Test Report

（Technical Construction File）

File No.:	TTCF0102-MD
Revision Date:	Jan. 21, 2025
Applicant/Holder:	GRACE GROUP CO., LTD.
Address:	24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China.
Manufacturer:	GRACE GROUP CO., LTD.
Address:	24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China.
Product Type:	Tractor
Models:	GR-25-1, GR-25-2, GR-25-1P, GR-35-1, GR-35-2, GR-35-1P, GR-50, GR-50P, GR-60, GR-60P, GR-80, GR-80P, GR-100, GR-100P, GR-120, GR-120P, GR-130, GR-130P, GR-140, GR-140P, GRA-01, GRA-02, GRA-03, GRA-04, GRA-05, GRA-06, GRA-07, GRA-08, GRA-09
According to:	MD 2006/42/EC

Test result	PASS

Date: Jan. 21, 2025
Tested by: Kelly Sun

Approved By: Jeff Zhang

TEST REPORT
EN ISO 12100:2010 EN 60204-1:2018 EN ISO 4254-1:2015/A1:2021
Safety of machinery - General principles for design - Risk assessment and risk reduction
Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Report Reference No......:	TTCF0102-MD
Tested by (Printed name and Signature).....:	Kelly Sun
Approved by (Printed name and Signature).....:	Jeff Zhang
Date of issue.....:	Jan. 21, 2025

Testing Laboratory Name.....:	Shanghai JAT Enterprise Management Consultation Co., Ltd.
Address .....:	No. 7222 lane, the North Jiasong Road, Jiading District, Shanghai,China
Test cation.....:	24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China
Applicant's name.....:	GRACE GROUP CO., LTD
Address.....:	24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China.
Manufacturer's name.....:	GRACE GROUP CO., LTD
Address.....:	24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China.

Test specification:

Standard.....:	EN ISO 12100:2010 EN 60204-1:2018 EN ISO 4254-1:2015/A1:2021
Test procedure.....:	IEC
Procedure deviation.....:	N/A
Non-standard test method.....:	N/A
Test Report Form No......:	TTCF0102-MD
Test Report Form(s) Originator....:	SEV
Master TRF.....:	Dated 01-15

Test item description.....:	Tractor
Trade Mark.....:	/
Model/Type reference.....:	GR-25-1, GR-25-2, GR-25-1P, GR-35-1, GR-35-2, GR-35-1P, GR-50, GR-50P, GR-60, GR-60P, GR-80, GR-80P, GR-100, GR-100P, GR-120, GR-120P, GR-130, GR-130P, GR-140, GR-140P, GRA-01, GRA-02, GRA-03, GRA-04, GRA-05, GRA-06, GRA-07, GRA-08, GRA-09

Copy of marking plate

Product Name: Tractor

Model: GR-25-1

CE

GRACE GROUP CO., LTD.
Address:24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China.

MADE IN CHINA

Summary of testing:
The tested equipment was found to be in compliance with standard EN ISO 12100:2010
EN 60204-1:2018 .EN ISO 4254-1:2015/A1:2021

Test items particulars:	
1.Special conditions	
a)Is the machine to be used in the open air?	No
b)Will the machine use , process or produce explosive or flammable material?	No
c)Is the machine for use in potentially explosive or flammable atmospheres	No
d)Can the machine present special hazards when producing or consuming certain materials	No
e)Is the machine use for mines	No
2.Electrical supplies and related conditions	
a)Anticipated voltage fluctuations(if more than ±10%)	Yes
b)Anticipated frequency fluctuations (if more than ±2%)	No
c) Indicate possible future changes in electrical equipment that will require an increase in the electrical supply requirements	Yes
d)Specify voltage interruptions in supply if longer than specified in Clause 4 where electrical equipment has to maintain operation under such conditions.	No
3.Physical environment and operating conditions	
a)Electromagnetic environment	Industrial environment
Special conditions or requirements	No
b)Ambient temperature range	0℃~40℃
c) Humidity range	/
d)Altitude	＜1000m
e) Special environmental conditions	No
f)Radiation	No
g)Vibration, shock	Yes
h)Special installation and operation requirements	Yes
i)Transportation and storage	Yes
4.Incoming electrical supplies	
a)Nominal voltage(V)	/
Prospective short-circuit current at the point of supply to the machine (kA r.m.s.)	No
b)Type of power supply earthing	TN
c)Is the electrical equipment to be connected to a neutral supply conductor?	No

d)supply disconnecting device	YES
Is disconnection of the neutral conductor required?	No
Is a removable link for disconnecting the neutral required?	No
Type of supply disconnecting device to be provided	YES
5. protection against electric shock	
Test items particulars:	
a)For, which of the following classes of persons is access to the interior of enclosures required during normal operation of the equipment?	Electrically skilled persons
b)Are locks with removable keys to be provided for securing the doors or covers?	Yes
6. Protection of equipment	
a)Will the user or the supplier provide the over current protection of the supply conductors?	Yes
Type and rating of over current protective devices	See technical file
b)Largest(kW) three-phase a.c. motor that may be started direct-on-line	/
c) May the number of motor overload detection devices be reduced?	No
7. Operation	
For cableless control systems, specify the time delay before automatic machine shutdown is initiated in the absence of a valid signal.	No
8. Operator interface and machine-mounted control devices	
Special colour preferences:	No
9. Controlgear	
Degree of protection of enclosures or special conditions:	/
10. Wiring practices	
Is there a specific method of identification to be used for the conductors?(see 13.2.1)	YES
Type	By a combination of numbers and alphanumerics
11. Accessories and lighting	
a)Is a particular type of socket-outlet required?	No
b)Are the socket-outlets for maintenance to be provided with additional protection by the use of Residual Curret protective Devices(RCD)?	No
c)Where the machine is equipped with local lighting:	No
12. Marking, warnings and reference designations	
a)Functional identification	Yes
b)Inscriptions/special markings	On electrical equipment, in English

c)Mark of certification	Yes, CE
13. Technical documentation	
a) Technical documentation	English
b) Size location and purpose of ducts, open cable trays or cable supports to be provided by the user	Yes
c)Indicate if special limitations on the size or weight which affect the transport of a particular machine or controlgear assemblies to the installation site	Yes
Test items particulars:	
-maximum dimensions:	/
-maximum weight:	/
d)In the case of specially built machines, is a certificate of operating tests with the loaded machine to be supplied?	No
e)In the case of other machines, is a certificated of operating type tests on a loaded prototype machine to be supplied?	Yes
test case verdicts:	
test case does not apply to the test object:	N/A
- test object does meet the requirement:	P (Pass)
- test object does not meet the requirement:	F (Fail)
Testing	
Date of receipt of test item:	Jan. 14, 2025
Date (s) of performance of tests:	Jan. 14, 2025 to Jan. 21, 2025

General remarks:

The test results presented in this report relate only to the object tested.

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"(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.

NO.	*Hazards source*	S	A	G	W	Level
10.1	Failure/disorder of the control system	*1*	*1*	*1*	*1*	-
Where	**the control system of the machine**					
When	*Mechanical hazards associated with selected machine movement during setting, cleaning*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Only authorized person can use the machine. *2. Make reference to the instruction manual before using this machine.* *3. Check before operation.* 4. *Periodic maintenance.*		*1*	*1*	*1*	*1*	-

NO.	*Hazards source*	S	A	G	W	Level
14	Failure of the control circuit	*1*	*1*	*1*	*1*	-
Where	**In the wireway**					
When	*Unexpected movements of machine during setting, cleaning or maintenance*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Checking before operation. *2. Make reference to the instruction manual before operate this machine.* 3. *Daily/periodic inspection and maintenance.*		*1*	*1*	*1*	*1*	-

NO.	*Hazards source*	S	A	G	W	Level
15	Errors of fitting	*1*	*1*	*1*	*1*	-
Where	**At machine**					
When	*machine elements fail or swing unexpectedly during process control, tool mounting, maintenance*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Only authorized person can use the machine. *2.Make reference to the instruction manual before using this machine.* *3.Check before operation.* *4. Periodic maintenance.*		*1*	*1*	*1*	*1*	-

2. EN ISO 12100:2010 part 6-7

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
6	Risk reduction		P
6.1	General		P
	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 measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2).	Appropriate machine design has been performed by the manufacturer	P
6.2	Inherently safe design measures		P
6.2.1	General		P
	Inherently safe design measures are the first and most important step in the risk reduction process because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding may fail or be violated and information for use may not be followed.	Appropriate machine design has been performed by the manufacturer.	P
	Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine. NOTE See 6.3 for safeguarding and complementary measures that can be used to achieve the risk reduction objectives in the case where inherently safe design measures are not sufficient (see 6.1 for the three-step method).	Appropriate machine design has been performed by the manufacturer.	P
6.2.2	Consideration of geometrical factors and physical aspects		P
6.2.2.1	Geometrical factors		P
	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 zones.	Reducing blind spots	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	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 of the body can enter it (see ISO 13854 and ISO 13857).	By increasing the minimum gap between the moving parts or by reducing the gap.	P
	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.	No sharp edges, no sharp angles, no rough surfaces, no protruding parts.	P
	d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).	Suitable working position,accessible manual controls.	P
6.2.2.2	Physical aspects		P
	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;	The actuating force has been limited to be a sufficiently low value.	P
	b)limiting the mass and/or velocity of the movable elements, and hence their kinetic energy;	The mass of the tool has been limited.	P
	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 the general technical knowledge regarding machine design		P
	This general technical knowledge can be derived from technical specifications for design (e.g. standards, design codes, calculation rules).These should be used to cover :		
	a) mechanical stresses such as stress limitation by implementation of correct calculation, construction and fastening methods as regards, e.g. bolted assemblies, welded assemblies - stress limitation by overload prevention, (e.g. “fusible”	The appropriate technical knowledge of mechanical has been taken into account.	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	plugs, pressure-limiting valve, breakage points, - torque-limiting devices); - avoiding fatigue in elements under variable stresses (notably cyclic stresses); - static and dynamic balancing of rotating elements;		
	b) materials and their properties such as - resistance to corrosion, ageing, abrasion and wear; - hardness, ductility, brittleness; - homogeneity; - toxicity; - flammability.	The materials have been treated by appropriate methods.	P
	c) emission values for : - noise; - vibration; - hazardous substances; - radiation.		P
	When the reliability of particular components or assemblies is critical for safety (e.g. ropes, chains, lifting accessories for lifting loads or persons), stress values shall be multiplied by appropriate working coefficients.	Appropriate working coefficients have been taken into account during design and calculation.	P
6.2.4	Choice of an appropriate technology		N
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certain applications, e.g. :		-
	a) on machines intended for use in explosive atmospheres: - fully pneumatic or hydraulic control system and machine actuators; - “intrinsically safe” electrical equipment (see IEC 60079-11)		N
	b) for particular products to be processed such as a solvent: equipment assuring that the temperature will remain far below the flash point.		N
	c) alternative equipment to avoid high noise level, e.g.: - electrical instead of pneumatic equipment - in certain conditions, water cutting instead of mechanical equipment.		N
6.2.5	Applying the principle of the positive mechanical action		P
	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 IEC 60947-5-1 and ISO 14119).		P
6.2.6	Provisions for stability		P
	Machines shall be designed to have sufficient stability to allow them to be used safely in their specified conditions of use.	These machines have been designed to have sufficient stability .	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	Factors to be taken into account include		-
	- geometry of the base;	The factor has been taken into account during design.	P
	- weight distribution, including loading;	The factor has been taken into account during design.	P
	- dynamic forces due to movements of parts of the machine, of the machine itself, or of elements held by the machine which may result in an overturning moment;	The factor has been taken into account during design.	P
	- vibration	The factor has been taken into account during design.	P
	- oscillations of the centre of gravity;	The factor has been taken into account during design	P
	- characteristics of the supporting surface in case of traveling or installation on different sites (e.g. ground conditions, slope);	The factor has been taken into account during design.	P
	- external forces (e.g. wind pressure, manual forces)	The factor has been taken into account during design.	P
	Stability shall be considered in all phases of the life of the machine, including handling, traveling, installation, use, de-commissioning and dismantling.	The factor has been taken into account during design.	P
	Other protective measures for stability relevant to safeguarding are given in 6.3.2.6	Please see the related clause.	P
6.2.7	Provision for maintainability		P
	When designing a machine, the following maintainability factors shall be taken into account:		-
	- accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used;	These factors have been taken into account during design.	P
	- ease of handling, taking into account human capabilities;	The factor has been taken into account during design.	P
	- limitation of the number of special tools and equipment;	The factor has been taken into account during design.	P
6.2.8	Observing ergonomic principles		P
	Ergonomic principles shall be taken into account in designing machinery to reduce mental or physical stress and strain of the operator.	Appropriate ergonomic principles have been taken into account in designing machinery.	P
	These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design.	These principles have been taken into account during allocating functions to operator and machine.	P
	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	All these factors have been taken into account during design.	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	ISO 10075-2)		
	All elements of the “operator-machine” interface such as controls, signaling 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 EN 614-1, ISO 6385, EN 13861 and IEC 61310-1)	All arrangement and design of manual controls have been checked in compliance with.	P
	Designer’s attention is especially drawn to following ergonomic aspects of machine design		-
	a) Avoiding stressful postures and movements during use of the machine (e.g. by providing facilities to adjust the machine to suit the various operators).	Stressful postures and movements during use of the machine have been avoided.	P
	b) Designing machines, and more especially hand-held and mobile machines to enable them to be operated easily taking into account human effort, actuation of controls and hand, arm and leg anatomy.	This machine has been adjusted to the human strength and convenient movement.	P
	c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures.	This machine has been designed with low noise, vibration.	P
	d) Avoid linking the operator's working rhythm to an automatic succession of cycles.	This situation has been avoided.	P
	e) Select, locate and identify manual controls (actuators) so that		-
	- they are clearly visible and identifiable and appropriately marked where necessary (see6.4.4)	Clearly visible and appropriately marked	P
	- they can be safely operated without hesitation or loss of time and without ambiguity (e.g. 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)	Standard layout of controls. See the photos.	P
	- their location(for push-buttons) and their movement (for levers and handwheels) are consistent with their effect (see IEC 61310-3)		P
	- their operation cannot cause additional risk		P
	Where a control is designed and constructed to perform several different actions, namely where there is no one-to-one correspondence (e.g. keyboards), the action to be performed shall be clearly displayed and subject to confirmation where necessary.	one-to-one Correspondence.	N
	Controls shall be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles.	Taking account of ergonomic principles.	P
	Constraints due to the necessary or foreseeable use of personal protective equipment(such as footwear, gloves)shall		P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	be taken into account.		
	f) Select, design and locate indicators, dials and visual display units so that		-
	- they fit within the parameters and characteristics of human perception		P
	- information displayed can be detected, identified and interpreted conveniently, i.e. long lasting, distinct, unambiguous and understandable with respect to the operator's requirements and the intended use;	All the information displayed comply with this requirement.	P
	- the operator is able to perceive them form the control position		P
6.2.9	Preventing electrical hazard		P
	For the design of the electrical equipment of machines EN 60204-1 gives general provisions, especially in clause 6 for protection against electric shock.	See the test report of EN 60204-1	P
	For requirements related to specific machines, see corresponding IEC standards (e.g. series of IEC 61029, IEC 60745, IEC 60335).		N
6.2.10	Preventing and hydraulic hazards		N
	Pneumatic and hydraulic equipment of machinery shall be designed so that :		-
	- the maximum rated pressure cannot be exceeded in the circuits (e.g. by means of pressure limiting devices)		N
	- no hazard results from pressure surges or rises, pressure losses or drops or losses of vacuum;		N
	- no hazardous fluid jet or sudden hazardous movement of the hose (whiplash)results from leakage or component failures;		N
	- air receivers, air reservoirs or similar vessels (e.g. in gas loaded accumulators) comply with the design rules for these elements;		N
	- air elements of the equipment, and especially pipes and hoses, be protected against harmful external effects;		N
	- as far as possible, reservoirs and similar vessels (e.g. in gas loaded accumulators)are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if it is not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, clause 5)		N
	- all elements which remain under pressure after isolation of the machine from its power supply be provided with clearly identified exhaust devices, and a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine. See also ISO 4413 and ISO4414		N

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
6.2.11	Applying inherently safe design measures to control system		P
6.2.11.1	General		P
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount of risk reduction (see ISO 13849-1 or IEC 62061)	Inherently safe design measures to control system have applied.	P
	The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behaviour.	Inherently safe design measures to control system have applied.	P
	Typical causes of hazardous machine behavior are :		-
	- an unsuitable design or modification (accidental or deliberate) of the control system logic;	No this kind of hazard in this machine.	N
	- a temporary or permanent defect or a failure of one or several components of the control system;		N
	- a variation or a failure in the power supply of the control system;	No this kind of hazard in this machine	N
	- inappropriate selection, design and location of the control devices;	No this kind of hazard in this machine	N
	Typical examples of hazardous machine behaviour are :		-
	- unintended/unexpected start-up(see ISO 14118)	No this kind of hazard in this machine	N
	- uncontrolled speed change;	Speed monitor	N
	- failure to stop moving parts;	Emergency stop devices	N
	- dropping or ejection of a mobile part of the machine or of a workpiece clamped by the machine;		P
	- machine action resulting from inhibition (defeating or failure) of protective devices	No this kind of hazard in this machine	N
	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.	See the related clause	P
	These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1 and EN 60204-1and IEC 62061).	See the test report of EN 60204-1	P
	Control systems shall be designed to enable the operator to interact with the machine safely and easily; this requires one or several of the following solutions;	The operator interact with the machine safely and easily.	P
	- systematic analysis of start and stop conditions;	Systematic analysis have been applied.	P
	- provision for specific operating modes (e.g. 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)	Enough provisions have been provided.	P
	- clear display of the faults;		P
	- measures to prevent accidental generation of unexpected	Main switch with lock and related devices are	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	start commands (e.g. shrouded start device) likely to cause dangerous machine behaviour (see ISO 14118:2000, figure 1)	provided.	
	- maintained stop commands(e.g. interlock) to prevent restarting that could result in dangerous machine behaviour (see ISO 14118:2000, figure 1)	This requirement is complied with.	P
	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.		P
	The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone.		P
	Likewise it shall be obvious which control devices (e.g. emergency stop devices, supply disconnecting devices)and/or protective devices belong to which zone.		P
	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.		P
	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(e.g. range, speed, acceleration, deceleration, load capacity). Allowance shall be made for dynamic effects (e.g. the swinging of loads).	The max. speed	P
	For example:		-
	- the traveling speed of mobile pedestrian controlled machinery other than remote-controlled shall be compatible with walking speed.		N
	- 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.		N
	- the range of movements of parts of machinery for lifting loads shall be kept within specified limits.		P
	When machinery is designed to use synchronously different elements which can also be used independently the control system shall be designed to prevent risks due to lack of synchronization.		N
6.2.11.2	Starting of internal power source/switching on an external power supply		P
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation. 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 EN 60204-1:2006, 7.5 (see also Annexes A and B).	Not result in the starting of working parts of a machine	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
6.2.11.3	Starting/stopping of a mechanism		P
	The primary action for starting or accelerating the movement of a mechanism should be performed by application or increase of voltage or fluid pressure, or, if binary logic elements are considered, by passage from state 0 to state 1(if state 1 represents the highest energy state)	This requirement has been taken into account during design.	P
	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 (if state 1 represents the highest energy state).	The type of stopping of this machine belongs to state 1 and state 0.	P
	When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (e.g. 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	No such situation exist.	N
6.2.11.4	Restart after power interruption		P
	If it may generate a hazard, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (e.g. by use of a self-maintained relay, contactor or valve).	A self-maintained relay	P
6.2.11.5	Interruption of power supply		P
	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:		P
	- the stopping function of the machinery shall remain;		P
	- all devices whose permanent operation is required for safety shall operation an effective way to maintain safety (e.g. locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery);		P
	- parts 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.		N
6.2.11.6	Use of automatic monitoring		P
	Automatic monitoring is intended to ensure that a safety function(s) implemented by a protective measure do(es) 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 in such a way that hazards are generated.		P
	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.		P
	In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (e.g. the beginning of the machine cycle.) The protective measures may be , e.g.:		P

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	- the stopping of the hazardous process;		P
	- preventing the re-start of this process after the first stop following the failure;		
	- the triggering of an alarm		N
6.2.11.7	Safety functions implemented by programmable electronic control systems		P
6.2.11.7.1	General		P
	A control system including programmable electronic equipment (e.g. programmable controllers) can be used to implement safety functions t machinery.		P
	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.		P
	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) are sufficiently low.	Comply with the requirement	P
	Where a programmable electronic control system performs a monitoring function, the system behaviour on detection of a fault shall be considered (see also IEC 61508 series for further guidance)		P
	The programmable electronic control system should be installed and validated to ensure that the specified performance (e.g. safety integrity level (SIL) in IEC 61508 series) for each safety function has been achieved.	Comply with the requirement	P
	Validation comprises testing an analysis (e.g. 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		P
	The hardware (including e.g. sensors, actuators, 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 :	Logic solvers	P
	- architectural constraints (e.g. the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault);		P
	- selecting (and/or designing) equipment and devices with an appropriate probability of dangerous random hardware failure;		P
	-Incorporating measures and techniques within the hardware to avoid systematic failures and control systematic faults.		P
6.2.11.7.3	Software aspects		P
	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)	Satisfy the performance specification for the safety functions	P
	Application software		-
	Application software should not be re-programmable by the user.		P

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	This may be achieved by use of embedded software in a non re-programmable memory (e.g. micro-controller, application specific integrated circuit (ASIC)		N
	When the application requires reprogramming by the user, the access o the software dealing with safety functions should be restricted e.g. by : - locks; - passwords for the authorized persons		N
6.2.11.8	Principles relating to manual control		P
	a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8	See the photo.	P
	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.	A stop control device has been placed near each start control device.	P
	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.	Manual controls have been located out of reach of the danger zones.	P
	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.	The operator is able to observe the working area or hazard zone.	P
	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.	Not a ride-on mobile machine.	N
	On machinery intended for lifting persons, controls for lifting 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.	Not for lifting persons.	N
	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 among others of a portable control unit (teach pendant, for instance), with which the operator may enter danger zones.	Only one control.	N
	f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1 and ISO 447)		P
	g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be taken to ensure the presence of the operator at the control position , e.g. by the design and location of control devices.		N
	h) For cableless control an automatic stop shall be performed when correct control signals are not received, including loss of communication (see EN 60204-1)		P
6.2.11.9	Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance		P
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to 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 in operation, safety of the operator shall be achieved using a specific control mode which simultaneously:		N

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	- disables all other control modes;		N
	- permits operation of the hazardous elements only by continuous actuation of an enabling device, a hold-to-run control device or a two-hand control device;		N
	- permits operation of the hazardous elements only in reduced risk conditions (e.g. reduced speed, reduced power/force, step-by-step operation, e.g. with a limited movement control device)		N
	prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.		N
	This control mode shall be associated with one or more of following measures:		-
	- restriction of access to the danger zone as far as possible.		P
	- emergency stop control within immediate reach of the operator;		P
	- portable control unit (teach pendant) and/or local controls allowing sight of the controlled elements.(see EN 60204-1:2006, 9.2.4)		P
6.2.11.10	Selection of control and operating modes		P
	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 (e.g. to allow for adjustment , setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position.	Fitted with a mode selector which can be locked in each position.	P
	Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode.		P
	The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (e.g. access codes for certain numerically controlled functions).		P
6.2.11.11	Applying measures achieve electromagnetic compatibility (EMC)		P
	For guidance on electromagnetic compatibility, see EN 60204-1, and IEC 61000-6 series.	EN 61000-6 series.	P
6.2.11.12	Provision of diagnostic systems to aid fault-finding		P
	Diagnostic systems to aid fault finding should be included in the control system so that there is no need to disable any protective measures.		P
6.2.12	Minimizing the probability of failure of safety functions		P
6.2.12.1	General		P
	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 :		P
6.2.12.2	Use of reliable components		P
	“Reliable components” means components which are capable of withstanding all disturbances and stresses associated with the 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 6.213)	Reliable components have been used.	P
6.2.12.3	Use of “oriented failure mode” components		P
	“Oriented failure mode” components or systems are those in which the predominant failure mode is known in advance and		P

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	which can be used so that such a failure leads to a non-hazardous alteration of the machine function.		
	The use of such components should always be considered, particularly in cases where redundancy is (see 6.2.12.4) not employed.		P
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 other components) continue(s) to perform its (their) function, thereby ensuring that the safety function remains available.	No duplication (or redundancy) of components.	N
	In order to allow the proper action to be initiated, component failure shall be preferably detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection,	Be preferably detected by automatic monitoring	P
	provided that the inspection interval is shorter than the expected lifetime of the components.		P
	Diversity of design and/or technology can be used to avoid common cause failures (e.g. from electromagnetic disturbance) or common mode failures.		P
6.2.13	Limiting exposure to hazards through reliability of equipment		
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring rectification, thereby reducing exposure to hazards.	This requirement is complied with.	P
	This applies to power systems (operative part) as well as to control systems, to safety functions as well as to other functions of machinery.	This requirement is complied with.	P
	Safety-critical components (as e.g. certain sensors) with a known reliability shall be used.	Safety-critical components are used.	P
	The elements of guards and of protective services shall be particularly reliable, as their failure can expose persons to hazards, and also as 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		P
	Mechanization and automation of machine loading/unloading operations and more generally of handling operations (of workpieces, materials, substances) limit the risk generated by these operations by reducing the exposure of persons to hazards at the operating points.		P
	Automation can be achieved e.g. by robots, handling devices, transfer mechanisms, air blast equipment.		N
	Mechanization can be achieved, e.g. by feeding slides, push rods, hand-operated indexing tables.		N
	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 rectified.		N
	Care shall be taken to ensure that the use of these devices does not introduce further hazards (e.g. trapping, crushing) between the devices and parts of the machine or workpieces/materials being processed.		N
	Suitable safeguards (see 6.3) shall be provided if this cannot be ensured.		N
	Automatic feeding and removal devices with their own control systems and the control systems of the associated machine shall be interconnected after thoroughly studying how all safety functions are performed in all control and operation modes of the whole equipment.	Comply with the requirement	P
6.2.15	Limiting exposure to hazards through location of the setting		N

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Clause	Requirement-Test	Result-Remark	Verdict
	and maintenance points outside of danger zones.		
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.		N
6.3	Safeguarding and complementary protective measures		P
6.3.1	General		P
	Guards and protective devices shall be used to protect persons whenever inherently safe design does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (e.g. emergency stop equipment) may have to be implemented.	Appropriate guards and protective devices have been used to protect persons	P
	Certain safeguards may be used to avoid exposure to more than one hazard (e.g. a fixed guard preventing access to a zone where a mechanical hazard is present being used to reduce noise level and collect toxic emissions)	Fixed guard is used.	P
6.3.2	Selection and implementation of guards and protective devices		P
6.3.2.1	General		P
	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 hazard generated by moving parts, according to the nature of those parts (see figure 4) and to the need for access to the danger zone(s).	Please see the related clause.	P
	The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine.		P
	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 access of an operator to the danger zone is not required during normal operation (operation without any malfunction) of the machinery.		P
	As the need for frequency of access increase this inevitably leads to the fixed guard not being replaced.		P
	This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment.)		P
	A combination of safeguards may 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 may be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard.		P
	Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards which may include:	This requirement has been taken into consideration.	P
	- hazards from falling or ejected objects (e.g. falling object protection structure)		P
	- emission hazards (e.g. protection against noise, vibration, radiation , harmful substances)		P
	- hazards due to the environment (e.g. protection against heat, cold, foul weather)		P
	- hazards due to tipping over or rolling over of machinery (e.g. roll-over or tip-over protection structure)	No such hazards exist in this machine.	N
	The design of such enclosed work stations (e.g. cabs and cabins) shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access,	No enclosed work stations.	N

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Clause	Requirement-Test	Result-Remark	Verdict
	posture.		
6.3.2.2	Where access to the hazard zone is not required during normal operation		P
	Where access to the hazard zone is not required during normal operation of the machinery, safeguard should be selected from the following:		-
	a) fixed guard (see also ISO 14120)	Fixed guards are provided.	P
	b) interlocking guard with or without guard locking (see also 6.3.3.2.3, ISO 14119, ISO 14120);		N
	c) self-closing guard (see ISO 14120:2002, 3.3.2)		P
	d) sensitive protective equipment, e.g. electro-sensitive protective equipment (see IEC 61496) or pressure sensitive mat (see ISO 13856)	No sensitive protective equipment	N
6.3.2.3	Where access to the hazard zone is required during normal operation		P
	Where access to the hazard zone is required during normal operation of the machinery , safeguards should be selected from the following:		-
	a) interlocking guard with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this standard);		N
	b) sensitive protective equipment, e.g electro-sensitive protective equipment (see IEC 61496)	No sensitive protective equipment	N
	c) adjustable guard;		N
	d) self-closing guard (see ISO 14120:2002, 3.3.2)		N
	e) two-hand control device (see ISO 13851)		N
	f) interlocking guard with a start function (control guard) (see 6.3.3.2.5 of this standard)		N
6.3.2.4	Where access to the hazard zone is required for machine setting, teaching, process changeover, fault finding, cleaning or maintenance.		P
	As far as possible, machines shall be designed so that the safeguards provided for the protection of the production operator may ensure also the protection of personnel in charge of setting, teaching, process changeover, fault finding, cleaning or maintenance without hindering them in performing their task.		P
	Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2)		P
6.3.2.5	Selection and implementation of sensitive protective equipment	No sensitive protective equipment	N
6.3.2.5.1	Selection		N
	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.		N
	The following provisions are intended to provide the designer with criteria for selecting , for each application , the most suitable device(s).		N
	Types of sensitive protective equipment include, e.g.:		-
	- light curtains;		N
	- scanning devices as, e.g. laser scanners;		N
	- pressure sensitive mats;		N
	- trip bars, trip wires.		N
	Sensitive protective equipment can be used:		-

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	- for tripping purposes;		N
	- for presence sensing;		N
	- for both tripping and presence sensing		N
	- to re-initiate machine operation, a practice which is subject to stringent conditions.		N
	The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment:		N
	- tendency for the machinery to eject materials or component parts;		N
	- necessity to guard against emissions (noise, radiation, dust, etc.)		N
	- erratic or excessive machine stopping time;		N
	- inability of a machine to stop part-way through a cycle.		N
6.3.2.5.2	Implementation		N
	consideration should be given to :		-
	a) - size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment)		N
	b) - reaction of the device to fault conditions (see IEC 61496for electro-sensitive protective equipment)		N
	c)- possibility of circumvention		N
	d)- detection capability and its variation over the course of time (e.g. as a result of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources, sunlight or impurities in the air.		N
	sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that:		N
	- a command is given as soon as a person or part of a person is detected;		N
	- the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function (s); therefore, the command given by the sensitive protective equipment shall be maintained by the control system until a new command is given;		N
	- 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;		N
	- he machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases,;		N
	- the position and the shape of detection field prevents, ,possibly together with fixed guards, a person or part of a person from entering the hazard zone, or being present in it, without being detected.		N
6.3.2.5.3	Additional requirements for sensitive protective equipment when used for cycle initiation.		N
	In this exceptional application, 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 equipment, the machine cycle shall be initiated only by voluntary actuation of		N

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Clause	Requirement-Test	Result-Remark	Verdict
	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;		N
	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;		N
	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;		N
	d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone;		N
	e) if there is more than one AOPD safeguarding the machine, only one of the AOPD（s） is capable of cycle re-initiation;		N
	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.		N
6.3.2.6	Protective measures for stability		P
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 4.6), it will be necessary to maintain it by protective measures such as the use of :		P
	- anchorage bolts;		P
	- locking devices;		P
	- movement limiters or mechanical stops;		N
	- acceleration or deceleration limiters;		N
	- load limiters;		N
	- alarms warning of the approach to stability or tipping limits;		N
6.3.2.7	Other protective devices		N
	When a machine requires continuous control by the operator(e.g. mobile machines, cranes) and an 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:		N
	- when the operator has insufficient visibility of the hazard zone;		N
	- when the operator lacks knowledge of the actual value of a safety –related parameter (e.g. .a distance, a speed, the mass of a load, the angle of a slope)		N
	- when hazards may result from operations other than those controlled by the operator;		N
	The necessary devices include:		-
	- devices for limiting parameters of movement (distance, angle, velocity , acceleration)		N
	- overloading and moment limiting devices:		N
	- devices to prevent collisions or interference with other machines;		N
	-device for preventing hazards to pedestrian operators of mobile machinery or other pedestrians;		N
	- torque limiting devices, breakage points to prevent excessive stress of components and assemblies;		N

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Clause	Requirement-Test	Result-Remark	Verdict
	- devices for limiting pressure, temperature;		N
	- devices for monitoring emissions;		N
	- devices prevent operation in the absence of the operator at the control position;		N
	- device to prevent lifting operations unless stabilizers are in place;		N
	- devices to limit inclination of the machine on a slope;		N
	- devices to ensure that components are in a safe position before traveling;		N
	Automatic protective measures triggered by such devices which take operation of the machinery out of the control of the operator (e.g. 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)		N
6.3.3	Requirements for the design of guards and protective devices		P
6.3.3.1	General requirements		P
	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.	Guards and protective devices have been appropriately designed.	P
	Guards and protective devices shall :		-
	- be of robust construction.	Steel	P
	- not give rise to any additional hazard;	No additional hazard	P
	- not be easy to by-pass or render non-operational;	Not be easy to by-pass	P
	- be located at an adequate distance from the danger zone (see ISO 13857 and ISO 13855).	An adequate distance from the danger zone	P
	- cause minimum obstruction to the view of the production process;		P
	- enable essential work to be carried out on installation and/or replacement of tools and also for maintenance by allowing access only to the area where the work has to be done, if possible without the guard or protective device having to be moved;		P
	For openings in the guards see ISO 13857		P
6.3.3.2	Requirements for fixed guards		P
6.3.3.2.1	Functions of guards		P
	The functions that guards can achieve are:		P
	- prevention of access to the space enclosed by guard and/or - containment/capture of materials, workpieces, chips, liquids which may be ejected or dropped by the machine and reduction of emissions(noise, radiation, hazardous substances such as dust, fumes, gases) which may be generated by the machine.	The space enclosed. Containment of workpieces, chips, liquids which may be ejected by the machine.	P
	Additionally, they may need to have particular propertied relating to electricity, temperature, fire, explosion, vibration, visibility(see ISO 14120) and operator position ergonomics(e.g. usability, operator’s movements, posture,		P

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Clause	Requirement-Test	Result-Remark	Verdict
	repetitive movements).		
6.3.3.2.2	Requirements for fixed guards		P
	Fixed guards shall be securely held in place:		-
	- either permanently (e.g. 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)	All the fixed guards are securely held in place by appropriate fasteners.	P
6.3.3.2.3	Requirements for movable guards		P
	a) movable guards which provide protection against hazards generated by moving transmission parts shall :		-
	- as far as possible remain fixed to the machinery or other structure (generally by means of hinges or guides) when open;	By means of guides or hinges	P
	- be interlocking guards (with guard locking when necessary) (see ISO 14119)		N
	b) 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 ; this can be achieved by interlocking guards, with guard locking when necessary.		N
	- they can be adjusted only by an intentional action , such as the use of a tool or a key;		N
	- the absence or failure of one of their components prevents starting of the moving parts or stops them; this can be achieved by automatic monitoring (see 4.11.6)		N
6.3.3.2.4	Requirements for adjustable guards		N
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed;		N
	They shall :		-
	- be designed so that the adjustment remains fixed during a given operation;		N
	- be readily adjustable without the use of tools;		N
6.3.3.2.5	Requirements for interlocking guards with a start function (control guards)		N
	An interlocking guard with a start function may be used provided that		-
	- all requirements for interlocking guards are satisfied (see ISO 14119)		N
	- the cycle time of the machine is short		N
	- the maximum opening time of the guard is present to a low value (e.g. equal to the cycle time). When this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine.		N
	- 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)		N
	- all other guards whether fixed (removable type) or movable are interlocking guards;		N
	- the interlocking device associated with the interlocking guard with a start function is designed in such a way – e.g. by duplication of position detectors and use of automatic monitoring (see 4.11.6)- that its failure cannot lead to an unintended/unexpected start-up;		N

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Clause	Requirement-Test	Result-Remark	Verdict
	- the guard is securely held open (e.g. by a spring or counterweight)such that it cannot initiate a start while falling by its own weight;		N
6.3.3.2.6	Hazards from guards		P
	Care shall be taken to prevent hazards which might be generated by :		-
	- the guard construction (e.g. sharp edges or corners, material);	No harp edges and corners.	P
	- the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall)		N
6.3.3.3	Technical characteristics of protective devices		P
	Protective devices shall be selected or designed and connected to the control system so as to ensure correct implementation of their safety function (s) is ensured.		P
	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 IEC 62061.		P
	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.		N
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it s known that this fitting will be necessary because the work to be done on it will vary.		N
6.3.4	Safeguarding for reducing emissions		P
6.3.4.1	General		
	If the measures for the reduction of emissions at source mentioned 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		P
	Additional protective measures include, for example: - enclosures (see ISO 15667) - screens fitted to the machine; - silencers (see ISO 14163)	Enclosures	P
6.3.4.3	Vibration		N
	Additional protective measures include, for example, damping devices for vibration isolation between the source and the exposed person such as resilient mounting or suspended seats.		N
	For measures for vibration isolation of stationary industrial machinery see EN 1299		N
6.3.4.4	Hazardous substances		P
	Additional protective measures include, for example:		-
	- encapsulation of the machine (enclosure with negative pressure);	Encapsulation of the machine.	P
	- local exhaust ventilation with filtration.		N
	- wetting with liquids;		N
	- special ventilation in the area of the machine (air curtains , cabins for operators)		N
6.3.4.5	Radiation		N
	Additional protective measures include, for example:		-

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Clause	Requirement-Test	Result-Remark	Verdict
	- use of filtering and absorption;		N
	- use of attenuating screens or guards		N
6.3.5	Complementary protective measures		P
6.3.5.1	General		P
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use may 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 , the ones dealt with in 6.3.5.2 to 6.3.5.6		P
6.3.5.2	Components and elements to achieve the emergency stop function		P
	If following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function to enable actual or impending emergency situations to be averted, the following requirements apply:		-
	- the actuators shall be clearly identifiable, clearly visible and readily accessible		P
	- the hazardous process shall be stopped as quickly as possible without creating additional hazards . 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;		N
	- the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary.		P
	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.		P
	This reset shall be possible only at that location where the emergency stop command has been initiated.The reset of the device shall not restart the machinery , but only permit restarting.		P
	More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in EN 60204 series.		P
6.3.5.3	Measures for the escape and rescue of trapped persons		P
	Measures for the escape and rescue of trapped persons may consist e.g. of :		-
	- escape routes and shelters in installations generating operator-trapping hazards		P
	- arrangements for moving some elements by hand, after an emergency stop		N
	- arrangements for reversing the movement of some elements		N
	- anchorage points for descender devices;		N
	- means of communication to enable trapped operators to call for help		P
6.3.5.4	Measures for isolation and energy dissipation		P
	Especially with regard to their maintenance and repair , machines shall be equipped with the technical means to achieve the isolation from power supply(ies) and dissipation of stored energy as a result of following actions:		P
	a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;		P
	b) locking (or otherwise securing) all the isolating units in the isolating position;		P

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Clause	Requirement-Test	Result-Remark	Verdict
	c) dissipating or , if this is not possible or practicable, restraining (containing) any stored energy which may give rise to a hazard;		N
	d) verifying, by means of a safe working procedure, that the actions taken according to a), b) and c) above have produced the desired effect.		P
	See ISO 14118:2000, clause 5 and EN 60204-1:2006, 5.5 and 5.6	See the test report of EN 60204-1.	P
6.3.5.5	Provisions for easy and safe handling of machines and their heavy component parts		P
	Machines and their component parts which cannot be moved or transported by hand shall be provided or capable of being provided with suitable attachment devices for transport by means of lifting gear.	Provided with suitable attachment devices for transport by means of lifting gear.	P
	These attachments may be, among others,		-
	- standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing;	Slings	P
	- appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground.		N
	- guiding grooves for machines to be transported by a fork truck;		N
	- lifting gear and appliances integrated into the machine.		N
	Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement; See also 6.4.4c)（ item 3).	Not removed manually in operation.	N
6.3.5.6	Measures for safe access to machinery		N
	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.	Comply with requirements	P
	Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks, but care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery.		N
	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, suitable guard-rails (see ISO 14122-3) shall be provided.	Comply with requirements	P
	In large automated installations, particular attention shall be given to safe means of access such as walkways, conveyor bridges or crossover points.		N
	Means of access to parts of machinery located at a height shall be provided with collective means of protection against falls (e.g. guard-rails for stairways, stepladders and platforms and/or safety cages for ladders)		N
	As necessary , anchorage points for personal protective equipment against falls from a height shall also be provided (e.g. in carriers of machinery for lifting persons or with elevating control sations)		N
	Openings shall whenever possible open towards a safe position. They shall be designed to prevent hazards due to unintended opening.		N
	The necessary aids for access shall be provided (e.g. steps, handholds). Control devices shall be designed and located to prevent their being used as aids for access.		N
	When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards preventing falls when the platform is not		P

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Clause	Requirement-Test	Result-Remark	Verdict
	present at the level.		
	Movement of the lifting platform shall be prevented while the guards are open.		P
	For detailed provisions see ISO 14122.		N
6.4	Information for use		P
6.4.1	General requirements		P
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see figure 2).		P
	Information of 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. It is directed to professional and/or non-professional users.		P
6.4.1.2	Information shall be provided to the user about the intended use of the machine, taking into account, notably, all its operating modes.	See the instruction.	P
	The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it shall inform and warn the user about residual risk.	See the instruction.	P
	The information shall indicate, as appropriate,		-
	- the need for training,	See the instruction.	P
	- the need for personal protective equipment,		P
	- the possible need for additional guards or protective devices (see Figure 2, Footnote d).	See the instruction.	P
	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.	See the instruction.	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, disabling and scrapping.	See the instruction.	P
6.4.2	Location and nature of the information for use		P
	Depending on the risk , the time when the information is needed by the user and the machine design , it shall be decided whether the information – or parts thereof – are to be given:		P
	- in /on the machine itself (see 6.3 and 6.4.4)	Adequate information is stated in the machine itself.	P
	- in accompanying documents (in particular instruction handbook , see 6.4.5)	See the instruction.	P
	- on the packaging	Adequate information is stated on the packaging	P
	- by other means such as signals and warnings outside the machine.	Signals and warnings Outside the machine.	P
	Standardized phrases shall be considered where important messages such as warnings need to be given (see also IEC 62079)		P
6.4.3	Signals and warning devices		P
	Visual signals (e.g. flashing lights) and audible signals (e.g. sirens) may be used to warn of an impending hazardous event such as machine start-up or overspeed.	Signals and warning devices are provided.	P

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Clause	Requirement-Test	Result-Remark	Verdict
	Such signals may also be used to warn the operator before the triggering of automatic protective measures (see last paragraph of 5.2.7)	Please the related clause.	P
	It is essential that these signals:		-
	- be emitted before the occurrence of the hazardous event; - be unambiguous; - be clearly perceived and differentiated from all other signals used; - be clearly recognized by the operator and other persons.	Unambiguous, clearly perceived, clearly recognized	P
	The warning devices shall be designed and located such that checking is easy.		N
	The information for use shall prescribe regular checking of warning devices.		P
	The attention of designers is drawn to the risks from “sensorial saturation” which results from too many visual and/or acoustic signals, which may also lead to defeating the warning devices.		P
6.4.4	Markings, signs (pictograms), written warnings		P
	Machinery shall bear all markings which are necessary:		-
	a) for its unambiguous identification, at least :		-
	- name and address of the manufacturer; - designation of series or type; - serial number, if any.	GRACE GROUP CO., LTD. 24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China.	P
	b) in order to indicate its compliance with mandatory requirements; - marking; - written indications (e.g. for machines intended for use in potentially explosive atmosphere)		N
	c) for its safe use, e.g. :		-
	- maximum speed of rotating parts;		N
	- maximum diameter of tools;		N
	- mass (expressed in kilograms) of the machine itself and/or of removable parts		N
	- maximum working load;		N
	-necessity of wearing personal protective equipment;		P
	- guard adjustment data;		P
	- frequency of inspection.	See the instruction.	P
	Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine.	Permanent and remain legible	P
	Signs or written warnings only saying “danger” shall not be used.		P
	Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine which they are related to.		P
	Readily understandable signs (pictograms) should be used in preference to written warnings.		P
	Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be used.		P
	Markings shall comply with recognized standards (see ISO 2972, ISO 7000, particularly for pictograms, symbols , colours) See EN 60204 series as regards marking of electrical equipment.	All the markings are standard.	P

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Clause	Requirement-Test	Result-Remark	Verdict
6.4.5	Accompanying documents (in particular, instruction handbook)		P
6.4.5.1	Contents		P
	The instruction handbook or other written instructions (e.g. on the packaging) shall contain among others:		-
	a) information relating to transport, handling and storage of the machine e.g. : - storage conditions for the machine; - dimensions , mass value(s), position of the centre (s) of gravity; - indications for handling (e.g. drawings indicating application points for lifting equipment)	All the related information is stated in the instruction handbook.	P
	b) information relating to installation and commissioning of the machine, e.g. - fixing/anchoring and vibration dampening requirements; - assembly and mounting conditions; - space needed for use and maintenance; - permissible environmental conditions (e.g. temperature, moisture, vibration, electromagnetic radiation); - instructions for connecting the machine to power supply (particularly about protection against electrical overloading); - advice about waste removal /disposal; - if necessary, recommendations about protective measures which have to be taken by the user; e.g. additional safeguards, safety distances, safety signs and signals.	All the related information is stated in the instruction handbook..	P
	c) information relating to the machine itself, e.g. : - detailed description of the machine, its fittings, its guards and/or protective devices; - 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. - diagrams ; - data about noise and vibration generated by the machine, about radiation , gases, vapours, dust emitted by it, with reference to the measuring methods used. - technical documentation about electrical equipment - documents attesting that the machine complies with mandatory requirements;	All the related information is stated in the instruction handbook.	P
	d) information relating to the use of the machine, e.g. about: - intended use; - description of manual controls (actuators); - setting and adjustment; - modes and means for stopping - risks which could not be eliminated by the protective measures taken by the designer; - particular risks which may be generated by certain applications, by the use of certain fittings, and about specific safeguards which are necessary for such applications. - reasonably foreseeable misuse and prohibited usages; - fault identification and location , repair, and re-starting after an intervention; - personal protective equipment which need to be used and training required.	All the related information is stated in the instruction handbook.	P
	e) information for maintenance e.g. - nature and frequency of inspections for safety functions; - instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence should be carried out exclusively by skilled persons (e.g. maintenance staff, specialists) - instructions relating to maintenance actions (e.g.	All the related information is stated in the instruction handbook.	P

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Clause	Requirement-Test	Result-Remark	Verdict
	replacement of parts) which do not require specific skills and hence may be carried out by users (e.g. operators) - drawings and diagrams enabling maintenance personnel to carry out their task rationally		
	f) information relating to de-commissioning , dismantling and disposal;	See the instruction. handbook	P
	g) information for emergency situations , e.g. : - type of fire-fighting equipment to be used. - warning about possible emission or leakage of harmful substance(s), and if possible, indication of means to fight their effects.		N
	h) maintenance instructions provided for skilled persons (second dash in e))and maintenance instructions provided for unskilled persons (third dash in e)), that should appear clearly separated from each other.	All the related information is stated in the instruction handbook.	P
6.4.5.2	Production of the instruction handbook		P
	a) type and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized the use of colours, symbols and/or large print.	Legibility.	P
	b) 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 are to be used, each language should be readily distinguished from the other(s), and efforts should be made to keep the translated text and the relevant illustration together.	English	P
	c) whenever helpful to the understanding, text should be supplemented with written details enabling , for instance, manual controls (actuators) to be located and identified; they should not be separated from the accompanying text and should follow sequential operations.	See the instruction. handbook.	P
	d) consideration should be given to presenting information in tabular form where this will aid understanding. Tables should be adjacent to the relevant text.	See the instruction. handbook.	P
	e) the use of colours should be considered, particularly in relation to components requiring quick identification.		N
	f) when information for use is lengthy, a table of contents and/or an index should be given.		P
	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		P
	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).	See the difference between the models	P
	b) communicate 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.		P
	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.		P
	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 users. If personal protective equipment is required for the safe use of the machine, clear advice should be given, e.g. on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale.	Not for non-professional use	N

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Clause	Requirement-Test	Result-Remark	Verdict
	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 may be useful to mark them “keep for future reference”. Where information for use is kept in electronic form (e.g. CD, DVD, tape) information on safety-related issues that need immediate action shall always be backed up with a hand copy that is readily available.	Kept in electronic form	P
7	Documentation of risk assessment and risk reduction		P
	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);		P
	b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.);		P
	c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment;		P
	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.);		P
	2) the uncertainty associated with the data used and its impact on the risk assessment;		P
	e) the risk reduction objectives to be achieved by protective measures;		P
	f) the protective measures implemented to eliminate identified hazards or to reduce risk;	Warning sign and wear PPE	P
	g) residual risks associated with the machinery;		P
	h) the result of the risk assessment (see Figure 1);	See the risk assessment report.	P
	i) any forms completed during the risk assessment.		P
	Standards or other specifications used to select protective measures referred to in f) above should be referenced.		P

3. EN 60204-1:2018

EN 60204-1:2018			
Clause	Requirement- Test	Result	Verdict
1	SCOPE		
	Nominal supply voltages not exceeding 1000V AC or 1500V DC between lines, and nominal frequencies not exceeding 200Hz	/	P
4	GENERAL REQUIREMENTS		
4.2	Selection of equipment		
4.2.1	General		
	Electrical components and devices shall be	The components and devices have been chosen that conforms to the relevant standard	
	- suitable for their intended use, and		P
	- conform to relevant IEC standards, and		P
	- be applied in accordance with the instructions.	See certification document for Critical components.	P
4.2.2	The electrical equipment of the machine shall satisfy the safety requirements identified by the risk assessment of the machine.		P
	Parts in compliance with EN 60439-1 and other relevant parts of the EN 60439 series may be selected.		N/A
4.3	Electrical supply		
4.3.1	General		
	The electrical equipment shall be designed to operate correctly with the supply:		
	- as specified in 4.3.2 or 4.3.3, or See 4.3.2		P
	- as otherwise specified by the user, or		P
	- as specified by the supplier in the case of a special source of supply such as an on-board generator.		P
4.3.2	AC supplies		
	Steady state voltage: 0.9 to 1.1 of nominal voltage	Operating normally at 0.9~1.1 times rated voltage	P
	Symbol nature of supply		P
	Frequency: 0.99 to 1.01 of nominal frequency continuously	50Hz	P
	Harmonic distortion not exceeding 10 %.	2~5 order harmonics sum≤10% 6~30 order harmonics sum≤2%	P
	Voltage unbalance not exceeding 2%.		P
	Voltage interruption not more than 3 ms		P
	Voltage dips shall not exceed 20 %		P
4.3.3	DC supplies		
	From batteries:		
	Voltage: 0.85 to 1.15 of nominal voltage		N/A
	Voltage: 0.7 to 1.2 of nominal voltage in the case of battery-operated vehicles		N/A
	Voltage interruption not exceeding 5 ms.		N/A
	From converting equipment:		
	Voltage: 0.9 to 1.1 of nominal voltage		N/A
	Voltage interruption not exceeding 20 ms.		N/A
	Ripple (peak-to-peak) not exceeding 0.15 of nominal voltage.		N/A
4.3.4	Special supply systems		
	For special supply systems such as on-board generators, the limits given in 4.3.2 and 4.3.3 may be exceeded.		N/A
4.4	Physical environment and operating conditions	The physical environment and operating conditions has been described in the	P

EN 60204-1:2018			
Clause	Requirement- Test	Result	Verdict
		instruction manual	
4.4.1	General		
	The electrical equipment shall be suitable for use in the physical environment and operating conditions specified in 4.4.2 to 4.4.8.		P
	When the physical environment or the operating conditions are outside those specified, an agreement may be needed between the supplier and the user (see Annex B)		N/A
4.4.2	Electromagnetic compatibility (EMC)		
	The equipment shall not generate electromagnetic disturbances above levels that are appropriate for its intended places of use.		N/A
	The equipment shall have an adequate level of immunity to electromagnetic disturbances so that it can operate correctly in its intended environment		N/A
4.4.3	Ambient air temperature		
	Electrical equipment shall be capable of operating correctly in the intended ambient air temperature (minimum-5°C~+40°C)	0°C ~ +50°C	P
4.4.4	Humidity		
	Electrical equipment shall be capable of operating correctly when the relative humidity not exceeding 50 % at a maximum temperature of 40 °C.		P
	Higher relative humidity may be permitted at lower temperatures		N/A
	Harmful effects of occasional condensation shall be avoided by proper design of the equipment or, where necessary, by proper additional measures.		N/A
4.4.5	Altitude		
	Electrical equipment shall be capable of operating correctly at altitudes up to 1 000 m above mean sea level.		P
4.4.6	Contaminants		
	Electrical equipment shall be adequately protected against the ingress of solid bodies and liquids (see 12.3).		P
4.4.7	Ionizing and non-ionizing radiation		
	When equipment is subject to radiation, additional measures shall be taken to avoid malfunctioning and accelerated deterioration of the insulation.		N/A
	A special agreement may be necessary between the supplier and the user (see Annex B).		N/A
4.4.8	Vibration, shock, and bump		
	Undesirable effects of vibration, shock and bump shall be avoided by the selection of suitable equipment, by mounting it away from the machine, or by the use of anti-vibration mountings.		P
	A special agreement may be necessary between the supplier and the user (see Annex B).		P
4.5	Transportation and storage		
	Electrical equipment shall be designed to withstand, or suitable precautions shall be taken to protect against, the effects of transportation and storage temperatures within a range of - 25 °C to + 55 °C and for short periods not exceeding 24 h at up to + 70 °C.		P
	Suitable means shall be provided to prevent damage from humidity, vibration, and shock.		P
4.6	Provisions for handling		

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Clause	Requirement- Test	Result	Verdict
	Heavy and bulky electrical equipment shall be provided with suitable means for handling by cranes or similar equipment (see also 14.4.6).	See the instruction manual.	P
4.7	Installation and operation		
	Electrical equipment shall be installed and operated in accordance with the supplier's instructions	See the instruction manual.	P
5	INCOMING SUPPLY CONDUCTOR TERMINATIONS AND DEVICES FOR DISCONNECTING AND SWITCHING OFF		
5.1	Incoming supply conductor terminations		
	The electrical equipment of a machine should be connected to a single power supply.	A single power supply	P
	Where it is necessary to use another supply for certain parts of the equipment, that supply should be derived from devices as part of the electrical equipment of the machine as far as is practicable.		N/A
	For large complex machinery comprising a number of widely-spaced machines working together, there may be a need for more than one incoming supply depending on the site supply arrangements (see 5.3.1).		P
	Unless a plug is provided with the machine for the connection to the supply (see 5.3.2 d), the supply conductors shall be terminated at the supply disconnecting device.		P
	When that is not practicable, separate terminations shall be provided.		P
	Where a neutral conductor is used, it shall be clearly indicated.	No neutral conductor used on this machine	N/A
	A separate insulated terminal, labelled N, shall be provided for the neutral conductor (see also Annex B).		P
	No connection shall be used between the neutral conductor and the protective bonding circuit	No this situation.	N/A
	No combined PEN terminal shall be used.		N/A
	For the identification of the external protective conductor terminal, see 5.2.		P
5.2	Terminal for connection to the external protective earthing system		
	For each incoming supply, a terminal shall be provided in the vicinity of the associated phase conductor terminals for connection of the machine to the external protective earthing system or to the external protective conductor.		P
	The terminal shall be of such a size as to enable the connection of an external protective copper conductor in accordance with Table 1.		P
	Where an external protective conductor is using material other than copper, the terminal size shall be selected accordingly (see also 8.2.2).		N/A
	At each incoming supply point, the terminal for the external protective conductor shall be identified by marking with the letters PE.	Marked with "PE".	P
	The other terminals used for the connection of machine components or subassemblies to the protective bonding circuit shall be identified.		P
5.3	Supply disconnecting (isolating) device		
5.3.1	General		
	A supply disconnecting device shall be provided:		
	- for each incoming source of supply to a machine;		P

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Clause	Requirement- Test	Result	Verdict
	- for each on-board power supply.		P
	The supply disconnecting device shall disconnect the electrical equipment of the machine from the supply when required		P
	When two or more supply disconnecting devices are provided, protective interlocks for their correct operation shall be used where a hazardous condition or damage can occur.		P
5.3.2	The supply disconnecting device shall be one of the following types:		
	a) a switch-disconnector in accordance with IEC 60947-3, utilization category AC-23B or DC-23B;		P
	b) a disconnector in accordance with IEC 60947-3, that has an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector;		N/A
	c) a circuit-breaker suitable for isolation in accordance with IEC 60947-2;		N/A
	d) any other switching device in accordance with the IEC standard and meeting the isolation requirements of IEC 60947-1 and a utilization category defined in the product standard as appropriate for on-load switching of motors or other inductive loads;		N/A
	e) a plug/ socket combination for a flexible cable supply.		N/A
5.3.3	Requirements		
	When the supply disconnecting device is one of the first three types specified in 5.3.2, it shall fulfil all of the following requirements:		P
	- isolate the electrical equipment from the supply and have one OFF and one ON position only, clearly marked with “O” and “I”, and	Clearly marked with ”0” and ”I”.	P
	- have a visible gap or a position indicator which cannot indicate OFF until all contacts are actually open and there is an adequate isolating distance between all the contacts in accordance with IEC 60947-3;		P
	- have an external operating means in BLACK or GREY (exception: see 10.7.4); - be provided with a means permitting it to be locked in the OFF position (e.g. by padlocks). When so locked, remote as well as local closing shall be prevented;		P
	- disconnect all live conductors of its power supply circuit. However, for TN supply systems, the neutral conductor may or may not be disconnected.		P
	- have a breaking capacity sufficient to interrupt the current of the largest motor when stalled together with the sum of the normal running currents of all other motors and/or loads.		P
	The calculated breaking capacity may be reduced by the use of a proven diversity factor		P
5.3.4	Operating handle		
	The handle of the supply disconnecting device shall be easily accessible and located between 0,6 m and 1,9 m above the servicing level.		P
5.3.5	Excepted circuits		
	The following circuits need not be disconnected by		

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Clause	Requirement- Test	Result	Verdict
	the supply disconnecting device:		
	- lighting circuits for lighting needed during maintenance or repair;	No lighting circuits.	N/A
	- plug and socket outlets for the exclusive connection of repair or maintenance tools and equipment (e.g. hand drills, test equipment);	No plug/socket outlets.	N/A
	- under-voltage protection circuits that are only used for automatic tripping in the event of supply failure;		N/A
	- circuits supplying equipment that should normally remain energized for satisfactory operation;	No this situation.	N/A
	- control circuits for interlocking.	No this situation.	N/A
5.4	Devices for switching off for prevention of unexpected start-up		
	Devices for switching off for the prevention of unexpected start-up shall be provided.		P
	Devices described in 5.3.2 may fulfil that function.		P
	Disconnectors, withdrawable fuse links or withdrawable links may be used, but only when located in an enclosed electrical operating area.		P
	Such devices shall be appropriate and convenient for the intended use, shall be suitably placed, and readily identifiable (e.g. by a durable marking necessary).		P
	Means shall be provided to prevent inadvertent, and/or mistaken closure of the disconnecting device (see also 5.6).		P
	When means other than supply disconnecting devices in accordance with 5.3.2 are used (e.g. a contactor switched off by a control circuit), such means for switching off are intended to be employed only for situations that include:		
	- no significant dismantling of the machine;	No this situation.	N/A
	- adjustments requiring a relatively short time;	No this situation.	N/A
	- no work carried out on the electrical equipment except when:		
	- there is no hazard arising from electric shock (see clause 6) and burn;	No this situation.	N/A
	- the switching off means cannot be negated by the work;		N/A
	- the work is of a minor nature.		N/A
5.5	Devices for disconnecting electrical equipment		
	The supply disconnecting device may be used as for disconnecting electrical equipment to enable work to be carried out without a risk from electric shock or burn.		P
	Where it is necessary to work on individual parts of the electrical equipment of a machine, or on one of a number of machines fed by a common collector bar or collector wire system, a disconnecting device shall be provided for each part, or for each machine, requiring separate isolation.		P
	Devices described in 5.3.2 may fulfill that function.		P
	Disconnectors, withdrawable fuse links or withdraw- able links may be used but only when located in an enclosed electrical operating area, and shall be:	They are used only in enclosed lectrical operating areas	
	- appropriate and convenient for the intended use;	Appropriate and convenient	P
	- suitably located;	Suitably located	P

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	- readily identifiable as to which part or circuit(s) of the equipment is Cd;	Can readily identify.	P
	- provided with adequate means to prevent unauthorized, inadvertent, and/or mistaken closure of the disconnecting devices (except as allowed in 5.6).		P
5.6	Protection against unauthorized, inadvertent and/or mistaken connection		
	The devices described in 5.4 and 5.5 that are located outside shall be equipped with means to secure them in the OFF position and remote as well as local reconnection shall be prevented.		P
	Where a non-lockable disconnecting device, other means of protection against reconnection, such as warning label on accordance with 16.1 may be provided.		P
	When a plug/socket combination according to 5.3.2 e) is so positioned that it can be kept under the immediate supervision of the person carrying out the work, means for securing in the disconnected state need not be provided.		N/A
6	PROTECTION AGAINST ELECTRIC SHOCK		
6.2	Protection against direct contact		
6.2.2	Protection by enclosures		
	Live parts shall be located inside enclosures that conform to the relevant requirements of clauses 4, 12, and 15 and that provide protection against direct contact of at least IP2X or IPXXB:	Degree of protection for live parts inside the enclosures is at least IP2X	P
	Where the top surfaces of the enclosure are readily accessible, the minimum degree of protection against direct contact provided by the top surfaces shall be IP4X or IPXXD:		N/A
	Opening an enclosure shall be possible only under one of the following condition:		
	a) The use of a key or tool is necessary for access by skilled or instructed persons.	Use a tool to open the enclosure	P
	Live parts on the inside of doors shall be protected against direct contact to at least IP1X or IPXXA.		P
	Live parts likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected, shall be protected against direct contact to at least IP2X or IPXXB		P
	b) The disconnection of live parts inside the enclosure before the enclosure may be opened.	No this design.	N/A
	Where more than one door can provide access to live parts, care should be taken to implement the intent of this sub-clause.		N/A
	All parts that are still live after switching off the disconnecting device(s) shall be protected against direct contact to at least IP2X or IPXXB.		N/A
	Such parts shall be marked with a warning sign in accordance with 17.2, excepted for		N/A
	- parts that can be live only because of connection to interlocking circuits and that are distinguished by color as potentially live in accordance with 14.2.4;		N/A
	- the supply terminals of the supply disconnecting device when the latter is mounted alone in a separate enclosure.		N/A
	c) Opening without the use of a key or a tool and		N/A

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	without disconnection of live parts shall be possible only when all live parts are protected against direct contact to at least IP2X or IPXXB.		
	Where barriers provide this protection, either they shall require a tool for their removal or all live parts protected by them shall be automatically disconnected when the barrier is removed.		N/A
6.2.3	Protection by insulation of live parts		
	Live parts protected by insulation shall be completely covered with insulation that can only be removed by destruction.	Some of electrical components Are protected by this way	P
	Such insulation shall be capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which it can be subjected under normal service conditions.	They are proved to be in compliance with this requirement.	P
6.2.4	Protection against residual voltages		
	Live parts having a residual voltage greater than 60 V after the supply has been disconnected shall be discharged to 60 V or less within a time period of 5 s after disconnection of the supply voltage, excepted for components having a stored charge of 60 µC or less.	In any case, the residual voltage discharged to 0 V within 1 s	N/A
	Where the rate of discharge would interfere with the proper functioning of the equipment, a durable warning notice drawing attention to the hazard and stating the delay required before the enclosure may be opened shall be displayed at an easily visible location on or immediately adjacent to the enclosure containing the capacitances.		N/A
	In the case of plugs or similar devices, the withdrawal of which results in the exposure of conductors, the discharge time shall not exceed 1s, otherwise such conductors shall be protected against direct contact to at least IP2X or IPXXB.		N/A
	If neither a discharge time of 1 s nor a protection of at least IP2X or IPXXB can be achieved, additional disconnecting devices or an appropriate warning device shall be applied.		N/A
6.2.5	Protection by barriers		
	Protection by barriers shall comply with 412.2 of IEC 60364-4-41.	No this situation.	N/A
6.2.6	Protection by placing out of reach or protection by obstacles	No this situation.	N/A
	Protection by placing out of reach shall comply with 412.4 of IEC 60364-4-41.	No this situation.	N/A
	Protection by obstacles shall comply with 412.3 of IEC 60364-4-41.	No this situation.	N/A
	For collector wire systems or collector bar systems with a degree of protection less than IP2X shall comply with 13.8.1.	No this situation.	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	Protection by use of class II equipment or by equivalent insulation		
	This protection is provided by one or more of the following means:		
	- use of class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation in accordance with IEC	No class II electrical devices is used for this machine	N/A

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	60536);		
	- use of switchgear and control gear assemblies having total insulation in accordance with IEC 60439-1;		N/A
	- application of supplementary or reinforced insulation in accordance with 413.2 of IEC 60364-4-41.		N/A
6.3.2.3	Protection by electrical separation		
	This type of protection shall comply with the requirements of 413.5 of IEC 60364-4-41.		P
6.3.3	Protection by automatic disconnection of supply		
	This type of protection shall comply with the requirements of 413.1 of IEC 60364-4-41.		P
6.4	Protection by the use of PELV		
6.4.1	PELV circuits shall satisfy all of the following conditions:		
	a) the nominal voltage shall not exceed:		
	- 25 V a.c. r.m.s. or 60 V ripple-free d.c. when the equipment is normally used in dry locations and when large area contact of live parts with the human body is not expected; or		N/A
	- 6 V a.c. r.m.s. or 15 V ripple-free d.c. in all other cases;		P
	b) one side of the circuit or one point of the source of the supply of that circuit shall be connected to the protective bonding circuit;	Has been connected to PE circuit	P
	c) live parts of PELV circuits shall be electrically separated from other live circuits. Electrical separation shall be not less than that required between the primary and secondary circuits of a safety isolating transformer;	Appropriate electrical Separation.	P
	d) conductors of each PELV circuit shall be physically separated from those of any other circuit. When this requirement is impracticable, the insulation provisions of 14.1.3 shall apply;		P
	e) plugs and socket-outlets for a PELV circuit shall conform to the following:		N/A
	1) plugs shall not be able to enter socket-outlets of other voltage systems;		N/A
	2) socket-outlets shall not admit plugs of other voltage systems.		N/A
6.4.2	Sources for PELV		
	The source for PELV shall be one of the following:		
	- a safety isolating transformer;		P
	- a source of current providing a degree of safety equivalent to that of the safety isolating transformer (e.g. a motor generator with winding providing equivalent isolation);		N/A
	- an electrochemical source (e.g. a battery) or another source independent of a higher voltage circuit (e.g. a diesel-driven generator);		N/A
	- an electronic power supply conforming to appropriate standards specifying measures to be taken to ensure that, even in the case of an internal fault, the voltage at the outgoing terminals cannot exceed the values specified in 6.4.1.		N/A
7	PROTECTION OF EQUIPMENT		
7.2	Over-current protection		
7.2.1	General		
	Over-current protection shall be provided where the		P

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	current in a machine circuit can exceed either the rating of any component or the current carrying capacity of the conductors, whichever is the lesser value.		
7.2.2	Supply conductors		
	Unless otherwise specified by the user, the supplier of the electrical equipment shall not be responsible for providing the over-current protective device for the supply conductors to the electrical equipment.	No over-current protection is provided for the supply conductor by the manufacturer.	P
	The supplier of the electrical equipment shall state on the installation diagram the data necessary for selecting the over-current protective device (see Annex B).		P
7.2.3	Power circuits		
	Devices for detection and interruption of over-current, selected in accordance with 7.2.10, shall be applied to each live conductor.	over current protective devices have been provided.	P
	Where the cross-sectional area of the neutral conductor is at least equal to or equivalent to that of the phase conductors, it is not necessary to provide over-current detection for the neutral conductor nor a disconnecting device for that conductor.	No any neutral conductor.	N/A
	For a neutral conductor with a cross-sectional area smaller than that of the associated phase conductors shall comply with item b) of 473.3.2.1 of IEC 60364-4-473.	Not applicable.	N/A
	In IT systems, if a neutral conductor is used, the requirements in 473.3.2.2 of IEC 60364-4-473 shall be complied with.	Not applicable.	N/A
7.2.4	Control circuits		
	Conductors of control circuits directly connected to the supply voltage and of circuits feeding control circuit transformers shall be protected against over-current in accordance with 7.2.3.	The over current protective device is provided for conductors of control circuits	P
	In control circuits fed through a transformer, of which one end of the secondary winding is connected to the protective bonding circuit, an over-current protective device is required only in the other secondary circuit conductor.		P
7.2.5	Socket outlets and their associated conductors		
	Over-current protection shall be provided for the circuits feeding the general purpose socket outlets intended primarily for supplying power to maintenance equipment.	No this situation.	N/A
	Over-current protective devices shall be provided in the unearthed live conductors of each circuit feeding such socket outlets.	No lighting circuits.	N/A
7.2.6	Lighting circuits		
	All unearthed conductors of circuits supplying lighting shall be protected against the effects of short circuits by the provision of over-current devices separate from those protecting other circuits.		P
7.2.7	Transformers		
	Transformers shall be protected against over-current in accordance with IEC 60076-5 and IEC 60742 as appropriate.	The transformer has been protected against over current	P
	Such protection shall (see also 7.2.10):		
	- avoid nuisance tripping due to transformer magnetizing inrush currents;	Unnecessary tipping has been avoided	P

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	- avoid a winding temperature rise in excess of the permitted value for the insulation class of transformer when it is subjected to the effects of a short circuit at its secondary terminals.		P
7.2.8	Location of over-current protective devices		
	An over-current protective device shall be located at the point where the conductor to be protected is connected to its supply.	Appropriate location of over current protective device	P
	Where that is not possible, no over-current protection is required for those conductors with current-carrying capacity less than that of the supply conductors, provided that the possibility of a short circuit is reduced by all of the following measures:		
	- the current-carrying capacity of the conductor is at least equal to that required for the load;		N/A
	- each connecting conductor to the over-current protective devices is no longer than 3 m;		N/A
	- the conductor is protected by an enclosure or duct		N/A
7.2.9	Over-current protective devices		
	The rated short-circuit breaking capacity shall be at least equal to the prospective fault current at the point of installation.	Every over current protective device has sufficient breaking capacity	P
	Where the short-circuit current to an over-current protective device can include additional currents other than from the supply (e.g. from motors, from power factor correction capacitors), those currents shall be taken into consideration.		N/A
	A lower breaking capacity is permitted where another protective device having the necessary breaking capacity is installed on the supply side.		N/A
	In that case, the characteristics of the two devices shall be coordinated so that the let-through energy (I2t) of the two devices in series does not exceed that which can be withstood without damage to the over-current protective device on the load side and to the conductors protected by that device.		N/A
	Where fuses are used, a type readily available in the country of use shall be selected, or arrangements shall be made with the user for the supply of spare parts.		P
7.2.10	Rating and setting of over-current protective devices		
	The rated current of fuses or the setting current of other over-current protective devices shall be selected as low as possible but adequate for the anticipated over-currents	The rating and setting of over current protective devices is appropriate.	P
	When selecting those protective devices, consideration should be given to the protection of control switching devices against damage due to over-currents.	Settings of over current protective devices have been listed in the electrical wiring diagrams	P
	The rated current or setting of an over-current protective device is determined by the current carrying capacity of the conductors to be protected by that device in accordance with 12.4, D.2 and the maximum allowable interrupting time in accordance with Clause D.3.		P
	That should take into account the needs of coordination with other electrical devices in the protected circuit.		P

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7.3	Protection of motors against overheating		
	Overload protection of motors shall be provided for each motor rated at more than 0.5 kW.	Overload protection of motors have been provided for the machine.	P
	In applications where an automatic interruption of the motor operation is unacceptable (e.g. fire pumps), the overload detection shall give a warning signal to which the operator can respond.		N/A
	Overload protection of motors can be achieved by		
	- overload protection (7.3.2),		N/A
	- over-temperature protection (7.3.3), or		N/A
	- current-limiting protection (7.3.4).		P
7.3.2	Overload Protection		
	Detection of overload(s) (except in the case of current limitation or built-in thermal protection in accordance with IEC 60034-11) shall be provided in each live conductor except for the neutral conductor.		N/A
	However, the number of overload detection devices may be reduced at the request of the user (see Annex B).		N/A
	For motors having single-phase or d.c. power supplies, detection in only one unearthed live conductor is permitted.		N/A
	Where overload protection is achieved by switching off, the switching device shall switch off all live conductors, but the neutral conductor may not be necessary.		N/A
	Where motors with special duty ratings are required to start or to brake frequently, the use of appropriate protective devices designed to accommodate special duty motors or over temperature protection (see 7.3.3) is necessary.		N/A
	For motors that cannot be overloaded, overload protection is not required.		N/A
7.3.3	Over-temperature protection		
	The use of motors with over-temperature protection (see IEC 60034-11) is recommended in situations where the cooling can be impaired.		N/A
	Depending upon the kind of motor, protection under stalled rotor or loss of phase conditions is not always ensured by over-temperature protection, and additional protection should then be provided.		N/A
	Over-temperature protection is also recommended for motors that cannot be overloaded, where the possibility of over temperature exists.		N/A
7.3.4	Current limiting protection		
	Where protection against the effects of overheating in three phase motors is achieved by current limitation, the number of current limitation devices may be reduced from 3 to 2 (see 7.3.2).		P
	For motors having single phase a.c or d.c. power supplies, current limitation in only one unearthed live conductor is permitted.		P
7.4	Abnormal temperature protection		
	Resistance heating or other circuits that are capable of attaining or causing abnormal temperatures and therefore can cause a hazardous condition shall be provided with suitable detection to initiate an appropriate control response.	No heat generating parts.	N/A

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7.5	Protection against supply interruption or voltage reduction and subsequent restoration		
	Where a supply interruption or a voltage reduction can cause a hazardous condition, damage to the machine, or to the work in progress, under-voltage protection shall be provided at a predetermined voltage level		N/A
	Where the operation of the machine can allow for an interruption or a reduction of the voltage for a short time period, delayed under-voltage protection may be provided.		N/A
	The operation of the under-voltage device shall not impair the operation of any stopping control of the machine.		N/A
7.6	Motor over-speed protection		
	Over-speed protection shall be provided where over-speeding can occur and could possibly cause a hazardous condition taking into account measures in accordance with 9.3.2.		N/A
	Over-speed protection shall initiate appropriate control responses and shall prevent automatic restarting.		N/A
	The over-speed protection should operate in such a manner that the mechanical speed limit of the motor or its load is not exceeded.		N/A
7.7	Earth fault/residual current protection		
	In addition to providing earth fault/residual current protection for automatic disconnection as described in 6.3, this protection can be used to reduce damage to equipment due to earth fault currents less than the detection level of the over-current protection.	No this situation.	N/A
	The setting of the devices shall be as low as possible consistent with correct operation of the equipment.	No this situation.	N/A
7.8	Phase sequence protection		
	Where an incorrect phase sequence of the supply voltage can cause a hazardous condition or damage to the machine, protection shall be provided.		P
7.9	Protection against over-voltages due to lightning and to switching surges		
	Protective devices can be provided to protect against the effects of over-voltages due to lightning or to switching surges.		P
	Devices for the suppression of over-voltages due to lightning shall be connected to the incoming terminals of the supply disconnecting device.		P
	Devices for the suppression of over-voltages due to switching surges shall be connected across the terminals of all equipment requiring such protection.		P
8	EQUIPOTENTIAL BONDING		
8.2	Protective bonding circuit		
8.2.1	General		
	The protective bonding circuit consists of:		
	— PE terminal(s)		P
	— the conductive structural parts of the electrical equipment and the machine;		N/A
	— the protective conductors in the equipment of		P

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	the machine including sliding contacts where they are part of the circuit.		
	On mobile machines with on-board power supplies, the protective circuits, the exposed conductive parts, and the extraneous conductive parts shall all be connected to a protective bonding terminal to provide protection against electric shock.	Not a mobile machine without on-board power supplies.	N/A
	When a mobile machine is also capable of being connected to an external incoming supply, the protective bonding terminal shall be the connection point for the external protective conductor.	Not a mobile machine without on-board power supplies.	N/A
	When the supply of electrical energy is self-contained within stationary, mobile, or movable items of equipment, and when there is no external supply connected, there is no need to connect such equipment to an external protective conductor.		N/A
	All parts of the protective bonding circuit shall be so designed that they are capable of withstanding the highest thermal and mechanical stresses that can be caused by earth-fault currents that could flow in that part of the protective bonding circuit.	It is in compliance with this requirement.	P
	Any structural part of the electrical equipment or of the machine may be used as part of the protective bonding circuit provided that it satisfies the requirements of IEC 60364-5-54.	The continuity of PE circuit can be ensured.	P
	If an IT distribution system is used, the machine structure shall be used as part of the protective bonding circuit in conjunction with an earth fault supervision system.	No this situation.	N/A
	The structural bonding is not required where all the equipment provided is in accordance with 6.3.2.2.		P
8.2.2	Protective conductors		
	Protective conductors shall be identified in accordance with 14.2.2.	Identification and marking of protective conductors acc. to cl.14.2.2	P
	Copper conductors should be used. Where a conductor material other than copper is used, its electrical resistance per unit length shall not exceed that of the allowable copper conductor and such conductors shall be not less than 16 mm 2 in cross-sectional area.	Copper conductors are used.	P
8.2.3	Continuity of the protective bonding circuit		
	All exposed conductive parts of the electrical equipment and the machine(s) shall be connected to the protective bonding circuit.		P
	Where a part is removed for any reason, the protective bonding circuit for the remaining parts shall not be interrupted.		P
	Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences.		P
	Where enclosures and conductors of aluminium or aluminium alloys are used, particular consideration should be given to the problems of electrolytic corrosion.		N/A
	Metal ducts of flexible or rigid construction and metallic cable sheaths shall not be used as protective conductors.	No any metal conduit is used on this machine.	N/A
	Such metal ducts and the metal sheathing of all		P

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	connecting cables (e.g. cable armouring, lead sheath) shall be connected to the protective bonding circuit.		
	Where the electrical equipment is mounted on lids, doors, or cover plates, continuity of the protective bonding circuit shall be ensured and it is recommended that a protective conductor is used.		P
	Otherwise fastenings, hinges or sliding contacts designed to have a low resistance shall be used.		N/A
	The continuity of the protective conductor in cables that are exposed to damage (e.g. flexible trailing cables) shall be ensured by appropriate measures (e.g. monitoring).		P
	For requirements for the continuity of the protective conductor using collector wires, collector bars and slip-ring assemblies.		P
8.2.4	Exclusion of switching devices from the protective bonding circuit		
	The protective bonding circuit shall not incorporate a switching device, an over-current protective device (e.g. switch, fuse) nor a means for current detection for such devices.	It is in compliance with the requirement	P
	The only means permitted for interruption of the protective conductors shall be links intended to be opened only by instructed or skilled persons for certain test or measurement purposes, preferably by using a tool.		P
	It is permissible to include such devices that do not interrupt the protective bonding circuit, that have electrical characteristics that under all circumstances ensure prevention of a hazardous voltage rise in any part of the circuit, and that do not impair the performance of the circuit.		P
8.2.5	Parts that need not be connected to the protective bonding circuit		
	It is not necessary to connect exposed conductive parts to the protective bonding circuit where those parts are mounted so that they do not constitute a hazard because:		
	- they cannot be touched on large surfaces or grasped with the hand and they are small in size (less than approximately 50 mm × 50 mm); or		P
	— they are located so that either contact with live parts, or an insulation failure, is unlikely.		P
8.2.6	Interruption of the protective bonding circuit		
	Where the continuity of the protective bonding circuit can be interrupted by means of removable current collectors or plug/socket combinations, the protective bonding circuit shall not be interrupted before the live conductors have been disconnected, and shall be re-established before any live conductor is reconnected.		N/A
	This also applies to removable or withdraw-able plug-in units.		N/A
	Metallic housings of plug/socket combinations shall be connected to the protective bonding circuit except where used for PELV.	No this situation.	N/A
8.2.7	Protective conductor connecting points		
	All protective conductors shall be terminated in accordance with 14.1.1.		P

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	The protective conductor connecting points shall have no other function and shall not be used, for example, to attach or connect appliances or parts.		P
	Each protective conductor connecting point shall be identified as such using the symbol, or by the bicolor combination GREEN-AND-YELLOW.		P
	For the use of the letters PE, see 5.2		P
8.3	Bonding for operational purposes		
8.3.1	General		
	The objective of operational bonding is to minimize:		
	- the consequence of an insulation failure on the operation of the machine (see 8.3.2);		P
	- the consequences of electrical disturbances on the operation of sensitive electrical equipment (see 8.3.3).		P
8.3.2	Bonding to the protective circuit		
	One method for protection against unintended operation as a result of insulation failures is achieved by connecting one side of a control circuit fed by a transformer to the protective bonding circuit, with the control devices connected in accordance with 9.1.4. This connection shall be made at the source of the control circuit supply.		P
	Attention is drawn to the fact that by omitting the connection of the exposed conductive parts of the devices to the protective bonding circuit as permitted by 6.3.2.2 and 6.3.2.3, the safety measures of this sub-clause may not be effective.		P
8.3.3	Bonding to a common reference potential		N/A
	The effects of disturbances can be reduced by employing a low resistance conductor in a low impedance network that is used as a reference level for high frequency signals within the electrical equipment (e.g. the chassis or ground plane).	No this situation.	N/A
	The design of the bonding connections shall be such as to reduce the impedance to the ground plane as much as possible.	No this situation.	N/A
	Such termination points shall be identified by the symbol	No this situation.	N/A
	Bonding to a common reference potential other than that provided by the protective bonding circuit or to the terminal for connection to an external (noiseless earth) earth conductor shall be permitted providing the requirements of clauses 6 and 7 are met.	No this situation.	N/A
	Single point bonding connected directly to a point as close as possible to the PE terminal or to its own terminal for connection to an external (noiseless) earth conductor shall be used, where appropriate, to minimize common mode interferences.		N/A
	This latter terminal shall be identified by the symbol.		N/A
9	CONTROL CIRCUITS AND CONTROL FUNCTIONS		
9.1	Control circuits		
9.1.1	Control circuit supply		
	Transformers shall be used for supplying the control circuits.		P
	Such transformers shall have separate windings.	The transformer has separate isolated windings	P
	Where several transformers are used, it is		N/A

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	recommended that the windings of those transformers be connected in such a manner that the secondary voltages are in phase.		
	Where d.c. control circuits are connected to the protective bonding circuit, they shall be supplied from a separate winding of the a.c. control circuit transformer or by another control circuit transformer.		N/A
	Transformers are not mandatory for machines with a single motor starter and a maximum of two control devices (e.g. interlock device, start/stop control station).		N/A
9.1.2	Control circuit voltages		
	The value of the control voltage should be consistent with the correct operation of the control circuit.		P
	The nominal voltage shall not exceed 277 V when supplied from a transformer.		N/A
9.1.3	Protection		
	Control circuits shall be provided with over current protection in accordance with 7.2.4 and 7.2.10.		P
9.1.4	Connection of control devices		
	In control circuits with one side connected (or intended to be connected) to the protective bonding circuit, one terminal of the operating coil of each electromagnetically operated device or one terminal of any other electrical device shall be connected directly to that side of the control circuit.		P
	All switching elements of control devices that operate the coil or the device shall be inserted between the other terminal of the coil or device and the other side of the control circuit.		P
	The following exceptions are permitted:		
	- where the requirements of 9.4.3.1 are met.		N/A
9.2	Control functions		
9.2.1	Start functions		
	Start functions shall operate by energizing the relevant circuit (see 9.2.5.2).		P
9.2.2	Stop functions		
	There are three categories of stops as follows:		
	- category 0: stopping by immediate removal of power to the machine actuators;		N/A
	- category 1: a controlled stop (see 3.11) with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;		P
	- category 2: a controlled stop with power left available to the machine actuators.		N/A
	With the exception of emergency operations (see 9.2.5.4), and depending upon the risk assessment, removal of power may be accomplished by the use of either electromechanical or solid-state components.	Power switch.	P
9.2.3	Operating modes		
	Each machine can have one or more operating modes determined by the type of machine and its application.		P
	When a hazardous condition can result from a mode selection, such selection shall be prevented by suitable means. Mode selection by itself shall	No hazardous condition could arise from mode selection.	P

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Clause	Requirement- Test	Result	Verdict
	not initiate machine operation. A separate action by the operator shall be required.		
	Safeguarding shall remain effective for all operating modes (see 9.2.4 for suspension of safeguarding under special conditions).		P
	Indication of the selected operating mode shall be provided.		P
9.2.4	Suspension of safeguarding		
	Where it is necessary to suspend safeguarding, a mode selection device or means capable of being secured in the desired mode shall be provided so as to prevent automatic operation.	Mode selection by itself does not initiate machine operation.	P
	In addition, one or more of the following means should be provided:		
	- initiation of motion by a hold-to-run device or by a similar control device;		P
	- a portable control station with an emergency stop device and, where appropriate, an enabling device. Where a portable station is in use, motion may be initiated only from that station;	No this situation.	N/A
	- limitation of the speed or the power of motion;		N/A
	- limitation of the range of motion.		N/A
9.2.5	Operation		
9.2.5.1	General		
	Measures shall be taken to prevent movement of the machine in an unintended manner after any stopping of the machine.		P
9.2.5.2	Start		
	The start of an operation shall be possible only when all of the safeguards are in place and are functional except for conditions as described in 9.2.4.		P
	On those machines where safeguards cannot be applied for certain operations, manual control of such operations shall be by hold-to-run controls, together with enabling devices, as appropriate.		P
	Suitable interlocks shall be provided to secure correct sequential starting.		P
	On machines requiring the use of more than one control station to initiate a start:		
	- each control station shall have a separate manually actuated start control device;		P
	- all required conditions for machine operation shall be met;		P
	- all start control devices shall be in the released (off) position before a start may be permitted;		P
	- all start control devices shall be actuated concurrently (see 3.6).		P
9.2.5.3	Stop		
	Category 0, category 1 and/or category 2 stops shall be provided where indicated by the risk assessment and the functional requirements of the machine (see 4.1).	Use category 0 stops	P
	Category 0 and category 1 stops shall be operational regardless of operating modes (see 9.2.3) and category 0 shall take priority.	category 0 stop only	P
	Stop functions shall override related start functions (see 9.2.5.2).		P
	Where required, facilities to connect protective devices and interlocks shall be provided.		P

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	If such a protective device or interlock causes a stop of the machine, it may be necessary for that condition to be signalled to the logic of the control system.		P
	The reset of the stop function shall not initiate any hazardous condition.		P
9.2.5.4	Emergency operations (emergency stop, emergency switching off)		P
9.2.5.4.2	Emergency stop		
	In addition to the requirements for stop (see 9.2.5.3), the emergency stop function has the following requirements:		
	- it shall override all other functions and operations in all modes;		P
	- power to the machine actuators that can cause a hazardous condition(s) shall be removed as quickly as possible without creating other hazards;		
	- reset shall not initiate a restart.	Resetting does not initiate a restart	P
	The emergency stop shall function either as a category 0 stop or as a category 1 stop, which shall be determined by the risk assessment of the machine.		P
	Where a category 0 stop is used for the emergency stop function, it shall have only hardwired electromechanical components. In addition, its operation shall not depend on electronic logic (hardware or software) or on the transmission of commands over a communications network or link.		P
	Where a category 1 stop is used for the emergency stop function, final removal of power to the machine actuators shall be ensured and carried out by means of electromechanical components.		P
9.2.5.4.3	Emergency switching off		
	The functional aspects of emergency switching off are given in IEC 60364-4-46.		P
	Emergency switching off should be provided where:		
	- protection against direct contact is achieved only by placing out of reach or by obstacles (see 6.2.6); or		P
	- there is the possibility of other hazards or damage caused by electricity.		P
	Emergency switching off is accomplished by disconnecting the incoming supply of the machine effecting a category 0 stop.		P
	When a machine cannot tolerate the category 0 stop, it may be necessary to provide other protection, for example against direct contact, so that emergency switching off is not necessary.		P
9.2.5.5	Monitoring of command actions		
	Movement or action of a machine or part of a machine that can result in a hazardous condition shall be monitored.	No this situation.	N/A
	On manually controlled machines, operators can provide some of this monitoring.	No this situation.	N/A
9.2.6	Hold-to-run controls		

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Clause	Requirement- Test	Result	Verdict
9.2.6.1	Hold-to-run controls shall require continuous actuation of the control device(s) to achieve operation.	The hold-to-run controls have been provided.	P
9.2.6.2	Two-hand control		
	Three types of two-hand control are available, which is determined by the risk assessment.		P
	Type I: this type requires		
	- the provision of two control devices and their concurrent actuation by both hands;		P
	- continuous concurrent actuation during the hazardous condition;		P
	- machine operation shall cease upon the release of either one or both of the control devices when hazardous conditions are still present.		P
	Type II:		
	a type I control requiring the release of both control devices before machine operation may be reinitiated.	No this device	N/A
	Type III:		
	a type II control requiring concurrent actuation of the control devices as follows:		N/A
	- it shall be necessary to actuate the control devices within a certain time limit of each other, not exceeding 0,5 s (see Annex B);		N/A
	- where this time limit is exceeded, both control devices shall be released before operation may be reinitiated		N/A
9.2.6.3	Enabling control		
	An enabling device is an additional manually operated control device used in conjunction with a start control and which, when continuously actuated, allows a machine to function.		P
	When an enabling device is provided as a part of a system, it shall be designed to allow motion when actuated in one position only. In any other position motion shall be stopped.		P
	It shall have the following features:		
	- be connected to a category 0 stop or to a category 1 stop (see 9.2.2);		P
	- be designed in consideration of ergonomic principles;		P
	- for a two-position type:		
	- position 1: off-function of the switch (actuator is not operated),		P
	- position 2: enabling function (actuator is operated);		P
	- for a three-position type:		
	position 1: off-function of the switch (actuator is not operated),		P
	- position 2: enabling function (actuator is operated in its mid position),		P
	- position 3: off-function (actuator is operated past its mid position).		P
	When returning from position 3 to position 2, the function shall not be enabled		P
9.2.6.4	Combined start and stop controls		
	Push-buttons and similar control devices that, when operated, alternately initiate and stop motion shall only be used for functions which cannot result in a hazardous condition		P

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Clause	Requirement- Test	Result	Verdict
9.2.7	Cableless control		
9.2.7.1	General		
	Some of these application and system integrity considerations may also be applicable to control functions employing serial data communication techniques where the communications link uses a cable..	There is not any cable less control	N/A
	Means shall be provided to readily remove or disconnect the power supply of the operator control station.	There is not any cable less control	N/A
	Means shall be provided, as necessary, to prevent unauthorized use of the operator control station.	There is not any cable less control	N/A
	Each operator control station shall carry an unambiguous indication of which machine(s) is intended to be controlled by that operator control station.	There is not any cable less control	N/A
9.2.7.2	Control limitation		
	Measures shall be taken to ensure that control commands:		
	- affect only the intended machine;		N/A
	- affect only the intended functions.		N/A
	Measures shall be taken to prevent the machine from responding to signals other than those from the intended operator control station(s).		N/A
	Where necessary, means shall be provided so that the machine can only be controlled from operator control stations in one or more predetermined zones or locations.		N/A
9.2.7.3	Stop		
	Operator control stations shall include a separate and clearly identifiable means to initiate the stop function of the machine or of all the motions that can cause a hazardous condition.	No this situation.	N/A
	The actuating means to initiate this stop function shall not be marked or labelled as an emergency stop device, even though the stop function initiated on the machine can be an emergency stop function.		P
	A machine which is equipped with cableless control shall have a means of automatically initiating the stopping of the machine and of preventing a potentially hazardous operation, in the following situations:		
	- when a stop signal is received;		N/A
	- when a fault is detected in the system;		N/A
	- when a valid signal has not been detected within a specified period of time (see Annex B), except when a machine is executing a pre-programmed task taking it outside the range of the cableless control where no hazardous condition can occur.	No this situation.	N/A
9.2.7.4	Serial data communication		
	In a machine where the control of safety-related functions relies on serial data transfer, correct communications shall be ensured by using an error detection method that is able to cope with up to three error bits in any command sequence.		N/A
9.2.7.5	Use of more than one operator control station		
	Where a machine has more than one operator control station, measures shall be taken to ensure that only one control station can be enabled at a	No this situation.	N/A

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Clause	Requirement- Test	Result	Verdict
	given time.		
	An indication of which operator control station is in control of the machine shall be provided at suitable locations as determined by the risk assessment of the machine.	No this situation.	N/A
	Exception: a stop command from any one of the control stations shall be effective when required by the risk assessment of the machine.	No this situation.	N/A
9.2.7.6	Battery-powered operator control stations		
	A variation in the battery voltage shall not cause a hazardous condition.		N/A
	If one or more potentially hazardous motions are controlled using a battery-powered operator control station, a clear warning shall be given to the operator when a variation in battery voltage exceeds specified limits.		N/A
	Under those circumstances, the operator control station shall remain functional long enough to put the machine into a non-hazardous condition.		N/A
9.3	Protective interlocks		
9.3.1	Reclosing or resetting of an interlocking safeguard		
	The reclosing or resetting of an interlocking safeguard shall not initiate machine motion or operation where that can result in a hazardous condition.	No interlocking guards	N/A
9.3.2	Overtravel limits		
	Where an overtravel can cause a hazardous condition, a position sensor or limit switch shall be provided to initiate appropriate control action.		P
9.3.3	Operation of auxiliary functions		P
	The correct operation of auxiliary functions shall be checked by appropriate devices.		P
	Where the non-operation of a motor or device for an auxiliary function can cause a hazardous condition, or cause damage to the machine or to the work in progress, appropriate interlocking shall be provided.		P
9.3.4	Interlocks between different operations and for contrary motions		
	All contactors, relays, and other control devices that control elements of the machine and that can cause a hazardous condition when actuated at the same time, shall be interlocked against incorrect operation.		N/A
	Reversing contactors shall be interlocked in such a way that in normal service no short circuit can occur when switching.	Reversing is not necessary	N/A
	Where, for safety or for continuous operation, certain functions on the machine are required to be interrelated, proper co-ordination shall be ensured by suitable interlocks.		N/A
	For a group of machines working together in a coordinated manner and having more than one controller, provision shall be made to co-ordinate the operations of the controllers as necessary.		N/A
	Where a failure of a mechanical brake actuator can result in the brake being applied when the associated machine actuator is energized and a hazardous condition can result, interlocks shall be provided to switch off the machine actuator.		N/A

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Clause	Requirement- Test	Result	Verdict
9.3.5	Reverse current braking		
	Where reverse current braking is used on a motor, effective measures shall be taken to avoid the motor starting in the opposite direction at the end of braking where that reversal can cause a hazardous condition or damage to the machine or to the work in progress.		P
	The use of a device operating exclusively as a function of time shall not be allowed		P
	Control circuits shall be so arranged that rotation of a motor shaft shall not result in a hazardous condition.		P
9.4	Control functions in the event of failure		
9.4.1	General requirements		
	Where failures or disturbances in the electrical equipment can cause a hazardous condition or damage to the machine or to the work in progress, appropriate measures shall be taken to minimize the probability of the occurrence of such failures or disturbances.		P
	The required measures and the extent to which they are implemented, either individually or in combination, depend on the level of risk associated with the respective application.		P
	Measures to reduce those risks include but are not limited to:		
	- protective devices on the machine;		P
	- protective interlocking of the electrical circuit;		P
	- use of proven circuit techniques and components (see 9.4.2.1);		P
	- provision of partial or complete redundancy (see 9.4.2.2) or diversity (see 9.4.2.3);	A combination of electrical and non-electrical systems	P
	- provision for functional tests (see 9.4.2.4).		P
9.4.2	Measures to minimize risk in the event of failure		
9.4.2.1	Use of proven circuit techniques and components		
	These measures include but are not limited to:		
	- bonding of control circuits to the protective bonding circuit for operational purposes (see 9.4.3.1);		P
	- connection of control devices in accordance with 9.1.4;		P
	- stopping by de-energizing (see 9.2.2);		P
	- the switching of all live conductors to the device being controlled (see 9.4.3.1);		P
	- the use of switching devices having positive (or direct) opening operation (see IEC 60947-5-1);		P
	- circuit design to reduce the possibility of failures causing undesirable operations.		P
9.4.2.2	Provisions for redundancy		
	By providing partial or complete redundancy it is possible to minimize the probability that one single failure in the electrical circuit can result in a hazardous condition.	Redundancy is not required according to the result of risk assessment.	N/A
	Redundancy can be effective in normal operation or designed as special circuits that take over the protective function only where the operating function fails.		N/A
	Where off-line redundancy which is not active during normal operation is used, suitable measures shall be taken to ensure that those control circuits		N/A

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Clause	Requirement- Test	Result	Verdict
	are available when required.		
9.4.2.3	Use of diversity		
	The use of control circuits having different principles of operation or using different types of devices may reduce the probability of hazards resulting from faults and/or failures.		N/A
	Examples include:		
	- the combination of normally open and normally closed contacts operated by interlocking guards;		P
	- the use of different types of control circuit components in the circuit;		P
	- the combination of electromechanical and electronic circuits in redundant configurations;		P
	- the combination of electrical and non-electrical systems may perform the redundant function and provide the diversity.		N/A
9.4.2.4	Functional tests		
	Functional tests may be carried out automatically by the control system, or manually by inspection or tests at start-up and at predetermined intervals, or a combination as appropriate.		P
9.4.3	Protection against maloperation due to earth faults, voltage interruptions and loss of circuit continuity		
9.4.3.1	Earth faults		
	Earth faults on any control circuit shall not cause unintentional starting, potentially hazardous motions, or prevent stopping of the machine.		P
	In order to fulfil this requirement, bonding to the protective bonding circuit may be provided in accordance with 8.2 and the devices may be connected as described in 9.1.4.		P
	Control circuits fed from a transformer and not connected to the protective bonding circuit shall be provided with an insulation monitoring device that either indicates an earth fault or interrupts the circuit automatically after an earth fault.		P
	Where the control circuit is directly connected between the phase conductors of the supply or between a phase conductor and a neutral conductor that is not earthed or is earthed through a high impedance, multi-pole control switches that interrupt all live conductors shall be used for START or STOP of those machine functions that can cause a hazardous condition or damage to the machine in the event of unintentional starting or failure to stop.		P
9.4.3.2	Voltage interruptions		
	The requirements detailed in 7.5 shall apply.		P
	Where the control system uses a memory device(s), proper functioning in the event of power failure shall be ensured to prevent any loss of memory that can result in a hazardous condition.	Appropriate measures have been taken to prevent memory loss.	P
9.4.3.3	Loss of circuit continuity		
	Where the loss of continuity of safety-related control circuits depending upon sliding contacts can result in a hazardous condition, appropriate measures shall be taken.		P
10	OPERATOR INTERFACE AND MACHINE-MOUNTED CONTROL DEVICES		
10.1.1	General device requirements		
	As far as is practicable, those devices shall be	The relevant standard has	P

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Clause	Requirement- Test	Result	Verdict
	selected, mounted, and identified or coded in accordance with IEC 60073 and IEC 60447.	been followed as far as possible.	
10.1.2	Location and mounting		
	As far as is practicable, machine-mounted control devices shall be:	It is in compliance with this requirement.	
	- readily accessible for service and maintenance;		P
	The actuators of hand-operated control devices shall be selected and installed so that:		P
	- they are not less than 0.6 m above the servicing level and are within easy reach of the normal working position of the operator;		
	- the operator is not placed in a hazardous situation when operating them;		P
	- the possibility of inadvertent operation is minimized.		P
10.1.3	Protection		
	Where mounted as intended, operator interface and machine mounted control devices shall withstand the stresses of expected use.	Effective protection	P
	The degree of protection together with other appropriate measures shall afford protection against:	Effective protection	
	- the effects of aggressive liquids, vapours, or gases found in the physical environment or used on the machine;		P
	- the ingress of contaminants.		P
	In addition, the operator interface control devices shall have a minimum degree of protection against direct contact of IPXXD.	At least IP23	P
10.1.4	Position sensors		
	Position sensors shall be so arranged that they will not be damaged in the event of overtravel.		P
	Position sensors used in circuits with safetyrelated functions either shall have positive (or direct) opening operation (see IEC 60947-5-1) or shall provide similar reliability (see 9.4.2).		P
10.1.5	Portable and pendant control stations		
	Portable and pendant operator control stations and their control devices shall be so selected and arranged as to minimize the possibility of inadvertent machine operations caused by shocks and vibrations.	No this situation.	N/A
10.2	Push-buttons		
10.2.1	Colours		
	Push-button actuators shall be colour-coded in accordance with Table 2.	The suitable colour according to table 2 has been found on the control push buttons.	P
	The colours for START/ON actuators should be WHITE, GREY or BLACK and RED is forbidden.		P
	The colour RED shall be used for emergency stop and emergency switching off actuators.		P
	The colours for STOP/OFF actuators should be BLACK, GREY, or WHITE but BLACK. GREEN shall not be used. RED is also permitted, but it is recommended that RED is not used near an emergency operation device.		P
	WHITE, GREY, or BLACK are the preferred colours for push-button actuators that alternately act as START/ON and STOP/OFF push-buttons. The		P

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Clause	Requirement- Test	Result	Verdict
	colours RED, YELLOW, or GREEN shall not be used (see also 9.2.6).		
	WHITE, GREY, or BLACK are the preferred colours for push-button actuators that cause operation while they are actuated and cease the operation when they are released. The colours RED, YELLOW, or GREEN shall not be used.		P
	Reset push-buttons shall be BLUE, WHITE, GREY, or BLACK. Where they also act as a STOP/OFF button, the colours WHITE, GREY, or BLACK are preferred with the main preference being for BLACK. GREEN shall not be used.		P
10.2.2	Markings		
	Push-buttons shall be marked, near to or preferably directly on the actuators , with the following symbols:		
	- START or ON		P
	- STOP or OFF		P
	- Push-buttons acting alternately as START or STOP buttons and as ON or OFF buttons		P
	- Push-buttons acting as START or ON buttons when pressed and as STOP or OFF buttons when released		P
10.3	Indicator lights and displays		
10.3.1	Modes of use		
	Indicator lights and displays serve to give the following types of information:		
	- indication: to attract the operator’s attention or to indicate that a certain task should be performed. The colours RED, YELLOW, GREEN and BLUE are normally used in this mode;		P
	- confirmation: to confirm a command, or a condition, or to confirm the termination of a change or transition period. The colours BLUE and WHITE are normally used in this mode and GREEN may be used in some cases.		P
10.3.2	Colours		
	Unless otherwise agreed between the supplier and the user, indicator (pilot) light lenses shall be colour coded with respect to the condition (status) of the machine in accordance with Table 3.		P
	Alternative meanings may be assigned (see IEC 60073) in accordance with one of the following criteria:		
	- the safety of persons and the environment;		P
	- the state of the electrical equipment.		P
10.3.3	Flashing lights		
	For further distinction or information and especially to give additional emphasis, flashing lights may be used for the following purposes:	No flashing lights	N/A
	- to attract attention;		N/A
	- to request immediate action;		N/A
	- to indicate a discrepancy between the command and actual state;		N/A
	- to indicate a change in process (flashing during transition).		N/A
	It is recommended that higher frequency flashing lights be used for higher priority information.		N/A
10.4	Illuminated push-buttons		
	Illuminated push-button actuators shall be		P

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Clause	Requirement- Test	Result	Verdict
	colourcoded in accordance with Table 2 and Table 3.		
	Where there is difficulty in assigning an appropriate colour, WHITE shall be used.		P
	The colour RED for the emergency stop actuator Shall not depend on the illumination of its light.		P
10.5	Rotary control devices		
	Devices having a rotational member, such as potentiometers and selector switches, shall be mounted in such a way as to prevent rotation of the stationary member. Friction alone shall not be sufficient.		P
10.6	Start devices		
	Actuators used to initiate a start function or the movement of machine elements shall be constructed and mounted so as to minimize inadvertent operation. However, mushroom-type actuators may be used for two-hand control.		P
10.7	Devices for emergency stop		
10.7.1	Location		
	Devices for emergency stop shall be readily accessible.		P
	Emergency stop devices shall be located at each operator control station and at other locations where the initiation of an emergency stop can be required (exception: see 9.2.7.3).		P
10.7.2	Types		
	The types of device for emergency stop include:		
	- a push-button operated switch;		P
	- a pull-cord operated switch;		N/A
	- a pedal-operated switch without a mechanical guard.		N/A
	The devices shall be of the self-latching type and shall have positive (or direct) opening operation.	They are of self-latching type	P
10.7.3	Restoration of normal function after emergency stop	Restoring an emergency stop requires manual reset.	
	It shall not be possible to restore an emergency stop circuit until the emergency stop device has been manually reset.		P
	Where several emergency stop devices are provided in a circuit, it shall not be possible to restore that circuit until all emergency stop devices that have been operated have been reset		P
10.7.4	Actuators		
	Actuators of emergency stop devices shall be coloured RED.		N/A
	The background immediately around the actuator shall be coloured YELLOW.		N /A
	The actuator of a push-button operated emergency stop device shall be of the palm or mushroom head type.		N/A
10.7.5	Local operation of the supply disconnecting device to effect emergency stop		N/A
	The supply disconnecting device may be locally operated to serve the function of emergency stop when:		N/A
	- it is readily accessible to the operator;		N/A
	- it is of the type described in 5.3.2 a), b) or c).		N/A
	When intended for such use, the supply disconnecting device shall meet the colour		N/A

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Clause	Requirement- Test	Result	Verdict
	requirements of 10.7.4.		
10.8	Devices for emergency switching off		
10.8.1	Location		
	Emergency switching off devices shall be located as necessary for the given application. Normally, those devices will be located separate from operator control stations.		N/A
	Were it can be necessary to initiate the emergency switching off function from an operator control station, that control station need not also be equipped with a separate emergency stop device since the emergency switching off function effects a category 0 emergency stop		N/A
10.8.2	Types		
	The types of device for emergency switching off include:		
	- a push-button operated switch;		N/A
	- a pull-cord operated switch.		N/A
	The devices shall be of the Self-latching type and shall have positive (or direct) opening operation (see IEC 60947-5-1).		N/A
	The push-button operated switch may be in a break-glass enclosure.		N/A
10.8.3	Restoration of normal function after emergency switching off		N/A
	It shall not be possible to restore an emergency switching off circuit until the emergency switching off device has been manually reset.		N/A
	Where several emergency switching off devices are provided in a circuit, it shall not be possible to restore that circuit until all emergency switching off devices that have been operated have been reset.		N/A
10.8.4	Actuators		
	Actuators of emergency switching off devices shall be coloured RED.		P
	The background immediately around the device actuator should be coloured YELLOW		P
	The actuator of a push-button operated emergency switching off device shall be of the palm or mushroom head type.		P
10.8.5	Local operation of the supply disconnecting device to effect emergency switching off		
	Where the supply disconnecting device is to be locally operated for emergency switching off, it shall be readily accessible and should meet the colour requirements of 10.8.4.		N/A
10.9	Displays		N/A
	Displays shall be selected and installed in such a manner as to be visible from the normal position of the operator.		N/A
	Where displays are intended to be warning devices, it is recommended that they be of the flashing or rotary type and be provided with an audible warning device.		N/A
11	ELECTRONIC EQUIPMENT		
11.2	Basic requirements		
11.2.1	Inputs and outputs		
	An indication of the status of all digital inputs and outputs should be provided.		P
11.2.2	Equipotential bonding		

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Clause	Requirement- Test	Result	Verdict
	All input/output racks (remote or local), processor racks, and power supplies shall be electrically bonded together in accordance with the supplier's specifications and connected to the protective bonding circuit (see 8.2.3).		P
	Where it is necessary for operational purposes for some equipment to be isolated from the protective bonding circuit, such equipment may be excluded from this requirement in accordance with clause 8.		P
11.3	Programmable equipment		
11.3.1	Programmable controllers		
	Programmable controllers shall conform to relevant IEC standards.		N/A
11.3.2	Memory retention and protection		
	Means shall be provided to prevent memory alteration by unauthorized persons and the requirements detailed in 9.4.3.2 shall apply.		N/A
11.3.3	Software verification		
	Equipment using reprogrammable logic shall have means for verifying that the software is in accordance with the relevant program documentation.		N/A
11.3.4	Use in safety-related functions		
	Programmable electronic equipment shall not be used for category 0 emergency stop functions.		N/A
	For all other safety-related stop functions, the use of hard-wired electromechanical components is preferred.		N/A
	Where programmable electronic equipment is used for such functions, then appropriate measures in accordance with 9.4 shall be employed.		N/A
	These requirements shall not preclude the use of programmable electronic equipment for monitoring, testing, or backing-up such functions but that equipment shall not prevent the correct operation of those functions.		P
	Until such a time that this situation can be resolved, it is inadvisable to rely solely on the correct operation of such a single-channel device.		P
12	CONTROLGEAR: LOCATION, MOUNTING, AND ENCLOSURES		
12.1	General requirements		
	All controlgear shall be located and mounted so as to facilitate:	It is in compliance with this requirement.	P
	- its accessibility and maintenance;		
	- its protection against the external influences or conditions under which it is intended to operate;		P
	- operation and maintenance of the machine and its associated equipment.		P
12.2	Location and mounting		
12.2.1	Accessibility and maintenance		
	All items of controlgear shall be placed and oriented so that they can be identified without moving them or the wiring.	Can be clearly identified.	P
	For items that require checking for correct operation or that are liable to need replacement, those actions should be possible without dismantling other equipment or parts of the machine (except opening doors or removing covers).	It is in compliance with this requirement.	P
	Terminals not associated with controlgear shall also		P

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	conform to these requirements.		
	All controlgear shall be mounted so as to facilitate its operation and maintenance from the front.		P
	Where a special tool is necessary to remove a device, such a tool shall be supplied.		P
	Where access is required for regular maintenance or adjustment, the relevant devices shall be located between 0.4 m and 2.0 m above the servicing level.		P
	It is recommended that terminals be at least 0.2 m above the servicing level and be so placed that conductors and cables can be easily connected to them.		P
	No devices except devices for operating, indicating, measuring, and cooling shall be mounted on doors and on normally removable access covers of enclosures.		P
	Where control devices are connected through plug-in arrangements, their association shall be made clear by type (shape), marking or reference designation, singly or in combination (see 14.4.5).		P
	Plug-in devices that are handled during normal operation shall be provided with noninterchangeable features where the lack of such a facility can result in malfunctioning.		N/A
	Plug/socket combinations that are handled during normal operation shall be located and mounted so as to provide unobstructed access.		N/A
	Test points, where provided, shall be:		
	- mounted so as to provide unobstructed access;		P
	- clearly marked to correspond with the documentation;		P
	- adequately insulated;		P
	sufficiently spaced for connection of the test equipment or means.		P
12.2.2	Physical separation or grouping		
	Non-electrical parts and devices, not directly associated with the electrical equipment, shall not be located within enclosures containing controlgear.	It is in compliance with this requirement.	P
	Devices such as solenoid valves should be separated from the other electrical equipment.	Non-electrical parts and electrical parts are mounted separately.	P
	Control devices mounted in the same location and connected to the supply voltage, or to both supply and control voltages, shall be grouped separately from those connected only to the control voltages.		P
	Terminals shall be separated into groups for:		P
	- power circuits;		P
	- associated control circuits;		P
	- other control circuits, fed from external sources.	No this situation.	N/A
	The groups may be mounted adjacently, provided that each group can be readily identified.		P
	When arranging the location of devices (including interconnections), the clearances and creepage distances specified for them shall be maintained, taking into account the external influences or conditions of the physical environment.		P
12.2.3	Heating effects		
	Heat generating components shall be so located that the temperature of each component in the		P

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	vicinity remains within the permitted limit.		
12.3	Degrees of protection		
	The protection of controlgear against ingress of solid foreign objects and of liquids shall be adequate taking into account the external influences under which the machine is intended to operate and shall be sufficient against dust, coolants, and swarf.	It is in compliance with this requirement.	P
	Enclosures of controlgear shall provide a degree of protection of at least IP22 (see IEC 60529).		P
	Exceptions:		
	a) Where an electrical operating area is used as a protective enclosure for an appropriate degree of protection against the ingress of solid bodies and liquids.	Suitable protective enclosure is provided for protection	P
	b) Where removable collectors on collector wire or collector bar systems are used and IP22 is not achieved but the measures of 6.2.5 are applied.		N/A
	Some examples of applications, along with the degree of protection typically provided by their enclosures, are listed below:		N/A
	Depending upon the conditions where installed, another degree of protection may be appropriate.		N/A
12.4	Enclosures, doors and openings		
	Enclosures shall be constructed using materials capable of withstanding the mechanical, electrical and thermal stresses as well as the effects of humidity that are likely to be encountered in normal service.	Material of the enclosures is steel plate, which is able to withstand mechanical,electrical, thermal stress, etc.	P
	Fasteners used to secure doors and covers should be of the captive type.		P
	Windows provided for viewing internally mounted indicating devices shall be of a material suitable to withstand mechanical stress and chemical attack.	No such windows	P
	It is recommended that enclosure doors be not wider than 0.9 m and have vertical hinges, preferably of the lift off type, with an angle of opening of at least 95°.		P
	The joints or gaskets of doors, lids, covers and enclosures shall withstand the chemical effects of the aggressive liquids, vapours, or gases used on the machine.		
	The means used to maintain the degree of protection of an enclosure on doors, lids and covers that require opening or removal for operation or maintenance shall:		
	- be securely attached to either the door/cover or the enclosure;	It is in compliance with this requirement.	P
	not deteriorate due to removal or replacement of the door or the cover, and so impair the degree of protection.		P
	All openings in the enclosure, including those towards the floor or foundation or to other parts of machine, shall be closed by the supplier(s) in a manner ensuring the degree of protection specified for the equipment.		P
	Openings for cable entries shall be easily reopened on site.		P
	A suitable opening may be provided in the base of enclosures within the machine so that moisture due		P

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	to condensation may drain away.		
	There shall be no opening between enclosures containing electrical equipment and compartments containing coolant, lubricating or hydraulic fluids, or those into which oil, other liquids, or dust can penetrate, except for electrical devices specifically designed to operate in oil and electrical equipment in which coolants are used.		P
12.5	Access to controlgear		
	The minimum dimensions of gangways in front of and between controlgear shall be in accordance with 481.2.4 of IEC 60364-4-481.		N/A
	Doors in gangways and for access to electrical operating areas shall:		
	- be at least 0,7 m wide and 2.0 m high;		N/A
	- open outwards;		N/A
	- have a means to allow opening from the inside without the use of a key or tool.		
13	CONDUCTORS AND CABLES		
13.1	General requirements		
	Conductors and cables shall be selected so as to be suitable for the operating conditions and external influences that can exist.	Suitable for operating conditions	P
	These requirements do not apply to the integral wiring of assemblies, sub assemblies, and devices that are manufactured and tested in accordance with their relevant IEC standard.	(IEC 60439-1)	P
13.2	Conductors		
	In general, conductors shall be of copper.	Conductors are of copper	P
	Conductors of any other material shall have a nominal cross-sectional area such that, carrying the same current, the maximum conductor temperature shall not exceed the value given in Table 4.	No this situation.	N/A
	Where aluminium is used, the cross-sectional area shall be at least 16 mm2.		N/A
	Although class 1 conductors are primarily intended for use between rigid, non-moving parts, they may also be used where minimal flexing occurs provided that the cross-sectional area is less than 0.5 mm2.		P
	All conductors that are subject to frequent movement shall have flexible stranding of class 5 or class 6 (see Table C.4).	No such conductors	N/A
13.3	Insulation		
	The types of insulation include (but are not limited to):		
	- polyvinyl chloride (PVC);	/	N/A
	- rubber, natural and synthetic;		N/A
	- silicone rubber (SiR);		N/A
	- mineral;		N/A
	- cross-linked polyethylene (XLPE);		N/A
	- ethylene propylene compound (EPR).		N/A
	Where the insulation of conductors and cables can constitute hazards due to the propagation of a fire or the emission of toxic or corrosive fumes, guidance from the cable supplier should be sought.	The conductors comply with related IEC standard	P
	It is important to give special attention to the integrity of a circuit having a safety-related function.		P
	The dielectric strength of the insulation shall be	2000 VAC, 5 min No	P

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	adequate for the test voltage required with a minimum of 2000 V a.c. for 5 min duration for cables operating at voltages higher than 50 V a.c. or 120 V d.c.	breakdown	
	For separate PELV circuits, the dielectric strength shall be adequate for the test voltage of 500 V a.c. for a duration of 5 min.		N/A
	The mechanical strength and thickness of the insulation shall be such that the insulation cannot be damaged in operation or during laying, especially for cables pulled into ducts.	Appropriate protective measures have been provided to prevent damage of insulation.	P
13.4	Current-carrying capacity in normal service		
	The current-carrying capacity of conductors and cables is determined by both:		
	- the maximum allowable conductor temperature under the highest possible steady-state current or the thermal equivalent r.m.s. current for intermittent duty applications (see C.2); and		P
	- the ultimate allowable short-time conductor temperature under short-circuit conditions.		P
	The cross-sectional area of a conductor shall be such that, under those conditions, the conductor temperature does not exceed the value given in Table 4, unless otherwise specified by the cable manufacturer.		P
	The current-carrying capacities for PVC insulated wiring between enclosures and individual items of equipment under steady-state conditions are given in Table 5.		N/A
	For the selection of conductors and cables for intermittent duty applications, see C.2 for the calculation of the thermal equivalent r.m.s. current.		P
13.5	Conductor and cable voltage drop		
	The voltage drop from the point of supply to the shall not exceed 5 % of the nominal voltage under normal operating conditions.	Voltage drop ＜1%	P
13.6	Minimum cross-sectional area		
	To ensure adequate mechanical strength, the cross-sectional area of conductors should not be less than as shown in Table 6.		P
	Where it is considered necessary, conductors with smaller cross-sectional areas than shown in Table 6 may be used in equipment provided adequate mechanical strength is achieved by other means and proper functioning is not impaired.		P
13.7	Flexible cables		
13.7.1	General		
	Flexible cables shall have class 5 or class 6 conductors (see Table C.4).	cl. 5 conductors	P
	Cables that are subjected to severe duties shall be of adequate construction to protect against:		
	- abrasion due to mechanical handling and dragging across rough surfaces;	No cables exposed to severe duties	P
	- kinking due to operation without guides;		P
	- stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums.		P
13.7.2	Mechanical rating		
	The cable handling system of the machine shall be	No other tensile stress	P

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	so designed to keep the tensile stress of the conductors as low as is practicable during machine operations.	other than the net weight of the conductor	
	Where copper conductors are used, the tensile stress shall not exceed 15 N/mm2 of the copper cross-sectional area.	＜15N/mm2	P
	Where the demands of the application exceed the tensile stress limit of 15 N/mm2, cables with special construction features should be used and the allowed maximal tensile strength should be agreed with the cable manufacturer.	No this situation.	P
	The allowed maximum stress of conductors of flexible cables with material other than copper should be agreed with the cable manufacturer.		P
13.7.3	Current-carrying capacity of cables wound on drums		
	Cables to be wound on drums shall be selected with conductors having a cross-sectional area such that, when fully wound on the drum and carrying the normal service load, the maximum allowable conductor temperature is not exceeded.		P
	For cables of circular cross-sectional area installed on drums, the maximum current-carrying capacity in free air should be derated in accordance with Table	(see also clause 44 of IEC 60621-3).	P
13.8	Collector wires, collector bars and slip-ring assemblies		
13.8.1	Protection against direct contact		
	Collector wires, collector bars and slip-ring assemblies shall be installed or enclosed in such away that, during normal access to the machine, protection against direct contact shall be achieved by the application of one of the following protective measures:		
	- protection by partial insulation of live parts.		P
	- protection by enclosures or barriers of at least IP2X.		
	Horizontal top surfaces of barriers or enclosures that are readily accessible shall provide a degree of protection of at least IP4X.		N/A
	- prevent damage from a swinging load.		N/A
13.8.2	Protective conductor circuit		
	Where collector wires, collector bars and slip-ring assemblies are installed as part of the protective bonding circuit, the protective conductor (PE) and the neutral conductor (N) shall each use a separate collector wire, collector bar or slip-ring.	They do not carry current in normal operation	P
	The continuity of the protective conductor circuit using sliding contacts shall be ensured by taking appropriate measures.		P
13.8.3	Protective conductor current collectors		
	Protective conductor current collectors shall have a shape or construction so that they are not interchangeable with the other current collectors.		P
	Such current collectors shall be of the sliding contact type.		P
13.8.4	Removable current collectors with a disconnector function		
	Removable current collectors having a disconnector function shall be so designed that the		P

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	protective conductor circuit is interrupted only after the live conductors have been disconnected, and the continuity of the protective conductor circuit is re-established before any live conductor is reconnected.		
13.8.5	Clearances in air		
	Clearances between the respective conductors, and between adjacent systems, of collector wires, collector bars, slip-ring assemblies and their current collectors shall be suitable for operation in pollution degree 3 conditions		P
13.8.6	Creepage distances		
	Creepage distances between the respective conductors, between adjacent systems of collector wires, collector bars and slip-ring assemblies, and their current collectors shall be suitable for operation in pollution degree 3 conditions.	Cree page distance between protective bonding collector bar and the live parts is more than 30mm	P
	In abnormally dusty, moist or corrosive environments the following creepage distance requirements apply:		
	- unprotected collector wires, collector bars, and slip-ring assemblies shall be equipped with insulators with a minimum creepage distance of 60 mm;		P
	- enclosed collector wires, insulated multipole collector bars and insulated individual collector bars shall have a minimum creepage distance of 30 mm.		P
	The manufacturer’s recommendations shall be followed regarding special measures to prevent a gradual reduction in the insulation values due to unfavourable ambient conditions.	Protected by enclosure	P
13.8.7	Conductor system sectioning		
	Where collector wires or collector bars are arranged so that they can be divided into isolated sections, suitable design measures shall be employed to prevent the energization of adjacent sections by the current collectors themselves.		P
13.8.8	Construction and installation of collector wire, collector bar systems and slip-ring assemblies		
	Collector wires, collector bars and slip-ring assemblies used for power circuits shall be grouped separately from those used for control circuits.		P
	Collector wires, collector bars and slip-ring assemblies shall be capable of withstanding, without damage, the mechanical forces and thermal effects of short-circuit currents.		P
	Removable covers for collector wire and collector bar systems laid underground or underfloor shall be so designed that they cannot be opened by one person without the aid of a tool.		P
	Where collector bars are installed in a common metal enclosure, the individual sections of the enclosure shall be bonded together and earthed at several points depending upon their length.		P
	Metal covers of collector bars laid underground or underfloor shall also be bonded together and earthed.		P
	For equipotential bonding or protective conductor		P

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	connection to covers or coverplates of metal enclosures or underfloor ducts, the usual metal hinges are considered sufficient to ensure continuity.		
	Underground and underfloor collector bar ducts shall have drainage facilities.		P
14	WIRING PRACTICES		
14.1	Connections and routing		
14.1.1	General requirements		
	All connections, especially those of the protective bonding circuit, shall be secured against accidental loosening.	All connections reliable	P
	The means of connection shall be suitable for the cross-sectional areas and nature of the conductors being terminated.		P
	For aluminium or aluminium alloy conductors, particular consideration shall be given to the prevention of problems of electrolytic corrosion.	No this situation.	P
	The connection of two or more conductors to one terminal is permitted only in those cases where the terminal is designed for that purpose. However, only one protective conductor shall be connected to one terminal connecting point.		P
	Soldered connections shall only be permitted where terminals are provided that are suitable for soldering.	No soldered connections were found during inspection	P
	Terminals on terminal blocks shall be plainly identified to correspond with markings on the diagrams.		P
	The installation of flexible conduits and cables shall be such that liquids shall drain away from the fittings.		P
	Means of retaining conductor strands shall be provided when terminating conductors at devices or terminals that are not equipped with this facility. Solder shall not be used for that purpose.		P
	Shielded conductors shall be so terminated as to prevent fraying of strands and to permit easy disconnection.		P
	Identification tags shall be legible, permanent, and appropriate for the physical environment.		P
	Terminal blocks shall be mounted and wired so that the internal and external wiring does not cross over the terminals.	No wiring crosses over terminals	P
14.1.2	Conductor and cable runs		
	Conductors and cables shall be run from terminal to terminal without splices or joints.		P
	Where it is impracticable to provide terminals in a junction box, splices or joints may be used.		P
	Where it is necessary to connect and disconnect cables and cable assemblies, a sufficient extra length shall be provided for that purpose.		P
	The terminations of cables shall be adequately supported to prevent mechanical stresses at the terminations of the conductors.		P
	Wherever possible, the protective conductor shall be placed close to the associated live conductors in order to decrease the impedance of the loop.		P
14.1.3	Conductors of different circuits		
	Conductors of different circuits may be laid side by	Conductors and cables run	P

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	side, may occupy the same duct, or may be in the same multiconductor cable provided that the arrangement does not impair the proper functioning of the respective circuits.	from terminal to terminal without splices or joints.	
	Where those circuits operate at different voltages, the conductors shall be separated by suitable barriers or shall be insulated for the highest voltage to which any conductor within the same duct can be subjected.		P
14.2	Identification of conductors		
14.2.1	General requirements		
	Conductors shall be identifiable at each termination in accordance with the technical documentation.	Have identification at each termination point	P
	Where colour-coding is used for identification of conductors, the following colours may be used:	Use suitable colours	P
	BLACK, BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (including LIGHT BLUE), VIOLET, GREY, WHITE, PINK, TURQUOISE.		P
	It is recommended that, where colour is used for identification, the colour be used throughout the length of the conductor either by the colour of the insulation or by colour markers. An acceptable alternative may consist of additional identification at selected locations.		P
	For safety reasons, the colour GREEN or the colour YELLOW should not be used where there is a possibility of confusion with the bicolour combination GREEN-AND-YELLOW.	No colour Green or Yellow conductor were found during inspection.	N/A
	Colour identification using combinations of those colours listed above may be used provided there can be no confusion and that GREEN or YELLOW is not used except in the bicolour combination GREEN-AND-YELLOW.		P
14.2.2	Identification of the protective conductor		
	The protective conductor shall be readily distinguishable by shape, location, marking, or colour.	Distinguishable by marking and colour	P
	When identification is by colour alone, the bicolour combination GREEN-AND-YELLOW shall be used throughout the length of the conductor.		P
	This colour identification is strictly reserved for the protective conductor.		P
	For insulated conductors, the bicolour combination GREEN-AND-YELLOW shall be such that on any 15 mm length one of the colours covers at least 30% and not more than 70% of the surface of the conductor, the other colour covering the remainder of the surface.		P
	Where the protective conductor can be easily identified by its shape, position, or construction, or where the insulated conductor is not readily accessible, colour coding throughout its length is not necessary but the ends or accessible positions shall be clearly identified by the graphical symbol or by the bicolour combination GREEN-AND-YELLOW.		P
14.2.3	Identification of the neutral conductor		
	Where a circuit includes a neutral conductor identified by colour, the colour shall be LIGHT BLUE.	No neutral conductor	N/A

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	LIGHT BLUE shall not be used for identifying any other conductor where confusion is possible.		P
	Where identification by colour is used, bare conductor used as neutral conductors shall be either coloured by a LIGHT BLUE stripe, 15 mm to 100 mm wide in each compartment or unit or at each accessible position, or coloured LIGHT BLUE throughout their length.		P
14.2.4	Identification of other conductors		
	Identification of other conductors shall be by colour (either solid or with one or more stripes) number, alphanumeric, or a combination of colour and numbers or alphanumeric.	By numbers or alphanumerics	P
	When numbers are used, they shall be Arabic; letters shall be Roman (either upper or lower case).	Numbers are in Arabic, letters are in Roman characters.	P
	It is recommended that insulated conductors be colour-coded as follows:		
	- BLACK: a.c. and d.c. power circuits;		P
	- RED: a.c. control circuits;		P
	- BLUE: d.c. control circuits;		P
	- ORANGE: interlock control circuits supplied from an external power source		P
	Exceptions: to the above are permitted where:		
	- individual devices are purchased complete with internal wiring;		N/A
	- insulation is used that is not available in the colours required; or		P
	- multiconductor cable is used, but not the bicolour combination GREEN-AND-YELLOW.		P
14.3	Wiring inside enclosures		
	Panel conductors shall be supported where necessary to keep them in place.	Appropriate supporting devices have been provided.	P
	Non-metallic ducts shall be permitted only when they are made with a flame-retardant insulating material		P
	It is recommended that electrical equipment mounted inside enclosures be designed and constructed in such a way as to permit modification of the wiring from the front of the enclosure.		P
	Where that is not possible and control devices are connected from the rear of the enclosure, access doors or swingout panels shall be provided.		N/A
	Connections to devices mounted on doors or to other movable parts shall be made using flexible conductors in accordance with 13.2 to allow for the frequent movement of the part.		P
	The conductors shall be anchored to the fixed part and to the movable part independently of the electrical connection		P
	Conductors and cables that do not run in ducts shall be adequately supported.		P
	Terminal blocks or plug/socket combinations shall be used for control wiring that extends beyond the enclosure.		N/A
	Power cables and cables of measuring circuits may be directly connected to the terminals of the devices for which the connections were intended.		P
14.4	Wiring outside enclosures		

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14.4.1	General requirements		
	The means of introduction of cables or ducts with their individual glands, bushings, etc., into an enclosure shall ensure that the degree of protection is not reduced.		P
14.4.2	External ducts		
	Conductors and their connections external to the electrical equipment enclosure(s) shall be enclosed in suitable ducts as described in 14.5 except for suitably protected cables that may be installed without ducts and with or without the use of open cable trays or cable support means.	It is in compliance with this requirement.	P
	Fittings used with ducts or multiconductor cable shall be suitable for the physical environment.		P
	Flexible conduit or flexible multiconductor cable shall be used where it is necessary to employ flexible connections to pendant push-button stations.	No this situation.	N/A
	The weight of the pendant stations shall be supported by means other than the flexible conduit or the flexible multiconductor cable, except where the conduit or cable is specifically designed for that purpose.		N/A
	Flexible conduit or flexible multiconductor cable shall be used for connections involving small or infrequent movements.		P
	They shall also be permitted to complete the connection to normally stationary motors, to position switches, and to other externally mounted devices.		P
	Where prewired devices are supplied, the integral cable need not be enclosed in a duct.		P
14.4.3	Connection to moving elements of the machine		
	Connections to frequently moving parts shall be made using conductors in accordance with 13.2.	No this situation.	N/A
	Flexible cable and flexible conduit shall be so installed as to avoid excessive flexing and straining, particularly at the fittings.	No this situation.	N/A
	Cables subject to movement shall be supported in such a way that there is no mechanical strain on the connection points nor any sharp flexing.	No this situation.	N/A
	When this is achieved by the use of a loop, it shall have sufficient length to provide for a bending radius of the cable of at least 10 times the diameter of the cable.	No this situation.	N/A
	Flexible cables of machines shall be so installed or protected as to minimize the possibility of external damage due to factors that include the following cable use or potential abuse:	No this situation.	N/A
	- being run over by the machine itself;	No this situation.	N/A
	- being run over by vehicles or other machines;	No this situation.	N/A
	- coming into contact with the machine structure during movements;	No this situation.	N/A
	- running in and out on cable baskets, or on or off cable drums;		N/A
	- acceleration forces 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
	The cable sheath shall be resistant to the normal		N/A

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	wear that can be expected from movement and to the effects of atmospheric contaminants.		
	Where cables subject to movement are close to moving parts, precautions shall be taken to maintain a space of at least 25 mm between the moving parts and the cables.		N/A
	Where that distance is not practicable, fixed barriers shall be provided between the cables and the moving parts.		N/A
	The cable handling system shall be so designed that lateral cable angles do not exceed 5°, avoiding torsion in the cable when:	No this situation.	N/A
	- being wound on and off cable drums; and		N/A
	- approaching and leaving cable guidance devices.		N/A
	In order to prevent confusion of conduits with oil, air, or water piping, it is recommended that the onduits be either physically separated or suitably identified.		N/A
	Ducts and cable trays shall be rigidly supported and positioned at a sufficient distance from moving parts and in such a manner so as to minimize the possibility of damage or wear.		N/A
	In areas where human passage is required, the ducts and cable trays shall be mounted at least 2 m above the working surface.		N/A
	Ducts shall be provided only for mechanical protection (see 8.2.3 for requirements for connection to the protective bonding circuit).		N/A
	Cable trays that are partially covered should not be considered to be ducts or cable trunking systems, and the cables used shall be suitable for installation on cable trays.		N/A
14.5.2	Percentage fill of ducts		
	Consideration on the percentage fill of ducts should be based on the straightness and length of the duct and the flexibility of the conductors.		P
	It is recommended that the dimensions and arrangement of the ducts be such as to facilitate the insertion of the conductors and cables.		P
14.5.3	Rigid metal conduit and fittings		
	Rigid metal conduit and fittings shall be of galvanized steel or of a corrosion-resistant material suitable for the conditions.	No any metal conduit is used.	P
	The use of dissimilar metals in contact that can cause galvanic action should be avoided.	No any metal conduit is used.	N/A
	Conduits shall be securely held in place and supported at each end.	No any metal conduit is used.	N/A
	Fittings shall be compatible with the conduit and appropriate for the application.	No any metal conduit is used.	N/A
	Fittings shall be threaded unless structural difficulties prevent assembly.	No any metal conduit is used.	N/A
	Where threadless fittings are used, the conduit shall be securely fastened to the equipment.		N/A
	Conduit bends shall be made in such a manner that the conduit shall not be damaged and the internal diameter of the conduit shall not be effectively reduced.		N/A
14.5.4	Flexible metal conduit and fittings		
	A flexible metal conduit shall consist of a flexible metal tubing or woven wire armour.	No any flexible metallic conduit is used.	N/A

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	It shall be suitable for the expected physical environment.		N/A
	Fittings shall be compatible with the conduit and appropriate for the application.		N/A
14.5.5	Flexible non-metallic conduit and fittings		
	A flexible non-metallic conduit shall be resistant to kinking and shall have physical characteristics similar to those of the sheath of multiconductor cables.	Flexible non-metallic conduits are in compliance with this requirement.	P
	The conduit shall be suitable for use in the expected physical environment.	They are in compliance with this requirement.	P
	Fittings shall be compatible with the conduit and appropriate for the application.	They are in compliance with this requirement.	P
14.5.6	Cable trunking systems		
	Cable trunking systems external to enclosures shall be rigidly supported and clear of all moving or contaminating portions of the machine.	No any cable trunking system is used for this machine.	N/A
	Covers shall be shaped to overlap the sides; gaskets shall be permitted.		P
14.5.7	Machine compartments and cable trunking systems		
	The use of compartments or cable trunking systems within the column or base of a machine to enclose conductors shall be permitted provided the compartments, or		N/A
	Cable trunking systems are isolated from coolant or oil reservoirs and are entirely enclosed		N/A
	Conductors run in enclosed compartments and cable trunking systems shall be so secured and arranged that they are not subject to damage.		N/A
14.5.8	Connection boxes and other boxes		
	Connection boxes and other boxes used for wiring purposes shall be readily accessible for maintenance.	The connection boxes are readily accessible for maintenance.	P
	Those boxes shall provide protection against the ingress of solid bodies and liquids, taking into account the external influences under which the machine is intended to operate		P
	Those boxes shall not have opened but unused knockouts nor any other openings and shall be so constructed as to exclude materials such as dust, flyings, oil, and coolant	They have no unnecessary openings.	P
14.5.9	Motor connection boxes		
	Motor connection boxes shall enclose only connections to the motor and motor-mounted devices.		P
15	ELECTRIC MOTORS AND ASSOCIATED EQUIPMENT		
15.1	General requirements		
	Electric motors should conform to the requirements of IEC 60034-1.	They are in conformity with IEC 60034-1.	P
	The protection requirements for motors and associated equipment are given in 7.2 for over current protection, in 7.3 for overload protection, and in 7.6 for overspeed protection.		P
	As many controllers do not switch off the supply to a motor when it is at rest, care shall be taken to ensure compliance with the requirements of 5.3, 5.4, 5.5, 7.5, 7.6 and 9.4.		P
	Motor control equipment shall be located and mounted in accordance with clause 12.		P

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Clause	Requirement- Test	Result	Verdict
15.2	Motor enclosures		
	It is recommended that motor enclosures be chosen from those included in IEC 60034-5.		P
	The degree of protection shall be at least IP23 for all motors.		P
	More stringent requirements may be needed depending on the application and the physical environment.		P
	Motors incorporated as an integral part of the machine shall be so mounted that they are adequately protected from mechanical damage.	There is adequate protection Against mechanical damage for motor.	P
15.3	Motor dimensions		
	As far as is practicable, the dimensions of motors shall conform to those given in IEC 60072-1 and IEC 60072-2.		P
15.4	Motor mounting and compartments		
	Each motor and its associated couplings, belts and pulleys, or chains, shall be so mounted that they are adequately protected and are easily accessible for inspection, maintenance, adjustment and alignment, lubrication, and replacement.		N/A
	The motor mounting arrangement shall be such that all motor hold-down means can be removed and all terminal boxes are accessible		P
	Motors shall be so mounted that proper cooling is ensured and the temperature rise remains within the limits of the insulation class.	(see IEC 60034-1)	P
	Where possible, motor compartments should be clean and dry, and when required, shall be ventilated directly to the exterior of the machine.		P
	The vents shall be such that ingress of swarf, dust, or water spray is at an acceptable level.		P
	There shall be no opening between the motor compartment and any other compartment that does not meet the motor compartment requirements.		P
	Where a conduit or pipe is run into the motor compartment from another compartment not meeting the motor compartment requirements, any clearance around the conduit or pipe shall be sealed.		P
15.5	Criteria for motor selection		
	The characteristics of motors and associated equipment shall be selected in accordance with the anticipated service and physical environmental conditions		P
	In this respect, the points that shall be considered include:		
	- type of motor;		P
	- type of duty cycle (see IEC 60034-1);		P
	- fixed speed or variable speed operation, (and the consequent variable influence of the ventilation);		P
	- mechanical vibration;		P
	- type of convertor for motor speed control	see IEC 60146-1-1)	N/A
	- influence of the harmonic spectrum of the voltage and/or current feeding the motor (when it is supplied from a static convertor) on the temperature rise;		P
	- method of starting and the possible influence of the inrush current on the operation of other users,		P

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Clause	Requirement- Test	Result	Verdict
	taking also into account possible special considerations stipulated by the supply authority;		
	- variation of counter torque load with time and speed;		N/A
	- influence of loads with large inertia;		P
	- influence of constant torque or constant power operation;		P
	- possible need of inductive reactors between motor and converter.		N/A
15.6	Protective devices for mechanical brakes		
	Operation of the overload and over current protective devices for mechanical brake actuators shall initiate the simultaneous de-energization (release) of the associated machine actuators.		P
16	ACCESSORIES AND LIGHTING		
16.1	Accessories		
	Where the machine or its associated equipment is provided with socket-outlets that are to be used for accessory equipment, the following apply:		
	- the socket-outlets should conform to IEC 60309-1.		
	Where that is not possible, they should be clearly marked with the voltage and current ratings		N/A
	- the continuity of the protective bonding circuit to the socket-outlet shall be ensured;	(exception: see 6.4)	N/A
	- all unearthed conductors connected to the socket-outlet shall be protected against over current		N/A
	When required, against overload in accordance with 7.2 and 7.3 separately from the protection of other circuits;		N/A
	- where the power supply to the socket-outlet is not disconnected by the supply disconnecting device for the machine or the section of the machine, the requirements of 5.3.5 apply.		N/A
16.2	Local lighting of the machine and equipment	No local lighting	N/A
16.2.1	General		
	Connections to the protective bonding circuit shall be in accordance with 8.2.2.		N/A
	The ON-OFF switch shall not be incorporated in the lampholder or in the flexible connecting cords.		N/A
	Stroboscopic effects from lights shall be avoided by the use of appropriate luminaires.		N/A
	Where fixed lighting is provided in an enclosure, electromagnetic compatibility should be taken into account using the principles outlined in 4.4.2.		N/A
16.2.2	Supply		
	It is recommended that the nominal voltage of the local lighting circuit should not exceed 50 V between conductors.	No local lighting circuits is used on this machine.	N/A
	Where a higher voltage is used, that value shall not exceed 250 V between conductors.		P
	Lighting circuits shall be supplied from one of the following sources:		
	- a dedicated isolating transformer connected to the load side of the supply disconnecting device.		N/A
	over current protection shall be provided in the secondary circuit;		N/A
	- a dedicated isolating transformer connected to the line side of the supply disconnecting device.		N/A

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Clause	Requirement- Test	Result	Verdict
	That source shall be permitted for maintenance lighting circuits in control enclosures only.		N/A
	over current protection shall be provided in the secondary circuit (see also 5.3.5 and 14.1.3);		N/A
	- a machine circuit with dedicated over current protection;		N/A
	- an isolating transformer connected to the line side of the supply disconnecting device when a dedicated primary disconnecting means (see 5.3.5) and		N/A
	secondary over current protection are provided and mounted within the control enclosure adjacent to the supply disconnecting device (see also 14.1.3);		N/A
	- an externally supplied lighting circuit.		N/A
	This shall be permitted in control enclosures only, and for the machine work light(s) where the total power rating is not more than 3 kW.		N/A
	Exception: where fixed lighting is out of reach of operators during normal operations, the provisions of this subclause do not apply.		P
16.2.3	Protection		
	Local lighting circuits shall be protected in accordance with 7.2.6.		P
16.2.4	Fittings		
	Adjustable lighting fittings shall be suitable for the physical environment.		P
	The lampholders shall be:		
	- in accordance with the relevant IEC publication;		P
	- constructed with an insulating material protecting the lamp cap so as to prevent unintentional contact.		N/A
	Reflectors shall be supported by a bracket and not by the lampholder.		N/A
	Exception: where fixed lighting is out of reach of operators during normal operation, the provisions of this subclause do not apply.		P
17	MARKING, WARNING SIGNS AND REFERENCE DESIGNATIONS		
17.1	General		
	The electrical equipment shall be marked with the supplier’s name, trade mark, or other identifying symbol and, when required, with a certification mark.	The suppliers identification mark is found on the machine.	P
	Warning signs, nameplates, markings, and identification plates shall be of sufficient durability to withstand the physical environment involved.	They are durable.	P
17.2	Warning signs		
	Enclosures that do not otherwise clearly show that they contain electrical devices shall be marked with a black lightning flash on a yellow background within a black triangle.		P
	The warning sign shall be plainly visible on the enclosure door or cover.		P
	The warning sign may be omitted for:		
	- an enclosure equipped with a supply disconnecting device;		P
	- an operator-machine interface or control station;		P
	- a single device with its own enclosure.		P
17.3	Functional identification		
	Control devices, visual indicators, and displays used in the man-machine interface shall be clearly and durably marked with regard to their functions		P

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Clause	Requirement- Test	Result	Verdict
	either on or adjacent to the item.		
	Such markings may be as agreed between the user and the supplier of the equipment (see Annex B).		P
	Preference should be given to the use of standard symbols given in IEC 60417 and ISO 7000.		P
17.4	Marking of control equipment		
	Control equipment (e.g. controlgear assemblies) shall be legibly and durably marked in a way that is plainly visible after the equipment is installed.		P
	Wherever possible, a nameplate giving the following information shall be attached to the enclosure:		
	- name or trade mark of supplier;		P
	- certification mark, when required;		P
	- serial number, where applicable;		P
	- rated voltage, number of phases and frequency, and full-load current for each supply (see IEC61082);		P
	- short-circuit interrupting capacity of the machine over current protective device where furnished as part of the equipment;		P
	- the electrical diagram number(s) or the number of the index to the electrical drawings.		N/A
	The full-load current shown on the nameplate shall be not less than the combined full-load currents for all motors and other equipment that can be in operation at the same time under normal conditions of use.		P
	Where there are unusual loads or duty cycles, the thermal equivalent current (see C.2) shall be included in the full-load current specified on the nameplate.		P
	Where only a single motor controller is used, that information may instead be provided on the machine nameplate where it is plainly visible.		N/A
17.5	Reference designations		
	All enclosures, assemblies, control devices, and components shall be plainly identified with the same reference designation as shown in the technical documentation		P
	Where size or location preclude the use of an individual reference designation, group reference designation shall be used.		P
	Exception: the requirements of this subclause may not apply to machines on which the equipment comprises only a single motor, motorcontroller, push-button station(s), and worklight(s).		P
18	TECHNICAL DOCUMENTATION		
18.1	General		
	The information necessary for installation, operation, and maintenance of the electrical equipment of a machine shall be supplied in the form of drawings, diagrams, charts, tables, and instructions.	Required information is Included in the technical documentation	P
	The information shall be in an agreed language.	English	P
	The information provided may vary with the complexity of the electrical equipment.		P
	The supplier shall ensure that the technical documentation specified in this clause is provided with each machine.		P

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Clause	Requirement- Test	Result	Verdict
18.2	Information to be provided		
	The information provided with the electrical equipment shall include:		
	a) a clear, comprehensive description of the equipment, installation and mounting, and the connection to the electrical supply(ies);		P
	b) electrical supply(ies) requirements;		P
	c) information on the physical environment (e.g. lighting, vibration, noise levels, atmospheric contaminants) where appropriate;		P
	d) overview (block) diagram(s) where appropriate;		N/A
	e) circuit diagram(s);		P
	f) information (where appropriate) on:		
	1) programming;		N/A
	2) sequence of operation(s);		P
	3) frequency of inspection;		P
	4) frequency and method of functional testing;		N/A
	5) guidance on the adjustment, maintenance, and repair, particularly of the protective devices and circuits, and		P
	6) parts list and recommended spare parts list.		N/A
	g) a description (including interconnection diagrams) of the safeguards, interlocking functions, and interlocking of guards for potentially hazardous motions, particularly for machines operating in a co-ordinated manner;		P
	h) a description of the safeguarding and of the means provided where it is necessary to suspend the safeguarding.		P
18.3	Requirements applicable to all documentation		
	The documents shall be prepared in accordance with the requirements of 18.4 to 18.10 and the relevant parts of IEC 61082.		P
	The reference designation system shall be in accordance with IEC 61346-1.		P
	For referencing of the different documents, the supplier shall select one of the following methods:		
	- each of the documents shall carry as a crossreference the document numbers of all other documents belonging to the electrical equipment; or		N/A
	- all documents shall be listed with document numbers and titles in a drawing or document list.		P
	The first method shall be used only where the documentation consists of a small number of documents.		N/A
18.4	Basic information		
	The technical documentation shall contain, as a minimum, information on the following:	Included in the instruction book	P
	- normal operating conditions of the electrical equipment including the expected conditions of the electrical supply, and where appropriate, the physical environment;	Included in the instruction book	P
	- handling, transportation and storage;		P
	- inappropriate use(s) of the equipment.		P
	That information may be presented as a separate document or as part of the installation or operation documentation.		P
	The documentation should also contain, where appropriate, information regarding load currents,		P

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Clause	Requirement- Test	Result	Verdict
	peak starting currents and permitted voltage drops.		
	That information should be contained in either the system or circuit diagram(s).		P
18.5	Installation diagram		
	The installation diagram shall give all information necessary for the preliminary work of setting up the machine.		P
	In complex cases, it may be necessary to refer to the assembly drawings for details.		P
	The recommended position, type, and crosssectional areas of the supply cables to be installed on site shall be clearly indicated.		P
	The data necessary for choosing the type, characteristics, rated currents, and setting of the over current protective device(s) for the supply conductors to the electrical equipment of the machine shall be stated.		P
	Where necessary, the size, purpose, and location of any ducts in the foundation that are to be provided by the user shall be detailed.		P
	The size, type, and purpose of ducts, cable trays, or cable supports between the machine and the associated equipment that are to be provided by the user shall be detailed.		P
	Where necessary, the diagram shall indicate where space is required for the removal or servicing of the electrical equipment.		P
	Where it is appropriate an interconnection diagram or table shall be provided.		P
	That diagram or table shall give full information about all external connections.		P
	Where the electrical equipment is intended to be operated from more than one source of electrical supply, the interconnection diagram or table shall indicate the modifications or interconnections required for the use of each supply.		P
18.6	Block (system) diagrams and function diagrams		
	Where it is necessary to facilitate the understanding of the principles of operation, a block (system) diagram shall be provided.		N/A
	A block (system) diagram symbolically represents the electrical equipment together with its functional interrelationships without necessarily showing all of the interconnections.		N/A
	Function diagrams may be used as either part of, or in addition to, the block (system) diagram		N/A
18.7	Circuit diagrams		
	Where a block (system) diagram does not sufficiently detail the elements of the electrical equipment, a circuit diagram(s) shall be furnished.		P
	Those diagrams shall show the electrical circuits on the machine and its associated electrical equipment.		P
	Any graphical symbol not shown in IEC 60617 shall be separately shown and described on the diagrams or supporting documents.		P
	The symbols and identification of components and devices shall be consistent throughout all documents and on the machine.		P
	Where appropriate, a diagram showing the		P

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Clause	Requirement- Test	Result	Verdict
	terminals for interface connections shall be provided.		
	That diagram may be used in conjunction with the circuit diagram(s) for simplification.		P
	The diagram should contain a reference to the detailed circuit diagram of each unit shown.		P
	Switch symbols shall be shown on the electromechanical diagrams with all supplies turned off and with the machine and its electrical equipment in the normal starting condition.		P
	Conductors shall be identified in accordance with 14.2.		P
	Circuits shall be shown in such a way as to facilitate the understanding of their function as well as maintenance and fault location.		P
	Characteristics relating to the function of the control devices and components which are not evident from their symbolic representation shall be included on the diagrams adjacent to the symbol or referenced to a footnote.		P
18.8	Operating manual		
	The technical documentation shall contain an operating manual detailing proper procedures for set-up and use of the equipment.		P
	Particular attention should be given to the safety measures provided and to the improper methods of operation that are anticipated.		P
	Where the operation of the equipment can be programmed, detailed information on methods of programming, equipment required, program verification, and additional safety procedures (where required) shall be provided.		P
18.9	Maintenance manual		
	The technical documentation shall contain a maintenance manual detailing proper procedures for adjustment, servicing and preventive inspection, and repair.		P
	Recommendations on maintenance/service records should be part of that manual.		P
	Where methods for the verification of proper operation are provided (e.g. software testing programs), the use of those methods shall be detailed.		P
18.10	Parts list		
	The parts list shall comprise, as a minimum, information necessary for ordering spare or replacement parts required for preventive or corrective maintenance including those that are recommended to be carried in stock by the user of the equipment		P
	The parts list shall show for each item:		
	- the reference designation used in the documentation;		P
	- its type designation;		P
	- the supplier and alternative sources where available;		P
	- its general characteristics where appropriate.		P
19	TESTING AND VERIFICATION		
19.1	General		
	Where there is no dedicated product standard for		P

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Clause	Requirement- Test	Result	Verdict
	the machine, the appropriate tests may include one or more of the following but shall always include the verification of the continuity of the protective bonding circuit (see 19.2):		
	- verification that the electrical equipment is in compliance with the technical documentation;		P
	- continuity of the protective bonding circuit (see19.2)		P
	- insulation resistance tests (see 19.3);		P
	- voltage tests (see 19.4);		P
	- protection against residual voltages (see 19.5);		P
	- functional tests (see 19.6).		P
	When the electrical equipment is modified, the requirements stated in 19.7 shall apply.		P
19.2	Continuity of the protective bonding circuit		
	When the machine is installed and the electrical connections are complete, including those to the power supply, the continuity of the protective bonding circuit can be verified by a loop impedance test in accordance with 612.6.3 of IEC 60364-6-61.		P
	For small machines, pre-manufactured machines or parts of machines with protective bonding loops not exceeding approximately 30 m, and where the machine cannot be connected to the power supply for the loop impedance test, the following method may be appropriate:		
	- verify the continuity of the protective bonding circuit by injecting a current of at least 10 A at 50 Hz or 60 Hz derived from a PELV source.		P
	- the measured voltage between the PE terminal and the points of test is not to exceed the values given in Table 9 (see 8.2.2).		P
19.3	Insulation resistance tests		
	The insulation resistance measured at 500 V d.c. between the power circuit conductors and the protective bonding circuit is to be not less than 1 M.	500VDC	P
	For certain parts of electrical equipment, incorporating for example busbars, collector wire or collector bar systems or slip-ring assemblies, a lower minimum value shall permitted, but that value is not to be less than 50 k.		P
19.4	Voltage tests		
	The electrical equipment shall withstand a test voltage applied for a period of at least one second between the conductors of all circuits and the protective bonding circuit, except for those circuits intended to operate at or below PELV voltages.		P
19.5	Protection against residual voltages		
	Tests are performed to ensure compliance with 6.2.4.		P
19.6	Functional tests		
	The functions of electrical equipment shall be tested, particularly those related to safety and safeguarding.		P
19.7	Retesting		
	Where a portion of the machine and its associated equipment is changed or modified, that portion shall be reverified and retested, as is appropriate		P

18.2.2 Test current: 10A, 30s, max actual voltage drop:

Parts tested	Cross-sectional area of the branch protective conductor under test mm²	Actual voltage drop V	Max. measured voltage drop V
Machine metal enclosure-PE	1.0 mm²	0.079V	3.3V
3-phase asynchronous motor enclosure- PE	1.0 mm²	0.052V	3.3V
enclosure- PE	1.0 mm²	0.021V	3.3V

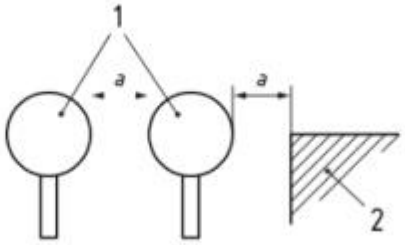
Equipment sheet of electrical safety test

No.	Name	Type	Serial No.	Valid calibration date	Used
1	Vernier callipers	0~150mm	KJ050	2024-08-21~2025-08-20	√
2	Test finger	---	KS048	2024-08-21~2025-08-20	√
3	Micrometer callipers	25~50mm	MJ003	2024-08-21~2025-08-20	√
4	Digital multimeter	1587(Fluke)	MJ035	2024-08-21~2025-08-20	√
5	Grounding resistance measurement instrument	PC39A	KJ065	2024-08-21~2025-08-20	√
6	High voltage withstand tester	CS2672B	KJ054	2024-08-21~2025-08-20	√

4. EN ISO 4254-1:2015/A1:2021

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
1	Scope		P
	This part of ISO 4254 specifies the safety requirements and the means of their verification for the design and construction of self-propelled ride-on machines, mounted, semi-mounted and trailed machines used in agriculture in order to deal with the hazards which are typical for most of the machines. In addition,it specifies the type of information on safe working practices including information about residual risks to be provided by the manufacturer. This document deals with significant hazards, hazardous situations and events, as listed in Annex A,relevant to this agricultural machinery when used as intended and under the conditions of misuse foreseeable by the manufacturer during normal operation and service. This part of ISO 4254 is not applicable to — agricultural or forestry tractors, — aircraft and air-cushion vehicles used in agriculture, — lawn and garden equipment, — machine-specific components or functions (e.g. working tools and/or processes). This part of ISO 4254 is not applicable to hazards related to periodic service, machine conversion and repairs intended to be carried out by professional service personnel, environmental hazards, road safety (e.g. steering, braking), or to the power take-off (PTO) drive shaft; neither is it applicable to guards of moving parts for power transmission except for strength requirements for guards and barriers. This part of ISO 4254 is not applicable to machines which are manufactured before the date of its publication. Not all of the hazards dealt with by this part of ISO 4254 are necessarily present on a particular machine. A risk assessment should be carried out by the manufacturer to determine the hazards that are applicable and any hazards in addition to those dealt with by this part or a relevant machine-specific part. The requirements of a machine-specific part of ISO 4254 take precedence over the requirements of this part		P
2	Normative references		P
	The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.		P
3	Terms and definitions		P
	For the purposes of this document, the terms and definitions given in ISO 12100 and the following apply		P
4	Safety requirements and/or measures applicable to all machines		P
	4.1 Fundamental principles, design guidance 4.1.1 The machinery shall comply with the safety requirements and/or protective measures of Clauses 4 and 5 or 6. In addition, the machinery shall be designed according to the principles of ISO 12100:2010 for relevant but not significant hazards, which are not dealt with by this document. Not all of the hazards dealt with by this part of ISO 4254 are necessarily present on a particular machine. A risk assessment should be carried out by the manufacturer to determine the hazards that are applicable and any hazards in addition to those dealt with by this part or a relevant machine-specific part. The manufacturer is responsible for the specification and provision of safety measures to deal with additional hazards. The requirements of a machine-specific part of ISO 4254 take precedence over the		P

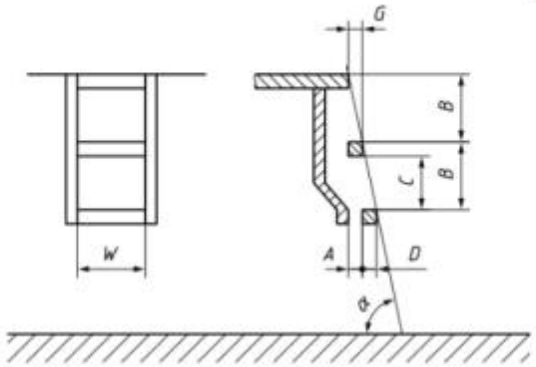
EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	requirements of this part. 4.1.2 Unless otherwise specified in this part of ISO 4254, safety distances shall comply with the requirements given in ISO 13857:2008, Table 1, 3, 4 or 6, as appropriate. 4.1.3 Functional components which need to be exposed for proper function, drainage or cleaning shall be guarded without causing other hazards, for example risk of fire due to the accumulation of organic material during the intended use, and without interfering with the proper function, drainage or cleaning.		
	4.2 Protection from moving parts involved in the work Within the intended use and reasonably foreseeable misuse of the machine, if guards cannot be used to prevent inadvertent contact with moving parts involved in the machine's work process, then other appropriate measures to prevent inadvertent contact shall be provided. During the risk assessment process selection of such appropriate measures shall take into consideration the strategies for risk reduction specified in ISO 12100:2010, and shall consider both normal operation and service operations as specified in the operator'smanual. An example of an appropriate measure is safety distance guarding through the use of a barrier		P
	4.3 Noise 4.3.1 The technical information given in ISO/TR 11688-1 shall be used as means to design low- noise machinery. 4.3.2 Noise emission values, if required to be declared, shall be determined in accordance with Annex B		P
	4.4 Vibration 4.4.1 If vibration emission values are required to be declared, then the weighted root-mean-square acceleration value and the measuring method shall be determined according to — ISO 5008:2002, — a relevant machine-specific part to this standard, or — a measuring method that shall be described in the operator'smanual. Vibration measurements are unnecessary for machines that do not require a ride-on operator. 4.4.2 Mechanical vibrations are caused by the unevenness of the travelling surface and the unbalanced movement of machine-related components such as engine, gearbox, drives and working tools. Technical measures for the reduction of vibrations are, for example, isolators, dampening or suspension systems. As the origin of vibrations depends on the machine type and the individual design, detailed specifications for vibration reduction measures are specified by the machine-specific parts of ISO 4254.		P
	4.5 Controls 4.5.1 The function of control devices and their different positions shall be identified at the operating position and explained in the operator's manual [see 8.2.3 d)]. Symbols shall be in accordance with ISO 3767-1:1998 and ISO 3767-2:2008.		P
	4.5.2 Pedals shall have a slip-resistant surface and be easy to clean. 4.5.3 Hand-operated controls requiring an actuating force ≥ 100 N shall have a minimum clearance, a, of 50 mm between the outer contours or from adjacent parts of the machine (see Figure 2). Controls requiring an actuating force < 100 N shall have a minimum clearance of 25 mm. This requirement does not apply to fingertip operation controls (e.g. push-buttons, electric switches).		

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	4.5.4 For requirements pertaining to machine-specific controls, see the relevant part(s) of ISO 4254.		
	 **Key** 1 hand-operated control 2 adjacent part *a* minimum clearance **Figure 2 — Clearance around hand-operated controls**		P
	4.5.5 Unless specified otherwise in 4.5.3 and 4.9.1, actuating forces, displacement, location and the method of operation shall be in accordance with ISO 15077:2008		P
	4.5.6 Controls shall be located outside the hazard zones. This requirement is also applicable to machine components (e.g. hydraulic valves) which need to be manually operated or controlled in case of malfunction of the primary control system.		P
	4.6 Automatic mode of operation Machinery functioning in automatic mode shall bring itself automatically to a safe state when the work cycle is involuntarily stopped or interrupted (e.g. blockage, overload, malfunction). Following an involuntary stop or interruption, are-start of the work cycle shall be possible only after an intentional actuation of a control located outside the hazard zone		P
	4.7 Operator stations 4.7.1 Boarding means		P
	4.7.1.1 General 4.7.1.1.1 If the vertical height of the operator station floor above ground level exceeds 550 mm, measured on level ground and with the specified tyres with the maximum diameter at specified inflation pressure [see 8.2.3 w)], or specified tracks, a boarding means shall be provided. The dimensions shall be as shown in Figure 3. 4.7.1.1.2 Whenever the boarding means is located directly in line and forward of a wheel or track (i.e. within the track of the machine), provision shall be made for a guardrail to be located on the wheel or track side. This does not apply when the machine is in the transport configuration. Shielding shall be provided on the back of steps or ladders whenever a protruding hand or foot can contact a hazardous part of the machine, e.g. wheel.		
	4.7.1.2 Steps and ladders 4.7.1.2.1 The height of the first step shall be achieved with the specified tyres and with the maximum diameter at specified inflation pressure [see 8.2.3 w)]. The vertical distance between successive steps shall be equal within a tolerance of ±20 mm. Each step shall have a slip-resistant surface, a lateral stop at each end and be so designed (e.g. mudguards, perforated steps) that an accumulation of mud and/or snow is minimized under normal work conditions. A flexible connection(s) between the first and second steps is permitted. 4.7.1.2.2 Dimensions for ladders and steps used as boarding means for operator stations shall be in accordance with Table 1 and		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	Figure 3.		
	Table 1 — Dimensions for boarding means for operator stations		P

	Ladders	Steps
α	70° to 90°	20° to 70°
$A + D$ min	150	150
B max	300	300
C min	120	120
D min	50	150
$2B + G$ max	-	800
W min	300	300

Dimensions in millimetres



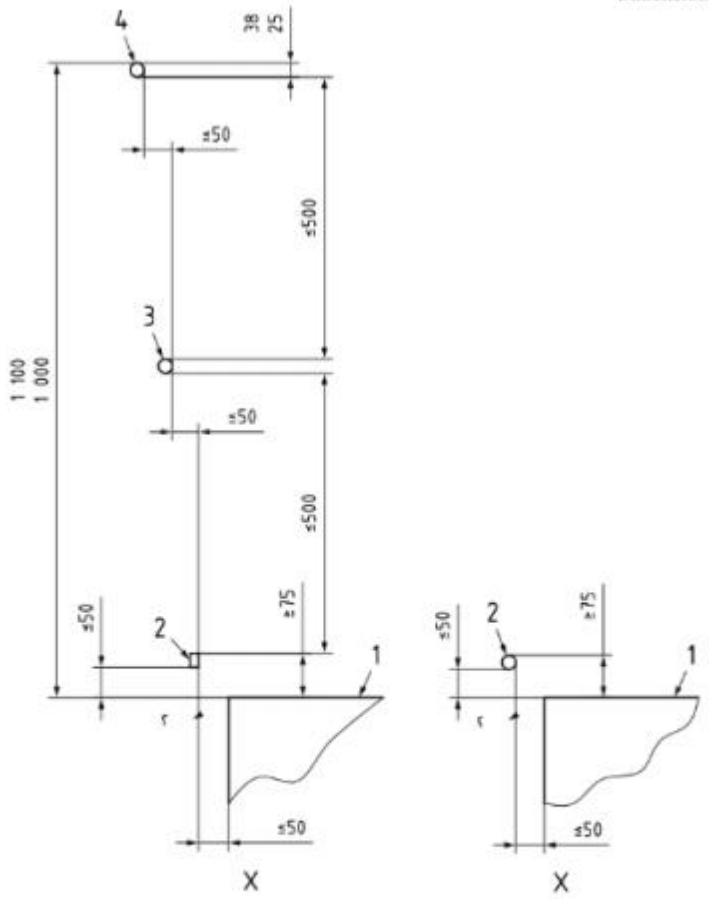
Key

A toe clearance
B vertical distance between tread surface of successive steps
C minimum clearance between successive steps
D tread depth
G horizontal distance between leading edge of successive steps
W width of step or rung
α angle of inclination

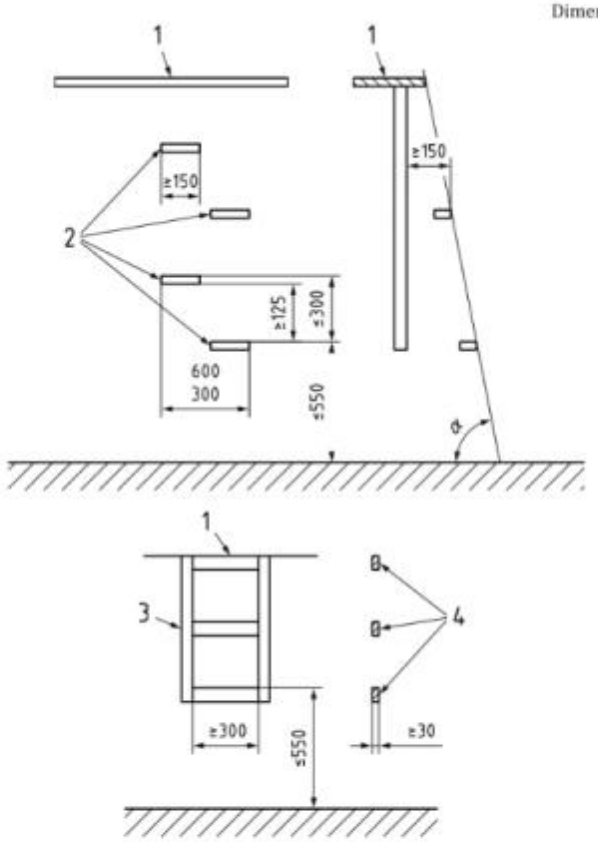
Figure 3 — Dimensions of boarding means for operator stations

P

	4.7.1.2.3 If parts of the boarding means are moveable, the operating force shall not exceed 200 N as the average value when moving from the start position to the stop position. The peak(s) shall not exceed 400 N. 4.7.1.2.4 When moving the boarding means, there shall be no shearing, pinching or uncontrollable movement hazards to the operator. 4.7.1.2.5 Where, on tracked machines, the track shoes and track pad surfaces are intended to be used as access steps, three-point contact support shall be provided to ensure safe boarding for the operator.		P
	4.7.1.3 Handrails/handhold 4.7.1.3.1 Handrails or handholds shall be provided on both sides of the boarding means and shall be so designed that the operator can maintain three-point contact support at all times. The width of the handrail/handhold cross section shall be between 25 mm and 38 mm. The lower end of the handrail/handhold shall be located no higher than 1 500 mm from the ground surface. A minimum clearance of 50 mm shall be provided for hand clearance between the handrail/handhold and the adjacent parts except at attaching points. 4.7.1.3.2 A handrail/handhold shall be provided above the uppermost step/rung of the boarding means at a height between 850 mm and 1 100 mm above the uppermost step/rung. The handhold shall be at least 150 mm long.		P
	4.7.2 Platforms 4.7.2.1 Platforms shall be flat and have a slip-resistant surface and, if necessary, provision for drainage		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	4.7.2.2 Platforms — except those only used when the machine is stationary and which are less than 1 000 mm above the ground — shall be equipped with a foot guard, handrail and intermediate rail around the edge of the platform with the dimensions shown in Figure 4. No foot guard shall be provided at the entrance of the platform. In addition, if static machine components are used as a foot guard, handrail and/or intermediate rail, the requirements given in 4.7.1.3.1 and 4.7.1.3.2 shall be fulfilled		P
	Dimensions in millimetres  **Key** *r* radius 50 mm max 1 platform 2 foot guard 3 intermediate rail 4 handrail **Figure 4 — Platform foot guard and hand rail**		P
	4.7.2.3 If the boarding means of platforms and cabs are made movable for transport purposes, provision shall be made for railing off access to the platform or cab. For cabs equipped with a door, the cab door satisfies this requirement.		P
	4.7.3 Operator seat Machines shall be provided with a seat for each ride-on driver and operator. When for technical reasons or due to the function, the driver or operator needs to stand upright on the machine, this exemption and relevant specific hazards maybe dealt with in the machine-specific standard of the machine concerned.		P
	4.8 Other than operator stations 4.8.1 General		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	Service locations that are more than 2 000 mm above the ground, or 1 500 mm for those locations involving filling or topping up of fluids or bulk materials, shall be provided with a suitable place for the operator to stand and, if the place to stand is more than 550 mm above the ground, with a boarding means.		
	4.8.2 Place to stand 4.8.2.1 A place provided for standing shall have sufficient space for both of the operator's feet, be flat and have a slip-resistant surface. Depending on the machine configuration, it may consist of two separate surfaces and may use machine components. It shall be positioned so the operator can maintain stability while carrying out the service required and be on the same height level with a tolerance of ±50 mm. 4.8.2.2 Handhold(s) and/or railings shall be provided in order to allow three-point contact. Parts of the machine can be considered to fulfil this requirement. 4.8.2.3 When access is needed above or next to the PTO (power take-off) drive shaft, an adequate place to stand and boarding means shall be provided in order to eliminate the need to use the PTO drive shaft or its guard as a step or a place to stand		P
	4.8.3 Boarding means		P
	4.8.3.1 If the place to stand for service is more than 550 mm above the ground (or the operator platform), a boarding means shall be provided. 4.8.3.2 Boarding means shall be provided with foot supports (e.g. rungs or steps) and handholds. If static machine components are used as foot supports and/or handholds, the requirements given in 4.7.1.2.1 and 4.7.1.3.1 and 4.7.1.3.2 shall be fulfilled. 4.8.3.3 Boarding means shall comprise a series of steps as shown in Figure 5 and shall be in accordance with a) orb) or c) as follows. a) The inclination α shall be between 70° and 90° from the horizontal (see Figure 5). Each step shall have a slip-resistant surface, a lateral stop at each end and be so designed that any accumulation of mud and/or snow is minimized in the normal conditions of work. The vertical and horizontal distance between successive steps shall be within atolerance of ±20 mm. b) The boarding means shall be a ladder. The top side of each rung shall have a horizontal slip-resistant surface at least 30 mm from front to back. If rungs can be used as handholds, then rectangular section rungs shall have corner radii ≥ 5 mm c) The boarding means shall be in accordance with 4.7.1.2. 4.8.3.4 If boarding means are located such that there is the hazard of inadvertent contact with the PTO drive shaft guard or PIC guard by reaching through the boarding means with foot or hand, shielding shall be provided on the rear of the boarding means. 4.8.3.5 By design, PTO drive shafts and their guards shall not be considered as steps.		

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	Dimensions in millimetres  **Key** 1 place to stand 2 step 3 ladder 4 rung **Figure 5 — Dimensions of boarding means for other than operator stations**		P
	4.9 Folding elements 4.9.1 Handle(s) located at least 300 mm from the nearest articulation shall be provided for manually folding/unfolding elements. The handle(s) maybe integral parts of the machine provided they are suitably designed and clearly identified. The force required for the manual folding/unfolding processes shall not exceed 250 N as an average value when moving from the start to the stop position. The peak(s) shall not exceed 400 N. There shall be no shearing, pinching or uncontrollable movement hazards to the operator during folding/unfolding. 4.9.2 Folded elements designed to reduce transport width and/or height shall have a means of retention in the transport position, either a positive mechanical lock or by other means (e.g. hydraulically, gravity). The means of retention shall be sufficient to retain the folded element in the transport position during travel. The change from transport position to working position and viceversa shall be possible without exposing the operator to crushing and pinching. In the case of mechanical or hydraulic locking devices, the unlocking and unfolding of the elements shall be controlled by means of separate actions by the operator.		P

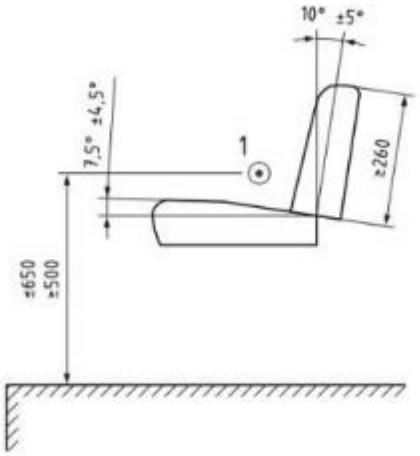
EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	4.9.3 Barriers which exceed the transport width maybe folded from the functional/protection position into a transport position. If folding of the barrier(s) exposes hazards, caused by working tools, operation of the hazardous components shall be prevented with the barrier(s) folded (for example by reducing the function or performance of the machine component in this situation).		
	4.10 Strength requirements for guards and barriers 4.10.1 Guards and barriers, and in particular barriers with a vertical height from the ground of up to 550 mm, whose use as access steps during normal use is not intended by the manufacturer but cannot be prevented, shall be designed so that they can withstand a vertical load of 1 200 N. Conformance with this requirement shall be checked using the test given in Annex C or an equivalent method which fulfils the same test acceptance criteria. 4.10.2 Barriers used as protection against hazards		P
	related to moving working parts shall withstand the following horizontal loads: — 1 000 N,up to 400 mm from the ground in the working position; — 600 N, above 400 mm from the ground in the working position. Conformance with these requirements shall be checked using the test given in Annex C or an equivalent method		
	4.11 Supports for service and maintenance 4.11.1 General 4.11.1.1 When it is necessary for the operator to work under raised parts of the machine in order to carry out maintenance or service, mechanical supports or hydraulic locking devices shall be provided to prevent inadvertent lowering. Means other than mechanical or hydraulic devices are acceptable, provided an equal or greater level of safety is ensured. 4.11.1.2 It shall be possible to engage and release hydraulic locking devices, mechanical supports and other forms of support from outside the hazard zones		P
	4.11.1.3 Mechanical supports and hydraulic locking devices shall be identified by use of a colour that contrasts with the overall machine colour or by a safety sign located either on, or in close proximity to, the device. 4.11.1.4 When the supports or hydraulic devices are controlled manually, their method of operation shall be explained in the operator's manual [see 8.2.3 k)] and, if such operation is not intuitive, on the machine itself using either a safety or informational sign.		P
	4.11.2 Mechanical supports 4.11.2.1 Mechanical supporting devices shall withstand a load of 1,5 times the maximum static load to be supported. 4.11.2.2 Detachable mechanical supports shall be retained in position on the machine. If this is not practicable, they shall have a dedicated and clearly visible and identifiable storage position on the machine allowing the safe storage of the support.		P
	4.11.3 Hydraulic locking devices		P
	Hydraulic locking devices shall be located on the hydraulic cylinder or connected to the hydraulic cylinder by rigid or flexible lines. In the latter case, the lines connecting the locking device to the hydraulic cylinder shall be designed to withstand a pressure at least four times the rated maximum hydraulic pressure. This rated maximum hydraulic pressure shall be specified in the operator's manual. The conditions for the replacement of such flexible lines shall also be given in the operator's manual [see 8.2.3 l)]. Inadvertently unlocking shall be avoided by design, location,		

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	etc. of the control.		
	4.12 Electric equipment 4.12.1 Electrical cables shall be protected if located in potentially abrasive contact with surfaces and shall be resistant to, or protected against, contact with lubricant or fuel. Electrical cables shall be located so that no portion is in contact with the exhaust system, moving parts or sharp edges. 4.12.2 Fuses or other overload protection devices shall be installed in all electrical circuits except for the starter-motor circuit and the high-tension spark ignition system. Electrical distribution of these devices between circuits shall prevent the possibility of cutting-offall warning systems simultaneously		P
	4.13? Hydraulic components and fittings 4.13.1 Hydraulic systems shall comply with the safety requirements of ISO 4413:2010. 4.13.2 Pressurized hoses, pipes and components shall be located or shielded so that in the event of rupture, the fluid cannot be discharged directly onto the operator when in the operating position. 4.13.3 Information on the renewal of hoses shall be provided in the operator's manual [see 8.2.3 l)].		P
	4.14 Pneumatic systems Pneumatic systems shall comply with the safety requirements of ISO 4414:2010.		P
	4.15 Operating fluids Any tank filler shall be located not more than 1 500 mm above the ground, a platform or a place to stand.		P
	The platform or the place to stand, if provided, shall be in accordance with 4.8.2 Changing of operating fluids, including the safety aspects, shall be explained in the operator's manual[see 8.2.3 j) and x)].		
	4.16 Manual operation of individual assemblies If special tools are required for the manual operation of individual assemblies, these shall be supplied with the machine and their use explained in the operator's manual [see 8.2.3 m)].		P
	4.17 Service and handling of machine parts 4.17.1 The service operations shall be capable of being carried out in a safe way, for example with the power source stopped. 4.17.2 Components which require frequent maintenance shall be accessible by means according to 4.8. 4.17.3 Hinged guards and doors shall be fitted with a means to retain them in the open position, if a hazard from uncontrolled closing exists. 4.17.4 For the parts of the machine that are handled by the operator: — if their mass is ≥ 40 kg, they shall be designed or fitted with attachments so that the use of lifting equipment is possible; — if their mass is < 40 kg, they shall be fitted with handles or parts of the machine located so that safe handling is ensured and such that, during this operation, any contact with hazardous parts (cutting tools, hot surfaces, etc.) is prevented.		P
	4.18 Electromagnetic compatibility Machinery shall comply with ISO 14982:1998.		P
	4.19 Emergency stop If — the (main) operator station is located in the direct proximity of a hazard zone for functional reasons, or — the machine is equipped with additional operator stations which are located in direct proximity of a hazard zone and used during normal operation, or — controls other than hold to run controls are		P
	located in the direct proximity of a hazard zone, or		

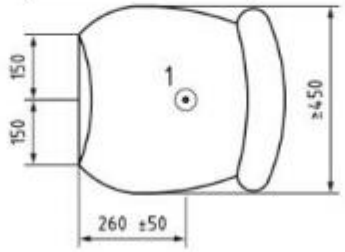
EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	— the vision or communication between operator stations which are used simultaneously is restricted, or — machines are operated by the use of remote controls (this means the operator is not at the operator station on the machine),the main, the additional operator station(s) and the remote control device(s) shall be fitted with emergency stop device(s) to enable actual or impending danger to be averted. Emergency stop devices – except wireless devices – shall comply with ISO 13850:2006.		
	4.20 Safety-related parts of control systems Safety-related parts and programmable control systems shall be in accordance with ISO 25119:2010, Parts 1 to 4 or ISO 13849-1:2006 and ISO 13849-2:2012		P
5	Safety requirements and/or measures — Self-propelled ride-on machines		P
	5.1 Operator station 5.1.1 Access to operator's seat For access to the operator's seat, the floor area shall have a minimum width of 300 mm. Devices such as rear- view mirrors shall not intrude into the access space in any of their engaged/disengaged positions, except in the case of devices intended to restrict the operator encountering hazards during normal operation.		P
	5.1.2 Operator's seat 5.1.2.1 On machines on which the operator is required to sit, a seat shall be provided which adequately supports the operator in all working and operating modes. Information on the seat adjustment shall be provided in the operator's manual [see 8.2.3 e)]. 5.1.2.2 The driver's seat dimensions and adjustment shall meet the requirements of ISO 4253, except that the seat index point (SIP) dimension above the platform shall be 500 mm minimum and 650 mm maximum (see Figure 6).		P
	The driver's seat adjustment mechanism(s) shall prevent unintended seat movement and shall have stops at the ends of the adjustment range. The suspension system, if provided,shall be adjustable to accommodate the weight of the driver. 5.1.2.3 If the machine is equipped with a roll-over protective structure (ROPS),the operator's station shall be equipped with a the seat and restraint system that complies with the requirements of ISO 3776-1:2006, ISO 3776-2:2013 and ISO 3776-3:2009.		
	5.1.3 Propulsion and steering 5.1.3.1 The controls used to activate machine propulsion shall be located or designed so that they can only be operated from the operator's station. 5.1.3.2 Self-propelled machines having automatic steering functions shall comply with the requirements of ISO 10975:2009. 5.1.3.3 The steering mechanism shall be so designed as to reduce the transmission of force to the operator's hand in the event of any sudden movement of the steering-wheel or -lever(s) in reaction to the steered wheel(s). 5.1.3.4 When the steering mechanism is in the operating position, the clearance between the fixed parts and the steering wheel shall be as shown in Figure 7. For the distance to controls, see 4.5.3		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
			P

Dimensions in millimetres



a) Intermediate seat adjustment



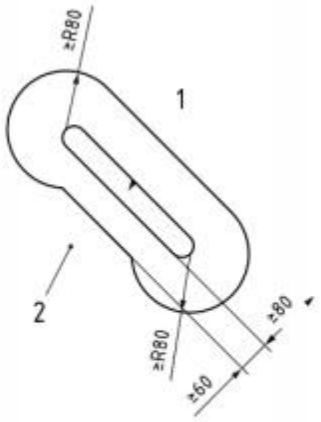
b) Coordinate for measuring width of seat

Key
1 SIP

Figure 6 — Seat dimensions and height

			P

Dimensions in millimetres



Key
1 steering wheel
2 fixed parts

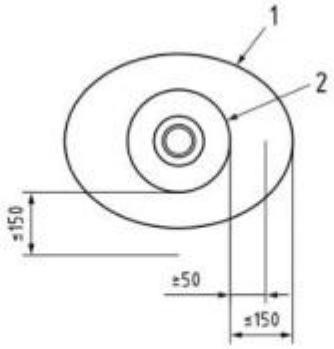
Figure 7 — Clearance between the steering wheel and fixed parts

	5.1.4 Shearing and pinching points		P
	In the operator's workplace, there shall be no shearing or pinching points within hand or foot reach of the operator when seated in the seat provided.		
	5.1.5 Emergency exit 5.1.5.1 When the operator's station is equipped with a cab,		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	provisions shall be made for an emergency exit. In addition to the primary door, at least one other exit shall be provided as an emergency exit. A second door, windshield(s), roof panel or window(s) not on the same sidewall as the primary door is to be considered as an emergency exit, provided that it can be opened or removed quickly from inside the cab. If a special tool is required, this tool shall be attached to the cab and provided for this purpose near the exit. 5.1.5.2 Emergency exits shall — be of a size to accommodate as a minimum an ellipse with principal axes of 640 mm and 440 mm; — be labelled with the user instructions if the intended emergency exit is not routinely used or if location and use is not obvious. If labelling is used, information on location and use shall be located in the cab near the exit and visible to the operator and reproduced in the operator's manual [see 8.2.3 g)]. Such exits include, but are not limited to, a single latch window or a second egress door with a handle and latch.		
	5.1.6 Cab material burning rate The burning rate of cab interior material such as seat covering, wall, floor and headliner coverings when provided shall not exceed the maximum rate of 150 mm/min when tested in accordance with ISO 3795:1989		P
	5.1.7 Visibility 5.1.7.1 The design and position of the operator's station shall be such that the operator has adequate visibility direct or indirect to operate the machine and view the work area of the machine. 5.1.7.2 When the operator's station is equipped with a cab, a windscreen wiper shall be provided. 5.1.7.3 Provisions for installing working lights shall be available		P
	5.1.8 Starting and stopping the engine 5.1.8.1 To avoid unauthorized activation of the engine starting, means such as the following shall be provided to avoid unauthorized activation: — key-operated ignition or starting switch; — lockable cab; — lockable cover for the ignition or starting switch; — security ignition or starting lock; — lockable battery disconnecting switch. Information to avoid unauthorized starting shall be provided in the operator's manual [see 8.2.3 f)]. 5.1.8.2 Provisions shall be made to prevent the engine starter, if provided, from engaging unless — the traction transmission(s) is (are) in the neutral or parked position; or — the traction clutch is disengaged; and — the master implement clutch (PTO) is disengaged. 5.1.8.3 Stopping the engine shall be achieved by a device constructed so that — the engine's stop device does not require sustained manual operation, and — when the device is set at the "off" or "stop" position, the engine cannot be re-started, unless the device has been reset.		P
	5.2 Moving the machine 5.2.1 Attachments for towing Attachment points for retrieving and towing (hooks, rings, ears, etc.) shall be provided at the front and/or rear of the machine. If these attachment points are not obvious, they shall be clearly indicated on the machine and in the operator's manual [see 8.2.3 n) and 8.4].		P
	5.2.2 Moveable attachments Means shall be provided to maintain movable attachments in their transport position.		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	5.2.3 Use of lifting jacks		P
	5.2.3.1 Application points for use with jacks when raising the machine shall be clearly marked, if not obvious, and their location and the procedure for using jacks shall be described in the operator's manual[see 8.2.3 n) and 8.4.2]		
	5.2.3.2 The jack-up points shall have the appropriate strength and be constructed so that a laden machine can be lifted from the ground (e.g. to change the wheels).		P
	5.3 Electric 5.3.1 Batteries shall be located so they can be properly maintained and exchanged, from the ground or a platform, and shall be secured to remain in position and located or constructed and sealed so as to reduce the possibility of spillage in the event of a machine overturn. The electrical, non-earth terminals of batteries shall be protected to prevent unintentional contact and shorting to earth. 5.3.2 It shall be possible to easily disconnect the battery electrical circuit (e.g. without tools, with common tools or a mechanical or electrical switch). 5.3.3 Information on service and replacement of the battery shall be provided in the operator's manual[see 8.2.3 s)].		P
	5.4 Fuel tank 5.4.1 Fuel tank filler(s) shall be located outside the cab. 5.4.2 Fuel tanks shall be corrosion-resistant and shall satisfy leakage tests at a pressure equal to double the working pressure, but in any event not less than 30 kPa. 5.4.3 Fuel cap design shall not allow leaking while the engine is at the normal operating temperature and in all machine working positions. Seepage from the fuel tank ventilation system shall not be considered as a leaking condition. 5.4.4 Information on filling of the fuel tank shall be provided in the operator's manual [see 8.2.3 t)].		P
	5.5 Hot surfaces		P
	Hot surfaces which can be reached inadvertently by the operator during normal operation of the machine shall be covered or insulated. This requirement applies to hot surfaces which are near steps, handrails,handholds and integral machine parts used as boarding means and which can be inadvertently touched		
	5.6 Exhaust gases The outlet of the exhaust pipe shall be located and directed in such a way that the operator or any other person required on the machine during operation are not normally exposed to harmful concentrations of noxious gases or fumes.		P
	5.7 Roll- and tip-over The principles for the assessment of stability with respect to hazards associated with roll-over and tip-over specified by ISO 16231-1 shall be applied		P
6	Safety requirements and/or measures — Mounted, semi-mounted and trailed machines		P
	6.1 Controls 6.1.1 The control device on the tractor or self-propelled machine for controlling the energy supply to a trailed or mounted machine shall be considered the normal device for stopping the trailed or mounted machine, unless — it is specified otherwise in a machine-specific part to this standard, or — there is an operator station on the trailed or mounted machine, or — an operator position is provided beside the machine for use with the machine operating in a stationary position. 6.1.2 Manual control(s) requiring the operator to stand on the		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	ground while the PTO drive shaft is running shall be situated at a minimum horizontal distance of 550 mm from the PTO drive shaft		
	6.2 Stability		P
	6.2.1 General 6.2.1.1 Machines shall be designed to be stable when parked on firm ground, with an inclination up to 8,5°in any direction. This requirement shall be met with any tanks or hoppers empty, and with any tanks or hoppers filled with the product handled by the machine, and in both cases with and without optional fitted equipment or containers for which the machine has been designed. 6.2.1.2 Supporting devices, other than wheels (e.g. stands, outriggers) shall have a bearing surface designed to limit the ground pressure to a maximum of 400 kPa. Outriggers or similar devices shall also be lockable in their transport position. It shall be possible for the driver/operator to verify visually that the outriggers are in the transport position. Appropriate information shall be provided in the operator's manual [8.2.3 o)] 6.2.1.3 If the required stability when in operation or stationary can only be achieved by employing special measures or by using the machine in a particular way, the required procedures shall be marked on the machine and repeated in the operator's manual [8.2.3 i)].		
	6.2.2 Mounted and semi-mounted machines 6.2.2.1 If a supporting device is necessary for storing the machine, this device shall remain attached to the machine. 6.2.2.2 The height of the lower hitch points of three-point mounted machines shall be compatible with the lower hitch point height of the intended three-point linkage		P
	6.2.3 Trailed machines with vertical load on draw bar hitch > 500 N 6.2.3.1 Trailers or machines with draw bars designed to be picked up mechanically by the towing vehicle shall be fitted with a stand capable of supporting the draw bar with the hitch point at least 150 mm above the ground (for the maximum ground pressure, see also 6.2.1.2)		P
	6.2.3.2 Trailers or machines with draw bars designed to be		P
	coupled to a fixed-height clevis shall be fitted with a supporting device or jack whose height is adjustable and which may be of one or the other of the following types: — non-folding, in which case the design shall be such that inadvertent movement of the position is not possible; — folding, in which case the design shall be such that the supporting device can be securely fastened in the transport and supporting positions. The supporting device shall have a manual control located on the left of the machine in relation to the direction of motion. The supporting device shall be lockable (by design or additional means). Supporting or height adjusting the drawbar shall not be possible unless the supporting device is locked. 6.2.3.3 If crushing and shearing points are unavoidable when operating the supporting device, then instructions giving advice on how to avoid such hazards shall be given in the operator's manual [see 8.2.3 u)]. 6.2.3.4 Supporting devices and their securing elements shall normally be fixed to the machine. If, however, such supporting devices do not permit the proper use of the machine, and providing that their removal does not affect the stability of the machine, then these supporting devices may be made detachable without the use of tools. In this case, suitable instructions shall be given in the operator's manual [see 8.2.3 u)]. If supporting devices are detachable, provision shall be made for storing them on the machine		
	6.3 Hitches for towing		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	6.3.1 Appropriate information about the hitching system, including maintenance and checks (including allowed maximum wear), shall be included in the operator's manual [see 8.2.3 a) and b)]. 6.3.2 Hitching points for towing the machines shall be clearly shown in the operator's manual which shall also include the maximum static vertical force exerted on the towing vehicle [see 8.2.3 a and b)].		
	6.4.2 Stationary operation PTO-driven equipment designed to operate in a stationary position shall be provided with means to prevent separation of the PTO drive shaft. Information on the use of such means shall be provided in the operator's manual [see 8.2.3 v)].		P
	6.5 Hydraulic, pneumatic and electrical connections with a self-propelled machine or towing vehicle Suitable devices for supporting disconnected hydraulic and pneumatic hoses and electric cables when the machine is not coupled to a self-propelled machine or towing vehicle or when the connections are not in use shall be provided.		P
	Dimensions in millimetres  **Key** 1 PIC guard 2 PTO drive shaft guard **Figure 8 — Clearance between PIC and PTO drive shaft guard**		P
7	Verification of safety requirements or protective measures		P
	See Table 2.		P
	Table 2 — List of safety requirements and/or protective measurements and their verification **Clause/ sub-clause** | **Verification** (Inspection | Measurement | Procedure/reference) 4.3 | X | X | Shall be verified in accordance with Annex B. 4.7.1.2. | X | X | Shall be verified by operating the boarding means according to the instructions in the operator's manual. 4.9 | X | X | Shall be verified by folding the elements in according to instructions in the operator's manual and while using the handles or integral parts identified for that purpose. 4.10.1 | X | X | Shall be verified in accordance with Annex C. 4.11.1.1 | X | — | Shall be verified by carrying out maintenance or service operations described in the operator's manual. 4.17 | X | — | Shall be verified carrying out lubrication and maintenance operations described in the operator's manual. 5.1.2.3 | X | — | Shall be verified in accordance with ISO 3776-1, ISO 3776-2 and ISO 3776-3. 5.1.6 | X | — | Shall be verified in accordance with ISO 3795. 5.4.2 | X | — | Shall be verified by using the manufacturer's specification (30 kPa min). 6.2.1.1 | X | X | Shall be verified by using the blocking devices (e.g. chocks), if provided, in place or actuated, and by parking the machine in the manner described in the operator's manual.		P
8	Information for use		P
	8.1 General		P

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	Information for use shall be in accordance with ISO 12100:2010, 6.4		
	8.2 Operator's manual 8.2.1 An operator's manual shall be supplied with each machine. 8.2.2 Easily accessible storage place for the operator's manual shall be provided on self-propelled machines. 8.2.3 The operator's manual shall conform to the requirements of ISO 3600:1996, including provision of safety instructions relative to normal operation and servicing of the machine and use of personal protective equipment as appropriate. In particular, the following information and points shall be included, if relevant: a) the correct methods of mounting and dismounting (see 6.3.1, 6.3.2); b) compatibility with the tractors, e.g. hitching system, PTO drive shaft, vertical load at the hitching point, engine power, stability (see 6.3.1, 6.3.2, 6.4.1); c) that the weight of mounted machines (including their loads) can influence tractor manoeuvrability and stability and a means of assessing stability (Annex D provides one means		P
	for assessing the stability of the tractor/machine combination); d) description and function of all controls including an explanation of the symbols used (see 4.5.1)		
	e) how to adjust the position of the seat to provide an ergonomic		P
	relationship with the controls and to reduce exposure to vibrations (see 5.1.2.1); f) method of starting and stopping the engine (see 5.1.8); g) location and method of opening emergency exits (see 5.1.5.2); h) precautions to be taken with moving parts involved in the working process; i) use of supports to ensure stability when parked (see 6.2.1.3, 8.4.3); j) general requirements for servicing and maintaining the machine and usage of special tools (see 4.15, 4.17.1); k) use of devices for maintaining machine parts in a raised position during maintenance and servicing(see 4.11.1.4); l) provision of information concerning the renewal of hoses used in hydraulic locking systems (see 4.11.3, 4.13.3); m) manual operation of individual parts (see 4.16); n) information on the correct method for towing and lifting the machine (see 5.2.1, 5.2.3.1, 8.4.2); o) information on how to verify that the outriggers are safely stored in the transport position (see 6.2.1.2); p) hazards associated with overhead power lines, if the maximum working height of the machine is greater than 4,0 m, including specification of the maximum working height; q) noise emission values (see 4.3.2); r) vibration emission values (see 4.4.1); s) hazards associated with the use of batteries (see 5.3.3); t) hazards associated with filling of fuel tanks (see 5.4.4); u) how and where to apply lifting jacks, including the use of jacks and supporting devices on the draw bar (see 6.2.3.3, 6.2.3.4); v) information on the use of means to prevent separation of the PTO drive shaft for PTO-driven equipment designed to operate in a stationary position (see 6.4.2); w) tyre size(s) and inflation pressure(s) (see 4.7.1.1.1, 4.7.1.2.1); x) instruction how to change operating fluids (see 4.15); y) additional information: 1) intended use of the machine; 2) initial set-up of the machinery (unless this is to be carried out by		

EN ISO 4254-1:2015			
Clause	**Requirement-Test**	**Result-Remark**	**Verdict**
	the dealer); 3) fire precautions; 4) clearing of blockages linked to material flows/working processes.		
	8.3 Safety and instructional signs 8.3.1 Safety signs shall be appropriately displayed when necessary to alert the operator and others of the risk of personal injury during normal operation and service		P
	8.3.2 Safety signs shall conform to the requirements of ISO 11684:1995. 8.3.3 Instructional signs relating to equipment operation, servicing and care shall have an appearance, especially in respect of colour, different from that of the safety signs on the equipment. 8.3.4 When parts of a self-propelled machine exceed the height of 4 m during normal operation, a warning sign in the immediate vicinity of the main operator station shall warn about the hazards associated with overhead hazards such as power lines or bridges.		P
	8.4 Marking 8.4.1 Information to be given on the machine shall be marked legibly and indelibly.		P
	8.4.2 Application points for use with jacks shall be clearly marked on the machine, if not obvious		P
	(see 5.2.3.1), and additional information shall be provided in the manual [see 8.2.3 n)]. 8.4.3 A sign on the machine shall be provided showing which special measures are to be taken or how the machine is to be used to ensure stability, if applicable (see 6.2.1.3) and additional information shall be provided in the operator's manual (see 8.2.3 i)].		

5. Product picture：

(1)

EU DECLARATION OF CONFORMITY

MANUFACTURER	GRACE GROUP CO., LTD.
ADDRESS	24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China
Name and address of the person authorised to compile the technical file	GRACE GROUP CO., LTD. 24-E9, Building 3, Aosheng Building, 1166 Xinlong Street, Jinan, Shandong, China

The undersigned Company certifies under its sole responsibility that the item of equipment specified below satisfies the requirements of the MD 2006/42/EC which is apply to it.
The item of equipment identified below has been subject to internal manufacturing checks with monitoring of the final assessment by GRACE GROUP CO., LTD.

PRODUCT	Tractor
MODEL / TYPE	GR-25-1, GR-25-2, GR-25-1P, GR-35-1, GR-35-2, GR-35-1P, GR-50, GR-50P, GR-60, GR-60P, GR-80, GR-80P, GR-100, GR-100P, GR-120, GR-120P, GR-130, GR-130P, GR-140, GR-140P, GRA-01, GRA-02, GRA-03, GRA-04, GRA-05, GRA-06, GRA-07, GRA-08, GRA-09

DIRECTIVES

MD 2006/42/EC

Regulations Applied acc. to HARMONIZE STANDARDS

EN ISO 12100:2010
EN 60204-1:2018
EN ISO 4254-1:2015/A1:2021

Place and date of issue : **China**
2025/01/21

Name and position of authorized person : - -

(e.g. *Sales & Marketing Manager, General Manager*)

Singanature of authorized person :

End Of The Report