Technical Construction File

File No：MD-TCF-200507-24681

Applicant:

KEENON ROBOTICS CO., LTD.

Address of applicant:

11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA,

SHANGHAI, CHINA

Directive: 2006/42/EC Machinery Directive
2014/35/EU Low Voltage Directive
2014/30/EU Electromagnetic Directive

Legal Person：_____

Product: DISINFECTION ROBOT
Model: M1, M2

Content

Part I: General

1.1 General description

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 ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reduction

EN ISO10218-1:2011 Robots and robotic devices-Safety requirements for industrial robots-Part 1:Robots

EN ISO10218-2:2011 Safety requirements for industrial robots-Part 2:Robots systems and integration

EN 60204-1:2018 Safety of machinery - Electrical equipment of machines

EN 61000-6-2:2016 Electromagnetic compatibility (EMC) — Part 6-2: Generic standards - Immunity for industrial environments

EN 61000-6-4:2018 Electromagnetic compatibility (EMC) — Part 6-4: Generic Standards - Emission Standard For Industrial Environments

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

1.2 List of the series products

M1, M2

1.3 Quality control system

In order to ensure the conformity of the series production, the KEENON ROBOTICS CO., LTD. has taken the related procedures mentioned below：

（1）Apply for the consultant form the qualified body in Germany

The KEENON ROBOTICS CO., LTD. has applied for the consultant from GTS Prüf- und Zertifizierungs GmbH who is a competent institute for the CE marking consultant and certification in China.
The complete technical construction file（TCF）have been established before applying for the CE marking certificate under the consultant of GTS.

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

Before the assemblies of the series production, the QC engineers of KEENON ROBOTICS CO., 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.

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

Before packing the products, the QC engineers of KEENON ROBOTICS CO., LTD. have to do the necessary inspection and testing to ensure the conformity of related requirements, in particularly, the testing and inspection of electrical characteristics and outer feature.

（4）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.

（5）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 KEENON ROBOTICS CO., LTD., if the change may effects the related electrical or mechanical characteristics.

（6）Provision for the Quality Assurance

For the provisions of internal control measures to ensure the conformity of series production of the machines, KEENON ROBOTICS CO., LTD. has built an internal quality control system in accordance with the international standard of ISO-9001.

TECHNICAL FILE

Essential health and safety requirements

The third Party	Shanghai Global Testing Services Co., Ltd Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China	Tel: / Fax: /
Name and address of the applicant	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Name and address of the manufacturer	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Name and address of the factory (production sites)	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Product	DISINFECTION ROBOT	
Mode/type reference	M1, M2	
Reviewed according to	Essential health and safety requirements	
Review Result	PASS	
TCF No.	MD-TCF-200507-24681-1	
Work carried out by	Tony Guo Director	Signature
Word verified by	Kevin Shi Manager	Signature
Date of issue	2020/05/12	

GLOBAL TESTING SERVICES CO., LTD. GTS CERTIFICATION

Part II：Assessment of conformity
2.1 Essential health and safety requirements

ESSENTIAL REQUIREMENTS ACCORDING TO ANNEX I

MACHINERY SAFETY DIRECTIVE 2006/42/EC

Article	Sub-article	Requirement	Fullfilment			Remark
			Y	N	N/A	
1	1.1.2	*Principles of safety integration* (a) Machinery must be so constructed that it is fitted for its function, and can be adjusted and maintained without putting persons at risk when these operations are carried out under the conditions foreseen by the manufacturer. The aim of measures taken must be to eliminate any risk of accident throughout the foreseeable lifetime of the machinery, including the phases of assembly and dismantling, even where risks of accident arise from foreseeable abnormal situations. (b) In selecting the most appropriate methods, the manufacturer must apply the following principles, in the order given: - eliminate or reduce risks as far as possible (inherently safe machinery design and construction), - take the necessary protection measures in relation to risks that cannot be eliminated, - inform users of the residual risks due to any shortcomings of the protection measures adopted, indicate whether any particular training is required and specify any need to provide personal protection equipment. (c) When designing and constructing machinery, and when drafting the instructions, the manufacturer must envisage not only the normal use of the	☑			**Pass.** All the machines are fitted for the function. Enough protection is provided - **Pass** Manufacturer has provided enough safety devices to eliminate or reduce risks.. **Pass.** Safety guards and other devices are used. **Pass.** Enough warnings are provided in the appropriate spot **Pass.** All the conditions are

		machinery but also uses which could reasonably be expected. The machinery must be designed to prevent abnormal use if such use would engender a risk. In other cases the instructions must draw the user's attention to ways - which experience has shown might occur - in which the machinery should not be used. (d) Under the intended conditions of use, the discomfort, fatigue and psychological stress faced by the operator must be reduced to the minimum possible taking ergonomic principles into account. (e) When designing and constructing machinery, the manufacturer must take account of the constraints to which the operator is subject as a result of the necessary or foreseeable use of personal protection equipment (such as footwear, gloves, etc.). (f) Machinery must be supplied with all the essential special equipment and accessories to enable it to be adjusted, maintained and used without risk.				considered by the manufacturer, and the related information also has been provided within the instruction **Pass.** These requirements have been complied with, and the related information also has been provided within the instruction manual. **Pass.** These requirements have been taken into account during the design of this machine
	1.1.3	*Materials and products* The materials used to construct machinery or products used and created during its use must not endanger exposed persons' safety or health. In particular, where fluids are used, machinery must be designed and constructed for use without risks due to filling, use, recovery or draining.	☑			**Pass**. They cannot endanger exposed person's safety or health
	1.1.4	*Lighting* 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. The manufacturer must ensure 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 due to the lighting provided by the manufacturer. . Internal parts requiring frequent inspection and adjustment and maintenance areas must be provided with appropriate lighting	☑			**Not applicable.** No integral lighting has been used. **Not applicable.** No integral lighting has been used. **Not applicable.** No integral lighting has been used.

	1.1.5	*Design of machinery to facilitate its handling* Machinery or each component part thereof must: - be capable of being handled safely, - be packaged or designed so that it can be stored safely and without damage (e.g. adequate stability, special supports, etc.). Where the weight, size or shape of machinery or its various component parts prevents them from being moved by hand, the machinery or each component part must; - either be fitted with attachments for lifting gear, or - be designed so that it can be fitted with such attachments (e.g. threaded holes), or - be shaped in such a way that standard lifting gear can easily be attached. Where machinery or one of its component parts is to be moved by hand, it must: - either be easily movable, or - be equipped for picking up (e.g. hand-grips, etc.) and moving in complete safety. Special arrangements must be made for the handling of tools and/or machinery parts, even if lightweight, which could be dangerous (shape, material, etc.).			☑	- **Pass.** Enough measures have been taken to ensure the safe of the handling. **Pass.** The machine can be stored in wood box safely and without damage. **Not applicable** **Not applicable** **Not applicable** **Not applicable** **Not applicable** **Not applicable** **Not applicable**
	1.2	**Controls**	☑			
	1.2.1	*Safety and reliability of control systems* Control systems must be designed and constructed so that they are safe and reliable, in a way that will prevent a dangerous situation arising.				**Pass.** The control system for this

		Above all they must be designed and constructed in such a way that: - they can withstand the rigours of normal use and external factors, - errors in logic do not lead to dangerous situations.				machine is safe and reliable by appropriate designing - **Pass.** The control system can withstand related effects during normal operation. **Pass.** Any error in logic doesn't lead to dangerous situations.
	1.2.2	*Control devices* Control devices must be: - clearly visible and identifiable and appropriately marked where necessary, - positioned for safe operation without hesitation or loss of time, and without ambiguity, - designed so that the movement of the control is consistent with its effect, - located outside the danger zones, except for certain controls where necessary, such as emergency stop, console for training of robots, - positioned so that their operation cannot cause additional risk,	☑			**Pass.** Appropriate lables and markings are provided This requirement has been complied with Pass. Appropriate positions have been taken into account during design. **Pass.** Movement of the control is consistent with its effect Pass. All control devices have been located outside the danger zones. **Pass.** All operation of control

						devices ’tcause additional risk.
		- designed or protected so that the desired effect, where a risk is involved, cannot occur without an intentional operation,				**Pass.** ppropriate safety devices have been used to comply with this requirement.
		- made so as to withstand foreseeable strain; particular attention must be paid to emergency stop devices liable to be subjected to considerable strain.				**Pass.** All of them can withstand foreseeable strain.
		Where a control is designed and constructed to perform several different actions, namely where there is no one-to-one correspondence (e.g. keyboards, etc.), the action to be performed must be clearly displayed and subject to confirmation where necessary.				**Not applicable.**
		Controls 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.				**Pass.** These requirements have been taken into account during design.
		Constraints due to the necessary or foreseeable use of personal protection equipment (such as footwear, gloves, etc.) must be taken into account.				**Not applicable.**
		Machinery must be fitted with indicators (dials, signals, etc.) as required for safe operation. The operator must be able to read them from the control position				**Pass.** The indicators have been provided.
		From the main control position the operator must be able to ensure that there are no exposed persons in the danger zones. If this is impossible, the control system must be designed and constructed so that an acoustic and/ or visual warning signal is given whenever the machinery is about to start. The exposed person must have the time and the means to take rapid action to prevent the machinery starting up.				**Pass.** Emergency stop , main switch and other related devices have been provided for the exposed person.
	1.2.3	*Starting*	☑			
		It must be possible to start machinery only by voluntary actuation of a control provided for the purpose.				**Pass.** Devices preventing unintended

		The same requirement applies: - when restarting the machinery after a stop-page, whatever the cause, - when effecting a significant change in the operating conditions (e.g. speed, pressure, etc.), unless such restarting or change in operating conditions is without risk to exposed persons. This essential requirement does not apply to the restarting of the machinery or to the change in operating conditions resulting from the normal sequence of an automatic cycle. Where machinery has several starting controls and the operators can therefore put each other in danger, additional devices (e.g. enabling devices or selectors allowing only one part of the starting mechanism to be actuated at any one time) must be fitted to rule out such risks. It must be possible for automated plant functioning in automatic mode to be restarted easily after a stoppage once the safety conditions have been fulfilled.				strating have been provided. **Pass.** Reset is necessary before restaring. **Pass.** These requirements have been complied with. — **Not applicable.** **Not applicable.**
	1.2.4	*Stopping device* *Normal stopping* Each machine must be fitted with a control whereby the machine can be brought safely to a complete stop. 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. The machinery's stop control must have priority over the start controls.. Once the machinery or its dangerous parts have stopped, the energy supply to the actuators concerned must be cut off	☑			**Pass.** A normal stop control has been provided. **Pass.** It has priority over the start control. Pass.

						The stops belong to the category 0, or category 1 stops.
		Emergency stop Each machine must be fitted with one or more emergency stop devices to enable actual or impending danger to be averted. 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, - hand-held portable machines and hand-guided machines. This device must: - have clearly identifiable, clearly visible and quickly accessible controls, - stop the dangerous process as quickly as possible, without creating additional hazards, - where necessary, trigger or permit the triggering of certain safeguard movements. 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; it must not be possible to engage the device without triggering a stop command; 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.	☑			**Pass.** These machines are fitted with one emergency stop devices. — **Not applicable.** **Not applicable.** — **Pass.** The emergency sop has red button, yellow background and maked with “emergency stop” **Pass.** The emergency stop will stop the machine as soon as it is pressed and it will not create any additional hazards. **Not applicable.**
		Complex installations	☑			—

		In the case of machinery or parts of machinery designed to work together, the manufacturer 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.				**Not applicable.**
	1.2.5	*Mode selection* The control mode selected must override all other control systems with the exception of the emergency stop. If machinery has been designed and built to allow for its use in several control or operating modes presenting different safety levels (e.g. to allow for adjustment, maintenance, inspection, etc.), it must be fitted with a mode selector which can be locked in each position. Each position of the selector must correspond to a single operating or control mode. The selector may be replaced by another selection method which restricts the use of certain functions of the machinery to certain categories of operator (e.g. access codes for certain numerically controlled functions, etc.). If, for certain operations, the machinery must be able to operate with its protection devices neutralised, the mode selector must simultaneously: - disable the automatic control mode, - permit movements only by controls requiring sustained action, - permit the operation of dangerous moving parts only in enhanced safety conditions (e.g. reduced speed, reduced power, step-by-step, or other adequate provision) while preventing hazards from linked sequences, - prevent any movement liable to pose a danger by acting voluntarily or involuntarily on the machine's internal sensors. In addition, the operator must be able to control operation of the parts he is working on at the adjustment point.	☑			**Pass.** The emergency stop is effective regardless of operating modes. **Not applicable.** No this kind of mode selectionhas been found. **Not applicable.** No this kind of mode selection has been found **Not applicable.** No this kind of mode selection has been found. **Not applicable.** No this kind of mode selection has been found. **Not applicable.** **Not applicable.** **Not applicable.** **Not applicable.** No this kind of mode

						selectionhas been found.
	1.2.6	*Failure of the power supply* 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. In particular: - the machinery must not start unexpectedly, - the machinery must not be prevented from stopping if the command has already been given, - no moving part of the machinery or piece held by the machinery must fall or be ejected, - automatic or manual stopping of the moving parts whatever they may be must be unimpeded, - the protection devices must remain fully effective.	☑			— **Pass.** No any dangerous situation has been found. — **Pass.** The stop command has the priorityover all other devices **Pass.** No such part is found.
	1.2.7	*Failure of the control circuit* A fault in the control circuit logic, or failure of or damage to the control circuit must not lead to dangerous situations.n particular: - the machinery must not start unexpectedly, - the machinery must not be prevented from stopping if the command has already been given, - no moving part of the machinery or piece held by the machinery must fall or be ejected, - automatic or manual stopping of the moving parts whatever they may be must be unimpeded,	☑			

		- the protection devices must remain fully effective.				
	1.2.8	*Software* Interactive software between the operator and the command or control system of a machine must be user-friendly.			☑	
	1.3 1.3.1	Protection against mechanical hazards Stability Machinery, components and fittings thereof must be so designed and constructed that they are stable enough, under the foreseen operating conditions (if necessary taking climatic conditions into account) for use without risk of overturning, falling or unexpected movement. If the shape of the machinery itself or its intended installation does not offer sufficient stability, appropriate means of anchorage must be incorporated and indicated in the instructions.	☑			- - **Pass.** These requirements have been taken into account design **Not applicable.** The sufficient stability has been offered for this machine.
	1.3.2	*Risk of break-up during operation* The various parts of machinery and their linkages must be able to withstand the stresses to which they are subject when used as foreseen by the manufacturer. phenomena of fatigue, ageing, corrosion and abrasion. The durability of the materials used must be adequate for the nature of the work place foreseen by the manufacturer, in particular as regards the The manufacturer must indicate in the instructions the type and frequency of inspection and maintenance required for safety reasons. He must, where appropriate, indicate the parts subject to wear and the criteria for replacement. Where a risk of rupture or disintegration remains despite the measures taken (e.g. as with grinding wheels) the moving parts must be mounted and positioned in such a way that in case of rupture their fragments will be	☑			**Pass.** All parts of the machine can withstand related stress when they are used. **Pass.** All materials used for this machine areappropriate for their intended useand have adequate life. **Pass.** The related information has been provided within the instruction manual. **Not applicable.** No such risk is possible.

		contained. 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; precautions must be taken to ensure that no risk is posed by a rupture (sudden movement, high-pressure jets, etc.). 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 (e.g. tool breakage): - when the workpiece comes into contact with the tool the latter must have attained its normal working conditions, - when the tool starts and/or stops (intentionally or accidentally) the feed movement and the tool movement must be coordinated.				**Not applicable.** **Pass.** **Pass.**
	1.3.3	*Risks due to falling or ejected objects* Precautions must be taken to prevent risks from falling or ejected objects (e.g. workpieces, tools, cuttings, fragments, waste, etc.).	☑			
	1.3.4	*Risks due to surfaces, edges or angles* 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.	☑			— **Pass.** No this kind injury has been found.
	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 (combined machinery), 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. For this purpose, it must be possible to start and stop separately any elements that are not protected.			☑	— **Not applicable.** No this kind of combined machinery. **Not applicable.** No this kind of combined machinery.

	1.3.6	*Risks relating to variations in the rotational speed of tools* When the machine is designed to perform operations under different conditions of use (e.g. different speeds or energy supply), it must be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably.	☑			— **Not applicable.**
	1.3.7	*Prevention of risks related to moving parts* The moving parts of machinery must be designed, built and laid out to avoid hazards or, where hazards persist, fixed with guards or 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.	☑			— **Pass.** This kind of hazards have been prevented by appropriate guards. **Pass.** All necessary steps have been taken.
		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.				**Not applicable.** No this kind of need.
	1.3.8	*Choice of protection against risks related to moving parts* 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. The following guidelines must be used to help make the choice. *A. Moving transmission parts* Guards designed to protect exposed persons against the risks associated with moving transmission parts (such as pulleys, belts, gears, rack and pinions, shafts, etc.) must be: - either fixed, complying with requirements 1.4.1 and 1.4.2.1, or - movable, complying with requirements 1.4.1 and 1.4.2.2.A.	☑			— **Pass.** It is in accordance with the risk assessment. See the related clauses. See the related clauses.

		Movable guards should be used where frequent access is foreseen.				
		B. Moving parts directly involved in the process Guards or protection devices designed to protect exposed persons against the risks associated with moving parts contributing to the work (such as cutting tools, moving parts of presses, cylinders, parts in the process of being machined, etc.) must be: - wherever possible fixed guards complying with requirements 1.4.1 and 1.4.2.1, - otherwise, movable guards complying with requirements 1.4.1 and 1.4.2.2.B or protection devices such as sensing devices (e.g. non-material barriers, sensor mats), remote-hold protection devices (e.g. two-hand controls), or protection devices intended automatically to prevent all or part of the operator's body from encroaching on the danger zone in accordance with requirements 1.4.1 and 1.4.3. However, when certain moving parts directly involved in the process cannot be made completely or partially inaccessible during operation owing to operations requiring nearby operator intervention, where technically possible such parts must be fitted with: - fixed guards, complying with requirements 1.4.1 and 1.4.2.1 preventing access to those sections of the parts that are not used in the work, - adjustable guards, complying with requirements 1.4.1 and 1.4.2.3 restricting access to those sections of the moving parts that are strictly for the work.	☑			
	1.4	*Required characteristics of guards and protection devices*	☑			
	1.4.1	*General requirements* Guards and protection devices must: - be of robust construction, - not give rise to any additional risk,				**Pass.** They all can be opened only with tools. **Not applicable.**

		- not be easy to by-pass or render non-operational, - be located at an adequate distance from the danger zone, - cause minimum obstruction to the view of the production process, - enable essential work to be carried out on installation and/or replacement of tools and also for maintenance by restricting access only to the area where the work has to be done, if possible without the guard or protection device having to be dismantled.				**Not applicable.**
	1.4.2 1.4.2.1	*Special requirements for guards* *Fixed guards* Fixed guards must be securely held in place. They must be fixed by systems that can be opened only with tools. Where possible, guards must be unable to remain in place without their fixings.	☑			
	1.4.2 1.4.2.2	*Movable guards* *A. Type A movable guards must* - as far as possible remain fixed to the machinery when open, - be associated with a locking device to prevent moving parts starting up as long as these parts can be accessed and to give a stop command whenever they are no longer closed.			☑	
	1.4.2 1.4.2.2	*B. Type B movable guards must be designed and incorporated into the* *control system so that:* - moving parts cannot start up while they are within the operator's reach, - the exposed person cannot reach moving parts once they have started up, - they can be adjusted only by means of an intentional action, such as the use of a tool, key, etc., - the absence or failure of one of their components prevents starting or stops the moving parts, - protection against any risk of ejection is proved by means of an appropriate barrier.			☑	

	1.4.2 1.4.2.3	*Adjustable guards restricting access* Adjustable guards restricting access to those areas of the moving parts strictly necessary for the work must: - be adjustable manually or automatically according to the type of work involved, - be readily adjustable without the use of tools, - reduce as far as possible the risk of ejection.			☑	
	1.4.3	*Special requirements for protection devices* Protection devices must be designed and incorporated into the control system so that:			☑	
		- moving parts cannot start up while they are within the operator's reach,				
		- the exposed person cannot reach moving parts once they have started up, - they can be adjusted only by means of an intentional action, such as the use of a tool, key, etc., - the absence or failure of one of their components prevents starting or stops the moving parts.				
	1.5 1.5.1	*Protection against other hazards* *Electricity supply* 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. The specific rules in force relating to electrical equipment designed for use within certain voltage limits must apply to machinery which is subject to those limits.	☑			
	1.5.2	*Static electricity* 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.	☑			
	1.5.3	*Energy supply other than electricity*	☑			

		Where machinery is powered by an energy other than electricity (e.g. hydraulic, pneumatic or thermal energy, etc.), it must be so designed, constructed and equipped as to avoid all potential hazards associated with these types of energy.				
	1.5.4	*Errors of fitting* 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 given on the parts themselves and/or the housings. The same information must be given on moving parts and/or their housings where the direction of movement must be known to avoid a risk. Any further information that may be necessary must be given in the instructions. Where a faulty connection can be the source of risk, incorrect fluid connections, including electrical conductors, must be made impossible by the design or, failing this, by information given on the pipes, cables, etc. and/or connector blocks.	☑			
	1.5.5	*Extreme temperatures* Steps 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. The risk of hot or very cold material being ejected should be assessed. Where this risk exists, the necessary steps must be taken to prevent it or, if this is not technically possible, to render it non-dangerous.			☑	
	1.5.6	*Fire* Machinery must be designed and constructed to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery.			☑	
	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, dust, vapours or other substances produced or used by the machinery. To that end the manufacturer must take steps to: - avoid a dangerous concentration of products, - prevent combustion of the potentially explosive atmosphere,			☑	

		- minimise any explosion which may occur so that it does not endanger the surroundings. The same precautions must be taken if the manufacturer foresees the use of the machinery in a potentially explosive atmosphere. Electrical equipment forming part of the machinery must conform, as far as the risk from explosion is concerned, to the provision of the specific Directives in force.				
	1.5.8	*Noise* Machinery must be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking account of technical progress and the availability of means of reducing noise, in particular at source.	☑			
	1.5.9	*Vibration* 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.			☑	
	1.5.10	*Radiation* Machinery must be so designed and constructed that any emission of radiation is limited to the extent necessary for its operation and that the effects on exposed persons are non-existent or reduced to non-dangerous proportions.			☑	
	1.5.11	*External radiation* Machinery must be so designed and constructed that external radiation does not interfere with its operation.			☑	
	1.5.12	*Laser equipment* Where laser equipment is used, the following provisions should be taken into account: - laser equipment on machinery must be designed and constructed so as to prevent any accidental radiation, - laser equipment on machinery must be protected so that effective radiation, radiation produced by reflection or diffusion and secondary radiation do not damage health,			☑	

		- 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.				
	1.5.13	*Emissions of dust, gases, etc* Machinery must be so designed, constructed and/or equipped that risks due to gases, liquids, dust, vapours and other waste materials which it produces can be avoided. Where a hazard exists, the machinery must be so equipped that the said substances can be contained and/or evacuated. Where machinery is not enclosed during normal operation, the devices for containment and/or evacuation must be situated as close as possible to the source emission.			☑	Adequate design and construction have bee taken All the condition has been considered
	1.5.14	*Risk of being trapped in a machine* Machinery must be designed, constructed or fitted with a means of preventing an exposed person from being enclosed within it or, if that is impossible, with a means of summoning help.	☑			
	1.5.15	*Risk of slipping, tripping or falling* 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.			☑	
	1.6 1.6.1	*Maintenance* *Machinery maintenance* Adjustment, lubrication and maintenance points must be located outside danger zones. It must be possible to carry out adjustment, maintenance, repair, cleaning and servicing operations while machinery is at a standstill. If one or more of the above conditions cannot be satisfied for technical reasons, these operations must be possible without risk (see 1.2.5). In the case of automated machinery and, where necessary, other machinery, the manufacturer must make provision for a connecting device for mounting diagnostic fault-finding equipment. 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. Access to the components must enable these tasks to be carried out with the necessary technical means (tools,	☑			

		measuring instruments, etc.) in accordance with an operating method specified by the manufacturer.				
	1.6.2	*Access to operating position and servicing points* The manufacturer must provide means of access (stairs, ladders, catwalks, etc.) to allow access in safety to all areas used for production, adjustment and maintenance operations.	☑			Appropriate guards and safety control device have been used
	1.6.3	*Isolation of energy sources* All machinery must be fitted with means to isolate it from all energy sources. Such isolators must be clearly identified. They must be capable of being locked if reconnection could endanger exposed persons. In the case of machinery supplied with electricity through a plug capable of being plugged into a circuit, separation of the plug is sufficient. 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. 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. As an exception to the above requirements, certain circuits may remain connected to their energy sources in order, for example, to hold parts, protect information, light interiors, etc. In this case, special steps must be taken to ensure operator safety.	☑			The power switch has been used
	1.6.4	*Operator intervention* Machinery must be so designed, constructed and equipped that the need for operator intervention is limited. If operator intervention cannot be avoided, it must be possible to carry it out easily and in safety.	☑			
	1.6.5	*Cleaning of internal parts* 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. If it is absolutely impossible to avoid entering the machinery, the manufacturer must take steps during its construction to	☑			

		allow cleaning to take place with the minimum of danger.				
	1.7 1.7.0	*Indicators* *Information devices* The information needed to control machinery must be unambiguous and easily understood. It must not be excessive to the extent of overloading the operator. Where the health and safety of exposed persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped to give an appropriate acoustic or light signal as a warning.	☑			
	1.7.1	*Warning devices* Where machinery is equipped with warning devices (such as signals, etc.), 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 Directives concerning colours and safety signals must be complied with.	☑			
	1.7.2	*Warning of residual risks* Where risks remain despite all the measures adopted or in the case of potential risks which are not evident (e.g. electrical cabinets, radioactive sources, bleeding of a hydraulic circuit, hazard in an unseen area, etc.), the manufacturer must provide warnings. Such warnings should preferably use readily understandable pictograms and/or be drawn up in one of the languages of the country in which the machinery is to be used, accompanied, on request, by the languages understood by the operators.			☑	
	1.7.3	*Marking* All machinery must be marked legibly and indelibly with the following minimum particulars: - name and address of the manufacturer,	☑			

		- the CE marking (see Annex III), - designation of series or type, - serial number, if any, - the year of construction. Furthermore, where the manufacturer constructs machinery intended for use in a potentially explosive atmosphere, this must be indicated on the machinery. Machinery must also bear full information relevant to its type and essential to its safe use (e.g. maximum speed of certain rotating parts, maximum diameter of tools to be fitted, mass, etc.). Where a machine part must be handled during use with lifting equipment, its mass must be indicated legibly, indelibly and unambiguously. The interchangeable equipment referred to in the third indent of Article 1(2)(a), must bear the same information.				
	1.7.4	*Instructions* (a) All machinery must be accompanied by instructions including at least the following: - a repeat of the information with which the machinery is marked, except the serial number (see 1.7.3) together with any appropriate additional information to facilitate maintenance (e.g. addresses of the importer, repairers, etc.), - foreseen use of the machinery within the meaning of 1.1.2(c), - workstation(s) likely to be occupied by operators, - instructions for safe: - putting into service, - use, - handling, giving the mass of the machinery and its various parts where they are regularly to be transported separately, - assembly, dismantling,	☑			User manual in English provided

- adjustment

- maintenance (servicing and repair),
- where necessary, training instructions,
- where necessary, the essential characteristics of tools which may be fitted to the machinery.

Where necessary, the instructions should draw attention to ways in which the machinery should not be used.

(b) The instructions must be drawn up in one of the Community languages by the manufacturer or his authorised representative established in the Community.

On being put into service, all machinery must be accompanied by a translation of the instructions in the language or languages of the country in which the machinery is to be used and by the instructions in the original language. This translation must be done either by the manufacturer or his authorised representative established in the Community or by the person introducing the machinery into the language area in question.

By way of derogation from this requirement, the maintenance instructions for use by specialised personnel employed by the manufacturer or his authorised representative established in the Community may be drawn up in only one of the Community languages understood by that personnel.

(c) The instructions must contain the drawings and diagrams necessary for putting into service, maintenance, inspection, checking of correct operation and, where appropriate, repair of the machinery, and all useful instructions in particular with regard to safety.

(d) Any literature describing the machinery must not contradict the instructions as regards safety aspects. The technical documentation describing the machinery must give information regarding the airborne noise emissions referred to in (f) and, in the case of hand-held and/or hand-guided machinery, information regarding vibration as referred to in 2.2.

(e) Where necessary, the instructions must give the requirements relating to installation and assembly for reducing noise or vibration (e.g. use of dampers, type and mass of foundation block, etc.).

(f) The instructions must give the following information concerning airborne noise emissions by the machinery, either the actual value or a value established on the basis of measurements made on identical machinery:

- equivalent continuous A-weighted sound pressure level at workstations, where this exceeds 70 dB(A); where this level does not exceed 70 dB(A), this

		fact must be indicated, - peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 mPa), - sound power level emitted by the machinery where the equivalent continuous A-weighted sound pressure level at workstations exceeds 85 dB(A). In the case of very large machinery, instead of the sound power level, the equivalent continuous sound pressure levels at specified positions around the machinery may be indicated. Where the harmonised standards are not applied, sound levels must be measured using the most appropriate method for the machinery. The manufacturer must indicate the operating conditions of the machinery during measurement and what methods have been used for the measurement. Where the workstation(s) are undefined or cannot be defined, sound pressure levels must be measured at a distance of 1 metre from the surface of the machinery and at a height of 1,60 metres from the floor or access platform. The position and value of the maximum sound pressure must be indicated. (g) If the manufacturer foresees that the machinery will be used in a potentially explosive atmosphere, the instructions must give all the necessary information. (h) In the case of machinery which may also be intended for use by non-professional operators, the wording and layout of the instructions for use, whilst respecting the other essential requirements mentioned above, must take into account the level of general education and acumen that can reasonably be expected from such operators.				
Technical construction file shall be retained and kept available for the competent national authorities for at least 10 years following the date of manufacture of the machinery or of the last unit produced.			☑			
Safety measures for fulfilling the product conformity requirements - Critical components shall be checked for every purchasing order if it is comply with the critical component list and relevant conformance and requirements are considered during incoming inspection. - Production flow chart and quality control plans			☑			

- Regulatory compliance records for the released machinery. (Availability and compliance) ¤ Relevant warning signs ¤ CE Conformity mark ¤ User manual ¤ Relevant circuit diagrams ¤ Relevant accessories, tools and apparatus ¤ Functional tests ¤ Mechanical tests ¤ Electrical safety tests				

TECHNICAL FILE

EN ISO 12100 and EN ISO 10218-1 and EN ISO 10218-2

The third party	Shanghai Global Testing Services Co., Ltd Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China	Tel: / Fax: /
Name and address of the applicant	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Name and address of the manufacturer	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Name and address of the factory (production sites)	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Product	DISINFECTION ROBOT	
Mode/type reference	M1, M2	
Reviewed according to	EN ISO 12100:2010, EN ISO 10218-1:2011, EN ISO 10218-2:2011	
Review Result	PASS	
Review Report No.	MD-TCF-200507-24681-2	
Work carried out by	Tony Guo Director	Signature
Word verified by	Kevin Shi Manager	Signature
Date of issue	2020/05/12	

GLOBAL TESTING SERVICES CO.,LTD. GTS CERTIFICATION

Part III：TCF

3.1 EN ISO 12100 and EN ISO 10218-1:2011 EN ISO 10218-2 TCF

EN ISO 12100:2010			
Clause	Requirement – Test	Result - Remark	Verdict
4.	Strategy for risk assessment and risk reduction		
	To implement risk assessment and risk reduction the designer shall take the following actions, in the order given:	According to the strategy.	Pass
	a) determine the limits of the machinery, which include the intended use and any reasonably foreseeable misuse thereof;	According to the strategy.	Pass
	b) identify the hazards and associated hazardous situations;	According to the strategy.	Pass
	c) estimate the risk for each identified hazard and hazardous situation;	According to the strategy.	Pass
	d) evaluate the risk and take decisions about the need for risk reduction;	According to the strategy.	Pass
	e) eliminate the hazard or reduce the risk associated with the hazard by means of protective measures.Actions a) to d) are related to risk assessment and e) to risk reduction.	According to the strategy.	Pass
	Risk assessment is a series of logical steps to enable, in a systematic way, the analysis and evaluation of the risks associated with machinery. Risk assessment is followed, whenever necessary, by risk reduction. Iteration of this process can be necessary to eliminate hazards as far as practicable and to adequately reduce risks by the implementation of protective measures.		Pass
	Protective measures are the combination of the measures implemented by the designer and the user in accordance with Figure 2. Measures which can be incorporated at the design stage are preferable to those implemented by the user and usually prove more effective.		Pass
	The objective to be met is the greatest practicable risk reduction, taking into account the four below factors. The strategy defined in this clause is represented by the flowchart in Figure 1. The process itself is iterative and several successive applications can be necessary to reduce the risk, making the best use of available technology. In carrying out this process, it is necessary to take into account these four factors, in the following order of		Pass

	preference:		
	- the safety of the machine during all the phases of its life		Pass
	cycle;		Pass
	—the ability of the machine to perform its function;		Pass
	—the usability of the machine;		Pass
	—the manufacturing, operational and dismantling costs of the machine.		Pass
5.	Risk assessment		—
5.1	General		—
	Risk assessment comprises (see Figure1)	According to the strategy.	Pass
	- risk analysis, comprising		
	1) determination of the limits of the machinery (see 5.3),		Pass
	2) hazard identification (5.4 and Annex B), and		Pass
	3) risk estimation (see 5.5), and		Pass
	- risk evaluation (see 5.6).		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.		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.		Pass
	The risk assessment shall be documented according to Clause 7.		Pass
5.2	Information for risk assessment		—
	The information for risk assessment should include the following.	According to the strategy.	P—
	a) Related to machinery description:		—
	1) user specifications;		Pass
	2) anticipated machinery specifications, including		Pass
	i) a description of the various phases of the whole life cycle of the machinery,		Pass
	ii) design drawings or other means of establishing the nature of the machinery, and		Pass

	iii) required energy sources and how they are supplied;		Pass
	3) documentation on previous designs of similar machinery, if relevant;		N/A
	4) information for use of the machinery, as available.	See instruction	Pass
	b) Related to regulations, standards and other applicable documents:		P—
	1) applicable regulations;		Pass
	2) relevant standards;		Pass
	3) relevant technical specifications;		Pass
	4) relevant safety data sheets.		Pass
	c) Related to experience of use:		—
	1) any accident, incident or malfunction history of the actual or similar machinery;		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;		Pass
	3) the experience of users of similar machines and, whenever practicable, an exchange of information with the potential users.		Pass
	d) Relevant ergonomic principles.		—
	The information shall be updated as the design develops or when modifications to the machine are required.	According to the strategy.	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.		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).		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	According to the strategy.	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:		Pass
	a) the different machine operating modes and different	See the instruction	Pass
	intervention procedures for the users, including interventions required by malfunctions of the machine;		
	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.);		Pass
	c) the anticipated levels of training, experience or ability of users including		Pass
	1) operators,		Pass
	2) maintenance personnel or technicians,		Pass
	3) trainees and apprentices, and		Pass
	4) the general public;		Pass
	d) exposure of other persons to the hazards associated with the machinery where it can be reasonably foreseen:		Pass
	1) persons likely to have a good awareness of the specific hazards, such as operators of adjacent machinery;		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;		Pass
	3) persons likely to have very little awareness of the machine hazards or the site safety procedures,		Pass

	such as visitors or members of the general public, including children.		
	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).		N/A
	5.3.3 Space limits		—
	Aspects of space limits to be taken into account include		
	a) the range of movement,		Pass
	b) space requirements for persons interacting with the machine, such as during operation and maintenance,		Pass
	c) human interaction such as the operator-machine interface, and		Pass
	d) the machine-power supply interface.		Pass
5.3.4	Time limits		—
	Aspects of time limits to be taken into account include:		
	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		Pass
	b) recommended service intervals.		Pass
5.3.5	Other limits		—
	Examples of other limits include:		—
	a) properties of the material(s) to be processed,		N/A
	b) housekeeping — the level of cleanliness required, and		N/A
	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	See the instruction	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.:		Pass
	- transport, assembly and installation;		Pass

	-commissioning;		Pass
	- use;		Pass
	- dismantling, disabling and scrapping.		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.		Pass
	The designer shall identify hazards taking into account the following.		
	a) Human interaction during the whole life cycle of the machine		P—
	Task identification should consider all tasks associated with every phase of the machine life cycle as given	According to the strategy.	Pass
	above. Task identification should also take into account, but not be limited to, the following task categories:		
	-setting;		Pass
	- testing;		Pass
	- teaching/programming;		Pass
	- process/tool changeover;		Pass
	- start-up;		Pass
	- all modes of operation;		Pass
	- feeding the machine;		Pass
	- removal of product from machine;		Pass
	- stopping the machine;		Pass
	-stopping the machine in case of emergency;		Pass
	- recovery of operation from jam or blockage;		Pass
	-restart after unscheduled stop;		Pass
	-fault-finding/trouble-shooting (operator intervention);		Pass
	-cleaning and housekeeping;		Pass
	- preventive maintenance;		Pass
	-corrective maintenance		Pass
	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.		Pass

	Several methods are available for the systematic identification of hazards. See also ISO/TR 14121-2.		
	In addition, reasonably foreseeable hazards, hazardous situations or hazardous events not directly related to tasks shall be identified.		Pass
	b) Possible states of the machine		—
	These are as follows:		—
	1) the machine performs the intended function (the machine operates normally);		Pass
	2) the machine does not perform the intended function (i.e. it malfunctions) due to a variety of reasons,including		Pass
	- variation of a property or of a dimension of the processed material or of the workpiece,		Pass
	- failure of one or more of its component parts or services,		Pass
	- external disturbances (for example, shocks, vibration, electromagnetic interference),		Pass
	- design error or deficiency (for example, software		Pass
	errors),		Pass
	- disturbance of its power supply, and		Pass
	-surrounding conditions (for example, damaged floor surfaces).		Pass
	c) Unintended behaviour of the operator or reasonably foreseeable misuse of the machine		P—
	Examples include - loss of control of the machine by the operator (especially for hand-held or mobile machines),		Pass
	- reflex behaviour of a person in case of malfunction, incident or failure during the use of the machine,		Pass
	- behaviour resulting from lack of concentration or carelessness,		Pass
	- behaviour resulting from taking the "line of least resistance" in carrying out a task,		Pass
	- behaviour resulting from pressures to keep the machine running in all circumstances, and		Pass
	- behaviour of certain persons (for example, children, disabled persons).		Pass
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 then aspects given in 5.5.3.	According to the strategy.	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	According to the strategy.	Pass
	-estimate the risk associated with the emissions,		Pass
	-evaluate the effectiveness of the protective measures implemented at the design stage,		Pass
	-provide potential buyers with quantitative information on emissions in the technical documentation, and		Pass
	- provide users with quantitative information on emissions in the information for use.		Pass
	Hazards other than emissions that are described by measurable parameters can be dealt with in a similar manner.		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;	According to the strategy .	Pass
	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.		Pass
5.5.2.2	Severity of harm		—
	The severity can be estimated by taking into account the following: a) the severity of injuries or damage to health, for example, -slight, -serious, - death.		Pass
	b) the extent of harm, for example, to - one person, - several persons.		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 be considered, but the highest foreseeable severity shall also be taken into account, even if the probability of such an occurrence is not high.		Pass
5.5.2.3	Probability of occurrence of harm		—
5.5.2.3. 1	Exposure of persons to the hazard		P—
	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,	According to the strategy.	Pass
	a) the need for access to the hazard zone (for normal operation, correction of malfunction, maintenance or repair, etc.),		Pass
	b) the nature of access (for example, manual feeding of materials),		Pass
	c) the time spent in the hazard zone,		Pass
	d) the number of persons requiring access, and		Pass
	e) the frequency of access.		Pass
5.5.2.3. 2	Occurrence of a hazardous event		P—
	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, a) reliability and other statistical data, b) accident history, c) history of damage to health, and d) comparison of risks (see 5.6.3).	According to the strategy.	
5.5.2.3. 3	Possibility of avoiding or limiting harm		P—
	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:	According to the strategy.	Pass
	a) different persons who can be exposed to the hazard(s), for example, - skilled, - unskilled;		Pass

	b) how quickly the hazardous situation could lead to harm, for example, - suddenly, - quickly, - slowly;		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;		Pass
	d) the human ability to avoid or limit harm (for example, reflex, agility, possibility of escape);		Pass
	e) practical experience and knowledge, for example, - of the machinery, - of similar machinery, - no experience.		Pass
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.	According to the strategy.	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.	According to the strategy.	Pass
	The risk estimation shall also take into account tasks, for which it is necessary to suspend protective measures.		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	According to the strategy.	Pass

	hazards shall also be considered. When considering these effects, risk estimation shall, as far as practicable, be based on appropriate recognized data.		
5.5.3.4	Human factors		—
	Human factors can affect risk and shall be taken into account in the risk estimation, including, for example, a) the interaction of person(s) with the machinery, including correction of malfunction,		Pass
	b) interaction between persons,		Pass
	c) stress-related aspects,		Pass
	d) ergonomic aspects,		Pass
	e) the capacity of persons to be aware of risks in a given situation depending on their training, experience and ability,		Pass
	f) fatigue aspects, and		Pass
	g) aspects of limited abilities (due to disability, age, etc.).		Pass
	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.	According to the strategy	Pass
5.5.3.5	Suitability of protective measures		—
	Risk estimation shall take into account the suitability of protective measures and shall		Pass
	a) identify the circumstances which can result in harm,		Pass
	b) whenever appropriate, be carried out using quantitative methods to compare alternative protective measures (see ISO/TR 14121-2), and		N/A
	c) provide information that can assist with the selection of appropriate protective measures.		Pass
	When estimating risk, those components and systems identified as immediately increasing the risk in case of failure need special attention.		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.		Pass
5.5.3.6	Possibility of defeating or circumventing protective measures		P—
	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.	According to the strategy.	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,		Pass
	a) the protective measure slows down production or interferes with another activity or preference of the user,		Pass
	b) the protective measure is difficult to use,		Pass
	c) persons other than the operator are involved, or		Pass
	d) the protective measure is not recognized by the user or not accepted as being suitable for its function.		Pass
	Whether or not a protective measure can be defeated depends on both the type of protective measure, such as an adjustable guard or programmable trip device, and its design details.	According to the strategy.	Pass
	Protective measures that use programmable electronic	According to the strategy and	Pass
	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.		Pass
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.		Pass
5.5.3.8	Information for use		—
	Risk estimation shall take into account the information for use, as available. See also 6.4.		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.		Pass
	Achieving the objectives of risk reduction and a favourable outcome of risk comparison applied when practicable gives confidence that risk has been adequately reduced.		Pass
5.6.2	Adequate risk reduction		—
	Application of the three-step method described in 6.1 is essential in achieving adequate risk reduction. Following the application of the three-step method, adequate risk reduction is achieved when		Pass
	- all operating conditions and all intervention procedures		Pass
	have been considered,		Pass
	- the hazards have been eliminated or risks reduced to the lowest practicable level,		Pass
	- any new hazards introduced by the protective measures have been properly addressed,		Pass
	- users are sufficiently informed and warned about the residual risks (see 6.1, step 3),		Pass
	- protective measures are compatible with one another,		Pass
	- sufficient consideration has been given to the consequences that can arise from the use in a nonprofessional/ non-industrial context of a machine designed for professional/industrial		Pass

	use, and		
	- the protective measures do not adversely affect the operator's working conditions or the usability of the machine.		Pass
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: - the similar machinery is in accordance with the relevant type-C standard(s);		N/A
	- the intended use, reasonably foreseeable misuse and the way both machines are designed and constructed are comparable;		N/A
	- the hazards and the elements of risk are comparable;		N/A
	- the technical specifications are comparable;		N/A
	- the conditions for use are comparable.		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.		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: _ severity of harm from the hazard under consideration; _ probability of occurrence of that harm. All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2).	This requirement is complied with.	Pass
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 because protective measures inherent	Appropriate machine design has been performed by the	Pass

	to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding may fail or be violated and information for use may not be followed.	manufacturer.	
	Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine. NOTE See 6.3 for safeguarding and complementary measures that can be used to achieve the risk reduction objectives in the case where inherently safe design measures are not sufficient (see 6.1 for the three-step method).	Appropriate machine design has been performed by the manufacturer.	Pass
6.2.2	Consideration of geometrical factors and physical aspects		
6.2.2.1	Geometrical factors		Pass
	Such factors include the following.		
	a) The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position — reducing blind spots, for example — and choosing and locating means of indirect vision where necessary (mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the operator, for example: _ the travelling and working area of mobile machines; _ the zone of movement of lifted loads or of the carrier of machinery for lifting persons; _ the area of contact of the tool of a hand-held or hand-guided machine with the material being worked. The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zones.	Appropriate machine design has been performed by the manufacturer.	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 by reducing the gap so that no part of the	Appropriate machine design has been performed by the manufacturer.	Pass

	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.	Appropriate machine design has been performed by the manufacturer.	Pass
	d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).	Appropriate machine design has been performed by the manufacturer.	Pass
6.2.2.2	Physical aspects		-
	Such aspects include the following:		-
	a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard;	The actuating force has been limited to be a sufficiently low value so that the actuated part does not generate a mechanical hazard.	Pass
	b) limiting the mass and/or velocity of the movable elements, and hence their kinetic energy;	The mass and/or velocity of the movable elements, and hence their kinetic energy have been limited.	Pass
	c) limiting the emissions by acting on the characteristics of the source using measures for reducing 1) noise emission at source (see ISO/TR 11688-1), 2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for hand-held and hand-guided machinery, see CR 1030-1)], 3) the emission of hazardous substances, including the use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding), and 4) radiation emissions, including, for example, avoiding the use of hazardous radiation sources, limiting the power of	The emissions by acting on the characteristics of the source have been limited.	Pass

	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)]		
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		
	a) mechanical stresses such as		
	- stress limitation by implementation of correct calculation, construction and fastening methods as regards, for example, bolted assemblies and welded assemblies,	The appropriate technical knowledge of mechanical has been taken into account.	Pass
	- stress limitation by overload prevention (bursting disk, pressure-limiting valves, breakage points, torque-limiting devices, etc.),	The appropriate technical knowledge of mechanical has been taken into account.	Pass
	- avoiding fatigue in elements under variable stresses (notably cyclic stresses),	The appropriate technical knowledge of mechanical has been taken into account.	Pass
	- static and dynamic balancing of rotating elements,	The appropriate technical knowledge of mechanical has been taken into account.	Pass
	b) materials and their properties such as		
	- resistance to corrosion, ageing, abrasion and wear,	The materials have been treated by appropriate methods.	Pass
	- hardness, ductility, brittleness,	The materials have been treated by appropriate methods.	Pass
	- homogeneity,	The materials have been treated by	Pass

		appropriate methods.	
	- toxicity,	The materials have been treated by appropriate methods.	Pass
	- flammability	The materials have been treated by appropriate methods.	Pass
	c) emission values for		
	- noise,	No noise will result in hazard in this machine.	Pass
	- vibration,	No vibration will result in hazard in this machine.	Pass
	- hazardous substances,	No hazardous substances will result in hazard in this machine.	Pass
	- radiation	No radiation will result in hazard in this machine.	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.	Appropriate working coefficients have been taken into account during design and calculation.	Pass
6.2.4	Choice of appropriate technology		
	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:		
	a) on machines intended for use in explosive atmospheres, using - appropriately selected pneumatic or hydraulic control system and machine actuators, - intrinsically safe electrical equipment (see IEC 60079-11);	Not applicable.	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;	Not applicable.	N/A
	c) the use of alternative equipment to avoid high noise levels, such as - electrical instead of pneumatic equipment, - in certain conditions, water-cutting instead of mechanical equipment.	The appropriate technology has been chosen.	Pass

6.2.5	Applying principle of positive mechanical action		
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5-1 and ISO 14119).	The principle of the positive mechanical action of a component on another component has been applied.	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.	These machines have been designed to have sufficient stability to allow them to be used safely in their specified conditions of use.	Pass
	Factors to be taken into account include		
	- the geometry of the base,	The factor has been taken into account during design.	Pass
	- the weight distribution, including loading,	The factor has been taken into account during design.	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,	The factor has been taken into account during design.	Pass
	- vibration	The factor has been taken into account during design.	Pass
	- oscillations of the centre of gravity,	Not applicable.	N/A
	- characteristics of the supporting surface in case of travelling or installation on different sites (ground conditions, slope, etc.),	The factor has been taken into account during design.	Pass
	- external forces, such as wind pressure and manual forces.	The factor has been taken into account during design.	Pass
	Stability shall be considered in all phases of the life cycle of the machine, including handling, travelling, installation, use, dismantling, disabling and scrapping.	The factor has been taken into account during design.	Pass
	Other protective measures for stability relevant to safeguarding are given in 6.3.2.6.	Please see the related clause.	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:		
	- accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used;	The factor has been taken into account during design.	Pass
	- ease of handling, taking into account human capabilities;	The factor has been taken into account during design.	Pass
	- limitation of the number of special tools and equipment.	The factor has been taken into account during design.	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.	Appropriate ergonomic principles have been taken into account in designing machinery to reduce mental or physical stress and strain of the operator.	Pass
	These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design.	These principles have been taken into account during allocating functions to operator and machine.	Pass
	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 these factors have been taken into account during design.	Pass
	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.	All arrangement and design of manual controls have been checked in compliance with.	Pass
	The designer's attention is particularly drawn to following ergonomic aspects of machine design.		-
	a) Avoid the necessity for stressful postures and movements during the use of the machine (for example, providing facilities to adjust the machine to suit the various operators).	Stressful postures and movements during use of the machine have been	Pass

		avoided.	
	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.	This machine has been adjusted to the human strength and convenient movement.	Pass
	c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures.	This machine has been designed with low noise, vibration.	Pass
	d) Avoid linking the operator's working rhythm to an automatic succession of cycles.		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.	All these factors have been taken into account during design.	Pass
	f) Select, locate and identify manual controls (actuators) so that		-
	- they are clearly visible and identifiable, and appropriately marked where necessary (see 6.4.4),	All design and arrangement of the control logic have been checked in compliance with this requirement.	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),	All design and arrangement of the control logic have been checked in compliance with this requirement.	Pass
	- their location (for push-buttons) and their movement (for levers and hand wheels) are consistent with their effect (see IEC 61310-3),	All the function has been checked in compliance with this requirement.	Pass
	- their operation cannot cause additional risk.		Pass
	Where a control is designed and constructed to perform several different actions — namely, where there is no one-to-one		N/A

	correspondence (for example, keyboards) — the action to be performed shall be clearly displayed and subject to confirmation where necessary.		
	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.	All the arrangement of the control logic have been checked in compliance with this requirement.	Pass
	g) Select, design and locate indicators, dials and visual display units so that		
	- they fit within the parameters and characteristics of human perception,		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,		Pass
	- the operator is able to perceive them from the control position.		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.	Please also make reference to EN 60204-1 test report.	Pass
	For requirements related to specific machines, see corresponding IEC standards (for example, IEC 61029, IEC 60745 or IEC 60335).		N/A
6.2.10	Pneumatic and hydraulic hazards		-
	Pneumatic and hydraulic equipment of machinery shall be designed so that		
	- the maximum rated pressure cannot be exceeded in the circuits (using, for example, pressure-limiting devices),	This requirement is complied with.	Pass
	- no hazard results from pressure fluctuations or increases, or from loss of pressure or vacuum,	This requirement is complied with.	Pass
	- no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures,	This requirement is complied with.	Pass
	- air receivers, air reservoirs or similar vessels (such as in gas-loaded accumulators) comply with the applicable design standard codes or	This requirement is complied with.	Pass

	regulations for these elements,		
	- all elements of the equipment, especially pipes and hoses, are protected against harmful external effects,	This requirement is complied with.	Pass
	- 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),	This requirement is complied with.	Pass
	- 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.	This requirement is complied with.	Pass
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).	Inherently safe design measures to control system have applied.	Pass
	The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behaviour.		Pass
	Typical causes of hazardous machine behaviour are		
	- an unsuitable design or modification (accidental or deliberate) of the control system logic,	No this kind of hazard in this machine	Pass
	- a temporary or permanent defect or failure of one or several components of the control system,	No this kind of hazard in this machine	Pass
	- a variation or a failure in the power supply of the control system,	No this kind of hazard in this machine	Pass
	- inappropriate selection, design and location of the control devices.	No this kind of hazard in this machine	Pass
	Typical examples of hazardous machine		

	behaviour are		
	- unexpected start-up (see ISO 14118),	No this kind of hazard in this machine	Pass
	- uncontrolled speed change,	No this kind of hazard in this machine	Pass
	- failure to stop moving parts,	No this kind of hazard in this machine	Pass
	- dropping or ejection of part of the machine or of a workpiece clamped by the machine,	No this kind of hazard in this machine	Pass
	- machine action resulting from inhibition (defeating or failure) of protective devices.	No this kind of hazard in this machine	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 (see ISO 13849-1, IEC 60204-1 and IEC 62061).	The design of control systems comply with the related principles and methods	Pass
	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:		
	- systematic analysis of start and stop conditions;	Systematic analysis have been applied.	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);	Enough provisions have been provided.	Pass
	- clear display of the faults;		Pass
	- 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);	Main switch with lock and related devices are provided.	Pass
	- maintained stop commands (for example, interlock) to prevent restarting that could result in dangerous machine behaviour (see	This requirement is complied with.	Pass

	ISO 14118:2000, Figure 1).		
	An assembly of machines may be divided into several zones for emergency stopping, for stopping as a result of protective devices and/or for isolation and energy dissipation. The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone. Likewise, it shall be obvious which control devices (for example, emergency stop devices, supply disconnecting devices) and/or protective devices belong to which zone. The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention.		N/A
	Control systems shall be designed to limit the movements of parts of the machinery, the machine itself, or work pieces and/or loads held by the machinery, to the safe design parameters (for example, range, speed, acceleration, deceleration, load capacity). Allowance shall be made for dynamic effects (swinging of loads, etc.).	This requirement is complied with.	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.	Please also make reference to EN 60204-1 test 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).	This requirement has been taken into account during design.	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)		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.		N/A
	When, in order for the operator to maintain		Pass

	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.		
6.2.11.4	Restart after power interruption		
	If a hazard could be generated, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (for example, by use of a self-maintained relay, contactor or valve).		Pass
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:	The hazardous situations resulting from interruption or excessive fluctuation of the power supply has been prevented.	Pass
	- the stopping function of the machinery shall remain;		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);		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.		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.	Appropriate automatic monitoring has been used.	Pass
	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).	Appropriate automatic monitoring has been used.	Pass

	The protective measure may be, for example,		-
	- the stopping of the hazardous process,		Pass
	- preventing the restart of this process after the first stop following the failure,		Pass
	- the triggering of an alarm.		Pass
6.2.11.7	Safety functions implemented by programmable electronic control systems		-
6.2.11.7.1	General		-
	A control system that includes programmable electronic equipment (for example, programmable controllers) can, where appropriate, be used to implement safety functions at machinery. Where a programmable electronic control system is used, it is necessary to consider its performance requirements in relation to the requirements for the safety functions. The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) is sufficiently low. Where a programmable electronic control system performs a monitoring function, the system behaviour on detection of a fault shall be considered (see also the IEC 61508 series for further guidance).		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.		N/A
6.2.11.7.2	Hardware aspects		
	The hardware (including, for example, sensors, actuators and logic solvers) shall be selected, and/or designed and installed, to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of - architectural constraints (the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault, etc.),		N/A

	- selection, and/or design, of equipment and devices with an appropriate probability of dangerous random hardware failure, and - the incorporation of measures and techniques within the hardware so as to avoid systematic failures and control systematic faults.		
6.2.11.7.3	Software aspects		
	The software, including internal operating software (or system software) and application software, shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3). Application software should not be reprogrammable by the user. This may be achieved by use of embedded software in a non-reprogrammable memory [for example, micro-controller, application-specific integrated circuit (ASIC)]. When the application requires reprogramming by the user, the access to the software dealing with safety functions should be restricted (for example, by locks or passwords for the authorized persons).		N/A
6.2.11.8	Principles relating to manual control		
	a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8, item f).	This requirement has been taken into account during design.	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.	A stop control device has been 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.	Manual controls have been located out of reach of the danger zones.	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.		Pass
	e) If it is possible to start the same hazardous element by means of several controls, the	Not applicable.	N/A

	control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means of, among others, a portable control unit (such as a teach pendant), with which the operator can enter danger zones.		
	f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1, ISO 9355-3 and ISO 447).		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).		Pass
	h) For cableless control, an automatic stop shall be performed when correct control signals are not received, including loss of communication (see IEC 60204-1).	Not applicable.	N/A
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	Not applicable.	N/A
	a) disables all other control modes,	Not applicable.	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,	Not applicable.	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),	Not applicable.	N/A
	d) prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.	Not applicable.	N/A
6.2.11.1	Selection of control and operating modes		

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	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.	This requirement is complied with.	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 codes for certain numerically controlled functions).	This requirement is complied with.	Pass
6.2.11.11	Applying measures to achieve electromagnetic compatibility (EMC)		
	For guidance on electromagnetic compatibility, see IEC 60204-1 and IEC 61000-6.	C	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.		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. 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.		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	Reliable components have been used.	Pass

	hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above (see also 6.2.13).		
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.		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.	Not applicable.	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.	Not applicable.	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.	Not applicable.	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.	This requirement is complied with.	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.	This requirement is complied with.	Pass
	Safety-related components (for example, certain sensors) of known reliability shall be used.	This requirement is complied with.	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.	This requirement is complied with.	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.	This requirement is complied with.	Pass
	Automation can be achieved by, for example, robots, handling devices, transfer mechanisms and air-blast equipment. Mechanization can be achieved by, for example, feeding slides, push-rods and hand-operated indexing tables.	This requirement has been complied with by design.	Pass
	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.	This requirement has been complied with by design.	Pass
	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.	This requirement has been complied with by design.	Pass
6.2.15	Limiting exposure to hazards through location of setting and maintenance points outside danger zones		
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.		Pass
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		Pass

	protective measures involving additional equipment (for example, emergency stop equipment) may have to be implemented. NOTE The different kinds of guards and protective devices are defined in 3.27 and 3.28.		
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).		Pass
	The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine.		Pass
	In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where the access of an operator into a danger zone is not required during the normal operation (operation without malfunction) of the machinery.		Pass
	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).	Movable interlocking guard is used.	Pass
	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.		N/A
	Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards including	This requirement has been taken in to consideration.	Pass
	a) hazards from falling or ejected objects, using, for example, protection in the form of a	No such hazards	Pass

	falling object protection structure (FOPS),	exist in this machine.	
	b) emission hazards (protection against noise, vibration, radiation, substances hazardous to health, etc.),	No such hazards exist in this machine.	Pass
	c) hazards due to the environment (protection against heat, cold, foul weather, etc.),	No such hazards exist in this machine.	Pass
	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 such hazards exist in this machine.	Pass
	The design of enclosed work stations, such as cabs and cabins, shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.	Ergonomic principles have been taken into account during design.	Pass
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:		
	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);	Not applicable.	N/A
	c) self-closing guards (see ISO 14120:2002, 3.3.2);	Not applicable.	N/A
	d) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496) or pressure-sensitive protective devices (see ISO 13856).	Not applicable.	N/A
6.3.2.3	Where access to the hazard zone is required during normal operation		
	Where access to the hazard zone is required during normal operation of the machinery, safeguards should be selected from the following:		
	a) interlocking guards with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this document); b) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496); c) adjustable guards; d) self-closing guards (see ISO 14120:2002,	Not applicable.	N/A

	3.3.2); e) two-hand control devices (see ISO 13851); f) interlocking guards with a start function (control guard) (see 6.3.3.2.5).		
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).	Not applicable.	N/A
6.3.2.5	Selection and implementation of sensitive protective equipment1)		
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).	Not applicable.	N/A
	Types of sensitive protective equipment include - light curtains, - scanning devices, for example, laser scanners, - pressure-sensitive mats, and - trip bars, trip wires.	Not applicable.	N/A
	Sensitive protective equipment can be used - for tripping purposes, - for presence sensing, - for both tripping and presence sensing, or - to re-initiate machine operation — a practice subject to stringent conditions.	Not applicable.	N/A
	The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment:	Not applicable.	N/A

	- tendency for the machinery to eject materials or component parts; - necessity to guard against emissions (noise, radiation, dust, etc.); - erratic or excessive machine stopping time; - inability of a machine to stop part-way through a cycle.		
6.3.2.5.2	Implementation		
	Consideration should be given to a) the size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment), b) the reaction of the device to fault conditions (see IEC 61496 for electrosensitive protective equipment), c) the possibility of circumvention, and d) detection capability and its variation over the course of time (as a result, for example, of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources and sunlight or impurities in the air).	Not applicable.	N/A
	Sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that - a command is given as soon as a person or part of a person is detected, - the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and therefore the command given by the sensitive protective equipment is maintained by the control system until a new command is given, - restarting the hazardous machine function(s) results from the voluntary actuation by the operator of a control device placed outside the hazard zone, where this zone can be observed by the operator, - the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, and - the position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone	Not applicable.	N/A

	without being detected.		
6.3.2.5.3	Additional requirements for sensitive protective equipment when used for cycle initiation		
	In this exceptional application, the starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control.	Not applicable.	N/A
	Cycle initiation by sensitive protective equipment shall be subject to the following conditions:	Not applicable.	N/A
	a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used;	Not applicable.	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 and monitoring of control and braking systems;	Not applicable.	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;	Not applicable.	N/A
	d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone;	Not applicable.	N/A
	e) if there is more than one AOPD safeguarding the machine, only one of the AOPDs is capable of cycle re-initiation;	Not applicable.	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.	Not applicable.	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		
	- anchorage bolts,		Pass
	- locking devices,		Pass
	- movement limiters or mechanical stops,		Pass
	- acceleration or deceleration limiters,		N/A
	- load limiters,		Pass
	- alarms warning of the approach to stability or tipping limits.		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 generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits, in particular	Not applicable.	N/A
	- when the operator has insufficient visibility of the hazard zone,	Not applicable.	N/A
	- when the operator lacks knowledge of the actual value of a safety-related parameter (distance, speed, mass, angle, etc.),	Not applicable.	N/A
	- when hazards can result from operations other than those controlled by the operator.	Not applicable.	N/A
	The necessary devices include		
	a) devices for limiting parameters of movement (distance, angle, velocity, acceleration), b) overloading and moment limiting devices, c) devices to prevent collisions or interference with other machines, d) devices for preventing hazards to pedestrian operators of mobile machinery or other pedestrians, e) torque limiting devices, and breakage points to prevent excessive stress of components and assemblies, f) devices for limiting pressure or temperature, g) devices for monitoring emissions, h) devices to prevent operation in the absence of the operator at the control position, i) devices to prevent lifting operations unless stabilizers are in place, j) devices to limit inclination of the machine on a slope, and k) devices to ensure that components are in a	Not applicable.	N/A

	safe position before travelling.		
	Automatic protective measures triggered by such devices that take operation of the machinery out of the control of the operator (for example, automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3).	Not applicable.	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.	Guards and protective devices have been appropriately designed.	Pass
	Guards and protective devices shall		
	a) be of robust construction,	This requirement has been taken into account during design.	Pass
	b) not give rise to any additional hazard,	This requirement has been taken into account during design.	Pass
	c) not be easy to bypass or render non-operational,	This requirement has been taken into account during design.	Pass
	d) be located at an adequate distance from the danger zone (see ISO 13855 and ISO 13857),	This requirement has been taken into account during design.	Pass
	e) cause minimum obstruction to the view of the production process,	This requirement has been taken into account during design.	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	This requirement has been taken into account during design.	Pass

	out — if possible, without the guard having to be removed or protective device having to be disabled.		
6.3.3.2	Requirements for guards		
6.3.3.2.1	Functions of guards		
	The functions that guards can achieve are		
	- prevention of access to the space enclosed by the guard, and/or - containment/capture of materials, workpieces, chips, liquids which can be ejected or dropped by the machine, and reduction of emissions (noise, radiation, hazardous substances such as dust, fumes, gases) that can be generated by the machine.	These functions are achieved by fixed guards	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).	These functions are achieved by fixed guards	Pass
6.3.3.2.2	Requirements for fixed guards		
	Fixed guards shall be securely held in place either - permanently (for example by welding), or - by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120).	All the fixed guards are securely held in place by appropriate fasteners.	Pass
6.3.3.2.3	Requirements for movable guards		
	Movable guards which provide protection against hazards generated by moving transmission parts shall a) as far as possible when open remain fixed to the machinery or other structure (generally by means of hinges or guides), and b) be interlocking (with guard locking when necessary) (see ISO 14119). See Figure 4. Movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that - moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have	Not applicable.	N/A

	started up, with this able to be achieved by interlocking guards, with guard locking when necessary, - they can be adjusted only by an intentional action, such as the use of a tool or a key, and - the absence or failure of one of their components either prevents starting of the moving parts or stops them, with this able to be achieved by automatic monitoring (see 6.2.11.6).		
6.3.3.2.4	Requirements for adjustable guards		
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed. Manually adjustable guards shall be - designed so that the adjustment remains fixed during a given operation, and - readily adjustable without the use of tools.	Not applicable.	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 a) all requirements for interlocking guards are satisfied (see ISO 14119), b) the cycle time of the machine is short, c) the maximum opening time of the guard is preset to a low value (for example, equal to the cycle time) and, when this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine, d) the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120), e) all other guards, whether fixed (removable type) or movable, are interlocking guards, f) the interlocking device associated with the interlocking guard with a start function is designed such that — for example, by duplication of position detectors and use of automatic monitoring (see 6.2.11.6) — its failure cannot lead to an unintended/unexpected start-up, and g) the guard is securely held open (for example, by a spring or counterweight) such that it cannot initiate a start while falling by	Not applicable.	N/A

	its own weight.		
6.3.3.2.6	Hazards from guards		
	Care shall be taken to prevent hazards which could be generated by - the guard construction (sharp edges or corners, material, noise emission, etc.), - the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall).	No such hazards exist in this machine.	Pass
6.3.3.3	Technical characteristics of protective devices		
	Protective devices shall be selected or designed and connected to the control system such that correct implementation of their safety function(s) is ensured.	This requirement has been taken into account 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.	This requirement has been taken into account during design.	Pass
	Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.	This requirement has been taken into account during design.	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.	Not applicable.	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).		Pass
6.3.4.2	Noise		
	Additional protective measures against noise include - enclosures (see ISO 15667), - screens fitted to the machine, and - silencers (see ISO 14163).	No such hazards exist in this machine.	Pass
6.3.4.3	Vibration		

	Additional protective measures against vibration include - vibration isolators, such as damping devices placed between the source and the exposed person, - resilient mounting, and - suspended seats. For measures for vibration isolation of stationary industrial machinery see EN 1299.	No such hazards exist in this machine.	Pass
6.3.4.4	Hazardous substances		
	Additional protective measures against hazardous substances include - encapsulation of the machine (enclosure with negative pressure), - local exhaust ventilation with filtration, - wetting with liquids, and — special ventilation in the area of the machine (air curtains, cabins for operators).	No such hazards exist in this machine.	Pass
6.3.4.5	Radiation		
	Additional protective measures against radiation include - use of filtering and absorption, and - use of attenuating screens or guards.	No such hazards exist in this machine.	Pass
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.		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:		
	- the actuators shall be clearly identifiable, clearly visible and readily accessible;	The actuators can be clearly identifiable, clearly visible and readily accessible	Pass

	- the hazardous process shall be stopped as quickly as possible without creating additional hazards, but if this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution;	The hazardous process can be stopped as quickly as possible without creating additional hazards	Pass
	- the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary.	No this situation exists.	Pass
	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.	Reset is necessary before re-start.	Pass
	This reset shall be possible only at the location where the emergency stop command has been initiated. The reset of the device shall not restart the machinery, but shall only permit restarting.	This requirement is complyied with by appropriate design of the emergency stop.	
	More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in IEC 60204.	Please see the related clauses.	Pass
6.3.5.3	Measures for the escape and rescue of trapped persons		
	Measures for the escape and rescue of trapped persons may consist, among others, of - escape routes and shelters in installations generating operator-trapping hazards, - arrangements for moving some elements by hand, after an emergency stop, - arrangements for reversing the movement of some elements, - anchorage points for descender devices, - means of communication to enable trapped operators to call for help.	Not applicable.	N/A
6.3.5.4	Measures for isolation and energy 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:		
	a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;	A main switch with lock is provided	Pass
	b) locking (or otherwise securing) all the isolating units in the isolating position;	Please see the report for EN60204	Pass
	c) dissipating or, if this is not possible or practicable, restraining (containing) any stored energy which can give rise to a hazard;	Please see the report for EN60204	Pass

	d) verifying, by means of safe working procedures, that the actions taken according to a), b) and c) above have produced the desired effect.	Please see the report for EN60204	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.	Appropriate attachments are provided.	Pass
	These attachments may be, among others,		
	- standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing,	Such devices are used	Pass
	- appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground,		N/A
	- fork locating devices for machines to be transported by a lift truck,	Such devices are used	Pass
	- lifting and stowing gear and appliances integrated into the machine.		N/A
	Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement.		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.		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. 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). In large automated installations, particular attention shall be given to safe means of access, such as walkways, conveyor bridges or crossover points. Means of access to parts of machinery located	Not applicable.	N/A

	at height shall be provided with collective means of protection against falls (for example, guard-rails for stairways, stepladders and platforms and/or safety cages for ladders). As necessary, anchorage points for personal protective equipment against falls from height shall also be provided (for example, in carriers of machinery for lifting persons or with elevating control stations). Openings shall, whenever possible, open towards a safe position. They shall be designed to prevent hazards due to unintended opening. The necessary aids for access shall be provided (steps, handholds, etc.). Control devices shall be designed and located to prevent their being used as aids for access. When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards for preventing falls when the platform is not present at a level. Movement of the lifting platform shall be prevented while the guards are open.		
6.4	Information for use		
6.4.1	General requirements		
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see Figure 2). Information for use consists of communication links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. Information for use is intended for professional and/or non-professional users.	All the information is stated in the appropriate place.	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.		
	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.	All the information is stated in the instruction manual.	Pass
	The information shall indicate, as appropriate,		
	- the need for training, - the need for personal protective equipment, and - the possible need for additional guards or protective devices (see Figure 2, Footnote d).	All the information is stated in the instruction manual.	Pass
	It shall not exclude uses of the machine that can reasonably be expected from its	All the information is stated in the	Pass

	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 place.	
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.	All the information is stated in the instruction manual.	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		Pass
	a) in/on the machine itself (see 6.4.3 and 6.4.4),	Adequate information is stated in the instruction manual.	Pass
	b) in accompanying documents (in particular instruction handbook, see 6.4.5),	Adequate information is stated in the instruction manual.	Pass
	c) on the packaging,	Adequate information is stated in the instruction manual.	Pass
	d) by other means such as signals and warnings outside the machine.	Adequate information is stated in the instruction manual.	Pass
	Standardized phrases shall be considered where important messages such as warnings are given (see also IEC 62079).		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 the triggering of automatic protective measures (see 6.3.2.7).	Signals and warning devices are provided.	Pass
	It is essential that these signals		
	a) be emitted before the occurrence of the hazardous event,	This requirement is taken into account	Pass

	b) be unambiguous, c) be clearly perceived and differentiated from all other signals used, and d) be clearly recognized by the operator and other persons.	during design and selection of the warning devices.	
	The warning devices shall be designed and located such that checking is easy. The information for use shall prescribe regular checking of warning devices.		Pass
	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.		Pass
6.4.4	Markings, signs (pictograms) and written warnings		
	Machinery shall bear all markings which are necessary		
	a) for its unambiguous identification, including at least		
	1) the name and address of the manufacturer, 2) the designation of series or type, and 3) the serial number, if any,	Adequate information is provided.	Pass
	b) in order to indicate its compliance with mandatory requirements, comprising		
	1) marking, and 2) written indications, such as the authorized representative of the manufacturer, designation of the machinery, year of construction, and intended use in potentially explosive atmospheres),	Adequate information is provided.	Pass
	c) for its safe use, for example,		
	1) maximum speed of rotating parts, 2) maximum diameter of tools, 3) mass (in kilograms) of the machine itself and/or of removable parts, 4) maximum working load, 5) necessity of wearing personal protective equipment, 6) guard adjustment data, and 7) frequency of inspection.	Adequate information is provided.	Pass
	Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine.	This requirement is complied with.	Pass
	Signs or written warnings indicating only “Danger” shall not be used.	This requirement is complied with.	Pass
	Markings, signs and written warnings shall be	This requirement is	Pass

	readily understandable and unambiguous, especially as regards the part of the function(s) of the machine to which they are related. Readily understandable signs (pictograms) should be used in preference to written warnings.	complied with.	
	Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be used.	This requirement is complied with.	Pass
	Markings shall comply with recognized standards (for example, ISO 2972 or ISO 7000, for pictograms, symbols and colours in particular).	All the markings are standard.	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:	All the related information is stated in the instruction handbook	Pass
	a) information relating to transport, handling and storage of the machine, such as		
	1) storage conditions for the machine, 2) dimensions, mass value(s), position of the centre(s) of gravity, and 3) indications for handling (for example, drawings indicating application points for lifting equipment);	All the related information is stated in the instruction handbook	Pass
	b) information relating to installation and commissioning of the machine, such as		
	1) fixing/anchoring and dampening of noise and vibration requirements, 2) assembly and mounting conditions, 3) space needed for use and maintenance, 4) permissible environmental conditions (for example, temperature, moisture, vibration, electromagnetic radiation), 5) instructions for connecting the machine to power supply (particularly on protection against electrical overloading), 6) advice on waste removal/disposal, and 7) if necessary, recommendations related to protective measures which have to be implemented by the user — for example, additional safeguards (see Figure 2, Footnote d), safety distances, safety signs and signals;	All the related information is stated in the instruction handbook	Pass

	c) information relating to the machine itself, such as		
	1) detailed description of the machine, its fittings, guards and/or protective devices, 2) the comprehensive range of applications for which the machine is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate, 3) diagrams (especially schematic representation of safety functions), 4) data on noise and vibration generated by the machine, and on radiation, gases, vapours and dust emitted by it, with reference to the measuring methods (including measurement uncertainties) used, 5) technical documentation of electrical equipment (see IEC 60204), and 6) documents attesting that the machine complies with mandatory requirements;	All the related information is stated in the instruction handbook	Pass
	d) information relating to the use of the machine, such as that related to or describing		
	1) intended use, 2) manual controls (actuators), 3) setting and adjustment, 4) modes and means for stopping (especially emergency stop), 5) risks which could not be eliminated by the protective measures implemented by the designer, 6) particular risks which can be generated by certain applications, by the use of certain fittings, and about specific safeguards necessary for such applications, 7) reasonably foreseeable misuse and prohibited applications, 8) fault identification and location, for repair and for restarting after an intervention, and 9) personal protective equipment needed to be used and the training that is required;	All the related information is stated in the instruction handbook	Pass
	e) information for maintenance, such as		
	1) the nature and frequency of inspections for safety functions, 2) specification of the spare parts to be used when these can affect the health and safety of operators, 3) instructions relating to maintenance operations which require a definite technical	All the related information is stated in the instruction handbook	Pass

	knowledge or particular skills and hence need to be carried out exclusively by skilled persons (for example, maintenance staff, specialists), 4) instructions relating to maintenance actions (replacement of parts, etc.) which do not require specific skills and hence may be carried out by users (for example, operators), and 5) drawings and diagrams enabling maintenance personnel to carry out their task rationally (especially fault-finding tasks);		
	f) information relating to dismantling, disabling and scrapping;	All the related information is stated in the instruction handbook	Pass
	g) information for emergency situations, such as		
	1) the operating method to be followed in the event of accident or breakdown, 2) the type of fire-fighting equipment to be used, and 3) a warning of possible emission or leakage of hazardous substance(s) and, if possible, an indication of means for fighting their effects;	All the related information is stated in the instruction handbook	Pass
	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.	All the related information is stated in the instruction handbook	Pass
6.4.5.2	Production of instruction handbook		
	The following applies to the production and presentation of the instruction handbook.		
	a) The type fount and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized by the use of colours, symbols and/or large print.	All the related information is stated in the instruction handbook	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.		Pass
	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..		Pass
	NOTE In some countries the use of specific language(s) is covered by legal requirements		

	c) Whenever helpful to the understanding, text should be supported by illustrations. These illustrations should be supplemented with written details enabling, for example, manual controls (actuators) to be located and identified. They should not be separated from the accompanying text and should follow sequential operations.		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.		Pass
	e) The use of colours should be considered, particularly in relation to components requiring quick identification.		Pass
	f) When information for use is lengthy, a table of contents and/or an index should be provided.		Pass
	g) Safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.		Pass
6.4.5.3	Drafting and editing information for use		
	The following applies to the drafting and editing of information for use.		Pass
	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).	All the related information is stated in the instruction handbook	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.		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.		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.		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.		Pass
7	Documentation of risk assessment and risk reduction		Pass
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of		Pass
	a) the machinery for which the risk assessment has been made (for example, specifications, limits, intended use);	Please see the risk assessment report in detail.	Pass
	b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.);		Pass
	c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment;		Pass
	d) the information on which risk assessment was based (see 5.2):		Pass
	1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.);		Pass
	2) the uncertainty associated with the data used and its impact on the risk assessment;		Pass
	e) the risk reduction objectives to be achieved by protective measures;		Pass
	f) the protective measures implemented to eliminate identified hazards or to reduce risk;		Pass
	g) residual risks associated with the machinery;		Pass
	h) the result of the risk assessment (see Figure 1);		Pass
	i) any forms completed during the risk assessment.		Pass
	Standards or other specifications used to select protective measures referred to in f) above should be referenced.		Pass

EN ISO 10218-1			
Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
5	**Design requirements and protective measures**		-
5.1	**General**		-
	The robot shall be designed according to the principles of ISO 12100-1 for relevant hazards. Significant hazards, such as sharp edges, are not dealt with by this document. Robots and robot systems shall be designed and constructed to comply with the following requirements.		P
5.2	**General requirements**		
5.2.1	**Power transmission components**		
	Exposure to hazards caused by components such as motor shafts, gears, drive belts, or linkages shall be prevented either by fixed guards or movable guards.		P
	Movable guards shall be interlocked with the hazardous movements in such a way that the hazardous movements come to a stop before the hazards can be reached.		P
	The safety related performance of an interlocking system shall conform to the requirements of 5.4.		P
5.2.2	**Power loss or change**		
	Loss of, or variations in power shall not result in a hazard.Re-initiation of power shall not lead to any motion.		P
	End-effectors shall be designed and constructed so that loss or change of electrical, hydraulic, pneumatic or vacuum power shall not result in a hazard.		P

	If this is not feasible, then other methods of safeguarding shall be provided to protect against hazards.		P
	Tool change systems shall be designed and installed to only allow release of tools when the tool is in an assigned location and release shall not create a hazard.		P
5.2.3	**Component malfunction**		
	Robot components shall be designed, constructed, secured, or contained so that hazards caused by breaking or loosening, or releasing stored energy are minimized.		P
5.2.4	**Sources of energy**		

	A means of isolating any electrical, mechanical, hydraulic, pneumatic, chemical, thermal, potential, kinetic or other hazardous energy source to the robot shall be provided.		P
	This means shall be provided with capability of locking or otherwise securing in the de-energized position.		P
5.2.5	**Stored energy**		
	A means shall be provided for the controlled release of stored hazardous energy. A label shall be affixed to identify the stored energy hazard.		P
5.2.6	**Electromagnetic compatibility (EMC)**		
	The design and construction of the robot shall be in accordance with IEC 61000 to prevent hazardous motion or situations due to the effects of electromagnetic interference (EMI), radio frequency interference (RFI) and electrostatic discharge (ESD).		P
5.2.7	**Electrical equipment**		
	The robot electrical equipment shall be designed and constructed according to the relevant requirements of IEC 60204-1.		P
5.3	**Actuating controls**		
5.3.1	**General**		
	Actuating controls that initiate power or motion shall be designed and constructed to meet the performance criteria mentioned in 5.3.2 to 5.3.5.		P
5.3.2	**Protection from unintended operation**		
	Actuating controls shall be constructed or located so as to prevent unintended operation.		P
	For example, a guarded push-button or key selector switch in appropriate locations may be		P

	used.		
5.3.3	**Status indication**		
	The status of the actuating controls shall be indicated, e.g. power on, fault detected, automatic operation		P
5.3.4	**Labelling**		
	Actuating controls shall be labelled to clearly indicate their function.		P
5.3.5	**Single point of control**		

	The robot control system shall be designed and constructed so that when the robot is placed under local pendant control or other teaching device control, initiation of robot motion or change of local control selection from any other source shall be prevented.		P
5.4	**Safety-related control system performance (hardware/software)**		
5.4.1	**General**		
	Safety-related control systems (electric, hydraulic, pneumatic, and software) shall meet the performance criteria listed in 5.4.2 as a minimum, unless the results of a risk assessment determine that an alternate performance criteria per 5.4.3 is appropriate.		P
	The safety-related control system performance that the piece of equipment meets shall be clearly stated in the information for use provided with the equipment.		P
	For the purpose of this part of ISO 10218, safety-related control system performance is stated as categories as described in ISO 13849-1:1999.		P
	Other standards offering alternative performance requirements such as control reliability, performance levels, and safety integrity levels may also be used.		P
	When using these standards to design safety-related control systems, care should be taken to ensure that an equivalent level of risk reduction is achieved.		P
5.4.2	**Performance requirement**		
	When safety-related control systems are required, the safety-related parts shall be designed so that:		P

	a) a single fault in any of these parts shall not lead to the loss of the safety function;		P
	b) whenever reasonably practicable, the single fault shall be detected at or before the next demand upon the safety function;		P
	c) when the single fault occurs, the safety function is always performed and a safe state shall be maintained until the detected fault is corrected; and		P

	d) all reasonably foreseeable faults shall be detected		P
	This requirement is considered to be a category 3 as described in ISO 13849-1:1999		P
5.4.3	**Other control system performance criteria**		
	The results of a comprehensive risk assessment performed on the robot and its intended application may determine that a safety-related control system performance other than category 3 (i.e. categories 2 or 4) is warranted for the application.		P
	Other performance criteria are described in ISO 13849-1:1999.		P
	Selection of one of these other safety-related performance criteria shall be specifically identified, and appropriate limitations and cautions shall be included in the information for use provided with the affected equipment.		P
5.5	**Robot stopping functions**		
5.5.1	**General**		
	Every robot shall have a protective stop function and an independent emergency stop function.		P
	These functions shall have provision for the connection of external protective devices.		P
	Optionally an emergency stop output signal may be provided according to Annex D.		P
	Table 1 shows a comparison of the emergency stop and protective stop functions.		P
5.5.2	**Emergency stop function**		
	Each control station capable of initiating robot motion or other hazardous situation shall have a manually initiated emergency stop function that:		P
	a) complies with requirements of 5.4 and IEC 60204-1:2005, 9.2.5.4.2;		P

	b) takes precedence over all other robot controls;		P
	c) causes all hazards to stop;		P
	d) removes drive power from the robot actuators;		P
	e) removes any other hazard controlled by the robot;		P
	f) remains active until it is reset; and		P
	g) shall only be reset by manual action that does not cause a restart after resetting, but shall only		P

	permit arestart to occur.		
	Selection of a category 0 or category 1 stop for the function shall be determined from the risk assessment according to IEC 60204-1:2005, 9.2.2		P
	.When an emergency stop output signal is provided:		P
	the output shall continue to function when the robot power is removed; or		P
	– if the output does not continue to function when the robot power supply is removed, an emergency stop signal shall be generated.		P
	The emergency stop device shall be in accordance with IEC 60204-1:2005, 10.7 and ISO 13850.		P
5.5.3	**Protective stop**		
	The robot shall have one or more protective stop circuits (stop category 0 or 1, as described in accordance with IEC 60204-1:2005, 9.2.2), designed for the connection of external protective devices.		P
	This stop circuit shall control the safeguarded hazard by causing a stop of all robot motion, removing power from the robot drive actuators, and causing any other hazard controlled by the robot system to cease.		P
	This stop may be initiated manually or by control logic.The protective stop function performance shall comply with the requirements of 5.4.		P
5.6	**Reduced speed control**		
	When operating under reduced speed control, the speed of the end-effector mounting flange and of the tool centre point (TCP) shall not exceed 250 mm/sec.		P
	It should be possible to select speeds lower than 250 mm/sec.		P

	Reduced speed control shall be designed and constructed so that in the event of any single reasonably foreseeable malfunction, the speed of the mounting flange and of the TCP shall not exceed the reduced speed velocity limits.		P
	An off-set feature shall be provided to enable the TCP speed to be adjusted.		P
5.7	**Operational modes**		

5.7.1	**Selection**		
	Operational modes shall be selected by a secure means that only enables the selected mode; e.g. a key operated switch or other means that provide an equivalent security (i.e. supervisory control). These means shall		P
	a) unambiguously indicate the selected operating mode; and		P
	b) by themselves not initiate robot motion or other hazards. An optional output(s) may be provided to indicate the mode selected.		P
	When provided for safety-related purposes, the output(s) shall comply with the requirements of 5.4 (see Annex D).		P
5.7.2	**Automatic**		
	In automatic mode, the robot shall execute the task programme.		P
	The robot controller shall not be in manual mode and the safeguarding measures shall be functioning.		P
	Automatic operation shall be prevented if any stop condition is detected.		P
	Switching from this mode shall result in a stop.		P
5.7.3	**Manual reduced speed**		
	Manual reduced speed mode shall meet the requirements of 5.3.4 and 5.6 and shall allow a robot to be operated by human intervention.		P
	Automatic operation is prohibited in this mode.		P
	This mode is used for jogging,teaching, programming and programme verification of the robot; it may be the mode selected when performing some maintenance tasks.		P

	Information for use shall contain appropriate instructions and warnings that, wherever possible, the manual mode of operation shall be performed with all persons outside the safeguarded space.		P
	Prior to selecting automatic mode, any suspended safeguards shall be returned to their full functionality.		P
5.7.4	**Manual high-speed**		
	If this mode is provided, speeds 250 mm/sec can		P

	be achieved. In this case, the robot shall:		
	a) have a means to select manual high speed mode which requires a deliberate action (e.g. a key switch on the robot control panel) and an additional confirming action;		P
	b) default to a speed u 250 mm/sec upon selection of manual high speed mode;		P
	c) provide a pendant conforming to 5.8 with an additional hold to run device, exclusive to this mode, that permits robot motion to continue;		P
	d) provide on the pendant a means to adjust the speed from the default value to the full programmed value;and		P
	e) provide on the pendant an indication of the adjusted speed (e.g. by a highlight on the pendant display).		P
5.8	**Pendant controls**		
5.8.1	**General**		
	Where a pendant control or other control device has the capability to control the robot from within the safeguarded space, the requirements in 5.8.2 to 5.8.7 shall apply.		P
5.8.2	**Motion control**		
	Motion of the robot initiated from the pendant or teaching control device shall be under reduced speed control as described in 5.6.		P
	When the pendant contains provisions for selecting higher speeds, the robot system shall meet the requirements in 5.7.4.		P
	All buttons and other devices on the pendant that cause robot motion shall stop motion when the button or device is released.		P
5.8.3	**Enabling device**		

	The pendant or teaching control device shall have a three position enabling device in accordance with IEC 60204-1:2005, 10.9 that, when continuously held in a centre-enabled position, permits robot motion and any other hazards controlled by the robot.		P
	The enabling device shall demonstrate the following performance characteristics:		P
	a) the enabling device may be integral with, or physically separate from (e.g. a grip-type enabling		P

	device),the pendant control and shall operate independently from any other motion control function or device;		
	b) release of or compression past the centre-enabled position of the device shall stop hazards (e.g. robot motion) in accordance with 5.4;		P
	c) when more than one enabling switch is used on a single enabling device (i.e. allowing alternating left and/or right hand operation without stopping), fully depressing any switch shall override the control of the other switches and cause a protective stop;		P
	d) when more than one enabling device is in operation (i.e. more than one person are in the safeguarded space with an enabling device), motion shall only be possible when each device is held in the centre (enabled) position at the same time;		P
	e) dropping the enabling device shall not result in a failure that would allow motion to be enabled; and		P
	f) if an enabling output signal is provided, then the output shall signal stop condition when the safety system supply is off and shall comply with the requirements of 5.4.		P
5.8.4	**Pendant emergency stop function**		
	The pendant or teaching control device shall have a stop function in accordance with 5.5.2.		P
	The presentation of the device shall be an emergency stop device as described in ISO 13850.		P
5.8.5	**Initiating automatic operation**		
	It shall not be possible to activate robot automatic operation using the pendant or teaching control device exclusively.		P

	A separate confirmation outside the safeguarded space shall be necessary prior to activating the automatic mode.		
5.8.6	**Cableless teach controls**		
	Where pendant or other teaching controls have no cables connecting to the robot control, the following shall apply:		P

	a) a visual indication shall be provided that the pendant is active, e.g. at the teach pendant display;		P
	b) loss of communication shall result in a protective stop for all robots when in manual reduced speed or manual high speed modes.		P
	Restoration of communication shall not restart robot motion without a separate deliberate action;		P
	c) the maximum response times for data communication (including error correction) and for loss of communication shall be stated in the information for use; and		P
	d) care shall be taken to avoid confusion between active and inactive emergency stop devices by providing for appropriate storage or design, and information for use.		P
5.8.7	**Control of multiple robots**		
	Where a pendant control has the capability to control multiple robots, the requirements in 5.9 shall apply.		P
5.9	**Control of simultaneous motion**		
5.9.1	**Single pendant control**		
	One or more robot controls can be linked to a single teach pendant.		P
	When so configured, the teach pendant shall have the capability to move one or more of the robots independently or in simultaneous motion.		P
	When in the manual operational mode, all functions of the robot system shall be under the control of the one pendant.		P
5.9.2	**Safety design requirements**		
	Each robot shall be selected individually before it can be activated.		P
	To be selected, all robots shall be in the same operational mode (e.g. manual reduced speed).		P

	An indication shall be provided at the point of selection (e.g. at the pendant, control cabinet, or robot) of those robot(s) that have been selected.		P
	Only selected robot(s) shall be activated.		P
	An indication, clearly visible from within the safeguarded space, shall be provided of those robot(s) that have been activated.		P

	Unexpected start-up of any robots not activated shall be prevented.		P
	This function shall comply with the requirements of 5.4.		P
	The robot system(s) shall not respond to any remote commands or conditions that can cause hazardous conditions.		P
5.10	**Collaborative operation requirements**		
5.10.1	**General**		
	Robots designed for collaborative operation shall provide a visual indication when the robot is in collaborative operation and comply with one or more of the requirements in 5.10.2 to 5.10.6.		P
5.10.2	**Stop**		
	The robot shall stop when a human is in the collaborative workspace.		P
	The stop function shall comply with 5.4 and 5.5.3. The robot may resume automatic operation when the human leaves the collaborative workspace.		P
5.10.3	**Hand guiding**		
	When provided, hand guiding equipment shall be located close to the end-effector and shall be equipped with:		P
	a) an emergency stop complying with 5.5.2 and 5.8.4; and		P
	b) an enabling device complying with 5.8.3.		
	The robot shall operate at a reduced speed determined by a risk assessment, but not exceeding 250 mm/sec.		P
	The reduced speed function shall comply with 5.4.		P
	If the reduced speed is exceeded, a protective stop shall be issued.		P
5.10.4	**Speed and position monitoring**		

	The robot shall maintain a separation distance from the operator.		P
	This distance shall be in accordance with ISO 13855.		P
	Failure to maintain the separation distance shall result in a protective stop.		P
	This shall comply with 5.4 and 5.5.3.		P
	The robot shall operate at a reduced speed not exceeding 250 mm/sec and its position shall be		P

	monitored.The reduced speed and position monitoring functions shall comply with 5.4.		
5.10.5	**Power and force limiting by inherent design**		
	The robot shall be designed to ensure either a maximum dynamic power of 80 W or a maximum static force of 150 N at the flange or TCP (determined by the risk assessment). The robot design shall ensure that these values cannot be exceeded.		P
5.10.6	**Power and force limiting by control system**		
	When a control function is used to ensure that the maximum values of power and force given in 5.10.4 are not exceeded, the function shall comply with 5.4.If the maximum values are exceeded, a protective stop shall be issued.		P
5.11	**Singularity protection**		
	When in the manual reduced speed mode, the robot control shall:		P
	a) stop robot motion and alert the teacher prior to the robot passing through or correcting for a singularity during coordinated motion initiated from the teach pendant; or		P
	b) generate an audible or visible warning signal and continue to pass through singularity with the velocity of each axis limited to a maximum speed of 250 mm/sec.		P
5.12	**Axis limiting**		
5.12.1	**General**		
	A means shall be provided to establish a restricted space around the robot by using limiting devices.		P
	A means for installing adjustable mechanical stops shall be provided to limit the motion of the primary axis (the axis with the greatest displacement		P

	motion) of the robot.		
	The manufacturer shall comply with either 5.12.2 or 5.12.3 or both.		P
5.12.2	**Mechanical and electro-mechanical axis limiting devices**		
	Provisions for adjustable mechanical or non-mechanical limiting devices shall be provided for axes two and three (the axes with the second and third largest displacement motions).		P

	Mechanical stops shall be capable of stopping robot motion at rated load, maximum speed conditions, and at maximum and minimum extension.		P
	Testing of mechanical hard stops shall be without any assisted stopping.		P
	Alternative methods of limiting the range of motion may be provided only if they are designed, constructed and installed to achieve the same level of safety as the mechanical stops.		P
	The control circuit performance of electro-mechanical limiting devices shall comply with the requirements in 5.4.		P
	The robot control and task programs shall not change electro-mechanical limit device settings.		P
5.12.3	**Safety-rated soft axis and space limiting**		
	Soft limits are software-defined limits to robot motion while in automatic mode or any mode using speeds above reduced speed.		P
	Axis limiting is used to define the restricted space of the robot.		P
	Space limiting is used to define any geometric shape which may be used as an exclusionary zone; either limiting robot motion within the defined space, or preventing the robot from entering the defined space.		P
	Safety-rated soft limits are permitted as a means to define and reduce the restricted space provided they can effect a stop of the robot at full rated load and speed.		P
	The restricted reach shall be defined at the actual expected stopping position that accounts for the stopping distance travel.		P

	The manufacturer shall state the capability in the information for use and shall disable safety-rated soft limits if this capability is not supported.		P
	Control systems using soft limiting shall comply with 5.4 and not be changeable at the user level.		P
	If the safety-rated soft limit is violated, a protective stop shall be initiated.		P
	Information for use shall include information on worst case stopping time at maximum speed for soft limits including monitoring time and distance travelled before full stop is achieved.		P

	Additional information is in Annex B.		P
	Safety-rated zone outputs for use in dynamic restricted space applications shall comply with 5.4.		P
	The hardware configuration of the outputs shall be stated in the information for use.		P
	A safety-rated soft limit shall be set as a stationary zone that cannot be changed without a system power up condition and shall not be changed dynamically.		P
	Authorization to change the safety-rated soft limit shall be password protected and secure.		P
	Once set, safety-rated soft limits shall always become activated upon powe up.		P
5.12.4	**Dynamic limiting devices**		
	Dynamic limiting is the automatically controlled change in a robot's restricted space during a portion of the robot system's cycle.		P
	Control devices such as, but not limited to, cam operated limit switches, light curtains or control activated retractable hard stops may be utilized to further limit robot movement within the restricted space while the robot performs its task programme.		P
	For this, the device and associated controls shall be capable of stopping the robot motion under rated load and speed conditions and the associated safety controls shall comply with category 3 of ISO 13849-1:1999, unless a risk assessment is performed and determines that another category is required.		P
5.13	**Movement without drive power**		
	The robot shall be designed so that the axes are capable of being moved without the use of drive		P

	power in emergency or abnormal situations.		
	Where practicable, moving the axes shall be carried out by a single person.		P
	Controls shall be readily accessible but protected from unintended operation.		P
	Instructions for doing this shall be included in the information for use along with recommendations for training personnel on responding to emergency or abnormal situations.		P
	The instructions to the user shall include warnings		P

	that gravity and the release of braking devices can create additional hazards.		
	Where practicable, warning notices shall be posted near to the activating controls.		P
5.14	**Provisions for lifting**		
	Provisions for lifting the robot and its associated components shall be provided and shall be adequate for handling the anticipated load.		P
	For example, lifting hooks, eye bolts, threaded holes, and fork pockets.		
5.15	**Electrical connectors**		
	Electrical connectors that can cause a hazard if they are separated, or if they break away, shall be designedand constructed so as to prevent unintended separation.		
	Connectors shall be provided with a means to prevent cross-connection.		P
6	Information for use		
6.1	General		
	Markings (e.g. signs, symbols) and instructional material (e.g. manuals for operation, maintenance) shall be provided by the manufacturer in accordance with ISO 12100-1, ISO 12100-2 and IEC 60204-1.		P
	When provided, machine warning devices (e.g. audible and visual signals) shall be in accordance with ISO 12100-2 and ISO 60204-1.		P
6.2	Instruction handbook		
	In addition to the requirements of 6.1, each robot or robot system shall be accompanied by an instruction handbook or appropriate media containing:		P
	a) the name, address, and necessary contact information of the manufacturer or supplier;		P

	b) instruction for commissioning, programming and restarting procedure including installation requirements such as utility needs, floor loading, environmental conditions, etc.;		P
	c) instructions for how the initial test and examination of the robot and its guarding system are to be carried out before first use and being placed into production, including functional testing of reduced speed control;		P

	d) instructions for any test or examination necessary after change of component parts or addition of optional equipment (both hardware and software) to the robot which can affect the safety functions including an emergency stop output signal as in 5.5.2 and common enabling circuit as in 5.8.3(d);		P
	e) instructions for safe operation, setting and maintenance including safe working practices, hazardous energy control procedures and the training required to achieve the necessary skill level of persons operating the equipment;		P
	f) instructions on location and function of all control systems including diagrams of the interface of electrical,hydraulic, and pneumatic systems necessary for setup and installation;		P
	g) information on the capability of selecting high speed control using the pendant;		P
	h) information on installation of limiting devices, including number, location and degree of adjustment of mechanical limiting capability, instructions on the number, location and implementation of any non-mechanical limiting devices, capabilities of dynamic limiting when included, and the actual expected stopping position that accounts for the stopping distance travel when using safety-rated soft limiting;		P
	i) information on the number and operation of enabling devices and instructions for installation of additional devices;		P
	j) information on the stopping time and distance or angle from initiation of stop signal of the three axes with the greatest displacement and motion		P

	per the metric in Annex B;		
	k) the safety control system performance of the robot as determined in 5.4;		P
	l) the specification for any fluids or lubricants to be used in lubrication, braking, or transmission system internal to the robot, including guidance on correct selection, preparation, application and maintenance of process unique expendables;		P
	m) guidance on the means for the release of persons trapped in or by the machine;		P
	n) information defining the limits for the range of		P

	motion and load capacity, including maximum mass,position of the centre of gravity of the workpiece and work holding fixture;		
	o) information defining the limits for the maximum mass, moment of inertia, tilting moment, and space required for auxiliary machines and for tools supplied with automatic tool magazine systems;		P
	p) procedures to avoid errors of fitting during maintenance of the machine;		P
	q) information on relevant standards the robot meets, including any that have been certified by a third party;and		P
	r) response time of detection of loss of communication signal for cableless pendants.		P
	Any changes or additions to the applicable information as provided by the manufacturer shall be provided by the party that makes the change or addition to the robot system.		P
6.3	Marking		
	Each robot shall be marked in a distinct, legible and durable manner with:		P
	a) manufacturer’s name and address, model number and reference number, month and year of manufacture;		P
	b) mass of machine;		P
	c) supply data for electrical and where applicable, hydraulic, and pneumatic systems (e.g. minimum and maximum pneumatic pressures);		P
	d) lifting points for transportation and installation		P

	purposes where applicable; and		
	e) range and load capacity.		P
	Guards, protective devices and other parts that are part of the robot but not fitted shall be clearly identified fortheir purpose.		P
	Any other information needed for fitting shall be provided.		P

EN ISO 10218-2			
Clause	Requirement – Test	Result - Remark	Verdict
4.	Strategy for risk assessment and risk reduction		
	To implement risk assessment and risk reduction the designer shall take the following actions, in the order given:	According to the strategy.	Pass
5.	Safety requirements and protective measures		Pass
6.	Verification and validation of safety requirements and protective measures		Pass
6.1	General		Pass
6.2	Verification and validation methods		Pass
6.3	Required verification and validation		Pass
6.4	Verification and validation of protective equipment		Pass
7	Information for use		Pass
7.1	General		Pass
7.2	Instruction handbook		Pass
7.3	Marking		Pass

3.2 Airborne noise report

I. Applicable standards

1. EN ISO 3744:2010 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane.
2. EN ISO 11202: Acoustics-Noise emitted by machinery and equipment-Measurement of emission sound pressure levels at the work station and at other specified positions-Survey method in situ.
3. ISO/TR 11688-1: Acoustics-Recommended practice for the design of low-noise machinery and equipment -Part 1 : Planning.

II. Review instrument

The sound level meter used in the noise measurement is TES1350A manufactured by TES Electrical Electronic Corp. with the following features

- Portable with light weight easy operation.
- Measurement range from 35 to 130 dBA.
- Type 1 precision.
- With “F”&“S” detect mode in accordance with IEC 651 type 1.
- Built in A-weighting network.
- Equipped with a high prepoarized condenser microphone.
- With automatic&manual display.
- DC output for level recorder.

III. Measurement method

The measurements of this review have been carried out by a hand-held sound level meter, and readings are taken by A-frequency weighting at each measuring position.
For operator positions in process of measurement, the measuring instrument is to be set at a distance of 1 m from the machine and 1.5 m above the floor.

IV. Review environment

The review was carried out in the location of machine inside the factory, and the background noise has been ensured that its measuring value is lower than that of machine.

V. Review result

1. Background
   Reading value : 60.5dB(A)

2. Sound pressure level (machine on “Stand by” and normal load condition)

Position	1	2	3	4	5
Reading (dB (A))	61.2	58.3	59.3	59.3	58.2

3. Sound pressure level (machine on full load condition)

Position	1	2	3	4	5
Reading (dB (A))	59.5	58.8	60.4	60.6	58.6

The following is the calculation formula of L_W (Sound power level):

$Lw = Lpf + 10 \times \log (S/S_o)$

· Lpf is the A-weighted or frequency bank surface sound pressure level
· S is the area of the measurement surface in square meters20 m^2
· S^0 is 1 m^2

- End of Airborne Noise review Report -

EMC TECHNICAL FILE

Product Name : DISINFECTION ROBOT

Model Name : M1, M2

Prepared for:

KEENON ROBOTICS CO., LTD.
11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA
TEL: /
FAX: /

Prepared by:

Shanghai Global Testing Services Co., Ltd.

Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China.
TEL: +86-21-33637866
FAX: +86-21-33637858

File Number	:	TESH20050724682
Date of File	:	May 07,2020
Date of Issue	:	May 07,2020 to May 12,2020

Notes：
The review results only relate to these samples which have been reviewed.
Partly using this file will not be admitted unless been allowed by GTS.
GTS is only responsible for the complete file with the fileed stamp of GTS.

Applicant:	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA
Manufacturer:	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA
Product Name:	DISINFECTION ROBOT
Brand Name:	/
Model Name:	M1, M2
Serial Number:	N/A
Power:	220V/50Hz, 90W, 500*500*1350mm, 20L
Date of Receipt:	May 07,2020
Date of Review:	May 07,2020 to May 12,2020
Review Standard:	EN 61000-6-2:2016, EN 61000-6-4:2018
Review Result:	PASS

Prepared by : _____

Approved by : _____

GLOBAL TESTING SERVICES CO.,LTD. CERTIFICATION

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 Description of EUT

Product Name:	DISINFECTION ROBOT
Model Name:	M1, M2
Serial Number:	N/A
Power Supply:	220V
Applicant:	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA
Manufacturer:	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA

1.2 Description of Review Facility

Site Description	:	Shanghai Global Testing Services Co., Ltd.
Name of Firm	:	Shanghai Global Testing Services Co., Ltd.
Site Location	:	Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China.

The site and apparatus are constructed in conformance with the requirements of ANSI C63.4, CISPR 16-1-1 and other equivalent standards.

1.3 Measurement Uncertainty

Conducted Emission Expanded Uncertainty	:	U = 1.26 dB
Radiated Emission Expanded Uncertainty	:	U = 3.02 dB

2. TECHNIACL SUMMARY

2.1 SUMMARY OF STANDARDS AND Review RESULTS

The EUT have been reviewed according to the applicable standards as referenced below:

EN 61000-6-4:2018 EN 61000-3-2:2014，EN61000-3-3:2013			
Review Item	**Review Standard**	**Limits**	**Results**
Conducted Disturbance at AC mains terminals ports	CISPR 16-2-1:2014 CISPR 16-1-2:2014	See 4.3	P
Conducted Disturbance at telecommunication /network ports	CISPR 22 :2009+A1:2010	N/A	N/A
Radiated Disturbance	CISPR 16-2-3:2016	See 6.3	P
Harmonic Current Emissions	EN 61000-3-2:2014	Class A	P
Voltage Fluctuations and Flicker	EN 61000-3-3: 2013	Section 5	P

EN 61000-6-2:2016			
Review Item	**Basic Standard**	**Performance Criteria**	**Results**
Electrostatic discharge Immunity	IEC 61000-4-2:2008	B	P
RF Electromagnetic Field Immunity	IEC 61000-4-3:2006+A1:2007 +A2:2010	A	P
Electrical Fast Transient/Burst Immunity	IEC 61000-4-4:2012	B	P
Surge Immunity	IEC 61000-4-5:2014	B	P
Conducted Disturbances Immunity	IEC 61000-4-6:2013+Cor 1:2015	A	P
Power-frequency Magnetic Field Immunity	IEC 61000-4-8:2009	A	P
Voltage Dips: 100% reduction, 1 cycle	IEC 61000-4-11:2004	B	P
Voltage Dips: 60% reduction, 10 cycles		C	P
Voltage Dips: 30% reduction, 25 cycles		C	P
Voltage Interruptions: 100% reduction, 250 periods		C	P

Note: P means pass, F means failure, N/A means not applicable

2.2 Description of Performance Criteria

The variety and the diversity of the apparatus within the scope of this standard make it difficult to define precise criteria for the evaluation of the immunity Review results.
If, as result of the application of the Reviews defined in this standard, the apparatus becomes dangerous or unsafe, the apparatus shall be deemed to have failed the Review.
A functional description and a definition of performance criteria, during or as a consequence of the EMC Reviewing, shall be provided by the manufacturer and noted in the Review report, based on the following criteria:

2.2.1 Performance criterion A
The apparatus shall continue to operate as intended during the Review. 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. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

2.2.2 Performance criterion B
The apparatus shall continue to operate as intended after the Review. 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 Review, degradation of performance is allowed however. 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, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

2.2.3 Performance criterion C
Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

3. REVIEW EQUIPMENT LIST

Conducted Disturbance at AC mains terminals				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
Shielding Room	CHENGYU	5m×4m×3m	CR	Sep 13, 2020
EMI Review Receiver	R&S	ESCI7	100787	Oct 24, 2020
Artificial Mains Network	TESEQ	NNB 51	33285	Oct 24, 2020

Radiated Disturbance Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
3m Semi-anechoic Chamber	CHENGYU	9.2×6.25×6.15m	SAR	Oct 24, 2020
EMI Review Receiver	R&S	ESCI7	100787	Oct 24, 2020
EMC Shielding room	Changzhou FeiTe	8 x 5 x 3 mm	Nil	Oct 24, 2020
Broadband Log Antenna	Schwarzbeck	VULB 9163	9163-561	Oct 24, 2020

Harmonic Current Emissions Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
Harmonic Currents and Flick Reviewer	APS	ECTS-3120T	550029	Oct 24, 2020

Voltage Fluctuations and Flicker Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
Harmonic Currents and Flick Reviewer	APS	ECTS-3120T	550029	Oct 24, 2020

Electrostatic Discharge Immunity Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
ESD Generator	SCHAFFNER	NSG 438	849	Oct 24, 2020

RF Electromagnetic Field Immunity				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
Radiated Immunity Review System	TESEQ	ITS 6006	37546	Oct 24, 2020
Power Meter	TESEQ	PMR 6006	73819	Oct 24, 2020
Power Amplifier	MILMEGA	AS1860-50	1066592	Oct 24, 2020
Log Periodic Antenna	Schwarzbeck	STLP 9128 D	9128 D 048	Oct 24, 2020
Field Probe	ETS-Lindgren	HI-6105	00161798	Oct 24, 2020

Electrical Fast Transient/SURGE Immunity Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
EFT/SURGE Generator	TESEQ	NSG 3060	1468	Oct 24, 2020
Single Phase Coupling/decoupling Network	TESEQ	CDN 3061	1404	Oct 24, 2020
Capacitive clamp	TESEQ	CDN 3425	1736	Oct 24, 2020

Conducted Disturbances Immunity Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
Conducted Immunity Review System	TESEQ	NSG 4070	25795	Oct 24, 2020
Coupling/Decoupling Network	TESEQ	CDN M116S	35371	Oct 24, 2020
EM-clamp	TESEQ	KEMZ 801	29530	Oct 24, 2020

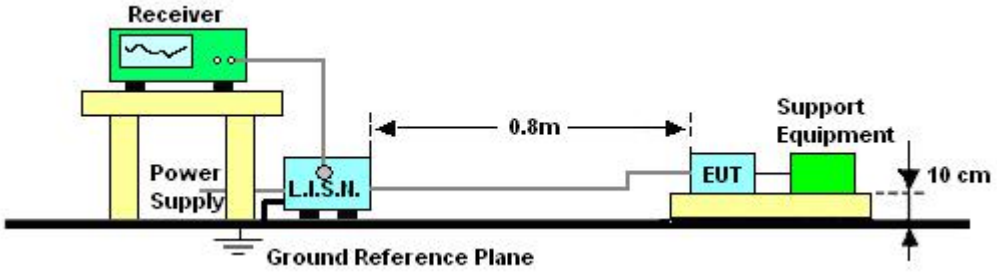
Power-frequency Magnetic Field Immunity Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
P-f Magnetic Field Loop	FCC	F-1000-4-8/9/10-1M	13	Oct 24, 2020
Power Magnetic Field Generator	SANKI	SKS-0805	/	Oct 24, 2020

Voltage Dips and Short Interruptions Immunity Review				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Next Cal.**
EFT/SURGE Generator	TESEQ	NSG 3060	1468	Oct 24, 2020
Single Phase Coupling/decoupling Network	TESEQ	CDN 3061	1404	Oct 24, 2020

The measuring equipment utilized to perform the Reviews documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and has been calibrated by accredited calibration laboratories.

4. CONDUCTED DISTURBANCE AT AC MAINS TERMINALS PORTS

4.1 DIAGRAM OF REVIEW SETUP



4.2 APPLICABLE STANDARD

EN 61000-6-4:2018(CISPR 16-2-1:2014&CISPR 16-1-2:2014)

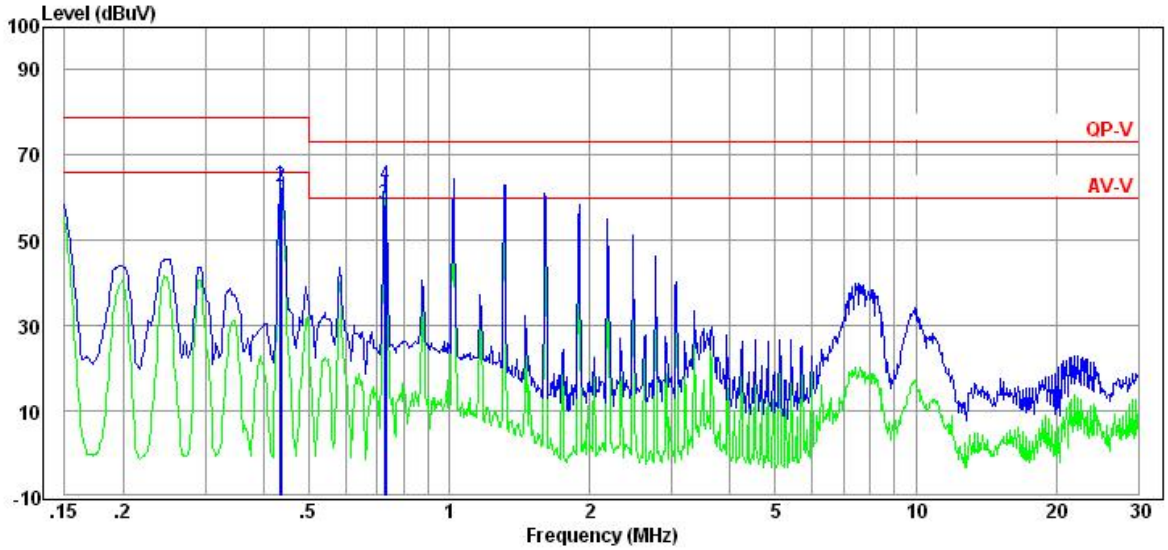
4.3 LIMITS FOR CONDUCTED DISTURBANCE

Frequency Range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0.15 ～ 0.5	79	66
0.5 ～ 30	73	60
NOTE 1 – The lower limit shall apply at the transition frequencies. NOTE 2 – Limits only apply to low voltage a.c. mains input ports.		

4.4 REVIEW RESULT

TEMPERATURE : 22℃ HUMIDITY : 53%
REVIEW MODEL : OPERATING POWER SUPPLY : AC220V

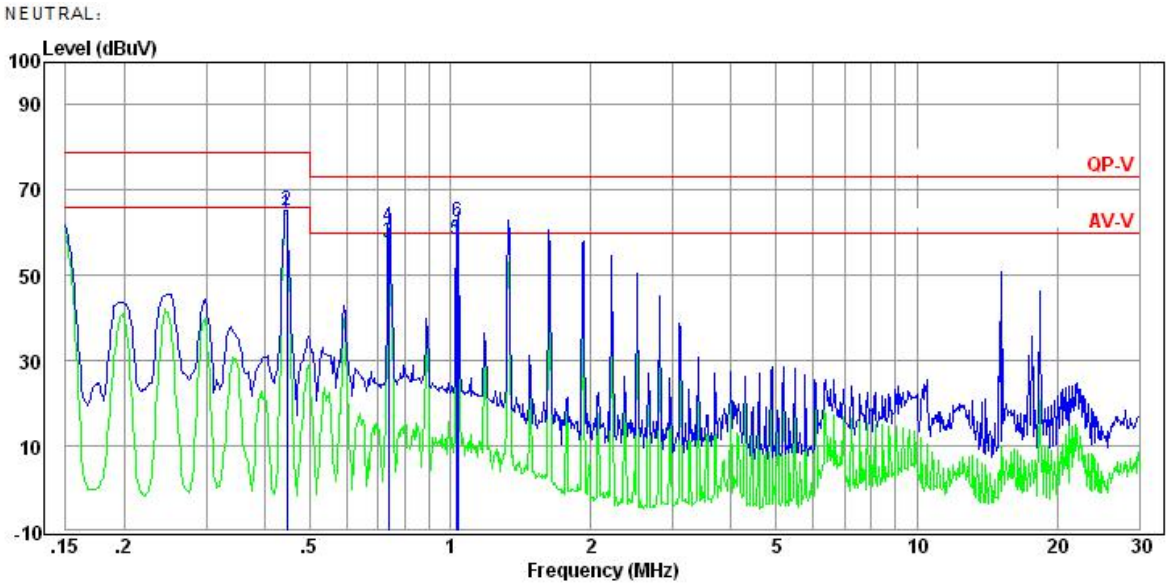
LINE：



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
0.44	53.36	9.62	62.98	66.00	3.02	Average
0.44	52.87	9.62	62.49	79.00	16.51	QP
0.73	48.76	9.69	58.45	60.00	1.55	Average
0.73	53.15	9.69	62.84	73.00	10.16	QP

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

NEUTRAL：



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
0.45	54.86	9.63	64.49	66.00	1.51	Average
0.45	55.72	9.63	65.35	79.00	13.65	QP
0.74	47.80	9.68	57.48	60.00	2.52	Average
0.74	51.87	9.68	61.55	73.00	11.45	QP
1.03	48.97	9.61	58.58	60.00	1.42	Average
1.04	52.80	9.61	62.41	73.00	10.59	QP

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

4.5 Review CONCLUSION

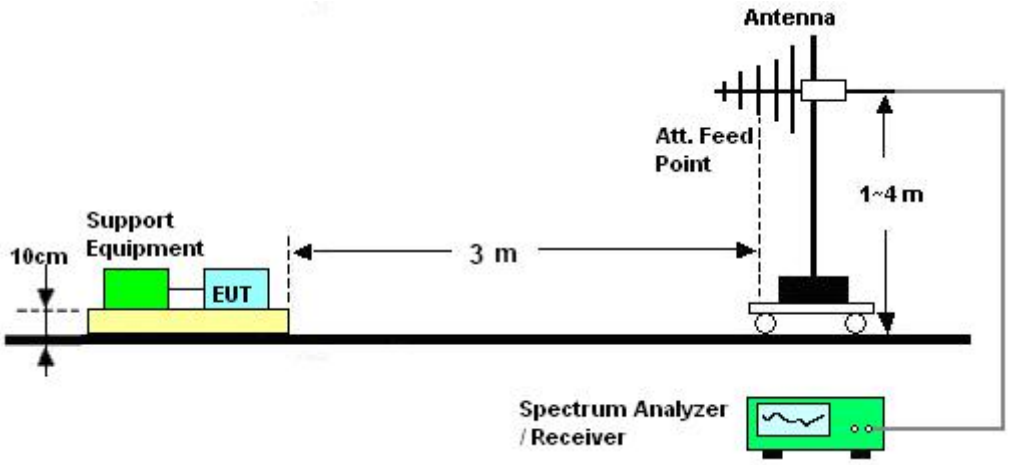
PASS

5. CONDUCTED DISTURBANCE AT TELECOMMUNICATION/NETWORK PORTS

N/A

6. RADIATED DISTURBANCE REVIEW

6.1 DIAGRAM OF REVIEW SETUP



6.2 APPLICABLE STANDARD

EN61000-6-4:2007+A1:2011 (CISPR 16-2-3:2016)

6.3 LIMITS FOR RADIATED DISTURBANC

Below 1GHz

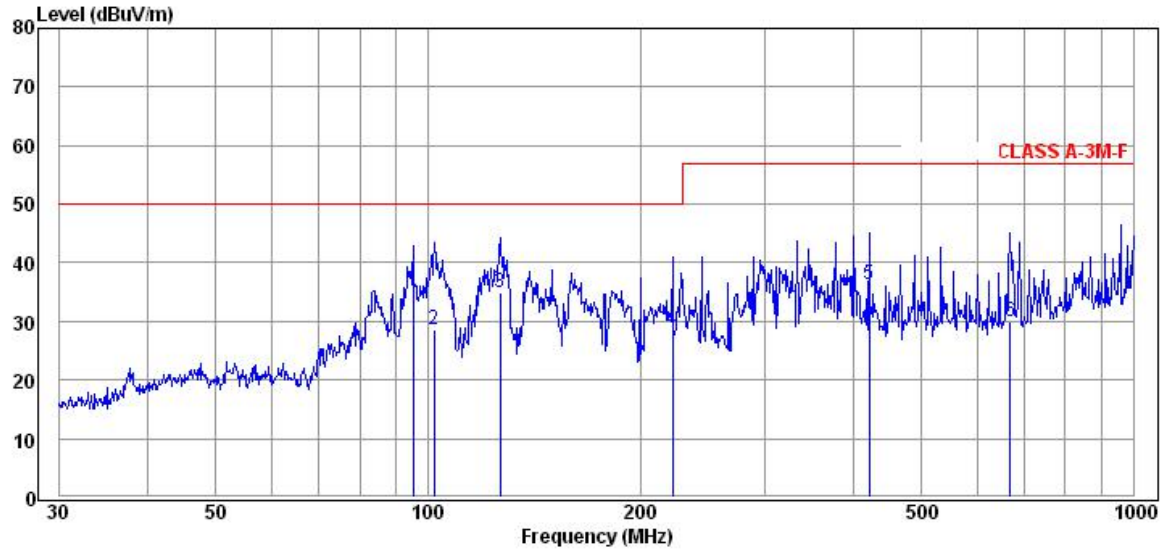
Frequency (MHz)	Distance (m)	Field Strength Limits dB(V/m)	Converted Field Strength Limits By 3 Meters Measuring Distance dB(V/m)
30 ~ 230	10	40	50
230 ~ 1000	10	47	57
NOTE 1 - The lower limit shall apply at the transition frequency. NOTE 2 – Additional provisions may be required for cases where interference occurs.			

6.4 REVIEW RESULT

Temperature : 22℃ Humidity : 53%

Review Model : Operating Power Supply : AC220V

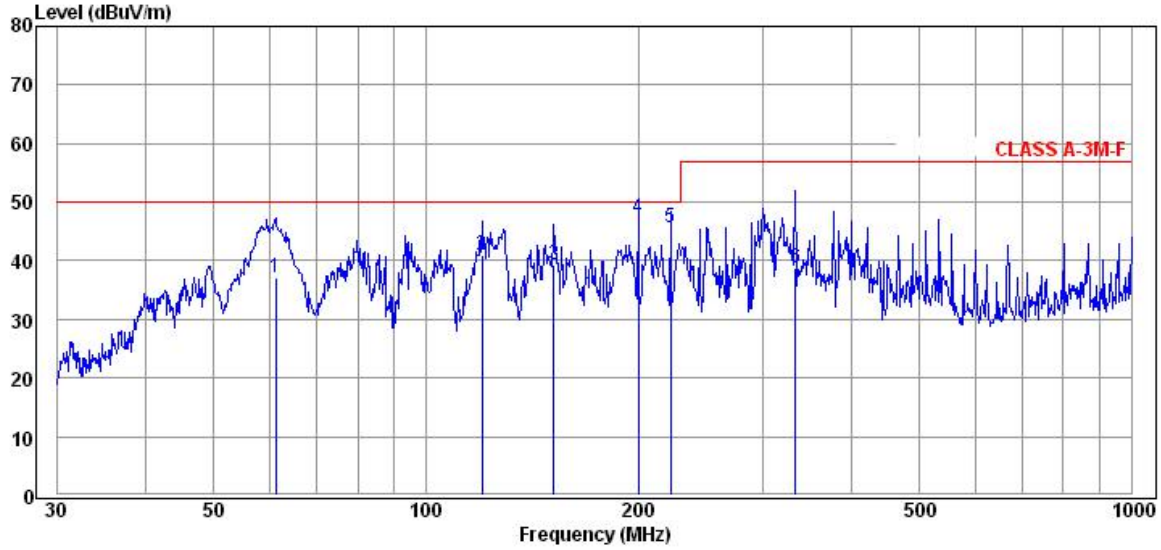
HORIZONTAL:



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
95.09	20.60	14.65	35.25	50.00	14.75	QP
102.00	14.20	14.48	28.68	50.00	21.32	QP
126.33	23.10	11.69	34.79	50.00	15.21	QP
222.17	14.00	14.53	28.53	50.00	21.47	QP
422.06	16.50	19.90	36.40	57.00	20.60	QP
668.14	5.60	24.43	30.03	57.00	26.97	QP

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

VERTICAL：



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
61.13	23.00	14.05	37.05	50.00	12.95	QP
119.86	28.30	12.74	41.04	50.00	8.96	QP
151.60	28.01	11.18	39.19	50.00	10.81	QP
199.99	33.00	14.39	47.39	50.00	2.61	QP
222.17	31.10	14.53	45.63	50.00	4.37	QP
333.69	21.00	17.82	38.82	57.00	18.18	QP

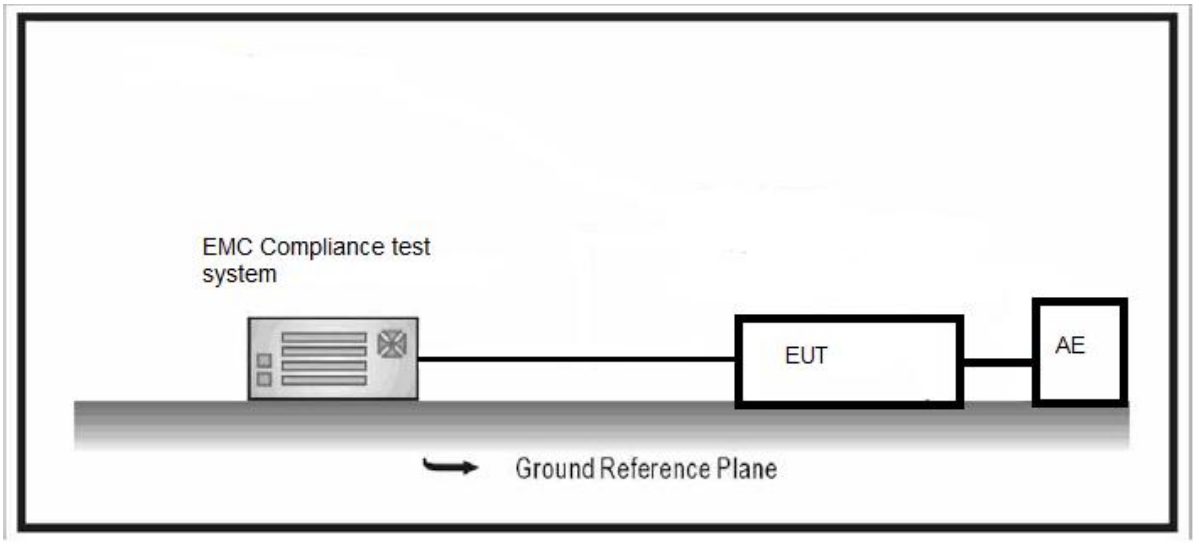
Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

6.5 REVIEW CONCLUSION

PASS

7. HARMONIC CURRENT EMISSION REVIEW

7.1 DIAGRAM OF REVIEW SETUP



7.2 APPLICABLE STANDARD
EN 61000-3-2:2014 (CLASS A)

7.3 HARMONIC CURRENT LIMITS

Limits for Class A equipment	
Harmonics Order n	Max. permissible harmonics current A
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15≤n≤39	0.15X15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8≤n≤40	0.23X8/n

7.4 REVIEW RESULTS

Temperature : 22℃ Humidity : 53%
Review Model : Operating Power Supply : AC220V

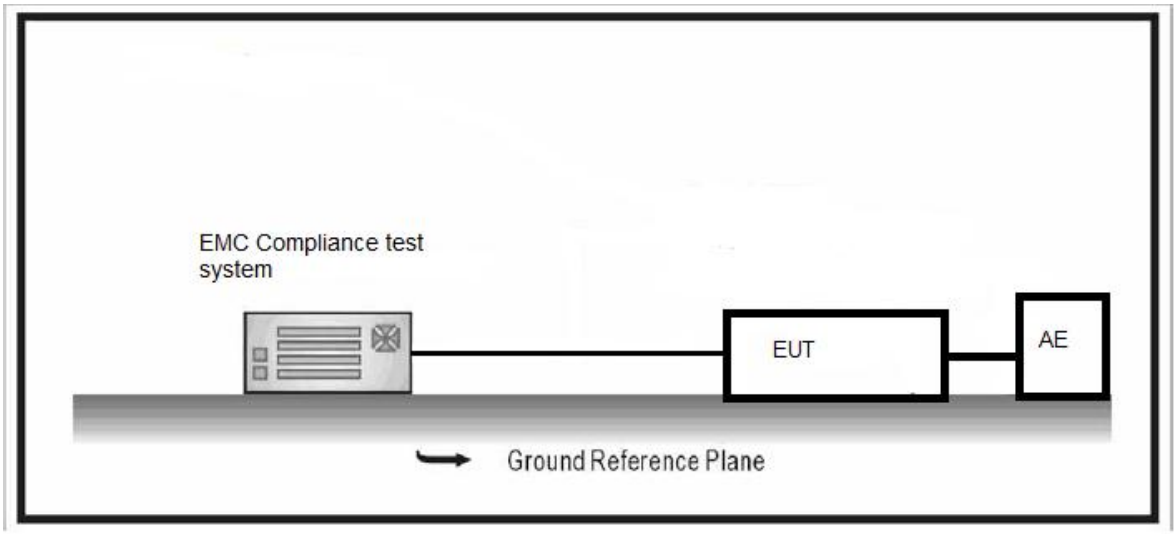
Harmonic	Status	Avg (A)	Avg L(A)	Avg %ofL	Peak (A)	Peak L(A)	Peak %ofL
1	PASS	0.36425	No Limit	N/A	0.3645	No Limit	N/A
2	PASS	0.0001	1.08	0.009559	0.00027	1.62	0.016873
3	PASS	0.34089	2.3	14.8213	0.34133	3.45	9.893623
4	PASS	0.00032	0.43	0.074881	0.00042	0.645	0.065122
5	PASS	0.30195	1.14	26.48684	0.30273	1.71	17.70351
6	PASS	0.00044	0.3	0.145803	0.00054	0.45	0.120938
7	PASS	0.25029	0.77	32.5052	0.25146	1.155	21.77143
8	PASS	0.00045	0.23	0.193478	0.00059	0.345	0.172043
9	PASS	0.19305	0.4	48.2625	0.19457	0.6	32.42833
10	PASS	0.00041	0.184	0.224772	0.00055	0.276	0.197909
11	PASS	0.1382	0.33	41.87879	0.13993	0.495	28.26869
12	PASS	0.00029	0.15333	0.191737	0.00043	0.23	0.185674
13	PASS	0.09452	0.21	45.00953	0.09627	0.315	30.56191
14	PASS	0.00012	0.13143	0.089021	0.00031	0.19715	0.155657
15	PASS	0.0698	0.15	46.53333	0.07125	0.225	31.66444
16	PASS	3.5E-05	0.115	0.03021	0.00022	0.1725	0.126864
17	PASS	0.06322	0.13235	47.76804	0.06431	0.19853	32.39391
18	PASS	5.6E-05	0.10222	0.054777	0.00025	0.15333	0.162871
19	PASS	0.0624	0.11842	52.69465	0.06344	0.17763	35.71469
20	PASS	0.00013	0.092	0.139196	0.0003	0.138	0.219123
21	PASS	0.05825	0.10714	54.36905	0.05945	0.16071	36.99459
22	PASS	0.00012	0.08364	0.138625	0.0003	0.12545	0.239753
23	PASS	0.04965	0.09783	50.75134	0.05102	0.14674	34.76785
24	PASS	3.5E-05	0.07667	0.04579	0.00027	0.115	0.231938
25	PASS	0.03949	0.09	43.88111	0.04087	0.135	30.27555
26	PASS	1.7E-05	0.07077	0.024071	0.00018	0.10615	0.167361
27	PASS	0.03199	0.08333	38.39055	0.03318	0.125	26.54171
28	PASS	9E-06	0.06571	0.01332	0.00015	0.09857	0.147153
29	PASS	0.02934	0.07759	37.81352	0.03022	0.11638	25.9686
30	PASS	9E-06	0.06133	0.014185	0.00015	0.092	0.164436
31	PASS	0.02915	0.07258	40.15652	0.02991	0.10887	27.47367
32	PASS	2.4E-05	0.0575	0.041275	0.00019	0.08625	0.215942
33	PASS	0.028	0.06818	41.07096	0.02884	0.10227	28.20099
34	PASS	2.3E-05	0.05412	0.043261	0.0002	0.08118	0.248038
35	PASS	0.02477	0.06429	38.53249	0.02573	0.09643	26.68492
36	PASS	0.00001	0.05111	0.01913	0.00011	0.07667	0.147861
37	PASS	0.02044	0.06081	33.61234	0.02141	0.09122	23.46834
38	PASS	7E-06	0.04842	0.013614	0.00011	0.07263	0.14396
39	PASS	0.01708	0.05769	29.60029	0.01785	0.08654	20.62678
40	PASS	5E-06	0.046	0.011391	8.2E-05	0.069	0.119319

7.5 REVIEW CONCLUSION

PASS

8. VOLTAGE FLUCTUATIONS AND FLICKER REVIEW

8.1 DIAGRAM OF REVIEW SETUP



8.2 APPLICABLE STANDARD

EN 61000-3-3:2013

8.3 VOLTAGE FLUCTUATIONS AND FLICKER EMISSION LIMITS

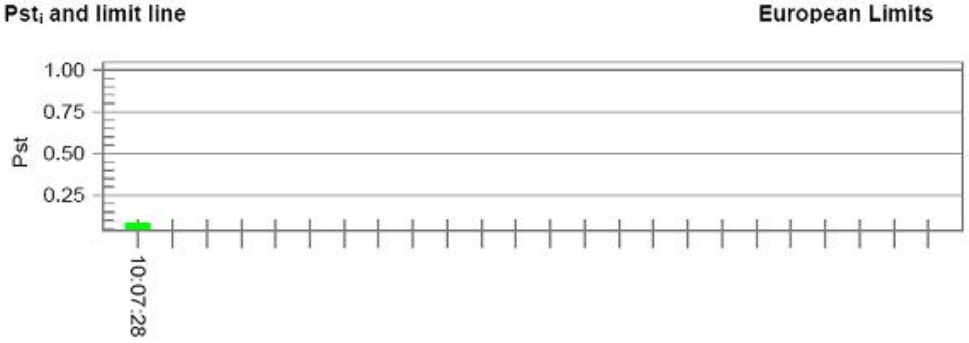
Review Item	Limit	Note
P_{st}	1.0	Short-term flicker indicator
P_{lt}	0.65	Long-term flicker indicator
T_{dt}(ms)	500	Maximum time that dt exceeds 3%
d_{max}(%)	4%	Maximum relative voltage change
d_c(%)	3.3%	Relative steady-state voltage change

8.4 REVIEW RESULTS

Temperature : 22℃ Humidity : 53%

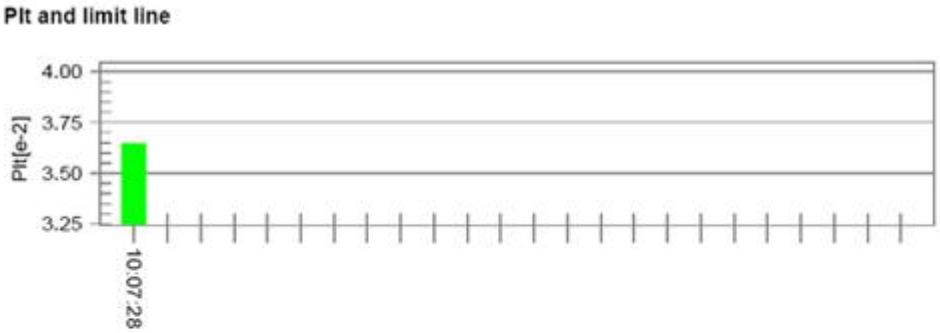
Review Model : Operating Power Supply : AC220V

Flicker Review Summary (Run time)



8.5 REVIEW CONCLUSION

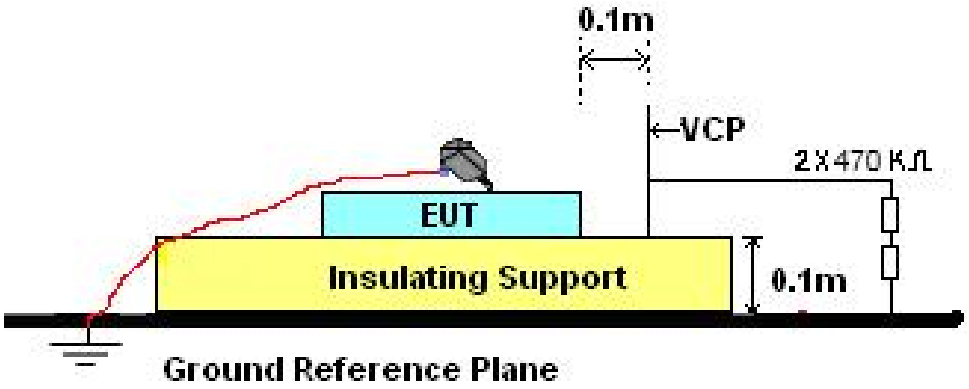
PASS



Parameter values recorded during the test:				
Vrms at the end of test (Volt):	229.94			
Highest dt (%):	0.62	Test limit (%):	3.30	Pass
Time(mS) > dt:	0.0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	-0.59	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.083	Test limit:	1.000	Pass

9. ELECTROSTATIC DISCHARGE IMMUNITY REVIEW

9.1 DIAGRAM OF REVIEW SETUP



9.2 APPLICABLE STANDARD

IEC 61000-4-2:2008, Contact Discharge: 2kV, 4kV;
Air Discharge: 2kV, 4kV, 8kV

9.3 SEVERITY LEVELS AND PERFORMANCE CRITERION

9.3.1 Severity levels

Level	Review Voltage	
	Contact Discharge (kV)	Air Discharge (kV)
1.	2	2
2.	4	4
3.	6	8
4.	8	15
X	Special	Special

9.3.2 Performance criterion: B

9.4 REVIEW RESULT

Temperature : 22℃ Humidity : 45%

Review Model : Operating Power Supply : AC220V

Air Discharge Voltage: ±2kV, ±4kV, ±8kV
Contact Discharge Voltage: ±2kV, ±4kV
Contact Discharge: For each point positive 10 times and negative 10 times discharge
Air Discharge: For each point positive 10 times and negative 10 times discharge

Location	Point	Kind	Result
Around the EUT	4	C (VCP)	A
Around the EUT	4	C (HCP)	A
Metal part of EUT and screws	28	C	B
Gap and screen	/	A	B

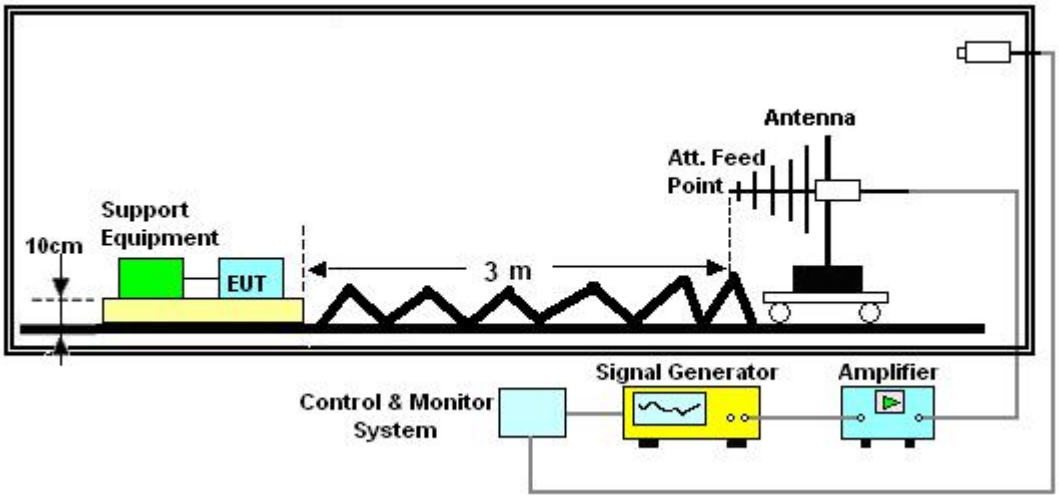
NOTE 1 – C (Contact Discharge), A(Air Discharge);
NOTE 2 – HCP (Horizontal Coupling Plane), VCP (Vertical Coupling Plane).

9.5 REVIEW CONCLUSION

PASS

10. RF ELECTROMAGNETIC FIELD IMMUNITY REVIEW

10.1 Diagram of Review Setup



10.2 Applicable Standard

IEC 61000-4-3:2006+A1:2007+A2:2010,
Frequency Range:
80 - 1000 MHz, Field Strength: 10 V/m, Modulation: 80% AM 1kHz;
1400 - 2000 MHz, Field Strength: 3V/m, Modulation: 80% AM 1kHz;
2000 - 2700 MHz, Field Strength: 1 V/m, Modulation: 80% AM 1kHz

10.3 Severity Levels and Performance Criterion

10.3.1 Severity levels

Level	Field Strength V/m
1	1
2	3
3	10
X	Special

10.3.2 Performance criterion: A

10.4 Review Result

Temperature	:	24℃	Humidity	:	55%
Review Model	:	Operating	Power Supply	:	AC220V

Frequency Range		80 MHz to 1000 MHz		1400 MHz to 2000 MHz		2000 MHz to 2700 MHz	
Modulation		80% AM 1 kHz		80% AM 1 kHz		80% AM 1 kHz	
Steps		1 %		1 %		1 %	
Dwell Time		3 s		3 s		3 s	
Antenna Polarization		80 MHz to 1000 MHz		1400 MHz to 2000 MHz		2000 MHz to 2700 MHz	
Field Strength		10V/m		3V/m		1V/m	
Antenna Polarization		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
EUT Position	Front	A	A	A	A	A	A
	Rear	A	A	A	A	A	A
	Right	A	A	A	A	A	A
	Left	A	A	A	A	A	A
	Floor	--	--	--	--	--	--
	Top	--	--	--	--	--	--

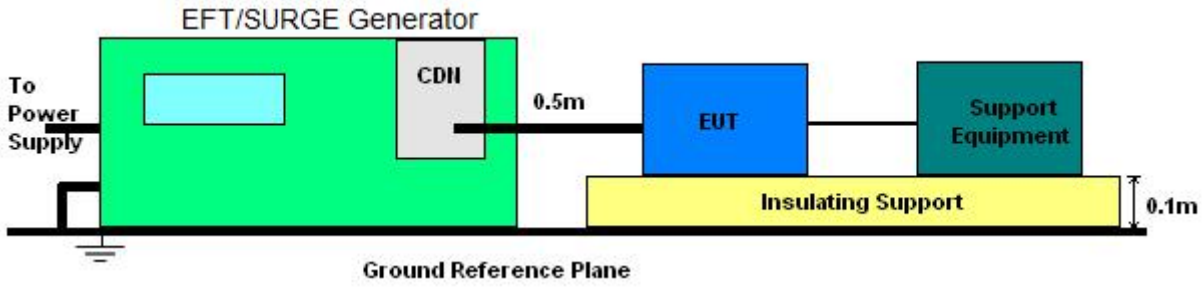
10.5 Review CONCLUSION

PASS

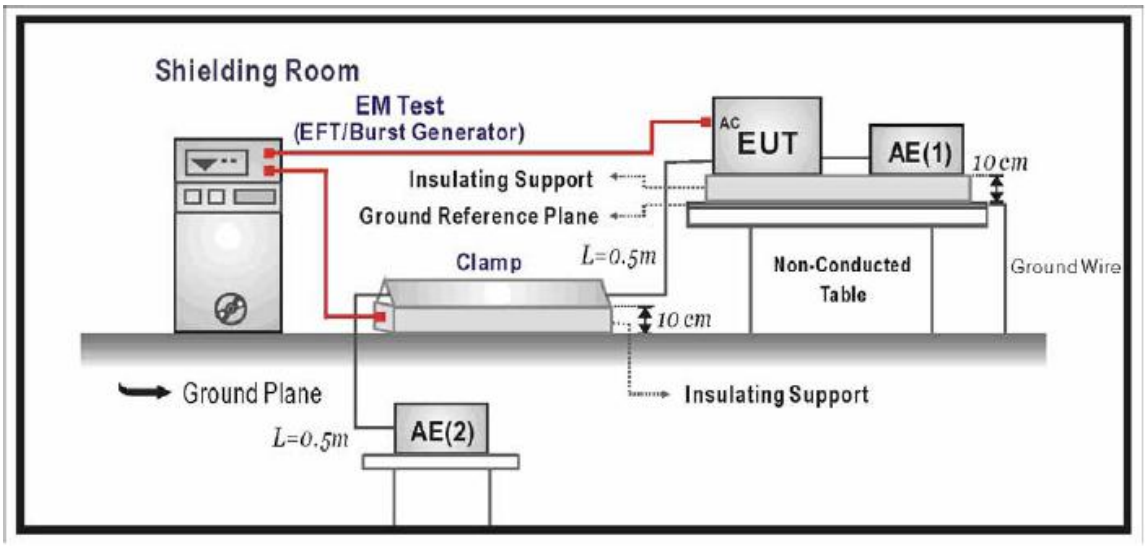
11. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY REVIEW

11.1 DIAGRAM OF REVIEW SETUP

FOR POWER PORT：



FOR SIGNAL PORT:



11.2 APPLICABLE STANDARD

IEC 61000-4-4:2012, Signal port：±1.0 kV, 5/50ns, 5kHz

Power port：±2.0 kV, 5/50ns, 5kHz

11.3 SEVERITY LEVELS AND PERFORMANCE CRITERION

11.3.1 SEVERITY LEVELS

Open circuit output Review voltage and repetition rate of the impulses				
Level	On power port, PE		On I/O (input/output) signal, data and control ports	
	Voltage peak kV	Repetition rate kHz	Voltage peak kV	Repetition rate kHz
1.	0.5	5 or 100	0.25	5 or 100

2.	1	5 or 100	0.5	5 or 100
3.	2	5 or 100	1	5 or 100
4.	4	5 or 100	2	5 or 100
Xa	Special	Special	Special	Special
Note 1: Use of 5kHz repetition rates is traditional; however, 100kHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types. Note 2: With some products, there may be no clear distinction between power ports and I/O ports, in which case it is up to product committees to make this determination for Review purposes.				
"Xa" is an open level. The level has to be specified in the dedicated equipment specification.				

11.3.2 PERFORMANCE CRITERION: B

11.4 REVIEW RESULTS

Temperature : 24℃ Humidity : 55%

Review Model : Operating Power Supply : AC220V

Inject Line	Voltage kV	Repetition rate kHz	Duration of Review (seconds)	Inject Method	Result
L	±2	5	120	Direct	B
N	±2	5	120	Direct	B
L、N	±2	5	120	Direct	B

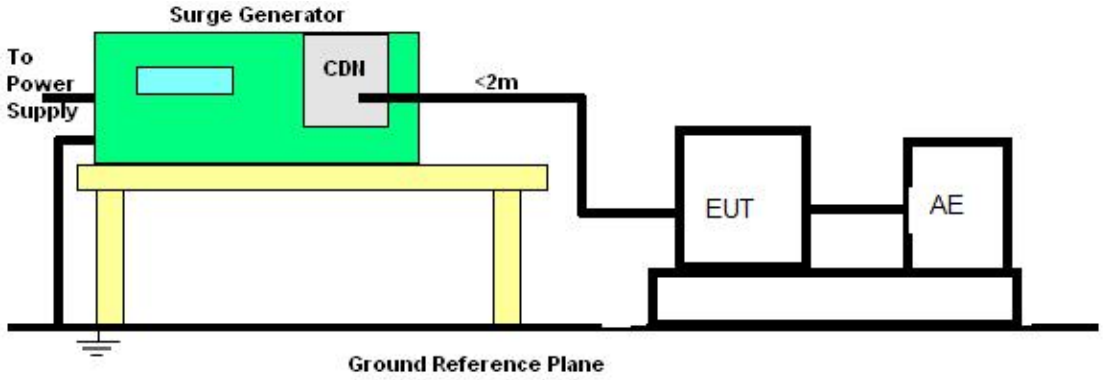
11.5 REVIEW CONCLUSION

PASS

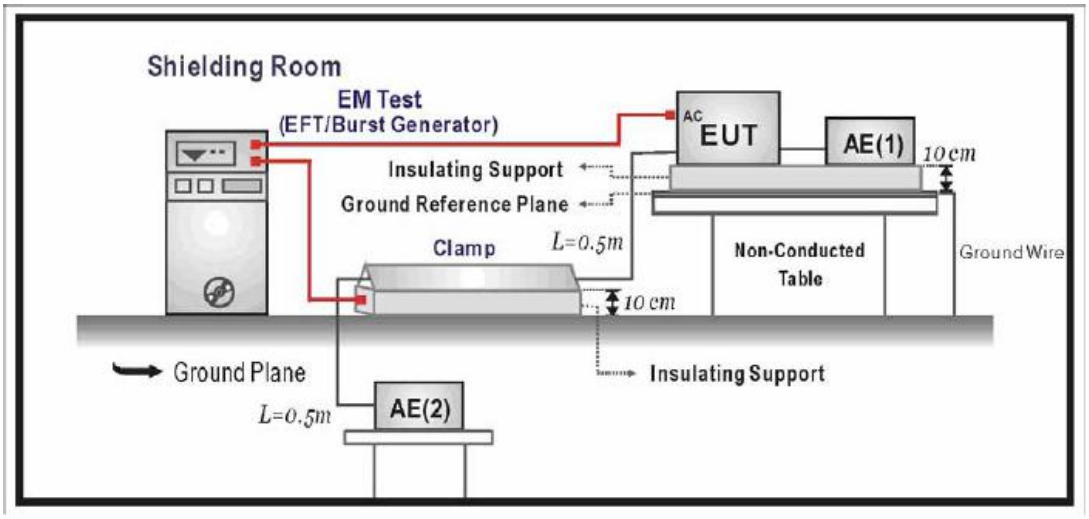
12. SURGE IMMUNITY REVIEW

12.1 Diagram of Review Setup

FOR POWER PORT：



FOR SIGNAL PORT:



12.2 Applicable Standard

IEC 61000-4-5:2014, Signal port：±1.0 kV, 1.2/50（8/20）

Line to line: ±1 kV, 1.2/50（8/20）Line to earth: ±2 kV, 1.2/50（8/20）

12.3 Severity Levels and Performance Criterion

12.3.1 Severity levels

Review Level	Power Supply Coupling Mode	
	Line to Line kV	Line to Earth kV
1	NA	0.5
2	0.5	1.0
3	1.0	2.0
4	2.0	4.0
X	Special	Special

12.3.2 Performance criterion: B

12.4 Review Result

Temperature : 24℃ Humidity : 55%

Review Model: Operating Power Supply : AC220V

AC Input Power Port						
Location	Polarity		Phase Angle	No. of Pulse	Pulse Voltage (kV)	Result
L-N	+	-	0	5	1.0	P
	+	-	90	5	1.0	P
	+	-	180	5	1.0	P
	+	-	270	5	1.0	P
L-PE	+	-	0	5	2.0	P
	+	-	90	5	2.0	P
	+	-	180	5	2.0	P
	+	-	270	5	2.0	P
N-PE	+	-	0	5	2.0	P
	+	-	90	5	2.0	P
	+	-	180	5	2.0	P
	+	-	270	5	2.0	P
Signal Line	--	--	--	--	--	--
NOTE “--” means the item is no applicable.						

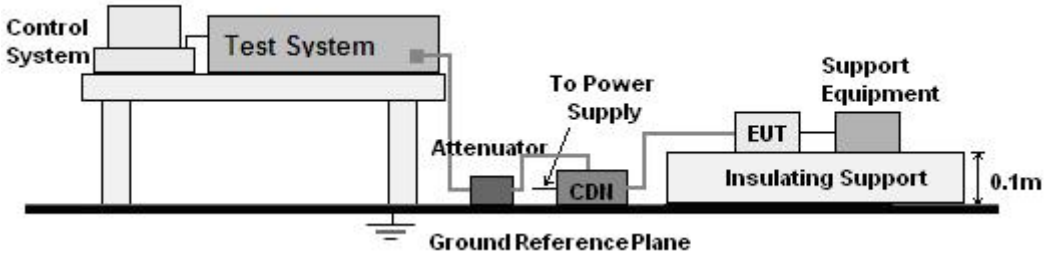
12.5 Review CONCLUSION

PASS

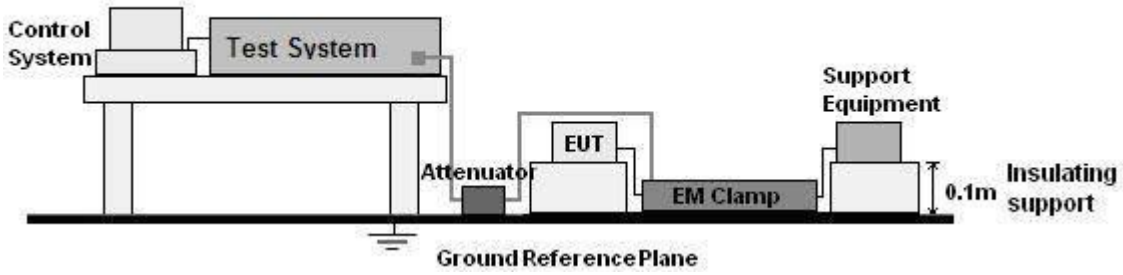
13. CONDUCTED DISTURBANCES IMMUNITY REVIEW

13.1 Diagram of Review Setup

FOR POWER PORT:



FOR SIGNAL PORT:



13.2 APPLICABLE STANDARD

IEC 61000-4-6:2013+Cor 1:2015, Power port：0.15-80MHz, 10V Modulation, 80%AM (1kHz), Signal port: 0.15-80MHz, 10V Modulation, 80%AM (1kHz)

13.3 SEVERITY LEVELS AND PERFORMANCE CRITERION

13.3.1 Severity levels

Frequency Range 0.15 MHz – 80 MHz		
Level	Voltage Level (e.m.f.)	
	U0 dB(μV)	U0 (V)
1.	120	1
2.	130	3
3.	140	10
Xa	Special	
Xa is an open level.		

13.3.2 Performance criterion: A

13.4 REVIEW RESULTS

Temperature : 24℃ Humidity : 55%
Review Model : Operating Power Supply : AC220V

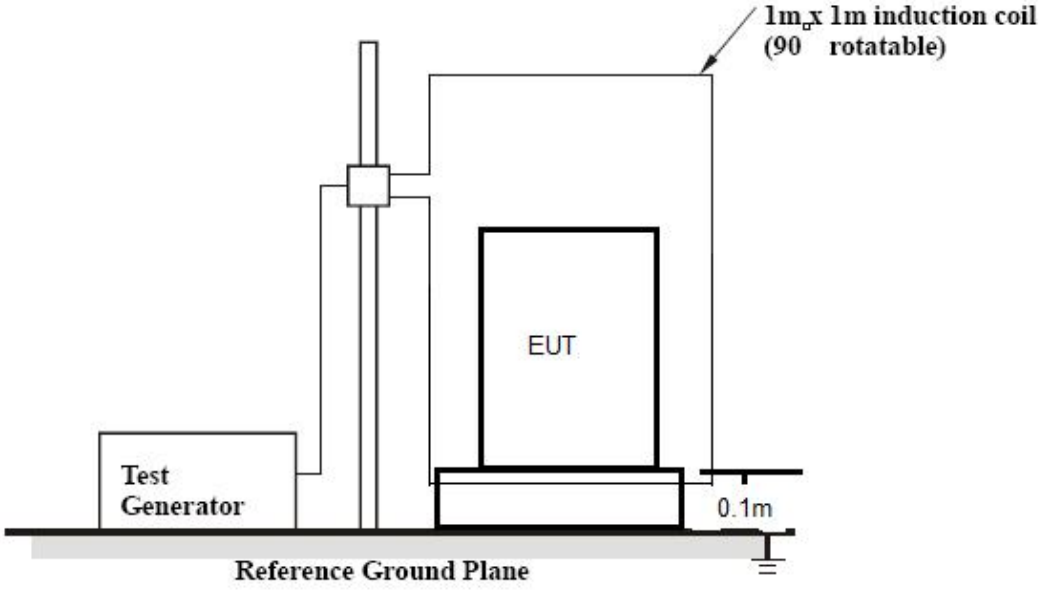
Frequency Range(MHz)	Injected Position	Strength (Unmodulated)	Results
0.15 ~ 80	AC Mains	10V(r.m.s.)	A

13.5 REVIEW CONCLUSION

PASS

14. POWER-FREQUENCY MAGNETIC FIELD IMMUNITY REVIEW

14.1 DIAGRAM OF Review SETUP



14.2 APPLICABLE STANDARD

IEC 61000-4-8:2009, Magnetic field strength: 30A/m

14.3 SEVERITY LEVELS AND PERFORMANCE CRITERION

14.3.1 Severity level:

Review Level	Magnetic field strength A/m
1	1
2	3
3	10
4	30
5	100
X	Special

14.3.2 Performance criterion: A

14.4 REVIEW RESULTS

Temperature : 22℃ Humidity : 53%

Review Model : Operating Power Supply : AC220V

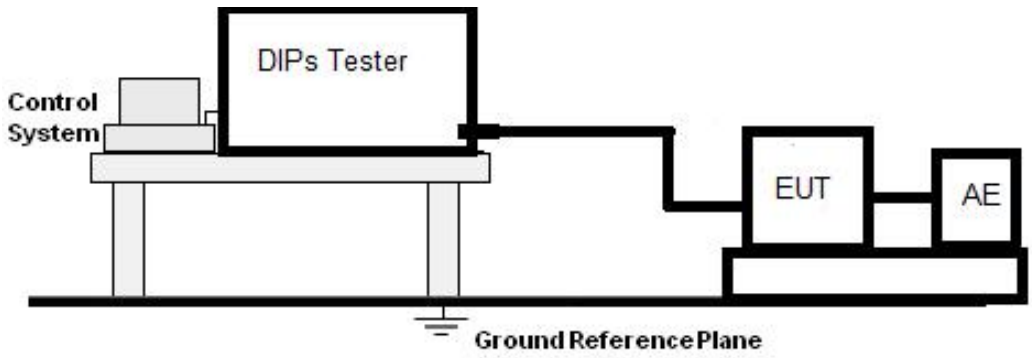
Review Level (A/m)	Reviewing Duration (in second)	Coil Orientation	Criterion	Result
30	120	Axis-X	A	P
30	120	Axis-Y	A	P
30	120	Axis-Z	A	P

14.5 REVIEW CONCLUSION

PASS

15. VOLTAGE DIPS AND SHORT INTERRUPTIONS IMMUNITY REVIEW

15.1 DIAGRAM OF Review SETUP



15.2 APPLICABLE STANDARD

IEC 61000-4-11: 2004, Review Value： Voltage dips: Dips 100% reduction: 1 cycle; Dips 60% reduction: 10 cycles; Dips 30% reduction: 25 cycles; Voltage interruptions 100% reduction: 250 cycles.

15.3 SEVERITY LEVELS AND PERFORMANCE CRITERION

15.3.1 Preferred severity levels and durations for voltage dips

Class[a]	Review level and durations for voltage dips (ts) (50Hz/60Hz)				
Class 1	Case-by-case according to the equipment requirements				
Class 2	0% during ½ cycle	0% during 1 cycle	70% during 25/30c cycles		
Class 3	0% during ½ cycle	0% during 1 cycle	40% during 10/12[c] cycles	70% during 25/30[c] cycles	80% during 250/300[c] cycles
Class X[b]	X	X	X	X	X

a Classes as per IEC 61000-2-4.
b To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2.
c “25/30 cycles” means “25 cycles for 50Hz Review” and “30 cycles for 60Hz Review”.

15.3.2 Preferred severity levels and durations for short interruptions:

Class[a]	Review level and durations for short interruptions (ts) (50Hz/60Hz)
Class 1	Case-by-case according to the equipment requirements

Class 2	0% during 250/300[c] cycles
Class 3	80% during 250/300[c] cycles
Class X[b]	X

a Classes as per IEC 61000-2-4.
b To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2.
c "250/300 cycles" means "250 cycles for 50Hz Review" and "300 cycles for 60Hz Review".

15.3.3 Performance criterion:
Voltage Dips 100%Reduction 1 cycle: B
Voltage Dips 60% Reduction 10 cycles: C
Voltage Dips 30% Reduction 25 period: C
Voltage interruptions 100% Reduction 250 period: C

15.4 REVIEW RESULTS

Temperature : 24℃ Humidity : 55%
Review Model : Operating Power Supply : AC220V

Review level (%U_t)	Voltage Dips& Short Interruptions (%U_t)	Duration （cycle）	Phase (in angle)	Criterion	Voltage phenomenon	Result
0	100	1	0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°	B	Dips	P
40	60	10	0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°	C	Dips	P
70	30	25	0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°	C	Dips	P
0	100	250	0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°	C	Interruptions	P

15.5 REVIEW CONCLUSION

PASS

----End of the report----

TECHNICAL FILE

EN 60204-1:2018 Safety of Machinery - Electrical Equipment of Machines Part 1: General Requirement

The Third Party	Shanghai Global Testing Services Co., Ltd Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China	Tel: / Fax: /
Name and address of the applicant	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Name and address of the manufacturer	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Name and address of the factory (production sites)	KEENON ROBOTICS CO., LTD. 11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA	
Product	DISINFECTION ROBOT	
Mode/type reference	M1, M2	
Reviewed according to	EN 60204-1:2018	
Review Result	PASS	
Review Report No.	MD-TCF-200507-24681-4	
Work carried out by	Tony Guo Director	Signature
Word verified by	Kevin Shi Manager	Signature
Date of issue	2020/05/12	

GLOBAL TESTING SERVICES CO.,LTD. GTS CERTIFICATION

3.3 IEC 60204-1 report

IEC 60204-1 **Safety of machinery - Electrical equipment of machines** **Part 1: General requirements**	
Report reference No...... :	MD-TCF-200507-24681-4
Date of issue .....:	2020/05/12
Total number of pages.....:	45
The third party.....:	Shanghai Global Testing Services Co., Ltd.
Address.....:	Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China
Applicant's name.....:	KEENON ROBOTICS CO., LTD.
Address.....:	11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA
TCF specification:	
Standard.....:	EN 60204-1:2018
TCF procedure.....:	CB
Non-standard Review method……..:	N/A
TCF Form No.....:	IEC60204_1A
TCF Form(s) Originator.....:	GTS
Master TRF.....:	Dated 2009-11
TCF item description.....:	DISINFECTION ROBOT
Model/Type reference.....:	M1, M2

Reviewing procedure and Reviewing location:	
☒ Reviewing procedure: TMP	
Reviewed by (name + signature)... :	
Approved by (+ signature)..... :	
Reviewing location/ address..... :	Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China
☐ Reviewing procedure: WMT	
Reviewed by (name + signature)... :	
Witnessed by (+ signature)..... :	
Approved by (+ signature)..... :	
Reviewing location/ address..... :	
☐ Reviewing procedure: SMT	
Reviewed by (name + signature)... :	
Approved by (+ signature)..... :	
Supervised by (+ signature)..... :	
Reviewing location/ address..... :	
☐ Reviewing procedure: RMT	
Reviewed by (name + signature)... :	
Approved by (+ signature)..... :	
Supervised by (+ signature)..... :	
Reviewing location/ address..... :	

Summary of Reviewing:

Reviews performed (name of Review and Review clause):	**Reviewing location:**
All of Review are performed at: Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China	Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China

Summary of compliance with National Differences:

N/A

Copy of marking plate

Review item particulars.....:	
Classification of installation and use.....:	Class I
Supply Connection.....:	Terminal
.....:	
.....:	
Possible Review case verdicts:	
- Review case does not apply to the Review object.....:	N/A
- Review object does meet the requirement.....:	Pass
- Review object does not meet the requirement.....:	Fail
Reviewing.....:	
Date of receipt of Review item.....:	2020/05/07
Date (s) of performance of Reviews.....:	2020/05/12

General remarks:

The review results presented in this report relate only to the objec reviewed.
This report shall not be reproduced, except in full, without the written approval of the Issuing reviewing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

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

This review report include:

Attachment to review Report IEC60204-1, **4** page(s)

4	**GENERAL REQUIREMENTS**		-
4.1	General		-
	Hazards relevant to the electrical equipment are assessed as part of the overall risk assessment of the machine.		P
4.2	Selection of equipment		P
4.2.1	Electrical components/devices suitable for their intended use and applied in accordance with supplier's instructions.		P
4.2.2	Where possible electrical equipment in compliance with the IEC 60439 series.		P
4.3	Electrical supply		P
4.3.1	Electrical equipment to be designed for correct operation within the conditions of mains power supply - as stated below (cl. 4.3.2 or 4.3.3)		P
	or as stated by the user (record specs in this TR)		N
	or as stated by the supplier[1]		P
4.3.2	AC supplies		P
	Supply Voltage: Steady state voltage: 0,9 ... 1,1 of nominal voltage		P
	Frequency: 0,99 ... 1,01 of nominal frequency continuously; 0,98 ... 1,02 short time.		P
	Harmonics: not exceeding 10 % of the total r.m.s. etc.		P
	Voltage unbalance: not exceeding 2% deviation.		P
	Voltage interruption: interrupted or at zero voltage for not more than 3 ms at any random time in the supply cycle with more than 1 s between successive interruptions.		P
	Voltage dips not exceeding 20 % of the peak voltage of the supply for more than one cycle with more than 1 s between successive dips.		P
4.3.3	DC supplies		N
	Supply Voltage: - other:0,85 to 1,15 of nominal voltage; - battery-operated vehicles: 0,7 to 1,2 of nom. volt. - from converting equipment: 0,9 to 1,1 of nom. volt.		N
	Voltage interruption: - other: not exceeding 5 ms - converting equipment: not exceeding 20 ms		N
	Ripple (peak-to-peak): not exceed. 0,15 of nom. volt.		N
4.3.4	Special supply systems; e.g. on board generators limits acc. 4.3.2 /.3 exceeded, but equipment designed acc. exceeded limits.		N
4.4	Physical environment and operating conditions		P

4.4.1	Electrical equipment suitable for the physical environment and operating conditions of its intended use.		P
4.4.2	Electromagnetic compatibility (EMC): Equipment shall not generate electromagnetic disturbances above levels that are appropriate for its intended operating environment and shall have a level of immunity to electromagnetic disturbances so that it can function in its intended environment (IEC 61000-6-1 or IEC 61000-6-2 and CISPR 61000-6-3 or IEC 61000-6-4 give general EMC emission and immunity limits.) Are there sufficient measures to limit the generation of electromagnetic disturbances, i.e. conducted and radiated provided? (E.g. power supply filtering; cable shielding; enclosures designed to minimize RF radiation; RF suppression techniques; design of functional bonding system, using conductors with low RF impedance and as short as practicable.		P
4.4.3	Electrical equipment shall be capable of operating correctly in the intended ambient air temperature. (Minimum requirement: air temperatures of +5 °C and +40 °C)		P
4.4.4	Electrical equipment shall be capable of operating correctly when the relative humidity is up to 50 % at a maximum temperature of +40 °C		P
4.4.5	Electrical equipment shall be capable of operating correctly at altitudes up to 1 000 m above mean sea level.		P
4.4.6	Electrical equipment shall be adequately protected against the ingress of solids and liquids (see 11.3)		P
4.4.7	Electrical equipment shall withstand ionizing and non-ionizing radiation.		P
4.4.8	Electrical equipment shall withstand vibration, shock and bump.		P
4.5	Electrical equipment designed to withstand the effects of transportation and storage within a temperature range of - 25 to + 55 °C.		P
4.6	Heavy or bulky electrical equipment of the machine provided with suitable means for handling.		P
4.7	Electrical equipment is installed and operated in accordance with the supplier’s instruction.		P

5	**INCOMING SUPPLY CONDUCTOR TERMINATIONS AND DEVICES FOR DISCONNECTING AND SWITCHING OFF**		-
5.1	Incoming supply conductor terminal		P
5.1	Electrical equipment of a machine connected to one single power supply (For large complex machinery comprising a number of widely-spaced machines working together in a coordinated manner, there can be a need for more than one incoming supply depending upon the site supply arrangements)		P

	Power supply conductors terminated to main disconnecting device of electrical equipment (unless a plug is provided for disconnection)		P
	Neutral conductor clearly indicated in technical documentation with "N" (see cl. 16.1)		P
	No connection between neutral conductor and protective bonding circuit nor combined PEN-terminals. Exception: a connection may be made between the neutral terminal and the PE terminal at the point of the connection of the power supply to the machine for TN-C systems.		P
	All terminals of incoming supply clearly marked in ac. with cl. 16.1 (symbols acc. to EN 60445)		P
5.2	Terminal for connection to external protective earthing system		P
	For each incoming supply, a terminal shall be provided in the vicinity of the associated phase conductor terminals for connection of the machine to the external protective earthing system or to the external protective conductor, depending upon the supply distribution system.		P
	Cross section of incoming PE conductor acc. to cl. 5.2, table 1. (Where an external protective conductor of a material other than copper is used, the terminal size shall be selected accordingly. See also 8.2.2).	1,5 mm^2	P
	Protective earth identified either by graphic symbol, letters "PE", or bicolour combination GREEN / YELLOW		P
5.3	Supply disconnecting device		-
5.3.1	A supply disconnecting device shall be provided: – for each incoming source of supply to a machine – for each on-board power supply.		P
5.3.2	Type of power supply disconnecting device:		—
	a) Switch-disconnector, acc. to EN 60947-3 for appliance category AC-23 B or DC-23 B		P
	b) Disconnector with or without fuses, with aux. contact (acc. to EN 60947-3		P
	c) Power circuit breaker suitable for isolation (acc. to EN 60947-2)		P
	d) any other switching device in accordance with an IEC product standard for that device and which meets the isolation requirements of IEC 60947-1as well as a utilization category		P
	e) Plug/socket combination for electrical load (requirements see cl. 5.3.3)	No such construction	N
5.3.3	Disconnection device has to fulfil all of the following requirements		—
	- isolate the electrical equipment from the supply and have only one OFF (isolated) and only one ON position marked with "O" and "I"		P

	- visible contact gap or a position indicator which cannot indicate OFF (isolated) until all contacts are actually open and the requirements for the isolating function have been satisfied		P
	- have an external operating means e.g.a handle (except power operated CB's)		P
	- coloured black or grey recommended (If used as an emergency stop, red/yellow combination selected)		P
	- be provided with a means permitting it to be locked in the OFF position (padlocks). When so locked, remote as well as local closing shall be prevented		P
	- disconnect all live conductors of its power supply circuit (For TN supply systems, the neutral conductor may or may not be disconnected except in countries where disconnection of the neutral conductor (when used) is compulsory.)		p
	Requirements for plug/socket combination as a disconnection device: - Breaking capacity of the plug/socket combination: sufficient to interrupt the current of the largest motor when stalled together with the sum of the normal running currents of all other motors and/or loads. - further see. cl. 13.4.5 a) to f)		N
5.3.4	The operating means are easily accessible and located between 0,6 m and 1,9 m above the servicing level.	1,25m	P
5.3.5	Only the following circuits need not be disconnected by the supply disconnecting device: - lighting circuits for lighting needed during maintenance or repair; – plug and socket outlets for the exclusive connection of repair or maintenance tools and equipment; – under voltage protection circuits that are only provided for automatic tripping in the event of supply failure; – circuits supplying equipment that should normally remain energized for correct operation – control circuits for interlocking Such circuits are provided with their own disconnecting device.		N
	Circuits not disconnected by the supply disconnecting device have: - permanent warning labels in accordance with cl. 16.1		N
	- a statement is included in the maintenance manual		N
	- additionally one or more of the following is applied; - a permanent warning label in accordance with 16.1 is affixed in proximity to each excepted circuit, or - the circuit is separated from other circuits, or - the conductors are identified by colour taking into account the recommendation of Cl.13.2.4.		N
5.4	Disconnecting devices to prevent of unexpected start-up:		—

	- Devices for the prevention of unexpected start-up are provided These devices are appropriate and convenient for the intended use, are suitably placed, and readily identifiable as to their function and purpose (for example by a durable marking in accordance with cl. 16.1).		P
	- Means are provided to prevent inadvertent and/or mistaken closure of these devices either at the controller or from other locations		P
	- Devices that do not fulfil the isolation function (e.g. a contactor switched off by a control circuit) are only used for situations that include: – inspections; – adjustments; – no hazardous work on the electrical equipment (for example replacement of plug-in devices without disturbing existing wiring)		P
5.5	Devices for disconnecting electrical equipment		—
	- Requirements to devices for disconnecting electrical equipment to enable work to be carried out when it is de-energised and isolated: – appropriate and convenient for the intended use; – suitably placed; – readily identifiable as to which part or circuit of the equipment is served (for example by durable marking in accordance with 16.1 where necessary). - Additional means are provided to prevent of inadvertent and/or mistaken closure of these devices either at the controller or from other locations		P
	- Where it is necessary to work on individual parts of the electrical equipment of a machine, or on one of a number of machines fed by a common conductor bar, conductor wire or inductive power supply system, a disconnecting device is provided for each part, or for each machine, requiring separate isolation. In addition to the mentioned supply disconnecting device, the following devices that fulfil the isolation function may be provided for this purpose: – devices described in 5.3.2; – disconnectors, withdrawable fuse links and withdrawable links only if located in an electrical operating area (see 3.15) and relevant information is provided with the electrical equipment (see 17.2 b)9) and b)12)).		P
5.6	Protection against unauthorized, inadvertent and/or mistaken connection		—
	For devices acc. to cl. 5.4(disconnecting electrical equipment) and 5.5 (prevention of unexpected start-up) locking means in OFF position are provided and no remote reconnection is possible.		P
	Where a non-lockable disconnecting device is provided (for example withdrawable fuse-links, withdrawable links), other means of protection against unintended energising are used.		P

	Where plug/socket combinations according to 5.3.2 e) are used for the purpose of prevention of unexpected start-up the are so positioned that they can be kept under the immediate supervision of the person carrying out the work.		P

6	**PROTECTION AGAINST ELECTRIC SHOCK**		-
6.2.2	Protection against direct contact		—
	Live parts that are located inside enclosures have to bee conform to the relevant requirements of Clauses 4, 11, and 14 and have to have a protection against direct contact of at least IP2X or IPXXB.		P
	Where the top surfaces of the enclosure are readily accessible, the minimum degree of protection against direct contact provided by the top surfaces shall be IP4X or IPXXD.	IP54	P
6.2.2 a	Opening an enclosure (i.e. opening doors, lids, covers, and the like) is possible only when: a) Either the use of a key or tool is necessary for access and: - all live parts, that are likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected are protected against direct contact to at least IP2X or IPXXB - live parts on the inside of doors are protected against direct contact to at least IP1X or IPXXA.		P

6.2.2 b	b) Or the opening of an enclosure (i.e. opening doors, lids, covers, and the like) is possible only if disconnection is provided for all live parts inside the enclosure before it can be opened. Exception: If a special device or tool (intended for use only by skilled or instructed persons) as prescribed by the supplier is provided that can be used to defeat the interlock and that intends that: - it is possible at all times while the interlock is defeated to open the disconnecting device and lock the disconnecting device in the OFF position or otherwise prevent unauthorised closure of the disconnecting device; - upon closing the door, the interlock is automatically restored - all live parts, that are likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected are protected against direct contact to at least IP2X or IPXXB - live parts on the inside of doors shall be protected against direct contact to at least IP1X or IPXXA - relevant information is provided with the electrical equipment like instructions on the procedures for securing the machine for safe maintenance and information on the residual risks. - means are provided to restrict access to live parts behind doors not directly interlocked with the disconnecting means to skilled or instructed persons. - parts still alive after switching off are protected at least IP 2X or IP XXB and marked with a warning sign in accordance with 16.2.1  Excepted from this marking are: - parts that can be live only because of connection to interlocking circuits and that are distinguished by colour as potentially live in accordance with 13.2.4 - the supply terminals of the supply disconnecting device when the latter is mounted alone in a separate enclosure.		P
6.2.2 c	c) Or the opening without the use of a key or a tool and without disconnection of live parts shall be possible only when all live parts are protected against direct contact to at least IP2X or IPXXB. Where barriers provide this protection, either they shall require a tool for their removal or all live parts protected by them shall be automatically disconnected when the barrier is removed.		P
6.2.3	Protection by insulation of live parts:		—
	Live parts are completely covered with insulation that can only be removed by destruction and that is capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which it can be subjected under normal operating conditions.		
	Paint, varnish lacquer etc. not used as the unique insulation layer.		P

6.2.4	Protection against residual voltages		—
	Live parts with residual voltage greater than 60 V after a time period of 5 s after disconnection of the supply shall be discharged until this interferes with the proper functioning of the equipment. Except are components with charges of ≤ 60 µC (→ equivalent to capacitor with less then 1µF @ 60V).		P
	Where pins of plugs or similar devices after withdrawal are exposed, discharge time is ≤ 1s. Otherwise such conductors are protected against direct contact to at least IP2X or IPXXB.	No such construction	N
	If above requirements cannot be achieved, additional disconnecting devices or appropriate warning devices shall be applied (e.g. warning acc. cl. 16.1).		P
6.2.5	For protection by barriers, 412.2 of IEC 60364-4-41 is applied.		N
6.2.6	For protection by placing out of reach, 412.4 of IEC 60364-4-41 shall apply. For protection by obstacles, 412.3 of IEC 60364-4-41 is applied.		P
6.3	Protection against indirect contact		-
6.3.2	Prevention of the occurrence of a touch voltage		—
6.3.2.2	Protection by provision of: - class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation in accordance with IEC 61140) or - switchgear and control gear assemblies having total insulation in accordance with IEC 60439-1or - supplementary or reinforced insulation in accordance with 413.2 of IEC 60364-4-41.		P
6.3.2.3	Protection by electrical separation. For this type of protection, the requirements of 413.5 of IEC 60364-4-41 apply.		P
6.3.3	Protection by automatic disconnection of supply.		
6.3.3 a)	Use of overcurrent protective device for automatic cut-off in the event of an insulation failure in a TN-System. Where disconnection within the time specified in Clause A.1 cannot be assured, supplementary bonding is provided as necessary to meet the requirements of Clause A.3.		P
6.3.3 b)	Use of residual current protective devices (RCD) for automatic cut-off in the event of an insulation failure in a TN - or TT -System.		P
6.3.3 c)	Use of earth fault detection device to initiate automatic disconnection in a IT-System.		P
6.4	Protection by the use of PELV		P

6.4.1 a)	PELV circuits shall satisfy all of the following conditions: -the nominal voltage does not exceed: • 25 V a.c. r.m.s. or 60 V ripple-free d.c. when the equipment is normally used in dry locations and when large area contact of live parts with the human body is not expected; or • 6 V a.c. r.m.s. or 15 V ripple-free d.c. in all other cases;		P
6.4.1 b)	one side of the circuit or one point of the source of the supply of that circuit is connected to the protective bonding circuit;		P
6.4.1 c)	live parts of PELV circuits is electrically separated from other live circuits		P
6.4.1 d)	Conductors of each PELV circuit are physically separated from those of any other circuit. If this requirement is impracticable, the insulation provisions of 13.1.3 are fulfilled;		P
6.4.1 e)	plugs and socket-outlets for a PELV circuit are conform to the following: 1) plugs do not to enter socket-outlets of other voltage systems; 2) socket-outlets do not admit plugs of other voltage systems.	No PELV plug and socket provided	N
6.4.2	Sources for PELV		—
	The source for PELV shall be one of the following: - safety isolating transformer in accordance with IEC 61558-1 and IEC 61558-2-6 or - a source of current with a degree of safety equivalent to that of the safety isolating transformer or - an source independent of circuit with higher voltage - electronic power supply conforming to appropriate standards		P
6.1	Other measures from IEC 60364-4-41 are used. (Description!)		P

7.	**PROTECTION OF EQUIPMENT**		-
7.2.	Overcurrent protection Unless otherwise specified by the user, the supplier of the electrical equipment is not responsible for providing the overcurrent protective device for the supply conductors to the electrical equipment (see Annex B).		P
7.2.2.	On the installation diagram data necessary for selecting the overcurrent protective device are stated for each incoming feeder. (see 7.2.10 and 17.4)		P
7.2.3	Power circuits:		—

	Devices for detection and interruption of overcurrent, selected in accordance with 7.2.10, are applied to each live conductor. And, none of the following conductors, as applicable, is disconnected without disconnecting all associated live conductors: – the neutral conductor of a.c. power circuits; – the earthed conductor of d.c. power circuits; – d.c. power conductors bonded to exposed conductive parts of mobile machines.		P
	Cross section area of neutral conductor is at least equal to the phase conductor. No overcurrent protective/ disconnecting device is required. (For a neutral conductor with a cross sectional area smaller than that of the associated phase conductors, the measures detailed in 524 of IEC 60364-5-52 shall apply.)		P
	IT-Systems:, no neutral conductor is used. Or, when it is used, the measures detailed in 431.2.2 of IEC 60364-4-43 are applied.		P
7.2.4	Control circuits		—
	Conductors of control circuits directly connected to the supply voltage and of circuits supplying control circuit transformers are protected against overcurrent in accordance with 7.2.3.		P
	Conductors of control circuits supplied by a control circuit transformer or d.c. supply: see 9.4.3.1		—
7.2.5	Socket outlets and their associated conductors		—
	Overcurrent protection is provided for the circuits feeding the general purpose socket.		P
7.2.6	Lighting circuits		—
	Lighting circuits are protected separate from other circuits.		P
7.2.7	Transformers		—
	Transformers are protected in accordance with the manufacturer’s instructions and includes: - avoiding tripping due to transformer magnetizing inrush currents - avoiding a winding temperature rise in excess of the permitted value for the insulation class when there is a short circuit at the secondary terminals. - type and setting of the overcurrent protective device in accordance with the recommendations of the transformer supplier.		P
7.2.8	Location of overcurrent protective devices:		—
	- located at the point where a reduction in the cross sectional area of the conductors or another change reduces the current-carrying capacity of the conductors.		P

	Exceptions: - current carrying capacity of the conductors is at least equal to that of the load and - conductors between the point of reduction of current-carrying capacity and the position of the overcurrent protective device is ≤ 3 m and - the conductor is protected e.g. by an enclosure or duct.		P
7.2.9	Selection of overcurrent protective devices		—
	The rated short-circuit breaking capacity Icn is at least equal to the prospective fault current at the point of installation. Additional currents other than from the supply (e.g. from motors, from power factor correction capacitors) shall be taken into consideration.		P
	Reduced breaking capacity is permitted, where another protective device is installed at supply side with the necessary breaking capacity. (In that case, the characteristics of the two devices shall be co-ordinated so that the let-through energy (I^2t) of the two devices in series does not exceed that which can be withstood without damage to the overcurrent protective device on the load side and to the conductors protected by that device. See Annex A of IEC 60947-2).		N
	Where fuses are provided as overcurrent protective devices, a type readily available in the country of use shall be selected, or arrangements shall be made for the supply of spare parts.		P
7.2.10	Rating and setting of overcurrent protective devices:		—
	Rated current of fuses or overcurrent setting of other protective devices selected as low as possible, but adequate for anticipated overcurrents.		P
	The rated current of overcurrent protective device is determined by the current carrying capacity of the conductors to be protected in accordance with Cl. 12.4, D.2 and the maximum allowable interrupting time *t* in accordance with Clause D.3, taking into account the needs of coordination with other electrical devices in the protected circuit.		P
7.3	Protection of motors against overheating		P
7.3.1	Overload protection for all motors provided for ratings of > 0.5 kW in continuous operation.		P
	Protective device may be omitted for motors, which cannot be overloaded.		P
	Exceptions: In applications where an automatic interruption of the motor operation is unacceptable (for example fire pumps), the means of detection shall give a warning signal to which the operator can respond.		P
7.3.2	Protection achieved by overload protection device: - detection in each live conductor - switching off of all live conductors (not necessary to switch of neutral conductor)		P

	For special duty motors, appropriate protective devices are recommended		P
7.3.3	Protection achieved by over-temperature protection device: Is recommended in situations where the cooling can be impaired (for example dusty environments)		P
7.3.4	Protection achieved by current limiting protection: Where protection against the effects of overheating in three phase motors is achieved by current limitation, the number of current limitation devices may be reduced from 3 to 2.		P
7.4	Abnormal temperature protection: Resistance heating or other circuits that are capable of attaining or causing abnormal temperatures and can cause a hazardous situation are provided with suitable detection to initiate an appropriate control response.		P
7.5	Protection against supply interruption or voltage reduction and subsequent restoration: Where a supply interruption or a voltage reduction can cause a hazardous situation, damage to the machine, or to the work in progress, undervoltage protection is provided.		P
	Upon restoration of supply voltage, automatic or unexpected restarting of machine prevented.		P
	Undervoltage protection does initiate appropriate control responses to ensure necessary coordination of groups of machines working together		P
7.6	Motor overspeed protection: Overspeed protection is provided where overspeeding can occur and could possibly cause a hazardous situation.		P
7.8	Phase sequence protection: Where an incorrect phase sequence of the supply voltage can cause a hazardous situation or damage to the machine, protection shall be provided.		P
7.9	Protection against overvoltage due to lightning and to switching surges: - Devices are connected to the incoming terminals of the supply disconnecting device.		P

8	**EQUIPOTENTIAL BONDING**		-
8.2	Protective bonding circuit		P
8.2.1	Where the conductance of structural parts of the electrical equipment or of the machine is less than that of the smallest protective conductor connected to the exposed conductive parts, a supplementary bonding conductor is provided.		P
	In IT distribution systems, the machine structure is part of the protective bonding circuit and insulation monitoring is provided.		P

	Exposed conductive parts of equipment in accordance with 6.3.2.3 (Protection by electrical separation) are not connected to the protective bonding circuit. (For this type of protection, the requirements of 413.5 of IEC 60364-4-41 apply.)		P
8.2.2	Protective conductors		—
	Protective conductors shall be identified in accordance with 13.2.2.		P
	Copper conductors are preferred.		P
	Where other material is used, its electrical resistance per unit length shall not exceed that of the allowable copper conductor and such conductors shall be not less than 16 mm^2 in cross-sectional area.	No other material used for conductor	N
	The cross-sectional area of protective conductors shall be determined in accordance with the requirements of: –543 of IEC 60364-5-54; or –7.4.3.1.7 of IEC 60439-1, as appropriate. This requirement is met in most cases if it is in accordance with Table 1 of this standard (see 5.2).		P
8.2.3	Continuity of the protective bonding circuit		
	All exposed conductive parts are connected to the protective bonding circuit in accordance with 8.2.1. Parts that are mounted so that they do not constitute a hazard because cannot be touched on large surfaces or grasped with the hand and they are small in size (less than approximately 50 mm × 50 mm) or they are located so that either contact with live parts, or an insulation failure is unlikely need not be connected to the protective bonding circuit		P
	Where a part is removed the protective bonding circuit for the remaining parts isn't interrupted.		P
	Current-carrying capacity of connection and bonding points cannot impaired by mechanical, chemical, or electrochemical influences (e.g. electrolytic corrosion on aluminium parts)		P
	Metal ducts of flexible or rigid construction and metallic cable sheaths are not used as protective conductors. Nevertheless they are connected to the protective bonding circuit.		P
	Where the electrical equipment is mounted on lids, doors, or cover plates, continuity of the protective bonding circuit shall be ensured. The use of a protective conductor (see 8.2.2) is recommended.		P
	For cables that are exposed to damage (for example flexible trailing cables) the continuity of the protective conductors are ensured by appropriate measures (for example monitoring).		P

8.2.4	No means of interruption of the protective bonding conductor are provided. Exception: links for Review or measurement purposes that cannot be opened without the use of a tool and that are located in an enclosed electrical operating area.		P
	As well the protective bonding circuit does not incorporate a switching device or an over current protective device (for example switch, fuse).		P
	Removable current collectors, plug/socket combinations or withdrawable plug-in units: The protective bonding circuit is interrupted by a first make last break contact. (see also 13.4.5)		P
8.2.6	Protective conductor connecting points: have no other function and are not intended to attach or connect appliances or parts.		P
	Each protective conductor connecting point is marked or labelled as such using the symbol IEC 60417-5019 or the letters PE or by use of bicolour GREEN / YELLOW		P
8.2.7	Mobile machines with on-board power supplies: The protective bonding system is connected to a single protective bonding terminal. This protective bonding terminal is the connection point for a possible additional external incoming power supply.		N
8.2.8	Electrical equipment having earth leakage currents higher than 10 mA a.c. or d.c.: Additional protective bonding requirements: - Cross section of protective conductor ≥ 10 mm^2 CU or 16 mm^2 AL - OR Second protective conductor of at least the same cross sectional area if above cross section is impracticable - OR monitoring of continuity of protective conductor with automatic disconnection function.		P
	Additionally a warning label is provided adjacent to the PE terminal.		P

9	**CONTROL CIRCUITS AND CONTROL FUNCTIONS**		
9.1.	Control circuit		P
9.1.1	Control circuit supply: Control transformers mandatory only when more then one motor starter or two control devices are used.		P
	Control transformers with separate windings are used for supplying the control circuits.		P
	Where several transformers are used, the secondary voltages are in phase.		P
	Separate windings on transformer for DC supplies connected to PE.		P

	Switch-mode units fitted with transformers in accordance with IEC 61558-2-17		P
9.1.2	The nominal voltage of control supply does not exceed 277 V when supplied from a transformer.		P
9.1.3	Control circuits are provided with overcurrent protection in accordance with 7.2.4 and 7.2.10.		P
9.2.	Control functions		P
	Safety related control functions in accordance with ISO 13849-1 (2006), ISO 13849-2 (2003) and /or IEC 62061 (see 9.4.1)		—
9.2.1	Start functions operating by energizing the relevant circuit (see 9.2.5.2).		P
9.2.3	Operating modes		—
	Suitable means are prevented for unauthorized or inadvertent mode selection if hazardous situations can result.		P
	Mode selection by itself does not initiate machine operation. A separate actuation of the start control has to be stated by the operator.		P
	Indication of the selected operating mode is provided (e.g. the position of a mode selector, the provision of an indicating light, a visual display indication).		P
9.2.4	Where it is necessary to suspend safety functions and/or protective measures (for example for setting or maintenance purposes), protection is ensured.		P
9.2.5	Operation		—
	Prevention of movement of the machine in an unintended or unexpected manner is taken after any stopping of the machine. (e.g. due to locked-off condition, power supply fault, battery replacement, lost signal condition with cableless control)		P
	When a machine has more than one control station, measures are provided to ensure that initiation of commands from different control stations do not lead to a hazardous situation.		P
9.2.5.2	Start of an operation is possible only when all of the relevant safety functions and/or protective measures are in place and are operational.		P
	Where safety functions and/or protective measures cannot be applied for certain operations, manual control of such operations are by hold-to-run controls, together with enabling devices, as appropriate.		P
	In the case of machines requiring the use of more than one control station to initiate a start, each of these control stations shall have a separate manually actuated start control device. The conditions to initiate a start are: - all required conditions for machine operation are met - and all start control devices are in the released (off) position - then all start control devices have to be actuated concurrently (see 3.6).		P

9.2.5.3	Stop category 0 and/or stop category 1 and/or stop category 2 stop functions are provided as indicated by the risk assessment and the functional requirements of the machine (see 4.1).		P
	Stop functions override related start functions		P
	Facilities to connect protective devices and interlocks are provided, where required. If such a protective device or interlock causes a stop of the machine, it may be necessary for that condition to be signalled to the logic of the control system. The reset of the stop function does not initiate any hazardous situation.		P
	Where more than one control station is provided, stop commands from any control station is effective when required by the risk assessment of the machine.		P
9.2.5.4	Emergency operations (emergency stop, emergency switching off)		—
	Emergency stop or emergency switching off commands are sustained until it is reset.		P
	This reset is possible only by a manual action at that location where the command has been initiated.		P
	The reset of the command does not restart the machinery but only permit restarting.		P
	It is not be possible to restart the machinery until all emergency stop commands are reset.		P
	It is not be possible to reenergize the machinery until all emergency switching off commands are reset.		P
9.2.5.4.2	The emergency stop does function either as a stop category 0 or as a stop category 1.		P
	- it overrides all other functions and operations in all modes;		P
9.2.5.4.3	Emergency switching off is provided where: -Protection against direct contact is achieved only by placing out of reach or by obstacles (see 6.2.6) - or there is the possibility of other hazards or damage caused by electricity.		P
	Emergency switching off is accomplished by electromechanical switching devices, effecting a stop category 0 of machine actuators connected to this incoming supply.		P
9.2.5.5	Movement or action that can result in a hazardous situation are monitored by providing, for example, overtravel limiters, motor overspeed detection, mechanical overload detection or anti-collision devices.		P
9.2.6	Other control functions		—
9.2.6.2	No type 1 two-hand control device is used for the initiation of hazardous operation. It need type 2 or type 3 two-hand control devices for such operations.		P

9.2.6.3	Enabling control: Enabling control are arranged in the way to minimize the possibility of defeating, e. g. by requiring the de-activation of the enabling control device before machine operation may be reinitiated. It is not possible to defeat the enabling function by simple means.		P
9.2.6.4	Combined start and stop controls: Push-buttons etc. that alternately initiate and stop motion are provided only for functions, which cannot result in a hazardous situation.		P
9.2.7	Cableless control station		N
9.2.7.1	Means shall be provided to readily remove or disconnect the power supply of the operator control station (see also 9.2.7.3).		N
	Means (for example key operated switch, access code) are provided, as necessary, to prevent unauthorized use of the operator control station.		N
	Each operator control station carries an unambiguous indication of which machine(s) is (are) intended to be controlled by that operator control station.		N
9.2.7.2	Measures shall be taken to ensure that control commands: – affect only the intended machine; – affect only the intended functions.		N
	Measures are taken to prevent the machine from responding to signals other than those from the intended operator control station(s).		N
	Where necessary, means are provided so that the machine can only be controlled from operator control stations in one or more predetermined zones or locations.		N
9.2.7.3	Operator control stations include a separate and clearly identifiable means to initiate the stop function of the machine or of all the operations that can cause a hazardous situation. The actuating means to initiate this stop function are not marked or labelled as an emergency stop device, even though the stop function initiated on the machine can fulfil an emergency stop function.		N
	Stopping of the machine and preventing a potentially hazardous operation is automatically initiated in the following situations: – when a stop signal is received; – when a fault is detected in the cableless control system; – when a valid signal (which includes a signal that communication is established and maintained) has not been detected within a specified period of time (see Annex B), except when a machine is executing a pre-programmed task taking it outside the range of the cableless control where no hazardous situation can occur.		N

9.2.7.4	Machines having more than one operator control station, including one or more cableless control stations, have measures provided to ensure that only one of the control stations can be enabled at a given time.		N
	An indication of which operator control station is in control of the machine is provided at suitable locations as determined by the risk assessment of the machine. Exception: a stop command from any one of the control stations are effective when required by the risk assessment of the machine.		N
9.2.7.5	Battery-powered cableless operator control stations: A variation in the battery voltage does not cause a hazardous situation.		N
	A clear warning is given to the operator when a variation in battery voltage exceeds specified limits.		N
	Under those circumstances, the cableless operator control station remains functional long enough for the operator to put the machine into a non- hazardous situation.		N
9.3	Protective interlocks		P
9.3.1	The reclosing or resetting of an interlocking safeguard does not initiate hazardous machine operation.		P
9.3.2	Where overtraveling an operating limit (for example speed, pressure, position) can lead to a hazardous situation, means are provided to detect when a predetermined limit(s) is exceeded and initiate an appropriate control action.		P
9.3.3	The correct operation of auxiliary functions is checked by appropriate devices.		P
	Appropriate interlocking is provided, when non-operation of an auxiliary function (for example lubrication, supply of coolant, swarf removal) can cause a hazardous situation, or cause damage to the machine or to the work in progress.		P
9.3.4	Interlocks between different operations and for contrary motions are provided if this operations lead to hazardous situations.		P
9.3.5	Reverse current braking: Where braking of a motor is accomplished by current reversal, measures prevent the motor starting in the opposite direction at the end of braking where that reversal can cause a hazardous situation or damage to the machine or to the work in progress.		P
	For this purpose, a device operating exclusively as a function of time is not permitted.		P
	Control circuits are arranged that rotation of a motor shaft, for example manually, does not result in a hazardous situation.		P
9.4	Control functions in the event of failure		P

9.4.1	The safety related electrical control circuits have an appropriate level of safety performance that has been determined from the risk assessment at the machine. The requirements of IEC 62061 and/or ISO 13849-1, ISO 13849-2 are met.		P
	Where memory retention is achieved for example, by battery power, measures are taken to prevent hazardous situations arising from failure or removal of the battery.		P
	Means are provided to prevent unauthorized or inadvertent memory alteration by, e.g. requiring the use of a key, access code or tool.		P
9.4.2	Measures are taken to minimize risk in the event of failure:		—
9.4.2.1	- Use of proven circuit techniques and components		P
9.4.2.2	- Provisions of partial or complete redundancy		P
9.4.2.3	- Provision of diversity		P
9.4.2.4	- Provision for functional Reviews		P
9.4.3	Protection against mal-operation due to earth faults, voltage interruptions and loss of circuit continuity		—
9.4.3.1	Earth faults on any control circuit don't cause unintentional starting, potentially hazardous motions, or prevent stopping of the machine. Methods to meet these requirements include but are not limited to the following:		—
	a) 1) Control circuits, fed by control transformers and connected to the protective bonding circuit at the point of supply. (PELV) (see Figure 3 of this standard)		P
	a) 2) Control circuits, fed by control transformers without connection to the protective bonding circuit at the point of supply in the arrangement according to figure 3 and having a device that interrupts the circuit automatically in the event of an earth fault		P
	b) Control circuits fed by a control transformer with a centre-tapped winding, this centre tap connected to the protective bonding circuit, arranged as shown in Figure 4 of this standard with the overcurrent protective device having switching elements in all control circuit supply conductors.		P
	c) Where the control circuit is not fed from a control transformer and is either: 1) directly connected between the phase conductors of an earthed supply, or; 2) directly connected between the phase conductors or between a phase conductor and a neutral conductor of a supply that is not earthed or is earthed through a high impedance, multpole switch that switch all live conductors are used for those functions that can cause hazardous situations or damage to the machine.		P
	Or in case of c) 2), a device is provided that interrupts the circuit automatically in the event of an earth fault.		P

9.4.3.2	For control systems using a memory device(s), proper functioning in the event of power failure is ensured (e.g. by using a non-volatile memory) to prevent any loss of memory that can result in a hazardous situation.		P
9.4.3.3	Upon sliding contacts the loss of continuity of safety-related control circuits depending on, can result in a hazardous situation. Appropriate measures are taken (for example by duplication of the sliding contacts).		P

10	**OPERATOR INTERFACE AND MACHINE-MOUNTED CONTROL DEVICES**		-
10.1.1	As far as is practicable, those devices are selected, mounted, and identified or coded in accordance with relevant parts of IEC 61310.		P
10.1.2	As far as is practicable, machine-mounted control devices are: – readily accessible for service and maintenance;		P
	– mounted in such a manner as to minimize the possibility of damage from activities such as material handling.		P
	The actuators of hand-operated control devices are selected and installed so that: – they are not less than 0,6 m above the servicing level and		P
	– are within easy reach of the normal working position of the operator;		P
	– the operator is not placed in a hazardous situation when operating them.		P
	The actuators of foot-operated control devices are selected and installed so that: – they are within easy reach of the normal working position of the operator;		P
	– the operator is not placed in a hazardous situation when operating them.		P
10.1.3	The degree of protection (see IEC 60529) together with other appropriate measures does afford protection against:		P
	– the effects of aggressive liquids, vapours, or gases found in the physical environment or used on the machine;		P
	– the ingress of contaminants (for example swarf, dust, particulate matter).		P
	The operator interface control devices has a minimum degree of protection against direct contact of IPXXD (see IEC 60529).		P
10.1.4	Position sensors (for example position switches, proximity switches) are so arranged that they will not be damaged in the event of overtravel.		P

	Position sensors in circuits with safety-related control functions shall have direct opening action (see IEC 60947-5-1) or shall provide similar reliability (see 9.4.2).		P
10.1.5	Portable and pendant operator control stations and their control devices are so selected and arranged as to minimize the possibility of inadvertent machine operations caused by shocks and vibrations		P
10.2	Push-buttons		P
10.2.1	Mandatory: The colour RED is used only for emergency stop and emergency switching off actuators.		P
	The recommend colours of push-buttons are as shown in table 2 of this standard.		P
10.2.2	The recommend markings on push-buttons are as shown in table 3 of this standard.		P
10.3	Indicator lights and displays		-
10.3.1	Indicator lights and displays are selected and installed in such a manner as to be visible from the normal position of the operator (see also IEC 61310-1).		P
	Indicator light circuits used for warning lights are fitted with facilities to check the operability of these lights.		P
	The recommend colours on Indicator light are as shown in table 4 of this standard.		P
	Indicating towers on machines have the applicable colours in the following order from the top down; RED, YELLOW, BLUE, GREEN and WHITE.		P
	Where flashing lights or displays are used to provide higher priority information, audible warning devices should also be provided.		P
10.4	illuminated push-button actuators are colour-coded in accordance with Tables 2 and 4. Where there is difficulty in assigning an appropriate colour, WHITE is used.		P
	The colour RED for the emergency stop actuator shall not depend on the illumination of its light.		P
10.5	Devices having a rotational member, such as potentiometers and selector switches, have means of prevention of rotation of the stationary member. Friction alone isn't considered sufficient.		P
10.6	Actuators used to initiate a start function or the movement of machine elements (for example slides, spindles, carriers) are constructed and mounted so as to minimize inadvertent operation.		P
	However, mushroom-type actuators are used for two-hand control only. (see also ISO 13851).		P
10.7	Emergency stop devices		-
10.7.1	Devices for emergency stop are readily accessible.		P

	They are located at each operator control station and at other locations where the initiation of an emergency stop can be required (exception: see 9.2.7.3).		P
	In circumstances where confusion can occur between active and inactive emergency stop devices caused by disabling the operator control station, means (for example, information for use) are provided to minimise confusion.		P
10.7.2	Allowed types of device for emergency stop: – a push-button operated switch with a palm or mushroom head type; – a pull-cord operated switch; – a pedal-operated switch without mechanical guard.		P
	The devices are direct opening operation (see IEC 60947-5-1, Annex K).		P
10.7.3	Actuators are coloured RED. If a background exists immediately around the actuator, then this background is coloured YELLOW. See also ISO 13850.		P
10.7.4	The supply disconnecting device may be locally operated to serve the function of emergency stop when: – it is readily accessible to the operator; and – it is of the type described in 5.3.2 a), b), c), or d). When also intended for this use, the supply disconnecting device meets the colours RED/YELLOW.		P
10.8	Emergency switing off device		P
10.8.1	Means are provided, where necessary, to avoid confusion between these devices.		P
10.8.2	The types of device for emergency switching off include: – a push-button operated switch with a palm or mushroom head type of actuator; – a pull-cord operated switch. The devices are direct opening action (see IEC 60947-5-1, Annex K). The push-button operated switch may be in a break-glass enclosure.		P
10.8.3	Actuators are coloured RED. If a background exists immediately around the actuator, then this background is coloured YELLOW. See also ISO 13850.		P
10.8.4	Where the supply disconnecting device is to be locally operated for emergency switching off, it is be readily accessible and meets the colours RED/YELLOW.		P
10.9	Enabling control device		P
	An enabling control device as a part of a system, does allow operation when actuated in one position only. In any other position, operation is stopped or prevented.		P

	Functions of two-position types: position 1: off-function of the switch (actuator is not operated); position 2: enabling function (actuator is operated)		P
	Functions of three-position types: position 1: off-function of the switch (actuator is not operated); position 2: enabling function (actuator is operated in its mid position); position 3: off-function (actuator is operated past its mid position); when returning from position 3 to position 2, the enabling function is not activated.		P

11	**CONTROLGEAR: LOCATION, MOUNTING AND ENCLOSURES**		
11.2.1	All items of controlgear (inclusively terminals that are not part of controlgear components or devices) are placed and oriented so that they can be identified without moving them or the wiring.		P
	For items that require checking for correct operation or that are liable to need replacement, those actions should be possible without dismantling other equipment or parts of the machine (except opening doors or removing covers, barriers or obstacles).		P
	All controlgear are mounted so as to facilitate its operation and maintenance from the front.		P
	Necessary tools to adjust, maintain, or remove a device are supplied.		P
	Where access is required for regular maintenance or adjustment, the relevant devices shall be located between 0,4 m and 2,0 m above the servicing level.		P
	Terminals are least 0,2 m above the servicing level and so placed that conductors and cables can be easily connected to them.		P
	Only operating, indicating, measuring, and cooling devices are mounted on doors or on normally removable access covers of enclosures.		P
	Plug-in arrangements of control devices and plug-in-devices:		—
	The connection is clearly identified by shape, marking or reference designation, singly or in combination.		P
	When they have to bee handled during normal operation means are provided with non-interchangeable features where the lack of such a facility can result in malfunctioning.		P
	Plug/socket combinations that are handled during normal operation are unobstructedly accessible.		P

	Review points for connection of Review equipment are: – unobstructedly accessible; – clearly identified to correspond with the documentation; – adequately insulated; – sufficiently spaced.		P
11.2.2	Non-electrical parts and devices, not directly associated with the electrical equipment, are not located within enclosures containing controlgear.		P
	Devices such as solenoid valves are separated from the other electrical equipment (for example in a separate compartment).		P
	Control devices mounted in the same location and connected to the supply voltage, or to both supply and control voltages, are grouped separately from those connected only to the control voltages.		P
	Terminals shall be separated into groups for: – power circuits; – associated control circuits; – other control circuits, fed from external sources (for example for interlocking).		P
	The clearances and creepage distances specified by the supplier are maintained, taking into account the external influences or conditions of the physical environment.		P
11.2.3	Heat generating components (for example heat sinks, power resistors) are located so, that the temperature of each component in the vicinity remains within the permitted limit.		P
	Controlgears are sufficiently protected against: - ingress of solid foreign objects - liquids - dust, coolants, and swarf, taking into account the external influences under which the machine is intended to operate (i.e. the location and the physical environmental conditions).		P
	Enclosures of controlgear provide a degree of protection of at least IP22 (see IEC 60529). Exceptions: a) specific electrical operating area b) When with removable collectors on conductor wire or conductor bar systems do not achieve IP22 measures of 6.2.5 are applied.		P
11.4	Enclosures, doors and openings		P
	Enclosures (inclusively screens of windows (windows: toughened glass or polycarbonate sheet of not less than 3 mm thickness), joints, gaskets of doors and lids) do withstand the foreseeable mechanical, electrical and thermal stresses and other environmental factors and of the aggressive liquids, vapours, or gases used on the machine.		P
	Fasteners used to secure doors and covers are of the captive type.		P

	Enclosure doors are not wider than 0,9 m and have vertical hinges, with an angle of opening > 95°.		P
	Openings in enclosures (for example, for cable access), including those towards the floor or foundation or to other parts of the machine are equipped with means to ensure the degree of protection specified for the equipment. A suitable opening may be provided in the base of enclosures within the machine so that moisture due to condensation can drain away.		P
	Openings for cable entries shall be easily re-opened on site.		P
	No openings between enclosures containing electrical equipment and compartments containing coolant, lubricating or hydraulic fluids, or those into which oil, other liquids, or dust can penetrate.		P
	Holes in an enclosure for mounting do not impair the required protection.		P
	Equipment that, in normal or abnormal operation, can attain a surface temperature sufficient to cause a risk of fire or harmful effect to an enclosure material is: – located within an enclosure that will withstand, such temperatures; and – is located at a sufficient distance from adjacent equipment allowing safe dissipation of heat (see also 11.2.3); or – is otherwise screened by material that can withstand to the harmful effect.		P
11.5	Access to control gear		N
	Doors in gangways for access to electrical operating areas: – are at least 0,7 m wide and 2,1 m high; – do open outwards; – have a means (for example panic bolts) to allow opening from the inside without the use of a key or tool.		N
	Enclosures which readily allow a person to fully enter are be provided with means to allow escape, e.g. panic bolts on the inside of doors.		N
	Enclosures intended for such access, for example for resetting, adjusting, maintenance, shall have a clear width of at least 0,7 m and a clear height of at least 2,1 m When equipment is likely to be live during access with > 1,0m and when on both side with > 1.5m.		N

12	**CONDUCTORS AND CABLES**		P
	IMPORTANT: The following requirements do not apply to the integral wiring of assemblies, subassemblies, and devices that are manufactured and Reviewed in accordance with their relevant IEC standard (for example IEC 60439-1).		—
12.2	In general, conductors are of copper. Where aluminium conductors are used, the cross-sectional area is at least 16 mm^2.		P

	The cross-sectional areas of conductors are according to Table 5 and its notes.		P
	All conductors that are often in movement (> one movement per hour of machine operation) have flexible stranding of class 5 or class 6.		P
	Where the insulation of conductors and cables (for example PVC) can constitute hazards due to the propagation of a fire or the emission of toxic or corrosive fumes adequate means are provided. Special attention is given to the integrity of a circuit having a safety-related function		P
	Minimum insulation Review voltages for used cables are: – ≥ 2 000 V a.c. for a duration of 5 min for operation at voltages higher than 50 V a.c. or 120 V d.c., or – ≥ 500 V a.c. for a duration of 5 min for PELV circuits (see IEC 60364-4-41, class III equipment).		P
	Insulation strong enough to withstand damage due to operation or during laying, especially for cables pulled into ducts.		P
12.4	Current-carrying capacity in normal service in accordance with table 6. Or in accordance with suppliers recommendation.		P
12.6	Flexible cables		P
12.6.1	All flexible cables have Class 5 or Class 6 conductors.		P
	Cables under severe duties are adequately protected against: - abrasion due to mechanical handling and dragging across rough surfaces; - kinking due to operation without guides; - stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums.		P
12.6.2	The tensile stress applied to copper conductors does not exceed 15 N/mm2 of cross-sectional area. Or special measures are taken to withstand the applied stress. For material other than copper the applied stress is within the cable manufacturer’s specification.		P
12.6.3	For cables installed on drums, the maximum current-carrying capacity in free air is derated in accordance with Table 7.		P
12.7	Conductor wires, conductor bars and slip-ring assemblies		P

12.7.1	During normal access to the machine, protection against direct contact to conductor wires, conductor bars and slip-ring assemblies is achieved by the application of one of the following protective measures: – protection by partial insulation of live parts, or where this is not practicable; – protection by enclosures or barriers of at least IP2X.		P
	Horizontal top surfaces of barriers or enclosures that are readily accessible provide a degree of protection of at least IP4X.		P
	Where the required degree of protection is not achieved, protection by placing live parts out of reach in combination with emergency switching off in accordance with 9.2.5.4.3 is applied.		P
	Conductor wires and conductor bars are so placed / protected as to: – prevent contact with conductive items such as the cords of pull-cord switches, strain-relief devices and drive chains; – prevent damage from a swinging load.		P
12.7.2	Protective conductor circuit (PE) and the neutral conductor (N) each use a separate conductor wire, conductor bar or slip-ring.		P
	The continuity of the protective conductor circuit using sliding contacts is ensured by taking appropriate measures (for example, duplication of the current collector, continuity monitoring)		P
12.7.3	Protective conductor current collectors have a shape or construction so that they are not interchangeable with the other current collectors. Such current collectors shall be of the sliding contact type.		P
12.7.4	Removable current collectors (e.g. swivelingable) with disconnector function: The protective conductor circuit interrupts after and reconnects before any live conductor.		P
12.7.5	Clearances in air between conductors and adjacent systems are suitable at least a rated impulse voltage of an overvoltage category III in accordance with IEC 60664-1 (For example 4 kV for 230/400 V systems → clearances 3mm)		P
12.7.6	Creepage distances between conductors and adjacent systems are suitable suitable for operation in the intended environment, e.g. open air (IEC 60664-1), inside buildings, protected by enclosures. In abnormally dusty, moist or corrosive environments, the following creepage distance requirements apply: – unprotected conductor etc.: minimum creepage dist. of 60 mm – enclosed conductor etc.: minimum creepage distance of 30 mm		P

12.7.7	Conductor system divided into isolated sections: suitable design measures are employed to prevent the energization of adjacent sections by the current collectors themselves.		P
12.7.8	Construction of conductor wires etc.: - power circuits are grouped separately from those in control circuits. - do withstand the foreseeable mechanical forces and thermal effects of short-circuit current. - covers can not be opened without the use of a tool - all conductive parts of accompanying enclosures are connected to the protective bonding circuit - underground and underfloor conductor bar ducts have drainage facilities		P

13	**WIRING PRACTICES**		P
13.1	Connections and routing		P
13.1.1	All connections are secured against accidental loosening.		P
	The means of connection are suitable for the cross-sectional areas and nature of the conductors being terminated.		P
	No connection of two or more conductors to one terminal, unless the terminal is designed for it.		P
	No soldered connections to terminals unless they are suitable for it.		P
	Terminals on terminal blocks are plainly marked or labelled corresponding with the diagrams.		P
	Installations of flexible conduits and cables are such that liquids drain away from the fittings.		P
	Retaining means for conductor strand and shields provided (no soldering for that purpose)		P
	Indentification tags legible, permanent, and appropriate for the physical environment.		P
	Terminal blocks mounted and wired so that the internal and external wiring does not cross over the terminals (see IEC 60947-7-1).		P
13.1.2	Conductors and cables run from terminal to terminal without splices or joints. Connections using plug/socket combinations with suitable protection against accidental disconnection are not considered to be joints for the purpose of this subclause.		P
	Terminations of cables are adequately supported to prevent mechanical stresses at the terminations of the conductors.		P

	Protective conductor placed close to the associated live conductors in order to decrease the impedance of the loop.		P
13.1.3	Conductors for circuits that operate at different voltages are separated by suitable barriers, or are insulated for the highest voltage that occurs within the same duct.		P
13.1	Connections and routing		P
13.2.1	Each conductor is identifiable at each termination in accordance with the technical documentation.		P
13.2.2	The protective conductor has the bicolour combination GREEN-AND-YELLOW Where the protective conductor can be easily identified colour coding throughout its length is not necessary, but the ends or accessible locations are clearly identified by the graphical symbol or by the bicolour combination GREEN-AND-YELLOW.		P
13.2.3	Neutral conductors are identified by the colour LIGHT BLUE. That colour is not used for identifying any other conductor where confusion is possible.		P
	Bare conductors used as neutral conductors have at minimum a stripe in LIGHT BLUE 15 mm to 100 mm wide in each compartment or unit and at each accessible location.		P
	Identification by colour for other conductors: Colours GREEN or YELLOW are not used. (Details to colour coding see this norm Cl. 13.2.3)		P
13.3	Wiring inside enclosures		P
	Conductors inside enclosures are supported where necessary. Conductors and cables that do not run in ducts are adequately supported.		P
	Non-metallic supports are made with a flame-retardant insulating material (see IEC 60332 series)		P
	Connections to devices mounted on doors or to other movable parts are using flexible conductors in accordance with 12.2 and 12.6.		P
13.4	Wiring outside enclosures		P
13.4.2	Conductors and their connections external to the electrical equipment are placed in suitable ducts (see cl.13.5). Exceptions: - Cables with special suitable protection. - Position switches or proximity switches supplied with a dedicated cable which is sufficiently short.		P
13.4.3	Connection to moving elements of the machine		N
	Connections to moving elements of the machine are made of flexible cable in accordance with 12.2 and 12.6.		N

	Bending radius of the cable are of at least 10 times the diameter of the cable		N
	Cables close to moving parts, maintain a space of at least 25 mm between the moving parts and the cables or barriers are provided.		N
	Cable handling systems: Lateral cable angles do not exceeding 5°, at being wound on and off cable drums or approaching and leaving cable guidance devices. The bending radius is in accordance with table 8.		N
	Flexible conduit: - is not used for connections to rapidly or frequently moving parts, except when specifically designed for that purpose. - is supported when adjacent to moving parts		N
13.4.4	Interconnection of devices on the machine is made through adequate terminals.		P

13.4.5	Requirements to plug/socket combinations outside of enclosures: Exceptions: components connected to a bus system by a plug/socket combination a) Prevention for unintentional contact with live parts at any time. At least IPXXB. (PELV circuits are excepted from this requirement.) b) First make last break protective bonding contact if used in TN- or TT-systems. c) Sufficient load-breaking capacity, when intended to be disconnected under running conditions. When rated at ≥ 30 A interlocked with a switching device d) When rated at ≥ 16 A having a retaining means to prevent unintended or accidental disconnection. e) when unintended or accidental disconnection +can cause a hazardous situation, having a retaining means. f) Component remaining live after disconnection having at least IP2X or IPXXB, taking into account the required clearance and creepage distances.(PELV circuits are excepted from this requirement.) g) Metallic housings of plug/socket combinations being connected to the protective bonding circuit. (PELV circuits are excepted from this requirement.) h) Having retaining means to prevent unintended or accidental disconnection and being marked that they are not intended to be disconnected under load. i) Clearly identifiable if more then one plug / socket per device. It is recommended that mechanical coding being used. j) When used in control circuits fulfilling the applicable requirements of IEC 61984. Exception: see item k). k) No plug/socket combinations intended for household and similar general purposes used for control circuits. In plug/socket combinations in accordance with IEC 60309-1, only those contacts shall be used for control circuits which are intended for those purposes. Exception: The requirements of item k) do not apply to control functions using high frequency signals on the power supply.	No such construction	N
13.4.6	Protection of Plug / socket from the physical environment during transportation and storage.		P
13.5	Ducts, connection boxes and other boxes		P
	Provided with a degree of protection suitable for the application.		P
	No sharp edges, flash, burrs, rough surfaces, or threads with which the insulation of the conductors can come into contact.		P
	Where human passage is required, least 2 m above the working surface.		P
	Not used as connection for protective bonding circuit.		P

	Where cable trays are a.s.o. are only partially covered, the cables used are of a suitable type.		P
13.5.2	Filling the percentage of ducts adapted to the straightness and length of the duct and the flexibility of the conductors.		P
13.5.3	Rigid metal conduit and fittings shall galvanized steel or of a corrosion-resistant material		P
	Fittings compatible with the conduit.		P
	Conduit bends properly made		P
13.5.4	Flexible metal tubing or woven wire armour suitable for the expected physical environment.		P
13.5.5	Flexible non-metallic conduit resistant to kinking and suitable for the expected physical environment.		P
13.5.6	Requirements to cable trunking systems: - Rigidly supported and clear of all moving or contaminating portions of the machine - Covers overlapping the sides and attached.		P
13.5.7	The compartments of machine used as cable trunking systems are isolated from coolant or oil reservoirs and are entirely enclosed, and the conductors are secured.		P
13.5.8	Connection boxes and other boxes used for wiring: - Are accessible for maintenance. - Provide protection against the ingress of solid bodies and liquids, taking into account the external influences under which the machine is intended to operate (see 11.3). - Do not have unused knockouts etc.		P
13.5.9	Motor connection boxes: Encloses only connections to the motor and motor-mounted devices (e.g brakes, temperature sensors)		P

14	**ELECTRIC MOTORS AND ASSOCIATED EQUIPMENT**		P
14.1	Electric motors are conform to the relevant parts of IEC 60034 series.		P
	There protection is conform to the requirements given in 7.2 for overcurrent protection, in 7.3 for overload protection, and in 7.6 for overspeed protection.		P
	Motor control equipment is located and mounted in accordance with Clause 11.		P
14.2	Minimal IP23 protection for all motors. More stringent requirements depending on the application and the physical environment.		P
14.4	Motors incorporated as an integral part of the machine are adequately protected from mechanical damage.		P
	motors and its associated parts (inclusively motor connection box) are easily accessible for inspection and maintenance etc		P

	Cooling is ensured and the temperature rise remains within the limits of the insulation class (see IEC 60034-1)		P
	No opening between the motor compartment and any other compartment that does not meet the motor compartment requirements.		P
14.5	The characteristics of motors and associated equipment are selected in accordance with the anticipated service and physical environmental conditions (see 4.4). Detailed criteria see 14.5 of this norm.		P
14.6	Overload and overcurrent protective devices for mechanical brake actuators initiate simultaneously the deenergization (release) of the associated motors.		P
15	**ACCESSORIES AND LIGHTING**		P
15.1	Requirements for socket-outlets for accessory equipment: – conform to IEC 60309-1 (Where that is not practicable, they are clearly marked with voltage and current ratings); –continuity of the protective bonding circuit to the socket-outlet is ensured, except where protected by PELV; – unearthed conductors connected to the socket-outlet are overcurrent- and if required overload-protected – protection is separately from other circuits; – power supply to the socket-outlet is not disconnected by the supply disconnecting device for the machine or the section of the machine, the requirements of 5.3.5 apply.		P
15.2.1	Requirements for local lighting of the machine and equipment: - protective bonding circuit in accordance with 8.2.2. - ON/OFF switch incorporated in the lamp-holder or in the flexible connecting cords. - Stroboscopic effects avoided. - Where fixed lighting electromagnetic compatibility is taken into account.		P

15.2.2	Requirements to the power supply for local lighting: – Nominal voltage not exceeding 250 V between conductors – isolating transformer connected to the load side of the supply with overcurrent protection in the secondary circuit; or – isolating transformer connected to the line side of the supply disconnecting device with overcurrent protection in the secondary circuit. That source is permitted for maintenance lighting circuits in control enclosures only; or – from a machine circuit with dedicated overcurrent protection; or – from an isolating transformer connected to the line side of the supply disconnecting device, provided with a dedicated primary disconnecting means and secondary overcurrent protection, and mounted within the control enclosure adjacent to the supply disconnecting device; or – from an externally supplied lighting circuit (for example factory lighting supply). This shall be permitted in control enclosures only, and for the machine work light(s) where their total power rating is not more than 3 kW. Exception: Where fixed lighting is out of reach of operators during normal operations, the provisions of this subclause do not apply.		P
15.2.3	All unearthed conductors of circuits supplying lighting have their own overcurrent protecting devices.		P
15.2.4	Requirements to the fittings for local lighting: – Adjustable lighting fittings are suitable for the physical environment. – lamp holders are in accordance with the relevant IEC standard; – lamp holders are constructed with an insulating material protecting the lamp cap – Reflectors are supported by a bracket and not by the lamp holder. Exception: where fixed lighting is out of reach of operators during normal operation, the provisions of this subclause do not apply.		P

16	**MARKING, WARNING SIGNS AND REFERENCE DESIGNATIONS**		
16.1	Warning signs, nameplates, markings, and identification plates are of sufficient durability to withstand the physical environment.		P

16.2.1	Enclosures that do not clearly show that they contain electrical equipment that has a risk of electric shock are marked with the graphical symbol  plainly visible on the enclosure door or cover. Exception: – enclosure equipped with a supply disconnecting device; – operator-machine interface or control station; – a single device with its own enclosure (for example position sensor).		P
16.2.2	Hazardous hot surfaces of the electrical equipment, are equipped with the graphical warning symbol 	No such construction	N
16.2.3	Control devices, visual indicators, and displays are clearly and durably marked to their functions.		P
16.2.4	Equipment (e.g. controlgear assemblies) is legibly and durably marked. A nameplate is attached to the enclosure adjacent to each incoming supply with: – name or trade mark of supplier; – certification mark, when required; – serial number, where applicable; – rated voltage, number of phases and frequency (if a.c.), – full-load current for each supply; – short-circuit rating of the equipment; – main document number (see IEC 62023).		P
16.2.5	All enclosures, assemblies, control devices, and components are plainly identified with the same reference designation as shown in the technical documentation.		P

17	**TECHNICAL DOCUMENTATION**		-
17.1	Documentation in agreed language provided.	Documentation in English	P

17.2	Information provided with the electrical equipment include: a) A main document (parts list or list of documents); b) Complementary documents including: 1) a clear, comprehensive description of the equipment, installation and mounting, and the connection to the electrical supply(ies); 2) electrical supply(ies) requirements; 3) information on the physical environment (for example lighting, vibration, noise levels, atmospheric contaminants) where appropriate; 4) overview (block) diagram(s) where appropriate; 5) circuit diagram(s); 6) information (as applicable) on: • programming, as necessary for use of the equipment; • sequence of operation(s); • frequency of inspection; • frequency and method of functional Reviewing; • guidance on the adjustment, maintenance, and repair, particularly of the protective devices and circuits; • recommended spare parts list; • list of tools supplied. 7) a description (including interconnection diagrams) of the safeguards, interlocking functions, and interlocking of guards against hazards, particularly for machines operating in a co-ordinated manner; 8) a description of the safeguarding and of the means provided where it is necessary to suspend the safeguarding (for example for setting or maintenance), (see 9.2.4); 9) instructions on the procedures for securing the machine for safe maintenance; (see also 17.8); 10) information on handling, transportation and storage; 11) information regarding load currents, peak starting currents and permitted voltage drops, as applicable; 12) information on the residual risks due to the protection measures adopted, indication of whether any particular training is required and specification of any necessary personal protective equipment.		P
17.3	Unless otherwise agreed between manufacturer and user: – the documentation is in accordance with relevant parts of IEC 61082; – reference designations are in accordance with relevant parts of IEC 61346; – instructions / manuals are in accordance with IEC 62079. – parts lists where provided are in accordance with IEC 62027, class B.		P

17.4	Installation documents giving all information necessary for the preliminary work of setting up the machine (including commissioning) are provided. (In complex cases, it may be necessary to refer to the assembly drawings for details.)		P
	The recommended position, type, and cross-sectional areas of the supply cables to be installed on are clearly indicated.		P
	Data necessary for choosing the type, characteristics, rated currents, and setting of the overcurrent protective device for the supply conductors to the electrical equipment of the machine is stated (see 7.2.2).		P
	The size, purpose, and location of any ducts in the foundation that are to be provided by the user are detailed (see Annex B).		P
	The size, type, and purpose of ducts, cable trays, or cable supports between the machine and the associated equipment that are to be provided by the user are detailed (see Annex B).		P
	A diagram indicates where space is required for the removal or servicing of the electrical equipment.		P
	An interconnection diagram or table is provided, where it is appropriate. They give full information about all external connections.		P
	Where the electrical equipment is intended to be operated from more than one source of electrical supply, the interconnection diagram or table does indicate the modifications or interconnections required for the use of each supply.		P
17.5	Where it is necessary to facilitate the understanding of the principles of operation, an overview diagram is provided.		P
17.6	The circuit diagram shows the electrical circuits on the machine and its associated electrical equipment.		P
	Any graphical symbol not shown in IEC 60617-DB:2001 are separately described on the diagrams or supporting documents.		P
	The symbols and identification of components and devices are consistent throughout all documents and on the machine.		P
	Switch symbols on the electromechanical diagrams are shown with all supplies turned off (for example electricity, air, water, lubricant) and with the machine and its electrical equipment ready for a normal start.		P
	Conductors are identified in accordance with 13.2.		P
	Characteristics relating to the function of the control devices and components which are not evident from their symbolic representation are included on the diagrams adjacent to the symbol or referenced to a footnote.		P

17.7	An operating manual detailing proper procedures for set-up and use of the electrical equipment is provided.		P
	Particular attention is given to the safety measures.		P
	Where the operation of the equipment can be programmed, detailed information on methods of programming, equipment required, program verification, and additional safety procedures (where required) is given.		P
17.8	A maintenance manual detailing proper procedures for adjustment, servicing and preventive inspection, and repair is provided. Recommendations on maintenance/service intervals and records are part of that manual. Where methods for the verification of proper operation are provided (for example software Reviewing programs), the use of those methods is detailed		P
17.9	The parts list, where provided, comprises, as a minimum, information necessary for ordering spare or replacement parts (for example components, devices, software, Review equipment, technical documentation) required for preventive or corrective maintenance including those that are recommended to be carried in stock by the user of the equipment.		P

18	**VERFICATION**		P
18.1	The extent of verification will be given in the dedicated product standard for a particular machine. Where there is no dedicated product standard for the machine, the verifications shall always include the items a), b) and f) and may include one or more of the items c) to e): a) verification that the electrical equipment complies with its technical documentation; b) in case of protection against indirect contact by automatic disconnection, conditions for protection by automatic disconnection shall be verified according to 18.2; c) insulation resistance Review (see 18.3); d) voltage Review (see 18.4); e) protection against residual voltage (see 18.5); f) functional Reviews (see 18.6).		—
18.2	Verification of conditions for protection by automatic disconnection of supply		
18.2.2	Review 1: Verification of the continuity of the protective bonding circuit		—
	The resistance of each protective bonding circuit between the PE terminal and relevant points that are part of each protective bonding circuit is measured with a current between at least 0,2 A. And the resistance measured is in the expected range according to the length, the cross sectional area and the material of the related protective bonding conductor.		P
	Review 2: Fault loop impedance verification and suitability of the associated overcurrent protective device.		P

	The connections of the power supply and of the incoming external protective conductor to the PE terminal of the machine are verified by inspection.		P
	The conditions for the protection by automatic disconnection of supply in accordance with 6.3.3 and Annex A a verified by both: 1) A verification of the fault loop impedance by - calculation, or - measurement in accordance with A.4, and		P
	2) A confirmation that the setting and characteristics of the associated overcurrent protective device are in accordance with the requirements of Annex A or table 10		P
18.3	Insulation resistance Reviews (facultative) The insulation resistance measured at 500 V d.c. between the power circuit conductors and the protective bonding circuit are not less than 1 MΩ.		P
18.4	Voltage Review (facultative) Reviewing voltage; twice the rated supply voltage of the equipment or 1 000 V whichever is the greater With Review voltage applied between the power circuit conductors and the protective bonding circuit for a period of approximately 1 s. there is no disruptive discharge occurred.		P
18.5	Protection against residual voltages (facultative) Compliance with 6.2.4. is ensured		P
18.6	Functional Reviews The function of circuits for electrical safety (for example earth fault detection) is insured.		P

1. Continuity of the protective bonding circuit

Review Points	Review Result(mΩ)	Review Current(A)	Voltage Drop(V)
PE-Control Panel	68	10	0.68
PE-Electrical Box	58	10	0.58
PE-Motor1	65	10	0.65
Transformer1	68	10	0.68

2. Insulation Resistance

Review Points	Review Result(MΩ)
PE-Power Inlet	230
PE-Motor1	250
Transformer1	220

3. Withstanding Voltage

Review Points	Breakdown
PE-Power Inlet	No
PE-Motor1	No
Transformer1	No

List of Review equipment used:
(Note: This is an example of the required attachment. Other forms with a different layout but containing similar information are also acceptable.)

Clause	ID of Review equipment	Measurement / Reviewing	Reviewing / measuring equipment / material used	Range used	Calibration due date
4.4	PT-2	Psychrometer-Thermograph	-10~50°C, 5％~98％R.H	10~50°C, 5％~98％ R.H	2020/09/20
4.3	JO-1	Oscilloscope	0~20KVac/ 0~16KVdc, 0 ~ 200MHz,0~200MS	0-500V	2020/09/20
7.4, 11.2.3	JT-4	Chart Recorder	0~1000°C	0-200°C	2020/09/20
17	TM-1	Tape-Measure	0~35 m	0-35m	2020/09/20
12.7.6	XS-1	Digital Caliper	0~200 mm	0-200mm	2020/09/20
18.4	DH-3	Withstanding Voltage Reviewer	0~5KV 0.3-100mA 50/60Hz	2000V ac	2020/09/20
8.2	DA-3	Leakage Current Meter	0-10mA, 0-150V / 0-500V	0-500V ac	2020/09/20
18.4	SW-2	Stop watch	0-99 h	0-99h	2020/09/20
18.3	INSU-01	Insulation resistance meter	0-500 M ohm	0-500 Mohm	2020/09/20
8.2	GRD-01	Earthening continuity meter	0-10 ohm	0-2 ohm	2020/09/20
7.4, 11.2.3	TH-1	Thermocouple	0-1000°C, type K	0-200°C	2020/09/20

- End of Main Report -

3.4 EN 60204-1:2018 Report

(ATTACHMENT TO TEST REPORT IEC 60204-1
European Group Differences and National Differences)

ATTACHMENT TO TEST REPORT IEC 60204-1 **EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES** SAFETY OF MACHINERY - ELECTRICAL EQUIPMENT OF MACHINES PART 1: GENERAL REQUIREMENTS	
Differences according to.....:	EN 60204-1:2018
Attachment Form No..... :	EU_GD_IEC60204_1A
Attachment Originator.....:	Electrosuisse
Master Attachment.....:	2009-11

	CENELEC COMMON MODIFICATIONS (EN)		
1.	Scope		—
	– are sewing machines, units, and systems; NOTE 7 For sewing machines, see EN 60204-31. – are hoisting machines. NOTE 8 For hoisting machines, see EN 60204-32.		—
3.	Terms and definitions		-
3.56	Uncontrolled stop NOTE This definition does not imply any particular state of other (for example, non-electrical) stopping devices, for example, mechanical or hydraulic brakes that are outside the scope of this standard.		-
4.2	Section of equipment		P
4.2.2	The electrical equipment of the machine shall satisfy the safety requirements identified by the risk assessment of the machine. Depending upon the machine, its intended use and its electrical equipment, the designer may select parts of the electrical equipment of the machine that are in compliance with EN 60439-1 and, as necessary, other relevant parts of the EN 60439 series (see also Annex F).		P
4.4	Physical environment and operating conditions		P
4.4.1	The electrical equipment shall be suitable for the physical environment and operating conditions of its intended use. The requirements of 4.4.2 to 4.4.8 cover the physical environment and operating conditions of the majority of machines covered by this part of EN 60204. When special conditions apply or the limits specified are exceeded, an agreement between user and supplier (see 4.1) is recommended (see Annex B).		P

4.4.3	Electrical equipment shall be capable of operating correctly in the intended ambient air temperature. The minimum requirement for all electrical equipment is correct operation between air temperatures of +5 °C and +40 °C. For very hot environments (for example hot climates, steel mills, paper mills) and for cold environments, additional measures are recommended (see Annex B).		P
4.4.7	When equipment is subject to radiation (for example microwave, ultraviolet, lasers, X-rays), additional measures shall be taken to avoid malfunctioning of the equipment and accelerated deterioration of the insulation. A special agreement is recommended between the supplier and the user (see Annex B).	No radiation subjected.	N
4.4.8	Undesirable effects of vibration, shock and bump (including those generated by the machine and its associated equipment and those created by the physical environment) shall be avoided by the selection of suitable equipment, by mounting it away from the machine, or by provision of anti-vibration mountings. A special agreement is recommended between the supplier and the user (see Annex B).		P
5.	Incoming supply conductor terminations and devices for disconnecting and switching off		P
5.1	Add: See 17.8 for the provision of instructions for maintenance.		—
5.4	NOTE 2 Further information on the location and actuation of devices such as those used for the prevention of unexpected start-up is provided in EN 60447. After the fifth paragraph, replace note 2 with: NOTE 3 The selection of a device should take into account, for example, information derived from the risk assessment, intended use and foreseeable misuse of the device. For example, the use of disconnectors, withdrawable fuse links		—
9.	Control circuits and control functions		P
9.2.6.3	Enabling control (see also 10.9) is a manually activated control function interlock that:		—
	a) when activated allows a machine operation to be initiated by a separate start control		N
	b) when de-activated – initiates a stop function in accordance with 9.2.5.3, and – prevents initiation of machine operation.		N

<table>
<tr><td></td><td>Enabling control shall be so arranged as to minimize the possibility of defeating, for example by requiring the de-activation of the enabling control device before machine operation may be reinitiated. It should not be possible to defeat the enabling function by simple means.</td><td></td><td>N</td></tr>
<tr><td>9.2.7.3</td><td colspan="2">Stop:</td><td>—</td></tr>
<tr><td></td><td>Cableless control stations shall include a separate and clearly identifiable means to initiate the stop function of the machine or of all the operations that can cause a hazardous situation. The actuating means to initiate this stop function shall not be marked or labelled as an emergency stop device (see10.7).</td><td></td><td>P</td></tr>
<tr><td>10.</td><td colspan="2">Operator interface and machine-mounted control devices</td><td>P</td></tr>
<tr><td></td><td colspan="2">Replace table 2 with

Table 2 – Colour coding for push-button actuators and their meanings
<table>
<tr><th>Colour</th><th>Meaning</th><th>Explanation</th><th>Examples of application</th></tr>
<tr><td>RED</td><td>Emergency</td><td>Actuate in the event of a hazardous situation or emergency</td><td>Emergency stop
Initiation of emergency function (see also 10.2.1)</td></tr>
<tr><td>YELLOW</td><td>Abnormal</td><td>Actuate in the event of an abnormal condition</td><td>Intervention to suppress abnormal condition
Intervention to restart an interrupted automatic cycle</td></tr>
<tr><td>BLUE</td><td>Mandatory</td><td>Actuate for a condition requiring mandatory action</td><td>Reset function</td></tr>
<tr><td>GREEN</td><td>Normal</td><td>Actuate to initiate normal conditions</td><td>(See 10.2.1)</td></tr>
<tr><td>WHITE</td><td rowspan="3">No specific meaning assigned</td><td rowspan="3">For general initiation of functions except for emergency stop</td><td>START/ON (preferred)
STOP/OFF</td></tr>
<tr><td>GREY</td><td>START/ON
STOP/OFF</td></tr>
<tr><td>BLACK</td><td>START/ON
STOP/OFF (preferred)</td></tr>
</table></td><td>P</td></tr>
<tr><td>12.</td><td colspan="2">Conductors and cables</td><td>P</td></tr>
<tr><td>12.7.8</td><td colspan="2">Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies</td><td>—</td></tr>
<tr><td></td><td>The protective bonding circuit shall include the covers or cover plates of metal enclosures or underfloor ducts. Where metal hinges form a part of the bonding circuit, their continuity shall be verified (see Clause 18).</td><td></td><td>P</td></tr>
<tr><td>17.</td><td colspan="2">Technical documentation</td><td>P</td></tr>
<tr><td>17.2</td><td>Information to be provided
3) information on the physical environment (for example lighting, vibration, atmospheric contaminants) where appropriate;</td><td></td><td>P</td></tr>
<tr><td>18.</td><td colspan="2">Verification</td><td>P</td></tr>
</table>

18.1	General (5th paragraph) For tests in accordance with 18.2 and 18.3, measuring equipment in accordance with the EN 61557 series is applicable. NOTE For other tests as required by this standard measuring equipment in accordance with relevant IEC or European Standards should be used.		P

ZA	**ANNEX ZA, Normative references to IEC standards (normative)**	P
	Normative references to international publications with their corresponding European publications The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.	—

ZZ	**ANNEX ZZ, Essential requirements EC directives (informative)**	**P**
	Coverage of Essential Requirements of EC Directives This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers only the following essential requirements out of those given in Annex I of the EC Directive 98/37/EC: – 1.1.2 – 1.2 – 1.5.1 – 1.5.4 – 1.6.3 (for isolation of electrical supplies of machinery) – 1.6.4 (for access to electrical equipment) – 1.7.0 – 1.7.1 – 1.7.2 (for residual risks of an electrical nature) – 1.7.4(c) Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned. WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.	—

-End of Attachment to Test Report IEC60204-1-

Annex： Technical Information

File No：MD-TCF-200507-24681-5

Applicant:

KEENON ROBOTICS CO., LTD.

Address of applicant:

11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA,

SHANGHAI, CHINA

CE

A.1 Declaration of conformity with signature
A.2 Safety pictures of the machine

Legal Person：_____

Product: DISINFECTION ROBOT
Model: M1, M2

Annex 1: Declaration of conformity with signature

EC DECLARATION OF CONFORMITY

THIS IS HEREBY DECLARED THAT FOLLOWING DESIGNATED PRODUCT COMPLIED WITH THE ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF MACHINE DIRECTIVE 2006/42/EC & LOW VOLTAGE DIRECTIVE 2014/35/EU & ELECTROMAGNETIC DIRECTIVE 2014/30/EU ON THE APPROXIMATION OF THE LAWS OF THE MEMBER STATES RELATING TO IT.

MANUFACTURER

KEENON ROBOTICS CO., LTD.

11TH FLOOR, BUILDING 56, NO. 1000, JINHAI RD., PUDONG NEW AREA, SHANGHAI, CHINA

PERSON AUTHORISED TO COMPILE THE TECHNICAL FILE:

DESCRIPTION OF MACHINERY

PRODUCT NAME: DISINFECTION ROBOT

MODEL TYPE: M1, M2

APPLICABLE STANDARDS

EN ISO 12100:2010, EN ISO 10218-1:2011, EN ISO 10218-2:2011,

EN 60204-1:2018, EN 61000-6-2:2016, EN 61000-6-4:2018

HIS DECLARATION APPLIES TO ALL SPECIMENS MANUFACTURED IDENTICAL TO THE MODEL SUBMITTED FOR TESTING / EVALUATION. ASSESSMENT OF COMPLIANCE OF THE PRODUCT WITH THE REQUIREMENTS RELATING TO SAFETY STANDARDS LISTED ABOVE WAS PERFORMED BY MANUFACTURER.

CE

SIGNED ON BEHALF OF

SIGNATURE:_____

TITLE: Person in Charge of Technical

PLACE: , China

DATE: 2020/05/12

Annex 2: Safety pictures of the machine

Photo documentation

Type of equipment, model: DISINFECTION ROBOT ,
M1, M2

Details of:

View:

[X] general

[ ] front

[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom

Details of:

View:

[X] general

[ ] front

[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom

- End of Photo Documentation -