

Technical Construction File (TCF)

File No. HLLM-200116

According to EC Machinery Directive (2006/42/EC)
Low Voltage Directive (2014/35/EU)

Related to the

High Speed Laminator Machine

Model: 1300mm×1250mm Model

Its variants and modifications

**1300mm×1250mm Model, 1400mm×1250mm Model, 1500mm×1250mm Model,
1600mm×1250mm Model**

Presented by

**Dongguang Henglong Machinery Manufacture Co., Ltd.
Xiaoxing Industrial Area, Dongguang County, Hebei Province, China**

Sign certificate acknowledgement

签发证书最终确认表



Name and address of the Applicant 申请商的名称和地址	Dongguang Henglong Machinery Manufacture CO., Ltd. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Name and address of the Manufacturer 工厂的名称和地址	Dongguang Henglong Machinery Manufacture CO., Ltd. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Product Name 产品名称	High Speed Laminator Machine
Trademark (If necessary) 商标 (如果需要)	/
Models (put it as annex if necessary) 型号 (如果必要可以做个附件)	1300mm×1250mm Model, 1400mm×1250mm Model, 1500mm×1250mm Model, 1600mm×1250mm Model
Directive and standard 申请的指令和标准	Machinery Directive(2006/42/EC): EN ISO 12100: 2010; Low Voltage Directive(2014/35/EU): EN 60204-1:2006/AC:2010
REMARK 其他需要说明资讯	

NOTE: We will issue the certificate referring the above information, please pay attention the necessary information must be correct and accurate.

注意：我们将参考以上的基本资讯签发证书，请注意以上的资讯必须是正确和准确的。

SHANGHAI GOM TESTING & TECHNICAL CO., LTD.

Signature

Lixi Long

Seal :



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Part I: Assessment of conformity

1.1. Essential health and safety requirements

1.1. Essential health and safety requirements



TEST REPORT

Essential health and safety requirements

Name and address of the testing laboratory	SHANGHAI GOM TESTING & TECHNICAL CO., LTD Tahui Road, Shihudang Town, Songjiang District, Shanghai, China
Name and address of the applicant	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Name and address of the manufacturer	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Name and address of the Factory (production sites)	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Product	HIGH SPEED LAMINATOR MACHINE
Trademark	
Model/type reference	1300mm×1250mm Model
Rating and principal Characteristics	Voltage 3P 380V, Power 10kw
Tested according to	Essential health and safety requirements
Test Result	PASS
Test report no.	HLLM-200116-001
Work carried out by	Manager
Work verified by	Jack Liu Manager
Date of issue	Jan 16, 2020



Signature

Jack Liu

Clause	Requirement - test	Verdict
1	Essential health and safety requirements	-
1.1	General remarks	-
1.1.1	Definitions	-
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 person at risk when these operations are carried out under the conditions foreseen but also taking into account any reasonably foreseeable misuse thereof.	Pass
	The aim of measures taken must be to eliminate any risk of accident throughout the foreseeable lifetime of the machinery, including the phases of transport, assembly, dismantling, disabling and scrapping.	Pass
b)	In selecting the most appropriate methods, the manufacturer or his authorised representative must apply the following principles, in the order given;	-
	-Eliminate or reduce risks as far as possible;	Pass
	- Take the necessary protection measure in relation to risks that can't be eliminated;	Pass
	- Inform users of the residual risks due to any particular raining is required and specify any need to provide personal protection equipment.	Pass
c)	When designing and constructing machinery, and when drafting the instructions, the manufacturer or his authorised representative must uses which could reasonably be expected.	Pass
	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.	Pass
d)	Machinery must be designed and constructed to take account of the constraints to which the operator is subject as a result of the necessary or foreseeable use of personal protective equipment.	Pass
e)	Machinery must be supplied with all the special equipment and accessories essential to enable it to be adjusted, maintained and used safely.	Pass
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	Pass
	In particular, where fluids are used, machinery must be designed and constructed for use without risks due to filling, use, recovery or draining.	Pass
1.1.4	Lighting	-

Clause	Requirement - test	Verdict
	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.	N/A
	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.	N/A
	Internal parts requiring frequent inspection, and adjustment and maintenance areas, must be provided with appropriate lighting.	N/A
1.1.5	Design of machinery to facilitate its handling	-
	Machinery or each component part thereof must:	-
	- Be capable of being handle and transported safely	Pass
	- be packaged or designed so that it can be stored safely and without damage	Pass
	During the transportation of the machine and/or its component parts, there must be no possibility of sudden movements or of hazards due to instability as long as the machinery and/or its component parts are handled in accordance with the instructions.	Pass
	Where the weight, size or shape of machinery or its various component parts prevents them from being moved by hand, the machinery or each components part must:	-
	- Either be fitted with attachments for lifting gear, or	Pass
	- Be designed so that it can be fitted with such attachments, or	Pass
	- Be shaped in such a way that standard lifting gear can easily be attached	Pass
	Where machinery or one of its component parts is to be moved by hand, it must:	-
	- Either be easily moveable, or	N/A
	- Be equipped for picking up and moving safety	N/A
	Special arrangement must be made for the handling of tools and/or machinery parts, even if light weight, which could be hazardous.	N/A
1.1.6	Ergonomics	
	Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator must be reduced to the minimum possible, taking into account ergonomic principles such as:	
	— allowing for the variability of the operator's physical dimensions, strength and stamina,	Pass
	— providing enough space for movements of the parts of the operator's body,	Pass
	— avoiding a machine-determined work rate,	Pass
	— avoiding monitoring that requires lengthy concentration,	Pass

Clause	Requirement - test	Verdict
	— adapting the man/machinery interface to the foreseeable characteristics of the operators.	Pass
1.1.7	Operating positions	
	The operating position must be designed and constructed in such a way as to avoid any risk due to exhaust gases and/or lack of oxygen.	Pass
	If the machinery is intended to be used in a hazardous environment presenting risks to the health and safety of the operator or if the machinery itself gives rise to a hazardous environment, adequate means must be provided to ensure that the operator has good working conditions and is protected against any foreseeable hazards.	Pass
	Where appropriate, the operating position must be fitted with an adequate cabin designed, constructed and/or equipped to fulfil the above requirements. The exit must allow rapid evacuation. Moreover, when applicable, an emergency exit must be provided in a direction which is different from the usual exit.	N/A
1.1.8	Seating	
	Where appropriate and where the working conditions so permit, work stations constituting an integral part of the machinery must be designed for the installation of seats.	N/A
	If the operator is intended to sit during operation and the operating position is an integral part of the machinery, the seat must be provided with the machinery.	N/A
	The operator's seat must enable him to maintain a stable position. Furthermore, the seat and its distance from the control devices must be capable of being adapted to the operator.	N/A
	If the machinery is subject to vibrations, the seat must be designed and constructed in such a way as to reduce the vibrations transmitted to the operator to the lowest level that is reasonably possible. The seat mountings must withstand all stresses to which they can be subjected. Where there is no floor beneath the feet of the operator, footrests covered with a slip-resistant material must be provided.	N/A
1.2	Controls systems	-
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
	Above all they must be designed and constructed:	-
	- They can withstand the rigors of normal use and external influences	Pass
	- A fault in the hardware or the software of the control system does not lead to hazardous situations	Pass
	- Errors in the control system logic don't lead to hazardous situations	Pass
	- reasonably foreseeable human error during operation does not	Pass

Clause	Requirement - test	Verdict
	lead to hazardous.	
	Particular attention must be given to the following points:	
	— the machinery must not start unexpectedly,	Pass
	— the parameters of the machinery must not change in an uncontrolled way, where such change may lead to hazardous situations	Pass
	— the machinery must not be prevented from stopping if the stop command has already been given,	Pass
	— no moving part of the machinery or piece held by the machinery must fall or be ejected,	Pass
	— automatic or manual stopping of the moving parts, whatever they may be, must be unimpeded,	Pass
	— the protective devices must remain fully effective or give a stop command,	Pass
	— the safety-related parts of the control system must apply in a coherent way to the whole of an assembly of machinery and/or partly completed machinery.	N/A
	For cable-less control, an automatic stop must be activated when correct control signals are not received, including loss of communication.	N/A
1.2.2	Control devices	-
	Control devices must be:	-
	- Clearly visible and identifiable, using pictograms where appropriate	Pass
	- Positioned for safe operation without hesitation or loss of time, and without ambiguity	Pass
	- Designed so that the movement of the control is consistent with its effect	Pass
	- Located outside the danger zones, except for certain controls where necessary, such as emergency stop, console for training of robots	Pass
	- Positioned so that their operation can't cause additional risk	Pass
	- Designed or protected so that the desired effect, where a risk is involved, can't occur without an intentional operation.	Pass
	- Made so as to withstand foreseeable strain, particular attention must be paid to emergency stop devices liable to be subjected to considerable strain	Pass
	Where a control is designed and constructed to perform several different actions, namely where there is no one-to-one correspondence, the action to be performed must be clearly displayed and subject to confirmation where necessary.	N/A
	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
	Machinery must be fitted with indicators as required for safe	Pass

Clause	Requirement - test	Verdict
	operation	
	The operator must be able to read them from the control position	Pass
	From each control position, the operator must be able to ensure that no one is in the danger zones, or the control system must be designed and constructed in such a way that starting is prevented while someone is in the danger zone.	Pass
	If neither of these possibilities is applicable, before the machinery starts, an acoustic and/or visual warning signal is given whenever the Machinery is about to start	Pass
	The exposed person must have the time and the means to take rapid action to prevent the machinery starting up	Pass
	If necessary, means must be provided to ensure that the machinery can be controlled only from control positions located in one or more predetermined zones or locations.	Pass
	Where there is more than one control position, the control system must be designed in such a way that the use of one of them precludes the use of the others, except for stop controls and emergency stops.	Pass
	When machinery has two or more operating positions, each position must be provided with all the required control devices without the operators hindering or putting each other into a hazardous situation.	Pass
1.2.3	Starting	-
	It must be possible to start machinery only by voluntary actuation of a control provided for the purpose	Pass
	The same requirement applies:	-
	- When restarting the machinery after stoppage, whatever the cause	Pass
	- When effecting a significant change in the operating conditions	Pass
	However, the restarting of the machinery or a change in operating conditions may be effected by voluntary actuation of a device other than the control device provided for the purpose, on condition that this does not lead to a hazardous situation.	Pass
	For machinery functioning in automatic mode, the starting of the machinery, restarting after a stoppage, or a change in operating conditions may be possible without intervention, provided this does not lead to a hazardous situation.	N/A
	Where machinery has several starting controls and the operators can therefore put each other in danger, additional devices must be fitted to rule out such risks	N/A
	If safety requires that starting and/or stopping must be performed in a specific sequence, there must be devices which ensure that these operations are performed in the correct order.	N/A
1.2.4	Stopping	-

Clause	Requirement - test	Verdict
1.2.4.1	Normal stopping	-
	Machinery must be fitted with a control whereby the machine can be brought safely to a complete stop.	Pass
	Each workstation must be fitted with a control to stop some or all of the functions of the machinery, depending on the type of hazard, so that the machinery is rendered safe.	Pass
	The machinery's stop control must have priority over the start controls.	Pass
	Once the machinery or its dangerous parts have stopped, the energy supply to the actuators concerned must be cut off	Pass
1.2.4.2	Operation stop	
	Where, for operational reasons, a stop control that does not cut off the energy supply to the actuators is required, the stop condition must be monitored and maintained.	Pass
1.2.4.3	Emergency stop	-
	Machinery must be fitted with one or more emergency stop devices to enable actual or impending danger to be averted	Pass
	The following exceptions apply:	-
	- Machinery in which an emergency stop device would not lessen the risk, either because it would not reduce the stopping time or because it would not enable the special measures required to deal with the risk to be taken	N/A
	- Portable hand-held machines and/or hand-guided machines	N/A
	The device must:	-
	- Have clearly identifiable, clearly visible and quickly accessible controls devices	Pass
	- Stop the dangerous process as quickly as possible, without creating additional hazards	Pass
	- Where necessary, trigger or permit the triggering of certain safeguard movements	Pass
	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	Pass
	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
	The emergency stop function must be available and operational at all times, regardless of the operating mode.	Pass
	Emergency stop devices must be a back-up to other safeguarding measures and not a substitute for them.	Pass
1.2.4.4	Assembly of machinery	-
	In the case of machinery or parts of machinery designed to work together, must so design and construct the machinery that	Pass

Clause	Requirement - test	Verdict
	the stop controls, including the emergency stop, can stop not only the machinery itself but also all related equipment, if its continued operation can be dangerous	
1.2.5	Selection of control or operating modes	-
	The control or operating mode selected must override all other control systems with the exception of the emergency stop.	Pass
	If machinery has been designed and built to allow for its use in several control or operating modes presenting different safety levels, it must be fitted with a mode selector which can be locked in each position	N/A
	Each position of the selector must be clearly identifiable and must correspond to a single operating or control mode.	N/A
	The selector may be replaced by another selection method which restricts the use of certain functions of the machinery to certain categories of operator	N/A
	If, for certain operations, the machinery must be able to operate with a guard displaced or removed and/or a protective device disabled, the control or operating mode selector must simultaneously:	-
	- Disable all other control or operating modes	N/A
	- Permit operation of hazardous functions only by control device requiring sustained action	N/A
	- Permit the operation of hazardous functions only in reduced risk conditions while preventing hazards from linked sequences	N/A
	- Prevent any operation of hazardous functions by voluntarily or involuntarily action on the machine's sensors	N/A
	If these four conditions cannot be fulfilled simultaneously, the control or operating mode selector must activate other protective measures designed and constructed to ensure a safe intervention zone.	N/A
	In addition, the operator must be able to control operation of the parts he is working on at the adjustment point.	N/A
1.2.6	Failure of the power supply	-
	The interruption, the re-establishment after an interruption or the fluctuation in whatever manner of the power supply to the machinery must not lead to dangerous situations.	Pass
	Particular attention must be given to the following points:	-
	- The machinery must not start unexpectedly	Pass
	- The parameters of the machinery must not change in an uncontrolled way when such change can lead to hazardous situations,	Pass
	- The machinery must not be prevented from stopping if the command has already been given	Pass
	- No moving part of the machinery or piece held by the	Pass

Clause	Requirement - test	Verdict
	machinery must fall or be ejected	
	- Automatic or manual stopping of the moving parts whatever they must be unimpeded	Pass
	- The protection devices must remain fully effective or give a stop command.	Pass
1.3	Protection against mechanical hazards	-
1.3.1	Risk of loss of stability	-
	Machinery and its components and fittings must be stable enough to avoid overturning, falling or uncontrolled movements during transportation, assembly, dismantling, scrapping, and any other action involving the machinery.	Pass
	If the shape of the machinery itself or its intended installation doesn't offer sufficient stability, appropriate means of anchorage must be incorporated and indicated in the instructions	Pass
1.3.2	Risk of break-up during operation	-
	The various parts of machinery and their linkages must be able to withstand the stress to which they are subject when used.	Pass
	The durability of the materials used must be adequate for the nature of the working environment foreseen by the manufacturer or his authorised representative, in particular as regards the phenomena of fatigue, aging, corrosion and abrasion	Pass
	The instructions must indicate the type and frequency of inspections and maintenance required for safety reasons. They must, where appropriate, indicate the parts subject to wear and the criteria for replacement	Pass
	Where a risk of rupture or disintegration remains despite the measures taken the moving parts must be mounted and positioned and/or guarded in such a way that any fragments will be contained, preventing hazardous situations.	Pass
	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 to ensure that no risk is posed by a rupture.	Pass
	Where the material to be processed is fed to the tool automatically, the following conditions must be fulfilled to avoid risks to the persons exposed:	-
	- When the work piece comes into contact with the tool the latter must have attained its normal working conditions	N/A
	- When the tool starts and/or stops(intentionally or accidentally), the feed movement and the tool movement must be coordinated	N/A
1.3.3	Risks due to falling or ejected objects	-
	Precautions must be taken to prevent risks from	Pass

Clause	Requirement - test	Verdict
	falling or ejected objects	
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
1.3.5	Risks related to combined machinery	-
	Where the machinery is intended to carry out several different operations with the manual removal of the piece between each operation, it must be designed and constructed in such a way as to enable each element to be used separately without the other elements constituting a risk for the exposed person	N/A
	For this purpose, it must be possible to start and stop separately and elements that are not protected	N/A
1.3.6	Risks relating to variations in operating conditions	-
	Where the machine performs operations under different conditions of use, it must be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably	Pass
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	Pass
	All necessary steps must be taken to prevent accidental blockage of moving parts involved in the work	Pass
	In cases where, despite the precautions taken, a blockage is likely to occur, the necessary specific protection devices or tools must, when appropriate, be provided to enable the equipment to be safe unblocked.	Pass
	The instructions and, where possible, a sign on the machinery shall identify these specific protective devices and how they are to be used.	Pass
1.3.8	Choice of protection against risks arising from moving parts	-
	Guards or protection devices designed to protect against the risks arising from moving parts must be selected on the basis of the type of risk.	Pass
	The following guidelines must be used to help make the choice	-
1.3.8.1	Moving transmission parts	-
	Guards designed to protect persons against the risks associated with moving transmission parts must be:	
	- Either fixed guards as referred to in section 1.4.1, or	Pass
	- interlocking movable guards as referred to in section 1.4.2.2.	N/A
1.3.8.2	Moving parts involved in the process	-

Clause	Requirement - test	Verdict
	Guards or protection devices designed to protect persons against the hazards generated by moving parts involved to the work must be:	-
	- either fixed guards as referred to in section 1.4.1, or	Pass
	- interlocking movable guards as referred to in section 1.4.2.2.	N/A
	- protective devices as referred to in section 1.4.3, or	N/A
	- a combination of the above.	N/A
	However, when certain moving parts directly involved in the process can't be made completely inaccessible during operation owing to operations requiring operator intervention, such parts must be fitted with:	N/A
	- Fixed guards or interlocking movable guards preventing access to those sections of the parts that are not used in the work, and	N/A
	- Adjustable guards as referred to in section 1.4.2.3 restricting access to those sections of the moving parts where access is necessary.	N/A
1.3.9	Risks of uncontrolled movements	
	When a part of the machinery has been stopped, any drift away from the stopping position, for whatever reason other than action on the control devices, must be prevented or must be such that it does not present a hazard.	N/A
1.4	Required characteristics of guards and protection devices	-
1.4.1	General requirement	-
	Guards and protection devices must:	-
	- Be of robust construction	Pass
	- be securely held in place	Pass
	- Not give rise to any additional risk	Pass
	- Not be easy to bypass or render non-operational	Pass
	- Be located at an adequate distance from the danger zone	Pass
	- Cause minimum obstruction to the view of the production process	Pass
	- 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	Pass
	In addition, guards must, where possible, protect against the ejection or falling of materials or objects and against emissions generated by the machinery.	Pass
1.4.2	Special requirements for guards	-
1.4.2.1	Fixed guards	-
	Fixed guards must be fixed by systems that can be opened or removed only with tools.	Pass

Clause	Requirement - test	Verdict
	Their fixing systems must remain attached to the guards or to the machinery when the guards are removed.	Pass
	Where possible, guards must be incapable of remaining in place without their fixings.	Pass
1.4.2.2	Interlocking movable guards	-
	Interlocking movable guards must:	-
	- As far as possible remain attached to the machinery when open	N/A
	- be designed and constructed in such a way that they can be adjusted only by means of an intentional action.	N/A
	Interlocking movable guards must be associated with an interlocking device that:	-
	- prevents the start of hazardous machinery functions until they are closed and	N/A
	- gives a stop command whenever they are no longer closed.	N/A
	Where it is possible for an operator to reach the danger zone before the risk due to the hazardous machinery functions has ceased, movable guards must be associated with a guard locking device in addition to an interlocking device that:	N/A
	- prevents the start of hazardous machinery functions until the guard is closed and locked, and	N/A
	- keeps the guard closed and locked until the risk of injury from the hazardous machinery functions has ceased.	N/A
	Interlocking movable guards must be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous machinery functions.	N/A
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:	-
	- Adjustable manually or automatically, depending on the type of work involved, and	N/A
	- Readily adjustable without the use of tools	N/A
1.4.3	Special requirements for protection devices	-
	Protection devices must be designed and incorporated into the control system in such a way that:	-
	- Moving parts can't start up while they are within the operator's reach	N/A
	- Person can't reach moving parts while the parts are moving, and	N/A
	- The absence or failure of one of their components prevents starting or stops the moving parts	N/A
	Protective devices must be adjustable only by means of an intentional action.	N/A
1.5	Protection against other hazards	-
1.5.1	Electricity supply	-

Clause	Requirement - test	Verdict
	Where machinery has an electricity supply it must be designed, constructed and equipped in such a way that all hazards of an electrical nature are or can be prevented	Pass
	The safety objectives set out in Directive 73/23/EEC shall apply to machinery. However, the obligations concerning conformity assessment and the placing on the market and/or putting into service of machinery with regard to electrical hazards are governed solely by this Directive.	Pass
1.5.2	Static electricity	
	Machinery must be designed and constructed to prevent or limit the build-up of potentially dangerous electrostatic charges and/or be fitted with a discharging system	Pass
1.5.3	Energy supply other than electricity	-
	Where machinery is powered by source of energy other than electricity, it must be so designed, constructed and equipped as to avoid all potential hazards associated with these types of energy	N/A
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 and construction of such parts or, failing this, by information given on the parts themselves and/or their housings. The same information must be given on moving parts and/or their housings where the direction of movement needs to be known in order to avoid a risk.	Pass
	Where necessary, the instructions must give further information on these risks.	Pass
	Where a faulty connection can be the source of risk, incorrect connections must be made impossible by design or, failing this, by information given on the elements to be connected and, where appropriate, on the means of connection.	Pass
1.5.5	Extreme temperatures	-
	Step must be taken to eliminate any risk of injury arising from contact with or proximity to machinery parts or materials at high or very low temperatures	N/A
	The necessary steps must also be taken to avoid or protect against the risk of hot or very cold material being ejected.	N/A
1.5.6	Fire	-
	Machinery must be designed and constructed in such a way to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dusts, vapors or other substances produced or used by the machinery	Pass
1.5.7	Explosion	-
	Machinery must be designed and constructed in such a way as to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dusts, vapors or other substances produced or	N/A

Clause	Requirement - test	Verdict
	used by the machinery	
	Machinery must comply, as far as the risk of explosion due to its use in a potentially explosive atmosphere is concerned, with the provisions of the specific Community Directives.	N/A
1.5.8	Noise	-
	Machinery must be so designed and constructed in such a way that risks resulting from the emission of airborne noise are reduced to the lowest level, taking accounting of technical progress and the availability of means of reducing noise, in particular at source	Pass
	The level of noise emission may be assessed with reference to comparative emission data for similar machinery.	Pass
1.5.9	Vibration	-
	Machinery must be so designed and constructed in such a way 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	Pass
	The level of vibration emission may be assessed with reference to comparative emission data for similar machinery.	
1.5.10	Radiation	-
	Undesirable radiation emissions from the machinery must be eliminated or be reduced to levels that do not have adverse effects on persons.	N/A
	Any functional ionising radiation emissions must be limited to the lowest level which is sufficient for the proper functioning of the machinery during setting, operation and cleaning. Where a risk exists, the necessary protective measures must be taken.	N/A
	Any functional non-ionising radiation emissions during setting, operation and cleaning must be limited to levels that do not have adverse effects on persons.	N/A
1.5.11	External radiation	-
	Machinery must be designed and constructed in such a way that external radiation does not interfere with its operation	N/A
1.5.12	Laser equipment	-
	Where laser equipment is used, the following provisions should be taken into account;	N/A
	- Laser equipment on machinery must be designed and constructed in such a way as to prevent any accidental radiation	N/A
	- Laser equipment on machinery must be protected in such a way that effective radiation, radiation produced by reflection or diffusion and secondary radiation don't damage health	N/A
	- Optical equipment for the observation or adjustment of laser equipment on machinery must be such that no health risk is created by the laser radiation.	N/A

Clause	Requirement - test	Verdict
1.5.13	Emission of hazardous materials and substances	-
	Machinery must be designed and constructed in such a way that risks of inhalation, ingestion, contact with the skin, eyes and mucous membranes and penetration through the skin of hazardous materials and substances which it produces can be avoided.	N/A
	Where a hazard cannot be eliminated, the machinery must be so equipped that hazardous materials and substances can be contained, evacuated, precipitated by water spraying, filtered or treated by another equally effective method.	N/A
	Where the process is not totally enclosed during normal operation of the machinery, the devices for containment and/or evacuation must be situated in such a way as to have the maximum effect.	N/A
1.5.14	Risk of being trapped in a machine	-
	Machinery must be so designed, constructed or fitted with a means of preventing a person from being enclosed within it or, if that is impossible, with a means of summoning help	N/A
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 in such a way as to prevent persons slipping, tripping or falling on or off these parts	N/A
	Where appropriate, these parts must be fitted with handholds that are fixed relative to the user and that enable them to maintain their stability.	N/A
1.5.16	Lightning	
	Machinery in need of protection against the effects of lightning while being used must be fitted with a system for conducting the resultant electrical charge to earth.	N/A
1.6	Maintenance	-
1.6.1	Machinery maintenance	-
	Adjustment and maintenance points must be located outside danger zones.	Pass
	It must be possible to carry out adjustment, maintenance, repair, cleaning and servicing operations while machinery is at a standstill.	Pass
	If one or more of the above conditions can't be satisfied for technical reasons, measures must be taken to ensure that these operations can be carried out safely(see section 1.2.5)	Pass
	In the case of automated machinery and, where necessary, other machinery, the manufacturer must take provision for a connecting device for mounting diagnostic fault-finding equipment	N/A
	Automated machine components which have to be changed frequently must be capable of being removed and replaced	Pass

Clause	Requirement - test	Verdict
	easily and in safety	
	Access to the components must enable these tasks to be carried out with the necessary technical means in accordance with a specified opening method.	Pass
1.6.2	Access to operating position and servicing points	-
	Machinery must be designed and constructed in such a way as to allow access in safety to all areas where intervention is necessary during operation, adjustment and maintenance of the machinery.	Pass
1.6.3	Isolation of energy sources	-
	Machinery must be fitted with means to isolate it from all energy sources.	Pass
	Such isolators must be clearly identified	Pass
	They must be capable of being locked if reconnection could endanger exposed persons	Pass
	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	Pass
	In the case of machinery capable of being plugged into an electricity supply, removal of the plug is sufficient, provided that the operator can check from any of the points to which he has access that the plug remains removed.	Pass
	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 persons	Pass
	As an exception to the requirements laid down in the previous paragraphs, certain circuits may remain connected to their energy source in order, for example, to hold parts, to protect information, to light interiors, etc. In this case, special steps must be taken to ensure operator safety	Pass
1.6.4	Operator intervention	-
	Machinery must be so designed, constructed and equipped that the need for operator intervention is limited	Pass
	If operator intervention can't be avoided, it must be possible to carry it out easily and in safety	Pass
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.	Pass
	If it is absolutely to avoid entering the machinery, the manufacturer must take steps during its construction to allow	N/A

Clause	Requirement - test	Verdict
	cleaning to take place safely.	
1.7	Indicators	-
1.7.1	Information and warnings on the machinery	
	Information and warnings on the machinery should preferably be provided in the form of readily understandable symbols or pictograms.	Pass
	Any written or verbal information and warnings must be expressed in an official Community language or languages, which may be determined in accordance with the Treaty by the Member State in which the machinery is placed on the market and/or put into service and may be accompanied, on request, by versions in any other official Community language or languages understood by the operators.	Pass
1.7.1.1	Information and information devices	-
	The information needed to control machinery must be unambiguous and easily understood	Pass
	It must not be excessive to the extent of overloading the operator	Pass
	Visual display units or any other interactive means of communication between the operator and the machine must be easily understood and easy to use.	Pass
1.7.1.2	Warning devices	-
	Where the health and safety of persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped to give an appropriate acoustic or light signal as a warning.	N/A
	Where machinery is equipped with warning devices, these must be unambiguous and easily perceived	N/A
	The operator must have facilities to check the operation of such warning devices at all times	N/A
	The requirements of the specific directives concerning colors and safety signals must be complied with	N/A
1.7.2	Warning of residual risks	-
	Where risks remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted, the necessary warnings, including warning devices, must be provided.	Pass
1.7.3	Marking of machinery	-
	All machinery must be marked legibly and indelibly with the following minimum particular:	-
	- The business name and full address of the manufacturer and, where applicable, his authorised representative,	Pass
	- Designation of the machinery	Pass
	- CE mark(see Annex III)	Pass
	- Designation of series or type	Pass

Clause	Requirement - test	Verdict
	- Serial number, if any	Pass
	- the year of construction, that is the year in which the manufacturing process is completed.	Pass
	It is prohibited to pre-date or post-date the machinery when affixing the CE marking.	Pass
	Furthermore, machinery designed and constructs for use in a potentially explosive atmosphere must be marked accordingly.	N/A
	Machinery must also bear full information relevant to its type and essential to its safe use. Such information is subject to requirement in section 1.7.1.	Pass
	Where a machine part must be handled during use with lifting equipment, its mass must be indicated legibly, indelibly and unambiguously	Pass
1.7.4	Instructions	-
	All machinery must be accompanied by instructions in the official Community language or languages of the Member State in which it is placed on the market and/or put into service.	Pass
	The instructions accompanying the machinery must be either 'Original instructions' or a 'Translation of the original instructions', in which case the translation must be accompanied by the original instructions.	Pass
	By way of exception, the maintenance instructions intended for use by specialised personnel mandated by the manufacturer or his authorised representative may be supplied in only one Community language which the specialised personnel understand.	Pass
	The instructions must be drafted in accordance with the principles set out below.	Pass
1.7.4.1	General principles for the drafting of instructions	
	(a) The instructions must be drafted in one or more official Community languages. The words 'Original instructions' must appear on the language version(s) verified by the manufacturer or his authorised representative.	Pass
	(b) Where no 'Original instructions' exist in the official language(s) of the country where the machinery is to be used, a translation into that/those language(s) must be provided by the manufacturer or his authorized representative or by the person bringing the machinery into the language area in question. The translations must bear the words 'Translation of the original instructions'.	N/A
	(c) The contents of the instructions must cover not only the intended use of the machinery but also take into account any reasonably foreseeable misuse thereof.	Pass
	(d) In the case of machinery intended for use by non-professional operators, the wording and layout of the instructions for use must take into account the level of general education and acumen that can reasonably be expected from such operators.	Pass

Clause	Requirement - test	Verdict
1.7.4.2	Contents of instructions	
	Each instruction manual must contain, where applicable, at least the following information:	
	(a) the business name and full address of the manufacturer and of his authorised representative;	Pass
	(b) the designation of the machinery as marked on the machinery itself, except for the serial number (see section 1.7.3);	Pass
	(c) the EC declaration of conformity, or a document setting out the contents of the EC declaration of conformity, showing the particulars of the machinery, not necessarily including the serial number and the signature;	Pass
	(d) a general description of the machinery;	Pass
	(e) the drawings, diagrams, descriptions and explanations necessary for the use, maintenance and repair of the machinery and for checking its correct functioning;	Pass
	(f) a description of the workstation(s) likely to be occupied by operators;	Pass
	(g) a description of the intended use of the machinery;	Pass
	(h) warnings concerning ways in which the machinery must not be used that experience has shown might occur;	Pass
	(i) assembly, installation and connection instructions, including drawings, diagrams and the means of attachment and the designation of the chassis or installation on which the machinery is to be mounted;	Pass
	(j) instructions relating to installation and assembly for reducing noise or vibration;	Pass
	(k) instructions for the putting into service and use of the machinery and, if necessary, instructions for the training of operators;	Pass
	(l) information about the residual risks that remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted;	Pass
	(m) instructions on the protective measures to be taken by the user, including, where appropriate, the personal protective equipment to be provided;	Pass
	(n) the essential characteristics of tools which may be fitted to the machinery;	Pass
	(o) the conditions in which the machinery meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdowns;	N/A
	(p) instructions with a view to ensuring that transport, handling and storage operations can be made safely, giving the mass of the machinery and of its various parts where these are regularly to be transported separately;	Pass
	(q) the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be	Pass

Clause	Requirement - test	Verdict
	safely unblocked;	
	(r) the description of the adjustment and maintenance operations that should be carried out by the user and the preventive maintenance measures that should be observed;	Pass
	(s) instructions designed to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;	Pass
	(t) the specifications of the spare parts to be used, when these affect the health and safety of operators;	Pass
	(u) the following information on airborne noise emissions:	
	— the A-weighted emission 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,	Pass
	— the peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 µPa),	N/A
	— the A-weighted sound power level emitted by the machinery, where the A-weighted emission sound pressure level at workstations exceeds 80 dB(A).	N/A
	These values must be either those actually measured for the machinery in question or those established on the basis of measurements taken for technically comparable machinery which is representative of the machinery to be produced.	N/A
	In the case of very large machinery, instead of the A-weighted sound power level, the A-weighted emission sound pressure levels at specified positions around the machinery may be indicated.	N/A
	Where the harmonised standards are not applied, sound levels must be measured using the most appropriate method for the machinery. Whenever sound emission values are indicated the uncertainties surrounding these values must be specified. The operating conditions of the machinery during measurement and the measuring methods used must be described.	N/A
	Where the workstation(s) are undefined or cannot be defined, A-weighted sound pressure levels must be measured at a distance of 1 metre from the surface of the machinery and at a height of 1,6 metres from the floor or access platform. The position and value of the maximum sound pressure must be indicated.	N/A
	Where specific Community Directives lay down other requirements for the measurement of sound pressure levels or sound power levels, those Directives must be applied and the corresponding provisions of this section shall not apply;	N/A
	(v) where machinery is likely to emit non-ionising radiation which may cause harm to persons, in particular persons with active or non-active implantable medical devices, information concerning the radiation emitted for the operator and exposed persons.	N/A
1.7.4.3	Sales literature	

Clause	Requirement - test	Verdict
	Sales literature describing the machinery must not contradict the instructions as regards health and safety aspects. Sales literature describing the performance characteristics of machinery must contain the same information on emissions as is contained in the instructions.	Pass

Part II: Test report

2.1 EN ISO 12100:2010 test report

2.2 EN 60204-1:2006/AC:2010 test report

2.1 EN ISO 12100:2010 test report



TEST REPORT

EN ISO 12100:2010

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

Name and address of the testing laboratory	SHANGHAI GOM TESTING & TECHNICAL CO., LTD Tahui Road, Shihudang Town, Songjiang District, Shanghai, China	
Name and address of the applicant	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China	
Name and address of the manufacturer	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China	
Name and address of the Factory (production sites)	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China	
Product	HIGH SPEED LAMINATOR MACHINE	
Trademark		
Model/type reference	1300mm×1250mm Model	
Rating and principal Characteristics	Voltage 3P 380V, Power 10kw	
Tested according to	EN ISO 12100:2010	
Test Result	PASS	
Test report no.	HLLM-200116-002	
Work carried out by	Manager	 Signature <i>Liu Xinlong</i>
	Jack Liu Manager	
Date of issue	Jan 16, 2020	



EN ISO 12100:2010 SAFETY OF MACHINERY
-Principles for design-risk assessment and risk reduction

TEST REPORT NO. HLLM-200116-002

Page 1 of 8

I. Introduction.

In general this risk assessment report for the **High Speed Laminator Machine**, model **1300mm×1250mm Model**, series and its variants made by **Dongguang Henglong Machinery Manufacture Co., Ltd.** was carried out in accordance with the requirements of Machinery Directive and the standards of EN ISO 12100:2010, in which an explicit risk level is evaluated with 4 factors described in next clause.

After the first assessment, some measures to eliminate the risks are given for the modification of machine or of relative documents with taking into account the explicit C-type EN standard or related B-type standard.

While taking appropriate provisions for the existing risks, the procedures and principles to eliminate the risk according to the most general B-type standard for any kind of machine, EN 12100:2010s, are followed, i.e.:

- First step: consider the possibility of eliminating risk at design stage.
- Second step: if impossible, protect the dangerous zone with appropriate design of safety guard or safety device.
- Third step: If above impossible, give warning signs to draw attention of operators about the residual risks.

In addition, some check list drawn from the explicit C-type EN standards, which are found suitable for or near the characteristic of this machine, are used to help developing the provisions for the elimination of the risks.

Finally the risk assessment was carried out again to ensure this machine and its relative documents are totally compliance with the Machinery Directive.

II. Risk assessment Methodology

This risk assessment report is based on the methods mentioned in the EN ISO 12100:2010 standards, and the 4 factors S-A-G-W have been used for evaluating the level of risks.

(a) S: Severity of harm

- S1: Slight injury(usually reversible, example: scratch, bruise. light wood requiring first aid etc.) nor more than two days incapable of performing the same task

- S2: Serious (usually irreversible, including fatality; examples: broken or torn out or crush limb, fracture, serious injury requiring stitches, major musculoskeletal trauma(MST) etc.) More than two days incapable of performing the same task

(b) F: Frequency and/or duration of exposure to hazard

- F1: Seldom to quite often and/or short duration of exposure

Twice or less per work shift or less than 15 min calculated exposure per work shift

- A2: Frequent to continuous or long duration of exposure

More than twice per work shift or more than 15 min calculated exposure per work shift

(c) O: Probability of occurrence of a hazardous event

- O1: Low(So unlikely that it can be assumed that occurrence may not be experienced) .Mature technology, proven and recognized in safety application, robustness

- O2:Medium(likely to occur sometime)

Technical failure observed in the last two years. Inappropriate human action by a well trained person aware of the risk and have more than six months on the work station.

- O3: High(Likely to occur frequently).Technical failure regularly observed(every six months or less). Inappropriate human action by an untrained person having less than six months on the work station.

(d) A: Possibilities of avoidance or reduction of harm

- A1: Possible under some conditions
 - If parts move at a speed less than 0.25m/s and the exposed work is familiar with the risk and with the indication of a hazardous situation or impending event; the worker also has to be capable of noticing the hazardous situation and being capable of reacting
 - depending on the particular conditions(temperature, noise, ergonomic, etc.)
- A2: Impossible

		Risk index calculation					
		O1		O2		O3	
		A1	A2	A1	A2	A1	A2
S1	F1	1				2	
	F2	1				2	
S2	F1	2		3		4	
	F2	3	4	5		6	

Solutions for the level of hazards

- 1 or 2:** Lowest risk which is acceptable, action A is ok
- 3 or 4:** Medium risk need action B
- 5 or 6:** Highest risk need action C

Solution definition

Action A: warning sign or indicator on the machine;

Action B: safety guard including but not limited to fixed guard and interlocking safety guard

Action C: Considering change of design and add both guard(for the machine and auxiliary equipment for the operator) and warning sign

No.	Sub-clause of EN 12100 : 2010	Hazards source	Original					After action					
			S	F	O	A	Index	S	F	O	A	Index	Action
4.3	6.2.4 c)	Loss of balance	----	----	----	----	----	----	----	----	----	----	N/A
4.4	6.2.8 c) 6.3.1	Permanent hear loss	----	----	----	----	----	----	----	----	----	----	N/A
4.5	6.3.2.1 b)	Stress	----	----	----	----	----	----	----	----	----	----	N/A
4.6	6.3.2.5.1	Tinnitus	----	----	----	----	----	----	----	----	----	----	N/A
4.7	6.3.3.2.1 6.3.4.2	Tiredness	----	----	----	----	----	----	----	----	----	----	N/A
4.8	6.4.3 6.4.5.1 b) and c)	Any other (for example, mechanical, electrical) as a consequence of an interference with speech communication or with acoustic signals.	<i>SI</i>	<i>F2</i>	<i>O2</i>	<i>AI</i>	<i>1</i>	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>AI</i>	<i>1</i>	<i>A</i>
Hazards generated by vibration													
5.1	6.2.2.2	Discomfort	----	----	----	----	----	----	----	----	----	----	N/A
5.2	6.2.3 c)	Low-back morbidity	----	----	----	----	----	----	----	----	----	----	N/A
5.3	6.2.8 c)	Neurological disorder	----	----	----	----	----	----	----	----	----	----	N/A
5.4	6.3.3.2.1 6.3.4.3	Osteo-articular disorder	----	----	----	----	----	----	----	----	----	----	N/A
5.5	6.4.5.1 c)	Trauma of the spine	----	----	----	----	----	----	----	----	----	----	N/A
5.6		Vascular disorder	----	----	----	----	----	----	----	----	----	----	N/A
Hazards generated by radiation													



EN ISO 12100:2010 SAFETY OF MACHINERY
-Principles for design-risk assessment and risk reduction

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No.	Sub-clause of EN 12100 : 2010	Hazards source	Original					After action					
			S	F	O	A	Index	S	F	O	A	Index	Action
8.2	6.2.7	Fatigue	----	----	----	----	----	----	----	----	----	----	N/A
8.3	6.2.8 6.2.11.8	Musculoskeletal disorder	----	----	----	----	----	----	----	----	----	----	N/A
8.4	6.3.2.1	Stress	----	----	----	----	----	----	----	----	----	----	N/A
8.5	6.3.3.2.1	Any other (e.g. mechanical, electrical) as a consequence of human error	----	----	----	----	----	----	----	----	----	----	N/A
Hazards associated with the environment in which the machine is used													
9.1		Light	----	----	----	----	----	----	----	----	----	----	N/A
9.2		Dust / fog	----	----	----	----	----	----	----	----	----	----	N/A
9.3		6.2.6	Water / moisture	----	----	----	----	----	----	----	----	----	N/A
9.4		6.2.11.11	Pollution	----	----	----	----	----	----	----	----	----	N/A
9.5		6.3.2.1 6.4.5.1 b)	Temperature	----	----	----	----	----	----	----	----	----	N/A
9.6		Snow / ice	----	----	----	----	----	----	----	----	----	----	N/A
9.7		Wind	----	----	----	----	----	----	----	----	----	----	N/A
9.8		Lack of oxygen	----	----	----	----	----	----	----	----	----	----	N/A

This list is not fully complete compared to the list presented in EN ISO 12100:2010. Especially those hazards connected to events such as lifting and the using of mobile equipments are excluded. (1. of 2. amendment of the Machinery directive)

Id. NO gives reference to the hazard listed in EN ISO 12100:2010. NOTE: "N/A" means that the hazard is negligible and not to assess.

2.2 EN 60204-1:2006/AC:2010 test report



TEST REPORT

EN 60204-1:2006/2010

EN 60204-1: 2006/2010 Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Name and address of the testing laboratory	SHANGHAI GOM TESTING & TECHNICAL CO., LTD Tahui Road, Shihudang Town, Songjiang District, Shanghai, China
Name and address of the applicant	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Name and address of the manufacturer	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Name and address of the Factory (production sites)	DONGGUANG HENGLONG MACHINERY MANUFACTURE CO., LTD. Xiaoxing Industrial Area, Dongguang County, Hebei Province, China
Product	HIGH SPEED LAMINATOR MACHINE
Trademark	
Model/type reference	1300mm×1250mm Model
Rating and principal Characteristics	Voltage 3P 380V, Power 10kw
Tested according to	EN 60204-1: 2006/2010
Test Result	PASS
Test report no.	HLLM-200116-003
Work carried out by	Manager
Work verified by	Jack Liu Manager
Date of issue	Jan 16, 2020



EN 60204-1:2006/AC:2010 Safety of machinery-Electrical equipment of machines-Part 1: General requirements

Test Report Content

This test report consists of:

*Main report

*Annex A

- Continuity of the protective bonding circuit
- Insulation resistance test
- Withstanding voltage test

General information:

The test results presented in this report relate only to the object tested and information given from applicant or manufacturer.

Test case verdicts:

Pass=Pass, Fail=Fail, N/A=Not applicable. Placed in the column marked“Verdict”.

This is a Computer generated Test Report.

×Information written in “Italic” or “Regular and bold” font style is a part of this “Test Report Form”.

CONTENT FOR ADDITIONAL INFORMATION

Clause	Requirement - test	Verdict
1	Scope	---
	This part of EN 60204 applies to the application of electrical and electronic equipment and systems to machines not portable by hand while working, including a group of machines working together in a coordinated manner but excluding higher level system aspects	Pass
	This part is applicable to the electrical equipment or parts of the electrical equipment that operate with nominal supply voltages not exceeding 1000V for alternating current and not exceeding 1500V for direct current, and with nominal frequencies not exceeding 200Hz	Pass
2	Normative references	---
3	Terms and Definitions	---
4	General requirements	---
4.1	General	---
	This part of IEC 60204 is intended to apply to electrical equipment used with a wide variety of machines and with a group of machines working together in a co-ordinated manner.	Pass
	The risks associated with the hazards relevant to the electrical equipment shall be assessed as part of the overall requirements for risk assessment of the machine. This will determine the adequate risk reduction and the necessary protective measures for persons who can be exposed to those hazards, while still maintaining an acceptable level of performance of the machine and its equipment.	Pass
	Hazardous situations can result from, but are not limited to, the following causes:	---
	– failures or faults in the electrical equipment resulting in the possibility of electric shock or electrical fire;	Pass
	– failures or faults in control circuits (or components and devices associated with those circuits) resulting in the malfunctioning of the machine;	Pass
	– disturbances or disruptions in power sources as well as failures or faults in the power circuits resulting in the malfunctioning of the machine;	Pass
	– loss of continuity of circuits that depend upon sliding or rolling contacts, resulting in a failure of a safety function;	Pass
	– electrical disturbances for example, electromagnetic, electrostatic either from outside the electrical equipment or internally generated, resulting in the malfunctioning of the machine;	Pass
	– release of stored energy (either electrical or mechanical) resulting in,	Pass

Clause	Requirement - test	Verdict
	for example, electric shock, unexpected movement that can cause injury;	
	surface temperatures that can cause injury.	N/A
	Safety measures are a combination of the measures incorporated at the design stage and those measures required to be implemented by the user.	Pass
	The design and development process shall identify hazards and the risks arising from them. Where the hazards cannot be removed and/or the risks cannot be sufficiently reduced by inherently safe design measures, protective measures (for example safeguarding,) shall be provided to reduce the risk. Additional means (for example, awareness means) shall be provided where further risk reduction is necessary. In addition, working procedures that reduce risk can be necessary.	Pass
	The use of the enquiry form as shown in Annex B of this part of IEC 60204 is recommended in order to facilitate an appropriate agreement between the user and the supplier(s) on basic conditions and additional user specifications related to the electrical equipment. Those additional specifications are to:	---
	– provide additional features that are dependent on the type of machine (or group of machines) and the application;	Pass
	– facilitate maintenance and repair; and	Pass
	– improve the reliability and ease of operation.	Pass
4.2	Selection of equipment	---
4.2.1	General	---
	Electrical components and devices shall:	---
	– be suitable for their intended use; and	Pass
	– conform to relevant IEC standards where such exist; and	Pass
	– be applied in accordance with the supplier’s instructions.	Pass
4.2.2	Electrical equipment in compliance with the EN 60439 series	---
	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).	Pass
4.3	Electrical supply	---
4.3.1	General	---
	The electrical equipment shall be designed to operate correctly with the	---

Clause	Requirement - test	Verdict
	conditions of the supply:	
	– as specified in 4.3.2 or 4.3.3, or	Pass
	– as otherwise specified by the user (see Annex B), or	N/A
	– as specified by the supplier in the case of a special source of supply such as an on-board generator.	N/A
4.3.2	AC supplies	---
	<p>Voltage Steady state voltage: 0,9 to 1,1 of nominal voltage.</p> <p>Frequency 0,99 to 1,01 of nominal frequency continuously; 0,98 to 1,02 short time.</p> <p>Harmonics Harmonic distortion not exceeding 10 % of the total r.m.s. voltage between live conductors for the sum of the 2nd through to the 5th harmonic. An additional 2 % of the total r.m.s. voltage between live conductors for the sum of the 6th through to the 30th harmonic is permissible.</p> <p>Voltage unbalance Neither the voltage of the negative sequence component nor the voltage of the zero sequence component in three-phase supplies exceeding 2 % of the positive sequence component.</p> <p>Voltage interruption Supply interrupted or at zero voltage for not more than 3 ms at any random time in the supply cycle with more than 1 s between successive interruptions.</p> <p>Voltage dips 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>	Pass
4.3.3	DC supplies	---
	<p>From batteries:</p> <p>Voltage 0,85 to 1,15 of nominal voltage; 0,7 to 1,2 of nominal voltage in the case of battery-operated vehicles.</p> <p>Voltage interruption Not exceeding 5 ms.</p>	N/A
	<p>From converting equipment:</p> <p>Voltage 0,9 to 1,1 of nominal voltage.</p> <p>Voltage interruption Not exceeding 20 ms with more than 1 s between successive interruptions.</p> <p>NOTE This is a variation to IEC Guide 106 to ensure proper operation of electronic equipment.</p> <p>Ripple (peak-to-peak) Not exceeding 0,15 of nominal voltage.</p>	Pass
4.3.4	Special supply systems	---
	For special supply systems such as on-board generators, the limits given in 4.3.2 and 4.3.3 may be exceeded provided that the equipment	N/A

Clause	Requirement - test	Verdict
	is designed to operate correctly with those conditions.	
4.4	Electromagnetic compatibility (EMC)	---
	The equipment shall not generate electromagnetic disturbances above levels that are appropriate for its intended operating environment. In addition, the equipment shall have a level of immunity to electromagnetic disturbances so that it can function in its intended environment.	Pass
	Measures to limit the generation of electromagnetic disturbances, i.e. conducted and radiated emissions include:	---
	– power supply filtering;	N/A
	– cable shielding;	Pass
	– enclosures designed to minimize RF radiation;	Pass
	– RF suppression techniques.	N/A
	Measures to enhance the immunity of the equipment against conducted and radiated RF disturbance include:	---
	– design of functional bonding system taking into account the following;	Pass
	- Connection of sensitive electrical circuits to the chassis. Such terminations should be marked or labelled with the symbol IEC 60417-5020 (DB:2002-10):	N/A
	- connection of the chassis to earth (PE) using a conductor with low RF impedance and as short as practicable;	N/A
	– connection of sensitive electrical equipment or circuits directly to the PE circuit or to a functional earthing conductor (FE) (see Figure 2), to minimize common mode disturbance. This latter terminal should be marked or labelled by the symbol IEC 60417-5018 (DB:2002-10):	Pass
	– separation of sensitive circuits from disturbance sources;	Pass
	– enclosures designed to minimize RF transmission;	Pass
	– EMC wiring practices:	N/A
	- using twisted conductors to reduce the effect of differential mode disturbances,	Pass
	- keeping sufficient distance between conductors emitting disturbances and conductors of sensitive circuits,	N/A
	- using cable orientation as close to 90° as possible when cables cross,	N/A
	- running the conductors as close as possible to the ground plane,	N/A
	- using electrostatic screens and/or electromagnetic shields with a low RF impedance termination.	N/A
4.4.3	Ambient air temperature	---

Clause	Requirement - test	Verdict
	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).	Pass
4.4.4	Humidity	---
	The electrical equipment shall be capable of operating correctly when the relative humidity does not exceed 50 % at a maximum temperature of +40 °C. Higher relative humidities are permitted at lower temperatures (for example 90 % at 20 °C).	Pass
	Harmful effects of occasional condensation shall be avoided by design of the equipment or, where necessary, by additional measures (for example built-in heaters, air conditioners, drain holes).	N/A
4.4.5	Altitude	---
	Electrical equipment shall be capable of operating correctly at altitudes up to 1 000 m above mean sea level.	Pass
4.4.6	Contaminants	---
	Electrical equipment shall be adequately protected against the ingress of solids and liquids (see 11.3).	Pass
	The electrical equipment shall be adequately protected against contaminants (for example dust, acids, corrosive gases, salts) that can be present in the physical environment in which the electrical equipment is to be installed (see Annex B).	Pass
4.4.7	Ionizing and non-ionizing radiation	---
	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).	N/A
4.4.8	Vibration, shock, and bump	---
	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).	Pass
4.5	Transportation and storage	---

Clause	Requirement - test	Verdict
	Electrical equipment shall be designed to withstand, or suitable precautions shall be taken to protect against, the effects of transportation and storage temperatures within a range of $-25\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$ and for short periods not exceeding 24 h at up to $+70\text{ }^{\circ}\text{C}$. Suitable means shall be provided to prevent damage from humidity, vibration, and shock. A special agreement can be necessary between the supplier and the user (see Annex B).	Pass
4.6	Provisions for handling	---
	Heavy and bulky electrical equipment that has to be removed from the machine for transport, or that is independent of the machine, shall be provided with suitable means for handling by cranes or similar equipment.	N/A
4.7	Installation	---
	Electrical equipment shall be installed in accordance with the electrical equipment supplier's instructions.	Pass
5	Incoming supply conductor terminations and devices for disconnecting and switching off	---
5.1	Incoming supply conductor terminations	---
	It is recommended that, where practicable, the electrical equipment of a machine is connected to a single incoming supply. Where another supply is necessary for certain parts of the equipment (for example, electronic equipment that operates at a different voltage), that supply should be derived, as far as is practicable, from devices (for example, transformers, converters) forming part of the electrical equipment of the machine. For large complex machinery 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 (see 5.3.1).	Pass
	Unless a plug is provided with the machine for the connection to the supply (see 5.3.2 e), it is recommended that the supply conductors are terminated at the supply disconnecting device.	Pass
	Where a neutral conductor is used it shall be clearly indicated in the technical documentation of the machine, such as in the installation diagram and in the circuit diagram, and a separate insulated terminal, labelled N in accordance with 16.1, shall be provided for the neutral conductor (see also Annex B).	Pass
	There shall be no connection between the neutral conductor and the protective bonding circuit inside the electrical equipment nor shall a	Pass

Clause	Requirement - test	Verdict
	combined PEN terminal be provided.	
	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.	N/A
	All terminals for the incoming supply connection shall be clearly identified in accordance with IEC 60445 and 16.1. For the identification of the external protective conductor terminal, see 5.2.	Pass
5.2	Terminal for connection to the external protective earthing system	---
	For each incoming supply, a terminal shall be provided in the vicinity of the associated phase conductor terminals for connection of the machine to the external protective earthing system or to the external protective conductor, depending upon the supply distribution system.	Pass
	The terminal shall be of such a size as to enable the connection of an external protective copper conductor with a cross-sectional area in accordance with Table 1.	Pass
	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).	N/A
	At each incoming supply point, the terminal for connection of the external protective earthing system or the external protective conductor shall be marked or labelled with the letters PE (see IEC 60445).	Pass
5.3	Supply disconnecting (isolating) device	---
5.3.1	General	---
	A supply disconnecting device shall be provided:	---
	– for each incoming source of supply to a machine(s);	Pass
	– for each on-board power supply.	N/A
	The supply disconnecting device shall disconnect (isolate) the electrical equipment of the machine from the supply when required (for example for work on the machine, including the electrical equipment).	Pass
	When two or more supply disconnecting devices are provided, protective interlocks for their correct operation shall also be provided in order to prevent a hazardous situation, including damage to the machine or to the work in progress.	N/A
5.3.2	Type	---
	The supply disconnecting device shall be one of the following types:	---
a)	switch-disconnector, with or without fuses, in accordance with IEC 60947-3, utilization category AC-23B or DC-23B;	N/A
b)	disconnecter, with or without fuses, in accordance with IEC 60947-3, that has an auxiliary contact that in all cases causes switching devices	N/A

Clause	Requirement - test	Verdict
	to break the load circuit before the opening of the main contacts of the disconnector;	
c)	a circuit-breaker suitable for isolation in accordance with IEC 60947-2;	Pass
d)	any other switching device in accordance with an IEC product standard for that device and which meets the isolation requirements of IEC 60947-1 as well as a utilization category defined in the product standard as appropriate for on-load switching of motors or other inductive loads;	N/A
e)	a plug/socket combination for a flexible cable supply.	N/A
5.3.3	Requirement	---
	When the supply disconnecting device is one of the types specified in 5.3.2 a) to d) it shall fulfil all of the following requirements:	---
	– isolate the electrical equipment from the supply and have one OFF (isolated) and one ON position marked with "O" and "I" (symbols IEC 60417-5008 (DB:2002-10) and IEC 60417-5007 (DB:2002-10), see 10.2.2);	N/A
	– have a visible contact gap or a position indicator which cannot indicate OFF (isolated) until all contacts are actually open and the requirements for the isolating function have been satisfied;	N/A
	– have an external operating means (for example handle), (exception: power-operated switchgear need not be operable from outside the enclosure where there are other means to open it). Where the external operating means is not intended for emergency operations, it is recommended that it be coloured BLACK or GREY (see 10.7.4 and 10.8.4);	Pass
	– be provided with a means permitting it to be locked in the OFF (isolated) position (for example by padlocks). When so locked, remote as well as local closing shall be prevented;	N/A
	– disconnect all live conductors of its power supply circuit. However, for TN supply systems, the neutral conductor may or may not be disconnected except in countries where disconnection of the neutral conductor (when used) is compulsory;	N/A
	– have a breaking capacity sufficient to interrupt the current of the largest motor when stalled together with the sum of the normal running currents of all other motors and/o loads. The calculated breaking capacity may be reduced by the use of a proven diversity factor.	N/A
	When the supply disconnecting device is a plug/socket combination, it shall fulfil the following requirements:	---
	– have the switching capability, or be interlocked with a switching	N/A

Clause	Requirement - test	Verdict
	device that has a breaking capacity, sufficient to interrupt the current of the largest motor when stalled together with the sum of the normal running currents of all other motors and/or loads. The calculated breaking capacity may be reduced by the use of a proven diversity factor. When the interlocked switching device is electrically operated (for example a contactor) it shall have an appropriate utilisation category.	
	– a) to f) of 13.4.5.	N/A
	Where the supply disconnecting device is a plug/socket combination, a switching device with an appropriate utilisation category shall be provided for switching the machine on and off. This can be achieved by the use of the interlocked switching device described above.	N/A
5.3.4	Operating means	---
	The operating means (for example, a handle) of the supply disconnecting device shall be easily accessible and located between 0,6 m and 1,9 m above the servicing level. An upper limit of 1,7 m is recommended.	Pass
5.3.5	Excepted circuits	---
	The following circuits need not be disconnected by the supply disconnecting device:	---
	– lighting circuits for lighting needed during maintenance or repair;	N/A
	– plug and socket outlets for the exclusive connection of repair or maintenance tools and equipment (for example hand drills, test equipment);	N/A
	– undervoltage protection circuits that are only provided for automatic tripping in the event of supply failure;	N/A
	– circuits supplying equipment that should normally remain energized for correct operation (for example temperature controlled measuring devices, product (work in progress) heaters, program storage devices);	N/A
	– control circuits for interlocking.	N/A
	It is recommended, however, that such circuits be provided with their own disconnecting device.	N/A
	Where such a circuit is not disconnected by the supply disconnecting device:	---
	– permanent warning label(s) in accordance with 16.1 shall be appropriately placed in proximity to the supply disconnecting device;	N/A
	– a corresponding statement shall be included in the maintenance	N/A

Clause	Requirement - test	Verdict
	manual, and one or more of the following shall apply;	
	- a permanent warning label in accordance with 16.1 is affixed in proximity to each excepted circuit, or	N/A
	- the excepted circuit is separated from other circuits, or	N/A
	- the conductors are identified by colour taking into account the recommendation of 13.2.4.	Pass
5.4	Devices for switching off for prevention of unexpected start-up	---
	Devices for switching off for the prevention of unexpected start-up shall be provided (for example where, during maintenance, a start-up of the machine or part of the machine can create a hazard).	N/A
	Such devices shall be appropriate and convenient for the intended use, shall be suitably placed, and readily identifiable as to their function and purpose (for example by a durable marking in accordance with 16.1 where necessary).	N/A
	Means shall be provided to prevent inadvertent and/or mistaken closure of these devices either at the controller or from other locations (see also 5.6).	N/A
	The following devices that fulfil the isolation function may be provided for this purpose:	---
	– devices described in 5.3.2,	N/A
	– disconnectors, withdrawable fuse links and withdrawable links only if located in an enclosed electrical operating area (see 3.19).	N/A
	Devices that do not fulfil the isolation function (for example a contactor switched off by a control circuit) may only be provided where intended to be used for situations that include:	---
	– inspections;	N/A
	– adjustments;	N/A
	work on the electrical equipment where:	---
	- there is no hazard arising from electric shock (see Clause 6) and burn;	N/A
	- the switching off means remains effective throughout the work;	N/A
	- the work is of a minor nature (for example replacement of plug-in devices without disturbing existing wiring).	N/A
5.5	Devices for disconnecting electrical equipment	---
	Devices shall be provided for disconnecting (isolating) electrical equipment to enable work to be carried out when it is de-energised and isolated. Such devices shall be:	---
	– appropriate and convenient for the intended use;	Pass
	– suitably placed;	Pass

Clause	Requirement - test	Verdict
	– readily identifiable as to which part(s) or circuit(s) of the equipment is served (for example by durable marking in accordance with 16.1 where necessary).	Pass
	Means shall be provided to prevent inadvertent and/or mistaken closure of these devices either at the controller or from other locations (see also 5.6).	Pass
	The supply disconnecting device (see 5.3) may, in some cases, fulfil that function. However, where it is necessary to work on individual parts of the electrical equipment of a machine, or on one of a number of machines fed by a common conductor bar, conductor wire or inductive power supply system, a disconnecting device shall be provided for each part, or for each machine, requiring separate isolation.	Pass
	In addition to the supply disconnecting device, the following devices that fulfil the isolation function may be provided for this purpose:	---
	– devices described in 5.3.2;	N/A
	– 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)).	N/A
5.6	Protection against unauthorized, inadvertent and/or mistaken connection	---
	The devices described in 5.4 and 5.5 that are located outside an enclosed electrical operating area shall be equipped with means to secure them in the OFF position (disconnected state), (for example by provisions for padlocking, trapped key interlocking). When so secured, remote as well as local reconnection shall be prevented.	N/A
	Where a non-lockable disconnecting device (for example withdrawable fuse-links, withdrawable links) other means of protection against reconnection (for example warning labels in accordance with 16.1) may be provided.	N/A
	However, when a plug/socket combination according to 5.3.2 e) is so positioned that it can be kept under the immediate supervision of the person carrying out the work, means for securing in the disconnected state need not be provided.	N/A
6	Protection against electric shock	---
6.1	General	---
	The electrical equipment shall provide protection of persons against electric shock from:	---

Clause	Requirement - test	Verdict
	– direct contact (see 6.2 and 6.4);	Pass
	– indirect contact (see 6.3 and 6.4).	Pass
	The measures for this protection given in 6.2, 6.3, and, for PELV, in 6.4, are a recommended selection from IEC 60364-4-41. Where those recommended measures are not practicable, for example due to the physical or operational conditions, other measures from IEC 60364-4-41 may be used.	Pass
6.2	Protection against direct contact	---
6.2.1	General	---
	For each circuit or part of the electrical equipment, the measures of either 6.2.2 or 6.2.3 and, where applicable, 6.2.4 shall be applied.	Pass
	Exception: where those measures are not appropriate, other measures for protection against direct contact (for example by using barriers, by placing out of reach, using obstacles, using construction or installation techniques that prevent access) as defined in IEC 60364-4-41 may be applied (see 6.2.5 and 6.2.6).	N/A
	When the equipment is located in places open to all persons, which can include children, measures of either 6.2.2 with a minimum degree of protection against direct contact corresponding to IP4X or IPXXD (see IEC 60529), or 6.2.3 shall be applied.	N/A
6.2.2	Protection by enclosures	---
	Live parts shall be located inside enclosures that conform to the relevant requirements of Clauses 4, 11, and 14 and that provide protection against direct contact of at least IP2X or IPXXB (see IEC 60529).	Pass
	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.	Pass
	Opening an enclosure (i.e. opening doors, lids, covers, and the like) shall be possible only under one of the following conditions:	---
a)	The use of a key or tool is necessary for access. For enclosed electrical operating areas, see IEC 60364-4-41, or IEC 60439-1 as appropriate.	Pass
	All live parts, that are likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected, shall be protected against direct contact to at least IP2X or IPXXB. Other live parts on the inside of doors shall be protected against direct contact to at least IP1X or IPXXA.	Pass
b)	The disconnection of live parts inside the enclosure before the	N/A

Clause	Requirement - test	Verdict
	enclosure can be opened. This may be accomplished by interlocking the door with a disconnecting device (for example, the supply disconnecting device) so that the door can only be opened when the disconnecting device is open and so that the disconnecting device can only be closed when the door is closed.	
	Exception: a special device or tool as prescribed by the supplier can be used to defeat the interlock provided 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 (isolated) position or otherwise prevent unauthorised closure of the disconnecting device;	N/A
	– upon closing the door, the interlock is automatically restored;	N/A
	– 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 and other live parts on the inside of doors are protected against direct contact to at least IP1X or IPXXA;	N/A
	– relevant information is provided with the electrical equipment (see 17.2 b)9) and b)12)).	N/A
	Means shall be provided to restrict access to live parts behind doors not directly interlocked with the disconnecting means to skilled or instructed persons. (See 17.2 b)12)).	N/A
	All parts that are still live after switching off the disconnecting device(s) (see 5.3.5) shall be protected against direct contact to at least IP2X or IPXXB (see IEC 60529). Such parts shall be marked with a warning sign in accordance with 16.2.1 (see also 13.2.4 for identification of conductors by colour).	N/A
	Excepted from this requirement for 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;	N/A
	– the supply terminals of the supply disconnecting device when the latter is mounted alone in a separate enclosure.	N/A
c)	Opening without the use of a key or a tool and without disconnection of live parts shall be possible only when all live parts are protected against direct contact to at least IP2X or IPXXB (see IEC 60529). Where barriers provide this protection, either they shall require a tool for their removal or all live parts protected by them shall be	N/A

Clause	Requirement - test	Verdict
	automatically disconnected when the barrier is removed.	
6.2.3	Protection by insulation of live parts	---
	Live parts protected by insulation shall be completely covered with insulation that can only be removed by destruction. Such insulation shall be capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which it can be subjected under normal operating conditions.	Pass
6.2.4	Protection against residual voltages	---
	Live parts having a residual voltage greater than 60 V after the supply has been disconnected shall be discharged to 60 V or less within a time period of 5 s after disconnection of the supply voltage provided that this rate of discharge does not interfere with the proper functioning of the equipment. Exempted from this requirement are components having a stored charge of 60 μC or less. Where this specified rate of discharge would interfere with the proper functioning of the equipment, a durable warning notice drawing attention to the hazard and stating the delay required before the enclosure may be opened shall be displayed at an easily visible location on or immediately adjacent to the enclosure containing the capacitances.	Pass
	In the case of plugs or similar devices, the withdrawal of which results in the exposure of conductors (for example pins), the discharge time shall not exceed 1 s, otherwise such conductors shall be protected against direct contact to at least IP2X or IPXXB. If neither a discharge time of 1 s nor a protection of at least IP2X or IPXXB can be achieved (for example in the case of removable collectors on conductor wires, conductor bars, or slip-ring assemblies, see 12.7.4), additional switching devices or an appropriate warning device (for example a warning notice in accordance with 16.1) shall be applied.	N/A
6.2.5	Protection by barriers	---
	For protection by barriers, 412.2 of IEC 60364-4-41 shall apply.	N/A
6.2.6	Protection by placing out of reach or protection by obstacles	---
	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 shall apply.	N/A
	For conductor wire systems or conductor bar systems with a degree of protection less than IP2X, see 12.7.1.	N/A
6.3	Protection against indirect contact	---
6.3.1	General	---

Clause	Requirement - test	Verdict
	Protection against indirect contact (3.29) is intended to prevent hazardous situations due to an insulation fault between live parts and exposed conductive parts.	Pass
	For each circuit or part of the electrical equipment, at least one of the measures in accordance with 6.3.2 to 6.3.3 shall be applied:	---
	– measures to prevent the occurrence of a touch voltage (6.3.2); or	Pass
	– automatic disconnection of the supply before the time of contact with a touch voltage can become hazardous (6.3.3).	N/A
6.3.2	Prevention of the occurrence of a touch voltage	---
6.3.2.1	General	---
	Measures to prevent the occurrence of a touch voltage include the following:	---
	– provision of class II equipment or by equivalent insulation;	Pass
	– electrical separation.	N/A
6.3.2.2	Protection by provision of class II equipment or by equivalent insulation	---
	This measure is intended to prevent the occurrence of touch voltages on the accessible parts through a fault in the basic insulation.	Pass
	This protection is provided by one or more of the following:	---
	– class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation in accordance with IEC 61140);	Pass
	– switchgear and controlgear assemblies having total insulation in accordance with IEC 60439-1;	Pass
	– supplementary or reinforced insulation in accordance with 413.2 of IEC 60364-4-41.	N/A
6.3.2.3	Protection by electrical separation	---
	Electrical separation of an individual circuit is intended to prevent a touch voltage through contact with exposed conductive parts that can be energized by a fault in the basic insulation of the live parts of that circuit.	N/A
	For this type of protection, the requirements of 413.5 of IEC 60364-4-41 apply.	N/A
6.3.3	Protection by automatic disconnection of supply	---

Clause	Requirement - test	Verdict
	This measure consists of the interruption of one or more of the line conductors by the automatic operation of a protective device in case of a fault. This interruption shall occur within a sufficiently short time to limit the duration of a touch voltage to a time within which the touch voltage is not hazardous. Interruption times are given in Annex A.	N/A
	This measure necessitates co-ordination between:	---
	– the type of supply and earthing system;	N/A
	– the impedance values of the different elements of the protective bonding system;	N/A
	– the characteristics of the protective devices that detect insulation fault(s).	N/A
	Automatic disconnection of the supply of any circuit affected by an insulation fault is intended to prevent a hazardous situation resulting from a touch voltage.	N/A
	This protective measure comprises both:	---
	– protective bonding of exposed conductive parts (see 8.2.3),	N/A
	– and either:	---
	a) overcurrent protective devices for the automatic disconnection of the supply on detection of an insulation fault in TN systems, or	N/A
	b) residual current protective devices to initiate the automatic disconnection of the supply on detection of an insulation fault from a live part to exposed conductive parts or to earth in TT systems, or	N/A
	c) insulation monitoring or residual current protective devices to initiate automatic disconnection of IT systems. Except where a protective device is provided to interrupt the supply in the case of the first earth fault, an insulation monitoring device shall be provided to indicate the occurrence of a first fault from a live part to exposed conductive parts or to earth. This insulation monitoring device shall initiate an audible and/or visual signal which shall continue as long as the fault persists.	N/A
	Where automatic disconnection is provided in accordance with a), and disconnection within the time specified in Clause A.1 cannot be assured, supplementary bonding shall be provided as necessary to meet the requirements of Clause A.3.	N/A
6.4	Protection by the use of PELV	---
6.4.1	General requirements	---
	The use of PELV (Protective Extra-Low Voltage) is to protect persons against electric shock from indirect contact and limited area direct	Pass

Clause	Requirement - test	Verdict
	contact (see 8.2.5).	
	PELV circuits shall satisfy all of the following conditions:	---
a)	the nominal voltage shall not exceed:	---
	25 V a.c. r.m.s. or 60 V ripple-free d.c. when the equipment is normally used in dry locations and when large area contact of live parts with the human body is not expected; or	Pass
b)	one side of the circuit or one point of the source of the supply of that circuit shall be connected to the protective bonding circuit;	Pass
c)	live parts of PELV circuits shall be electrically separated from other live circuits. Electrical separation shall be not less than that required between the primary and secondary circuits of a safety isolating transformer (see IEC 61558-1 and IEC 61558-2-6);	Pass
d)	conductors of each PELV circuit shall be physically separated from those of any other circuit. When this requirement is impracticable, the insulation provisions of 13.1.3 shall apply;	Pass
e)	plugs and socket-outlets for a PELV circuit shall conform to the following:	---
	1) plugs shall not be able to enter socket-outlets of other voltage systems;	Pass
	2) socket-outlets shall not admit plugs of other voltage systems.	Pass
6.4.2	Sources for PELV	---
	The source for PELV shall be one of the following:	---
	– a safety isolating transformer in accordance with IEC 61558-1 and IEC 61558-2-6;	Pass
	– a source of current providing a degree of safety equivalent to that of the safety isolating transformer (for example a motor generator with winding providing equivalent isolation);	N/A
	– an electrochemical source (for example a battery) or another source independent of a higher voltage circuit (for example a diesel-driven generator);	N/A
	– an electronic power supply conforming to appropriate standards specifying measures to be –taken to ensure that, even in the case of an internal fault, the voltage at the outgoing terminals cannot exceed the values specified in 6.4.1.	N/A
7	Protection of equipment	---
7.1	General	---
	This Clause details the measures to be taken to protect equipment against the effects of:	---

Clause	Requirement - test	Verdict
	– overcurrent arising from a short circuit;	Pass
	– overload and/or loss of cooling of motors;	Pass
	– abnormal temperature;	Pass
	– loss of or reduction in the supply voltage;	N/A
	– overspeed of machines/machine elements;	N/A
	– earth fault/residual current;	Pass
	– incorrect phase sequence;	N/A
	– overvoltage due to lightning and switching surges.	N/A
7.2	Overcurrent protection	---
7.2.1	General	---
	Overcurrent protection shall be provided where the current in a machine circuit can exceed either the rating of any component or the current carrying capacity of the conductors, whichever is the lesser value. The ratings or settings to be selected are detailed in 7.2.10.	Pass
7.2.2	Supply conductors	---
	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).	Pass
	The supplier of the electrical equipment shall state on the installation diagram the data necessary for selecting the overcurrent protective device (see 7.2.10 and 17.4).	Pass
7.2.3	Power circuits	---
	Devices for detection and interruption of overcurrent, selected in accordance with 7.2.10, shall be applied to each live conductor.	Pass
	The following conductors, as applicable, shall not be disconnected without disconnecting all associated live conductors:	---
	– the neutral conductor of a.c. power circuits;	Pass
	– the earthed conductor of d.c. power circuits;	Pass
	– d.c. power conductors bonded to exposed conductive parts of mobile machines.	N/A
	Where the cross-sectional area of the neutral conductor is at least equal to or equivalent to that of the phase conductors, it is not necessary to provide overcurrent detection for the neutral conductor nor a disconnecting device for that conductor. For a neutral conductor with a cross-sectional area smaller than that of the associated phase conductors, the measures detailed in 524 of IEC 60364-5-52 shall apply.	Pass

Clause	Requirement - test	Verdict
	In IT systems, it is recommended that the neutral conductor is not used. However, where a neutral conductor is used, the measures detailed in 431.2.2 of IEC 60364-4-43 shall apply.	N/A
7.2.4	Control circuits	---
	Conductors of control circuits directly connected to the supply voltage and of circuits supplying control circuit transformers shall be protected against overcurrent in accordance with 7.2.3.	Pass
	Conductors of control circuits supplied by a control circuit transformer or d.c. supply shall be protected against overcurrent (see also 9.4.3.1):	Pass
	– in control circuits connected to the protective bonding circuit, by inserting an overcurrent protective device into the switched conductor;	Pass
	– in control circuits not connected to the protective bonding circuit;	Pass
	- where the same cross sectional area conductors are used in all control circuits, by inserting an overcurrent protective device into the switched conductor, and;	Pass
	- where different cross sectional areas conductors are used in different sub-circuits, by inserting an overcurrent protective device into both switched and common conductors of each sub-circuit.	N/A
7.2.5	Socket outlets and their associated conductors	---
	Overcurrent protection shall be provided for the circuits feeding the general purpose socket outlets intended primarily for supplying power to maintenance equipment. Overcurrent protective devices shall be provided in the unearthed live conductors of each circuit feeding such socket outlets.	Pass
7.2.6	Lighting circuits	---
	All unearthed conductors of circuits supplying lighting shall be protected against the effects of short circuits by the provision of overcurrent devices separate from those protecting other circuits.	Pass
7.2.7	Transformers	---
	Transformers shall be protected against overcurrent in accordance with the manufacturer's instructions. Such protection shall (see also 7.2.10):	---
	– avoid nuisance tripping due to transformer magnetizing inrush currents;	Pass
	– avoid a winding temperature rise in excess of the permitted value for the insulation class of transformer when it is subjected to the effects of a short circuit at its secondary terminals.	Pass
	The type and setting of the overcurrent protective device should be in accordance with the recommendations of the transformer supplier.	Pass

Clause	Requirement - test	Verdict
7.2.8	Location of overcurrent protective devices	---
	An overcurrent protective device shall be located at the point where a reduction in the cross sectional area of the conductors or another change reduces the current-carrying capacity of the conductors, except where all the following conditions are satisfied:	---
	– the current carrying capacity of the conductors is at least equal to that of the load;	Pass
	– the part of the conductor between the point of reduction of current-carrying capacity and the position of the overcurrent protective device is no longer than 3 m;	Pass
	– the conductor is installed in such a manner as to reduce the possibility of a short-circuit, for example, protected by an enclosure or duct.	Pass
7.2.9	Overcurrent protective devices	---
	The rated short-circuit breaking capacity shall be at least equal to the prospective fault current at the point of installation. Where the short-circuit current to an overcurrent protective device can include additional currents other than from the supply (for example from motors, from power factor correction capacitors), those currents shall be taken into consideration.	Pass
	A lower breaking capacity is permitted where another protective device (for example the overcurrent protective device for the supply conductors (see 7.2.2) having the necessary breaking capacity is installed on the supply side. 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).	Pass
	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.	Pass
7.2.10	Rating and setting of overcurrent protective devices	---
	The rated current of fuses or the setting current of other overcurrent protective devices shall be selected as low as possible but adequate for the anticipated overcurrents (for example during starting of motors or energizing of transformers). When selecting those protective devices, consideration shall be given to the protection of switching devices against damage due to overcurrents (for example welding of the	Pass

Clause	Requirement - test	Verdict
	switching device contacts).	
	The rated current or setting of an overcurrent protective device is determined by the current carrying capacity of the conductors to be protected in accordance with 12.4, D.2 and the maximum allowable interrupting time t in accordance with Clause D.3, taking into account the needs of co-ordination with other electrical devices in the protected circuit.	Pass
7.3	Protection of motors against overheating	---
7.3.1	General	---
	Protection of motors against overheating shall be provided for each motor rated at more than 0,5 kW.	Pass
	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.	N/A
	Protection of motors against overheating can be achieved by:	---
	– overload protection (7.3.2),	Pass
	– over-temperature protection (7.3.3), or	N/A
	– current-limiting protection (7.3.4).	Pass
	Automatic restarting of any motor after the operation of protection against overheating shall be prevented where this can cause a hazardous situation or damage to the machine or to the work in progress.	N/A
7.3.2	Overload protection	---
	Where overload protection is provided, detection of overload(s) shall be provided in each live conductor except for the neutral conductor. However, where the motor overload detection is not used for cable overload protection (see also Clause D.2), the number of overload detection devices may be reduced at the request of the user (see also Annex B). For motors having single-phase or d.c. power supplies, detection in only one unearthed live conductor is permitted.	Pass
	Where overload protection is achieved by switching off, the switching device shall switch off all live conductors. The switching of the neutral conductor is not necessary for overload protection.	Pass
	Where motors with special duty ratings are required to start or to brake frequently (for example, motors for rapid traverse, locking, rapid reversal, sensitive drilling) it can be difficult to provide overload protection with a time constant comparable with that of the winding to be protected. Appropriate protective devices designed to accommodate	Pass

Clause	Requirement - test	Verdict
	special duty motors or over-temperature protection (see 7.3.3) can be necessary.	
	For motors that cannot be overloaded (for example torque motors, motion drives that either are protected by mechanical overload protection devices or are adequately dimensioned), overload protection is not required.	Pass
7.3.3	Over-temperature protection	---
	The provision of motors with over-temperature protection (see IEC 60034-11) is recommended in situations where the cooling can be impaired (for example dusty environments). Depending upon the type of motor, protection under stalled rotor or loss of phase conditions is not always ensured by over-temperature protection, and additional protection should then be provided.	N/A
	Over-temperature protection is also recommended for motors that cannot be overloaded (for example torque motors, motion drives that are either protected by mechanical overload protection devices or are adequately dimensioned), where the possibility of over-temperature exists (for example due to reduced cooling).	N/A
7.3.4	Current limiting protection	---
	Where protection against the effects of overheating in three phase motors is achieved by current limitation, the number of current limitation devices may be reduced from 3 to 2 (see 7.3.2). For motors having single phase a.c or d.c. power supplies, current limitation in only one unearthed live conductor is permitted.	Pass
7.4	Abnormal temperature protection	---
	Resistance heating or other circuits that are capable of attaining or causing abnormal temperatures (for example, due to short-time rating or loss of cooling medium) and therefore can cause a hazardous situation shall be provided with suitable detection to initiate an appropriate control response.	Pass
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 shall be provided by, for example, switching off the machine at a predetermined voltage level.	N/A
	Where the operation of the machine can allow for an interruption or a reduction of the voltage for a short time period, delayed undervoltage	N/A

Clause	Requirement - test	Verdict
	protection may be provided. The operation of the undervoltage device shall not impair the operation of any stopping control of the machine.	
	Upon restoration of the voltage or upon switching on the incoming supply, automatic or unexpected restarting of the machine shall be prevented where such a restart can cause a hazardous situation.	N/A
	Where only a part of the machine or of the group of machines working together in a coordinated manner is affected by the voltage reduction or supply interruption, the undervoltage protection shall initiate appropriate control responses to ensure co-ordination.	N/A
7.6	Motor overspeed protection	---
	Overspeed protection shall be provided where overspeeding can occur and could possibly cause a hazardous situation taking into account measures in accordance with 9.3.2. Overspeed protection shall initiate appropriate control responses and shall prevent automatic restarting.	Pass
	The overspeed protection should operate in such a manner that the mechanical speed limit of the motor or its load is not exceeded.	Pass
7.7	Earth fault/residual current protection	---
	In addition to providing overcurrent protection for automatic disconnection as described in 6.3, earth fault/residual current protection can be provided to reduce damage to equipment due to earth fault currents less than the detection level of the overcurrent protection.	Pass
	The setting of the devices shall be as low as possible consistent with correct operation of the equipment.	Pass
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.	N/A
7.9	Protection against overvoltages due to lightning and to switching surges	---
	Protective devices can be provided to protect against the effects of overvoltages due to lightning or to switching surges.	N/A
	Where provided:	---
	– devices for the suppression of overvoltages due to lightning shall be connected to the incoming terminals of the supply disconnecting device.	N/A
	– devices for the suppression of overvoltages due to switching surges shall be connected across the terminals of all equipment requiring such protection.	N/A

Clause	Requirement - test	Verdict
8	Equipotential bonding	---
8.1	General	---
	This Clause provides requirements for both protective bonding and functional bonding. Figure 2 illustrates those concepts.	---
	Protective bonding is a basic provision for fault protection to enable protection of persons against electric shock from indirect contact (see 6.3.3 and 8.2).	Pass
	The objective of functional bonding (see 8.3) is to minimize:	---
	– the consequence of an insulation failure which could affect the operation of the machine;	N/A
	– the consequences of electrical disturbances to sensitive electrical equipment which could affect the operation of the machine.	N/A
	Normally functional bonding is achieved by connection to the protective bonding circuit, but where the level of electrical disturbances on the protective bonding circuit is not sufficiently low for proper functioning of electrical equipment, it may be necessary to connect the functional bonding circuit to a separate functional earthing conductor (see Figure 2).	Pass
8.2	Protective bonding circuit	---
8.2.1	General	---
	The protective bonding circuit consists of:	---
	– PE terminal(s) (see 5.2);	Pass
	– the protective conductors in the equipment of the machine including sliding contacts where they are part of the circuit;	Pass
	– the exposed conductive parts and conductive structural parts of the electrical equipment;	Pass
	– those extraneous conductive parts which form the structure of the machine.	Pass
	All parts of the protective bonding circuit shall be so designed that they are capable of withstanding the highest thermal and mechanical stresses that can be caused by earth-fault currents that could flow in that part of the protective bonding circuit.	Pass
	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 shall be provided. This supplementary bonding conductor shall have a cross-sectional area not less than half that of the corresponding protective conductor.	Pass

Clause	Requirement - test	Verdict
	If an IT distribution system is used, the machine structure shall be part of the protective bonding circuit and insulation monitoring shall be provided. See 6.3.3 c).	N/A
	Conductive structural parts of equipment in accordance with 6.3.2.2 need not be connected to the protective bonding circuit. Extraneous conductive parts which form the structure of the machine need not be connected to the protective bonding circuit where all the equipment provided is in accordance with 6.3.2.2.	Pass
	Exposed conductive parts of equipment in accordance with 6.3.2.3 shall not be connected to the protective bonding circuit.	N/A
8.2.2	Protective conductors	---
	Protective conductors shall be identified in accordance with 13.2.2.	Pass
	Copper conductors are preferred. Where a conductor material other than copper is used, its electrical resistance per unit length shall not exceed that of the allowable copper conductor and such conductors shall be not less than 16 mm ² in cross-sectional area.	Pass
	The cross-sectional area of protective conductors shall be determined in accordance with the requirements of:	---
	– 543 of IEC 60364-5-54; or	N/A
	– 7.4.3.1.7 of IEC 60439-1, as appropriate.	Pass
	This requirement is met in most cases where the relationship between the cross-sectional area of the phase conductors associated with that part of the equipment and the cross sectional area of the associated protective conductor is in accordance with Table 1 (see 5.2).	Pass
	See also 8.2.8.	N/A
8.2.3	Continuity of the protective bonding circuit	---
	All exposed conductive parts shall be connected to the protective bonding circuit in accordance with 8.2.1.	Pass
	Exception: see 8.2.5.	---
	Where a part is removed for any reason (for example routine maintenance), the protective bonding circuit for the remaining parts shall not be interrupted.	Pass
	Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and conductors of aluminium or aluminium alloys are used, particular consideration should be given to the possibility of electrolytic corrosion.	Pass
	Metal ducts of flexible or rigid construction and metallic cable sheaths	N/A

Clause	Requirement - test	Verdict
	shall not be used as protective conductors. Nevertheless, such metal ducts and the metal sheathing of all connecting cables (for example cable armouring, lead sheath) shall be connected to the protective bonding circuit.	
	Where the electrical equipment is mounted on lids, doors, or cover plates, continuity of the protective bonding circuit shall be ensured and a protective conductor (see 8.2.2) is recommended. Otherwise fastenings, hinges or sliding contacts designed to have a low resistance shall be used (see 18.2.2, Test 1).	Pass
	The continuity of the protective conductor in cables that are exposed to damage (for example flexible trailing cables) shall be ensured by appropriate measures (for example monitoring).	N/A
	For requirements for the continuity of the protective conductor using conductor wires, conductor bars and slip-ring assemblies, see 12.7.2.	Pass
8.2.4	Exclusion of switching devices from the protective bonding circuit	---
	The protective bonding circuit shall not incorporate a switching device or an overcurrent protective device (for example switch, fuse).	Pass
	No means of interruption of the protective bonding conductor shall be provided.	Pass
	Exception: links for test or measurement purposes that cannot be opened without the use of a tool and that are located in an enclosed electrical operating area.	N/A
	Where the continuity of the protective bonding circuit can be interrupted by means of removable current collectors or plug/socket combinations, the protective bonding circuit shall be interrupted by a first make last break contact. This also applies to removable or withdrawable plug-in units (see also 13.4.5).	N/A
8.2.5	Parts that need not be connected to the protective bonding circuit	---
	It is not necessary to connect exposed conductive parts to the protective bonding circuit where those parts are mounted so that they do not constitute a hazard because:	---
	– they cannot be touched on large surfaces or grasped with the hand and they are small in size (less than approximately 50 mm 50 mm); or	N/A
	– they are located so that either contact with live parts, or an insulation failure, is unlikely.	N/A
	This applies to small parts such as screws, rivets, and nameplates and to parts inside an enclosure, irrespective of their size (for example electromagnets of contactors or relays and mechanical parts of devices)	N/A

Clause	Requirement - test	Verdict
	(sees also 410.3.3.5 of IEC 60364-4-41).	
8.2.6	Protective conductor connecting points	---
	All protective conductors shall be terminated in accordance with 13.1.1. The protective conductor connecting points shall have no other function and are not intended, for example, to attach or connect appliances or parts.	Pass
	Each protective conductor connecting point shall be marked or labelled as such using the symbol IEC 60417-5019 (DB:2002-10):	Pass
	or with the letters PE , the graphical symbol being preferred, or by use of the bicolour combination GREEN-AND-YELLOW, or by any combination of these.	Pass
8.2.7	Mobile machines	---
	On mobile machines with on-board power supplies, the protective conductors, the conductive structural parts of the electrical equipment, and those extraneous conductive parts which form the structure of the machine shall all be connected to a protective bonding terminal to provide protection against electric shock. Where a mobile machine is also capable of being connected to an external incoming power supply, this protective bonding terminal shall be the connection point for the external protective conductor.	N/A
8.2.8	Additional protective bonding requirements for electrical equipment having earth leakage currents higher than 10 mA a.c. or d.c.	---
	Where electrical equipment has an earth leakage current (for example adjustable speed electrical power drive systems and information technology equipment) that is greater than 10 mA a.c. or d.c. in any incoming supply, one or more of the following conditions for the associated protective bonding circuit shall be satisfied:	N/A
a)	the protective conductor shall have a cross-sectional area of at least 10 mm ² Cu or 16 mm ² Al, through its total run;	N/A
b)	where the protective conductor has a cross-sectional area of less than 10 mm ² Cu or 16 mm ² Al, a second protective conductor of at least the same cross-sectional area shall be provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm ² Cu or 16 mm ² Al.	N/A
c)	automatic disconnection of the supply in case of loss of continuity of the protective conductor.	N/A
	To prevent difficulties associated with electromagnetic disturbances,	N/A

Clause	Requirement - test	Verdict
	the requirements of 4.4.2 also apply to the installation of duplicate protective conductors.	
	In addition, a warning label shall be provided adjacent to the PE terminal, and where necessary on the nameplate of the electrical equipment. The information provided under 17.2 b)1) shall include information about the leakage current and the minimum crosssectional area of the external protective conductor.	N/A
8.3	Functional bonding	---
	Protection against maloperation as a result of insulation failures can be achieved by connecting to a common conductor in accordance with 9.4.3.1.	N/A
	For recommendations regarding functional bonding to avoid maloperation due to electromagnetic disturbances, see 4.4.2.	N/A
8.4	Measures to limit the effects of high leakage current	---
	The effects of high leakage current can be restricted to the equipment having high leakage current by connection of that equipment to a dedicated supply transformer having separate windings. The protective bonding circuit shall be connected to exposed conductive parts of the equipment and, in addition, to the secondary winding of the transformer. The protective conductor(s) between the equipment and the secondary winding of the transformer shall comply with one or more of the arrangements described in 8.2.8.	Pass
9	Control circuits and control functions	---
9.1	Control circuits	---
9.1.1	Control circuit supply	---
	Where control circuits are supplied from an a.c. source, control transformers shall be used for supplying the control circuits. Such transformers shall have separate windings. Where several transformers are used, it is recommended that the windings of those transformers be connected in such a manner that the secondary voltages are in phase.	Pass
	Where d.c. control circuits derived from an a.c. supply are connected to the protective bonding circuit (see 8.2.1), they shall be supplied from a separate winding of the a.c. control circuit transformer or by another control circuit transformer.	Pass
	Transformers are not mandatory for machines with a single motor starter and/or a maximum of two control devices (for example interlock device, start/stop control station).	Pass
9.1.2	Control circuit voltages	---

Clause	Requirement - test	Verdict
	The nominal value of the control voltage shall be consistent with the correct operation of the control circuit. The nominal voltage shall not exceed 277 V when supplied from a transformer.	Pass
9.1.3	Protection	---
	Control circuits shall be provided with overcurrent protection in accordance with 7.2.4 and 7.2.10.	Pass
9.2	Control functions	---
	NOTE 1 Information on the safety-related aspects of control functions is given in ISO 13849-1 (1999), ISO 13849-2 (2003), and IEC 62061.	Pass
	NOTE 2 This subclause does not specify requirements for the equipment used to implement control functions. Examples of such requirements are given in Clause 10.	Pass
9.2.1	Start functions	---
	Start functions shall operate by energizing the relevant circuit (see 9.2.5.2).	Pass
9.2.2	Stop functions	---
	There are three categories of stop functions as follows:	---
	– stop category 0: stopping by immediate removal of power to the machine actuators (i.e. an uncontrolled stop – see 3.56);	Pass
	– stop category 1: a controlled stop (see 3.11) with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;	N/A
	– stop category 2: a controlled stop with power left available to the machine actuators.	Pass
9.2.3	Operating modes	---
	Each machine can have one or more operating modes determined by the type of machine and its application. When a hazardous situation can result from a mode selection, unauthorised and/or inadvertent selection shall be prevented by suitable means (for example key operated switch, access code).	Pass
	Mode selection by itself shall not initiate machine operation. A separate actuation of the start control shall be required.	N/A
	For each specific operating mode, the relevant safety functions and/or protective measures shall be implemented.	N/A
	Indication of the selected operating mode shall be provided (for example the position of a mode selector, the provision of an indicating light, a visual display indication).	N/A
9.2.4	Suspension of safety functions and/or protective measures	---

Clause	Requirement - test	Verdict
	Where it is necessary to suspend safety functions and/or protective measures (for example for setting or maintenance purposes), protection shall be ensured by:	
	– disabling all other operating (control) modes; and	N/A
	– other relevant means (see 4.11.9 of ISO 12100-2:2003), that can include, for example, one or more of the following:	---
	- initiation of operation by a hold-to-run device or by a similar control device;	N/A
	- a portable control station with an emergency stop device and, where appropriate, an enabling device. Where a portable control station is in use, initiation of motion shall only be possible from that control station;	N/A
	- a cableless control station with a device to initiate stop functions in accordance with 9.2.7.3 and, where appropriate, an enabling device. Where a cableless control station is in use, initiation of motion shall only be possible from that control station;	N/A
	- limitation of the speed or the power of motion;	N/A
	- limitation of the range of motion.	N/A
9.2.5	Operation	---
9.2.5.1	General	---
	The necessary safety functions and/or protective measures (for example interlocks (see 9.3)) shall be provided for safe operation.	Pass
	Measures shall be taken to prevent movement of the machine in an unintended or unexpected manner after any stopping of the machine (for example due to locked-off condition, power supply fault, battery replacement, lost signal condition with cableless control).	Pass
	Where a machine has more than one control station, measures shall be provided to ensure that initiation of commands from different control stations do not lead to a hazardous situation.	Pass
9.2.5.2	Start	---
	The start of an operation shall be possible only when all of the relevant safety functions and/or protective measures are in place and are operational except for conditions as described in 9.2.4.	Pass
	On those machines (for example mobile machines) where safety functions and/or protective measures cannot be applied for certain operations, manual control of such operations shall be by hold-to-run controls, together with enabling devices, as appropriate.	N/A
	Suitable interlocks shall be provided to secure correct sequential starting.	N/A

Clause	Requirement - test	Verdict
	In the case of machines requiring the use of more than one control station to initiate a start, each of these control stations shall have a separate manually actuated start control device. The conditions to initiate a start shall be:	---
	– all required conditions for machine operation shall be met, and	N/A
	– all start control devices shall be in the released (off) position, then	N/A
	– all start control devices shall be actuated concurrently (see 3.6).	N/A
9.2.5.3	Stop	---
	Stop category 0 and/or stop category 1 and/or stop category 2 stop functions shall be provided as indicated by the risk assessment and the functional requirements of the machine (see 4.1).	Pass
	Stop functions shall override related start functions (see 9.2.5.2).	Pass
	Where required, facilities to connect protective devices and interlocks shall be provided. 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 shall not initiate any hazardous situation.	N/A
	Where more than one control station is provided, stop commands from any control station shall be effective when required by the risk assessment of the machine.	N/A
9.2.5.4	Emergency operations (emergency stop, emergency switching off)	---
9.2.5.4.1	General	---
	This part of IEC 60204 specifies the requirements for the emergency stop and the emergency switching off functions of the emergency operations listed in Annex E, both of which are, in this part of IEC 60204, initiated by a single human action.	Pass
	Once active operation of an emergency stop (see 10.7) or emergency switching off (see 10.8) actuator has ceased following a command, the effect of this command shall be sustained until it is reset. This reset shall be possible only by a manual action at that location where the command has been initiated. The reset of the command shall not restart the machinery but only permit restarting.	Pass
	It shall not be possible to restart the machinery until all emergency stop commands have been reset. It shall not be possible to reenergize the machinery until all emergency switching off commands have been reset.	Pass
	NOTE: Emergency stop and emergency switching off are complementary protective measures that are not primary	Pass

Clause	Requirement - test	Verdict
	means of risk reduction for hazards (for example trapping, entanglement, electric shock or burn) at a machine (see ISO 12100 (all parts)).	
9.2.5.4.2	Emergency stop	---
	Principles for the design of emergency stop equipment, including functional aspects, are given in ISO 13850.	Pass
	The emergency stop shall function either as a stop category 0 or as a stop category 1 (see 9.2.2). The choice of the stop category of the emergency stop depends on the results of a risk assessment of the machine.	Pass
	In addition to the requirements for stop (see 9.2.5.3), the emergency stop function has the following requirements:	---
	– it shall override all other functions and operations in all modes;	Pass
	– power to the machine actuators that can cause a hazardous situation(s) shall be either removed immediately (stop category 0) or shall be controlled in such a way to stop the hazardous motion as quickly as possible (stop category 1) without creating other hazards;	Pass
	– reset shall not initiate a restart.	Pass
9.2.5.4.3	Emergency switching off	---
	The functional aspects of emergency switching off are given in 536.4 of IEC 60364-5-53.	N/A
	Emergency switching off should be provided where:	---
	– protection against direct contact (for example with conductor wires, conductor bars, slipring assemblies, controlgear in electrical operating areas) is achieved only by placing out of reach or by obstacles (see 6.2.6); or	N/A
	– there is the possibility of other hazards or damage caused by electricity.	N/A
	Emergency switching off is accomplished by switching off the relevant incoming supply by electromechanical switching devices, effecting a stop category 0 of machine actuators connected to this incoming supply. When a machine cannot tolerate this stop category 0 stop, it may be necessary to provide other measures, for example protection against direct contact, so that emergency switching off is not necessary.	N/A
9.2.5.5	Monitoring of command actions	---
	Movement or action of a machine or part of a machine that can result in a hazardous situation shall be monitored by providing, for example, overtravel limiters, motor overspeed detection, mechanical overload	N/A

Clause	Requirement - test	Verdict
	detection or anti-collision devices.	
9.2.6	Other control functions	---
9.2.6.1	Hold-to-run controls	---
	Hold-to-run controls shall require continuous actuation of the control device(s) to achieve operation.	N/A
9.2.6.2	Two-hand control	---
	Three types of two-hand control are defined in ISO 13851, the selection of which is determined by the risk assessment. These shall have the following features:	N/A
Type I	this type requires:	---
	– the provision of two control devices and their concurrent actuation by both hands;	N/A
	– continuous concurrent actuation during the hazardous situation;	N/A
	– machine operation shall cease upon the release of either one or both of the control devices when hazardous situations are still present.	N/A
	A Type I two-hand control device is not considered to be suitable for the initiation of hazardous operation.	N/A
Type II	a type I control requiring the release of both control devices before machine operation can be reinitiated.	N/A
Type III	a type II control requiring concurrent actuation of the control devices as follows:	N/A
	– it shall be necessary to actuate the control devices within a certain time limit of each other, not exceeding 0,5 s;	N/A
	– where this time limit is exceeded, both control devices shall be released before machine operation can be initiated.	N/A
9.2.6.3	Enabling control	---
	Enabling control (see also 10.9) is a manually activated control function interlock that:	---
a)	when activated allows a machine operation to be initiated by a separate start control, and	N/A
b)	when de-activated	---
	– initiates a stop function in accordance with 9.2.5.3, and	N/A
	– prevents initiation of machine operation.	N/A
	Enabling control shall be so arranged as to minimize the possibility of defeating, for example by requiring the de-activation of the enabling control device before machine operation may be reinitiated. It should not be possible to defeat the enabling function by simple means.	N/A
9.2.6.4	Combined start and stop controls	---

Clause	Requirement - test	Verdict
	Push-buttons and similar control devices that, when operated, alternately initiate and stop motion shall only be provided for functions which cannot result in a hazardous situation.	N/A
9.2.7	Cableless control	---
9.2.7.1	General	---
	This subclause deals with the functional requirements of control systems employing cableless (for example radio, infra-red) techniques for transmitting commands and signals between a machine control system and operator control station(s).	N/A
	Means shall be provided to readily remove or disconnect the power supply of the operator control station (see also 9.2.7.3).	N/A
	Means (for example key operated switch, access code) shall be provided, as necessary, to prevent unauthorized use of the operator control station.	N/A
	Each operator control station shall carry an unambiguous indication of which machine(s) is (are) intended to be controlled by that operator control station.	N/A
9.2.7.2	Control limitation	---
	Measures shall be taken to ensure that control commands:	---
	– affect only the intended machine;	N/A
	– affect only the intended functions.	N/A
	Measures shall be taken to prevent the machine from responding to signals other than those from the intended operator control station(s).	N/A
	Where necessary, means shall be provided so that the machine can only be controlled from operator control stations in one or more predetermined zones or locations.	N/A
9.2.7.3	Stop	---
	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 (see 10.7).	N/A
	A machine which is equipped with cableless control shall have a means of automatically initiating the stopping of the machine and of preventing a potentially hazardous operation, in the following situations:	N/A
	– when a stop signal is received;	N/A
	– when a fault is detected in the cableless control system;	N/A

Clause	Requirement - test	Verdict
	– 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/A
9.2.7.4	Use of more than one operator control station	----
	Where a machine has more than one operator control station, including one or more cableless control stations, measures shall be provided to ensure that only one of the control stations can be enabled at a given time. An indication of which operator control station is in control of the machine shall be provided at suitable locations as determined by the risk assessment of the machine.	N/A
	Exception: a stop command from any one of the control stations shall be effective when required by the risk assessment of the machine.	N/A
9.2.7.5	Battery-powered operator control stations	---
	A variation in the battery voltage shall not cause a hazardous situation. If one or more potentially hazardous motions are controlled using a battery-powered cableless operator control station, a clear warning shall be given to the operator when a variation in battery voltage exceeds specified limits. Under those circumstances, the cableless operator control station shall remain functional long enough for the operator to put the machine into a nonhazardous situation.	N/A
9.3	Protective interlocks	---
9.3.1	Reclosing or resetting of an interlocking safeguard	---
	The reclosing or resetting of an interlocking safeguard shall not initiate hazardous machine operation.	N/A
9.3.2	Exceeding operating limits	---
	Where an operating limit (for example speed, pressure, position) can be exceeded leading to a hazardous situation, means shall be provided to detect when a predetermined limit(s) is exceeded and initiate an appropriate control action.	N/A
9.3.3	Operation of auxiliary functions	---
	The correct operation of auxiliary functions shall be checked by appropriate devices (for example pressure sensors).	N/A
	Where the non-operation of a motor or device for an auxiliary function (for example lubrication, supply of coolant, swarf removal) can cause a hazardous situation, or cause damage to the machine or to the work in progress, appropriate interlocking shall be provided.	N/A

Clause	Requirement - test	Verdict
9.3.4	Interlocks between different operations and for contrary motions	---
	All contactors, relays, and other control devices that control elements of the machine and that can cause a hazardous situation when actuated at the same time (for example those which initiate contrary motion), shall be interlocked against incorrect operation.	N/A
	Reversing contactors (for example those controlling the direction of rotation of a motor) shall be interlocked in such a way that in normal service no short circuit can occur when switching.	N/A
	Where, for safety or for continuous operation, certain functions on the machine are required to be interrelated, proper co-ordination shall be ensured by suitable interlocks. For a group of machines working together in a co-ordinated manner and having more than one controller, provision shall be made to co-ordinate the operations of the controllers as necessary.	N/A
	Where a failure of a mechanical brake actuator can result in the brake being applied when the associated machine actuator is energized and a hazardous situation can result, interlocks shall be provided to switch off the machine actuator.	N/A
9.3.5	Reverse current braking	---
	Where braking of a motor is accomplished by current reversal, measures shall be provided to prevent the motor starting in the opposite direction at the end of braking where that reversal can cause a hazardous situation or damage to the machine or to the work in progress. For this purpose, a device operating exclusively as a function of time is not permitted.	N/A
	Control circuits shall be so arranged that rotation of a motor shaft, for example manually, shall not result in a hazardous situation.	N/A
9.4	Control functions in the event of failure	---
9.4.1	General requirements	---
	Where failures or disturbances in the electrical equipment can cause a hazardous situation or damage to the machine or to the work in progress, appropriate measures shall be taken to minimize the probability of the occurrence of such failures or disturbances. The required measures and the extent to which they are implemented, either individually or in combination, depend on the level of risk associated with the respective application (see 4.1).	Pass
	The electrical control circuits shall have an appropriate level of safety performance that has been determined from the risk assessment at the	Pass

Clause	Requirement - test	Verdict
	machine. The requirements of IEC 62061 and/or ISO 13849-1:1999, ISO 13849-2:2003 shall apply.	
	Measures to reduce those risks include but are not limited to:	---
	– protective devices on the machine (for example interlocking guards, trip devices);	N/A
	– protective interlocking of the electrical circuit;	N/A
	– use of proven circuit techniques and components (see 9.4.2.1);	Pass
	– provision of partial or complete redundancy (see 9.4.2.2) or diversity	N/A
	– provision for functional tests (see 9.4.2.4).	N/A
	Where memory retention is achieved for example, by battery power, measures shall be taken to prevent hazardous situations arising from failure or removal of the battery.	N/A
	Means shall be provided to prevent unauthorized or inadvertent memory alteration by, for example, requiring the use of a key, access code or tool.	---
9.4.2	Measures to minimize risk in the event of failure	---
9.4.2.1	Use of proven circuit techniques and components	---
	These measures include but are not limited to:	---
	– bonding of control circuits to the protective bonding circuit for functional purposes (see 9.4.3.1 and Figure 2);	Pass
	– connection of control devices in accordance with 9.4.3.1;	Pass
	– stopping by de-energizing (see 9.2.2);	N/A
	– the switching of all control circuit conductors to the device being controlled (see 9.4.3.1);	Pass
	– switching devices having direct opening action (see IEC 60947-5-1);	N/A
	– circuit design to reduce the possibility of failures causing undesirable operations.	N/A
9.4.2.2	Provisions of partial or complete redundancy	---
	By providing partial or complete redundancy, it is possible to minimize the probability that one single failure in the electrical circuit can result in a hazardous situation. Redundancy can be effective in normal operation (on-line redundancy) or designed as special circuits that take over the protective function (off-line redundancy) only where the operating function fails.	Pass
	Where off-line redundancy which is not active during normal operation is provided, suitable measures shall be taken to ensure that those control circuits are available when required.	N/A
9.4.2.3	Provision of diversity	---

Clause	Requirement - test	Verdict
	The use of control circuits having different principles of operation, or using different types of components or devices can reduce the probability of hazards resulting from faults and/or failures. Examples include:	---
	– the combination of normally open and normally closed contacts operated by interlocking guards;	N/A
	– the use of different types of control circuit components in the circuit;	N/A
	– the combination of electromechanical and electronic equipment in redundant configurations.	N/A
	The combination of electrical and non-electrical systems (for example mechanical, hydraulic, pneumatic) may perform the redundant function and provide the diversity.	N/A
9.4.2.4	Provision for functional tests	---
	Functional tests may be carried out automatically by the control system, or manually by inspection or tests at start-up and at predetermined intervals, or a combination as appropriate (see also 17.2 and 18.6).	N/A
9.4.3	Protection against maloperation due to earth faults, voltage interruptions and loss of circuit continuity	---
9.4.3.1	Earth faults	---
	Earth faults on any control circuit shall not cause unintentional starting, potentially hazardous motions, or prevent stopping of the machine.	Pass
	Methods to meet these requirements include but are not limited to the following:	---
Method a)	Control circuits, fed by control transformers:	---
	1) In case of earthed control circuit supplies, the common conductor is connected to the protective bonding circuit at the point of supply. All contacts, solid state elements etc., which are intended to operate an electromagnetic or other device (for example, a relay, indicator light) are inserted between one side, the switched conductor of the control circuit supply and one terminal of the coil or device. The other terminal of the coil or device (preferably always having the same marking) is connected directly to the common conductor of the control circuit supply without any switching elements (see Figure 3).	Pass
	Exception: Contacts of protective devices may be connected between the common conductor and the coils, provided that:	N/A
	– the circuit is interrupted automatically in the event of an earth fault, or	N/A
	– the connection is very short (for example in the same enclosure) so	N/A

Clause	Requirement - test	Verdict
	that an earth fault is unlikely (for example overload relays).	
	2) Control circuits fed from a control transformer and not connected to the protective bonding circuit, having the same arrangement as shown in Figure 3 and provided with a device that interrupts the circuit automatically in the event of an earth fault (see also 7.2.4).	N/A
Method b)	Control circuits fed from a control transformer with a centre-tapped winding, this centre tap connected to the protective bonding circuit, arranged as shown in Figure 4 with the overcurrent protective device having switching elements in all control circuit supply conductors.	N/A
Method 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;	N/A
	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,	N/A
	Multi-pole control switches that switch all live conductors are used for START or STOP of those machine functions that can cause a hazardous situation or damage to the machine in the event of unintentional starting or failure to stop, or in the case of c) 2), a device shall be provided that interrupts the circuit automatically in the event of an earth fault.	N/A
9.4.3.2	Voltage interruptions	---
	The requirements detailed in 7.5 shall apply.	N/A
	Where the control system uses a memory device(s), proper functioning in the event of power failure shall be ensured (for example by using a non-volatile memory) to prevent any loss of memory that can result in a hazardous situation.	N/A
9.4.3.3	Loss of circuit continuity	---
	Where the loss of continuity of safety-related control circuits depending upon sliding contacts can result in a hazardous situation, appropriate measures shall be taken (for example by duplication of the sliding contacts).	N/A
10	Operator interface and machine-mounted control devices	---
10.1	General	---
10.1.1	General device requirements	---
	This Clause contains requirements for devices mounted outside or partially outside control enclosures.	Pass
	As far as is practicable, those devices shall be selected, mounted, and	Pass

Clause	Requirement - test	Verdict
	identified or coded in accordance with relevant parts of IEC 61310.	
	The possibility of inadvertent operation shall be minimized by, for example, positioning of devices, suitable design, and provision of additional protective measures. Particular consideration shall be given to the selection, arrangement, programming and use of operator input devices such as touchscreens, keypads and keyboards, for the control of hazardous machine operations. See IEC 60447.	Pass
10.1.2	Location and mounting	---
	As far as is practicable, machine-mounted control devices shall be:	---
	– readily accessible for service and maintenance;	Pass
	– mounted in such a manner as to minimize the possibility of damage from activities such as material handling.	Pass
	The actuators of hand-operated control devices shall be selected and installed so that:	---
	– they are not less than 0,6 m above the servicing level and are within easy reach of the normal working position of the operator;	Pass
	– the operator is not placed in a hazardous situation when operating them.	Pass
	The actuators of foot-operated control devices shall be selected and installed so that:	---
	– they are within easy reach of the normal working position of the operator;	N/A
	– the operator is not placed in a hazardous situation when operating them.	N/A
10.1.3	Protection	---
	The degree of protection (see IEC 60529) together with other appropriate measures shall afford protection against:	---
	– the effects of aggressive liquids, vapours, or gases found in the physical environment or used on the machine;	Pass
	– the ingress of contaminants (for example swarf, dust, particulate matter).	Pass
	In addition, the operator interface control devices shall have a minimum degree of protection against direct contact of IPXXD (see IEC 60529).	Pass
10.1.4	Position sensors	---
	Position sensors (for example position switches, proximity switches) shall be so arranged that they will not be damaged in the event of overtravel.	N/A
	Position sensors in circuits with safety-related control functions shall	N/A

Clause	Requirement - test	Verdict
	have direct opening action (see IEC 60947-5-1) or shall provide similar reliability (see 9.4.2).	
10.1.5	Portable and pendant control stations	---
	Portable and pendant operator control stations and their control devices shall be so selected and arranged as to minimize the possibility of inadvertent machine operations caused by shocks and vibrations (for example if the operator control station is dropped or strikes an obstruction) (see also 4.4.8).	N/A
10.2	Push-buttons	---
10.2.1	Colours	---
	Push-button actuators shall be colour-coded in accordance with Table 2 (see also 9.2 and Annex B).	Pass
	The colours for START/ON actuators should be WHITE, GREY, BLACK or GREEN with a preference for WHITE. RED shall not be used.	Pass
	The colour RED shall be used for emergency stop and emergency switching off actuators.	Pass
	The colours for STOP/OFF actuators should be BLACK, GREY, or WHITE with a preference for BLACK. GREEN shall not be used. RED is permitted, but it is recommended that RED is not used near an emergency operation device.	Pass
	WHITE, GREY, or BLACK are the preferred colours for push-button actuators that alternately act as START/ON and STOP/OFF push-buttons. The colours RED, YELLOW, or GREEN shall not be used (see also 9.2.6).	N/A
	WHITE, GREY, or BLACK are the preferred colours for push-button actuators that cause operation while they are actuated and cease the operation when they are released (for example hold-to-run). The colours RED, YELLOW, or GREEN shall not be used.	N/A
	Reset push-buttons shall be BLUE, WHITE, GREY, or BLACK. Where they also act as a STOP/OFF button, the colours WHITE, GREY, or BLACK are preferred with the main preference being for BLACK. GREEN shall not be used.	N/A
	Where the same colour WHITE, GREY, or BLACK is used for various functions (for example WHITE for START/ON and for STOP/OFF actuators) a supplementary means of coding (for example shape, position, symbol) shall be used for the identification of push-button actuators.	N/A

Clause	Requirement - test	Verdict
10.2.2	Markings	---
	In addition to the functional identification as described in 16.3, it is recommended that pushbuttons be marked, near to or preferably directly on the actuators, with the symbols given in Table 3.	Pass
10.3	Indicator lights and displays	---
10.3.1	General	---
	Indicator lights and displays serve to give the following types of information:	---
	– indication: to attract the operator's attention or to indicate that a certain task should be performed. The colours RED, YELLOW, BLUE, and GREEN are normally used in this mode; for flashing indicator lights and displays, see 10.3.3.	Pass
	– confirmation: to confirm a command, or a condition, or to confirm the termination of a change or transition period. The colours BLUE and WHITE are normally used in this mode and GREEN may be used in some cases.	Pass
	Indicator lights and displays shall be selected and installed in such a manner as to be visible from the normal position of the operator (see also IEC 61310-1).	Pass
	Indicator light circuits used for warning lights shall be fitted with facilities to check the operability of these lights.	Pass
10.3.2	Colours	---
	Unless otherwise agreed between the supplier and the user (see Annex B), indicator lights shall be colour-coded with respect to the condition (status) of the machine in accordance with Table 4.	Pass
	Indicating towers on machines should have the applicable colours in the following order from the top down; RED, YELLOW, BLUE, GREEN and WHITE.	N/A
10.3.3	Flashing lights and displays	---
	For further distinction or information and especially to give additional emphasis, flashing lights and displays can be provided for the following purposes:	---
	– to attract attention;	Pass
	– to request immediate action;	Pass
	– to indicate a discrepancy between the command and actual state;	Pass
	– to indicate a change in process (flashing during transition).	Pass
	It is recommended that higher frequency flashing lights or display be used for higher priority information (see IEC 60073 for recommended	N/A

Clause	Requirement - test	Verdict
	flashing rates and pulse/pause ratios).	
	Where flashing lights or displays are used to provide higher priority information, audible warning devices should also be provided.	N/A
10.4	Illuminated push-buttons	---
	Illuminated push-button actuators shall be colour-coded in accordance with Tables 2 and 4. Where there is difficulty in assigning an appropriate colour, WHITE shall be used. The colour RED for the emergency stop actuator shall not depend on the illumination of its light.	N/A
10.5	Rotary control devices	---
	Devices having a rotational member, such as potentiometers and selector switches, shall have means of prevention of rotation of the stationary member. Friction alone shall not be considered sufficient.	N/A
10.6	Start devices	---
	Actuators used to initiate a start function or the movement of machine elements (for example slides, spindles, carriers) shall be constructed and mounted so as to minimize inadvertent operation. However, mushroom-type actuators may be used for two-hand control (see also ISO 13851).	Pass
10.7	Emergency stop devices	---
10.7.1	Location of emergency stop devices	---
	Devices for emergency stop shall be readily accessible.	Pass
	Emergency stop devices shall be located at each operator control station and at other locations where the initiation of an emergency stop can be required (exception : see 9.2.7.3).	Pass
	There can be circumstances where confusion can occur between active and inactive emergency stop devices caused by disabling the operator control station. In such cases, means (for example, information for use) shall be provided to minimise confusion.	N/A
10.7.2	Types of emergency stop device	N/A
	The types of device for emergency stop include:	---
	– a push-button operated switch with a palm or mushroom head type;	Pass
	– a pull-cord operated switch;	N/A
	– a pedal-operated switch without a mechanical guard.	N/A
	The devices shall have direct opening operation (see IEC 60947-5-1, Annex K).	N/A
10.7.3	Colour of actuators	---
	Actuators of emergency stop devices shall be coloured RED. If a	Pass

Clause	Requirement - test	Verdict
	background exists immediately around the actuator, then this background shall be coloured YELLOW. See also ISO 13850.	
10.7.4	Local operation of the supply disconnecting device to effect emergency stop	---
	The supply disconnecting device may be locally operated to serve the function of emergency stop when:	---
	– it is readily accessible to the operator; and	N/A
	– it is of the type described in 5.3.2 a), b), c), or d).	N/A
	When also intended for such use, the supply disconnecting device shall meet the colour requirements of 10.7.3.	N/A
10.8	Emergency switching off devices	---
10.8.1	Location of emergency switching off devices	---
	Emergency switching off devices shall be located as necessary for the given application. Normally, those devices will be located separate from operator control stations. Where it is necessary to provide a control station with an emergency stop device and an emergency switching off device, means shall be provided to avoid confusion between these devices.	N/A
10.8.2	Types of emergency switching off device	---
	The types of device for emergency switching off include:	---
	– a push-button operated switch with a palm or mushroom head type of actuator;	N/A
	– a pull-cord operated switch.	N/A
	The devices shall have direct opening action (see IEC 60947-5-1, Annex K).	N/A
	The push-button operated switch may be in a break-glass enclosure.	N/A
10.8.2	Colour of actuators	---
	Actuators of emergency switching off devices shall be coloured RED. If a background exists immediately around the actuator, then this background shall be coloured YELLOW.	N/A
	Where confusion can occur between emergency stop and emergency switching off devices, means shall be provided to minimise confusion.	N/A
10.8.3	Local operation of the supply disconnecting device to effect emergency switching off	---
	Where the supply disconnecting device is to be locally operated for emergency switching off, it shall be readily accessible and should meet the colour requirements of 10.8.3.	N/A
10.9	Enabling control device	---

Clause	Requirement - test	Verdict
	When an enabling control device is provided as a part of a system, it shall signal the enabling control to allow operation when actuated in one position only. In any other position, operation shall be stopped or prevented.	N/A
	Enabling control devices shall be selected and arranged so as to minimize the possibility of defeating.	---
	Enabling control devices shall be selected that have the following features:	N/A
	– designed in accordance with ergonomic principles;	N/A
	– for a two-position type:	N/A
	- position 1: off-function of the switch (actuator is not operated);	N/A
	- position 2: enabling function (actuator is operated).	N/A
	– for a three-position type:	N/A
	- position 1: off-function of the switch (actuator is not operated);	N/A
	- position 2: enabling function (actuator is operated in its mid position);	N/A
	- position 3: off-function (actuator is operated past its mid position);	N/A
	- when returning from position 3 to position 2, the enabling function is not activated.	N/A
11	Controlgear: location, mounting, and enclosures	---
11.1	General requirements	---
	All controlgear shall be located and mounted so as to facilitate:	---
	– its accessibility and maintenance;	Pass
	– its protection against the external influences or conditions under which it is intended to operate;	Pass
	– operation and maintenance of the machine and its associated equipment.	Pass
11.2	Location and mounting	---
11.2.1	Accessibility and maintenance	---
	All items of controlgear shall be placed and oriented so that they can be identified without moving them or the wiring. For items that require checking for correct operation or that are liable to need replacement, those actions should be possible without dismantling other equipment or parts of the machine (except opening doors or removing covers, barriers or obstacles). Terminals not part of controlgear components or devices shall also conform to these requirements.	Pass
	All controlgear shall be mounted so as to facilitate its operation and maintenance from the front. Where a special tool is necessary to adjust, maintain, or remove a device, such a tool shall be supplied. Where	Pass

Clause	Requirement - test	Verdict
	access is required for regular maintenance or adjustment, the relevant devices shall be located between 0,4 m and 2,0 m above the servicing level. It is recommended that terminals be at least 0,2 m above the servicing level and be so placed that conductors and cables can be easily connected to them.	
	No devices except devices for operating, indicating, measuring, and cooling shall be mounted on doors or on normally removable access covers of enclosures. Where control devices are connected through plug-in arrangements, their association shall be made clear by type (shape), marking or reference designation, singly or in combination (see 13.4.5).	Pass
	Plug-in devices that are handled during normal operation shall be provided with non-interchangeable features where the lack of such a facility can result in malfunctioning.	N/A
	Plug/socket combinations that are handled during normal operation shall be located and mounted so as to provide unobstructed access.	N/A
	Plug/socket combinations that are handled during normal operation shall be located and mounted so as to provide unobstructed access.	N/A
	Test points for connection of test equipment, where provided, shall be:	
	– mounted so as to provide unobstructed access;	N/A
	– clearly identified to correspond with the documentation (see 17.3);	N/A
	– adequately insulated;	N/A
	– sufficiently spaced.	N/A
11.2.2	Physical separation or grouping	---
	Non-electrical parts and devices, not directly associated with the electrical equipment, shall not be located within enclosures containing controlgear. Devices such as solenoid valves should be separated from the other electrical equipment (for example in a separate compartment).	N/A
	Control devices mounted in the same location and connected to the supply voltage, or to both supply and control voltages, shall be grouped separately from those connected only to the control voltages.	N/A
	Terminals shall be separated into groups for:	---
	– power circuits;	N/A
	– associated control circuits;	N/A
	– other control circuits, fed from external sources (for example for interlocking).	N/A
	The groups may be mounted adjacently, provided that each group can be readily identified (for example by markings, by use of different	N/A

Clause	Requirement - test	Verdict
	sizes, by use of barriers or by colours).	
	When arranging the location of devices (including interconnections), the clearances and creepage distances specified for them by the supplier shall be maintained, taking into account the external influences or conditions of the physical environment.	N/A
11.2.3	Heating effects	---
	Heat generating components (for example heat sinks, power resistors) shall be so located that the temperature of each component in the vicinity remains within the permitted limit.	Pass
11.3	Degrees of protection	---
	The protection of controlgear against ingress of solid foreign objects and of liquids shall be adequate taking into account the external influences under which the machine is intended to operate (i.e. the location and the physical environmental conditions) and shall be sufficient against dust, coolants, and swarf.	Pass
	Enclosures of controlgear shall provide a degree of protection of at least IP22 (see IEC 60529).	Pass
	Exceptions:	---
a)	Where an electrical operating area is used as a protective enclosure for an appropriate degree of protection against the ingress of solid bodies and liquids.	N/A
b)	Where removable collectors on conductor wire or conductor bar systems are used and IP22 is not achieved, but the measures of 6.2.5 are applied.	N/A
11.4	Enclosures, doors and openings	---
	Enclosures shall be constructed using materials capable of withstanding the mechanical, electrical and thermal stresses as well as the effects of humidity and other environmental factors that are likely to be encountered in normal service.	Pass
	Fasteners used to secure doors and covers should be of the captive type. Windows provided for viewing internally mounted indicating devices shall be of a material suitable to withstand mechanical stress and chemical attack (for example toughened glass or polycarbonate sheet of not less than 3 mm thickness).	Pass
	It is recommended that enclosure doors be not wider than 0,9 m and have vertical hinges, with an angle of opening of at least 95°.	Pass
	The joints or gaskets of doors, lids, covers and enclosures shall withstand the chemical effects of the aggressive liquids, vapours, or	---

Clause	Requirement - test	Verdict
	gases used on the machine. The means provided to maintain the degree of protection of an enclosure on doors, lids and covers that require opening or removal for operation or maintenance shall:	
	– be securely attached to either the door/cover or the enclosure;	Pass
	– not deteriorate due to removal or replacement of the door or the cover, and so impair the degree of protection.	Pass
	Where openings in enclosures are provided (for example, for cable access), including those towards the floor or foundation or to other parts of the machine, means shall be provided to ensure the degree of protection specified for the equipment. Openings for cable entries shall be easily re-opened on site. A suitable opening may be provided in the base of enclosures within the machine so that moisture due to condensation can drain away.	Pass
	There shall be no opening between enclosures containing electrical equipment and compartments containing coolant, lubricating or hydraulic fluids, or those into which oil, other liquids, or dust can penetrate. This requirement does not apply to electrical devices specifically designed to operate in oil (for example electromagnetic clutches) nor to electrical equipment in which coolants are used.	Pass
	Where there are holes in an enclosure for mounting purposes, means may be necessary to ensure that after mounting, the holes do not impair the required protection.	N/A
	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 shall:	---
	– be located within an enclosure that will withstand, without risk of fire or harmful effect, such temperatures as can be generated; and	N/A
	– be mounted and located at a sufficient distance from adjacent equipment so as to allow safe dissipation of heat (see also 11.2.3); or	N/A
	– be otherwise screened by material that can withstand, without risk of fire or harmful effect, the heat emitted by the equipment.	N/A
11.5	Access to controlgear	---
	Doors in gangways and for access to electrical operating areas shall:	---
	– be at least 0,7 m wide and 2,1 m high;	N/A
	– open outwards;	N/A
	– have a means (for example panic bolts) to allow opening from the inside without the use of a key or tool.	N/A
	Enclosures which readily allow a person to fully enter shall be provided	N/A

Clause	Requirement - test	Verdict
	with means to allow escape, for example panic bolts on the inside of doors. 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.	
	In cases where:	---
	– equipment is likely to be live during access; and	N/A
	– conducting parts are exposed,	N/A
	the clear width shall be at least 1,0 m. In cases where such parts are present on both sides of the access way, the clear width shall be at least 1,5 m.	N/A
12	Conductors and cables	---
12.1	General requirements	---
	Conductors and cables shall be selected so as to be suitable for the operating conditions (for example voltage, current, protection against electric shock, grouping of cables) and external influences (for example ambient temperature, presence of water or corrosive substances, mechanical stresses (including stresses during installation), fire hazards) that can exist.	Pass
	These requirements do not apply to the integral wiring of assemblies, subassemblies, and devices that are manufactured and tested in accordance with their relevant IEC standard (for example IEC 60439-1	Pass
12.2	Conductors	---
	In general, conductors shall be of copper. Where aluminium conductors are used, the cross-sectional area shall be at least 16 mm ² .	Pass
	To ensure adequate mechanical strength, the cross-sectional area of conductors should not be less than as shown in Table 5. However, conductors with smaller cross-sectional areas or other constructions than shown in Table 5 may be used in equipment provided adequate mechanical strength is achieved by other means and proper functioning is not impaired.	Pass
	Class 1 and class 2 conductors are primarily intended for use between rigid, non-moving parts.	N/A
	All conductors that are subject to frequent movement (for example one movement per hour of machine operation) shall have flexible stranding of class 5 or class 6.	N/A
12.3	Insulation	---
	The types of insulation include (but are not limited to):	---
	– polyvinyl chloride (PVC);	Pass

Clause	Requirement - test	Verdict
	– rubber, natural and synthetic;	N/A
	– silicone rubber (SiR);	N/A
	– mineral;	N/A
	– cross-linked polyethylene (XLPE);	N/A
	– ethylene propylene compound (EPR).	N/A
	Where the insulation of conductors and cables (for example PVC) can constitute hazards due to the propagation of a fire or the emission of toxic or corrosive fumes, guidance from the cable supplier should be sought. It is important to give special attention to the integrity of a circuit having a safety-related function.	Pass
	The insulation of cables and conductors used, shall be suitable for a test voltage:	---
	– not less than 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	Pass
	– not less than 500 V a.c. for a duration of 5 min for PELV circuits (see IEC 60364-4-41, class III equipment).	N/A
	The mechanical strength and thickness of the insulation shall be such that the insulation cannot be damaged in operation or during laying, especially for cables pulled into ducts.	Pass
12.4	Current-carrying capacity in normal service	---
	The current-carrying capacity depends on several factors, for example insulation material, number of conductors in a cable, design (sheath), methods of installation, grouping and ambient temperature.	Pass
	One typical example of the current-carrying capacities for PVC insulated wiring between enclosures and individual items of equipment under steady-state conditions is given in Table 6.	Pass
12.5	Conductor and cable voltage drop	---
	The voltage drop from the point of supply to the load shall not exceed 5 % of the nominal voltage under normal operating conditions. In order to conform to this requirement, it can be necessary to use conductors having a larger cross-sectional area than that derived from Table 6.	Pass
12.6	Flexible cables	---
12.6.1	General	---
	Flexible cables shall have Class 5 or Class 6 conductors.	Pass
	Cables that are subjected to severe duties shall be of adequate construction to protect against:	---
	– abrasion due to mechanical handling and dragging across rough surfaces;	Pass

Clause	Requirement - test	Verdict
	– kinking due to operation without guides;	Pass
	– stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums.	Pass
12.6.2	Mechanical rating	---
	The cable handling system of the machine shall be so designed to keep the tensile stress of the conductors as low as is practicable during machine operations. Where copper conductors are used, the tensile stress applied to the conductors shall not exceed 15 N/mm ² of the copper cross-sectional area. Where the demands of the application exceed the tensile stress limit of 15 N/mm ² , cables with special construction features should be used and the allowed maximal tensile stress should be agreed with the cable manufacturer.	Pass
	The maximum stress applied to the conductors of flexible cables with material other than copper shall be within the cable manufacturer's specification.	N/A
12.6.3	Current-carrying capacity of cables wound on drums	---
	Cables to be wound on drums shall be selected with conductors having a cross-sectional area such that, when fully wound on the drum and carrying the normal service load, the maximum allowable conductor temperature is not exceeded.	N/A
	For cables of circular cross-sectional area installed on drums, the maximum current-carrying capacity in free air should be derated in accordance with Table 7 (see also Clause 44 of IEC 60621-3).	N/A
12.7	Conductor wires, conductor bars and slip-ring assemblies	---
12.7.1	Protection against direct contact	---
	Conductor wires, conductor bars and slip-ring assemblies shall be installed or enclosed in such a way that, during normal access to the machine, protection against direct contact 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;	N/A
	– protection by enclosures or barriers of at least IP2X (see 412.2 of IEC 60364-4-41).	Pass
	Horizontal top surfaces of barriers or enclosures that are readily accessible shall provide a degree of protection of at least IP4X (see 412.2.2 of IEC 60364-4-41).	Pass
	Where the required degree of protection is not achieved, protection by	N/A

Clause	Requirement - test	Verdict
	placing live parts out of reach in combination with emergency switching off in accordance with 9.2.5.4.3 shall be applied.	
	Conductor wires and conductor bars shall be so placed and/or protected as to:	---
	– prevent contact, especially for unprotected conductor wires and conductor bars, with conductive items such as the cords of pull-cord switches, strain-relief devices and drive chains;	N/A
	– prevent damage from a swinging load.	N/A
12.7.2	Protective conductor circuit	---
	Where conductor wires, conductor bars and slip-ring assemblies are installed as part of the protective bonding circuit, they shall not carry current in normal operation. Therefore, the protective conductor (PE) and the neutral conductor (N) shall each use a separate conductor wire, conductor bar or slip-ring. The continuity of the protective conductor circuit using sliding contacts shall be ensured by taking appropriate measures (for example, duplication of the current collector, continuity monitoring).	Pass
12.7.3	Protective conductor current collectors	---
	Protective conductor current collectors shall have a shape or construction so that they are not interchangeable with the other current collectors. Such current collectors shall be of the sliding contact type.	N/A
12.7.4	Removable current collectors with a disconnecter function	---
	Removable current collectors having a disconnecter function shall be so designed that the protective conductor circuit is interrupted only after the live conductors have been disconnected, and the continuity of the protective conductor circuit is re-established before any live conductor is reconnected (see also 8.2.4).	N/A
12.7.5	Clearances in air	---
	Clearances between the respective conductors and between adjacent systems, of conductor wires, conductor bars, slip-ring assemblies and their current collectors shall be suitable for at least a rated impulse voltage of an overvoltage category III in accordance with IEC 60664-1.	Pass
12.7.6	Creepage distances	---
	Creepage distances between the respective conductors, between adjacent systems of conductor wires, conductor bars and slip-ring assemblies, and their current collectors shall be suitable for operation in the intended environment, for example open air (IEC 60664-1), inside buildings, protected by enclosures.	Pass

Clause	Requirement - test	Verdict
	In abnormally dusty, moist or corrosive environments, the following creepage distance requirements apply:	---
	– unprotected conductor wires, conductor bars, and slip-ring assemblies shall be equipped with insulators with a minimum creepage distance of 60 mm;	N/A
	– enclosed conductor wires, insulated multipole conductor bars and insulated individual conductor bars shall have a minimum creepage distance of 30 mm.	N/A
	The manufacturer's recommendations shall be followed regarding special measures to prevent a gradual reduction in the insulation values due to unfavourable ambient conditions (for example deposits of conductive dust, chemical attack).	N/A
12.7.7	Conductor system sectioning	---
	Where conductor wires or conductor bars are arranged so that they can be divided into isolated sections, suitable design measures shall be employed to prevent the energization of adjacent sections by the current collectors themselves.	N/A
12.7.7	Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies	---
	Conductor wires, conductor bars and slip-ring assemblies in power circuits shall be grouped separately from those in control circuits.	Pass
	Conductor wires, conductor bars and slip-ring assemblies shall be capable of withstanding, without damage; the mechanical forces and thermal effects of short-circuit currents.	Pass
	Removable covers for conductor wire and conductor bar systems laid underground or underfloor shall be so designed that they cannot be opened by one person without the aid of a tool.	N/A
	Where conductor bars are installed in a common metal enclosure, the individual sections of the enclosure shall be bonded together and connected to a protective bonding conductor at several points depending upon their length. Metal covers of conductor bars laid underground or underfloor shall also be bonded together and connected to a protective bonding conductor.	Pass
	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).	N/A
	Underground and underfloor conductor bar ducts shall have drainage	N/A

Clause	Requirement - test	Verdict
	facilities.	
13	Wiring practices	---
13.1	Connections and routing	---
13.1.1	General requirements	---
	All connections, especially those of the protective bonding circuit, shall be secured against accidental loosening.	Pass
	The means of connection shall be suitable for the cross-sectional areas and nature of the conductors being terminated.	Pass
	The connection of two or more conductors to one terminal is permitted only in those cases where the terminal is designed for that purpose. However, only one protective conductor shall be connected to one terminal connecting point.	Pass
	Soldered connections shall only be permitted where terminals are provided that are suitable for soldering.	N/A
	Terminals on terminal blocks shall be plainly marked or labelled to correspond with markings on the diagrams.	Pass
	Where an incorrect electrical connection (for example, arising from replacement of devices) can be a source of risk and it is not practicable to reduce the possibility of incorrect connection by design measures, the conductors and/or terminations shall be identified in accordance with 13.2.1.	Pass
	The installation of flexible conduits and cables shall be such that liquids shall drain away from the fittings.	N/A
	Means of retaining conductor strands shall be provided when terminating conductors at devices or terminals that are not equipped with this facility. Solder shall not be used for that purpose.	Pass
	Shielded conductors shall be so terminated as to prevent fraying of strands and to permit easy disconnection.	Pass
	Identification tags shall be legible, permanent, and appropriate for the physical environment.	Pass
	Terminal blocks shall be mounted and wired so that the internal and external wiring does not cross over the terminals (see IEC 60947-7-1).	Pass
13.1.2	Conductor and cable runs	---
	Conductors and cables shall be run from terminal to terminal without splices or joints. Connections using plug/socket combinations with suitable protection against accidental disconnection are not considered to be joints for the purpose of this Subclause.	Pass
	Exception: Where it is impracticable to provide terminals in a junction	N/A

Clause	Requirement - test	Verdict
	box (for example on mobile machines, on machines having long flexible cables; cable connections exceeding a length which is not practical to be supplied by the cable manufacturer on one cable drum; repair of cable due to mechanical stresses during installation and operation), splices or joints may be used.	
	Where it is necessary to connect and disconnect cables and cable assemblies, a sufficient extra length shall be provided for that purpose.	N/A
	The terminations of cables shall be adequately supported to prevent mechanical stresses at the terminations of the conductors.	N/A
	Wherever practicable, the protective conductor shall be placed close to the associated live conductors in order to decrease the impedance of the loop.	Pass
13.1.3	Conductors of different circuits	---
	Conductors of different circuits may be laid side by side, may occupy the same duct (for example conduit, cable trunking system), or may be in the same multiconductor cable provided that the arrangement does not impair the proper functioning of the respective circuits. Where those circuits operate at different voltages, the conductors shall be separated by suitable barriers or shall be insulated for the highest voltage to which any conductor within the same duct can be subjected, for example line to line voltage for unearthed systems and phase to earth voltage for earthed systems.	N/A
13.1.4	Connection between pick-up and pick-up converter of an inductive power supply system	---
	The cable between the pick-up and the pick-up converter as specified by the manufacturer of the inductive power supply shall be:	---
	– as short as practicable;	Pass
	– adequately protected against mechanical damage.	Pass
13.2	Identification of conductors	---
13.2.1	General requirements	---
	Each conductor shall be identifiable at each termination in accordance with the technical documentation (see Clause 17).	Pass
	It is recommended (for example to facilitate maintenance) that conductors be identified by number, alphanumeric, colour (either solid or with one or more stripes), or a combination of colour and numbers or alphanumeric. When numbers are used, they shall be Arabic; letters shall be Roman (either upper or lower case).	Pass
13.2.2	Identification of the protective conductor	---

Clause	Requirement - test	Verdict
	The protective conductor shall be readily distinguishable by shape, location, marking, or colour. When identification is by colour alone, the bicolour combination GREEN-AND-YELLOW shall be used throughout the length of the conductor. This colour identification is strictly reserved for the protective conductor.	Pass
	For insulated conductors, the bicolour combination GREEN-AND-YELLOW shall be such that on any 15 mm length, one of the colours covers at least 30 % and not more than 70 % of the surface of the conductor, the other colour covering the remainder of the surface.	Pass
	Where the protective conductor can be easily identified by its shape, position, or construction (for example a braided conductor, uninsulated stranded conductor), or where the insulated conductor is not readily accessible, colour coding throughout its length is not necessary but the ends or accessible locations shall be clearly identified by the graphical symbol IEC 60417-5019 (DB:2002-10) or by the bicolour combination GREEN-AND-YELLOW.	N/A
13.2.3	Identification of the neutral conductor	---
	Where a circuit includes a neutral conductor that is identified by colour alone, the colour used for this conductor shall be BLUE. In order to avoid confusion with other colours, it is recommended that an unsaturated blue be used, called here "light blue" (see 3.2.2 of IEC 60446). Where the selected colour is the sole identification of the neutral conductor, that colour shall not be used for identifying any other conductor where confusion is possible.	Pass
	Where identification by colour is used, bare conductors used as neutral conductors shall be either coloured by a stripe, 15 mm to 100 mm wide in each compartment or unit and at each accessible location, or coloured throughout their length.	N/A
13.2.4	Identification by colour	---
	Where colour-coding is used for identification of conductors (other than the protective conductor (see 13.2.2) and the neutral conductor (see 13.2.3)), the following colours may be used:	---
	BLACK, BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (including LIGHT BLUE), VIOLET, GREY, WHITE, PINK, TURQUOISE.	Pass
	For safety reasons, the colour GREEN or the colour YELLOW should not be used where there is a possibility of confusion with the bicolour combination GREEN-AND-YELLOW (see 13.2.2).	Pass

Clause	Requirement - test	Verdict
	Colour identification using combinations of those colours listed above may be used provided there can be no confusion and that GREEN or YELLOW is not used except in the bicolour combination GREEN-AND-YELLOW.	Pass
	Where colour-coding is used for identification of conductors, it is recommended that they be colour-coded as follows:	---
	– BLACK: a.c. and d.c. power circuits;	Pass
	– RED: a.c. control circuits;	Pass
	– BLUE: d.c. control circuits;	N/A
	– ORANGE: excepted circuits in accordance with 5.3.5.	N/A
	Exceptions: to the above are permitted where:	
	– insulation is used that is not available in the colours recommended; or	N/A
	– multiconductor cable is used, but not the bicolour combination GREEN-AND-YELLOW.	N/A
13.3	Wiring inside enclosures	---
	Conductors inside enclosures shall be supported where necessary to keep them in place. Non-metallic ducts shall be permitted only when they are made with a flame-retardant insulating material (see the IEC 60332 series).	Pass
	It is recommended that electrical equipment mounted inside enclosures be designed and constructed in such a way as to permit modification of the wiring from the front of the enclosure (see also 11.2.1). Where that is not practicable and control devices are connected from the rear of the enclosure, access doors or swingout panels shall be provided.	Pass
	Connections to devices mounted on doors or to other movable parts shall be made using flexible conductors in accordance with 12.2 and 12.6 to allow for the frequent movement of the part. The conductors shall be anchored to the fixed part and to the movable part independently of the electrical connection (see also 8.2.3 and 11.2.1).	N/A
	Conductors and cables that do not run in ducts shall be adequately supported.	Pass
	Terminal blocks or plug/socket combinations shall be used for control wiring that extends beyond the enclosure. For plug/socket combinations, see also 13.4.5 and 13.4.6.	Pass
	Power cables and cables of measuring circuits may be directly connected to the terminals of the devices for which the connections were intended.	Pass
13.4	Wiring outside enclosures	---

Clause	Requirement - test	Verdict
13.4.1	General requirements	---
	The means of introduction of cables or ducts with their individual glands, bushings, etc., into an enclosure shall ensure that the degree of protection is not reduced (see 11.3).	N/A
13.4.2	External ducts	---
	Conductors and their connections external to the electrical equipment enclosure(s) shall be enclosed in suitable ducts (i.e. conduit or cable trunking systems) as described in 13.5 except for suitably protected cables that may be installed without ducts and with or without the use of open cable trays or cable support means. Where devices such as position switches or proximity switches are supplied with a dedicated cable, their cable need not be enclosed in a duct when the cable is suitable for the purpose, sufficiently short, and so located or protected, that the risk of damage is minimized.	N/A
	Fittings used with ducts or multiconductor cable shall be suitable for the physical environment.	N/A
	Flexible conduit or flexible multiconductor cable shall be used where it is necessary to employ flexible connections to pendant push-button stations. The weight of the pendant stations shall be supported by means other than the flexible conduit or the flexible multiconductor cable, except where the conduit or cable is specifically designed for that purpose.	N/A
13.4.3	Connection to moving elements of the machine	---
	Connections to frequently moving parts shall be made using conductors in accordance with 12.2 and 12.6. Flexible cable and flexible conduit shall be so installed as to avoid excessive flexing and straining, particularly at the fittings.	N/A
	Cables subject to movement shall be supported in such a way that there is no mechanical strain on the connection points nor any sharp flexing. When this is achieved by the provision of a loop, it shall have sufficient length to provide for a bending radius of the cable of at least 10 times the diameter of the cable.	N/A
	Flexible cables of machines shall be so installed or protected as to minimize the possibility of external damage due to factors that include the following cable use or potential abuse:	N/A
	– being run over by the machine itself;	N/A
	– being run over by vehicles or other machines;	N/A
	– coming into contact with the machine structure during movements;	N/A

Clause	Requirement - test	Verdict
	– running in and out of cable baskets, or on or off cable drums;	N/A
	– acceleration forces and wind forces on festoon systems or suspended cables;	N/A
	– excessive rubbing by cable collector;	N/A
	– exposure to excessive radiated heat.	---
	The cable sheath shall be resistant to the normal wear that can be expected from movement and to the effects of environmental contaminants (for example oil, water, coolants, dust).	N/A
	Where cables subject to movement are close to moving parts, precautions shall be taken to maintain a space of at least 25 mm between the moving parts and the cables. Where that distance is not practicable, fixed barriers shall be provided between the cables and the moving parts.	N/A
	The cable handling system shall be so designed that lateral cable angles do not exceed 5°, avoiding torsion in the cable when:	---
	– being wound on and off cable drums; and	N/A
	– approaching and leaving cable guidance devices.	N/A
	Measures shall be taken to ensure that at least two turns of flexible cables always remain on a drum.	N/A
	Devices serving to guide and carry a flexible cable shall be so designed that the inner bending radius at all points where the cable is bent is not less than the values given in Table 8, unless otherwise agreed with the cable manufacturer, taking into account the permissible tension and the expected fatigue life.	N/A
	The straight section between two bends shall be at least 20 times the diameter of the cable.	N/A
	Where flexible conduit is adjacent to moving parts, the construction and supporting means shall prevent damage to the flexible conduit under all conditions of operation.	N/A
	Flexible conduit shall not be used for connections subject to rapid or frequent movements except when specifically designed for that purpose.	N/A
13.4.4	Interconnection of devices on the machine	---
	Where several machine-mounted switching devices (for example position sensors, pushbuttons) are connected in series or in parallel, it is recommended that the connections between those devices be made through terminals forming intermediate test points. Such terminals shall be conveniently placed, adequately protected, and shown on the	N/A

Clause	Requirement - test	Verdict
	relevant diagrams.	
13.4.5	Plug/socket combinations	---
	Where plug/socket combinations are provided, they shall fulfil one or more of the following requirements as applicable:	N/A
	Exception: The following requirements do not apply to components or devices inside an enclosure, terminated by fixed plug/socket combinations (no flexible cable), or components connected to a bus system by a plug/socket combination.	---
a)	When installed correctly in accordance with f), plug/socket combinations shall be of such a type as to prevent unintentional contact with live parts at any time, including during insertion or removal of the connectors. The degree of protection shall be at least IPXXB. PELV circuits are excepted from this requirement.	N/A
b)	Have a first make last break protective bonding contact (earthing contact) (see also 6.3, 8.2.4) if used in TN- or TT-systems.	N/A
c)	Plug/socket combinations intended to be connected or disconnected during load conditions shall have sufficient load-breaking capacity. Where the plug/socket combination is rated at 30 A, or greater, it shall be interlocked with a switching device so that the connection and disconnection is possible only when the switching device is in the OFF position.	N/A
d)	Plug/socket combinations that are rated at more than 16 A shall have a retaining means to prevent unintended or accidental disconnection.	N/A
e)	Where an unintended or accidental disconnection of plug/socket combinations can cause a hazardous situation, they shall have a retaining means.	N/A
	The installation of plug/socket combinations shall fulfil the following requirements as applicable:	N/A
f)	The component which remains live after disconnection shall have a degree of protection of at least IP2X or IPXXB, taking into account the required clearance and creepage distances. PELV circuits are excepted from this requirement.	Pass
g)	Metallic housings of plug/socket combinations shall be connected to the protective bonding circuit. PELV circuits are excepted from this requirement.	N/A
h)	Plug/socket combinations intended to carry power loads but not to be disconnected during load conditions shall have a retaining means to prevent unintended or accidental disconnection and shall be clearly	N/A

Clause	Requirement - test	Verdict
	marked that they are not intended to be disconnected under load	
i)	Where more than one plug/socket combination is provided in the same electrical equipment, the associated combinations shall be clearly identifiable. It is recommended that mechanical coding be used to prevent incorrect insertion.	N/A
j)	Plug/socket combinations used in control circuits shall fulfil the applicable requirements of IEC 61984. Exception: see item k).	N/A
k)	Plug/socket combinations intended for household and similar general purposes shall not be 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.	N/A
	Exception: The requirements of item k) do not apply to control functions using high frequency signals on the power supply.	N/A
13.4.6	Dismantling for shipment	---
	Where it is necessary that wiring be disconnected for shipment, terminals or plug/socket combinations shall be provided at the sectional points. Such terminals shall be suitably enclosed and plug/socket combinations shall be protected from the physical environment during transportation and storage.	N/A
13.4.7	Additional conductors	---
	Consideration should be given to providing	---
	Consideration should be given to providing additional conductors for maintenance or repair. When spare conductors are provided, they shall be connected to spare terminals or isolated in such a manner as to prevent contact with live parts.	N/A
13.5	Ducts, connection boxes and other boxes	---
13.5.1	General requirements	---
	Ducts shall provide a degree of protection suitable for the application (see IEC 60529).	Pass
	All sharp edges, flash, burrs, rough surfaces, or threads with which the insulation of the conductors can come in contact shall be removed from ducts and fittings. Where necessary, additional protection consisting of a flame-retardant, oil-resistant insulating material shall be provided to protect conductor insulation.	Pass
	Drain holes of 6 mm diameter are permitted in cable trunking systems, connection boxes, and Mother boxes used for wiring purposes that can be subject to accumulations of oil or moisture. In order to prevent confusion of conduits with oil, air, or water piping, it is recommended	Pass

Clause	Requirement - test	Verdict
	that the conduits be either physically separated or suitably identified.	
	Ducts and cable trays shall be rigidly supported and positioned at a sufficient distance from moving parts and in such a manner so as to minimize the possibility of damage or wear. In areas where human passage is required, the ducts and cable trays shall be mounted at least 2 m above the working surface.	N/A
	Ducts shall be provided only for mechanical protection (see 8.2.3 for requirements for connection to the protective bonding circuit).	N/A
	Cable trays that are partially covered should not be considered to be ducts or cable trunking systems (see 13.5.6), and the cables used shall be of a type suitable for installation with or without the use of open cable trays or cable support means.	N/A
13.5.2	Percentage fill of ducts	---
	Consideration of the percentage fill of ducts should be based on the straightness and length of the duct and the flexibility of the conductors. It is recommended that the dimensions and arrangement of the ducts be such as to facilitate the insertion of the conductors and cables.	Pass
13.5.3	Rigid metal conduit and fittings	---
	Rigid metal conduit and fittings shall be of galvanized steel or of a corrosion-resistant material suitable for the conditions. The use of dissimilar metals in contact that can cause galvanic action should be avoided.	N/A
	Conduits shall be securely held in place and supported at each end.	N/A
	Fittings shall be compatible with the conduit and appropriate for the application. Fittings shall be threaded unless structural difficulties prevent assembly. Where threadless fittings are used, the conduit shall be securely fastened to the equipment.	N/A
	Conduit bends shall be made in such a manner that the conduit shall not be damaged and the internal diameter of the conduit shall not be effectively reduced.	N/A
13.5.4	Flexible metal conduit and fittings	---
	A flexible metal conduit shall consist of a flexible metal tubing or woven wire armour. It shall be suitable for the expected physical environment	N/A
	Fittings shall be compatible with the conduit and appropriate for the application.	N/A
13.5.5	Flexible non-metallic conduit and fittings	---
	Flexible non-metallic conduit shall be resistant to kinking and shall	Pass

Clause	Requirement - test	Verdict
	have physical characteristics similar to those of the sheath of multiconductor cables.	
	The conduit shall be suitable for use in the expected physical environment.	Pass
	Fittings shall be compatible with the conduit and appropriate for the application.	Pass
13.5.6	Cable trunking systems	---
	Cable trunking systems external to enclosures shall be rigidly supported and clear of all moving or contaminating portions of the machine.	N/A
	Covers shall be shaped to overlap the sides; gaskets shall be permitted. Covers shall be attached to cable trunking systems by suitable means. On horizontal cable trunking systems, the cover shall not be on the bottom unless specifically designed for such installation.	N/A
	NOTE Requirements for cable trunking and ducting systems for electrical installations are given in the IEC 61084 series.	N/A
	Where the cable trunking system is furnished in sections, the joints between sections shall fit tightly but need not be gasketed.	N/A
	The only openings permitted shall be those required for wiring or for drainage. Cable trunking systems shall not have opened but unused knockouts.	N/A
13.5.7	Machine compartments and cable trunking systems	---
	The use of compartments or cable trunking systems within the column or base of a machine to enclose conductors is permitted provided the compartments or cable trunking systems are isolated from coolant or oil reservoirs and are entirely enclosed. Conductors run in enclosed compartments and cable trunking systems shall be so secured and arranged that they are not subject to damage.	N/A
13.5.8	Connection boxes and other boxes	---
	Connection boxes and other boxes used for wiring purposes shall be accessible for maintenance. Those boxes shall provide protection against the ingress of solid bodies and liquids, taking into account the external influences under which the machine is intended to operate (see 11.3).	Pass
	Those boxes shall not have opened but unused knockouts nor any other openings and shall be so constructed as to exclude materials such as dust, flyings, oil, and coolant.	Pass
13.5.9	Motor connection boxes	---
	Motor connection boxes shall enclose only connections to the motor	Pass

Clause	Requirement - test	Verdict
	and motor-mounted devices (for example brakes, temperature sensors, plugging switches, tachometer generators).	
14	Electric motors and associated equipment	---
14.1	General requirements	---
	Electric motors should conform to the relevant parts of IEC 60034 series.	Pass
	The protection requirements for motors and associated equipment are given in 7.2 for overcurrent protection, in 7.3 for overload protection, and in 7.6 for overspeed protection.	Pass
	As many controllers do not switch off the supply to a motor when it is at rest, care shall be taken to ensure compliance with the requirements of 5.3, 5.4, 5.5, 7.5, 7.6 and 9.4. Motor control equipment shall be located and mounted in accordance with Clause 11.	N/A
14.2	Motor enclosures	---
	It is recommended that motor enclosures be chosen from those included in IEC 60034-5.	Pass
	The degree of protection shall be at least IP23 (see IEC 60529) for all motors. More stringent requirements can be needed depending on the application and the physical environment (see 4.4). Motors incorporated as an integral part of the machine shall be so mounted that they are adequately protected from mechanical damage.	Pass
14.3	Motor dimensions	---
	As far as is practicable, the dimensions of motors shall conform to those given in the IEC 60072 series.	Pass
14.4	Motor mounting and compartments	---
	Each motor and its associated couplings, belts, pulleys, or chains, shall be so mounted that they are adequately protected and are easily accessible for inspection, maintenance, adjustment and alignment, lubrication, and replacement. The motor mounting arrangement shall be such that all motor hold-down means can be removed and all terminal boxes are accessible.	Pass
	Motors shall be so mounted that proper cooling is ensured and the temperature rise remains within the limits of the insulation class (see IEC 60034-1).	Pass
	Where practicable, motor compartments should be clean and dry, and when required, shall be ventilated directly to the exterior of the machine. The vents shall be such that ingress of swarf, dust, or water spray is at an acceptable level.	N/A

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

Clause	Requirement - test	Verdict
	example hand-held power tools, test equipment), the following apply:	
	the socket-outlets should conform to IEC 60309-1. Where that is not practicable, they should be clearly marked with the voltage and current ratings;	Pass
	the continuity of the protective bonding circuit to the socket-outlet shall be ensured except where protection is provided by PELV;	Pass
	all unearthed conductors connected to the socket-outlet shall be protected against overcurrent and, when required, against overload in accordance with 7.2 and 7.3 separately from the protection of other circuits;	Pass
	where the power supply to the socket-outlet is not disconnected by the supply disconnecting device for the machine or the section of the machine, the requirements of 5.3.5 apply.	N/A
	NOTE 1 See also Annex B.	---
	NOTE 2 Circuits for socket-outlets can be provided with residual current protective devices (RCDs).	---
15.2	Local lighting of the machine and equipment	---
15.2.1	General	---
	Connections to the protective bonding circuit shall be in accordance with 8.2.2.	Pass
	The ON/OFF switch shall not be incorporated in the lampholder or in the flexible connecting cords.	Pass
	Stroboscopic effects from lights shall be avoided by the selection of appropriate luminaires.	Pass
	Where fixed lighting is provided in an enclosure, electromagnetic compatibility should be taken into account using the principles outlined in 4.4.2.	Pass
15.2.2	Supply	---
	The nominal voltage of the local lighting circuit shall not exceed 250 V between conductors. A voltage not exceeding 50 V between conductors is recommended.	Pass
	Lighting circuits shall be supplied from one of the following sources (see also 7.2.6):	Pass
	a dedicated isolating transformer connected to the load side of the supply disconnecting device. Overcurrent protection shall be provided in the secondary circuit;	N/A
	a dedicated isolating transformer connected to the line side of the supply disconnecting device. That source shall be permitted for	Pass

Clause	Requirement - test	Verdict
	maintenance lighting circuits in control enclosures only. Overcurrent protection shall be provided in the secondary circuit (see also 5.3.5 and 13.1.3);	
	a machine circuit with dedicated overcurrent protection;	N/A
	an isolating transformer connected to the line side of the supply disconnecting device, provided with a dedicated primary disconnecting means (see 5.3.5) and secondary overcurrent protection, and mounted within the control enclosure adjacent to the supply disconnecting device (see also 13.1.3);	N/A
	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.	N/A
	Exception: where fixed lighting is out of reach of operators during normal operations, the provisions of this Subclause do not apply.	N/A
15.2.3	Protection	---
	Local lighting circuits shall be protected in accordance with 7.2.6.	Pass
15.2.4	Fittings	---
	Adjustable lighting fittings shall be suitable for the physical environment.	N/A
	The lampholders shall be:	---
	in accordance with the relevant IEC standard;	N/A
	constructed with an insulating material protecting the lamp cap so as to prevent unintentional contact.	N/A
	Reflectors shall be supported by a bracket and not by the lampholder.	N/A
	Exception: where fixed lighting is out of reach of operators during normal operation, the provisions of this Subclause do not apply.	N/A
16	Marking, warning signs and reference designations	---
16.1	General	---
	Warning signs, nameplates, markings, and identification plates shall be of sufficient durability to withstand the physical environment involved.	Pass
16.2	Warning signs	---
16.2.1	Electric shock hazard	---
	Enclosures that do not otherwise clearly show that they contain electrical equipment that can give rise to a risk of electric shock shall be marked with the graphical symbol IEC 60417-5036 (DB:2002-10).	Pass
	The warning sign shall be plainly visible on the enclosure door or cover.	Pass

Clause	Requirement - test	Verdict
	The warning sign may be omitted (see also 6.2.2 b)) for:	---
	an enclosure equipped with a supply disconnecting device;	N/A
	an operator-machine interface or control station;	N/A
	a single device with its own enclosure (for example position sensor).	N/A
16.2.2	Hot surfaces hazard	---
	Where the risk assessment shows the need to warn against the possibility of hazardous surface temperatures of the electrical equipment, the graphical symbol IEC 60417-5041 (DB:2002-10) shall be used.	N/A
	NOTE For electrical installations, this measure is dealt with in IEC 60364-4-42, Clause 423 and Table 42A.	N/A
16.3	Functional identification	---
	Control devices, visual indicators, and displays (particularly those related to safety) shall be clearly and durably marked with regard to their functions either on or adjacent to the item. Such markings may be as agreed between the user and the supplier of the equipment (see Annex B). Preference should be given to the use of standard symbols given in IEC 60417- DB:2002 and ISO 7000.	Pass
16.4	Marking of equipment	---
	Equipment (for example controlgear assemblies) shall be legibly and durably marked in a way that is plainly visible after the equipment is installed. A nameplate giving the following information shall be attached to the enclosure adjacent to each incoming supply:	Pass
	name or trade mark of supplier;	Pass
	certification mark, when required;	Pass
	serial number, where applicable;	Pass
	rated voltage, number of phases and frequency (if a.c.), and full-load current for each supply;	Pass
	short-circuit rating of the equipment;	N/A
	main document number (see IEC 62023).	N/A
	The full-load current shown on the nameplate shall be not less than the running currents for all motors and other equipment that can be in operation at the same time under normal conditions	Pass
	Where only a single motor controller is used, that information may instead be provided on the machine nameplate where it is plainly visible.	Pass
16.5	Reference designations	---
	All enclosures, assemblies, control devices, and components shall be	Pass

Clause	Requirement - test	Verdict
	plainly identified with the same reference designation as shown in the technical documentation.	
17	Technical documentation	---
17.1	General	---
	The information necessary for installation, operation, and maintenance of the electrical equipment of a machine shall be supplied in the appropriate forms, for example, drawings, diagrams, charts, tables, instructions. The information shall be in an agreed language (see also Annex B). The information provided may vary with the complexity of the electrical equipment. For very simple equipment, the relevant information may be contained in one document, provided that the document shows all the devices of the electrical equipment and enables the connections to the supply network to be made.	Pass
	NOTE 1 The technical documentation provided with items of electrical equipment can form part of the documentation of the electrical equipment of the machine.	---
	NOTE 2 In some countries, the requirement to use specific language(s) is covered by legal requirements.	---
17.2	Information to be provided	---
	The information provided with the electrical equipment shall include:	---
a)	A main document (parts list or list of documents);	Pass
b)	Complementary documents including:	---
1)	a clear, comprehensive description of the equipment, installation and mounting, and the connection to the electrical supply(ies);	Pass
2)	electrical supply(ies) requirements;	Pass
3)	information on the physical environment (for example lighting, vibration, atmospheric contaminants) where appropriate;	N/A
4)	overview (block) diagram(s) where appropriate;	Pass
5)	circuit diagram(s);	Pass
6)	information (as applicable) on:	---
	programming, as necessary for use of the equipment;	N/A
	sequence of operation(s);	Pass
	frequency of inspection;	Pass
	frequency and method of functional testing;	N/A
	guidance on the adjustment, maintenance, and repair, particularly of the protective devices and circuits;	Pass
	recommended spare parts list; and	Pass
	list of tools supplied.	Pass

Clause	Requirement - test	Verdict
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;	Pass
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);	N/A
9)	instructions on the procedures for securing the machine for safe maintenance; (see also 17.8);	Pass
10)	information on handling, transportation and storage;	Pass
11)	information regarding load currents, peak starting currents and permitted voltage drops, as applicable;	N/A
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.	N/A
17.3	Requirements applicable to all documentation	---
	Unless otherwise agreed between manufacturer and user:	---
	the documentation shall be in accordance with relevant parts of IEC 61082;	Pass
	reference designations shall be in accordance with relevant parts of IEC 61346;	Pass
	Instructions/manuals shall be in accordance with IEC 62079.	Pass
	parts lists where provided shall be in accordance with IEC 62027, class B.	Pass
	NOTE See item 13 of Annex B.	---
	For referencing of the different documents, the supplier shall select one of the following methods:	---
	where the documentation consists of a small number of documents (for example less than 5) each of the documents shall carry as a cross-reference the document numbers of all other documents belonging to the electrical equipment; or	Pass
	for single level main documents only (see IEC 62023), all documents shall be listed with document numbers and titles in a drawing or document list; or	N/A
	all documents of a certain level (see IEC 62023) of the document structure shall be listed, with document numbers and titles, in a parts list belonging to the same level.	N/A
17.4	Installation documents	
	The installation documents shall give all information necessary for the	Pass

Clause	Requirement - test	Verdict
	preliminary work of setting up the machine (including commissioning). In complex cases, it may be necessary to refer to the assembly drawings for details.	
	The recommended position, type, and cross-sectional areas of the supply cables to be installed on site shall be clearly indicated.	Pass
	The data necessary for choosing the type, characteristics, rated currents, and setting of the overcurrent protective device(s) for the supply conductors to the electrical equipment of the machine shall be stated (see 7.2.2).	Pass
	Where necessary, the size, purpose, and location of any ducts in the foundation that are to be provided by the user shall be detailed (see Annex B).	N/A
	The size, type, and purpose of ducts, cable trays, or cable supports between the machine and the associated equipment that are to be provided by the user shall be detailed (see Annex B).	N/A
	Where necessary, the diagram shall indicate where space is required for the removal or servicing of the electrical equipment.	Pass
	In addition, where it is appropriate, an interconnection diagram or table shall be provided. That diagram or table shall give full information about all external connections. Where the electrical equipment is intended to be operated from more than one source of electrical supply, the interconnection diagram or table shall indicate the modifications or interconnections required for the use of each supply.	Pass
17.5	Overview diagrams and function diagrams	---
	Where it is necessary to facilitate the understanding of the principles of operation, an overview diagram shall be provided. An overview diagram symbolically represents the electrical equipment together with its functional interrelationships without necessarily showing all of the interconnections.	Pass
	Function diagrams may be provided as either part of, or in addition to, the overview diagram.	N/A
17.6	Circuit diagrams	---
	A circuit diagram(s) shall be provided. This diagram(s) shall show the electrical circuits on the machine and its associated electrical equipment. Any graphical symbol not shown in IEC 60617-DB:2001 shall be separately shown and described on the diagrams or supporting documents. The symbols and identification of components and devices shall be consistent throughout all documents and on the machine.	Pass

Clause	Requirement - test	Verdict
	Where appropriate, a diagram showing the terminals for interface connections shall be provided. That diagram may be used in conjunction with the circuit diagram(s) for simplification. The diagram should contain a reference to the detailed circuit diagram of each unit shown.	Pass
	Switch symbols shall be shown on the electromechanical diagrams with all supplies turned off (for example electricity, air, water, lubricant) and with the machine and its electrical equipment ready for a normal start.	Pass
	Conductors shall be identified in accordance with 13.2.	Pass
	Circuits shall be shown in such a way as to facilitate the understanding of their function as well as maintenance and fault location. Characteristics relating to the function of the control devices and components which are not evident from their symbolic representation shall be included on the diagrams adjacent to the symbol or referenced to a footnote.	Pass
17.7	Operating manual	---
	The technical documentation shall contain an operating manual detailing proper procedures for set-up and use of the electrical equipment. Particular attention should be given to the safety measures provided.	Pass
	Where the operation of the equipment can be programmed, detailed information on methods of programming, equipment required, program verification, and additional safety procedures (where required) shall be provided.	N/A
17.8	Maintenance manual	---
	The technical documentation shall contain a maintenance manual detailing proper procedures for adjustment, servicing and preventive inspection, and repair. Recommendations on maintenance/service intervals and records should be part of that manual. Where methods for the verification of proper operation are provided (for example software testing programs), the use of those methods shall be detailed.	Pass
17.9	Parts list	---
	The parts list, where provided, shall comprise, as a minimum, information necessary for ordering spare or replacement parts (for example components, devices, software, test 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.	Pass

Clause	Requirement - test	Verdict
18	Verification	---
18.1	General	---
	This part of IEC 60204 gives general requirements for the electrical equipment of machines.	---
	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;	Pass
b)	in case of protection against indirect contact by automatic disconnection, conditions for protection by automatic disconnection shall be verified according to 18.2;	N/A
c)	insulation resistance test (see 18.3);	Pass
d)	voltage test (see 18.4);	Pass
e)	protection against residual voltage (see 18.5);	N/A
f)	functional tests (see 18.6).	Pass
	When these tests are performed, it is recommended that they follow the sequence listed above.	Pass
	When the electrical equipment is modified, the requirements stated in 18.7 shall apply.	Pass
	For tests in accordance with 18.2 and 18.3, measuring equipment in accordance with the EN 61557 series is applicable.	Pass
	The results of the verification shall be documented.	Pass
18.2	Verification of conditions for protection by automatic disconnection of supply	---
18.2.1	General	---
	The conditions for automatic disconnection of supply (see 6.3.3) shall be verified by tests.	N/A
	For TN-systems, those test methods are described in 18.2.2; their applications for different conditions of supply are specified in 18.2.3.	N/A
	For TT and IT systems, see IEC 60364-6-61.	---
18.2.2	Test methods in TN-systems	---
	Test 1 verifies the continuity of the protective bonding circuit. Test 2 verifies the conditions for protection by automatic disconnection of the supply.	N/A
	Test 1 – Verification of the continuity of the protective bonding circuit	---

Clause	Requirement - test	Verdict
	The resistance of each protective bonding circuit between the PE terminal (see 5.2 and Figure 3) and relevant points that are part of each protective bonding circuit shall be measured with a current between at least 0,2 A and approximately 10 A derived from an electrically separated supply source (for example SELV, see 413.1 of IEC 60364-4-41) having a maximum no-load voltage of 24 V a.c. or d.c.. It is recommended not to use a PELV supply since such supplies can produce misleading results in this test. The resistance measured shall be in the expected range according to the length, the cross sectional area and the material of the related protective bonding conductor(s).	N/A
	Test 2 – Fault loop impedance verification and suitability of the associated overcurrent protective device	---
	The connections of the power supply and of the incoming external protective conductor to the PE terminal of the machine, shall be verified by inspection.	N/A
	The conditions for the protection by automatic disconnection of supply in accordance with 6.3.3 and Annex A shall be verified by both:	---
1)	verification of the fault loop impedance by:	---
	calculation, or	N/A
	measurement in accordance with A.4, and	N/A
2)	confirmation that the setting and characteristics of the associated overcurrent protective device are in accordance with the requirements of Annex A.	N/A
18.2.3	Application of the test methods for TN-systems	---
	Test 1 of 18.2.2 shall be carried out on each protective bonding circuit of a machine.	N/A
	When Test 2 of 18.2.2 is carried out by measurement, it shall always be preceded by Test 1.	N/A
	The tests that are necessary for machines of different status are specified in Table 9. Table 10 can be used to enable determination of the machine status.	N/A
18.3	Insulation resistance tests	---
	When insulation resistance tests are performed, the insulation resistance measured at 500 V d.c. between the power circuit conductors and the protective bonding circuit shall be not less than 1 M Ω . The test may be made on individual sections of the complete electrical installation.	Pass
	Exception: for certain parts of electrical equipment, incorporating for example busbars, conductor wire or conductor bar systems or slip-ring	N/A

Clause	Requirement - test	Verdict
	assemblies, a lower minimum value is permitted, but that value shall not be less than 50 k .	
	If the electrical equipment of the machine contains surge protection devices which are likely to operate during the test, it is permitted to either:	---
	disconnect these devices, or	Pass
	reduce the test voltage to a value lower than the voltage protection level of the surge protection devices, but not lower than the peak value of the upper limit of the supply (phase to neutral) voltage.	N/A
18.4	Voltage tests	---
	When voltage tests are performed, test equipment in accordance with IEC 61180-2 should be used.	Pass
	The test voltage shall be at a nominal frequency of 50 Hz or 60 Hz.	Pass
	The maximum test voltage shall have a value of twice the rated supply voltage of the equipment or 1 000 V, whichever is the greater. The maximum test voltage shall be applied between the power circuit conductors and the protective bonding circuit for a period of approximately 1 s. The requirements are satisfied if no disruptive discharge occurs.	Pass
	Components and devices that are not rated to withstand the test voltage shall be disconnected during testing.	Pass
	Components and devices that have been voltage tested in accordance with their product standards may be disconnected during testing.	Pass
18.5	Protection against residual voltages	---
	Where appropriate, tests shall be performed to ensure compliance with 6.2.4.	N/A
18.6	Functional tests	---
	The functions of electrical equipment shall be tested.	Pass
	The function of circuits for electrical safety (for example earth fault detection) shall be tested.	Pass
18.7	Retesting	---
	Where a portion of the machine and its associated equipment is changed or modified, that portion shall be reverified and retested, as appropriate (see 18.1).	N/A
	Particular attention should be given to the possible adverse effects that retesting can have on the equipment (for example overstressing of insulation, disconnection/reconnection of devices).	N/A

High Speed Laminator Machine

TEST REPORT NO.: HLLM-200116-003

EN60204-1 Test Report

Manufacturer: Dongguang Henglong Machinery Manufacture Co., Ltd.
EUT High Speed Laminator Machine
Model 1300mm×1250mm Model
Test Equipment Withstand Voltage Tester:MI2094
Insulation Resistance Tester:MI2094
Grounding Tester:MI2094
Test conditions 10A/50HZ
According to Chapter 52 and 53 of EN 60204-1
Date Jan 16, 2020

1. Continuity of the protective bonding circuit

Test Points	Test Result(mΩ)	Test Current(A)	Voltage Drop(V)
PE-Electrical Box	53	10	0.53

2. Insulation Resistance

Test Points	Test Result(M Ω)
PE-Power Inlet	>19.99

3. Withstanding Voltage

Test Points	Breakdown
PE-Power Inlet	NO

Annex: Technical Information

A.1 Declaration of conformity with signature

A.2 Specification

A.3 Photo documents

A.4 Mechanical drawing

A.5 Electrical drawing

A.6 CE certificates of key components

A.7 Instruction manual

A.1 Declaration of conformity with signature

EC DECLARATION OF CONFORMITY

We Dongguang Henglong Machinery Manufacture Co., Ltd.

Of

Xiaoxing Industrial Area, Dongguang County, Hebei Province, China

Declare that the High Speed Laminator Machine

Model:

1300mm×1250mm Model, 1400mm×1250mm Model, 1500mm×1250mm Model,
1600mm×1250mm Model

Meets all relevant requirements of the following European directives

2006/42/EC

Machinery Directive

2014/35/EU

Low Voltage Directive

Using the following draft and transposed standards

EN ISO 12100:2010, EN 60204-1:2006/AC:2010

Having been examined to the requirements of the Machinery directive 2006/42/EC and
Low Voltage Directive 2014/35/EU by:

UDEM Adriatic d.o.o.

Notification Number: 2696

Gajeva 2b

Croatia

Lixilong Service Manager 2020.2.17
Title and Signature Date and place



A.2 Specification

型号 Model				
最大贴面尺寸 Max laminating size	1300mm×1250mm	1400mm×1250mm	1500mm×1250mm	1600mm×1250mm
最小贴面尺寸 Min laminating size	400mm×400mm	400mm×400mm	400mm×400mm	400mm×400mm
经济速度 Economic speed	0-100sheets/min	0-100sheets/min	0-100sheets/min	0-100sheets/min
裱合精度 Laminating precision	±1.5	±1.5	±1.5	±1.5
功率 Power	10kw	12kw	12kw	12kw
外形尺寸 Size	13.5m×2m×2.4m	13.5m×2.05m×2.4m	13.5m×2.15m×2.4m	13.5m×2.25m×2.4m
重量 Weight	About 4.8t	About 5t	About 5.2t	About 5.4t
底纸厚度 Bottom paper thickness	A/B/C/E flute, 3/4/5 layer , less than 12mm thickness			
面纸克重 Surface paper gram weight	150-600 g/m ²			

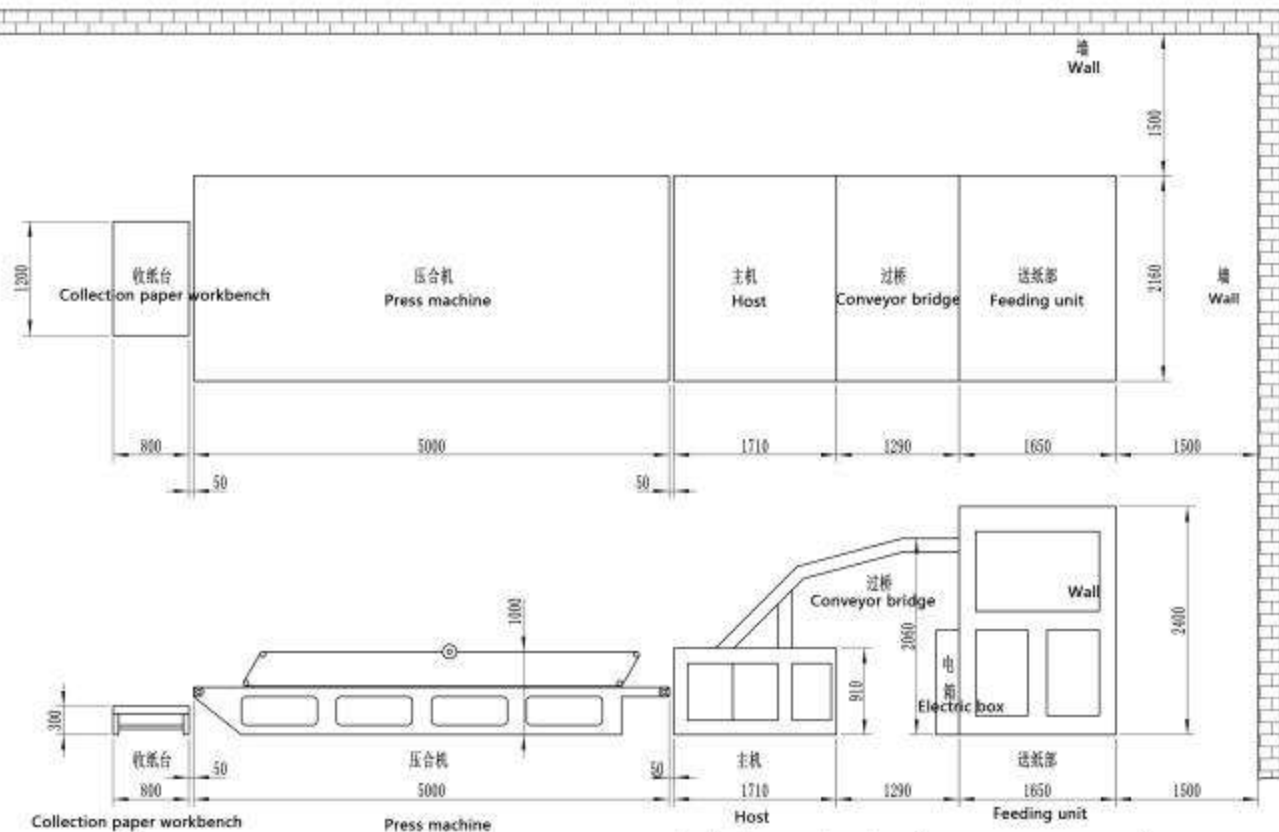
A.3 Photo documents

Photos of sample





A.4 Mechanical drawing



图号	图名
比例	日期
设计	审核
日期	日期

图号	图名	比例	日期
设计	审核	日期	日期
日期	日期	日期	日期

东光县恒隆机械制造有限公司

机械全图/外观尺寸图

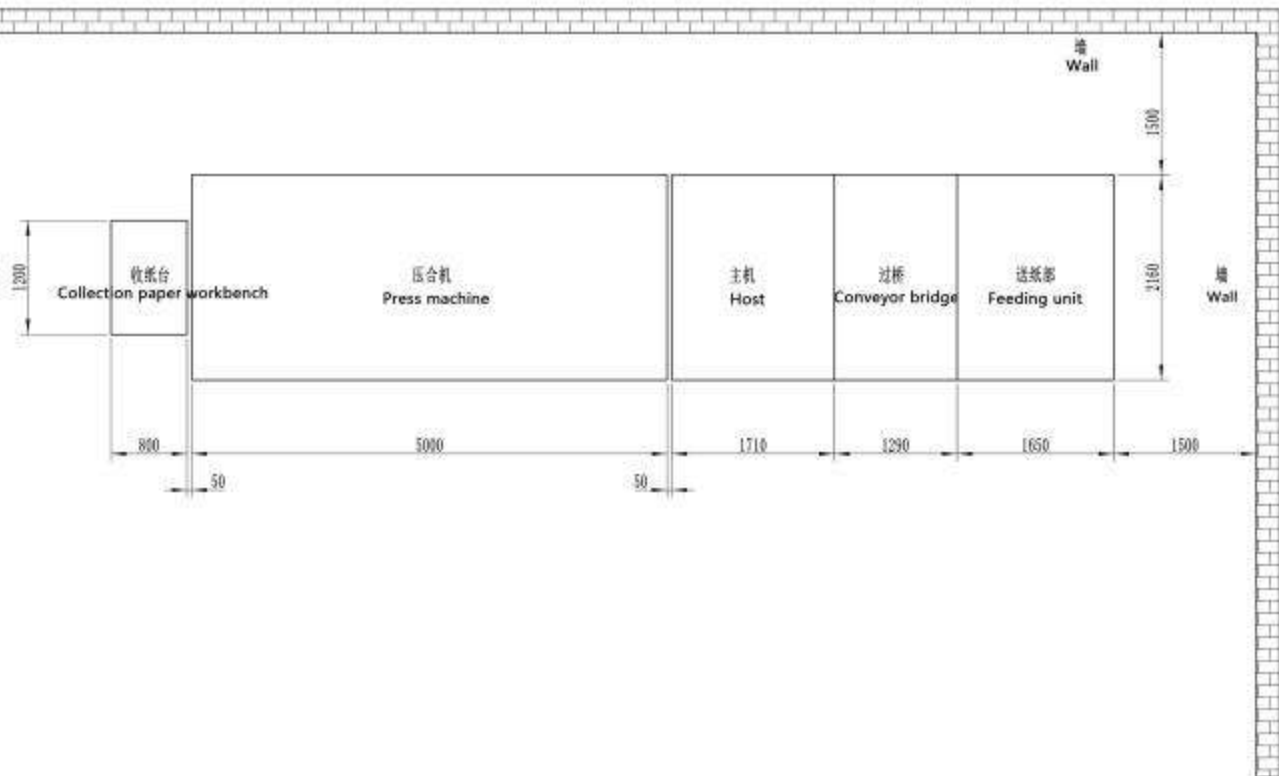


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				东光县恒隆机械制造有限公司		
				机械总装图/机械安装尺寸图		
标记	数量	更改文件号	签字	日期	图 样 标 记	重 量
设计						比 例
						1:1

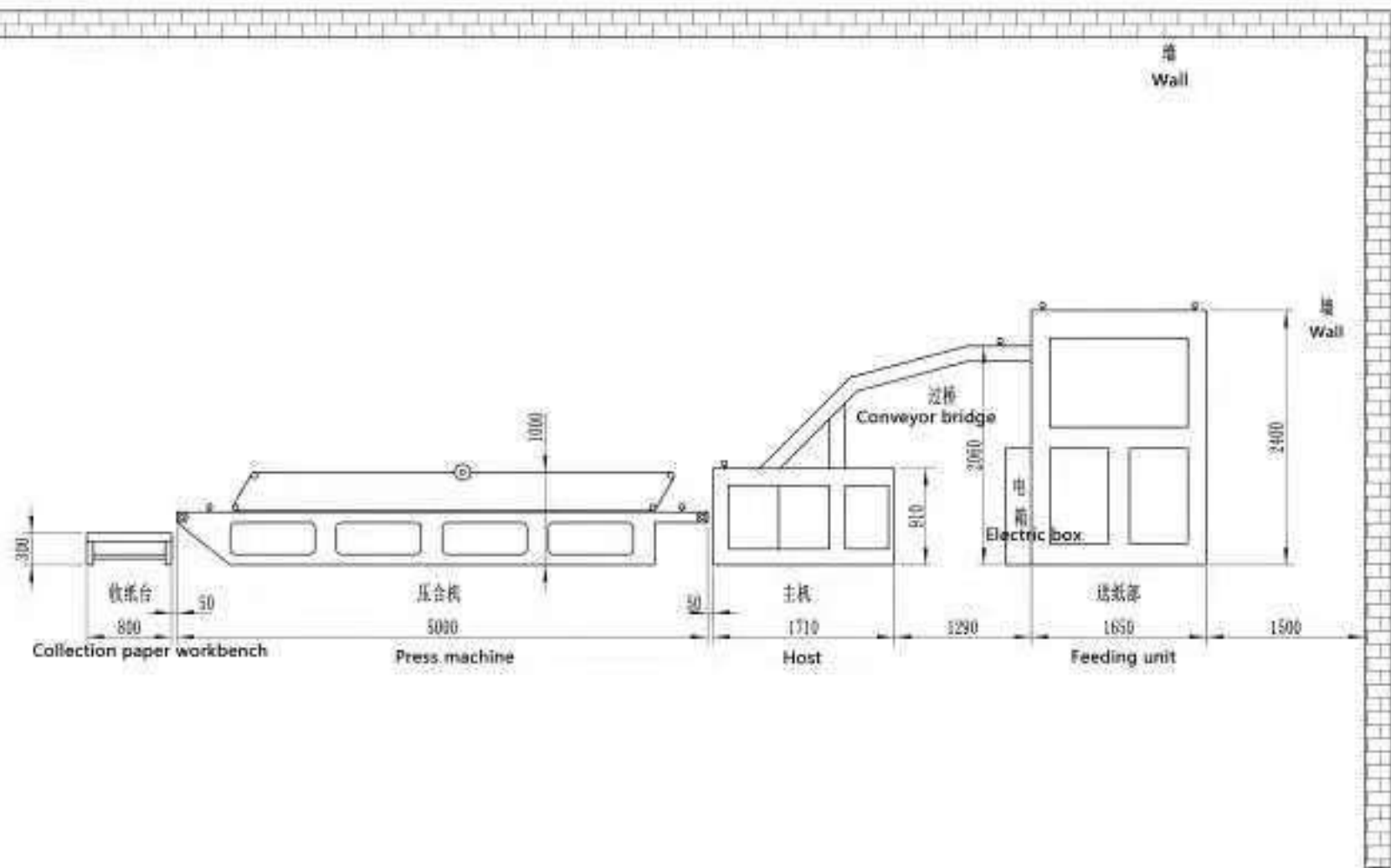
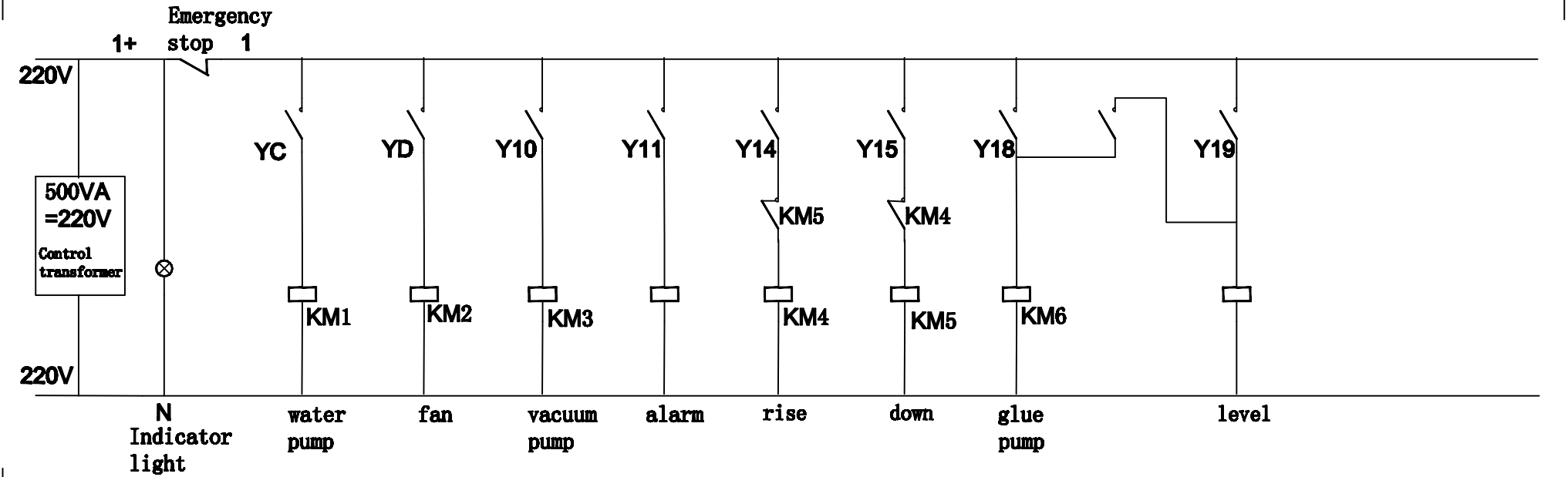
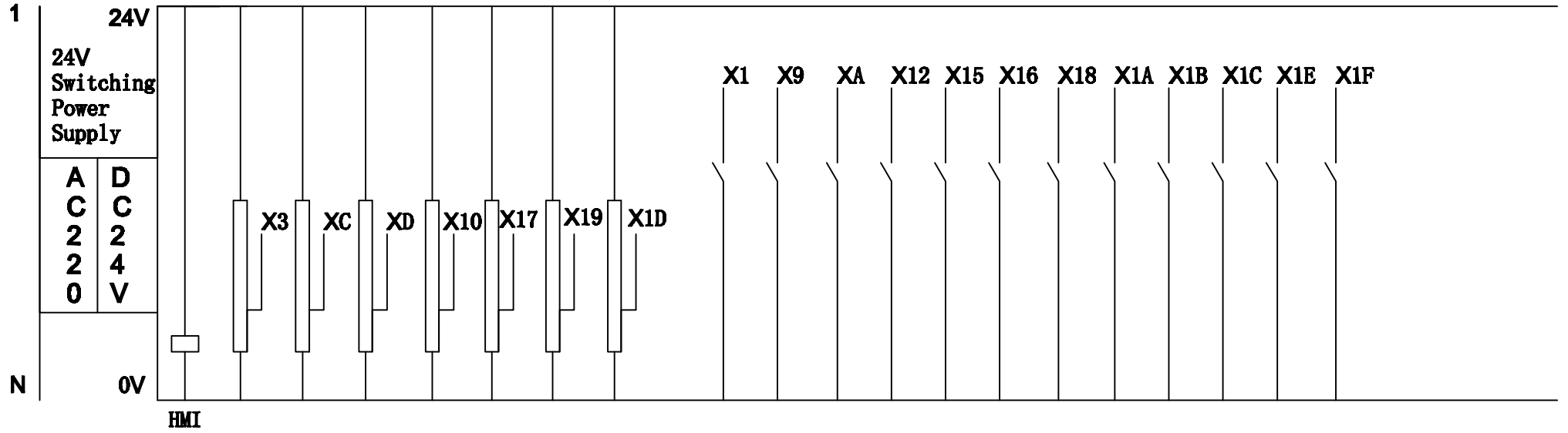


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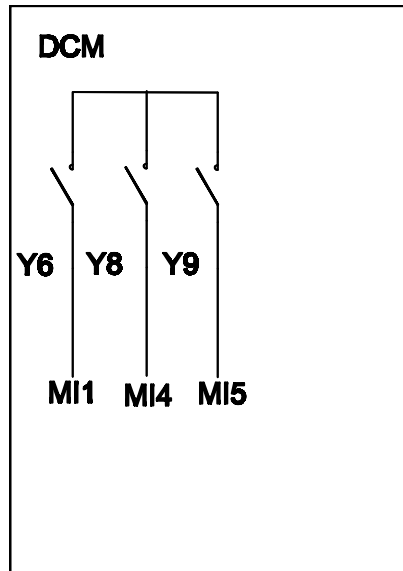
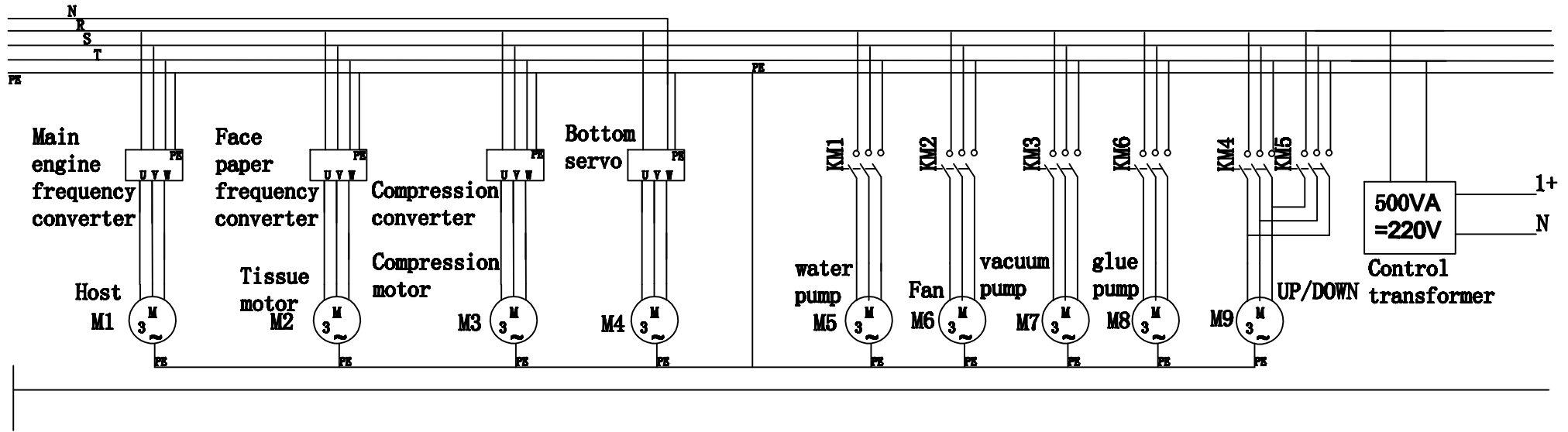
				东光县恒隆机械制造有限公司		
				机械总装图/机械安装尺寸图		
设计	审核	工艺	日期	图 样 标 记	重 复	比 例
						1:1
				大 图 表		

A.5 Electrical drawing

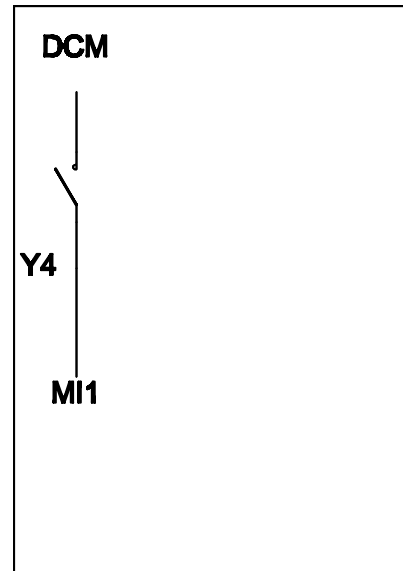


input voltage:R,S,T AC380V-400V 50HZ

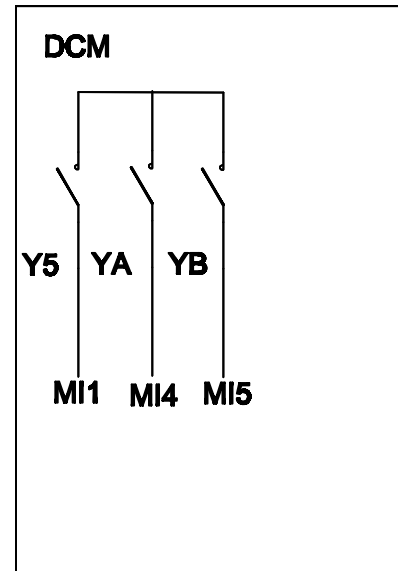
input voltage:R,N AC210V-250V 50HZ



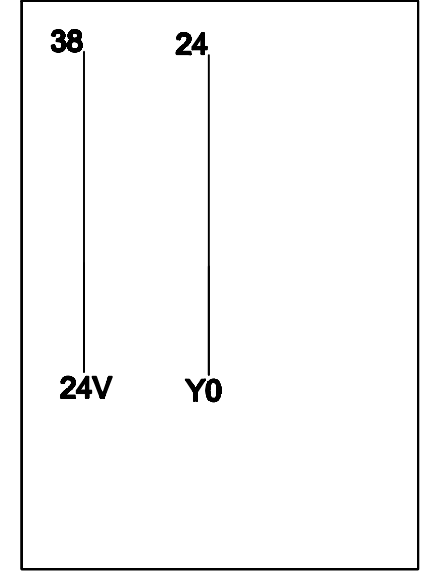
Main engine frequency converter



Face paper frequency converter



Compression converter



Bottom servo

Y0	Bottom paper pulse	Y10	Vacuum pump
Y1		Y11	Alarm lamp
Y2		Y12	
Y3		Y13	
Y4	Press operation	Y14	Rise
Y5	Tissue running	Y15	decline
Y6	Host operation	Y16	
Y7	Main engine deceleration	Y17	
Y8	Host acceleration	Y18	Glue pump manual
Y9	Main engine deceleration	Y19	Glue pump automatic
YA	Compression acceleration	Y1A	
YB	Compression deceleration	Y1B	
YC	Water pump		
YD	Fan		
YE			
YF			

X0		X10	Paper feed approach
X1	Host stop	X11	
X2	Speed encoder	X12	Paper pile up
X3	Speed encoder	X13	
X4	Fan start up	X14	
X5	Fan stop	X15	Vacuum pump start
X6		X16	Vacuum pump stop
X7		X17	Vacuum pump stop
X8		X18	Rise
X9	Tissue boot	X19	Suction needle approach
XA	Tissue stop	X1A	Upper limit
XB		X1B	lower limit
XC	Photoelectricity	X1C	Lift stop
XD	Lower photoelectric	X1D	Fidone inching approach
XE		X1E	decline
XF		X1F	decline

A.6 CE certificates of key components

Original



EU DECLARATION OF CONFORMITY

1. Product Models/Products:

E3Z series

2. Name and address of the manufacturer:

OMRON Corporation

Shiokoji Horikawa, Shimogyo-Ku, Kyoto, 600-8530 Japan

3. This declaration of conformity is issued under the sole responsibility of the manufacturer.

4. Objects of the declaration:

E3Z series, Photoelectric Sensor

5. The objects of the declaration described above are in conformity with the relevant Union harmonisation legislation:

2004/108/EC EMC Directive (valid until 19 April 2016)

2014/30/EU EMC Directive (valid from 20 April 2016)

6. References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

EN 60947-5-2:2007+A1:2012

Signed and on behalf of: OMRON Corporation

Date and Place of issue: Kyoto, Japan 3 Mar. 2016

Signature: 

Name: Hiroaki Nakanishi

Function: General Manager, Sensor Div., Product Business Division HQ.
Industrial Automation Company

Name and address of contact in EU

OMRON Europe B.V.

Quality & Environment Department

Attn: J.J.P.W. Vogelaar, European Quality & Environment Manager

Zilverenberg 2, 5234 GM, 's-Hertogenbosch, The Netherlands

Additional information

Nomenclature

Type E3Z series

E3Z - () () () () () - () () - () - ()
 I II III IV V VI VII VIII IX X

- I - E3Z
- II - R, B, D, T, L, LS, LR, LT or LL
- III - 6 or 8
- IV - 1 to 4 or 6 to 9
- V - Blank or A
- VI - Blank or K
- VII - Blank, L or D
- VIII - Blank, G0 or G2
- IX - Blank, M1J, M1TJ, M3J, M5J or ECON
- X - Blank, Number (s) or letter (s)

Type E3Z series (Customize type)

E3Z - () () () () - () () () () - () - ()
 I II III IV V VI VII VIII IX X XI

- I - E3Z
- II - R, B, D, T, L, LS, LR, LT or LL
- III - 6 or 8
- IV - 1, 2 or 3
- V - Blank, C, P, H or E
- VI - S0, J0, G0, G2 or S1
- VII - S, T or V
- VIII - R, G, B, H, D, M, L, F, D
- IX - L, D or W

X - 05, P1, P2, P5, CN, E3, E5, E2, M1, M3, M5 or other

XI - Blank, Number(s) or letter(s)

Except for following models
E3Z-R61H-SOSRW-P5-B

EC DECLARATION OF CONFORMITY

We hereby declare that the following product is in conformity with the requirements of the following EC Directive :

Product :	Switching Power Supply
Type :	S8FS-C 15/25/35/50/75/100/150/200/350W series
No. of Directive :	2004 / 108 / EC
Title of Directive :	Electromagnetic Compatibility
No. of Directive :	2006 / 95 / EC
Title of Directive :	Low Voltage

This product is designed and manufactured in accordance with the following standards.

EMC :	EN61204-3: 2000 Class B (Class A for 200W and 350W) , High severity levels
Safety :	EN60950-1: 2006+A1: 2010+A11:2009+A12:2011+A2:2013

Year which the CE marking is affixed : '15

Manufacturer :

Name : OMRON Corporation, Industrial Automation Company,
Product Business Division HQ

Address :

Shiokoji Horikawa
Shimogyo-ku
Kyoto, 600-8530 Japan

Date :

2015. 8. 20

Signed :



Junta Tsujinaga
Division Manager, Components Division

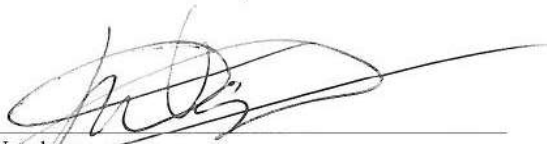
Representative in EU :

Name : Omron Europe B.V.
Address : Zilverenberg 2, 5234 GM,
's-Hertogenbosch,
The Netherlands

Date :

2015. 08. 27

Signed :



J.J.P.W. Vogelaar
European Quality & Environment Manager

Nomenclature / Variants / Similarities

Type S8FS-C series

S8FS - C () () () - () ()
 a b c d e f

a. Basic Type Unit

b. Output Wattage

015:	15 W
025:	25W
035:	35W
050:	50W
075:	75W
100:	100W
150:	150 W
200:	200 W
350:	350 W

c. Output Voltage

05:	5 V
12:	12 V
15:	15V
24:	24V
36:	36 V
48:	48 V

d. Special Type

Maybe followed by an additional character from A through Z, AA through ZZ or AAA through ZZZ

e. Special Type

Maybe followed by an additional character from A through Z, AA through ZZ or AAA through ZZZ

f. Special Type

Maybe followed by an additional number from 300 through 999 denote optional suffix



EC Declaration of Conformity

Product Name : AC Motor Drive

Rev.02

Product identification (catalogue number): VFD-EL Series

See appendix for details.

are in conformity with the provisions of the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:

We declare under our sole responsibility that the product

2014/35/EU Low Voltage Directive (LVD)

2014/30/EU Electromagnetic Compatibility Directive (EMC)

is herewith confirmed to comply with the requirements set out in the Council Directive(s) for electrical equipment used within certain voltage limits. For the evaluation of the compliance with the Directive(s), the following standards were applied:

LVD : EN 61800-5-1: 2007

EMC : EN61800-3: 2004/A1:2012

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation: Directives 2006/95/EC and 2004/108/EC(until April 19th, 2016) and Directive 2014/35/EU and 2014/30/EU(from April 20th, 2016).

The following manufacturer/importer is responsible for this declaration:

Delta Electronics, Inc.

(Company Name)

No. 18, Xinglong Rd., Taoyuan City 33068, Taiwan.

(Company Address)

Person responsible for making this declaration:

Brad Wang

(Name)

Industrial Automation Business Group / QE Manager

(Position/Title)

886-3-362-6301 / 886-3-362-7267

(TEL / FAX)

TAIWAN

(Place)

Nov. 29th, 2016

(Date)

Brad Wang
(legal Signature)

The first CE was taken on Jul. 11th, 2007.
Rev.01 was issued on Oct. 22th, 2010.



Appendix

Product p/n	Product description
VFD002EL11A	AC MOTOR DRIVES
VFD004EL11A	AC MOTOR DRIVES
VFD007EL11A	AC MOTOR DRIVES
VFD002EL21A	AC MOTOR DRIVES
VFD004EL21A	AC MOTOR DRIVES
VFD004EL21U	AC MOTOR DRIVES
VFD007EL21A	AC MOTOR DRIVES
VFD015EL21A	AC MOTOR DRIVES
VFD022EL21A	AC MOTOR DRIVES
VFD002EL23A	AC MOTOR DRIVES
VFD004EL23A	AC MOTOR DRIVES
VFD007EL23A	AC MOTOR DRIVES
VFD015EL23A	AC MOTOR DRIVES
VFD022EL23A	AC MOTOR DRIVES
VFD037EL23A	AC MOTOR DRIVES
VFD004EL43A	AC MOTOR DRIVES
VFD007EL43A	AC MOTOR DRIVES
VFD015EL43A	AC MOTOR DRIVES
VFD022EL43A	AC MOTOR DRIVES
VFD037EL43A	AC MOTOR DRIVES

The first CE was taken on Jul. 11th, 2007.
Rev.01 was issued on Oct. 22th, 2010.

Underwriters Laboratories (UL LLC) Manufacturer Report



Model: DOP-107EG, DOP-107BG, DOP-107BV, DOP-107EV, DOP-107CV, DOP-110CS, DOP-103BQ

Manufacturing Factory(ies): Same as Applicant

Delta Networks (Dongguan) Ltd
DELTA PLANT 5, DELTA INDUSTRIAL ESTATE, SHIJIE TOWN
DONGGUAN GUANGDONG CHINA

Delta Electronics Components (Wujiang) Ltd
1688 JIANGXING E RD,
WUJIANG ECONOMY DEVELOPMENT ZONE
WUJIANG
JIANG SU 215200 CHINA

Applicant: DELTA ELECTRONICS INC
31-1 SHIEN PAN RD
KUEI SAN INDUSTRIAL ZONE
TAOYUAN HSIEN , 333 TAIWAN

Report No.: E206327-D1009-1/A0/C0

Report Issue Date: 2018-07-05

Standard(s): UL 61010-1, 3rd Edition, May 11, 2012, Revised April 29 2016,
CAN/CSA-C22.2 No. 61010-1-12, 3rd Edition, Revision dated April 29 2016

Additional Standards: UL 61010-2-201, First Edition, Revised date, February 20, 2017
CSA C22.2 NO. 61010-2-201, First Edition, issue date, February, 2014

Report Types: This report consists of the following report types:

[Yes] US Certification (UL Listing)

[Yes] CAN Certification (UL Listing)

You are receiving this report as a Manufacturing Factory for the above-referenced Applicant.

This report covers the Safety evaluation of the referenced model(s) according to the standard(s) specified above.

This report includes portions of the full Applicant report and is designed to support any Follow-Up inspections at the Manufacture's facility.

Please refer to any Supplements to this document for a detailed manufacturer report, which includes information for the Follow-Up Inspection as specified below:

- **Appendix C:** Follow-Up Service Documentation
- **Appendix A:** Enclosures

Report Modifications Summary

The following changes were made to this report. If none listed in the below table, this report is the originally issued report.

NOTE: Some of the changes listed below were made in the full report and may not reflect the changes in this associated Factory Report, which just includes the Appendices listed above from the main report.

Date Modified <i>(Year-Month-Day)</i>	Modifications Made (include Report Reference Number)	Modified By

EU DECLARATION OF CONFORMITY

We : Schneider Electric Industries SAS
35 rue Joseph Monier
Rueil Malmaison 92506 – France

Hereby declare under our own responsibility that the products:

Trademark	Schneider Electric
Product, Type	Control and signaling units, 22 mm diameter XB2-B...C, ZB2-B...C Metal operator range ZB2-BE...C, ZB2-BV...C, ZB2-BW...C, ZB2-BZ...C, Electrical blocks XD2-P...C, XD2-G...C, Joystick controllers And all their accessories

Are in conformity with the requirements of the following directives and conformity was checked in accordance with the following standards.

Directive	Harmonized standard
LV Directive 2014/35/EU	EN 60947-5-1:2004/A1:2009

Subject to correct installation, maintenance and use conforming to its intended purpose, to the applicable regulations and standards, to the supplier's instructions and to accepted rules of the art.

This declaration becomes invalid in the case of any modification to the products not authorized by us.

Issued at Carros - FRANCE: date April 20, 2016

Name : Alain BERNERD
 Industrial Control & Drives
 Customer Satisfaction & Quality
 Vice President



41SD5402



CERTIFICATE

of conformity

No. 8600817

In compliance with the requirements for documentation specified in Annex III (art. 2) of the European Parliament and of the Council on the market of electrical equipment designed for use within certain voltage limits, this certificate applies to the electrical equipment:

Servo Drivers SV-DA200 (small-power series)

Technical specification: **Power Range: 0.1kw~5.5kw**

Technical file: **TCF-VC-JO-2017111405**

Assessment Performed: **2014/35/EU & 2014/30/EU**

Category (Annex IV): **N/A**

Applied Standards: **EN 61800-5-1:2007, EN 61800-3:2004/A1:2010**

placed on the market under the name or trade mark of
INVT INDUSTRIAL TECHNOLOGY(SHANGHAI) CO., LTD.
Building No.1 188 Xinjun Ring Rd, Minhang Dist, Shanghai , P.R. China

and produced in the manufacturing plant(s)
INVT INDUSTRIAL TECHNOLOGY(SHANGHAI) CO., LTD.
Building No.1 188 Xinjun Ring Rd, Minhang Dist, Shanghai , P.R. China

This certificate attests that all provisions described in relevant parts of the standard

EN 61800-5-1:2007, EN 61800-3:2004/A1:2010

have been fulfilled. The CE mark as shown below can be affixed, under the responsibility of the manufacturer, after the completion of EC declaration of conformity and compliance all the relevant directives.

This certificate was first issued on **15th November 2017** and is valid until **14th November 2022** and is based on the evaluation of the technical file of the equipment/machinery device. The voluntary certification does not imply an assessment of the production and it does not permit the use of a mark of conformity or of a safety mark of the LL-C (Certification). The holder of this certificate may use this certificate together with his EC declaration of conformity. This is not NB statement. The first certificate date of issue is 15th November 2017.

Prague, 15th November 2017


Daniel Tilcer
Deputy Head of CB



validity code: **41SD540-730**

Check the validity of this certificate using this code at www.ll-c.info

CERTIFICATE

of conformity

No.8600817 Annex1

Page 1 of 4

Models:

0.1KW		
SV-DA200-0R1-2-S0	SV-DA200-0R1-2-E7	SV-DA200-0R1-2-E0-C000
SV-DA200-0R1-2-K0	SV-DA200-0R1-2-K7	SV-DA200-0R1-2-E0-D0D0
SV-DA200-0R1-2-C0	SV-DA200-0R1-2-M0	SV-DA200-1R0-2-E0-D542
SV-DA200-0R1-2-P0	SV-DA200-0R1-2-S0-C000	SV-DA200-1R0-2-N0-F000
SV-DA200-0R1-2-E0	SV-DA200-0R1-2-K0-00L0	SV-DA200-1R0-4-E7-055L
SV-DA200-0R1-2-N0	SV-DA200-0R1-2-K7-00L0	SV-DA200-1R0-4-E0-055L
SV-DA200-0R1-2-S7	SV-DA200-0R1-2-E0-00T0	

0.2KW		
SV-DA200-0R2-2-S0	SV-DA200-0R2-2-S7	SV-DA200-0R2-2-K0-I0L0
SV-DA200-0R2-2-K0	SV-DA200-0R2-2-E7	SV-DA200-0R2-2-K7-00L0
SV-DA200-0R2-2-C0	SV-DA200-0R2-2-K7	SV-DA200-0R2-2-E0-00T0
SV-DA200-0R2-2-P0	SV-DA200-0R2-2-M0	SV-DA200-0R2-2-E0-C000
SV-DA200-0R2-2-E0	SV-DA200-0R2-2-S0-C000	SV-DA200-0R2-2-E0-D0D0
SV-DA200-0R2-2-N0	SV-DA200-0R2-2-K0-00L0	SV-DA200-0R2-2-E0-E0T2

0.4KW		
SV-DA200-0R4-2-S0	SV-DA200-0R4-2-K7	SV-DA200-0R4-2-E0-00Z0
SV-DA200-0R4-2-K0	SV-DA200-0R4-2-M0	SV-DA200-0R4-2-E0-D0D0
SV-DA200-0R4-2-C0	SV-DA200-0R4-2-S0-C000	SV-DA200-0R4-2-E0-B000
SV-DA200-0R4-2-P0	SV-DA200-0R4-2-K0-00L0	SV-DA200-0R4-2-E0-E0T2
SV-DA200-0R4-2-E0	SV-DA200-0R4-2-K0-I0L0	SV-DA200-0R4-2-E0-L53J
SV-DA200-0R4-2-N0	SV-DA200-0R4-2-K7-00L0	SV-DA200-0R4-2-E0-000X
SV-DA200-0R4-2-S7	SV-DA200-0R4-2-E0-00T0	SV-DA200-0R4-2-K0-Z521
SV-DA200-0R4-2-E7	SV-DA200-0R4-2-E0-C000	SV-DA200-0R4-2-E0-C510

0.75KW	
SV-DA200-0R7-2-S0	SV-DA200-0R7-2-K0-I0L0
SV-DA200-0R7-2-K0	SV-DA200-0R7-2-K7-00L0
SV-DA200-0R7-2-C0	SV-DA200-0R7-2-E0-00T0
SV-DA200-0R7-2-P0	SV-DA200-0R7-2-E0-C000
SV-DA200-0R7-2-E0	SV-DA200-0R7-2-E0-00Z0
SV-DA200-0R7-2-N0	SV-DA200-0R7-2-E0-D0D0
SV-DA200-0R7-2-S7	SV-DA200-0R7-2-E0-B000
SV-DA200-0R7-2-E7	SV-DA200-0R7-2-E0-0531
SV-DA200-0R7-2-K7	SV-DA200-0R7-2-E0-E0T2
SV-DA200-0R7-2-M0	SV-DA200-0R7-2-E0-000B
SV-DA200-0R7-2-S0-C000	SV-DA200-0R7-2-E0-000X
SV-DA200-0R7-2-K0-00L0	



CERTIFICATE

of conformity

No.8600817 Annex1

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Models:

1KW		
SV-DA200-1R0-4-S0	SV-DA200-1R0-2-P0	SV-DA200-1R0-2-E0-00T0
SV-DA200-1R0-4-K0	SV-DA200-1R0-2-E0	SV-DA200-1R0-2-E0-C000
SV-DA200-1R0-4-C0	SV-DA200-1R0-2-N0	SV-DA200-1R0-2-E0-D0D0
SV-DA200-1R0-4-P0	SV-DA200-1R0-2-S7	SV-DA200-1R0-4-S0-C000
SV-DA200-1R0-4-E0	SV-DA200-1R0-2-E7	SV-DA200-1R0-4-K0-00L0
SV-DA200-1R0-4-N0	SV-DA200-1R0-2-K7	SV-DA200-1R0-4-K0-I0L0
SV-DA200-1R0-4-S7	SV-DA200-1R0-2-M0	SV-DA200-1R0-4-K7-00L0
SV-DA200-1R0-4-E7	SV-DA200-1R0-2-S0-C000	SV-DA200-1R0-4-E0-00T0
SV-DA200-1R0-4-K7	SV-DA200-1R0-2-K0-00L0	SV-DA200-1R0-4-E0-C000
SV-DA200-1R0-4-M0	SV-DA200-1R0-2-K0-I0L0	SV-DA200-1R0-4-E0-D0D0
SV-DA200-1R0-2-S0	SV-DA200-1R0-2-K7-00L0	SV-DA200-1R0-2-E0-E0T2
SV-DA200-1R0-2-K0	SV-DA200-1R0-2-E0-00T0	SV-DA200-1R0-2-E0-000B
SV-DA200-1R0-2-C0	SV-DA200-1R0-2-K7-00L0	

1.5KW		
SV-DA200-1R5-4-S0	SV-DA200-1R5-2-E0	SV-DA200-1R5-4-S0-C000
SV-DA200-1R5-4-K0	SV-DA200-1R5-2-N0	SV-DA200-1R5-4-K0-00L0
SV-DA200-1R5-4-C0	SV-DA200-1R5-2-S7	SV-DA200-1R5-4-K0-I0L0
SV-DA200-1R5-4-P0	SV-DA200-1R5-2-E7	SV-DA200-1R5-4-K7-00L0
SV-DA200-1R5-4-E0	SV-DA200-1R5-2-K7	SV-DA200-1R5-4-E0-00T0
SV-DA200-1R5-4-N0	SV-DA200-1R5-2-M0	SV-DA200-1R5-4-E0-C000
SV-DA200-1R5-4-S7	SV-DA200-1R5-2-S0-C000	SV-DA200-1R5-4-E0-D0D0
SV-DA200-1R5-4-E7	SV-DA200-1R5-2-K0-00L0	SV-DA200-1R5-2-E0-B000
SV-DA200-1R5-4-K7	SV-DA200-1R5-2-K0-I0L0	SV-DA200-1R5-2-E0-E0T2
SV-DA200-1R5-4-M0	SV-DA200-1R5-2-K7-00L0	SV-DA200-1R5-4-E7-055L
SV-DA200-1R5-2-S0	SV-DA200-1R5-2-E0-00T0	SV-DA200-1R5-4-E0-055L
SV-DA200-1R5-2-K0	SV-DA200-1R5-2-E0-C000	SV-DA200-1R5-2-E0-000X
SV-DA200-1R5-2-C0	SV-DA200-1R5-2-E0-00Z0	
SV-DA200-1R5-2-P0	SV-DA200-1R5-2-E0-D0D0	



CERTIFICATE

of conformity

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Models:

2KW		
SV-DA200-2R0-4-S0	SV-DA200-2R0-2-P0	SV-DA200-2R0-2-E0-D0D0
SV-DA200-2R0-4-K0	SV-DA200-2R0-2-E0	SV-DA200-2R0-4-S0-C000
SV-DA200-2R0-4-C0	SV-DA200-2R0-2-N0	SV-DA200-2R0-4-K0-00L0
SV-DA200-2R0-4-P0	SV-DA200-2R0-2-S7	SV-DA200-2R0-4-K0-I0L0
SV-DA200-2R0-4-E0	SV-DA200-2R0-2-E7	SV-DA200-2R0-4-K7-00L0
SV-DA200-2R0-4-N0	SV-DA200-2R0-2-K7	SV-DA200-2R0-4-E0-00T0
SV-DA200-2R0-4-S7	SV-DA200-2R0-2-M0	SV-DA200-2R0-4-E0-C000
SV-DA200-2R0-4-E7	SV-DA200-2R0-2-S0-C000	SV-DA200-2R0-4-E0-D0D0
SV-DA200-2R0-4-K7	SV-DA200-2R0-2-K0-00L0	SV-DA200-2R0-2-E0-E0T2
SV-DA200-2R0-4-M0	SV-DA200-2R0-2-K0-I0L0	SV-DA200-2R0-2-E0-000H
SV-DA200-2R0-2-S0	SV-DA200-2R0-2-K7-00L0	SV-DA200-2R0-4-E7-055L
SV-DA200-2R0-2-K0	SV-DA200-2R0-2-E0-00T0	SV-DA200-2R0-4-E0-055L
SV-DA200-2R0-2-C0	SV-DA200-2R0-2-E0-C000	

3KW		
SV-DA200-3R0-4-S0	SV-DA200-3R0-2-E0	SV-DA200-3R0-4-S0-C000
SV-DA200-3R0-4-K0	SV-DA200-3R0-2-N0	SV-DA200-3R0-4-K0-00L0
SV-DA200-3R0-4-C0	SV-DA200-3R0-2-S7	SV-DA200-3R0-4-K0-I0L0
SV-DA200-3R0-4-P0	SV-DA200-3R0-2-E7	SV-DA200-3R0-4-K7-00L0
SV-DA200-3R0-4-E0	SV-DA200-3R0-2-K7	SV-DA200-3R0-4-E0-00T0
SV-DA200-3R0-4-N0	SV-DA200-3R0-2-M0	SV-DA200-3R0-4-E0-C000
SV-DA200-3R0-4-S7	SV-DA200-3R0-2-S0-C000	SV-DA200-3R0-4-E0-D0D0
SV-DA200-3R0-4-E7	SV-DA200-3R0-2-K0-00L0	SV-DA200-3R0-2-E0-B000
SV-DA200-3R0-4-K7	SV-DA200-3R0-2-K0-I0L0	SV-DA200-3R0-2-E0-E0T2
SV-DA200-3R0-4-M0	SV-DA200-3R0-2-K7-00L0	SV-DA200-3R0-4-E0-0501
SV-DA200-3R0-2-S0	SV-DA200-3R0-2-E0-00T0	SV-DA200-3R0-4-E7-055L
SV-DA200-3R0-2-K0	SV-DA200-3R0-2-E0-C000	SV-DA200-3R0-4-E0-055L
SV-DA200-3R0-2-C0	SV-DA200-3R0-2-E0-00Z0	SV-DA200-3R0-4-S7-000C
SV-DA200-3R0-2-P0	SV-DA200-3R0-2-E0-D0D0	



CERTIFICATE

of conformity

No.8600817 Annex1

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Models:

4.4KW		
SV-DA200-4R4-4-S0	SV-DA200-4R4-2-C0	SV-DA200-4R4-2-E0-00T0
SV-DA200-4R4-4-K0	SV-DA200-4R4-2-P0	SV-DA200-4R4-2-E0-C000
SV-DA200-4R4-4-C0	SV-DA200-4R4-2-E0	SV-DA200-4R4-2-E0-D0D0
SV-DA200-4R4-4-P0	SV-DA200-4R4-2-N0	SV-DA200-4R4-4-S0-C000
SV-DA200-4R4-4-E0	SV-DA200-4R4-2-S7	SV-DA200-4R4-4-K0-00L0
SV-DA200-4R4-4-N0	SV-DA200-4R4-2-E7	SV-DA200-4R4-4-K0-I0L0
SV-DA200-4R4-4-S7	SV-DA200-4R4-2-K7	SV-DA200-4R4-4-K7-00L0
SV-DA200-4R4-4-E7	SV-DA200-4R4-2-M0	SV-DA200-4R4-4-E0-00T0
SV-DA200-4R4-4-K7	SV-DA200-4R4-2-S0-C000	SV-DA200-4R4-4-E0-C000
SV-DA200-4R4-4-M0	SV-DA200-4R4-2-K0-00L0	SV-DA200-4R4-4-E0-D0D0
SV-DA200-4R4-2-S0	SV-DA200-4R4-2-K0-I0L0	SV-DA200-4R4-4-E0-0501
SV-DA200-4R4-2-K0	SV-DA200-4R4-2-K7-00L0	SV-DA200-4R4-4-E0-0501

5.5KW		
SV-DA200-5R5-4-S0	SV-DA200-5R5-4-S7	SV-DA200-5R5-4-K0-00L0
SV-DA200-5R5-4-K0	SV-DA200-5R5-4-E7	SV-DA200-5R5-4-K0-I0L0
SV-DA200-5R5-4-C0	SV-DA200-5R5-4-K7	SV-DA200-5R5-4-K7-00L0
SV-DA200-5R5-4-P0	SV-DA200-5R5-4-M0	SV-DA200-5R5-4-E0-00T0
SV-DA200-5R5-4-E0		SV-DA200-5R5-4-E0-C000
SV-DA200-5R5-4-N0	SV-DA200-5R5-4-S0-C000	SV-DA200-5R5-4-E0-D0D0



A.7 Instruction manual



恒隆精工
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恒隆新型全自动贴面 配置单 (中英文)

**Henglong New Type
Full Automatic Flute Laminating Machine
Configuration
(Chinese - English)**



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High Speed Full Automatic Flute Laminating Machine

全自动高速贴面机



功能特点 Introduction:

- ❖ 适合 150-600 克的卡纸和瓦楞纸贴合
Suitable for laminating of cardboard and corrugated cardboard in 150-600 g/m².
- ❖ 真空吸盘式飞达送纸系统, 可将纸张准确送入机器中; 循环堆纸架可在不停机的状态下堆好下一批面纸, 让效率更高。
The vacuum suction-type feeding system can lead the paper accurately into the machine; cycle stacking planes in a state of non-stop the next batch of paper stack well, so that more efficient.
- ❖ 底纸采用吸气自动进纸, 可根据人工送面纸的速度, 自动同步跟踪。
Using suction automatic feeding of bottom sheet, according to the main machine operating speed, continuous automatic tracking.
- ❖ 全新概念弹性前规定位, 定位精度高, 底纸永不超前。
The machine operation is stable, surface paper with corrugated paper joint very accurate. The corrugated paper never pull ahead, surface paper's location is easy adjust.
- ❖ 整机采用触摸屏/PLC/伺服电机控制系统, 双变频控制方式, 电路系统运行稳定, 并自动显示故障报警。
Machine uses touch-screen/PLC/servo motor control system, double frequency control type, the circuit system is stable, and can automatically display the failure alarm.
- ❖ 全自动胶水补充系统, 自动补充损失胶量, 并配合胶水循环回收, 避免胶水损耗浪费。
Automatic gluing, and the glue can be used circulatory, avoid glue waste.
- ❖ 计量辊线速度科学设计, 保证胶量均匀的同时, 避免高速运转时甩胶。



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Measure roller line-speed design scientifically, avoid glue fly out when the speed is high.

- ❖ 压力辊单边调节, 方便快速。

Pressure rollers adopt unilateral adjustment, convenient and fast.

- ❖ 采用底轴被胶皮轴挤压清洗的方式来清洗裱胶底压力轴, 保证底纸背面的清洁, 把清洗掉的胶水等异物直接沉淀到水槽中。同时采用齿轮齿条方式控制水槽升降, 可以轻松把水槽抽出, 方便清洗。

Cleaning type : bottom roller is extruded by rubber roller to clean the bottom laminating pressure roller, ensure the cleaner on the reverse of the bottom paper . Make glue etc. foreign matter after washing direct subside in tank. At the same time , adopting the gear and chain to control the lifting of tank, can take out the tank easily and convenient to wash .

- ❖ 压平部采用悬浮式可移动结构, 总长 5 米, 配备 28 根压纸轴, 让纸板在压平过程中均匀受力。

The pressure conveyor adopt floating movable structure , total length 5m , equipped with 28 paper pressing rollers , make the cardboard uniform bearing strength in pressing process.

- ❖ 人性化设计计数器, 方便记录您每日的工作量。易于计件工作。

Counter designs scientifically, easy recording the amount you have been worked.

- ❖ 选配小压床一套。长度 2.5 米, 大压床长度 5 米。

Small pressure table (optional) . length 2.5m , big pressure table length 5m.





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技术参数 Technological parameter

型号 Model	HL-1300A-III	HL-1450A-III	HL-1550A-III	HL-1650A-III
最大贴面尺寸 Max laminating size	1300mm×1250mm	1400mm×1250mm	1500mm×1250mm	1600mm×1250mm
最小贴面尺寸 Min laminating size	400mm×400mm	400mm×400mm	400mm×400mm	400mm×400mm
经济速度 Economic speed	0-100sheets/min	0-100sheets/min	0-100sheets/min	0-100sheets/min
裱合精度 Laminating precision	±1.5	±1.5	±1.5	±1.5
功率 Power	10kw	12kw	12kw	12kw
外形尺寸 Size	13.5m×2m×2.4m	13.5m×2.05m×2.4m	13.5m×2.15m×2.4m	13.5m×2.25m×2.4m
重量 Weight	About 4.8t	About 5t	About 5.2t	About 5.4t
底纸厚度 Bottom paper thickness	A/B/C/E flute, 3/4/5 layer, less than 12mm thickness			
面纸克重 Surface paper gram weight	150-600 g/m ²			

主要配置 Main configuration

显示屏	Display screen	台达 (台湾)	Delta (Taiwan)
开关电源	Switching power supply	欧姆龙 (日本)	OMRON
主机电机	Mainframe Motor	天津同德利	Tianjin Tong'de'li
飞达	Feeder	日本日光公司 (零件组装)	Japanese Rigung
减速电机	Geared motors	上海人民	Shanghai Renmin
真空泵	Vacuum pump	欧乐霸 (台湾)	EUROVAC (Taiwan)
漩涡气泵	Vortex Pump	上海恒力牌	Shanghai Hengli
同步带	Synchronous belt	宁波贝递 (合资)	Ningbo Beidi (Joint venture)
整机轴承	Bearing	瓦、哈、洛 (三大厂)	WTJB,HRB,LYC
整机链条	The host chain	朝和牌 (中日合资)	CHOHO (sino-Japanese Joint venture)
压输皮带	Transfer press belt	意大利 (合资)	Italy (Joint venture)
可编程控制器PLC	PLC	松下 (日本)	Panasonic (Japanese)
接触器	Contacting	施耐德 (法国)	SCHNEIDER (The French)
主机变频器	The host inverter	台达 (台湾)	Delta (Taiwan)
压输平台变频器	Pressure platform inverter	台达 (台湾)	Delta (Taiwan)
压输平台电机	Pressure platform motor	上海欧特	Shanghai OTT



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分部介绍 Unit Introduction :

1. 飞达系统 Feeder System



- ❖ 高精度高速飞达送纸，送纸平滑顺畅。

High precision high speed feeder , make the feeding smooth .

- ❖ 加强型送纸装置，吸嘴角度可自由调节，适应不同类型面纸

Strengthen type feeder device , the suction mouth angle can be adjustable , according to different kinds of surface paper .



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2. 电器系统 Electric system :



- ❖ 主要电器元件采用进口品牌
Main electric appliances all adopt the imported famous brand .
- ❖ PLC 跟踪技术, 故障自动侦测
PLC tracking technique , automatic fault detection .



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3. 压力调节系统 Pressure adjustment system :



- ❖ 压力单边调节，确保二边压力一致
Adjust the pressure in single side , to ensure the pressure is same on both sides .
- ❖ 带压力刻度表显示，更换纸张规格时调节轻松简便
With pressure gauge display , can easily adjust when change the paper size.



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4. 压输系统 Pressure conveyor :



- ❖ 浮动式压平设计，无需调节压床压力
Floating type pressure design , don't need to adjust the pressure of flatbed .
- ❖ 加高设计，利于厚瓦楞纸板的顺畅工作
Heightening design , good for the smooth work of thick corrugated cardboard .



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操作手册

Operation Manual

(请在安装和使用本设备前仔细阅读操作手册)

(please read this manual carefully before installing and using the machine)

安全注意事项 Attention for safety :

1. 设备周边环境设置 Device peripheral environment setting

- a. 请将设备设置在无烟火的环境中, 以防止发生火灾。

Please set the machine in a firework-free environment to prevent fire.

- b. 请将设备设置在有足够通风的环境中(必要时, 请在设备周边环境中安装通风装置)。以保证员工的工作通风环境良好。

Please set the machine in an environment with sufficient ventilation (if necessary, please install ventilation in the surrounding environment of the machine). To ensure a good working environment for employees.

- c. 设备的周边环境应有足够的自然采光或照明。

The surrounding environment of the equipment should be provided with adequate natural lighting.

- d. 本设备对周边环境无粉尘、噪音、油污等污染。

The equipment has no dust, noise, oil pollution and other pollution to the surrounding environment.

2. 搬运和安装 Handling and installation

- a. 在搬运本设备时, 请使用合适的升降工具及移动设备(必要时, 请用柔软体衬垫), 以防止设备损坏及人员以外伤害。

Please use proper lifting tools and moving equipment when carrying this machine (use soft materials cushion if necessary), to prevent equipment damage and other injuries.

- b. 在安装设备时, 请按照说明书进行(必要时应给予本公司技术人员协作)。



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When installing the machine, please follow the instructions (if necessary, the company's technical staff should be provided with coordination).

3. 布线 Wiring

- a. 请在布线前，仔细查看说明书确保输入正确电源。

Please check the instructions carefully before wiring to make sure the correct power supply is input.

- b. 确认输入电源是断开的，然后再布线，以免触电。

Make sure the input power is disconnected, and then wire it. To avoid electric shock.

- c. 必需有良好的接地性，以免触电或发生火灾。

Good grounding is necessary to avoid electrical shock or fire.

- d. 应由专职电工进行，以免触电或发生火灾。

The business shall be conducted by a full-time electrician to avoid electric shock or fire.

4. 试运行 Test Running

- a. 运行前，请确保各电机的运转方式正确无误。

Before running, please make sure that the motor runs correctly.

- b. 运行前，请检查本设备每一部分的传动机构，确保各部分机构传动运行良好。

Before running, please check the transmission mechanism of each part of the machine to make sure that the transmission mechanism of each part runs well.

- c. 试运行 10 分钟左右，确信整机运行良好。

Test run for about 10 minutes and make sure that the whole machine runs well.

5. 操作 Operations

- a. 请给予操作员必要的岗前培训。

Please give the operator the necessary pre-job training.

- b. 操作前测试所有急停开关。

Test all emergency stop switches before operation.

- c. 所有的安全开关和防护装置必须正确安装并使用。

All safety switches and protective devices must be properly installed and used.

- d. 确保在开机之前所有的杂物已从输送带和码纸台上清理。否则可能会导致机器损伤或人身伤害。

Make sure all debris is cleared from the conveyor belt and stacking table before starting up. Otherwise it may cause the machine injuries or personal injuries.

- e. 操作机器时避免与他人交谈，分散注意力会导致人员受伤甚至严重事故。

Avoid talking with others while operating the machine. Distraction can lead to human injuries or even serious accidents.



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- f. 事先做好筹备工作，以便可以用伸手所及的东西处理一切可能的突发事件，不恰当的处理方式会导致事故的发生。

Prepare well in advance so that you can handle all possible emergencies with what you can reach. Improper handling can lead to accidents.

- g. 旋转的辊筒很危险，可能导致严重伤害，不许在开机时打开安全防护装置，打开安全防护装置后只能点动。

The rotating roller is dangerous and may cause serious injury. Do not open the safety protection device when starting up. Only can use the jog function after opening the safety protection device.

- h. 当有人员生命危险禁止开机或者机器处于维修状态时，不要随意开动机器。

Do not start the machine at will when the life of a person is at risk or the machine is in maintenance state.

- i. 在机器的操作、调试、安装及维护时，不要穿肥大的衣服、不要佩戴饰品或将长发散在外面。

During the operation, debugging, installation and maintenance of the machine, do not wear loose clothes, accessories or with long hair hangs out .

- j. 应调整好各辊间隙。匀胶辊与上胶辊与下胶辊的间隙不能调整到零，以免辊间互相摩擦而损坏。

The gap of each roller should be adjusted. The gap between the glue distribution roller and upper roller and lower roller cannot be adjusted to zero , to avoid roller friction between them.

- k. 胶泵不能空载运行以免摩擦损坏胶泵叶轮。

The rubber pump cannot be operated without load to avoid friction damage of the rubber pump impeller.

6. 维护与检查 Maintenance and inspection

- a. 请不要改变或破坏主电机变频器的设置程序。

Please do not change or damage the settings of the main motor frequency converter.

- b. 请建立设备的维护与保养规章制度，并按制度严格执行。

Please establish the rules and regulations for equipment maintenance and strict implementation.

- c. 设备长时间闲置后重新使用前必须进行全面检查和试运行。

The machine must be thoroughly checked and tested before being put back into use after being idle for a long time.

- d. 清洗辊水箱每使用一段时间，需更换水箱内的水，使水保持清洁。

The water in the water tank of the cleaning roller should be replaced for a period of time to keep the water clean.

- e. 请使用本公司生产的零配件进行检修换件，对使用非本公司的零配件造成的机械损伤，本公司将不给予保修。



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Please use the spare parts produced by our company for maintenance and replacement, which is caused by the use of spare parts from other companies, no warranty will be given for mechanical damage.

- f. 未经本公司技术人员的允许, 谢绝对设备进行任何形势的改造, 用户自行改造, 我公司不承担任何责任。

Without the permission of our technical personnel, we decline any modification of the machine in any situation, and our company will not assume any responsibility for the modification of the machine by users themselves.

贴合原理 Laminating principle

面纸由自动输纸机送出由输纸带输送前定规处静止定位, 光电开关得到信息后控制漩涡气泵吸气阀门打开, 将底纸吸附在吸风皮带上, 吸风皮带电机转动使底纸自动送出, 经上胶部分上胶后到前规处与面纸平齐定位, 同时借助辊筒对底纸的推力使定规打开, 面纸和底纸通过贴合辊和压合辊的压力作用粘合在一起, 并送至压平部分压平。

Surface paper is fed by automatic paper feeder and transported by conveyor belt to the front initiating and static positioning, the photoelectric switch control vortex pump to open the suction valve after get the signal, adsorb the bottom paper on the suction belt, then suction motor rotate to output the bottom paper automatically, after coating of glue in glue part to the front initiating, positioning and alignment with surface paper, at the same time with the help of the thrust of the roller against the bottom paper to open the initiating structure, surface paper and bottom paper paste together by the pressure of laminating roller and pressing roller, and sent to pressing parts.

操作程序 Operating procedures

1. 机器开机工作前准备调整: 调整输纸辊的间隙距离, 约为底纸厚度的 85-90%, 贴合辊之间的间隙则为底纸和面纸加在一起的厚度的 85-90%。飞达输纸处尺寸调节合适, 压力适中。

Preparation before starting the machine: adjust the gap distance of the paper feeding rollers, about the 85-90% of the bottom paper thickness, the gap between the laminating rollers is 85-90% of the total thickness of surface paper and bottom paper. Suitable size and pressure adjustment in feeder.

2. 调整完毕后, 自动清洗水泵工作, 至水槽注满水, 把刮刀靠上, 刮刀不要靠的太紧, 也不要太松, 自然接触到辊筒表面即可。

After the adjustment, clean the water pump automatically and fill the sink with water. Put the scraper onto the tank, not too tight or loose, just touch the surface of roller naturally.

3. 调整间隙后, 在工作前要试运行(先不要上胶)。顺序: a: 合上电源, b: 旋转调整旋钮至屏幕上显示数值为 15Hz 左右。c: 启动主电机。d: 同时开启飞达输纸, 飞达气泵, 压平机, 吸风泵。



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After adjusting the clearance, need test running before work (do not apply glue first). Order: a: switch on the power; b: Rotate the adjustment knob until the display value of about 15Hz on the screen. c: start the main motor. d: simultaneously open the feeder to feed paper, feed air pump, pressing part and air pump.

4. 机器刚贴合时，需要贴合 20-30 张来进行自行调整，这属于自动校准阶段，待输纸参数变化稳定后才可以随意调整。注意输纸参数变化没有稳定时不能调整，否则会引起面纸和底纸的粘合误差大。建议：机器在自行校准时，用户可采用同样规格的废品纸张，这样不会引起更多的浪费。

When the machine start to laminate paper, 20-30 pieces of paper need to be glued together for self-adjustment, which belongs to the automatic calibration stage, and can only be adjusted at will after the paper feeding parameters are stable. Note that the change of paper feeding parameters can not be adjusted without stability, otherwise it will cause a large error in laminating between surface paper and bottom paper. Recommendation: when the machine is in self-calibrate, users can use the same specification of waste paper, so that it will not cause more waste.

5. 以上程序都完成后，就可以启动胶泵开始上胶调整及工作

When the above procedures are completed, the glue pump can be started to adjust and work.



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故障排除方法 Troubleshooting method

故障现象 Failure phenomenon	存在原因 Existing reason	排除方法 Elimination method
吸风带不转动 Suction belt not rotate	光电开关不作用 The photoelectric switch doesn't work.	调节光电开关 Adjust the photoelectric switch
	伺服电机不作用 The servo motor does not work.	调节伺服驱动器 Adjust the servo driver.
底纸不能自动输出或一次输出多张 Bottom paper can't feed automatically or feed more than one piece in one time .	分纸头间隙过小或过大 the clearance of paper-separating head is too big or small .	调节分纸头间隙 Adjust the clearance of paper-separating head
	风力过小或过大 Wind power is too small or big	调节风量大小 Adjust the air volume.
贴合不准 Irregular laminating	输纸不到位 Paper feeding is not in place	调节卡纸位置 Adjust the paper position
	前定规位置不准确 Front initiating position is not right	调节前定规手轮 Adjust the hand wheel of front initiating .
	辊两侧压力不一致 The pressure in both ends of roller is not same .	调节压力至一致 Adjust the pressure to be same .
两纸贴合后有胶水溢出 Glue ran out when the two pieces of paper were glued together.	贴合辊或压合辊的间隙过小 The clearance of laminating roller or pressing roller is too small .	调节间隙 Adjust the clearance
	上胶量过大 The glue feeding volume is too big	调整上胶量 Adjust the glue volume.
底纸上胶左右不匀 The glue on the bottom paper	上胶辊和匀胶辊两端不平行 The both ends of glue roller and glue	调节各辊之间的平行度 Adjust the parallelism between



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is uneven.	distribution roller are not parallel .	rollers.
	上胶辊和下胶辊两端不平行 The both ends of upper glue roller and lower glue roller are not parallel .	



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