GUANGDONG ARTECO REFRIGERATION EQUIPMENT CO.,LTD.

CE Technical Documents

Product Name:BS Series Box-Type Condensing Units

Applied Directive :Machinery Directive 2006/42/EC

Low Voltage Directive(2014/35/EU)

Electromagnetic compatibility Directive 2014/30/EU

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Technical Construction File

Test Report No. **XMT0202400001H/MD**
XMT0202400002H/LVD
XMT0202400003H/EMC

According to Machinery Directive (2006/42/EC)
Electromagnetic Compatibility Directive (2014/30/EU)
Low Voltage Directive (2014/35/EU)

Related to the BS Series Box-Type Condensing Units

Model: **BS EBF-05H**

Its variants and modifications：

BS Series

Presented by
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Contents

Part I: General

1.1 General description

1.1 General description

The **BS Series Box-Type Condensing Units** belong to the machinery listed in Annex IV of 2006/42/EC, the machinery safety directive.

Summary of the regulations and standards the machinery complies with

- The machines must accord to the following EC Directives:
- Machinery Directive:2006/42/EC

  EN ISO 12100:2010

  Safety of machinery - general principles for design - risk assessment and risk reduction (Iso12100:2010)

  EN 13771-2:2017

  Compressors and condensing units for refrigeration. Performance testing and test methods Condensing units
- Low Voltage Directive 2014/35/EU

  EN 60204-1:2018

  Safety of Machinery – Electrical Equipment of Machines - Part 1: General requirements
- Electromagnetic Compatibility Directive 2014/30/EU

  EN IEC 61000-6-1:2019

  Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments.

  EN IEC 61000-6-3:2021

  Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

  EN IEC 61000-3-2:2019+A1:2021

  EMC-Limits-Limits for the harmonic current emissions (equipment input current up to and including 16 Aper phase).

  EN 61000-3-3:2013+A2:2021

  EMC-Limits-Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection.

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

1.1 Variations of the series products

Regarding the whole family of the series, they are:

BS Series

To present the conformity of this series machine with Machinery Directive, we di scuss the conformity systematically with the relative Directive and standards for **BS EBF-05H** as a basic evaluation in clause.

Part II: Declarations

2.1 The CE Declaration of Conformity with signature

Part II: Assessment of conformity

3.1 Risk assessment

3.2 Essential health and safety requirements

3.1 Risk assessment

I.Introduction.

In general this risk assessment report for the **BS Series Box-Type Condensing Units** Model:**BS EBF-05H** series and its variants made by **GUANGDONG ARTECO REFRIGERATION EQUIPMENT CO., LTD.** was carried out in accordance with the requirements of Machinery Directive and the standards of EN ISO 12100：2010+AC:2011and ISO 14121-2:2012, 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 292-part Ⅰ, 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+AC:2011and ISO 14121-2 standards, and the 4 factors S-F-O-A have been used for evaluating the level of risks.

(a) S: Severity of possible harm

- S1: Slight (normally reversible)
- S2: Serious (normally irreversible)

(b) F: Exposure

- F1: Seldom
- F2: Frequent

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

- O1: Very low
- O2: Medium
- O3: High

(d) A: Probability of avoidance

- A1: Possible
- A2: Impossible

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

a) a risk index of 1 or 2 corresponds to the lowest risk,
b) a risk index of 3 or 4 corresponds to a medium risk, and
c) a risk index of 5 or 6 corresponds to the highest risk.

Solutions for the level of hazards

1: Protected by warning sign
2: Protected by guard and warning sign
3: Consider the other design, choose the best one, and add both guard and warning sign
4: Consider another two designs, choose the best one, and add both guard and warning sign
5: Consider another three designs, choose the best one, and add both guard and warning sign

No.	Hazards source	S	F	O	A	Level
	Mechanical hazards					
1.0-1	Mechanical hazards due to machine parts or work pieces	***S1***	***F1***	***O1***	***A1***	**-**
1.0-2	Mechanical hazards due to accumulation of energy inside the machinery	***S1***	***F2***	***O1***	***A1***	**-**
1.1	Crushing/Squeezing					***N/A***
1.2	Shearing					***N/A***
1.3	Cutting or severing					***N/A***
1.4	Entanglement					***N/A***
1.5	Drawing-in or trapping					***N/A***
1.6	Impact	***S2***	***F1***	***O1***	***A1***	**-**
1.7	Stabbing or puncture					***N/A***
1.8	Friction or abrasion	***S2***	***F1***	***O1***	***A1***	**-**
1.9	High pressure fluid injection or ejection					***N/A***
	Electrical hazards					
2.1	Contact with live parts	***S1***	***F1***	***O1***	***A1***	**-**
2.2	Contact with parts which have become live under faulty conditions	***S1***	***F1***	***O1***	***A1***	**-**
2.3	Approach to live part under high voltage	***S1***	***F1***	***O1***	***A1***	**-**
2.4	Electrostatic phenomena	***S1***	***F1***	***O1***	***A1***	**-**
2.5	Thermal radiation or other phenomena such as projection of molten particles and chemical effects from short-circuits, overloads etc.					***N/A***
	Thermal hazards					
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	***S1***	***F1***	***O1***	***A1***	**-**
3.2	Damage to health by hot or cold working environment					***N/A***
	Hazards generated by noise					
4.1	Hearing loss (deafness), other physiological disorders	***S1***	***F1***	***O1***	***A1***	**-**
4.2	Interference with speech communication, acoustic signals, etc.	***S1***	***F1***	***O1***	***A1***	**-**
	Hazards generated by vibration					
5.1	Use of hand-held machines resulting in a variety of neurological and vascular disorder					***N/A***
5.2	Whole body vibration, particular when combined with poor postures					***N/A***
	Hazards generated by radiation					

6.1	Low frequency, radio frequency radiation, microwaves					*N/A*
6.2	Infrared, visible and ultraviolet light					*N/A*
6.3	X and gamma rays					*N/A*
6.4	Ranger, beta rays, electron or ion beams, neutrons					*N/A*
6.5	Lasers					*N/A*
Hazards generated by materials and substances processed or used by the machinery						
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	*S1*	*F1*	*O1*	*A1*	-
7.2	Fire and explosion hazard					*N/A*
7.3	Biological and micro-biological (viral or bacterial) hazards					*N/A*
Hazards generated by neglecting ergonomic principles in machine design						
8.1	Unhealthy postures or excessive effort					*N/A*
8.2	Inadequate consideration of hand-arm or foot-leg anatomy					*N/A*
8.3	Neglected use of personal protection equipment	*S1*	*F1*	*O1*	*A1*	-
8.4	Inadequate local lighting					*N/A*
8.5	Mental overload or underload, stress					*N/A*
8.6	Human error, human behavior	*S1*	*F1*	*O1*	*A1*	-
8.7	Inadequate design, location or identification of manual controls	*S1*	*F1*	*O1*	*A1*	*N/A*
8.8	Inadequate design or location of visual display units					*N/A*
Combination of hazards						
9	Combination of hazards					*N/A*
Unexpected start-up, unexpected overrun/over-speed						
10.1	Failure/disorder of the control system	*S1*	*F1*	*O1*	*A1*	-
10.2	Restoration of energy supply after an interruption	*S1*	*F1*	*O1*	*A1*	-
10.3	External influences on electrical equipment	*S1*	*F1*	*O1*	*A1*	-
10.4	Other external influences (gravity, wind, etc.)					*N/A*
10.5	Errors in the software					*N/A*
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)	*S1*	*F1*	*O1*	*A1*	-
Impossibility of stopping the machine in the best possible conditions						
11	Impossibility of stopping the machine in the best possible conditions					*N/A*
Variations in the rotational speed of tools						
12	Variations in the rotational speed of tools					*N/A*
Failure of the power supply						
13	Failure of the power supply	*S1*	*F1*	*O1*	*A1*	-

Failure of the control circuit						
14	Failure of the control circuit	***S1***	***F1***	***O1***	***A1***	**-**
Errors of fitting						
15	Errors of fitting	***S1***	***F1***	***O1***	***A1***	**-**
Break-up during operation						
16	Break-up during operation	***S1***	***F1***	***O1***	***A1***	**-**
Falling or ejected objects or fluids						
17	Falling or ejected objects or fluids					***N/A***
Loss of stability / overturning of machinery						
18	Loss of stability / overturning of machinery					***N/A***
Slip, trip and fall of persons (related to machinery)						
19	Slip, trip and fall of persons (related to machinery)					***N/A***
Additional hazards, hazardous situations and hazardous events due to mobility						
20	**Relating to the traveling function**					
20.1	Movement when starting the engine	***S1***	***F1***	***O1***	***A1***	**-**
20.2	Movement without a driver at the driving position					***N/A***
20.3	Movement without all parts in a safe position					***N/A***
20.4	Excessive speed of pedestrian controlled machinery					***N/A***
20.5	Excessive oscillations when moving	***S1***	***F1***	***O1***	***A1***	**-**
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilized					***N/A***
Linked to the work position (including driving station) on the machine						
21.1	Fall of persons during access to (or at/from) the work position					***N/A***
21.2	Exhaust gases/lack of oxygen at the work position					***N/A***
21.3	Fire (flammability of the cab, lack of extinguishing means)					***N/A***
21.4	Mechanical hazards at the work position: a) contact with the wheels; b) rollover; c) fall of objects, penetration by objects; d) break-up of parts rotating at high speed; e) contact of persons with machine parts or tools (pedestrian controlled machines).	***S1***	***F1***	***O1***	***A1***	**-**
21.5	Insufficient visibility from the work positions					***N/A***
21.6	Inadequate lighting					***N/A***
21.7	Inadequate seating					***N/A***
21.8	Noise at the work position	***S1***	***F1***	***O1***	***A1***	**-**
21.9	Vibration at the work position					***N/A***
21.10	Insufficient means for evacuation/emergency exit					***N/A***

Due to the control system						
22.1	Inadequate location of manual controls					***N/A***
22.2	Inadequate design of manual controls and their mode of operation					***N/A***
From handling the machine (lack of stability)						
23	From handling the machine (lack of stability)					***N/A***
Due to the power source and to the transmission of power						
24.1	Hazards from the engine and the batteries	***S1***	***F1***	***O1***	***A1***	**-**
24.2	Hazards from transmission of power between machines					***N/A***
24.3	Hazards from coupling and towing					***N/A***
From/to third persons						
25.1	Unauthorized start-up/use	***S1***	***F1***	***O1***	***A1***	**-**
25.2	Drift of a part away from its stopping position					***N/A***
25.3	Lack or inadequacy of visual or acoustic warning means					***N/A***
Insufficient instructions for the driver/operator						
26	Insufficient instructions for the driver/operator	***S1***	***F1***	***O1***	***A1***	**-**
Additional hazards, hazardous situations and hazardous events due to lifting						
27	Mechanical hazards and hazardous events					
27.1	From load falls, collisions, machine tipping caused by:					
27.1.1	Lack of stability	***S1***	***F1***	***O1***	***A1***	**-**
27.1.2	Uncontrolled loading - overloading - overturning moments exceeded					***N/A***
27.1.3	Uncontrolled amplitude of movements					***N/A***
27.1.4	Unexpected/unintended movement of loads					***N/A***
27.1.5	Inadequate holding devices/accessories					***N/A***
27.1.6	Collision of more than one machine					***N/A***
27.2	From access of persons to load support					***N/A***
27.3	From derailment					***N/A***
27.4	From insufficient mechanical strength of parts					***N/A***
27.5	From inadequate design of pulleys, drums					***N/A***
27.6	From inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine					***N/A***
27.7	From lowering of the load under the control of friction brake					***N/A***
27.8	From abnormal conditions of assembly/testing/use/ maintenance					***N/A***
27.9	From the effect of load on persons (impact by load or	***S1***	***F1***	***O1***	***A1***	**-**

	counterweight)					
Electrical hazards						
28.1	From lightning					***N/A***
Hazards generated by neglecting ergonomic principles						
29.1	Insufficient visibility from the driving position	***S1***	***F1***	***O1***	***A1***	**-**
Additional hazards, hazardous situations and hazardous events due to underground work						
30	Mechanical hazards and hazardous events due to:					
30.1	Lack of stability of powered roof supports					***N/A***
30.2	Failing accelerator or brake control of machinery running on rails					***N/A***
30.3	Failing or lack of deadman's control of machinery running on rails					***N/A***
31	Restricted movement of persons					***N/A***
32	Fire and explosion					***N/A***
33	Emission of dust, gases etc.	***S1***	***F1***	***O1***	***A1***	**-**
Additional hazards, hazardous situations and hazardous events due to the lifting or moving of persons						
34	Mechanical hazards and hazardous events due to:					
34.1	Inadequate mechanical strength - inadequate working coefficients					***N/A***
34.2	Failing of loading control					***N/A***
34.3	Failing of controls in person carrier (function, priority)					***N/A***
34.3	Overspeed of person carrier					***N/A***
35	Falling of person from person carrier					***N/A***
36	Falling or overturning of person carrier					***N/A***
37	Human error, human behavior					***N/A***

NOTE: "N/A" means that the hazard is not required to assess.

No.	Hazards source	S	F	O	A	Level
1.1	Crushing	***S1***	***F1***	***O1***	***A1***	**-**
Where	*Workplace*					
When	*during operation*					
Improvement result						
Method		**S**	**F**	**O**	**A**	**Level**
1. Use the movable guard with interlocking. *2. Read instruction manual before operate the machine.* *3. Afixing suitable warning signs.manual.*		***S1***	***F1***	***O1***	***A1***	**-**

No.	Hazards source	S	F	O	A	Level
2.1	Contact with live parts	***S1***	***F1***	***O1***	***A1***	**-**
Where	*Whole power and control systems*					
When	*The machine is power on*					
Improvement result						
Method		**S**	**F**	**O**	**A**	**Level**
1. Only operation by training/authorizedpersons. *2. Operation ofthe machine shall conform to the instructions of the instruction manual.* *3. Check and inspection according to the specified durations of the instruction manual.* *4. Using safety components in accordance with those relevant international standards.* *5. Use ofwarning label.*		***S1***	***F1***	***O1***	***A1***	**-**

No.	Hazards source	S	F	O	A	Level
2.2	Contact with parts which have become live under faulty conditions	***S1***	***F1***	***O1***	***A1***	**-**
Where	*Whole power and control systems*					
When	*The machine is power on*					
Improvement result						
Method		**S**	**F**	**O**	**A**	**Level**

1. Only operation by training/authorizedpersons. *2. Operation ofthe machine shall conform to the instructions ofthe instruction manual.* *3. Check and inspection according to the specified durations ofthe instruction manual.* *4. Using safety components in accordance with those relevant international standards.* *5. Use ofwarning label.*		***S1***	***F1***	***O1***	***A1***	**-**
No.	**Hazards source**	**S**	**F**	**O**	**A**	**Level**
10.3	External influences on electrical equipment	***S2***	***F1***	***O1***	***A1***	**-**
Where	*All electrical equipments equipped on the machine*					
When	*Working ofthe electrical equipments*					
Improvement result						
Method		**S**	**F**	**O**	**A**	**Level**
1. Whole machine has been submitted to carry out the EMC testing according to relevant EN standards (e.g EN 55011, EN 50081-2 and EN 50082-2 etc.). *2. Connection ofprotective earthing indeed.* *3. Excellent electrical shielded housing.*		***S1***	***F1***	***O1***	***A1***	**-**
No.	**Hazards source**	**S**	**F**	**O**	**A**	**Level**
14	Failure of the control circuit	***S1***	***F1***	***O1***	***A1***	**-**
Where	*Control circuit/control components*					
When	*During operation ofthe machine*					
Improvement result						
Method		**S**	**F**	**O**	**A**	**Level**
1.Checking before operation. *2.Make reference to the instruction manual before operate this machine.* *3.Daily/periodic inspection and maintenance.*		***S1***	***F1***	***O1***	***A1***	**-**
No.	**Hazards source**	**S**	**F**	**O**	**A**	**Level**
25.1	Unauthorised start-up/use	***S1***	***F1***	***O1***	***A1***	**-**
Where	*Control system*					
When	*Operation, adjustment or maintenance ofthe machine*					
Improvement result						
Method		**S**	**F**	**O**	**A**	**Level**
1. Always starting the machine by training/authorizedpersons. *2. During adjustment or maintenance, put a warning nameplate near the working area.* *3. Lock the power switch ofthe machine.*		***S1***	***F1***	***O1***	***A1***	**-**

No.	Hazards source	S	F	O	A	Level
26	Insufficient instructions for the driver/operator	***S1***	***F1***	***O1***	***A1***	**-**
Where	*Whole machine*					
When	*Installation, assembly/disassembly, operation, adjustment or maintenance ofthe machine*					
Improvement result						
Method		**S**	**F**	**O**	**A**	**Level**
1. Edit the instruction manual in conformity with those requirement ofMachinery Directive and EN 292-2 standard. *2. Each machine accompanied with a complete instruction manual.*		***S1***	***F1***	***O1***	***A1***	**-**

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 to 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 by the manufacturer	Pass. Enough protection is provided.
	The aim of measures taken must be to eliminate any risk of accident throughout the foreseeable lifetime of the machinery, including the phases of assembly and dismantling, even where risks of accident arise from foreseeable abnormal situations	Pass. These requirements have been complied with.
b)	In selecting the most appropriate methods, the manufacturer must apply the following principles, in the order given:	-
	- eliminate or reduce risks as far as possible	Pass Manufacturer has provided enough safety devices to eliminate or reduce risks.
	- take the necessary protection measure in relation to risks that can't be eliminated	Pass. Safety guards and other devices are used.
	- inform users of the residual risks due to any shortcomings of the protection measures adopted, indicate whether any particular training is required and specify any need to provide personal protection equipment	Pass. Enough warnings are provided in the appropriate spot
c)	When designing and constructing machinery, and when drafting the instruction, the manufacturer must envisage not the normal use of the machinery but also uses which could reasonably be expected	Pass. All the conditions are considered by the manufacturer, and the related information also has been provided within the instruction manual
	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. These requirements have been complied with, and the related information also has been provided within the instruction manual.
d)	Under the intended conditions of use, the discomfort, fatigue and psychological stress faced by the operator must be reduced to the minimum possible taking ergonomic principles into account	Pass. These requirements have been taken into account during the design of this machine.
e)	When designing and constructing machinery, the manufacturer must taken account of the constraints to	Pass. These requirements have been taken

Clause	Requirement - test	Verdict
	which the operator is subject as a result of the necessary or foreseeable use of personal protection equipment	into account during the design of this machine.
f)	Machinery must be supplied with all the essential special equipment and accessories to enable it to be adjusted, maintained and used without risk	Pass. All the essential special equipment and related accessories have been supplied.
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. They cannot endanger exposed person's safety or health.
	In particular, where fluids are used, machinery must be designed and constructed for use without risks due to filling, use, recovery or draining	Not applicable.
1.1.4	Lighting	-
	The manufacturer must supply integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity	Pass. There is no risk when there is no integral lighting.
	The manufacturer must ensure that, there is no area of shadow likely to cause nuisance, that there is no irritating dazzle and that there are no dangerous stroboscopic effects due to the lighting provided by the manufacturer	Pass. There is no this kind of risk has been found.
	Internal parts requiring frequent inspection, and adjustment and maintenance areas, must be provided with appropriate lighting	Pass. The appropriate lighting has been provided in the specified areas;.
1.1.5	Design of machinery to facilitate its handling	-
	Machinery or each component part thereof must:	-
	- be capable of being handle safely	Pass. Enough measures have been taken to ensure the safe of the handling.
	- be packaged or designed so that it can be stored safely and without damage	Pass. The machine can be stored in wood box safely and without damage.
	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	Not applicable.
	- be designed so that it can be fitted with such attachments, or	Not applicable.
	- be shaped in such a way that standard lifting gear can easily be attached	Not applicable.
	Where machinery or one of its component parts is to be moved by hand, it must:	-

Clause	Requirement - test	Verdict
	- either be easily movable, or	Not applicable.
	- be equipped for picking up and moving in complete safety	Not applicable.
	Special arrangement must be made for the handling of tools and/or machinery parts, even if lightweight, which could be dangerous	Not applicable.
1.2	Controls	-
1.2.1	Safety and reliability of control systems	-
	Control systems must be designed and constructed so that they are safe and reliable, in a way that will prevent a dangerous situation arising	Pass. The control system for this machine is safe and reliable by appropriate designing
	Above all they must be designed and constructed:	-
	- they can withstand the rigors of normal use and external factors	Pass. The control system can withstand related effects during normal operation.
	- errors in logic don't lead to dangerous situations	Pass. Any error in logic doesn't lead to dangerous situations.
1.2.2	Control devices	-
	Control devices must be:	-
	- clearly visible and identifiable and appropriately marked where necessary	Pass. Appropriate labels and markings are provided. This requirement has been complied with.
	- positioned foe safe operation without hesitation or loss of time, and without ambiguity	Pass. Appropriate positions have been taken into account during design.
	- designed so that the movement of the control is consistent with its effect	Not applicable
	- located outside the danger zones, except for certain controls where necessary, such as emergency stop, console for training of robots	Pass. All control devices have been located outside the danger zones.
	-positioned or that their operation can't cause additional risk	Pass. All operation of control devices won't cause additional risk.
	- designed or protected so that the desired effect, where a risk is involved, can't occur without an intentional operation	Pass. Appropriate safety devices have been used to comply with this requirement.
	- made so as to withstand foreseeable strain, particular attention must be paid to emergency stop devices liable to be subjected to considerable strain	Pass. The emergency stop and other control devices have enough strength to withstand foreseeable strain.

Clause	Requirement - test	Verdict
	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	Not applicable
	Controls must be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles	Pass. These requirements have been taken into account during design.
	Constraints due to the necessary foreseeable use of personal protection equipment must be taken into account	Not applicable.
	Machinery must be fitted with indicators as required for safe operation	Pass. The indicators have been provided.
	The operator must be able to read them from the control position	Pass. The indicators are clearly visible in the control position.
	From the main control position the operator must be able to ensure that there are no exposed persons in the danger zones	Pass. The danger zones are visible for the operator in the main control position.
	If this is impossible, the control system must be designed and constructed so that an acoustic and/or visual warning signal is given whenever the machinery is about to start	Not applicable.
	The exposed person must have the time and the means to take rapid action to prevent the machinery starting up	Pass. Emergency stop, main switch and other related devices have been provided for the exposed person.
1.2.3	Starting	-
	It must be possible to start machinery only by voluntary actuation of a control provided for the purpose	Pass. Devices preventing unintended starting have been provided.
	The same requirement applies:	-
	- when restarting the machinery after stoppage, whatever the cause	Pass. Reset is necessary before restarting.
	- when effecting a significant change in the operating conditions	Pass. These requirements have been complied with.
	Unless such restarting or change in operating conditions is without risk to exposed persons	-
	This essential requirement doesn't apply to the restarting of the machinery or to the change in operating conditions resulting from the normal sequence of an automatic cycle	Pass. These requirements have been complied with by appropriate design.
	Where machinery has several starting controls and the operators can therefore put each other in danger,	Pass. An interlocking device is provided to

Clause	Requirement - test	Verdict
	additional devices must be fitted to rule out such risks	eliminate these risks.
	It must be possible for automated plant functioning in automatic mode to be restarted easily after a stoppage once the safety conditions have been fulfilled	Pass. These requirements have been complied with by appropriate design.
1.2.4	Stopping device	-
	Normal stopping	-
	Each machine must be fitted with a control whereby the machine can be brought safety to a complete stop	Pass. A normal stop control has been provided.
	Each workstation must be fitted with a control to stop some or all of the moving parts of the machinery, depending on the type of hazard, so that the machinery is rendered safe	Pass. A normal stop control has been provided.
	The machinery's stop control must have priority over the start controls	Pass. It has priority over the start control.
	Once the machinery or its dangerous parts have stopped, the energy supply to the actuators concerned must be cut off	Pass. The stops belong to the category 0, or category 1 stops.
	Emergency stop	-
	Each machinery must be fitted with one or more emergency stop devices to enable actual or impending danger to be averted	Pass. One emergency stop is provided.
	The following exceptions apply:	-
	- machines in which an emergency stop device would not lessen the risk, either because it would not reduce the stopping time or because it would not enable the special measures required to deal with the risk to be taken	Not applicable
	The emergency stop device must:	-
	- have clearly identifiable, clearly visible and quickly accessible controls	Pass. The emergency sop has red button, yellow background and marked with "emergency stop"
	- stop the dangerous process as quickly as possible, without creating additional hazards	Pass. The emergency stop will stop the machine as soon as it is pressed and it will not create any additional hazards.
	- where necessary, trigger or permit the triggering of certain safeguard movements	Not applicable
	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. After the action of the emergency stop machine can not be restarted until reset the emergency stop.
	It must be possible to disengage the device only by an appropriate operation, and disengaging the device must	Pass. Operator should turn the emergency

Clause	Requirement - test	Verdict
	not restart the machinery but only permit restarting	stop to disengage the device.
	Complex installations	-
	In the case of machinery or parts of machinery designed to work together, must so design and construct the machinery that the stop controls, including the emergency stop, can stop not only the machinery itself but also all equipment upstream and/or downstream if its continued operation can be dangerous	Not applicable.
1.2.5	Mode selection	-
	The control mode selected must override all other control systems with the exception of the emergency stop	Pass The emergency stop is effective regardless of operating modes.
	If machinery has been designed and built to allow for its use in several control or operating modes presenting different safety levels, it must be fitted with a mode selector which can be locked in each position	Not applicable. No this kind of mode selection has been found.
	Each position of the selector must correspond to a single operating or control mode	Not applicable. No this kind of mode selection has been found.
	The selector may be replaced by another selection method which restricts the use of certain functions of the machinery or certain categories of operator	Not applicable. No this kind of mode selection has been found.
	If, for certain operations, the machinery must be able to operate with its protection devices neutralized, the mode selector must simultaneously:	Not applicable. No this kind of mode selection has been found.
	- disable the automatic control mode	Not applicable.
	- permit movements only by controls requiring sustained action	Not applicable.
	- permit the operation of dangerous moving parts only in enhanced safety conditions while preventing hazards from linked sequences	Not applicable.
	- prevent any movement liable to pose a danger by acting voluntarily or involuntarily on the machine's internal sensors	Not applicable.
	In addition, the operator must be able to control operation of the parts he is working on at the adjustment point	Not applicable. No this kind of mode selection has been found.
1.2.6	Failure of the power supply	-
	The interruption, re-establishment after an interruption or fluctuation in whatever manner of the power supply to the machinery must not lead to a dangerous situation	Pass. No any dangerous situation has been found.
	In particular:	-
	- the machinery must not start unexpectedly	Pass. Reset is necessary before restarting

Clause	Requirement - test	Verdict
		the machine.
	- the machinery must not be prevented from stopping if the command has already been given	Pass. The stop command has the priority over all other devices
	- no moving part of the machinery or piece held by the machinery must fall or be ejected	Pass. No such part is found.
	- automatic or manual stopping of the moving parts whatever they may be must be unimpeded	Pass. Stopping of the moving parts is always effective.
	- the protection devices must remain fully effective	Pass. The protection devices remain effective after the failure of the power supply.
1.2.7	Failure of the control circuit	-
	A fault in the control circuit, or failure of or damage to the control circuit must not lead to dangerous situations	Pass. No dangerous situation is found.
	In particular:	-
	- the machinery must not start unexpectedly	Pass. Reset is necessary before restarting the machine.
	- the machinery must not be prevented from stopping if the command has already been given	Pass. The stop command has the priority over all other devices
	- no moving part of the machinery or piece held by the machinery must fall or be ejected	Pass. No such part is found.
	- automatic or manual stopping of the moving parts whatever they may be must be unimpeded	Pass. Stopping of the moving parts is always available.
	- the protection device must remain fully effective	Pass. The protection devices remain effective after the failure of the control circuit
1.2.8	Software	-
	Interactive software between the operator and the command or control system of a machine must be user-friendly	Pass. Ergonomic principles are taken into account in design the interactive software
1.3	Protection against mechanical hazards	-
1.3.1	Stability	-
	Machinery, components and fittings there of must be so designed and constructed that they are stable enough, under the foreseen operating conditions for use without risk of overturning, falling or unexpected movement	Pass. These requirements have been taken into account design
	If the shape of the machinery itself or its intended	Not applicable.

Clause	Requirement - test	Verdict
	installation doesn't offer sufficient stability, appropriate means of anchorage must be incorporated and indicated in the instructions	The sufficient stability has been offered for this machine.
1.3.2	Risk of break-up during operation	-
	The various parts of machinery and their linkages must be able to withstand the stress to which they are subject when used when as foreseen by the manufacturer	Pass. All parts of the machine can withstand related stress when they are used.
	The durability of the materials used must be adequate for the nature of the workplace foreseen by the manufacturer, in particular as regards the phenomena of fatigue, aging, corrosion and abrasion	Pass. All materials used for this machine are appropriate for their intended use and have adequate life.
	The manufacturer must indicate in the instructions the type and frequency of inspection and maintenance required for safety reasons, where appropriate, indicate the parts subject to wear and the criteria for replacement	Pass. The related information have been provided within the instruction manual.
	Where a risk of rupture or disintegration remains despite the measures taken the moving parts must be mounted and positioned in such a way that in case of rupture their fragments will be contained	Not applicable. No such risk is possible.
	Both rigid and flexible pipes carrying fluids, particularly those under high pressure, must be able to withstand the foreseen internal and external stresses and must be firmly attached and/or protected against all manner of external stresses and strains, precaution must be taken to ensure that no risk is posed by a rupture	Not applicable.
	Where the material to be processed is fed to the tool automatically, the following conditions must be fulfilled to avoid risks to the persons exposed:	-
	- when the work piece comes into contact with the tool the later must have attained its normal working conditions	Not applicable.
	- when the tool starts and/or stops the feed movement and the tool movement must be coordinated	Not applicable.
1.3.3	Risked due to falling or ejected objects	-
	Precautions must be taken to prevent risks from falling or ejected object	Not applicable.
1.3.4	Risks due to surfaces, edges or angles	-
	In so far as their purpose allows, accessible parts of the machinery must have no sharp edges, no sharp angles, and no rough surfaces likely to cause injury	Pass. No this kind injury has been found.
1.3.5	Risks related to combined machinery	-
	Where the machinery is intended to carry out several different operations with the manual removal of the piece between each operation, it must be designed and	Not applicable. No this kind of combined machinery.

Clause	Requirement - test	Verdict
	constructed in such a way as to enable each element to be used separately without the other element constituting a danger or risk for the exposed person	
	For this purpose, it must be possible to start and stop separately and elements that are not protected	Not applicable. No this kind of combined machinery.
1.3.6	Risks relating to variations in the rotation speeds of tools	-
	When the machine is designed to perform 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	Not applicable.
1.3.7	Prevention of risks related to moving parts	-
	The moving parts of machinery must be designed, built and laid out to avoid hazards or, where hazards persist, fixed with guards or protective devices in such a way as to prevent all risk of contact which could lead to accidents	Pass. This kind of hazards have been prevented by appropriate guards.
	All necessary steps must be taken to prevent accidental blockage of moving parts involved in the work	Pass. All necessary steps have been taken.
	In cases where, despite the precaution taken, a blockage is likely to occur, specific protection devices or tools, the instruction handbook and possibly a sign on the machinery should be provided by the manufacturer to enable the equipment to be safely unblocked	Not applicable. No this kind of need.
1.3.8	Choice of protection against risk related to moving parts	-
	Guards or protection devices used to protect against the risks related to moving parts must be selected on the basis of the type of risk	Pass. It is in accordance with the risk assessment.
	The following guidelines must be used to help make the choice	-
	Moving transmission parts.Guards designed to protect exposed persons against the risks associated with moving transmission parts must be：	-
	- either fixed, complying with requirements 1.4.1 and 1.4.2.1 or	See the related clauses.
	- movable, complying with requirements 1.4.1 and 1.4.2.2.A	See the related clauses.
	Moving parts directly involved in the process Guards or protection devices designed to protect exposed persons against the risks associated with moving parts contributing to the work must be：	-
	- wherever possible fixed guards complying with requirements 1.4.1 and 1.4.2.1	See the related clauses.
	- otherwise, movable guards complying with	See the related clauses.

Clause	Requirement - test	Verdict
	requirements 1.4.1 and 1.4.2.2.B or protection devices such as sensing devices, remote-hold protection devices, or protection devices intended automatically to prevent all part of the operator's body from encroaching to the danger zone in accordance with requirements 1.4.1 and 1.4.3	
	However, when certain moving parts directly involved in the process can't be completely or partially inaccessible during operation owing to operations requiring near-by operator intervention, where technically possible such parts must be fitted with：	-
	- fixed guards, complying with requirements 1.4.1 and 1.4.2.1 preventing access to those sections of the parts that are not used in the work	See the related clauses.
	- adjustable guards, complying with requirements 1.4.1 and 1.4.2.3 restricting access to those sections of the moving parts that are strictly for the work	See the related clauses.
1.4	Required characteristics of guards and protection devices	-
1.4.1	General requirement	-
	Guards and protection devices must:	-
	- be of robust construction	Pass. All the guards have enough strength.
	- not give rise to any additional risk	Pass. No additional risk is found.
	- not be easy to bypass or render non-operational	Pass. All the guards can't be bypassed or rendered non-operational by design.
	- be located at an adequate distance from the danger zone	Pass. All the guards comply with the safety distances.
	- cause minimum obstruction to the view id the production process	Pass. Transparent materials are used to make guards.
	- 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. These requirements have been taken into account during design.
1.4.2	Special requirements for guards	-
1.4.2.1	Fixed guards	-
	Fixed guard must be securely held in place	Pass. They all be securely held in place by appropriate fixation.
	They must be fixed by system that can be opened only	Pass.

Clause	Requirement - test	Verdict
	with tools	They all can be opened only with tools.
	Where possible, guards must be unable to remain in place without their fixings	Not applicable.
1.4.4.2	Movable guards	-
	A. Type A movable guards must:	-
	- as far as possible remain fixed to the machinery when open	Pass. Gemels are used to satisfy this requirement.
	- be associated with a locking device to prevent moving parts starting up as these parts can be accessed and to give a stop command whenever they are no longer closed	Pass. Interlocking switch is provided.
	B. Type B movable guards must be designed and incorporated into the control system so that	Not applicable. No this kind of guard has been used.
	- moving parts can't start up while they are within the operator's reach	Not applicable.
	- the exposed person can't reach moving parts once they have started up	Not applicable.
	- they can be adjusted only by means of an intentional action, such as the use of a tool, etc.	Not applicable.
	- the absence or failure of one of their components prevents starting or stops the moving parts	Not applicable.
	- protection against any risk of ejection is provided by means of an appropriate barrier	Not applicable.
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:	Not applicable. No this kind of guard has been used.
	- be adjustable manually or automatically according to the type of work involved	Not applicable.
	- be readily adjustable without the use of tools	Not applicable.
	- reduce as far as possible the risk of ejection	Not applicable.
1.4.3	Special requirements for protection devices	-
	Protection devices must be designed and incorporated into the control system so that:	-
	- moving parts can't start up while they are within the operator's reach	Pass. These requirements have been taken into account during design.
	- the exposed person can't reach moving parts once they have started up	Pass. Appropriate guards have been provided.
	- they can be adjusted only by means of an intentional action, such as the use of a tool, etc.	Pass. These requirements have been taken into account during design.

Clause	Requirement - test	Verdict
	-the absence or failure of one of their components prevents starting or stops the moving parts	Pass. These requirements have been taken into account during design.
1.5	Protection against other hazards	-
	Electricity supply	-
	Where machinery has an electricity supply it must be designed, constructed and equipped so that all hazards of an electrical nature are or can be prevented	Pass. See the EN 60204-1 test report in detail.
	The specific rules in force relating to electrical equipment designed for use within certain voltage limits must apply to machinery which is subject to those limits	Pass. See the EN 60204-1 test report in detail.
1.5.2	Static electricity	-
	Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous electrostatic changes and/or be fitted with a discharging system	Pass. See the EN 60204-1 test report in detail.
1.5.3	Energy supply other than electricity	-
	Where machinery is powered by an energy other than electricity, it must be so designed, constructed and equipped as to avoid all potential hazards associated with these types of energy	Pass. No any additional hazard has been found for energy supply.
1.5.4	Error of fitting	-
	Errors likely to be made when fitting or refitting certain parts which could be a source of risk must be made impossible by the design of such parts or, failing this, by information on moving parts and/or their housing where the direction of movement must be known to avoid a risk	Pass. These requirements have been taken into account during design.
	Any further information that may be necessary must be given in the instructions	Pass. The related information has been provided within the instruction manual.
	Where a faulty connection can be the source of risk, incorrect fluid connections, including electrical conductors, must be made impossible by the design or, failing this, by information given on the pipes, cables, etc. and/or connectors blocks	Pass. All related information have been provided within the instruction manual. Necessary labels and markings have been provided.
1.5.5	Extreme temperatures	-
	Step must be taken to eliminate any risk of injury caused by contact with or proximity to machinery parts or materials at high or very low temperatures	Pass. Sufficient safety protection for extreme temperatures has been provided.
	The risk of hot or very cold materials being ejected should be assessed. Where this risk exists, the necessary steps must be taken to prevent it or, if this is not	Not applicable. No this kind of risk exists.

Clause	Requirement - test	Verdict
	technically possible, to render it non-dangerous	
1.5.6	Fire	-
	Machinery must be designed and constructed to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dusts, vapors or the other substances produced or used by the machinery	Pass. The design and construction of this machine are in conformity with these requirements.
1.5.7	Explosion	-
	Machinery must be designed and constructed to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dusts, vapors or other substances produced or used by the machinery	Not applicable. No such risk is exist
	To that end the manufacturer must take steps to:	-
	-avoid a dangerous concentration of products	Not applicable.
	- prevent combustion of the potentially explosive atmosphere	Not applicable.
	-minimize any explosion which may occur so that it doesn't endanger the surroundings	Not applicable.
	The same precautions must be taken if the manufacturer foresees the use of the machinery in potentially explosive atmosphere	Not applicable. This machine is not intended to be used in potentially explosive atmosphere.
	Electrical equipment forming part of the machinery must conform, as far as the risk from explosion is concerned, to the provision of the specific Directive in force	Pass. See the 60204-4 test report in detail.
1.5.8	Noise	-
	Machinery must be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking accounting of technical progress and the availability of means of reducing noise, in particular at source	Pass. The design and construction of this machine are in conformity with this requirement. Noise of this machine is not more than 75db.
1.5.9	Vibration	-
	Machinery must be so designed and constructed that risks resulting from the 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 design and construction of this machine are in conformity with this requirement. Vibrations of this machine will not create any risk.
1.5.10	Radiation	-
	Machinery must be so designed and constructed that any emission of radiation is limited to the extent necessary for its operation and that the effects on exposed persons non-existent or reduced to non-dangerous proportions	Pass. The design and construction of this machine are in conformity with this requirement.
1.5.11	External radiation	-
	Machinery must be so designed and constructed that external radiation doesn't interfere with its operation	Pass. The machine can withstand the

Clause	Requirement - test	Verdict
		external radiation by appropriate design and construction.
1.5.12	Laser equipment	-
	Where laser equipment is used, the following provisions should be taken into account;	Not applicable. No laser equipment has been used.
	- laser equipment on machinery must be designed and constructed so as to prevent any accidental radiation	Not applicable.
	- laser equipment on machinery must be protected so that effective radiation, radiation produced by reflection or diffusion and secondary radiation don't damage health	Not applicable.
	- optical equipment for the observation or adjustment of laser equipment on machinery must be such that no health risk is created by the laser rays	Not applicable.
1.5.13	Emission of dust, gases, etc	-
	Machinery must be so designed, constructed and/or equipped that risk due to gases, liquids, dust, vapors and other waste materials which it produces can be avoided	Not applicable. No such risk is exist
	Where a hazard exists, the machinery must be so equipped that the said substances can be contained and/or evacuated	Not applicable
	Where machinery is not enclosed during normal operation, the devices for containment and/or evacuation must be situated as close as possible to the source emission	Not applicable.
1.5.14	Risk of being trapped in a machine	-
	Machinery must be so designed, constructed or fitted with a means of preventing a exposed person from being enclosed within it or, if that is impossible, with a means of summoning held	Pass. The appropriate measure has been provided for this machine.
1.5.15	Risk of slipping, tripping or falling	-
	Parts of the machinery where persons are liable to move about or stand must be designed and constructed to prevent persons slipping, tripping or falling on or off these parts	Not applicable
1.6	Maintenance	-
1.6.1	Machinery maintenance	-
	Adjustment, lubrication And maintenance points must be located outside danger zones	Pass. The design and construction of this machine are in conformity with this requirement.
	It must be possible to carry out adjustment, Maintenance, repair, cleaning and servicing Operations while machinery is at a standstill	Pass. Maintenance, repair, cleaning and servicing, operations can only be implemented while machinery is at a

Clause	Requirement - test	Verdict
		standstill
	If one or more of the above conditions can't be satisfied for technical reasons, operations must be possible without risk	Not applicable. No this kind of situation.
	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	Pass. Some adequate provisions have been taken.
	Automated machine components which have to be changed frequently, in particular for a change in manufacture or where they are liable to wear or likely to deteriorate following an accident, must be capable of being removed and replaced easily and in safety	Pass. The related parts can be removed and replaced easily and in safety.
	Access to the components must enable these tasks to be carried out with the necessary technical means in accordance with an operating method specified by the manufacturer	Pass. All operation methods have been specified by the manufacturer.
1.6.2	Access to operating position and servicing points	-
	The manufacturer must provide means of access to allow access in safety to all areas used for production, adjustment and maintenance operations	Pass. Appropriate guards and safety control devices have been used.
1.6.3	Isolation of energy sources	-
	All machinery must be fitted with means to isolate it from all energy sources	Pass. The power switch has been used.
	Such isolators must be clearly identified	Pass. It has passed CE
	They must be capable of being locked if reconnection could endanger exposed persons	Not applicable.
	In the case of machinery supplied with electricity through a plug capable of being plugged into a circuit, separation of the plug is sufficient	Not applicable.
	The isolator must be capable of being locked also where an operator is unable, from any of the points to which he has access, to check that the energy is still cut off	Pass. The isolator can be locked in the off position.
	After the energy is cut off, it must be possible to dissipate normally any energy remaining or stored in the circuits of the machinery without risk to exposed persons	Pass. All the parts will not be live after the energy is cut off.
	As an exception to the above requirement, certain circuits may remain connected to their energy source in order, for example, to hold parts, protect information, light interiors, etc. In this case, special steps must be taken to ensure operator safety	Not applicable. No this kind of situation.
1.6.4	Operator intervention	-
	Machinery must be so designed, constructed and	Pass.

Clause	Requirement - test	Verdict
	equipped that the need for operator intervention is limited	The design and construction of this machine are in conformity with these requirements.
	If operator intervention can't be avoided, it must be possible to carry it out easily and in safety	Not applicable. No this kind of situation.
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. The design of this machine is allowed to carry out this work.
	If it is absolutely impossible to avoid entering the machinery, the manufacturer must take steps during its construction to allow cleaning to take place with the minimum of danger	Not applicable. No this kind of situation.
1.7	Indicators	-
1.7.1	Information devices	-
	The information needed to control machinery must be unambiguous and easily understood	Pass. The information is identified clearly and can be easily under understood.
	It must not be excessive to the extent of overloading the operator	Pass.
	Where the health and safety of exposed persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped to give an appropriate acoustic or light signal as a warning	Pass. An alarm light with buzzer has been used.
1.7.2	Warning devices	-
	Where machinery is equipped with warning devices, these must be unambiguous and easily perceived	Pass. The warning devices comply with ergonomic principles.
	The operator must have facilities to check the operation of such warning devices at all times	Pass. Such facilities are provided.
	The requirements of the specific directives concerning colors and safety signals must be complied with	Pass. These requirements are complied with.
1.7.3	Warning of residual risks	-
	Where risks remain despite all the measures adopted or in the case of potential risks which are not evident, the manufacturer must provide warnings	Not applicable. No any residual risk has been found.
	Such warnings should preferably use readily understandable pictograms and/or be drawn up in one of the languages of the country in which the machinery is to be used, accompanied, on request, by the languages understood by the operators	Not applicable.

Clause	Requirement - test	Verdict
1.7.4	Marking	-
	All machinery must be marked legibly and indelibly with the following minimum particular:	-
	- name and address of the manufacturer	Pass. Name and address of the manufacturer has been marked in the nameplate.
	- CE mark, which includes the year of construction	Pass.
	- designation of series or type	Pass. Designation of series or type has been marked in the nameplate.
	- serial number, if any	Pass. Serial number has been marked in the nameplate.
	Furthermore, where the manufacturer constructs machinery intended for use in a potentially explosive atmosphere, this must be indicated on the machinery	Not applicable. This machine is not intended to be used in a potentially explosive atmosphere.
	Machinery must also bear full information relevant to its type and essential to its safe use	Pass. Such information is
	Where a machine part must be handled during use with lifting equipment, its mass must be indicated legible, indelibly and unambiguously	Not applicable.
	The interchangeable equipment referred to in Article 1(2), third subparagraph, must bear the same information	Pass. All the related information is provided legible, indelibly and unambiguously.
1.7.5	Instruction	-
	a) All machinery must be accompanied by instructions including at least the following:	-
	- a repeat of the information with which the machinery is marked, except the serial number, together with any appropriate additional information to facilitate maintenance	Pass. All related information have been provided within the instruction manual.
	- foreseen use of the machinery within the meaning of 1.1.2(c)	Pass. All related information have been provided within the instruction manual
	- workstation(s) likely to be occupied by operators	Pass. All related information have been provided within the instruction manual.
	- instructions for safe	Pass. All related information have been provided within the instruction manual.
	- putting into service	Pass. All related information have been

Clause	Requirement - test	Verdict
		provided within the instruction manual.
	- use	-
	- handling, giving the mass of the machinery and its various parts where they are regularly to be transported separately	Pass. All related information has been provided within the instruction manual.
	- installation	Pass. All related information has been provided within the instruction manual.
	- assembling, dismantling	Pass.
	- adjustment	Pass.
	- maintenance (servicing and repair)	Pass.
	- where necessary, training instructions	Pass.
	- where necessary, the essential characteristics of tools which may be fitted to the machinery	Pass.
	Where necessary, the instructions should draw attention to ways in which the machinery should not be used	Pass. All related information has been provided within the instruction manual.
	b) The instructions , must be drawn up in one of the Community languages by the manufacturer or his authorized representative established in the Community	Pass. Chinese and English versions of the instruction manual are provided.
	On being put into service, all machinery must be accompanied by a translation of the instructions in the language or languages of the country in which the machinery is to be used and by the instructions in the original language	Pass. English versions of the instruction manual are provided.
	This translation must be done either by the manufacturer or his authorized representative established in the Community or by the person introducing the machinery into the language area in question	Pass. The translation is done by the manufacture.
	By way of derogation from this requirement, the maintenance instructions for use by the specialized personnel employed by the manufacturer or his authorized representative established in the Community may be drawn up in only one of the Community languages understood by that personnel	Pass.
	c) The instructions must contain the drawing and diagrams necessary for putting into service, maintenance, inspection, checking of correct operation and, where appropriate, repair of the machinery and all useful instructions in particular with regard to safety	Pass. All related information has been provided within the instruction manual.
	d) Any literature describing the machinery must not	Pass.

Clause	Requirement - test	Verdict
	contradict the instructions as regards safety aspects	No such situation exists.
	The technical documentation describing the machinery must give information regarding the airborne noise emission referred to in(f) and, in the case of hand-help and/or hand-guided machinery, information regarding vibration as referred to in 2.2	Pass. All related information has been provided within the technical documentation.
	e) Where necessary, the instructions must give the requirement relating to installation and assembly for reducing noise or vibration	Not applicable.
	f) The instructions must give the following information concerning airborne noise emission by the machinery, either the actual value or a value established on the basis of measurements made on identical machinery:	-
	- equivalent continuous A-weighted pressure level at workstations, where this exceeds 70 dB(A); where this level doesn't exceed 70dB(A),this fact must be indicated	Pass. The noise pressure level not exceeds 70dB.
	- peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa(130 dB in relation to 20 mPa)	Not applicable.
	- sound power level emitted by the machinery where the equivalent continuous A-weight sound pressure level at workstations exceeds 85 dB(A)	Not applicable. Not exceeds 85dB
	In the case of very large machinery, instead of the sound power level, the equivalent continuous sound pressure levels at specified positions around the machinery may be indicated	Pass. The sound pressure levels not exceed 70dB
	Where the harmonized standards are not applied sound levels must be measured using the most appropriate method for the machinery	Pass. Appropriate standards are applied to determine the sound level.
	The manufacturer must indicate the operating conditions of the machinery during measurement and what methods have been used for the measurement	Pass. All related information has been provided within the technical documentation.
	Where the workstation(s) are undefined or can't be defined, sound pressure levels must be measured at a distance of 1 meter from the surface of the machinery and at a height of 1.60 meters from the floor or access platform	Not applicable. The workstation has been defined.
	The position and value of the maximum sound pressure must be indicated	Pass. It has been indicated in the appropriate position of the machine.
	g) If the manufacturer foresees that the machinery will be used in a potentially explosive atmosphere, the instructions must give all the necessary information	Not applicable. This machine is not intended to be used in a potentially explosive atmosphere.

Clause	Requirement - test	Verdict
	h) In the case of machinery which may also be intended for use by non-professional operators, the wording and layout of the instructions for use, whilst respecting the other essential requirement mentioned above, must take into account the level of general education and acumen that can reasonably be expected from such operators	Pass. All these requirements have been taken into account.
2	Essential health and safely requirements for certain categories of machinery	-
2.1	Agri-foodstuffs machinery	-
	Where machinery is intended to prepare and process foodstuffs, it must be so designed and constructed as to avoid any risk of infection, sickness or contagion and the following hygiene rules must be observed:	Not applicable.
	a) materials in contact, or intended to come into contact, with the foodstuffs must satisfy the conditions set down in the relevant Directives	Not applicable.
	The machinery must be so designed and constructed that these materials can be clean before each use	Not applicable.
	b) all surfaces including their joinings must be so smooth, and must have neither ridges nor crevices which could harbor organic materials	Not applicable.
	c) assemblies must be designed in such a way as to reduce projections, edges and recesses to a minimum	Not applicable.
	They should preferably by made by welding or continuous bonding	Not applicable.
	Screws, screw heads and rivets may not be used except where technically unavoidable	Not applicable.
	d) all surfaces in contact with the foodstuffs must be easily cleaned and disinfected, where possible after removing easily dismantled parts	Not applicable.
	The inside surfaces must have curves of a radius sufficient to allow through cleaning	Not applicable.
	e) liquid deriving from foodstuffs as well as cleaning disinfecting and rinsing fluids should be able to be discharged from the machine without impediment	Not applicable.
	f) machinery must be so designed and constructed as to prevent any liquids or living creatures, in particular insects, entering, or any organic matter accumulating in area that can’t be cleaned	Not applicable.
	g) machinery must be so designed and constructed that no ancillary substances can come into contact with foodstuffs	Not applicable.
	Where necessary, machinery must be designed and constructed so that continuing compliance with this	Not applicable.

Clause	Requirement - test	Verdict
	requirement can be checked	
	Instructions	Not applicable.
	In addition to the information required in Section1, the instructions must indicate recommended products and methods for cleaning, disinfecting and rinsing(not only for easily accessible areas but also where areas to which access is impossible or inadvisable, such as piping, have to be cleaned in it situ)	Not applicable.
2.2	Portable hand-help and/or hand-guided machinery	-
	Portable hand-help and/or hand-guided machinery must conform to the following essential health and safety requirements:	-
	- according to the type of machinery, it must have a supporting surface of sufficient size and have a sufficient number of handles and supports of an appropriate size and arranged to ensure the stability of the machinery under the operating conditions foreseen by the manufacturer	Not applicable.
	- except where technically impossible or where there is an independent control, in the case of handles which can't be released in complete safety, it must be fitted with start and stop controls arranged in such a way that the operator can operate them without releasing the handles	Not applicable.
	- it must be designed, constructed or equipped ton eliminate the risks of accidental starting and/or continued operation after the operator has released the handles	Not applicable.
	Equivalent steps must be taken if the requirement is not technically feasible	Not applicable.
	- portable hand-help machinery must be designed an constructed to allow, where necessary, a visual check of the contact of the tool with the material being processed	Not applicable.
	Instructions	-
	The instructions must give the following information concerning vibrations transmitted by hand-help and hand-guided machinery	-
	- the weight root mean square value to which the arms are subjected, if it exceeds 2.5 m/s2 as determined by the appropriate test code	Not applicable.
	Where the acceleration doesn't exceed 2.5 m/s2, this must be mentioned	Not applicable.
	If there is no applicable test code, the manufacturer must indicate the measurement methods and conditions under	Not applicable.

Clause	Requirement - test	Verdict
	which measurement were made	
2.3	Machinery for working wood and analogous materials	Not applicable
	Machinery for working wood and machinery for working materials with physical and technology characteristics similar to those of wood, such as cork, bone, hardened rubber, hardened plastic material and other similar stiff material must conform the following essential health and safety requirements	Not applicable.
	a) the machinery must be designed, constructed or equipped so that the piece being machined can be placed and guided in safety; where the piece is hand-help on a work-bench the later must be sufficiently stable during the work and must not impede the movement of the piece	Not applicable.
	b) where the machinery is likely to be used in conditions involving the risk of ejection of pieces of wood, it must be designed, constructed or equipped to eliminate this ejection, or, if this is not the case, so that the ejection doesn't engender risks for the operator and/or exposed persons	Not applicable.
	c) the machinery must be equipped with an automatic brake that stops the tool in a sufficiently short time if there is a risk of contact with the tool whilst it runs down	Not applicable.
	d) where the tool is incorporated into a non-fully automated machine, the latter must be so designed and constructed as eliminate or reduce the risk of serious accidental injury	Not applicable.
3	Essential health and safety requirement to offset the particular hazards due to the mobility machinery	-
4	Essential health and safety requirement to offset the particular hazards due to a lifting operation	-
5	Essential health and safety requirement for machinery intended for underground work	-
6	Essential health and safety requirement to offset the particular hazards due to the lifting or moving of persons	-

Clause	Requirement - test		Verdict
3	Terms, definitions and symbols		-
3.1	Terms and definitions		-
	For the purposes of this document, the following terms and definitions apply.		P
3.1.1	refrigerating capacity		-
	⟨ condensing unit⟩ product of the refrigerant mass flow and the difference between the specific enthalpy of the refrigerant at the inlet of the condensing unit (Figure 1, point 11) and the specific enthalpy of the fluid at the outlet of the condensing unit (Figure 1, point 12) Note 1 to entry: The outlet (point 12) of condensing unit depends on design (single stage or two stage or internal heat exchangers, see Figure 1 a), b), c) and d).		P
3.1.2	specific enthalpy		-
3.1.2.1	specific enthalpy of the refrigerant at the inlet of the condensing unit		-
	specific enthalpy of the refrigerant at pressure and temperature to the inlet (superheated above the dew point temperature to the stated value)		P
3.1.2.2	specific enthalpy of the refrigerant fluid at the outlet of the condensing unit		-
	specific enthalpy of the refrigerant at pressure and temperature at the outlet		P
3.1.3	subcooling		-
	ΔT12 difference between the bubble point temperature of the refrigerant corresponding to the pressure at the condensing unit outlet and the temperature of the liquid refrigerant measured at the same place Note 1 to entry: Applicable for subcritical pressure only.		P
3.1.4	power absorbed		-
	P power demand to drive the condensing unit		P
3.1.5	refrigerant mass flow		-
	m refrigerant mass flow at the condensing unit inlet		P
3.1.6	coefficient of performance		-
	COPR ratio of the refrigerating capacity to the power absorbedNote 1 to entry: Both the above are at the specified test condition.		P
3.1.7	subcritical operation		-
	operating condition with condensing unit outlet pressure below the critical pressure of the refrigerant		P

Clause	Requirement - test	Verdict	
3.1.8	transcritical operation		-
	operating condition with condensing unit outlet pressure above the critical pressure of the refrigerant		P
3.1.9	part load operation		-
	operation with active capacity control at reduced capacity for compressors with capacity control mechanism Note 1 to entry: On/off cycling of the compressor motor is not considered as capacity control.		P
3.1.10	fluid		-
	refrigerant liquid, gas or vapour including the state of appearance close to and above the critical pressure		P
3.1.11	oil circulation ratio		-
	xoil ratio of the measured oil mass flow to the mass flow of the circulating oil/refrigerant mixture		P
3.1.12	condensing unit		-
	combination of one or more compressors, condensers/gas coolers and, where applicable, liquid receivers and the regularly furnished accessories Note 1 to entry: In transcritical operation the condenser operates as gas cooler.		P
3.1.13	cyclic capacity control		-
	control that reduces suction flow in cycles shorter than the test period, without switching off compressor motors		P
3.2	Symbols		-
	For the purposes of this document, the symbols in Table 1 and the indices in Table 2 apply.		P
3.3	Refrigerant circuit state points		-
	Figure 2b) shows the state of the refrigerant in the refrigerating circuit shown in Figure 2a).		P
4	Uncertainty of measurement and test conditions		-
4.1	Uncertainty of performance data		-
	Measuring instruments shall be selected and calibratedso that the final result is within the maximum uncertainties of the measured value as indicated:		P
4.2	Uncertainty of measurement		-
	Uncertainty values are considered to cover a 95 % confidence interval, i.e. ± 2 times the standard deviation. Except where otherwise stated in the particular clauses, measurements shall be carried out within the maximum uncertainty of the measured value as given in Table 3.		P
4.3	Test conditions		-
	The specified test conditions under which the test is to be performed and their allowable deviations are given in		P

Clause	Requirement - test	Verdict	
	Table 4.		
5	General requirements		-
5.1	Test equipment		-
	All equipment shall comply with the requirements of EN 378-2		P
5.2	Calculation methods		-
5.2.1	Principle		-
	The determination of the refrigerating capacity of a condensing unit at the specified test conditions comprises:		P
5.2.2	Specific enthalpy		-
	The value of the specific enthalpy is listed in the recognized data of the thermodynamic properties of the refrigerant used depending on pressure and temperature.		P
5.2.3	Refrigerant mass flow		-
	The refrigerant mass flow is either measured directly or calculated from measured values.		P
5.2.4	Power absorbed		-
	Within a superheat range of ± 3 K it is assumed that the power consumption will stay constant.		P
	Basic formulae		-
5.2.5	The refrigerant mass flow m determined by measurement is converted to that at the specified test conditions using the following formula:		P
5.3	Requirements for the selection of test methods		-
5.3.1	General		-
	In general two different test methods as specified in Clause 6 shall be used at the same time for determining the mass flow. The results of the two methods shall not differ more than 4 %. The test result is the mean value of the two methods. Different methods according to 6.2 are allowed to be combined for the determination.		P
5.3.2	Second concurrent test		-
	Where testing devices are in constant use and are subject to periodical calibration in accordance with the recommended EN ISO 9001 a second concurrent test is not necessary.		P
5.4	Test procedure		-
	General		-
	The tests specified refer exclusively to a condensing unit operating continuously under conditions so that, for a specified period, fluctuations in all the factors likely to affect the results of a test remain within the limits prescribed and show no definite tendency to move outside		P

Clause	Requirement - test	Verdict	
	these limits. These conditions are specified as steady working conditions and are defined precisely in 4.3.		
5.4.2	Steady working conditions		-
	After the condensing unit has been started, adjustments shall be made during a preliminary run until the measurements required are within the allowable deviations regarding Table 4. Depending on the chosen test method, additional parameters are relevant for test results (see Table 5). These parameters have to be stable to an extent which is considered not to increase the uncertainty of the result significantly. A linear trend up or down of more than 50 % of the allowable deviations during the test period might indicate non steady-state conditions. Compressor mechanical equilibrium (run-in time) has to be considered according the manufacturer's requirements.		P
5.4.3	Recording of measured data		-
	Once steady working conditions have been reached, the measured data shall be recorded. At least one complete measuring cycle shall be carried out every minute. The recording period shall be at least 15 min. The mean value of any measured quantity shall be calculated from all the values of this quantity during the recording period. When using cyclic capacity control at least 15 complete measuring readings have to be taken per control cycle. The test period shall comprise only complete control cycles and at least 10. Averages shall additionally be formed from all measured values per cycle.		P
5.5	Pressure and temperature measuring points		-
	The pressure and temperature at the inlet of the condensing unit shall be measured at the same place. This shall be located in a straight run of pipe at a distance of at least four times the pipe diameter, but not less than 150 mm from the shut-off valve or connection.		P
5.6	Oil circulation		-
	The quantity of oil in circulation shall be determined after the test. From the liquid phase of the refrigerant circuit the refrigerant/oil mixture shall be poured into a collecting device intended for this specific purpose and the oil fraction determined. In case of repeated tests of a compressor type for the known quantity of oil in circulation, random sampling may be sufficient. Alternative procedures withthe same accuracy may be		P

Clause	Requirement - test	Verdict	
	used. The collecting deviceshall be constructed according to EN 378-2.		
5.7	Refrigerant composition		-
	The composition of any refrigerant to be used in a test shall be in accordance with ISO 817. NOTE Zeotropic refrigerants have a certain composition in the as-specified condition. Changes in pressure and temperature can cause a change in the concentration of the different components in the circulating refrigerant. This can be exacerbated by unfavourable distribution of the refrigerant in the circuit, leakage from the system and selective oil solubility. The thermodynamic properties will also change with resulting inaccuracies in the determination of performance data.		P
5.8	Calibration and requirements regarding measurement uncertainty		-
5.8.1	Calibration of calorimeters for methods A, B and C		-
	Calorimeters for methods A, B and C shall be calibrated by determining a heat leakage factor		P
	which specifies the heat exchange between the calorimeter and the ambient temperature.		P
5.8.2	Determination of the refrigerating capacity		-
	The final refrigerating capacity shall be determined with a maximum uncertainty of ± 4 % independent from the individual uncertainties of measurements according to 4.2.		P
5.8.3	Determination of the power absorbed by the condensing unit		-
	Measuring instruments shall be selected and calibrated so that the total power absorbed is within an uncertainty of measurement of ± 1 % for units with motor compressors and ± 2,5 % for units with open compressors.		P
5.9	Source of refrigerant data		-
	The source of the thermodynamic properties of the refrigerant shall be indicated in the test report		P
5.10	Test setup for air cooled condensing units		-
5.10.1	Air inlet temperature		-
	The air inlet temperature shall be measured in the centre of equal sections of the face area. These sections shall not be larger than 0,2 m2 and be square if possible. There shall be at least 6 sections. Temperature sensing elements shall be shielded against radiation and any other form of heat transfer affecting the accuracy of the measurement. They are placed max. 0,25 m from the air inlet of the		P

Clause	Requirement - test	Verdict	
	condensing unit		
5.10.2	Test room		-
	The test installation shall be capable of maintaining steady-state conditions as required by this standard.		P
5.10.3	Refrigerant charge		-
	The refrigerant charge is adjusted to reach the subcooling (see 3.1.3) as stated in the declared performance data and measured at point 12, respecting the allowed deviations, see Table 4.		P
6	Test methods		-
6.1	General		-
	A number of recognized test methods are specified in this standard. However, other test methods may be used if they conform to the requirements listed in 5.8.2 and 5.8.3.		P
6.2	List of test methods		-
6.2.1	Calorimetric methods		-
6.2.1.1	Evaporator calorimeter		-
	Method A: secondary fluid calorimeter on the suction side (see 6.3). Method B: dry system refrigerant calorimeter on the suction side (see 6.4).		P
6.2.1.2	Condenser calorimeter		-
	Method C: Condenser/gas cooler calorimeter on the discharge side, water cooled (see 6.5). NOTE Only applicable with liquid cooled condensing units.		P
6.2.2	Flow meter methods		-
	Method D: Refrigerant gas flow meter on the suction side (see 6.6). Method E: Refrigerant flow meter in the liquid line (see 6.7).		P
6.3	Method A: secondary fluid calorimeter on the suction side		-
6.3.1	Description		-
	The secondary fluid calorimeter (see Figure 3) consists of a direct expansion coil or a set of coils in parallel serving as a primary evaporator. This evaporator is suspended in the upper part of a pressuretight and heat-insulated vessel. A heater is located in the base of this vessel, which is charged with a volatile secondary fluid so that the heater is well below the liquid surface. The refrigerant flow is controlled by either a manual or a constant-pressure expansion device, located close to the calorimeter. The expansion device and the refrigerant pipes connecting it to the calorimeter shall be insulated to minimize the heat		P

Clause	Requirement - test	Verdict	
	gain.		
6.3.2	Calibration		-
	The heat leakage factor is to be determined according to 5.8.1. The bubble temperature tbs of the secondary fluid is to be used as the reference temperature tx		P
6.3.3	Test procedure		-
6.3.3.1	General		-
	The pressure and temperature of the refrigerant gas at the condensing unit inlet are set using the expansion device and varying the heat input to the evaporator. For the condenser the cooling medium is adjusted to maintain the steady flow conditions required. These shall be at the specified test conditions and in accordance with Table 4.		P
6.3.3.2	Water cooled condensing unit		-
	Cooling water inlet and outlet temperature shall be controlled according to specified test conditions.		P
6.3.3.3	Air cooled condensing unit		-
	Air inlet temperature shall be controlled according to specified test conditions.		P
6.3.4	Requirements		-
	In the case of continuously operated heating, a change of the heat input during the duration of the test shall not exceed 1 % of the calculated condensing unit refrigerating capacity.		P
6.3.5	Determination of refrigerant mass flow		-
	The refrigerant mass flow, as determined by the test, is given by the following formula:		P
6.4	Method B: dry system refrigerant calorimeter on the suction side		-
6.4.1	Description		-
	The dry system refrigerant calorimeter (see Figure 4) consists of an arrangement of refrigerant tubes or tubular vessels of suitable length and diameter to accomplish evaporation of the refrigerant circulated by the condensing unit. The external surface of the evaporator may be heated either by means of a liquid circulating in an outer jacket, which may be a concentric tube, or electrically. Alternatively, a similar means of heating may be used within the evaporator.		P
6.4.2	Calibration		-
	The heat leakage factor is to be determined in accordance with 5.8.1. The mean surface temperature tcal of the calorimeter is to be used as the reference temperature tx		P
6.4.3	Test procedure		-

Clause	Requirement - test	Verdict	
	The pressure and temperature of the refrigerant gas at the condensing unit inlet are set by using the expansion device and varying the heat input to the evaporator. For the condenser the cooling medium isadjusted to maintain the steady flow conditions required. These shall be at the specified test conditions and in accordance with Table 4.		P
6.4.4	Requirements		-
	Where liquid is used for heating, the inlet temperature shall be maintained constant within ± 0,3 K and the flow controlled so that the temperature difference between inlet and outlet is not less than 6 K. The mass of liquid circulated shall be maintained constant within ± 0,5 %.		P
6.4.5	Determination of refrigerant mass flow		-
	The refrigerant mass flow, as determined by the test, is given by the following formulae:		P
6.5	Method C: Water cooled condenser calorimeter		-
6.5.1	Description		-
	This test method is applicable only to single stage condensing units, as it does not determine the mass flow on the suction side. The water cooled condenser (see Figure 5) which forms part of the condensing unit being tested shall be equipped to act as a calorimeter by the provision of instruments for measuring temperatures, pressures and cooling water flow within the uncertainties prescribed in 4.2.		P
6.5.2	Calibration		-
	The heat leakage factor is to be determined in accordance with to 5.8.1.		P
6.5.3	Test procedure		-
	The pressure and temperature of the refrigerant vapour at the condensing unit inlet are set by using the expansion device and varying the heat input to the evaporator. For the condenser, the cooling medium is adjusted to maintain the steady flow conditions required. These shall be at the specified test conditions and in accordance with Table 4.		P
6.5.4	Requirements		-
	The inlet temperature of the cooling water shall be maintained constant within ± 0,3 K and the flow controlled so that the temperature difference between inlet and outlet is not less than 6 K. The mass of liquid circulated shall be maintained constant within ± 0,5 %.		P
6.5.5	Determination of refrigerant mass flow		-
	The refrigerant mass flow, as determined by the test, is		P

Clause	Requirement - test	Verdict	
	given by the following formula:		
6.6	Method D: Refrigerant gas flow meter on the suction side (see 6.6)		-
6.6.1	Description		-
	The refrigerant gas flow meter is placed in the suction line (see Figure 5). The refrigerant circuit comprises the condensing unit together with an expansion device and an evaporator.		P
6.6.2	Test procedure		-
	The pressure and temperature of the refrigerant gas at the condensing unit inlet are set by using the expansion device and varying the heat input to the evaporator. For the condenser the cooling medium is adjusted to maintain the steady flow conditions required. These shall be at the specified test conditions and in accordance with Table 4.		P
6.6.3	Requirements		-
	Means shall be provided to ensure that the gas (superheated vapour) at the intake of the flow meter is homogeneous and completely free from entrained droplets of liquid refrigerant. Where pulsating flow occurs in the pipe, sufficient means of damping shall be provided to reduce or eliminate the flow wave to the meter, for example by the insertion of a surge vessel.		P
6.6.4	Determination of refrigerant mass flow		-
6.6.4.1	Measurement with mass flow meter		-
	In case the refrigerant mass flow ma is measured directly m m a x		P
6.6.4.2	Measurement with volumetric flow meter		-
	In case the refrigerant mass flow ma is calculated from the flow measured and the gas density m V a a = × ρ		P
6.7	Method E: refrigerant flow meter in the liquid line		-
6.7.1	Description		-
	The refrigerant flow is determined (see Figure 7) using either a volumetric or a mass flow meter inserted into the liquid line. The flow meter is connected to the liquid line between the condensing unit outlet in front of the expansion device.		P
6.7.2	Test procedure		-
	The pressure and temperature of the refrigerant gas at the condensing unit inlet are set by using the expansion device and varying the heat input to the evaporator. For the condenser the cooling medium is adjusted to maintain the		P

Clause	Requirement - test	Verdict	
	steady flow conditions required. These shall be at the specified test conditions and in accordance with Table 4.		
6.7.3	Requirements		-
	During the test the refrigerant liquid shall be homogenous and subcooled by at least 3 K at the outlet of the measuring device, which may require an additional liquid subcooler before the flow meter.		P
6.7.4	Determination of the refrigerant mass flow		-
	The refrigerant mass flow, as determined by the test, is given by the following formulae:		P
7	Determination of the power absorbed by the condensing unit		-
	General		-
7.1.1	Introduction		-
	The measurement of the power absorbed by the condensing unit is conducted at the same time as the measurements made in accordance with Clause 6. The power absorbed by the condensing unit (P) consists of the power absorbed by the compressor (Pm or Pel) and the power absorbed by the fans and other regularly furnished auxiliaries (PF).		P
7.1.2	Measurement for condensing units where the motor is not an integral part of the condensing unit		-
	The actual compressor power absorbed (Pm) where the motor is not an integral part of the unit is to be determined from the mean torque on the compressor shaft. Alternatively, a calibrated electric motor of known characteristics may be used. If a belt-drive is used, allowance shall be made for the belt transmission losses.		P
7.1.3	Measurement for condensing units where the motor is an integral part of the condensing unit		-
	The actual compressor power absorbed (Pel) where the motor is an integral part of the unit: is the electrical power input at the motor terminals, or with a specific means of factory assembled or factory specified frequency inverter for variable speed (part load) capacity regulation, the electrical power input at the inverter input terminals.		P
7.1.4	Measurement of the power absorbed by the auxiliary components and fans		-
	The actual fan power absorbed:		P
7.2	Calculation		-
	The absorbed power by the condensing unit is the sum of		P

Clause	Requirement - test	Verdict	
	the compressor power, the fan power and the power taken up by additional devices needed to operate the condensing unit, e.g. oil pump. The power absorbed by the condensing unit at the specified test conditions is calculated according to Formula (4).		
8	Test report		-
8.1	General		-
	A test report shall be completed for each test and shall include the following information:		P
8.2	Test data		-
	The following test data are to be reported: a) specified test conditions according to Table 4; b) measured actual values; c) ambient air pressure. The specified test conditions and actual values are to be compared in a table. The tester or test bench operator bears responsibility for the accuracy of the test results.		P
8.3	Test results		-
	The following values are to be determined as specified in 5.2.5: — related enthalpy difference; — refrigerant mass flow at the specified test conditions m; — enthalpy difference (inlet and outlet of the unit); — refrigerating capacity of the condensing unit at the specified test conditions Q; — power absorbed by the unit at the specified test conditions P; — coefficient of performance COPR; — measurement uncertainty at a 95 % confidence level; — oil circulation ratio xoil		P
8.4	Overview of test values		-
	To allow the proper calculation the following values shall be recorded depending on the chosen test method, see Table 5.		P

Clause	Requirement-Test	Result-Remark	Verdict
4	**Strategy for risk assessment and risk reduction**		-
	To implement risk assessment and risk reduction the designer shall take the following actions, in the order given (see Figure 1):	see Figure 1	P
	a) determine the limits of the machinery, which include the intended use and any reasonably foreseeable misuse thereof;		P
	b) identify the hazards and associated hazardous situations;		P
	c) estimate the risk for each identified hazard and hazardous situation;		P
	d) evaluate the risk and take decisions about the need for risk reduction;		P
	e) eliminate the hazard or reduce the risk associated with the hazard by means of protective measures.		P
	Actions a) to d) are related to risk assessment and e) to risk reduction.		P
	Risk assessment is a series of logical steps to enable, in a systematic way, the analysis and evaluation of the risks associated with machinery.		P
	Risk assessment is followed, whenever necessary, by risk reduction. Iteration of this process can be necessary to eliminate hazards as far as practicable and to adequately reduce risks by the implementation of protective measures.		P
	It is assumed that, when present on machinery, a hazard will sooner or later lead to harm if no protective measure or measures have been implemented. Examples of hazards are given in Annex B.		P
	Protective measures are the combination of the measures implemented by the designer and the user in accordance with Figure 2. Measures which can be incorporated at the design stage are preferable to those implemented by the user and usually prove more effective.		P
	The objective to be met is the greatest practicable risk reduction, taking into account the four below factors. The strategy defined in this clause is represented by the flowchart in Figure 1. The process itself is iterative and several successive applications can be necessary to reduce the risk, making the best use of available technology. In carrying out this process, it is necessary to take into account these four factors, in the following order of preference:		P
	- the safety of the machine during all the phases of its		P

Clause	Requirement-Test	Result-Remark	Verdict
	life cycle;		
	- the ability of the machine to perform its function;		P
	- the usability of the machine;		P
	- the manufacturing, operational and dismantling costs of the machine.		P
5	**Risk assessment**		-
5.1	**General**		-
	Risk assessment comprises (see Figure 1)		-
	- risk analysis, comprising		-
	1) determination of the limits of the machinery (see 5.3),		-
	2) hazard identification (5.4 and Annex B), and		-
	3) risk estimation (see 5.5), and		-
	- risk evaluation (see 5.6).		-
	Risk analysis provides information required for the risk evaluation, which in turn allows judgments to be made about whether or not risk reduction is required.		P
	These judgments shall be supported by a qualitative or, where appropriate, quantitative estimate of the risk associated with the hazards present on the machinery.		P
	The risk assessment shall be documented according to Clause 7.		P
5.2	**Information for risk assessment**		-
	The information for risk assessment should include the following.		P
	a) **Related to machinery description**:		-
	1) user specifications;	See manual	P
	2) anticipated machinery specifications, including	See manual	P
	i) a description of the various phases of the whole life cycle of the machinery,	See manual	P
	ii) design drawings or other means of establishing the nature of the machinery, and		P
	iii) required energy sources and how they are supplied;	Pass Muster	P
	3) documentation on previous designs of similar machinery, if relevant;		P
	4) information for use of the machinery, as available.	See manual	P
	b) **Related to regulations, standards and other applicable documents**:		-
	1) applicable regulations;		P
	2) relevant standards;		P

Clause	Requirement-Test	Result-Remark	Verdict
	3) relevant technical specifications;		P
	4) relevant safety data sheets.		P
	c) **Related to experience of use:**		-
	1) any accident, incident or malfunction history of the actual or similar machinery;	Pass Muster	P
	2) the history of damage to health resulting, for example, from emissions (noise, vibration, dust, fumes, etc.), chemicals used or materials processed by the machinery;		P
	3) the experience of users of similar machines and, whenever practicable, an exchange of information with the potential users.		P
	d) **Relevant ergonomic principles.**		-
	The information shall be updated as the design develops or when modifications to the machine are required.		P
	Comparisons between similar hazardous situations associated with different types of machinery are often possible, provided that sufficient information about hazards and accident circumstances in those situations is available.	Pass Muster	P
	For quantitative analysis, data from databases, handbooks, laboratories or manufacturers' specifications may be used, provided that there is confidence in the suitability of the data. Uncertainty associated with these data shall be indicated in the documentation (see Clause 7).	see Clause 7	P
5.3	**Determination of limits of machinery**		P
5.3.1	**General**		-
	Risk assessment begins with the determination of the limits of the machinery, taking into account all the phases of the machinery life. This means that the characteristics and performances of the machine or a series of machines in an integrated process, and the related people, environment and products, should be identified in terms of the limits of machinery as given in 5.3.2 to 5.3.5.	Pass Muster	P
5.3.2	**Use limits**		-
	Use limits include the intended use and the reasonably foreseeable misuse. Aspects to be taken into account include the following:		-
	a) the different machine operating modes and different intervention procedures for the users, including interventions required by malfunctions of the machine;	Pass Muster	P
	b) the use of the machinery (for example, industrial,		P

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

Clause	Requirement-Test	Result-Remark	Verdict
	a) properties of the material(s) to be processed,		N/A
	b) housekeeping — the level of cleanliness required, and		N/A
	c) environmental — the recommended minimum and maximum temperatures, whether the machine can be operated indoors or outdoors, in dry or wet weather, in direct sunlight, tolerance to dust and wet, etc.		N/A
5.4	**Hazard identification**		-
	After determination of the limits of the machinery, the essential step in any risk assessment of the machinery is the systematic identification of reasonably foreseeable hazards (permanent hazards and those which can appear unexpectedly), hazardous situations and/or hazardous events during all phases of the machine life cycle, i.e.:	Pass Muster	P
	- transport, assembly and installation;		P
	- commissioning;		P
	- use;		P
	- dismantling, disabling and scrapping.		P
	Only when hazards have been identified can steps be taken to eliminate them or to reduce risks. To accomplish this hazard identification, it is necessary to identify the operations to be performed by the machinery and the tasks to be performed by persons who interact with it, taking into account the different parts, mechanisms or functions of the machine, the materials to be processed, if any, and the environment in which the machine can be used.	Comply with the requirement	P
	The designer shall identify hazards taking into account the following.		-
	a) **Human interaction during the whole life cycle of the machine**		-
	Task identification should consider all tasks associated with every phase of the machine life cycle as given above. Task identification should also take into account, but not be limited to, the following task categories:		P
	- setting; - testing; - teaching/programming; - process/tool changeover; - start-up;		P

Clause	Requirement-Test	Result-Remark	Verdict
	- all modes of operation; - feeding the machine; - removal of product from machine; - stopping the machine; - stopping the machine in case of emergency; - recovery of operation from jam or blockage; - restart after unscheduled stop; - fault-finding/trouble-shooting (operator intervention); - cleaning and housekeeping; - preventive maintenance; - corrective maintenance.		
	All reasonably foreseeable hazards, hazardous situations or hazardous events associated with the various tasks shall then be identified. Annex B gives examples of hazards, hazardous situations and hazardous events to assist in this process. Several methods are available for the systematic identification of hazards. See also ISO/TR 14121-2.	See also ISO/TR 14121-2	P
	In addition, reasonably foreseeable hazards, hazardous situations or hazardous events not directly related to tasks shall be identified.	Pass Muster	P
	b) **Possible states of the machine**		-
	These are as follows:		-
	1) the machine performs the intended function (the machine operates normally);		P
	2) the machine does not perform the intended function (i.e. it malfunctions) due to a variety of reasons, including		-
	- variation of a property or of a dimension of the processed material or of the workpiece, - failure of one or more of its component parts or services, - external disturbances (for example, shocks, vibration, electromagnetic interference), - design error or deficiency (for example, software errors), - disturbance of its power supply, and - surrounding conditions (for example, damaged floor surfaces).		P
	c) **Unintended behaviour of the operator or reasonably foreseeable misuse of the machine**		-
	- loss of control of the machine by the operator (especially for hand-held or mobile machines), - reflex behaviour of a person in case of malfunction, incident or failure during the use of the machine,		P

Clause	Requirement-Test	Result-Remark	Verdict
	- behaviour resulting from lack of concentration or carelessness, - behaviour resulting from taking the “line of least resistance” in carrying out a task, - behaviour resulting from pressures to keep the machine running in all circumstances, and - behaviour of certain persons (for example, children, disabled persons).		
5.5	**Risk estimation**		-
5.5.1	**General**		-
	After hazard identification, risk estimation shall be carried out for each hazardous situation by determining the elements of risk given in 5.5.2. When determining these elements, it is necessary to take into account the aspects given in 5.5.3.		P
	If standardized (or other suitable) measurement methods exist for an emission, they should be used, in conjunction with existing machinery or prototypes, to determine emission values and comparative emission data. This makes it possible for the designer to		-
	- estimate the risk associated with the emissions,		P
	- evaluate the effectiveness of the protective measures implemented at the design stage,		P
	- provide potential buyers with quantitative information on emissions in the technical documentation, and		P
	- provide users with quantitative information on emissions in the information for use.		P
	Hazards other than emissions that are described by measurable parameters can be dealt with in a similar manner.		P
5.5.2	**Elements of risk**		-
5.5.2.1	**General**		-
	The risk associated with a particular hazardous situation depends on the following elements:		-
	a) the severity of harm;		P
	b) the probability of occurrence of that harm, which is a function of		P
	1) the exposure of person(s) to the hazard,		P
	2) the occurrence of a hazardous event, and		P
	3) the technical and human possibilities to avoid or limit the harm.		P

Clause	Requirement-Test	Result-Remark	Verdict
	The elements of risk are shown in Figure 3. Additional details are given in 5.5.2.2, 5.5.2.3 and 5.5.3.	See Figure 3	P
5.5.2.2	**Severity of harm**		-
	The severity can be estimated by taking into account the following:		-
	a) the severity of injuries or damage to health, for example,		-
	- slight, - serious, - death.	Slight	P
	b) the extent of harm, for example, to		-
	- one person, - several persons.	One person	P
	When carrying out a risk assessment, the risk from the most likely severity of the harm that is likely to occur from each identified hazard shall be considered, but the highest foreseeable severity shall also be taken into account, even if the probability of such an occurrence is not high.	Pass Muster	P
5.5.2.3	**Probability of occurrence of harm**		-
5.5.2.3.1	**Exposure of persons to the hazard**		-
	The exposure of a person to the hazard influences the probability of the occurrence of harm. Factors to be taken into account when estimating the exposure are, among others,		P
	a) the need for access to the hazard zone (for normal operation, correction of malfunction, maintenance or repair, etc.)		P
	b) the nature of access (for example, manual feeding of materials),		P
	c) the time spent in the hazard zone,		P
	d) the number of persons requiring access, and		P
	e) the frequency of access.		P
5.5.2.3.2	**Occurrence of a hazardous event**		-
	The occurrence of a hazardous event influences the probability of occurrence of harm. Factors to be taken into account when estimating the occurrence of a hazardous event are, among others,		-
	a) reliability and other statistical data,		P
	b) accident history,		P
	c) history of damage to health, and		P
	d) comparison of risks (see 5.6.3).		P
5.5.2.3.3	**Possibility of avoiding or limiting harm**		-

Clause	Requirement-Test	Result-Remark	Verdict
	The possibility of avoiding or limiting harm influences the probability of occurrence of harm. Factors to be taken into account when estimating the possibility of avoiding or limiting harm are, among others, the following:		P
	a) different persons who can be exposed to the hazard(s), for example,		-
	- skilled, - unskilled;	Skilled	P
	b) how quickly the hazardous situation could lead to harm, for example,		-
	- suddenly, - quickly, - slowly;	Quickly	P
	c) any awareness of risk, for example,		-
	- by general information, in particular, information for use, - by direct observation, - through warning signs and indicating devices, in particular, on the machinery;	Through warning signs and indicating devices, in particular, on the machinery;	P
	d) the human ability to avoid or limit harm (for example, reflex, agility, possibility of escape);	Reflex	P
	e) practical experience and knowledge, for example,		-
	- of the machinery, - of similar machinery, - no experience.	practical experience and knowledge of the machinery	P
5.5.3	**Aspects to be considered during risk estimation**		-
5.5.3.1	**Persons exposed**		-
	Risk estimation shall take into account all persons (operators and others) for whom exposure to the hazard is reasonably foreseeable.	Pass Muster	P
5.5.3.2	**Type, frequency and duration of exposure**		-
	The estimation of the exposure to the hazard under consideration (including long-term damage to health) requires analysis of, and shall account for, all modes of operation of the machinery and methods of working. In particular, the analysis shall account for the needs for access during loading/unloading, setting, teaching, process changeover or correction, cleaning, fault-finding and maintenance.		P
	The risk estimation shall also take into account tasks, for		P

Clause	Requirement-Test	Result-Remark	Verdict
	which it is necessary to suspend protective measures.		
5.5.3.3	**Relationship between exposure and effects**		-
	The relationship between an exposure to a hazard and its effects shall be taken into account for each hazardous situation considered. The effects of accumulated exposure and combinations of hazards shall also be considered. When considering these effects, risk estimation shall, as far as practicable, be based on appropriate recognized data.		P
5.5.3.4	**Human factors**		-
	Human factors can affect risk and shall be taken into account in the risk estimation, including, for example,		-
	a) the interaction of person(s) with the machinery, including correction of malfunction, b) interaction between persons, c) stress-related aspects, d) ergonomic aspects, e) the capacity of persons to be aware of risks in a given situation depending on their training, experience and ability, f) fatigue aspects, and g) aspects of limited abilities (due to disability, age, etc.).		P
	Training, experience and ability can affect risk; nevertheless, none of these factors shall be used as a substitute for hazard elimination, risk reduction by inherently safe design measure or safeguarding, wherever these protective measures can be practicably implemented.		P
5.5.3.5	**Suitability of protective measures**		-
	Risk estimation shall take into account the suitability of protective measures and shall		P
	a) identify the circumstances which can result in harm,		P
	b) whenever appropriate, be carried out using quantitative methods to compare alternative protective measures (see ISO/TR 14121-2), and		P
	c) provide information that can assist with the selection of appropriate protective measures.	Provided	P
	When estimating risk, those components and systems identified as immediately increasing the risk in case of failure need special attention.		P
	When protective measures include work organization, correct behaviour, attention, application of personal protective equipment (PPE), skill or training, the relatively		P

Clause	Requirement-Test	Result-Remark	Verdict
	low reliability of such measures compared with proven technical protective measures shall be taken into account in the risk estimation.		
5.5.3.6	**Possibility of defeating or circumventing protective measures**		-
	For the continued safe operation of a machine, it is important that the protective measures allow its easy use and do not hinder its intended use. Otherwise, there is a possibility that protective measures might be bypassed in order for maximum utility of the machine to be achieved.		P
	Risk estimation shall take account of the possibility of defeating or circumventing protective measures. It shall also take account of the incentive to defeat or circumvent protective measures when, for example,		P
	a) the protective measure slows down production or interferes with another activity or preference of the user, b) the protective measure is difficult to use, c) persons other than the operator are involved, or d) the protective measure is not recognized by the user or not accepted as being suitable for its function.		P
	Whether or not a protective measure can be defeated depends on both the type of protective measure, such as an adjustable guard or programmable trip device, and its design details.		P
	Protective measures that use programmable electronic systems introduce additional possibilities of defeat or circumvention if access to safety-related software is not appropriately restricted by design and monitoring methods. Risk estimation shall identify where safety-related functions are not separated from other machine functions and shall determine the extent to which access is possible. This is particularly important when remote access for diagnostic or process correction purposes is required.	Comply with the requirement	P
5.5.3.7	**Ability to maintain protective measures**		-
	Risk estimation shall consider whether the protective measures can be maintained in the condition necessary to provide the required level of protection.		P
5.5.3.8	**Information for use**		-
	Risk estimation shall take into account the information for use, as available.	See also 6.4	P
5.6	**Risk evaluation**		-
5.6.1	**General**		-

Clause	Requirement-Test	Result-Remark	Verdict
	After risk estimation has been completed, risk evaluation shall be carried out to determine if risk reduction is required. If risk reduction is required, then appropriate protective measures shall be selected and applied (see Clause 6). As shown in Figure 1, the adequacy of the risk reduction shall be determined after applying each of the three steps of risk reduction described in Clause 6. As part of this iterative process, the designer shall also check whether additional hazards are introduced or other risks increased when new protective measures are applied. If additional hazards do occur, they shall be added to the list of identified hazards and appropriate protective measures will be required to address them.		P
	Achieving the objectives of risk reduction and a favourable outcome of risk comparison applied when practicable gives confidence that risk has been adequately reduced.		P
5.6.2	**Adequate risk reduction**		-
	Application of the three-step method described in 6.1 is essential in achieving adequate risk reduction.		P
	Following the application of the three-step method, adequate risk reduction is achieved when		P
	- all operating conditions and all intervention procedures have been considered,		P
	- the hazards have been eliminated or risks reduced to the lowest practicable level,		P
	- any new hazards introduced by the protective measures have been properly addressed,		P
	- users are sufficiently informed and warned about the residual risks (see 6.1, step 3),		P
	- protective measures are compatible with one another,		P
	- sufficient consideration has been given to the consequences that can arise from the use in a nonprofessional/ non-industrial context of a machine designed for professional/industrial use, and		
	- the protective measures do not adversely affect the operator's working conditions or the usability of the machine.		P
5.6.3	**Comparison of risks**		-
	As part of the process of risk evaluation, the risks associated with the machinery or parts of machinery can be compared with those of similar machinery or parts of machinery, provided the following criteria apply:	Pass Muster	P
	- the similar machinery is in accordance with the relevant		P

Clause	Requirement-Test	Result-Remark	Verdict
	type-C standard(s);		
	- the intended use, reasonably foreseeable misuse and the way both machines are designed and constructed are comparable;		P
	- the hazards and the elements of risk are comparable;		P
	- the technical specifications are comparable;		P
	- the conditions for use are comparable.		P
	The use of this comparison method does not eliminate the need to follow the risk assessment process as described in this International Standard for the specific conditions of use. For example, when a band saw used for cutting meat is compared with a band saw used for cutting wood, the risks associated with the different material shall be assessed.	Pass Muster	P
6	**Risk reduction**		-
6.1	**General**		-
	The objective of risk reduction can be achieved by the elimination of hazards, or by separately or simultaneously reducing each of the two elements that determine the associated risk:		P
	- severity of harm from the hazard under consideration;		P
	- probability of occurrence of that harm.		P
	All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2).	See also Figures 1 and 2	P
	Step 1: Inherently safe design measures		-
	Inherently safe design measures eliminate hazards or reduce the associated risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine. See 6.2.	Pass Muster	P
	Step 2: Safeguarding and/or complementary protective measures		-
	Taking into account the intended use and the reasonably foreseeable misuse, appropriately selected safeguarding and complementary protective measures can be used to reduce risk when it is not practicable to eliminate a hazard, or reduce its associated risk sufficiently, using inherently safe design measures. See 6.3.	Pass Muster	P
	Step 3: Information for use		-
	Where risks remain despite inherently safe design measures, safeguarding and the adoption of		P

Clause	Requirement-Test	Result-Remark	Verdict
	complementary protective measures, the residual risks shall be identified in the information for use. The information for use shall include, but not be limited to, the following:		
	- operating procedures for the use of the machinery consistent with the expected ability of personnel who use the machinery or other persons who can be exposed to the hazards associated with the machinery;		P
	- the recommended safe working practices for the use of the machinery and the related training requirements adequately described;		P
	- sufficient information, including warning of residual risks for the different phases of the life of the machinery;		P
	- the description of any recommended personal protective equipment, including detail as to its need as well as to training needed for its use.		P
	Information for use shall not be a substitute for the correct application of inherently safe design measures, safeguarding or complementary protective measures.		P
6.2	**Inherently safe design measures**		-
6.2.1	**General**		-
	Inherently safe design measures are the first and most important step in the risk reduction process. This is because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding can fail or be violated and information for use may not be followed.		P
	Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features for the machine itself and/or interaction between the exposed persons and the machine.		P
6.2.2	**Consideration of geometrical factors and physical aspects**		-
6.2.2.1	**Geometrical factors**		-
	Such factors include the following.		-
	a) The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position — reducing blind spots, for example — and choosing and locating means of indirect vision where necessary (mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the	Pass Muster	P

Clause	Requirement-Test	Result-Remark	Verdict
	operator, for example:		
	- the travelling and working area of mobile machines;		P
	- the zone of movement of lifted loads or of the carrier of machinery for lifting persons;		P
	- the area of contact of the tool of a hand-held or hand-guided machine with the material being worked.		P
	The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zones.		P
	b) The form and the relative location of the mechanical components parts: for instance, crushing and shearing hazards are avoided by increasing the minimum gap between the moving parts, such that the part of the body under consideration can enter the gap safely, or by reducing the gap so that no part of the body can enter it (see ISO 13854 and ISO 13857).		P
	c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can “trap” parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed, and open ends of tubes which can cause a “trap” shall be capped.	Pass Muster	P
	d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).		P
6.2.2.2	**Physical aspects**		-
	Such aspects include the following:		-
	a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard;		P
	b) limiting the mass and/or velocity of the movable elements, and hence their kinetic energy;		P
	c) limiting the emissions by acting on the characteristics of the source using measures for reducing		P
	1) noise emission at source (see ISO/TR 11688-1),		P
	2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for hand-held and hand-guided machinery, see CR 1030-1)],		P
	3) the emission of hazardous substances, including the		P

Clause	Requirement-Test	Result-Remark	Verdict
	use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding),		
	4) radiation emissions, including, for example, avoiding the use of hazardous radiation sources, limiting the power of radiation to the lowest level sufficient for the proper functioning of the machine, designing the source so that the beam is concentrated on the target, increasing the distance between the source and the operator or providing for remote operation of the machinery [measures for reducing emission of non-ionizing radiation are given in 6.3.4.5 (see also EN 12198-1 and EN 12198-3)].	Pass Muster	P
6.2.3	**Taking into account general technical knowledge of machine design**		-
	This general technical knowledge can be derived from technical specifications for design (standards, design codes, calculation rules, etc.), which should be used to cover		P
	a) mechanical stresses such as		-
	- stress limitation by implementation of correct calculation, construction and fastening methods as regards, for example, bolted assemblies and welded assemblies, - stress limitation by overload prevention (bursting disk, pressure-limiting valves, breakage points, torque-limiting devices, etc.), - avoiding fatigue in elements under variable stresses (notably cyclic stresses), and - static and dynamic balancing of rotating elements,	The appropriate technical knowledge of mechanical has been taken into account.	P
	b) materials and their properties such as		-
	- resistance to corrosion, ageing, abrasion and wear, - hardness, ductility, brittleness, - homogeneity, - toxicity, and - flammability, and	The materials have been treated by appropriate methods.	P
	c) emission values for		-
	- noise, - vibration, - hazardous substances, and - radiation.		P
	When the reliability of particular components or assemblies is critical for safety (for example, ropes,	Appropriate working	P

Clause	Requirement-Test	Result-Remark	Verdict
	chains, lifting accessories for lifting loads or persons), stress limits shall be multiplied by appropriate working coefficients.	coefficients have been taken into account during design and calculation.	
6.2.4	**Choice of appropriate technology**		-
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certain applications such as the following:		-
	a) on machines intended for use in explosive atmospheres, using		N/A
	- appropriately selected pneumatic or hydraulic control system and machine actuators, - intrinsically safe electrical equipment (see IEC 60079-11);		N/A
	b) for particular products to be processed (for example, by a solvent), by using equipment that ensures the temperature will remain far below the flash point;		N/A
	c) the use of alternative equipment to avoid high noise levels, such as		P
	- electrical instead of pneumatic equipment, - in certain conditions, water-cutting instead of mechanical equipment.	The appropriate technology has been chosen.	P
6.2.5	**Applying principle of positive mechanical action**		-
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5-1 and ISO 14119).	The principle of the positive mechanical action of a component on another component has been applied.	P
6.2.6	**Provisions for stability**		-
	Machines shall be designed so that they have sufficient stability to allow them to be used safely in their specified conditions of use. Factors to be taken into account include	These machines have been designed to have sufficient stability to allow them to be used safely in their specified conditions of use.	P
	- the geometry of the base, - the weight distribution, including loading, - the dynamic forces due to movements of parts of the machine, of the machine itself or of elements held by the	These factors have been taken into account during design.	P

Clause	Requirement-Test	Result-Remark	Verdict
	machine which can result in an overturning moment, - vibration, - oscillations of the centre of gravity, - characteristics of the supporting surface in case of travelling or installation on different sites (ground conditions, slope, etc.), and - external forces, such as wind pressure and manual forces.		
	Stability shall be considered in all phases of the life cycle of the machine, including handling, travelling, installation, use, dismantling, disabling and scrapping.		P
	Other protective measures for stability relevant to safeguarding are given in 6.3.2.6.		P
6.2.7	**Provisions for maintainability**		-
	When designing a machine, the following maintainability factors shall be taken into account to enable maintenance of the machine:		-
	- accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used; - ease of handling, taking into account human capabilities; - limitation of the number of special tools and equipment.	These factors have been taken into account during design.	P
6.2.8	**Observing ergonomic principles**		-
	Ergonomic principles shall be taken into account in designing machinery so as to reduce the mental or physical stress of, and strain on, the operator. These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design.	Appropriate ergonomic principles have been taken into account in designing machinery to reduce mental or physical stress and strain of the operator.	P
	Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2).		P
	All elements of the operator–machine interface, such as controls, signalling or data display elements, shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible. See EN 614-1, EN 13861 and IEC	All arrangement and design of manual controls have been checked in	P

Clause	Requirement-Test	Result-Remark	Verdict
	61310-1.	compliance with.	
	The designer's attention is particularly drawn to following ergonomic aspects of machine design.		P
	a) Avoid the necessity for stressful postures and movements during the use of the machine (for example, providing facilities to adjust the machine to suit the various operators).	Stressful postures and movements during use of the machine have been avoided.	P
	b) Design machines, especially hand-held and mobile machines, so as to enable them to be operated easily, taking into account human effort, actuation of controls and hand, arm and leg anatomy.	This machine has been adjusted to the human strength and convenient movement.	P
	c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures.		P
	d) Avoid linking the operator's working rhythm to an automatic succession of cycles.		P
	e) Provide local lighting on or in the machine for the illumination of the working area and of adjusting, setting-up and frequent maintenance zones when the design features of the machine and/or its guards render the ambient lighting inadequate. Flicker, dazzling, shadows and stroboscopic effects shall be avoided if they can cause a risk. If the position or the lighting source has to be adjusted, its location shall be such that it does not cause any risk to persons making the adjustment.	Adequate lighting is provided.	P
	f) Select, locate and identify manual controls (actuators) so that		-
	- they are clearly visible and identifiable, and appropriately marked where necessary (see 6.4.4), - they can be safely operated without hesitation or loss of time and without ambiguity (for example, a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation), - their location (for push-buttons) and their movement (for levers and hand wheels) are consistent with their effect (see IEC 61310-3), and - their operation cannot cause additional risk.	All design and arrangement of the control logic have been checked in compliance with this requirement.	P
	See also ISO 9355-3.		P
	Where a control is designed and constructed to perform		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	several different actions — namely, where there is no one-to-one correspondence (for example, keyboards) — the action to be performed shall be clearly displayed and subject to confirmation where necessary.		
	Controls shall be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles. Constraints due to the necessary or foreseeable use of personal protective equipment (such as footwear, gloves) shall be taken into account.		N/A
	g) Select, design and locate indicators, dials and visual display units so that		N/A
	- they fit within the parameters and characteristics of human perception, - information displayed can be detected, identified and interpreted conveniently, i.e. long-lasting, distinct, unambiguous and understandable with respect to the operator's requirements and the intended use, and - the operator is able to perceive them from the control position.		N/A
6.2.9	**Electrical hazards**		-
	For the design of the electrical equipment of machines, IEC 60204-1 gives general provisions about disconnection and switching of electrical circuits and for protection against electric shock. For requirements related to specific machines, see corresponding IEC standards (for example, IEC 61029, IEC 60745 or IEC 60335).	Pass Muster	P
6.2.10	**Pneumatic and hydraulic hazards**		-
	Pneumatic and hydraulic equipment of machinery shall be designed so that		-
	- the maximum rated pressure cannot be exceeded in the circuits (using, for example, pressure-limiting devices),	Appropriate limiting devices have been provided.	P
	- no hazard results from pressure fluctuations or increases, or from loss of pressure or vacuum,		N/A
	- no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures,		N/A
	- air receivers, air reservoirs or similar vessels (such as in gas-loaded accumulators) comply with the applicable design standard codes or regulations for these elements,	The pipes have been protected by appropriated	P

Clause	Requirement-Test	Result-Remark	Verdict
		devices.	
	- all elements of the equipment, especially pipes and hoses, are protected against harmful external effects,	The pipes have been protected by appropriated devices.	P
	- as far as possible, reservoirs and similar vessels (for example, gas-loaded accumulators) are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, Clause 5)		P
	- all elements which remain under pressure after isolation of the machine from its power supply are provided with clearly identified exhaust devices, and there is a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine.	This requirement is complied with by appropriate design.	P
6.2.11	**Applying inherently safe design measures to control systems**		-
6.2.11.1	**General**		-
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount of risk reduction (see ISO 13849-1 or IEC 62061).	Inherently safe design measures to control system have applied.	P
	The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behaviour.		P
	Typical causes of hazardous machine behaviour are		-
	- an unsuitable design or modification (accidental or deliberate) of the control system logic, - a temporary or permanent defect or failure of one or several components of the control system, - a variation or a failure in the power supply of the control system, and - inappropriate selection, design and location of the control devices.	No this kind of hazard in this machine	P
	Typical examples of hazardous machine behaviour are		-
	- unexpected start-up (see ISO 14118), - uncontrolled speed change, - failure to stop moving parts, - dropping or ejection of part of the machine or of a workpiece clamped by the machine, and	No this kind of hazard in this machine	P

Clause	Requirement-Test	Result-Remark	Verdict
	- machine action resulting from inhibition (defeating or failure) of protective devices.		
	In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause (6.2.11) and in 6.2.12. These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1, IEC 60204-1 and IEC 62061).	the design of control systems comply with the related principles and methods	P
	Control systems shall be designed to enable the operator to interact with the machine safely and easily. This requires one or several of the following solutions:		-
	- systematic analysis of start and stop conditions;		P
	- provision for specific operating modes (for example, start-up after normal stop, restart after cycle interruption or after emergency stop, removal of the workpieces contained in the machine, operation of a part of the machine in case of a failure of a machine element);	Enough provisions have been provided.	P
	- clear display of the faults;		P
	- measures to prevent accidental generation of unexpected start commands (for example, shrouded start device) likely to cause dangerous machine behaviour (see ISO 14118:2000, Figure 1);		P
	- maintained stop commands (for example, interlock) to prevent restarting that could result in dangerous machine behaviour (see ISO 14118:2000, Figure 1).		P
	An assembly of machines may be divided into several zones for emergency stopping, for stopping as a result of protective devices and/or for isolation and energy dissipation. The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone. Likewise, it shall be obvious which control devices (for example, emergency stop devices, supply disconnecting devices) and/or protective devices belong to which zone. The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention.		N/A
	Control systems shall be designed to limit the movements of parts of the machinery, the machine itself, or workpieces and/or loads held by the machinery, to the safe design parameters (for example, range, speed,		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	acceleration, deceleration, load capacity). Allowance shall be made for dynamic effects (swinging of loads, etc.).		
	For example:		-
	- the travelling speed of mobile pedestrian controlled machinery other than remote-controlled shall be compatible with walking speed;		N/A
	- the range, speed, acceleration and deceleration of movements of the person-carrier and carrying vehicle for lifting persons shall be limited to non-hazardous values, taking into account the total reaction time of the operator and the machine;		N/A
	- the range of movements of parts of machinery for lifting loads shall be kept within specified limits.		N/A
	When the machinery contains various elements that can be operated independently, the control system shall be designed to prevent risks arising out of a lack of coordination (for example, collision prevention system).		N/A
6.2.11.2	**Starting of an internal power source/switching on an external power supply**		-
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation.		P
	For example:		-
	- starting the internal combustion engine shall not lead to movement of a mobile machine;		P
	- connection to mains electricity supply shall not result in the starting of working parts of a machine.		P
	See IEC 60204-1:2005, 7.5 (see also Annexes A and B).		P
6.2.11.3	**Starting/stopping of a mechanism**		-
	The primary action for starting or accelerating the movement of a mechanism should be performed by the application or an increase of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 0 to state 1 (where state 1 represents the highest energy state).		P
	The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 1 to state 0 (where state 1 represents the highest energy state).	The type of stopping of this machine belongs to state 1 and state 0.	P
	In certain applications, such as high-voltage switchgear, this principle cannot be followed, in which case other		P

Clause	Requirement-Test	Result-Remark	Verdict
	measures should be applied to achieve the same level of confidence for the stopping or slowing down.		
	When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (for example, a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system.	No such situation exists.	P
6.2.11.4	**Restart after power interruption**		-
	If a hazard could be generated, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (for example, by use of a self-maintained relay, contactor or valve).	The spontaneous restart of a machine when it is re-energized after power interruption has been prevented by contactor.	P
6.2.11.5	**Interruption of power supply**		
	Machinery shall be designed to prevent hazardous situations resulting from interruption or excessive fluctuation of the power supply. At least the following requirements shall be met:	The hazardous situations resulting from interruption or excessive fluctuation of the power supply has been prevented.	P
	- the stopping function of the machinery shall remain;		P
	- all devices whose permanent operation is required for safety shall operate in an effective way to maintain safety (for example, locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery);		P
	- parts of machinery or workpieces and/or loads held by machinery which are liable to move as a result of potential energy shall be retained for the time necessary to allow them to be safely lowered.	No such situation exists.	P
6.2.11.6	**Use of automatic monitoring**		-
	Automatic monitoring is intended to ensure that a safety function or functions implemented by a protective measure do not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed such that hazards are	Appropriate automatic monitoring has been used.	P

Clause	Requirement-Test	Result-Remark	Verdict
	generated.		
	Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function. In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (for example, the beginning of the machine cycle).		P
	The protective measure may be, for example,		-
	- the stopping of the hazardous process,	Emergency stop is provided.	P
	- preventing the restart of this process after the first stop following the failure, or	Reset before restart is necessary.	P
	- the triggering of an alarm.	An alarm is provided.	P
6.2.11.7	**Safety functions implemented by programmable electronic control systems**		-
6.2.11.7.1	**General**		-
	A control system that includes programmable electronic equipment (for example, programmable controllers) can, where appropriate, be used to implement safety functions at machinery. Where a programmable electronic control system is used, it is necessary to consider its performance requirements in relation to the requirements for the safety functions. The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) is sufficiently low. Where a programmable electronic control system performs a monitoring function, the system behaviour on detection of a fault shall be considered (see also the IEC 61508 series for further guidance).	Such equipment is provided.	P
	The programmable electronic control system should be installed and validated to ensure that the specified performance [for example, safety integrity level (SIL) in IEC 61508] for each safety function has been achieved. Validation comprises testing and analysis (for example, static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.	All parts interact correctly to perform the safety function and that unintended functions do not occur.	P
6.2.11.7.2	**Hardware aspects**		-
	The hardware (including, for example, sensors, actuators and logic solvers) shall be selected, and/or designed and	The hardware has been selected and	P

Clause	Requirement-Test	Result-Remark	Verdict
	installed, to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of	installed to meet both the functional and performance requirements of the safety functions to be performed.	
	- architectural constraints (the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault, etc.),		P
	- selection, and/or design, of equipment and devices with an appropriate probability of dangerous random hardware failure, and		P
	- the incorporation of measures and techniques within the hardware so as to avoid systematic failures and control systematic faults.	Appropriate devices are provided.	P
6.2.11.7.3	**Software aspects**		-
	The software, including internal operating software (or system software) and application software, shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3).	This requirement has been taken into account during designing the software.	P
	Application software should not be reprogrammable by the user. This may be achieved by use of embedded software in a non-reprogrammable memory [for example, micro-controller, application-specific integrated circuit (ASIC)].	Application software could not be re-programmable by the user.	P
	When the application requires reprogramming by the user, the access to the software dealing with safety functions should be restricted (for example, by locks or passwords for the authorized persons).	Passwords for the authorized persons have been used.	P
6.2.11.8	**Principles relating to manual control**		-
	These are as follows.		-
	a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8, item f).	Manual control devices have been designed and located according to the relevant ergonomic principles given in 6.2.8,	P
	b) A stop control device shall be placed near each start control device. Where the start/stop function is performed	A stop control device has been	P

Clause	Requirement-Test	Result-Remark	Verdict
	by means of a hold-to-run control, a separate stop control device shall be provided when a risk can result from the hold-to-run control device failing to deliver a stop command when released.	placed near each start control device.	
	c) Manual controls shall be located out of reach of the danger zones (see IEC 61310-3), except for certain controls where, of necessity, they are located within a danger zone, such as emergency stop or teach pendant.	Manual controls have been located out of reach of the danger zones.	P
	d) Whenever possible, control devices and control positions shall be located so that the operator is able to observe the working area or hazard zone.	The control devices and control positions have been located so that the operator is able to observe the working area or hazard zone.	P
	1) The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions. 2) On machinery intended for lifting persons, controls for lifting and lowering and, if appropriate, for moving the carrier shall generally be located in the carrier. If safe operation requires controls to be situated outside the carrier, the operator in the carrier shall be provided with the means of preventing hazardous movements.		N/A
	e) If it is possible to start the same hazardous element by means of several controls, the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means of, among others, a portable control unit (such as a teach pendant), with which the operator can enter danger zones.		N/A
	f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1, ISO 9355-3 and ISO 447).	Control actuators have been designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation.	P
	g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures	Pass Muster	P

Clause	Requirement-Test	Result-Remark	Verdict
	shall be implemented to ensure the presence of the operator at the control position (for example, by the design and location of control devices).		
	h) For cableless control, an automatic stop shall be performed when correct control signals are not received, including loss of communication (see IEC 60204-1).		N/A
6.2.11.9	**Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance**		-
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to be displaced or removed and/or a protective device has to be disabled, and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put into operation, the safety of the operator shall be achieved using a specific control mode which simultaneously		N/A
	a) disables all other control modes,		N/A
	b) permits operation of the hazardous elements only by continuous actuation of an enabling device, a two-hand control device or a hold-to-run control device,		N/A
	c) permits operation of the hazardous elements only in reduced risk conditions (for example, reduced speed, reduced power/force, step-by-step, for example, with a limited movement control device), and		N/A
	d) prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.		N/A
	This control mode shall be associated with one or more of the following measures:		-
	- restriction of access to the danger zone as far as possible;		N/A
	- emergency stop control within immediate reach of the operator;		N/A
	- portable control unit (teach pendant) and/or local controls (allowing sight of the controlled elements). See IEC 60204-1.		N/A
6.2.11.10	**Selection of control and operating modes**		-
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (for example, to allow for adjustment, setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position. Each position of the selector shall be clearly identifiable and shall exclusively		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	allow one control or operating mode.		
	The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (for example, access codes for certain numerically controlled functions).		N/A
6.2.11.11	**Applying measures to achieve electromagnetic compatibility (EMC)**		-
	For guidance on electromagnetic compatibility, see IEC 60204-1 and IEC 61000-6.		P
6.2.11.12	**Provision of diagnostic systems to aid fault-finding**		-
	Diagnostic systems to aid fault-finding should be included in the control system so that there is no need to disable any protective measure.	Diagnostic systems are provided	P
6.2.12	**Minimizing probability of failure of safety functions**		-
6.2.12.1	**General**		-
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine.		P
	The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by the measures given in 6.2.12.2 to 6.2.12.4.		P
6.2.12.2	**Use of reliable components**		-
	“Reliable components” means components which are capable of withstanding all disturbances and stresses associated with the usage of the equipment in the conditions of intended use (including the environmental conditions), for the period of time or the number of operations fixed for the use, with a low probability of failures generating a hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above (see also 6.2.13).	Reliable components have been used.	P
6.2.12.3	**Use of “oriented failure mode” components**		-
	“Oriented failure mode” components or systems are those in which the predominant failure mode is known in advance and which can be used so that the effect of such a failure on the machine function can be predicted.		N/A
	The use of such components should always be considered, particularly in cases where redundancy (see 6.2.12.4) is not employed.		N/A
6.2.12.4	**Duplication (or redundancy) of components or subsystems**		-

Clause	Requirement-Test	Result-Remark	Verdict
	In the design of safety-related parts of the machine, duplication (or redundancy) of components may be used so that, if one component fails, another component or components continue to perform the respective function(s), thereby ensuring that the safety function remains available.		N/A
	In order to allow the proper action to be initiated, component failure shall be detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection, provided that the inspection interval is shorter than the expected lifetime of the components.		N/A
	Diversity of design and/or technology can be used to avoid common cause failures (for example, from electromagnetic disturbance) or common mode failures.		N/A
6.2.13	**Limiting exposure to hazards through reliability of equipment**		-
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring intervention, thereby reducing exposure to hazards.		P
	This applies to power systems (operative part, see Annex A) as well as to control systems, and to safety functions as well as to other functions of machinery.	Pass Muster	P
	Safety-related components (for example, certain sensors) of known reliability shall be used.	Safety-critical components are used in this machine.	P
	The elements of guards and of protective devices shall be especially reliable, as their failure can expose persons to hazards, and also because poor reliability would encourage attempts to defeat them.	Pass Muster	P
6.2.14	**Limiting exposure to hazards through mechanization or automation of loading (feeding)/unloading (removal) operations**		-
	Mechanization and automation of machine loading/unloading operations and, more generally, of handling operations — of workpieces, materials or substances — limits the risk generated by these operations by reducing the exposure of persons to hazards at the operating points.	Pass Muster	P
	Automation can be achieved by, for example, robots, handling devices, transfer mechanisms and air-blast equipment. Mechanization can be achieved by, for example, feeding slides, push-rods and hand-operated indexing tables.		P

Clause	Requirement-Test	Result-Remark	Verdict
	While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being corrected. Care shall be taken to ensure that the use of these devices does not introduce further hazards, such as trapping or crushing, between the devices and parts of the machine or workpieces/materials being processed. Suitable safeguards (see 6.3) shall be provided if this cannot be ensured.	Appropriate provisions have been provided.	P
	Automatic feeding and removal devices with their own control systems and the control system of the associated machine shall be interconnected after thorough study of how all safety functions are performed in all the control and operation modes of the entire equipment.	This requirement has been complied with by design.	P
6.2.15	**Limiting exposure to hazards through location of setting and maintenance points outside danger zones**		-
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.	Pass Muster	P
6.3	**Safeguarding and complementary protective measures**		-
6.3.1	**General**		-
	Guards and protective devices shall be used to protect persons whenever an inherently safe design measure does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (for example, emergency stop equipment) may have to be implemented.	Pass Muster	P
	Certain safeguards may be used to avoid exposure to more than one hazard.		P
6.3.2	**Selection and implementation of guards and protective devices**		-
6.3.2.1	**General**		-
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against hazards generated by moving parts, according to the nature of those parts (see Figure 4) and to the need for access to the danger zone(s).	Pass Muster	P
	The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine.		P

Clause	Requirement-Test	Result-Remark	Verdict
	In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where the access of an operator into a danger zone is not required during the normal operation (operation without malfunction) of the machinery.		P
	As the need for frequency of access increases, this inevitably leads to the fixed guard not being replaced. This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment).	Movable interlocking guard is used.	P
	A combination of safeguards can sometimes be required. For example, where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device can be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard.		N/A
	Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards including	This requirement has been taken in to consideration.	P
	a) hazards from falling or ejected objects, using, for example, protection in the form of a falling object protection structure (FOPS),	No such hazards exist in this machine.	P
	b) emission hazards (protection against noise, vibration, radiation, substances hazardous to health, etc.),	No such hazards exist in this machine.	P
	c) hazards due to the environment (protection against heat, cold, foul weather, etc.),	No such hazards exist in this machine.	P
	d) hazards due to tipping over or rolling over of machinery, using, for example, protection in the form of roll-over or tip-over protection structures (ROPS and TOPS).	No such hazards exist in this machine.	P
	The design of enclosed work stations, such as cabs and cabins, shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.	Ergonomic principles have been taken into account during design.	P
6.3.2.2	**Where access to the hazard zone is not required during normal operation**		-
	Where access to the hazard zone is not required during normal operation of the machinery, safeguards should be selected from the following:		-

Clause	Requirement-Test	Result-Remark	Verdict
	a) fixed guards (see also ISO 14120);	Fixed guards are provided.	P
	b) interlocking guards with or without guard locking (see also 6.3.3.2.3, ISO 14119 and ISO 14120);	Interlocking guards are provided.	N/A
	c) self-closing guards (see ISO 14120:2002, 3.3.2);		N/A
	d) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496) or pressure-sensitive protective devices (see ISO 13856).		N/A
6.3.2.3	**Where access to the hazard zone is required during normal operation**		-
	Where access to the hazard zone is required during normal operation of the machinery, safeguards should be selected from the following:		-
	a) interlocking guards with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this document);		N/A
	b) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496);		N/A
	c) adjustable guards;		N/A
	d) self-closing guards (see ISO 14120:2002, 3.3.2);		N/A
	e) two-hand control devices (see ISO 13851);		N/A
	f) interlocking guards with a start function (control guard) (see 6.3.3.2.5).		N/A
6.3.2.4	**Where access to the hazard zone is required for machine setting, teaching, process changeover, fault-finding, cleaning or maintenance**		-
	As far as possible, machines shall be designed so that the safeguards provided for the protection of the production operator also ensure the protection of personnel carrying out setting, teaching, process changeover, fault-finding, cleaning or maintenance, without hindering them in the performance of their task. Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2).		N/A
6.3.2.5	**Selection and implementation of sensitive protective equipment**		-
6.3.2.5.1	**Selection**		-
	Due to the great diversity of the technologies on which their detection function is based, all types of sensitive protective equipment are far from being equally suitable for safety applications. The following provisions are		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	intended to provide the designer with criteria for selecting, for each application, the most suitable device(s).		
	Types of sensitive protective equipment include		-
	- light curtains, - scanning devices, for example, laser scanners, - pressure-sensitive mats, and - trip bars, trip wires.		N/A
	Sensitive protective equipment can be used		-
	- for tripping purposes, - for presence sensing, - for both tripping and presence sensing, or - to re-initiate machine operation — a practice subject to stringent conditions.		N/A
	The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment:		N/A
	- tendency for the machinery to eject materials or component parts; - necessity to guard against emissions (noise, radiation, dust, etc.); - erratic or excessive machine stopping time; - inability of a machine to stop part-way through a cycle.		N/A
6.3.2.5.2	**Implementation**		-
	Consideration should be given to		-
	a) the size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment),		N/A
	b) the reaction of the device to fault conditions (see IEC 61496 for electrosensitive protective equipment),		N/A
	c) the possibility of circumvention, and		-
	d) detection capability and its variation over the course of time (as a result, for example, of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources and sunlight or impurities in the air).		N/A
	Sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that		N/A
	- a command is given as soon as a person or part of a		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	person is detected,		
	- the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and therefore the command given by the sensitive protective equipment is maintained by the control system until a new command is given,		N/A
	- restarting the hazardous machine function(s) results from the voluntary actuation by the operator of a ontrol device placed outside the hazard zone, where this zone can be observed by the operator,		N/A
	- the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, and		N/A
	- the position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone without being detected.		N/A
	For detailed consideration of the fault behaviour of, for example, active optoelectronic protective devices, IEC 61496 should be taken into account.		N/A
6.3.2.5.3	**Additional requirements for sensitive protective equipment when used for cycle initiation**		-
	In this exceptional application, the starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control.		N/A
	Cycle initiation by sensitive protective equipment shall be subject to the following conditions:		N/A
	a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used;		N/A
	b) the requirements for an AOPD used as a tripping and presence-sensing device (see IEC 61496) are satisfied — in particular, location, minimum distance (see ISO 13855), detection capability, reliability and monitoring of control		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	and braking systems;		
	c) the cycle time of the machine is short and the facility to re-initiate the machine upon clearing of the sensing field is limited to a period commensurate with a single normal cycle;		N/A
	d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone;		N/A
	e) if there is more than one AOPD safeguarding the machine, only one of the AOPDs is capable of cycle re-initiation;		N/A
	f) with regard to the higher risk resulting from automatic cycle initiation, the AOPD and the associated control system comply with a higher safety-related performance than under normal conditions.		N/A
6.3.2.6	**Protective measures for stability**		-
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 6.2.6), it shall be maintained by the use of protective measures such as		-
	- anchorage bolts,		P
	- locking devices,		N/A
	- movement limiters or mechanical stops,		N/A
	- acceleration or deceleration limiters,		N/A
	- load limiters, and		N/A
	- alarms warning of the approach to stability or tipping limits.		N/A
6.3.2.7	**Other protective devices**		-
	When a machine requires continuous control by the operator (for example, mobile machines, cranes) and an error of the operator can generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits, in particular		N/A
	- when the operator has insufficient visibility of the hazard zone,		N/A
	- when the operator lacks knowledge of the actual value of a safety-related parameter (distance, speed, mass, angle, etc.), and		N/A

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

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

Clause	Requirement-Test	Result-Remark	Verdict
	Movable guards which provide protection against hazards generated by moving transmission parts shall		-
	a) as far as possible when open remain fixed to the machinery or other structure (generally by means of hinges or guides), and	Gemels are used for the movable guards.	P
	b) be interlocking (with guard locking when necessary) (see ISO 14119).	Interlock switches are used.	P
	See Figure 4.		-
	Movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that		P
	- moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up, with this able to be achieved by interlocking guards, with guard locking when necessary,	Interlocking guards are provided to comply with these requirements.	P
	- they can be adjusted only by an intentional action, such as the use of a tool or a key, and	This requirement is complied with.	P
	- the absence or failure of one of their components either prevents starting of the moving parts or stops them, with this able to be achieved by automatic monitoring (see 6.2.11.6).		P
	See Figure 4 and ISO 14119.		-
6.3.3.2.4	**Requirements for adjustable guards**		-
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed.		N/A
	Manually adjustable guards shall be		-
	- designed so that the adjustment remains fixed during a given operation, and		N/A
	- readily adjustable without the use of tools.		N/A
6.3.3.2.5	**Requirements for interlocking guards with a start function (control guards)**		-
	An interlocking guard with a start function may only be used provided that		N/A
	a) all requirements for interlocking guards are satisfied (see ISO 14119),		N/A
	b) the cycle time of the machine is short,		N/A
	c) the maximum opening time of the guard is preset to a low value (for example, equal to the cycle time) and, when this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	machine,		
	d) the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120),		N/A
	e) all other guards, whether fixed (removable type) or movable, are interlocking guards,		N/A
	f) the interlocking device associated with the interlocking guard with a start function is designed such that — for example, by duplication of position detectors and use of automatic monitoring (see 6.2.11.6) — its failure cannot lead to an unintended/unexpected start-up, and		N/A
	g) the guard is securely held open (for example, by a spring or counterweight) such that it cannot initiate a start while falling by its own weight.		N/A
6.3.3.2.6	**Hazards from guards**		-
	Care shall be taken to prevent hazards which could be generated by		
	- the guard construction (sharp edges or corners, material, noise emission, etc.),	No such hazards exist in this machine.	P
	- the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall).	No such hazards exist in this machine.	P
6.3.3.3	**Technical characteristics of protective devices**		-
	Protective devices shall be selected or designed and connected to the control system such that correct implementation of their safety function(s) is ensured.	This requirement has been taken into account during design.	P
	Protective devices shall be selected on the basis of their having met the appropriate product standard (for example, IEC 61496 for active optoelectronic protective devices) or shall be designed according to one or several of the principles formulated in ISO 13849-1 or IEC 62061.	This requirement has been taken into account during design.	P
	Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.		P
6.3.3.4	**Provisions for alternative types of safeguards**		-
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it is known that it will be necessary to change the safeguards because of the range of work to be carried out.		N/A
6.3.4	**Safeguarding to reduce emissions**		-
6.3.4.1	**General**		-

Clause	Requirement-Test	Result-Remark	Verdict
	If the measures for the reduction of emissions at source specified in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).	No such hazard exists.	P
6.3.4.2	**Noise**		-
	Additional protective measures against noise include		-
	- enclosures (see ISO 15667), - screens fitted to the machine, and - silencers (see ISO 14163).	No such hazard exists.	P
6.3.4.3	**Vibration**		-
	Additional protective measures against vibration include		-
	- vibration isolators, such as damping devices placed between the source and the exposed person, - resilient mounting, and - suspended seats.	No such hazard exists.	P
	For measures for vibration isolation of stationary industrial machinery see EN 1299.		P
6.3.4.4	**Hazardous substances**		
	Additional protective measures against hazardous substances include		-
	- encapsulation of the machine (enclosure with negative pressure),		N/A
	- local exhaust ventilation with filtration,		N/A
	- wetting with liquids, and		N/A
	- special ventilation in the area of the machine (air curtains, cabins for operators). See ISO 14123-1.		N/A
6.3.4.5	**Radiation**		-
	Additional protective measures against radiation include		-
	- use of filtering and absorption, and - use of attenuating screens or guards.		N/A
6.3.5	**Complementary protective measures**		-
6.3.5.1	**General**		-
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use, could have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine. Such measures include, but are not limited to, those dealt with in 6.3.5.2 to 6.3.5.6.	Pass Muster	P

Clause	Requirement-Test	Result-Remark	Verdict
6.3.5.2	**Components and elements to achieve emergency stop function**		-
	If, following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function for enabling actual or impending emergency situations to be averted, the following requirements apply:		
	- the actuators shall be clearly identifiable, clearly visible and readily accessible;	The actuators can be clearly identifiable, clearly visible and readily accessible	P
	- the hazardous process shall be stopped as quickly as possible without creating additional hazards, but if this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution;	The hazardous process can be stopped as quickly as possible without creating additional hazards	P
	- the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary.	Pass Muster	P
	Once active operation of the emergency stop device has ceased following an emergency stop command, the effect of this command shall be sustained until it is reset. This reset shall be possible only at the location where the emergency stop command has been initiated. The reset of the device shall not restart the machinery, but shall only permit restarting.	Reset is necessary before re-start.	P
	More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in IEC 60204.		P
6.3.5.3	**Measures for the escape and rescue of trapped persons**		-
	Measures for the escape and rescue of trapped persons may consist, among others, of		-
	- escape routes and shelters in installations generating operator-trapping hazards,		N/A
	- arrangements for moving some elements by hand, after an emergency stop,		N/A
	- arrangements for reversing the movement of some elements,		N/A
	- anchorage points for descender devices,		N/A
	- means of communication to enable trapped operators to call for help.		N/A

Clause	Requirement-Test	Result-Remark	Verdict
6.3.5.4	**Measures for isolation and energy dissipation**		-
	Machines shall be equipped with the technical means to achieve isolation from power supply(ies) and dissipation of stored energy by means of the following actions:		P
	a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;	A main switch with lock is provided.	P
	b) locking (or otherwise securing) all the isolating units in the isolating position;	Please see the report for EN 60204	P
	c) dissipating or, if this is not possible or practicable, restraining (containing) any stored energy which can give rise to a hazard;	Please see the report for EN 60204	P
	d) verifying, by means of safe working procedures, that the actions taken according to a), b) and c) above have produced the desired effect.	Please see the report for EN 60204	P
	See ISO 14118:2000, Clause 5, and IEC 60204-1:2005, 5.5 and 5.6.		P
6.3.5.5	**Provisions for easy and safe handling of machines and their heavy component parts**		-
	Machines and their component parts which cannot be moved or transported by hand shall be provided or be capable of being provided with suitable attachment devices for transport by means of lifting gear.	Appropriate attachments are provided.	P
	These attachments may be, among others,		-
	- standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing,	Such devices are used.	P
	- appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground,		N/A
	- fork locating devices for machines to be transported by a lift truck,	Such devices are used.	P
	- lifting and stowing gear and appliances integrated into the machine.		N/A
	Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement. See also 6.4.4 c), item 3).		P
6.3.5.6	**Measures for safe access to machinery**		-
	Machinery shall be so designed as to enable operation and all routine tasks relating to setting and/or maintenance to be carried out as far as possible by a person remaining at ground level.	These requirements have been taken into account during design.	P
	Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks; however, care should be taken to ensure	Not applicable	N/A

Clause	Requirement-Test	Result-Remark	Verdict
	that such platforms or stairs do not give access to danger zones of machinery.		
	The walking areas shall be made from materials which remain as slip resistant as practicable under working conditions and, depending on the height from the ground, shall be provided with suitable guard-rails (see ISO 14122-3).		N/A
	In large automated installations, particular attention shall be given to safe means of access, such as walkways, conveyor bridges or crossover points.		N/A
	Means of access to parts of machinery located at height shall be provided with collective means of protection against falls (for example, guard-rails for stairways, stepladders and platforms and/or safety cages for adders). As necessary, anchorage points for personal protective equipment against falls from height shall also be provided (for example, in carriers of machinery for lifting persons or with elevating control stations).		N/A
	Openings shall, whenever possible, open towards a safe position. They shall be designed to prevent hazards due to unintended opening.		N/A
	The necessary aids for access shall be provided (steps, hand holds, etc.). Control devices shall be designed and located to prevent their being used as aids for access.		N/A
	When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards for preventing falls when the platform is not present at a level. Movement of the lifting platform shall be prevented while the guards are open.		N/A
	For detailed provisions see ISO 14122.		N/A
6.4	**Information for use**		-
6.4.1	**General requirements**		-
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see Figure 2). Information for use consists of communication links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. Information for use is intended for professional and/or non-professional users.	Please see the related clause.	P
6.4.1.2	Information shall be provided to the user about the intended use of the machine, taking into account, notably, all its operating modes.	All the information is stated in the appropriate place.	P

Clause	Requirement-Test	Result-Remark	Verdict
	The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it shall inform and warn the user about residual risk.		P
	The information shall indicate, as appropriate,		-
	- the need for training, - the need for personal protective equipment, and - the possible need for additional guards or protective devices (see Figure 2, Footnote d).	All the information is stated in the appropriate place.	P
	It shall not exclude uses of the machine that can reasonably be expected from its designation and description and shall also warn about the risk which would result from using the machine in other ways than the ones described in the information, especially considering its reasonably foreseeable misuse.		
6.4.1.3	Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use of the machine (setting, teaching/programming or process changeover, operation, cleaning, fault-finding and maintenance) and, if necessary, dismantling, disabling and scrapping.		
6.4.2	**Location and nature of information for use**		-
	Depending on the risk, the time when the information is needed by the user and the machine design, it shall be decided whether the information — or parts thereof — are to be given	All the information is stated in the appropriate place.	P
	a) in/on the machine itself (see 6.4.3 and 6.4.4),	Adequate information is stated in the machine itself.	P
	b) in accompanying documents (in particular instruction handbook, see 6.4.5),	Adequate information is stated in the accompanying documents	P
	c) on the packaging,	Adequate information is stated on the packaging	P
	d) by other means such as signals and warnings outside the machine.	Adequate information is stated	P
	Standardized phrases shall be considered where important messages such as warnings are given (see also IEC 62079).	This requirement is considered.	P

Clause	Requirement-Test	Result-Remark	Verdict
6.4.3	**Signals and warning devices**		-
	Visual signals, such as flashing lights and audible signals such as sirens may be used to warn of an impending hazardous event such as machine start-up or overspeed. Such signals may also be used to warn the operator before the triggering of automatic protective measures (see 6.3.2.7).	Signals and warning devices are provided.	P
	It is essential that these signals		-
	a) be emitted before the occurrence of the hazardous event,		P
	b) be unambiguous,		
	c) be clearly perceived and differentiated from all other signals used, and		P
	d) be clearly recognized by the operator and other persons.		P
	The warning devices shall be designed and located such that checking is easy. The information for use shall prescribe regular checking of warning devices.	Pass Muster	P
	The attention of designers is drawn to the possibility of “sensorial saturation”, which can result from too many visual and/or acoustic signals and which can also lead to defeating the warning devices.		P
6.4.4	**Markings, signs (pictograms) and written warnings**		-
	Machinery shall bear all markings which are necessary		P
	a) for its unambiguous identification, including at least		P
	1) the name and address of the manufacturer, 2) the designation of series or type, and 3) the serial number, if any,	Adequate information is provided.	P
	b) in order to indicate its compliance with mandatory requirements, comprising		-
	1) marking, and 2) written indications, such as the authorized representative of the manufacturer, designation of the machinery, year of construction, and intended use in potentially explosive atmospheres),	Adequate information is provided.	P
	c) for its safe use, for example,		-
	1) maximum speed of rotating parts, 2) maximum diameter of tools, 3) mass (in kilograms) of the machine itself and/or of removable parts, 4) maximum working load,	Adequate information is provided.	P

Clause	Requirement-Test	Result-Remark	Verdict
	5) necessity of wearing personal protective equipment, 6) guard adjustment data, and 7) frequency of inspection.		
	Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine.	Pass Muster	P
	Signs or written warnings indicating only "Danger" shall not be used.		P
	Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine to which they are related. Readily understandable signs (pictograms) should be used in preference to written warnings.	All the markings are standard.	P
	Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be used.		P
	Written warnings shall be drawn up in the language(s) of the country in which the machine will be used for the first time and, on request, in the language(s) understood by operators.	Pass Muster	P
	Markings shall comply with recognized standards (for example, ISO 2972 or ISO 7000, for pictograms, symbols and colours in particular).	This requirement is complied with	P
	See IEC 60204-1 as regards marking of electrical equipment. See ISO 4413 and ISO 4414 for hydraulic and pneumatic equipment.		P
6.4.5	**Accompanying documents (in particular — instruction handbook)**		-
6.4.5.1	**Contents**		-
	The instruction handbook or other written instructions (for example, on the packaging) shall contain, among others, the following:		P
	a) information relating to transport, handling and storage of the machine, such as		P
	1) storage conditions for the machine, 2) dimensions, mass value(s), position of the centre(s) of gravity, and 3) indications for handling (for example, drawings indicating application points for lifting equipment);	All the related information is stated in the instruction handbook	P
	b) information relating to installation and commissioning of the machine, such as		P
	1) fixing/anchoring and dampening of noise and vibration requirements, 2) assembly and mounting conditions,	All the related information is stated in the	P

Clause	Requirement-Test	Result-Remark	Verdict
	3) space needed for use and maintenance, 4) permissible environmental conditions (for example, temperature, moisture, vibration, electromagnetic radiation), 5) instructions for connecting the machine to power supply (particularly on protection against electrical overloading), 6) advice on waste removal/disposal, and 7) if necessary, recommendations related to protective measures which have to be implemented by the user — for example, additional safeguards (see Figure 2, Footnote d), safety distances, safety signs and signals;	instruction handbook	
	c) information relating to the machine itself, such as		-
	1) detailed description of the machine, its fittings, guards and/or protective devices, 2) the comprehensive range of applications for which the machine is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate, 3) diagrams (especially schematic representation of safety functions), 4) data on noise and vibration generated by the machine, and on radiation, gases, vapours and dust emitted by it, with reference to the measuring methods (including measurement uncertainties) used, 5) technical documentation of electrical equipment (see IEC 60204), and 6) documents attesting that the machine complies with mandatory requirements;	All the related information is stated in the instruction handbook	P
	d) information relating to the use of the machine, such as that related to or describing		-

Clause	Requirement-Test	Result-Remark	Verdict
	1) intended use, 2) manual controls (actuators), 3) setting and adjustment, 4) modes and means for stopping (especially emergency stop), 5) risks which could not be eliminated by the protective measures implemented by the designer, 6) particular risks which can be generated by certain applications, by the use of certain fittings, and about specific safeguards necessary for such applications, 7) reasonably foreseeable misuse and prohibited applications, 8) fault identification and location, for repair and for restarting after an intervention, and 9) personal protective equipment needed to be used and the training that is required;	All the related information is stated in the instruction handbook	P
	e) information for maintenance, such as		-
	1) the nature and frequency of inspections for safety functions, 2) specification of the spare parts to be used when these can affect the health and safety of operators, 3) instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence need to be carried out exclusively by skilled persons (for example, maintenance staff, specialists), 4) instructions relating to maintenance actions (replacement of parts, etc.) which do not require specific skills and hence may be carried out by users (for example, operators), and 5) drawings and diagrams enabling maintenance personnel to carry out their task rationally (especially fault-finding tasks);	All the related information is stated in the instruction handbook	P
	f) information relating to dismantling, disabling and scrapping;		
	g) information for emergency situations, such as		-
	1) the operating method to be followed in the event of accident or breakdown, 2) the type of fire-fighting equipment to be used, and 3) a warning of possible emission or leakage of hazardous substance(s) and, if possible, an indication of means for fighting their effects;	All the related information is stated in the instruction handbook	P
	h) maintenance instructions provided for skilled persons [item e) 3) above] and maintenance instructions provided for unskilled persons [item e) 4) above], that need to		P

Clause	Requirement-Test	Result-Remark	Verdict
	appear clearly separated from each other.		
6.4.5.2	**Production of instruction handbook**		-
	The following applies to the production and presentation of the instruction handbook.		P
	a) The type fount and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized by the use of colours, symbols and/or large print.		P
	b) The information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language is to be used, each should be readily distinguished from another, and efforts should be made to keep the translated text and relevant illustration together.	All the related information is stated in the instruction handbook	P
	c) Whenever helpful to the understanding, text should be supported by illustrations. These illustrations should be supplemented with written details enabling, for example, manual controls (actuators) to be located and identified. They should not be separated from the accompanying text and should follow sequential operations.	All the related information is stated in the instruction handbook	P
	d) Consideration should be given to presenting information in tabular form where this will aid understanding. Tables should be adjacent to the relevant text.		P
	e) The use of colours should be considered, particularly in relation to components requiring quick identification.		P
	f) When information for use is lengthy, a table of contents and/or an index should be provided.		P
	g) Safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.		P
6.4.5.3	**Drafting and editing information for use**		-
	The following applies to the drafting and editing of information for use.		-
	a) Relationship to model: the information shall clearly relate to the specific model of machine and, if necessary, other appropriate identification (for example, by serial number).	P	P
	b) Communication principles: when information for use is being prepared, the communication process “see – think – use” should be followed in order to achieve the maximum effect and should follow sequential operations. The questions, “How?” and “Why?” should be anticipated and the answers provided.	All the related information is stated in the instruction handbook	P
	c) Information for use shall be as simple and as brief as	All the related	P

Clause	Requirement-Test	Result-Remark	Verdict
	possible, and should be expressed in consistent terms and units with a clear explanation of unusual technical terms.	information is stated in the instruction handbook	
	d) When it is foreseen that a machine will be put to non-professional use, the instructions should be written in a form that is readily understood by the non-professional user. If personal protective equipment is required for the safe use of the machine, clear advice should be given, for example, on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale.	All the related information is stated in the instruction handbook	P
	e) Durability and availability of the documents: documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It can be useful to mark them "keep for future reference". Where information for use is kept in electronic form (CD, DVD, tape, hard disk, etc.), information on safety-related issues that need immediate action shall always be backed up with a hard copy that is readily available.	All the related information is stated in the instruction handbook	P
7	**Documentation of risk assessment and risk reduction**		-
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of		P
	a) the machinery for which the risk assessment has been made (for example, specifications, limits, intended use);		P
	b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.);		P
	c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment;		P
	d) the information on which risk assessment was based (see 5.2): 1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.); 2) the uncertainty associated with the data used and its impact on the risk assessment;		P
	e) the risk reduction objectives to be achieved by protective measures;		P
	f) the protective measures implemented to eliminate identified hazards or to reduce risk;		P

Clause	Requirement-Test	Result-Remark	Verdict
	g) residual risks associated with the machinery;		P
	h) the result of the risk assessment (see Figure 1);		P
	i) any forms completed during the risk assessment.		P
	Standards or other specifications used to select protective measures referred to in f) above should be referenced.		P

Clause	Requirement - test	Result-Remark	Verdict
6	**Protection against electric shock**		**-**
6.1	**General**		**-**
	The electrical equipment shall provide protection of persons against electric shock from:		**-**
	– direct contact (see 6.2 and 6.4);		**N/A**
	– indirect contact (see 6.3 and 6.4).		**P**
	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.	Protection measures given in 6.2,6.3 and 6.4	**P**
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.	Protection measures given in 6.2.2 and 6.2.3	**P**
	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).		**P**
	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.		**P**
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).		**P**
	Where the top surfaces of the enclosure are readily accessible, the minimum degree of protection against direct contact provided by the top surfaces shall be IP4X or IPXXD.		**-**
	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.		**P**

Clause	Requirement - test	Result-Remark	Verdict
	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.	Comply with the requirement	**P**
b)	The disconnection of live parts inside the enclosure before the 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.		**N/A**
	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**

Clause	Requirement - test	Result-Remark	Verdict
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 automatically disconnected when the barrier is removed.		**N/A**
6.2.3	**Protection by insulation of live parts**		**-**
	Live parts protected by insulation shall be completely covered with insulation that can only be removed by destruction. Such insulation shall be capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which it can be subjected under normal operating conditions.	Not applicable	**N/A**
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.	No residual voltage	**N/A**
	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		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	apply. For protection by obstacles, 412.3 of IEC 60364-4-41 shall apply.		-
	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**		-
	Protection against indirect contact (3.29) is intended to prevent hazardous situations due to an insulation fault between live parts and exposed conductive parts.		P
	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		N/A
	– automatic disconnection of the supply before the time of contact with a touch voltage can become hazardous (6.3.3).	Automatic disconnection of the supply	P
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;		P
	– 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.		P
	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);		P
	– switchgear and controlgear assemblies having total insulation in accordance with IEC 60439-1;		P
	– 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

Clause	Requirement - test	Result-Remark	Verdict
6.3.3	**Protection by automatic disconnection of supply**		-
	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.		P
	This measure necessitates co-ordination between:		-
	– the type of supply and earthing system;		P
	– the impedance values of the different elements of the protective bonding system;		P
	– the characteristics of the protective devices that detect insulation fault(s).		P
	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.		P
	This protective measure comprises both:		-
	– protective bonding of exposed conductive parts (see 8.2.3),		P
	– and either:		-
	a) overcurrent protective devices for the automatic disconnection of the supply on detection of an insulation fault in TN systems, or		P
	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.	Pass muster	P
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 contact (see 8.2.5).		N/A

Clause	Requirement - test	Result-Remark	Verdict
	PELV circuits shall satisfy all of the following conditions:		-
a)	the nominal voltage shall not exceed:		-
	25 V a.c. r.m.s. or 60 V ripple-free d.c. when the equipment is normally used in dry locations and when large area contact of live parts with the human body is not expected; or		N/A
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;		N/A
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);		N/A
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;		N/A
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;		N/A
	2) socket-outlets shall not admit plugs of other voltage systems.		N/A
6.4.2	**Sources for PELV**		-
	The source for PELV shall be one of the following:		-
	– a safety isolating transformer in accordance with IEC 61558-1 and IEC 61558-2-6;		N/A
	– 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		-
	– overcurrent arising from a short circuit;		P

Clause	Requirement - test	Result-Remark	Verdict
	– overload and/or loss of cooling of motors;		N/A
	– abnormal temperature;		N/A
	– loss of or reduction in the supply voltage;		P
	– overspeed of machines/machine elements;		N/A
	– earth fault/residual current;		P
	– 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.	Overcurrent protective device is provided	P
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).		P
	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).	There are relative statements	P
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.		P
	The following conductors, as applicable, shall not be disconnected without disconnecting all associated live conductors:		-
	– the neutral conductor of a.c. power circuits;		N/A
	– the earthed conductor of d.c. power circuits;		N/A
	– 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.		N/A

Clause	Requirement - test	Result-Remark	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.	Overcurrent protective device is provided	P
	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):		P
	– in control circuits connected to the protective bonding circuit, by inserting an overcurrent protective device into the switched conductor;		P
	– in control circuits not connected to the protective bonding circuit;		N/A
	- where the same cross sectional area conductors are used in all control circuits, by inserting an overcurrent protective device into the switched conductor, and;		P
	- 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.	Comply with the requirement	P
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.		N/A
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;		P
	– 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.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	The type and setting of the overcurrent protective device should be in accordance with the recommendations of the transformer supplier.	Control circuits, power supply overall protection	P
7.2.8	**Location of overcurrent protective devices**		-
	An overcurrent protective device shall be located at the point where a reduction in the crosssectional area of the conductors or another change reduces the current-carrying capacity of the conductors, except where all the following conditions are satisfied:	Comply with the requirement	P
	– the current carrying capacity of the conductors is at least equal to that of the load;		P
	– 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;		P
	– 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.		P
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.	Installation location of overcurrent protective device meets the requirement.	P
	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 ($I2t$) 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).	The breaking capacity meets the requirement.	P
	Where fuses are provided as overcurrent protective devices, a type readily available in the country of use shall be selected, or arrangements shall be made for the supply of spare parts.		P
7.2.10	**Rating and setting of overcurrent protective devices**		-
	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 switching device contacts).	Rating and setting of overcurrent protective devices meet the requirement.	P

Clause	Requirement - test	Result-Remark	Verdict
	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.		P
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.		P
	Exceptions: In applications where an automatic interruption of the motor operation is unacceptable (for example fire pumps), the means of detection shall give a warning signal to which the operator can respond.		P
	Protection of motors against overheating can be achieved by:		-
	– overload protection (7.3.2),		P
	– over-temperature protection (7.3.3), or		P
	– current-limiting protection (7.3.4).		P
	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.		P
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.	Compressor motors internally installed over-load protector	P
	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.		P
	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 special duty motors or over-temperature protection (see 7.3.3) can be necessary.		P

Clause	Requirement - test	Result-Remark	Verdict
	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.		P
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.	Compressor motors internally installed over- temperature protector	P
	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).		P
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.		N/A
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.	No corresponding circuit	N/A
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.		P
	Where the operation of the machine can allow for an interruption or a reduction of the voltage for a short time period, delayed undervoltage protection may be provided. The operation of the undervoltage device shall not impair the operation of any stopping control of the machine.		P

Clause	Requirement - test	Result-Remark	Verdict
	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.	Automatic or unexpected restarting of the machine can be prevented	P
	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.		P
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.		N/A
	The overspeed protection should operate in such a manner that the mechanical speed limit of the motor or its load is not exceeded.		N/A
7.7	**Earth fault/residual current protection**		-
	In addition to providing 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.		N/A
	The setting of the devices shall be as low as possible consistent with correct operation of the equipment.		N/A
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.		-
8	**Equipotential bonding**		-
8.1	General		-

Clause	Requirement - test	Result-Remark	Verdict
	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 muster	P
	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;	Pass muster	P
	– 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).	Comply with the Figure 2	P
8.2	**Protective bonding circuit**		-
8.2.1	General		-
	The protective bonding circuit consists of:		-
	– PE terminal(s) (see 5.2);		P
	– the protective conductors in the equipment of the machine including sliding contacts where they are part of the circuit;	Pass muster	P
	– the exposed conductive parts and conductive structural parts of the electrical equipment;		N/A
	– those extraneous conductive parts which form the structure of the machine.		N/A
	All parts of the protective bonding circuit shall be so designed that they are capable of withstanding the highest thermal and mechanical stresses that can be caused by earth-fault currents that could flow in that part of the protective bonding circuit.	Pass muster	P
	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 muster	P
	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).	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	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 muster	**P**
	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.		**P**
	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 mm2 in cross-sectional area.		**N/A**
	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.		**P**
	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 crosssectional area of the associated protective conductor is in accordance with Table 1 (see 5.2).	In accordance with Table 1	**P**
	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 muster	**P**
	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 muster	**P**
	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.	Comply with the requirement	**P**
	Metal ducts of flexible or rigid construction and metallic cable sheaths 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.		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	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).	Comply with the requirement	**P**
	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.		**N/A**
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).		**N/A**
	No means of interruption of the protective bonding conductor shall be provided.		**N/A**
	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		**N/A**
	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		**-**
	– 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) (sees also 410.3.3.5 of IEC 60364-4-41).		**N/A**
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.	Comply with the requirement	**P**

Clause	Requirement - test	Result-Remark	Verdict
	Each protective conductor connecting point shall be marked or labeled as such using the symbol IEC 60417-5019 (DB:2002-10):		**N/A**
	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 muster	**P**
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. automatic disconnection of the supply in case of loss of continuity of the protective conductor		**N/A**
c)	To prevent difficulties associated with electromagnetic disturbances, the requirements of 4.4.2 also apply to the installation of duplicate protective conductors.		**N/A**
	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**

Clause	Requirement - test	Result-Remark	Verdict
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.		N/A
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.	Control transformers supplying the control circuits	P
	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.		N/A
	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).		P
9.1.2	**Control circuit voltages**		-
	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.	220V	P
9.1.3	**Protection**		-
	Control circuits shall be provided with overcurrent protection in accordance with 7.2.4 and 7.2.10.	Overcurrent protection is provided	P
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.		-
	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.		-
9.2.1	**Start functions**		-
	Start functions shall operate by energizing the relevant circuit (see 9.2.5.2).	Pass muster	P
9.2.2	**Stop functions**		-

Clause	Requirement - test	Result-Remark	Verdict
	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);		N/A
	– 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;	Stop category 1	P
	– stop category 2: a controlled stop with power left available to the machine actuators.		N/A
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).		N/A
	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**		-
	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.	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
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.	protective measures are provided	P
	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 muster	P
	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.		N/A
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 muster	P
	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
	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:		N/A
	– 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		N/A
9.2.5.3	S(top)		-
	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).	Stop category 1	P
	Stop functions shall override related start functions (see 9.2.5.2).		P
	Where required, facilities to connect protective devices and interlocks shall be provided. 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.	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	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.		-
	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.	Comply with the requirement	P
	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 muster	P
	NOTE: Emergency stop and emergency switching off are complementary protective measures that are not primary means of risk reduction for hazards (for example trapping, entanglement, electric shock or burn) at a machine (see ISO 12100 (all parts)).		P
9.2.5.4.2	Emergency stop		-
	Principles for the design of emergency stop equipment, including functional aspects, are given in ISO 13850.		-
	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 muster	P
	In addition to the requirements for stop (see 9.2.5.3), the emergency stop function has the following requirements:		-
	– it shall override all other functions and operations in all modes;		P
	– power to the machine actuators that can cause a hazardous 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;	Stop category 1	P
	– reset shall not initiate a restart.		P
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		N/A

Clause	Requirement - test	Result-Remark	Verdict
	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 detection or anti-collision devices.		N/A
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;		-
	– 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

Clause	Requirement - test	Result-Remark	Verdict
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 Licensed Copy: Wang Bin, na, Fri Aug 25 01:48:36 BST 2006, Uncontrolled Copy, (c) BSI		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**		-
	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

Clause	Requirement - test	Result-Remark	Verdict
	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 (see10.7).		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
	– 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

Clause	Requirement - test	Result-Remark	Verdict
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.	Pass muster	P
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).	Pass muster	P
	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.	Pass muster	P
9.3.4	**Interlocks between different operations and for contrary motions**		-
	All contactors, relays, and other control devices that control elements of the machine and that can cause a hazardous situation when actuated at the same time (for example those which initiate contrary motion), shall be interlocked against incorrect operation.		-
	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		N/A

Clause	Requirement - test	Result-Remark	Verdict
	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).	Comply with the requirement	P
	The electrical control circuits shall have an appropriate level of safety performance that has been determined from the risk assessment at the machine. The requirements of IEC 62061 and/or ISO 13849-1:1999, ISO 13849-2:2003 shall apply.	Pass muster	P
	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;		P
	– use of proven circuit techniques and components (see 9.4.2.1);		N/A
	– provision of partial or complete redundancy (see 9.4.2.2) or diversity		N/A
	– provision for functional tests (see 9.4.2.4).		P
	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.	Pass muster	P
	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);		P
	– connection of control devices in accordance with 9.4.3.1;		P

Clause	Requirement - test	Result-Remark	Verdict
	– stopping by de-energizing (see 9.2.2);		P
	– the switching of all control circuit conductors to the device being controlled (see 9.4.3.1);		N/A
	– 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 muster	P
	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**		-
	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;		-
	– 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).	Pass muster	P
9.4.3	**Protection against maloperation due to earth faults, voltage interruptions and loss of circuit continuity**		-
9.4.3.1	**Earth faults**		-
	Earth faults on any control circuit shall not cause unintentional starting,	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	potentially hazardous motions, or prevent stopping of the machine.		
	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).		N/A
	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 that an earth fault is unlikely (for example overload relays).		N/A
	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.	Pass muster	P
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		-

Clause	Requirement - test	Result-Remark	Verdict
	interrupts the circuit automatically in the event of an earth fault.		
9.4.3.2	**Voltage interruptions**		-
	The requirements detailed in 7.5 shall apply.		-
	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).	Pass muster	P
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.		-
	As far as is practicable, those devices shall be selected, mounted, and identified or coded in accordance with relevant parts of IEC 61310.	Pass muster	P
	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.	Comply with the requirement	P
10.2	**Location and mounting**		-
	As far as is practicable, machine-mounted control devices shall be:		-
	– readily accessible for service and maintenance;	Pass muster	P
	– mounted in such a manner as to minimize the possibility of damage from activities such as material handling.	Pass muster	P
	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 muster	P
	– the operator is not placed in a hazardous situation when operating them.	Pass muster	P
	The actuators of foot-operated control devices shall be selected and		N/A

Clause	Requirement - test	Result-Remark	Verdict
	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.		-
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;		N/A
	– the ingress of contaminants (for example swarf, dust, particulate matter).	Pass muster	P
	In addition, the operator interface control devices shall have a minimum degree of protection against direct contact of IPXXD (see IEC 60529).	Pass muster	P
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 have direct openingaction (see IEC 60947-5-1) or shall provide similar reliability (see 9.4.2).		N/A
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).		P
	The colours for START/ON actuators should be WHITE, GREY, BLACK or GREEN with a preference for WHITE. RED shall not be used.	Pass muster	P
	The colour RED shall be used for emergency stop and emergency switching off actuators.		P
	The colours for STOP/OFF actuators should be BLACK, GREY, or	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	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.		
	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).	Pass muster	**P**
	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.	Pass muster	**P**
	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.	Pass muster	**P**
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.	Comply with the requirement	**P**
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.	Comply with the requirement	**P**
	– confirmation: to confirm a command, or a condition, or to confirm the termination of a change or transition period. The colours BLUE and WHITE are normally used in this mode and GREEN may be used in some cases.		**N/A**
	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	Pass muster	**P**

Clause	Requirement - test	Result-Remark	Verdict
	also IEC 61310-1).		
	Indicator light circuits used for warning lights shall be fitted with facilities to check the operability of these lights.	Pass muster	**P**
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.	In accordance with Table 4	**P**
	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;		**P**
	– to request immediate action;		**P**
	– to indicate a discrepancy between the command and actual state;		**P**
	– to indicate a change in process (flashing during transition).		**N/A**
	It is recommended that higher frequency flashing lights or display be used for higher priority information (see IEC 60073 for recommended flashing rates and pulse/pause ratios).		**N/A**
	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,	Pass muster	**P**

Clause	Requirement - test	Result-Remark	Verdict
	mushroom-type actuators may be used for two-hand control (see also ISO 13851).		
10.7	**Emergency stop devices**		-
10.7.1	**Location of emergency stop devices**		-
	Devices for emergency stop shall be readily accessible.		P
	Emergency stop devices shall be located at each operator control station and at other locations where the initiation of an emergency stop can be required (**exception**: see 9.2.7.3).	Emergency stop devices are located at suitable locations	P
	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**		-
	The types of device for emergency stop include:		-
	– a push-button operated switch with a palm or mushroom head type;		P
	– 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).	Pass muster	P
10.7.3	**Colour of actuators**		-
	Actuators of emergency stop devices shall be coloured RED. If a background exists immediately around the actuator, then this background shall be coloured YELLOW. See also ISO 13850.	Pass muster	P
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		N/A

Clause	Requirement - test	Result-Remark	Verdict
	switching off device, means shall be provided to avoid confusion between these devices.		
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**		-
	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

Clause	Requirement - test	Result-Remark	Verdict
	- 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;		P
	– its protection against the external influences or conditions under which it is intended to operate;		P
	– operation and maintenance of the machine and its associated equipment.		P
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.	Comply with the requirement	P
	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 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.	Comply with the requirement	P
	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).	Comply with the requirement	P
	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	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	shall be located and mounted so as to provide unobstructed access.		
	Plug/socket combinations that are handled during normal operation shall be located and mounted so as to provide unobstructed access.	Pass muster	**P**
	Test points for connection of test equipment, where provided, shall be:		**-**
	– mounted so as to provide unobstructed access;		**P**
	– clearly identified to correspond with the documentation (see 17.3);		**P**
	– adequately insulated;		**P**
	– sufficiently spaced.		**P**
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 sizes, by use of barriers or by colours).		**N/A**
	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.		**N/A**
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		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	sufficient against dust, coolants, and swarf.		
	Enclosures of controlgear shall provide a degree of protection of at least IP22 (see IEC 60529).		**N/A**
	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.	Comply with the requirement	**P**
	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).	Toughened glass of not less than 3 mm thickness	**P**
	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°.	0,75m and 105°	**P**
	The joints or gaskets of doors, lids, covers and enclosures shall withstand the chemical effects of the aggressive liquids, vapours, or gases used on the machine. The means 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;		**P**
	– not deteriorate due to removal or replacement of the door or the cover, and so impair the degree of protection.		**P**
	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.	Comply with the requirement	**P**
	There shall be no opening between enclosures containing electrical	Pass muster	**P**

Clause	Requirement - test	Result-Remark	Verdict
	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.		
	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;		**P**
	– 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 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.		**N/A**
	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	Comply with the requirement	**P**

Clause	Requirement - test	Result-Remark	Verdict
	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.		
	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 muster	**P**
12.2	**Conductors**		**-**
	In general, conductors shall be of copper. Where aluminium conductors are used, the crosssectional area shall be at least 16 mm^2.	20 mm^2	**P**
	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.	Comply with the requirement	**P**
	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);		**P**
	– 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.	Comply with the requirement	**P**
	The insulation of cables and conductors used, shall be suitable for a test voltage:		

Clause	Requirement - test	Result-Remark	Verdict
	– 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 muster	**P**
	– 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 muster	**P**
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 muster	**P**
	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 muster	**P**
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.	Comply with the requirement	**P**
12.6	**Flexible cables**		**-**
12.6.1	**General**		**-**
	Flexible cables shall have Class 5 or Class 6 conductors.		**N/A**
	Cables that are subjected to severe duties shall be of adequate construction to protect against:		**N/A**
	– abrasion due to mechanical handling and dragging across rough surfaces;		**N/A**
	– kinking due to operation without guides;		**N/A**
	– stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums.		**N/A**
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.		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	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 muster	**P**
	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).	IP44	**P**
	Where the required degree of protection is not achieved, protection by placing live parts out of reach in combination with emergency switching off in accordance with 9.2.5.4.3 shall be applied.		**N/A**
	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;	Pass muster	**P**
	– prevent damage from a swinging load.		**P**
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)	Comply with the requirement	**P**

Clause	Requirement - test	Result-Remark	Verdict
	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).		
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.	Pass muster	P
12.7.4	**Removable current collectors with a disconnector function**		-
	Removable current collectors having a disconnector 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.		N/A
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.		N/A
	In abnormally dusty, moist or corrosive environments, the following creepage distance requirements apply:		N/A
	– 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

Clause	Requirement - test	Result-Remark	Verdict
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 muster	P
	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 muster	P
	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.	Comply with the requirement	P
	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).	Pass muster	P
	Underground and underfloor conductor bar ducts shall have drainage facilities.		N/A
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 muster	P
	The means of connection shall be suitable for the cross-sectional areas and nature of the conductors being terminated.	Pass muster	P
	The connection of two or more conductors to one terminal is permitted only in those cases where the terminal is designed for that purpose. However, only one protective conductor shall be connected to one terminal connecting point.	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	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.	Terminals is plainly marked	**P**
	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.	The conductors and terminations are identified in accordance with 13.2.1.	**P**
	The installation of flexible conduits and cables shall be such that liquids shall drain away from the fittings.	Pass muster	**P**
	Means of retaining conductor strands shall be provided when terminating conductors at devices or terminals that are not equipped with this facility. Solder shall not be used for that purpose.		**N/A**
	Shielded conductors shall be so terminated as to prevent fraying of strands and to permit easy disconnection.		**N/A**
	Identification tags shall be legible, permanent, and appropriate for the physical environment.	Pass muster	**P**
	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 muster	**P**
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.	Comply with the requirement	**P**
	Exception: Where it is impracticable to provide terminals in a junction 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.		**N/A**
	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.	The protective conductor is placed suitably	**P**

Clause	Requirement - test	Result-Remark	Verdict
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;		**P**
	– adequately protected against mechanical damage.		**P**
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).	Conductor is identifiable	**P**
	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).	Comply with the requirements	**P**
13.2.2	**Identification of the protective conductor**		**-**
	The protective conductor shall be readily distinguishable by shape , location, marking, or colour. When identification is by colour alone, the bicolour combination GREEN-ANDYELLOW shall be used throughout the length of the conductor. This colour identification is strictly reserved for the protective conductor.	Comply with the requirement	**P**
	For insulated conductors, the bicolour combination GREEN-AND- YELLOW shall be such that on any 15 mm length, one of the colours covers at least 30 % and not more than 70 % of the surface of the conductor, the other colour covering the remainder of the surface .		**N/A**
	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		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	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.		
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.		**N/A**
	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 muster	**P**
	BLACK, BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (including LIGHT BLUE), VIOLET, GREY, WHITE, PINK, TURQUOISE.	Pass muster	**P**
	For safety reasons, the colour GREEN or the colour YELLOW should not be used where there is a possibility of confusion with the bicolour combination GREEN-AND-YELLOW (see 13.2.2).	Pass muster	**P**
	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.	Comply with the requirement	**P**
	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;		**N/A**
	– RED: a.c. control circuits;		**P**
	– BLUE: d.c. control circuits;		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	– 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).	Comply with the requirement	**P**
	It is recommended that electrical equipment mounted inside enclosures be designed and constructed in such a way as to permit modification of the wiring from the front of the enclosure (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.	Comply with the requirement	**P**
	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).	Comply with the clauses 8.2.3 and 11.2.1	**P**
	Conductors and cables that do not run in ducts shall be adequately supported.	Conductors and cables are adequately supported	**P**
	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.		**N/A**
	Power cables and cables of measuring circuits may be directly connected to the terminals of the devices for which the connections were intended.		**N/A**
13.4	**Wiring outside enclosures**		**-**
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).	Pass muster	**P**
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	Comply with the requirement	**P**

Clause	Requirement - test	Result-Remark	Verdict
	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.		
	Fittings used with ducts or multiconductor cable shall be suitable for the physical environment.	Fittings are suitable	**P**
	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**
	– 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.		**N/A**
	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,		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	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.		
	The cable handling system shall be so designed that lateral cable angles do not exceed 5°, avoiding torsion in the cable when:		**N/A**
	– 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 relevant diagrams.		**N/A**
13.4.5	**Plug/socket combinations**		**-**
	Where plug/socket combinations are provided, they shall fulfil one or more of the following requirements as applicable:	Pass muster	**P**
	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	Pass muster	**P**

Clause	Requirement - test	Result-Remark	Verdict
	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.		
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.		**N/A**
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 marked that they are not intended to be disconnected under load		**N/A**
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		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	combinations in accordance with IEC 60309-1, only those contacts shall be used for control circuits which are intended for those purposes.		
	Exception: The requirements of item k) do not apply to control functions using high frequency signals on the power supply.		**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.	Comply with the requirements	**P**
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.		**P**
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).		**P**
	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.	Puss muster	**P**
	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 that the conduits be either physically separated or suitably identified.	Comply with the requirements	**P**
	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 Page 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		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	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.		
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.	Comply with the requirements	**P**
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 have physical characteristics similar to those of the sheath of multiconductor cables.	Puss muster	**P**
	The conduit shall be suitable for use in the expected physical environment.	Puss muster	**P**
	Fittings shall be compatible with the conduit and appropriate for the application.	Puss muster	**P**
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**

Clause	Requirement - test	Result-Remark	Verdict
	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).	The boxes provide protection against the ingress of solid bodies and liquids	P
	Those boxes shall not have opened but unused knockouts nor any other openings and shall be so constructed as to exclude materials such as dust, flyings, oil, and coolant.	Puss muster	P
13.5.9	**Motor connection boxes**		-
	Motor connection boxes shall enclose only connections to the motor and motor-mounted devices (for example brakes, temperature sensors, plugging switches, tachometer generators).		N/A
14	**Electric motors and associated equipment**		-
14.1	**General requirements**		-
	Electric motors should conform to the relevant parts of IEC 60034 series.		N/A
	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.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	As many controllers do not switch off the supply to a motor when it is at rest, care shall betaken 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.		N/A
	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.		N/A
14.3	**Motor dimensions**		-
	As far as is practicable, the dimensions of motors shall conform to those given in the IEC 60072 series.		N/A
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.		N/A
	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).		N/A
	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
	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		-

Clause	Requirement - test	Result-Remark	Verdict
	environmental conditions (see 4.4). In this respect, the points that shall be considered include:		
	type of motor;		N/A
	type of duty cycle (see IEC 60034-1);		N/A
	fixed speed or variable speed operation, (and the consequent variable influence of the ventilation);		-
	mechanical vibration;		N/A
	type of motor control;		N/A
	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;		N/A
	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;		N/A
	variation of counter-torque load with time and speed;		N/A
	influence of loads with large inertia;		N/A
	influence of constant torque or constant power operation;		N/A
	possible need of inductive reactors between motor and converter.		N/A
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 example hand-held power tools, test equipment), the following apply:		N/A
	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;		N/A
	the continuity of the protective bonding circuit to the socket-outlet shall be ensured except where protection is provided by PELV;		N/A
	all unearthed conductors connected to the socket-outlet shall be protected against overcurrent and, when required, against overload in		N/A

Clause	Requirement - test	Result-Remark	Verdict
	accordance with 7.2 and 7.3 separately from the protection of other circuits;		
	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.		N/A
	NOTE 2 Circuits for socket-outlets can be provided with residual current protective devices (RCDs).		N/A
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.		N/A
	The ON/OFF switch shall not be incorporated in the lampholder or in the flexible connecting cords.		N/A
	Stroboscopic effects from lights shall be avoided by the selection of appropriate luminaires.		N/A
	Where fixed lighting is provided in an enclosure, electromagnetic compatibility should be taken into account using the principles outlined in 4.4.2.		N/A
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.		N/A
	Lighting circuits shall be supplied from one of the following sources (see also 7.2.6):		N/A
	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 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);		N/A
	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		N/A

Clause	Requirement - test	Result-Remark	Verdict
	(see also 13.1.3);		
	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.		**N/A**
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 muster	**P**
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 muster	**P**
	The warning sign shall be plainly visible on the enclosure door or cover.	Pass muster	**P**
	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		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	equipment, the graphical symbol IEC 60417-5041 (DB:2002-10) shall be used.		
	NOTE For electrical installations, this measure is dealt with in IEC 60364-4-42, Clause 423 and Table 42A.		-
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.	Comply with the requirements	P
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:	Comply with the requirements	P
	name or trade mark of supplier;		P
	certification mark, when required;		N/A
	serial number, where applicable;		P
	rated voltage, number of phases and frequency (if a.c.), and full-load current for each supply;		P
	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 muster	P
	Where only a single motor controller is used, that information may instead be provided on the machine nameplate where it is plainly visible.	Pass muster	P
16.5	**Reference designations**		-
	All enclosures, assemblies, control devices, and components shall be plainly identified with the same reference designation as shown in the technical documentation.	Pass muster	P
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	Information supplied in the appropriate forms	P

Clause	Requirement - test	Result-Remark	Verdict
	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.		
	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);		P
b)	Complementary documents including:		-
1)	a clear, comprehensive description of the equipment, installation and mounting, and the connection to the electrical supply(ies);		P
2)	electrical supply(ies) requirements;		P
3)	information on the physical environment (for example lighting, vibration, atmospheric contaminants) where appropriate;		N/A
4)	overview (block) diagram(s) where appropriate;		P
5)	circuit diagram(s);		P
6)	information (as applicable) on:		-
	programming, as necessary for use of the equipment;		N/A
	sequence of operation(s);		P
	frequency of inspection;		P
	frequency and method of functional testing;		N/A
	guidance on the adjustment, maintenance, and repair, particularly of the protective devices and circuits;		P
	recommended spare parts list; and list of tools supplied.		N/A
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;		N/A
8)	a description of the safeguarding and of the means provided where it is necessary to suspend the safeguarding (for example for setting or		N/A

Clause	Requirement - test	Result-Remark	Verdict
	maintenance), (see 9.2.4);		
9)	instructions on the procedures for securing the machine for safe maintenance; (see also 17.8);		P
10)	information on handling, transportation and storage;		P
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;	Accord to IEC 61082	P
	reference designations shall be in accordance with relevant parts of IEC 61346;	Accord to IEC 61346	P
	Instructions/manuals shall be in accordance with IEC 62079.	Accord to IEC 62079	P
	parts lists where provided shall be in accordance with IEC 62027, class B.	Accord to IEC 62027	P
	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	The documentation has a reference number	P
	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 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 installation documents meet the requirements	P
	The recommended position, type, and cross-sectional areas of the		P

Clause	Requirement - test	Result-Remark	Verdict
	supply cables to be installed on site shall be clearly indicated.		
	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).		**N/A**
	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.	The diagram meet the requirements	**P**
	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.	Interconnection table is provided	**P**
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.	Overview diagram is provided	**P**
	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.	A right circuit diagram is provided	**P**
	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	Pass muster	**P**

Clause	Requirement - test	Result-Remark	Verdict
	unit shown.		
	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.	Switch symbols are shown on the electromechanical diagrams	P
	Conductors shall be identified in accordance with 13.2.	Pass muster	P
	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.	Circuits are shown in suitable way	P
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.	Comply with the requirements	P
	Where the operation of the equipment can be programmed, detailed information on methods of programming, equipment required, program verification, and additional safety procedures (where required) shall be provided.		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.	Comply with the requirements	P
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.	Comply with the requirements	P
18	**Verification**		-
18.1	**General**		-
	This part of IEC 60204 gives general requirements for the electrical equipment of machines.		-

Clause	Requirement - test	Result-Remark	Verdict
	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;		**N/A**
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);		**P**
d)	voltage test (see 18.4);		**P**
e)	protection against residual voltage (see 18.5);		**P**
f)	functional tests (see 18.6).		**P**
	When these tests are performed, it is recommended that they follow the sequence listed above.		**P**
	When the electrical equipment is modified, the requirements stated in 18.7 shall apply.	Comply with the requirements stated in 18.7	**P**
	For tests in accordance with 18.2 and 18.3, measuring equipment in accordance with the EN 61557 series is applicable.	In accordance with 18.2 and 18.3	**P**
	The results of the verification shall be documented.		**P**
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.		**N/A**
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		**N/A**
	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		**N/A**

Clause	Requirement - test	Result-Remark	Verdict
	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).		
	Test 2 – Fault loop impedance verification and suitability of the associated overcurrent protective device		**N/A**
	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:		**N/A**
1)	verification of the fault loop impedance by:		**N/A**
	calculation, or		**N/A**
	measurement in accordance with A.4, and		**N/A**
2)	confirmation that the setting and characteristics of the associated overcurrent protectivedevice 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 made on individual sections of the complete electrical installation.	Comply with the requirements	**P**
	Exception: for certain parts of electrical equipment, incorporating for example busbars, conductor wire or conductor bar systems or slip-ring assemblies, a lower minimum value is permitted, but that value shall not be less than 50K		**N/A**
	If the electrical equipment of the machine contains surge protection devices which are likely to operate during the test, it is permitted to either:		**-**

Clause	Requirement - test	Result-Remark	Verdict
	disconnect these devices, or		P
	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 muster	P
	The test voltage shall be at a nominal frequency of 50 Hz or 60 Hz.		P
	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.	No disruptive discharge occurs	P
	Components and devices that are not rated to withstand the test voltage shall be disconnected during testing.	Pass muster	P
	Components and devices that have been voltage tested in accordance with their product standards may be disconnected during testing.	Pass muster	P
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 muster	P
	The function of circuits for electrical safety (for example earth fault detection) shall be tested.	Pass muster	P
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

Clause	Requirement-Test	Result-Remark	Verdict

EN IEC 61000-3-2:2019+A1:2021

1.1	Test Equipment List and Details		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
EMC-PARTNER	Harmonics and Flicker Analyzer	HARMONIC S-1000	HAR1000-40	10/09/23	10/08/25

1.2	Description of Measurement Conditions		-
	Temperature: 21℃ Humidity: 60% Pressure: 1033mbar Electromagnetic environment: normal		P
1.3	Configuration		-
	The configuration is in accordance with the requirement in EN IEC 61000-3-2.		P
1.4	Test Data and Records		-
	Temperature: 21℃ Humidity: 59% Pressure: 1033mbar Electromagnetic environment: normal		P
2.1.3	Configuration		

Order	Freq[Hz]	Iavg[A]	Iavg%L[%]	Imax[A]	Imax%L[%]	Limit[A]	Status
1	50	0.3129		0.4966			
2	100	0.0133	0.1241	0.0171	1.4563	1.0800	
3	150	0.0245	2.2358	0.0826	3.6303	2.3000	
4	200	0.0000	0.0051	0.0059	1.3626	0.4300	
5	250	0.0021	0.2193	0.0233	2.0399	1.1400	
6	300	0.0000	0.0000	0.0031	1.0376	0.3000	
7	350	0.0004	0.0549	0.0154	1.9975	0.7700	
8	400	0.0000	0.0000	0.0013	0.5838	0.2300	
9	450	0.0002	0.0499	0.0102	2.5482	0.4000	
10	500	0.0000	0.0000	0.0004	0.1990	0.1840	
11	550	0.0000	0.0091	0.0054	1.6276	0.3300	
12	600	0.0000	0.0000	0.0003	0.1990	0.1533	
13	650	0.0000	0.0000	0.0026	1.2498	0.2100	
14	700	0.0000	0.0000	0.0002	0.1858	0.1314	
15	750	0.0000	0.0000	0.0030	1.9938	0.1500	
16	800	0.0000	0.0000	0.0002	0.1592	0.1150	
17	850	0.0000	0.0000	0.0022	1.6602	0.1324	
18	900	0.0000	0.0000	0.0003	0.2985	0.1022	
19	950	0.0000	0.0000	0.0017	1.4431	0.1184	
20	1000	0.0000	0.0000	0.0002	0.2654	0.0920	
21	1050	0.0000	0.0000	0.0014	1.3102	0.1071	
22	1100	0.0000	0.0000	0.0001	0.1460	0.0836	
23	1150	0.0000	0.0000	0.0012	1.2478	0.0978	
24	1200	0.0000	0.0000	0.0001	0.0796	0.0767	
25	1250	0.0000	0.0000	0.0011	1.2207	0.0900	
26	1300	0.0000	0.0000	0.0001	0.0862	0.0708	
27	1350	0.0000	0.0000	0.0008	0.9521	0.0833	
28	1400	0.0000	0.0000	0.0001	0.1858	0.0657	
29	1450	0.0000	0.0000	0.0007	0.8653	0.0776	
30	1500	0.0000	0.0000	0.0001	0.0995	0.0613	
31	1550	0.0000	0.0000	0.0007	1.0091	0.0726	
32	1600	0.0000	0.0000	0.0001	0.2123	0.0575	
33	1650	0.0000	0.0000	0.0005	0.8057	0.0682	
34	1700	0.0000	0.0000	0.0001	0.2256	0.0541	
35	1750	0.0000	0.0000	0.0004	0.6646	0.0643	
36	1800	0.0000	0.0000	0.0001	0.1194	0.0511	
37	1850	0.0000	0.0000	0.0005	0.9033	0.0608	
38	1900	0.0000	0.0000	0.0001	0.1261	0.0484	
39	1950	0.0000	0.0000	0.0004	0.7406	0.0577	
40	2000	0.0000	0.0000	0.0001	0.1327	0.0460	
Result: Pass							

1.5	Verdict		-
	The EUT met the requirement		P

Clause	Requirement-Test	Result-Remark	Verdict

EN 61000-3-3:2013+A2:2021

2.1	Test Equipment List and Details		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
EMC-PARTNER	Harmonics and Flicker Analyzer	HARMONIC S-1000	HAR1000-40	10/09/23	10/08/25

2.2	Description of Measurement Conditions		-
	Temperature: 21℃ Humidity: 60% Pressure: 1033mbar Electromagnetic environment: normal		P
2.3	Configuration		-
	The configuration is in accordance with the requirement in EN 61000-3-3.		P
2.4	Test Data and Records		-

Plt = 0.140				
	Pst	dmax	dc	dt>Lim
1	0.084	0.350	0.310	0.000
2	0.075	0.000	0.100	0.000
3	0.079	0.000	0.100	0.000
4	0.223	1.090	1.110	0.000
5	0.092	0.400	0.320	0.000
6	0.074	0.000	0.110	0.000
7	0.077	0.000	0.080	0.000
8	0.156	1.090	1.140	0.000
9	0.083	0.340	0.310	0.000
10	0.072	0.000	0.110	0.000
11	0.072	0.000	0.090	0.000
12	0.237	1.090	1.080	0.000
Result: Pass				

2.5	Verdict		-
	The EUT met the requirement		P

Clause	Requirement-Test	Result-Remark	Verdict

EN IEC 61000-6-1:2019

4.1	**SURGES**		-
4.1.1	**Test Equipment List and Detail**		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Japan	Surge Lite	LSS-6030	9099E00350	10/14/23	10/13/25

4.1.2	**Description of Measurement Conditions**		-
	Temperature: 21℃ Humidity: 58% Pressure: 1033mbar Electromagnetic environment: normal		P
4.1.3	**Configuration**		-
	The configuration is in accordance with the requirement in EN61000-4-5.		P
4.1.4	**Test Data and Records**		-

Level	Voltage	Poll	Path	Pass	Fail
1	1kV	±	L-N	B	
2	2kV	±	L-PE, N-PE	B	
3					
4					

4.1.5	**Verdict**		-
	The EUT was working as normal, so they met the requirement of performance criteria B.		P
4.2	**ESD**		-
4.2.1	**Test Equipment List and Details**		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Shanghai Sanki	Electrostatic Discharge tester	ESD-320	0329501C	6/23/23	6/22/25

4.2.2	**Description of Measurement Conditions**		-
	Temperature: 21℃ Humidity: 58% Pressure: 1033mbar Electromagnetic environment: normal		P
4.2.3	**Configuration**		-
	The configuration is in accordance with the requirement in EN61000-4-2.		P
4.2.4	**Test Data and Records**		-
	Air Discharge		P

Test Levels																
EN61000-4-2 Test Points	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV	-10 kV	+10 kV	-12.5 kV	+12.5 kV	-15 kV	+15 kV	-20 kV	+20 kV
EUT Front Side	B	B	B	B	B	B	B	B								
EUT Top Side	B	B	B	B	B	B	B	B								
EUT Back Side	B	B	B	B	B	B	B	B								
EUT Left Side	B	B	B	B	B	B	B	B								
EUT Right Side	B	B	B	B	B	B	B	B								

Direct Contact

Test Levels																
EN61000-4-2 Test Points	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV	-10 kV	+10 kV	-12.5 kV	+12.5 kV	-15 kV	+15 kV	-20 kV	+20 kV
EUT Front Side	B	B	B	B												
EUT Top Side	B	B	B	B												
EUT Back Side	B	B	B	B												
EUT Left Side	B	B	B	B												
EUT Right Side	B	B	B	B												

4.2.5	**Verdict**		-
	The EUT was working as normal, so they met the requirement of performance criteria B.		P
4.3	**EFT/B**		-
4.3.1	**Test Equipment List and Details**		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Shanghai Sanki	E.F.TB Generator	8014	069504E	6/23/23	6/22/25

4.3.2	**Description of Measurement Conditions**		-
	Temperature: 21℃ Humidity: 58% Pressure: 1033mbar Electromagnetic environment: normal		P
4.3.3	**Configuration**		-
	The configuration is in accordance with the requirement in EN61000-4-4.		P
4.3.4	**Test Data and Records**		-

Test Levels (kV)									
EN61000-4-4 Test Points		+0.25	-0.25	+0.5	-0.5	+1.0	-1.0	+2.0	-2.0
Power Port	L1	B	B	B	B				
	L2	B	B	B	B				
	L1+L2	B	B	B	B				
I/O Port		B	B	B	B				

4.3.5	**Verdict**		-
	The EUT was working as normal, so they met the requirement of performance criteria B.		P
4.4	**INJECTED CURRENTS**		-
4.4.1	**Test Equipment List and Details**		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
FLUKE	Synthesized RF Signal Generator	6061A	5080312	3/23/23	3/22/25
QF	Broadband Power Amplifier	QF3860	No	4/15/23	4/14/25
QF	Millivoltmeter	QF2281	92028	4/15/23	4/14/25

4.4.2	**Description of Measurement Conditions**		-
	Temperature: 21℃ Humidity: 58% Pressure: 1033mbar Electromagnetic environment: normal		P
4.4.3	**Configuration**		-
	The configuration in accordance with the requirement in EN 61000-4-6.		P
4.4.4	**Test Data and Records**		-

EN61000-4-6 Test Points	Frequency range MHz	Levels	Voltage Level (e.m.f.)V	Pass	Fail
Power Line	0.15-230MHz	1	1		
		2	3	A	
		3	10		
		X	Special		
I/O Line	0.15-230MHz	1	1		
		2	3	A	
		3	10		
		X	Special		

4.4.5	**Verdict**		-
	The EUT was working as normal, so they met the requirement of performance criteria A.		P
4.5	**VOLTAGE DIPS AND INTERRUPTIONS**		-
4.5.1	**Test Equipment List and Details**		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Japan	Voltage Dip Simulator	VDS-220B	2199D00098	10/22/23	10/21/25

4.5.2	**Description of Measurement Conditions**		-
	Temperature: 21℃ Humidity: 58% Pressure: 1033mbar Electromagnetic environment: normal		P
4.5.3	**Configuration**		-
	The configuration in accordance with the requirement in EN 61000-4-11.		P
4.5.4	**Test Data and Records**		-

Environmental phenomena		Test level in % U_T	Duration (in periods of the rated frequency)	Phase Angle	Pass	Fail
Interruptions		0	0.5T	0/180	B	
Voltage dips in % U_T	60	40	10T	0/180	B	
	30	70	50T	0/180	B	

4.5.5	**Verdict**		-
	The EUT was working as normal, so they met the requirement of performance criteria B.		P

Clause	Requirement-Test	Result-Remark	Verdict

EN IEC 61000-6-3:2021

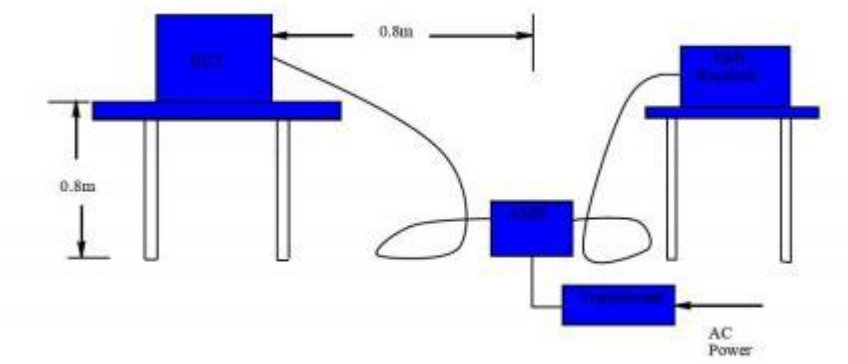
3.1	**Continuous Disturbance Voltage at Mains Terminal**		-
3.1.1	**Test Equipment List and Details**		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
No.2 Radio factory of Changzhou	Screened Room	P-22	No	12/6/23	12/5/25
AFJ	EMI Receiver	ER55 CR/2.8	55790015165	12/6/23	12/5/25
AFJ	16A LINE Impedance Stabilization	LS16C	16010020077	12/6/23	12/5/25

3.1.2	**Description of Measurement Conditions**		-
	Temperature: 21℃ Humidity: 58% Pressure: 1033mbar Electromagnetic environment: normal		P
3.1.3	**Limits of Continuous Disturbance Voltage at Mains Terminal.**		-

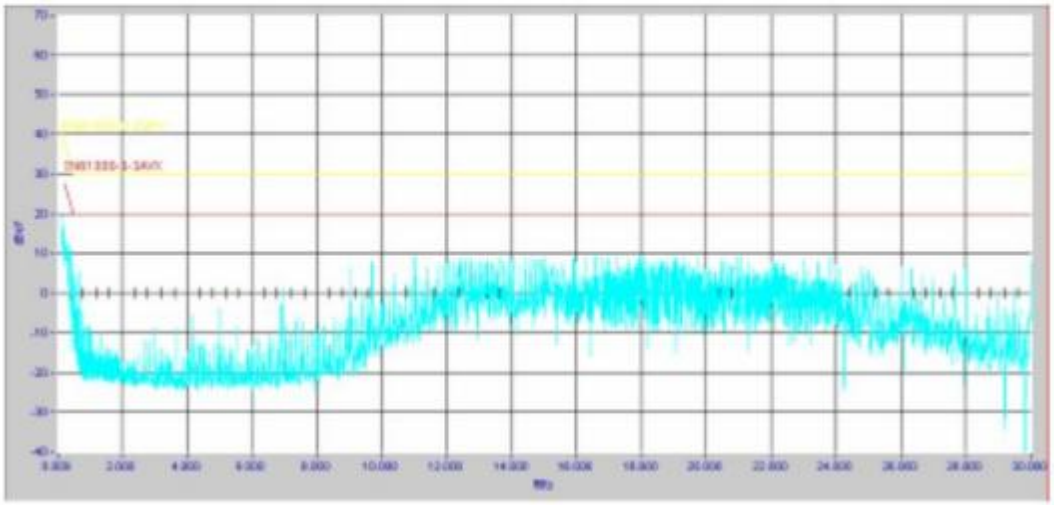
Equipment type	Frequency range MHz	Limit values dBμV	
		Quasi-peak	Average
Household appliance	0.15 to 0.5	66-56 [a]	56- 46 [a]
	0.5 to 5	56	46
	5 to 30	60	50
[a] Decreasing linearly with logarithm of the frequency.			

3.1.4	**Configuration**		-
	The configuration is in accordance with the requirement in EN IEC 61000-6-3, the sketch map as follow:		P



3.1.5	**Test Data and Records**		

Disturbance Voltage at the Mains Terminal TEST DATA			EN IEC 61000-6-3
Frequency	Amplitude	Detector	Limit
MHz	dBμV	QP/Ave/Peak	dBμV
0.15-0.5	*	QP	66-56 Decreasing linearly with logarithm of the frequency
0.50-5	*	QP	56
5-30	*	QP	60
* Means the continuous disturbance voltage level 10dB lower than limits.			



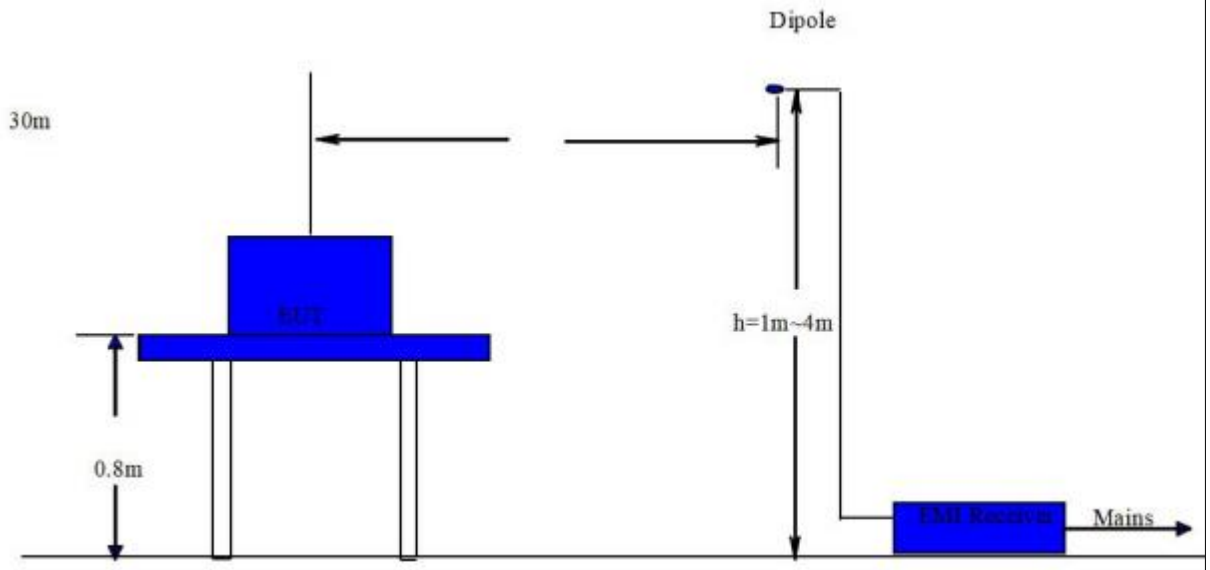
3.1.6	**Verdict**		**-**
	The EUT met the requirement.		P
3.2	**Radiated disturbances**		**-**
3.2.1	**Test Equipment List and Detail**		**-**

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
SCHAFFNER	Receive Antenna	CBL6112B	/	12/6/23	12/5/25
AFJ	EMI Receiver	ER55 CR/2.8	55790015165	6/23/23	6/22/25
Albatross Project	3Meter Anechoic Chamber		9290832	12/13/23	12/12/25
AFJ	16A LINE Impedance Stabilization Network	LS16C	16010020077	6/23/23	6/22/25

3.2.2	**Description of Measurement Conditions**		
	Temperature：20℃ Humidity: 60% Pressure: 1033mbar Electromagnetic environment: normal		P
3.2.3	**Limits of radiated disturbances of class B ITE at a measuring distance of 10m.**		-

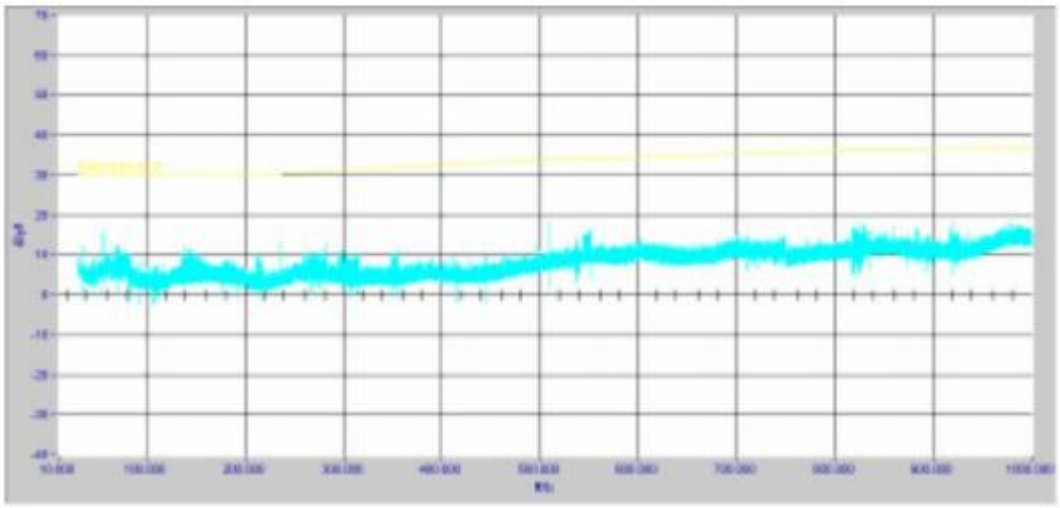
Frequency range MHz	Quasi-peak limits(10m) dB(μV/m)
30 to 230	30
230 to 1000	37
NOTE: The lower limit shall apply at the transition frequency. NOTE: Additional provisions may be required for cases where interference occurs.	

3.2.4	**Configuration**		-
	The configuration is in accordance with the requirement in EN IEC 61000-6-3, the sketch map as follow:		P



3.2.5	**Test Data and Records**		-

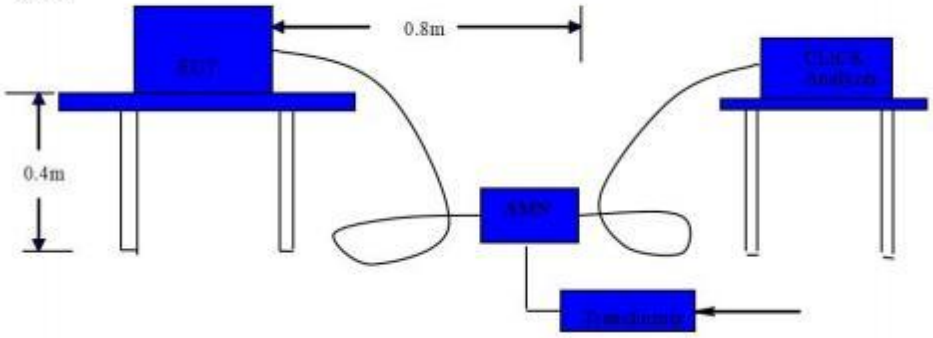
Radiated disturbances TEST DATA			EN IEC 61000-6-3	
Frequency	Amplitude	Detector	Limit(10m)	Margin
MHz	dB(μV/m)	Qp/Ave/Peak	dB(μV/m)	dB
30 to 230	*	QP	30	
230 to 1000	*	QP	37	



3.2.6	**Verdict**		-
	The EUT met the requirement.		P
3.3	**Discontinuous Disturbance Voltage at Mains Terminal (Click)**		-
3.3.1	**Test Equipment List and Details**		-

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
No.2 Radio factory of Changzhou	Screened Room	P-22	No	12/6/23	12/5/25
AFJ	CLICK Analyzer	CL-55C	55040019044	3/7/23	3/7/25
AFJ	16A LINE Impedance Stabilization Network	LS16C	16010020077	6/23/23	6/22/25

3.3.2	**Description of Measurement Conditions**		-
	Temperature: 22℃ Humidity: 56% Pressure: 1033mbar Electromagnetic environment: normal		P
3.3.3	**Limits of Click**		-
	For discontinuous disturbance, the click limit is attained by increasing the relevant limit of Continuous		P

	Disturbance Voltage with: 44dB for N < 0.2 or 20lg(30/N) dB for		
3.3.4	**Configuration**		-
	The configuration in accordance with the requirement in EN IEC 61000-6-3, the sketch map as follow:  		
3.3.5	**Verdict**		-
	The EUT met the requirement		P

4.1.5 Earthing continuity test report

Manufacturer：GUANGDONG ARTECO REFRIGERATION EQUIPMENT CO., LTD.

No. 56 Sanhe Road, Sanzhou Park, Cangjiang IndustrialPark, Hecheng Street, Gaoming District,Foshan City,China

2 EUT：BS Series Box-Type Condensing Units

3 Test model：BS EBF-05H

4 Ratings: 60Kw

5 Test Equipment：Ground Resistance Tester

Withstanding Voltage/Arc/Insulation/Grounding Tester

Model：WB2678A

- Test conditions ：50Hz
- Date：Aug.1, 2024

Test Point	Diameter of Conductor (mm^2)	Test Result-Voltage Drop (V)
Control transformer	1.25	0.36
Control panel	1.25	0.16
L1-PE	1.25	0.16
L2-PE	1.25	0.16
L3-PE	1.25	0.16
Motor1	1.25	0.25
Motor2	1.25	0.25
Motor3	1.25	0.25
Motor4	1.25	0.25
Motor5	1.25	0.25
Motor6	1.25	0.25
Motor7	1.25	0.25
Motor8	1.25	0.25
Controller	1.25	0.36

Insulation resistance test report

Manufacturer：GUANGDONG ARTECO REFRIGERATION EQUIPMENT CO., LTD.

No. 56 Sanhe Road, Sanzhou Park, Cangjiang IndustrialPark, Hecheng Street, Gaoming District,Foshan City,China

6 EUT：BS Series Box-Type Condensing Units

7 Test model：BS EBF-05H

8 Ratings: 60Kw

9 Test Equipment：Ground Resistance Tester

Withstanding Voltage/Arc/Insulation/Grounding Tester

Model：WB2678A

- Test conditions ：50Hz
- Date：Aug.1, 2024

Test Point	Test Result (MΩ)
Control transformer	625
Control panel	857
L1-PE	>1000
L2-PE	>1000
L3-PE	>1000
Motor1	818
Motor2	910
Motor3	990
Motor4	965
Motor5	925
Motor6	927
Motor7	946
Motor8	946
Controller	885

Withstand voltage test report

10 Manufacturer：GUANGDONG ARTECO REFRIGERATION EQUIPMENT CO.,LTD.

No. 56 Sanhe Road, Sanzhou Park, Cangjiang IndustrialPark, Hecheng Street, Gaoming District,Foshan City,China

11 EUT：BS Series Box-Type Condensing Units

12 Test model：BS EBF-05H

13 Ratings: 60Kw

14 Test Equipment：Ground Resistance Tester

Withstanding Voltage/Arc/Insulation/Grounding Tester

Model：WB2678A

- Test conditions ：50Hz
- Date：Aug.1, 2024

Test Point	Test Result (MΩ)
Control transformer	Pass
Control panel	Pass
L1-PE	Pass
L2-PE	Pass
L3-PE	Pass
Motor 1	Pass
Motor2	Pass
Motor3	Pass
Motor4	Pass
Motor5	Pass
Motor6	Pass
Motor7	Pass
Motor8	Pass
Controller	Pass

Noise Test Report **No. XMT0202400001H/MD** **Date:Aug.1, 2024**

Manufacturer: GUANGDONG ARTECO REFRIGERATION EQUIPMENT CO., LTD.
No. 56 Sanhe Road, Sanzhou Park, Cangjiang IndustrialPark, Hecheng Street, Gaoming District,Foshan City,China

Report on the submitted sample said to be

Ref No. : XMT0202300001H/MD

Testing Period :Aug.1, 2024

Test Method :With reference to BS EN11202; EN ISO 3746 and ISO/TR 11688-1

Test Results : Please refer to next pages

Noise test at workstation

I. Applicable standards

1. EN ISO 3746：Acoustics-Determination of sound power levels of noise sources using sound pressure –Survey method using an enveloping measurement surface over a reflecting plane.
2. EN ISO 11202：Acoustics—Noise emitted by machinery and equipment—Measurement of emission sound pressure levels at the work station and at other specified positions—Survey method in situ.
3. ISO/TR 11688-1：Acoustics—Recommended practice for the design of low-noise machinery and equipment—Part 1 ： Planning.

II. Test instrument

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

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

III. Measurement method

The measurements of this test have been carried out by a hand-held sound level meter, and readings are taken by A-frequency weighting at each measuring position.

For operator positions in process of measurement, the measuring instrument is to be set at a distance of 1 m from the machine and 1.5 m above the floor.

IV. Test environment

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

V. Test result

1.Description of testing place:

Back ground noise:= 58.6 dB(A) △L=(tested noise)-(back ground noise)= 40.8 Db (must >=3dB)

Correction for background noise △L>10db, K_{1A}= 0 db

Measurement time per position= 20 s (>= 15s of time interval of a processing cycle)

Position	1	2	3	4	5
Reading (dB (A))	67.5	67.1	67.2	67.1	67.5

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

Position	1	2	3	4	5
Reading (dB (A))	69.2	68.5	69.3	69.5	68.2

3.Sound power level (where the measuring value of sound pressure level exceeds 85 dB(A))

Position	1	2	3	4	5
Readings (dB (A))	-	-	-	-	-
Position	6	7	8	9	Lw
Readings (dB (A))	-	-	-	-	-

Annex:Technical Information

A.1 Safety pictures

EC Declaration of conformity

Council Directive 2006/42/EC on Machine Directive
2014/30/EU on Electromagnetic Compatibility
2014/35/EU on Low Voltage Directive

GUANGDONG ARTECO REFRIGERATION EQUIPMENT CO., LTD.

No. 56 Sanhe Road, Sanzhou Park, Cangjiang IndustrialPark, Hecheng Street, Gaoming District,Foshan City,China.

Certify that the product described is in conformity with

the2006/42/EC,2014/35/EU,2014/30/EU

as amended

Product Name:

BS Series Box-Type Condensing Units

Item No:

BS EBF-05H

The product has been assessed by the application of the following standards:

EN 13771-2:2017,EN ISO 12100:2010,EN 60204-1:2018,EN IEC 61000-6-1:2019,EN IEC 61000-6-3:2021,EN IEC 61000-3-2:2019+A2:2024,EN IEC 61000-3-3:2013+A2:2021

2024.8.16

Issue place and date

Company stamp and Signature of authorized personnel

Notice

1. This test report shall be invalidation without the cachet of the testing laboratory.

2. This copied report shall be invalidation without sealed the cachet of the testing laboratory.

3. This report shall be invalidation without tester signature.

4. This altered report shall be invalidation.

5. Client shall put forward demurrer within 15 days after received report. The testing laboratory shall refuse disposal if exceeded the time limit.

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