TEST REPORT
EN 60204-1:2018
Safety of machine- Electrical equipment of machines, Part 1: General requirements
EN ISO 12100:2010
Safety of machinery – General principles for design – Risk assessment and risk reduction

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Tested by (+ signature)..... :	Pahsien Ma
Approved by (+ signature)..... :	Kind Yang
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Representative Laboratory Name ..... :	**ShenZhen Promise Test Technology Co., Ltd.**
Address ..... :	103, Building 1, Yibaolai Industrial City, Qiaotou Community, Fuhai Street, Baoan District, Shenzhen, Guangdong, China
Applicant's name ..... :	**Civan Makina Muh. Mim.Ins.Tic.Ltd.Sti**
Address ..... :	Eskişehir/Odunpazarı 75. Yıl OSB Mah. 8.Cadde No:16, Turkey
Test specification:	
Standard..... :	EN ISO 12100:2010 EN 60204-1:2018
TRF Originator ..... :	Promise
Master TRF ..... :	Dated 2014-12
Test item description ..... :	Air Source Heat Pump
Trade Mark..... :	AIRMAX
Manufacturer..... :	Guangzhou Sprsun New Energy Technology Development Co., Ltd. No.15 Tangxi Road, Yinsha industrial Park, Xintang.Zengcheng District,Guangzhou,511338, China
Model/Type reference ..... :	ARX-15DF32SP-1F
List Model..... :	ARX-9SF32SP-1F, ARX-12SF32SP-1F, ARX-18DF32SP-1F, ARX-21DF32SP-1F, ARX-6SF290SP-1F，ARX-9SF290SP-1F, ARX-11SF290SP-1F, ARX-15DF290SP-1F
Ratings..... :	Input: AC220-240V 50Hz Power: 15KW

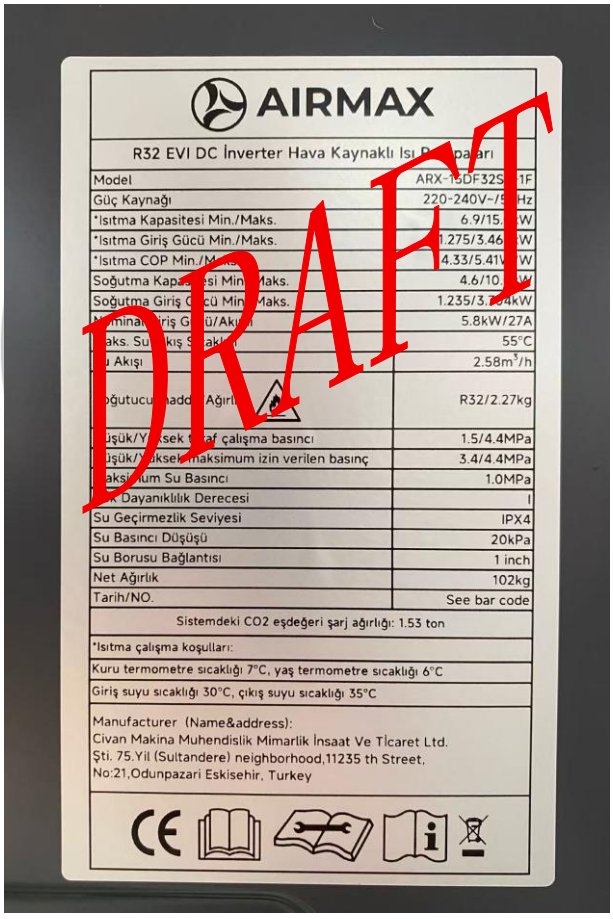
Summary of testing:

Tests performed:	**Testing location:**
The sample(s) tested complies with the requirements of EN ISO 12100:2010 EN 60204-1:2018 The tested samples were found to comply with the above standards.	**ShenZhen Promise Test Technology Co., Ltd.** 103, Building 1, Yibaolai Industrial City, Qiaotou Community, Fuhai Street, Baoan District, Shenzhen, Guangdong, China

Summary of compliance with National Differences:

N/A

Copy of marking plate:



Note:
The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added. The marking for other models is same as above except model name.

Test item particulars.....:	
Equipment mobility ..... :	☐ movable ☐ hand-held ☐ transportable ☒ stationary ☐ for building-in ☐ direct plug-in
Connection to the mains ..... :	☒pluggable equipment ☒ type A ☐ type B ☐ permanent connection ☒ detachable power supply cord ☐ non-detachable power supply cord ☐ not directly connected to the mains
Operating condition ..... :	☒ continuous ☐ rated operating / resting time:
Access location ..... :	☒ operator accessible ☐ restricted access location
Over voltage category (OVC) ..... :	☒ OVC I ☐OVC II ☐ OVC III ☐ OVC IV ☐other: Supplied by external power adapter
Mains supply tolerance (%) or absolute mains supply values ..... :	-10%, +10% (declared by client)
Tested for IT power systems ..... :	☐ Yes ☒ No
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	☒Class I ☐ Class II ☐ Class III ☐ Not classified
Pollution degree (PD) ..... :	☐ PD 1 ☒ PD 2 ☐ PD 3
IP protection class ..... :	IPX0
Altitude during operation (m) ..... :	Up to 2000m
Altitude of test laboratory (m) ..... :	Up to 2000m
Mass of equipment (kg) ..... :	/
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A (Not apply)
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing..... :	
Date of receipt of test item..... :	2026-01-02
Date(s) of performance of tests..... :	2026-01-03 to 2026-01-16

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a comma (point) is used as the decimal separator.

Name and address of factory(ies)……:	Same as manufacturer

General product information and other remarks:
The product is powered by a built-in approved power supply, which has passed the CE certification.
All the models are same except the model number.

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
6	**Risk reduction**		
	The objective of risk reduction can be achieved by the elimination of hazards, or by separately or simultaneously reducing each of the two elements that determine the associated risk: - severity of harm from the hazard under consideration; - probability of occurrence of that harm. All protective measure intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method(see also Figures1 and2) Step1: Inherently safe design measures Step2: Safeguarding and/or complementary protective measures Step3: Information for use		P
6.2	**Inherently safe design measures**		
6.2.1	**General**		
	Inherently safe design measures are the first and most important step in the risk reduction process. This is because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding can fail or be violated and information for use may not be followed. Inherently safe design measures are achieved by avoiding hazards or reducing risk by a suitable choice of design features for the machine itself and/or interaction between the exposed persons and the machine.		P
6.2.2	**Consideration of geometrical factors and physical aspects**		
6.2.2.1	**Geometrical factors**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Such factors include the following. a) The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position -reducing blind spots, for example; -and choosing and locating means of indirect vision where necessary(mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the operator, for example; - the travelling and working area of mobile machines; - the zone of movement of lifted loads or of the carrier of machinery for lifting persons; - the area of contact of the tool of a hand-held or hand-guided machine with the material being worked. The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zone. b) The form and the relative location of the mechanical components parts; for instance, crushing and shearing hazards are avoided by increasing the minimum gap between the moving parts, such that the part of the body under consideration can enter the gap safely, or by reducing the gap so that no part the body can enter it (see ISO 13854 and ISO 13857) c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can "trap" parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed , and open ends of tubes which can cause a "trap" shall be capped. The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators)		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
6.2.2.2	**Physical aspects**		
	Such aspects include the following: a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard; b) limiting the mass and/or velocity of the movable elements, and hence their kinetic energy; c) limiting the emissions by acting on the characteristics of the source using measures for reducing 1) noise emission at source (see ISO/TR 11688-1) 2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for hand-held and hand-guided machinery, see CR 1030-1] 3) the emission of hazardous substances, including the use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding), and 4) radiation emissions, including, for example, avoiding the use of hazardous radiation sources, limiting the power of radiation to the lowest level sufficient for the proper functioning of the machine, designing the source so that the beam is concentrated on the target, increasing the distance between the source and the operator or providing for remote operation of the machinery [measures for reducing emission of non-ionizing radiation are given in 6.3.4.5 (see also EN 12198-1 and EN 12198-3)		P
6.2.3	**Taking into account general technical knowledge of machine design**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	This general technical knowledge can be derived from technical specifications for design(standards, design codes, calculation rules, etc.),which should be used to cover a)mechanical stresses such as - stress limitation by implementation of correct calculation, construction and fastening methods as regards, for example, bolted assemblies and welded assemblies, - stress limitation by overload prevention(bursting disk, pressure-limiting valves, breakage points, torque-limiting devices, etc.), - avoiding fatigue in elements under variable stresses (notably cyclic stresses), and -static and dynamic balancing of rotating elements,		P
	b) materials and their properties such as - resistance to corrosion, ageing, abrasion and wear, - hardness, ductility, brittleness, - homogeneity, - toxicity, and - flammability, and c) emission values for - noise -vibration - hazardous substances, and -radiation When the reliability of particular components or assemblies is critical for safety (for example, ropes, chains, lifting accessories for lifting loads or persons), stress limits shall be multiplied by appropriate working coefficients		
6.2.4	**Choice ofappropriate technology**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certainapplications such as the following: a) on machines intended for use in explosive atmospheres, using - appropriately selected pneumatic or hydraulic control system and machine actuators, - intrinsically safe electrical equipment (see IEC 60079-11); b) for products to be processed (for example, by a solvent), by using equipment that ensures the temperature will remain far below the flash point; c) the use of alternative equipment to avoid high noise levels such as - electrical instead of pneumatic equipment, -in certain conditions, water-cutting instead of mechanical equipment		N/A
6.2.5	**Applying principle of positive mechanical action**		
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC60947-5-1 and ISO 14119).		P
6.2.6	**Provisions for stability**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Machines shall be designed so that they have sufficient stability to allow them to be used safely in their specified conditions of use. Factors to be taken into account include - the geometry of the base, - the weight distribution, including loading, - the dynamic forces due to movements of parts of the machine, of the machine itself or of elements held by the machine which can result in an overturning moment, - vibration, - oscillations of the centre of gravity, - characteristics of the supporting in case of travelling or installation on different sites (ground conditions, slope, etc.), and - external forces, such as wind pressure and manual forces. Stability shall be considered in all phases of the life cycle of the machine, including handling , traveling, installation, use, dismantling, disabling and scrapping. Other protective measures for stability relevant to safeguarding are given in 6.3.2.6.		P
6.2.7	**Provisions for maintainability**		
	When designing a machine, the following maintainability factors shall be taken into account to enable maintenance of the machine: - accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used; - ease of handling, taking into account human capabilities; - limitation of the number of special tools and equipment.		P
6.2.8	**Observing ergonomic principles**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Ergonomic principles shall be taken into account in designing machinery so as to reduce the mental or physical stress of, and strain on, the operator. These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design. NOTE Also improved are the performance and reliability of operation and hence the reduction in the probability of errors at all stages of machine use. Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2). All elements of the operator-machine interface, such as controls, signalling or data display elements shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible. See EN614-1,EN 13861 and IEC61310-1. The designer's attention is particularly drawn to following ergonomic aspects of machine design. a) Avoid the necessity for stressful postures and movements during the use of the machine (for example, providing facilities to adjust the machine to suit the various operators) b) Design machines, especially hand-held and mobile machines, so as to enable them to be operated easily, taking into account human effort, actuation of controls and hand , arm and leg anatomy. c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures. d) Avoid linking the operator's working rhythm to an automatic succession of cycles. e) Provide local lighting on or in the machine for the illumination of the working area and of adjusting , setting-up and frequent maintenance zones when the design features of the machine and/or its guards render the ambient lighting inadequate. Flicker, dazzling , shadows and stroboscopic effects shall be avoided if they can cause a risk. If the position or the lighting source has to be adjusted , its location shall be such that it does not cause any risk to persons making the adjustment. f) Select, locate and identify manual controls (actuators) so that - they are clearly visible and identifiable, and appropriately marked where necessary (see 6.4.4),		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	- they can be safely operated without hesitation or loss of time and without ambiguity (for example, a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation), - their location (for push-buttons) and their movement (for levers and hand wheels) are consistent with their effect (see IEC 61310-3), and - their operation cannot cause additional risk. See also ISO 9355-3.		
6.2.9	**Electrical hazards**		
	For the design of the electrical equipment of machines, IEC 60204-1 gives general provisions about disconnection and switching of electrical circuits and for protection against electric shock. For requirements related to specific machines, see corresponding IEC standards (for example, IEC 61029, IEC 60745 or IEC 60335).	See IEC/EN 60204-1 for details	P
6.2.10	**Pneumatic an hydraulic hazard**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Pneumatic and hydraulic equipment of machinery shall be designed so that - the maximum rated pressure cannot be exceeded in the circuits (using, for example, pressure-limiting devices), - no hazard results from pressure fluctuations or increases, or from loss of pressure or vacuum, - no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures, - air receivers, air reservoirs or similar vessels (such as in gas-loaded accumulators) comply with the applicable design standard codes or regulations for these elements, - all elements of the equipment, especially pipes and hoses, are protected against harmful external effects, - as far as possible, reservoirs and similar vessels (for example, gas-loaded accumulators) are automatically depressurized when isolating the machine from its power supply (see 6.3.3.4) and, if not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 4414:2000, Clause 5), and - all elements which remain under pressure after isolation of the machine from its power supply are provided with clearly identified exhaust devices, and there is a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine.		P

6.2.11	**Applying inherently safe design measures to control systems**
6.2.11.1	**General**

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount risk reduction (see ISO 13849-1 or IEC 62061). The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behavior. Typical causes of hazardous machine behavior are - an unsuitable design or modification (accidental or deliberate) of the control system logic, - at temporary or permanent defect or failure of one or several components of the control system , - a variation or a failure in the power supply of the control system, and - inappropriate selection, design and location of the control devices. Typical examples of hazardous machine behavior are - unexpected start-up(See ISO 14118) - uncontrolled speed change, -failure to stop moving parts, - dropping or ejection of part of the machine or of a workpiece clamped by the machine, and - machine action resulting from inhibition (defeating or failure) of protective devices In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause (6.2.11) and in 6.2.12. These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1, IEC60204-1 and IEC62061). Control systems shall be designed to enable the operator interact with the machine safely and easily. This requires one or several of the following solutions:		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	- systematic analysis of start and stop conditions; - provision for specific operating modes (for example, start-up after normal stop, restart after cycle interruption or after emergency stop, removal of the workpieces contained in the machine, operation of a part of the machine in case of a failure of a machine element); - clear display of the faults; - measures to prevent accidental generation of unexpected start commands (for example, shrouded start device) likely to cause dangerous machine behavior (see ISO 14118:2000, Figure 1); - maintained stop commands (for example, interlock) to prevent restarting that could result in dangerous machine behavior (see ISO 14118:2000, Figure 1). An assembly of machines may be divided into several zones for emergency stopping , for stopping as a result of protective devices and/or for isolation and energy dissipation. The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone. Likewise, it shall be obvious which control devices (for example, emergency stop devices, supply disconnecting devices) and/or protective devices belong to which zone. The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention. Control systems shall be designed to limit the movements of parts of the machinery, the machine itself, or workpieces and/or loads held by the machinery, to the safe design parameters (for example, range , speed , acceleration, deceleration, load capacity) Allowance shall be made for dynamic effects (swinging of loads, etc.) . For example : - the travelling speed of mobile pedestrian controlled machinery other than remote-controlled shall be compatible with walking speed ; - the range, speed, acceleration and deceleration of movements of the person-carrier and carrying vehicle for lifting persons shall be limited to non-hazardous values, taking into account the total reaction time of the operator and the machine; - the range of movements of parts of machinery for lifting loads shall be kept within specified limits. When the machinery contains various elements that can be operated independently, the control system shall be designed to prevent risks arising out of a lack of coordination (for example, collision prevention system).		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
6.2.11.2	**Starting of an internal power source/switching on an external power supply**		
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous For example: - starting the internal combustion engine shall not lead to movement of a mobile machine; - connection to mains electricity supply shall not result in the starting of working parts of a machine. See IEC 60204-1:2005,7.5 (see also Annexes A and B)	See IEC/EN 60204-1 for details	P
6.2.11.3	**Starting/stopping of a mechanism**		
	The primary action for starting or accelerating the movement of a mechanism should be performed by the application or an increase of voltage or fluid pressure, or- if binary logic elements are considered - by passage from state 0 to state 1 (where state 1 represents the highest energy state). The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or-if binary logic elements are considered - by passage from state 1 to state 0 (where state 1 represents the highest energy state) . In certain applications, such as high-voltage switchgear, this principle cannot be followed , in which case other measures should be applied to achieve the same level of confidence for the stopping or slowing down. When , in order for the operator to maintain permanent control of deceleration, this principle is not observed (for example, a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system.		P
6.2.11.4	**Restart after power interruption**		
	If a hazard could be generated , the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (for example, by use of a self-maintained relay, contactor or valve) .	No hazard	P
6.2.11.5	**Interruption of power supply**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Machinery shall be designed to prevent hazardous situations resulting from interruption or excessive fluctuation of the power supply. At least the following requirements shall be met: - the stopping function of the machinery shall remain; - all devices whose permanent operation is required for safety shall operate in an effective way to maintain safety (for example, locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery); -part of machinery or workpieces and/or loads held by machinery which are liable to move as a result of potential energy shall be retained for the time necessary to allow them to be safely lowered.		P
6.2.11.6	**Use of automatic monitoring**		
	Automatic monitoring is intended to ensure that a safety function or functions implemented by a protective measure do not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed such that hazards are generated. Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function. In other cases the protective measure can be initiated immediately or delayed until a specific event occurs (for example the beginning of the machine cycle) The protective measure may be, for example, - the stopping of the hazardous process, - preventing the restart of this process after the first stop following the failure, or - the triggering of an alarm.		N/A
6.2.11.7	**Safety functions implemented by programmable electronic**		
6.2.11.7.1	**General**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	A control system that includes programmable electronic equipment (for example, programmable controllers) can, where appropriate, be used to implement safety functions at machinery. Where a programmable electronic control system is used, it is necessary to consider its performance requirements in relation to the requirements for the safety functions. The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) is sufficiently low. Where a programmable electronic control system performs a monitoring function, the system behavior on detection of a fault shall be considered (see also the IEC 61508 series for further guidance). NOTE both ISO 13849-1 and IEC 62061 , specific to machinery safety, provide guidance applicable to programmable electronic control systems. The programmable electronic control system should be installed and validated to ensure that the specified performance [for example, safety integrity level (SIL) in IEC 61508] for each safety function has been achieved. Validation comprises testing and analysis (for example, static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.		P
6.2.11.7.2	**Hardware aspects**		
	The hardware (including , for example, sensors, actuators and logic solvers) shall be selected, and/or designed and installed, to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of - architectural constraints (the configuration of the system , its ability to tolerate faults, its behaviour on detection of a fault, etc.), - selection, and/or design, of equipment and devices with an appropriate probability of dangerous random hardware failure, and -the incorporation of measures and techniques within the hardware so as to avoid systematic failures and control systematic faults.		P
6.2.11.7.3	**Software aspects**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	The software, including internal operating software (or system software) and application software, shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3). Application software should not be reprogrammable by the user. This may be achieved by use of embedded software in a non-reprogrammable memory [for example, micro-controller, application-specific integrated circuit (ASIC)]. When the application requires reprogramming by the user, the access to the software dealing with safety functions should be restricted (for example, by locks or passwords for the authorized persons).		N/A
6.2.11.8	**Principles relating to manual control**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	These are as follows. a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in item f) .b) A stop control device shall be placed near each start control device. Where the start/stop function is performed by means of a hold-to-run control, a separate stop control device shall be provided when a risk can result from the hold-to-run control device failing to deliver a stop command when released. c) Manual controls shall be located out of reach of the danger zones (see IEC 61310-3), except for certain controls where, of necessity, they are located within a danger zone, such as emergency stop or teach pendant. d) Whenever possible, control devices and control positions shall be located so that the operator is able to observe the working area or hazard zone. 1) The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions 2) On machinery intended for lifting persons, controls for and lowering and , if appropriate, for moving the carrier shall generally be located in the carrier. If safe operation requires controls to be situated outside the carrier, the operator in the carrier shall be provided with the means of preventing hazardous movements. e) If it is possible to start the same hazardous element by means of several controls ,the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means of, among others, a portable control unit(such as a teach pendant),with which the operator can enter danger zones. f) Control actuators shall be designed or guarded so that their		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	effect, where a risk is involved, cannot occur without intentional operation (see ISO 9335-1,ISO 9355-3and ISO 447). g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be implemented to ensure the presence of the operator at the control position (for example, by the design and location of control devices). h) For cableless control, an automatic stop shall be performed when correct control signals are not received , including loss of communication (see IEC 60204-1).		
6.2.11.9	**Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to be displaced or removed and/or a protective device has to be disabled , and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put into operation, the safety of the operator shall be achieved using a specific control mode which simultaneously a) disables all other control modes, b) permits operation of the hazardous elements only by continuous actuation of an enabling device, a two-hand control device or a hold-to-run control device, c) permits operation of the hazardous elements only in reduced risk conditions (for example, reduced speed , reduced power/force, step-by-step, for example, with a limited movement control device), and d) prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors. NOTE For some special machinery other protective measures can be appropriate. This control mode shall be associated with one or more of the following measures: - restriction of access to the danger zone as far as possible; -emergency stop control within immediate reach of the operator; -portable control unit (teach pendant) and/or local controls(allowing sight of the controlled elements). See IEC 60204-1.		P
6.2.11.10	**Selection of control and operating modes**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (for example, to allow for adjustment, setting , maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position. Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode. The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (for example, access codes for certain numerically controlled functions) .		P
6.2.11.11	**Applying measures to achieve electromagnetic compatibility (EMC)**		
	For guidance on electromagnetic compatibility, see IEC 60204-1 and IEC 61000-6.	Exceed evaluation scope	N/A
6.2.11.12	**Provision of diagnostic systems to aid fault-finding**		
	Diagnostic systems to aid fault-finding should be included in the control system so that there is no need to disable any protective measure. NOTE Such systems not only improve availability and maintainability of machinery, they also reduce the exposure of maintenance staffto hazards.		N/A
6.2.12	**Minimizing probability of failure of safety functions**		
6.2.12.1	**General**		
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine. The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by the measures given in 6.2.12.2 to 6.2.12.4.		P
6.2.12.2	**Use of reliable components**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	"Reliable components" means components which are capable of withstanding all disturbances and stresses associated with usage of the equipment in the conditions of intended use(including the environmental conditions), for the period of time or the number of operations fixed for the use, with a low probability of failures generating a hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above (see also 6.2. 13). NOTE 1 "Reliable components" is not a synonym for "well-tried components" (see 180 13849-1:2006, 6.2.4). NOTE 2 Environmental conditions for consideration include impact, vibration, cold , heat, moisture, dust, corrosive and/or abrasive substances, static electricity and magnetic and electric fields. Disturbances which can be generated by those conditions include insulation failures and temporary or permanent failures in the function of control system components.		P
6.2.12.3	**Use of "oriented failure mode" components**		
	"Oriented failure mode" components or systems are those in which the predominant failure mode is known in advance and which can be used so that the effect of such a failure on the machine function can be predicted. NOTE In some cases, it will be necessary to take additional measures to limit the negative effects of such a failure. The use of such components should always be considered , particularly in cases where redundancy (see 6.2.12.4) is not employed.		N/A
6.2.12.4	**Duplication (or redundancy) of components or subsystems**		
	In the design of safety-related parts of the machine, duplication(or redundancy) of components may be used so that, if one component fails, another component or components continue to perform the respective function(s) , thereby ensuring that the safety function remains available. In order to allow the proper action to be initiated, component failure shall be detected by automatic monitoring (see 6.2.11 .6) or in some circumstances by regular inspection, provided that the inspection interval is shorter than the expected lifetime of the components. Diversity of design and/or technology can be used to avoid common cause failures (for example, from electromagnetic disturbance) or common mode failures.		N/A
6.2.13	**Limiting exposure to hazards through reliability of equipment**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring intervention, thereby reducing exposure to hazards. This applies to power systems (operative part, see Annex A) as well as to control systems, and to safety functions as well as to other functions of machinery. Safety-related components (for example, certain sensors) of known reliability shall be used. The elements of guards and of protective devices shall be especially reliable, as their failure can expose persons to hazards, and also because poor reliability would encourage attempts to defeat them.		P
6.2.14	**Limiting exposure to hazards through mechanization or automation of loading (feeding)/unloading (removal) operations**		
	Mechanization and automation of machine loading/unloading operations and, more generally, of handling operations of workpieces, materials or substances-limits the risk generated by these operations by reducing the exposure of persons to hazards at the operating points. Automation can be achieved by, for example, robots, handling devices, transfer mechanisms and air-blast equipment. Mechanization can be achieved by, for example, feeding slides, push-rods and hand-operated indexing tables. While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being corrected. Care shall be taken to ensure that the use of these devices does not introduce further hazards, such as trapping or crushing , between the devices and parts of the machine or workpieces/materials being processed . Suitable safeguards (see 6.3) shall be provided if this cannot be ensured. Automatic feeding and removal devices with their own control systems and the control system of the associated machine shall be interconnected after thorough study of how all safety functions are performed in all the control and operation modes of the entire equipment.		P
6.2.15	**Limiting exposure to hazards through location of setting and maintenance points outside danger zones**		
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.		P
6.3	**Safeguarding and complementary protective measures**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict

6.3.1	**General**		
	Guards and protective devices shall be used to protect persons whenever an inherently safe design measure does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (for example, emergency stop equipment) may have to be implemented. NOTE The different kinds of guards and protective devices are defined in 3.27 and 3.28. Certain safeguards may be used to avoid exposure to more than one hazard. EXAMPLE A fixed guard preventing access to a zone where a mechanical hazard is present used to reduce noise levels and collect toxic emissions.		P
6.3.2	**Selection and implementation of guards and protective devices**		
6.3.2.1	**General**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against hazards generated by moving according to the nature of those parts (see Figure 4) and to the need for access to the danger zone(s) The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine. In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where the access of an operator into a danger zone is not required during the normal operation (operation without malfunction) of the machinery. As the need for frequency of access increases, this inevitably leads to the fixed guard not being replaced. This requires the use an alternative protective measure (movable interlocking guard , sensitive protective equipment) A combination of safeguards can sometimes be required. For example, where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device can be required to protect against the nip or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard. Consideration shall be given to the enclosure of control positions, intervention zones to provide combined protection against several hazards including: a) hazards from falling or ejected objects, using, for example, protection in the form of a falling object protection structure(FOPS) b) emission hazards (protection against noise, vibration, radiation, substances hazardous to health, etc.), c) hazards due to the environment (protection against heat, cold , foul weather, etc.), d) hazards due to tipping over or rolling over ofmachinery, using, for example, protection in the form of roll-over or tip-over protection structures (ROPS and TOPS) The design ofenclosed work stations, such as cabs and cabins, shall take into account ergonomic principles concerning visibility, lighting , atmospheric conditions, access, posture.		P
6.3.2.2	**Where access to the hazard zone is not required during normal operation**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Where access to the hazard zone is not required during normal operation of the machinery, safeguards should be selected from the following a) fixed guards (see also ISO14120); b) interlocking guards with or without guard locking (see also 6.3.3.2.3, ISO 141 19 and ISO 14120); c) self-closing guards (see ISO 14120:2002, 3.3.2); d) sensitive protective such as electrosensitive protective equipment (see IEC 61496) or pressure-sensitive protective devices (see ISO 13856).		N/A
6.3.2.3	**Where access to the hazard zone is required during normal operation**		
	Where access to the hazard zone is required during normal operation of the machinery, safeguards should be selected from the following a) interlocking guards with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this document); b) sensitive protective such as electrosensitive protective equipment (see IEC 61496) c) adjustable guards; d) self-closing guards (see ISO 14120:2002, 3.3.2); e) two-hand control devices (see ISO 13851) f) interlocking guards with a start function (control guard) (see6.3.3.2.5)		P
6.3.2.4	**Where access to the hazard zone is required for machine setting, teaching, process changeover, fault-finding, cleaning or maintenance**		
	production operator also ensure the protection of personnel carrying out setting, teaching , process changeover, fault-finding , cleaning or maintenance, without hindering them in the of their task. 8uch tasks shall be identified and considered in the risk assessment as of the use of the machine (see 5.2). Isolation and energy dissipation for machine shut-down(see 6.3.5.4, and also ISO 14118:2000, 4.1 and Clause 5) ensure the highest level of safety when carrying out tasks (especially maintenance and repair tasks) that do not require the machine to remain connected to its power supply.		P
6.3.2.5	**Selection and implementation of sensitive protective equipment')**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Due to the great diversity of the technologies on which their detection function is based , all types of sensitive protective equipment are far from being equally suitable for safety applications. The following provisions are intended to provide the designer with criteria for selecting , for each application , the most suitable device(s). Types of sensitive protective equipment include —light curtains, —scanning devices, for example, laser scanners, —pressure-sensitive mats, and —trip bars, trip wires. Sensitive protective equipment can be used —for tripping purposes, —for presence sensing , —for both tripping and presence sensing, or —to re-initiate machine operation-a practice subject to stringent Conditions. NOTE Some types of sensitive protective equipment can be unsuitable either or presence sensing or for tripping purposes. The following characteristics of the among others, can preclude the sole use of sensitive protective equipment:		P
	— tendency for the machinery to eject materials or component parts; —necessity to guard against emissions (noise, radiation, dust, etc.); —erratic or excessive machine stopping time; —inability of a machine to stop part-way through a cycle.		
6.3.2.5.2	**Implementation**		
	Consideration should be given to a) the size, characteristics and positioning of the detection zone(see ISO 13855, which deals with the positioning of some types of sensitive protective equipment), b) the reaction of the device to fault conditions (see IEC 61496 for electrosensitive protective equipment),the possibility of circumvention , and d) detection capability and its variation over the course of time (as a result, for example, of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources and sunlight or impurities in the air). NOTE 1 IEC 61496 defines the detection capability of electrosensitive protective equipment. Sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that —a command is given as soon as a person or part of a person is detected , —the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and therefore the command given by the sensitive protective equipment		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	ismaintained by the control system until a new command is given, —restarting the hazardous machine function(s) results from the voluntary actuation by the operator of a control device placed outside the hazard zone, where this zone can be observed by the operator, —the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, and —the position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone without being detected. NOTE 2 Muting is the temporary automatic suspension of a safety function(s) by safety-related of the control system (see ISO 13849-1). For detailed consideration of the fault behaviour of, for example, active optoelectronic protective devices ,IEC 61496 should be taken into account.		
6.3.2.5.3	**Additional requirements for sensitive protective equipment when used for cycle initiation**		
	In this exceptional application, the starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command , hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply or when the machine has been stopped by the tripping function of the sensitive protective protective equipment the machine cycle shall be initiated only by voluntary actuation of a start control Cycle initiation by sensitive protective equipment shall be subject to the following conditions: a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used; b) the requirements for an AOPD used as a tripping and presence-sensing device (see IEC 61496) are satisfied-in particular, location, minimum distance (see ISO 13855), detection capability, reliability and monitoring of control and braking systems; c) the cycle time of the machine is short and the facility to re- initiate the machine upon clearing of the sensing field is limited to a period commensurate with a single normal cycle; d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone; e) if there is more than one AOPD safeguarding the machine, only one of the AOPDs is capable of cycle re-initiation; f) with regard to the higher risk resulting from automatic cycle initiation, the AOPD and the associated control system comply with a higher safety-related performance than under normal conditions. NOTE 1 The hazard zone as referred to in d) is any zone where the hazardous function (including ancillary equipment and transmission elements) is initiated by clearing of the sensing field. NOTE 2 8ee also IEC/T8 62046.		P
6.3.2.6	**Protective measures for stability**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 6.2.6), it shall be maintained by the use of protective measures such as —anchorage bolts, —locking devices —movement limiters or mechanical stops, —acceleration or deceleration limiters, —load limiters, and —alarms warning of the approach to stability or tipping limits		P
6.3.2.7	**Other protective devices**		
	Error of the operator can generate a hazardous situation, This Machine shall be equipped with the necessary devices to enable the operation to remain within specified limits, in particular -when the operator has insufficient visibility of the hazard zone, -when the operator lacks knowledge of the actual value of a safety-related parameter (distance, speed ,mass, angle, etc.), and -when hazards can result from operations other than those controlled by the operator. The necessary devices include		P
	a)devices for limiting parameters of movement (distance, angle, velocity , acceleration) , b) overloading and moment limiting devices, c)devices to prevent collisions or interference with other machines, d) devices for preventing hazards to pedestrian operators of mobile machinery or other pedestrians, e) torque limiting devices, and breakaway points to prevent excessive stress of components and assemblies, f) devices for limiting pressure or temperature, g) devices for monitoring emissions, h) devices to prevent operation in the absence of the operator at the control position, i)devices to prevent lifting operations unless stabilizers are in place j), devices to limit inclination of the machine on a slope, and k) devices to ensure that components are in a safe position before travelling Automatic protective measures triggered by such devices that take operation of the machinery out of the control of the operator (for example, automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3)		
6.3.3	**Requirements for design of guards and protective devices**		
6.3.3.1	**General requirements**		
	Guards and protective devices shall be designed to be suitable for the intended use, taking into account mechanical and other hazards involved. Guards and protective devices shall be compatible with the working environment of the machine and designed so that they cannot be easily defeated. They shall provide the minimum possible interference with activities during operation and other phases of machine life, in order to reduce any incentive to defeat them.		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	NOTE For additional information, see ISO 14120, ISO 13849-1 ,ISO13851,ISO14119,ISO13856,IEC61496 and 1EC 62061. a)Guards and protective devices shall b)be of robust construction, c)not give rise to any additional hazard , d)not be easy to bypass or render non-operational, be located at an adequate distance from the danger zone (see ISO 13855 and ISO 13857), e) cause minimum obstruction to the view of the production process, and f) enable essential work to be carried out for the installation and/or replacement of tools and for maintenance by allowing access only to the area where the work has to be carried out - if possible, without the guard having to be removed or protective device having to be disabled. For openings in the guards, see ISO 13857.		
6.3.3.2	**Requirements for guards**		
6.3.3.2.1	**Functions of guards**		
	The functions that guards can achieve are - prevention of access to the space enclosed by the guard, and/or -containment/capture of materials, workpieces, chips, liquids which can be ejected or dropped by the machine, and reduction of emissions (noise, radiation , hazardous substances such as dust, fumes, gases) that can be generated by the machine. Additionally, they could need to have particular properties relating to electricity, temperature, fire, explosion, vibration, visibility(see ISO14120) and operator position ergonomics (for example, usability, operator's movements, postures, repetitive movements).		P
6.3.3.2.2	**Requirements for fixed guards**		
	Fixed guards shall be securely held in place either -permanently (for example by welding) , or - by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120). NOTE A fixed guard can be hinged to assist in its opening.		P
6.3.3.2.3	**Requirements for movable guards**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Movable guards which provide protection against hazards generated by moving transmission parts shall a) as far as possible when open remain fixed to the machinery or other structure (generally by means of hinges or guides) , and b) be interlocking (with guard locking when necessary) (see ISO 14119) See Figure 4. Movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that -moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up, with this able to be achieved by interlocking guards, with guard locking when necessary, -they can be adjusted only by an intentional action, such as the use of a tool or a key, and -the absence or failure of one of their components either prevents starting of the moving parts or stops them, with this able to be achieved by automatic monitoring (see 6.2.11.6). See Figure4 and SO 14119.		N/A
6.3.3.2.4	**Requirements for adjustable guards**		
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed. Manually adjustable guards shall be -designed so that the adjustment remains fixed during a given operation, and -readily adjustable without the use of tools.		P
6.3.3.2.5	**Requirements for interlocking guards with a start function (control guards)**		
	An interlocking guard with a start function may only be used provided that a) all requirements for interlocking guards are satisfied (see ISO 14119), b) the cycle time of the machine is short c) the maximum opening time of the guard is preset to a low value (for example, equal to the cycle time) and , when this time is exceeded, the hazardous function(s) cannot be initiated by the closing o fthe interlocking guard with a start function and resetting is necessary before restarting the machine, d) the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120), e) all other guards, whether fixed (removable type) or movable, are interlocking guards, f) the interlocking device associated with the interlocking guard with a start function is designed such that –for example, by duplication of position detectors and use of automatic monitoring (see 6.2.11.6) - its failure cannot lead to an unintended/unexpected start-up, and g)the guard is securely held open (for example, by a spring or counterweight) such that it cannot initiate a start while falling by its own weight.		N/A
6.3.3.2.6	**Hazards from guards**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Care shall be taken to prevent hazards which could be generated by -the guard construction(sharp edges or corners, material, noise emission, etc), -the movements of the guards(shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall.		P
6.3.3.3	**Technical characteristics of protective devices**		
	Protective devices shall be selected or designed and connected to the control system such that correct implementation of their safety function(s) is ensured . Protective devices shall be selected on the basis of their having met the appropriate product standard(for example, IEC 61496 for active optoelectronic protective devices) or shall be designed, According to one or several of the principles formulated in ISO 13849-1 or IEC62061. Protective devices shall be installed and connected to the control system so that they cannot be easily defeated .		P
6.3.3.4	**Provisions for alternative types of safeguards**		
	Provisions should be made to facilitate the fitting of alternative types of safe guards on machinery where it is known that it will be necessary to change the safeguards because of the range of work to be carried out.		N/A
6.3. 4	**Safeguarding to reduce emissions**		
6.3. 4.1	**General**		
	If the measures for the reduction of emissions at source specified in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).		P
6.3.4.2	**Noise**		
	Additional protective measures against noise include - enclosures (see 180 15667), - screens fitted to the machine, and -silencers (see ISO 14163).		P
6.3.4.3	**Vibration**		
	Additional protective measures against vibration include - vibration isolators, such as damping devices placed between the source and the exposed person, -resilient mounting, -suspended seats. For measures for vibration isolation of stationary industrial machinery see EN 1299.		P
6.3.4.4	**Hazardous substances**		
	Additional protective measures against hazardous substances Include -encapsulation of the machine (enclosure with negative pressure) , -local exhaust ventilation with filtration , -wetting with liquids, and - special ventilation in the area of the machine (air curtains, cabins for operators) . See ISO 14123-1 .		N/A
6.3.4.5	**Radiation**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Additional protective measures against radiation include - use of filtering and absorption, and - use of attenuating screens or guards.		N/A
6.3. 5	**Complementary protective measures**		
6.3. 5.1	**General**		
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use, could have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine. Such measures include, but are not limited to, those dealt with in 6.3.5.2 to 6.3.5.6.		P
6.3. 5.2	**Components and elements to achieve emergency stop function**		
	If, following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function for enabling actual or impending emergency situations to be averted, the following requirements apply: -the actuators shall be clearly identifiable, clearly visible and readily accessible; -the hazardous process shall be stopped as quickly as possible without creating additional hazards, but if this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution; -the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary. NOTE For more detailed provisions see ISO 13850. Once active operation of the emergency stop device has ceased following an emergency stop command , the effect of this command shall be sustained until it is reset. This reset shall be possible only at the location where the emergency stop command has been initiated. The reset of the device shall not restart the machinery, but shall only permit restarting. More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in IEC 60204.		N/A
6.3. 5.3	**Measures for the escape and rescue of trapped persons**		
	Measures for the escape and rescue of trapped persons may consist, among others, of -escape routes and shelters in installations generating operator-trapping hazards, -arrangements for moving some elements by hand , after an emergency stop, -arrangements for reversing the movement of some elements, -anchorage points for descender devices, -means of communication to enable trapped operators to call for hope		N/A
6.3. 5.4	**Measures for isolation and energy dissipation**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Machines shall be equipped with the technical means to achieve isolation from power supply(ies) and dissipation of stored energy by means of the following actions: a) isolating (disconnecting , separating) the machine (or defined parts of the machine) from all power supplies; b) locking (or otherwise securing) all the isolating units in the isolating position; c) dissipating or, if this is not possible or practicable, restraining d) verifying, by means of safe working procedures, that the actions taken according to a),b)and c) above have produced the desired effect. See ISO 14118:2000,Clause 5,and IEC 60204-1:2005,5.5and5.6		N/A
6.3. 5.5	**Provisions for easy and safe handling of machines and their heavy component parts**		
	Machines and their component parts which cannot be moved or transported by hand shall be provided or be capable of being provided with suitable attachment devices for transport by means of lifting gear. These attachments may be, among others, -standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing -appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground, - fork locating devices for machines to be transported by a lift truck, -lifting and stowing gear and appliances integrated into the machine. Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement. See also 6.4.4 c), item 3)		P
6.3. 5.6	**Measures for safe access to machinery**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	Machinery shall be so designed as to enable operation and all routine tasks relating to setting and/or maintenance to be carried out as far as possible by a person remaining at ground level. Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks; however, care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery. The walking areas shall be made from materials which remain as slip resistant as practicable under working conditions and , depending on the height from the ground, shall be provided with suitable guard-rails (see 180 14122-3). In large automated installations, particular attention shall be given to safe means of access, such as walkways, conveyor bridges or crossover points. Means of access to parts of machinery located at height shall be provided with collective means of protection against falls (for example, guard-rails for stairways, stepladders and platforms and/or safety cages for ladders) As necessary, anchorage points for personal protective equipment against falls from height shall also be provided (for example, in carriers of machinery for lifting persons or with elevating control stations). Openings shall, whenever possible, open towards a safe position. They shall be designed to prevent hazards due to unintended opening . The necessary aids for access shall be provided (steps, handholds, etc.). Control devices shall be designed and located to prevent their being used as aids for access. When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards for preventing falls when the platform is not present at a level. Movement of the lifting platform shall be prevented while the guards are open. For detailed provisions see ISO 14122.		P
6.4	**Information for use**		
6.4.1	**General requirements**		
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see Figure 2). Information for use consists of communication links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. Information for use is intended for professional and/or non-professional users. NOTE See also IEC 62079 for structuring and presentation of information for use.		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
6.4.1.2	Information shall be provided to the user about the intended use the machine, taking into account, notably, all its operating modes. The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it and warn the user about residual risk. The information shall indicate, as appropriate, - the need for training - the need for personal protective equipment, and - the possible need for additional guards or protective devices (see Figure 2, Footnote d). It shall not exclude uses of the machine that can reasonably be expected from its designation and description and shall also warn about the risk which would result from using the machine in other ways than the ones described in the information, especially considering its reasonably foreseeable misuse.		P
6.4.1.3	Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning , use of the machine (setting , teaching/programming or process changeover, operation cleaning, fault-finding and maintenance) and , if necessary dismantling and scrapping.		P
6.4.2	**Location and nature of information for use**		
	Depending on the risk, the time when the information is needed by the user and the machine design, it shall be decided whether the the information-or parts thereof are to be given a) in/on the machine itself (see 6.4.3 and 6.4.4), b) in accompanying documents (particular instruction handbook, see 6.4.5) , c) on the packaging, d) by other means such as signals and warnings outside the machine. Standardized phrases shall be considered where important messages such as warnings are given (see also IEC 62079).		P
6.4.3	**Signals and warning devices**		
	Visual signals, such as flashing lights and audible signals sucf1 as sirens may be used to warn of an impending hazardous event such as machine start-up or over speed. Such signals may also be used to warn the operator before the triggering of automatic protective measures (see 6.3.2.7). It is essential that these signals a) be emitted before the occurrence of the hazardous event, b) be unambiguous, c) be clearly perceived and differentiated from all other signals used , and d) be clearly recognized by the operator and other persons. The warning devices shall be designed and located such that checking is easy. The information for use shall prescribe regular checking of warning devices. The attention of designers is drawn to the possibility of "sensorial saturation", which can result from too many visual and/or acoustic signals and which can also lead to defeating the warning devices. NOTE Consultation of the user on this subject is often necessary.		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict

6.4.4	**Markings, signs (pictograms) and written warnings**		
	Machinery shall bear all markings which are necessary a) for its unambiguous identification, including at least 1) the name and address of the manufacturer, 2) the designation of series or type, and 3) the serial number, if any, b) in order to indicate its compliance with mandatory requirements, comprising 1) marking, and 2) written indications, such as the authorized representative of the manufacturer, designation of the machinery, year of construction, and intended use in potentially explosive atmospheres) , c) for its safe use, for example, 1) maximum speed of rotating parts, 2) maximum diameter of tools, 3) mass (in kilograms) of the machine itself and/or of removable parts, 4) maximum working load, 5) necessity of wearing personal protective equipment 6) guard adjustment data, and, 7) frequency of inspection. Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine. Signs or written warnings indicating only "Danger" shall not be used. Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine to which they are related. Readily understandable signs (pictograms) should be used in preference to written warnings. Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be Used. Written warnings shall be drawn up in the language(s) of the country in which the machine will be used for the first time and, on request, in the language(s) understood by operators. NOTE In some countries the use of specific language(s) is covered by legal requirements. Markings shall comply with recognized standards (for example, ISO 2972 or ISO 7000, for pictograms, symbols and colours in particular. See IEC 60204-1 as regards marking of electrical equipment. See ISO 4413 and ISO4414 for hydraulic and pneumatic equipment.		P
6.4.5	**Accompanying documents (in particular- instruction handbook)**		
6.4.5.1	**Contents**		

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	The instruction handbook or other written instructions(for example, on the packaging) shall contain, among others, the following: a)information relating to transport ,handling and storage of the machine, such as 1) storage conditions for the machine, 2) dimensions, mass value(s),position of the centre(s) of gravity, and 3)indications for handing(for example, drawings indicating application points for lifting equipment); b)information relating to installation and commissioning of the machine, such as		P

EN ISO 12100:2010			
Clause	Requirement	Test Result	Remark Verdict
	1) fixing/anchoring and dampening of noise and vibration requirements, 2)assembly and mounting conditions, 3) space needed for use and maintenance 4) permissible environmental conditions (for example, temperature, moisture, vibration , electromagnetic radiation), 5) instructions for connecting the machine to power supply,(praticularly on protection against electrical overloading), 6) advice on waste removal/disposal, and 7) if necessary, recommendations related to protective measures which have to be implemented by the user- for example, additional safeguards (see Figure 2, Footnote d), safety distances, safety signs and signals; c) information relating to the machine itself, such as 1)detailed description of the machine, its fittings, guards and/or protective devices, 2)the comprehensive range of applications for which the machine is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate. 3) diagrams (especially schematic representation of safety functions), 4)data on noise and vibration generated by the machine, and on radiation, gases, vapours and dust emitted by it, with reference to the measuring methods (including measurement uncertainties)used, 5) technical documentation of electrical equipment (see IEC60204) , and 6) documents attesting that the machine complies with mandatory requirements; d)information relating to the use of the machine, such as that related to or describing 1) intended use, 2) manual controls (actuators), 3) setting and adjustment, 4) modes and means for stopping (especially emergency stop.), 5) risks which could not be eliminated by the protective measure implemented by the designer, 6) particular risks which can be generated by certain applications, by the use of certain fittings, and about specific safeguards necessary for such applications, 7) reasonably foreseeable misuse and prohibited applications, 8) fault identification and location, for repair and for restarting after an intervention, and 9) personal protective equipment needed to be used and the training that is required; e) information for maintenance, such as 1) the nature and frequency of inspections for safety functions, 2) specification of the spare parts to be used when these can affect the health and safety of operators, 3) instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence need to be carried out exclusively by skilled persons (for example maintenance staff specialists), 4) instructions relating to maintenance actions (replacement of parts, etc.) which do not require specific skills and hence may be carried out by users (for example, operators), and		

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Clause	Requirement	Test Result	Remark Verdict
	5) drawings and diagrams enabling maintenance personnel to carry out their task rationally(especially fault-finding tasks); f) information relating to dismantling, disabling and scrapping, g) information for emergency situations, such as 1) the operating method to be followed in the event of accident or breakdown, 2) the type of fire-fighting equipment to be used, and 3) a warning of possible emission or leakage of hazardous substance(s) and , if possible, an indication of means for fighting their effects; h) maintenance instructions provided for skilled persons [item e) 3) above] and maintenance instructions provided for unskilled persons [item e) 4) above], that need to appear clearly separated from each other.		
6.4.5.2	**Production of instruction handbook**		
	The following applies to the production and presentation of the instruction handbook. a) The type fount and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized by the use of colours, symbols and/or large print. b) The information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language is to be used, each should be readily distinguished from another, and efforts should be made to keep the translated text and relevant illustration together. NOTE In some countries the use of specific language(s) is covered by legal requirements. c) Whenever helpful to the understanding , text should be supported by illustrations. These illustrations should be supplemented with written details enabling , for example, manual controls (actuators) to be located and identified. They should not be separated from the accompanying text and should follow sequential operations. d) Consideration should be given to presenting information in tabular form where this will aid understanding .Tables should be adjacent to the relevant text. e) The use of colours should be considered, particularly in relation to components requiring quick identification. f) information for use is lengthy, a table of contents and/or an index should be provided. g) Safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.		P
6.4.5.3	**Drafting and editing information for use**		

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Clause	Requirement	Test Result	Remark Verdict
	The following applies to the drafting and editing of information for use . a) Relationship to model: the information shall clearly relate to the specific model of machine and , if necessary, other appropriate identification (for example, by serial number). b) Communication principles: when information for use is being prepared, the communication process "see - think- use" should be followed in order to achieve the maximum effect and should follow sequential operations. The questions, "How?" and "Why?" should be anticipated and the answers provided. c) Information for use shall be as simple and as brief as possible and should be expressed in consistent terms and units with a clear explanation of unusual technical terms. d) When it is foreseen that a machine will be put to non- professional use, the instructions should be written in a form that is readily understood by the non-professional user. If personal protective equipment is required for the safe use of the machine, clear advice should be given, for example, on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale. e) Durability and availability of the documents: documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It can be useful to mark them "keep for future reference". Where information for use is kept in electronic form (CD, DVD, tape, hard disk, etc.), information on safety-related issues that need immediate action shall always be backed up with a hard copy that is readily available.		P
7	**Documentation of risk assessment and risk reduction**		
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of a)the machinery for which the risk assessment has been made (for example ,specifications, limits ,intended use); b)any relevant assumptions that have been made(loads, strengths, safety factors, etc.); c)the hazards and hazardous situations identified and the hazardous events considered in the risk assessment; d) the information on which risk assessment was based (see 5.2): 1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.); 2) the uncertainty associated with the data used and its if!1 pact on the risk assessment;		P

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Clause	Requirement	Test Result	Remark Verdict
	e) the risk reduction objectives to be achieved by protective measure; f) the protective measures implemented to eliminate identified hazards or to reduce risk ; g) residual risks associated with the machinery ; h) the result of the risk assessment (see Figure 1); i) any forms completed during the risk assessment. Standards or other specifications used to select protective measures referred to in f) above should be referenced . NOTE No requirement is given in this International Standard to deliver the risk assessment documentation together with the machine. See ISO/TR 14121 -2 for information on documentation.		

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Clause	Requirement	Test Result	Remark Verdict
4	**GENERAL REQUIREMENTS**		
4.1	General considerations	See below	P
	Hazard and risk assessment		P
4.2	Electrical components/devices suitable for their intended use	Suitable for their intended use	P
	and conform to the relevant IEC or EN standards	(See appended table 4.2)	P
4.3	Power supply and related conditions:		
4.3.1	Electrical equipment to be designed for correct operation with conditions of mains power supply	See below	P
4.3.2	Supply Voltage :	AC:220V~, comply with ±10% rated voltage	P
	Frequency :	50/60Hz, comply with ±1% rated frequency	P
	Harmonics :	Exceed evaluation scope	N/A
	Voltage unbalance :	Exceed evaluation scope	N/A
	Voltage interruption :	Exceed evaluation scope	N/A
	Voltage dips :	Exceed evaluation scope	N/A
4.3.3	DC Supplies Voltage :	AC power supply	N/A
	Voltage interruption		N/A
	Ripple (peak-peak):		N/A
4.3.4	Onboard power supply acc. to cl. 4.3.2 and 4.3.3		N/A
4.4	Physical environment and operating conditions		P
4.4.1	Electrical equipment to be suitable for use in physical environment and operating conditions		P
4.4.2	Electromagnetic compatibility (EMC)	Only evaluate safety	N/A
	Equipment not to generate electromagnetic disturbances above harmful levels: (applicable EMC-standard: EN 50081-2)		N/A
	Equipment has adequate level of immunity to EMC: (applicable EMC-standards: EN 50082-2)		N/A
4.4.3	Electrical equipment to be capable for correct operation at intended ambient air temperature		P
4.4.4	Electrical equipment to be capable for correct operation at specified relative humidity: at and		P
4.4.5	Electrical equipment capable of operating correctly at altitudes up to 1000 m above m.s.l.		P
4.4.6	Electrical equipment shall be adequately protected against ingress of solid properties and liquids	For electrical equipment, IP2X	P
4.4.7	Ionizing and non-ionizing radiation Electrical equipment subject to radiation, additional measures to be taken to avoid equipment malfunction	No ionizing and non-ionizing radiation outside this equipment	N/A
4.4.8	Undesirable effects of vibration, shock and bump avoided		P

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Clause	Requirement	Test Result	Remark Verdict
4.5	Electrical equipment designed to withstand the effects of transportation and storage within a temperature range of -25 to +55 °C		P
4.6	Heavy or bulky electrical equipment of the machine provided with suitable means for handling		P
4.7	Electrical equipment installed and operated in accordance with the supplier's instruction	Skilled person for installing and See instruction	P
5 .	**INCOMING SUPPLY CONDUCTOR TERMINATIONS AND DEVICES FOR DISCONNECTING AND SWITCHING OFF**		P
5.1	Incoming supply conductor terminal		P
	electrical equipment of a machine connected to a single power supply		P
	Power supply conductors terminated to main disconnecting device of electrical equipment		P
	neutral conductor "N" clearly indicated in technical documentation.	N letter marking	P
	no connection between neutral conductor and protective bonding circuit nor combined PEN-terminals.		P
	All terminals of incoming supply clearly marke (symbols acc. to EN 60445)		P
5.2	Terminal for connection to exte nal protective earthing s stem.		
	Terminal for connection of external protective conductor provided an marked with "PE"	PE letter and grounding sign used	P
	Cross section of incom ng PE conductor a c. to cl. 5.2, table 1		P
	Terminals allow conne tion of external protective earth conductors PE		P
	other protective earth identified either by graphic symbol, letters "PE", or bicolour combination green / yellow	Identified by graphic symbol Green/Yellow bicolour used	P
5.3	Supply disconnecting device		
5.3.1	Power supply disconnecting device provided for electrical equipment		P
5.3.2	The power supply disconnecting device shall be one of the following type:		
	a) Switch-disconnector, acc. to EN 60947-3 for appliance category AC-23 B or DC-23 B		N/A
	b) Disconnector with or without fuses, with aux. contact (acc. to EN 60947-3)		N/A
	c) Power CB suitable for isolation (acc. to EN 60947-2)		P
	d) Plug/socket combination for electrical load =3kW or 16A.		N/A
	e) plug and socket outlets or appliance couplers for flexible cable supply under following conditions:		
	- not possible to connect or disconnect while load is connected		N/A
	-wired such with equipment, that IP-Protection degree is at least IP2X or IPXXB		N/A

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Clause	Requirement	Test Result	Remark Verdict
	plug/socket-outlet combination as supply disconnecting device have sufficient breaking capacity		N/A
	plug/socket-outlet combination as overload connecting device have sufficient overload capacity		N/A
	equipment has a switching device		N/A
5.3.3	When supply disconnecting device is a switch-disconnector or a circuit- breaker		P
	Isolate electrical equipment from supply (acc. to EN 60947-2)		P
	One OFF (isolated) and one ON position only		P
	Clearly marked with ”0” and ”I”	Clearly marked with ”0” and ”I”	P
	CB’s with additional reset position between ”0” and ”I”		N/A
	visible isolating distance or		P
	Position indication which cannot indicate the OFF-position until all contacts are actually open		P
	External operating device provided (except power operated CB’s)	Handle used	P
	Colour black or grey preferred.	Gery used	P
	If used as an emergency stop, red/yellow combination selected		N/A
	Locking means provided to lock in OFF-position	Padlock used	P
	In locked position an unintended closing for local or remote operation mode possible		P
	Disconnection of all live conductors (Exception: TN- supply systems, neutral conductor)		P
	Sufficient breaking capacity		P
5.3.4	Handle of disconnecting device to be easily accessible		P
	Handle located between 0.6m and 1.9m above service level	≈1.7m	P
5.3.5	Following circuits not disconnect by supply disconnecting device:		
	Lighting circuits during maintenance or repair	Not such circuits	N/A
	Plug/socket outlets exclusively used for maintenance or repair		N/A
	Undervoltage protection circuits used for automatic tripping only at power supply failures		N/A
	Circuits of equipment to remain normally energised for satisfactory operation		N/A
	Control circuits for interlocking purposes		N/A
	Circuits which are not disconnected by supply disconnecting device:		
	Permanent warning labels placed in proximity of supply disconnectors		N/A
	Appropriate remark in maintenance manual		N/A
	Warning label in proximity of circuit concerned		N/A
	or wiring separated from other wiring		N/A

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Clause	Requirement	Test Result	Remark Verdict
	Wiring of safety interlocking circuits installed with different colour of insulation.		N/A
5.4	Devices for switching off for prevention of unexpected start-up:		
	Means shall be provided to prevent inadvertent and / or mistaken closure of the disconnecting device		N/A
	Such devices appropriate and convenient for intended use		N/A
	Suitable placed		N/A
	Readily identifiable		N/A
	Disconnecting devices acc. to cl. 5.3.2 used:		N/A
	Other disconnecting devices for the following situations only:		
	- no significant dismantling of the machine		N/A
	- adjustments requiring a relatively short time		N/A
	No work at the electrical equipment of the machine except:		
	- no hazard arising of electric shock or burn		N/A
	- switched-off status cannot be released due to maintenance work		N/A
	- work of minor nature		N/A
5.5	Devices provided for disconnecting electrical equipment	Device in 5.3 applied	P
	Supply-disconnecting device used		P
	Disconnecting device provided for each separated part of the machine or partial machine where necessary		P
	Disconnectors, fuse links etc. used only in enclosed electrical operating areas		P
	Such disconnecting devices appropriate and convenient for intended use and		P
	Suitably located and		P
	readily identifiable to which part it serves and		P
5.6	Provided with adequate means to prevent unauthorised, inadvertent and /or mistaken closing		P
	Devices acc. to cl. 5.4 and 5.5 provided with locking means		P
	Locking means provided with device	Padlock used	P
	Other means of protection against unintended energising used for non-lockable disconnecting devices (for electrical operating areas only)		N/A
	Locking device not necessary for plug/ socket outlet combinations, if located in a suitable manner and		N/A
	Under immediate supervision of the person carrying out the work		N/A

6	**PROTECTION AGAINST ELECTRIC SHOCK**		P
6.2	Protection against direct contact:		
6.2.1	- by means of protection by enclosure	Enclosure used	P

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Clause	Requirement	Test Result	Remark Verdict
	- by means of insulation of live parts	Insulation applied	P
	- by means of protection against residual voltages	Residual voltage less than 60V after 5s	P
6.2.2	Protection by enclosure:		
	Live parts located inside enclosures conform to relevant requirements of clauses 4, 12 and 15 Protection against direct contact at least IP2X or IPXXB	Protected by grounded metal enclosure, which only can be opened by screwdriver, and IP30 used	P
	Where top surfaces of enclosures are readily accessible, degree of protection against direct contact is IP4X or IPXXD.	Impossible to cause accessible hazard	P
	Opening of enclosure possible only under one of the following conditions:		
	a) use of a key or a tool. Special requirements for enclosed electrical operating areas may apply	Locked by a key	P
	live parts inside of doors with protection degree of IP1X or IPXXA	IP1X used	P
	live parts likely to be touched during resetting or adjustment with protection degree IP2X or IPXXB	Higher than IP2X used	P
	b) disconnection of live parts inside enclosure prior to opening of enclosure		N/A
	at door interlocking safety circuit, door will open only when main isolator is in open position		N/A
	For skilled persons a special device provided, to defeat interlocking circuit under following conditions:		
	Special device or tool provided to permit skilled persons to defeat the interlock provided that:		
	- opening of disconnector possible at all times while interlock is defeated		N/A
	- upon closing the door, interlock is automatically restored		N/A
	If more than one door allows access to live parts, care must be taken, at implementation of this subclause		N/A
	All parts remaining live after switching off mains supply to be protected against direct contact with at least IP2X or IPXXB		N/A
	Such parts marked with warning symbol acc. to cl.17.2		N/A
	Excepted from this requirement for marking are:		
	- Parts that can be live only due to connection to interlocking circuits, distinguished by colour as potentially live acc. to cl. 14.2.4		N/A
	- Terminals of supply disconnecting device when latter mounted alone in a separate enclosure		N/A

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Clause	Requirement	Test Result	Remark Verdict
	c) opening of doors without use of key or tool and without disconnection of live parts possible only when all live parts are protected against direct contact by IP2X or IPXXB		N/A
	where protection is provided by barriers, tools required for their removal or		N/A
	all live parts automatically disconnected when barrier is removed		N/A
6.2.3	Protection by insulation of live parts:		
	Live parts completely covered with insulation	Complestely covered	P
	insulation can be removed only by destruction	Only removed by destruction	P
	insulation capable to withstand mechanical, chemical, electrical and thermal stress occurring under normal service conditions	CE approved component	P
	Paint, varnish lacquer etc. not used as insulation		N/A
6.2.4	Protection of residual voltage:		
	Live parts with residual voltage = 60V after disconnection, to be discharged to = 60V within 5s after disconnection Except are components with charges of = 60 µC	Residual voltage less than 60V after 5s	P
	where pins of plugs or similar devices after withdrawal are exposed, discharge time = 1s		N/A
	such conductors protected against direct contact by at least IP2X or IPXXB		N/A
	if above requirements cannot be achieved, additional disconnecting devices or appropriate warning devices shall be applied. (see cl. 13.8.4)		N/A
6.2.5	Protection by barriers acc. to EN 60364-4-41 cl. 412.2		N/A
6.2.6	Protection by placing out of reach or protection by obstacles acc. to EN 60364-4-41, cl. 412.4 and 412.3)	IP22	P
	For collector wire- or bar systems, with protection less than IP2X, see cl. 13.8.1		N/A
6.3	Protection against indirect contact:		
6.3.2	Measures to prevent the occurrence of a hazardous touch voltage		
6.3.2.2	use of class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation acc. to EN 60536)	Accessible Class I devices are used and enough gap	P
	use of switchgear and control gear assemblies with total insulation acc. to EN 60439-1	Compy with requirements	P
	application of supplementary or reinforced insulation acc. to EN 60364-4-41, 413.2	Enough gap used	P
6.3.2.3	Electrical separation of an individual circuit to prevent hazardous touch voltage acc. to EN 60364-4-41, cl. 413.5	Electrical clearance and creepage distance comply relevant requirements	P

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Clause	Requirement	Test Result	Remark Verdict
6.3.2.4	Protection provided by use of a supply system, where its neutral point is either insulated or of high impedance to earth, so that an earth-fault will not produce a hazardous touch voltage		N/A
6.3.3	Protection by automatic disconnection of supply:		
	This protective measure comprise both:		
	Connection of all exposed conductive parts to protective earth bonding circuit		P
	a) Use of protective device for automatic cut-off in the event of an insulation failure in a TN – or TT- system		P
	b) Use of earth fault detection device to initiate automatic disconnection in an IT-System.	Not used	N/A
	initiation of warning signal only in case of first occurrence of a fault permitted		N/A
6.4	Protection by application of PELV circuit which have to fulfil following requirements:		
6.4.1	a) nominal voltage not to exceed 25 AC (r.m.s.) or 60 DC (ripple-free) or		N/A
	6VAC or 15VDC for all other cases		N/A
	b) one side of PELV- circuit or one point of source of supply to be connected to PE- circuit		N/A
	c) live parts of PELV- circuits to be electrically separated from other live circuits.		N/A
	Electrical separation equal as required for safety isolating transformers (see IEC 61558)		N/A
	d) conductors of each PELV circuit to be physically separated from those of any other circuit.		N/A
	If not practicable, insulation provisions acc. to cl. 14.1.3 shall be applied		N/A
	e) plugs and socket outlets for PELV- circuits shall conform to following requirements:		N/A
	plugs shall not be able to enter socket outlets of other voltage systems		N/A
	socket outlets shall not admit plugs of other voltage systems		N/A
6.4.2	Sources for PELV- circuits to be one of the following:		
	safety isolating transformers		N/A
	source of current providing a degree of safety, equivalent to safety isolating transformers		N/A
	electrochemical or other source, independent of circuit with higher voltage		N/A
	electronic power supply conforming to appropriate standards	EN61558-1	N/A
7	**PROTECTION EQUIPMENT**		P
7.2	Overcurrent protection:		
7.2.1	Overcurrent protection device provided		P
7.2.2	Supply conductors		

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Clause	Requirement	Test Result	Remark Verdict
	Overcurrent protective device at incoming feeder to the electrical equipment (see to cl. 7.2.10 and cl. 18.5)	User provided	P
	Electrical equipment supplier state data for overcurrent protective device	See instruction	P
7.2.3	Power circuits:		
	Overcurrent protective devices applied to each live conductors except for neutral earth conductor	Thermal relay used for power circuit overcurrent	P
	Cross section area of neutral conductor to be at least equal to phase conductor, no overcurrent protective/ disconnecting device required	Cross section area for neutral equal to other phase conductor	P
	For neutral earth conductors with cross sections smaller than phase conductors, measures acc. to item b, cl 473.3.2.1 of IEC 60364-4-473 will apply		N/A
	For IT-systems use of neutral earth conductor (N) is not recommended. Nevertheless if an N-conductor is used, measures acc. to cl. 473.3.2.2 of IEC 60364-4-473 shall apply		N/A
7.2.4	Control circuits:		
	Conductors of control circuits directly connected to supply voltage and circuits feeding control voltage transformers protected against overcurrent acc. to cl. 7.2.3		P
	Control circuits fed via transformers of which one end of secondary winding is connected to PE circuit, will require overcurrent protective device only in the other secondary conductor		N/A
7.2.5	Socket outlets and their associated conductors:		
	Overcurrent protection devices for socket outlets provided for non-earthed live conductors of each circuit feeding such socket outlets		N/A
7.2.6	Lighting circuits:		
	All unearthed conductors of local lighting circuits protected by overcurrent protective devices		N/A
7.2.7	Transformers:		
	Transformers protected against overcurrent acc. to EN 60076-5 or EN 60742		N/A
	Avoid unnecessary tripping due to overcurrent caused by magnetizing inrush currents		N/A
	Avoid temperature rise of transformer winding in excess of its permitted of its insulation class of transformer in case of short circuit at secondary terminals		N/A
	Type and setting of overcurrent protective device acc. to recommendations of transformer manufacturer		N/A
7.2.8	Location of protective devices:		P

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Clause	Requirement	Test Result	Remark Verdict
	Overcurrent protective device located at point where conductor is connected to the supply	located at point where conductor is connected to the supply	P
	Current carrying capacity of conductors at least equal to that required for electrical load	Comply with requirement	P
	Each connecting conductor to overcurrent protective devices not longer than 3 meters	No longer than 3 meters	P
	Conductor protected by enclosure or duct	By enclosure	P
7.2.9	Overcurrent protective devices:		
	Rated short-circuit breaking capacity at least equal to prospective fault current at point of installation	Rated short-circuit breaking capacity of circuit breaker used complying with requirement	P
	Current other than those coming from supply side taken into account	complying with requirement	P
	Reduced breaking capacity is permitted, where another protective device is installed at supply side with the necessary breaking capacity		N/A
	Back-up protection carefully checked, no destruction of conductor or overcurrent protective device may result		N/A
	Co-ordination with other protective devices in circuit required		N/A
	Overcurrent protective devices in power circuits include fuses and circuit breakers. Electronic current limiting devices may also be used for protected circuits	CB's and fuse used	P
7.2.10	Rating and setting of overcurrent protective devices:		
	Rated current of fuses or overcurrent setting of other protective devices selected as low as possible, but adequate for anticipated overcurrents.	See above	P
	Settings of overcurrent protective devices appropriately listed in technical documentation		N/A
7.3	Overload protection of motors:		N/A
	Overload protection for all motors provided for ratings of > 0.5 kW in continuous operation.		N/A
	Protective device may be omitted for motors which cannot be overloaded		N/A
	Overload protection achieved by current sensing or limiting devices or temperature sensors.		N/A
	Current overload detection provided for each live conductor except for neutral conductor		N/A
	For motors supplied by single phase AC or DC power supply, current detection in one non-earthed live conductor only is permitted		N/A

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Clause	Requirement	Test Result	Remark Verdict
	If overload protection is achieved by switching-off device, all live conductors cut from power supply except neutral conductor		N/A
	For special duty motors, appropriate protective devices are recommended		N/A
	For motors where cooling can be impaired, a built- in thermal protection is recommended		N/A
	Automatic restarting of motors prevented after operation of overload protective device, to avoid cause of a hazardous condition		N/A
7.4	Abnormal temperature protection:		
	Resistance heating or similar devices which cause excessive heat, equipped with suitable overtemperature detection		N/A
7.5	Protection against supply interruption or voltage reduction and subsequent restoration		
	Undervoltage protection provided for applications where loss of supply or undervoltage causes a hazardous condition		N/A
	If interruption or reduction of supply voltage is allowed for a short period of time, delayed undervoltage protection provided:		N/A
	Undervoltage protection not impair any stopping control of the machine		N/A
	Upon restoration of supply voltage, automatic or unexpected restarting of machine prevented	.	N/A
	Undervoltage protection to initiate appropriate control responses to ensure co-ordination the groups of machines working together		N/A
7.6	Motor overspeed protection:		
	Overspeed protection provided where overspeeding causes a hazardous condition	Speed controller used	P
	Overspeed protection initiates appropriate control response and prevents automatic restarting	Speed controller used	P
7.7	Earth fault / residual current protection:		
	To reduce damage to equipment due to earth fault currents below detection level, earth fault/residual protect used		P
	Detection level for earth fault protection set as low as possible		P
7.8	Phase sequence protection:		
	Protection from incorrect phase sequence of supply voltage provided	No hazard	N/A
7.9	Protection against overvoltages due to lightning strike or switching action:		
	Protective devices for the suppression of overvoltages caused by lightning strikes or switching surges provided		N/A

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Clause	Requirement	Test Result	Remark Verdict
	Devices for suppression of overvoltages due to lightning, connected at incoming terminals of the supply disconnecting device		N/A
	Devices for suppression of overvoltages due to switching surges connected across terminals of all equipment requiring such protection		N/A
8	**EQUIPOTENTIAL BONDING**		P
8.2.1	General:		
	On mobile machines with on-board power supplies, protective circuits, exposed conductive parts connected to a protective bonding terminal		P
	when mobile machines will be connected to an external incoming power supply, protective bonding terminal (PE) fixed to connecting point for the protective conductor.		P
	All parts of protective bonding circuit capable to withstand max. thermal and mechanical stress, caused by earth-fault currents		P
	Any structural part of electrical equipment or of a machine used as part of protective bonding circuit		N/A
	When an IT distribution system is used, machine structure will be used as part of protective bonding circuit in conjunction with an earth fault supervision system.	No IT system used	N/A
8.2.2	Protective conductors:		
8.2.2	Identification and marking of protective conductors acc. to cl. 14.2.2	Comply with clause 14.2.2, PE marking used	P
	Copper conductors used as protective conductors	4 mm^2 Copper conductors used	P
	Other conductor materials allowed, if cross section of such conductors is not less than 16 mm^2		P
	Cross-sectional area of protective conductors determined acc. to IEC 60364-5-54, cl. 543 or EN 60439-1, cl. 7.4.3.1.7, table 4		N/A
	Relationship between cross-section area of phase conductor and PE acc. to table 1	PE used	P
8.2.3	Continuity of protective bonding circuit:		
	All exposed conductive parts of electrical equipment and machine(s) connected to protective bonding circuit.		P
	In case of removal of parts of PE system, remaining parts not to be interrupted	All metal part are protective earth as double protection	P
	Current-carrying capacity of connections and bonding points not impaired by mechanical, chemical or electrochemical influences	Not impaired by mechanical, chemical or electrochemical influences	P
	Particular consideration should be given if enclosure consists of aluminium and its alloys	No aluminium and its alloys used	P

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Clause	Requirement	Test Result	Remark Verdict
	Metal ducts and cable sheaths not used as protective conductors and not connected to protective bonding circuit	No metal ducts used	N/A
	If electrical equipment is mounted on lids, doors or cover plates, continuity of protective bonding circuit ensured		P
	Continuity of protective conductor ensured at cables which are exposed to damage		N/A
8.2.4	Exclusions of switching devices from protective bonding circuit:		
	Protective bonding circuit not incorporate a switching-/overcurrent protective device nor a means for current detection	Protective bonding circuit not incorporate switching and overcurrent protective devices	P
	Interruption of protective conductors permitted by links, intended to be opened by instructed/skilled persons for test or measurement purposes by using a tool	Screw fixed protective bonding point	P
8.2.5	Equipment parts that need not to be connected to protective bonding circuit:		
	Parts which cannot be touched on large surfaces or grasped by hand due to its small size (less than approx. 50 x 50 mm), small parts such as screws, rivets, nameplates or		P
	are located in such way, that either contact with live parts or an insulation failure is unlikely	No such live parts	N/A
8.2.6	Interruption of the protective bonding circuit:		
	PE- circuit shall not be interrupted prior to disconnection of live conductors by means of removable current collectors or plug/socket combinations and re-established prior to reconnection of live conductors	PE circuit not interrupted except for destructing	P
	Metallic housings of plug /socket combinations connected to the protective bonding circuit except where used for PELV circuits		N/A
	PE conductors connected to protective bonding circuit acc. to cl. 14.1.5		N/A
8.2.7	Protective conductor connecting points:		
	PE conductor connecting points have no other functions and not used for connection of appliances or other parts		N/A
	Each PE connecting point identified by using the protective earth symbol		N/A
	Alternatively, terminals for connection of protective conductors identified by bicolour combination GREEN-YELLOW or letter PE		N/A
8.3	Equipotential bonding connections for functional reasons:		
8.3.2	Connecting of one side of control circuit fed by a transformer to PE-circuit.		N/A
	PE- connection located at source of control circuit supply		N/A
	Connection of control devices acc. to cl. 9.1.4		N/A
8.3.3	Bonding to a common reference potential:		

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Clause	Requirement	Test Result	Remark Verdict
	Effects of disturbances reduced by using a conductor with low resistance at a low impedance network		N/A
	Terminals identified by symbol		N/A
	Bonding to a common reference potential other than PE- circuit allowed (requirements in cl. 6 and 7 fulfilled).		N/A
	Single point bonding connected close to PE terminal or to its own terminal. Identification by symbol		N/A
9	**CONTROL CIRCUITS AND CONTROL FUNCTIONS**		P
9.1.1	Control circuits supplied by transformers have separately isolated windings		P
	If several transformers used, secondary voltages in phase		N/A
	DC- control circuits connected to PE circuit supplied from a separate winding of the control circuit transformer or supplied from another control circuit transformer		N/A
	Transformers not mandatory for machines with a single motor starter and maximum of two control devices		N/A
9.1.2	Nominal voltage not exceed 277 VAC when supplied from a transformer		P
9.1.3	Control circuits provided with over current protection Section7.2.4		P
9.1.4	Connection of control devices in control circuits with one side connected to PE circuit:		
	one terminal of each operating coil of an electromagnetically operated device or any other control device connected to PE circuit		P
	switching elements of control devices that operate coils of it, connected between other terminal of coil or device and the non-earthed side of the control circuit		P
	Exceptions:		
	Contacts elements of protective devices may be connected between PE- side and coil of such control devices, providing they are in same enclosure and the connections to it are so short, that an earth fault is unlikely		N/A
	Requirements of cl. 9.4.3.1 are fulfilled		N/A
9.2	Control functions:		
9.2.1	Start function initiated by energising relevant starting circuit	The Circuit breaker opened-> Start pushbutton pushed down-> the equipment started	P
9.2.2	Stop functions:		
	Category 0: Stopping by immediate removal of power to machine actuators	Stop pushbutton pushed down-> the equipment stop-> The Circuit breaker closed-> Incoming supply disconnected	P

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Clause	Requirement	Test Result	Remark Verdict
	Category 1: A controlled stop with power available to machine actuators. Then removal of power when stop condition has been achieved.		N/A
	Category 2: A controlled stop with power left available to machine actuators		N/A
	With exception for actions in emergency situations and basing on a risk analysis, shut down of power supply can be realised by: Electromechanical devices or Solid state devices		N/A
9.2.3	Mode of operations of machines:		
	Hazardous condition, resulting from a mode selection, prevented by suitable means		P
	Mode selection does not start up the machine		N/A
	Separate control action required by operator		P
	Safeguarding means to remain effective for all operating modes		P
	Indication of selected operating mode provided		N/A
9.2.4	If technical safeguard measures need to be suspended, a mode selection device be provided, capable to be secured in locked position to prevent automatic operation		P
	In addition, one or more of following safety means to be provided:		
	Initiation of a motion by means of a hold to run or similar control device		P
	Portable control station with an emergency stop device and an enabling control device		P
	Initiation of motion possible only from portable control station		N/A
	Limitation of speed or power of motion		P
	Limitation of range of motion		N/A
9.2.5	Operation:		
9.2.5.1	Necessary interlocking devices provided for safe operation		P
	Unintended movement of machine prevented after any stopping of machine		N/A
9.2.5.2	Start of operation possible only when all safeguards are functional, except for conditions stated in cl.9.2.4		P
	For machines where under certain operating conditions no safeguard devices can be applied, manual control of such operations by hold-to-run controls, together with enabling devices		N/A
	Suitable interlocks provided to secure correct sequential start		P
	On machines requiring the use of more than one control station to initiate a start:		
	Each control station has a separate, manually actuated start control device		P

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Clause	Requirement	Test Result	Remark Verdict
	Separate control action required by operator		N/A
	Safeguarding means to remain effective for all operating modes		P
	Indication of selected operating mode provided		N/A
	All required conditions for automatic machine operation are fulfilled		P
	All start control devices in released position (OFF), before a start is permitted		P
	All start control devices simultaneously actuated		P
9.2.5.3	Stop functions of categories 0, 1 and/or 2 shall be provided, based on a risk-assessment and functional requirements of the machine	Categories 0	P
	Stop functions of categories 0 and 1 functionally independent of selected operating mode.	Categories 0	P
	Category 0 stop has priority over cat. 1 and 2	Categories 0	P
	Stop functions have priority over start functions		P
	Facilities provided for connection of protective devices / interlocks		P
	If such protective device/ interlock causes a machine stop, it may be necessary to send such condition to the logic of the control system (PLC)		N/A
	Resetting of stop function must not initiate any hazardous condition		P
9.2.5.4.2	Emergency stop has priority over all other functions and over all modes of operation	When emergency stop function starting, all power supply disconnected and other control function can not been operated.	P
	Power to machine actuators that can cause hazardous condition(s) removed as quickly as possible without creating other hazards	When emergency stop function starting, all power supply disconnected and hazardous conditions removed	P
	Resetting must not initiate a restart	Comply with requirement	P
	Emergency stop acts either as stop of category 0 or as stop of category 1	Category 0 act used	P
	For determination of category of emergency stop, see risk assessment	By the risk assessment of the machine	P
	If a category 0 stop is used for emergency stop function, it have hard-wired electromechanical components	Category 0 used	P
	Operation must not depend on electronic logic control devices (hardware or software) or on transmission of stop commands via communications network or link		N/A
	Where a category 1 stop is used for an emergency stop function, final removal of power to machine actuators ensured by means of electromechanical components		N/A

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Clause	Requirement	Test Result	Remark Verdict
9.2.5.4.3	Functional aspects of emergency switching-off function are given in IEC 60364-4-46 and should be provided where:		
	Protection against direct contact is achieved only by placing out of reach or by obstacles		N/A
	There is the possibility of other hazards or damage by electricity		N/A
	Emergency switching- off is accomplished by disconnecting incoming supply of the machine, effecting in a category 0 stop		N/A
	When a machine cannot tolerate a category 0 stop, other means of protection is to be provided so that emergency switching-off is not necessary		N/A
9.2.5.5	Monitoring of command actions:		
	Movement or action of a machine or parts of it, that can result in a hazardous condition be monitored		P
	On manually controlled machines, operators to provide some monitoring		P
	Conditions expected to be unreasonable for monitoring by the operator, require means to monitor such conditions		N/A
9.2.5.6	Hold-to-run controls (inching switches) require continuous actuation of control devices to achieve operation		N/A
9.2.5.7	Type of two-hand control:		N/A
	Type I:		
	Two control devices and their and their simultaneous actuation by both hands		N/A
	Continuous simultaneous actuation during the hazardous condition		N/A
	Machine operation to cease upon the release of either one or both control devices when the hazardous conditions are still present		N/A
	Type II:		
	Type I control, requiring release of both control devices before machine operation may be re-initiated		N/A
	Type III:		
	It shall be necessary to actuate the control devices within a certain time limit of each other, not exceeding 0.5 s		N/A
	After exceeding this time limit, both controls shall be released before an operation may be re-initiated		N/A
9.2.5.8	If an enabling device is part of the system, it shall be designed to allow motion when actuated in one position only		N/A
	In any other position motion shall be stopped		N/A
	It shall have following features:		
	Connected to a category 0 or to a cat. 1 stop		N/A

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Clause	Requirement	Test Result	Remark Verdict
	Designed in consideration with ergonomic principles		N/A
	Requirements for a two-position type:		
	Position 1: OFF-function of switch (actuator is not operated)		N/A
	Position 2: enabling function (actuator is operated)		N/A
	Requirements for a three-position type:		
	Position 1: OFF-function of switch, (actuator is not operated)		N/A
	Position 2: enabling function of switch, (actuator is operated and in its mid position)		N/A
	Position 3: OFF-function of switch, (actuator is operated past its mid position)		N/A
	When returning from position 3 to 2, function not enabled		N/A
9.2.6	Push-buttons and similar control devices, that when operated, alternately initiate and stop motion use only for functions which cannot produce a hazardous condition		P
9.2.7	Cableless control	Not provided	N/A
9.2.7.1	Means provided to readily remove or disconnect power supply of operator control station		N/A
	Means provided as necessary to prevent unauthorised use of operator control station		N/A
	Each operator control station shall carry an unambiguous indication of which machine is intended to be controlled by that operator control station		N/A
9.2.7.2	Measures shall be taken to ensure that control commands:		
	Affect intended machine only and		N/A
	Affect intended functions only		N/A
	Measures taken to prevent machine from responding signals other than those from intended operator control station(s)		N/A
	If necessary, means shall be provided so that machine can be controlled only from operator control stations in one or more predetermined zones or locations		N/A
9.2.7.3	Operator control station include a separate, clearly identifiable mean to indicate stop function of machine or of all motions which could cause a hazardous condition		N/A
	Actuating means to indicate this stop function, not marked or labelled as emergency stop device		N/A
	A machine equipped with cableless control to have means automatically initiating a stop to prevent a hazardous operation for the following situations:		
	a stop signal is received		N/A
	a fault is detected in the system		N/A

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Clause	Requirement	Test Result	Remark Verdict
	a valid signal has not been detected within a certain time, outside of range of cableless control, where no hazardous condition can occur (see annex B)		N/A
9.2.7.4	Where safety related functions rely on serial data transfer, correct data transfer ensured by applying an error detection method which can cope with up to 3 error bits in any command sequence		N/A
9.2.7.5	For machines with more than one operator control station, measures taken to ensure, that one control station only can be enabled at a given time		N/A
	Indication of which operator control station is in control of the machine, provided at suitable locations, as determined by risk assessment of the machine		N/A
	Exception: stop commands from any one of the control stations shall be effective		N/A
9.2.7.6	Variation in battery voltage not cause a hazardous condition		N/A
	Clear warning given to operator of battery powered control stations, if the are controlling one or more potentially hazardous motions when the battery voltage exceeds specified limits		N/A
	Under those circumstances operator control station remain functional long enough to bring machine in a non-hazardous condition		N/A
9.3	Protective interlocks:		
9.3.1	Reclosing or resetting of an interlocking safeguard not to initiate a machine motion or operation which can produce a hazardous condition		N/A
9.3.2	Where an overtravel causes a hazardous condition, a position sensor or limit switch provided, to initiate appropriate control action		N/A
9.3.3	Where non-operation of devices for auxiliary functions causes a hazardous condition, damage to the machine or to the process, appropriate interlocking be provided		N/A
9.3.4	Interlocks of contactors, relays, etc. between different operations and for opposite motions, interlocks against such incorrect operation provided		N/A
	Reversing contactors interlocked in such way, that in normal service no short circuit occurs during switching operation		N/A
	Where, for safety or for continuous operation, certain functions on the machine are required to be interrelated, proper co-ordination ensured by suitable interlocks		N/A

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Clause	Requirement	Test Result	Remark Verdict
	For a group of machines working together in a co-ordinated manner and having more than one controller, provisions made for co-ordination of this controller		N/A
	If a failure of a mechanical brake actuator can result that the brake, is applied when the associated machine actuator is energised and a hazardous condition results, interlocks be provided to switch off the machine actuator		N/A
9.3.5	Reverse current breaking on a motor, effective measures taken to avoid motor starting in opposite direction at end of breaking where that reversal causes a hazardous condition, damage to the machine or to the process		N/A
	Control circuits arranged so, that rotation of a motor shaft, not to result in a hazardous condition		N/A
9.4	Control functions in the event of failure:		
	Measures to reduce those risks include but are not limited to:		
	protective devices on the machine, (e.g. interlocking guards, trip devices)		N/A
	protective interlocking of electrical circuit		P
	use of proven circuit techniques and components (see cl. 9.4.2.)	CE approved component used	P
	provision of partial or complete redundancy (see cl. 9.4.2.2) or diversity (see cl. 9.4.2.3)		N/A
	provision for functional tests (see cl. 9.4.2.4)	Comply with clause 19.6	P
	single failures only are to be considered	Single failure used	P
	for higher levels of risks, it may be necessary to ensure, that more than one failure cannot result in a hazardous condition	No hazard	P
9.4.2	Measures to reduce the risk in case of failure:		
9.4.2.1	bonding of control circuits to protective circuit for operational purposes (see cl. 9.4.3.1)		P
	connection of control devices in accordance with cl. 9.1.4		P
	stopping by de-energising (see cl. 9.2.2)	Comply with cl.9.2.2	P
	switching of all live conductors to device being controlled (see cl. 9.4.3.1)		N/A
	use of switching devices having positive (or direct) opening operation (see IEC 60947-5-1)		P
	circuit design to reduce possibility of failures causing undesirable operations		P
9.4.2.2	on-line redundancy for normal operation		N/A
	off-line redundancy for protective functions, effective only when operating function fails		N/A
	where off-line redundancy is use, suitable measures taken, to ensure that those control circuits are available when required		N/A

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Clause	Requirement	Test Result	Remark Verdict
9.4.2.3	Use of control circuits having different principles of operation or using different types of devices may reduce faults and failures. Examples include:		
	Combination of normally open and normally closed contacts operated by interlocking guards		N/A
	Use of different types of circuit components in control circuit		N/A
	Combination of electromechanical and electronic circuits in redundant configurations		N/A
	Combination of electrical and non-electrical systems (e.g. mechanical, hydraulic, pneumatic) may perform redundant functions and provide diversity		N/A
9.4.2.4	Automatic functional test carried out by the control system	Comply with clause 19.6	P
	Manual function tests by inspection	Comply with clause 19.6	P
	Tests at start-up and at predetermined intervals or as a	Comply with clause 19.6	P
	Combination as appropriate (see cl.18.2 and 19.6)	Comply with clause 19.6	P
9.4.3	Protection against mal-operation due to earth faults, voltage interruptions and loss of circuit continuity:		
9.4.3.1	Earth faults on any control circuit causes no unintentional starting, potentially hazardous motions or prevent stopping of machine		P
	For fulfilment of this requirement bonding to PE-circuit provided and correct connection of devices ensured (see cl. 8.2 and cl. 9.4.4)		P
	Control circuits fed from transformer and not connected to PE- circuit provided with an insulation monitoring device		P
	Multi-pole control switches which interrupt all live conductors use for START or STOP functions, which could cause hazardous condition or damage to the machine, in the event of unintentional starting or failure to stop.		P
9.4.3.2	If control system uses a memory device, proper functioning in the event of power failure ensured to prevent any loss of memory that could result in a hazardous condition		P
9.4.3.3	If loss of continuity of safety-related control circuits depending upon sliding contacts which could result in a hazardous condition, appropriate measures be taken	No sliding contact used	N/A
10	**OPERATOR INTERFACE AND MACHINE-MOUNTED CONTROL DEVICES**		P
10.1.1	Devices to be selected, mounted and identified or coded acc. to EN 60073 and EN 60447	Comply with requirements	P
10.1.2	Machine-mounted control devices readily accessible for service and maintenance and	Readily accessible for service and maintenance	P

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Clause	Requirement	Test Result	Remark Verdict
	Mounted to minimise possibility of damage from activities such as material handling	Mounting style have been not influenced by material handling	P
	Actuators of hand-operated control devices selected and installed as follows:		
	Mounted not less than 0.6 m above servicing level, and within easy reach for operator (normal working position)		P
	Placed so that operator is not exposed to a hazardous situation when operating them	Not place in the hazardous position	P
	Possibility of inadvertent operation is minimised	No possible,see user manual	P
10.1.3	Degree of protection sufficient for expected use against:		
	Effects of aggressive liquids, vapours or gases in environment of machine		P
	Ingress of contaminants		P
	Operator interface control devices have a minimum degree of protection against direct contact of IPXXD	IP4X used	P
	Operator interface and machine mounted control devices shall withstand the stresses of the expected use declared by the manufacturer(EN12601:2001)		P
	A minimum degree of protection IP33 according IEC529 is sufficient(EN12601:2001)	IP33 used	P
10.1.4	Position sensors arranged so, that they will not be damaged in the event of over travel		N/A
	Position sensors use in circuits with safety related functions either have positive opening operation or provide similar reliability		N/A
10.1.5	Portable or pendant operator control stations and control devices selected or arranged in such way as to minimise possibility of inadvertent machine operations caused by shocks and vibrations		N/A
10.2.1	Pushbutton actuators colour-coded acc. to table 2	Start – green colour Stop- red colour	P
10.2.2	Recommendation that pushbuttons are preferably marked directly on actuator with symbols acc. to table 2	ON for start OFF for stop	P
10.3.1	Colours for indication lights: RED, YELLOW, GREEN, BLUE Colours for confirmation: GREEN and WHITE	RED LED indication lights used	P
10.3.2	Unless otherwise agreed between supplier and user, indicator light lenses colour-coded with respect to status of machine acc. to table 3		P
	Alternative meanings may be assigned in accordance to following criteria:		
	safety of persons and environment	Red and green flash light used	P
	state of electrical equipment	RED LED indication lights used	P
10.3.3	Flashing lights for further information may be used for following purposes:		P
	to attract attention or	Flash light used	P

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Clause	Requirement	Test Result	Remark Verdict
	to request immediate action or		P
	to indicate a discrepancy between command and actual state or		P
	to indicate a change in process (flashing during transition)		P
	higher frequency of flashing lights (pulse/pause ratios) recommended for higher priority of information		P
10.4	Illuminated push-button actuators colour-coded acc. to tables 2 and 3		N/A
	WHITE colour shall be use, if it is difficult in assigning an appropriate colour		N/A
	RED colour shall be use, for emergency stop actuators, not depending upon illumination conditions (ON /OFF status) only		N/A
10.5	Rotary control devices having a rotational member such as potentiometers and selector switches, mounted in such way as to prevent rotation of stationary member		N/A
10.6	Start devices use to initiate start functions or movement of machine or elements designed and mounted such as to minimise inadvertent operation		N/A
	Mushroom - type actuators used for two-hand control devices		N/A
10.7	Devices for emergency stop:		
10.7.1	Devices for emergency stop readily accessible	See below	P
	Devices for emergency stop located at each operator control station and other locations where initiation of emergency stop is required (see cl. 9.2.7.3 for exception)	Comply with requirements	P
10.7.2	Types of devices for emergency stop include following elements:		
	push-button operated switch or	Push-button operated switch used	P
	pull-cord operated switch or		N/A
	pedal-operated switch without mechanical guard		N/A
	Devices be of self- latching type and contacts are of positive (or direct) opening operation		N/A
10.7.3	It is not possible to restore an emergency stop circuit, until the emergency stop device has been manually reset	Reset the emergency stop position by manual	P
10.7.4	Actuators of emergency stop devices are coloured RED	Red actuator used	P
	Background immediately around actuator is coloured YELLOW	Yellow background used	P
	Actuator of pushbutton operated emergency stop device shall be of palm- or mushroom head type	mushroom head type used	P
10.7.5	Supply disconnecting device may be locally operated to serve as function of emergency stop when:		

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Clause	Requirement	Test Result	Remark Verdict
	it is readily accessible to operator		N/A
	it is of type described in cl. 5.3.2 a), b) or c)		N/A
	Supply disconnecting device shall meet colour requirements of cl. 10.7.4		N/A
10.8	Devices for emergency switching off:		
10.8.1	Location of emergency switching-off devices normally placed separate from operator control station		N/A
	Operator control station equipped with separate emergency stop device, since function effects a category 0 emergency stop		N/A
10.8.2	Types of emergency switching-off devices include: Push-button operated switch or		N/A
	Pull-cord operated switch		N/A
	Devices of self-latching type and ensure positive (or direct) opening operation		N/A
	Push-button operated switch in break-glass enclosure		N/A
10.8.3	Not possible to restore an emergency switching-off circuit, until device have been manually reset		N/A
	Where several emergency switching-off devices are in a circuit, it is not possible to restore that circuit, until all emergency switching-off devices have been reset		N/A
10.8.4	Actuators of emergency switching-off devices are coloured RED		N/A
	Background immediately around actuator (push-button) coloured YELLOW		N/A
	Actuators of push-button operated emergency switching-off devices be of palm- or mushroom-head type		N/A
10.8.5	When supply disconnecting device is locally operated for emergency switching-off, it shall be readily accessible		N/A
	Supply disconnecting device locally operated for emergency switching-off, shall meet colour requirement acc. to cl. 10.8.4		N/A
10.9	Displays selected and installed in such manner as to be visible from normal position of operator		P
	If displays are used as warning devices, it is recommended, that are of flashing or rotary type equipped with audible warning device		P
1 1	**ELECTRONIC EQUIPMENT**		P
11.2.1	Basic requirements: Indication of status of all digital inputs and outputs provided	Label used for input and output	P

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Clause	Requirement	Test Result	Remark Verdict
11.2.2	All input /output card racks, processor-racks, power supply units etc. electrically bonded together acc. to suppliers specifications and connected to PE-circuit (see cl. 8.2.3)		P
	If necessary for operation, some equipment be isolated from PE- circuit, such equipment be excluded from this requirement (see cl. 8)		P
11.3.1	PLC's to conform to relevant IEC standards		P
11.3.2	Means provided to prevent memory alteration by unauthorised persons		P
	Requirements of cl.9.4.3.2 shall be fulfilled		N/A
11.3.3	Equipment using PLC's have means for verifying, that software is in accordance with relevant program documentation		P
11.3.4	PLC equipment not be used for category 0 emergency stop functions (safety-related stop functions)		P
	The use of hard-wired electromechanical devices is preferred for all other safety-related stop functions		N/A
	If PLC equipment is used for such functions, then appropriate measures acc. to cl. 9.4 shall be employed		N/A
	Above requirements not preclude use of PLC equipment for monitoring, testing or back-up functions, but such equipment not prevent the correct operation of these functions		P
12	**CONTROLGEAR: LOCATION, MOUNTING, AND ENCLOSURES**		P
12.1	All control gear located and mounted so, as to cover the following points: facilitate accessibility and maintain ability	All control gear located and mounted are facilitated accessibility and maintain ability	P
	facilitate protection against external influences or operating conditions under which operation is intended	Screw used	P
	facilitate easy access for operation and maintenance of the machine and its associated equipment	Easy accessible	P
12.2	Location and mounting:		
12.2.1	all control-gear components placed and oriented so, that identification is possible without moving them or the associated wiring	Component lane layouted	P
	Components checked for correct operation or possible replacement without dismantling other equipment or parts of the machine	Comply with requirements	P
	Terminals not associated with control gear also to conform to this requirement	Comply with requirements	P
	Operation and maintenance of all control gear possible from front of cabinet		N/A

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Clause	Requirement	Test Result	Remark Verdict
	Special tools for removal of electronic devices provided with the equipment	Screwdriver used	P
	Access for regular maintenance or adjustment to equipment, relevant devices located between 0.4m to 2.0 m above servicing level	At least 0.4m provided	P
	Terminals located at least 0.2 m above servicing level and placed such, that conductors and cables can be easily connected	At least 0.2m above servicing level	P
	No devices mounted on doors, except those for operating, indicating, measuring and cooling purposes on normally removable access-covers of enclosure	No devices mounted on doors	P
	Plug-in type control devices belonging functionally together, their association made clear by type (shape), marking or reference designation single or in combination (see cl. 14.4.5)	No plug-in type control devices	N/A
	Plug-in type control devices, that are handled during normal operation, shall be designed with non-interchangeable characteristics, where lack of such facility can result in malfunctioning	No plug-in type control devices	N/A
	Plug/socket combinations, handled during normal operation, shall be located and mounted so as to provide unobstructed access	No plug/socket combination device	N/A
	If test points are provided, they should be:		
	mounted so as to provide unobstructed access		N/A
	clearly marked to correspond with the documentation (see cl. 18.2)		N/A
	adequately insulated		N/A
	sufficiently spaced for connection of test equipment or means		N/A
12.2.2	Non-electrical parts and devices, not directly associated with the electrical equipment, not located within enclosures containing control gear	Comply with requirements	P
	Devices such as solenoid valves separated from other electrical equipment	Not provided	N/A
	Control devices mounted at same location and connected to the main supply voltage, or to both main supply and control voltage, are grouped separately from those connected to control voltage only	Main supply and control voltage are grouped separately	P
	Terminals separated into groups for: power circuits or	Terminals separated into: power circuits, control circuit, protective bonding	P
	associated control circuits or		P
	other control circuits, fed from external sources		N/A
	Terminal groups mounted adjacently, providing that each group is readily identified	Clear mark the identified marking	P

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Clause	Requirement	Test Result	Remark Verdict
	When arranging the location of devices, clearances and creepage distances specified for them shall be maintained, taking into account external influences or physical conditions of its environment	Comply with clearances and creepage distance requirement.	P
12.2.3	Heat generating components located so, that temperature of each component in its vicinity remains within the permitted limits		P
12.3	Degrees of protection:		
	Protection of control gear against ingress of solid foreign objects and liquids shall be adequate. External influences under which the equipment is intended to operate is to be taken into account and is to be	Enclosure and barriers used	P
	Its protection sufficient against dust, coolants and swarf	Comply with requirement	P
	Enclosures of control gear provide a degree of protection of at least IP22		N/A
	Control and switchgear shall withstand the stresses of the expected use declared by the manufacturer. (EN12601:2001)		P
	For generators of generating sets the degree of protection IP23 applies. (EN12601:2001)	IP23 used	P
	For control and switchgear in electrical operating areas the degree of protection IP41 is sufficient(EN12601:2001)	IP41 used	P
	Exceptions:		
	a) Where an electrical operating area is use as a protective enclosure for an appropriate degree of protection against ingress of solid bodies and liquids		N/A
	b) Where removable collectors on collector bar systems are use, and IP22 is not achieved but measures of cl. 6.2.5 are applied		N/A
12.4	Enclosures doors and openings:		
12.4	Enclosures to withstand mechanical, electrical and thermal stress as well as effects of humidity during normal service	Metal used Front door for body	P
	Fasteners for doors or covers of captive type	Covers of captive type	P
	Windows for viewing internally mounted indicating devices, made of material suitable to withstand mechanical stress and chemical attack		P
	Doors of enclosure not wider than 0,9 meter	Steel door used <0.9m width	P
	Doors with vertical hinges, preferably lift-off type		P
	Doors with opening angle of at least 95 °		P
	Gaskets of doors, lids, covers and enclosures withstand the chemical effects of aggressive liquids, vapours or gases use on the machine		P

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Clause	Requirement	Test Result	Remark Verdict
	Means use to maintain degree of protection of an enclosure of doors, lids and covers that require opening or removed for operational or maintenance shall:		
	be securely attached to either door, cover or enclosure		N/A
	not deteriorate due to removal or replacement of door or cover and so impair degree of protection		N/A
	all openings in enclosure closed by supplier(s), ensuring degree of protection specified for equipment		N/A
	openings for cable entries at enclosure to be easily re-opened on site		N/A
	suitable opening in base of enclosure within the machine provided, as to enable drainage of moisture due to condensation		N/A
	no opening between enclosure containing electrical equipment and compartment containing coolant, lubricating or hydraulic fluids		N/A
	holes in enclosure for mounting purposes not impair required degree of protection	Not impair required degree of protection Hole open to down	P
	If equipment could attain a surface temperature sufficient to cause a risk of fire during normal or abnormal operation:		
	located within an enclosure, that can withstand, without risk of fire or harmful effect, the heat emitted by the equipment or		N/A
	mounted and located at sufficient distance from adjacent equipment, so as to allow safe dissipation of heat or		N/A
	otherwise screened by material that can withstand, without risk of fire or harmful effect, the heat emitted by the equipment		N/A
12.5	Access to control gear:		
	Minimum dimensions of doors and corridors for access to electrical operating areas: at least 0.7 meter wide and 2.0 meter high		P
	Doors open outwards		N/A
	Doors equipped with means to allow opening from inside without the use of a key or tool		P
13	**CONDUCTORS AND CABLES**		
13.1	Conductors and cables selected so as to be suitable for operating conditions and external influences that are existing	Comply with requirement	P
	Requirements not applicable for integral wiring of assemblies, subassemblies and devices that are manufactured and tested acc. to their relevant standard	Conform to relevant IEC standards	P
13.2	Generally conductors shall be of copper	Copper used	P

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Clause	Requirement	Test Result	Remark Verdict
	Conductors of other material shall have nominal cross-section area such that, carrying the same current, max. conductor temperature does not exceed values given in table 4		N/A
	If aluminium conductors are used, the min. cross-sectional area to be at least 16 mm^2		N/A
	Max. permitted conductor temperatures under normal-/ short circuit conditions will not exceed values given in table 4	Normal temperature < 60°C	P
	All conductors which are subject to frequent movement to be of flexible stranded copper acc. to class 5 or class 6 (see table C.4 in annex C)	Class 1 and 2	N/A
13.3	Types of insulation include: Polyvinyl chloride (PVC)		P
	Rubber, natural and synthetic		N/A
	Silicone rubber (SiR)		N/A
	Mineral		N/A
	Cross-linked Polyethylene (XLPE)		N/A
	Ethylene Propylene Rubber compound (EPR)		N/A
	Poly-Tetra-Fluor-Ethylene (PTFE)		N/A
	Where insulation of conductors or cables can constitute hazards due to propagation of fire or emission of toxic/ corrosive fumes, guidance from cable supplier to be sought		N/A
	Special attention to integrity of a circuit having a safety-related function		N/A
	Dielectric strength of insulation adequate for required test voltage with a 5min. of 2000VAC for cables operating with voltages >50VAC or >120 VDC	After 2000VAC for a duration of 5 minutes, insulation not damage	P
	For separate PELV circuits, dielectric strength adequate for test voltage of 500VAC for a duration of 5 minutes	After 500VAC for a duration of 5 minutes, insulation not damage	P
	Mechanical strength and thickness of insulation such that, insulation cannot be damaged during cable laying or in operation	Comply with requirement	P
13.4	Cross-sectional area of a conductor to be such, that under stated conditions, conductor temperature does not exceed the values given in table 4	PVC used Normal temperature < 60°C	P
	Current-carrying capacities for PVC insulated wiring between enclosures and individual items of equipment under steady-state conditions according to values given in table 5	Copper used	P
13.5	Voltage drop from point of supply to load not exceeding 5% of nominal voltage under normal operating conditions	Voltage drop < 5%	P
13.6	To ensure adequate mechanical strength, cross-sectional area of conductors not less than values given in table 6.	Copper used	P

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Clause	Requirement	Test Result	Remark Verdict
13.7.1	Flexible cables have cl. 5 or cl. 6 conductors (see table C.4)	Not applicalbe,user provide	N/A
	cables exposed to severe duties shall be of adequate construction to protect against:		
	abrasion due to mechanical handling and dragging across rough surfaces		N/A
	kinking to operation without cable guides		N/A
	stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums		N/A
13.7.2	Cable handling system of machine designed such, as to keep tensile stress of conductors as low as practicable during machine operation		N/A
	tensile stress for copper conductors not to exceed 15 N/mm^2 of copper cross section area		N/A
	where tensile stress of conductors is exceeding 15 N/mm^2 , cables of special design are use		N/A
	maximum stress for flexible cables agreed with the cable manufacturer		N/A
13.7.3	Cables wound on drums selected such, as the maximum allowable conductor temperature is not exceeded		N/A
	cables for circular cross-section area, installed on drums, max. current-currying capacity in free air as declared acc. to table 7		N/A
13.8.1	Collector wires, collector bars and slip-ring assemblies:		
	They shall be installed or enclosed in such way, that during normal access to the machine, protection against direct contact is achieved by application by one of the following protective measures:		
	protection by partial insulation of live parts	Comply with requirement	P
	protection by enclosure or barriers provide a degree of protection of at least IP2X	Protection by enclosure, at least IP20	P
	horizontal top surfaces of barriers or enclosures which are readily accessible provide a degree of protection of at least IP4X	IP4X	P
	if required degree of protection is not achieved, protection by placing live parts out of reach in combination with emergency switching-off acc. to cl. 9.2.5.4.3 applied		N/A
	collector wires and bares placed such and / or protected as to prevent contact, especially for unprotected wires and bars, with conductive items such as, cords of pull-cord switches, strain-relief devices and drive chains and		N/A
	prevent damage from a swinging load		N/A
13.8.2	Where collector wires, collector bars and slip-ring assemblies are installed as part of the PE-circuit, they do not carry current in normal operation	No current through PE circuit	P

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Clause	Requirement	Test Result	Remark Verdict
13.8.3	Protective conductors of current collectors have a shape or are designed such, so that they are not interchangeable with other current collectors of the sliding contact type	No interchangeable	N/A
13.8.4	Removable current collectors with disconnector function are designed such, that PE-circuit is interrupted only after live conductors have been disconnected and the continuity of the PE-circuit is re-established before any live conductor is reconnected		N/A
13.8.5	Clearances between respective conductors and between adjacent systems of collector wires, bars, slip-ring assemblies and their current collectors designed for operation in pollution degree 3 conditions		P
13.8.6	Creepage distances suitable for operation in pollution degree 3		P
	In abnormally dusty, moist or corrosive environments, following creepage distances apply:		
	for unprotected collector wires, bars and slip-ring assemblies equipped with insulators, the minimum creepage distance is 60 mm		N/A
	for enclosed collector wires, insulated multipole collector bars and insulated individual collector bars, the minimum creepage distance is 30 mm		N/A
	gradual reduction of insulation values due to unfavourable ambient conditions regarded		N/A
13.8.7	Suitable design measures taken, in order to prevent energisation of adjacent sections by current collectors themselves		N/A
13.8.8	Collector wires, collector bar systems and slip-ring assemblies use for power circuits kept separately from those use for control circuit applications	Power circuits kept grouped separately from control circuit applicants	P
	above systems capable of withstanding without damage to mechanical forces and thermal effects of short circuit currents	Comply with requirements	P
	removable covers to above systems, laid underground or under floor, designed that they cannot be opened by one person without the use of a tool		N/A
	collector bars which are installed in a common metal enclosure, the individual section of it bonded together and earthed at several points depending upon their length		N/A
	Metal covers of collector bars laid underground or under floor, bonded together end earthed		N/A
	Underground and under floor collector bar ducts have drainage facilities		N/A
14	**WIRING PRACTICES**		P

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Clause	Requirement	Test Result	Remark Verdict
14.1.1	All connections, especially those of the protective bonding circuit, secured against accidental loosening	Terminal and bonding used for fixing	P
	Means of connection suitable for cross-sectional areas and nature of conductors being terminated	Comply with requirement	P
	For aluminium or aluminium alloy conductors, consideration given due to prevention of problems of electrolytic corrosion (see cl. 13.2)	Not aluminium or aluminium alloy conductor used	N/A
	Connection of two or more conductors to one terminal only where terminal is designed for that purpose	Press wire terminal used for two or more conductors	P
	Only one PE-conductor connected to one terminal connecting point	Only one PE-conductor connected to one terminal connecting point	P
	Soldered connections only, where terminals are provided which are suitable for soldering connections	No solderd used	N/A
	Terminals on terminal blocks plainly identified to correspond with markings on wiring diagrams	Marking intended for using	P
	Installation of flexible conduits and cables such, that liquids are drained away from fittings and joints	No liquids	N/A
	Means to retain stranded conductors together when terminating conductors at terminals devices provided	Press wire terminal provided	P
	Solder not use for that purpose		N/A
	Shielded conductors terminated so as to prevent fraying of strands and to permit easy disconnection	No shielded conductors used	N/A
	Identification tags legible, permanent and appropriate for physical environment	Marking legible and permanent	P
	Terminal blocks mounted and wired so, that internal and external wiring does not cross over terminals	No cross	P
14.1.2	Conductors and cables runned from terminal to terminal without splices or joints	Connector used for connecting between terminals	P
	Where it is impracticable to provide terminals in a junction box, splices or joints may be use		N/A
	Where it is necessary to connect or disconnect cables, sufficient extra length provided for that purpose	Sufficient extra length provided	P
	Terminations of cables adequately supported to prevent mechanical stress at termination points of conductors	Adequately supported	P
	Protective conductor (PE) placed close to associated conductors in order to decrease loop impedance	Close placed	P

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Clause	Requirement	Test Result	Remark Verdict
14.1.3	Conductors of different circuits laid side by side and occupy the same duct or be in same multiconductor cable, provided that such arrangement does not impair proper functioning of respective circuits	Conductor for different circuits laid side by side or occupy the same duct	P
	Where circuits operate at different voltage levels, conductors separated by suitable barriers or insulated for maximum voltage to which any conductor within the same duct is subjected	Enough insulation provided	P
14.2	Identification of conductors:		
14.2.1	Conductors identifiable at each termination point acc. to technical documentation	Identification at each termination	P
	If colour coding of conductors applies, conductors coded over its full length, either by colouring of insulation or coloured markings	GREEN – AND – YELLOW used	P
	As an acceptable alternative, additional identification at selected locations use		N/A
	For safety reasons, colour GREEN or colour YELLOW not use where there is a possibility of confusion with the bicolour combination GREEN – AND - YELLOW	Bicolour combination Green or Yellow used in protective earthing only	P
	GREEN or YELLOW as a single code must not be use, except in bicolour combination GREEN-AND-YELLOW		N/A
14.2.2	Protective conductor readily distinguishable by shape, location, marking or colour	See below	P
	Bicolour combination GREEN- AND- YELLOW use throughout the length of the conductor	Bicolour combination GREEN-AND- YELLOW used throughout the length of the conductor	P
	This colour identification is strictly reserved for the protective conductor, so that it can be easily identified by its shape	Bicolour combination GREEN-AND- YELLOW used throughout the length of the conductor	P
	Ends or accessible positions of a protective conductor clearly identified by graphical symbol or by bicolour combination GREEN- AND-YELLOW	Ends or accessible positions of a protective conductor clearly identified by graphical symbol	P
14.2.3	Where a circuit includes a neutral conductor identified by colour, the colour is LIGHT BLUE	Light-blue used	P
	LIGHT BLUE must not be use for identification of any other conductor where confusion is possible	Not aprovided	N/A
	Where bare conductors are use as neutral conductors and identification by colour is use, they either be coloured by LIGHT BLUE stripes, 15 to 100 mm wide in each compartment or unit, or at each accessible position		N/A

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Clause	Requirement	Test Result	Remark Verdict
	Bare conductor colour coloured LIGHT BLUE over its full length	Over full length	P
14.2.4	Identification of other conductors by colour, number, alphanumeric or a combination of colour and numbers or alphanumeric	Alphanumeric used Black—ac and dc power circuits Red--- ac control circuits Navy-blue---dc control circuits	P
	When numbers are use, they are in Arabic writing ; letters are in Roman characters	Arabic writing are used	P
14.3	Panel wiring supported where necessary to keep it in place	Keep in place and modify from front door,and against flame	P
	Non-metallic ducts permitted only when they are of flame-retardant insulating material	Non-metallic ducts no used	N/A
	Electrical equipment mounted inside cabinets, designed to permit modification of wiring from front of cabinet (see cl. 12.2.1)	Modification of wiring from front of cabinet	P
	Where that is not possible, access, doors or swingout panels provided	Doors provided	P
	Connections to devices mounted on doors or to other movable parts made with flexible conductors (acc. to cl.13.2) to allow for frequent movement of those parts		N/A
	Conductors be anchored to the fixed part and the movable part, independently of the electrical connection		N/A
	Conductors and cables that do not run in ducts are adequately supported		N/A
	Terminal blocks or plug /socket combinations use for control wiring, that extends beyond the enclosure	Incoming supply conductor terminal blocks used	P
	Power cables and cables for measuring-circuits are directly connected to terminals of field located devices		N/A
14.4	Wiring outside enclosures:		
14.4.1	Introduction of cables- or ducts by means of individual glands, bushings etc. into an enclosure must not reduce degree of protection of it	Above IP32	P
14.4.2	Conductors and their connections outside of the enclosure, are enclosed in suitable ducts as described in cl. 14.5		N/A
	Exempt from above requirements are suitably protected cables, installed without ducts and with or without use of open cable trays or cable supporting means	Suitably protected cables used	P
	Fittings use with ducts or multiconductor cables are suitable for the physical environment	Comply with requirements	P
	Flexible conduit or flexible multiconductor cable is used for flexible connections to pendant push-button stations		N/A

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Clause	Requirement	Test Result	Remark Verdict
	Weight of pendant stations is supported by other means than flexible conduits or flexible multicore cables		N/A
	Flexible conduits or flexible multicore cables use, for connections involving small or infrequent movements	Comply with requirements	P
	Flexible cables also permitted to complete the connection of normal stationary motors, position switches and other externally mounted devices	Comply with requirements	P
	Where prewired devices are supplied, the integral cables not enclosed in a duct		N/A
14.4.3	Connection to moving elements of the machine		N/A
	Connections to frequently moving elements of the machine, designed acc. to cl. 13.2		N/A
	Flexible cables and conduits installed so, as to avoid excessive flexing and straining, particularly at the fittings		N/A
	Cables exposed to movement supported in such way, as to prevent mechanical strain at connecting points		N/A
	If this is achieved by use of a loop, it has sufficient length to provide for a bending radius of at least 10 times the diameter of the cable		N/A
	Flexible cables of machines installed or protected in such way, as to minimise the possibility of external damage due to factors, that include the following cable use or potential abuse:		N/A
	being runned over by the machine itself		N/A
	being runned over by vehicles or other machines		N/A
	coming into contact with the machine structure during movements		N/A
	running in and out of cable baskets or, on / off cable drums		N/A
	acceleration and wind forces on festoon systems or suspended cables		N/A
	excessive rubbing by cable collector		N/A
	exposure to excessive radiated heat		N/A
	Cable sheath resistant to normal wear expected from normal movement and effects of atmospheric contaminants		N/A
	Where cables are close to moving parts, space of at least 25mm maintained between moving parts and cables		N/A
	Where that distance is not practicable, fixed barriers provided between cables and moving parts		N/A
	Cable handling system designed such, that lateral cable angle does not exceed 5°, avoiding torsion at the cable when		N/A

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Clause	Requirement	Test Result	Remark Verdict
	being wound on and off the cable drums and		N/A
	approaching and leaving cable guidance's		N/A
	measures taken to ensure that at least two turns of cable remain on the drum		N/A
	cable guides designed such, that the inner bending radius is not less than values given in table 8		N/A
	straight section between two bends at least 20 times the cable diameter		N/A
	construction and supporting means prevent damage to flexible cable under all operating conditions		N/A
14.4.4	Interconnection of devices on the machine	Comply with requirements	P
	In case where several sensors or control elements are connected in series, it is recommended to connect them via intermediate terminals	Comply with requirements	P
	Intermediate terminals are adequately protected	Comply with requirements	P
	Intermediate terminals are indicated on the wiring diagram	Comply with requirements	P
	This enables easy access for testing purposes	Comply with requirements	P
14.4.5	Plug/socket combinations		P
	Plug /socket combinations are of adequate size and have sufficient contact pressure plus a wiping action to ensure electrical continuity		N/A
	Clearances between contacts are adequate for the voltage levels use		N/A
	Plug/socket combinations of such type and installed in such way, as to prevent unintentional contact with live parts at any time		N/A
	Plug/socket combinations are designed so, that PE-circuit connection is made before any live connections are made.		N/A
	This applies vice versa when the plug/socket combinations are disconnected		N/A
	Plug /socket combinations rated for 63 A or above are of interlocked type with an appropriate switch		N/A
	Where more than on plug /socket combination is use for the same electrical equipment, it is clearly marked for identification		N/A
	Plug /socket combinations in accordance with IEC 60309-1 or of a type use for domestic applications shall not be use in control circuits		N/A
14.4.6	If wiring needs to be disconnected for shipment, terminals or plug/socket combinations are provided at the disconnecting points	Comply with requirements	P
14.4.7	Additional wiring for maintenance or repair purposes provided	Comply with requirements	P
14.5	Ducts, connection boxes and other boxes:		

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Clause	Requirement	Test Result	Remark Verdict
14.5.1	Ducts provide a minimum degree of protection of IP33	Comply with requirements	N/A
	All sharp edges, flash, burrs, rough surfaces or threads which the insulation of conductors may come into contact, removed from ducts and conduits	Comply with requirements	P
	In order to avoid confusion between conduits for electrical installation and those for oil, water or air, either physically separated or suitably identified	Comply with requirements	P
	Ducts or cable trays rigidly supported and positioned at sufficient distance from moving parts	Comply with requirements	P
	Ducts or cable trays mounted at least 2 meters above the working surface in areas where human passage is required		N/A
	Ducts provided only for mechanical protection (see cl. 8.2.3)	Comply with requirements	N/A
	Cable trays which are partially covered, not to serve as cable trays or installation trunking	Comply with requirements	N/A
	Conductors and cables suitable for installation in cable trays	Comply with requirements	N/A
14.5.2	Cable trays dimensioned or located such as to enable easy access for installation of additional conductors and cables	Comply with requirements	P
	Consideration given on percentage of filling of such ducts.	Comply with requirements	P
14.5.3	Rigid metal conduits or trays consist of galvanised steel or corrosion-resistant material, suitable for the environmental conditions.		N/A
	Application of cable trays of different metal avoided, due to electrolytic corrosion		N/A
	Installation conduits secured, held in place and supported at each end		N/A
	Joints and fittings compatible with conduits and appropriate for its application		N/A
	Conduit-bends fabricated such, as to avoid damage or reduction of internal cross-section		N/A
14.5.4	Flexible metallic conduits and fittings consist of flexible metal tubing or wire mesh armour.		N/A
	They are suitable for its application and environmental conditions		N/A
14.5.5	Flexible non-metallic conduits are resistant to buckling and with similar characteristics as the sheath of multicore cables	Comply with requirements	P
	They shall be suitable for its application and environmental conditions	Comply with requirements	P
	Joints and fittings compatible with conduits and appropriate for its application	Comply with requirements	P

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Clause	Requirement	Test Result	Remark Verdict
14.5.6	Cable trunking systems outside of enclosures are rigidly supported and kept clear of moving and contaminating parts of the machine		N/A
	Covers of cable trunking designed such, as to overlap at both sides of cable trunking (see cl. 14.5.6)		N/A
14.5.7	Installation of cables layed in cable trays with covers permitted within the machine-foundations, providing that they are completely closed and separated from coolant and lubrication systems (see cl. 14.5.6)		N/A
14.5.8	Cable connection boxes and junction boxes use for wiring purposes are readily accessible for maintenance (see cl. 12.3)	Comply with requirements	P
	They provide protection against ingress of solids or liquids, taking into account external influences during operation of the machine (see cl. 12.3)	Comply with requirements	P
	Junction boxes not have openings for cable entries and are designed so, as to avoid ingress of entrained dust, lubricants and coolant	Comply with requirements	P
14.5.9	Motor terminal boxes use for motor cable connection and for devices attached to the motor	Attached to the motor	P
15.	**ELECTRIC MOTORS AND ASSOCIATED EQUIPMENT**		N/A
15.1	Electric motors are conform to EN 60034-		N/A
	Electric motors and associated equipment protected against following risks:		
	overcurrent (see cl. 7.2)		N/A
	thermal overload (see cl. 7.3)		N/A
	overspeed (see cl. 7.6)		N/A
	Compliance ensured with the requirements stated (see clauses 5.3, 5.4, 5.5, 7.5, 7.6 and 9.4)		N/A
	Motor control equipment located and mounted acc. to cl. 12		N/A
15.2	Selection of motor enclosure recommended acc. to EN 60034-5		N/A
	Degree of protection at least IP23		N/A
	Incorporated motors mounted such, as to provide adequate protection against mechanical damage		N/A
15.3	Dimensions of motors conform to those given in IEC regulations (see EN 60072-1 and EN 60072-2)		N/A
15.4	Each motor with associated coupling, belt, pulley or chain mounted such, as to provide adequate protection and easy access for inspection, maintenance, adjustment or alignment, lubrication and replacement		N/A
	Motors mounted such, as to allow easy access to all terminal boxes		N/A

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Clause	Requirement	Test Result	Remark Verdict
	Motors mounted such, as to ensure proper cooling Temperature rise to be within limits of relevant insulation class		N/A
	Temperature rise within limits of relevant insulation class		N/A
	If possible, motor compartments stay clean and dry and when required, ventilated directly to the outside of the machine		N/A
	Motor-vents at an acceptable level and designed such, as to avoid ingress of swarf, dust or water spray		N/A
	No opening between motor compartment and any other compartment, which does not fulfil the requirement for motor compartments		N/A
15.5	Electric motors selected acc. to service and environmental conditions		N/A
	Design criteria for evaluation include: type of motor and		N/A
	type of duty cycle (see IEC 60034-1) and		N/A
	fixed speed or variable speed operation and		N/A
	mechanical vibrations and		N/A
	type of converter for motor speed control and		N/A
	influence of the harmonic spectrum of voltage and/or current when supplied from static converter on the temperature rise and		N/A
	method of starting and possible influence of inrush current		N/A
	variation of counter torque load with time and speed		N/A
	influence of loads with large inertia and		N/A
	influence of constant torque or constant power operation and		N/A
	possible need of inductive reactors between motor and converter		N/A
15.6	Operation of overload or overcurrent protective devices for mechanical brake-actuators initiate simultaneous de-energisation(release) of associated machine actuators		N/A

16	**ACCESSORIES AND LIGHTING**		N/A
	No accessories and lighting		
16.1	Where the machine or its associated equipment is provided with socket-outlets for auxiliary equipment, the following will apply:		
	socket-outlets are conform to regulations	Not applicable	N/A
	if not possible, they are clearly marked with voltage and current ratings		N/A
	continuity of protective bonding circuit to be ensured		N/A

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Clause	Requirement	Test Result	Remark Verdict
	all unearthed conductors connected to socket-outlets, protected against overcurrent		N/A
	when required, protection against overload in accordance with cl. 7.2 and cl. 7.3 separately from protection of other circuits		N/A
	if power supply to socket-outlets is not disconnected, than requirements of cl.5.3.5 apply		N/A
16.2.1	Connection to PE-circuit acc. to cl. 8.2.2		N/A
	ON-OFF switch not incorporated in lampholder or in flexible connecting cord		N/A
	Stroboscopic effects from lights avoided		N/A
	If fixed lighting is provided in an enclosure, electromagnetic compatibility (EMC) taken into account		N/A
	Application of EMC requirements acc. to principles stated in cl. 4.4.2		N/A
16.2.2	Nominal voltage of local lighting circuits not exceeding 50 V		N/A
	If higher voltages are applied, value not exceeding 250 V between conductors		N/A
	Lighting circuits supplied from one of the following sources:		
	from a dedicated isolating transformer connected to load side or		N/A
	overcurrent protection provided in secondary circuit or		N/A
	a dedicated isolating transformer connected to line side provided or		N/A
	source permitted for maintenance purpose or		N/A
	lighting circuits placed in control enclosures only or		N/A
	overcurrent protection provided in secondary circuit or		N/A
	from a machine-circuit with dedicated overcurrent protection or		N/A
	from an isolating transformer connected to line side of supply disconnecting device, when a dedicated primary disconnecting means and a secondary overcurrent protection are provided or		N/A
	for an externally supplied lighting circuit, which is only permitted in a control enclosures		N/A
	where fixed lighting is out of reach for operator during normal operations, provisions of this subclause do not apply		N/A
16.2.3	local lighting circuits protected		N/A
16.2.4	adjustable lighting fittings suitable for the physical environment provided		N/A
	lampholders in accordance with relevant IEC-publications and		N/A

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Clause	Requirement	Test Result	Remark Verdict
	designed of an insulating material protecting the lamp cap, as to prevent unintentional contact		N/A
	reflectors supported by a bracket and not by the lampholder		N/A
	where fixed lighting is out of reach for operator during normal operations, provisions of this subclause do not apply		N/A
17.	**MARKING, WARNING SIGNS AND REFERENCE DESIGNATIONS**		
17.1	Electrical equipment marked with supplier's name, trade mark or other identifying symbol and if required with a certification mark	See label	P
	Warning signs, nameplates, markings- and identification plates of sufficient durability to withstand the physical environment involved	Metal label used	P
17.2	Enclosures which do not clearly show otherwise, that they contain electrical devices, are marked with a black lightning flash on a yellow background within a black triangle	A black lightning flash on a yellow background within a black triangle used on front door	P
	Warning sign plainly visible on the enclosure, door or cover-plate	Enclosure,door, or cover-plate used	P
	The warning sign may be omitted for:		
	an enclosures equipped with a supply disconnecting device or		P
	an operator - machine interface or for a control station or		P
	a single device with its own enclosure		P
17.3	Control devices, visual indicators and displays use for man - machine interfaces clearly and durably marked with regard to their functions either on, or adjacent to it	Marking clear and durable	P
	such markings as agreed between user and supplier		N/A
	preference given to the use of standard symbols	According to standard	P
17.4	Control equipment legibly and durably marked so that it is plainly visible after equipment installation	On control equipments, marking legible and durable	P
	Nameplates attached to enclosures shall contain the following information:		
	name or trade mark of supplier and	See marking plate	P
	certification mark, when required and	CE mark used	P
	serial number, where applicable and	See nameplate	P
	rated voltage and	See nameplate	P
	number of phases and	See nameplate	P
	frequency (if AC) and	See nameplate	P
	Power or full-load current for each supply	See nameplate	P
	short-circuit interrupting capacity of overcurrent protective device, where furnished as part of device of equipment	See circuit diagram	P
	electrical wiring diagram number(s) or number of index to electrical drawings	See circuit diagram	P

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Clause	Requirement	Test Result	Remark Verdict
	Full-load current shown on nameplate not less than combined full-load currents of all motors and other electrical loads, that are in operation at the same time under normal conditions of use		N/A
	for unusual loads or duty cycles, thermal equivalent current included in full-load current, specified on the nameplate		N/A
	if a single motor controller is use, that information provided instead, on the machine nameplate		N/A
17.5	All enclosures, assemblies, control devices and components plainly identified with the same reference designation as shown in technical documentation	See circuit diagram	P
	All enclosures, assemblies, control devices and components in accordance with IEC 61346-1	Comply with requirements	P
	where size or location precludes the use of an individual reference designation, the group reference designation is use		N/A
	Requirements of above subclause not applicable to machines, on which the equipment comprises a single motor, motor-controller, pushbutton-station(s) and working light(s) only		N/A
18	**TECHNICAL DOCUMENTATION**		P
18.1	Information necessary for installation, operation and maintenance of electrical equipment for a machine supplied by means of drawings, wiring diagrams, charts, tables and instruction manuals	See instruction	P
	Information provided in an agreed language	English	
	Equipment supplier make sure, that documentation referred to under cl.18 will be provided with each supplied machine	See instruction	P
18.2	Information provided with electrical equipment shall include:		
	a) A clear, comprehensive description of the equipment, installation and mounting instructions and information regarding connection to the electrical supply(ies)	See instruction	P
	b) Electrical supply requirements	See instruction	P
	c) Information about the physical environment	See instruction	
	d) Overview (block) diagram(s)	See instruction	P
	e) Circuit / wiring diagram(s)	See instruction	P
	f) information about:		
	1) Software program documentation/ listing	See instruction	P
	2) Sequence of operation(s)	See instruction	P
	3) Frequency of inspection	See instruction	P
	4) Frequency and method of functional testing	See instruction	P
	5) Guidance on the adjustment, maintenance and repair, particularly of the protective devices and circuits	See instruction	P
	6) Parts list and recommended spare	See instruction	P

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Clause	Requirement	Test Result	Remark Verdict
	g) Description of safeguards, interlocking functions and interlocking of separating safeguards for dangerous movements of co-ordinated operating machines	See instruction	P
	h) Description of safeguards and means provided for applications with to suspend the safeguards	See instruction	P
18.3	Documents prepared in accordance with requirements of cl.18.4 to cl.18.10 and relevant parts of EN 61082	See instruction	P
	Reference designation system to be in accordance with EN 61346-1	See instruction	P
	For referencing to different documents, the supplier has to select one of following methods:		
	Each of the documents carry a cross-reference with document numbers of all other documents belonging to the electrical equipment or		N/A
	All documents to be listed with document numbers and titles in a drawing or document list		N/A
	The first method use only where the documentation consists of a small number of documents		N/A
18.4	Technical documentation contains as a minimum, information on the following:		
	Normal operating conditions of electrical equipment incl. expected conditions of electrical supply and where appropriate about the physical environment	See instruction	P
	Handling, transportation or storage requirements	See instruction	P
	Inappropriate use(s) of the equipment	See instruction	P
	That information presented as a separate document or as part of the installation or operation documentation	See instruction	P
	Documentation also contains information regarding load currents, peak starting currents and permitted voltage drops	See instruction	P
	Above information included either in the system- or circuit-diagram(s)	See instruction	P
18.5	The installation diagram provides all necessary information regarding preliminary work for the setting-up of the machine	See installation diagram	P
	In complex cases, it is necessary to refer to the assembly drawings for details	See installation diagram	P
	Recommended routing, type and cross-sectional areas for the conductors of the supply cables installed on site clearly indicated	See installation diagram	P
	Necessary data or choosing type, characteristics, rated currents and setting for the overcurrent protective devices for the supply conductors stated (see cl. 7.2.2)	See installation diagram	P

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Clause	Requirement	Test Result	Remark Verdict
	Detailed information provided about size, purpose and location of any cable ducts within the foundation, that are provided by the user	See installation diagram	P
	Detailed information provided about size, type and purpose of cable ducts, trays or supports between machine and associated equipment	See installation diagram	P
	Diagram to indicate where space is required for removal or servicing of electrical equipment	See installation diagram	P
	Where appropriate, an interconnection diagram or table provided	See installation diagram	P
18.6	Where necessary a block diagram provided for explanation of the principle of operation	See block diagram	P
	Block diagram symbolically represents the electrical equipment with its functional interrelationships without showing all the interconnections	See block diagram	P
	The function diagram use as either part of or addition to the block diagram	See block diagram	P
18.7	Circuit diagrams show the electrical circuits on the machine and its associated electrical equipment	See circuit diagram	P
	Any graphical symbol not shown in EN 60617 and EN 60417-1 must be separately shown and described on the wiring diagrams or supporting documents	See circuit diagram	P
	The symbols and identification of components consistent throughout all documents and on the machine	See circuit diagram	P
	Where appropriate, a diagram provided, showing the interface terminals and connections	See circuit diagram	P
	The diagram shows a reference to the detailed circuit diagram of each unit	See circuit diagram	P
	Switch symbols shown on the circuit diagrams with all supplies turned off and with the machine and its electrical equipment in normal starting condition	See circuit diagram	P
	Conductors identified acc. to cl.14.2	See circuit diagram	P
	Characteristics relating to the function of the control device and components which are not evident from their symbolic representation, included on the diagrams adjacent to the symbol or referenced to a footnote	See circuit diagram	P
18.8	Technical documentation containing an operating manual, outlining proper procedures for set-up and use of equipment	See instruction	P
	Particular attention given to safety measures provided and the improper methods of operation, that are anticipated	See instruction	P

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Clause	Requirement	Test Result	Remark Verdict
	Detailed information provided on methods for equipment programming, program verification and additional safety procedures	See instruction	P
18.9	Technical documentation to contain a maintenance manual, detailing proper procedures for adjustment, servicing or preventive inspection and repair	See maintenance instruction	P
	Recommendations regarding maintenance or service records are part of it	See maintenance instruction	P
	Methods for the verification of proper operation provided	See maintenance instruction	P
18.10	The spare parts list comprises as a minimum information for ordering of spares or replacement of parts which are required for preventive or corrective maintenance and recommended spares	See table 4.2 List of Components	P
	The spare parts list has to provide for each item the following information:		
	reference designation use in documentation and	See table 4.2 List of Components	P
	type designation and	See table 4.2 List of Components	P
	supplier and alternative sources where available and	See table 4.2 List of Components	P
	general characteristics where appropriate	See table 4.2 List of Components	P
19	**TESTING AND VERIFICATION**		P
19.1	Verification, that electrical equipment is in compliance with the technical documentation	See below	P
	The relevant tests for the particular machine type will be given in the dedicated product standard		N/A
	In case of absence of such product standards, the appropriate tests include the ones listed under cl. 19.2 – 19.6	See below	P
19.2	After completion of installation and electrical connection, continuity of the PE- circuit verified by a loop impedance test	(See appended table 19.2)	P
	For small or pre-manufactured machines or parts of it, with protective bonding loops not exceeding approx. 30 meters, and where the machine cannot be connected to the power supply for loop impedance tests, following method is appropriate:		
	Verify continuity of the PE-circuit by injecting a current of =10 A with 50Hz or 60Hz supply, derived from a PELV source	7A current, 50/60Hz applied	P
	Test made between PE- terminal and relevant points of PE-circuit (see cl. 5.2)	Incoming PE an relevant points of PE	P
	Measured voltage between PE-terminal and points of test not exceed values given in table 9	Not exceeding the values in table 9	P

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Clause	Requirement	Test Result	Remark Verdict
19.3	Insulation resistance measured with 500VDC between power circuit conductors and PE-circuit is to be =1.0 MΩ	(See appended table 19.3)	P
	Insulation value must be = 1.0 MΩ	(See appended table 19.3)	P
	Test made on individual sections of complete electrical installation	(See appended table 19.3)	P
	For certain parts of the electrical equipment, a lower minimum insulation value is permitted, but not less than 50 kΩ		N/A
19.4	Electrical equipment withstand a test voltage applied for a period of at least 1 second between live conductors of all circuits and the PE-circuit	(See appended table 19.4)	P
	Exempt from above requirements are circuits intended to operate at, or below PELV voltages		N/A
	The test voltage is defined as having:		
	a value of twice the rated supply voltage of the equipment or 1000 VAC, which ever applies	(See appended table 19.4)	P
	Supplied from a transformer with a min. output rating of 500VA	100VA voltage tester applied	P
	a frequency of 50Hz or 60Hz,	50/60Hz applied	P
	Components not rated to withstand thes test voltage are disconnected during testing		N/A
19.5	Tests for protection against re dua vol es are performed to ensure com ian e w th c. 6.2.4	Comply with clause 6.2.4	P
19.6	Functions tests of the lect ca quipment performed, particularly thos r lated to safety and safeguarding	(See appended table 19.6)	P
19.7	Where a portion of the machin and its associated equipment s changed or modified, that portion is reverified and retested as appropriate (see cl. 19.1)		N/A

Table 4.2	List of Components				P
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity[1)] 2)
Motor-compressor	Panasonic Wanbao Appliances Compressor (Guangzhou) Co., Ltd	9KD420ZAA28	280VDC; 50Hz; R32/R410A	EN 60335-1 EN 60335-2-34 EN 60335-2-40	UL SA4615
Fan motor	Jiangmen LT Motor Co., Ltd	RD80HB	DC310V;80W;8P; ClassE; 850r/min	EN 60335-2-40	Tested with appliance
Alternative	Jiangsu Match-Well Electrical Products Co.,Ltd	MWS100-10K-PD6	DC310V;100W;10P; ClassB; 850r/min	EN 60335-2-40	Tested with appliance
Electric expansion valve I	Fujikoki Suzhou Co., Ltd.	CBM-BD18FKS-7（ D18FKS-7R）	DC12V	EN 60335-2-40	Tested with appliance
Alternative	DANFOSS (Tianjin) Ltd.	ETS6-18（034G5024）	DC12V	EN 60335-2-40	Tested with appliance
Electric expansion valve II	Fujikoki Suzhou Co., Ltd.	CBM-BD13FKS-1（ D13FKS-1R）	DC12V	EN 60335-2-40	Tested with appliance
Alternative	SAGINOMIYA SEISAKUSHO,INC	UHV-4P204	DC12V	EN 60335-2-40	Tested with appliance
4-ways valve	zhejiang sanhua climate & appliance controls group co.,ltd	SHF-11H-15D1	220-240V; 50/60Hz; 4.5/3.5W; Class B	EN 60730-1	VDE 40048077
Alternative	Zhejiang Dunan Artificial Environment Co., Ltd.	DSF-11B-1106	220-240V; 50/60Hz; 7/5W; Class B	EN 60730-1	VDE 40013212
Water pump	SHIMGE PUMP INDUSTRY (JIANGSU) CO., LTD.	APM25-12-130E FPWM1	230V~; 50/60Hz; 180W; 1.8A; TF95; Class F	EN 60335-1 EN 60335-2-40	Tested with appliance
Alternative	HEFEI XINHU CANNED MOTOR PUMP CO.,LTD	GPA25-11H/130	140W;230VAC;50/60Hz	EN 60335-1:2012	TUV R 50471089
Terminal block	Foshan Shunde Huangzhong Electrical Appliances Co.,Ltd.	TC1-1	250V; 2.5 mm²	EN 60335-2-40	Tested with appliance
Terminal block	Foshan Shunde Huangzhong Electrical Appliances Co.,Ltd.	ET0601	660V; 6 mm²	EN 60335-2-40	Tested with appliance

Internal wire	Guangdong Yongrui Cable Technology Co., Ltd	UL1015	600V; 105°C 20-8AWG	EN 60335-2-40	UL E204893
Alternative	Hichain Electricity (Zhaoging) Co Ltd	UL1015	600V; 105°C 20-8AWG	EN 60335-2-40	UL E304337
Alternative	HESHAN CITY TEHSING HUANCHIU ELECTRIC CABLE CO LTD	UL1015	600V; 105°C 20-8AWG	EN 60335-2-40	UL E229340
Low pressure sensor	CHANGZHOU MATCH-WELL PRESSURE CONTROL TECHNIQUE CO LTD	DYK-BA34.5-DV5-4.5	5VDC±10%; 0-34.5 barG; 0-650,0 psiG; T135℃	EN 60335-2-40	Tested with appliance & UL E502183
High pressure switch	Changzhou Match-well Pressure Control Technique Co., Ltd.	YK-4.4/3.6	Open: 3.6MPa; Off: 4.4MPa; 3A; 250VAC; T85; 1E4	EN 60730-1 EN 60730-2-6 EN 60079-15	VDE 40000571
Flow switch	Kaobo Electrical (Shanghai) Co., LTD.	VKS/G65/WJ	DC24V; 1A	EN 60335-2-40	Tested with appliance
Alternative	Kaobo Electrical (Shanghai) Co., LTD.	WFS-27	DC24V; 1A	EN 60335-2-40	Tested with appliance
DC Power adapter	Moso Power supply Technology Co.,Ltd	MS-V1000R120-012H0-DE	Input:100-240VAC;50/60Hz;0.3A max Output:8-12VDC; 1.0A	EN 62368-1:2014/A11:2017	TUV TR 6821020084303
Main PCB material	Kingboard Laminates Holdings Limited	KB-6160C	FR4; V-0	EN 60065 EN 6005205 EN 60065 EN 60065	VDE 40020729
Alternative	SHANDONG JINBAO ELECTROACOUSTIC CO LTD	XPC-ZD-90	FR4 V-0	EN 60065 EN 6005205 EN 60065 EN 60065	VDE 40032178
Varistor	BestBright Electronics Co. Ltd	561KD14	AC560V; -40 to 85°C	EN 61051-2 EN 61051-2-2	VDE 40027827

Alternative	Dongguan City Dafu Electronics Co. Ltd.	14D561K	AC560V; -40 to 85°C	EN 61051-2 EN 61051-2-2	VDE 40050909
Alternative	Cerglass MFG inc（standby）	14D561K	AC560V; -40 to 85°C	EN 61051-2 EN 61051-2-2	VDE on page 30 40028836
Y1 capacitor	Dongguan City Dafu Electronics Co. Ltd	NDF CT7 Y1	400VAC;50/60Hz;100-4700pF	EN 60384-14	VDE 40041523
Alternative	XIAMEN WANMING ELECTRONICS CO.,LTD.	HJ, CK, UK	400VAC;50/60Hz;100-4700pF	EN 60384-14	VDE 40034438
Y2 capacitor	Dongguan City Dafu Electronics Co. Ltd	CT7 Y2	300VAC 4700pF	EN 60384-14	VDE 40041521
Alternative	XIAMEN WANMING ELECTRONICS CO.,LTD.	HM,CM, UM	300VAC 4700pF	EN 60384-14	VDE 40034436
X capacitor	Shantou High-New Technology	MPX	X2 310VAC 0.1uF/0.47uF/1uF	EN 60384-14	VDE 40034679
Alternative	Dongguan City DAFU ELECTROACOUSTIC CO LTD	MPX	X2 310VAC 0.1uF/0.47uF/1uF	EN 60384-14	VDE 40044620
Alternative	Ultra Tech Xiphi	HQX	X2 310VAC 0.1uF/0.47uF/1uF	EN 60384-14	VDE 40024534
Alternative	Dong Guan Hongfarad Electronics Co. Ltd.（standby）	HMKP	X2 310VAC 0.1uF/0.47uF/1uF	EN 60384-14	VDE 40044173
Alternative	FOSHAN SHUNDE BEIJIAO HUA DA ELECTRIC INDUSTRIUL CO LTD（standby）	HD MKP	X2 310VAC 0.1uF/0.47uF/1uF	EN 60384-14	VDE 40027182
Fuse	Dongguan Better Electronics Technology Co.,ltd	616	40A 250V	EN 60127-1 EN 60127-2	UL E300003
Relay I	Sanyou Corporation Limited	SJ-SH-112DM2	5A 250V	EN 61810-1	VDE 40002146
Alternative	XIAMEN HONGFA ELECTROACOUSTIC CO LTD	HF32FV系列	5A 250V	EN 61810-1	VDE 40012204
Alternative	Dongguan Churod Electronics Co Ltd	A1-S-112DA	5A 250V	EN 61810-1	TUV

				EN 6180-1	R50174892
Alternative	ZHEJIANG MEISHUO ELECTRIC TECHNOLOGY CO.,LTD	MPD-S-112-A	5A 250V	EN 61810-1 EN 6180-1	TUVR50184948
Relay II	XIAMEN HONGFA ELECTROACOUSTIC CO LTD	HF7FD-T	16A 250V	EN 61810-1 EN 6180-1	VDE 50457893
Alternative	Sanyou Corporation Limited	SM-SH-112DM-F	16A 250V	EN 61810-1 EN 6180-1	VDE 40031353
Alternative	Dongguan Churod Electronics Co Ltd	A16-V-112DA2F	16A 250V	EN 61810-1 EN 6180-1	TUV R50461636
Relay III	Dongguan Churod Electronics Co Ltd	CHS01-S-112LA	30A 277V	EN 61810-1 EN 6180-1	TUV R50271657
Alternative	XIAMEN HONGFA ELECTROACOUSTIC CO LTD	HF165F	50A 250V	EN 61810-1 EN 6180-1	TUV R50463438
Supplementary information: 1) Provided evidence ensures the agreed level of compliance. See OD-CB2039. 2) License available upon request.					

19.2	TABLE: Continuity of the protective bonding circuit			N/A
Location	Current(A)	Frequency(Hz)	Measured voltage(V)	Limit(V)

19.4	TABLE: voltage tests	P
test voltage applied between:	test voltage (V) a.c. / d.c.	breakdown Yes / No
The conductors of all circuits and the protective bonding circuits	1000 a.c., 50Hz, 1min	No
Between power circuit conductor and protective bonding circuit	1000 a.c., 50Hz, 1min	No
supplementary information		

Attachment 1: Photos of Product

Photo 1

Photo 2

Photo 3


Panasonic
9KD420ZAA28
Panasonic Corporation
R32/R410A
DC MOTOR 280V
S/N:K42AD F0000374 7975841
松下．万宝（广州）压缩机有限公司 Made in China
Panasonic Wanbao Appliances Compressor (Guangzhou) Co., Ltd.
WARNING 注意（维修，检查时必须遵守）
Danger of Electric Shock
• Earth the equipment.
• Disconnect power before work.
• Mount the terminal cover in place.
有触电的危险
• 须在空调主机上接入地线。
• 操作前须切断全部电源。
• 接线端子安装之后方可通电。
Explosion or Fire
火灾的危险
Hot Surface
with bare hands
9KD420ZAA28-V5F0000374
DRAFT

Photo 4

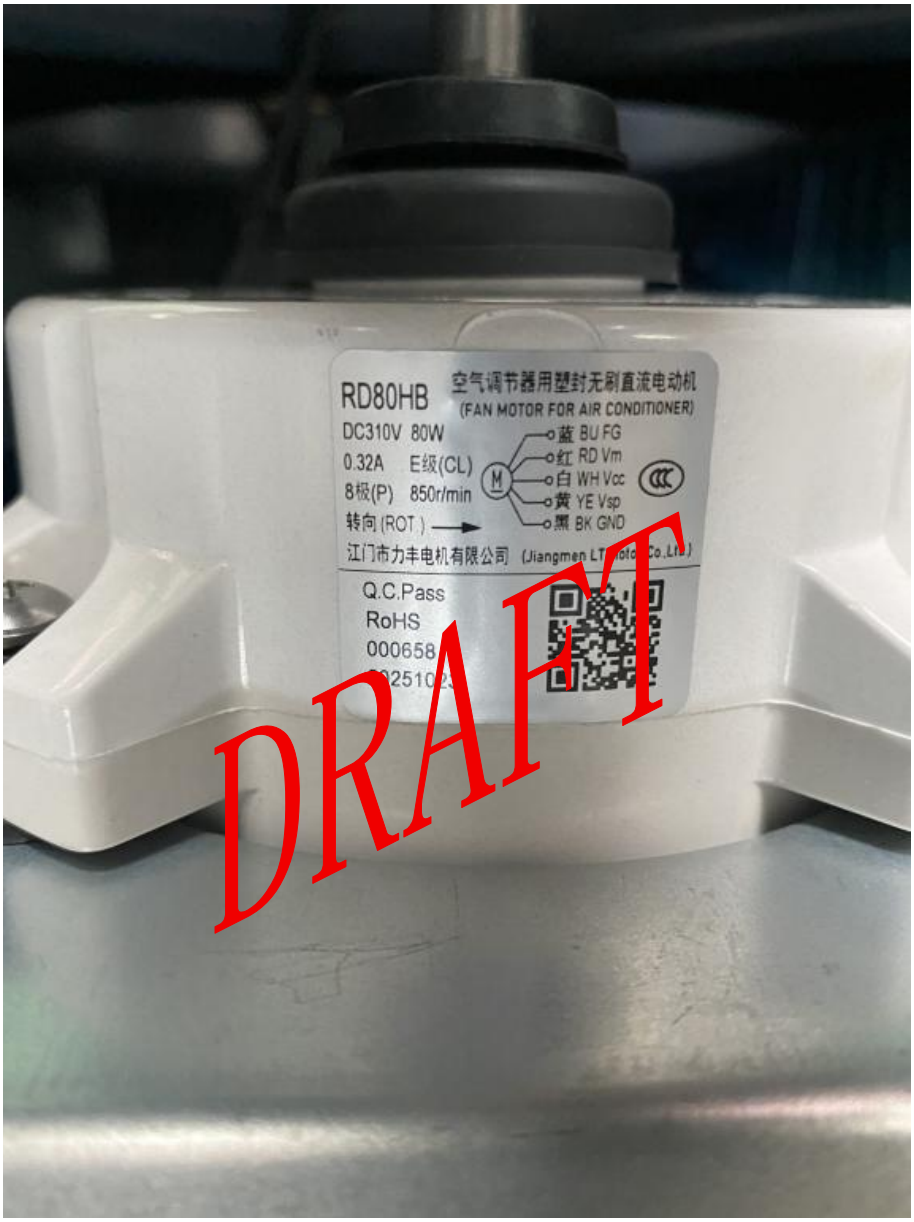

Photo 5

.....End of Report.....