TECHNICAL CONSTRUCTION FILE
FILE NO.：EBO2308087-E219-1

ACCORDING TO
2006/42/EC MACHINERY DIRECTIVE
2014/30/EU EMC DIRECTIVE

RELATED TO THE

Robot

MODEL: ACR-7, ACR-12, ACR-18, ACR-20, ASR-3, ASR-4, AX-4, AX-7, AX-7L, AX-7XL, AX-12 R707-4, AX-12 R906-4-LAR, AX-10 R1206, AN-12-10/1.6, AN-12-12/1.4, AN-12-16/0.95-4, AN-12-16/1.1, AN-25-12/2.1, AN-25-20/2.0, AN-25-25/1.8, AN-25-35/1.8, AN-25-30/1.6, AN-80-50/2.6, AN-80-80/2.2, BR-07S-930, BR-10Z-1440, BR-10ZD-1440, BR-10CD-1488, BR-10C-1488, BR-10W-1440-D, BR-10L-2050, BR-10LD-2050, BR-12Z-1550, BR-12-2010, BR-20L-2050, BR-20LD-2050, BR-20ED-1840, BR-20E-1840, BR-08Z-1840, BR-08ZD-1840, BR-25E-1840, BR-25ED-1840, BR-80E-2250, BR-30-1700, BR-06SC-500, BR-06SC-600, BR-06SC-700

PRESENTED BY

Guangzhou Auctech Automation Technology Ltd
Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA

Content

Part I：General

1.1 Version

Version No.	Date	Description
00	*August 29, 2023*	*Original*
01	*September 28, 2023*	*New report(change model)*

1.2 General description

Basically, this kind of machine doesn't belong to hazard machine and with low risk when using it. All possible risk have been analysis in the risk assessment report and been prevent by suitable ways.

The main risk of this kind of machine could be:

－ The risk of access to the power transmission elements.

－ The risk of access to the electrictial parts

In order to prevent the main risks mentioned above, the protection guarding systems are provided, and all the detail safety provision are constructed in accordance with the requirement of EN13857.

In order to ensure the conformity for CE marking for these machines, some main European and/or International standards have been used to made assessment of conformity, they are：

－EN 60204-1 for checking of electrical equipment

－EN ISO 12100, EN ISO 10218-1 and EN ISO 13849-1 for checking the machinery safety

－EN IEC 61000-6-4:2019/EN IEC 61000-6-2:2019 for cheching the machinery EMC

The test reports for these applicable standards in detail have been included in the relevant sub-clauses of this technical construction file.

1.3 Quality control system

In order to ensure the conformity of the series production, the **Guangzhou Auctech Automation Technology Ltd** has taken the related procedures mentioned below：

（1）Carry out the inspection for parts and components according to the TCF

Before the assemblies of the series production, the QC engineers of **Guangzhou Auctech Automation Technology Ltd** has to check and inspect the technical specifications and intended functions of parts and components to ensure the correct use of them according to the contents of TCF and principle described in the related technical information.

（2）Carry out the inspection＆testing for the products before packing

Before packing the products, the QC engineers of **Guangzhou Auctech Automation Technology Ltd** have to do the necessary inspection and testing to ensure the conformity of related requirements. In particular, the testing and inspection of electrical characteristics and outer feature.

（3）Carry out the inspection for the packing

After finishing the necessary inspection and testing for the products, an inspection for the packing has to be done to ensure the necessary elements being included in this packing before shipment.

（4）Provision for the change of design

Any change of the products described in this TCF must be checked in detail and written down again in the TCF by the designer of **Guangzhou Auctech Automation Technology Ltd** The change may effects the related electrical or mechanical characteristics.

（5）Provision for the Quality Assurance

For the provisions of internal control measures to ensure the conformity of series production of the machines, **Guangzhou Auctech Automation Technology Ltd** has built an internal quality control system in accordance with the international standard of ISO-9001.

1.4 Declaration of conformity

EC DECLARATION OF CONFORMITY

CE

according to the following EC Directive
- Machinery Directive : 2006/42/EC
- Electromagnetic Compatibility: 2014/30/EU

The undersigned, representing

Applicant Name: Guangzhou Auctech Automation Technology Ltd
Applicant Address: Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Manufacturer Name: Guangzhou Auctech Automation Technology Ltd
Manufacturer Address: Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Importer: _____
Importer Address: _____
Name and address of the person(established in the Community) authorised to compile the technical file: _____

declaring that the machine
Product Name: Robot
Commercial Name: Robot
Function: _____
Brand Name: AUCTECH
Model: ACR-7, ACR-12, ACR-18, ACR-20, ASR-3, ASR-4, AX-4, AX-7, AX-7L, AX-7XL, AX-12 R707-4, AX-12 R906-4-LAR, AX-10 R1206, AN-12-10/1.6, AN-12-12/1.4, AN-12-16/0.95-4, AN-12-16/1.1, AN-25-12/2.1, AN-25-20/2.0, AN-25-25/1.8, AN-25-35/1.8, AN-25-30/1.6, AN-80-50/2.6, AN-80-80/2.2, BR-07S-930, BR-10Z-1440, BR-10ZD-1440, BR-10CD-1488, BR-10C-1488, BR-10W-1440-D, BR-10L-2050, BR-10LD-2050, BR-12Z-1550, BR-12-2010, BR-20L-2050, BR-20LD-2050, BR-20ED-1840, BR-20E-1840, BR-08Z-1840, BR-08ZD-1840, BR-25E-1840, BR-25ED-1840, BR-80E-2250, BR-30-1700, BR-06SC-500, BR-06SC-600, BR-06SC-700
Type: ACR-7
Serial Number: _____

Fulfils all the relevant provisions of Directive
2006/42/EC

And tested in accordance with below standards:

EN 60204-1:2018, Safety of machinery - Electrical equipment of machines, Part 1: General Requirements
EN ISO 12100: 2010, Safety of machinery — General principles for design — Risk assessment and risk reduction
EN ISO 10218-1:2011, Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration
EN ISO 13849-1: 2015, Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design
EN IEC 61000-6-4:2019, Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments
EN IEC 61000-6-2:2019, Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments

Person responsible for making this declaration
Name ,Surname : GuangQiang Yan
Position/ Title : General Manager
Guangdong, P.R.CHINA (place) September 26, 2023 (date) (company stamp and legal signature)

1.5 List of applicable regulations and standards

Regulations

- Machinery Directive: 2006/42/EC
- EMC Directive: 2014/30/EU
- Standards
- EN ISO 12100: 2010, Safety of machinery — General principles for design — Risk assessment and risk reduction
- EN 60204-1:2018, Safety of machinery - Electrical equipment of machines, Part 1: General Requirements
- EN ISO 10218-1:2011, Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration
- EN ISO 13849-1: 2015/ Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design
- EN IEC 61000-6-4:2019, Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments
- EN IEC 61000-6-2:2019, Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments

Part II：Assessment of conformity

Council Directive 2006/42/EC, Annex I Essential health and safety requirements relating to the design and construction of machinery and safety components EN 60204-1: 2018 Safety of machinery – Electrical equipment of machines, Part 1: General requirements EN ISO 12100:2010 Safety of machinery – General principles for design – Risk assessment and risk reduction EN ISO 10218-1:2011 Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration	
Tested by(name and signature)…... .:	Bernie Xia
Approved by(name and signature...:	Kevin Wang
Date of issue .....:	September 28, 2023
Testing Laboratory	Shenzhen EBO Testing Center
Address .....:	2F, Qiaohongsheng Cultural Creative Park, Yintian Industrial Zone, Xixiang Street, Bao 'an District, Shenzhen
Testing location/procedure.....:	Guangzhou Auctech Automation Technology Ltd
Address .....:	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Applicant's name.....	Guangzhou Auctech Automation Technology Ltd
Address .....:	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Test specification:	
Directive.....:	2006/42/EC
Test procedure	CE-MD
Manufacturer……..:	Guangzhou Auctech Automation Technology Ltd
Address	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Factory	Guangzhou Auctech Automation Technology Ltd
Address	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Test item description .....:	Robot
Trademark .....:	AUCTECH
Main model/Type reference.....:	ACR-7, ACR-12, ACR-18, ACR-20, ASR-3, ASR-4, AX-4, AX-7, AX-7L, AX-7XL, AX-12 R707-4, AX-12 R906-4-LAR, AX-10 R1206, AN-12-10/1.6, AN-12-12/1.4, AN-12-16/0.95-4, AN-12-16/1.1, AN-25-12/2.1, AN-25-20/2.0, AN-25-25/1.8, AN-25-35/1.8, AN-25-30/1.6, AN-80-50/2.6, AN-80-80/2.2, BR-07S-930, BR-10Z-1440, BR-10ZD-1440, BR-10CD-1488, BR-10C-1488, BR-10W-1440-D, BR-10L-2050, BR-10LD-2050, BR-12Z-1550, BR-12-2010, BR-20L-2050, BR-20LD-2050, BR-20ED-1840, BR-20E-1840, BR-08Z-1840, BR-08ZD-1840, BR-25E-1840, BR-25ED-1840, BR-80E-2250, BR-30-1700, BR-06SC-500, BR-06SC-600, BR-06SC-700

Rating(s)..... :	Input: 220V~, 50Hz, 1PH

Part II：Assessment of conformity

1.	**Essential Health and Safety Requirements**		**—**
1.1	**General remarks**		**—**
1.1.1	Definitions	Information only	P
1.1.2	Principles of safety integration	Considered for the machine	P
a)	Machinery must be designed and constructed so that it is fitted for its function, and can be operated, adjusted and maintained without putting persons at risk when these operations are carried out under the conditions foreseen but also taking into account any reasonably foreseeable misuse thereof.	These requirements have been complied with.	P
	The aim of measures taken must be to eliminate any risk throughout the foreseeable lifetime of the machinery including the phases of transport, assembly, dismantling, disabling and scrapping.	These requirements have been complied with.	P
b)	In selecting the most appropriate methods, the manufacturer or his authorized representative must apply the following principles, in the order given:		P
	-eliminate or reduce risks as far as possible (inherently safe machinery design and construction),	The measures have been taken to eliminate or reduce risks as far as possible.	P
	-take the necessary protective measures in relation to risks that cannot be eliminated	Appropriate guards and warning signs are used.	P
	-inform users of the residual risks due to any shortcomings of the protective measures adopted, indicate whether any particular training is required and specify any need to provide personal protective equipment.	The related safety information for the users to operate the machine has been included in the instruction manual.	P
c)	When designing and constructing machinery and when drafting the instructions, the manufacturer or his authorised representative must envisage not only the intended use of the machinery but also any reasonably foreseeable misuse thereof.	All safety principles have been taken into account as far as possible during the design of these machines.	P
	The machinery must be designed and constructed in such a way as to prevent abnormal use if such use would engender a risk. Where appropriate, the instructions must	These requirements have been complied with, and the related information also has been provided within the instruction	P

	draw the user's attention to ways -which experience has shown might occur - in which the machinery should not be used.	manual.	
d)	Machinery must be designed and constructed to take account of the constraints to which the operator is subject as a result of the necessary or foreseeable use of personal protective equipment.	These requirements have been taken into account during the design of this machine.	P
e)	Machinery must be supplied with all the special equipment and accessories essential to enable it to be adjusted, maintained and used safely.	It has been complied with.	P
1.1.3	Materials and products	The machine comprise of metal.	P
	The materials used to construct machinery or products used and created during its use must not endanger exposed persons' safety or health	Materials and products cannot endanger exposed person's safety or health.	P
	In particular, where fluids are used, machinery must be designed and constructed for use without risks due to filling, use, recovery or draining.	It has been complied with.	P
1.1.4	Lighting		P
	The manufacturer must supply integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity.		P
	Machinery must be designed and constructed so that there is no area of shadow likely to cause nuisance, that there is no irritating dazzle and that there are no dangerous stroboscopic effects on moving parts due to the lighting.	It has been complied with..	P
	Internal parts requiring frequent inspection and adjustment and maintenance areas must be provided with appropriate lighting.		P
1.1.5	Design of machinery to facilitate its Handling	Wood package and transporting vehicle used	--
	Machinery or each component part thereof must:		--
	-be capable of being handled and transported safely,		P
	-be packaged or designed so that it can be stored safely and without damage	The machinery can be stored safely and without damage.	P
	During the transportation of the machinery and/or its component parts, there must be no	movements or of hazards due to insability as long as the	P

	possibility of sudden movements or of hazards due to instability as long as the machinery and/or its component parts are handled in accordance with the instructions.	machinery and/or its component parts are handled.	
	Where the weight, size or shape of machinery or its various component parts prevents them from being moved by hand, the machinery or each components part must:		--
	-Either be fitted with attachments for lifting gear, or		N
	-Be designed so that it can be fitted with such attachments, or		P
	- Be shaped in such a way that standard lifting gear can easily be attached		N
	Where machinery or one of its component parts is to be moved by hand, it must:		-
	-Either be easily movable, or		N
	-Be equipped for picking up and moving in complete safety		N
	Special arrangement must be made for the handling of tools and/or machinery parts, even if lightweight, which could be dangerous.		N
1.1.6	Ergonomics		--
	Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator must be reduced to the minimum possible, taking into account ergonomic principles such as:		--
	-allowing for the variability of the operator's physical dimensions, strength and stamina,	The requirement has been complied with.	P
	- providing enough space for movements of the parts of the operator's body,	The requirement has been complied with.	P
	-avoiding a machine-determined work rate,	The requirement has been complied with.	P
	- avoiding monitoring that requires lengthy concentration,	The requirement has been complied with.	P
	- adapting the man/machinery interface to the foreseeable characteristics of the operators.		N
1.1.7	Operating positions		P
	The operating position must be designed and constructed in such a way as to avoid any risk due to exhaust gases and/or lack of oxygen.	The requirement has been complied with.	P

	If the machinery is intended to be used in a hazardous environment presenting risks to the health and safety of the operator or if the machinery itself gives rise to a hazardous environment, adequate means must be provided to ensure that the operator has good working conditions and is protected against any foreseeable hazards.		N
	Where appropriate, the operating position must be fitted with an adequate cabin designed, constructed and/or equipped to fulfill the above requirements. The exit must allow rapid evacuation. Moreover, when applicable, an emergency exit must be provided in a direction which is different from the usual exit.		N
1.1.8	Seating		N
	Where appropriate and where the working conditions so permit, work stations constituting an integral part of the machinery must be designed for the installation of seats.	Not applicable.	N
	If the operator is intended to sit during operation and the operating position is an integral part of the machinery, the seat must be provided with the machinery.		N
	The operator's seat must enable him to maintain a stable position. Furthermore, the seat and its distance from the control devices must be capable of being adapted to the operator.		N
	If the machinery is subject to vibrations, the seat must be designed and constructed in such a way as to reduce the vibrations transmitted to the operator to the lowest level that is reasonably possible. The seat mountings must withstand all stresses to which they can be subjected. Where there is no floor beneath the feet of the operator, footrests covered with a slip-resistant material must be provided.		N
1.2	**Controls**	See below	P
1.2.1	Safety and reliability of control systems		P
	Control systems must be designed and constructed so that they are safe and reliable,	All related safe and reliable technologies have been used	P

	in a way that will prevent a dangerous situation arising.	adequately for these machines.	
	Above all they must be designed and constructed:		--
	- They can withstand the rigors of normal use and external influences	The whole control system can withstand the rigors of normal use and external factors.	P
	-a fault in the hardware or the software of the control system does not lead to hazardous situations,	The requirement has been complied with.	P
	-Errors in control system logic don't lead to dangerous situations	Errors in logic don't lead to dangerous situations.	P
	- reasonably foreseeable human error during operation does not lead to hazardous situations.	The requirement has been complied with.	P
	Particular attention must be given to the following points:		--
	- the machinery must not start unexpectedly,	The machinery cannot start unexpectedly.	P
	-the parameters of the machinery must not change in an uncontrolled way, where such change may lead to hazardous situations,	The requirement has been complied with.	P
	- the machinery must not be prevented from stopping if the stop command has already been given,	The machinery cannot be prevented from stopping when the stop command has already been given.	P
	-no moving part of the machinery or piece held by the machinery must fall or be ejected,		P
	-automatic or manual stopping of the moving parts, whatever they may be, must be unimpeded,	The requirement has been complied with.	P
	-the protective devices must remain fully effective or give a stop command,	Remain fully effective.	P
	-the safety-related parts of the control system must apply in a coherent way to the whole of an assembly of machinery and/or partly completed machinery.	The requirement has been complied with.	P
	For cable-less control, an automatic stop must be activated when correct control signals are not received, including loss of communication.		N
1.2.2	Control devices		--
	Control devices must be:		--

	-clearly visible and identifiable, using pictograms where appropriate,	It has been complied with.	P
	- positioned in such a way as to be safely operated without hesitation or loss of time and without ambiguity,	Suitable position for each control device has been taken.	P
	-Designed so that the movement of the control is consistent with its effect	The movement of the control is consistent with its effect.	P
	- located outside the danger zones, except where necessary for certain control devices such as an emergency stop or a teach pendant,	They are located outside the danger zones.	P
	- Positioned so that their operation can't cause additional risk	Suitable position for each control device has been taken.	P
	-designed or protected in such a way that the desired effect, where a hazard is involved, can only be achieved by a deliberate action,		N
	-made in such a way as to withstand foreseeable forces; particular attention must be paid to emergency stop devices liable to be subjected to considerable forces.		P
	Where a control is designed and constructed to perform several different actions, namely where there is no one-toone correspondence, the action to be performed must be clearly displayed and subject to confirmation where necessary.		N
	Controls devices must be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles	All control devices have been arranged adequately and taking account of ergonomic principles.	P
	Constraints due to the necessary foreseeable use of personal protection equipment must be taken into account		N
	Machinery must be fitted with indicators as required for safe operation		P
	The operator must be able to read them from the control position		P
	From each control position, the operator must be able to ensure that no-one is in the danger zones, or the control system must be designed and constructed in such a way that starting is prevented while someone is in the danger zone.	The operator can be able to ensure the no-oe is in the danger zones from the control position.	P

	If neither of these possibilities is applicable, before the machinery starts, an acoustic and/or visual warning signal must be given. The exposed persons must have time to leave the danger zone or prevent the machinery starting up.		N
	If necessary, means must be provided to ensure that the machinery can be controlled only from control positions located in one or more predetermined zones or locations.		P
	Where there is more than one control position, the control system must be designed in such a way that the use of one of them precludes the use of the others, except for stop controls and emergency stops.		N
	When machinery has two or more operating positions, each position must be provided with all the required control devices without the operators hindering or putting each other into a hazardous situation.		N
1.2.3	Starting		P
	It must be possible to start machinery only by voluntary actuation of a control provided for the purpose	These machines shall be started only by voluntary actuation of a control.	P
	The same requirement applies:		--
	-When restarting the machinery after stoppage, whatever the cause		P
	- When effecting a significant change in the operating conditions		P
	However, the restarting of the machinery or a change in operating conditions may be effected by voluntary actuation of a device other than the control device provided for the purpose, on condition that this does not lead to a hazardous situation.		N
	For machinery functioning in automatic mode, the starting of the machinery, restarting after a stoppage, or a change in operating conditions may be possible without intervention, provided this does not lead to a hazardous situation.		N
	Where machinery has several starting control devices and the operators can therefore put		N

	each other in danger, additional devices must be fitted to rule out such risks. If safety requires that starting and/or stopping must be performed in a specific sequence, there must be devices which ensure that these operations are performed in the correct order.		
1.2.4	Stopping devices		P
1.2.4.1	Normal stopping		P
	Each machine must be fitted with a control whereby the machine can be brought safely to a complete stop	The normal stopping devices have been used for these machines.	P
	Each workstation must be fitted with a control to stop some or all of the moving parts of the machinery, depending on the type of hazard, so that the machinery is rendered safe	Workstation has fitted with a normal stopping device.	P
	The machinery's stop control must have priority over the start controls	They have priority over the start controls.	P
	Once the machinery or its dangerous parts have stopped, the energy supply to the actuators concerned must be cut off	The energy supply has been cut off after the machine is stopped.	P
1.2.4.2	Operational stop		--
	Where, for operational reasons, a stop control that does not cut off the energy supply to the actuators is required, the stop condition must be monitored and maintained.		P
1.2.4.3	Emergency stop		P
	machinery must be fitted with one or more emergency stop devices to enable actual or impending danger to be averted	The requirement has been complied with.	P
	The following exceptions apply:		--
	- Machines in which an emergency stop device would not lessen the risk, either because it would not reduce the stopping time or because it would not enable the special measures required to deal with the risk to be taken		N
	- Hand-held portable machines and hand-guided machines		N
	The emergency stop device must:		--
	- Have clearly identifiable, clearly visible and quickly accessible controls	The requirement has been complied with.	P
	-Stop the dangerous process as quickly as	The requirement has been	P

	possible, without creating additional hazards	complied with.	
	-Where necessary, trigger or permit the triggering of certain safeguard movements	No this kind of application	N
	Once active operation of the emergency stop control has ceased following a stop command, that command must be sustained by engagement of the emergency stop device until that engagement is specifically overridden		N
	It must be possible to disengage the device only by an appropriate operation, and disengaging the device must not restart the machinery but only permit restarting		N
	The emergency stop function must be available and operational at all times, regardless of the operating mode.		N
	Emergency stop devices must be a backup to other safeguarding measures and not a substitute for them.		N
1.2.4.4	Complex installations		P
	In the case of machinery or parts of machinery designed to work together, must so design and construct the machinery that the stop controls, including the emergency stop, can stop not only the machinery itself but also all equipment upstream and/or downstream if its continued operation can be dangerous		N
1.2.5	Mode Selection		P
	The control mode selected must override all other control systems with the exception of the emergency stop	These specified requirements have been complied with.	P
	If machinery has been designed and built to allow for its use in several control or operating modes presenting different safety levels, it must be fitted with a mode selector which can be locked in each position	Not applicable.	N
	Each position of the selector must correspond to a single operating or control mode	Each of them is corresponding to a single operating or control mode.	P
	The selector may be replaced by another selection method which restricts the use of certain functions of the machinery to certain categories of operator	No this kind of application.	N

	If, for certain operations, the machinery must be able to operate with its protection devices neutralized, the mode selector must simultaneously:		N
	-disable all other control or operating modes,		N
	-Permit movements only by controls requiring sustained action		N
	-Permit the operation of dangerous moving parts only in enhanced safety conditions while preventing hazards from linked sequences		N
	-Prevent any movement liable to pose a danger by acting voluntarily or involuntarily on the machine's internal sensors		N
	If these four conditions cannot be fulfilled simultaneously, the control or operating mode selector must activate other protective measures designed and constructed to ensure a safe intervention zone.		N
	In addition, the operator must be able to control operation of the parts he is working on at the adjustment point.		N
1.2.6	Failure of the power supply		P
	The interruption, re-establishment after an interruption or fluctuation in whatever manner of the power supply to the machinery must not lead to a dangerous situation	No risk is generated from these accidental situations.	P
	In particular:		--
	-The machinery must not start unexpectedly		P
	-the parameters of the machinery must not change in an uncontrolled way when such change can lead to hazardous situations,	the parameters of the machinery will not change in an uncontrolled way	P
	-The machinery must not be prevented from stopping if the command has already been given	This requirement has been complied with.	P
	- No moving part of the machinery or piece held by the machinery must fall or be ejected	This clause has been met.	P
	- Automatic or manual stopping of the moving parts whatever they must be unimpeded	This requirement has been complied with.	P
	- The protection devices must remain fully effective	All protection devices can remain effective fully.	P
1.2.7	Failure of the control circuit		P

1.2.8	Software		P
1.3	Protection against mechanical hazards	See below	P
1.3.1	Risk of loss of stability	Square construction and low center of gravity, no overturn, drop and movement	P
	Machinery, components and fittings thereof must be so designed and constructed that they are stable enough, under the foreseen operating conditions for use without risk of overturning, falling or unexpected movement	The stability of machines, components and fittings has been taken into consideration.	P
	If the shape of the machinery itself or its intended installation doesn't offer sufficient stability, appropriate means of anchorage must be incorporated and indicated in the instructions		N
1.3.2	Risk of break-up during Operation		P
	The various parts of machinery and their linkages must be able to withstand the stress to which they are subject when used as foreseen by the manufacturer	All parts used can withstand sufficient stress for working.	P
	The durability of the materials used must be adequate for the nature of the workplace foreseen by the manufacturer, in particular as regards the phenomena of fatigue, aging, corrosion and abrasion	All materials used have adequate durability.	P
	The manufacturer must indicate in the instructions the type and frequency of inspection and maintenance required for safety reasons, where appropriate, indicate the parts subject to wear and the criteria for replacement	This information in relation to inspection and maintenance etc. are indicated in the instruction manual.	P
	Where a risk of rupture or disintegration remains despite the measures taken the moving parts must be mounted and positioned in such a way that in case of rupture their fragments will be contained	No this kind of situation.	N
	Both rigid and flexible pipes carrying fluids, particularly those under high pressure, must be able to withstand the foreseen internal and external stresses and must be firmly attached and/or protected against all manner of external stresses and strains; precaution must be taken to ensure that no risk is posed by a rupture		N

	Where the material to be processed is fed to the tool automatically, the following conditions must be fulfilled to avoid risks to the persons exposed:		--
	-When the work piece comes into contact with the tool the later must have attained its normal working conditions	This requirement has been complied with.	P
	- When the tool starts and/or stops the feed movement and the tool movement must be coordinated	This requirement has been complied with.	P
1.3.3	Risks due to falling or ejected Objects	No object falling and ejecting	P
	Precautions must be taken to prevent risks from falling or ejected objects		N
1.3.4	Risks due to surfaces, edges or angles	Smooth surface and edges	P
	In so far as their purpose allows, accessible parts of the machinery must have no sharp edges, no sharp angles, and no rough surfaces likely to cause injury	All parts have been processed carefully so that they have no sharp edges, no sharp angles, and no rough surfaces likely to cause injury.	P
1.3.5	Risks related to combined machinery		--
	Where the machinery is intended to carry out several different operations with the manual removal of the piece between each operation, it must be designed and constructed in such a way as to enable each element to be used separately without the other elements constituting a danger or risk for the exposed person		N
	For this purpose, it must be possible to start and stop separately and elements that are not protected		N
1.3.6	Risks relating to variations in the rotational speed of tools		--
	Where the machinery persforms operations under different conditions of use, it must be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably		P
1.3.7	Prevention of risks related to moving parts		P
	The moving parts of machinery must be designed, built and laid out to avoid hazards or, where hazards persist, fixed with guards or	Appropriate protective guards have been fitted to avoid hazards.	P

	protective devices in such a way as to prevent all risk of contact which could lead to accidents		
	All necessary steps must be taken to prevent accidental blockage of moving parts involved in the work		P
	In cases where, despite the precautions taken, a blockage is likely to occur, specific protection devices or tools, the instruction handbook and possibly a sign on the machinery should be provided by the manufacturer to enable the equipment to be safely unblocked		N
	The instructions and, where possible, a sign on the machinery shall identify these specific protective devices and how they are to be used.		N
1.3.8	Choice of protection against risks arising from moving parts	A nip warning symbol provided	P
	Guards or protection devices used to protect against the risks related to moving parts must be selected on the basis of the type of risk	Guards or protection devices have been used appropriately.	P
	The following guidelines must be used to help make the choice		--
1.3.8.1	Moving transmission parts		P
	Guards designed to protect exposed persons against the risks associated with moving transmission parts must be:		--
	-Either fixed, complying with requirements 1.4.1 and 1.4.2.1 or	The fixed guards are used.	P
	- interlocking movable guards as referred to in section 1.4.2.2.		N
	Interlocking movable guards should be used where frequent access is envisaged.		N
1.3.8.2	Moving parts involved in the process		--
	guards or protection devices designed to protect exposed persons against the risks associated with moving parts contributing to the work must be:		--
	- either fixed guards complying with requirements 1.4.1 and 1.4.2.1	fixed guards complying with requirements 1.4.1 and 1.4.2.1	P
	- interlocking movable guards as referred to in section 1.4.2.2, or		N
	- protective devices as referred to in section 1.4.3, or		N

	- a combination of the above.		N
	However, when certain moving parts directly involved in the process can't be made completely or partially inaccessible during operation owing to operations requiring near-by operator intervention, where technically possible such parts must be fitted with:		--
	- fixed guards or interlocking movable guards preventing access to those sections of the parts that are not used in the work, and		N
	-adjustable guards as referred to in section 1.4.2.3 restricting access to those sections of the moving parts where access is necessary.		N
1.3.9	Risks of uncontrolled movements		--
	When a part of the machinery has been stopped, any drift away from the stopping position, for whatever reason other than action on the control devices, must be prevented or must be such that it does not present a hazard.	The requirement has been complied with.	P
1.4	Required characteristics of guard and protection devices		P
1.4.1	General requirements	Steel used	P
	Guards and protection devices must:		
	-Be of robust construction	They are of robust construction.	P
	-be securely held in place,	be securely held in place,	P
	-Not give rise to any additional risk	No additional risk is generated.	P
	-Not be easy to bypass or render nonoperational	They cannot be easy to bypass or render non-operational.	P
	-Be located at an adequate distance from the danger zone	Appropriate safety distances according to EN ISO13857 has been complied with.	P
	-Cause minimum obstruction to the view of the production process	This requirement has been complied with.	P
	-enable essential work to be carried out on the installation and/or replacement of tools and for maintenance purposes by restricting access exclusively to the area where the work has to be done, if possible without the guard having to be removed or the protective device having to be disabled.		P
	In addition, guards must, where possible,		N

	protect against the ejection or falling of materials or objects and against emissions generated by the machinery.		
1.4.2	Special requirements for guards		P
1.4.2.1	Fixed guards		P
	Fixed guards must be fixed by systems that can be opened or removed only with tools.		P
	Their fixing systems must remain attached to the guards or to the machinery when the guards are removed.		P
	Where possible, guards must be unable to remain in place without their fixings		P
1.4.2.2	Movable guards	Not provided	N
	Interlocking movable guards must:		--
	-As far as possible remain fixed to the machinery when open		N
	-be designed and constructed in such a way that they can be adjusted only by means of an intentional action.		N
	Interlocking movable guards must be associated with an interlocking device that:		--
	-prevents the start of hazardous machinery functions until they are closed and		N
	-gives a stop command whenever they are no longer closed.		N
	Where it is possible for an operator to reach the danger zone before the risk due to the hazardous machinery functions has ceased, movable guards must be associated with a guard locking device in addition to an interlocking device that:		N
	-prevents the start of hazardous machinery functions until the guard is closed and locked, and		N
	-keeps the guard closed and locked until the risk of injury from the hazardous machinery functions has ceased.		N
	Interlocking movable guards must be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous machinery functions.		N
1.4.2.3	Adjustable guards restricting access	Not provided	N

	Adjustable guards restricting access to those areas of the moving parts strictly necessary for the work must:		N
	- Be adjustable manually or automatically according to the type of work involved		N
	-Be readily adjustable without the use of tools		N
1.4.3	Special requirements for protection devices		N
	Protection devices must be designed and incorporated into the control system so that:		N
	- Moving parts can't start up while they are within the operator's reach		N
	-persons cannot reach moving parts while the parts are moving, and		N
	- The absence or failure of one of their components prevents starting or stops the moving parts		N
	Protective devices must be adjustable only by means of an intentional action.		N
1.5	Protection against other hazards	See below	P
1.5.1	Electricity supply	All electrical parts, protecting by enclourse and reinforced insulation construction, protective earthing used. Overcurrent, overvoltage, overload, overspeed, overtemperature, overvoltage and undervoltage protection provided by circuit breaker. No residual voltage hazard No electric shock hazard All connection comply with requirements, identification correct. The details pls see EN60204-1 safety report	P
	Where machinery has an electricity supply it must be designed, constructed and equipped so that all hazards of an electrical nature are or can be prevented		P
	The safety objectives set out in Directive 2014/35/EU shall apply to machinery. However, the obligations concerning conformity assessment and the placing on the market		P

	and/or putting into service of machinery with regard to electrical hazards are governed solely by this Directive.		
1.5.2	Static electricity	Protective earthing circuits used	P
	Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous electrostatic charges and/or be fitted with a discharging system	Adequate safety design for this requirement has been taken.	P
1.5.3	Energy supply other than electricity		N
	Where machinery is powered by an energy other than electricity, it must be so designed, constructed and equipped as to avoid all potential hazayijingshuo le, nishuoqu a rds associated with these types of energy		N
1.5.4	Errors of fitting	Machine design to avoid assembly Errors. machine assembly by manufacturer relevant identification and tag provided	P
	Errors likely to be made when fitting or refitting certain parts which could be a source of risk must be made impossible by the design of such parts or, failing this, by information on moving parts and/or their housings where the direction of movement must be known to avoid a risk	Appropriate design has been taken during design and attention has been paid during fitting.	P
	Where necessary, the instructions must give further information on these risks.	Adequate instructions are given in the instruction manual.	P
	Where a faulty connection can be the source of risk, incorrect connections must be made impossible by design or, failing this, by information given on the elements to be connected and, where appropriate, on the means of connection.		P
1.5.5	Extreme temperature	No hazard	P
	Step must be taken to eliminate any risk of injury caused by contact with or proximity to machinery parts or materials at high or very low temperatures		N
	The necessary steps must also be taken to avoid or protect against the risk of hot or very cold material being ejected.		N
1.5.6	Fire	No hazard	P

	Machinery must be designed and constructed to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dusts, vapors or the other substances produced or used by the machinery		N
1.5.7	Explosion		--
	Machinery must be designed and constructed to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dusts, vapors or other substances produced or used by the machinery		N
	Machinery must comply, as far as the risk of explosion due to its use in a potentially explosive atmosphere is concerned, with the provisions of the specific Community Directives.		N
1.5.8	Noise	No infective noise, comply with requirement<80dB	P
	Machinery must be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking accounting of technical progress and the availability of means of reducing noise, in particular at source	Appropriate measure has been taken.	P
	The level of noise emission may be assessed with reference to comparative emission data for similar machinery.		N
1.5.9	Vibration	Shock-proof washer used	P
	Machinery must be so designed and constructed that risks resulting from vibrations produced by the machinery are reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source		N
	The level of vibration emission may be assessed with reference to comparative emission data for similar machinery.		N
1.5.10	Radiation	No hazard	P
	Undesirable radiation emissions from the machinery must be eliminated or be reduced to levels that do not have adverse effects on persons.	The requirement has been complied with.	P
	Any functional ionising radiation emissions must	No harmful emission of radiation	P

	be limited to the lowest level which is sufficient for the proper functioning of the machinery during setting, operation and cleaning. Where a risk exists, the necessary protective measures must be taken.	has been found.	
	Any functional non-ionising radiation emissions during setting, operation and cleaning must be limited to levels that do not have adverse effects on persons.	No harmful emission of radiation has been found.	N
1.5.11	External radiation		N
	Machinery must be so designed and constructed that external radiation doesn't interfere with its operation		N
1.5.12	Laser equipment		N
	Where laser equipment is used, the following provisions should be taken into account;		N
	-Laser equipment on machinery must be designed and constructed so as to prevent any accidental radiation		N
	-Laser equipment on machinery must be protected so that effective radiation, radiation produced by reflection or diffusion and secondary radiation don't damage health		N
	-Optical equipment for the observation or adjustment of laser equipment on machinery must be such that no health risk is created by the laser rays		N
1.5.13	Emission of dust, gases, etc.	No dust emission	N
	Machinery must be so designed, constructed and/or equipped that risks due to gases, liquids, dust, vapors and other waste materials which it produces can be avoided		N
	Where a hazard cannot be eliminated, the machinery must be so equipped that hazardous materials and substances can be contained, evacuated, precipitated by water spraying, filtered or treated by another equally effective method.		N
	Where the process is not totally enclosed during normal operation of the machinery, the devices for containment and/or evacuation must be situated in such a way as to have the		N

	maximum effect.		
1.5.14	Risk of being trapped in a machine	Can't stand into machine	N
	Machinery must be so designed, constructed or fitted with a means of preventing a exposed person from being enclosed within it or, if that is impossible, with a means of summoning help		N
1.5.15	Risk of slipping, tripping or falling		N
	Parts of the machinery where persons are liable to move about or stand must be designed and constructed to prevent persons slipping, tripping or falling on or off these parts		N
	Where appropriate, these parts must be fitted with handholds that are fixed relative to the user and that enable them to maintain their stability.		N
1.6	Maintenance		P
1.6.1	Machinery maintenance	Requirement in instruction Adjustment, lubricate and maintenance under disconnecting power and no hazard to person	P
	Adjustment and maintenance points must be located outside danger zones.	They are located outside danger zones.	P
	It must be possible to carry out adjustment, maintenance, repair, cleaning and servicing operations while machinery is at a standstill		P
	If one or more of the above conditions can't be satisfied for technical reasons, these operations must be possible without risk		N
	In the case of automated machinery and, where necessary, other machinery, the manufacturer must take provision for a connecting device for mounting diagnostic fault-finding equipment	The requirement has been complied with	P
	Automated machine components which have to be changed frequently, in particular for a change in manufacture or where they are liable to wear or likely to deteriorate following an accident, must be capable of being removed and replaced easily and in safety	The relative components can be removed and replaced easily and in safety.	P
	Access to the components must enable these tasks to be carried out with the necessary technical means in accordance with an	Appropriate means have been given in the instruction manual.	P

	operating method specified by the manufacturer		
1.6.2	Access to operating position and servicing points		P
	Machinery must be designed and constructed in such a way as to allow access in safety to all areas where intervention is necessary during operation, adjustment and maintenance of the machinery.	Appropriate protection measures have been taken so that all areas can be accessed safely.	P
1.6.3	Isolation of energy source	Power system provided by user Seperated by single trunk cable system Connection and requirement in instruction	P
	All machinery must be fitted with means to isolate it from all energy sources	Circuit breaker has been taken into used.	P
	Such isolators must be clearly identified		P
	They must be capable of being locked if reconnection could endanger exposed persons		N
	The isolator must be capable of being locked also where an operator is unable, from any of the points to which he has access, to check that the energy is still cut off		N
	In the case of machinery supplied with electricity through a plug capable of being plugged into a circuit, separation of the plug is sufficient		N
	After the energy is cut off, it must be possible to dissipate normally any energy remaining or stored in the circuits of the machinery without risk to exposed persons		P
	As an exception to the above requirements, certain circuits may remain connected to their energy source in order, for example, to hold parts, protect information, light interiors, etc. In this case, special steps must be taken to ensure operator safety		N
1.6.4	Operator intervention	Maintenance by skilled person.	P
	Machinery must be so designed, constructed and equipped that the need for operator intervention is limited		P
	If operator intervention can't be avoided, it must be possible to carry it out easily and in safety		P
1.6.5	Cleaning of internal parts	No dangerous residual object.	P

	The machinery must be designed and constructed in such a way that it is possible to clean internal parts which have contained dangerous substances or preparations without entering them; any necessary unblocking must also be possible from the outside		P
	If it is absolutely impossible to avoid entering the machinery, the manufacturer must take steps during its construction to allow cleaning to take place safely.		P
1.7	INFORMATION	See below	P
1.7.1	Information and warnings on the machinery		N
	Information and warnings on the machinery should preferably be provided in the form of readily understandable symbols or pictograms.	Information and warnings are readily understandable pictograms.	P
	Any written or verbal information and warnings must be expressed in an official Community language or languages, which may be determined in accordance with the Treaty by the Member State in which the machinery is placed on the market and/or put into service and may be accompanied, on request, by versions in any other official Community language or languages understood by the operators.	The requirement has been complied with.	P
1.7.1.1	Information and information devices		--
	The information needed to control machinery must be provided in a form that is unambiguous and easily understood. It must not be excessive to the extent of overloading the operator.		P
	Visual display units or any other interactive means of communication between the operator and the machine must be easily understood and easy to use.		N
1.7.1.2	Warning devices		--
	Where the health and safety of persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped in such a way as to give an appropriate acoustic or light signal as a warning.	It has been complied with.	P
	Where machinery is equipped with warning		P

	devices these must be unambiguous and easily perceived. The operator must have facilities to check the operation of such warning devices at all times.		
	The requirements of the specific Community Directives concerning colors and safety signals must be complied with	It has been complied with.	P
1.7.2	Warning of residual risks		--
	Where risks remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted, the necessary warnings, including warning devices, must be provided.		P
1.7.3	Marking		--
	All machinery must be marked legibly and indelibly with the following minimum particular:		--
	-the business name and full address of the manufacturer and, where applicable, his authorised representative,	It has been marked.	P
	- designation of the machinery,	It has been marked.	P
	-the CE Marking (see Annex III),	It has been marked.	P
	-designation of series or type,	It has been marked.	P
	-serial number, if any,	It has been marked.	P
	-the year of construction, that is the year in which the manufacturing process is completed.	This information has been provided.	P
	It is prohibited to pre-date or post-date the machinery when affixing the CE marking.	This information has been provided.	P
	Furthermore, machinery designed and constructed for use in a potentially explosive atmosphere must be marked accordingly.		N
	Machinery must also bear full information relevant to its type and essential for safe use. Such information is subject to the requirements set out in section 1.7.1.	The requirement has been complied with.	P
	Where a machine part must be handled during use with lifting equipment, its mass must be indicated legibly, indelibly and unambiguously.		P
1.7.4	Instructions		P
	All machinery must be accompanied by instructions in the official Community language or languages of the Member State in which it is	The language of the instructions is english.	P

	placed on themarket and/or put into service.		
	The instructions accompanying the machinery must be either ‘Original instructions’ or a ‘Translation of the original instructions’, in which case the translation must be accompanied by the original instructions.	It has been included in the instructions.	P
	By way of exception, the maintenance instructions intended for use by specialised personnel mandated by the manufacturer or his authorized representative may be supplied in only one Community language which the specialised personnel understand.	It has been included in the instructions.	P
	The instructions must be drafted in accordance with the principles set out below.	It has been included in the instructions.	P
1.7.4.1	General principles for the drafting of instructions		P
	a) The instructions must be drafted in one or more official Community languages. The words ‘Original instructions’ must appear on the language version(s) verified by the manufacturer or his authorized representative.	In english.	P
	(b) Where no ‘Original instructions’ exist in the official language(s) of the country where the machinery is to be used, a translation into that/those language(s) must be provided by the manufacturer or his authorized representative or by the person bringing the machinery into the language area in question. The translations must bear the words ‘Translation of the original instructions’.		P
	(c) The contents of the instructions must cover not only the intended use of the machinery but also take into account any reasonably foreseeable misuse thereof.	It is included in the instructions.	P
	(d) In the case of machinery intended for use by non-professional operators, the wording and layout of the instructions for use must take into account the level of general education and acumen that can reasonably be expected from such operators.		P
1.7.4.2	Contents of the instructions		--
	Each instruction manual must contain, where		--

	applicable, at least the following information:		
	a) the business name and full address of the manufacturer and of his authorized representative;	it is included.	P
	b) the designation of the machinery as marked on the machinery itself, except for the serial number (see section 1.7.3);	it is included.	P
	(c) the EC declaration of conformity, or a document setting out the contents of the EC declaration of conformity, showing the particulars of the machinery, not necessarily including the serial number and the signature;	it is included.	P
	(d) a general description of the machinery;	it is included.	P
	(e) the drawings, diagrams, descriptions and explanations necessary for the use, maintenance and repair of the machinery and for checking its correct functioning;	it is included.	P
	(f) a description of the workstation(s) likely to be occupied by operators;	it is included.	P
	(g) a description of the intended use of the machinery;	it is included.	P
	(h) warnings concerning ways in which the machinery must not be used that experience has shown might occur;	it is included.	P
	(i) assembly, installation and connection instructions, including drawings, diagrams and the means of attachment and the designation of the chassis or installation on which the machinery is to be mounted;	it is included.	P
	(j) instructions relating to installation and assembly for reducing noise or vibration;	it is included.	P
	(k) instructions for the putting into service and use of the machinery and, if necessary, instructions for the training of operators;	it is included.	P
	(l) information about the residual risks that remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted;	it is included.	P
	(m) instructions on the protective measures to be taken by the user, including, where appropriate, the personal protective equipment to be provided;		N

	(n) the essential characteristics of tools which may be fitted to the machinery;		P
	(o) the conditions in which the machinery meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdowns;		P
	(p) instructions with a view to ensuring that transport, handling and storage operations can be made safely, giving the mass of the machinery and of its various parts where these are regularly to be transported separately;		P
	(q) the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;		P
	(r) the description of the adjustment and maintenance operations that should be carried out by the user and the preventive maintenance measures that should be observed;		P
	(s) instructions designed to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;		P
	(t) the specifications of the spare parts to be used, when these affect the health and safety of operators;		P
	(u) the following information on airborne noise emissions:		--
	- Equivalent continuous A-weighted pressure level at workstations, where this exceeds 70 dB (A); where this level doesn't exceed 70 dB (A), this fact must be indicated		P
	-Peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 uPa)		N
	-Sound power level emitted by the machinery where the equivalent continuous A-weight sound pressure level at workstations exceeds 80 dB (A)		N
	These values must be either those actually measured for the machinery in question or	The requirement has been complied with.	P

	those established on the basis of measurements taken for technically comparable machinery which is representative of the machinery to be produced.		
	In the case of very large machinery, instead of the A-weighted sound power level, the A-weighted emission sound pressure levels at specified positions around the machinery may be indicated.		N
	Where the harmonized standards are not applied, sound levels must be measured using the most appropriate method for the machinery		N
	Whenever sound emission values are indicated the uncertainties surroundingthese values must be specified. The operating conditions of the machinery during measurement and the measuring methods used must be described.		P
	Where the workstation(s) are undefined or cannot be defined, A-weighted sound pressure levels must be measured at a distance of 1 metre from the surface of the machinery and at a height of 1, 6 metres from the floor or access platform.		P
	The position and value of the maximum sound pressure must be indicated		P
	Where specific Community Directives lay down other requirements for the measurement of sound pressure levels or sound power levels, those Directives must be applied and the corresponding provisions of this section shall not apply;		N
	(v) Where machinery is likely to emit nonionising radiation which may cause harm to persons, in particular persons with active or non-active implantable medical devices, information concerning the radiation emitted for the operator and exposed persons.		N
1.7.4.3	Sales literature		--
	Sales literature describing the machinery must not contradict the instructions as regards health and safety aspects. Sales literature describing the performance characteristics of machinery	The requirement has been complied with.	P

	must contain the same information on emissions as is contained in the instructions.		
2.	**Essential Health and Safety Requirements for Certain Categories of Machinery**		**—**
2.1	**Agri-foodstuffs machinery**		N
2.1.1	General		N
	Machinery intended for use with foodstuffs or with cosmetics or pharmaceutical products		N
	must be designed and constructed in such a way as to avoid any risk of infection, sickness or contagion. The following requirements must be observed:		N
	(a) materials in contact with, or intended to come into contact with, foodstuffs or cosmetics or pharmaceutical products must satisfy the conditions set down in the relevant Directives. The machinery must be designed and constructed in such a way that these materials can be cleaned before each use. Where this is not possible disposable parts must be used;		N
	(b) all surfaces in contact with foodstuffs or cosmetics or pharmaceutical products, other than surfaces of disposable parts, must:		N
	– be smooth and have neither ridges nor crevices which could harbour organic materials. The same applies to their joinings,		N
	– be designed and constructed in such a way as to reduce the projections, edges and recesses of assemblies to a minimum		N
	– be easily cleaned and disinfected, where necessary after removing easily dismantled parts; the inside surfaces must have curves with a radius sufficient to allow thorough cleaning;		N
	(c) it must be possible for liquids, gases and aerosols deriving from foodstuffs, cosmetics or pharmaceutical products as well as from cleaning, disinfecting and rinsing fluids to be completely discharged from the machinery (if possible, in a ‘cleaning’ position);		N
	(d) machinery must be designed and constructed in such a way as to prevent any		N

	substances or living creatures, in particular insects, from entering, or any organic matter from accumulating in areas that cannot be cleaned;		
	(e) machinery must be designed and constructed in such a way that no ancillary substances hazardous to health, including the lubricants used, can come into contact with foodstuffs, cosmetics or pharmaceutical products. Where necessary, machinery must be designed and constructed in such a way that continuing compliance with this requirement can be checked.		N
2.1.2	Instructions		N
	The instructions for foodstuffs machinery and machinery for use with cosmetics or pharmaceutical products must indicate recommended products and methods for cleaning, disinfecting and rinsing, not only for easily accessible areas but also for areas to which access is impossible or inadvisable		N
2.2	**Portable hand-held and/or hand-guided machinery**	The machine is not a portable hand-held or hand-guided type	N
2.3	**Machinery for working wood and analogous materials**	The machine is not used in the wood working industry	N
3.	**Essential Health and Safety Requirements to Offset due to the Mobility of Machinery**		**—**
3.1	**General**	The machine is not intended for mobility application	N
3.1.1	Definition	Information only	N
3.1.2	Lighting		N
3.1.3	Design of machinery to facilitate its handling		N
3.2	**Work stations**		N
3.2.1	Driving position		N
3.2.2	Seating		N
3.2.3	Other places		N
3.3	**Controls**		N
3.3.1	Control devices		N
3.3.2	Starting/moving		N
3.3.3	Travelling function		N
3.3.4	Movement of pedestrian-controlled machinery		N

3.3.5	Control circuit failure		N
3.4	**Protection against mechanical hazards**		N
3.4.1	Uncontrolled moverments		N
3.4.2	Risk of break-up during operation		N
3.4.3	Rollover		N
3.4.4	Falling objects		N
3.4.5	Means of access		N
3.4.6	Towing devices		N
3.4.7	Transmission of power between self-propelled machinery (or tractor) and recipient machinery		N
3.4.8	Moving transmission parts		N
3.5	Protection against other hazards		N
3.5.1	Batteries		N
3.5.2	Fire		N
3.5.3	Emissions of dust, gases, etc.		N
3.6	Indications		N
3.6.1	Signs and warning		N
3.6.2	Marking		N
3.6.3	Instruction handbook		N
4.	Essential Health and Safety Requirements to Offset the Particular Hazards due to a Lifting Operation		—
4.1	General remarks	The machine is not intended for any lifting operations	N
4.1.1	Definition	Information only	N
4.1.2	Protection against mechanical hazards		N
4.1.2.	Risk due to lack of stability		N
4.1.2.	Guide rails and rail tracks		N
4.1.2.	Mechanical strength		N
4.1.2.	Pulleys, drums, chains or ropes		N
4.1.2.	Seperate lifting accessories		N
4.1.2.	Control of movements		N
4.1.2.	Handling of loads		N
4.1.2.	Lightning		N
4.2	Special requirements for machinery whose power source is other than manual effort		N
4.2.1	Controls		N
4.2.1.1	Driving position		N
4.2.1.2	Seating		N

4.2.1.3	Control devices		N
4.2.1.4	Loading control		N
4.2.2	Installation guided by cables		N
4.2.3	Risks to exposed persons. Means of access to driving position and intervention points		N
4.2.4	Fitness for purpose		N
4.3	Marking		N
4.3.1	Chains and ropes		N
4.3.2	Lifting accessories		N
4.3.3	Machinery		N
4.4	Instruction handbook		N
4.4.1	Lifting accessories		N
4.4.2	Machinery		N
5.	Essential Health and Safety Requirements for Machinery Intended for Underground Work		—
5.1	Risks due to lack of stability	The machine is not intended for underground work	N
5.2	Movement		N
5.3	Lighting		N
5.4	Control devices		N
5.5	Stopping		N
5.6	Fire		N
5.7	Emissions of dust, gases, etc.		N

Part II: 2.2 Risk assessment

Risk assessment Methodology

The risk assessment is based on a method recommended in ISO/TR14121-2:2007, in which the factors Se-CI(Fr, Pr, Av) and diagram are used to evaluate the level of risk. The meaning of those is described in the following:

(1) Se, severity of the possible harm:

1: Scratches, bruises that are cured by first aid or similar.

2: More severe scratches, bruises, stabbing which require medical attention from professionals.

3: Normally irreversible injury; it will be slightly difficult to continue work after healing.

4: Irreversible injury in such a way that it will very difficult to continue work after healing, if possible at all.

(2) Fr, average interval between frequency of the exposure and its duration:

1: Interval between exposure is more than a year.

2: Interval between exposure is more than two weeks but less than or equal to a year.

3: Interval between exposure is more than a day but less than or equal to two weeks.

4: Interval between exposure is more than an hour but less than or equal to a day. Where the duration is short than 10 min, the above values may be decreased to the next level.

5: Interval less than or equal to an hour. This value is not to be decreased at any time.

(3) Pr, possibility of occurrence of a hazardous event:

1: Negligible: for example, this kind of component never fails so that a hazardous event occurs. No possibility of human error.

2: Rarely: for example, it is unlikely that this kind of component will fail so that a hazardous event occurs. Human error is unlikely.

3: Possible: for example, this kind of component can fail so hazardous event occurs. Human error is possible.

4: Likely: for example, this kind of component will probably fail so a hazardous event occurs. Human error is likely.

5: Very High: for example, this kind of component is not made for this application. It will fail so that a hazardous event occurs. Human behavior is such that the likelihood of error is very high.

(4) Av, possibility of avoiding or limiting harm:

1: Likely: for example, it is likely that contact with moving parts behind and inter locked guard will be avoided in most cases should the interlocking fail and the movements continue.

2: Possible: for example, it is possible to avoid an entanglement hazard where the speed is slow.

3: Impossible: for example, it is impossible to avoid the sudden appearance of a powerful laser beam or a part of machine becoming live because of a fault in electrical insulation.

The risk is evaluated by using the matrix as below:

Severity Se	Class CI (Fr+Pr+Av)				
	3-4	5-7	8-10	11-13	14-15
4					
3					
2					
1					

Where the severity, Se, cross the class, CI:

In the black area, protective measures have to be implemented to reduce risk;

In the gray area, protective measures are recommended to be implemented to further reduce risk;

In the remaining area, the risk is already adequately reduced.

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
1. Mechanical							
1.1		6.2.2.1	Being run over	-	N/A	-	-
1.2		6.2.2.2 6.2.3 a) 6.2.3 b) 6.2.6 6.2.10 6.3.1 6.3.2 6.3.3 6.3.5.2 6.3.5.4 6.3.5.5	Being thrown	1.Commissioning 2. Operation	The machine operator or machine maintenance operator approach to the area nearby the pneumatic systems.	Se 1, Fr 4, Pr 2, Av 1; Cl 7	Pressure regulator has been provided to prevent over pressure. Terminals of pneumatic hoes has been tied to fixed parts to reduce the possibility of loosen. Pneumatic systems have been shielded as far as possible. Warning labels and safety instructions are provided to remind operator for relevant risk.
1.3	1.3.7	6.3.5.6 6.4.1 6.4.3	Crushing	-	N/A	-	-
1.4	1.3.4	6.4.4 6.4.5	Cutting or severing	-	N/A	-	-
1.5	1.3.7		Drawing in or trapping	-	N/A	-	-
1.6	1.3.7		Entanglement	-	N/A	-	-
1.7			Friction, abrasion	-	N/A	-	-
1.8			Impact	1.Commissioning 2. Operation	1. When entering the working area of the mould. 2. The machine maintenance operator put his/her head or into the machine process zone during setting, change of fixture, and visual inspection check.	Se 4, Fr 4, Pr 3, Av 3; Cl 10	Fixed guard provided to relevant risk Warning labels and safety instructions are provided to remind operator for relevant risk.

1.9			Injection	-	N/A	-	-
1.10	1.3.7		Shearing	-	N/A	-	-
1.11	1.5.15		Slip, trip, and fall of person	-	N/A	-	-
1.12			Stabbing or puncture	-	N/A	-	-
1.13			Suffocation	-	N/A	-	-
2. Electrical							
2.1		6.2.9 6.3.2 6.3.3.2 6.3.5.4 6.4.4 6.4.5	Burn	1. Normal operation 2. Maintenance	Overload and/or short circuit of power circuit. Short circuit of control circuit. Failure of components of power circuit and/or control circuit.	Se 2, Fr 1, Pr 3, Av 2; CI 6	Overcurrent protection devices are provided to prevent overload or short circuit of power circuits and short circuit of control circuits. Warning labels and safety instructions are provided to remind operator for relevant risk.
2.2			Chemical effects	-	See 17 below	-	-
2.3			Effects on medical implants	-	See 17 below	-	-
2.4			Electrocution	-	See 17 below	-	-
2.5			Falling, being thrown	-	See 17 below	-	-
2.6			Fire	-	See 17 below	-	-
2.7			Projection of molten particles	-	See 17 below	-	-
2.8			Shock	1. Normal operation 2. Maintenance	Failure of electric insulation.	Se 2, Fr 1, Pr 3, Av 2; CI 6	Basic insulation is applied to live parts to prevent direct contact of live parts. Supplementary insulation or reinforced insulation is provided to live parts to prevent indirect contact of live parts. Protective bonding of accessible metal parts of machine and electric components and provide residual current trip devices and overcurrent protection devices. Live parts inside control

							panel are provided with appropriate IP protection degree. Control panel are fitted with main disconnector and key lock devices. Warning labels and safety instructions are provided to remind operator for relevant risk.

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
3. Thermal							
3.1	1.5.5	6 .2 .4 b) 6.2.8 c) 6.3.2.7 6.3.3.2.1 6.3.4.5	Burn	-	N/A	-	-
3.2			Dehydration	-	N/A	-	-
3.3			Discomfort	-	N/A	-	-
3.4			Frostbite	-	N/A	-	-
3.5			Injuries by the radiation of heat sources	-	N/A	-	-
3.6	1.5.5		Scald	-	N/A	-	-
4. Noise							
4.1		6.2.2.2 6.2.3 c) 6 .2 .4 c) 6.2.8 c) 6.3.1 6.3.2.1 b) 6.3.2.5.1 6.3.3.2.1 6.3.4.2 6.4.3 6.4.5.1 b) and c)	Discomfort	-	N/A	-	-
4.2			Loss of awareness	-	N/A	-	-
4.3			Loss of balance	-	N/A	-	-
4.4			Permanent hear loss	-	N/A	-	-
4.5			Stress	-	N/A	-	-
4.6			Tinnitus	-	N/A	-	-
4.7			Tiredness	-	N/A	-	-
4.8			Any other (e.g. mechanical, electrical) as a consequence of an interference with speech communication or with acoustic signals	-	N/A	-	
5. Vibration							
5.1		6.2.2.2 6.2.3 c) 6.2.8 c) 6.3.3.2.1 6.3.4.3 6.4.5.1 c)	Discomfort	-	N/A	-	-
5.2			Low- back morbidity	-	N/A	-	-
5.3			Neurological disorder	-	N/A	-	-
5.4			Osteo- articular disorder	-	N/A	-	-
5.5			Trauma of the spine	-	N/A	-	-

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
5.6			Vascular disorder	-	N/A	-	-
6. Radiation							
6.1		6.2.2.2 6.2.3 c) 6.3.3.2.1 6.3.4.5 6.4.5.1 c)	Burn	-	N/A	-	-
6.2			Damage to eyes and skin	-	N/A	-	-
6.3			Effects on reproductive capability	-	N/A	-	-
6.4			Genetic mutation	-	N/A	-	-
6.5			Headache, insomnia, etc.	-	N/A	-	-
7. Material / substance							
7.1		6.2.2.2 6.2.3 b) 6 .2 .3 c) 6 .2 .4 a) 6.2.4 b) 6.3.1 6.3.3.2.1 6.3.4.4 6.4.5.1 c) 6.4.5.1 g)	Breathing difficulties, suffocation	-	N/A	-	-
7.2			Cancer	-	N/A	-	-
7.3			Corrosion	-	N/A	-	-
7.4			Effects on reproductive capability	-	N/A	-	-
7.5			Explosion	-	N/A	-	-
7.6			Fire	-	N/A	-	
7.7			Infection	-	N/A	-	-
7.8			Mutation	-	N/A	-	-
7.9			Poisoning	1. Normal operation,	1.When the machine operator puts the test sample into the machine processing area or takes the test sample out of the machine processing area, the machine operator may be exposured to spray paint or breathe in volatile gases	Se 4, Fr 4, Pr 3, Av 3; Cl 10	Wear gas masks and protective clothing Warning labels and safety instructions are provided to remind operator for relevant risk.
7.10			Sensitization	-	N/A		-
8. Ergonomic							

8.1		6.2.2.1 6.2.7 6.2.8 6.2.11.8 6.3.2.1 6.3.3.2.1	Discomfort	-	N/A	-	-
8.2			Fatigue	1. Normal operation, 2. maintenance setting 3. change of fixture 4. visual inspection check	The machine operator placing the test sample into the machine process zone. The machine operator taking the test sample out of the machine process zone. Normal operation of the control panel. Setting of fixture. Change of fixture. Visual inspection check. Maintenance of different parts of the machine such as mechanical parts, electrical system, pneumatic systems.	Se 4, Fr 1, Pr 4, Av 1; Cl 6	Ergonomic design for the fixture, process of setting and changing of fixture, weight of fixture and assistant handling equipment. Ergonomic design for the operation process for placing and taking of test sample. Ergonomic design for the operation of control panel, touch screen and pilot devices. Warning labels and safety instructions are provided to remind operator for relevant risk.
8.3			Musculoskeletal disorder	-	N/A	-	-
8.4			Stress	-	N/A	-	-
8.5			Any other (e.g. mechanical, electrical) as a	-	N/A	-	-

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
			consequence of human error				
9. Associated with environment in which the machine is used							
9.1		6.2.6 6.2.11.11 6.3.2.1 6.4.5.1 b)	Burn	-	N/A	-	-
9.2			Slight disease	-	N/A	-	-
9.3			Slipping, falling	-	N/A	-	-
9.4			Suffocation	-	N/A	-	-
9.5			Any other as a consequence of the effect caused by the sources of the hazards on the machine or parts of the machine	-	N/A	-	-
10. Hazard combination							
10.1		-	E.g. dehydration, loss of awareness het stroke	-	N/A	-	-
11. shape and/or superficial finishing of accessible parts of the machine							
11.1		6.2.2.1	Contact with rough surfaces	-	N/A	-	-
11.2			Contact with sharp edges and corners, protruding part	-	N/A	-	-
12. Moving parts of machine							
12.1		6.2.2, 6.2.14, 6.2.15 6.3. 1 to 6.3.3 6.3.5.2 to 6.3.5.4 6.4.3 to 6.4.5	Contact with moving parts	-	N/A	-	-
12.2			contact with rotating open ends	-	N/A	-	-
13. Kinetic energy and/or potential energy (gravity) of the machine, tools and materials used, processed, handled							
13.1		6.2.3, 6.2.5 6.2.10 to 6.2.12 6.3.2.1, 6.3.2.2 6.3.2.7 6.3.3 6.3.5.2, 6.3.5.4,	falling or ejection of objects	-	N/A	-	-

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
		6.3.5.5 6.4.4, 6.4.5					
14. Stability of the machine and/or parts of the machine							
14.1	1.3.1	6.2.3 a) and b) 6.2.6 6.3.2.6, 6.3.2.7 6.4.3 to 6.4.5	Loss of stability	-	Machine is always in stable position	-	-
15. Mechanical strength of parts of the machine, tools, etc.							
15.1	1.3.2	6.2.3 a) and b) 6.2. 11, 6.2. 13 6.3.2, 6.3.2.7 6.3.3.1 to 6.3.3.3 6.3.5.2, 6.4.4, 6.4.5	Break- up during operation	-	N/A	-	-
16. Pneumatic, hydraulic equipment							
16.1		6.2.3 a) and b) 6.2. 10, 6.2. 13, 6.3.2.7 6.3.3.1 to 6.3.3.3 6.3.5.4, 6.4.4, 6.4.5	displacement of moving elements	1. Installation, commissioning 2. Setting 3. Maintenance 4. Fault finding, troubleshooting	When the hydraulic cylinder moves suddenly. This hazard could result in crushing, cutting, bumping or pinching of the operator.	Se 4, Fr 1, Pr 1, Av 3, Cl 5	The design and manufacture of hydraulic equipment should take into account sudden movement hazards, for example by using measures such as brakes, protective nets and safety limiters to reduce the speed and amplitude of movement. Operators should receive the necessary training and safety instructions to avoid approaching or touching the equipment while it is in motion. Hydraulic equipment that meets CE requirements has been

							purchased
16.2	1.3.2		High pressure fluid injection or ejection	-	N/A	-	-
16.3			Uncontrolled movements	-	N/A	-	-
17. Electrical equipment							
17.1	1.5.1	6.2.4 a) 6.2.9, 6.2.12 6.3.2, 6.3.3, 6.3.5.4 6.4.4, 6.4.5	Direct contact	1. Installation, commissioning 2. Setting 3. Maintenance 4. Fault finding, troubleshooting	With live terminals in the control cabinets.	Se 4, Fr 3, Pr 3, Av 3, Cl 9	1. Operation panel with good characteristics to prevent creepage and water, and worked with PELV 2. Maintenance by regular electrician 3. Fully enclosed control cabinets, for main electrical cabinet, when open the cabinet, the power will cut off, for second cabinet, only

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
							authorized person with key can open it, finger guards provided where appreciate. For more detail, please see EN 60204- 1 test report.
17.2			Disruptive discharge	-	See 17.6 below	-	
17.3			Electric arc	-	N/A	-	
17.4			Fire	-	N/A	-	
17.5	1.5.2		Indirect contact	-	When insulation failures	Se 4, Fr 6, Pr 2, Av 3; CI 11	1. Enhanced or double insulation with current breakers. 2. Approved under-voltage contactors are used. 3. earthing the accessible metal.
17.6			Short- circuit	-	-	-	Approved breakers with overcurrent protection functions are fitted.
18. Control system							
18.1		6.2.5 6.2. 11 to 6.2. 13 6.3.5.2 to 6.3.5.4 6.4.3 to 6.4.5	Dropping or ejection of a moving part of the machine or of a workpiece clamped by the machine	-	N/A	-	-
18.2			Failure to stop moving parts	-	N/A	-	-

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
18.3			Machine action resulting from inhibition (defeating of failure) of protective devices	Normal operation	Failure of safety related parts of control systems.	Se 4, Fr 3, Pr 3, Av 3; CI 9	Safety related parts of control systems have been designed and verified in accordance with relevant functional safety standards. Well tried components, basic safety principles and well-tried safety principles have been applied to the safety related parts of control systems. Performance level of safety related parts of control systems have achieved the required performance level. Warning labels and safety instructions are provided to remind operator for relevant risk.
18.4			Uncontrolled movements (including speed changes)	-	N/A	-	-
18.5			Unintended/ unexpected start-up	Operation/ Operating manual mode, semi-automatic mode, automatic mode	If power source off and resume, the machine would start up automatically	Se 4, Fr 3, Pr 3, Av 3; CI 9	1. Contactors fitted in the main motor circuit 2. Approved components are applied in the circuits

18.6	1.2. 1, 1.2.7		Other hazardous events due to failure (s) or poor design of the control system	-	N/A	-	-
19. Materials and substances or with physical factors (temperature, noise, vibration, radiation and environment)							
19.1		6.2.2.2 6.2.3 c) 6.2.4 6.2.8 6.3.1 6.3.3.2 6.3.4 6.4.3 to 6.4.5	Contact with objects with high or low temperature	-	N/A	-	-
19.2			Emission of a substance that can be hazardous	-	N/A	-	-
19.3			Emission of a level of noise that can be hazardous	-	N/A	-	-
19.4			Emission of a level of noise that can interfere with a speech communication or with acoustic signals	-	N/A	-	-
19.5			Emission of a level of vibration that can be hazardous	-	N/A	-	-

No.	EHSR	Subclause of EN ISO 12100	Hazard/ Hazardous event	Life cycle/ Tasks	Hazardous situation	Risk Estimation	Risk reduction and protective measures
19.6			Emission of a level of radiation fields that can be hazardous	Operation	Unintended movement due to the environment EMI affection on the control system	Se 4, Fr 6, Pr 2, Av 3; Cl 11	EMC and EMI safety performance is verified based on the Declaration of EMC Conformity issued by the supplier.
19.7			Harsh environmental conditions	-	Machine operates only in a normal natural environment	-	-
20. Workstation and/or process design							
20.1	1. 1.2d, 1.1.5 1.2.2	6.2.2.1 6.2.7, 6.2.8 6.2.11.8 6.3.5.5, 6.3.5.6 6.4.3 to 6.4.5	Excessive efforts	-	N/A	-	-
20.2			Human errors/ misbehaviour (unintentional and/or deliberately induced by the design	-	N/A	-	-
20.3			Loss of direct visibility of the working area	-	N/A	-	-
20.4			Painful and tiring postures	-	N/A	-	-
20.5			Repetitive handling at high frequency	-	N/A	-	-

Part III： Test report

EN 60204 test report

EN 60204-1:2018			
Clause	**Requirement**	**Comment**	**Verdict**
4	General		-
4.1	General		-
	This standard specifies requirements for theelectricalequipment of machines.		P
	The risks associated with thehazardsrelevant to the electrical equipment shall be assessedaspartof the overall requirements for risk assessment of themachine. Thiswill: – identify theneed forriskreduction;and – determine the adequate riskreductions;and – determine thenecessaryprotectivemeasures for persons who canbe exposed to thosehazards, whilestillmaintaining an acceptablelevel of appropriate performance of the machine anditsequipment.	See therisk assessment report.	P
4.2	Selection		-
4.2.1	General		-
	Electrical components and devicesshall:		-
	-be suitable for their intendeduse;and		P
	- conform to relevantIEC standards wheresuchexist;and	See theCDF.	P
	-be applied in accordance with thesupplier'sinstructions.		P
4.2.2	Switchgear		-
	InadditiontotherequirementsofIEC60204-1,depending upon themachine, itsintendeduse anditselectrical equipment, the designer may selectpartsof the electricalequipment of the machine that areincompliance with relevantpartsoftheIEC 61439 series (seealsoAnnexF).		P
4.3	Electrical supply		-
4.3.1	General		-
	The electrical equipment shallbe designed tooperatecorrectly with the conditions of the supply:		-
	– asspecifiedin 4.3.2or 4.3.3,or	See 4.3.2	P
	– as otherwise specifiedbytheuser,or		N/A
	– as specified by the supplierof aspecialsourceof supply(see 4.3.4)		N/A
4.3.2	AC supplies		-
	Voltage Steadystatevoltage: 0,9 to1,1 ofnominalvoltage.		P
	Frequency 0,99 to1,01 ofnominalfrequencycontinuously;0,98 to 1,02 shorttime.		P

	Harmonics Harmonicdistortionnotexceeding12% ofthetotalr.m.s.voltage betweenlive conductors for the sumof the2nd throughtothe 30thharmonic.		P
	Voltage unbalance		P

EN 60204-1:2018			
Clause	**Requirement**	**Comment**	**Verdict**
	Neither the voltage of thenegative sequence componentnor the voltage of the zero sequence componentin three-phase supplies exceeding 2 %of thepositivesequence component.		
	Voltage interruption Supplyinterrupted or at zero voltage for notmorethan3 ms at anyrandom timein the supplycycle withmore than1sbetween successive interruptions.		P
	Voltage dips Voltagedipsnotexceeding 20 %ofthermsvoltageofthe supply for more than one cycle withmorethan1sbetweensuccessive dips.		P
4.3.3	DC supplies	Not thiscase	-
	Frombatteries		-
	Voltage 0,85 to1,15 ofnominalvoltage; 0,7 to1,2 ofnominalvoltageinthecaseofbattery-operated vehicles.		N/A
	Voltage interruption Notexceeding5ms.		N/A
	From converting equipment		-
	Voltage 0,9 to1,1 ofnominalvoltage.		N/A
	Voltage interruption Notexceeding 20mswithmorethan1 sbetween successiveinterruptions.		N/A
	Ripple (peak-to-peak) Notexceeding 0,15 ofnominalvoltage.		N/A
4.3.4	Special supply systems	Notbeused.	-
	Forspecialsupplysystems(e.g. on-boardgenerators,DC bus, etc.) thelimitsgivenin 4.3.2and 4.3.3maybe exceededprovided that the equipmentis designed tooperate correctly with those conditions.		N/A
4.4	Physical environment and operating conditions		-
4.4.1	General		-
	The electrical equipment shallbe suitable for thephysicalenvironment and operating conditions ofitsintendeduse. Therequirementsof 4.4.2 to 4.4.8 coverthephysical environment and operating conditions of themajority of machinescoveredbythispartofEN 60204.Whenspecial conditions apply or thelimits specified areexceeded,an exchange of informationbetweenuser and supplier (see4.1)isrecommended.	See the following clauses.	P
4.4.2	Electromagnetic compatibility (EMC)		-

	The electrical equipment shallnot generate electromagnetic disturbances abovelevels that are appropriate for itsintended operating environment.In addition, the electrical equipment shallhave asufficient	Refer to theEMC test report.	P

EN 60204-1:2018			
Clause	**Requirement**	**Comment**	**Verdict**
	level of immunity to electromagnetic disturbancessothatitcan functioninitsintended environment.		
	Immunity and/or emission tests arerequiredon the electrical equipmentunless the following conditions arefulfilled:		P
	- The incorporated devicesand componentscomplywith theEMC requirements for theintendedEMCenvironment specified in therelevantproduct standard (or generic standard wherenoproductstandard exist),and;		P
	- The electrical installation and wiringareconsistent with theinstructionsprovided by the supplier of thedevices and components with regardtomutual influences, (cabling, screening, earthingetc.)orwithinformationAnnexHif suchinstructions arenot available from the supplier.		P
4.4.3	Ambient air temperature		-
	Electrical equipment shall be capableof operatingcorrectlyin theintended ambient air temperature. Theminimum requirement for all electrical equipmentis correct operationin ambient air temperatures outside of enclosures(cabinet orbox)between+5°Cand+40°C.	Statedininstruction manual.	P
4.4.4	Humidity		-
	The electrical equipment shallbe capable of operating correctlywhentherelativehumiditydoesnotexceed50% atamaximumtemperatureof +40°C.Higherrelative humidities arepermitted atlower temperatures (for example 90%at 20°C).	Statedininstruction manual.	P
	Harmful effects of occasional condensation shallbe avoided by design of the equipmentor, wherenecessary,by additionalmeasures(for examplebuilt-in heaters, air conditioners, drainholes).	Dry environmentuse only.	P
4.4.5	Altitude		-
	Electrical equipment shall be capableof operatingcorrectly ataltitudesupto1 000mabovemeansealevel.	Statedininstruction manual.	P
	For equipment tobe used athigheraltitudes,itisnecessary to takeinto account thereduction of:	Nothigherthan1000m	N/A
	-The dielectric strength,and		N/A
	- The switchingcapabilityof the devices,and		N/A
	-The cooling effectof theair		N/A
	Itisrecommended that themanufactureris consultedregarding the correction factors to beused wherethefactors arenot specifiedinproduct data.		P
4.4.6	Contaminants		-

	Electrical equipment shall be adequatelyprotectedagainst theingressofsolidsandliquids(see11.3).	Statedininstruction manual.	P
	The electrical equipment shallbe adequatelyprotectedagainst contaminants (for example dust, acids,corrosive		P

EN 60204-1:2018			
Clause	**Requirement**	**Comment**	**Verdict**
	gases, salts) that canbepresentin thephysical environmentin which the electrical equipmentis tobeinstalled.		
4.4.7	Ionizing andnon-ionizing radiation		-
	When equipmentis subject to radiation(forexample microwave,ultraviolet,lasers, X-rays), additionalmeasuresshallbe taken to avoidmalfunctioning of the equipment andaccelerated deterioration of theinsulation.		P
4.4.8	Vibration, shock, andbump		-
	Undesirable effects of vibration, shock and bump(including those generatedby themachine andits associated equipment and those created by thephysicalenvironment)shallbe avoidedby the selection of suitable equipment,by mountingit away from themachine, orbyprovision of anti-vibrationmountings.	Designed suitable for application environment.	P
4.5	Transportation and storage		-
	Electrical equipment shall be designedto withstand,or suitableprecautions shall be taken toprotect against,the effects of transportation and storage temperatures within arangeof -25 °Cto +55°Candforshortperiodsnot exceeding 24hatupto+70°C.Suitablemeansshallbe provided toprevent damage fromhumidity, vibration, andshock.	Statedininstruction manual.	P
4.6	Provisions for handling		-
	Heavy andbulky electrical equipment thathastoberemoved from themachine for transport, or thatis independent of themachine, shallbe provided with suitablemeans for handling,including where necessarymeans for handlingby cranes or similar equipment.		P
5	Incoming supply conductor terminations and devices fordisconnecting and switching off		-
5.1	Incoming supply conductor terminations		-
	It isrecommended that, where practicable, theelectrical equipment of amachineis connected to a singleincoming supply. Where another supplyisnecessary for certainpartsof the equipment (for example, electronic equipmentthat operates at a different voltage), that supplyshouldbe derived, as far asispracticable, from devices(for example,transformers, converters) forming part of the electrical equipment of the machine.For large complexmachinery,there canbe aneed for more thanoneincomingsupply dependinguponthesitesupplyarrangements (see5.3.1).		P

	Unless aplugisprovided with themachine for the connectiontothesupply(see 5.3.2 e),itisrecommended that the supply conductors are terminatedat thesupply disconnecting device.		N/A
	Where a neutral conductorisuseditshallbeclearly indicated in the technical documentation of themachine,such asin theinstallation diagram andinthecircuit		P

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Clause	**Requirement**	**Comment**	**Verdict**
	diagram, and a separateinsulated terminal,labelledNin accordancewith16.1, shallbeprovidedfortheneutral conductor. The neutral terminalmaybe providedaspartofthe supply disconnecting device.		
	There shallbeno connection between theneutral conductor and theprotective bonding circuitinside theelectrical equipment.		P
	Exception: a connection maybemadebetween theneutralterminal and thePE terminal at the pointof theconnectionof the electrical equipment to a TN-C supplysystem.		N/A
	For machines supplied fromparallel sources, the requirementsofIEC 60364-1 formultiplesourcesystems apply.		N/A
	Terminals for theincoming supply connection shallbe clearlyidentifiedinaccordancewithIEC 60445.Forthe identification of the externalprotective conductor terminal, see5.2.		P
5.2	Terminal for connection of the external protective conductor		-
	For eachincoming supply, a terminal shallbeprovidedinthe same compartment as the associatedlineconductor terminals for connection of the machine to theexternal protective conductor.		P
	The terminal shall be of sucha sizeastoenablethe connection of an externalprotective copper conductor witha cross-sectional area determined inrelationtothesizeofthe associatedline conductorsin accordance with Table1.		P
	Where an external protective conductorof amaterialotherthan copper isused, the terminal sizeandtypeshallbe selected accordingly.		N/A
	At each incoming supplypoint, the terminal for connectionof the externalprotective conductor shall bemarked or labelledwiththelettersPE(seeIEC60445).		P
5.3	Supply disconnecting (isolating)device		-
5.3.1	General		-
	A supply disconnecting device shallbeprovided:		-
	- for each incoming supply toamachine(s);		P
	- for each on-boardpower supply.		N/A
	The supply disconnecting device shall disconnect(isolate)the electrical equipment of the machine from thesupply when required (for example for workon themachine,including the electrical equipment).		P

	When two or more supplydisconnecting devicesare provided, protectiveinterlocks for their correct operation shall alsobeprovidedin order toprevent ahazardous situation,including damage to the machine or tothe workinprogress.		N/A
5.3.2	Type		-
	The supply disconnecting device shallbe oneof the		-

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Clause	**Requirement**	**Comment**	**Verdict**
	following types:		
	a) switch-disconnector, withorwithoutfuses, in accordancewithIEC 60947-3, utilizationcategoryAC-23B orDC-23B;		P
	b) control andprotective switching device suitablefor isolation,inaccordancewithIEC 60947-6-2;		N/A
	c) a circuit-breaker suitable forisolationinaccordance withIEC 60947-2;		N/A
	d) any other switching devicein accordancewithanIECproduct standard for that device and whichmeets the isolation requirements and the appropriateutilization category and/or specified endurance requirementsdefinedin theproduct standard;		N/A
	e) a plug/socket combination for a flexiblecablesupply.		N/A
5.3.3	Requirements		-
	When the supply disconnecting deviceis oneof the types specifiedin 5.3.2 a) tod)itshallfulfilallofthefollowing requirements:		-
	-isolate the electrical equipment from the supply andhave oneOFF (isolated) andoneONpositionmarkedwith"O" and "I"(symbolsIEC 60417-5008 (DB:2002-10)andIEC 60417-5007 (DB:2002-10), see10.2.2);		P
	-have a visible contact gap orapositionindicator which cannotindicate OFF (isolated)until all contactsareactuallyopen and the requirements for theisolating functionhave been satisfied;		P
	-haveanoperatingmeans(see 5.3.4);		P
	-beprovided with ameanspermittingit tobelockedin the OFF (isolated) position (forexamplebypadlocks).Whensolocked,remote as well aslocal closingshallbe prevented;		P
	- disconnect alllive conductors of itspowersupplycircuit.However, for TN supply systems, the neutralconductor may or maynotbe disconnected exceptincountries wheredisconnection of theneutral conductor (whenused)is compulsory;		P
	-have abreaking capacity sufficient tointerrupt thecurrentof the largest motor when stalled together with thesumof the normal running currentsof allothermotorsandother loads. The calculated breaking capacitymaybereducedbythe use of a provendiversityfactor.Wheremotorsare suppliedby converter or similar devices, the calculation should takeinto account the possible effectontherequiredbreaking capacity		P

	When the supply disconnecting deviceis aplug/socket combination,itshallcomplywiththerequirementsof13.4.5and shall have thebreaking capacity,orbeinterlocked witha switching device thathas abreaking capacity,sufficient to interrupt the current of thelargestmotor when stalled together with the sum of the normal runningcurrentsof all		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	other motors and otherloads. Thecalculatedbreaking capacitymaybe reducedby the useof aprovendiversityfactor. When theinterlocked switching deviceis electricallyoperated (for example acontactor)itshallhavean appropriate utilization category. Where motorsaresupplied by converters or similar devices, the calculationshouldtakeinto account thepossible effect on therequiredbreaking capacity.		
	Where the supply disconnecting deviceis aplug/socketcombination, a switching device with an appropriate utilization category shall beprovided for switchingthe machine on and off. This canbeachievedbytheuseof theinterlocked switching device described above.		N/A
5.3.4	Operatingmeans of the supply disconnecting device		-
	The operatingmeans (for example, ahandle) of thesupplydisconnecting device shallbe external to the enclosureofthe electrical equipment.		P
	Exception:power-operated switchgear need notbe provided with a handle outside theenclosure whereother means(e.g.pushbuttons) areprovidedtoopenthesupply disconnecting device from outside the enclosure		N/A
	The operatingmeans (for example, ahandle)of the supplydisconnecting device shallbe easily accessible andlocated between 0,6mand1,9 mabovetheservicinglevel.An upperlimitof1,7misrecommended.		P
	Where the external operating meansisintendedfor emergencyoperation, see10.7.3 or10.8.3		P
	Where the external operating meansisnotintendedforemergency operations:	Not thiscase.	N/A
	-itisrecommended thatitbe coloredBLACK or GREY (see10.2)		N/A
	- a supplementarycoverordoor thatcanbereadilyopened without theuse of akey or toolmaybe provided, for example for protection against environment conditions or mechanical damage. Such a cover/door shall clearlyshowthatit provides access to the operatingmeans. Thiscanbe achieved, for example,byuse of therelevant symbolIEC 60417-6169-1 (figure 2)orIEC60417-6169-2(figure 3)		N/A
5.3.5	Excepted circuits		-
	The following circuitsneednot be disconnectedby thesupply disconnecting device:		-

	- lighting circuits for lightingneeded duringmaintenanceor repair;		N/A
	- socket outlets for the exclusive connection ofrepair or maintenance tools and equipment (for examplehanddrills, testequipment)(see15.1);		N/A
	- undervoltageprotection circuits that are onlyprovided forautomatic tripping in the eventof supply failure;		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	- circuits supplying equipment that shouldnormallyremainenergized for correct operation (for example temperaturecontrolledmeasuring devices, heaters, program storage devices);		N/A
	Itisrecommended, however, that such circuitsbeprovidedwith their own disconnecting device.		N/A
	Control circuits supplied via another supplydisconnecting device, regardless of whether that disconnecting deviceis locatedin the electrical equipment or inanothermachineorother electrical equipment,neednotbe disconnectedby the supply disconnecting device of the electrical equipment.		N/A
	Where excepted circuits arenot disconnectedbythesupply disconnecting device:		P
	-permanent warninglabel(s) shall be appropriatelyplacedinproximity to the operating meansof thesupply disconnecting device to draw attention to thehazard;		P
	- a corresponding statement shallbeincludedin the maintenancemanual, and one or moreof the followingshallapply;		P
	- excepted circuits areidentified bypermanent warninglabel		P
	- excepted circuits are separated fromother circuits,or		N/A
	- the conductors areidentified bycolour takingintoaccount therecommendationof13.2.4.		P
5.4	Devices for removal of power forprevention ofunexpectedstart-up		-
	Devices for removalpower for theprevention of unexpected start-up shallbe provided (forexample where,during maintenance, a start-up of themachineorpartof the machine cancreateahazard).		P
	Such devices shallbe appropriate andconvenient for theintendeduse, shallbe suitablyplaced, andreadily identifiable as to their function and purpose.Wheretheir function andpurposeisnot otherwise obvious (e.g.bytheirlocation) these devices shallbe marked toindicatethe extent of removalofpower.		P
	The supply disconnecting device or otherdevicesin accordancewith 5.3.2 maybeusedforpreventionof unexpected start-up		P
	Disconnectors, withdrawable fuselinks and withdrawablelinksmaybeused for protection of unexpected start-up onlyif they arelocatedin an enclosed electrical operating area(see 3.1.23)		N/A

	Devices that donot fulfil the isolation function(forexamplea contactor switched off by acontrolcircuit,orPowerDriveSystem (PDS) with a SafeTorqueOff(STO) functionin accordancewithIEC 61800-5-2)mayonlybeusedforprevention of unexpected start-up during tasks suchas:		N/A
	- inspections;		N/A
	- adjustments;		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	- work on the electrical equipment where: - thereisnohazard arising from electricshock(see Clause 6)andburn; - the switching off meansremains effective throughoutthe work; - the workis of aminor nature(for examplereplacementof plug-in devices without disturbing existing wiring).		N/A
5.5	Devices for isolating electrical equipment		-
	Devices shall be provided forisolating(disconnecting) theelectrical equipment or parts of theelectrical equipmenttoenable work tobe carried out whenit isde-energisedandisolated. Such devicesshallbe:		P
	- appropriate and convenient for theintendeduse;		P
	- suitablyplaced;		P
	-readilyidentifiableastowhichpart(s) orcircuit(s)ofthe equipmentis served. Where their function and purposeis nototherwiseobvious (e.g.bytheirlocation) thesedevices shallbemarked toindicate the extent of the equipment thattheyisolate		P
	Thesupplydisconnectingdevice (see5.3)may,insome cases, fulfill that function.However, whereit isnecessaryto work onindividualparts of the electrical equipment of amachine, or on one of themachines fedbyacommon conductor bar, conductor wire or inductivepowersupply system, a disconnecting device shallbeprovided for eachpart, or for eachmachine, requiring separateisolation.		P
	In addition to the supply disconnecting device,the followingdevices that fulfill the isolation function maybeprovidedforthispurpose:		P
	- devicesdescribedin5.3.2;		P
	- disconnections, withdraw able fuselinks and withdrawablelinks onlyif locatedin an enclosedelectrical operatingarea(see 3.15) andrelevantinformationis providedwiththeelectricalequipment (see17.2b)9) and b)12)).		N/A
5.6	Protection againstunauthorized,inadvertent and/ormistaken connection		-
	Thedevicesdescribedin 5.4 and5.5 thatarelocated outside an enclosed electrical operatingarea shallbe equipped withmeans to secure them in theOFFposition(disconnected state), (for examplebyprovisions for padlocking, trappedkeyinterlocking). When so secured,remote as well aslocal reconnectionshallbeprevented.		P
	Wherethedevicesdescribedin5.4and5.5arelocated inside an enclosed electrical operating areaothermeansofprotection against reconnection (forexample warning		P

	labelsinaccordancewith16.1) canbesufficient.		
	However, when a plug/socket combination accordingto5.3.2 e)issopositionedthatitcanbekeptunderthe	Notthiscase.	N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	immediate supervision of the person carrying out the work,means for securingin the disconnected state neednotbeprovided.		
6	Protection against electricshock		-
6.1	General		-
	The electrical equipment shallprovide protectionofpersons against electricshockby:		-
	-basicprotection (see 6.2and6.4);		P
	- faultprotection (see 6.3 and 6.4).		P
	Themeasuresforthisprotectiongivenin 6.2,6.3,and,for PELV,in 6.4, areaselectionfromIEC60364-4-41.Wherethosemeasures are not practicable, forexampleduetothephysical or operational conditions, other measuresfrom IEC 60364-4-41maybeused(e.g.SELV).		P
6.2	BasicProtection		-
6.2.1	General		-
	For each circuit or partof theelectricalequipment, the measuresofeither 6.2.2 or 6.2.3and, whereapplicable,6.2.4 shallbeapplied.		P
	When the equipmentislocatedinplaces open to all persons, which caninclude children,measures of either 6.2.2 with aminimum degree of protectionagainstcontactwithlivepart corresponding toIP4X orIPXXD (seeIEC 60529), or 6.2.3 shallbeapplied.	Restrictedlocation useonly	N/A
6.2.2	Protectionby enclosures		-
	Liveparts shall be locatedinsideenclosuresthatprovide protection against contact withliveparts of atleastIP2X or IPXXB (seeIEC60529).	Min.IP2Xachieved inside electrical cabinet.	P
	Where the top surfaces of the enclosureareareadily accessible, theminimum degree of protection against contact withlivepartsprovidedby the top surfaces shallbe IP4XorIPXXD.		N/A
	Openinganenclosure(i.e. openingdoors, lids, covers,and thelike) shallbepossible onlyunder one of the following conditions:		-
	a) Theuseofakeyortoolisnecessaryforaccess.	Keyisnecessary.	P
	All live parts,(including those ontheinsideofdoors)that are likely to be touched whenresettingoradjustingdevicesintended for such operations while the equipmentis still connected, shallbeprotected against contact to atleast IP2X orIPXXB. Other liveparts ontheinsideof doorsshallbe protected againstunintentional direct contact toatleast IP1XorIPXXA.		P

	b)The disconnection of livepartsinside the enclosurebefore the enclosure canbeopened. Thismaybe accomplishedbyinterlocking the door with adisconnecting device (for example, thesupply disconnecting device) so that the door can onlybeopened		P

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Clause	**Requirement**	**Comment**	**Verdict**
	when the disconnecting device isopenandsothatthe disconnecting device can onlybe closed when thedoorisclosed.		
	Exception: akey or tool asprescribedby thesupplier canbe used to defeat theinterlockprovided that the followingconditions aremet:		N/A
	- itispossible at all times whiletheinterlockisdefeatedtoopen the disconnecting device andlock thedisconnecting devicein the OFF (isolated)position or otherwisepreventunauthorised closure of the disconnecting device;		N/A
	- upon closing the door, theinterlockisautomaticallyrestored;		N/A
	- alliveparts, (including those on theinsideof doors) thatare likely to be touched whenresettingoradjustingdevicesintended for such operations while the equipmentis still connected, areprotected against unintentional contact withliveparts to at leastIP2X orIPXXBandotherlivepartson theinside of doors are protectedagainstunintentional contacttoatleastIP1XorIPXXA;		N/A
	- relevantinformation about the procedures for thedefeatof theinterlockisprovided with theinstructions for use of theelectricalequipment (seeclause17).		N/A
	-Means areprovided to restrict access tolivepartsbehinddoors that arenot directlyinterlocked with the disconnecting means to skilled orinstructedpersons.(See17.2b)12)).		N/A
	All parts that arestillliveafter switchingoff the disconnectingdevice(s) (see 5.3.5) shallbeprotected against direct contact to atleastIP2XorIPXXB(seeIEC60529).		P
	Suchparts shall bemarked with a warningsignin accordancewith16.2.1 (seealso13.2.4 foridentificationof conductorsby colour), except for;		P
	- parts that canbelive onlybecauseof connection to interlocking circuits and that are distinguishedbycolouras potentiallyliveinaccordancewith13.2.4;		N/A
	- the supply terminals of the supply disconnecting devicewhen thelatter ismounted alonein aseparateenclosure.		N/A
	c) Opening without the useof akey oratoolandwithoutdisconnection of liveparts shallbepossible only whenall liveparts areprotected against contact to atleastIP2Xor IPXXB (seeIEC 60529). Wherebarriersprovidethis protection, either they shallrequire a tool for theirremovalor all livepartsprotected by themshallbeautomatically disconnected when the barrier isremoved.		N/A

6.2.3	Protectionbyinsulation of liveparts		-
	Liveparts shall be coveredbyinsulation whichcanonlyberemovedby destruction.		P
	Suchinsulation shall withstand themechanical, chemical,electrical and thermal stresses undernormal service		P

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Clause	**Requirement**	**Comment**	**Verdict**
	conditions.		
6.2.4	Protection against residual voltages		-
	Livepartshavingaresidualvoltagegreaterthan60V when the supplyis disconnected shallbe discharged to60V or less within a timeperiodof5sprovidedthatthisrate of discharge doesnotinterfere with the proper functioningof the equipment.Exempted from thisrequirement are componentshavingastoredchargeof 60 µCorless. Where this specifiedrate of discharge wouldinterfere withthe proper functioning of the equipment, a durable warningnotice drawing attention to the hazardandstatingthedelayrequiredbefore the enclosure maybe openedshallbe displayed at an easily visiblelocation onorimmediatelyadjacent to the enclosure containing theliveparts.		N/A
	In the case of plugs or similardevices,the withdrawalof which resultsin the exposure of conductors(forexample pins), thedischargetimeto 60Vshallnotexceed1s, otherwise such conductors shallbeprotected to atleast IP2XorIPXXB. Ifneitheradischargetimeof1snora protectionofatleastIP2XorIPXXBcanbeachieved(forexamplei n the case of removable collectorsonconductor wires, conductorbars, orslip-ringassemblies,see12.7.4),additional switching devices or an appropriate warning, forexample a warning sign drawing attention tothehazard and stating the delayrequired shallbeprovided. When theequipmentislocatedinplaces open to allpersons, which can include children, warnings arenot sufficientand therefore aminimum degree of protection againstcontactwithliveparts toIP4X orIPXXDisrequired		N/A
6.2.5	Protectionbybarriers		-
	Forprotectionbybarriers, see 412.2 ofIEC60364-4-41		P
6.2.6	Protectionbyplacing out of reach orprotectionbyobstacles		-
	Forprotectionbyplacingoutofreach, 412.4ofIEC60364-4-41 shallapply.		N/A
	Forprotectionbyobstacles, 412.3 ofIEC 60364-4-41shall apply.		N/A
	For conductor wire systems or conductor bar systemswith a degree of protectionless thanIP2XorIPXXB, see 12.7.1.		N/A
6.3	FaultProtection		-
6.3.1	General		-
	FaultProtectionagainst(3.31)isintendedtoprevent hazardous situations due to aninsulation faultbetweenliveparts and exposedconductiveparts.		P

	For each circuit or part of theelectricalequipment,atleast oneofthemeasuresinaccordancewith 6.3.2 to6.3.3shall be applied:		P

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Clause	**Requirement**	**Comment**	**Verdict**
	- measures toprevent the occurrence of atouchvoltage(6.3.2);or		P
	- automatic disconnection of the supply before thetimeofcontact with a touch voltage canbecomehazardous (6.3.3).		P
6.3.2	Prevention of the occurrence of a touch voltage		-
6.3.2.1	General		-
	Measures to prevent the occurrence of atouchvoltageinclude the following:		-
	-provision of classII equipment or byequivalentinsulation;		P
	- electrical separation.		P
6.3.2.2	Protectionbyprovision of classII equipment orbyequivalentinsulation		-
	Thisprotectionisprovidedby one or more of the following:		-
	- classII electrical devices or apparatus(doubleinsulation,reinforcedinsulation or by equivalentinsulationin accordancewithIEC 61140);		P
	- switchgear and controlgear assemblieshaving total insulationinaccordancewithIEC 61439-1	See component certificates.	P
	- supplementary or reinforced insulationinaccordance with413.2 ofIEC 60364-4-41.		N/A
6.3.2.3	Protectionby electrical separation		-
	Electrical separation of anindividual circuit isintendedtoprevent a touch voltage through contact withexposed conductiveparts that canbe energized byafaultinthebasicinsulation of theliveparts of that circuit.		P
	Forthistypeofprotection, therequirementsof 413.5 of IEC 60364-4-41apply.		P
6.3.3	Protectionby automatic disconnection of supply		-
	Thismeasure consists of the interruption of oneormoreoftheline conductorsby the automatic operation ofa protective devicein case of a fault. Thisinterruptionshalloccur within a sufficiently short time tolimit thedurationofa touch voltage to a time within thelimitsspecifiedin Annex A for TN and TTsystem.		P
	Thismeasure necessitates co-ordination between:		-

	- the type of supply system, the supplysourceimpedanceand earthingsystem; - the impedance values of the different elementsof thelineand of the associated fault currentpaths throughthe protectivebonding circuit; - the characteristics of theprotective devices that detect insulationfault(s).		P
	Thisprotective measure comprisesboth:		-
	-protectivebonding of exposed conductiveparts (see 8.2.3),		P
	- andoneofthefollowing:		-

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Clause	**Requirement**	**Comment**	**Verdict**
	a) inTNsystems,the followingprotectivedevices maybeused		-
	-overcurrent protective devices		P
	- residualcurrentprotectivedevices(RCDs)andassociated overcurrentprotective devices		P
	b)inTTsystems,either		-
	-RCDs and associated overcurrentprotective devices toinitiate the automatic disconnection of the supply on detection of aninsulation fault fromalivepart to exposed conductiveparts or toearth,or		N/A
	-Overcurrentprotective devicesmaybe used for faultprotection provided a suitablylow valueof the fault loopimpedanceZs(seeA.2.2.3)ispermanently and reliablyassured;		N/A
	c)InIT systems therelevantrequirements ofIEC 60364-4-41 shallbefulfilled.Duringaninsulation fault, an acoustic andoptical signalshallbe sustained. After annunciation, the acoustic signalmay thenbemanuallymuted. This can requireanagreementbetween the supplier anduser regarding theprovision of insulation monitoringdevices and/or insulation faultlocation systems		N/A
	Where automatic disconnectionisprovidedin accordancewith a), and disconnection within the timespecifiedin Clause A.1.1 cannot be assured, supplementaryprotective bonding shallbeprovided asnecessary to meetthe requirementsofClauseA.1.3.		P
	Where a power drive system(PDS)isprovided, fault protection shall beprovided for those circuitof thepower drive system that are supplied bytheconverter. Wherethisprotectionisnotprovided within the converter, the necessaryprotectionmeasures shall be in accordancewiththe converter manufacturer'sinstructions		P
6.4	Protectionby theuse ofPELV		-
6.4.1	Generalrequirements		-
	The use of PELV(ProtectiveExtra-Low Voltage)isto protectpersons against electric shock fromindirect contact andlimitedareadirectcontact(see8.2.5).		P
	PELV circuits shall satisfy all of the followingconditions:		-
	a) thenominal voltage shallnot exceed:		-
	• 25 Va.c. r.m.s.or60Vripple-freed.c. whenthe equipmentisnormallyusedin drylocations and when large area contact of liveparts withthehumanbodyisnotexpected; or		P
	• 6 Va.c.r.m.s. or15 Vripple-freed.c.inallothercases;		N/A

	b) onesideofthecircuitoronepointofthesourceofthe supply of that circuit shallbe connected to theprotective bonding circuit;		P

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	c)liveparts of PELV circuits shallbeelectricallyseparatedfrom other live circuits.Electrical separationshallbenot less than that required between theprimaryandsecondary circuitsofasafetyisolatingtransformer (seeIEC61558-1 andIEC 61558-2-6);		P
	d) conductors of eachPELV circuit shallbephysically separated from those of any other circuit. Whenthis requirement isimpracticable, the insulationprovisions of13.1.3 shallapply;		P
	e)plugs and socket-outlets for aPELV circuit shallconformto the following:		-
	1)plugs shallnotbe able to enter socket-outletsof othervoltage systems;		P
	2) socket-outlets shall not admitplugsof other voltagesystems.		P
6.4.2	Sources forPELV		-
	The sources forPELV shallbe one of the following:		-
	- a safety isolating transformerin accordance withIEC61558-1 andIEC 61558-2-6;		N/A
	- a source of currentproviding adegreeof safety equivalent to that of the safety isolatingtransformer(forexample a motor generator with windingproviding equivalentisolation);		N/A
	- an electrochemical source (for exampleabattery)or another sourceindependent of ahigher voltage circuit(forexample a diesel-driven generator);		N/A
	- an electronicpower supply conforming to appropriate standards specifying measures tobe taken toensure that,even in the case of aninternal fault,thevoltageatthe outgoing terminals cannot exceed the values specifiedin6.4.1.		P
7	Protection of equipment		-
7.1	General		-
7.2	Overcurrent protection		-
7.2.1	General		-
	Overcurrent protection shall beprovided where thecurrentin any circuit canexceedeither theratingof any component or the current carrying capacityof the conductors, whichever is the lesser value. Theratingsor settingstobeselectedaredetailedin7.2.10.	Statedinmanual.	P
7.2.2	Supply conductors		-

	Unless otherwise specifiedby theuser, the supplier of theelectrical equipmentisnot responsible for providingthe supply conductors and the overcurrentprotective devicefor the supply conductors to the electricalequipment.		P
	The supplier of the electrical equipment shall statein the installation documents the datanecessary for conductor dimensioning (including themaximum cross-sectional area		P

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Clause	**Requirement**	**Comment**	**Verdict**
	of the supply conductor that can beconnectedto the terminals of the electrical equipment) and for selecting the overcurrentprotectivedevice (see7.2.10 and17.4).		
7.2.3	Power circuits		-
	Devices for detection andinterruption of overcurrent, selectedinaccordancewith 7.2.10, shallbeappliedto each live conductor includingcircuitssupplyingcontrolcircuit transformers.		P
	The following conductors, as applicable, shallnotbe disconnected without disconnecting all associatedliveconductors:	See electricalcircuitdiagram.	P
	- theneutral conductor of a.c. power circuits;		P
	- the earthed conductor of d.c.power circuits;		P
	- d.c. power conductors bondedtoexposedconductiveparts of mobilemachines.		N/A
	Where the cross-sectional area of theneutral conductorisat least equal to or equivalent tothatof thelineconductors,itisnotnecessary to provide overcurrent detection fortheneutral conductor nor a disconnectingdevice for that conductor.For a neutral conductor with across-sectional area smaller than that of the associatedline conductors, themeasuresdetailedin 524 ofIEC60364-5-52:2009shall apply.		P
	InIT systems,itisrecommended that the neutral conductorisNotbeused.However, where aneutral conductorisused, themeasuresdetailedin 431.2.2 ofIEC 60364-4-43 shallapply.		N/A
7.2.4	Control circuits		-
	Conductors of control circuits directly connected tothesupply voltage shallbeprotected against overcurrentin accordancewith 7.2.3.	Checked to confirm theconformity.	P
	Conductors of control circuits suppliedby a transformer ord.c. supply shall be protectedagainstovercurrent(seealso9.4.3.1):		P
	- in control circuits connectedtotheprotectivebondingcircuit, byinserting an overcurrentprotective deviceintothe switched conductor;		P
	- in control circuitsnot connectedto theprotectivebondingcircuit;		N/A
	- where all control circuits of theequipmenthave the same current carrying capacity, byinsertinganovercurrentprotective deviceinto the switched conductor, or;		N/A
	- where different control circuit of the equipmenthavedifferent current carrying capacity,byinserting an overcurrent protective device intobothswitchedandcommon conductors of each		N/A

	controlcircuit.		
	Exception: where the supplyunitprovides currentlimitingbelow the current carrying capacity of theconductorsinacircuit and below the currentratingofconnected		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	components,no separate overcurrent protective devicesisrequired		
7.2.5	Socket outlets and their associated conductors	Notbeused.	-
	Overcurrent protection shall beprovided for thecircuitsfeeding the general purpose socketoutletsintended primarily for supplying power tomaintenance equipment.Overcurrentprotective devices shallbeprovidedin the unearthedlive conductors of each circuit feeding such socketoutlets. Seealso15.1		N/A
7.2.6	Lighting circuits	Notbeused.	-
	All unearthed conductors of circuits supplyinglightingshallbe protected against the effectsof shortcircuitsbythe provision of overcurrent devices separate from thoseprotecting other circuits.		N/A
7.2.7	Transformers		-
	Transformers shallbe protected byanovercurrent protectivehaving a type and settingin accordance withthetransformer manufacturer'sinstructions. Such protection shall(seealso7.2.10):		P
	- avoidnuisance tripping due to transformermagnetizinginrush currents;		P
	- avoid a winding temperaturerisein excessof the permitted value for theinsulation class of transformer whenitis subjected to the effects of ashortcircuitatits secondary terminals.		P
7.2.8	Location of overcurrentprotective devices		-
	An overcurrentprotective device shallbelocated at the point where areductionin the cross- sectional areaof the conductors or another change reduces thecurrent-carryingcapacity of the conductors, except where all the following conditions are satisfied:	See circuitdiagram.	P
	– the current carrying capacity of theconductorsisatleast equaltothatoftheload;		P
	– thepart of the conductor between thepoint ofreductionof current-carrying capacity and theposition of the overcurrentprotectivedeviceisnolongerthan 3 m;		P
	– the conductor isinstalledin suchamanner astoreducethe possibility of a short-circuit, for example,protectedbyan enclosureor duct.		P
7.2.9	Overcurrent protective devices		-

	The rated short-circuit breakingcapacityshallbeatleastequal to the prospective fault currentatthepointof installation. Where the short-circuit current to an overcurrent protective device caninclude additional currents other than from the supply (forexamplefrom motors, from power factor correction capacitors), thosecurrents shall be takenintoconsideration.	See circuitdiagram.	P
	Where fuses areprovided as overcurrentprotective devices, a type readily availablein thecountryofuseshall		P

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Clause	**Requirement**	**Comment**	**Verdict**
	be selected, or arrangements shallbemade for the supplyof spareparts.		
7.2.10	Rating and setting of overcurrent protectivedevices		-
	The rated current of fuses or the settingcurrentofother overcurrentprotective devices shallbe selected aslow aspossible but adequate for the anticipated overcurrents(forexample during starting of motorsorenergizingof transformers). When selecting those protective devices, consideration shallbe given to theprotection of switchingdevices against damage due toovercurrent.	See circuitdiagram.	P
	The rated current or settingof anovercurrentprotective device for conductorsis determinedby the current carryingcapacity of the conductors to beprotectedinaccordance with12.4,D.2 andthemaximumallowableinterruptingtime tin accordance with ClauseD.3, takinginto account the needs of co-ordination with other electrical devicesin theprotected circuit.		P
7.3	Protection of motors against overheating		-
7.3.1	General		-
	Protection of motors against overheating shallbeprovided foreachmotorratedatmorethan0,5kW.		P
	Exceptions:In applications where an automaticinterruptionof the motor operationisunacceptable (for examplefire pumps), themeans of detection shall give a warning signalto which the operator canrespond.		N/A
	Protection of motors against overheating canbeachievedby:		-
	- overloadprotection(7.3.2),		P
	- over-temperatureprotection(7.3.3), or		N/A
	- current-limiting protection.		N/A
	Automaticrestarting of anymotor after the operation ofprotection against overheating shall beprevented wherethis can cause ahazardous situationordamage tothe machine or to the workinprogress		P
7.3.2	Overloadprotection		-
	Where overloadprotectionisprovided, detection of overload(s) shallbeprovided in eachlive conductorexceptfor theneutral conductor.	See circuitdiagram.	P
	However,where themotor overload detectionisNotbe used for cable overloadprotection (see alsoClauseD.2),detection of overloadmaybe omittedin one of thelive conductors.For motorshaving single-phase or d.c.powersupplies, detectionin only oneunearthed liveconductorispermitted.		N/A

	Where overloadprotectionis achievedby switching off, theswitching device shall switch off alllive conductors.The switching of theneutral conductor isnotnecessary foroverload protection.		P

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Clause	**Requirement**	**Comment**	**Verdict**
	Wheremotors with special dutyratings arerequired tostartor to brake frequently (forexample,motors forrapid traverse, locking, rapidreversal, sensitivedrilling)it canbedifficult toprovide overloadprotection with a time constantcomparable with that of the winding tobeprotected. Appropriate protective devices designed to accommodatespecial dutymotors or over-temperatureprotection (see 7.3.3) canbenecessary.		N/A
	For motors that cannotbe overloaded(for exampletorquemotors,motion drives that either areprotectedby mechanical overloadprotection devices or are adequatelydimensioned), overloadprotection isnot required.		N/A
7.3.3	Over-temperature protection	Notbeused.	-
	The provision of motors with over-temperatureprotection(seeIEC 60034-11)isrecommendedinsituationswherethe cooling can beimpaired(forexampledusty environments).Dependingupon the type of motor, protection under stalledrotor or loss ofphaseconditionsisnot always ensuredby over-temperatureprotection, and additional protection should thenbeprovided.		N/A
	Over-temperature protection is alsorecommended formotors that cannotbe overloaded (forexample torquemotors,motion drives that are eitherprotectedby mechanical overloadprotection devices or are adequatelydimensioned), where the possibility of over-temperature exists (for example due toreducedcooling).		N/A
7.4	Protection against abnormal temperature	Notbeused.	-
	Equipment shall beprotected againstabnormal temperatures that can resultin ahazardoussituation.		N/A
7.5	Protection against the effects of supplyinterruption orvoltage reduction and subsequentrestoration	Notbeused.	-
	Where a supplyinterruption or a voltagereductioncan cause a hazardous situation, damage tothemachine,or tothe workinprogress, undervoltage protection shallbe provided by, for example, switching off themachineatapredetermined voltagelevel.		N/A
	Where the operation of themachine can allow foran interruption or a reduction of the voltage forashorttime period, delayed undervoltage protectionmaybeprovided.The operation of the undervoltage device shallnotimpairthe operation of any stopping control of themachine.		N/A

	Upon restoration of the voltage or uponswitchingonthe incoming supply, automatic or unexpectedrestarting of themachine shall beprevented where sucharestart can cause a hazardoussituation.		N/A
	Where only apart of themachine orof thegroupof machines working together in a co-ordinatemanneris affected by the voltage reductionor supplyinterruption, theunder voltageprotection shallinitiate appropriate control commands to ensure co-ordination.		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
7.6	Motor overspeedprotection	Notbeused.	-
	Overspeed protection shallbe providedwhere overspeeding can occur and couldpossiblycause ahazardous situation takinginto account measuresin accordancewith 9.3.2. Overspeedprotectionshallinitiateappropriate control responses and shallprevent automaticrestarting.		N/A
	The overspeed protection should operatein suchamannerthat themechanical speedlimit of themotor or itsloadis not exceeded.		N/A
7.7	Additional earth fault/residual currentprotection		-
	In addition toproviding overcurrent protection for automatic disconnection as describedin 6.3, earth fault/residual currentprotection canbe provided to reducedamagetoequipment due to earth fault currentslessthanthe detectionlevel of the overcurrent protection.	Checked to confirm theconformity.	P
	The setting of the devices shallbe aslowaspossibleconsistent with correct operation of the equipment.		P
	If fault currents withDC components are possible,anRCD oftypeBinaccordancewithIECTR 60755 canbe required		N/A
7.8	Phase sequenceprotection	Notbeused.	-
	Where anincorrectphase sequence of the supply voltage can cause ahazardous situation or damagetothemachine,protection shall beprovided.		N/A
7.9	Protection against overvoltages due tolightningand toswitching surges	Notbeused.	-
	Surgeprotective devices (SPDs) canbeprovided to protect against the effects of overvoltages due tolightningor to switching surges.		N/A
	Whereprovided:		-
	- SPDs for the suppression of overvoltages duetolightningshallbe connected to the incoming terminals of thesupply disconnecting device.		N/A
	- SPDs for the suppression of overvoltagesdue to switching surges shall be connectedasnecessaryforequipment requiring suchprotection.		N/A
7.10	Short-circuit currentrating		-
	The short-circuit current rating of theelectricalequipment shallbe determined. This can bedoneby theapplicationofdesignrules or bycalculation orbytest		P
8	Equipotential bonding		-
8.1	General		-
8.2	Protective bondingcircuit		-

8.2.1	General		-
	All parts of the protectivebondingcircuitshallbeso designed that they are capable of withstanding thehighest		P

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Clause	**Requirement**	**Comment**	**Verdict**
	thermal andmechanical stresses that canbe causedbyearth-fault currents that could flowin thatpartof the protectivebonding circuit.		
	The cross-sectional areaofwhich doesnot formpart ofcommon enclosure with thethan every protective conductor a cable or whichisnotina line conductor shallbenotless		P
	- 2.5mm^2Cuor16mm^2 Alifprotectionagainst mechanical damageisprovided		P
	- 4mm^2Cuor16mm^2 Alifprotectionagainst mechanical damageisnotprovided		P
	A protective conductor notformingpartofacableis considered tobemechanicallyprotectedif itisinstalledina conduit, trunking or protectedinasimilar way. Conductive structural parts of equipmentin accordance with6.3.2.2neednotbeconnectedtotheprotective bonding circuit where all the equipmentprovidedisin accordancewith6.3.2.2		P
	Exposed conductive parts of equipmentin accordance with6.3.2.3shallnotbeconnectedtotheprotectivebonding circuit.		P
8.2.2	Protective conductors		-
	Protective conductors shallbe identifiedin accordancewith 13.2.2.	Checked to confirm theconformity.	P
	Copper conductors arepreferred. Where a conductor material other than copper isused,its electricalresistanceper unitlength shall notexceed thatof theallowable copper conductor and such conductors shallbenotless than16mm2incross-sectionalareaforreasonsof mechanical durability.		P
	Metal enclosures or frames or mountingplatesof electricalequipment, connected to the protectivebonding circuit, maybeused asprotective conductorsif they satisfy thefollowing threerequirements:		P
	- Their electricalcontinuityshallbeassuredby construction or by suitableconnectionsoas to ensure protection againstmechanical, chemical orelectrochemical deterioration		P
	- Theycomplywiththerequirementsof 543.1ofIEC 60364-5-54:2011		P
	- They shallpermit theconnectionof otherprotectiveconductors at everypredetermined tap-off point		P
	The cross-sectional area of protective conductorsshall eitherbecalculatedinaccordancewith543.1.2ofIEC 60364-5-54:2011 orselectedinaccordancewithTable1(see 5.2), seealso 8.2.6and17.2(d)ofthisdocument.		P

	Each protectiveconductor shall:		-
	-Bepartofamulticorecable,or:		P
	- Beinacommonenclosurewiththelineconductor,or		P

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Clause	**Requirement**	**Comment**	**Verdict**
	-Have a cross-sectional areaof atleast;		-
	- 2.5mm^2Cuor16mm^2 Alifprotectionagainst mechanical damageisprovided		P
	- 4mm^2Cuor16mm^2 Alifprotectionagainst mechanical damageisnotprovided		P
	A protective conductor notformingpartofcableis considered tobemechanicallyprotectedif itisinstalledina conduit, trunking orprotectedin asimilar way		P
	The followingparts of themachine andits electrical equipment shall be connected to theprotectivebondingcircuitbut shallnotbeused asprotective conductors		P
	- Conductivestructuralpartsof themachine		P
	-Metal ducts of flexible or rigidconstruction		P
	-Metallic cable sheaths orarmouring		P
	- Metallicpipescontaining flammablematerialssuchas gases,liquids,powder		P
	-Flexible or pliablemetalconduits		P
	- Constructionalparts subjecttomechanicalstressinnormal service		P
	- Flexiblemetalparts;support wires;cabletraysandcableladders		P
8.2.3	Continuity of theprotectivebonding circuit		-
	Where a partisremoved for anyreason(forexample routine maintenance), theprotective bonding circuit fortheremaining parts shallnotbeinterrupted.	Checked to confirm theconformity.	P
	Connection and bonding pointsshallbesodesigned that their current-carrying capacityisnot impairedby mechanical, chemical, or electrochemical influences. Where enclosures and conductors of aluminiumor aluminium alloys are used,particular consideration shouldbe given to the possibility ofelectrolyticcorrosion.		P
	Where the electrical equipmentismounted onlids,doors,or cover plates, continuity of theprotectivebonding circuit shallbeensuredandaprotectiveconductor(see8.2.2)is recommended. Where a protectiveconductorisnot provided, fastenings,hinges or sliding contacts designed to havealowresistanceshallbeused(see18.2.2, Test1).		P
	The continuity of conductor in cablesthatareexposedto damage (for example flexible trailing cables)shallbeensuredby appropriatemeasures(for example monitoring).		P
	For requirements for the continuity of conductorusing conductor wires, conductor bars and slip-ring assemblies,see12.7.2.		P

	The protectivebonding circuit shallnotincorporate a switching device, an overcurrent protective device,orothermeans of interruption.		P
	Exception:links that cannotbe opened without theuse of a		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	tool and that arelocatedin an enclosedelectricaloperatingareamaybeprovided for test ormeasurement purposes		
	Where the continuity of theprotectivebonding circuit canbe interruptedbymeans of removable currentcollectorsorplug/socket combinations, the protectivebonding circuit shallbeinterruptedby a firstmake lastbreak contact.Thisalso applies to removable or withdrawableplug-inunits (seealso13.4.5)		N/A
8.2.4	Protective conductor connectingpoints		-
	All protective conductors shallbe terminatedinaccordance with13.1.1. Theprotectiveconductorconnectingpointsare notintended, for example, to attach appliances orparts	Checked to confirm theconformity.	P
	Eachprotective conductor connectingpoint shall be markedorlabelledassuchusingthesymbolIEC60417-5019:2006-08; orwiththelettersPE, thegraphicalsymbol being preferred, or byuseof thebicolor combination GREEN-AND-YELLOW, or by any combinationof those		P
8.2.5	Mobilemachines	Notthiscase.	-
	On mobile machines with on-boardpowersupplies,the protective conductors, the conductive structural partsof theelectrical equipment, and those extraneous conductive parts which form the structure of themachine shall allbeconnected to a protectivebonding terminal toprovide protection against electric shock.		N/A
	Where amobilemachineis also capableofbeing connected to an external incomingpowersupply,this protectivebonding terminal shall be the connectionpointfor the external protectiveconductor.		N/A
8.2.6	Additional requirements for electrical equipmenthavingearthleakage currentshigher than10mA		-
	Where electrical equipmenthas an earthleakagecurrent thatisgreaterthan10mAa.c. ord.c.inanyprotective conductor, one or more of the followingconditions for theintegrity of each section of the associatedprotective bonding circuit that carries the earthleakagecurrentshallbe satisfied:		N/A
	a) The protectiveconductoriscompletelyenclosed within electrical equipment enclosuresor otherwiseprotected throughoutitslength against mechanicaldamage		N/A
	b) the protectiveconductoracross-sectionalareaof atleast10mm2 Cuor16mm2 Al		N/A

	c) where theprotectiveconductorhasacross-sectionalareaoflessthan10mm2Cuor16mm2Al, a second protectiveconductorof atleastthe same cross-sectional areaisprovided up toapointwhere the protective conductorhasacross-sectionalareanotlessthan10mm2 Cuor16mm2-Al.		N/A
	d) automatic disconnectionof thesupplyincaseof		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	loss of continuity of the protectiveconductor.		
	e) Where aplug-socketcombinationisused,an industrialconnectorinaccordancewithIEC60309series, with adequate strainrelief and aminimum protectiveearthingconductorcross-sectionof 2.5 mm^2 aspart of amulti-conductor powercableisprovided.		N/A
	A statement shallbe givenin theinstructions for installation that the equipment shallbeinstalled as describedinthis8.2.6		N/A
8.3	Functional bonding		-
	Protection againstmaloperation as aresult ofinsulationfailures canbe achieved byconnectingtoacommon conductorinaccordancewith9.4.3.1.	Checked to confirm theconformity.	P
	For recommendationsregarding functionalbonding to avoidmaloperation due to electromagnetic disturbances, see 4.4.2 andAnnexH		P
	Functional bonding connectingpoints shouldbemarked or labelledassuchusingthesymbolIEC60417-5020:2002-10		P
8.4	Measures to restrict the effectsof highleakagecurrent		-
	The effects of high leakagecurrentcanberestricted totheequipmenthaving high leakage currentbyconnectionof that equipment to a dedicated supplytransformerhavingseparate windings. The protective bondingcircuitshallbeconnected to exposed conductive partsof the equipmentand,in addition, to the secondary windingof the transformer. The protective conductor(s)between the equipment and the secondary winding of the transformershall comply with one ormore of thearrangements describedin 8.2.8.		N/A
9	Control circuits and controlfunctions		-
9.1	Control circuits		-
9.1.1	Control circuitsupply		-
	Where control circuits are supplied fromana.c.source,transformershaving separate windings shallbeused toseparate thepower supply from the control supply.		P
	Examplesinclude:		-
	- Control transformershavingseparate windingsin accordancewithIEC 61558-2-2		P
	- Switchmodepowersupplyunitsinaccordance withIEC 61558-2-16 fittedwithtransformershaving separate windings		P

	- Lowvoltagepowersuppliersinaccordance with IEC 61204-7 fittedwithtransformershaving separate windings		N/A
	Where several transformers are used,itisrecommendedthat the windings of those transformersbe connectedin		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	such a manner that the secondaryvoltagesareinphase.		
	Exception: Transformers or switch modepower supplyunits fitted with transformers are notmandatoryfor machines with a singlemotor starter and/or amaximum oftwo control devices (for exampleinterlock device,start/stopcontrol station).		N/A
	Where d.c. control circuits derived fromana.c.supplyare connectedtotheprotectivebondingcircuit (see 8.2.1), they shallbe supplied from a separate windingof thea.c.control circuit transformer or by anothercontrolcircuit transformer.		P
9.1.2	Control circuit voltages		-
	The nominal value of the control voltageshallbe consistent with the correct operation of the controlcircuit.		P
	The nominal voltage of AC control circuit shouldpreferablynotexceed		N/A
	- 230 Vforcircuitswith 50Hznominalfrequency		N/A
	- 277 Vforcircuitswith60Hznominalfrequency		N/A
	The nominal voltage of DCcontrolcircuitsshould preferablynotexceed 220V		P
9.1.3	Protection		-
	Control circuits shall beprovided withovercurrent protectioninaccordancewith 7.2.4 and7.2.10.	See electricalcircuitdiagram.	P
9.2	Control functions		-
9.2.1	General		-
9.2.2	Categories of stop functions		-
	There are three categories of stop functionsas follows:		
	- stop category 0: stoppingbyimmediateremoval ofpowerto the machine actuators(i.e. anuncontrolled stop -see 3.56);		P
	- stopcategory1: acontrolledstop(see3.11) withpower available to themachine actuators to achieve the stop and thenremovalofpowerwhen the stopisachieved;		P
	- stop category 2: a controlled stop withpowerremainingavailable to the machineactuators.		P
9.2.3	Operation		-
9.2.3.1	General		-
	Safety functions and/or protective measures(for example interlocks(see 9.3)) shallbeprovidedwhererequiredtoreduce the possibility of hazardoussituations.		P

	Where amachinehasmore than one control station, measures shallbeprovided to ensure thatinitiation of commands from different control stations donotleadtoahazardous situation.		P
9.2.3.2	Start		-

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Clause	**Requirement**	**Comment**	**Verdict**
	Start functions shall operate byenergizing therelevantcircuit		P
	The start of an operation shallbepossible onlywhenall relevant safety functions and/or protectivemeasuresarein place and are operational except forconditionsas describedin 9.2.4.		P
	For thosemachines(for examplemobile machines) wheresafety functions and/or protective measurescannotbe applied for certain operations, starting of such operationsshallbebyhold-to-run controls, together with enabling devices, as appropriate.		P
	The provision of acoustic and/or visual warning signals before the starting of hazardousmachine operation shouldbe considered		P
	Suitableinterlocks shall beprovided where necessary forcorrect sequential starting.		P
	In the case of machinesrequiring theuse ofmorethanonecontrol station toinitiate a start, eachof these control stations shall have a separatemanuallyactuatedstartcontrol device. The conditions toinitiate astartshallbe:	Notthiscase.	N/A
	- all required conditions formachineoperationshallbe met, and		N/A
	- all start control devicesshallbein thereleased(off)position, then		N/A
	- all start control devices shallbeactuatedconcurrently(see3.6).		N/A
9.2.3.3	Stop		-
	Stopcategory 0 and/orstopcategory1and/orstop category 2 stop functions shall beprovidedasindicatedbythe risk assessment and the functionalrequirementsof the machine (see4.1).	Checked to confirm theconformity.	P
	Stop functions shall override related start functions.		P
	Wheremore than one control stationisprovided, stop commands from any control station shallbeeffective whenrequired by the riskassessmentof themachine.		P
9.2.3.4	Emergency operations (emergency stop, emergencyswitching off)		-
9.2.3.4.1	General		-
	Emergency stop and emergency switchingoff are complementaryprotectivemeasures that are notprimarymeans of riskreduction for hazards(for exampletrapping, entanglement, electric shock orburn) atamachine	Checked to confirm theconformity.	P

	ThispartofIEC 60204 specifiestherequirementsforthe emergency stop and the emergency switching off functionsof the emergency operationslistedin AnnexE, both of which are,intended tobeinitiatedby a singlehumanaction.		P
	Onceactiveoperationofanemergencystop(see10.7)or emergencyswitchingoff (see10.8) actuatorhasceased following a stop or switching off command, theeffectof this		P

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Clause	**Requirement**	**Comment**	**Verdict**
	command shallbe sustaineduntilitisreset. Thisreset shallbepossible onlyby amanual action atthedevicewhere the commandhasbeeninitiated. Thereset of thecommand shallnotrestart the machinerybut onlypermitrestarting.		
	It shall not bepossibletorestartthemachineryuntilallemergency stop commandshave beenreset.It shallnotbe possible to reenergizethemachineryuntilall emergency switching off commandshavebeen reset.		P
9.2.3.4.2	Emergency stop		-
	Requirements for the design of emergency stop equipment,including functional aspects, are giveninISO13850.		P
	The emergency stop shall function either asastop category 0 orasastopcategory1. Thechoiceofthestop category of the emergency stop depends ontheresultsofa risk assessmentof themachine.		P
	Exception:in some cases, to avoid creatingadditional risks,it can benecessary toperform acontrolledstopandmaintain thepower to machine actuators evenafter stoppingis achieved. The stopped condition shallbemonitored and upon detection of failureof the stoppedcondition, power shallbe removed withoutcreatinga hazardous situation		N/A
	Inadditiontotherequirementsforstop(see9.2.5.3),the emergency stop function has the followingrequirements:		P
	-it shall override all other functionsand operationsinallmodes;		P
	-it shall stop thehazardousmotion asquicklyaspracticable without creating other hazards;		P
	-reset shall notinitiatearestart.		P
9.2.3.4.3	Emergency switching off	Notbeused.	-
	Emergency switching off should beprovided where:		-
	- basicprotection (for example conductor wires, conductorbars, slipring assemblies, controlgear inelectrical operatingareas)is achieved onlybyplacing outof reachorby obstacles (see6.2.6);or		N/A
	- thereis the possibility of otherhazardsor damagecaused byelectricity.		P
	Emergency switching off is accomplishedbyswitchingoff the relevant supplyby electromechanical switching devices, effecting a stop category 0ofmachineactuatorsconnected to thisincoming supply. When amachine cannot tolerate this category 0 stop,itmaybenecessarytoprovide other measures, for		P

	exampleprotection, sothat emergency switching off isnotnecessary.		
9.2.3.5	Operatingmodes		-
	Eachmachine canhave one or moreoperatingmodes(forexamplemanualmode, automaticmode, settingmode,		P

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Clause	**Requirement**	**Comment**	**Verdict**
	maintenancemode) determined by the type ofmachineandits application.		
	Wheremachineryhasbeen designed and constructed toallowitsusein several control or operatingmodes requiring different protective measuresandhavinga differentimpact on safety,it shall befittedwithamode selector which canbelockedin eachposition (for examplekey operated switch).Eachposition of the selector shallbeclearlyidentifiable and shall correspond toa single operating or controlmode		N/A
	The selector maybe replacedby anotherselectionmethodwhich restricts the use of certainfunctionsof themachineryto certain categories of operator (for exampleaccesscode)		P
	Mode selectionbyitself shallnotinitiatemachine operation. A separate actuation of the start control shallberequired.		P
	For each specific operatingmode, the relevantsafety functions and/or protectivemeasures shallbe implemented.		P
	Indication of the selected operatingmode shallbeprovided(for example theposition of a mode selector,theprovision of anindicating light, a visual displayindication).		P
9.2.3.6	Monitoring of command actions		-
	Movement or action of amachine orpart of amachinethatcan resultin ahazardous situation shallbemonitoredby providing, for example, overtravellimiters, motor overspeed detection, mechanical overload detection oranti-collision devices.		P
9.2.3.7	Hold-to-run controls	Notbeused.	-
	Hold-to-run controls shallrequire continuous actuation ofthe control devices to achieveoperation		N/A
9.2.3.8	Two-hand control	Notbeused	-
	ThreetypesoftwO-handcontrolaredefinedinISO13851,the selection of which is determinedbytherisk assessment		N/A
9.2.3.9	Enabling control		-
	Enabling control shallbe so arranged astominimizethepossibility of defeating, for exampleby requiring thede-activation of the enabling control devicebeforemachine operationmaybereinitiated.It shouldnot bepossible todefeat the enabling function bysimplemeans.		P
9.2.3.10	Combined start and stopcontrols		-

	Push-buttons and similar control devices that, when operated, alternatelyinitiate and stopmotion shall onlybeprovided for functions which cannot result inahazardoussituation.		P
9.2.4	Cableless control system(CCS)	Notbeused.	-
9.2.4.1	Generalrequirements		-

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Clause	**Requirement**	**Comment**	**Verdict**
	This subclause deals with the functional requirementsof control systems employing cableless(for exampleradio, infra-red) techniques for transmitting control signals and databetween operator control station(s) and otherpartsof thecontrolsystem(s).		N/A
	Transmission reliabilityrequirements canbenecessary forsafety functions of a CCS thatrely ondatatransmission (for example, safety-related active stop,motion commands)		N/A
	The CCS shallhave functionality and aresponsetime suitable for the applicationbased on the riskassessment.		N/A
9.2.4.2	Monitoring the ability of a cablelesscontrol systemtocontrol amachine		-
	The ability of a cableless controlsystem(CCS) tocontrola machine shall be automaticallymonitored, either continuously or at suitable intervals. Thestatusof thisability shall be clearlyindicated(forexample,byan indicatinglight, a visual displayindication, etc.)		N/A
	If the communication signalis degraded inamanner thatmight lead to theloss of theability of aCCStocontrola machine (e.g. reducedsignallevel,lowbatterypower)a warning to the operator shallbe providedbefore theabilityof the CCS to control amachineislost.		N/A
	When the ability of a CCS tocontrolamachinehasbeenlost for a time thatis determined from ariskassessmentofthe application, an automatic stop of themachine shallbeinitiated		N/A
	Restoration of the ability of a CCStocontrolamachineshallnotrestart themachine.Restart shall require a deliberate action, for examplemanual actuation of a startbutton		N/A
9.2.4.3	Control limitation		-
	Measuresshallbetaken (e.g. codedtransmission) to prevent themachine from responding to signals other thanthose from the intended cableless operator controlstation		N/A
	Cableless operator control stations shall onlycontrol theintendedmachine and shall affect only theintended machine functions		N/A
9.2.4.4	Use of multiple cableless operator controlstations		-
	When more than one cablelessoperator controlstationisused to control amachine,then:		N/A
	- Only onecablelessoperatorcontrolstationshallbeenabled at a time exceptasnecessaryforthe operation of themachine;		N/A

	- Transfer of control fromonecablelessoperator control station to another shall requireadeliberatemanual action at the controlstationthathas control;		N/A
	- Duringmachineoperation,transferof controlshallonlybepossible whenboth cableless operator		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	control stations are set to thesamemodeof machine operation and/or functions of themachine;		
	- Transfer of control shallnotchangetheselected mode of machine operation and/or functionsof themachine;		N/A
	-Each cableless operator control station thathas control of the machine shallbeprovided withanindication thatithas control(by for example, theprovision of anindicatinglight, a visual displayindication)		N/A
9.2.4.5	Portable cableless operator control stations		-
	Portable cableless operator control stationsshallbe provided withmeans (for example keyoperatedswitch,access code) to preventunauthorizeduse.		N/A
	Eachmachineunder cableless control shouldhave anindication whenitisunder cableless control.		N/A
	When aportable cableless operator control stationcanbeconnected to one or moreof severalmachines,means shallbeprovided on the portable cablelessoperator control station to select which machineis tobeconnected.Selecting amachine tobe connected shallnotinitiate control commands.		N/A
9.2.4.6	Deliberate disabling of cableless operator control stations		-
	Where a cableless operator control stationisdisabled whenunder control, the associatedmachine shallmeet therequirements for loss of ability of aCCS tocontrola machinein9.2.4.2.		N/A
	Whereitisnecessary to disable a cablelessoperator control station withoutinterruptingmachine operation, means shall beprovided(for example on thecableless operator control station) to transfer control to another fixedor portablecontrol station.		N/A
9.2.4.7	Emergency stop devices on portablecablelessoperatorcontrol stations		-
	Emergency stop devices onportable cableless operator control stations shallnotbe the solemeans ofinitiating theemergency stop function of amachine.		N/A
	Confusionbetween active andinactive emergency stopdevices shallbe avoidedby appropriate designand informationforuse. SeealsoISO13850.		N/A
9.2.4.8	Emergency stopreset		-
	Restarting of cableless control after powerloss,disabling and re-enabling,loss of communication, or failure ofpartsof the CCS shallnotresultin a resetof anemergencystopcondition.		N/A

	The instructions for use shallstatethattheresetof an emergency stop condition initiatedby aportablecablelessoperator control station shall onlybeperformed whenit can be seen that thereason forinitiationhasbeen cleared.		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	Depending on the risk assessment,inaddition tothe resetting of the emergency stop actuator on theportablecableless operator control station, oneormore supplementary fixed reset devices shouldbeprovided.		N/A
9.3	Protective interlocks	Notbeused.	-
9.3.1	Reclosing or resetting of aninterlocking safeguard		-
	The reclosing or resetting of aninterlockingsafeguardshallnotinitiate hazardousmachine operation.		N/A
9.3.2	Exceeding operatinglimits		-
	Where an operatinglimit (for examplespeed,pressure,position) can be exceededleadingtoahazardous situation,means shallbeprovided to detect when apredeterminedlimit(s)is exceeded andinitiate an appropriate control action.		N/A
9.3.3	Operation of auxiliary functions	Notbeused.	-
	The correct operation of auxiliary functions shallbechecked by appropriatedevices		N/A
	Where thenon-operation of a motor or device foran auxiliary function (for examplelubrication, supplyof coolant, swarf removal) can cause ahazardoussituation, or cause damage to the machineortothe workin progress, appropriateinterlocking shallbeprovided.		N/A
9.3.4	Interlocksbetween different operations and for contrarymotions	Notbeused.	-
	All contactors, relays, and other controldevicesthatcontrolelements of the machine and that cancauseahazardoussituation when actuated at the same time(for example those whichinitiate contrarymotion), shallbeinterlockedagainst incorrectoperation.		N/A
	Reversing contactors(for example those controlling the direction of rotation of amotor) shallbeinterlockedin suchaway thatin normal service noshortcircuitcanoccur when switching.		N/A
	Where, for safety or for continuous operation, certain functions on themachine are requiredtobeinterrelated, proper co-ordination shallbe ensured bysuitable interlocks.For a group of machines working togetherina co-ordinatedmanner andhavingmore than one controller,provision shallbemade to co-ordinate the operations of the controllers asnecessary.		N/A

	Where a failure of amechanicalbrake actuator canresultin the brakebeing applied when theassociatedmachine actuator is energized and ahazardoussituationcanresult,interlocks shall beprovided to switchoff themachine actuator.		N/A
9.3.5	Reverse currentbraking	No such function.	-
	Wherebraking of amotor is accomplishedby current reversal,measures shallbeprovided toprevent themotorstartingin the opposite direction at theendofbraking		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	where that reversal can causeahazardoussituationor damage to themachine or to the workinprogress.For thispurpose, a device operating exclusivelyas a functionof timeisnot permitted.		
	Control circuits shall be soarrangedthatrotationof a motor shaft, for example by applyingamanual forceoranyother force causing the shaft to rotateafterithasstopped, shallnotresultin a hazardoussituation.		N/A
9.3.6	Suspension of safety functions and/or protectivemeasures	Notthiscase.	-
	Whereitisnecessary to suspend safety functions and/orprotectivemeasures(for example for setting or maintenancepurpose), the control or operatingmodeselector shall simultaneously:		N/A
	-Disable all other operating(control)modes;		N/A
	-Permitoperationonlybytheuseofahold-to-rundevice or by asimilar controldevicepositionedsoas to permit sightof thehazardouselements;		N/A
	- Permitoperationof thehazardouselementsonlyin reducedriskconditions(e.g.reducedspeed, reducedpower/ force, step-by-stepoperation, e.g.with a limitedmovementcontroldevice);		N/A
	- Preventanyoperationofhazardousfunctionsbyvolu ntary or involuntary action onthemachine'ssensors.		N/A
	If these four conditions cannot be fulfilled simultaneously, the control or operatingmode selector shall activateotherprotectivemeasures designed and constructed to ensure asafe intervention zone.In addition, theoperator shallbe able to control operation of the operation of thepartsheisworking on from the adjustmentpoint.		N/A
9.4	Control functionsin the event of failure		-
9.4.1	Generalrequirements		-
	Where failures or disturbancesin the electrical equipment can cause ahazardous situation ordamageto the machine or to the workinprogress, appropriate measures shallbe taken tominimize the probability of theoccurrenceof such failures or disturbances. The requiredmeasures and the extent to which they areimplemented, either individually or in combination,depend onthelevelofriskassociated with the respective application(see 4.1).	Checked to confirm theconformity.	P

	Examples of such measures that canbeappropriateincludebut arenotlimited to: – protective interlocking of theelectricalcircuit; – use of proven circuittechniquesandcomponents(see9.4.2.1); – provisionofpartialorcompleteredundancy(see9.4.2.2) ordiversity(see9.4.2.3); – provisionforfunctionaltests (see9.4.2.4).		P
	The electrical control systems shall haveanappropriate		P

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Clause	**Requirement**	**Comment**	**Verdict**
	performance thathasbeen determined from the riskassessment of themachine.		
	The requirements for safety-related control functions ofIEC62061 and/orISO13849-1,ISO13849-2 shallapply.		P
	Where functionsperformedby the electrical control systemshave safetyimplicationsbut application of IEC 62061 leadstoarequiredsafetyintegritylessthanthat requiredby SIL1, compliance with therequirements of this partofIEC 60204 canleadtoanadequateperformanceof the electrical control systems		P
	Whereмemoryretentionis achieved for example,bybatterypower,measures shall be taken toprevent hazardous situations arising from failure,undervoltage orremoval of thebattery.	Nonvolatile memory used.	N/A
	Means shall be providedtopreventunauthorizedor inadvertentmemory alteration by, for example,requiringthe use of akey,accesscodeortool.		P
9.4.2	Measures tominimizeriskin the event of failure		-
9.4.2.1	General		-
	Measures tominimizeriskin the event of failureinclude butarenotlimited to:	Checked to confirm theconformity.	-
	- Useofprovencircuittechniquesandcomponents;		P
	-Provisions of partial or completeredundancy		P
	-Provision of diversity		P
	-Provision for functional tests		P
9.4.2.2	Use of proven circuit techniques andcomponents		-
	Thesemeasuresinclude but arenotlimited to:		-
	- Bondingof controlcircuitstotheprotectivebonding circuitforfunctionalpurposes (see9.4.3.1.1and figure 4)		P
	- Connection ofcontroldevicesinaccordancewith9.4.3.1.1		P
	-Stoppingby de-energizing		P
	- The switchingof allcontrolcircuitconductors(forexampleboth sides of a coil)of the devicebeingcontrolled		P
	- Switchingdeviceshavingdirectopeningaction(se eIEC 60947-5-1)		P
	-Monitoringby: 1. Useofmechanicallylinkedcontacts(seeIEC 60947-5-1) 2.Useofmirrorcontacts(seeIEC 60947-4-1)		P
	- Circuitdesign toreducethepossibilityof failurescausingundesirable operations		P

9.4.2.3	Provisions of partial or completeredundancy		-
	Byprovidingpartial or completeredundancy,itispossibleto minimize theprobability that onesingle failurein the		P

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Clause	**Requirement**	**Comment**	**Verdict**
	electrical circuit can resultinahazardoussituation. Redundancy can be effectiveinnormal operation(on-line redundancy) or designed as special circuits that takeoverthe protective function (off-lineredundancy) only whereretheoperating function fails.		
	Where off-line redundancy whichisnot activeduring normal operationisprovided, suitablemeasures shallbetaken to ensure that those control circuitsareavailable whenrequired.		P
9.4.2.4	Provision of diversity		-
	The use of control circuitshavingdifferentprinciples ofoperation, or using different typesof componentsor devices can reduce theprobability ofhazardsresultingfrom faults and/or failures.Examplesinclude:		P
	-theuse of combination of normally openandnormallyclosed contacts;		P
	-theuse of different types of control devices inthecircuit;		P
	-the combination of electromechanical and electronicequipmentin redundant configurations.		P
9.4.2.5	Provision for functional tests		-
	Functional testsmay be carriedoutautomaticallyby the control system, or manuallybyinspectionor testsat start-up and atpredeterminedintervals, ora combination as appropriate		P
9.4.3	Protection againstmalfunction of control circuits		-
9.4.3.1	General		-
	Measures shallbeprovided to reduce theprobability that insulation faults on any controlcircuitcancause malfunction such as unintentional starting,potentially hazardousmotions, or prevent stopping of themachine.	Checked to confirm theconformity.	P
	The measures tomeet therequirementsinclude butarenotlimited to the followingmethods:		P
	-Method a)Earthed control circuits fedbytransformers		P
	-Method b)Non-earthed control circuits fedbytransformers;		N/A
	- Methodc)Controlcircuitsfedbytransformer withan earthed center-tap winding		N/A
	-Method d) Control circuitnot fedbya transformer		N/A
9.4.3.1.2	Method a) - earthed control circuits fedby transformers		-

	The common conductor shallbe connected to theprotectivebonding circuit at thepoint of supply. All contacts, solidstateelements, etc., whichareintendedtooperate an electromagnetic or other device(for example;arelay,indicator light) are tobeinsertedbetween the switched conductor of the control circuit supply andone terminal of the coil or device. The other terminalof thecoil or deviceis connected directly to the commonconductorof		P

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Clause	**Requirement**	**Comment**	**Verdict**
	the control circuit supply without any switchingelements(seefigure7)		
9.4.3.1.3	Method b) - non-earthedcontrolcircuits fedby transformers		-
	Control circuits fed from a control transformer thatisnotconnected to theprotectivebonding circuit shall either:		N/A
	1) Have2-polecontrolswitchesthatoperateonboth conductors, seefigure 8;or		N/A
	2)Beprovided with a device, for exampleand insulationmonitoring device, that interrupts the circuit automaticallyin the event of anearth fault, seefigure9; or		N/A
	3) Whereaninterruptionasperitem2abovewould increase the risk, for example whencontinued operationisrequired during the first fault to earth,itcan be sufficient toprovide aninsulationmonitoring device (e.g. inaccordancewithIEC61557-8)thatwill initiate an acousticandopticalsignalatthe machine, seefigure10.Requirementsforthe procedure to beperformedby themachineuserinresponse to this alarm shallbedescribedin the information for use.		N/A
9.4.3.1.4	Method c) - control circuits fedby transformer withanearthed center-tap winding		-
	Control circuits fed from a control transformer withits center-tap winding connected to theprotective bonding circuit shallhave overcurrent protective devices thatbreakboth the conductors.		N/A
	The control switches shallbe 2-pole types thatoperateonboth conductors.		N/A
9.4.3.1.5	Method d) - control circuitsnot fedby a transformer		-
	Control circuits that are not fedbyacontroltransformerorswitch modepower supplyunits fitted with transformers havingseparatewindingsinaccordancewithIEC 61558-2-16 are only allowed for machineswithamaximumof one motor starter and/or maximum of two control devices,in accordancewith 9.1.1.		N/A
	Depending on the earthing of the supplysystem thepossible casesare:		N/A
	1) Directlyconnectedtoanearthedsupplysystem(TN - orTT-system) and: a)Beingpoweredbetween a line conductorand theneutralconductor,seefigure12;or b) Beingpoweredbetweentwo-lineconductors, seefigure13; or		N/A

	2)Directly connected to a supplysystem thatisnotearthed or is earthed throughahighimpedance(IT-system) and: a)Beingpoweredbetween a line conductorand theneutralconductor,seefigure14;or b) Beingpoweredbetweentwo-lineconductors,		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	seefigure15		
	Method d1b)requiresmulti-pole control switches that switch alllive conductorsin order to avoidanunintentionalstartin case of an earth faultin thecontrolcircuit.		N/A
	Methodd2)requiresthatadeviceshallbeprovidedthatinterrupts the circuit automaticallyin the eventof anearthfault.		N/A
9.4.3.2	Voltage interruptions		-
	Where the control system usesamemorydevices,properfunctioningin the event of power failure shallbeensured (for examplebyusing anon-volatilememory) toprevent anyloss of memory that canresultin ahazardoussituation	Notthiscase.	N/A
9.4.3.3	Loss of circuitcontinuity		-
	Where theloss of continuity of control circuitsdependingupon sliding contacts can resultinahazardoussituation,appropriatemeasures shallbe taken (for exampleby duplication of the sliding contacts)	Notthiscase.	N/A
10	Operator interface and machine-mounted controldevices		-
10.1	General		-
10.1.1	Generalrequirements		-
	Control devices for operator interface shall,as farasis practicable,be selected, mounted, andidentified orcoded inaccordancewithIEC 61310 series.	Checked to confirm theconformity.	P
	The possibility of inadvertent operationshallbeminimizedby, for example, positioning of devices, suitabledesign, provision of additionalprotective measures.Particular consideration shallbe given to the selection, arrangement,programming anduse of operator input devicessuchas touchscreens, keypads andkeyboards for the controlofhazardousmachine operations, and of sensors(for exampleposition sensor) that caninitiatemachine operation.FurtherinformationcanbefoundinIEC 60447.		P
	Ergonomicprinciples shallbe takeninto accountin thelocation of operator interface devices.		P
10.1.2	Location andmounting		-
	As far asispracticable, machine-mounted control devices shallbe: - readily accessible for service andmaintenance; - mounted in suchamanner astominimizethepossibilityof damage from activities such asmaterialhandling.	Checked to confirm theconformity.	P

	The actuators of hand-operated control devicesshallbeselected andinstalled so that: - they are notless than0,6mabove theservicingleveland are within easyreachof the normal workingposition of the operator; - the operator isnotplacedin ahazardoussituation whenoperating them.		P
	The actuators of foot-operated control devices shallbe		P

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Clause	**Requirement**	**Comment**	**Verdict**
	selected andinstalled so that: - they are within easy reachof thenormal workingpositionof the operator; - the operator isnotplacedin ahazardoussituation whenoperating them.		
10.1.3	Protection		-
	The degree of protection (IPratinginaccordance withIEC60529) togetherwithotherappropriatemeasuresshall provideprotection against:		P
	- the effects of liquids, vapours, or gasesfoundinthephysical environment orused on themachine;		P
	- theingress of contaminants (for example swarf,dust,particulate matter).		P
	the operator interface control devicesshallhavea minimum degree of protection against contact withlive partsofIPXXD(seeIEC60529).		P
10.1.4	Position sensors	Notbeused.	-
	Position sensors(for exampleposition switches, proximity switches) shall be so arrangedthattheywillnotbedamaged in theevent of overtravel.		N/A
	Position sensorsin circuits with safety-related control functions (for example, tomaintain the safe conditionof themachine or preventhazardous situations arisingatthe machine) shallhavedirectopeningaction(seeIEC60947-5-1) orshallprovidesimilarreliability(see9.4.2).		N/A
10.1.5	Portable and pendantcontrolstations		-
	Portable and pendant operator controlstationsandtheir control devices shallbe so selectedandarrangedas to minimize the possibility of machineoperationscausedby inadvertent actuation shocks and vibrations (forexampleif the operator control stationis dropped orstrikesan obstruction) (seealso 4.4.8).		P
10.2	Actuators		-
10.2.1	Colors		-
	Actuators(see 3.1.1) shallbecolor-codedasfollows.		-
	The colours for START/ON actuators shouldbeWHITE,GREY,BLACK or GREEN with apreference for WHITE.RED shallnotbeused.		N/A
	The colourRED shallbeused for emergency stopand emergency switching off actuators (including supply disconnecting devices where itis foreseen that they areforusein an emergency).If abackground existsimmediatelyaround the actuator, then thisbackground shall becoloredYELLOW. The combination of aRED actuator with a YELLOWbackground shall onlybe used for		P

	emergencyoperation devices.		
	The colours for STOP/OFF actuators shouldbeBLACK,GREY, or WHITE with apreference for BLACK.GREEN		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	shallnotbeused.REDispermitted,butitisrecommendedthatREDisNotbeusednear an emergency operation device.		
	WHITE, GREY, or BLACKare thepreferredcoloursforactuators that alternately act asSTART/ONand STOP/OFF. The coloursRED, YELLOW, or GREEN shall notbeused.		P
	WHITE, GREY, or BLACKare thepreferredcoloursfor actuators that cause operation while they areactuatedandcease the operation when they are released(forexample hold-to-run). The coloursRED, YELLOW, or GREEN shall notbeused.		N/A
	Reset actuators shallbeBLUE, WHITE, GREY, orBLACK.Where they also act asaSTOP/OFFactuator, thecolours WHITE, GREY, or BLACKarepreferred with themain preferencebeing forBLACK. GREEN shall notbeused.		N/A
	The color YELLOWisreserved for usein abnormalconditions, for example,in the event of an abnormal condition of theprocess, or to interrupt anautomaticcycle.		N/A
	Where the same colour WHITE, GREY,orBLACKisusedfor various functions (for example WHITE for START/ON and for STOP/OFF actuators) a supplementarymeans ofcoding (for example shape,position, symbol) shallbeusedfor theidentification of actuators.		P
10.2.2	Markings		-
	In addition to the functionalidentification as describedin16.3,recommendedsymbolstobeplacednearto or preferably directly on certain actuatorsare giveninTable2 or3.		P
10.3	Indicator lights anddisplays		-
10.3.1	General		-
	Indicator lights and displays servetogivethe followingtypes ofinformation:		-
	- indication: to attract the operator'sattentionor toindicatethat a certain task shouldbeperformed. ThecoloursRED,YELLOW,BLUE, and GREEN arenormallyusedin this mode; forflashingindicatorlightsanddisplays, see10.3.3.		P
	- confirmation: to confirm a command,or acondition,or toconfirm the termination of a change or transitionperiod. The coloursBLUE and WHITE arenormallyusedin thismode and GREENmaybeusedin somecases.		P
	Indicator lights and displays shallbe selectedandinstalledin such amanner as tobe visible fromthenormalposition oftheoperator (seealsoIEC61310-1).		P

	Circuitsused for visual or audible devicesused to warn persons of animpending hazardous event shallbefittedwith facilities to check the operability of thesedevices.		P
10.3.2	Colours		-
	Indicator lights shouldbe colour-coded withrespect to the		P

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Clause	**Requirement**	**Comment**	**Verdict**
	condition (status) of themachinein accordance with Table4.		
	Indicating towers onmachines shouldhave the applicablecoloursin the following order from the top down;RED, YELLOW,BLUE, GREEN and WHITE.	Notbeused.	N/A
10.3.3	Flashinglights and displays	Notbeused.	-
	For further distinction orinformation and especially togiveadditional emphasis, flashinglights and displays canbe provided for the following purposes:		N/A
	- to attractattention; - to requestimmediate action; - toindicate a discrepancybetween the command andactual state; - toindicate a changein process(flashingduringtransition).		N/A
	Itisrecommended that higher flashing frequencies are usedforhigherpriorityinformation (seeIEC 60073for recommended flashing rates and pulse/pauseratios).		N/A
	Where flashinglights or displays areused toprovide higher priorityinformation, additional acoustic warningsshould beconsidered.		N/A
10.4	Illuminatedpush-buttons		-
	Illuminatedpush-button actuators shallbe colour-coded inaccordance with Tables 2 and 4. Where thereisdifficultyinassigning an appropriate colour, WHITE shallbeused. ThecolourRED for the emergency stop actuator shallnot depend on theillumination ofitslight.		P
10.5	Rotary control devices	Notbeused.	-
	Deviceshaving arotationalmember, such as potentiometers and selector switches, shallhavemeans ofprevention of rotation of the stationarymember.Friction alone shallnotbe considered sufficient.		N/A
10.6	Start devices		-
	Actuatorsused toinitiate a start function or themovement of machine elements (for exampleslides,spindles,carriers) shallbe constructed and mountedsoastominimize inadvertentoperation.	Not thiscase.	N/A
10.7	Emergency stop devices		-
10.7.1	Location of emergency stop devices		-
	Devices for emergency stop shall bereadilyaccessible.		P
	Emergency stop devices shallbeprovided at eachlocationwhere theinitiation of an emergency stop canberequired.		P

	There canbe circumstances where confusion canoccur between active andinactive emergency stopdevices caused by, for example, unplugging orotherwisedisablingthe operator control station.In such cases,means(for example, design andinformation for use) shallbeprovidedto minimizeconfusion.		P

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Clause	**Requirement**	**Comment**	**Verdict**
10.7.2	Types of emergency stop device		-
	The types of device for emergency stopinclude,but are notlimitedto:		-
	- a push-button device for actuationby withapalmor the fist (e.g.mushroomheadtype); - a pull-cordoperatedswitch; - a pedal-operated switch without amechanicalguard.		P
	ThedevicesshallbeinaccordancewithIEC60947-5-5.		P
10.7.3	Operation of the supply disconnecting device toeffectemergency stop		-
	Where a stop category0is suitable,thesupply disconnecting device may serve the function of emergencystop when:		P
	- itis readilyaccessibleto theoperator;and - itisofthetypedescribedin5.3.2a),b),c),ord).		P
	When also intended for such use,thesupplydisconnecting deviceshallmeetthecolourrequirementsof10.2.1		P
10.8	Emergency switching off devices	Notbeused.	-
10.8.1	Location of emergency switching off devices		-
	Emergency switching off devices shallbelocated asnecessary for the given application. Normally, those devices will belocated separate from operator control stations. Where confusion canoccur between emergency stop and emergency switchingoffdevices,means shall beprovided tominimize confusion.		N/A
10.8.2	Types of emergency switching off device		-
	The types of device for initiation of emergency switchingoffinclude:		-
	- a push-button operated switch withapalmormushroomhead type of actuator; - a pull-cordoperatedswitch.		N/A
	The devices shall have directopeningaction(seeIEC 60947-5-1, AnnexKandIEC 60947-5-1:2003/AMD1:2009).		N/A
10.8.3	Local operation of the supply disconnecting device to effectemergency switching off		-
	Where the supply disconnecting deviceis tobelocallyoperated for emergency switching off,it shallbereadilyaccessible and shall meet thecolourrequirementsof 10.8.3.		N/A
10.9	Enabling control device		-
	Enabling control devices shallbe selected andarrangedsoas to minimize thepossibility ofdefeating.		P
	Enabling control devices shallbe selected thathave thefollowing features:		P

	- designed in accordance with ergonomicprinciples; - for a two-position type: -position1: off-functionoftheswitch(actuatorisnot	Threepositions.	P

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Clause	**Requirement**	**Comment**	**Verdict**
	operated); -position 2: enabling function (actuatoris operated). - for a three-position type: -position1: off-functionoftheswitch(actuatorisnot operated); -position 2: enabling function (actuatorisoperatedinits midposition); -position 3: off-function (actuatorisoperatedpastitsmid position); - when returning fromposition 3 toposition 2,theenablingfunctionisnot activated.		
11	Controlgear: location,mounting, and enclosures		-
11.1	Generalrequirements		-
	All controlgear shallbelocated andmounted so astofacilitate:	Checked to confirm theconformity.	P
	- its accessibilityandmaintenance; - its protection againsttheexternalinfluencesorconditionsunder whichitisintended to operate; - operation andmaintenance of the machineanditsassociated equipment.		P
11.2	Location andmounting		-
11.2.1	Accessibility andmaintenance		-
	All items of controlgear shallbeplaced andorientedso that they canbeidentified withoutmoving them or the wiring.For items thatrequire checking for correctoperationor that areliable toneed replacement, thoseactions should bepossible without dismantling other equipmentor parts of themachine (except opening doors orremovingcovers, barriers or obstacles). Terminalsnotpartof controlgear components or devices shall alsoconformtothese requirements.	Checked to confirm theconformity.	P
	All controlgear shallbemounted so as to facilitateits operation and maintenance. Where aspecialtoolis necessary to adjust,maintain, or removea device,suchatool shall be supplied. Where accessisrequired forregularmaintenance or adjustment, therelevant devices shallbe locatedbetween 0,4mand 2,0mabovetheservicing level. Itisrecommendedthatterminalsbeatleast 0,2m above the servicinglevel and be soplacedthatconductorsand cables can beeasilyconnectedtothem.		P
	No devices except devices for operating,indicating, measuring, and cooling shallbemountedon doorsoronnormallyremovable access covers of enclosures. Wherecontrol devices are connected throughplug-in arrangements, their association shallbemade clear by type (shape),marking or reference designation,singlyorin combination (see13.4.5).		P
	Plug-in devices that are handledduringnormaloperation	No suchdevice.	N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	shallbeprovided withnoninterchangeable features wherethelack of such a facility canresultinmalfunctioning.		
	Plug/socket combinations that arehandled duringnormaloperation shallbelocated andmounted so as toprovide unobstructed access.	No suchdevice.	N/A
	Test points for connection of test equipment, whereprovided, shallbe:	Nosuchpoint.	N/A
	- mounted so as toprovideunobstructedaccess; - clearlyidentified to correspond with the documentation; - adequatelyinsulated; - sufficiently spaced.		N/A
11.2.2	Physical separation or grouping		-
	Non-electricalparts and devices, not directlyassociatedwith the electrical equipment, shallnotbelocated withinenclosures containing controlgear.Devices such as solenoid valves should be separated fromtheother electrical equipment (for exampleina separate compartment).		P
	Control devicesmountedin the samelocation and connected to thepower supply, or tobothpower and control circuit should be groupedseparately fromthoseconnected only to the controlcircuits.		P
	Terminals shallbe separated intogroups for:		P
	- powercircuits; - control circuits of themachine; - other control circuits, fed from external sources(forexample for interlocking).		P
	The groupsmaybemounted adjacently, provided thateach group canbereadilyidentified(for exampleby markings,byuse of different sizes,byuse of barriersorbycolours).		P
	When arranging thelocation of devices (including interconnections), the clearances and creepage distancesspecified for them by the supplier shallbemaintained, takinginto account the externalinfluences or conditions ofthe physicalenvironment.		P
11.2.3	Heating effects		-
	The temperature rise insideelectricalequipment enclosures shall not exceed theambient temperaturespecified by the componentmanufacturers.		P
	Heat generating components (for exampleheatsinks, power resistors) shallbe solocated that the temperatureofeach componentin the vicinityremains within thepermitted limit.		N/A
11.3	Degrees of protection		-
	The protection of controlgear againstingress of solid foreign objects and of liquids shallbeadequatetakingintoaccount the external influences under which themachineis intendedtooperate (i.e. thelocationandthephysical	Checked to confirm theconformity.	P

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Clause	**Requirement**	**Comment**	**Verdict**
	environmental conditions) and shallbe sufficientagainstdust, coolants, lubricantsandswarf.		
	Enclosures of controlgear shall provide adegreeof protectionofatleastIP22 (seeIEC60529).		P
	Exception: an enclosure providingaminimum degreeof protectionIP22isnotrequiredwhere:		N/A
	a) An electricaloperatingareaprovidesan appropriate degree of protection againstingressofsolids andliquids,or		N/A
	b)Removable collectors on conductor wire or conductor bar systems areused and themeasures of12.7.1 areapplied.		N/A
11.4	Enclosures, doors andopenings		-
	Enclosures shall be constructed usingmaterialscapableof withstanding themechanical, electrical and thermal stresses as well as the effectsofhumidityandother environmental factors that are likely tobeencounteredinnormal service.	Checked to confirm theconformity.	P
	Fastenersused to secure doors and coversshouldbeofthe captive type.		P
	Windows shall be of amaterial suitableto withstandmechanical stress and chemicalattack.		N/A
	Itisrecommended that enclosure doorsbenot wider than 0,9 m and have verticalhinges,withanangleofopeningof atleast 95°.		P
	Thejoints or gaskets of doors, lids, coversandenclosuresshall withstand the chemical effects of the aggressive liquids, vapours, or gasesused on themachine.		P
	The meansprovided tomaintain the degree ofprotectionof an enclosure on doors, lidsandcoversthatrequire opening or removal for operation ormaintenanceshall:		P
	- be securely attached toeither the door/coveror theenclosure; - not deteriorate due toremoval orreplacementof the dooror the cover, and soimpair thedegreeofprotection.		P
	Where openingsin enclosures are provided(forexample,for cable access), including those towardsthefllooror foundation or to other parts of themachine,meansshallbeprovided to ensure the degree ofprotectionspecified for the equipment. Openings for cable entriesshallbeeasily re-opened on site. A suitable openingmaybeprovidedin the base of enclosures within the machinesothatmoisturedue to condensation candrainaway.		P
	There shallbeno openingbetween enclosures containingelectrical equipment and compartments containingcoolant,lubricating or hydraulic fluids, or thoseinto which oil,otherliquids, or dust can penetrate. Thisrequirementdoesnot apply to electrical devices specifically designed tooperate in oil(for example electromagnetic clutches)nor toelectrical equipmentin which coolants areused.		P

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Clause	**Requirement**	**Comment**	**Verdict**
	Where there areholesin an enclosure formounting purposes,meansmaybenecessary to ensure that aftermounting, theholes donotimpair the requiredprotection.		P
	Equipment that, in normalorabnormaloperation,can attain a surface temperature sufficient tocauseariskof fireor harmful effect to anenclosurematerialshall:		P
	- be located within anenclosure that will withstand, without riskoffireorharmfuleffect,suchtemperaturesascanbegenerated ; and - bemounted and locatedatasufficientdistance from adjacent equipment so as to allowsafedissipationofheat(seealso11.2.3);or - be otherwise screenedbymaterial that can withstand, without risk of fire or harmfuleffect,theheatemittedbytheequipment.		P
11.5	Access to electrical equipment		-
	Doorsin gangways and for access to electricaloperatingareas shall:		N/A
	- beatleast0,7mwideand 2,0mhigh; - open outwards; - have a means(forexamplepanicbolts) toallowopeningfrom theinside without theuse of akey or tool.		N/A
12	Conductors andcables		-
12.1	Generalrequirements		-
	Conductors and cables shallbe selectedsoastobe suitable for the operating conditions (forexample voltage,current, protection against electric shock,groupingof cables) and externalinfluences (for exampleambient temperature,presence of water or corrosive substances, mechanical stresses (including stresses during installation), fire hazards) that canexist.	Checked to confirm theconformity.	P
	These requirements donot apply totheintegralwiringofassemblies, subassemblies, and devices thatare manufactured and testedin accordance with their relevant IECstandard(forexampleIEC 61800 series).		P
12.2	Conductors		-
	Conductors should be of copper. Wherealuminum conductors areused, the cross-sectional area shallbeat least16mm2.	Checked to confirm theconformity.	P
	To ensure adequatemechanical strength, thecross-sectional area of conductors shouldnotbeless than as shownin Table 5.However, conductors with smaller cross-sectional areas or other constructions than showninTable 5maybeusedin equipment provided adequate mechanical strengthis achieved byothermeansandproper functioningisnotimpaired.		P
	All conductors that are subject to frequentmovement shouldhave flexible stranding of class 5 orclass6(see tableC.4)		P

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Clause	**Requirement**	**Comment**	**Verdict**
12.3	Insulation		-
	Where theinsulation of conductors andcables can constitute hazards due for example to thepropagationof afire or the emission of toxic or corrosive fumes,guidance from the cable supplier shouldbe sought.Itisimportant togive special attention to theintegrity of acircuithavinga safety-related function.	Checked to confirm theconformity.	P
	The insulation of cables and conductorsused,shallbesuitable for a test voltage: -Notlessthan 2000VACforadurationof5minfor operationatvoltagehigherthan 50VACor120V DC,or -Notlessthan 500VACforadurationof5minfor PELVcircuits(seeIEC 60364-4-41, classIII equipment).		P
	The mechanical strength and thickness of theinsulationshallnotbe damagedin operation or duringlaying, especially for cablespulledinto ducts.		P
12.4	Current-carrying capacityinnormal service		-
	The current-carrying capacity depends on several factors, for exampleinsulation material,number of conductorsin acable, design (sheath),methods of installation,grouping and ambient temperature.	Checked to confirm theconformity.	P
	One typical example of the current-carrying capacities for PVCinsulated wiring between enclosures andindividual items of equipmentunder steady-state conditionsis given inTable6.		P
12.5	Conductor and cable voltage drop		-
	The voltage drop from thepoint of supply to theloadshall notexceed 5 %ofthenominalvoltageundernormal operating conditions.In order to conform to this requirement,it canbenecessary to use conductorshavinga larger cross-sectional area than that derivedfromTable 6.	Checked to confirm theconformity.	P
	In control circuits, the voltage drop shallnotreducethevoltage at any devicebelow themanufacturer's specification for that device, taking into accountinrushcurrents.		P
	The voltage dropin components, for example overcurrentprotective devices and switching devices,shouldbe considered.		P
12.6	Flexible cables		-
12.6.1	General		-
	Flexible cables shall haveClass 5orClass6conductors.		P

	Cables that are subjected to severe dutiesshallbeofadequate construction to protectagainst: – abrasion due tomechanical handlinganddraggingacrossrough surfaces;	Checked to confirm theconformity.	P

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Clause	**Requirement**	**Comment**	**Verdict**
	– kinking due to operationwithoutguides; – stressresulting from guide rollers and forcedguiding,being wound and re-wound oncabledrums.		
12.6.2	Mechanical rating		-
	The cablehandling system of the machineshallbeso designed to keep the tensile stressof theconductorsas low asispracticable duringmachine operations. Wherecopper conductors areused, the tensile stress appliedto theconductorsshallnotexceed15N/mm2 ofthecopper cross-sectional area. Where the demands of the applicationexceedthetensilestresslimitof15N/mm2,cables with special construction features shouldbe used and the allowedmaximal tensile stress shouldbeagreedwith the cablemanufacturer.	Checked to confirm theconformity.	P
	The maximum stress applied to theconductorsof flexiblecables withmaterial other than copper shall be withinthecablemanufacturer's specification.		P
12.6.3	Current-carry capacity of cables wound on drums	Notbeused.	-
	Cables tobe wound on drums shallbe selected with conductorshaving a cross-sectional area such that, whenfully wound on the drum and carrying thenormalservice load, themaximum allowable conductor temperature isnotexceeded.		N/A
	For cables of circular cross-sectional areainstalled on drums, the maximum current-carrying capacityin freeairshould be deratedinaccordance with Table7.		N/A
12.7	Collector wires, collector bars and slip-ringassemblies		-
12.7.1	Basicprotection		-
	Conductor wires, conductor bars and slip-ring assembliesshallbeinstalled or enclosed in suchawaythat,during normal access to themachine, basicprotectionisachieved by the application of one of the followingprotectivemeasures:		P
	– protectionbypartial insulation ofliveparts,or where thisisnotpracticable; – protectionbyenclosuresorbarriersofatleastIP2X		P
	Horizontal top surfaces of barriers or enclosuresthatare readily accessible shallprovide a degree ofprotectionof at leastIP4XorIPXXD		P
	Where therequired degree of protectionisnot achieved,protection byplacingliveparts out of reachincombination withemergencyswitchingoffinaccordancewith9.2.5.4.3shallb e applied.		P

	Conductor wires and conductor bars shallbesoplacedand/or protectedas to: – prevent contact, especially forunprotectedconductor wires and conductor bars, with conductiveitemssuchasthe cords of pull-cord switches, strain-relief devicesand drive chains;		P

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Clause	**Requirement**	**Comment**	**Verdict**
	- prevent damage froma swingingload.		
12.7.2	Protective conductors		-
	Where conductor wires, conductor bars andslip-ring assemblies areinstalled aspart of theprotective bondingcircuit, they shallnot carry currentinnormaloperation. Therefore, theprotective conductor (PE) and theneutralconductor (N) shall eachuse a separateconductorwire,conductor bar orslip-ring.		P
	The continuity of protective conductorusingsliding contacts shall be ensuredby takingappropriatemeasures(for example, duplication of the current collector, continuitymonitoring).		N/A
12.7.3	Protective conductor current collectors		-
	Protective conductor current collectors shallhave ashapeor construction so that they arenotinterchangeable withthe other current collectors. Suchcurrentcollectorsshall be of the slidingcontact type.		N/A
12.7.4	Removable current collectors with a disconnector function		-
	Removable current collectorshaving a disconnector function shallbe so designed that theprotective conductor circuitisinterrupted only after thelive conductorshavebeen disconnected, and the continuity of theprotectiveconductor circuitisre-established before anylive conductor isreconnected		N/A
12.7.5	Clearancein air		-
	Clearancesbetween the respective conductors, and between adjacent systems, of conductor wires, conductorbars, slip-ring assemblies and their currentcollectorsshallbe suitable forat least a rated impulse voltageofanovervoltagecategoryIII inaccordancewithIEC 60664-1.		N/A
12.7.6	Creepage distances		-
	Creepage distances between therespective conductors, between adjacent systems of conductor wires, conductorbars and slip-ring assemblies, and theircurrentcollectors shallbe suitable for operation in theintended environment, for example open air,inside buildings,protectedbyenclosures.		N/A
	In abnormally dusty, moist orcorrosiveenvironments,thefollowing creepage distancerequirements apply: - unprotected conductor wires, conductor bars,andslip-ring assemblies shall be equippedwithinsulators witha minimumcreepagedistanceof 60mm; - enclosed conductor wires, insulated multipoleconductorbars andinsulatedindividual conductor barsshallhavea minimumcreepagedistanceof 30mm.		N/A

	The manufacturer'srecommendations shallbe followed regarding special measures toprevent a gradualreductionin theinsulation values due to unfavourableambient		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	conditions(for example deposits of conductive dust,chemical attack).		
12.7.7	Conductor system sectioning		-
	Where conductor wires or conductor barsarearrangedsothat they canbe dividedintoisolated sections, suitable designmeasures shallbe employed to preventthe energization of adjacent sectionsby the current collectorsthemselves.		N/A
12.7.8	Construction andinstallation of conductor wire, conductorbar systems and slip-ringassemblies		-
	Conductor wires, conductor bars and slip-ring assemblies inpower circuits shallbe grouped separately from thoseincontrol circuits.		N/A
	Conductor wires, conductor bars and slip-ringassemblies,including their current collectors, shallbe capableof withstanding, without damage, the mechanical forces andthermal effects of short-circuit currents.		N/A
	Removable covers for conductor wire and conductorbarsystemslaidunderground or underfloor shallbe so designed that they cannotbe openedbyonepersonwithout the aidofatool.		N/A
	Where conductor bars areinstalledinacommonmetal enclosure, the individual sections of the enclosureshallbebonded together and connected to aprotectivebonding circuit.Metal covers of conductor barslaid undergroundorunderfloor shall also be bondedtogether andconnectedtoa protectivebondingcircuit.		N/A
	The protectivebonding circuit shallinclude thecoversor cover plates of metal enclosuresorunderfloor ducts. Wheremetalhinges form apart of thebonding circuit, their continuityshallbeverified(seeClause18)		N/A
	Conductor bar ducts that canbe subject toaccumulationofliquid such as oil or water shallhavedrainage facilities.		N/A
13	Wiringpractices		-
13.1	Connections androuting		-
13.1.1	Generalrequirements		-
	All connections, especially those of theprotective bondingcircuit, shallbe secured against accidentalloosening.	Checked to confirm theconformity.	P
	The means of connection shallbe suitable for thecross-sectional areas and natureof the conductorsbeing terminated.		P
	The connection of two or more conductorstoone terminalispermitted onlyin those cases where the terminalis designed for that purpose.However, only oneprotectiveconductor shall be connected to oneterminalconnecting point.		P

	Soldered connections shall onlybepermitted whereterminals are provided that aresuitableforsoldering.		P
	Terminals on terminalblocks shallbeplainlymarked or		P

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Clause	**Requirement**	**Comment**	**Verdict**
	labelled to correspond with theidentificationusedin thediagrams.		
	Where anincorrect electrical connection (forexample,arising from replacement of devices)isidentified asasource of risk thatneeds tobereducedanditisnot practicable to reduce the possibilityof incorrectconnectionby design measures, the conductors and/orterminations shallbeidentified.		P
	The installation of flexible conduits andcablesshallbesuch thatliquids shall drain awayfrom the fittings.		P
	Means of retaining conductor strands shallbeprovided when terminating conductors at devices or terminalsthatarenot equipped with this facility. Solder shallnotbeusedfor thatpurpose.		P
	Shielded conductors shall be soterminatedastopreventfraying of strands and topermit easydisconnection.		P
	Identification tags shallbelegible,permanent, andappropriate for thephysical environment.		P
	Terminalblocks shallbemounted and wired so that thewiring doesnot cross over the terminals.		P
13.1.2	Conductor and cableruns		-
	Conductors and cables shallberun from terminalto terminal without splices orjoints.Connections using plug/socket combinations with suitableprotection againstaccidental disconnection are notconsidered tobesplices orjointsforthepurposeof13.1.2.	Checked to confirm theconformity.	P
	Exception: whereitisimpracticable toprovide terminalsinajunction box (for exampleonmobilemachines,on machineshavinglong flexible cables; cable connections exceeding alength whichisnotpractical tobe suppliedbythe cablemanufacturer on one cable drum),splicesor jointsmaybeused.		P
	Whereitisnecessary to connect and disconnect cablesand cable assemblies, a sufficientextralength shallbe provided for thatpurpose.		P
	The terminations of cables shallbe adequately supportedto prevent mechanical stresses attheterminationsof theconductors.		P
	Wherever practicable, the protective conductorshallbeplaced close to the associatedlive conductorsinorder todecrease theimpedance of theloop.		P
13.1.3	Conductors of different circuits		-

	Conductors of different circuitsmaybelaid sideby side, may occupy the same duct(for exampleconduit,cable trunking system), or maybein thesamemulticonductor cable or in the sameplug/socket combinationprovidedthatthe arrangement doesnotimpair theproper functioning ofthe respectivecircuitsand: - Where those circuitsoperateatdifferentvoltages,the conductors shallbe separatedby suitable	Checked to confirm theconformity.	P

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Clause	**Requirement**	**Comment**	**Verdict**
	barriersor - insulated for thehighestvoltageto whichanyof theconductors canbe subjected, for exampleline to line voltage for unearthed systems andphasetoearth voltage for earthed systems.		
13.1.4	AC circuits -Electromagnetic effects (prevention of eddycurrents)		-
	Conductors of AC circuitsinstalledin ferromagnetic enclosures shall be arranged so thatallconductorsof eachcircuit, including the protective conductorof eachcircuit, are containedin the same enclosure. Wheresuch conductors enter a ferrous enclosure, theyshallbe arranged such that the conductors arenotindividuallysurrounded by ferromagneticmaterial.		P
	Single-core cables armoured with steel wire or steel tapeshouldnotbeused for AC circuits.		P
13.1.5	Connection between pick-up andpick-up converterof aninductive power supplysystem	No suchsystem	-
	The cable between thepick-up and thepick-upconverter shallbe: - as shortaspracticable; - adequately protected againstmechanical damage.		N/A
13.2	Identification of conductors		-
13.2.1	Generalrequirements		-
	Each conductor shall be identifiableateachterminationinaccordance with the technical documentation.	Checked to confirm theconformity.	P
	Itisrecommended (for example to facilitatemaintenance)that conductorsbe identified bynumber,alphanumeric, colour (eithersolidorwithoneormorestripes),oracombination of colour andnumbers or alphanumeric. Whennumbers are used, they shallbe Arabic;lettersshallbeRoman (either upperorlowercase).		P
13.2.2	Identification of the protective conductor/protective bondingconductor		-
	The protective conductor/protectivebonding conductor shallbe readily distinguishable from other conductorsby shape,location, marking, or colour. Whenidentificationisby colour alone, thebicolour combinationGREEN-ANDYELLOW shall be used throughout thelengthof theconductor. This colour identification isstrictlyreservedforthe protective conductors/protective bonding conductors.	Checked to confirm theconformity.	P
	For insulated conductors, the bicolourcombination GREEN-AND-YELLOWshallbesuchthatonany15mm length, oneofthecolourscoversatleast30 %andnot morethan 70 % ofthesurfaceoftheconductor,theother colour covering the remainder of the surface.		P

	Where theprotective conductors can beeasilyidentifiedbyits shape, position, or construction(for exampleabraidedconductor,uninsulated stranded conductor), or where theinsulated conductor isnot readilyaccessibleorispartof a		P

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Clause	**Requirement**	**Comment**	**Verdict**
	multicore cable, colour coding throughoutitslengthisnotnecessary.However, where the conductor isnot clearlyvisible throughoutitslength, the ends or accessible locations shallbe clearlyidentified by the graphicalsymbol IEC 60417-5019:2006-08 (seefigure16) orwiththeletterPE or by the bicolour combinationGREEN-AND-YELLOW.		
13.2.3	Identification of the neutral conductor		-
	Where a circuit includesaneutralconductor thatis identified by colour alone, thecolourusedfor this conductor shall beBLUE.In order to avoidconfusion withother colours,itisrecommended that an unsaturatedblue beused, calledhere “lightblue”(see3.2.2ofIEC60445:2010). Wheretheselectedcolouristhesole identification of the neutral conductor, that colour shall not beused foridentifyinganyother conductorwhere confusionispossible.		P
	Whereidentification by colour isused,bareconductors used asneutral conductors shall beeithercolouredbya stripe,15mmto100mmwideineachcompartmentorunit and at each accessiblelocation, or colouredthroughout theirlength.		P
13.2.4	Identification bycolour		-
	Where colour-codingisused for identification of conductors(other than theprotective conductor (see13.2.2) andtheneutralconductor(see13.2.3)),the following coloursmaybe used: BLACK,BROWN,RED, ORANGE, YELLOW, GREEN, BLUE (includingLIGHTBLUE), VIOLET, GREY, WHITE,PINK, TURQUOISE.		P
	Itisrecommended that, where colour isused for identification, the colour beused throughoutthelength ofthe conductor either by thecolour of theinsulationorby colourmarkers atregular intervals andat theendsor accessiblelocation.		P
	For safetyreasons, the colour GREEN orthecolour YELLOW shouldnotbe used where thereis apossibilityofconfusion with thebicolour combination GREEN-AND- YELLOW (see13.2.2).		P
	Colour identification using combinations of thosecolourslisted abovemaybeusedprovided there canbeno confusion and that GREEN or YELLOWisNotbeused except in the bicolour combinationGREEN-AND-YELLOW.		P
	Where colour-codingisused for identification of conductors,itisrecommended that theybe colour-codedas follows: –BLACK: a.c. andd.c.powercircuits; –RED: a.c. controlcircuits; –BLUE: d.c. controlcircuits; – ORANGE: exceptedcircuitsinaccordancewith5.3.5.		P

	Exceptions to the above arepermitted where:		P

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Clause	**Requirement**	**Comment**	**Verdict**
	- insulation isused thatisnotavailablein thecoloursrecommended (for exampleinmulticonductor cables)		
13.3	Wiringinside enclosures		-
	Conductorsinside enclosures shall be supported where necessary to keep them inplace.Non-metallicductsshallbe permitted only when they aremade witha flame-retardantinsulatingmaterial (seetheIEC 60332series).	Checked to confirm theconformity.	P
	Itisrecommended that electrical equipmentmounted inside enclosuresbe designed and constructedinsuchaway as topermit modification of the wiring from the frontof theenclosure(seealso11.2.1). Wherethatisnot practicable and control devices areconnected fromtherear of the enclosure, access doors or swingoutpanelsshallbeprovided.		P
	Connections to devicesmounted on doors or toother movableparts shall bemade using flexibleconductorsin accordancewith12.2 and12.6 toallowforthefrequent movement of the part. The conductorsshallbeanchored tothe fixedpart and to the movablepartindependentlyof the electricalconnection (seealso8.2.3and11.2.1).		P
	Conductors and cables that donotruninductsshallbeadequately supported.		P
	Terminalblocks or plug/socket combinations shallbeusedfor control wiring that extendsbeyond the enclosure.For plug/socketcombinations, seealso13.4.5 and13.4.6.		P
	Power cables and cables ofmeasuringcircuitsmaybe directly connected to the terminals of thedevices for whichthe connections were intended.		P
13.4	Wiring outside enclosures		-
13.4.1	Generalrequirements		-
	The means of introduction of cablesorducts withtheir individual glands,bushings, etc., intoanenclosure shallensure that the degree of protectionisnotreduced(see11.3).	Checked to confirm theconformity.	P
	Conductors of a circuit shall notbedistributedover differentmulti-core cables, conduits, cable ducting systems or cable trunking systems. Thisisnot required wherea number of multi-core cables, forming one circuit,are installedinparallel. Wheremulti-core cables areinstalled inparallel, each cable shall contain oneconductorof eachphase and theneutralif any.		P
13.4.2	External ducts		-
	Conductors and their connections external to theelectrical equipment enclosure(s) shallbe enclosedin suitableducts(i.e. conduitorcabletrunkingsystems)asdescribedin 13.5 exceptforsuitablyprotectedcablesthatmaybe installed without ducts and with or without theuse of cabletrays or cable supportmeans. Where devices suchas position switches or proximity switchesare supplied witha		P

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Clause	**Requirement**	**Comment**	**Verdict**
	dedicated cable, their cableneednot beenclosedinaductwhen the cable is suitable forthepurpose,sufficiently short, and so located orprotected, thattheriskof damageisminimized.		
	Fittingsused with ducts or cables shallbe suitableforthephysical environment.		P
	Flexible conduit or flexiblemulticonductor cable shallbe used whereitisnecessary to employ flexible connectionsto pendant push-button stations. The weightof thependantstations shall be supportedbymeans other thanthe flexible conduit or the flexiblemulticonductor cable, exceptwhere the conduit or cable isspecificallydesignedfor thatpurpose.		P
13.4.3	Connection tomoving elements of themachine		-
	The design of connections to movingpartsshall takeintoaccount the foreseeable frequency of movement and shall bemadeusingconductorsinaccordancewith12.2and 12.6.Flexiblecableandflexibleconduitshallbeso installed as to avoid excessive flexingandstraining,particularly at the fittings.		P
	Cables subject tomovement shallbe supportedin suchaway that thereisno mechanical strainontheconnection pointsnor any sharp flexing. When thisis achievedby theprovision of a loop, itshallhavesufficientlength toprovidefor a bending radiusof thecableas specifiedbythecablemanufacturer or if no suchspecificationisgiven,atleast 10 timesthediameterofthecable.		P
	Flexible cables of machines shallbesoinstalledor protected as tominimize the possibility ofexternaldamage due to factors thatinclude the following cableuse orpotential abuse: - beingrun overby themachineitself; - beingrun over byvehiclesorothermachines; - cominginto contact with the machine structureduringmovements; - running in andoutof cablebaskets,oronoroff cabledrums; - acceleration forces and wind forces on festoon systemsor suspended cables; - excessive rubbingbycable collector; - exposure to excessiveradiatedheat.		P
	The cable sheath shall beresistant tothenormal wearthat can be expected frommovement and totheeffectsofenvironmental contaminants (for example oil, water,coolants, dust).		P

	Where cables subject tomovement are closetomoving parts,precautions shallbe taken tomaintain a space of atleast 25 mm betweenthemovingpartsandthecables. Where that distanceisnotpracticable, fixedbarriers shallbe provided between thecablesand themovingparts.		P

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Clause	**Requirement**	**Comment**	**Verdict**
	The cable handling systemshallbe sodesigned that lateral cable angles donot exceed5°, avoiding torsioninthe cable when: - being wound on andoff cabledrums;and - approaching andleaving cable guidancedevices.		P
	Measures shallbe taken to ensure that atleasttwoturnsofflexible cables alwaysremain onadrum.		P
	Devices serving to guide and carrya flexiblecableshallbeso designed that theinnerbending radiusatallpoints where the cableisbentisnot less than thevaluesgiveninTable 8,unless otherwise agreed with thecable manufacturer, taking into account thepermissible tensionand the expected fatiguelife.		P
	The straight sectionbetween twobends shall beatleast20 timesthediameterofthecable.		P
	Where flexible conduitis adjacent tomoving parts,the construction and supporting means shallpreventdamageto the flexible conduit under all conditionsof operation.		P
	Flexible conduit shall notbeused for connectionssubjectto rapid or frequentmovements except whenspecifically designed for that purpose.		P
13.4.4	Interconnection of devices on themachine		-
	Where severalmachine-mounted devices (for example position sensors, pushbuttons) are connectedinseriesorinparallel,itisrecommended that the connections between those devicesbemade through terminals formingintermediate testpoints. Such terminals shallbe conveniently placed, adequatelyprotected, and shown onthe relevantdiagrams.		P
13.4.5	Plug/socket combinations		-
	Components or devicesinside an enclosure, terminatedbyfixedplug/socket combinations (no flexible cable),or components connected to a bussystembyaplug/socket combination, arenot considered tobeplug/socket combinationsforthepurposeofthis13.4.5.		P
	After installationin accordance withitem a)below, plug/socket combinations shall be of suchatypeasto prevent unintentional contact withliveparts atany time,including duringinsertion or removal of the connectors. The degree of protection shallbe atleastIP2XorIPXXB.PELV circuits are excepted from thisrequirement.		P
	Where theplug/socket contains a contact for theprotectivebonding circuit,it shall have a firstmakelastbreakcontact(seealso8.2.4).		P

	Plug/socket combinationsintended to be connectedor disconnected duringload conditions shallhave sufficient load-breaking capacity. Where theplug/socket combination isratedat 30 A, orgreater,itshallbeinterlockedwitha switching device so that the connection anddisconnectionispossible only when the switching deviceisintheOFF		P

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Clause	**Requirement**	**Comment**	**Verdict**
	position.		
	Plug/socketcombinationsthatareratedatmorethan16 Ashallhave aretainingmeans topreventunintended or accidental disconnection.		P
	Where anunintended or accidental disconnectionof plug/socket combinations can cause ahazardous situation,they shallhave aretainingmeans.		N/A
	The installation of plug/socket combinationsshall fulfil thefollowing requirements asapplicable:		P
	a) The component which remainslive afterdisconnectionshallhave a degree of protectionofatleastIP2Xor IPXXB, takinginto account the required clearanceand creepage distances.PELV circuits are excepted from thisrequirement.		P
	b)Metallichousings of plug/socket combinations shallbeconnected to theprotectivebonding circuit.		P
	c)Plug/socket combinationsintended to carrypower loadsbutnot tobe disconnected duringload conditionsshall have a retainingmeans topreventunintended or accidental disconnection and shallbe clearlymarked thatthey arenotintended to be disconnectedunderload.		P
	d) Wheremore than oneplug/socket combinationis provided in the same electrical equipment,theassociatedcombinations shall be clearlyidentifiable.Itis recommended thatmechanical coding be usedtopreventincorrectinsertion.		P
	e)Plug/socket combinationsused in control circuitsshall fulfiltheapplicablerequirementsofIEC61984.		P
	Exception:Inplug/socket combinationsin accordance with IEC 60309-1, onlythosecontactsshallbeusedforcontrol circuits which areintended for thosepurposes. This exception doesnot apply to controlcircuitsusinghigh frequency signals superimposed on the powercircuits.		N/A
13.4.6	Dismantling for shipment		-
	Whereitisnecessary that wiring be disconnected for shipment, terminals or plug/socket combinationsshallbeprovided at the sectionalpoints. Such terminalsshallbe suitably enclosed and plug/socketcombinations shallbe protected from thephysical environment during transportation and storage.		P
13.4.7	Additional conductors		-
	Consideration should be given toproviding additionalconductors for maintenance orrepair. When spare conductors areprovided, theyshallbe connected to spare terminals or isolatedin suchamanneras to preventcontact withliveparts.	No suchconductor.	N/A
13.5	Ducts, connectionboxes and otherboxes		-
13.5.1	Generalrequirements		-
	Ducts shall provide a degreeofprotectionsuitable for the		P

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Clause	**Requirement**	**Comment**	**Verdict**
	application (seeIEC60529).		
	All sharp edges, flash, burrs,rough surfaces,or threads with which theinsulation of the conductors cancomein contact shallbe removed from ducts andfittings. Where necessary, additional protection consisting of a flame-retardant, oil-resistantinsulating material shall beprovidedto protect conductorinsulation.		P
	Drainholes of 6mm diameter arepermittedin cable trunking systems, connection boxes, andotherboxesusedfor wiringpurposes that can be subject toaccumulations ofoil ormoisture.		P
	In order to prevent confusion ofconduitswithoil,air,or water piping,itisrecommended that the conduitsbe eitherphysically separated or suitablyidentified.		P
	Ducts and cable trays shallberigidlysupportedand positioned at a sufficient distance frommovingparts andinsuch a manner so as tominimizethepossibilityof damage orwear.		P
	In areas wherehumanpassageisrequired, the ducts andcable trays shall bemountedatleast2mabove the working surface.		P
	Cable trays that arepartially covered shouldnotbe considered tobe ducts or cable trunkingsystems(see 13.5.6), andthecablesusedshallbeofatypesuitablefor installation on open cabletrays.		N/A
	Itisrecommended that the dimensions and arrangement of ductsbe such as to facilitate theinsertion of the conductors and cables.		P
13.5.2	Rigid metal conduitand fittings	Notbeused.	-
	Rigidmetal conduit and fittings shall beof galvanizedsteelor of a corrosion-resistantmaterial suitable for the conditions. Theuse of dissimilar metalsin contact thatcancause galvanic action shouldbeavoided.		N/A
	Conduits shallbe securelyheldinplace and supported ateachend.		N/A
	Fittings shallbe compatible with theconduit and appropriate for the application.Fittings shouldbe threadedunless structural difficultiesprevent assembly. Where threadless fittings areused, the conduit shallbe securelyfastened to the equipment.		N/A
	Conduitbends shallbe made insuchamanner thatthe conduit shallnotbe damaged and theinternal diameter ofthe conduit shallnotbe effectivelyreduced.		N/A
13.5.3	Flexiblemetal conduit and fittings	Notbeused.	-
	A flexiblemetal conduit shall consist of a flexiblemetaltubing or woven wire armour.It shallbe suitable for theexpectedphysical environment.		N/A
	Fittings shallbe compatible with theconduit andappropriate for the application.		N/A
13.5.4	Flexiblenon-metallic conduit and fittings		-

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Clause	**Requirement**	**Comment**	**Verdict**
	Flexiblenon-metallic conduit shallbe resistant to kinking and shallhavephysical characteristics similar tothose of the sheath of multiconductor cables.		P
	The conduit shallbe suitable for useintheexpectedphysical environment.		P
	Fittings shallbe compatible with theconduit andappropriate for the application.		P
13.5.5	Cable trunking systems		-
	Cable trunking systems external to enclosuresshallberigidly supported and clear of allmovingpartsof the machine and of sources of contamination.	Checked to confirm theconformity.	P
	Covers shall be shaped to overlapthesides;gasketsshallbepermitted.		P
	Covers shall be attached tocabletrunkingsystemsbysuitablemeans.		P
	On horizontal cable trunking systems, thecovershallnotbe on the bottomunless specificallydesigned forsuch installation.		P
	Where the cable trunking system isfurnishedinsections,the jointsbetween sections shall fit tightlybutneed notbegasketed.		P
	The only openingspermitted shall be thoserequiredforwiring or for drainage.		P
	Cable trunking systems shallnothave openedbutunusedknockouts.		P
13.5.6	Machine compartments and cable trunking systems		-
	Are isolated from coolant or oilreservoirsandareentirelyenclosed.	Checked to confirm theconformity.	P
	Conductorsrun in enclosed compartmentandcable trunking systems shall be sosecuredandarranged thatthey arenot subject todamage		P
13.5.7	Connection boxes andotherboxes		-
	Shallbe accessible formaintenance.		P
	Shall provide protectionagainst theingressof solidbodies andliquids, taking into accounttheexternal influences under which the machineisintendedto operate (see11.3).		P
	Shallnothave openedbutunusedknockoutsnor any otheropening and shallbe so constructedas toexclude materials such as dust, flyings,oil,andcoolant		P
13.5.8	Motor connectionboxes		-
	Shall enclose only connections to themotorandmotor-mounted devices		P
14	Electricmotors and associated equipment		-
14.1	Generalrequirements		-
	Electricmotor should conform to the requirementsofIEC60034 series		P

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Clause	**Requirement**	**Comment**	**Verdict**
	The protection requirements formotors andassociated equipmentaregivenin 7.2 forovercurrentprotection, in 7.3 forprotectionofmotorsagainstoverheating,andin7.6for overspeed protection.		P
	As many controllers donotswitchoff thesupplytoa motor when it isatrest,careshallbetaken toensure compliancewiththerequirementsof 5.3,5.4, 5.5,7.5,7.6 and 9.4. Motorcontrolequipmentshallbelocated andmountedinaccordancewithClause11.		P
14.2	Motor enclosures		-
	Enclosures for motors should beinaccordance withIEC60034-5.		P
	The degree of protection shallbe dependentonthe applicationandthephysicalenvironment(see 4.4). All motors shallbe adequatelyprotected frommechanicaldamage.		P
14.3	Motor dimensions		-
	As far asispracticable, the dimensions of themotors shall conformtothosegiveninthelEC 60072series.		P
14.4	Motor mounting andcompartments		-
	Eachmotor andits associated couplings,belts andpulleys, or chains, shall be somounted that theyareadequatelyprotected and are easily forinspectionmaintenance, adjustment and alignment, lubrication, andreplacement.	Checked to confirm theconformity.	P
	The motor mounting arrangementshallbe suchthatallmotor mountingmeans canbe removedandall terminalboxes areaccessible.		P
	The proper cooling shallbe ensuredand thetemperaturerise remains within thelimits of theinsulation class.		P
	Motor compartment shouldbe clean and dry,andwhen required, shallbe ventilated directly to the exterior of themachine.		P
	The vents shall be such thatingressof swarf,dust,orwater sprayis at anacceptablelevel.		P
	There shallbeno openingbetween themotor compartment and any other compartmentthatdoesnotmeet themotor compartment requirements.		P
	where a conduit or pipeisrunintothemotorcompartmentfrom another compartmentnot meet themotor compartment requirements, any clearancearound theconduit or pipeshallbesealed.		P
14.5	Criteria for motor selection		-
	Shallbe selected according to the anticipated serviceandphysical environment conditions	Checked to confirm theconformity.	P
	In this respect, thepoints thatshallbeconsideredinclude:		P
	- type ofmotor;		P
	- typeofdutycycle(seeIEC 60034-1);		P

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Clause	**Requirement**	**Comment**	**Verdict**
	- fixed speed or variable speed operation,(and theconsequent variableinfluence of the ventilation);		P
	- mechanical vibration;		P
	- type of motorcontrol;		P
	- temperature rise and other effectsof the frequency spectrum of the voltage and/or current feeding themotor(particularly whenitis supplied from a converter);		P
	- method of starting and thepossibleinfluenceof the inrush current on the operationof otherusersof the same power supply, taking alsointo accountpossiblespecial considerations stipulatedby the supply authority;		P
	- variation of counter-torque load with time and speed;		P
	- influence ofloads withlargeinertia		P
	- influence of constant torque or constantpower operation;		P
	- possibleneed of inductivereactorsbetweenmotor andconverter.		P
14.6	Protective devices for mechanicalbrakes		-
	Operation of the overload and overcurrentprotective devices for mechanical brake actuatorsshallinitiatethe simultaneous de-energization (release) of the associatedmachine actuators	Checked to confirm theconformity.	P
15	Socket-outlets andlighting	Notbeused.	-
15.1	Socket-outlet Accessories		-
	Socket-outlets for accessory equipment shall comply:		N/A
	ShouldconformtoIEC 60309-1. Wherethatisnot possible, they shouldbe clearlymarked with the voltageand currentratings		N/A
	The continuity of the protectivebonding circuittothesocket-outlet shallbe ensured;		N/A
	All unearthed conductors: Overcurrentor overload protectionaccordingto 7.2 and7.3 separatelyfromthe protection of other circuits		N/A
	where the power supply to thesocketoutletisnot disconnectedby the supply disconnecting device, the clause 5.3.5shallapply		N/A
	- where faultprotectionisprovidedby automatic disconnection of supply, the disconnection time shallbe in accordancewithTableA.1 forTNsystemsorTableA.2 forTT systems;		N/A
	- circuits supplying socket-outlets with a currentratingnotexceeding 20 A shallbe provided withresidual current protection (RCDs) with a ratedoperatingcurrentnot exceeding 30mA.		N/A
15.2	Locallighting of themachine and equipment		-
15.2.1	General		-
	The ON-OFF switch shallnotbeincorporatedin the		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	lampholder or in the flexible connectingcords		
	Stroboscopic effects fromlights shallbe avoided.		N/A
	Where fixed lightingisprovidedin anenclosure, electromagnetic compatibility should be takeninto account usingtheprinciplesoutlinedin 4.4.2.		N/A
15.2.2	Supply		-
	The nominal voltage of thelocallighting circuit shallnot exceed 250 Vbetweenconductors. Avoltagenot exceeding 50 V between conductorsisrecommended.		N/A
	Lighting circuits shall be supplied fromoneof the following sources (seealso7.2.6):		-
	- a dedicatedisolating transformer connected to theloadside of the supply disconnecting device. Overcurrent protection shall beprovidedin the secondarycircuit;		N/A
	- a dedicatedisolating transformer connected to theline side of the supply disconnecting device. That sourceshallbe permitted for maintenancelighting circuitsincontrol enclosures only. Overcurrent protection shallbeprovided inthesecondarycircuit(seealso5.3.5);		N/A
	- a circuit of the electrical equipmentof themachine forlighting, with dedicated overcurrentprotection;		N/A
	- anisolating transformer connected to the line sideof thesupply disconnecting device,provided with a dedicated primarydisconnectingmeans (see5.3.5)andsecondary overcurrent protection, andmounted within the control enclosure adjacent to the supply disconnectingdevice;		N/A
	- an externally supplied lightingcircuit(for example factorylighting supply). This shallbepermittedin control enclosures only, and for the machine worklight(s) wheretheir total power ratingisnotmorethan3kW.		N/A
	- power supply units, forDC supplytoLEDlightsources,fitted withisolating transformers (for example,in accordancewithIEC 61558-2-6).		N/A
	Exception: where fixedlightingis out of reach of operators duringnormaloperations, theprovisionsof15.2.2donotapply.		N/A
15.2.3	Protection		-
	Locallightingshallbeprotectedaccordingto7.2.6		N/A
15.2.4	Fittings		-
	Adjustablelighting fittings shall be suitable for thephysicalenvironment		N/A
	The lampholdersshallbe: - according to therelevantIECpublication; - constructed with aninsulatingmaterial protecting thelamp cap so as topreventunintendedcontact		N/A

	Reflectors shall be supportedby abracketandnotbythelampholder		N/A

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Clause	**Requirement**	**Comment**	**Verdict**
16	Marking, warning signs andreference designations		-
16.1	General		-
	Warning signs,nameplates, markings, and identificationplates shall be of sufficientdurability to withstandthe physical environmentinvolved.	Checked to confirm theconformity.	P
16.2	Warning signs		-
16.2.1	Electric shockhazard		-
	Enclosures that donot otherwise clearly showthatthey contain electrical equipment that can giverise toariskofelectric shock shallbemarked with the graphical symbolISO 7010-W012(seefigure18) △	Checked to confirm theconformity.	P
	The warning sign shallbeplainly visible on the enclosuredoor orcover		P
	Thewarningsignmaybeomitted (seealso6.2.2b))for:		-
	- an enclosure equipped with a supplydisconnectingdevice;		P
	- an operator-machine interface orcontrolstation;		P
	- a single device withits own enclosure(forexampleposition sensor).		P
16.2.2	Hot surfaceshazard		-
	Where therisk assessment shows theneed to warn against the possibility of hazardous surface temperaturesof the electrical equipment, the graphical symbolISO 7010-W017 shallbeused (seefigure19). △		P
16.3	Functional identification		-
	Control devices, visual indicators shallbeclearlyand durablymarked with regard to their functions either onoradjacent to theitem	Checked to confirm theconformity.	P
	Itisrecommended that suchmarkings aremadein accordancewithIEC 60417 andISO7000.		P
	Preference shouldbe given to the useof standardsymbols giveninIEC 60417 andISO7000		P
16.4	Marking of enclosures of electrical equipment		-
	The followinginformation shall be legiblyanddurably markedin a way thatisplainly visible after theequipmentisinstalled on enclosures that receiveincomingpower supplies.	Checked to confirm theconformity.	P
	- name or trademarkof supplier;		P

	- certificationmark or other marking thatcanberequiredbylocal or regional legislation, whenrequired;		P
	- type designation or model, whereapplicable;		P
	- serial number, where applicable;		P
	- maindocumentnumber (seeIEC62023) where applicable;		P

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Clause	**Requirement**	**Comment**	**Verdict**
	– ratedvoltage, numberofphasesandfrequency (ifa.c.),and full-load current for each incomingsupply;		P
	Itisrecommended that thisinformationisprovidedadjacent to the mainincoming supply(ies).		P
16.5	Reference designations		-
	All enclosures, assemblies, control devices,and components shall beplainlyidentified with the samereference designations as shownin thetechnical documentation	Checked to confirm theconformity.	P
17	Technical documentation		-
17.1	General		-
	The informationnecessary for identification, transport,installation, use, maintenance, decommissioningand disposal of the electrical equipment shallbe supplied.	Checked to confirm theconformity.	P
	AnnexI shouldbe considered as guidance for thepreparation of information and documents.		P
17.2	Information related to the electricalequipment		-
	The following shall besupplied:	Checked to confirm theconformity.	-
	a) wheremore than one documentisprovided, amain document for the electrical equipment asa whole,listingthe complementary documents associated with the electrical equipment;		P
	b)identificationoftheelectricalequipment(see16.4);		P
	c)information oninstallation and mountingincluding:		P
	• a description of the electrical equipment'sinstallation andmounting, andits connection to the electrical suppliesandwhere relevant othersupplies;		P
	• short-circuit current rating of the electricalequipment foreach incomingpower supply;		P
	• ratedvoltage,numberofphasesandfrequency(ifAC.), type of distribution system (TT, TN,IT) andfull-loadcurrentfor eachincoming supply;		P
	• any additional electrical supply(ies)requirements(forexamplemaximum supply source impedance,leakagecurrent) for eachincoming supply;		P
	• space required for theremoval or servicingof theelectrical equipment;		P
	• installation requirements whereneeded toensure thatthearrangements for cooling are notimpaired;		P
	• environmental limitations (for examplelighting, vibration,EMC environment, atmospheric contaminants) where appropriate;		P
	• functionallimitations (for example peakstartingcurrentsandpermitted voltage drop(s)) as applicable;		P

	• precautions to be taken for theinstallationof theelectricalequipment relevant to the electromagnetic compatibility;		P
	d) aninstruction for the connection of simultaneously		P

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Clause	**Requirement**	**Comment**	**Verdict**
	accessible extraneous-conductivepartsin the vicinity of the machine (forexample, within 2,5metres) suchasthe following to the protectivebonding circuit:		
	•metallicpipes;		P
	• fences;		P
	•ladders;		P
	•handrails.		P
	e) information on the functioning andoperation,includingas applicable:		P
	• an overview of the structure of the electricalequipment(for exampleby structure diagram or overviewdiagram);		P
	• procedures for programming or configuring,asnecessaryfor theintendeduse;		P
	•procedures for restarting after anunexpected stop;		P
	• a sequenceof operation;		P
	f)information onmaintenance of the electrical equipment,as appropriate,including:		P
	• frequency and method of functional testing;		P
	•instructions on the procedures for safemaintenanceandwhereitisnecessary to suspend a safety function and/or protectivemeasure (see 9.3.6);		P
	• guidance on the adjustment,repair, andfrequencyandmethod of preventivemaintenance;		P
	• details of theinterconnections of the electrical components subject to replacement (forexamplebycircuitdiagrams and/or connection tables);		P
	•information onrequired special devices or tools;		P
	•information on spareparts;		P
	•information onpossibleresidual risks,indication of whether anyparticular trainingisrequired and specificationof anynecessarypersonalprotective equipment;		P
	• where applicable,instructions to restrict availabilityof key(s) ortool(s) toskilledorinstructedpersonsonly;		P
	• settings (DIP-switches, programmableparameter values, etc);		P
	• information for validation of safetyrelated control functions after repair or modification,andforperiodictesting where necessary;		P
	g) information onhandling, transportation andstorageasappropriate (for example dimensions, weight, environmental conditions,possible ageing constraints);		P
	h) information for proper disassemblyandhandlingofcomponents (for example for recyclingordisposal).		P
18	Verification		-
18.1	General		-
	The extent of verification willbe givenin the dedicated		P

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Clause	**Requirement**	**Comment**	**Verdict**
	product standard for aparticular machine. Where there isno dedicatedproduct standard for the machine, the verifications shall alwaysinclude theitems a),b) andf) andmayincludeoneormoreoftheitemsc)toe):		
	a) verification that the electrical equipment complies withits technical documentation;	Verifiedby check.	P
	b) verification of continuity of the protectivebonding circuit(Test1 of18.2.2);	Verifiedby test.	P
	c)in case of fault protectionby automaticdisconnectionof supply, conditions for protectionby automatic disconnectionshallbeverifiedaccordingto18.2;		P
	d)insulationresistancetest(see18.3);		N/A
	e) voltagetest(see18.4);		N/A
	f)protectionagainstresidualvoltage(see18.5);		N/A
	g) verificationthattherelevantrequirementsof 8.2.6are met;		N/A
	h) functionaltests (see18.6).		N/A
	When these tests areperformed,itisrecommended thatthey follow the sequencelisted above.		N/A
	When the electrical equipmentismodified, the requirementsstatedin18.7 shallapply.		N/A
	For verifications thatinclude measurement,measuring equipmentinaccordancewiththeIEC61557 seriesis recommended.		N/A
	The results of the verification shall bedocumented.	See theTDS	P
18.2	Verification of conditions for protection byautomaticdisconnection of supply		-
18.2.1	General		-
	The conditions for automatic disconnection of supply(see6.3.3) shallbeverifiedbytests.		P
	Test1 verifies the continuity of theprotective bondingcircuit.	Verifiedby test.	P
	Test 2 verifies the conditions for protectionbyautomaticdisconnection of the supplyin TN systems.		N/A
	For TN-systems, those testmethods are describedin 18.2.2 and18.2.3; theirapplicationfordifferentconditions ofsupplyarespecifiedin18.2.4.		N/A
	ForTTsystems, seeClauseA.2.		N/A
	ForITsystems, seeIEC 60364-6.		N/A
	WhereRCDs areusedin the electrical equipment, their function shallbe verifiedin accordance with the manufacturer'sinstructions. The testprocedure and testinterval shallbe specifiedin themaintenanceinstructions.		N/A
18.2.2	Test1 – Verification of the continuity of the protectivebonding circuit	Verifiedby test.	-
	The resistance between thePE terminal(see5.2andFigure 2) andrelevantpoints that arepartof protective		P

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Clause	**Requirement**	**Comment**	**Verdict**
	bonding circuit shall bemeasured with acurrentbetween atleast 0,2 Aandapproximately10 Aderivedfroman electrically separated supply source (for exampleSELV, see 413.1 ofIEC 60364-4-41.2005)havingamaximumno-loadvoltageof 24 Va.c.ord.c..		
	The resistancemeasured shall bein theexpectedrangeaccording to thelength, the cross sectionalareaand thematerial of the relatedprotective bonding conductor(s).		P
	EarthedPELV supplies canproducemisleading resultsinthis test and thereforeshallnotbeused.		P
18.2.3	Test 2 –Fault loopimpedance verification and suitabilityofthe associated overcurrentprotective device		-
	The connections of eachpower supplyincluding the connection of associatedprotective conductor to thePEterminal of themachine, shallbe verifiedbyinspection.		N/A
	The conditions for theprotectionby automatic disconnectionofsupplyinaccordancewith 6.3.3 and Annex A shall beverifiedbyboth:		N/A
	1) verificationofthefaultloopimpedanceby:		N/A
	– calculation,or		N/A
	– measurementin accordance with A.4,and		N/A
	2) confirmation that the setting andcharacteristicsof the associated overcurrentprotective device arein accordancewith the requirements of Annex A, and whereapower drive system (PDS)isused, confirmation that the settingand characteristics of theprotective device(s) associated with aPDS arein accordance with the convertermanufacturer'sandprotective device manufacturer'sinstructions.		N/A
18.2.4	Application of the test methods for TN-systems		-
	WhenTest 2 of18.2.2iscarriedoutbymeasurement,it shallalwaysbeprecededbyTest1 of18.2.2		N/A
	The tests that are necessary formachinesof differentstatus are specifiedin Table9.		N/A
18.3	Insulation resistance tests	Verifiedby test	-
	When insulation resistance testsareperformed, the insulationresistancemeasuredat 500 Vd.c.betweenthe power circuit conductors and theprotective bondingcircuit shallbenotlessthan1MΩ. Thetestmaybemadeon individual sections of the complete electricalinstallation.		P
	Exception: for certain parts of electrical equipment, incorporating for examplebusbars, conductor wire or conductor bar systems or slip-ring assemblies,alower minimum valueispermitted,but that value shallnotbeless than50kΩ.		P

	If the electrical equipment of themachine contains surgeprotection devices which are likely tooperateduring the test,itispermitted to either:		P

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Clause	**Requirement**	**Comment**	**Verdict**
	- disconnect these devices, or		P
	- reduce the test voltage to a valuelowerthanthevoltageprotectionlevel of the surgeprotection devices, butnot lower than thepeak value of theupper limit of the supply(phasetoneutral) voltage.		P
18.4	Voltage tests	Verifiedby test	-
	When voltage tests areperformed, test equipmentin accordancewithIEC 61180-2 shouldbeused.		P
	The test voltage shall be atanominal frequencyof50Hz or60Hz.		P
	The maximum test voltage shallhave avalueof twice the ratedsupplyvoltageoftheequipmentor1000V, whichever is the greater. Themaximum test voltageshallbe applied between the powercircuitconductorsand the protectivebonding circuit for at least1 s. Therequirementsare satisfiedif no disruptive dischargeoccurs.		P
	Components and devices that arenotrated to withstandthe test voltage and surgeprotection devices which are likely to operate during the test shallbedisconnected during testing.		P
	Components and devices that havebeen voltage testedin accordance with their product standardsmaybedisconnected during testing.		P
18.5	Protection against residual voltages		-
	Where appropriate, tests shall beperformedtoensure compliancewith 6.2.4.		N/A
18.6	Functional tests		-
	The functions of electrical equipment shallbe tested.	Verifiedby test	P
18.7	Retesting		-
	Where a portion of the machineitsassociatedequipmentis changed or modified, theneed forre-verificationand testing of the electrical equipment shallbeconsidered.		N/A
	Particular attention should begiven tothepossible adverse effects that retestingcanhaveon the equipment (for example overstressing of insulation,disconnection/reconnection of devices).		N/A

☒ **Continuity test of the protective bonding circuit** **Test methods in 18.2.2 Test 1 of EN 60204-1**	☐**N/A** ☐**Fail** ☒**Pass**
Test Requirement: The resistance between the PE terminal and relevant points that are part of the protective bonding circuit shall be measured with a current from 0.2 Ato 10 A.	
Test Record/Data	
Test duration	10 s
Test record of protective bonding test for EUT, with setting current 10 A and test duration 10 s.	
Test position	Resistance (mΩ)
PE – DC power supply	12
PE – Servo driver	9
PE – Transformer	15
PE – Filter	9
PE – Cooler	67
PE – Door	32

☒ **Insulation resistance test** **Test methods in 18.3 of EN 60204-1**			☐**N/A** ☐**Fail** ☒**Pass**
Test Requirement: When insulation resistance tests are performed, the insulation resistance measured at 500 V d.c..between the power circuit conductors and the protective bonding circuit shall be not less than 1 MQ. The test may be made on individual sections of the complete electrical installation.			
CONDITION I INSTALLATION: Insulation resistance test, 500V DC >1 MΩ, duration 10 s.			
Test Record/Data			
Test position	**Voltage V**	**Measured value MΩ**	**Test result**
PE-L1	532	22.05	Pass
PE-L2	531	31.08	Pass
PE-L3	531	30.94	Pass
PE-N	536	1.005	Pass

☒**Voltage test** **Test methods in 18.4 of EN 60204-1**			☐**N/A** ☐**Fail** ☒**Pass**
Test Requirement: The test voltage shall be at a nominal frequency of 50 Hz or 60 Hz. The maximum test voltage shall have avalue of twice the rated supply voltage of the equipment or 1 000 V, whichever is the greater. Themaximum test voltage shall be applied between the power circuit conductors and the protective bondingcircuit for a period of approximately 1 s.			
CONDITION I INSTALLATION: Voltage test, 1000V AC, phase to bonding, duration2s.			
Test Record/Data			
Test voltage applied between:	**Test voltage V**	**I Leakagecurrent mA**	**Breakdown Yes /No**
PE-L1	1034	0.0	No
PE-L2	1031	0.0	No
PE-L3	1034	0.0	No
PE-N	1035	0.0	No

☒**Functional test according to 18.6 of EN 60204-1**		☐**N/A** ☐**Fail** ☒**Pass**
Test Requirement: The function of electrical equipment shall be tested, particularly those related to safety and safeguarding.		
CONDITION I INSTALL ATION: Test according to safety circuit and electrical schematic.		
Test Record/Data		
The following functions of electrical control system were tested:		
Test items:	**Test method**	**Result**
Normal start local	Normal start function initiated from control station when machineis stopped.	Pass
Normal stop local	Normal stop function initiated from control station when machine is running.	Pass
Emergency stop function	Emergency stop function initiated from emergency stop devices when machine is running. When activated, the machine can stopsuccessfully. Manual reset necessary for a restart.	Pass

Noise Test Report

Reference Standards

2006/42/EC, Clause 1.7.4.2(u)

Test Procedure

1) Measure and record the ambient noise level

2) Measure and record the sound pressure level under simulated operating conditions

Test Result.

Sound Pressure Level Test

Location	Measured sound level(dBA)
Front side	67.4 dBA
Right side	68.3 dBA
Left side	66.9 dBA
Rear side	68.2 dBA
Ambient Sound Level was measured 59.7 dBA	

EN ISO 12100 test report

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Clause	**Requirement**	**Result**	**Verdict**
5	**Risk assessment**		**Pass**
5.1	**General** Risk assessment comprises (see Figure 1)	See risk assessment report	Pass
	- Risk analysis, comprising	See risk assessment report	Pass
	1) determination of the limits of the machinery (see 5.3),	See risk assessment report	Pass
	2) hazard identification (5.4 and Annex B), and	See risk assessment report	Pass
	3) risk estimation (see 5.5), and	See risk assessment report	Pass
	- Risk evaluation (see 5.6).	See risk assessment report	Pass
	Risk analysis provides information required for the risk evaluation, which in turn allows judgments to be made about whether or not risk reduction is required.	See risk assessment report	Pass
	These judgments shall be supported by a qualitative or, where appropriate, quantitative estimate of the risk associated with the hazards present on the machinery.	See risk assessment report	Pass
	NOTE A quantitative approach can be appropriate when useful data is available. However, a quantitative approach is restricted by the useful data that are available and/or the limited resources of those conducting the risk assessment. Therefore, in many applications only qualitative risk estimation will be possible.	Noted	Pass
	The risk assessment shall be documented according to Clause 7.	See risk assessment report	Pass
5.2	**Information for risk assessment**	-	-
	The information for risk assessment should include the following.	See risk assessment report	Pass
	a) Related to machinery description:	See risk assessment report	Pass
	1) user specifications;	See risk assessment report	Pass
	2) anticipated machinery specifications, including	See risk assessment report	Pass
	i) a description of the various phases of the whole life cycle of the machinery,	See risk assessment report	Pass
	ii) design drawings or other means of establishing the nature of the machinery, and	See risk assessment report	Pass
	iii) required energy sources and how they are supplied;	See risk assessment report	Pass
	3) documentation on previous designs of similar machinery, if relevant;	See risk assessment report	Pass
	4) Information for use of the machinery, as available.	See risk assessment report	Pass
	b) Related to regulations, standards and other applicable documents:	See risk assessment report	Pass
	1) applicable regulations;	See risk assessment report	Pass
	2) relevant standards;	See risk assessment report	Pass
	3) relevant technical specifications;	See risk assessment report	Pass
	4) Relevant safety data sheets.	See risk assessment report	Pass
	c) Related to experience of use:	See risk assessment report	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	1) any accident, incident or malfunction history of the actual or similar machinery;	Considered	Pass
	2) the history of damage to health resulting, for example, from emissions (noise, vibration, dust, fumes, etc.), chemicals used or materials processed by the machinery;	Considered	Pass
	3) the experience of users of similar machines and, whenever practicable, an exchange of information with the potential users.	Considered	Pass
	NOTE An incident that has occurred and resulted in harm can be referred to as an "accident", whereas an incident that has occurred and that did not result in harm can be referred to as a "near miss" or "dangerous occurrence".	Noted	Pass
	d) Relevant ergonomic principles.	Considered	Pass
	The information shall be updated as the design develops or when modifications to the machine are required.	Considered	Pass
	Comparisons between similar hazardous situations associated with different types of machinery are often possible, provided that sufficient information about hazards and accident circumstances in those situations is available.	Considered	Pass
	NOTE The absence of an accident history, a small number of accidents or low severity of accidents ought not to be taken as a presumption of a low risk.	Noted	Pass
	For quantitative analysis, data from databases, handbooks, laboratories or manufacturers' specifications may be used, provided that there is confidence in the suitability of the data. Uncertainty associated with these data shall be indicated in the documentation (see Clause 7).	Considered	Pass
5.3	**Determination of limits of machinery**	-	-
5.3.1	**General** Risk assessment begins with the determination of the limits of the machinery, taking into account all the phases of the machinery life. This means that the characteristics and performances of the machine or a series of machines in an integrated process, and the related people, environment and products should be identified in terms of the limits of machinery as given in 5.3.2 to 5.3.5.	All the limits have been considered	Pass
5.3.2	**Use limits.** Use limits include the intended use and the reasonably foreseeable misuse. Aspects to be taken into account include the following:	C	Pass
	a) the different machine operating modes and different intervention procedures for the users, including interventions required by malfunctions of the machine;	Considered	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	b) the use of the machinery (for example, industrial, non-industrial and domestic) by persons identified by sex, age, dominant hand usage, or limiting physical abilities (visual or hearing impairment, size, strength, etc.);	Considered	Pass
	c) the anticipated levels of training, experience or ability of users including	Considered	Pass
	1) operators,	Considered	Pass
	2) maintenance personnel or technicians,	Considered	Pass
	3) trainees and apprentices, and	Considered	Pass
	4) the general public;	Not used for general public	N/A
	d) exposure of other persons to the hazards associated with the machinery where it can be reasonably foreseen:	Considered	Pass
	1) persons likely to have a good awareness of the specific hazards, such as operators of adjacent machinery;	Considered	Pass
	2) persons with little awareness of the specific hazards but likely to have a good awareness of site safety procedures, authorized routes, etc., such as administration staff;	Considered	Pass
	3) persons likely to have very little awareness of the machine hazards or the site safety procedures, such as visitors or members of the general public, including children.	Considered	Pass
	If specific information is not available in relation to b), above, the manufacturer should take into account general information on the intended user population (for example, appropriate anthropometric data).	The information has been stated in manual	N/A
5.3.3	**Space limits** Aspects of space limits to be taken into account include	Considered	Pass
	a) the range of movement,	Considered	Pass
	b) space requirements for persons interacting with the machine, such as during operation and maintenance,	The space has been considered during design, see installation diagram.	Pass
	c) human interaction such as the operator– machine interface, and	Considered, see operator position diagram	Pass
	d) the machine–power supply interface.	The position of power supply is according to EN 60204-1	Pass
5.3.4	**Time limits** Aspects of time limits to be taken into account include	Considered, see below	Pass
	a) the life limit of the machinery and/or of some of its components (tooling, parts that can wear, electromechanical components, etc.), taking into account its intended use and reasonably foreseeable misuse, and	The life limit has been stated in manual	Pass
	b) Recommended service intervals.	See manual	Pass
5.3.5	**Other limits** Examples of other limits include	See below	Pass
	a) properties of the material(s) to be processed,	For wood only, see manual .	Pass
	b) housekeeping — the level of cleanliness required, and	Considered	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	c) environmental — the recommended minimum and maximum temperatures, whether the machine can be operated indoors or outdoors, in dry or wet weather, in direct sunlight, tolerance to dust and wet, etc.	The information has been stated in manual.	Pass
5.4	**Hazard identification** After determination of the limits of the machinery, the essential step in any risk assessment of the machinery is the systematic identification of reasonably foreseeable hazards (permanent hazards and those which can appear unexpectedly), hazardous situations and/or hazardous events during all phases of the machine life cycle, i.e.:	All the phases of the machine life cycle have been considered. See risk assessment report.	Pass
	Installation;	See above	Pass
	– commissioning;	See above	Pass
	– use;	See above	Pass
	– dismantling, disabling and scrapping.	See above	Pass
	Only when hazards have been identified can steps be taken to eliminate them or to reduce risks. To accomplish this hazard identification, it is necessary to identify the operations to be performed by the machinery and the tasks to be performed by persons who interact with it, taking into account the different parts, mechanisms or functions of the machine, the materials to be processed, if any, and the environment in which the machine can be used.	Considered	Pass
	The designer shall identify hazards taking into account the following.	All the hazards have been taking into account	Pass
	a) Human interaction during the whole life cycle of the machine	Considered	Pass
	Task identification should consider all tasks associated with every phase of the machine life cycle as given above. Task identification should also take into account, but not be limited to, the following task categories:	All phases of the machine life cycle have been considered	Pass

	– setting; – testing; – teaching/programming; – process/tool changeover; – start-up; – all modes of operation; – feeding the machine; – removal of product from machine; – stopping the machine; – stopping the machine in case of emergency; – recovery of operation from jam or blockage; – restart after unscheduled stop; – fault-finding/trouble-shooting (operator intervention); – cleaning and housekeeping; – preventive maintenance; – corrective maintenance.	All the phases of this clause has been considered	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	All reasonably foreseeable hazards, hazardous situations or hazardous events associated with the various tasks shall then be identified. Annex B gives examples of hazards, hazardous situations and hazardous events to assist in this process. Several methods are available for the systematic identification of hazards. See also ISO/TR 14121-2.	All the hazards stated in annex B have been considered, and the risk assessment has been carried out according to ISO/TR 14121-2, in which the factors Se-Cl(Fr, Pr, Av) and diagram are used to evaluate the level of risk.	Pass
	In addition, reasonably foreseeable hazards, hazardous situations or hazardous events not directly related to tasks shall be identified.	Considered	Pass
	EXAMPLE Seismic events, lightning, excessive snow loads, noise, break-up of machinery, hydraulic hose burst.	noted	Pass
	b) Possible states of the machine	The possible states of the machine have been considered.	Pass
	These are as follows:	See below	Pass
	1) the machine performs the intended function (the machine operates normally);	Considered	Pass
	2) the machine does not perform the intended function (i.e. it malfunctions) due to a variety of reasons, including	Considered	Pass
	– variation of a property or of a dimension of the processed material or of the workpiece, – failure of one or more of its component parts or services, – external disturbances (for example, shocks, vibration, electromagnetic interference), – design error or deficiency (for example, software errors), – disturbance of its power supply, and – surrounding conditions (for example, damaged floor surfaces).	Considered	Pass
	c) Unintended behaviour of the operator or reasonably foreseeable misuse of the machine	The	Pass
	Examples include	See below	Pass
	– loss of control of the machine by the operator (especially for hand-held or mobile machines), – reflex behaviour of a person in case of malfunction, incident or failure during the use of the machine, – behaviour resulting from lack of concentration or carelessness, – behaviour resulting from taking the "line of least resistance" in carrying out a task, – behaviour resulting from pressures to keep the machine running in all circumstances, and – behaviour of certain persons (for example, children, disabled persons).	All the hazards have been taken into account during design.	Pass
	NOTE Examination of the available design documentation can be a useful means of identifying hazards related to the machinery,	Noted	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	particularly those associated with moving elements such as motors or hydraulic cylinders.		
5.5	**Risk estimation**	-	-
5.5.1	**General**	-	-
	After hazard identification, risk estimation shall be carried out for each hazardous situation by determining the elements of risk given in 5.5.2. When determining these elements, it is necessary to take into account the aspects given in 5.5.3.	Risk estimation has been carried out according to ISO 14121-2	Pass
	If standardized (or other suitable) measurement methods exist for an emission, they should be used, in conjunction with existing machinery or prototypes, to determine emission values and comparative emission data. This makes it possible for the designer to – estimate the risk associated with the emissions, – evaluate the effectiveness of the protective measures implemented at the design stage, – provide potential buyers with quantitative information on emissions in the technical documentation, and – provide users with quantitative information on emissions in the information for use. Hazards other than emissions that are described by measurable parameters can be dealt with in a similar manner.	Noise emission has been tested according to EN ISO 11202.	Pass
5.5.2	**Elements of risk**	-	-
5.5.2.1	**General**	-	-
	The risk associated with a particular hazardous situation depends on the following elements: a) the severity of harm; b) the probability of occurrence of that harm, which is a function of 1) the exposure of person(s) to the hazard, 2) the occurrence of a hazardous event, and 3) the technical and human possibilities to avoid or limit the harm. The elements of risk are shown in Figure 3. Additional details are given in 5.5.2.2, 5.5.2.3 and 5.5.3.	All the elements have been considered, see risk assessment report.	Pass
5.5.2.2	**Severity of harm**	-	-
	The severity can be estimated by taking into account the following:	Considered, see risk assessment report	Pass
	a) the severity of injuries or damage to health, for example, – slight, – serious, – death.	See above	Pass
	b) the extent of harm, for example, to – one person, – several persons.	See above	Pass
	When carrying out a risk assessment, the risk from the most likely severity of the harm that is likely to occur from each identified hazard shall	This requirement has been taken into account during risk assessment.	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	be considered, but the highest foreseeable severity shall also be taken into account, even if the probability of such an occurrence is not high.		
5.5.2.3	**Probability of occurrence of harm**	-	-
5.5.2.3.1	**Exposure of persons to the hazard**	-	-
	The exposure of a person to the hazard influences the probability of the occurrence of harm. Factors to be taken into account when estimating the exposure are, among others,	Considered, see risk assessment report.	Pass
	a) the need for access to the hazard zone (for normal operation, correction of malfunction, maintenance or repair, etc.),	See above	Pass
	b) the nature of access (for example, manual feeding of materials),	See above	Pass
	c) the time spent in the hazard zone,	See above	Pass
	d) the number of persons requiring access, and	See above	Pass
	e) the frequency of access.	See above	Pass
5.5.2.3.2	**Occurrence of a hazardous event**	-	-
	The occurrence of a hazardous event influences the probability of occurrence of harm. Factors to be taken into account when estimating the occurrence of a hazardous event are, among others,	Considered, see risk assessment report.	Pass
	a) reliability and other statistical data,	See above	Pass
	b) accident history,	See above	Pass
	c) history of damage to health, and	See above	Pass
	d) comparison of risks (see 5.6.3).	See above	Pass
	NOTE The occurrence of a hazardous event can be of a technical or human origin.	Noted	Pass
5.5.2.3.3	**Possibility of avoiding or limiting harm**	-	-
	The possibility of avoiding or limiting harm influences the probability of occurrence of harm. Factors to be taken into account when estimating the possibility of avoiding or limiting harm are, among others, the following:	Considered, see risk assessment report.	Pass
	a) different persons who can be exposed to the hazard(s), for example, – skilled, – unskilled;	See above	Pass
	b) how quickly the hazardous situation could lead to harm, for example, – suddenly, – quickly, – slowly;	See above	Pass
	c) any awareness of risk, for example, – by general information, in particular, information for use, – by direct observation, – through warning signs and indicating devices, in particular, on the machinery;	See above	Pass
	d) the human ability to avoid or limit harm (for example, reflex, agility, possibility of escape);	See above	Pass
	e) practical experience and knowledge, for example,	See above	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	– of the machinery, – of similar machinery, – no experience.		
5.5.3	**Aspects to be considered during risk estimation**	-	-
5.5.3.1	**Persons exposed**	-	-
	Risk estimation shall take into account all persons (operators and others) for whom exposure to the hazard is reasonably foreseeable.	Considered	Pass
5.5.3.2	**Type, frequency and duration of exposure**	-	-
	The estimation of the exposure to the hazard under consideration (including long-term damage to health) requires analysis of, and shall account for, all modes of operation of the machinery and methods of working. In particular, the analysis shall account for the needs for access during loading/unloading, setting, teaching, process changeover or correction, cleaning, fault-finding and maintenance.	All the situations have been taken into account	Pass
	The risk estimation shall also take into account tasks, for which it is necessary to suspend protective measures.	Considered	Pass
5.5.3.3	**Relationship between exposure and effects**	-	-
	The relationship between an exposure to a hazard and its effects shall be taken into account for each hazardous situation considered. The effects of accumulated exposure and combinations of hazards shall also be considered. When considering these effects, risk estimation shall, as far as practicable, be based on appropriate recognized data.	Considered	Pass
	NOTE 1 Accident data can assist in establishing the probability and severity of injury associated with the use of a particular type of machinery with a particular type of protective measure.	Noted	Pass
	NOTE 2 Zero accident data is, however, no guarantee of the low probability and severity of an injury.	Noted	Pass
5.5.3.4	**Human factors**	-	-
	Human factors can affect risk and shall be taken into account in the risk estimation, including, for example,	Considered	Pass
	a) the interaction of person(s) with the machinery, including correction of malfunction,	Considered	Pass
	b) interaction between persons,	Considered	Pass
	c) stress-related aspects,	Considered	Pass
	d) ergonomic aspects,	Considered	Pass
	e) the capacity of persons to be aware of risks in a given situation depending on their training, experience and ability,	Considered	Pass
	f) fatigue aspects, and	Considered	Pass
	g) aspects of limited abilities (due to disability,	Considered	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	age, etc.).		
	Training, experience and ability can affect risk; nevertheless, none of these factors shall be used as a substitute for hazard elimination, risk reduction by inherently safe design measure or safeguarding, wherever these protective measures can be practicably implemented.	Considered	Pass
5.5.3.5	**Suitability of protective measures**	-	-
	Risk estimation shall take into account the suitability of protective measures and shall	Considered, see risk assessment report	Pass
	a) identify the circumstances which can result in harm,	Identified	Pass
	b) whenever appropriate, be carried out using quantitative methods to compare alternative protective measures (see ISO/TR 14121-2), and	See risk assessment report	Pass
	c) provide information that can assist with the selection of appropriate protective measures.	Appropriate information has been provided.	Pass
	When estimating risk, those components and systems identified as immediately increasing the risk in case of failure need special attention.	Considered	Pass
	When protective measures include work organization, correct behaviour, attention, application of personal protective equipment (PPE), skill or training, the relatively low reliability of such measures compared with proven technical protective measures shall be taken into account in the risk estimation.	Considered	Pass
5.5.3.6	**Possibility of defeating or circumventing protective measures**	-	-
	For the continued safe operation of a machine, it is important that the protective measures allow its easy use and do not hinder its intended use. Otherwise, there is a possibility that protective measures might be bypassed in order for maximum utility of the machine to be achieved.	Assemble the safety components according to EN 1088.	Pass
	Risk estimation shall take account of the possibility of defeating or circumventing protective measures. It shall also take account of the incentive to defeat or circumvent protective measures when, for example,	Considered	Pass
	a) the protective measure slows down production or interferes with another activity or preference of the user,	No protective measure will slow down production or interferes with another activity	N/A
	b) the protective measure is difficult to use,	No this kind of situation	N/A
	c) persons other than the operator are involved, or	Considered	Pass
	d) the protective measure is not recognized by the user or not accepted as being suitable for its function.	No this kind of situation	N/A
	Whether or not a protective measure can be defeated depends on both the type of protective measure, such as an adjustable guard or	considered	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	programmable trip device, and its design details.		
	Protective measures that use programmable electronic systems introduce additional possibilities of defeat or circumvention if access to safety-related software is not appropriately restricted by design and monitoring methods. Risk estimation shall identify where safety-related functions are not separated from other machine functions and shall determine the extent to which access is possible. This is particularly important when remote access for diagnostic or process correction purposes is required.	Not use programmable electronic system as Protective measure.	N/A
5.5.3.7	**Ability to maintain protective measures**	-	-
	Risk estimation shall consider whether the protective measures can be maintained in the condition necessary to provide the required level of protection.	Considered	Pass
	NOTE If the protective measure cannot easily be maintained in correct working order, this can encourage the defeat or circumvention of the protective measure in order to allow continued use of the machinery.	Noted	Pass
5.5.3.8	**Information for use**	-	-
	Risk estimation shall take into account the information for use, as available. See also 6.4.	Appropriate information has been provided, see manual.	Pass
5.6	**Risk evaluation**	-	-
5.6.1	**General**	-	-
	After risk estimation has been completed, risk evaluation shall be carried out to determine if risk reduction is required. If risk reduction is required, then appropriate protective measures shall be selected and applied (see Clause 6). As shown in Figure 1, the adequacy of the risk reduction shall be determined after applying each of the three steps of risk reduction described in Clause 6. As part of this iterative process, the designer shall also check whether additional hazards are introduced or other risks increased when new protective measures are applied. If additional hazards do occur, they shall be added to the list of identified hazards and appropriate protective measures will be required to address them.	Comply with the requirement, see risk assessment report.	Pass
	Achieving the objectives of risk r	The risk has been reduced to acceptable level after correction	Pass
5.6.2	**Adequate risk reduction**	-	-
	Application of the three-step method described in 6.1 is essential in achieving adequate risk reduction.	applied	Pass
	Following the application of the three-step method, adequate risk reduction is achieved	Comply with the requirement.	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	when – all operating conditions and all intervention procedures have been considered, – the hazards have been eliminated or risks reduced to the lowest practicable level, – any new hazards introduced by the protective measures have been properly addressed, – users are sufficiently informed and warned about the residual risks (see 6.1, step 3), – protective measures are compatible with one another, – sufficient consideration has been given to the consequences that can arise from the use in a non-professional/non-industrial context of a machine designed for professional/industrial use, and – the protective measures do not adversely affect the operator's working conditions or the usability of the machine.		
5.6.3	**Comparison of risks**	-	-
	As part of the process of risk evaluation, the risks associated with the machinery or parts of machinery can be compared with those of similar machinery or parts of machinery, provided the following criteria apply:	No similar machine used to comparison of this machine.	N/A
	– the similar machinery is in accordance with the relevant type-C standard(s);	See above	N/A
	– the intended use, reasonably foreseeable misuse and the way both machines are designed and constructed are comparable;	See above	N/A
	– the hazards and the elements of risk are comparable;	See above	N/A
	– the technical specifications are comparable;	See above	N/A
	– the conditions for use are comparable.	See above	N/A
	The use of this comparison method does not eliminate the need to follow the risk assessment process as described in this International Standard for the specific conditions of use. For example, when a band saw used for cutting meat is compared with a band saw used for cutting wood, the risks associated with the different material shall be assessed.	See above	N/A
6	**Risk reduction**	-	-
6.1	**General**	-	-
	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:	Considered, see risk assessment report	Pass
	– severity of harm from the hazard under consideration;	See above	Pass
	– probability of occurrence of that harm .	See above	Pass
	All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method	Protective measures have been used according to three-step method.	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	(see also Figures 1 and 2).		
	Step 1: Inherently safe design measures	considered	Pass
	Inherently safe design measures eliminate hazards or reduce the associated risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine. See 6.2.	considered	Pass
	NOTE 1 This stage is the only one at which hazards can be eliminated, thus avoiding the need for additional protective measures such as safeguarding or complementary protective measures.	noted	Pass
	Step 2: Safeguarding and/or complementary protective measures	considered	Pass
	Taking into account the intended use and the reasonably foreseeable misuse, appropriately selected safeguarding and complementary protective measures can be used to reduce risk when it is not practicable to eliminate a hazard, or reduce its associated risk sufficiently, using inherently safe design measures. See 6.3.	Appropriate guarding have been provided	Pass
	Step 3: Information for use		Pass
	Where risks remain despite inherently safe design measures, safeguarding and the adoption of complementary protective measures, the residual risks shall be identified in the information for use. The information for use shall include, but not be limited to, the following:	Appropriate information has been provided.	Pass
	– operating procedures for the use of the machinery consistent with the expected ability of personnel who use the machinery or other persons who can be exposed to the hazards associated with the machinery;	See manual	Pass
	– the recommended safe working practices for the use of the machinery and the related training requirements adequately described;	See manual	Pass
	– sufficient information, including warning of residual risks for the different phases of the life of the machinery;	See manual and warning label	Pass
	– the description of any recommended personal protective equipment, including detail as to its need as well as to training needed for its use.	See manual	Pass
	Information for use shall not be a substitute for the correct application of inherently safe design measures, safeguarding or complementary protective measures.	See manual	Pass
	NOTE 2 Adequate protective measures associated with each of the operating modes and intervention procedures reduce the	noted	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	possibility of operators being induced to use hazardous intervention techniques in case of technical difficulties.		
6.2	**Inherently safe design measures**	-	-
6.2.1	**General**	-	-
	Inherently safe design measures are the first and most important step in the risk reduction process. This is because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding can fail or be violated and information for use may not be followed.	Inherently safe design has been considered first	Pass
	Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features for the machine itself and/or interaction between the exposed persons and the machine.		Pass
	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).	Considered	Pass
6.2.2	**Consideration of geometrical factors and physical aspects**	-	-
6.2.2.1	**Geometrical factors**	-	-
	Such factors include the following.	See below	Pass
	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 working area can be seen from the control position	Pass
		Not mobile machine	N/A
	− the zone of movement of lifted loads or of the carrier of machinery for lifting persons;	Not this kind of machine	N/A
	− the area of contact of the tool of a hand-held or hand-guided machine with the material being worked.	Not this kind of machine	N/A
	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.	This requirement has been considered during design.	Pass
	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	Safety distance has been considered according to ISO 13857.	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	by reducing the gap so that no part of the body can enter it (see ISO 13854 and ISO 13857).		
	c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can "trap" parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed, and open ends of tubes which can cause a "trap" shall be capped.	All edges and corners have been rounded. No trap hazard is found on this machine.	Pass
	d) The form of the machine is d	This requirement has been considered during design.	Pass
6.2.2.2	**Physical aspects**	-	-
	Such aspects include the following:	See below	Pass
	a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard;	This requirement has been considered during design.	Pass
	b) limiting the mass and/or velocity of the movable elements, and hence their kinetic energy;	This requirement has been considered during design. esigned so as to	Pass
	c) limiting the emissions by acting on the characteristics of the source using measures for reducing	This requirement has been considered during design.	Pass
	1) noise emission at source (see ISO/TR 11688- 1),	This requirement has been considered during design.	Pass
	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)], achieve a suitable working position and provide accessible manual controls (actuators).	This requirement has been considered during design.	Pass
	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	This requirement has been considered during design.	Pass
	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)].	No this kind of risk	N/A
6.2.3	**Taking into account general technical knowledge of machine design**	-	-

	This general technical knowledge can be derived from technical specifications for design (standards, design codes, calculation rules, etc.), which should be used to cover	This requirement has been considered during design.	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	a) mechanical stresses such as	See below	Pass
	– stress limitation by implementation of correct calculation, construction and fastening methods as regards, for example, bolted assemblies and welded assemblies,	This requirement has been considered during design.	Pass
	– stress limitation by overload prevention (bursting disk, pressure-limiting valves, breakage points, torque-limiting devices, etc.),	This requirement has been considered during design.	Pass
	– avoiding fatigue in elements under variable stresses (notably cyclic stresses), and	This requirement has been considered during design.	Pass
	– static and dynamic balancing of rotating elements,	This requirement has been considered during design.	Pass
	b) materials and their properties such as	See below	Pass
	– resistance to corrosion, ageing, abrasion and wear,	Considered	Pass
	– hardness, ductility, brittleness,		Pass
	– homogeneity,	Considered	Pass
	– toxicity, and	Considered	Pass
	– flammability, and	Considered	Pass
	c) emission values for	See below	Pass
	– noise,	The noise is less than 80 dB	Pass
	– vibration,	considered	Pass
	– hazardous substances, and	No this kind of risk	Pass
	– radiation.	No this kind of risk	Pass
	When the reliability of particular components or assemblies is critical for safety (for example, ropes, chains, lifting accessories for lifting loads or persons), stress limits shall be multiplied by appropriate working coefficients.	No this kind of risk	N/A
6.2.4	**Choice of appropriate technology**	Considered	Pass
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certain applications such as the following:	See below	Pass
	a) on machines intended for use in explosive atmospheres, using	Not used in explosive atmospheres	N/A
	– appropriately selected pneumatic or hydraulic control system and machine actuators,	See above	N/A
	– intrinsically safe electrical equipment (see IEC 60079-11);	See above	N/A
	b) for particular products to be processed (for example, by a solvent), by using equipment that ensures the temperature will remain far below the flash point;	No this kind of risk	N/A
	c) the use of alternative equipment to avoid high noise levels, such as	Considered	Pass
	– electrical instead of pneumatic equipment,	pneumatic equipment used	Pass
	– in certain conditions, water-cutting instead of mechanical equipment.	Not applicable	N/A
6.2.5	**Applying principle of positive mechanical action**	-	-
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An	Not applicable	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5- 1 and ISO 14119).		
	NOTE Where a mechanical component moves and thus allows a second component to move freely (for example, by gravity or spring force), there is no positive mechanical action of the first component on the second.	noted	Pass
6.2.6	**Provisions for stability.**	-	-
	Machines shall be designed so that they have sufficient stability to allow them to be used safely in their specified conditions of use. Factors to be taken into account include	This requirement has been considered during design.	Pass
	– the geometry of the base,	Considered	Pass
	– the weight distribution, including loading,	Considered	Pass
	– the dynamic forces due to movements of parts of the machine, of the machine itself or of elements held by the machine which can result in an overturning moment,	Considered	Pass
	– vibration,	Considered	Pass
	– oscillations of the centre of gravity,	Considered	Pass
	– characteristics of the supporting surface in case of travelling or installation on different sites (ground conditions, slope, etc.), and	Considered	Pass
	– external forces, such as wind pressure and manual forces.	manual force has been considered	Pass
	Stability shall be considered in all phases of the life cycle of the machine, including handling, travelling, installation, use, dismantling, disabling and scrapping.	Considered	Pass
	Other protective measures for stability relevant to safeguarding are given in 6.3.2.6.	Considered	Pass
6.2.7	**Provisions for maintainability**	-	-
	When designing a machine, the following maintainability factors shall be taken into account to enable maintenance of the machine:	This requirement has been considered during design.	Pass
	– accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used;	Considered	Pass
	– ease of handling, taking into account human capabilities;	Considered	Pass
	– limitation of the number of special tools and equipment.	Considered	Pass
6.2.8	**Observing ergonomic principles**	-	-
	Ergonomic principles shall be taken into account in designing machinery so as to reduce the mental or physical stress of, and strain on, the operator. These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design.	This requirement has been considered during design.	Pass
	NOTE Also improved are the performance and reliability of operation and hence the reduction	noted	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	in the probability of errors at all stages of machine use.		
	Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2).		
	All elements of the operator–machine interface, such as controls, signalling or data display elements, shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible. See EN 614- 1, EN 13861 and IEC 61310- 1.	Considered	Pass
	The designer' s attention is particularly drawn to following ergonomic aspects of machine design.	Considered	Pass
	a) Avoid the necessity for stressful postures and movements during the use of the machine (for example, providing facilities to adjust the machine to suit the various operators).	Considered	Pass
	b) Design machines, especially hand-held and mobile machines, so as to enable them to be operated easily, taking into account human effort, actuation of controls and hand, arm and leg anatomy.	Considered	Pass
	c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures.	Considered	Pass
	d) Avoid linking the operator' s working rhythm to an automatic succession of cycles.	Considered	Pass
	e) Provide local lighting on or in the machine for the illumination of the working area and of adjusting, setting-up and frequent maintenance zones when the design features of the machine and/or its guards render the ambient lighting inadequate. Flicker, dazzling, shadows and stroboscopic effects shall be avoided if they can cause a risk. If the position or the lighting source has to be adjusted, its location shall be such that it does not cause any risk to persons making the adjustment.	No need	N/A
	f) Select, locate and identify manual controls (actuators) so that	Considered	Pass
	− they are clearly visible and identifiable, and appropriately marked where necessary (see 6.4.4),	This requirement has been considered during design.	Pass
	− they can be safely operated without hesitation or loss of time and without ambiguity (for example, a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation),	This requirement has been considered during design.	Pass

	– their location (for push-buttons) and their movement (for levers and hand wheels) are consistent with their effect (see IEC 61310-3), and	According to IEC 61310-3	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	– their operation cannot cause additional risk . See also ISO 9355-3.	No additional risk is found.	Pass
	Where a control is designed and constructed to perform several different actions — namely, where there is no one-to-one correspondence (for example, keyboards) — the action to be performed shall be clearly displayed and subject to confirmation where necessary.	Marked with words.	Pass
	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. Constraints due to the necessary or foreseeable use of personal protective equipment (such as footwear, gloves) shall be taken into account.	This requirement has been considered during design.	Pass
	g) Select, design and locate indicators, dials and visual display units so that	See below	Pass
	– they fit within the parameters and characteristics of human perception,	Considered	Pass
	– 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, and	Considered	Pass
	– the operator is able to perceive them from the control position.	Considered	Pass
6.2.9	**Electrical hazards**	-	-
	For the design of the electrical equipment of machines, IEC 60204-1 gives general provisions about disconnection and switching of electrical circuits and for protection against electric shock. For requirements related to specific machines, see corresponding IEC standards (for example, IEC 61029, IEC 60745 or IEC 60335).	See EN 60204- 1 report	Pass
6.2.10	**Pneumatic and hydraulic hazards**	-	-
	Pneumatic and hydraulic equipment of machinery shall be designed so that	Pneumatic equipment has been used, See below	Pass
	– the maximum rated pressure cannot be exceeded in the circuits (using, for example, pressure-limiting devices),	By user	Pass
	– no hazard results from pressure fluctuations or increases, or from loss of pressure or vacuum,	No this kind of risk	Pass
	– no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures,	No this kind of risk	Pass
	– air receivers, air reservoirs or similar vessels (such as in gas-loaded accumulators) comply with the applicable design standard codes or regulations for these elements,	Not used	N/A
	– all elements of the equipment, especially pipes and hoses, are protected against harmful external effects,	protected	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	– as far as possible, reservoirs and similar vessels (for example, gas-loaded accumulators) are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, Clause 5), and	No this kind of equipment used on this machine.	N/A
	– all elements which remain under pressure after isolation of the machine from its power supply are provided with clearly identified exhaust devices, and there is a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine.	No this kind of situation	N/A
	NOTE See also ISO 4413 and ISO 4414.	Noted	N/A
6.2.11	**Applying inherently safe design measures to control systems**	-	-
6.2.11.1	**General**	-	-
	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).	No this kind of situation	N/A
	The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behaviour.	This requirement has been considered during design.	Pass
	Typical causes of hazardous machine behaviour are	See below	Pass
	– an unsuitable design or modification (accidental or deliberate) of the control system logic,	considered	Pass
	– a temporary or permanent defect or failure of one or several components of the control system,	No need according to risk assessment	N/A
	– a variation or a failure in the power supply of the control system, and	considered	Pass
	– inappropriate selection, design and location of the control devices.	considered	Pass
	Typical examples of hazardous machine behaviour are	See below	Pass
	– unexpected start-up (see ISO 14118),	Comply with ISO14118	Pass
	– uncontrolled speed change,	No this kind of risk	N/A
	– failure to stop moving parts,	No this kind of risk .	Pass
	– dropping or ejection of part of the machine or of a workpiece clamped by the machine, and	Considered	Pass
	– machine action resulting from inhibition (defeating or failure) of protective devices.	Considered	Pass

	In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause (6.2.11) and in 6.2.12. These principles and methods shall be applied singly or in combination as appropriate to the circumstances	The design of control systems shall comply with the principles and methods presented in 6.2.11 and in 6.2.12	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	(see ISO 13849- 1, IEC 60204- 1 and IEC 62061).		
	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:	Considered.	Pass
	– systematic analysis of start stop and conditions;	Analysis has been carried out by designer.	Pass
	– provision for specific operating modes (for example, start-up after normal stop, restart after cycle interruption or after emergency stop, removal of the workpieces contained in the machine, operation of a part of the machine in case of a failure of a machine element);	Considered, see EN 60204- 1 report for detail	Pass
	– clear display of the faults;	No need.	N/A
	– measures to prevent accidental generation of unexpected start commands (for example, shrouded start device) likely to cause dangerous machine behaviour (see ISO 14118:2000, Figure 1);	Design according to ISO 14118:2000, Figure 1.	Pass
	– maintained stop commands (for example, interlock) to prevent restarting that could result in dangerous machine behaviour (see ISO 14118:2000, Figure 1).	Design according to ISO 14118:2000, Figure 1.	Pass
	An assembly of machines may be divided into several zones for emergency stopping, for stopping as a result of protective devices and/or for isolation and energy dissipation. The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone. Likewise, it shall be obvious which control devices (for example, emergency stop devices, supply disconnecting devices) and/or protective devices belong to which zone. The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention.	Just one emergency stop is provided.	N/A
	For example:	-	-
	– the travelling speed of mobile pedestrian controlled machinery other than remote- controlled shall be compatible with walking speed;	No this kind of situation	N/A
	– 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	No this kind of situation	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	account the total reaction time of the operator and the machine;		
	– the range of movements of parts of machinery for lifting loads shall be kept within specified limits.	No this kind of situation	N/A
	When the machinery contains various elements that can be operated independently, the control system shall be designed to prevent risks arising out of a lack of coordination (for example, collision prevention system).	This requirement has been taken into account during design.	Pass
6.2.11.2	**Starting of an internal power source/ switching on an external power supply**	-	-
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation.	No hazardous situation is found	Pass
	For example:	See below	Pass
	– starting the internal combustion engine shall not lead to movement of a mobile machine;	No internal combustion engine used	N/A
	– connection to mains electricity supply shall not result in the starting of working parts of a machine.	Start the machine shall actuate the start button	Pass
	See IEC 60204-1:2005, 7.5 (see also Annexes A and B).	See EN 60204- 1 report	Pass
6.2.11.3	**Starting/ stopping of a mechanism**	-	-
	The primary action for starting or accelerating the movement of a mechanism should be performed by the application or an increase of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 0 to state 1 (where state 1 represents the highest energy state).	By increase of voltage.	Pass
	The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 1 to state 0 (where state 1 represents the highest energy state) .	By removal the voltage	Pass
	In certain applications, such as high-voltage switchgear, this principle cannot be followed, in which case other measures should be applied to achieve the same level of confidence for the stopping or slowing down.	No this kind of situation	N/A
	When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (for example, a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system.	No this kind of risk	N/A
6.2.11.4	**Restart after power interruption**	-	-
	If a hazard could be generated, the spontaneous restart of a machine when it is	Restart the machine shall re- actuate the start manual	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	re- energized after power interruption shall be prevented (for example, by use of a self- maintained relay, contactor or valve) .		
6.2.11.5	Interruption of power supply	-	-
	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:	See below	Pass
	– the stopping function of the machinery shall remain;	Comply with the requirement	Pass
	– all devices whose permanent operation is required for safety shall operate in an effective way to maintain safety (for example, locking, clamping devices, cooling or heating devices, power- assisted steering of self- propelled mobile machinery) ;	Comply with the requirement	Pass
	– 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.	Comply with the requirement	Pass
6.2.11.6	**Use of automatic monitoring**	-	-
	Automatic monitoring is intended to ensure that a safety function or functions implemented by a protective measure do not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed such that hazards are generated.	No need.	N/A
	Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function. In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (for example, the beginning of the machine cycle).	No need.	N/A
	The protective measure may be, for example,	See above	N/A
	– the stopping of the hazardous process,	See above	N/A
	– preventing the restart of this process after the first stop following the failure, or	See above	N/A
	– the triggering of an alarm .	See above	N/A
6.2.11.7	**Safety functions implemented by programmable electronic control systems**	No safety function implemented by programmable electronic control system	N/A
6.2.11.7.1	**General**	See above	N/A
	A control system that includes programmable electronic equipment (for example, programmable controllers) can, where appropriate, be used to implement safety functions at machinery. Where a programmable electronic control system is used, it is necessary to consider its performance requirements in relation to the requirements for the safety functions. The design of the programmable		

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Clause	**Requirement**	**Result**	**Verdict**
	electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) is sufficiently low. Where a programmable electronic control system performs a monitoring function, the system behaviour on detection of a fault shall be considered (see also the IEC 61508 series for further guidance).		
	NOTE Both ISO 13849- 1 and IEC 62061, specific to machinery safety, provide guidance applicable to programmable electronic control systems.	See above	N/A
	The programmable electronic control system should be installed and validated to ensure that the specified performance [for example, safety integrity level (SIL) in IEC 61508] for each safety function has been achieved. Validation comprises testing and analysis (for example, static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.	See above	N/A
6.2.11.7.2	**Hardware aspects**	See above	N/A
	The hardware (including, for example, sensors, actuators and logic solvers) shall be selected, and/or designed and installed, to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of	See above	N/A
	– architectural constraints (the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault, etc.),	See above	N/A
	– selection, and/or design, of equipment and devices with an appropriate probability of dangerous random hardware failure, and	See above	N/A
	– the incorporation of measures and techniques within the hardware so as to avoid systematic failures and control systematic faults.		
6.2.11.7.3	**Software aspects**	See above	N/A
	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).	See above	N/A
	Application software should not be reprogrammable by the user. This may be achieved by use of embedded software in a non-reprogrammable memory [for example, micro-controller, application-specific integrated circuit (ASIC)].	See above	N/A
	When the application requires reprogramming by the user, the access to the software dealing with safety functions should be restricted (for example, by locks or passwords for the	See above	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	authorized persons) .		
6.2.11.8	**Principles relating to manual control**	-	-
	These are as follows.	See below	Pass
	a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8, item f).	See related clause	Pass
	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.	Stop control device is placed near each start control device	Pass
	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.	All manual controls are located out of reach of the danger zone.	Pass
	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.	Operator can observe the working area from the control position	Pass
	1) The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions.	Not this kind of machine.	N/A
	2) 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 this kind of machine.	N/A
	e) If it is possible to start the same hazardous element by means of several controls, the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means of, among others, a portable control unit (such as a teach pendant), with which the operator can enter danger zones.	no this kind of situation	N/A
	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, ISO 9355-3 and ISO 447).	All the hazards have been guarded.	Pass
	g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be implemented to ensure the presence of the operator at the control position (for example, by the design and location of control devices).	Not depends on operator.	N/A
	h) For cableless control, an automatic stop shall be performed when correct control signals are	No cableless control used	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	not received, including loss of communication (see IEC 60204- 1).		
6.2.11.9	**Control mode for setting, teaching, process changeover, fault- finding, cleaning or maintenance**	-	-
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to be displaced or removed and/or a protective device has to be disabled, and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put into operation, the safety of the operator shall be achieved using a specific control mode which simultaneously	For this kind of mode, the power to machine shall cut off or no need displaced safety protective device.	N/A
	a) disables all other control modes,	See above	N/A
	b) permits operation of the hazardous elements only by continuous actuation of an enabling device, a two-hand control device or a hold- to- run control device,	See above	N/A
	c) permits operation of the hazardous elements only in reduced risk conditions (for example, reduced speed, reduced power/force, step- by- step, for example, with a limited movement control device), and	See above	N/A
	d) prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.	See above	N/A
	NOTE For some special machinery other protective measures can be appropriate.	noted	N/A
	This control mode shall be associated with one or more of the following measures:	See above	N/A
	– restriction of access to the danger zone as far as possible;	See above	N/A
	– emergency stop control within immediate reach of the operator;	See above	N/A
	– portable control unit (teach pendant) and/or local controls (allowing sight of the controlled elements).	See above	N/A
	See IEC 60204-1.	See above	N/A
6.2.11.10	**Selection of control and operating modes**	-	-
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (for example, to allow for adjustment, setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position. Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode.	Key switch provided for setting use.	Pass

	The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (for example, access	No this kind of function.	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	codes for certain numerically controlled functions) .		
6.2.11.11	**Applying measures to achieve electromagnetic compatibility (EMC)**	Covered by EMC directive	N/A
	For guidance on electromagnetic compatibility, see IEC 60204- 1 and IEC 61000-6.	Covered by EMC directive	N/A
6.2.11.12	**Provision of diagnostic systems to aid fault- finding**	-	-
	Diagnostic systems to aid fault-finding should be included in the control system so that there is no need to disable any protective measure.	No need to disable any protective measure	Pass
	NOTE Such systems not only improve availability and maintainability of machinery, they also reduce the exposure of maintenance staff to hazards.	noted	Pass
6.2.12	**Minimizing probability of failure of safety functions**	-	-
6.2.12.1	**General**	-	-
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine.	considered	Pass
	The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by the measures given in 6.2.12.2 to 6.2.12.4.	See related clause.	Pass
6.2.12.2	**Use of reliable components**	-	-
	" 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 6.2.13).	All safety function component has Passed CE	Pass
	NOTE 1 "Reliable components" is not a synonym for "well-tried components" (see ISO 13849- 1:2006, 6.2.4).		Pass
	NOTE 2 Environmental conditions for consideration include impact, vibration, cold, heat, moisture, dust, corrosive and/or abrasive substances, static electricity and magnetic and electric fields. Disturbances which can be generated by those conditions include insulation failures and temporary or permanent failures in the function of control system components.	noted	Pass
6.2.12.3	**Use of " oriented failure mode" components**	-	-
	" Oriented failure mode" components or systems are those in which the predominant failure mode is known in advance and which can be used so that the effect of such a failure on the machine function can be predicted.	No need according to risk assessment	N/A

	NOTE In some cases, it will be necessary to	noted	N/A

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	take additional measures to limit the negative effects of such a failure.		
	The use of such components should always be considered, particularly in cases where redundancy (see 6.2.12.4) is not employed.	noted	N/A
6.2.12.4	**Duplication (or redundancy) of components or subsystems**	-	-
	In the design of safety-related parts of the machine, duplication (or redundancy) of components may be used so that, if one component fails, another component or components continue to perform the respective function(s), thereby ensuring that the safety function remains available.	No need.	N/A
	In order to allow the proper action to be initiated, component failure shall be detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection, provided that the inspection interval is shorter than the expected lifetime of the components.	No need.	N/A
	Diversity of design and/or technology can be used to avoid common cause failures (for example, from electromagnetic disturbance) or common mode failures.	No need.	N/A
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 intervention, thereby reducing exposure to hazards.	Considered	Pass
	This applies to power systems (operative part, see Annex A) as well as to control systems, and to safety functions as well as to other functions of machinery.	Applied	Pass
	Safety-related components (for example, certain sensors) of known reliability shall be used.	Applied	Pass
	The elements of guards and of protective devices shall be especially reliable, as their failure can expose persons to hazards, and also because poor reliability would encourage attempts to defeat them.	Comply with the requirement	Pass
6.2.14	**Limiting exposure to hazards through mechanization or automation of loading (feeding)/ unloading (removal) operations**	--	-
	Mechanization and automation of machine loading/unloading operations and, more generally, of handling operations — of workpieces, materials or substances — limits the risk generated by these operations by reducing the exposure of persons to hazards at the operating points.	Loading and unloading manually	N/A
	Automation can be achieved by, for example, robots, handling devices, transfer mechanisms	See above	N/A

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	and air-blast equipment. Mechanization can be achieved by, for example, feeding slides, push-rods and hand-operated indexing tables.		
	While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being corrected. Care shall be taken to ensure that the use of these devices does not introduce further hazards, such as trapping or crushing, between the devices and parts of the machine or workpieces/materials being processed. Suitable safeguards (see 6.3) shall be provided if this cannot be ensured.	See above	N/A
	Automatic feeding and removal devices with their own control systems and the control system of the associated machine shall be interconnected after thorough study of how all safety functions are performed in all the control and operation modes of the entire equipment.	See above	N/A
6.2.15	**Limiting exposure to hazards through location of setting and maintenance points outside danger zones**	No need according to risk assessment	N/A
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.	See above	N/A
6.3	**Safeguarding and complementary protective measures**	-	-
6.3.1	**General**	-	-
	Guards and protective devices shall be used to protect persons whenever an inherently safe design measure does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (for example, emergency stop equipment) may have to be implemented.	Fixed guards are provided.	Pass
	NOTE The different kinds of guards and protective devices are defined in 3.27 and 3.28.	noted	Pass
	Certain safeguards may be used to avoid exposure to more than one hazard.	Fixed guards are provided.	Pass
6.3.2	**Selection and implementation of guards and protective devices**	-	-
6.3.2.1	**General**	-	-
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against hazards generated by moving parts, according to the nature of those parts (see Figure 4) and to the need for access to the danger zone(s).	The guards have been selected according to the subclause.	Pass
	The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine.	See risk assessment report.	Pass
	In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it	Fixed guards are used.	Pass

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	shall be borne in mind that a fixed guard is simple and shall be used where the access of an operator into a danger zone is not required during the normal operation (operation without malfunction) of the machinery.		
	As the need for frequency of access increases, this inevitably leads to the fixed guard not being replaced. This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment).	No this kind of situation	N/A
	A combination of safeguards can sometimes be required. For example, where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device can be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard.	No this kind of situation	N/A
	Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards including	No this kind of hazard	N/A
	a) hazards from falling or ejected objects, using, for example, protection in the form of a falling object protection structure (FOPS),	No this kind of hazard	N/A
	b) emission hazards (protection against noise, vibration, radiation, substances hazardous to health, etc.),	No this kind of hazard	N/A
	c) hazards due to the environment (protection against heat, cold, foul weather, etc.),	No this kind of hazard	N/A
	d) hazards due to tipping over or rolling over of machinery, using, for example, protection in the form of roll-over or tip-over protection structures (ROPS and TOPS).	No this kind of hazard	N/A
	The design of enclosed work stations, such as cabs and cabins, shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.	No enclosed work station provided on this machine.	N/A
6.3.2.2	**Where access to the hazard zone is not required during normal operation**	-	-
	Where access to the hazard zone is not required during normal operation of the machinery, safeguards should be selected from the following:	See below	Pass
	a) fixed guards (see also ISO 14120);	Fixed guards are provided.	Pass
	b) interlocking guards with or without guard locking (see also 6.3.3.2.3, ISO 14119 and ISO 14120);	No this kind of situation	N/A
	c) self-closing guards (see ISO 14120:2002, 3.3.2);	No this kind of guard used	N/A
	d) sensitive protective equipment, such as electrosensitive protective equipment (see IEC	Not used	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	61496) or pressure-sensitive protective devices (see ISO 13856).		
6.3.2.3	**Where access to the hazard zone is required during normal operation**	-	-
	Where access to the hazard zone is required during normal operation of the machinery, safeguards should be selected from the following:	No this kind of situation	N/A
	a) interlocking guards with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this document);	Not used.	N/A
	b) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496);	Not used.	N/A
	c) adjustable guards;	Not used.	N/A
	d) self-closing guards (see ISO 14120:2002, 3.3.2);	Not used.	N/A
	e) two-hand control devices (see ISO 13851);	Not used.	N/A
	f) interlocking guards with a start function (control guard) (see 6.3.3.2.5).	Not used.	N/A
6.3.2.4	**Where access to the hazard zone is required for machine setting, teaching, process changeover, fault-finding, cleaning or maintenance**	-	-
	As far as possible, machines shall be designed so that the safeguards provided for the protection of the production operator also ensure the protection of personnel carrying out setting, teaching, process changeover, fault-finding, cleaning or maintenance, without hindering them in the performance of their task . Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2).	No this kind of situation	N/A
	NOTE Isolation and energy dissipation for machine shut-down (see 6.3.5.4, and also ISO 14118:2000, 4.1 and Clause 5) ensure the highest level of safety when carrying out tasks (especially maintenance and repair tasks) that do not require the machine to remain connected to its power supply.	No this kind of situation	N/A
6.3.2.5	**Selection and implementation of sensitive protective equipment**	-	-
6.3.2.5.1	**Selection**	-	-
	Due to the great diversity of the technologies on which their detection function is based, all types of sensitive protective equipment are far from being equally suitable for safety applications. The following provisions are intended to provide the designer with criteria for selecting, for each application, the most suitable device(s).	No sensitive protective equipment used on this machine.	N/A
	Types of sensitive protective equipment include	No sensitive protective equipment used on this machine.	N/A

	– light curtains,	No sensitive protective	N/A

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		equipment used on this machine.	
	– scanning devices, for example, laser scanners,	No sensitive protective equipment used on this machine.	N/A
	– pressure-sensitive mats, and	No sensitive protective equipment used on this machine.	N/A
	– trip bars, trip wires.	No sensitive protective equipment used on this machine.	N/A
	Sensitive protective equipment can be used	No sensitive protective equipment used on this machine.	N/A
	– for tripping purposes,	No sensitive protective equipment used on this machine.	N/A
	– for presence sensing,	No sensitive protective equipment used on this machine.	N/A
	– for both tripping and presence sensing, or	No sensitive protective equipment used on this machine.	N/A
	– to re-initiate machine operation — a practice subject to stringent conditions.	No sensitive protective equipment used on this machine.	N/A
	NOTE Some types of sensitive protective equipment can be unsuitable either for presence sensing or for tripping purposes.	No sensitive protective equipment used on this machine.	N/A
	The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment:	No sensitive protective equipment used on this machine.	N/A
	– tendency for the machinery to eject materials or component parts;	No sensitive protective equipment used on this machine.	N/A
	– necessity to guard against emissions (noise, radiation, dust, etc.);	No sensitive protective equipment used on this machine.	N/A
	– erratic or excessive machine stopping time;	No sensitive protective equipment used on this machine.	N/A
	– inability of a machine to stop part-way through a cycle.	No sensitive protective equipment used on this machine.	N/A
6.3.2.5.2	**Implementation**	-	-
	Consideration should be given to	-	-
	a) the size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment),	No sensitive protective equipment used on this machine.	N/A
	b) the reaction of the device to fault conditions (see IEC 61496 for electrosensitive protective equipment),	No sensitive protective equipment used on this machine.	N/A
	c) the possibility of circumvention, and	No sensitive protective equipment used on this	N/A

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		machine.	
	d) detection capability and its variation over the course of time (as a result, for example, of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources and sunlight or impurities in the air).	No sensitive protective equipment used on this machine.	N/A
	NOTE 1 IEC 61496 defines the detection capability of electrosensitive protective equipment.	No sensitive protective equipment used on this machine.	N/A
	Sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that	No sensitive protective equipment used on this machine.	N/A
	– a command is given as soon as a person or part of a person is detected,	No sensitive protective equipment used on this machine.	N/A
	– the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and therefore the command given by the sensitive protective equipment is maintained by the control system until a new command is given,	No sensitive protective equipment used on this machine.	N/A
	– 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,	No sensitive protective equipment used on this machine.	N/A
	– the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, and	No sensitive protective equipment used on this machine.	N/A
	– the position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone without being detected.	No sensitive protective equipment used on this machine.	N/A
	NOTE 2 Muting is the temporary automatic suspension of a safety function(s) by safety-related parts of the control system (see ISO 13849-1).	No sensitive protective equipment used on this machine.	N/A
	For detailed consideration of the fault behaviour of, for example, active optoelectronic protective devices, IEC 61496 should be taken into account.	No sensitive protective equipment used on this machine.	N/A
6.3.2.5.3	**Additional requirements for sensitive protective equipment when used for cycle initiation**	-	-

	In this exceptional application, the starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has	No sensitive protective equipment used on this machine.	N/A

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	been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control.		
	Cycle initiation by sensitive protective equipment shall be subject to the following conditions:	No sensitive protective equipment used on this machine.	N/A
	a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used;	No sensitive protective equipment used on this machine.	N/A
	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 andmonitoring of control and braking systems;	No sensitive protective equipment used on this machine.	N/A
	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;	No sensitive protective equipment used on this machine.	N/A
	d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone;	No sensitive protective equipment used on this machine.	N/A
	e) if there is more than one AOPD safeguarding the machine, only one of the AOPDs is capable of cycle re-initiation;	No sensitive protective equipment used on this machine.	N/A
	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.	No sensitive protective equipment used on this machine.	N/A
	NOTE 1 The hazard zone as referred to in d) is any zone where the hazardous function (including ancillary equipment and transmission elements) is initiated by clearing of the sensing field.	No sensitive protective equipment used on this machine.	N/A
	NOTE 2 See also IEC/TS 62046.	No sensitive protective equipment used on this machine.	N/A
6.3.2.6	**Protective measures for stability**	-	-
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 6.2.6), it shall be maintained by the use of protective measures such as	By inherently safe design.	Pass
	– anchorage bolts,	provided	Pass
	– locking devices,	Not use	N/A
	– movement limiters or mechanical stops,	Not use	N/A
	– acceleration or deceleration limiters,	Not use	N/A
	– load limiters, and	Not use	N/A
	– alarms warning of the approach to stability or tipping limits.	Not use	N/A
6.3.2.7	**Other protective devices**	-	-
	When a machine requires continuous control by the operator (for example, mobile machines, cranes) and an error of the operator can	No need to continuous control of this machine.	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits, in particular		
	– when the operator has insufficient visibility of the hazard zone,	See above	N/A
	– when the operator lacks knowledge of the actual value of a safety-related parameter (distance, speed, mass, angle, etc.), and	See above	N/A
	– when hazards can result from operations other than those controlled by the operator.	See above	N/A
	The necessary devices include	See above	N/A
	a) devices for limiting parameters of movement (distance, angle, velocity, acceleration),	See above	N/A
	b) overloading and moment limiting devices,	See above	N/A
	c) devices to prevent collisions or interference with other machines,	See above	N/A
	d) devices for preventing hazards to pedestrian operators of mobile machinery or other pedestrians,	See above	N/A
	e) torque limiting devices, and breakage points to prevent excessive stress of components and assemblies,	See above	N/A
	f) devices for limiting pressure or temperature,	See above	N/A
	g) devices for monitoring emissions,	See above	N/A
	h) devices to prevent operation in the absence of the operator at the control position,	See above	N/A
	i) devices to prevent lifting operations unless stabilizers are in place,	See above	N/A
	j) devices to limit inclination of the machine on a slope, and	See above	N/A
	k) devices to ensure that components are in a safe position before travelling.	See above	N/A
	Automatic protective measures triggered by such devices that take operation of the machinery out of the control of the operator (for example, automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3).	See above	N/A
6.3.3	**Requirements for design of guards and protective devices**	-	-
6.3.3.1	**General requirements**	-	-
	Guards and protective devices shall be designed to be suitable for the intended use, taking into account mechanical and other hazards involved. Guards and protective devices shall be compatible with the working environment of the machine and designed so that they cannot be easily defeated. They shall provide the minimum possible interference with activities during operation and other phases of machine life, in order to reduce any incentive to defeat them.	Fixed guards have been designed according to this clause.	Pass

	NOTE For additional information, see ISO	ISO 14120 has been	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	14120, ISO 13849- 1, ISO 13851, ISO 14119, ISO 13856, IEC 61496 and IEC 62061.	considered.	
	Guards and protective devices shall	See below	Pass
	a) be of robust construction,	Considered during design.	Pass
	b) not give rise to any additional hazard,	No additional hazard exists.	Pass
	c) not be easy to bypass or render non- operational,	Comply with the requirement	Pass
	d) be located at an adequate distance from the danger zone (see ISO 13855 and ISO 13857),	Comply with the requirement	Pass
	e) cause minimum obstruction to the view of the production process, and	Not obstruction to the view of production process.	Pass
	f) enable essential work to be carried out for the installation and/or replacement of tools and for maintenance by allowing access only to the area where the work has to be carried out — if possible, without the guard having to be removed or protective device having to be disabled.	Comply with the requirement.	Pass
	For openings in the guards, see ISO 13857.	considered	Pass
6.3.3.2	**Requirements for guards**	-	-
6.3.3.2.1	**Functions of guards**	-	-
	The functions that guards can achieve are	See below	Pass
	– prevention of access to the space enclosed by the guard, and/or	Fixed guards are provided for this function	Pass
	– containment/capture of materials, workpieces, chips, liquids which can be ejected or dropped by the machine, and reduction of emissions (noise, radiation, hazardous substances such as dust, fumes, gases) that can be generated by the machine.	Fixed guards are provided for this function	Pass
	Additionally, they could need to have particular properties relating to electricity, temperature, fire, explosion, vibration, visibility (see ISO 14120) and operator position ergonomics (for example, usability, operator's movements, postures, repetitive movements).	Fixed guards are provided for this function	Pass
6.3.3.2.2	**Requirements for fixed guards**	-	-
	Fixed guards shall be securely held in place either	Fastener provided	Pass
	– permanently (for example by welding), or	By fastener	N/A
	– by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120).	Screws and nuts are provided to fix the guards.	Pass
	NOTE A fixed guard can be hinged to assist in its opening.	Hinge is provided.	Pass
6.3.3.2.3	**Requirements for movable guards**	-	-
	Movable guards which provide protection against hazards generated by moving transmission parts shall	No this kind of situation	N/A
	a) as far as possible when open remain fixed to the machinery or other structure (generally by means of hinges or guides), and	See above.	Pass

	b) be interlocking (with guard locking when necessary) (see ISO 14119).	See above.	Pass

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Clause	**Requirement**	**Result**	**Verdict**
	Movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that	See above.	Pass
	– moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up, with this able to be achieved by interlocking guards, with guard locking when necessary,	See above.	Pass
	– they can be adjusted only by an intentional action, such as the use of a tool or a key, and	See above.	Pass
	– the absence or failure of one of their components either prevents starting of the moving parts or stops them, with this able to be achieved by automatic monitoring (see 6.2.11.6).	See above.	Pass
	See Figure 4 and ISO 14119.	See above.	Pass
6.3.3.2.4	**Requirements for adjustable guards**	-	-
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed.	No this kind of situation.	N/A
	Manually adjustable guards shall be	See above	N/A
	– designed so that the adjustment remains fixed during a given operation, and	See above	N/A
	– readily adjustable without the use of tools.	See above	N/A
6.3.3.2.5	**Requirements for interlocking guards with a start function (control guards)**	-	-
	An interlocking guard with a start function may only be used provided that	No this kind of situation.	N/A
	a) all requirements for interlocking guards are satisfied (see ISO 14119),	No this kind of situation.	N/A
	b) the cycle time of the machine is short,	No this kind of situation.	N/A
	c) the maximum opening time of the guard is preset to a low value (for example, equal to the cycle time) and, when this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine,	No this kind of situation.	N/A
	d) the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120),	No this kind of situation.	N/A
	e) all other guards, whether fixed (removable type) or movable, are interlocking guards,	No this kind of situation.	N/A
	f) the interlocking device associated with the interlocking guard with a start function is designed such that — for example, by duplication of position detectors and use of automatic monitoring (see 6.2.11.6) — its failure cannot lead to an unintended/unexpected start-up, and	No this kind of situation.	N/A
	g) the guard is securely held open (for	No this kind of situation.	N/A

	example,		

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Clause	**Requirement**	**Result**	**Verdict**
	by a spring or counterweight) such that it cannot initiate a start while falling by its own weight.		
6.3.3.2.6	**Hazards from guards**	-	-
	Care shall be taken to prevent hazards which could be generated by	See below	Pass
	– the guard construction (sharp edges or corners, material, noise emission, etc.),	No this kind of risk	Pass
	– the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall).	No this kind of risk	Pass
6.3.3.3	**Technical characteristics protective of devices**	-	-
	Protective devices shall be selected or designed and connected to the control system such that correct implementation of their safety function(s) is ensured.	Considered during design	Pass
	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.	Fixed guards comply with EN 953	Pass
	Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.	Comply with the requirement	pass
6.3.3.4	**Provisions for alternative types of safeguards**	-	-
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it is known that it will be necessary to change the safeguards because of the range of work to be carried out.	No this kind of situation	N/A
6.3.4	**Safeguarding to reduce emissions**	-	-
6.3.4.1	**General**	-	-
	If the measures for the reduction of emissions at source specified in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).	See below	Pass
6.3.4.2	**Noise**	-	-
	Additional protective measures against noise include	See below	Pass
	– enclosures (see ISO 15667),		Pass
	– screens fitted to the machine, and	Not used	N/A
	– silencers (see ISO 14163).	Not used	N/A
6.3.4.3	**Vibration**	-	-
	Additional protective measures against vibration include	Not used	N/A
	– vibration isolators, such as damping devices placed between the source and the exposed person,	Not used	N/A
	– resilient mounting, and	Not used	N/A
	– suspended seats.	Not used	N/A

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Clause	**Requirement**	**Result**	**Verdict**
	For measures for vibration isolation of stationary industrial machinery see EN 1299.	Not used	N/A
6.3.4.4	**Hazardous substances**	-	-
	Additional protective measures against hazardous substances include	See below	N/A
	– encapsulation of the machine (enclosure with negative pressure),	Not used	N/A
	– local exhaust ventilation with filtration,	Not used	N/A
	– wetting with liquids, and	Not used	N/A
	– special ventilation in the area of the machine (air curtains, cabins for operators).	Not used	N/A
	See ISO 14123-1.	Not used	N/A
6.3.4.5	Radiation	-	-
	Additional protective measures against radiation include	See below	N/A
	– use of filtering and absorption, and	Covered by EMC	N/A
	– use of attenuating screens or guards.	Covered by EMC	N/A
6.3.5	**Complementary protective measures**	-	-
6.3.5.1	**General**	-	-
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use, could have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine. Such measures include, but are not limited to, those dealt with in 6.3.5.2 to 6.3.5.6.	Comply with the requirement	Pass
6.3.5.2	**Components and elements to achieve emergency stop function**	-	-
	If, following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function for enabling actual or impending emergency situations to be averted, the following requirements apply:	No this kind of situation.	N/A
	– the actuators shall be clearly identifiable, clearly visible and readily accessible;	No this kind of situation.	N/A
	– the hazardous process shall be stopped as quickly as possible without creating additional hazards, but if this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution;	No this kind of situation.	N/A
	– the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary.	No this kind of situation.	N/A
	NOTE For more detailed provisions, see ISO 13850.	No this kind of situation.	N/A
	Once active operation of the emergency stop device has ceased following an emergency stop command, the effect of this command shall be sustained until it is reset. This reset shall be possible only at the location where the emergency stop command has been initiated.	No this kind of situation.	N/A

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	The reset of the device shall not restart the machinery, but shall only permit restarting.		
	More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in IEC 60204.	No this kind of situation.	N/A
6.3.5.3	**Measures for the escape and rescue of trapped persons**	-	-
	Measures for the escape and rescue of trapped persons may consist, among others, of	No this kind of risk	N/A
	– escape routes and shelters in installations generating operator- trapping hazards,	No this kind of risk	N/A
	– arrangements for moving some elements by hand, after an emergency stop,	No this kind of risk	N/A
	– arrangements for reversing the movement of some elements,	No this kind of risk	N/A
	– anchorage points for descender devices,	No this kind of risk	N/A
	– means of communication to enable trapped operators to call for help.	No this kind of risk	N/A
6.3.5.4	**Measures for isolation energy and dissipation**	-	-
	Machines shall be equipped with the technical means to achieve isolation from power supply(ies) and dissipation of stored energy by means of the following actions:	Main switch has been provided for this kind of application	Pass
	a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;	Main switch has been provided for this kind of application	Pass
	b) locking (or otherwise securing) all the isolating units in the isolating position;	The main switch can be locked by pad lock .	Pass
	c) dissipating or, if this is not possible or practicable, restraining (containing) any stored energy which can give rise to a hazard;	No hazard was found.	N/A
	d) verifying, by means of safe working procedures, that the actions taken according to a), b) and c) above have produced the desired effect.	considered	Pass
	See ISO 14118:2000, Clause 5, and IEC 60204- 1:2005, 5.5 and 5.6.	The requirements have been considered.	Pass
6.3.5.5	**Provisions for easy and safe handling of machines and their heavy component parts**	-	-
	Machines and their component parts which cannot be moved or transported by hand shall be provided or be capable of being provided with suitable attachment devices for transport by means of lifting gear.	Lifting gear has been provided, see manual.	Pass
	These attachments may be, among others,	See below	Pass
	– standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing,	Tapped holes are provided.	Pass
	– appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground,	No this kind of situation	N/A

	– fork locating devices for machines to be transported by a lift truck,	Not design for lifting by fork lift.	N/A

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	– lifting and stowing gear and appliances integrated into the machine.	Comply with the requirement	Pass
	Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement.	Comply with the requirement	Pass
	See also 6.4.4 c), item 3).	See related clause.	Pass
6.3.5.6	**Measures for safe access to machinery**	-	-
	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.	All the setting and maintenance can be carried out at ground level	Pass
	Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks; however, care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery.	No this kind of situation	N/A
	The walking areas shall be made from materials which remain as slip resistant as practicable under working conditions and, depending on the height from the ground, shall be provided with suitable guard-rails (see ISO 14122-3).	No this kind of situation	N/A
	In large automated installations, particular attention shall be given to safe means of access, such as walkways, conveyor bridges or crossover points.	No this kind of situation	N/A
	Means of access to parts of machinery located at height shall be provided with collective means of protection against falls (for example, guard-rails for stairways, stepladders and platforms and/or safety cages for ladders). As necessary, anchorage points for personal protective equipment against falls from height shall also be provided (for example, in carriers of machinery for lifting persons or with elevating control stations).	No this kind of situation	N/A
	Openings shall, whenever possible, open towards a safe position. They shall be designed to prevent hazards due to unintended opening.	No this kind of situation	N/A
	The necessary aids for access shall be provided (steps, handholds, etc.). Control devices shall be designed and located to prevent their being used as aids for access.	No this kind of situation	N/A
	When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards for preventing falls when the platform is not present at a level. Movement of the lifting platform shall be prevented while the guards are open.	Not for such use	N/A
	For detailed provisions see ISO 14122.	No this kind of situation	N/A
6.4	**Information for use**	-	-
6.4.1	**General requirements**	-	-
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see Figure 2). Information for use consists of communication	Appropriate information has provided.	Pass

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. Information for use is intended for professional and/or non-professional users.		
	NOTE See also IEC 62079 for structuring and presentation of information for use.	noted	Pass
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.	Appropriate information has provided.	Pass
	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.	Appropriate information has provided.	Pass
	The information shall indicate, as appropriate,	See below	Pass
	– the need for training,	No need	N/A
	– the need for personal protective equipment, and	No need	N/A
	– the possible need for additional guards or protective devices (see Figure 2, Footnote d).	No need	N/A
	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.	Appropriate information has provided.	Pass
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.	Appropriate information has provided.	Pass
6.4.2	**Location and nature of information for use**	-	-
	Depending on the risk, the time when the information is needed by the user and the machine design, it shall be decided whether the information — or parts thereof — are to be given	Appropriate information has provided.	Pass
	a) in/on the machine itself (see 6.4.3 and 6.4.4),	See related clause	Pass
	b) in accompanying documents (in particular instruction handbook, see 6.4.5),	Manual is provided.	Pass
	c) on the packaging,	Provided.	Pass
	d) by other means such as signals and warnings outside the machine.	Labels are provided	Pass
	Standardized phrases shall be considered where important messages such as warnings are given (see also IEC 62079).	Comply with the requirement	Pass
6.4.3	**Signals and warning devices**	-	-

	Visual signals, such as flashing lights and audible signals such as sirens may be used to warn of an impending hazardous event such as machine start-up or overspeed. Such signals may also be used to warn the operator before	Not used	N/A

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	the triggering of automatic protective measures (see 6.3.2.7).		
	It is essential that these signals	See above	N/A
	a) be emitted before the occurrence of the hazardous event,	See above	N/A
	b) be unambiguous,	See above	N/A
	c) be clearly perceived and differentiated from all other signals used, and	See above	N/A
	d) be clearly recognized by the operator and other persons.	See above	N/A
	The warning devices shall be designed and located such that checking is easy. The information for use shall prescribe regular checking of warning devices.	See above	N/A
	The attention of designers is drawn to the possibility of "sensorial saturation", which can result from too many visual and/or acoustic signals and which can also lead to defeating the warning devices.	See above	N/A
	NOTE Consultation of the user on this subject is often necessary.	See above	N/A
6.4.4	**Markings, signs (pictograms) and written warnings**	-	-
	Machinery shall bear all markings which are necessary	Appropriate markings are provided.	Pass
	a) for its unambiguous identification, including at least	provided	Pass
	1) the name and address of the manufacturer,	provided	Pass
	2) the designation of series or type, and	provided	Pass
	3) the serial number, if any,	provided	Pass
	b) in order to indicate its compliance with mandatory requirements, comprising	provided	Pass
	1) marking, and	provided	Pass
	2) written indications, such as the authorized representative of the manufacturer, designation of the machinery, year of construction, and intended use in potentially explosive atmospheres),	Designation of the machinery, year of construction is provide.	Pass
	c) for its safe use, for example,	See below	Pass
	1) maximum speed of rotating parts, 2) maximum diameter of tools, 3) mass (in kilograms) of the machine itself and/or of removable parts, 4) maximum working load, 5) necessity of wearing personal protective equipment, 6) guard adjustment data, and 7) frequency of inspection.	Appropriate markings are provided.	Pass
	Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine.	Comply with the requirement	Pass
	Signs or written warnings indicating only "Danger" shall not be used.	No used	Pass

	Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine to which they are related.	Comply with the requirement.	Pass

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	Readily understandable signs (pictograms) should be used in preference to written warnings.		
	Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be used.	Comply with the requirement.	Pass
	Written warnings shall be drawn up in the language(s) of the country in which the machine will be used for the first time and, on request, in the language(s) understood by operators.	No written warnings.	N/A
	NOTE In some countries the use of specific language(s) is covered by legal requirements.	No written warnings.	N/A
	Markings shall comply with recognized standards (for example, ISO 2972 or ISO 7000, for pictograms, symbols and colours in particular).	Comply with the requirement	Pass
	See IEC 60204-1 as regards marking of electrical equipment.	See EN 60204- 1 report.	Pass
	See ISO 4413 and ISO 4414 for hydraulic and pneumatic equipment.	Pneumatic equipment complies with the requirement.	Pass
6.4.5	**Accompanying documents (in particular — instruction handbook)**	-	-
6.4.5.1	**Contents**	-	-
	The instruction handbook or other written instructions (for example, on the packaging) shall contain, among others, the following:	See below	Pass
	a) information relating to transport, handling and storage of the machine, such as	See manual.	Pass
	1) storage conditions for the machine,	See manual .	Pass
	2) dimensions, mass value(s), position of the centre(s) of gravity, and	See manual.	Pass
	3) indications for handling (for example, drawings indicating application points for lifting equipment);	See manual.	Pass
	b) information relating to installation and commissioning of the machine, such as	See manual.	Pass
	1) fixing/ anchoring and dampening of noise and vibration requirements,	See manual.	Pass
	2) assembly and mounting conditions,	See manual .	Pass
	3) space needed for use and maintenance,	See manual .	Pass
	4) permissible environmental conditions (for example, temperature, moisture, vibration, electromagnetic radiation),	See manual.	Pass
	5) instructions for connecting the machine to power supply (particularly on protection against electrical overloading),	See manual.	Pass
	6) advice on waste removal/ disposal, and	See manual .	Pass
	7) if necessary, recommendations related to protective measures which have to be implemented by the user — for example, additional safeguards (see Figure 2, Footnote d), safety distances, safety signs and signals;	See manual.	Pass

	c) information relating to the machine itself, such as	See manual.	Pass

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	1) detailed description of the machine, its fittings, guards and/or protective devices,	See manual.	Pass
	2) the comprehensive range of applications for which the machine is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate,	See manual.	Pass
	3) diagrams (especially schematic representation of safety functions),	See manual.	Pass
	4) data on noise and vibration generated by the machine, and on radiation, gases, vapours and dust emitted by it, with reference to the measuring methods (including measurement uncertainties) used,	See manual.	Pass
	5) technical documentation of electrical equipment (see IEC 60204), and	See manual.	Pass
	6) documents attesting that the machine complies with mandatory requirements;	See manual.	Pass
	d) information relating to the use of the machine, such as that related to or describing	See manual.	Pass
	1) intended use,	See manual .	Pass
	2) manual controls (actuators),	See manual .	Pass
	3) setting and adjustment,	See manual .	Pass
	4) modes and means for stopping (especially emergency stop),	See manual.	Pass
	5) risks which could not be eliminated by the protective measures implemented by the designer,	See manual.	Pass
	6) particular risks which can be generated by certain applications, by the use of certain fittings, and about specific safeguards necessary for such applications,	See manual.	Pass
	7) reasonably foreseeable misuse and prohibited applications,	See manual.	Pass
	8) fault identification and location, for repair and for restarting after an intervention, and	See manual.	Pass
	9) personal protective equipment needed to be used and the training that is required;	See manual.	Pass
	e) information for maintenance, such as	See manual .	Pass
	1) the nature and frequency of inspections for safety functions,	See manual.	Pass
	2) specification of the spare parts to be used when these can affect the health and safety of operators,	See manual.	Pass
	3) instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence need to be carried out exclusively by skilled persons (for example, maintenance staff, specialists),	See manual.	Pass
	4) instructions relating to maintenance actions (replacement of parts, etc.) which do not require specific skills and hence may be carried out by users (for example, operators), and	See manual.	Pass
	5) drawings and diagrams enabling maintenance personnel to carry out their task rationally (especially fault-finding tasks);	See manual.	Pass

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	f) information relating to dismantling, disabling and scrapping;	See manual.	Pass
	g) information for emergency situations, such as	See below	Pass
	1) the operating method to be followed in the event of accident or breakdown,	No this kind of risk	N/A
	2) the type of fire-fighting equipment to be used, and	No this kind of risk	N/A
	3) a warning of possible emission or leakage of hazardous substance(s) and, if possible, an indication of means for fighting their effects;	No this kind of risk	N/A
	h) maintenance instructions provided for skilled persons [item e) 3) above] and maintenance instructions provided for unskilled persons [item e) 4) above], that need to appear clearly separated from each other.	See manual.	Pass
6.4.5.2	**Production of instruction handbook**	-	-
	The following applies to the production and presentation of the instruction handbook .	See below	Pass
	a) The type fount and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized by the use of colours, symbols and/or large print.	used	Pass
	b) The information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language is to be used, each should be readily distinguished from another, and efforts should be made to keep the translated text and relevant illustration together.	English	Pass
	NOTE In some countries the use of specific language(s) is covered by legal requirements.	Noted	Pass
	c) Whenever helpful to the understanding, text should be supported by illustrations. These illustrations should be supplemented with written details enabling, for example, manual controls (actuators) to be located and identified. They should not be separated from the accompanying text and should follow sequential operations.	Appropriate illustrations are used	Pass
	d) Consideration should be given to presenting information in tabular form where this will aid understanding. Tables should be adjacent to the relevant text.	considered	Pass
	e) The use of colours should be considered, particularly in relation to components requiring quick identification.	considered	Pass
	f) When information for use is lengthy, a table of contents and/or an index should be provided.	Provided.	Pass
	g) Safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.	Comply with the requirement	Pass
6.4.5.3	**Drafting and editing information for use**	-	-

	The following applies to the drafting and editing of information for use.	See below	Pass

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	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).	Identified by model number	Pass
	b) Communication principles: when information for use is being prepared, the communication process "see – think – use" should be followed in order to achieve the maximum effect and should follow sequential operations. The questions, "How?" and "Why?" should be anticipated and the answers provided.	Comply with the requirement	Pass
	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.	Comply with the requirement	Pass
	d) When it is foreseen that a machine will be put to non-professional use, the instructions should be written in a form that is readily understood by the non-professional user. If personal protective equipment is required for the safe use of the machine, clear advice should be given, for example, on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale.	Comply with the requirement	Pass
	e) Durability and availability of the documents: documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It can be useful to mark them "keep for future reference". Where information for use is kept in electronic form (CD, DVD, tape, hard disk, etc.), information on safety-related issues that need immediate action shall always be backed up with a hard copy that is readily available.	Comply with the requirement	Pass
7	**Documentation of risk assessment and risk reduction**	-	-
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of	See risk assessment report	Pass
	a) the machinery for which the risk assessment has been made (for example, specifications, limits, intended use);	See above	Pass
	b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.);	See above	Pass
	c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment;	See above	Pass
	d) the information on which risk assessment was based (see 5.2):	See above	Pass
	1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.);	See above	Pass
	2) the uncertainty associated with the data used and its impact on the risk assessment;	See above	Pass

EN ISO 12100:2010			
Clause	**Requirement**	**Result**	**Verdict**
	e) the risk reduction objectives to be achieved by protective measures;	See above	Pass
	f) the protective measures implemented to eliminate identified hazards or to reduce risk;	See above	Pass
	g) residual risks associated with the machinery;	See above	Pass
	h) the result of the risk assessment (see Figure 1);	See above	Pass
	i) any forms completed during the risk assessment.	See above	Pass
	Standards or other specifications used to select protective measures referred to in f) above should be referenced.	See above	Pass
	NOTE No requirement is given in this International Standard to deliver the risk assessment documentation together with the machine. See ISO/TR 14121-2 for information on documentation.	noted	Pass

EN ISO 13849-1 report

SF Safety function: Emergency stops

Identifier of the Safety function:	
Safety function type:	Emergency stop function
Triggering event:	When the emergency stop button is pressed, the relay will cut off the power supply of the coil of hydraulic and pneumatic valves, and all the hydraulic and pneumatic cylinder movments will be stopped.
Reaction and Behaviour on power failure:	All the movments of hydraulic and pneumatic cylinder will be stopped.
Safe state:	All the movments of hydraulic and pneumatic cylinder will be stopped.
Operation mode:	
Demand rate:	
Running-on time:	
Priority:	
Documentation:	
Document:	

Required Performance Level Safety function

PLr (by direct input):	d
Documentation:	EN ISO 10218-1:2011 Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
Document:	
Source (e.g. standard):	
File:	

Performance Level Safety function

Reached PL: d	PFHD [1/h]: 1.8E-7

Status / Messages Safety function

Status:	green

Subsystems (1 / 1)

SB Name: Emergency stop for moving parts

Reference designator:	Inventory number:

Device details Subsystem

Device Manufacturer:	
Device Identifier:	
Device group:	
Part number:	Revision:
Function:	☐ Input ☐ Output ☐ Logic ☑ unknown
Use case:	

SF Safety function: Emergency stops

Description of the use case:	

Documentation Subsystem

Documentation:	
Document:	

Performance Level Subsystem

PL determination:	Determine PL/PFHD from Category, MTTFD and DCavg
Software suitable up to PL:	n.a.
PL requirements:	fulfilled
The PL shall be determined by the estimation of the following aspects:	- Behaviour of the safety function under fault conditions (see clause 6) [fulfilled] - safety-related software according to clause 4.6 or no software included [fulfilled] - systematic failure (see Annex G) [fulfilled] - Ability to perform a safety function under expected environmental conditions [fulfilled]
Reached PL: d	PFHD [1/h]: 1.8E-7
Documentation:	

Category Subsystem

Cat.:	3
Category requirements:	fulfilled
Requirements of the Category:	- Accordance with relevant standards to withstand the expected influences. [fulfilled] - Basic safety principles are being used. [fulfilled] - Well-tried safety principles are being used. [fulfilled] - A single fault tolerance and reasonable fault detection are given. [fulfilled] - MTTFD is at least Low or Medium or High. [fulfilled] - DCavg is at least Low or Medium; [fulfilled] - The achieved score of the CCF-rating is at least 65. [fulfilled]
Documentation:	
Source (e.g. standard) Category:	
File:	

MTTFD and Mission time Subsystem

MTTFD [a]:	44.6 (High)
Mission time [a]: 20	Shortest mission time [a]: 20

Diagnostic coverage Subsystem

DCavg [%]:	86.3 (Low)

SF Safety function: Emergency stops

Common cause failure Subsystem

CCF Points:	85 (fulfilled)
CCF Measures:	- Separation / Segregation (15 Points) Physical separation between signal paths, for example: ¡ª separation in wiring/piping; ¡ª detection of short circuits and open circuits in cables by dynamic test; ¡ª separate shielding for the signal path of each channel; ¡ª sufficient clearances and creepage distances on printed-circuit boards. - Design / application / experience (15 Points) Protection against over-voltage, over-pressure, over-current, over-temperature, etc. - Design / application / experience (5 Points) Components used are well-tried. - Competence / training (5 Points) Training of designers to understand the causes and consequences of common cause failures. - Environmental (25 Points) For electrical/electronic systems, prevention of contamination and electromagnetic disturbances (EMC) to protect against common cause failures in accordance with appropriate standards (e.g. IEC 61326¨C3-1). Fluidic systems: filtration of the pressure medium, prevention of dirt intake, drainage of compressed air, e.g. in compliance with the component manufacturers¡¯ requirements concerning purity of the pressure medium. NOTE For combined fluidic and electric systems, both aspects should be considered. - Diversity (20 Points) Different technologies/design or physical principles are used, for example: ¡ª first channel electronic or programmable electronic and second channel electromechanical hardwired, ¡ª different initiation of safety function for each channel (e.g. position, pressure, temperature), and/or digital and analog measurement of variables (e.g. distance, pressure or temperature) and/or Components of different manufactures.
Documentation:	
Document:	

Status / Messages Subsystem

Status:	green

SF Safety function: Emergency stops

Channels / Test channels (1 / 2)

CH Name: Channel 1

MTTFD [a]: 44.6

Blocks (1 / 3)

BL Name: Emergency stop button

Reference designator:		Inventory number:	

Device details Block

Device Manufacturer:	LANBOO
Device Identifier:	LB19M5.1-M22Z/S/A(L)
Device group:	
Part number: -SB4	Revision:
Function:	☑ Input ☐ Logic ☐ Output ☐ unknown
Technology:	mechanic
Category:	3
Use case:	
Description of the use case:	

Documentation Block

Documentation:	
Document:	

MTTFD and Mission time Block

MTTFD [a]: 416.7 (High)			
Mission time [a]: 20		Shortest mission time [a]: 20	
B10D [cycles]: 100000		nop [cycles/a]: 2400	
Nop parameter:	Days: 300	Hours: 16	Seconds: 7200
Documentation:	EN ISO 13849-1:2015 Table C.1 Safety of machinery - Safetyrelated parts of control systems - Part 1: General principles for design		

Diagnostic coverage Block

DC [%]: 60 (Low)	
Measure:	Cross monitoring of inputs without dynamic test (Input devices) (0 % - 99 % depending on how often a signal change is done by the application)
Documentation:	

Status / Messages Block

SF Safety function: Emergency stops

Status:	green

Blocks (2 / 3)

BL Name: Safety PLC

Reference designator:		Inventory number:	
Device details Block			
Device Manufacturer:	REER		
Device Identifier:	MI8£¬Input module		
Device group:			
Part number: -110U1, -110U2, -110U3, -110U4		Revision:	
Function:	☐ Input ☐ Output	☑ Logic ☐ unknown	
Technology:	electronic		
Category:	3		
Use case:			
Description of the use case:			
Documentation Block			
Documentation:			
Document:			
MTTFD and Mission time Block			
MTTFD [a]: 100 (High)			
Mission time [a]: 20		Shortest mission time [a]: 20	
Rate of dangerous failure [FIT]: 1141.6			
Documentation:	8540780 15/09/2016 Rev.28		
Diagnostic coverage Block			
DC [%]: 99 (High)			
Measure:	Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements) (Logic) (99 %)		
Documentation:			
Status / Messages Block			
Status:	green		

Blocks (3 / 3)

BL Name: STO

SF Safety function: Emergency stops

Reference designator:	Inventory number:

Device details Block

Device Manufacturer:	TSINO DYNATRON
Device Identifier:	CDRC6-A0502-T0-V1-C08
Device group:	
Part number: -301U1	Revision:
Function:	☐ Input ☐ Logic ☑ Output ☐ unknown
Technology:	electronic
Category:	3
Use case:	
Description of the use case:	

Documentation Block

Documentation:
Document:

MTTFD and Mission time Block

MTTFD [a]: 100 (High)	
Mission time [a]: 20	Shortest mission time [a]: 20
Rate of dangerous failure [FIT]: 1141.6	
Documentation:	

Diagnostic coverage Block

DC [%]: 80 (Low)
Documentation:

Status / Messages Block

Status:	green

Channels / Test channels (2 / 2)

CH Name: Channel 2

MTTFD [a]: 44.6

Blocks (1 / 3)

BL Name: Emergency stop button

Reference designator:	Inventory number:

Device details Block

Device Manufacturer:	LANBOO

SF Safety function: Emergency stops

Device Identifier:	LB19M5.1-M22Z/S/A(L)		
Device group:			
Part number: -SB4		Revision:	
Function:	☑ Input ☐ Output	☐ Logic ☐ unknown	
Technology:	mechanic		
Category:	3		
Use case:			
Description of the use case:			

Documentation Block

Documentation:	
Document:	

MTTFD and Mission time Block

MTTFD [a]: 416.7 (High)			
Mission time [a]: 20		Shortest mission time [a]: 20	
B10D [cycles]: 100000		nop [cycles/a]: 2400	
Nop parameter:	Days: 300	Hours: 16	Seconds: 7200
Documentation:	EN ISO 13849-1:2015 Table C.1 Safety of machinery - Safetyrelated parts of control systems - Part 1: General principles for design		

Diagnostic coverage Block

DC [%]: 60 (Low)	
Measure:	Cross monitoring of inputs without dynamic test (Input devices) (0 % - 99 % depending on how often a signal change is done by the application)
Documentation:	

Status / Messages Block

Status:	green

Blocks (2 / 3)

BL Name: Safety PLC

Reference designator:	Inventory number:

Device details Block

Device Manufacturer:	REER
Device Identifier:	MI8£¬Input module
Device group:	

SF Safety function: Emergency stops

Part number: -110U1, -110U2, -110U3, -110U4	Revision:	
Function:	☐ Input ☐ Output	☑ Logic ☐ unknown
Technology:	electronic	
Category:	3	
Use case:		
Description of the use case:		

Documentation Block

Documentation:	
Document:	

MTTFD and Mission time Block

MTTFD [a]: 100 (High)	
Mission time [a]: 20	Shortest mission time [a]: 20
Rate of dangerous failure [FIT]: 1141.6	
Documentation:	8540780 15/09/2016 Rev.28

Diagnostic coverage Block

DC [%]: 99 (High)	
Measure:	Direct monitoring (e.g. electrical position monitoring of control valves, monitoring of electromechanical devices by mechanically linked contact elements) (Logic) (99 %)
Documentation:	

Status / Messages Block

Status:	green

Blocks (3 / 3)

BL Name: STO

Reference designator:	Inventory number:	

Device details Block

Device Manufacturer:	TSINO DYNATRON	
Device Identifier:	CDRC6-A0502-T0-V1-C08	
Device group:		
Part number: -301U1	Revision:	
Function:	☐ Input ☑ Output	☐ Logic ☐ unknown
Technology:	electronic	

SF Safety function: Emergency stops

Category:	3
Use case:	
Description of the use case:	

Documentation Block

Documentation:	
Document:	

MTTFD and Mission time Block

MTTFD [a]: 100 (High)	
Mission time [a]: 20	Shortest mission time [a]: 20
Rate of dangerous failure [FIT]: 1141.6	
Documentation:	

Diagnostic coverage Block

DC [%]: 80 (Low)	
Documentation:	

Status / Messages Block

Status:	green

EN ISO 10218-1 test report

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
5	Designrequirements andprotectivemeasures		-
5.1	General		-
	The robot shallbe designedinaccordance withthe principlesofISO12100 forrelevanthazards.Significant hazards, such as sharp edges,arenotdealt withby thispartofISO10218.	Refertotherisk assessment report accordingtoISO 12100.	P
	Robots shall be designed andconstructedtocomply withtherequirementsin5.2 to5.15.	See the following clauses.	P
5.2	Generalrequirements		-
5.2.1	Power transmission components		-
	Exposure tohazards caused by componentssuchas motor shafts, gears, drivebelts, or linkages whicharenotprotectedbyintegralcovers(e.g. paneloveragearbox)shallbeprevented either by fixed guardsormovable guards. The fixing systems of the fixed guards which areintended tobe removed for routine serviceactionsshall remain attached to themachine or the guard.Movable guards shallbeinterlocked with thehazardous movementsin such a way that thehazardousmachine functions ceasebefore they can bereached. Thesafety-related control systemperformance of aninterlocking system shall conform to therequirements of5.4.	Fixedguardsarefitted.	P
5.2.2	Power lossorchange		-
	Loss of, or variationsinpower shallnotresultin ahazard.	Functionalverified.	P
	Re-initiation of power shallnotlead to anymotion.	Functionalverified.	P
	Robots shall be designed andconstructedsothatlossor change of electrical,hydraulic, pneumatic or vacuum power doesnot resultin ahazard.If hazardsexistthatarenotprotectedby design, then other protective measures shallbe taken toprotect against those hazards.Unprotectedhazards of the expected use shallbe identifiedin theinformation foruse. NOTE1 SeeIEC 60204-1 for electrical power supplyrequirements.	Designchecked.	P
5.2.3	Component malfunction		-
	Robot components shallbe designed, constructed, secured, or contained so thathazardscausedby breaking or loosening, orreleasing storedenergyareminimized.	Designchecked.	P
5.2.4	Sources of energy		-
	A means of isolating anyhazardousenergysourcetotherobot shall beprovided. Thismeans shallbeprovided with capability of locking or otherwisesecuringin thede-energizedposition.	Isolatingswitchis provided.	P

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
5.2.5	Stored energy		-
	A means shallbeprovided for the controlledreleaseofstoredhazardous energy. A label shallbeaffixed to identify the stored energyhazard. NOTE Stored energy can occur inairandhydraulicpressure accumulators, capacitors, batteries, springs, counterbalances,flywheels, etc.	Release buttonsareprovidedforthe mechanical brakes.	P
5.2.6	Electromagnetic compatibility (EMC)		-
	The design and construction of therobot shallpreventhazardousmotion or situations due to theexpected effects of electromagneticinterference (EMI), radio frequencyinterference (RFI) and electrostatic discharge(ESD). NOTE SeeIEC 61000 for designinformation.	RefertotheEMCtest report.	P
5.2.7	Electrical equipment		-
	The robot electrical equipment shallbedesignedand constructed in accordance with therelevant requirementsofIEC60204-1.	Refertothereportof EN 60204-1:2018.	P
5.3	Actuating controls		-
5.3.1	General		-
	Actuating controls that initiatepower ormotionshallbedesigned and constructed tomeet theperformance criteriamentionedin 5.3.2 to 5.3.5.	See the following clauses.	P
5.3.2	Protection fromunintended operation		-
	Actuating controls shallbe constructed orlocated soas to prevent unintendedoperation.Forexample, appropriately designedpush-buttons or key selectorswitchesin appropriatelocations can beused.	Designchecked.	P
5.3.3	Statusindication		-
	The status of the actuating controlsshallbeclearlyindicated, e.g. poweron, faultdetected,automaticoperation.	Designchecked.	P
	If anindicator lightisused,it shallbe suitable foritsinstalledlocation andits colour shallmeet the requirementsofIEC60204-1.	Designchecked.	P
5.3.4	Labelling		-
	Actuating controls shallbelabelled to clearlyindicatetheir function.	Designchecked.	P
5.3.5	Single pointof control		-
	The robot control system shallbedesignedand constructed so that when the robotisplacedunderlocal pendant control or other teaching device control,initiationof robot motion or change oflocalcontrolselection fromany other sourceisprevented.	Designchecked.	P
5.4	Safety-related control systemperformance (hardware/software)		-

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
5.4.1	General		-
	Safety-related control systems (electric,hydraulic, pneumaticandsoftware) shallcomplywith5.4.2,unless the results of the riskassessment determinethatan alternativeperformance criterion as describedin 5.4.3isappropriate.	Referto 5.4.2 and 5.4.3.	P
	The safety-related control system performanceof the robot and any furnished equipment shallbeclearlystatedin theinformation foruse.	Refertotheinstructionmanual.	P
	NOTE1 Safety-related control systems can alsobe called SRP/CS(safety-related parts of control systems).		-
	ForthepurposesofthispartofISO10218, safety-related control systemperformance is statedas: ----PerformanceLevels(PL) andcategoriesas describedinISO13849-1:2006, 4.5.1; ---- SafetyIntegrityLevels(SIL) andhardwarefault tolerancerequirementsasdescribedinIEC 62061:2005,5.2.4. Those two standards address functional safetyusing similar but differentmethods.Requirementsin those standards should be usedfor therespectivesafety-related control systems for which they areintended. Thedesigner may choose to useeitherof the twostandards. The data and criterianecessary to determinethe safety-related control system performance shallbeincludedin theinformation for use. NOTE 2 The comparison withISO13849-1 andIEC 62061is describedinISO/TR 23849.	RefertothePL calculation note accordingtoISO 13849-1.	P
	Other standards offering alternativeperformance requirements, such as the term.control reliability.usedinNorth America, may alsobeused. Whenusing these alternative standards to design safety-related controlsystems, an equivalent level ofriskreductionshallbeachieved.	Notbeused.	N/A
	Any failure of the safety-related control system shall resultinastopcategory 0or1inaccordancewithIEC 60204-1.		P
5.4.2	Performance requirement		-
	Safety-related parts of control systems shallbedesigned so that they comply withPL=d with structure category3asdescribedinISO13849-1:2006, orsothatthey comply with SIL 2 with ahardware faulttoleranceof1withaprooftestintervalofnotlessthan 20years,as describedinIEC 62061:2005.	RefertothePL calculation note accordingtoISO 13849-1.	P
	Thismeansinparticular: a) a single faultin any of thesepartsdoesnotleadtotheloss of the safety function; b) whenever reasonablypracticable, the single fault shallbe detected at or beforethenextdemanduponthe safety function;		P

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	c) when the single fault occurs, the safety functionis alwaysperformed and a safe state shallbemaintaineduntil the detected faultis corrected;and d) all reasonably foreseeable faults shallbedetected.The requirements a) tod)areconsidered tobe equivalent to structure category 3 asdescribedinISO13849-1:2006. NOTE The requirement of single fault detection doesnotmean that allfaults willbe detected. Consequently, the accumulation of undetected faults canlead to an unintended output andahazardoussituationat themachine.		
5.4.3	Other control system performancecriteria		-
	The results of a comprehensiveriskassessment performed on the robot anditsintendedapplicationmaydetermine that a safety-related control system performanceotherthanthatstatedin 5.4.2 iswarranted for the application.	Nosuchcontrol system	N/A
	Selection of one of these other safety-related performance criteria shall be specificallyidentified,andappropriate limitations and cautionsshallbeincludedin theinformation for useprovided with the affectedequipment.	Nosuchcontrol system	N/A
5.5	Robot stopping functions		-
5.5.1	General		
	Everyrobot shall have aprotective stop functionandanindependent emergency stop function. These functionsshallhaveprovision for the connection of external protective devices. Optionally, an emergency stopoutputsignal maybeprovided. Table1 shows acomparisonof the emergency stop andprotective stop functions.	Designchecked.	P
5.5.2	Emergency stop		-
	The robot shallhave oneormoreemergencystop functions(stop category 0 or1,in accordance withIEC60204-1).		P
	Each control station capable of initiatingrobotmotionorother hazardous situation shall haveamanuallyinitiatedemergency stop function that: a) complieswiththerequirementsof 5.4 andIEC60204-1; b) takesprecedence over all otherrobot controls;c) causes all controlledhazardstostop; d) removes drivepower from therobot actuators; e) provides capability for controllinghazards controlledby therobot system; f)remainsactiveuntilitisreset; and g) shall onlybereset bymanual actionthatdoesnot cause a restart afterresetting,butshallonlypermitarestart to occur.		p

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	Selectionofacategory 0orcategory1stop(in accordancewithIEC 60204-1) functionshallbe determined from the risk assessment		P
	When an emergency stop outputsignalisprovided: - the output shall continue to function whentherobotpowerisremoved; or -if the output doesnot continue to function when therobot power supplyisremoved, an emergencystopsignal shallbe generated.		P
	The emergency stop device shallbein accordance withIEC 60204-1 andISO13850.		P
5.5.3	Protective stop		
	The robot shallhave oneormoreprotectivestopfunctions designed for the connection of externalprotective devices.	Designchecked.	P
	The protective stop function performanceshallcomplywiththerequirementsof5.4.	Designchecked.	P
	This stop function shall cause a stopof allrobotmotion,remove or controlpower to the robot driveactuators,andallow for the control of any other hazardcontrolledbytherobot. This stopmaybeinitiatedmanually or bycontrol logic.		P
	At least oneprotective stop functionshallbeastop category 0 or1, asdescribedinIEC60204-1. Therobot mayhave an additionalprotective stop functionusing stopcategory 2 asdescribedinIEC60204-1thatdoes notresultin drivepower being removedbutdoesrequiremonitoring of the standstill condition after the robotstops.Anyunintendedmotion of the robot in themonitored standstill condition or detected failure of theprotectivestop function shall resultin acategory0stopin accordancewithIEC 60204-1. Themonitoredstandstillfunction performance shall comply with5.4. Thisfunctionmay alsobeinitiated from external devices(input stop signal from protective devices).		P
	NOTE A monitored category 2 stop function inaccordance withIEC60204-1 canbeprovidedby an electricpower drive system which corresponds to a safe operational stop (SOS) inaccordance withIEC61800-5-2..		-
	The manufacturer shallinclude the stop categoryof everyprotective stop circuitinputin theinformation foruse.	Refertotheinstructionmanual.	P
5.6	Speed control		-
5.6.1	General		-
	The speed of therobot end-effector mounting flange andof the tool centrepoint (TCP) shallbe controllableat selectable speeds.		P
	An off-set feature (defining thelocation of the TCP relative to themounting flange) shallbeprovided to	Off-setfeatureis provided.	P

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	enable the TCP speed tobecontrolled.		
5.6.2	Reduced speed controloperation		-
	When operatingunder reduced speed control, thespeedoftheTCPshallnotexceed250mm/s.	RefertoTDS.	P
	Itshouldbepossibletoselectspeedslowerthan250mm/s as theassignedlimit.		P
5.6.3	Safety-rated reduced speedcontrol		-
	When provided, safety-rated reduced speedcontrolshallbe designed and constructed inaccordance with5.4.2sothatin the event of a fault, the speedof theTCPdoesnotexceedthelimitforreducedspeed(see5.6.2)anda protective stopisissued when a fault occurs.	Notbeprovided.	N/A
5.6.4	Safety-ratedmonitored speed		-
	When provided, the speed of the TCPor ofanaxisshallbemonitoredinaccordancewith 5.4.2.Ifthespeed exceeds thelimit selected, aprotective stopshallbeissued.	Notbeprovided.	N/A
5.7	Operational modes		-
5.7.1	Selection		-
	Operational modes shall beselectable withamode selectorwhichcanbelockedineachposition (e.g. akey operated switch which canbe inserted andextractedin eachposition).	A keyoperated selectorisprovided.	P
	Eachposition of the selector shallbe clearlyidentifiableand shall exclusively allow onecontrolor operating mode.	Functional checked.	P
	The selector canbe replacedby anotherselection means whichrestricts theuse of certain functions of therobot (e.g. accesscodes).	Notthiscase.	N/A
	These meansshall: a) unambiguouslyindicate the selected operatingmode;and b)by themselvesnotinitiaterobotmotion or otherhazards.	Functional checked.	P
	An optional output(s)maybe provided toindicatethe mode selected. Whenprovided for safety-relatedpurposes, the output(s) shall comply withthe requirementsof 5.4 (seeAnnexD).		P
	NOTE1 Methods for modelabelling areillustrated in AnnexE.		-
5.7.2	Automatic		-
	In automaticmode, the robot shallexecute thetaskprogramme and the safeguarding measuresshallbefunctioning.	Designchecked.	P
	Automatic operation shall bepreventedif anystopcondition isdetected.	Designchecked.	P

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	Switching from thismode shall resultinastop.		P
5.7.3	Manual reducedspeed		-
	Manual reduced-speedmode shallmeet the requirementsof 5.3.4 and 5.6 andshallallowarobotto be operated byhumanintervention.	Functional checked.	P
	Automatic operationisprohibitedin thismode. This modeisused forjogging, teaching,programming and programme verification of the robot;it maybethemodeselected when performing somemaintenance tasks.		P
	Manual control of the robot frominside the safeguardedspace shall be performed withareducedspeedin conjunction with either of the following:		
	a) hold-to-run controlsin conjunction with anenablingdeviceinaccordancewith 5.8,or		P
	b) for programme verification only, a start/stopcontrolinconjunction with an enabling devicein accordance with5.8.	Notthiscase.	N/A
	Information for use shall contain appropriateinstructionsand warnings that, wherever possible, the manualmodeof operation shall be performed withallpersons outsidethe safeguarded space.Information for use shallalso instruct that prior to selecting automaticmode,any suspended safeguards shall bereturned to their fullfunctionality.		P
	NOTEPreviously, thismode was also known as T1,or teach.		-
5.7.4	Manualhigh-speed		-
	Ifthismodeisprovided, speedsgreaterthan 250mm/scan be achieved.In thiscase, therobotshall:	Thismodeisnot provided.	N/A
	a)have ameans to selectmanualhigh-speed mode whichrequiresadeliberateaction(e.g. akeyswitchon the robot controlpanel) andanadditionalconfirming action;		N/A
	b)provideapendantconformingto 5.8 withahold-to-run functionin addition to the enabling device thatpermits robotmotion to continue;		N/A
	c) setaninitialspeedlimitofupto,butnotexceeding,250mm/suponselectionofmanualhigh-speedmode;		N/A
	d)provide on thependant ameans for the operator toincrementally adjust the speed from theinitial value tothe full programmed value inmultiplesteps;		N/A
	e)provide on thependant an indicationof theadjustedspeed;		N/A
	---its speed islimited to theinitial speedlimitwhentheenabling deviceisre-initiated byplacing the switch in the centre-enabled positionaftereitherhavingbeenreleased or fully compressed, and		N/A
	---a separate deliberate action isrequiredtoreturntothe		N/A

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	higher speed that was selected beforethe enabling device switch was released orcompressed,and		
	---the option to resume thehigher the speedusingseparate action shallbecome no inoperativeaftermore than fiveminutes after enabling therelease of thedevice		N/A
	The option toresume the higher speedand thetime-outisnot safety-rated.Information for use shall contain appropriate instructions and warning that, whereverpossible, themanualmode of operation shall be performed with all persons outside thesafeguarded space.Information for use shall alsoinstructthatprior toselecting automaticmode, any suspended safeguards shallbe returned to their full functionality.		N/A
	NOTE This optional manual mode haspreviouslybeenknownasT2,orhigh-speed attended programme verification		N/A
5.8	Pendant controls		-
5.8.1	General		-
	Where a pendant control orother teachingcontroldevicehas the capability to control therobotfrom withinthe safeguardedspace, therequirementsin 5.3.5and5.8.2to 5.8.7shallapply.	Refertorelative clauses.	P
	NOTE This applies to any device usedin themanualmode tocontrolarobot from within the safeguarded space while drivepower is applied toany of the robot axes. This includesrobots withpoweredlead-through teach, whether usingrobot-mountedmanual controls or main/secondary teaching controls.		-
5.8.2	Motion control		-
	Motion of the robotinitiated from thependant or teachingcontrol device shall beunder reducedspeedcontrolas describedin 5.6. When the controlscontainprovisions for selectingmanual high speed, therobot shallmeet therequirementsin 5.7.4.	Refertoclause 5.6.	P
5.8.3	Enabling device		-
	The pendant or teaching controldeviceshallhavea three-position enabling device in accordancewithIEC60204-1.	Functional checked.	P
	When continuouslyheldin a centre-enabledposition, theenabling device shall permitrobotmotion andanyotherhazards controlledby the robot. Theenablingdevice shallhave theperformance characteristics outlinedbelow.	Functional checked.	P
	NOTE1Itisimportant to consider the ergonomicissues of sustainedactivation in the design and installationof the enablingdevice. NOTE 2 Additional information on enablingis containedin AnnexC.		-
	a) The enabling devicemaybe integral with,orphysicallyseparatefrom (e.g. agrip-typeenablingdevice), the pendant control and shall operateindependently fromany other motion control functionordevice.	Integralwiththe pendantcontrol.	P

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	b)Release of or compression past thecentre-enabledpositionofthedeviceshallstophazards (e.g.robot motion)inaccordancewith 5.4 and5.5.3.	Functional checked.	P
	c) After compressionpast the centre-enabled position ofthe enabling device, the enabling deviceneedstobefullyreleased. Going from fully compressed to thecentre position shall notpermitrobotmotion.	Functional checked.	P
	d) When two or more enablingswitchesareprovidedon a single enabling device/pendant to allowalternatingleft-or right-handed operation, any orallswitchescanbein the centre-enabledposition:	Notthiscase.	N/A
	1) whenonlyoneoftheswitchesisbeingused andisin the centre-enabledpositionit shall function asdescribedinb);		N/A
	2) when the enabling device designallowsbothswitches tobeheldin the centre-enabledposition to allow changing fromleft- toright-hand operation, releasing one switch shall notcauseaprotectivestopbutfully depressing either switch shall override thecontrolofthe other switches and causeaprotective stop.		N/A
	Information for use shall containadescriptionofthis functional operation and a warning that apotential hazard couldexist.		N/A
	NOTE 3If multiple switches arebeingheldin the centre-enabledposition,it cannot be distinguished if oneof themisintentionally released or itisunconsciouslyreleased as aresult of anaccident.		-
	e) Whenmore than one enabling deviceisinoperation (i.e.morethanonepersonisinthesafeguardedspace with an enabling device),motion shallonlybepossible when each deviceisheldin the centre(enabled)positionat the sametime.	Notthiscase.	N/A
	f)Dropping the enabling device shallnotresultinafailure that would allowmotion tobe enabled.		P
	g)Ifanenablingoutputsignalisprovided, thenthe output shall signal a stopcondition when the safetyrelated system supplyis off and shall comply withtherequirementsof 5.4.	Designchecked.	P
	h) When themode is changed while theenablingdeviceisin the centre-enabledposition, aprotective stop shallbe initiated. The control systemshallrequire thatthe enabling devicebe released andre-enabledbefore drivepowercanbeapplied. SeeIEC 60204-1forguidanceon preventing the defeat of an enablingdevice.		P
5.8.4	Pendant emergency stop function		-
	The pendant or teaching controldeviceshallhaveanemergencystopfunctioninaccordancewit h 5.5.2.		P
5.8.5	Initiating automatic operation		-
	It shall not bepossibletoactivaterobotautomatic operation using the pendant or teachingcontroldeviceexclusively. There shall beameans fora separate	Notbeprovided.Partly completed.	N/A

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	confirmation actionlocated outside the safeguardedspace prior to activating theautomaticmode.		
5.8.6	Cableless teach controls	Notbeused.	-
	Wherependant or other teaching controlshaveno cables connecting to the robot control,or wheretheymaybe detached, the following shall apply.		N/A
	a) A visualindication shallbeprovided to show that thependantisactive, e.g. attheteachpendantdisplay.		N/A
	b)Loss of communication shall resultin aprotectivestopfor all robotsbeing controlled wheninmanual reduced-speed or manual high-speedmodes.Restorationof communication shallnot restart robotmotion withoutaseparate deliberate action.		N/A
	c) Confusion between activeandinactiveemergency stop devices shall be avoidedbyprovidingappropriatestorage or design.Information for use shallcontainadescription of the storage or design.		N/A
	d) When applicable, the maximumresponse times for data communication (including error correction)and forloss of communication shallbe statedin theinformationforuse.		N/A
5.8.7	Control of multiplerobots	Notthiscase.	-
	Where a pendant controlhas thecapabilitytocontrolmultiplerobots, therequirementsin 5.9 shallapply.		N/A
5.9	Control of simultaneousmotion	Notthiscase.	-
5.9.1	Single pendantcontrol		-
	One or morerobot controlsmaybelinked toasingle teach pendant. When so configured,theteachpendantshallhave the capability tomove one ormoreof the robotsindependently or in simultaneousmotion. Wheninthe manual operational mode,all functionsof therobot system shallbeunder the control of the onependant.		N/A
5.9.2	Safety designrequirements		-
	All robotsin a robotsystem,designed forsimultaneousmotion, shall normallybein the sameoperatingmode, e.g.manualorautomatic, andinthesamestate,e.g. power on orpower off. Capabilityshallbeprovidedto allow one or morerobots tobeinaservo-disconnected state for thepurpose of troubleshooting or running errorsor in test cases. These disconnectedrobotsarethennot includedin the simultaneousmotion.		N/A
	For the robots tobeincludedin simultaneousmotion, eachrobot shallbe selectedbeforeit canbemoved. Tobe selected, all robotsshallbein thesameoperating mode(e.g.manualreducedspeed). Anindicationshallbeprovidedatthepointofselection(e.g.atthependant,controlcabinet, orrobot) oftherobot(s)thathave		N/A

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	been selected. Only selectedrobot(s) shallbemoved.		
	Itshallalsobepossibletodeactivateanyrobot,i.e.to haveitin apower off state. Anindication, clearly visiblefromwithinthesafeguardedspace, oftherobot(s) thathave been activatedshallbeprovided.		N/A
	Unexpected start-up of anyrobotsnot selected shallbe prevented. This function shall comply with the requirementsof 5.4.		N/A
5.10	Collaborative operation requirements	Notthiscase.	-
5.10.1	General		-
	Robots designed for collaborative operation shallprovidea visual indication when therobotisin collaborative operation and shall comply with oneormoreof therequirementsin 5.10.2 to5.10.5.		N/A
5.10.2	Stop		-
	The robot shall stop when ahumanisin thecollaborativeworkspace. The stop function shall comply with 5.4and5.5.3. Therobotmayresumeautomaticoperationwhenthe human leaves thecollaborative workspace.		N/A
	Alternatively, the robotmay decelerate,resultingin a category 2 stopinaccordancewithIEC 60204-1. Once stopped, this standstill shallbe monitoredby thesafety-relatedcontrolsysteminaccordancewith 5.4.Faultofthe safety-ratedmonitored stop function shall resultinacategory 0stop.		N/A
	NOTE This can include a monitoredcategory2stopfunctionin accordance withIEC 60204-1providedby an electricpower drive system that corresponds to an SOSin accordance withIEC 61800-5-2.		-
5.10.3	Hand guiding		-
	Whenprovided, hand guiding equipment shallbelocatedclose to the end-effector and shallbeequipped with the following:		N/A
	a) anemergencystopcomplyingwith5.5.2 and5.8.4,and		N/A
	b) anenablingdevicecomplyingwith5.8.3.		N/A
	The robot shall operate with asafety-ratedmonitoredspeedfunctionactive (see 5.6.4).Thesafety-rated monitored speed limit shallbe determinedbytheriskassessment.		N/A
5.10.4	Speed andposition monitoring		-
	The robot shall operateatareducedspeednotexceeding 250mm/secanditspositionshallbe monitored.		N/A
	The robot shallmaintain adetermined speedand separation distance from the operator. These functionsmaybe accomplishedbyintegral features or a combination of external inputs.Detection of the failure to		N/A

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	maintain the determined speed or separation distanceshallresultinaprotectivestop(see5.5.3). Thespeed and separationmonitoringfunctionsshallcomplywith 5.4.2.		
	The robot is simplyacomponentina finalcollaborativerobot system andisnotinitself sufficient for a safe collaborative operation. The collaborative operation applications are dynamic and shallbedeterminedby therisk assessment performed during the applicationsystemdesign.Information for use shall containdirection for implementing speed values and separation distances.ISO10218-2 shallbeusedfordesigningcollaborative operations. Additional information willbe containedinISO/TS15066 (currentlyunderpreparation).		N/A
	The relative speeds of the operator androbotneedtobeconsidered when calculating theminimum safe separation distance.Minimum distance requirements canbefoundinISO13855.		N/A
5.10.5	Power and forcelimitingbyinherent design		-
	The power or force limiting functionof therobot shallbe incompliancewith 5.4.Ifanyparameterlimitis exceeded, aprotective stop shallbeissued.		N/A
	The robot isonlya componentinafinalcollaborative robot system and aloneisnot sufficientforasafe collaborative operation. The collaborative operation application shallbe determinedby the riskassessmentperformed during the application system design. Information for use shallinclude details for setting establishedparameter limitsin the controlled robot.ISO10218-2 shallbeusedfordesigningcollaborative operations. Additional information willbe containedinISO/TS15066 (currentlyunderpreparation).		N/A
5.11	Singularityprotection		-
	Motions definedin Cartesian space thatpassnear singularities can produce highaxisspeeds.Thesehighspeeds canbeunexpected to an operator.Whenin themanual reduced-speedmode or hand guiding(see 5.10.3), therobotcontrolshalldooneofthefollowing:		P
	a) stop robot motionandprovidea warningprior totherobot passing through or correcting forasingularity during coordinatedmotion (control wherein the axesofthe robot arrive attheirrespectiveendpoints simultaneously, giving a smooth appearance tothe motion and control wherein themotions of the axesaresuch that the TCPmoves along aprescribedpath) initiated from the teachpendant, or	Functional checked.	P
	b) generate an audible or visible warningsignaland continue to pass through the singularity with the velocity of eachlink of the robot armlimited toamaximumspeed	Notthiscase.	N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	of 250mm/s, or		
	c)in the case that the singularitycanbecontrolled without creating anyhazardousmotion, no additionalprotectionisrequired.	Notthiscase.	N/A
5.12	Axislimiting		-
5.12.1	General		-
	A means shallbeprovided to establisharestricted spacearound therobotbyusinglimiting devices.		P
	A means for installing adjustablemechanicalstopsshallbe provided tolimit themotion of theaxis withthe greatest displacementmotion(primary axis) of the robot.		P
	Therobotshallcomplywitheither 5.12.2or5.12.3,or both.	Refertoclauses 5.12.2 and 5.12.3.	P
	This doesnot apply torobots with alimitingstructureresulting from construction, e.g.parallel kinematic construction.	Notthiscase.	N/A
	When therobot reaches an axislimit,therobotshallbestopped. Whether the robotmotion can continueat thepoint of the axislimit ornotshouldbestatedin the information for use.	Refertotheinstruction manual.	P
	NOTE Thismeans canbe met by theprovisionof engineering information andinstructions for obtaining andinstalling external mechanical stops.Use of the optional feature of safety-rated soft axisand space limiting (see 5.12.3) canalsosatisfy thisrequirement		-
5.12.2	Mechanical and electro-mechanical axislimiting devices		-
	Provisions for adjustablemechanical or non-mechanicallimiting devices shall beprovided foraxes twoandthree (the axes with the second and thirdlargest displacementmotions).		P
	Mechanical stops shallbe capable of stoppingrobot motion at ratedload, maximumspeedconditions,andatmaximum andminimum extension. Testing of mechanical hard stops shallbe withoutanyassistedstopping.		P
	Alternativemethods of limiting the rangeof motionmaybe provided onlyif they aredesigned, constructedandinstalledtomeettheperformancespecifiedin5.4.2 .	Notthiscase.	N/A
	The control circuit performance of electro-mechanicallimiting devices shall comply with therequirementsin 5.4. Therobotcontrolandtaskprogrammesshallnotchange electro-mechanicallimit device settings.	Not electro-mechanicallimitingdevice.	N/A
	The adjustable devices allow theuser tominimize the size of the restricted space. Thedegreeof adjustment shouldbeincludedin the requiredinformation for useasspecifiedin 7.2i).	Refertotheinstructionmanual .	P
	Information for use shallinclude information onstoppingtime atmaximum speed for electro-mechanical limiting devicesincluding monitoring time and distance travelledbefore full stop is achieved. Additionalinformationis	Not electro-mechanicallimitingdevice.	N/A

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Clause	**Requirement**	**Comment**	**Verdict**
	givenin AnnexB.		
	NOTE1Examples of non-mechanical limiting devicesinclude devicessuch as stops that arepositioned electrically, pneumaticallyor hydraulically,limit switches, light curtains, laser scanning devicesandpull cords whenused tolimit robot travel anddefine therestricted space. NOTE 2 Mechanical stopsincludemechanical stops that are adjustedand then secured with fasteners.		-
5.12.3	Safety-rated soft axis andspacelimiting	Notthiscase.	-
	Softlimits are software-definedlimits to robotmotion. Spacelimitingisused to define any geometric shape whichmaybe used as aninclusionaryor exclusionaryzone, either limiting robotmotion within thedefined space, or preventing the robot fromentering thedefinedspace.		N/A
	Safety-rated softlimits arepermitted as ameansto define and reduce therestricted spaceprovided theycaneffect a stop of the robotatfull-ratedloadandspeed. The restricted space shallbedefined attheactual expected stoppingposition that accounts for the stopping distance travel. Themanufacturer shall state the capabilityin theinformation for use and shalldisable safety-rated soft limitsif this capabilityisnot supported.		N/A
	Control programmes that monitor andperformsoftaxisand space limiting functionsbased on safety-ratedsoft limits shall comply with 5.4andbe changeableonlybyauthorizedpersonnel.If the safety-rated soft limitis violated, a protective stopshallbeinitiated.Motion during alimit violation shallbe underreducedspeed controlasdescribedin5.6.3.Informationontheactive settings and configuration of the safetylimits shallbe capable of being viewed and documented withauniqueidentifier so that changes to the configurationcanbe easilyidentified.		N/A
	A safety-rated softlimit shallbe set asastationaryzonethat cannotbe changed without re-initialization of the safety-related sub-system and shall notbereconfiguredduring automatic execution of the taskprogramme. Authorization to change the safety-rated softlimit shallbe protected and secure,e.g.requireauthorized persons to enter a password.Once set,safety-ratedsoftlimits shall alwaysbecome activateduponpower up.		N/A
	Information for use shallinclude information onstopping time atmaximum speed for safety-rated softlimits includingmonitoring time and distance travelledbeforefull stopis achieved. Additional informationisgiveninAnnexB.		N/A
	Safety-rated zone outputs for use indynamicrestrictedspace applications shall comply with 5.4.Thehardware configuration of the outputs shall bestatedintheinformation for use.		N/A

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	NOTE1 Safety-rated soft axislimits canbeparticularlyusefulin controlling motion on the additional axesnot fitted withlimiting devicesas describedin5.12.2. NOTE 2 Safety-rated soft space limits canbeparticularlyusefulin controlling motionin irregular shaped work areas orprotecting againstpinch-points createdby obstructions. NOTE 3 An example of auniqueidentifier is a checksum,aunique value that is automatically generatedby therobot system when the soft limit configuration is defined. Any change to the configuration willcause the generation ofanew value.		-
5.12.4	Dynamiclimiting devices	Notbeuse.	-
	Dynamiclimitingis the automatically controlled changeinarobot'srestricted space during aportion of therobot system's operation. Control devices suchas,butnot limited to, cam-operatedlimit switches,light curtains or control-activatedretractablehard stopsmaybeutilized tofurther limit robotmovement within therestricted space while the robotperformsits taskprogramme.For this, thedevice and associated control systemsshallbecapable of stopping the robot motionunderratedloadandspeed conditions and the associated safety-related control systemsshallcomplywith 5.4.2,unlessarisk assessment isperformed and determines thatanothercategoryisrequired.		N/A
5.13	Movement without drivepower		
	The robot shallbe designed so thattheaxesarecapable of beingmoved without theuse of drivepowerinemergency or abnormal situations.	Brake release functionisprovided.	P
	Whererpracticable, moving the axes shallbecarriedoutby asingleperson.	Carriedoutbytwo persons.	P
	Controls shall bereadily accessiblebutprotected fromunintended operation.		P
	Instructions for doing this shallbeincludedin the information for use along withrecommendations fortrainingpersonnel onresponding to emergency or abnormal situations. The information foruse shallincludewarnings that gravity and the releaseofbrakingdevices can create additionalhazards.	Refertoinstruction manual.	P
	Whererpracticable, warningnotices shall be postednearto the activatingcontrols.		P
5.14	Provisions forlifting		-
	Instructions andprovisions forlifting the robotandits associated components shallbeprovided and shallbeadequate for handling the anticipatedload. EXAMPLELiftinghooks, eyebolts, threadedholes, forkpockets.	Liftingpointis provided.	P
	NOTEFor very smallrobots that canbe easilyhandledby oneperson,instructions for proper safelifting canbe sufficient.		-
5.15	Electrical connectors.		-
	Electrical connectors that can cause ahazardif theyare	Designchecked.	P

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Clause	**Requirement**	**Comment**	**Verdict**
	separated, or if theybreak away, shallbedesignedandconstructed so as toprevent unintended separation.		
	Connectors shall be provided withameanstopreventcross-connection.	Designchecked.	P
6	Verification and validation of safety requirementsandprotectivemeasures		-
6.1	General		-
	The robot manufacturer shallprovide for the verificationand validation of design and construction ofrobots including appropriate safeguarding devicesin accordance with theprinciples describedin Clauses 4and5.		P
	The risk assessment shouldbereviewed to assessifallreasonably foreseeablehazardshave beenidentified and corrective actionstaken.	Refertotherisk assessment report.	P
	NOTE Sincenot all hazardsidentifiedin Annex A apply to everyrobot, thelevel of risk associated with a givenhazardous situation willnotbethe same fromrobot to robot. A risk assessmentneeds tobeconductedto determine what the appropriate protective measures shouldbe for agivenrobot.		-
6.2	Verification and validationmethods		-
	Verification and validation can besatisfiedbymethodsincluding butnotlimited to: A visual inspection; Bpractical tests; Cmeasurement; D observation duringoperation; E review of application-specific schematics,circuitdiagrams and designmaterial; Freview of task-basedrisk assessment; Greview of specifications and information foruse.SeeTableF.1.		P
6.3	Required verification and validation		-
	AnnexFlists specificperformance requirements that areidentified as essential to the safety of therobot thatshallbe verified or validated, or both.Usingappropriate methods, requirements shallbe evaluated todetermineif theyhavebeen adequatelymetby the design andconstruction of the robot.		P
	NOTE1 Theitemslistedin Table F.1 mightnot allapply toeveryrobot.Theremight beinstances whereit willbeimpossible to verify and/or		-

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	validate certainitems.		
	NOTE 2 TableF.1 isneither comprehensivenor limiting. Theremightbe additional verification requirements depending on specificrobot design.		-
	NOTE 3Itis the manufacturer'sresponsibility to ensure thatallapplicableitems are verified or validated, or both		-
	NOTE 4If using TableF.1 as achecklist, thecontentsneedtobe reviewed andlimited to represent the actual robotconfigurationbeingevaluated and the suitablemethod for that evaluation.		-
7	Information for use		-
7.1	General		-
	Markings(e.g. signs, symbols) andinstructionalmaterial (e.g. manualsforoperation,maintenance) shallbe providedby the manufacturer inaccordance withISO12100 andIEC60204-1.	Refertotheinstructionmanual.	P
	When provided, machine warning devices(e.g.audibleand visual signals) shallbein accordance withISO 12100 andIEC60204-1.	Notbeprovided.	N/A
7.2	Instructionhandbook		-
	Inadditiontotherequirementsof 6.1,eachrobotshallbe accompanied by an instructionhandbookorappropriate media containing:	Refertotheinstructionmanual.	P
	a) thebusinessname, full address, andnecessary contact information of themanufacturer andif necessaryof the authorized representative or authorized supplier;	Refertotheinstructionmanual.	P
	b) instruction for commissioning, programmingand restartingprocedure including installation requirementssuch asutilityneeds, floor loading, environmental conditions, etc.;	Refertotheinstructionmanual.	P
	c)instructions for how the initial testandexaminationofthe robot anditsprotectivemeasures are tobecarried outbefore firstuse andbeing placedintoproduction, including functional testing of reduced speed control;	Refertotheinstructionmanual.	P
	d) instructions for any testor examinationnecessary after change of componentparts or addition of optional equipment (bothhardware and software) totherobot which can affect the safety-related functions, includinganemergencystopoutputsignalasin5.5.2 andcommon enablingcircuitasin5.8.3d);	Refertotheinstructionmanual.	P
	e) instructions for safe operation,settingand maintenance,including safe working practices,	Refertotheinstructionmanual.	P

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	hazardous energy controlprocedures and the trainingrequired to achieve the necessaryskilllevelof personsoperating the equipment;		
	f)instructions onlocation and function of all control systemsincluding diagrams of theinterface of electrical,hydraulic, and pneumatic systemsnecessary for setupandinstallation;	Refertotheinstructionmanual.	P
	NOTE This doesnot include schematics of robotor othercontrols,components or proprietaryproperty.		-
	g) information on the capabilityof selectinghigh-speedcontrolusing the pendant;	Notthiscase.	N/A
	h)instructionsinordertoinformthemachinedesignerthatrestricted space shall beprovided when therobotisforeseen to beusedinmanualhigh speed;	Notthiscase.	N/A
	i)information oninstallation of limiting devices,including number, location and degreeof adjustmentof mechanical limiting capability;		
	j)instructions on the number,locationand implementation of anynon-mechanical limiting devices;		
	k) capabilities of dynamiclimiting, whenincluded		
	l)information on the actual expected stoppingposition that accounts for the stopping distance travel whenusingsafety-rated softlimiting;		
	m) information on thenumber andoperation of enablingdevices and instructions forinstallation of additional devicesincluding the data and criterianecessary to determine the safety-related control system performance;		
	n)information on the stopping time anddistanceor anglefrom initiation of stop signal of the threeaxes withthe greatest displacement andmotionin accordance with themetricinAnnexB;		
	o) the safety-related control system performanceof therobotsafetyfunctionsasdeterminedin5.4;		
	p) the specification for any fluids or lubricantstobeusedinlubrication,braking, or transmission systeminternal to the robot,including guidance oncorrect selection, preparation, application and maintenance ofprocess-unique expendables;		
	q) guidance on themeans for therelease ofpersonstrappedin or bythemachine;		
	r)instructions for movement of robot axes withoutdrive		

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	power,including warnings that gravity and the releaseofbraking devices can createadditionalhazards;		
	s)recommendations for training personnel on respondingto emergency or abnormal situations;		
	t)information defining thelimits for the rangeofmotionandload capacity, including maximummass,positionofthe centre of gravity of the workpiece and workholdingfixture;		
	u) procedures to avoiderrorsof fitting during maintenance of the machine;		
	v)information on relevant standards therobotmeets,including any thathavebeen certifiedby athirdparty;		
	w)response time of detection of loss of communicationsignal for cablelesspendants;		
	x)information on unprotected hazardsassociated withexpecteduse of themachine;		
	y)instructions and warnings that manual operationshallbe performed with all personsoutside thesafeguardedspace;		
	z)instructions thatprior to selecting automaticmode any suspended safeguards shall bereturned to fullfunctionality;		
	aa)instructions for the proper storage of cablelesspendants,if so configured;		
	bb)information on response timeandlossof communication of cablelesspendants,if so configured;		
	cc)information on the stop categoryof everyprotectivestop circuitinput.		
	Any changes or additions to theapplicableinformationasprovidedby the manufacturer shall beprovidedbythe party thatmakes the change or addition totherobotsystem.		
7.3	Marking		-
	Eachrobot shall bemarkedin adistinct,legibleanddurablemanner with:	Refertonameplate.	P
	a) themanufacturer's and, where appropriate, theauthorized supplier'sbusinessname and completeaddress;	Refertonameplate.	P
	b) thedesignationoftypeofmachine(i.e.industrial robot) and modelnumber or referencenumber(ifany);	Refertonameplate.	P
	c) the monthand yearofmanufacture;	Refertonameplate.	P

ENISO10218-1:2011			
Clause	**Requirement**	**Comment**	**Verdict**
	d) themassand/orweightofmachine;	Refertonameplate.	P
	e) themaximumreach andload capacity;	Refertonameplate.	P
	f) supply data for electrical and, whereapplicable, hydraulic andpneumatic systems (e.g.minimumandmaximumpneumaticpressures);	Refertonameplate.	P
	g) lifting points for transportationandinstallationpurposes, where applicable.	Refertothemarking forliftingpoint.	P
	Guards,protective devicesand other parts thatarepartof therobotbutnot fitted shallbe clearlyidentified for their purpose. Any other informationneeded for fittingshallbeprovided.	Notthiscase.	N/A

☒**TCP speed measurement according to 5.6.2 of EN ISO 10218-1:2011**	☐**N/A** ☐**Fail** ☒**Pass**
Test Requirement: The speed of the TCP shall not exceed 250 mm/s.	
CONDITION I INSTALL ATION: Test at the max. reach of the robot. The robot rotated by the primary and secondary axis respectively, the TCP speed was measured.	
Test Record/Data – rotated by the primary axis	

Measurement number	**Mean TCP speed (mm/s) Rotated by the primary axis**	**Mean TCP speed (mm/s) Rotated by the secondary axis**
1	226	229
2	227	229
3	226	227

☒**Stop time and distance metric according to Annex B of EN ISO 10218-1:2011**	☐**N/A** ☐**Fail** ☒**Pass**
Test Requirement: The stopping time shall be determined from the initiation of a stop signal to when all manipulator motion ceases. The stop distance shall be determined as the total distance travelled after the initiation of a stop signal.	
CONDITION I INSTALLATION: Test at the max. reach of the robot. The robot rotated by the primary axis, the TCP is used as the measured point (MP). Test loads are 33% (7 kg), 66% (14 kg) and 100% (20 kg) of the max. load.	
Test Record/Data	

Measurement number	Stopping distance (mm)			Stopping time (ms)		
	33%	66%	99%	33%	66%	99%
1	682	717	637	289	289	286
2	682	717	637	291	292	282
3	682	717	637	289	290	289
4	682	717	637	289	289	281
5	682	717	637	292	290	283
6	682	718	638	289	289	281
7	682	718	638	290	289	289
8	682	717	638	289	290	287
9	682	718	638	293	292	285
10	682	718	638	290	291	282

EN IEC 61000-6-4:2019/EN IEC 61000-6-2:2019 Test report

EN IEC 61000-6-4:2019 Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments EN IEC 61000-6-2:2019 Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments	
Tested by(name and signature)…… :	Bernie Xia
Approved by(name and signature...:	Kevin Wang
Date of issue ..... :	September 28, 2023
Testing Laboratory..... :	Shenzhen EBO Testing Center
Address ..... :	3/F, 2F, Qiaohongsheng Cultural Creative Park, Yintian Industrial Zone, Xixiang Street, Bao 'an District, Shenzhen
Applicant's name..... :	Guangzhou Auctech Automation Technology Ltd
Address ..... :	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Test specification:	
Directive..... :	2014/30/EU
Test procedure ..... :	EMC
Manufacturer…… :	Guangzhou Auctech Automation Technology Ltd
Address	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Factory	Guangzhou Auctech Automation Technology Ltd
Address	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Test item description ..... :	Robot
Trademark ..... :	AUCTECH
Main model/Type reference..... :	ACR-7, ACR-12, ACR-18, ACR-20, ASR-3, ASR-4, AX-4, AX-7, AX-7L, AX-7XL, AX-12 R707-4, AX-12 R906-4-LAR, AX-10 R1206, AN-12-10/1.6, AN-12-12/1.4, AN-12-16/0.95-4, AN-12-16/1.1, AN-25-12/2.1, AN-25-20/2.0, AN-25-25/1.8, AN-25-35/1.8, AN-25-30/1.6, AN-80-50/2.6, AN-80-80/2.2, BR-07S-930, BR-10Z-1440, BR-10ZD-1440, BR-10CD-1488, BR-10C-1488, BR-10W-1440-D, BR-10L-2050, BR-10LD-2050, BR-12Z-1550, BR-12-2010, BR-20L-2050, BR-20LD-2050, BR-20ED-1840, BR-20E-1840, BR-08Z-1840, BR-08ZD-1840, BR-25E-1840, BR-25ED-1840, BR-80E-2250, BR-30-1700, BR-06SC-500, BR-06SC-600, BR-06SC-700

Rating(s)..... :	Input: 220V~, 50Hz, 1PH

1 General Information

1.1 Description of EUT

Product:	Robot
Brand Name:	AUCTECH
Model No.:	ACR-7, ACR-12, ACR-18, ACR-20, ASR-3, ASR-4, AX-4, AX-7, AX-7L, AX-7XL, AX-12 R707-4, AX-12 R906-4-LAR, AX-10 R1206, AN-12-10/1.6, AN-12-12/1.4, AN-12-16/0.95-4, AN-12-16/1.1, AN-25-12/2.1, AN-25-20/2.0, AN-25-25/1.8, AN-25-35/1.8, AN-25-30/1.6, AN-80-50/2.6, AN-80-80/2.2, BR-07S-930, BR-10Z-1440, BR-10ZD-1440, BR-10CD-1488, BR-10C-1488, BR-10W-1440-D, BR-10L-2050, BR-10LD-2050, BR-12Z-1550, BR-12-2010, BR-20L-2050, BR-20LD-2050, BR-20ED-1840, BR-20E-1840, BR-08Z-1840, BR-08ZD-1840, BR-25E-1840, BR-25ED-1840, BR-80E-2250, BR-30-1700, BR-06SC-500, BR-06SC-600, BR-06SC-700 Remark: All the models are identical in the same PCB layout, interior structure and electrical circuits. The only differences are the model name and appearance color for commercial purpose.
Test Model No.:	ACR-7
Applicant:	Guangzhou Auctech Automation Technology Ltd
Applicant Address:	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Manufacturer:	Guangzhou Auctech Automation Technology Ltd
Manufacturer Address:	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Factory:	Guangzhou Auctech Automation Technology Ltd
Factory Address:	Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA
Test Standards:	EN IEC 61000-6-4:2019 EN IEC 61000-6-2:2019
Serial No.:	N/A
Rating:	Input: 220V~, 50Hz, 1PH
Accessories:	/
NOTE: (1) For more detailed features description about the EUT, please refer to User's Manual.	

1.2 Objective

Perform ElectroMagnetic Interference (EMI) and ElectroMagnetic Susceptibility (EMS) tests for CE Marking.

1.3 Test Standards and Results
The EUT has been tested according to the following specifications:

EMISSION		
Standard	**Test Type**	**Result**
EN IEC 61000-6-4:2019	Mains terminal disturbance voltage	Pass
	Radiated disturbance	Pass
IMMUNITY (EN IEC 61000-6-2:2019)		
Basic Standard	**Test Type**	**Result**
IEC 61000-4-2	Electrostatic discharge immunity	Pass
IEC 61000-4-3	Radiated, radio frequency electromagnetic field immunity	Pass
IEC 61000-4-4	Electrical fast transient/burst immunity	Pass
IEC 61000-4-5	Surge immunity	Pass
IEC 61000-4-6	Immunity to conducted disturbances induced by RF fields	Pass
IEC 61000-4-8	Power Frequency Magnetic Field Immunity	Pass
IEC 61000-4-11	Voltage Dips and Short Interruptions Immunity Test	Pass

Note: The latest versions of basic standards are applied.

1.4 List of Equipments Used

Description	Manufacturer	Model No.	Serial No.
Test Receiver	Schwarzbeck	FCKL1528	A0304230
LISN	Schwarzbeck	NSLK8127	A0304233
Broadband Ant.	CHASE	CBL6111A	A9704202
EMS Antenna	Amplifier Research	AR AT1080	A0304249
Power Frequency Test System	CI	15003iX-400-CTS	A0801521
Voltage Dips, Short Interruptions and Variation Test System	HAEFELY	PLine 1610	A0103106
ESD Test System	EM TEST	ESD30C	A0712513
EFT Test System	HAEFELY	PEFT JUNIOR	A0103110
Surge Test System	EM TEST	VCS500M10	A0712509
CDN	ROHDE&SCHWARZ	M2	---
Signal Generator	ROHDE&SCHWARZ	SML02	A0304261
Power Amplifier	Amplifier Research	AR 150W1000	A0304247
Power Amplifier	Amplifier Research	AR 75A250M	A0304255
Field Monitor	Amplifier Research	AR FM5004	305128
Magnetic Field Tester	HAEFELY	MAG 100.1	A0103109
Shield Room	Nanbo Tech	Site 3	A9901141
Anechoic Chamber	Albatross	B83117-B1482-T161	A0412372
Anechoic Chamber	Albatross	H-249	A0304210

NOTE: Equipments above have been calibrated and are in the period of validation.

2 Emission Test

2.1 EUT Setup and Operating Conditions

The EUT was power by AC 220V Mains and operated in continuous test condition.

2.2 Mains Terminal Disturbance Voltage Measurement

2.2.1 Limits of Mains Terminal Disturbance Voltage

Frequency range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 - 0.50	79	66
0.50 - 30	73	60

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz

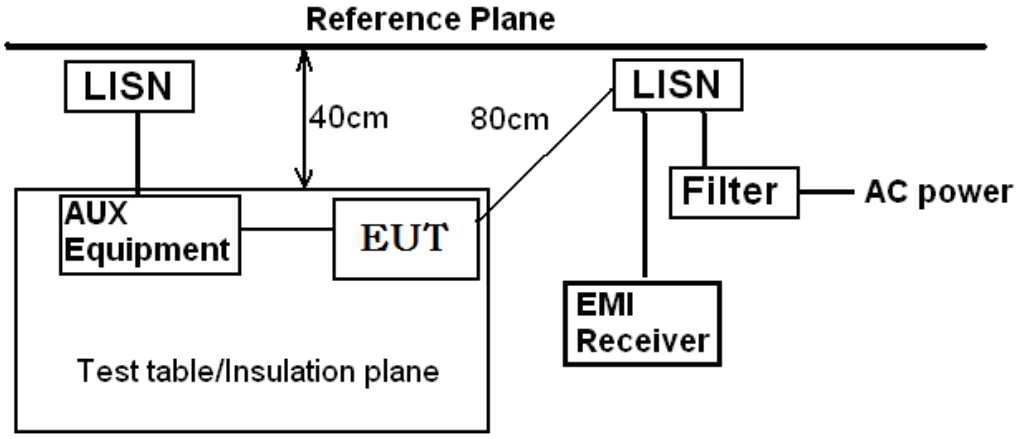
2.2.2 Test Procedure

a. The EUT was placed 0.4 meters from the conducting wall of shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provide 50Ω/50μH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150 kHz to 30MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.

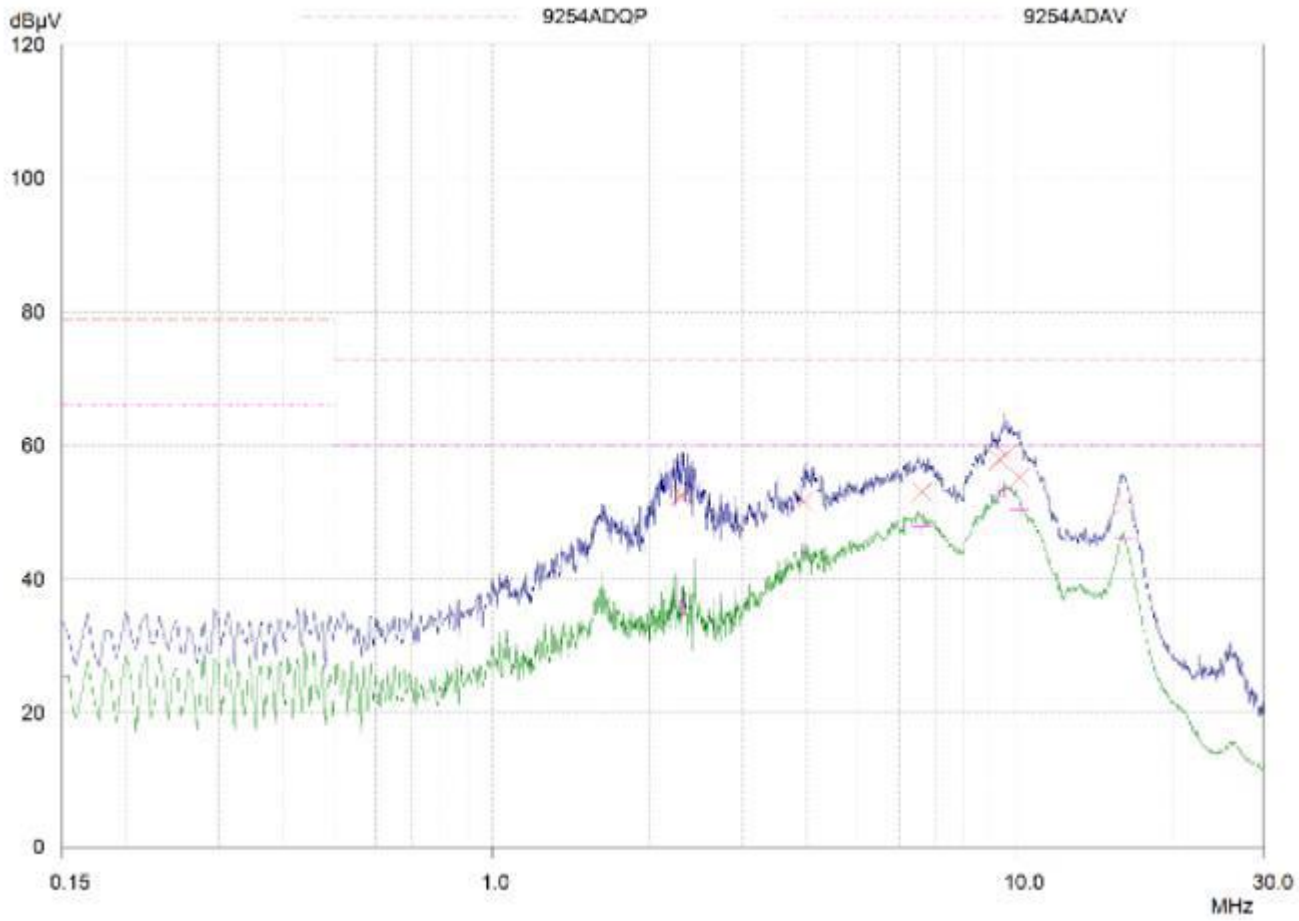
2.2.3 Test Setup



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

2.2.4 Test Result

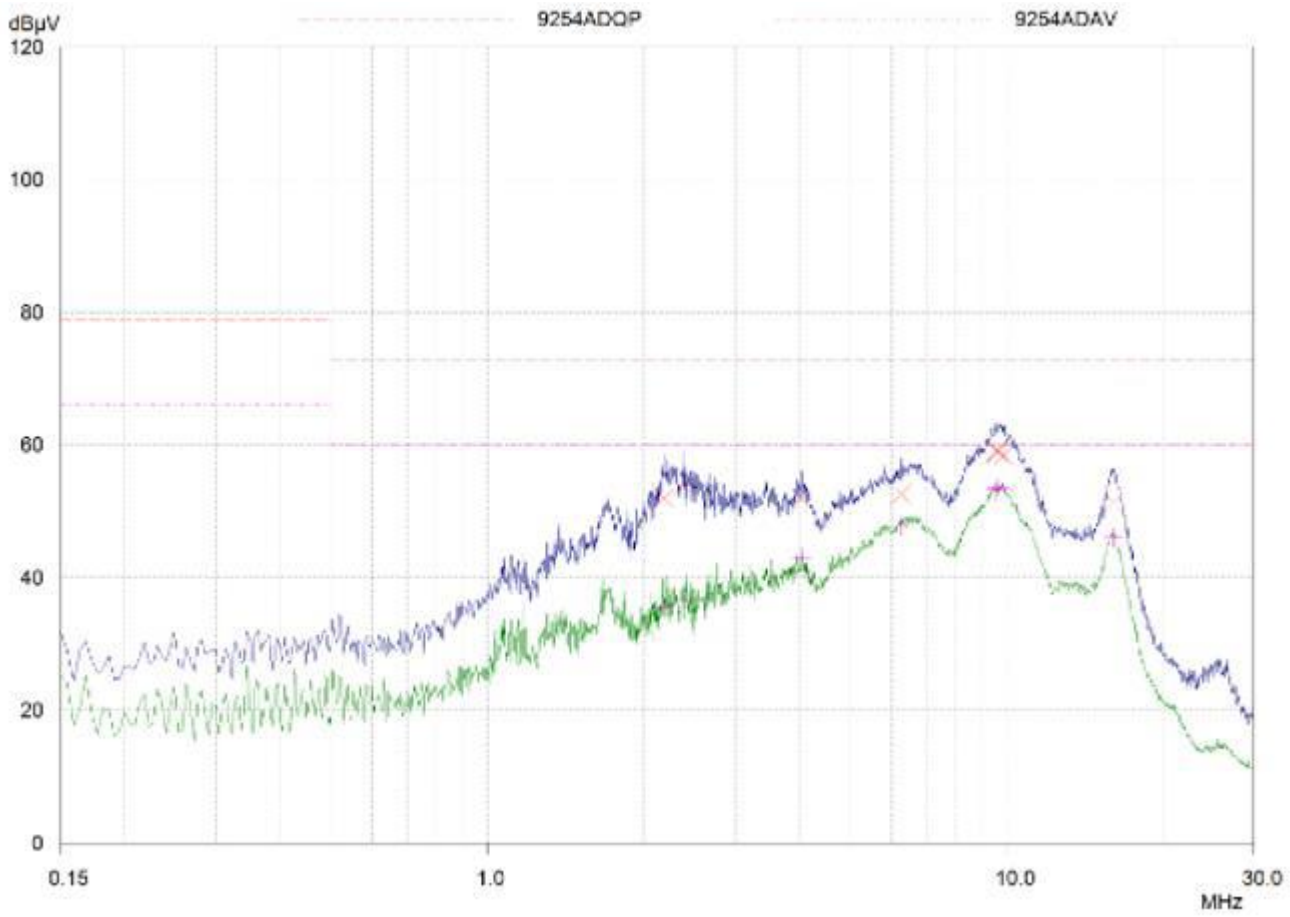
1. Mains terminal disturbance voltage, L phase



Final measurement result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Margin - QPK (dB)	Limit - QPK (dBuV)	Margin - CAV (dB)	Limit - CAV (dBuV)
2.2785	52.47	37.79	20.53	73.0	22.21	60.0
2.3145	52.53	35.79	20.47	73.0	24.21	60.0
3.9435	51.62	44.06	21.38	73.0	15.94	60.0
6.639	53.04	47.84	19.96	73.0	12.16	60.0
9.3165	57.83	53.69	15.17	73.0	6.31	60.0
9.5685	58.50	53.40	14.50	73.0	6.60	60.0
10.185	55.24	50.35	17.76	73.0	9.65	60.0
16.1385	51.12	45.96	21.88	73.0	14.04	60.0

2. Mains terminal disturbance voltage, N



Final measurement result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Margin - QPK (dB)	Limit - QPK (dBuV)	Margin - CAV (dB)	Limit - CAV (dBuV)
2.184	51.95	35.44	21.05	73.0	24.56	60.0
2.3775	53.93	36.66	19.07	73.0	23.34	60.0
4.02449	51.90	42.87	21.10	73.0	17.13	60.0
6.279	52.57	47.72	20.43	73.0	12.28	60.0
9.537	58.98	53.09	14.02	73.0	6.91	60.0
9.636	58.90	53.59	14.10	73.0	6.41	60.0
9.8745	58.39	53.29	14.61	73.0	6.71	60.0
16.062	51.32	45.96	21.68	73.0	14.04	60.0

2.3 Radiated Disturbance Measurement

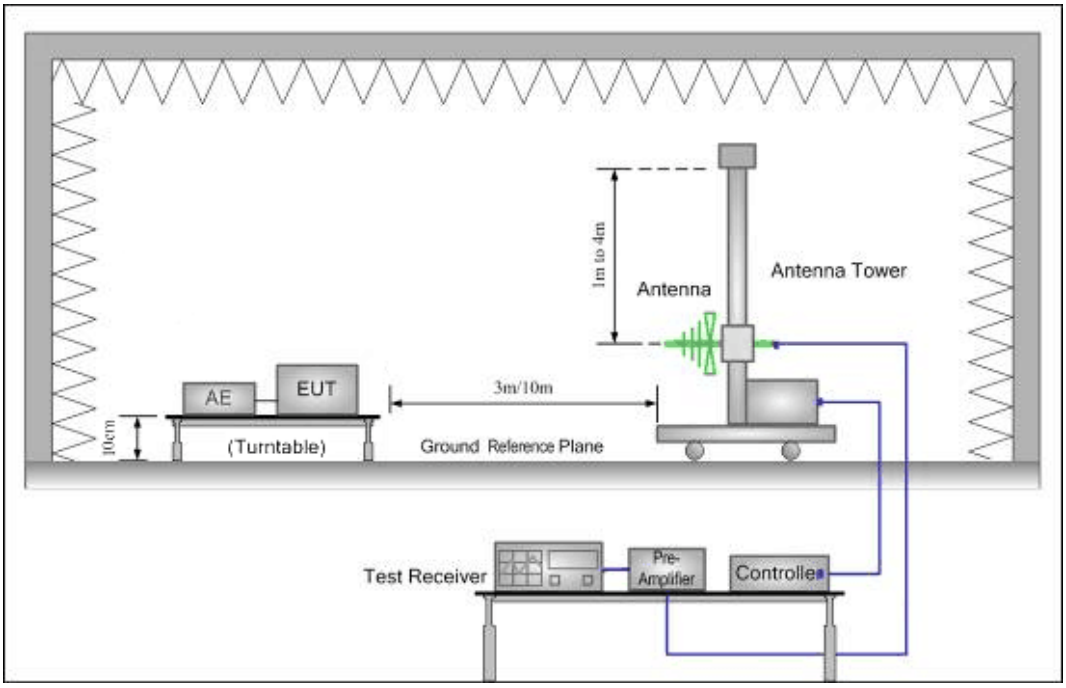
2.3.1 Limits of Radiated Disturbance

Frequency range (MHz)	Quasi peak limits(dBμV/m), At 3 m measurement distance
30 – 230	50
230 - 1000	57

Notes:
(1) The lower limit shall apply at the transition frequency.
(2) Additional provisions may be required for cases where interference occurs.

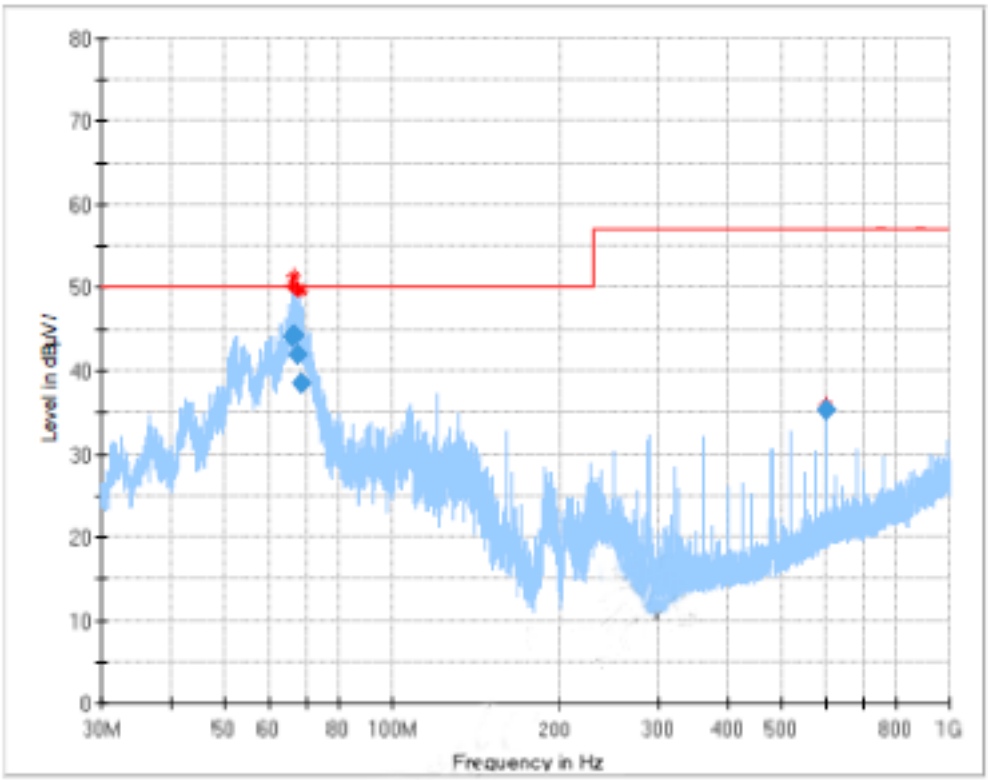
2.3.2 Test Procedure
a. The EUT was placed on the top of an insulating table 0.8 meters above the ground at an anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna is a broadband antenna, and its height is varied from 1 to 4 meter above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the heights from 1 to 4 meters and the ratable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detector Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emission that did not have 10dB margin would be retested one by one using the quasi-peak method.

2.3.3 Test Setup



1.3.4 Test Result

1. Radiation disturbances, antenna polarization: Vertical

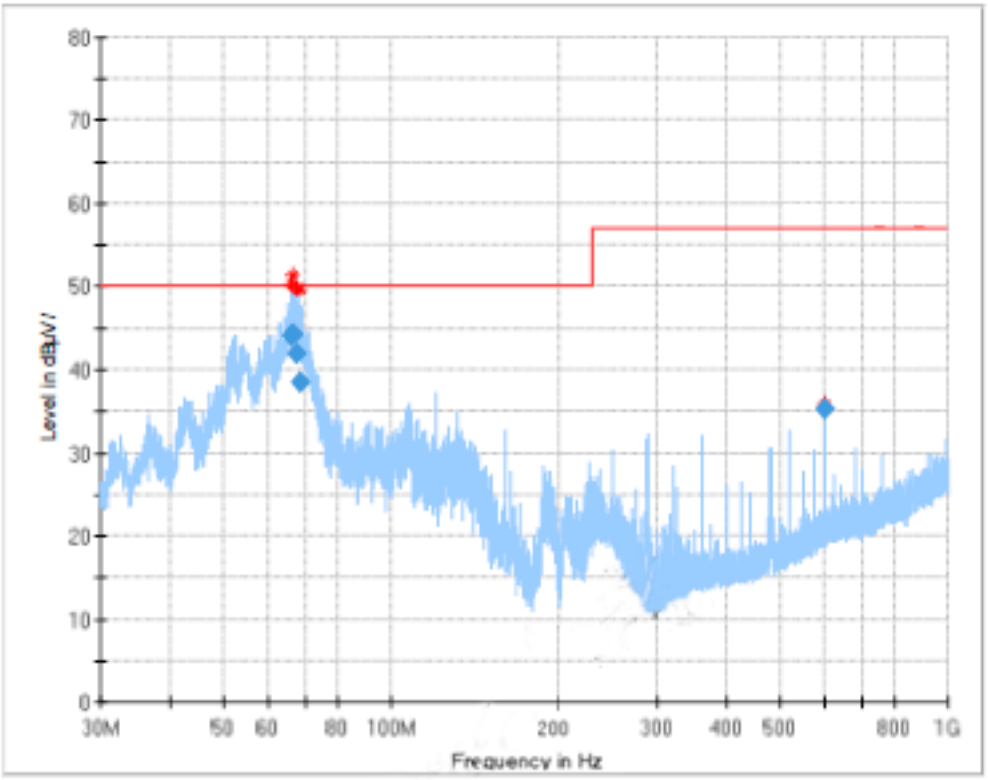


Final measurement result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit - QPK (dBuV/m)	Margin - QPK (dB)
66.093333	44.14	50.0	5.86
66.629000	44.22	50.0	5.78
67.691667	41.92	50.0	8.08
68.670333	38.49	50.0	11.51

2. Radiation disturbances, antenna polarization: Horizontal

Figure 12: Radiated Emission, Horizontal



Final measurement result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit - QPK (dBµV/m)	Margin - QPK (dB)
30.064667	26.6	50.0	23.4
53.862	39.3	50.0	10.7
104.496	27.9	50.0	22.1
600.004333	35.18	57.0	21.82

3 Immunity Test

3.1 EUT Setup and Operating Conditions

Same as 2.1

3.2 Performance Criteria Description in Clause 4 of EN IEC 61000-6-2:2019

Criterion A:	The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.
Criterion B:	The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.
Criterion C:	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

3.3 Electrostatic Discharge Immunity Test

3.3.1 Test Specification

Basic Standard:	EN 61000-4-2
Discharge Impedance	330Ω / 150 pF
Discharge Voltage:	Air Discharge – 8 kV Contact Discharge – 4 kV
Polarity:	Positive / Negative
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single discharge
Discharge Period:	1-second minimum

3.3.2 Test Procedure

The discharges shall be applied in two ways:

a. Contact discharges to the conductive surfaces and coupling planes:

The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three contact test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

b. Air discharges at slots and apertures and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled selected test point for each such area.

The basic test procedure was in accordance with EN 61000-4-2:

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

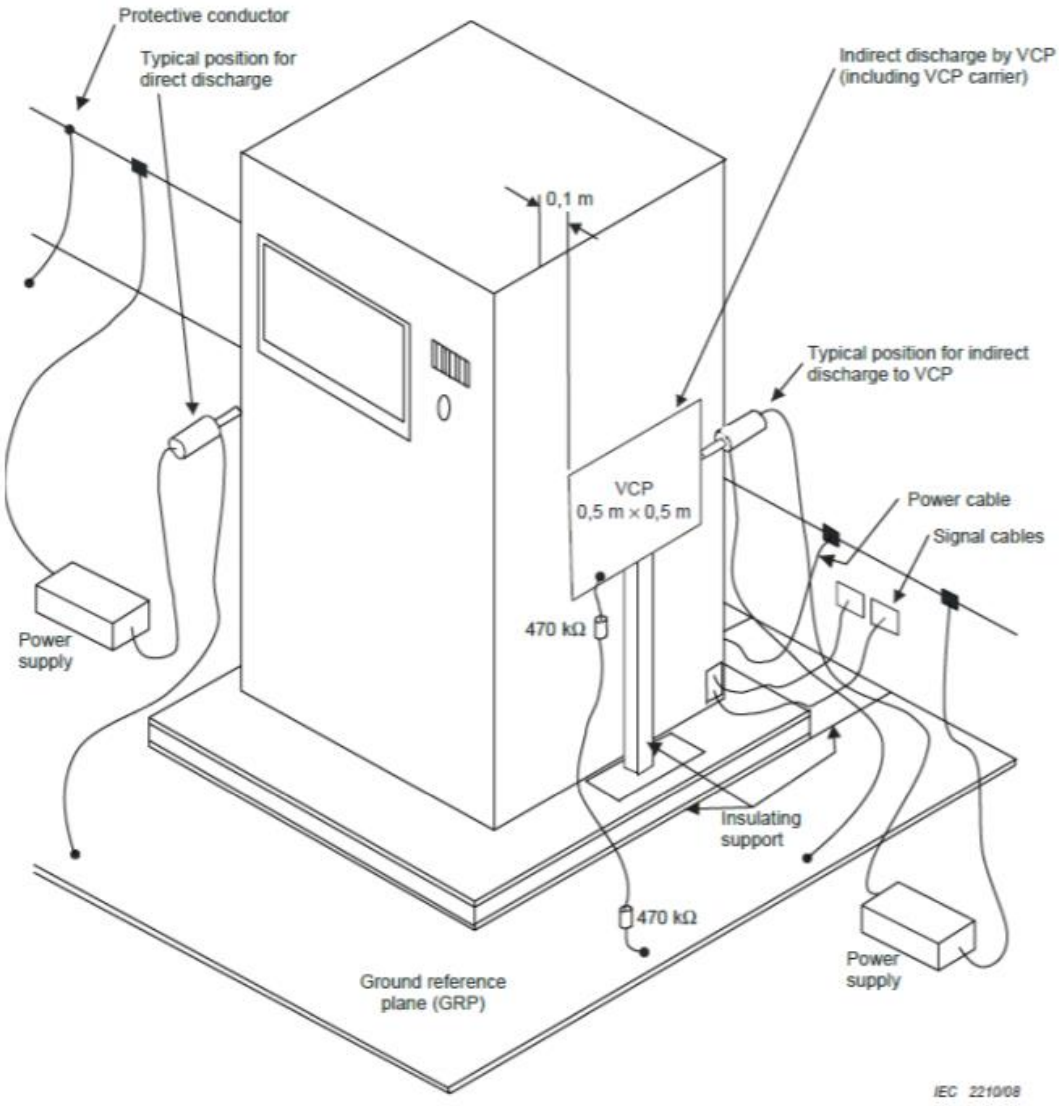
f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test

was repeated until all discharges were completed.

g. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator was positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m×0.5m) was placed vertically to and 0.1 meters from the EUT.

3.3.3 Test Setup



3.3.4 Test Result

Test Points	Discharge Level (kV)	Discharge Mode	Observation	Comply with Criterion
Enclosure(conductive)	±4	Contact	Note(1)	A
Wiring ducts,	±4	Contact	Note(1)	A
Connection boxes	±4	Contact	Note(1)	A
HCP	±4	Contact	Note(1)	A
VCP	±4	Contact	Note(1)	A
Enclosure(non-conductive)	±8	Air	Note(1)	A
Screen	±8	Air	Note(1)	A
Switch buttons	±8	Air	Note(1)	A

Note:

(1) The EUT continued to operate as intended. No degradation of performance was observed.

3.4 Radiated, Radio Frequency Electromagnetic Field Immunity Test

3.4.1 Test Specification

Basic Standard:	EN 61000-4-3
Frequency Range:	80 MHz – 1000MHz, 1.4GHz-6.0GHz
Field Strength:	10V/m, 3V/m
Modulation:	1kHz sine wave, 80%, AM modulation
Frequency Step:	1% of fundamental
Polarity of Antenna	Horizontal and Vertical
Test Distance:	10m
Antenna Height:	1.5m
Dwell Time:	3 seconds

3.4.2 Test Procedure

The test procedure was in accordance with EN 61000-4-3.

The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 10 meters from the EUT.

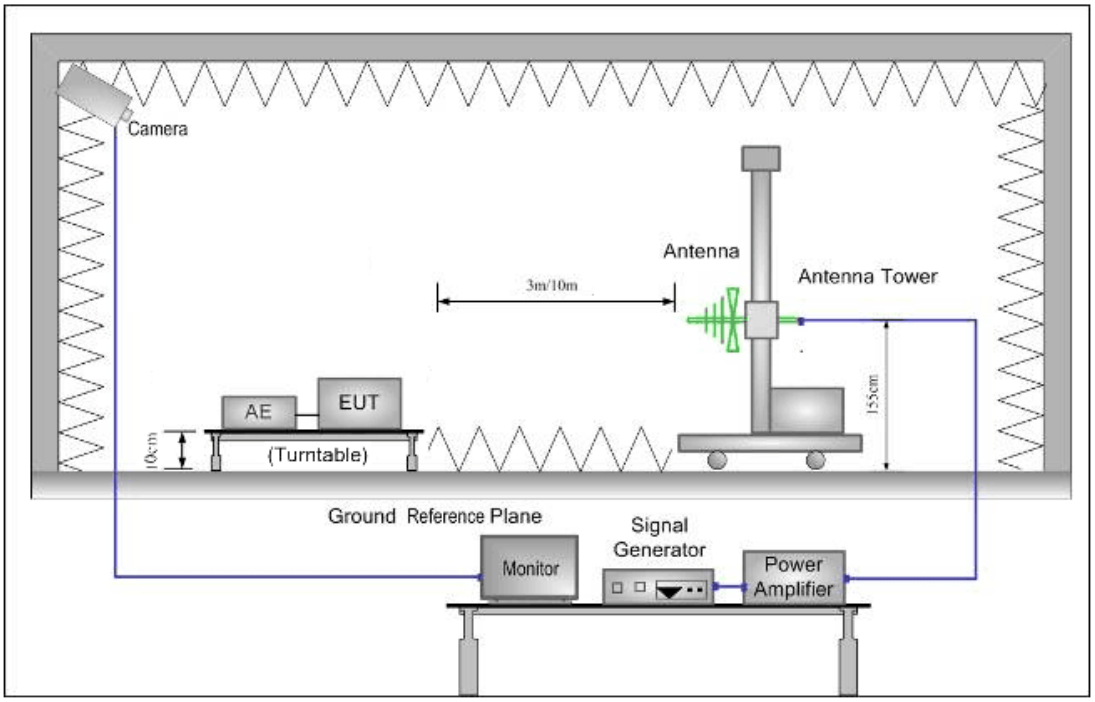
The frequency range is swept from 80 MHz to 1000MHz with the signal 80% amplitude modulated with a 1 kHz sine wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.

The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond

The field strength level was 10V/m.

The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

3.4.3 Test Setup



3.4.4 Test Result

Frequency	Polarity	Azimuth	Field Strength (V/m)	Observation	Comply with Criterion
80-1000 MHz	V&H	0, 90, 180, 270	10	Note(1)	A
1.4GHz-6.0GHz	V&H	0, 90, 180, 270	3	Note(1)	A

Note:

(1) The EUT continued to operate as intended. No degradation of performance was observed.

3.5 Electrical Fast Transient/Burst Immunity Test

3.5.1 Test Specification

Basic Standard:	EN 61000-4-4
Test Voltage:	a.c. power port – 2 kV
Polarity:	Positive/Negative
Impulse Frequency:	5kHz
Impulse wave shape:	5/50ns
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	Not less than 1 min.

3.5.2 Test Procedure

a. The EUT was tested with 1000-volt discharges to the AC power input leads.

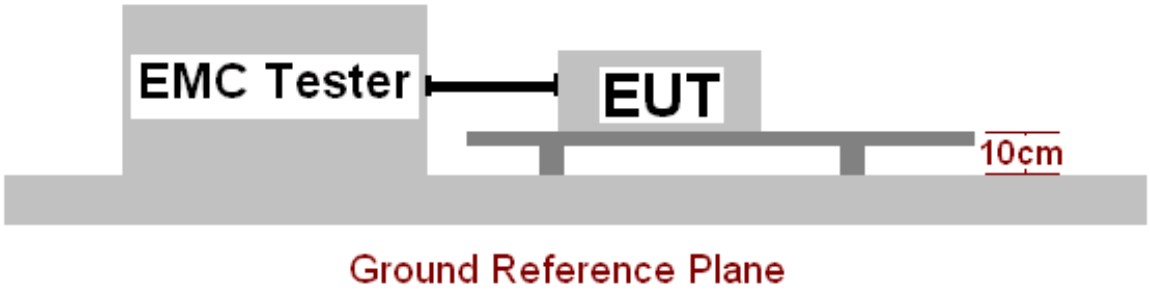
b. Both positive and negative polarity discharges were applied.

c. The length of the “hot wire” from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 meter

d. The duration time of each test sequential was 1 minute.

e. The transient/burst waveform was in accordance with EN 61000-4-4, 5/50ns.

3.5.3 Test Setup



3.5.4 Test Result

Test Point	Polarity	Test Level (kV)	Observation	Comply with Criterion
L	+/- 2kV	Direct	A	Pass
N	+/- 2kV	Direct	A	Pass
L-N	+/- 2kV	Direct	A	Pass
PE	+/- 2kV	Direct	A	Pass
L-PE	+/- 2kV	Direct	A	Pass
N-PE	+/- 2kV	Direct	A	Pass

Note:

The EUT continued to operate as intended. No degradation of performance was observed.

3.6 Surge Immunity Test

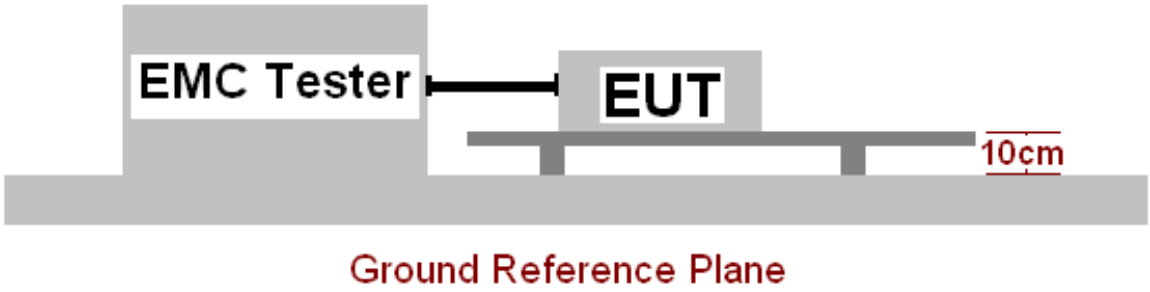
3.6.1 Test Specification

Basic Standard:	EN 61000-4-5
Waveform:	Voltage 1.2/50 μs; Current 8/20 μs
Test Voltage:	a.c. power port, line to line 1 kV, line to earth 2kV
Polarity:	Positive/Negative
Phase Angle:	0°, 90°, 180°, 270°
Repetition Rate:	60sec
Times:	5 times/each condition.

3.6.2 Test Procedure

a. The EUT and the auxiliary equipment were placed on a table of 0.8m heights above a metal ground reference plane. The size of ground plane is greater than 1m×1m and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT was less than 2 meters (provided by the manufacturer).
b. The EUT was connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise was applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).
c. The surges were applied line to line and line(s) to earth. When testing line to earth the test voltage was applied successively between each of the lines and earth. Steps up to the test level specified increased the test voltage. All lower levels including the selected test level were tested. The polarity of each surge level included positive and negative test pulses.

3.6.3 Test Setup



3.6.4 Test Result

Coupling Line	Polarity	Voltage (kV)	Observation	Comply with Criterion
a.c. power, L-PE	+/-	2	Note (1)	A
a.c. power, N- PE	+/-	2	Note (1)	A
a.c. power, L-N	+/-	1	Note (1)	A

Note:

(1) The EUT continued to operate as intended. No degradation of performance was observed.

3.7 Immunity to Conducted Disturbances Induced by RF Fields

3.7.1 Test Specification

Basic Standard:	EN 61000-4-6
Frequency Range:	0.15 MHz – 80 MHz
Field Strength:	10V
Modulation:	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1% of fundamental
Coupled Cable:	a.c. power line, Ethernet line, Phone line
Coupling Device:	CDN-M2

3.7.2 Test Procedure

The EUT shall be tested within its intended operating and climatic conditions.

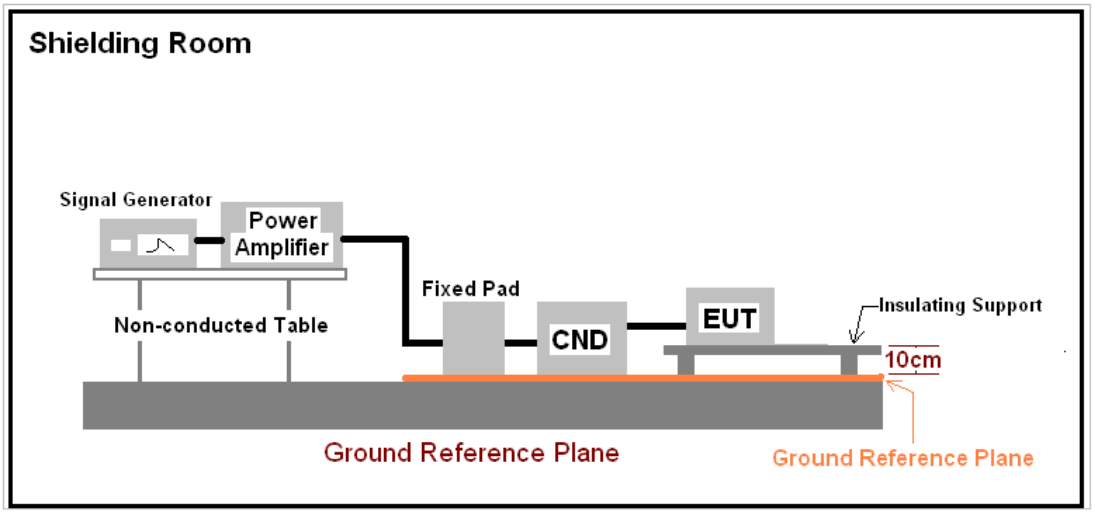
The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80% amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate shall not exceed 1.5×10-3 decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.

The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.

Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

3.7.3 Test Setup



3.7.4 Test Result

Test Point	Frequency	Field Strength (Vrms)	Observation	Comply with criterion
a.c. power line	0.15 – 80 MHz	10	Note(1)	A

Note:

(1) The EUT continued to operate as intended. No degradation of performance was observed.

3.8 Power Frequency Magnetic Field Immunity Test

3.8.1 Test Specification

Basic Standard:	EN 61000-4-8
Frequency Range:	50Hz
Field Strength:	30 A/m
Observation Time:	2 minute
Inductance Coil:	Rectangular type, 1m×1m

3.8.2 Test Procedure

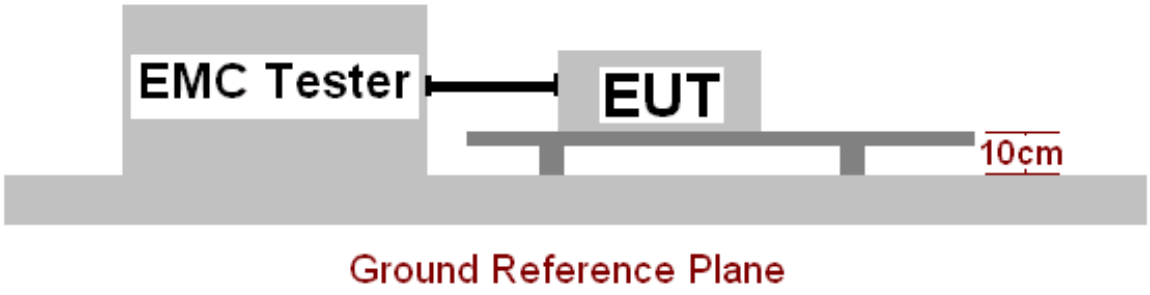
The equipment is configured and connected to satisfy its functional requirements. It shall be placed on the GRP with the interposition of a 0.1m thick insulating support.

The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.

The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.

The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.

3.8.3 Test Setup



3.8.4 Test Result

Direction	Field Strength(A/m)	Observation	Comply with Criterion
X	30	Note(1)	A
Y	30	Note(1)	A
Z	30	Note(1)	A

Note:

The EUT continued to operate as intended. No degradation of performance was observed.

3.9 Voltage Dips and Short Interruptions Immunity Test

3.9.1 Test Specification

Basic Standard:	IEC 61000-4-11
Voltage Dips:	0% reduction, 1 period 40% reduction, 10 periods 70% reduction, 25 period
Voltage Interruptions:	>95% reduction, 250 periods
Voltage Phase Angle:	0°

3.9.2 Test Procedure

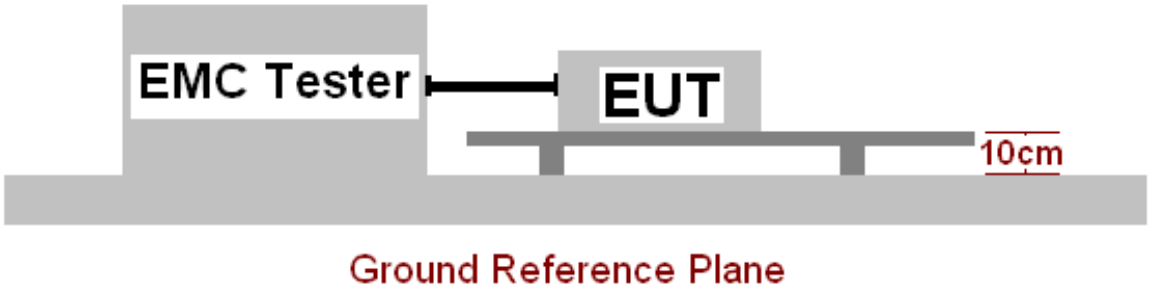
The power cord was used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.

The EUT was tested for (I) 95% voltage dip of supplied voltage with duration of 10ms, (II)30% voltage dip of supplied voltage and duration 500ms. Both of the dip tests were carried out for a sequence of three voltage dips with intervals of 10 seconds.

95% voltage interruption of supplied voltage with duration of 5000ms was followed, which was a sequence of three voltage interruptions with intervals of 10 seconds.

Voltage reductions occur at 0 dePOWERLDe crossover point of the voltage waveform. The performance of the EUT was checked after the voltage dip or interruption.

3.9.3 Test Setup



3.9.4 Test Result

Test Mode	Voltage Reduction	Duration (ms)	Times	Interval (Sec)	Observation	Comply with Criterion
Voltage dips	100%	20	3	10	Note (1)	A
	60%	200	3	10	Note (1)	A
	30%	500	3	10	Note (1)	A
Voltage interruptions	100%	5000	3	10	Note (1)	A

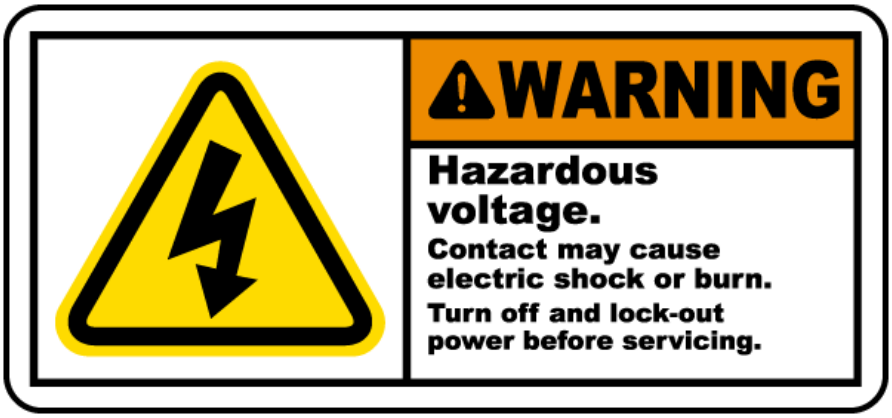
Note:

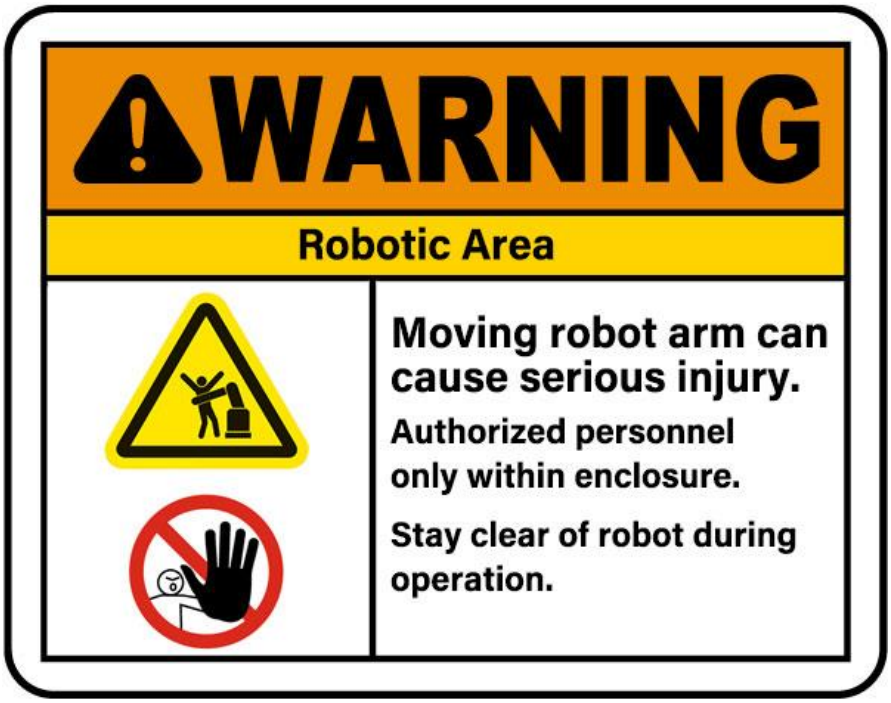
(1). The EUT continued to operate as intended. No degradation of performance was observed.

Annex：Technical Information

A1. Picture of machine

A2. Warning Label





A3.Nameplate

AUCTECH	Robot	
Model: ACR-7	Total Power:	
Volatge/Frequence/Phase No: 220 V~ / 50 Hz /1 P		
Series No:	Date for manufactured: 2023.6	
Range: 850mm	Weight: 27kg	
Made in China		
Manufacture name： Guangzhou Auctech Automation Technology Ltd		
Manufacture address： Hongshi Business Building, 11 Kehua Road, SCI-TECH Industry Park, Taihe Town, Baiyun District, Guangzhou, CHINA		
Importer:******* Address:*******		