective interlocking of the electrical circuit; • use of proven circuit techniques and components (see 9.4.2.2); • provision of partial or complete redundancy (see 9.4.2.3) or diversity (see 9.4.2.4); • provision for functional tests (see 9.4.2.5).		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The electrical control system(s) shall have an appropriate performance that has been determined from the risk assessment of the machine. The requirements for safety-related control functions of IEC 62061 and/or ISO 13849-1, ISO 13849-2 shall apply.		P
	Where functions performed by the electrical control system(s) have safety implications but application of IEC 62061 leads to a required safety integrity less than that required by SIL 1, compliance with the requirements of this part of IEC 60204 can lead to an adequate performance of the electrical control system(s).		P
	Where memory retention is achieved for example, by battery power, measures shall be taken to prevent hazardous situations arising from failure, undervoltage or removal of the battery.		N/A
	Means shall be provided to prevent unauthorized or inadvertent memory alteration by, for example, requiring the use of a key, access code or tool.		N/A
9.4.2	Measures to minimize risk in the event of failure		P
9.4.2.1	General		P
	Measures to minimize risk in the event of failure include but are not limited to: • use of proven circuit techniques and components; • provisions of partial or complete redundancy; • provision of diversity; • provision for functional tests.		P
9.4.2.2	Use of proven circuit techniques and components		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	These measures include but are not limited to: • bonding of control circuits to the protective bonding circuit for functional purposes (see 9.4.3.1.1 and Figure 4); • connection of control devices in accordance with 9.4.3.1.1; • stopping by de-energizing; • the switching of all control circuit conductors (for example both sides of a coil) of the device being controlled; • switching devices having direct opening action (see IEC 60947-5-1); • monitoring by: – use of mechanically linked contacts (see IEC 60947-5-1); – use of mirror contacts (see IEC 60947-4-1); • circuit design to reduce the possibility of failures causing undesirable operations.		P
9.4.2.3	Provisions of partial or complete redundancy		P
	By providing partial or complete redundancy, it is possible to minimize the probability that one single failure in the electrical circuit can result in a hazardous situation. Redundancy can be effective in normal operation (on-line redundancy) or designed as special circuits that take over the protective function (off-line redundancy) only where the operating function fails.		P
	Where off-line redundancy which is not active during normal operation is provided, suitable measures shall be taken to ensure that those control circuits are available when required.		N/A
9.4.2.4	Provision of diversity		P
	The use of control circuits having different principles of operation, or using different types of components or devices can reduce the probability of hazards resulting from faults and/or failures. Examples include: – the use of a combination of normally open and normally closed contacts; – the use of different types of control devices in the circuit(s); – the combination of electromechanical and electronic equipment in redundant configurations.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The combination of electrical and non-electrical systems (for example mechanical, hydraulic, pneumatic) may perform the redundant function and provide the diversity.		P
9.4.2.5	Provision for functional tests		P
	Functional tests may be carried out automatically by the control system, or manually by inspection or tests at start-up and at predetermined intervals, or a combination as appropriate (see also 17.2 and 18.6).		P
9.4.3	Protection against malfunction of control circuits		P
9.4.3.1	Insulation faults		P
9.4.3.1.1	General		P
	Measures shall be provided to reduce the probability that insulation faults on any control circuit can cause malfunction such as unintentional starting, potentially hazardous motions, or prevent stopping of the machine. The measures to meet the requirements include but are not limited to the following methods: – method a) Earthed control circuits fed by transformers; – method b) Non-earthed control circuits fed by transformers; – method c) Control circuits fed by transformer with an earthed centre-tap winding; – method d) Control circuits not fed by a transformer.		P
9.4.3.1.2	Method a) – Earthed control circuits fed by transformers		P
	The common conductor shall be connected to the protective bonding circuit at the point of supply. All contacts, solid state elements, etc., which are intended to operate an electromagnetic or other device (for example, a relay, indicator light) are to be inserted between the switched conductor of the control circuit supply and one terminal of the coil or device. The other terminal of the coil or device is connected directly to the common conductor of the control circuit supply without any switching elements (see Figure 7). NOTE Method a) can be used also for DC control circuits. In this case the transformer shown in Figure 7 is substituted by a DC power supply unit.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Exception: Contacts of protective devices may be connected between the common conductor and the coils, provided that the connection is very short (for example in the same enclosure) so that an earth fault is unlikely (for example overload relays directly fitted to contactors).		N/A
9.4.3.1.3	Method b) – Non-earthed control circuits fed by transformers		N/A
	Control circuits fed from a control transformer that is not connected to the protective bonding circuit shall either: 1) have 2-pole control switches that operate on both conductors, see Figure 8; or 2) be provided with a device, for example an insulation monitoring device, that interrupts the circuit automatically in the event of an earth fault, see Figure 9; or 3) where an interruption as per item 2 above would increase the risk, for example when continued operation is required during the first fault to earth, it can be sufficient to provide an insulation monitoring device (e.g. in accordance with IEC 61557-8) that will initiate an acoustic and optical signal at the machine, see Figure 10. Requirements for the procedure to be performed by the machine user in response to this alarm shall be described in the information for use.		N/A
	NOTE 1 Method b1) can be used also for DC control circuits. In this case the transformer shown in Figure 8 is substituted by a DC power supply. NOTE 2 Method b2) can be used also for DC control circuits. In this case the transformer shown in Figure 9 is substituted by a DC power supply. NOTE 3 Figure 9 does not show the overcurrent protective devices in the measurement circuits for protection of the insulation monitoring device. NOTE 4 Method b3) can be used also for DC control circuits. In this case the transformer shown in Figure 10 is substituted by a DC power supply. When a transformer and rectifier combination is used, the insulation monitoring device is connected to the protective bonding circuit in the DC part of the control circuit, so after the rectifier. NOTE 5 Figure 10 does not show the overcurrent protective devices in the measurement circuits for protection of the insulation monitoring device.		N/A
9.4.3.1.4	Method c) – Control circuits fed by transformer with an earthed centre-tap winding		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Control circuits fed from a control transformer with its centre-tap winding connected to the protective bonding circuit shall have overcurrent protective devices that break both the conductors.		N/A
	The control switches shall be 2-pole types that operate on both conductors.		N/A
9.4.3.1.5	Method d) – Control circuits not fed by a transformer		N/A
	Control circuits that are not fed by a control transformer or switch mode power supply units fitted with transformers having separate windings in accordance with IEC 61558-2-16 are only allowed for machines with a maximum of one motor starter and/or maximum of two control devices, in accordance with 9.1.1.		N/A
	Depending on the earthing of the supply system the possible cases are: 1) directly connected to an earthed supply system (TN- or TT-system) and: a) being powered between a line conductor and the neutral conductor, see Figure 12; or b) being powered between two line conductors, see Figure 13; or 2) directly connected to a supply system that is not earthed or is earthed through a high impedance (IT-system) and: a) being powered between a line conductor and the neutral conductor, see Figure 14; or b) being powered between two line conductors, see Figure 15.		N/A
	Method d1b) requires multi-pole control switches that switch all live conductors in order to avoid an unintentional start in case of an earth fault in the control circuit. Method d2) requires that a device shall be provided that interrupts the circuit automatically in the event of an earth fault.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	NOTE 1 Figure 12 shows the case where the supply system is a TN system. The control circuit is the same in the case of a TT system. NOTE 2 Figure 12 does not show any protective devices for the power circuit and control circuit, provisions for which are stated in 6.3 and 7.2. NOTE 3 Figure 13 shows the case where the supply system is a TN system. The control circuit is the same in case of a TT system. NOTE 4 Figure 13 does not show any necessary protective devices for power circuit and control circuit, provisions for which are stated in 6.3 and 7.2. NOTE 5 Figure 14 does not show any necessary protective devices for the power circuit and control circuit, provisions for which are stated in 6.3 and 7.2. NOTE 6 Figure 15 does not show any necessary protective devices for power circuit and control circuit, provisions for which are stated in 6.3 and 7.2.		--
9.4.3.2	Voltage interruptions		N/A
	See also 7.5. Where the control system uses a memory device(s), proper functioning in the event of power failure shall be ensured (for example by using a non-volatile memory) to prevent any loss of memory that can result in a hazardous situation.		N/A
9.4.3.3	Loss of circuit continuity		N/A
	Where the loss of continuity of control circuits depending upon sliding contacts can result in a hazardous situation, appropriate measures shall be taken (for example by duplication of the sliding contacts).		N/A
10	Operator interface and machine-mounted control devices		P
10.1	General		P
10.1.1	General requirements		P
	Control devices for operator interface shall, as far as is practicable, be selected, mounted, and identified or coded in accordance with IEC 61310 series.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The possibility of inadvertent operation shall be minimized by, for example, positioning of devices, suitable design, provision of additional protective measures. Particular consideration shall be given to the selection, arrangement, programming and use of operator input devices such as touchscreens, keypads and keyboards for the control of hazardous machine operations, and of sensors (for example position sensors) that can initiate machine operation. Further information can be found in IEC 60447.		P
	Ergonomic principles shall be taken into account in the location of operator interface devices.		P
10.1.2	Location and mounting		P
	As far as is practicable, machine-mounted control devices shall be: • readily accessible for service and maintenance; • mounted in such a manner as to minimize the possibility of damage from activities such as material handling.		P
	The actuators of hand-operated control devices shall be selected and installed so that: • they are not less than 0,6 m above the servicing level and are within easy reach of the normal working position of the operator; • the operator is not placed in a hazardous situation when operating them.		P
	The actuators of foot-operated control devices shall be selected and installed so that: • they are within easy reach of the normal working position of the operator; • the operator is not placed in a hazardous situation when operating them.		P
10.1.3	Protection		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The degree of protection (IP rating in accordance with IEC 60529) together with other appropriate measures shall provide protection against: • the effects of liquids, vapours, or gases found in the physical environment or used on the machine; • the ingress of contaminants (for example swarf, dust, particulate matter). In addition, the operator interface control devices shall have a minimum degree of protection against contact with live parts of IPXXD in accordance with IEC 60529.		P
10.1.4	Position sensors		P
	Position sensors (for example position switches, proximity switches) shall be so arranged that they will not be damaged in the event of overtravel.		P
	Position sensors in circuits with safety-related control functions (for example, to maintain the safe condition of the machine or prevent hazardous situations arising at the machine) shall have direct opening action (see IEC 60947-5-1) or shall provide similar reliability (see 9.4.2).		N/A
10.1.5	Portable and pendant control stations		N/A
	Portable and pendant operator control stations and their control devices shall be so selected and arranged as to minimize the possibility of machine operations caused by inadvertent actuation, shocks and vibrations (for example if the operator control station is dropped or strikes an obstruction) (see also 4.4.8).		N/A
10.2	Actuators		P
10.2.1	Colours		P
	Actuators (see 3.1.1) shall be colour-coded as follows.		P
	The colours for START/ON actuators should be WHITE, GREY, BLACK or GREEN with a preference for WHITE. RED shall not be used.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The colour RED shall be used for emergency stop and emergency switching off actuators (including supply disconnecting devices where it is foreseen that they are for use in an emergency). If a background exists immediately around the actuator, then this background shall be coloured YELLOW. The combination of a RED actuator with a YELLOW background shall only be used for emergency operation devices.		P
	The colours for STOP/OFF actuators should be BLACK, GREY, or WHITE with a preference for BLACK. GREEN shall not be used. RED is permitted, but it is recommended that RED is not used near an emergency operation device.		P
	WHITE, GREY, or BLACK are the preferred colours for actuators that alternately act as START/ON and STOP/OFF actuators. The colours RED, YELLOW, or GREEN shall not be used.		N/A
	WHITE, GREY, or BLACK are the preferred colours for actuators that cause operation while they are actuated and cease the operation when they are released (for example hold-to-run). The colours RED, YELLOW, or GREEN shall not be used.		N/A
	Reset actuators shall be BLUE, WHITE, GREY, or BLACK. Where they also act as a STOP/OFF actuator, the colours WHITE, GREY, or BLACK are preferred with the main preference being for BLACK. GREEN shall not be used.		N/A
	The colour YELLOW is reserved for use in abnormal conditions, for example, in the event of an abnormal condition of the process, or to interrupt an automatic cycle.		N/A
	Where the same colour WHITE, GREY, or BLACK is used for various functions (for example WHITE for START/ON and for STOP/OFF actuators) a supplementary means of coding (for example shape, position, symbol) shall be used for the identification of actuators.		P
10.2.2	Markings		P
	In addition to the functional identification as described in 16.3, recommended symbols to be placed near to or preferably directly on certain actuators are given in Table 2 or 3.		P
10.3	Indicator lights and displays		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
10.3.1	General		P
	Indicator lights and displays serve to give the following types of information: – indication: to attract the operator's attention or to indicate that a certain task should be performed. The colours RED, YELLOW, BLUE, and GREEN are normally used in this mode; for flashing indicator lights and displays, see 10.3.3. – confirmation: to confirm a command, or a condition, or to confirm the termination of a change or transition period. The colours BLUE and WHITE are normally used in this mode and GREEN may be used in some cases.		P
	Indicator lights and displays shall be selected and installed in such a manner as to be visible from the normal position of the operator (see also IEC 61310-1).		P
	Circuits used for visual or audible devices used to warn persons of an impending hazardous event shall be fitted with facilities to check the operability of these devices.		N/A
10.3.2	Colours		P
	Indicator lights should be colour-coded with respect to the condition (status) of the machine in accordance with Table 4.		P
	Indicating towers on machines should have the applicable colours in the following order from the top down; RED, YELLOW, BLUE, GREEN and WHITE.		P
10.3.3	Flashing lights and displays		N/A
	For further distinction or information and especially to give additional emphasis, flashing lights and displays can be provided for the following purposes: – to attract attention; – to request immediate action; – to indicate a discrepancy between the command and actual state; – to indicate a change in process (flashing during transition).		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	It is recommended that higher flashing frequencies are used for higher priority information (see IEC 60073 for recommended flashing rates and pulse/pause ratios). Where flashing lights or displays are used to provide higher priority information, additional acoustic warnings should be considered.		N/A
10.4	Illuminated push-buttons		P
	Illuminated push-button actuators shall be colour-coded in accordance with 10.2.1. Where there is difficulty in assigning an appropriate colour, WHITE shall be used.		P
	The colour of active emergency stop actuators shall remain RED regardless of the state of the illumination.		N/A
10.5	Rotary control devices		P
	Devices having a rotational member, such as potentiometers and selector switches, shall have means of prevention of rotation of the stationary member. Friction alone shall not be considered sufficient.		P
10.6	Start devices		P
	Actuators used to initiate a start function or the movement of machine elements (for example slides, spindles, carriers) shall be constructed and mounted so as to minimize inadvertent operation.		P
10.7	Emergency stop devices		P
10.7.1	Location of emergency stop devices		P
	Devices for emergency stop shall be readily accessible.		P
	Emergency stop devices shall be provided at each location where the initiation of an emergency stop can be required.		P
	There can be circumstances where confusion can occur between active and inactive emergency stop devices caused by, for example, unplugging or otherwise disabling an operator control station. In such cases, means (for example, design and information for use) shall be provided to minimise confusion.		P
10.7.2	Types of emergency stop device		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The types of device for emergency stop include, but are not limited to: • a push-button device for actuation by the palm or the fist (e.g. mushroom head type); • a pull-cord operated switch; • a pedal-operated switch without a mechanical guard. The devices shall be in accordance with IEC 60947-5-5.		P
10.7.3	Operation of the supply disconnecting device to effect emergency stop		P
	Where a stop category 0 is suitable, the supply disconnecting device may serve the function of emergency stop where: • it is readily accessible to the operator; and • it is of the type described in 5.3.2 a), b), c), or d). Where intended for emergency use, the supply disconnecting device shall meet the colour requirements of 10.2.1.		P
10.8	Emergency switching off devices		N/A
10.8.1	Location of emergency switching off devices		N/A
	Emergency switching off devices shall be located as necessary for the given application. Normally, those devices will be located separate from operator control stations. Where confusion can occur between emergency stop and emergency switching off devices, means shall be provided to minimise confusion. NOTE This can be achieved by, for example, the provision of a break-glass enclosure for the emergency switching off device.		N/A
10.8.2	Types of emergency switching off device		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The types of device for initiation of emergency switching off include: • a push-button operated switch with a palm or mushroom head type of actuator; • a pull-cord operated switch. A1:2025 The devices shall have direct opening action (see Annex K of IEC 60947-5-1:2003 and IEC 60947-5-1:2003/AMD1:2009). The devices shall have direct opening action (see Annex K of IEC 60947-5-1:2016).		N/A
10.8.3	Local operation of the supply disconnecting device to effect emergency switching off		N/A
	Where the supply disconnecting device is to be locally operated for emergency switching off, it shall be readily accessible and shall meet the colour requirements of 10.2.1.		N/A
10.9	Enabling control device		N/A
	The enabling control function is described in 9.2.3.9.		N/A
	Enabling control devices shall be selected and arranged so as to minimize the possibility of defeating.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Enabling control devices shall be selected that have the following features: – designed in accordance with ergonomic principles; – for a two-position type: • position 1: off-function of the switch (actuator is not operated); • position 2: enabling function (actuator is operated). – for a three-position type: • position 1: off-function of the switch (actuator is not operated); • position 2: enabling function (actuator is operated in its mid position); • position 3: off-function (actuator is operated past its mid position); • when returning from position 3 to position 2, the enabling function is not activated. NOTE IEC 60947-5-8 specifies requirements for three-position enabling switches.		N/A
11	Controlgear: location, mounting, and enclosures		P
11.1	General requirements		P
	All controlgear shall be located and mounted so as to facilitate: – its accessibility and maintenance; – its protection against the external influences or conditions under which it is intended to operate; – operation and maintenance of the machine and its associated equipment.		P
11.2	Location and mounting		P
11.2.1	Accessibility and maintenance		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	All items of controlgear shall be placed and oriented so that they can be identified without moving them or the wiring. For items that require checking for correct operation or that are liable to need replacement, those actions should be possible without dismantling other equipment or parts of the machine (except opening doors or removing covers, barriers or obstacles). Terminals not part of controlgear components or devices shall also conform to these requirements.		P
	All controlgear shall be mounted so as to facilitate its operation and maintenance. Where a special tool is necessary to adjust, maintain, or remove a device, such a tool shall be supplied. Where access is required for regular maintenance or adjustment, the relevant devices shall be located between 0,4 m and 2,0 m above the servicing level. It is recommended that terminals be at least 0,2 m above the servicing level and be so placed that conductors and cables can be easily connected to them.		P
	No devices except devices for operating, indicating, measuring, and cooling shall be mounted on doors or on access covers of enclosures that are expected to be removed.		P
	Where control devices are connected through plug-in arrangements, their association shall be made clear by type (shape), marking or reference designation, singly or in combination (see 13.4.5).		N/A
	Plug-in devices that are handled during normal operation shall be provided with noninterchangeable features where the lack of such a facility can result in malfunctioning.		N/A
	Plug/socket combinations that are handled during normal operation shall be located and mounted so as to provide unobstructed access.		N/A
	Test points for connection of test equipment, where provided, shall be: – mounted so as to provide unobstructed access; – clearly identified to correspond with the documentation; – adequately insulated; – sufficiently spaced.		N/A
11.2.2	Physical separation or grouping		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Non-electrical parts and devices, not directly associated with the electrical equipment, shall not be located within enclosures containing controlgear. Devices such as solenoid valves should be separated from the other electrical equipment (for example in a separate compartment).		P
	Control devices mounted in the same location and connected to the power circuits, or to both power and control circuits, should be grouped separately from those connected only to the control circuits.		P
	Terminals shall be separated into groups for: – power circuits; – control circuits of the machine; – other control circuits, fed from external sources (for example for interlocking). The groups may be mounted adjacently, provided that each group can be readily identified (for example by markings, by use of different sizes, by use of barriers or by colours).		P
	When arranging the location of devices (including interconnections), the clearances and creepage distances specified for them by the supplier shall be maintained, taking into account the external influences or conditions of the physical environment.		P
11.2.3	Heating effects		P
	The temperature rise inside electrical equipment enclosures shall not exceed the ambient temperature specified by the component manufacturers. NOTE 1 IEC TR 60890 can be used for the calculation of temperature rise inside enclosures.		P
	Heat generating components (for example heat sinks, power resistors) shall be so located that the temperature of each component in the vicinity remains within the permitted limit. NOTE 2 Information on the selection of insulating materials to resist thermal stresses is given in IEC 60216 and IEC 60085.		P
11.3	Degrees of protection		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The protection of controlgear against ingress of solid foreign objects and of liquids shall be adequate taking into account the external influences under which the machine is intended to operate (i.e. the location and the physical environmental conditions) and shall be sufficient against dust, coolants, lubricants and swarf. NOTE 1 The degrees of protection against ingress of water are covered by IEC 60529. Additional protective measures can be necessary against other liquids.		P
	Enclosures of controlgear shall provide a degree of protection of at least IP22 (see IEC 60529). Exception: an enclosure providing a minimum degree of protection IP22 is not required where: a) an electrical operating area provides an appropriate degree of protection against ingress of solids and liquids, or: b) removable collectors on conductor wire or conductor bar systems are used and the measures of 12.7.1 are applied. NOTE 2 Some examples of applications, along with the degree of protection typically provided by their enclosures, are listed below: – ventilated enclosure, containing only motor starter resistor and other large size equipment IP10 – ventilated enclosure, containing other equipment IP32 – enclosure used in general industry IP32, IP43 and IP54 – enclosure used in locations that are cleaned with low-pressure water jets (hosing) IP55 – enclosure providing protection against fine dust IP65 – enclosure containing slip-ring assemblies IP2X Depending upon the conditions where installed, another degree of protection can be appropriate.		P
11.4	Enclosures, doors and openings		P
	Enclosures shall be constructed using materials capable of withstanding the mechanical, electrical and thermal stresses as well as the effects of humidity and other environmental factors that are likely to be encountered in normal service.		P
	Fasteners used to secure doors and covers should be of the captive type.		P
	Windows of enclosures shall be of a material suitable to withstand expected mechanical stress and chemical attack.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	It is recommended that enclosure doors having vertical hinges be not wider than 0,9 m, with an angle of opening of at least 95°.		P
	The joints or gaskets of doors, lids, covers and enclosures shall withstand the chemical effects of the aggressive liquids, vapours, or gases used on the machine. The means provided to maintain the degree of protection of an enclosure on doors, lids and covers that require opening or removal for operation or maintenance shall: • be securely attached to either the door/cover or the enclosure; • not deteriorate due to removal or replacement of the door or the cover, and so impair the degree of protection.		P
	Where openings in enclosures are provided (for example, for cable access), including those towards the floor or foundation or to other parts of the machine, means shall be provided to ensure the degree of protection specified for the equipment. Openings for cable entries shall be easy to re-open on site. A suitable opening may be provided in the base of enclosures within the machine so that moisture due to condensation can drain away.		P
	There shall be no opening between enclosures containing electrical equipment and compartments containing coolant, lubricating or hydraulic fluids, or those into which oil, other liquids, or dust can penetrate. This requirement does not apply to electrical devices specifically designed to operate in oil (for example electromagnetic clutches) nor to electrical equipment in which coolants are used. Where there are holes in an enclosure for mounting purposes, means may be necessary to ensure that after mounting, the holes do not impair the required protection.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	A1:2025 Equipment that, in normal or abnormal operation, can attain a surface temperature sufficient to cause a risk of fire or harmful detrimental effect to an enclosure material shall: – be located within an enclosure that will withstand, without risk of fire or harmful effect, such temperatures as can be generated; and – be mounted and located at a sufficient distance from adjacent equipment so as to allow safe dissipation of heat (see also 11.2.3); or – be otherwise screened by material that can withstand, without risk of fire or harmful effect, the heat emitted by the equipment. NOTE A warning label in accordance with 16.2.2 can be necessary.		P
11.5	Access to electrical equipment		N/A
	Doors in gangways and for access to electrical operating areas shall: – be at least 0,7 m wide and 2,0 m high; – open outwards; – have a means (for example panic bolts) to allow opening from the inside without the use of a key or tool. NOTE Further information is given in IEC 60364-7-729.		N/A
12	Conductors and cables		P
12.1	General requirements		P
	Conductors and cables shall be selected so as to be suitable for the operating conditions (for example voltage, current, protection against electric shock, grouping of cables) and external influences (for example ambient temperature, presence of water or corrosive substances, mechanical stresses (including stresses during installation), fire hazards) that can exist.		P
	These requirements do not apply to the integral wiring of assemblies, subassemblies, and devices that are manufactured and tested in accordance with their relevant IEC standard (for example IEC 61800 series).		P
12.2	Conductors		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Conductors should be of copper. Where aluminium conductors are used, the cross-sectional area shall be at least 16 mm ² .		P
	To ensure adequate mechanical strength, the cross-sectional area of conductors should not be less than as shown in Table 5. However, conductors with smaller cross-sectional areas or other constructions than shown in Table 5 may be used in equipment provided adequate mechanical strength is achieved by other means and proper functioning is not impaired. NOTE Classification of conductors is given in Table D.4.		P
	Class 1 and class 2 conductors are primarily intended for use between rigid, non-moving parts where vibration is not considered to be likely to cause damage.		P
	All conductors that are subject to frequent movement (for example one movement per hour of machine operation) should have flexible stranding of class 5 or class 6.		P
12.3	Insulation		P
	A1:2025 Where the insulation of conductors and cables can constitute hazards due for example to the propagation of a fire or the emission of toxic or corrosive fumes, guidance from the cable supplier should be sought shall be considered. It is important to give special attention to the integrity of a circuit having a safety-related function.		P
	The insulation of cables and conductors used, shall be suitable for a test voltage: – not less than 2 000 V AC for a duration of 5 min for operation at voltages higher than 50 V AC or 120 V DC, or – not less than 500 V AC for a duration of 5 min for PELV circuits (see IEC 60364-4-41, class III equipment).		P
	The mechanical strength and thickness of the insulation shall be such that the insulation cannot be damaged in operation or during laying, especially for cables pulled into ducts.		P
12.4	Current-carrying capacity in normal service		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The current-carrying capacity depends on several factors, for example insulation material, number of conductors in a cable, design (sheath), methods of installation, grouping and ambient temperature. NOTE 1 Detailed information and further guidance can be found in IEC 60364-5-52, in some national standards or given by the manufacturer.		P
	One typical example of the current-carrying capacities for PVC insulated wiring between enclosures and individual items of equipment under steady-state conditions is given in Table 6. NOTE 2 For specific applications where the correct cable dimensioning can depend on the relationship between the period of the duty cycle and the thermal time constant of the cable (for example starting against high-inertia load, intermittent duty), the cable manufacturer can provide information.		P
12.5	Conductor and cable voltage drop		P
	The voltage drop from the point of supply to the load in any power circuit cable shall not exceed 5 % of the nominal voltage under normal operating conditions. In order to conform to this requirement, it can be necessary to use conductors having a larger cross-sectional area than that derived from Table 6.		P
	In control circuits, the voltage drop shall not reduce the voltage at any device below the manufacturer's specification for that device, taking into account inrush currents. See also 4.3.		P
	The voltage drop in components, for example overcurrent protective devices and switching devices, should be considered.		P
12.6	Flexible cables		P
12.6.1	General		P
	Flexible cables shall have Class 5 or Class 6 conductors. NOTE 1 Class 6 conductors have smaller diameter strands and are more flexible than Class 5 conductors (see Table D.4).		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Cables that are subjected to severe duties shall be of adequate construction to protect against: – abrasion due to mechanical handling and dragging across rough surfaces; – kinking due to operation without guides; – stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums. NOTE 2 Cables for such conditions are specified in some national standards. NOTE 3 The operational life of the cable will be reduced where unfavourable operating conditions such as high tensile stress, small radii, bending into another plane and/or where frequent duty cycles coincide.		P
12.6.2	Mechanical rating		P
	The cable handling system of the machine shall be so designed to keep the tensile stress of the conductors as low as is practicable during machine operations. Where copper conductors are used, the tensile stress applied to the conductors shall not exceed 15 N/mm² of the copper cross-sectional area. Where the demands of the application exceed the tensile stress limit of 15 N/mm², cables with special construction features should be used and the allowed maximal tensile stress should be agreed with the cable manufacturer.		P
	The maximum stress applied to the conductors of flexible cables with material other than copper shall be within the cable manufacturer's specification. NOTE The following conditions affect the tensile stress on the conductors: – acceleration forces; – speed of motion; – dead (hanging) weight of the cables; – method of guiding; – design of cable drum system.		P
12.6.3	Current-carrying capacity of cables wound on drums		N/A
	Cables to be wound on drums shall be selected with conductors having a cross-sectional area such that, when fully wound on the drum and carrying the normal service load, the maximum allowable conductor temperature is not exceeded.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	For cables of circular cross-sectional area installed on drums, the maximum current-carrying capacity in free air should be derated in accordance with Table 7 NOTE The current-carrying capacity of cables in free air can be found in manufacturers' specifications or in relevant national standards.		N/A
12.7	Conductor wires, conductor bars and slip-ring assemblies		P
12.7.1	Basic protection		P
	Conductor wires, conductor bars and slip-ring assemblies shall be installed or enclosed in such a way that, during normal access to the machine, basic protection is achieved by the application of one of the following protective measures: – protection by partial insulation of live parts, or where this is not practicable; – protection by enclosures or barriers of at least IP2X or IPXXB.		P
	Horizontal top surfaces of barriers or enclosures that are readily accessible shall provide a degree of protection of at least IP4X or IPXXD.		P
	Where the required degree of protection is not achieved, protection by placing live parts out of reach in combination with emergency switching off in accordance with 9.2.3.4.3 shall be applied.		N/A
	Conductor wires and conductor bars shall be so placed and/or protected as to: – prevent contact, especially for unprotected conductor wires and conductor bars, with conductive items such as the cords of pull-cord switches, strain-relief devices and drive chains; – prevent damage from a swinging load. See also 6.2.6.		P
12.7.2	Protective conductors		N/A
	Where conductor wires, conductor bars and slip-ring assemblies are installed as part of the protective bonding circuit, they shall not carry current in normal operation. Therefore, the protective conductor (PE) and the neutral conductor (N) shall each use a separate conductor wire, conductor bar or slip-ring.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The continuity of protective conductors using sliding contacts shall be ensured by taking appropriate measures (for example, duplication of the current collector, continuity monitoring).		N/A
12.7.3	Protective conductor current collectors		N/A
	Protective conductor current collectors shall have a shape or construction so that they are not interchangeable with the other current collectors. Such current collectors shall be of the sliding contact type.		N/A
12.7.4	Removable current collectors with a disconnecter function		N/A
	Removable current collectors having a disconnecter function shall be so designed that the protective conductor circuit is interrupted only after the live conductors have been disconnected, and the continuity of the protective conductor circuit is re-established before any live conductor is reconnected (see also 8.2.3).		N/A
12.7.5	Clearances in air		P
	Clearances between the respective conductors, and between adjacent systems, of conductor wires, conductor bars, slip-ring assemblies and their current collectors shall be suitable for at least a rated impulse voltage of an overvoltage category III in accordance with IEC 60664-1.		P
12.7.6	Creepage distances		P
	Creepage distances between the respective conductors, between adjacent systems of conductor wires, conductor bars and slip-ring assemblies, and their current collectors shall be suitable for operation in the intended environment, for example open air, inside buildings, protected by enclosures.		P
	In abnormally dusty, moist or corrosive environments, the following creepage distance requirements apply: – unprotected conductor wires, conductor bars, and slip-ring assemblies shall be equipped with insulators with a minimum creepage distance of 60 mm; – enclosed conductor wires, insulated multipole conductor bars and insulated individual conductor bars shall have a minimum creepage distance of 30 mm.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The manufacturer's recommendations shall be followed regarding special measures to prevent a gradual reduction in the insulation values due to unfavourable ambient conditions (for example deposits of conductive dust, chemical attack).		N/A
12.7.7	Conductor system sectioning		N/A
	Where conductor wires or conductor bars are arranged so that they can be divided into isolated sections, suitable design measures shall be employed to prevent the energization of adjacent sections by the current collectors themselves.		N/A
12.7.8	Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies		N/A
	Conductor wires, conductor bars and slip-ring assemblies in power circuits shall be grouped separately from those in control circuits.		N/A
	Conductor wires, conductor bars and slip-ring assemblies, including their current collectors, shall be capable of withstanding, without damage, the mechanical forces and thermal effects of short-circuit currents.		N/A
	Removable covers for conductor wire and conductor bar systems laid underground or underfloor shall be so designed that they cannot be opened by one person without the aid of a tool.		N/A
	Where conductor bars are installed in a common metal enclosure, the individual sections of the enclosure shall be bonded together and connected to the protective bonding circuit. Metal covers of conductor bars laid underground or underfloor shall also be bonded together and connected to the protective bonding circuit.		N/A
	The protective bonding circuit shall include the covers or cover plates of metal enclosures or underfloor ducts. Where metal hinges form a part of the protective bonding circuit, their continuity shall be verified (see Clause 18).		N/A
	Conductor bar ducts that can be subject to accumulation of liquid such as oil or water shall have drainage facilities.		N/A
13	Wiring practices		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
13.1	Connections and routing		P
13.1.1	General requirements		P
	All connections, especially those of the protective bonding circuit, shall be secured against accidental loosening.		P
	The means of connection shall be suitable for the cross-sectional areas and nature of the conductors being terminated.		P
	The connection of two or more conductors to one terminal is permitted only in those cases where the terminal is designed for that purpose. However, only one protective conductor shall be connected to one terminal connecting point.		P
	Soldered connections shall only be permitted where terminals are provided that are suitable for soldering.		P
	Terminals on terminal blocks shall be plainly marked or labelled to correspond with the identification used in the diagrams. NOTE IEC 61666 provides rules that can be used for the designation of terminals within the electrical equipment.		P
	Where an incorrect electrical connection (for example, arising from replacement of devices) is identified as a source of risk that needs to be reduced and it is not practicable to reduce the possibility of incorrect connection by design measures, the conductors and/or terminations shall be identified.		P
	The installation of flexible conduits and cables shall be such that liquids shall drain away from the fittings.		P
	Means of retaining conductor strands shall be provided when terminating conductors at devices or terminals that are not equipped with this facility. Solder shall not be used for that purpose.		P
	Shielded conductors shall be so terminated as to prevent fraying of strands and to permit easy disconnection.		N/A
	Identification tags shall be legible, permanent, and appropriate for the physical environment.		P
	Terminal blocks shall be mounted and wired so that the wiring does not cross over the terminals.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
13.1.2	Conductor and cable runs		P
	Conductors and cables shall be run from terminal to terminal without splices or joints. Connections using plug/socket combinations with suitable protection against accidental disconnection are not considered to be splices or joints for the purpose of 13.1.2.		P
	Exception: Where it is impracticable to provide terminals in a junction box (for example on mobile machines, on machines having long flexible cables; cable connections exceeding a length which is not practical to be supplied by the cable manufacturer on one cable drum), splices or joints may be used.		N/A
	Where it is necessary to connect and disconnect cables and cable assemblies, sufficient extra length shall be provided for that purpose.		P
	The terminations of cables shall be adequately supported to prevent mechanical stresses at the terminations of the conductors.		P
	Wherever practicable, the protective conductor shall be placed close to the associated live conductors in order to decrease the impedance of the loop.		P
13.1.3	Conductors of different circuits		P
	Conductors of different circuits may be laid side by side, may occupy the same duct (for example conduit, cable trunking system), or may be in the same multiconductor cable or in the same plug/socket combination provided that the arrangement does not impair the proper functioning of the respective circuits and: • where those circuits operate at different voltages, the conductors are separated by suitable barriers or; • the conductors are insulated for the highest voltage to which any of the conductors can be subjected, for example line to line voltage for unearthed systems and phase to earth voltage for earthed systems.		P
13.1.4	AC circuits – Electromagnetic effects (prevention of eddy currents)		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Conductors of AC circuits installed in ferromagnetic enclosures shall be arranged so that all conductors of each circuit, including the protective conductor of each circuit, are contained in the same enclosure. Where such conductors enter a ferrous enclosure, they shall be arranged such that the conductors are not individually surrounded by ferromagnetic material.		N/A
	Single-core cables armoured with steel wire or steel tape should not be used for AC circuits.		N/A
	NOTE 1 The steel wire or steel tape armour of a single-core cable is regarded as a ferromagnetic enclosure. For single-core wire armoured cables, the use of aluminium armour is recommended. NOTE 2 Derived from IEC 60364-5-52.		N/A
13.1.5	Connection between pick-up and pick-up converter of an inductive power supply system		N/A
	The cable between the pick-up and the pick-up converter shall be: – as short as practicable; – adequately protected against mechanical damage. NOTE The output of the pick-up can be a current source, therefore damage to the cable can result in a high voltage hazard.		N/A
13.2	Identification of conductors		P
13.2.1	General requirements		P
	Each conductor shall be identifiable at each termination in accordance with the technical documentation.		P
	It is recommended (for example to facilitate maintenance) that conductors be identified by number, alphanumeric, colour (either solid or with one or more stripes), or a combination of colour and numbers or alphanumeric. When numbers are used, they shall be Arabic; letters shall be Roman (either upper or lower case).		P
	NOTE 1 Annex B can be used for agreement between supplier and user regarding a preferred method of identification. NOTE 2 IEC 62491 provides rules and guidelines for the labelling of cables and cores/conductors used in industrial installations, equipment and products.		P
13.2.2	Identification of the protective conductor / protective bonding conductor		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The protective conductor / protective bonding conductor shall be readily distinguishable from other conductors by shape, location, marking, or colour. When identification is by colour alone, the bicolour combination GREEN-AND-YELLOW shall be used throughout the length of the conductor. This colour identification is strictly reserved for protective conductors/protective bonding conductors.		P
	For insulated conductors, the bicolour combination GREEN-AND-YELLOW shall be such that on any 15 mm length, one of the colours covers at least 30 % and not more than 70 % of the surface of the conductor, the other colour covering the remainder of the surface.		P
	Where the protective conductor(s) can be easily identified by its shape, position, or construction (for example a braided conductor, uninsulated stranded conductor), or where the insulated conductor is not readily accessible or is part of a multicore cable, colour coding throughout its length is not necessary. However, where the conductor is not clearly visible throughout its length, the ends or accessible locations shall be clearly identified by the graphical symbol IEC 60417-5019:2006-08 (see Figure 16) or with the letters PE or by the bicolour combination GREEN-AND-YELLOW. Exception: Protective bonding conductors may be marked with the letters PB and/or the symbol IEC 60417-5021 (2002-10) (see Figure 17).		P
13.2.3	Identification of the neutral conductor		P
	A1:2025 Where a circuit includes a neutral conductor that is identified by colour alone, the colour used for this conductor shall be BLUE. In order to avoid confusion with other colours, it is recommended that an unsaturated blue be used, called here "light blue" (see 6.2.2 of IEC 60445:2010 IEC 60445:2017). Where the selected colour is the sole identification of the neutral conductor, that colour shall not be used for identifying any other conductor where confusion is possible.		P
	Where identification by colour is used, bare conductors used as neutral conductors shall be either coloured by a stripe, 15 mm to 100 mm wide in each compartment or unit and at each accessible location, or coloured throughout their length.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
13.2.4	Identification by colour		P
	Where colour-coding is used for identification of conductors (other than the protective conductor (see 13.2.2) and the neutral conductor (see 13.2.3)), the following colours may be used: BLACK, BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (including LIGHT BLUE), VIOLET, GREY, WHITE, PINK, TURQUOISE. NOTE This list of colours is derived from IEC 60757.		P
	It is recommended that, where colour is used for identification, the colour be used throughout the length of the conductor either by the colour of the insulation or by colour markers at regular intervals and at the ends or accessible location.		P
	For safety reasons, the colour GREEN or the colour YELLOW should not be used where there is a possibility of confusion with the bicolour combination GREEN-AND-YELLOW (see 13.2.2).		P
	Colour identification using combinations of those colours listed above may be used provided there can be no confusion and that GREEN or YELLOW is not used except in the bicolour combination GREEN-AND-YELLOW.		P
	Where colour-coding is used for identification of conductors, it is recommended that they be colour-coded as follows: – BLACK: AC and DC power circuits; – RED: AC control circuits; – BLUE: DC control circuits; – ORANGE: excepted circuits in accordance with 5.3.5. Exceptions to the above are permitted where insulation is not available in the colours recommended (for example in multiconductor cables).		P
13.3	Wiring inside enclosures		P
	Conductors inside enclosures shall be supported where necessary to keep them in place. Non-metallic ducts shall be permitted only when they are made with a flame-retardant insulating material (see the IEC 60332 series).		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	It is recommended that electrical equipment mounted inside enclosures be designed and constructed in such a way as to permit modification of the wiring from the front of the enclosure (see also 11.2.1). Where that is not practicable and control devices are connected from the rear of the enclosure, access doors or swingout panels shall be provided.		P
	Connections to devices mounted on doors or to other movable parts shall be made using flexible conductors in accordance with 12.2 and 12.6 to allow for the frequent movement of the part. The conductors shall be anchored to the fixed part and to the movable part independently of the electrical connection (see also 8.2.3 and 11.2.1).		P
	Conductors and cables that do not run in ducts shall be adequately supported.		P
	Terminal blocks or plug/socket combinations shall be used for control wiring that extends beyond the enclosure. For plug/socket combinations, see also 13.4.5 and 13.4.6.		P
	Power cables and cables of measuring circuits may be directly connected to the terminals of the devices for which the connections were intended.		P
13.4	Wiring outside enclosures		P
13.4.1	General requirements		P
	The means of introduction of cables or ducts with their individual glands, bushings, etc., into an enclosure shall ensure that the degree of protection is not reduced (see 11.3).		P
	Conductors of a circuit shall not be distributed over different multi-core cables, conduits, cable ducting systems or cable trunking systems. This is not required where a number of multi-core cables, forming one circuit, are installed in parallel. Where multi-core cables are installed in parallel, each cable shall contain one conductor of each phase and the neutral if any.		P
13.4.2	External ducts		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Conductors and their connections external to the electrical equipment enclosure(s) shall be enclosed in suitable ducts (i.e. conduit or cable trunking systems) as described in 13.5 except for suitably protected cables that may be installed without ducts and with or without the use of cable trays or cable support means. Where devices such as position switches or proximity switches are supplied with a dedicated cable, their cable need not be enclosed in a duct when the cable is suitable for the purpose, sufficiently short, and so located or protected, that the risk of damage is minimized.		N/A
	Fittings used with ducts or cables shall be suitable for the physical environment.		N/A
	Flexible conduit or flexible multiconductor cable shall be used where it is necessary to employ flexible connections to pendant push-button stations. The weight of the pendant stations shall be supported by means other than the flexible conduit or the flexible multiconductor cable, except where the conduit or cable is specifically designed for that purpose.		N/A
13.4.3	Connection to moving elements of the machine		P
	The design of connections to moving parts shall take into account the foreseeable frequency of movement and shall be made using conductors in accordance with 12.2 and 12.6. Flexible cable and flexible conduit shall be so installed as to avoid excessive flexing and straining, particularly at the fittings.		P
	Cables subject to movement shall be supported in such a way that there is no mechanical strain on the connection points nor any sharp flexing. When this is achieved by the provision of a loop, it shall have sufficient length to provide for a bending radius of the cable as specified by the cable manufacturer or if no such specification is given, at least 10 times the diameter of the cable.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Flexible cables of machines shall be so installed or protected as to minimize the possibility of external damage due to factors that include the following cable use or potential abuse: – being run over by the machine itself; – being run over by vehicles or other machines; – coming into contact with the machine structure during movements; – running in and out of cable baskets, or on or off cable drums; – acceleration forces and wind forces on festoon systems or suspended cables; – excessive rubbing by cable collector; – exposure to excessive radiated heat.		P
	The cable sheath shall be resistant to the normal wear that can be expected from movement and to the effects of environmental contaminants (for example oil, water, coolants, dust).		P
	Where cables subject to movement are close to moving parts, precautions shall be taken to maintain a space of at least 25 mm between the moving parts and the cables. Where that distance is not practicable, fixed barriers shall be provided between the cables and the moving parts.		P
	The cable handling system shall be so designed that lateral cable angles do not exceed 5°, avoiding torsion in the cable when: – being wound on and off cable drums; and – approaching and leaving cable guidance devices.		N/A
	Measures shall be taken to ensure that at least two turns of flexible cables always remain on a drum.		N/A
	Devices serving to guide and carry a flexible cable shall be so designed that the inner bending radius at all points where the cable is bent is not less than the values given in Table 8, unless otherwise agreed with the cable manufacturer, taking into account the permissible tension and the expected fatigue life.		N/A
	The straight section between two bends shall be at least 20 times the diameter of the cable.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where flexible conduit is adjacent to moving parts, the construction and supporting means shall prevent damage to the flexible conduit under all conditions of operation.		P
	Flexible conduit shall not be used for connections subject to rapid or frequent movements except when specifically designed for that purpose.		N/A
13.4.4	Interconnection of devices on the machine		P
	Where several machine-mounted devices (for example position sensors, push-buttons) are connected in series or in parallel, it is recommended that the connections between those devices be made through terminals forming intermediate test points. Such terminals shall be conveniently placed, adequately protected, and shown on the relevant diagrams.		P
13.4.5	Plug/socket combinations		P
	Components or devices inside an enclosure, terminated by fixed plug/socket combinations (no flexible cable), or components connected to a bus system by a plug/socket combination, are not considered to be plug/socket combinations for the purpose of this 13.4.5.		N/A
	After installation in accordance with item a) below, plug/socket combinations shall be of such a type as to prevent unintentional contact with live parts at any time, including during insertion or removal of the connectors. The degree of protection shall be at least IP2X or IPXXB. PELV circuits are excepted from this requirement.		P
	Where the plug/socket contains a contact for the protective bonding circuit, it shall have a first make last break contact (see also 8.2.4).		P
	Plug/socket combinations intended to be connected or disconnected during load conditions shall have sufficient load-breaking capacity. Where the plug/socket combination is rated at 30 A, or greater, it shall be interlocked with a switching device so that the connection and disconnection is possible only when the switching device is in the OFF position.		N/A
	Plug/socket combinations that are rated at more than 16 A shall have a retaining means to prevent unintended or accidental disconnection.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where an unintended or accidental disconnection of plug/socket combinations can cause a hazardous situation, they shall have a retaining means.		N/A
	The installation of plug/socket combinations shall fulfil the following requirements as applicable: a) The component which remains live after disconnection shall have a degree of protection of at least IP2X or IPXXB, taking into account the required clearance and creepage distances. PELV circuits are excepted from this requirement. b) Metallic housings of plug/socket combinations shall be connected to the protective bonding circuit. c) Plug/socket combinations intended to carry power loads but not to be disconnected during load conditions shall have a retaining means to prevent unintended or accidental disconnection and shall be clearly marked that they are not intended to be disconnected under load. d) Where more than one plug/socket combination is provided in the same electrical equipment, the associated combinations shall be clearly identifiable. It is recommended that mechanical coding be used to prevent incorrect insertion. e) Plug/socket combinations used in control circuits shall fulfil the applicable requirements of IEC 61984.		P
	Exception: In plug/socket combinations in accordance with IEC 60309-1, only those contacts shall be used for control circuits which are intended for those purposes. This exception does not apply to control circuits using high frequency signals superimposed on the power circuits.		N/A
13.4.6	Dismantling for shipment		N/A
	Where it is necessary that wiring be disconnected for shipment, terminals or plug/socket combinations shall be provided at the sectional points. Such terminals shall be suitably enclosed and plug/socket combinations shall be protected from the physical environment during transportation and storage.		N/A
13.4.7	Additional conductors		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Consideration should be given to providing additional conductors for maintenance or repair. When spare conductors are provided, they shall be connected to spare terminals or isolated in such a manner as to prevent contact with live parts.		N/A
13.5	Ducts, connection boxes and other boxes		P
13.5.1	General requirements		P
	Ducts shall provide a degree of protection (see IEC 60529) suitable for the application.		P
	All sharp edges, flash, burrs, rough surfaces, or threads with which the insulation of the conductors can come in contact shall be removed from ducts and fittings. Where necessary, additional protection consisting of a flame-retardant, oil-resistant insulating material shall be provided to protect conductor insulation.		P
	Drain holes of 6 mm diameter are permitted in cable trunking systems, connection boxes, and other boxes used for wiring purposes that can be subject to accumulations of oil or moisture.		N/A
	In order to prevent confusion of conduits with oil, air, or water piping, it is recommended that the conduits be either physically separated or suitably identified.		N/A
	Ducts and cable trays shall be rigidly supported and positioned at a sufficient distance from moving parts and in such a manner so as to minimize the possibility of damage or wear. In areas where human passage is required, the ducts and cable trays shall be mounted at least 2 m above the working surface.		N/A
	Cable trays that are partially covered should not be considered to be ducts or cable trunking systems (see 13.5.6), and the cables used shall be of a type suitable for installation on open cable trays.		N/A
	It is recommended that the dimensions and arrangement of ducts be such as to facilitate the insertion of the conductors and cables.		N/A
13.5.2	Rigid metal conduit and fittings		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	A1:2025 Rigid metal conduit and fittings shall be of galvanized steel or of a corrosion-resistant material suitable for the conditions. The use of dissimilar metals in contact that can cause galvanic action should be avoided. Where galvanic action is possible between dissimilar metals these metal combinations shall not be used.		N/A
	Conduits shall be securely held in place and supported at each end.		N/A
	Fittings shall be compatible with the conduit and appropriate for the application. Fittings should be threaded unless structural difficulties prevent assembly. Where threadless fittings are used, the conduit shall be securely fastened to the equipment.		N/A
	Conduit bends shall be made in such a manner that the conduit shall not be damaged and the internal diameter of the conduit shall not be effectively reduced.		N/A
13.5.3	Flexible metal conduit and fittings		N/A
	A flexible metal conduit shall consist of a flexible metal tubing or woven wire armour. It shall be suitable for the expected physical environment.		N/A
	Fittings shall be compatible with the conduit and appropriate for the application.		N/A
13.5.4	Flexible non-metallic conduit and fittings		P
	Flexible non-metallic conduit shall be resistant to kinking and shall have physical characteristics similar to those of the sheath of multiconductor cables.		P
	The conduit shall be suitable for use in the expected physical environment.		P
	Fittings shall be compatible with the conduit and appropriate for the application.		P
13.5.5	Cable trunking systems		N/A
	Cable trunking systems external to enclosures shall be rigidly supported and clear of all moving parts of the machine and of sources of contamination.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Covers shall be shaped to overlap the sides; gaskets shall be permitted. Covers shall be attached to cable trunking systems by suitable means. On horizontal cable trunking systems, the cover shall not be on the bottom unless specifically designed for such installation. NOTE Requirements for cable trunking and ducting systems for electrical installations are given in the IEC 61084 series.		N/A
	Where the cable trunking system is furnished in sections, the joints between sections shall fit tightly but need not be gasketed.		N/A
	The only openings permitted shall be those required for wiring or for drainage. Cable trunking systems shall not have opened but unused knockouts.		N/A
13.5.6	Machine compartments and cable trunking systems		P
	The use of compartments or cable trunking systems within the column or base of a machine to enclose conductors is permitted provided the compartments or cable trunking systems are isolated from coolant or oil reservoirs and are entirely enclosed. Conductors run in enclosed compartments and cable trunking systems shall be so secured and arranged that they are not subject to damage.		P
13.5.7	Connection boxes and other boxes		N/A
	Connection boxes and other boxes used for wiring purposes shall be accessible for maintenance. Those boxes shall provide protection against the ingress of solid bodies and liquids, taking into account the external influences under which the machine is intended to operate (see 11.3).		N/A
	Those boxes shall not have opened but unused knockouts nor any other openings and shall be so constructed as to exclude materials such as dust, flyings, oil, and coolant.		N/A
13.5.8	Motor connection boxes		P
	Motor connection boxes shall enclose only connections to the motor and motor-mounted devices (for example brakes, temperature sensors, plugging switches, tachometer generators).		P
14	Electric motors and associated equipment		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
14.1	General requirements		P
	Electric motors should conform to the relevant parts of IEC 60034 series.		P
	The protection requirements for motors and associated equipment are given in 7.2 for overcurrent protection, in 7.3 for protection of motors against overheating, and in 7.6 for overspeed protection.		P
	As many controllers do not switch off the supply to a motor when it is at rest, care shall be taken to ensure compliance with the requirements of 5.3, 5.4, 5.5, 7.5, 7.6 and 9.4. Motor control equipment shall be located and mounted in accordance with Clause 11.		P
14.2	Motor enclosures		P
	Enclosures for motors should be in accordance with IEC 60034-5.		P
	The degree of protection shall be dependent on the application and the physical environment (see 4.4). All motors shall be adequately protected from mechanical damage.		P
14.3	Motor dimensions		P
	As far as is practicable, the dimensions of motors shall conform to those given in the IEC 60072 series.		P
14.4	Motor mounting and compartments		P
	Each motor and its associated couplings, belts, pulleys, or chains, shall be so mounted that they are adequately protected and are easily accessible for inspection, maintenance, adjustment and alignment, lubrication, and replacement. The motor mounting arrangement shall be such that all motor mounting means can be removed and all terminal boxes are accessible.		P
	Motors shall be so mounted that proper cooling is ensured and the temperature rise remains within the limits of the insulation class (see IEC 60034-1).		P
	Where practicable, motor compartments should be clean and dry, and when required, shall be ventilated directly to the exterior of the machine. The vents shall be such that ingress of swarf, dust, or water spray is at an acceptable level.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	There shall be no opening between the motor compartment and any other compartment that does not meet the motor compartment requirements. Where a conduit or pipe is run into the motor compartment from another compartment not meeting the motor compartment requirements, any clearance around the conduit or pipe shall be sealed.		P
14.5	Criteria for motor selection		P
	The characteristics of motors and associated equipment shall be selected in accordance with the anticipated service and physical environmental conditions (see 4.4). In this respect, the points that shall be considered include: – type of motor; – type of duty cycle (see IEC 60034-1); – fixed speed or variable speed operation, (and the consequent variable influence of the ventilation); – mechanical vibration; – type of motor control; – temperature rise and other effects of the frequency spectrum of the voltage and/or current feeding the motor (particularly when it is supplied from a converter); – method of starting and the possible influence of the inrush current on the operation of other users of the same power supply, taking also into account possible special considerations stipulated by the supply authority; – variation of counter-torque load with time and speed; – influence of loads with large inertia; – influence of constant torque or constant power operation; – possible need of inductive reactors between motor and converter.		P
14.6	Protective devices for mechanical brakes		N/A
	Operation of the overload and overcurrent protective devices for mechanical brake actuators shall initiate the simultaneous de-energization (release) of the associated machine actuators. NOTE Associated machine actuators are those associated with the same motion, for example cable drums and long-travel drives.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
15	Socket-outlets and lighting		N/A
15.1	Socket-outlets for accessories		N/A
	Where the machine or its associated equipment is provided with socket-outlets that are intended to be used for accessory equipment (for example hand-held power tools, test equipment), the following apply: – the socket-outlets should conform to IEC 60309-1. Where that is not practicable, they should be clearly marked with the voltage and current ratings; – the continuity of the protective bonding circuit to the socket-outlet shall be ensured; – all unearthed conductors connected to the socket-outlet shall be protected against overcurrent and, when required, against overload in accordance with 7.2 and 7.3 separately from the protection of other circuits; – where the power supply to the socket-outlet is not disconnected by the supply disconnecting device for the machine or the section of the machine, the requirements of 5.3.5 apply; – where fault protection is provided by automatic disconnection of supply, the disconnection time shall be in accordance with Table A.1 for TN systems or Table A.2 for TT systems; – circuits supplying socket-outlets with a current rating not exceeding 20 A shall be provided with residual current protection (RCDs) with a rated operating current not exceeding 30 mA.		N/A
15.2	Local lighting of the machine and of the equipment		N/A
15.2.1	General		N/A
	The ON/OFF switch shall not be incorporated in the lampholder or in the flexible connecting cord.		N/A
	Stroboscopic effects from lights shall be avoided by the selection of appropriate luminaires.		N/A
	Where fixed lighting is provided in an enclosure, electromagnetic compatibility should be taken into account using the principles outlined in 4.4.2.		N/A
15.2.2	Supply		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The nominal voltage of the local lighting circuit shall not exceed 250 V between conductors. A voltage not exceeding 50 V between conductors is recommended.		N/A
	Lighting circuits shall be supplied from one of the following sources (see also 7.2.6): – a dedicated isolating transformer connected to the load side of the supply disconnecting device. Overcurrent protection shall be provided in the secondary circuit; – a dedicated isolating transformer connected to the line side of the supply disconnecting device. That source shall be permitted for maintenance lighting circuits in control enclosures only. Overcurrent protection shall be provided in the secondary circuit (see also 5.3.5); – a circuit of the electrical equipment of the machine for lighting, with dedicated overcurrent protection; – an isolating transformer connected to the line side of the supply disconnecting device, provided with a dedicated primary disconnecting means (see 5.3.5) and secondary overcurrent protection, and mounted within the control enclosure adjacent to the supply disconnecting device; – an externally supplied lighting circuit (for example factory lighting supply). This shall be permitted in control enclosures only, and for the machine work light(s) where their total power rating is not more than 3 kW; – power supply units, for DC supply to LED light sources, fitted with isolating transformers (for example, in accordance with IEC 61558-2-6). Exception: where fixed lighting is out of reach of operators during normal operations, the provisions of 15.2.2 do not apply.		N/A
15.2.3	Protection		N/A
	Local lighting circuits shall be protected in accordance with 7.2.6.		N/A
15.2.4	Fittings		N/A
	Adjustable lighting fittings shall be suitable for the physical environment.		N/A

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The lampholders shall be: – in accordance with the relevant IEC standard; – constructed with an insulating material protecting the lamp cap so as to prevent unintentional contact.		N/A
	Reflectors shall be supported by a bracket and not by the lampholder.		N/A
	Exception: where fixed lighting is out of reach of operators during normal operation, the provisions of 15.2.4 do not apply.		N/A
16	Marking, warning signs and reference designations		P
16.1	General		P
	Warning signs, nameplates, markings, labels and identification plates shall be of sufficient durability to withstand the physical environment involved.		P
16.2	Warning signs		P
16.2.1	Electric shock hazard		P
	Enclosures that do not otherwise clearly show that they contain electrical equipment that can give rise to a risk of electric shock shall be marked with the graphical symbol ISO 7010-W012 (see Figure 18).		P
	The warning sign shall be plainly visible on the enclosure door or cover.		P
	The warning sign may be omitted (see also 6.2.2 b)) for: – an enclosure equipped with a supply disconnecting device; – an operator-machine interface or control station; – a single device with its own enclosure (for example position sensor).		P
16.2.2	Hot surfaces hazard		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	Where the risk assessment shows the need to warn against the possibility of hazardous surface temperatures of the electrical equipment, the graphical symbol ISO 7010-W017 shall be used (see Figure 19). NOTE ISO 13732-1 gives guidance for the assessment of the risks of burns when humans might touch hot surfaces with their unprotected skin.		P
16.3	Functional identification		P
	Control devices and visual indicators shall be clearly and durably marked with regard to their functions either on or adjacent to the item. It is recommended that such markings are made in accordance with IEC 60417 and ISO 7000.		P
16.4	Marking of enclosures of electrical equipment		P
	A1:2025 The following information shall be legibly and durably marked in a way that is plainly visible after the equipment is installed on enclosures that receive incoming power supplies: • name or trade mark of supplier; • certification mark or other marking that can be required by local or regional legislation, when required; • type designation or model, where applicable; • serial number where applicable; • main document number (see IEC 62023) where applicable; • rated voltage, number of phases and frequency (if AC), and full-load current for each incoming supply.		P
	It is recommended that this information is provided adjacent to the main incoming supply(ies).		P
16.5	Reference designations		P
	All enclosures, assemblies, control devices, and components shall be plainly identified with the same reference designation as shown in the technical documentation.		P
17	Technical documentation		P
17.1	General		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	The information necessary for identification, transport, installation, use, maintenance, decommissioning and disposal of the electrical equipment shall be supplied. NOTE 1 Documentation is sometimes supplied in paper form, since it cannot be assumed that the user has access to the means of reading instructions supplied in electronic form or made available on an Internet site. However, it is often useful for the documentation to be made available in electronic form and on the Internet as well as in paper form, since this enables the user to download the electronic file if he so wishes and to recover the documentation if the paper copy has been lost. This practice also facilitates the updating of the documentation when this is necessary. NOTE 2 In some countries, the requirement to use specific language(s) is covered by legal requirements.		P
	Annex I should be considered as guidance for the preparation of information and documents.		P
17.2	Information related to the electrical equipment		P
	The following shall be supplied:		P
	a) where more than one document is provided, a main document for the electrical equipment as a whole, listing the complementary documents associated with the electrical equipment;		P
	b) identification of the electrical equipment (see 16.4);		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	c) information on installation and mounting including: • a description of the electrical equipment's installation and mounting, and its connection to the electrical supplies and where relevant other supplies; • short-circuit current rating of the electrical equipment for each incoming power supply; • rated voltage, number of phases and frequency (if AC.), type of distribution system (TT, TN, IT) and full-load current for each incoming supply; • any additional electrical supply(ies) requirements (for example maximum supply source impedance, leakage current) for each incoming supply; • space required for the removal or servicing of the electrical equipment; • installation requirements where needed to ensure that the arrangements for cooling are not impaired; • environmental limitations (for example lighting, vibration, EMC environment, atmospheric contaminants) where appropriate; • functional limitations (for example peak starting currents and permitted voltage drop(s)) as applicable; • precautions to be taken for the installation of the electrical equipment relevant to the electromagnetic compatibility;		P
	d) an instruction for the connection of simultaneously accessible extraneous-conductive parts in the vicinity of the machine (for example, within 2,5 metres) such as the following to the protective bonding circuit: • metallic pipes; • fences; • ladders; • handrails.		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	e) information on the functioning and operation, including as applicable: • an overview of the structure of the electrical equipment (for example by structure diagram or overview diagram); • procedures for programming or configuring, as necessary for the intended use; • procedures for restarting after an unexpected stop; • a sequence of operation;		P
	f) information on maintenance of the electrical equipment, as appropriate, including: • frequency and method of functional testing; • instructions on the procedures for safe maintenance and where it is necessary to suspend a safety function and/or protective measure (see 9.3.6); • guidance on the adjustment, repair, and frequency and method of preventive maintenance; • details of the interconnections of the electrical components subject to replacement (for example by circuit diagrams and/or connection tables); • information on required special devices or tools; • information on spare parts; • information on possible residual risks, indication of whether any particular training is required and specification of any necessary personal protective equipment; • where applicable, instructions to restrict availability of key(s) or tool(s) to skilled or instructed persons only; • settings (DIP-switches, programmable parameter values, etc); • information for validation of safety related control functions after repair or modification, and for periodic testing where necessary;		P
	g) information on handling, transportation and storage as appropriate (for example dimensions, weight, environmental conditions, possible ageing constraints);		P

EN 60204-1			
Clause No.	Requirement	Result - Remark	Verdict
	h) information for proper disassembly and handling of components (for example for recycling or disposal).		P
18	Verification		P
18.1	General		P
18.2	Verification of conditions for protection by automatic disconnection of supply		N/A
18.2.1	General		P
18.2.2	Test 1 – Verification of the continuity of the protective bonding circuit		P
18.2.3	Test 2 – Fault loop impedance verification and suitability of the associated overcurrent protective device		N/A
18.2.4	Application of the test methods for TN-systems		N/A
18.3	Insulation resistance tests		P
18.4	Voltage tests		P
18.5	Protection against residual voltages		P
18.6	Functional tests		P
18.7	Retesting		N/A

--- End of test and checklist report ---

Test Report

18.2.2 Test 1 – Verification of the continuity of the protective bonding circuit	
Test requirement: The resistance between the PE terminal (see 5.2 and Figure 4) and relevant points that are part of the protective bonding circuit shall be measured with a current between at least 0,2 A and approximately 10 A derived from an electrically separated supply source (for example SELV, see 414 of IEC 60364-4-41:2005) having a maximum no-load voltage of 24 V AC or DC. The resistance measured shall be in the expected range according to the length, the cross-sectional area and the material of the related protective conductors and protective bonding conductor(s). Earthed PELV supplies can produce misleading results in this test and therefore shall not be used.	
Test Environment Temperature and Relative Humidity	23.6°C, RH 69%

Measure part/point	Test current	Measured value	Result verdict
Between PE terminal and protective bonding point of air pump	10A	0.01 Ω	☒ Pass ☐ Fail
Between PE terminal and protective bonding point of exhaust fan	10A	0.02 Ω	☒ Pass ☐ Fail
Between PE terminal and protective bonding point of EMI filter	10A	0.01 Ω	☒ Pass ☐ Fail
Between PE terminal and protective bonding point of electric motor M2	10A	0.01 Ω	☒ Pass ☐ Fail
Between PE terminal and protective bonding point of switching power supply PS1	10A	0.01 Ω	☒ Pass ☐ Fail
Between PE terminal and protective bonding point of switching power supply PS2	10A	0.03 Ω	☒ Pass ☐ Fail
Between PE terminal and protective bonding point of switching power supply PS3	10A	0.02 Ω	☒ Pass ☐ Fail

18.3 Insulation resistance tests				
Test requirement: When insulation resistance tests are performed, the insulation resistance measured at 500 V DC between the power circuit conductors and the protective bonding circuit shall be not less than 1 MΩ. The test may be made on individual sections of the complete electrical installation. Exception: for certain parts of electrical equipment, incorporating for example busbars, conductor wire or conductor bar systems or slip-ring assemblies, a lower minimum value is permitted, but that value shall not be less than 50 kΩ. If the electrical equipment of the machine contains surge protection devices which are likely to operate during the test, it is permitted to either: – disconnect these devices, or – reduce the test voltage to a value lower than the voltage protection level of the surge protection devices, but not lower than the peak value of the upper limit of the supply (phase to neutral) voltage.				
Test Environment Temperature and Relative Humidity			24.7°C, RH 72%	
Test applied part/point	Test applied voltage	Measured value	Limited value	Result verdict
Between the L/N pole and the PE terminal	500V DC	500 MΩ	≥1 MΩ	☒ Pass ☐ Fail

18.4 Voltage tests			
Test requirement: When voltage tests are performed, test equipment in accordance with IEC 61180-2 should be used. The test voltage shall be at a nominal frequency of 50 Hz or 60 Hz. The maximum test voltage shall have a value of twice the rated supply voltage of the equipment or 1 000 V, whichever is the greater. The maximum test voltage shall be applied between the power circuit conductors and the protective bonding circuit for at least 1 s. The requirements are satisfied if no disruptive discharge occurs. Components and devices that are not rated to withstand the test voltage and surge protection devices which are likely to operate during the test shall be disconnected during testing. Components and devices that have been voltage tested in accordance with their product standards may be disconnected during testing.			
Test Environment Temperature and Relative Humidity		24.8°C, RH 71%	
Test applied part/point	Test applied voltage	Tested applied duration	Observation of disruptive discharge
Between the L/N pole and the PE terminal	1000V	1s	☒ Not occurs ☐ Occurs
Result verdict: ☒ Pass ☐ Fail			

18.5 Protection against residual voltages

Test requirement:

Live parts having a residual voltage greater than 60V when the supply is disconnected shall be discharged to 60 V or less within a time period of 5s provided that this rate of discharge does not interfere with the proper functioning of the equipment. Exempted from this requirement are components having a stored charge of 60 μ C or less. Where this specified rate of discharge would interfere with the proper functioning of the equipment, a durable warning notice drawing attention to the hazard and stating the delay required before the enclosure may be opened shall be displayed at an easily visible location on or immediately adjacent to the enclosure that contains the live parts.

In the case of plugs or similar devices, the withdrawal of which results in the exposure of conductors (for example pins), the discharge time to 60 V shall not exceed 1 s, otherwise such conductors shall be protected to at least IP2X or IPXXB. If neither a discharge time of 1 s nor a protection of at least IP2X or IPXXB can be achieved (for example in the case of removable collectors on conductor wires, conductor bars, or slip-ring assemblies, see 12.7.4), additional switching devices or an appropriate warning, for example a warning sign drawing attention to the hazard and stating the delay required shall be provided. When the equipment is located in places open to all persons, which can include children, warnings are not sufficient and therefore a minimum degree of protection against contact with live parts to IP4X or IPXXD is required.

Test Environment Temperature and Relative Humidity 24.6°C, RH 71%

Main supply connection: ☒ Connection by plug ☐ Connection by fixed wiring

Measure part/point	Measured time period discharged to 60 V or less	Limited value	Result verdict
Between L/N pole	0.3s	≤ 5 s for fixed wiring ≤ 1 s for plug connection	☒ Pass ☐ Fail

18.6 Functional tests		
Test requirement: The functions of electrical equipment shall be tested.		
Test Environment Temperature and Relative Humidity		24.6°C, RH 71%
Function	Test applied	Observation
Emergency stop	Push the emergency stop button during operation.	Hazardous movement of all moving parts stop immediately, and power to danger moving parts are cut off. Laser power source is cut off immediately.
Interlock	Open the interlocking movable door and try to start the machine. Open the interlocking movable cover during machine in process operation.	Machine can not be started due to open of interlocking movable cover. Hazardous movement of all moving parts and laser radiation stop immediately once the interlocking cover is opened.
Result verdict: ☒ Pass ☐ Fail		

18.7 Retesting
Test requirement: Where a portion of the machine or its associated equipment is changed or modified, the need for re-verification and testing of the electrical equipment shall be considered. Particular attention should be given to the possible adverse effects that retesting can have on the equipment (for example overstressing of insulation, disconnection/reconnection of devices).
No retesting. Not applicable for 18.7.

Equipment ID.	Name of equipment	Calibration validity period
NE-008	IEC/EN 60204-1 Multi-function Tester	08/15/2025 to 08/14/2026

---End of test report---