Technical Construction File

Tcf No: Applicant:	CE-SH25051201-SO-MD Shandong huanyu heavy industry co., ltd
Address:	Room 2308, Building 3, Aosheng Building, Jinan High-tech Zone, Shandong Province
Manufacturer:	Shandong huanyu heavy industry co., ltd
Address:	No.1 Huihe Industrial Park, Jiyang District, Jinan City
Product:	Lift Platform
Model:	HYSJY0.5-4, HYSJY0.5-6, HYSJY0.5-8, HYSJY0.5-10, HYSJY0.5-12, HYSJY0.5-14, HYSJY0.5-16, HYSJY0.5-18, HYGTJZ0.23-4, HYGTJZ0.23-4.5, HYGTJZ0.23-6, HYGTJZ0.45-6, HYGTJZ0.45-8, HYGTJZ0.32-10, HYGTJZ0.32-12, HYGTJZ0.23-14, HYGTJZ0.23-16, HYDT(1-30), HYGDCQ6, HYGDCQ8, HYGDCQ10, HYGDCQ12, HYGDCQ14, HYGDCQ16, HYGDCQ18, HYGDCQ20, HYYDCQ8, HYYDCQ10, HYYDCQ12, HYYDCQ15, HYYDCQ20, HYSJG(1-20), HYRZ(10-40), HYXHPT2.0, HYXHPT3.0, HYSJL(4-24)
Test standard:	EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:2015
Conclusion:	The products meet the above standards.
Edit Date:	2025-05-12
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ASSESSMENT REPORT

TCF

Reference No. ..... : No: CE-SH25051201-SO-MD

Tested by(+ signature).....: Project Engineer/Downey Xue

Reviewed by(+ signature).....: Manager/Vincent Yan

Date of issue ..... : 2025-05-12

Applicant

Name .....: Shandong huanyu heavy industry co., ltd

Address ..... : Room 2308, Building 3, Aosheng Building, Jinan High-tech Zone, Shandong Province

Test specification

Standard .....: EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:2015

Test procedure ..... : CE-MD

Non-standard test method ..... : N.A.

Test item description：

Manufacturer..... : Shandong huanyu heavy industry co., ltd

Factory..... : Shandong huanyu heavy industry co., ltd

Trademark .....: Refer to the nameplate.

Model/Type reference .....: Refer to the page 1

Rating(s) ..... : Refer to the nameplate.

General product information:

The machine is Lift Platform.

1. Risk assessment

This risk assessment report is based on the methods in the EN ISO 12100:2010 and EN ISO 14121-2 standards, and the 4 factors S-A-G-W have been used for evaluating the level of risks.

S：Severity of possible harm

- S1：Slight（normally reversible）
- S2：Serious（normally irreversible）
- S3：Cause a few men die
- S4：Calamity or cause many men die

A：Frequency any duration of exposure

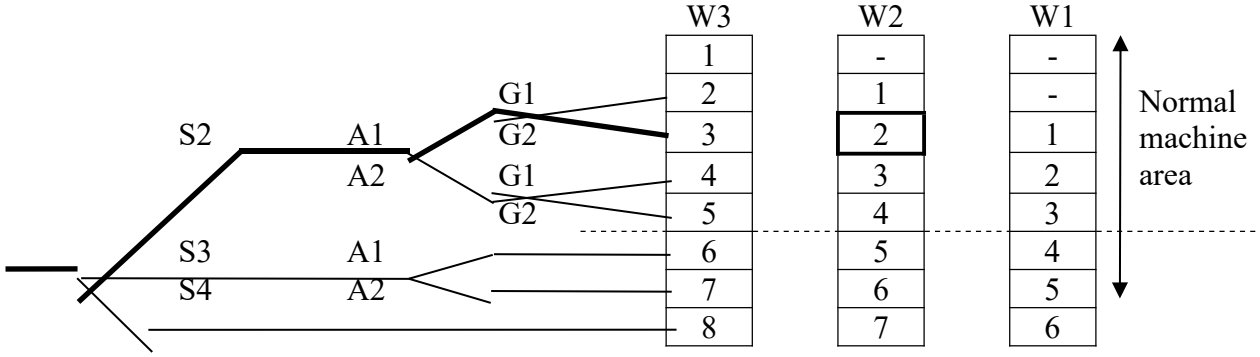
- A1：Seldom to very often
- A2：Frequent to continuous

G：Possibilities of avoidance

- G1：Possible
- G2：Impossible

W：Probability of occurrence of harm

- W1：Low
- W2：Medium
- W3：High



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, add both guard and warning sign

4：Consider another two design, choose the best one, add both guard and warning sign

5：Consider another three design, choose the best one, add both guard and warning sign

NO.	Hazards source	S	A	G	W	Level
	Mechanical hazards					
1.0-1	Mechanical hazards due to machine parts or work pieces					
1.0-2	Mechanical hazards due to accumulation of energy inside the machinery					
1.1	Crushing	***2***	***1***	***1***	***2***	***1***
1.2	Shearing	***2***	***1***	***1***	***2***	***1***
1.3	Cutting or severing	***2***	***1***	***1***	***2***	***1***
1.4	Entanglement	***2***	***1***	***1***	***2***	***1***
1.5	Drawing-in or trapping	***2***	***1***	***1***	***2***	***1***

1.6	Impact	*2*	*1*	*1*	*2*	*1*
1.7	Stabbing or puncture					
1.8	Friction or abrasion					
1.9	High pressure fluid injection or ejection					
Electrical hazards						
2.1	Contact with live parts					
2.2	Contact with parts which have become live under faulty conditions					
2.3	Approach to live part under high voltage					
2.4	Electrostatic phenomena					
2.5	Thermal radiation or other phenomena such as projection of molten particles and chemical effects form short-circuits, overloads etc.					
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					
3.2	Damage to health by hot or cold working environment					
Hazards generated by noise						
4.1	Hearing loss (deafness), other physiological disorders					
4.2	Interference with speech communication, acoustic signals, etc.	*1*	*1*	*1*	*1*	*-*
Hazards generated by vibration						
5.1	Use of hand-help machines resulting in a variety of neurological and vascular disorder					
5.2	Whole body vibration, particular when combined with poor postures					
Hazards generated by radiation						
6.1	Low frequency, radio frequency radiation, microwaves					
6.2	Infrared, visible and ultraviolet light					
6.3	X and gamma rays					
6.4	Alpha, beta rays, electron or ion beams, neutrons					
6.5	Lasers					
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					
7.2	Fire and explosion hazard					
7.3	Biological and micro-biological (viral or bacterial) hazards					
Hazards generated by neglecting ergonomic principles in machine design						
8.1	Unhealthy postures or excessive effort					
8.2	Inadequate consideration of hand-arm or foot-leg anatomy					
8.3	Neglected use of personal protection equipment					
8.4	Inadequate local lighting					
8.5	Mental overload or underload, stress					
8.6	Human error, human behavior	*1*	*1*	*1*	*1*	*-*
8.7	Inadequate design, location or identification of manual controls					
8.8	Inadequate design, location or identification of manual					

	controls					
Combination of hazards						
9	Combination of hazards					
Unexpected start-up, unexpected overrun/over-speed						
10.1	Failure/disorder of the control system	*1*	*1*	*1*	*1*	-
10.2	Restoration of energy on supply after an interruption					
10.3	External influences on electrical equipment	*1*	*1*	*1*	*1*	-
10.4	Other external influences (gravity, wind, etc.)					
10.5	Errors in the software					
10.6	Error made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)					
Impossibility of stopping the machine in the best possible conditions						
11	Impossibility of stopping the machine in the best possible conditions					
Variations in the rotational speed of tools						
12	Variations in the rotational speed of tools					
Failure of the power supply						
13	Failure of the power supply					
Failure of the control circuit						
14	Failure of the control circuit	*1*	*1*	*1*	*1*	-
Errors of fitting						
15	Errors of fitting					
Break-up during operation						
16	Break-up during operation					
Falling or ejected objects or fluids						
17	Falling or ejected objects or fluids					
Loss of stability / overturning of machinery						
18	Loss of stability / overturning of machinery					
Slip, trip and fall of persons (related to machinery)						
19	Slip, trip and fall of persons(related to machinery)					
Additional hazards, hazardous situations and hazardous events due to mobility						
20	Relating to the traveling function					
20.1	Movement when starting the engine					
20.2	Movement without a driver at the driving position					
20.3	Movement without all parts in a safe position					
20.4	Excessive speed of pedestrian controlled machinery					
20.5	Excessive oscillations when moving					
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilisated					
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					
21.2	Exhaust gases/lack of oxygen at the work position					
21.3	Fire（flammability of the cab, lack of extinguishing means）					
21.4	Mechanical hazards at the work position： contact with the wheels； rollover； fall of objects, penetration by objects；					

	break-up of parts rotation at high speed； contact of persons with machine parts or tools（pedestrian controlled machines）					
21.5	Insufficient visibility form the work positions					
21.6	Inadequate lighting					
21.7	Inadequate seating					
21.8	Noise at the work position					
21.9	Vibration at the work position					
21.10	Insufficient means for evacuation/emergency exit					
Due to the control system						
22.1	Inadequate location of manual controls					
22.2	Inadequate design of manual controls and their mode of operation					
Form handling the machine（lack of stability）						
23	Form handling the machine（lack of stability）					
Due to the power source and to the transmission of power						
24.1	Hazards form the engine and the batteries					
24.2	Hazards form the transmission of power between machines					
24.3	Hazards form coupling and towing					
Form/to third persons						
25.1	Unauthorized start-up/use	***1***	***1***	***1***	***2***	**-**
25.2	Drift of a part away from its stopping position					
25.3	Lack or inadequacy of visual or acoustic warning means					
Insufficient instructions for the driver/operator						
26	Insufficient instructions for the driver/operator	***1***	***1***	***1***	***1***	**-**
Additional hazards, hazardous situations and hazardous events due to lifting						
27	Mechanical hazards and hazardous events					
27.1	Form load falls, collisions, machine tipping caused by：					
27.1.1	Lack of stability					
27.1.2	Uncontrolled loading-overloading-overturning moments exceeded					
27.1.3	Uncontrolled amplitude of movements					
27.1.4	Unexpected/unintended movement of loads					
27.1.5	Inadequate holding devices/accessories					
27.1.6	Collision of more then one machine					
27.2	Form access of persons to load support					
27.3	Form derailment					
27.4	Form insufficient mechanical strength of parts					
27.5	Form inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine					
27.6	Form inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine					
27.7	Form lowering of the load under the control of friction brake					
27.8	Form abnormal conditions of assembly/testing/use/maintenance					
27.9	Form the effect of load on persons（impact by load or counterweight）					

Electrical hazards						
28.1	Form lightning					
Hazards generated by neglecting ergonomic principles						
29.1	Insufficient visibility from the driving position					
Additional hazards, hazardous and 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					
30.2	Failing accelerator or brake control of machinery running on rails					
30.3	Failing or lack of dead man's control of machinery running on rails					
31	Restricted movement of persons					
32	Fire and explosion					
33	Emission of dust, gases etc.					
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					
34.2	Failing of loading control					
34.3	Failing of controls in person carrier (function, priority)					
34.4	Over speed of person carrier					
35	Falling of person from person carrier					
36	Falling or overturning of person carrier					
37	Human error, human behavior					
NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.1	Crushing	***2***	***1***	***1***	***2***	***1***
Where	*Movable parts*					
When	*Access to the machine during running, machine setting, maintenance, repair.*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Affixing suitable warning signs. *2. Only operation by training/authorized persons.* *3. Operation of the machine shall conform to the instructions of the instruction manual.* *4. Check and inspection according to the specified durations of the instruction manual.* *5. Provide the guides.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.2	Shearing	***2***	***1***	***1***	***2***	***1***
Where	*Movable parts*					
When	*Access to the machine during running, machine setting, maintenance, repair.*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Affixing suitable warning signs. *2. Only operation by training/authorized persons.* *3. Operation of the machine shall conform to the instructions of the*		***1***	***1***	***1***	***1***	**-**

instruction manual. *4. Check and inspection according to the specified durations of the instruction manual.* *5. Provide the guides*						

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.3	Cutting or severing	***2***	***1***	***1***	***2***	***1***
Where	*Knife*					
When	*Access to the machine during running, machine setting, maintenance, repair.*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Affixing suitable warning signs. *2. Only operation by training/authorized persons.* *3. Operation of the machine shall conform to the instructions of the instruction manual.* *4. Check and inspection according to the specified durations of the instruction manual.* *5. Provide the guides.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.4	Entanglement	***2***	***1***	***1***	***2***	***1***
Where	*Rotary parts*					
When	*Access to the machine during running, machine setting, maintenance, repair.*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Affixing suitable warning signs. *2. Only operation by training/authorized persons.* *3. Operation of the machine shall conform to the instructions of the instruction manual.* *4. Check and inspection according to the specified durations of the instruction manual.* *5. Provide fixed guards.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.5	Drawing-in or trapping	***2***	***1***	***1***	***2***	***1***
Where	*Rotary parts*					
When	*Access to the machine during running, machine setting, maintenance, repair.*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Affixing suitable warning signs. *2. Only operation by training/authorized persons.* *3. Operation of the machine shall conform to the instructions of the instruction manual.* *4. Check and inspection according to the specified durations of the instruction manual.* *5. Provide fixed guards.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.6	Impact	***2***	***1***	***1***	***2***	***1***

Where	*Movable parts*
When	*Access to the machine during running, machine setting, maintenance, repair.*

Improvement result

Method	S	A	G	W	Level
1. Affixing suitable warning signs. *2. Only operation by training/authorized persons.* *3. Operation of the machine shall conform to the instructions of the instruction manual.* *4. Check and inspection according to the specified durations of the instruction manual.* *5. Provide fixed guards.*	*1*	*1*	*1*	*1*	-

NO.	Hazards source	S	A	G	W	Level
4.2	Interference with speech communication, acoustic signals, etc.	*1*	*1*	*1*	*1*	-
Where	*The whole machine*					
When	*Machine is running .*					

Improvement result

Method	S	A	G	W	Level
1. *Only operation by training/authorized persons.* *2. Operation of the 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 of warning label.*	*1*	*1*	*1*	*1*	-

NO.	Hazards source	S	A	G	W	Level
8.6	Human error, human behavior	*2*	*1*	*1*	*1*	*1*
Where	*At machine.*					
When	*Reasonably foreseeable misuse. Inadvertent operation of controls.*					

Improvement result

Method	S	A	G	W	Level
1.Only authorized person can use the machine. *2.Training before using this machine.* *3.Make reference to the instruction manual before using this machine.*	*1*	*1*	*1*	*1*	-

NO.	Hazards source	S	A	G	W	Level
10.1	Failure/disorder of the control system	*1*	*1*	*1*	*1*	-
Where	*Control circuit/control components*					
When	*during setting, cleaning*					

Improvement result

Method	S	A	G	W	Level
1. Only authorized person can use the machine. *2. Make reference to the instruction manual before using this machine.* *3. Check before operation.* 4. *Periodic maintenance.*	*1*	*1*	*1*	*1*	-

NO.	Hazards source	S	A	G	W	Level
10.3	External influences on electrical equipment	*1*	*1*	*1*	*1*	-
Where	*At or near machine*					
When	*during setting or operating cycle of the machine*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. All electrical equipments have been submitted to carry out the EMC testing according to relevant EN standards and get the CE E-mark. *2. Connection of protective earthing indeed.* 3. *Excellent electrical shielded housing.*		*1*	*1*	*1*	*1*	-

NO.	Hazards source	S	A	G	W	Level
14	Failure of the control circuit	*1*	*1*	*1*	*1*	-
Where	*Control circuit/control components*					
When	*During operation of the machine*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Checking before operation. *2. Make reference to the instruction manual before operate this machine.* 3. *Daily/periodic inspection and maintenance.*		*1*	*1*	*1*	*1*	-

NO.	Hazards source	S	A	G	W	Level
25.1	Unauthorized start-up/use	*1*	*1*	*1*	*1*	-
Where	*Control system*					
When	*Operation, adjustment or maintenance of the machine*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Always starting the machine by training/authorized persons. *2. During adjustment or maintenance, put a warning nameplate near the working area.* 3. *Lock the power switch of the machine.*		*1*	*1*	*1*	*1*	-

NO.	Hazards source	S	A	G	W	Level
26	Insufficient instructions for the driver/operator	*1*	*1*	*1*	*1*	-
Where	*Whole machine*					
When	*Installation, assembly/disassembly, operation, adjustment or maintenance of the machine*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. Edit the instruction manual in conformity with those requirement of Machinery Directive and EN ISO 12100：2010 standard. 2. *Each machine accompanied with a complete instruction manual.*		*1*	*1*	*1*	*1*	-

Council Directive 2006/42/EC, Annex I			
Clause	Requirement-Test	Result-Remark	Verdict
1	**Essential health and safety requirements**		-
1.1	**General remarks**		-
1.1.1	Definitions		P
1.1.2	Principles of safety integration	Considered for the machine professionally. See the drawings and instruction.	P
1.1.3	Materials and products	The materials and products is safe, no hazards.	P
1.1.4	Lighting		N
1.1.5	Design of machinery to facilitate its handling	The machine is well designed to facilitate its handling.	P
1.1.6	Ergonomics	Comply with requirement	P
1.1.7	Operating positions	No hazards in the operating positions	P
1.1.8	Seating	No seat.	N
1.2	**Controls**		-
1.2.1	Safety and reliability of control systems	Reliable design, certificated control components provided, no dangerous.	P
1.2.2	Control devices	Identification clear, durable. The movement of the control is consistent with its effect. Locations are adequate to operate.	P
1.2.3	Starting	Start button provided. Not restart after stop.	P
1.2.4	Stopping	See below.	P
1.2.4.1	Normal stopping	Mains power switch provided. It cut off the power.	P
1.2.4.2	Operational stop	Stop button and soft stop button of touch screen used	P
1.2.4.3	Emergency stop		P
1.2.4.4	Assembly of machinery		P
1.2.5	Selection of control or operating modes		P
1.2.6	Failure of the power supply	AC power supply used. all the movement of the machine stopped immediately once failure of the power supply presented, don't lead dangerous situation.	P
1.3	**Protection against mechanical hazards**	See below	P
1.3.1	Risk of loss of stability	The machine is stable enough.	P
1.3.2	Risk of break-up during operation	Fixed guard provided	P
1.3.3	Risked due to falling or ejected objects	Guard to prevent the ejected objects.	P
1.3.4	Risks due to surfaces, edges or angles	Smooth surface and edges	P
1.3.5	Risks related to combined machinery		P
1.3.6	Risks related to variations in operating conditions	No such hazards	P
1.3.7	Prevention of risks related to moving parts	The moving parts are separated by interlock guard and fixed guards. Some parts	P

Council Directive 2006/42/EC, Annex I			
Clause	Requirement-Test	Result-Remark	Verdict
		are added warning signs.	
1.3.8	Choice of protection against risk arising from moving parts	Guards are used to protect against risk.	P
1.3.8.1	Moving transmission parts	Fixed guards provided, and all of the moving parts are separated by guard.	P
1.3.8.2	Moving parts involved in the process	Fixed guards provided.	P
1.3.9	Risks of uncontrolled movements	No such risk.	N
1.4	Required characteristics of guards and protection devices	See below	P
1.4.1	General requirement	Comply with the requirement	P
1.4.2	Special requirements for guards		P
1.4.2.1	Fixed guards	Cannot be apart without tools	P
	Fixed guards must be fixed by systems that can be opened or removed only with tools.	Can be opened only with tools	P
	Their fixing systems must remain attached to the guards or to the machinery when the guards are removed.	The bolts remain attached to the guards.	P
1.4.4.2	Interlocking movable guards		N
	Interlocking movable guards must:		N
	-as far as possible remain attached to the machinery when open,		N
	-be designed and constructed in such a way that they can be adjusted only by means of an intentional action.		N
	Interlocking movable guards must be associated with an interlocking device that		N
	-prevents the start of hazardous machinery functions until they are closed, and		N
	-gives a stop command whenever they are no longer closed.		N
	Where it is possible for an operator to reach the danger zone before the risk due to the hazardous machinery functions has ceased, movable guards must be associated with a guard locking device in addition to an interlocking device that：		N
	-prevents the start of hazardous machinery functions until the guard is closed and locked, and		N
	-keeps the guard closed and locked until the risk of injury from the hazardous machinery functions has ceased.		N
	Interlocking movable guards must be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous machinery functions		N
1.4.2.3	Adjustable guards restricting access	Not provided	N
1.4.3	Special requirements for protection devices	No such special requirements.	N
1.5	**Protection against other hazards**	See below	P

Council Directive 2006/42/EC, Annex I			
Clause	Requirement-Test	Result-Remark	Verdict
1.5.1	Electricity supply	AC power supply provided and protection is enough, see the report for EN 60204-1.	P
1.5.2	Static electricity	Comply with the requirement. PE system.	P
1.5.3	Energy supply other than electricity	Pneumatic pressure supply provided, comply with the requirement	P
1.5.4	Error of fitting	The machine should be well fitted and installed by Manufacturer. See the drawings and instruction.	P
1.5.5	Extreme temperatures		P
1.5.6	Fire	The machine was well designed and manufactured to avoid fire.	P
1.5.7	Explosion	The machine can't used in potencial explosion environment, and the machine was well designed and manufactured to avoid explosion.	P
1.5.8	Noise	The noise that emitted by the machine is at a level <85dB(A), the operator worked around the control station.	P
1.5.9	Vibration		N
1.5.10	Radiation	Not within the assessment scope	N
1.5.11	External radiation	Not within the assessment scope	N
1.5.12	Laser equipment		N
1.5.13	Emissions of hazardous materials and substances		N
1.5.14	Risk of being trapped in a machine	No such hazards	P
1.5.15	Risk of slipping, tripping or falling	Using personal fall protection equipment	P
1.5.16	Lightning		N
1.6	**Maintenance**	See below	P
1.6.1	Machinery maintenance	Professional maintainer required,see user manual. outside danger zones.	P
1.6.2	Access to operating position and servicing points	Comply with the requirement. access in safety to all areas	P
1.6.3	Isolation of energy sources	See report of EN 60204-1.	P
1.6.4	Operator intervention	Professional maintainer required	P
1.6.5	Cleaning of internal parts	Easy to access and clean.	P
1.7	**Indicators**	See below	P
1.7.1	Information and warnings on machinery	Comply with the requirement	P
1.7.1.1	Information and information devices	See the labels on the machine.	P

Council Directive 2006/42/EC, Annex I			
Clause	Requirement-Test	Result-Remark	Verdict
1.7.1.2	Warning devices	warning device and warning signs are provided	P
1.7.2	Warning of residual risks	Comply with requirements. See the copy of marking label .	P
1.7.3	Marking of machinery	See the marking on the machine.	P
1.7.4	Instruction		P
1.7.4.1	General principles for the drafting of instructions	See the instruction	P
1.7.4.2	Contents of the instructions	See the instruction	P
1.7.4.3	Sales literature	The same as instruction	P
2	**SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR CERTAIN CATEGORIES OF MACHINERY**	Not such machine	N
2.1.	**FOODSTUFFS MACHINERY AND MACHINERY FOR COSMETICS OR PHARMACEUTICAL PRODUCTS**		N
2.2	**PORTABLE HAND-HELD AND/OR HAND-GUIDED MACHINERY**		N
2.3	**MACHINERY FOR WORKING WOOD AND MATERIAL WITH SIMILAR PHYSICAL CHARACTERISTICS**		N
3	**Essential health and safety requirement to offset the particular hazards due to the mobility machinery**	Not mobility machine	N
3.1	**General**		N
3.1.1	Definition		N
3.2	**Work positions**		N
3.2.1	Driving position		N
3.2.2	Seating		N
3.2.3	Positions for other persons		N
3.3	**Controls**		N
3.3.1	Control devices		N
3.3.2	Starting/moving		N
3.3.3	Travelling function		N
3.3.4	Movement of pedestrian-controlled machinery		N
3.3.5	Control circuit failure		N
3.4	**Protection against mechanical hazards**		N
3.4.1	Uncontrolled moverments		N
3.4.2	Moving transmission parts		N
3.4.3	Roll-over and tip-over		N
3.4.4	Falling objects		N
3.4.5	Means of access		N
3.4.6	Towing devices		N
3.4.7	Transmission of power between self-propelled machinery (or tractor) and recipient machinery		N

Council Directive 2006/42/EC, Annex I			
Clause	Requirement-Test	Result-Remark	Verdict
3.5	**Protection against other hazards**		N
3.5.1	Batteries		N
3.5.2	Fire		N
3.5.3	Emissions of hazardous substances		N
3.6	**Indications**		N
3.6.1	Signs, signals and warnings		N
3.6.2	Marking		N
3.6.3	Instruction handbook		N
3.6.3.1	Vibrations		N
3.6.3.2	Multiple uses		N
4	**Essential health and safety requirement to offset the particular hazards due to a lifting operation**		N
4.1	**General**		N
4.1.1	Definition		N
4.1.2	Protection against mechanical hazards		N
4.1.2.1	Risk due to lack of stability		N
4.1.2.2	Machinery running on guide rails and rail tracks		N
4.1.2.3	Mechanical strength		N
4.1.2.4	Pulleys, drums, wheels, chains or ropes		N
4.1.2.5	Lifting accessories and their components		N
4.1.2.6	Control of movements		N
4.1.2.7	Movements of loads during handling		N
4.1.2.8	Machinery serving fixed landings		N
4.1.2.8.1	Movements of the carrier		N
4.1.2.8.2	Access to the carrier		N
4.1.2.8.3	Risks due to contact with the moving carrier		N
4.1.2.8.4	Risk due to the load falling off the carrier		N
4.1.2.8.5	Landings		N
4.1.3	Fitness for purpose		N
4.2	**Requirements for machinery whose power source is other than manual effort**		N
4.2.1	Control of movements		N
4.2.2	Loading control		N
4.2.3	Installation guided by cables		N
4.3	**Information and markings**		N
4.3.1	Chains, ropes and webbing		N
4.3.2	Lifting accessories		N
4.3.3	Lifting machinery		N
4.4	**Instructions**		N
4.4.1	Lifting accessories		N
4.4.2	Lifting machinery		N
5	**Essential health and safety requirement for machinery intended for underground work**	Not such machine	N
5.1	**Risks due to lack of stability**		N

Council Directive 2006/42/EC, Annex I			
Clause	Requirement-Test	Result-Remark	Verdict
5.2	**Movement**		N
5.3	**Control devices**		N
5.4	**Stopping**		N
5.5	**Fire**		N
5.6	**Exhaust emissions**		N
6	**Essential health and safety requirement to offset the particular hazards due to the lifting or moving of persons**		N
6.1	**General**		N
6.1.1	Mechanical strength		N
6.1.2	Loading control for machinery moved by power other than human strength		N
6.2	**Control devices**		N
6.3	**Risk to persons in or on the carrier**		N
6.3.1	Risks due to movements of the carrier		N
6.3.2	Risk of persons falling from the carrier		N
6.3.3	Risk due to objects falling on the carrier		N
6.4	**Machinery serving fixed landings**		N
6.4.1	Risks to persons in or on the carrier		N
6.4.2	Controls at landings		N
6.4.3	Access to the carrier		N
6.5	**Markings**		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
1	**Scope**		
	This part of EN 60204 applies to the application of electrical and electronic equipment and systems to machines not portable by hand while working. Including a group of machines working higher level system aspects		**P**
	This part is applicable to the electrical equipment or parts of the electrical equipment that operate with nominal supply voltages not exceeding 1000V for alternating current and not exceeding 1500V for direct current, and with nominal frequencies not exceeding 200Hz		P
2	**Normative references**		**-**
3	**Definitions**		**-**
4	**General requirements**		**P**
4.1	The risks associated with the hazards relevant to the electrical equipment shall be assess as part of the overall requirements for risk assessment of the machine		P
4.2	Selection of equipment		P
	Electrical components and devices shall be suitable for their intended use and shall conform to relevant IEC standards where such exist		P
4.3	Electrical supply		P
4.3.1	Electrical equipment to be designed for correct operation with conditions of mains power supply		P
4.3.2	Supply Voltage:		P
	Frequency:		P
	Harmonics:		P
	Voltage unbalance:		P
	Voltage interruption:		P
	Voltage dips:		P
4.3.3	DC Supplies Voltage:		N
	Voltage interruption		N
	Ripple (peak-peak):		N
4.3.4	Onboard power supply acc. to cl. 4.3.2 and 4.3.3		N
4.4	Physical environment and operating conditions		P
4.4.1	Electrical equipment to be suitable for use in physical environment and operating conditions		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
4.4.2	Electromagnetic compatibility (EMC)		N
	Equipment not to generate electromagnetic disturbances above harmful levels: (applicable EMC-standard: EN 50081-2)		N
	Equipment has adequate level of immunity to EMC: (applicable EMC-standards: EN 50082-2)		N
4.4.3	Electrical equipment to be capable for correct operation at intended ambient air temperature		P
4.4.4	Electrical equipment to be capable for correct operation at specified relative humidity: at and		P
4.4.5	Electrical equipment capable of operating correctly at altitudes up to 1000 m above m.s.l.		P
4.4.6	Electrical equipment shall be adequately protected against ingress of solid properties and liquids		P
4.4.7	Ionizing and non-ionizing radiation Electrical equipment subject to radiation, additional measures to be taken to avoid equipment malfunction		N
4.4.8	Undesirable effects of vibration, shock and bump avoided		P
4.5	Transportation and storage		P
	-2.5 ◦ C to + 55 ◦ C And short periods not exceeding 24 h at up to + 70 ◦ C		P
4.6	Provisions for handling		P
	Heavy and bulky equipment shall be moved by cranes or similar equipment		P
4.7	Installation and operation		P
	According to supplier’s instructions		P
5	**Incoming supply conductors terminations and devices for disconnecting and switching off**		**P**
5.1	Incoming supply conductor terminations		P
	Single or multiple power supply		P
	The supply conductors are terminated at the supply disconnection device if not, the separate terminals shall be provided		P
	If a neutral conductor is used, it shall be indicated clearly in the technical documentation		P
	No connection between the protective bonding circuit and the neutral conductor		P
	All terminals for the incoming supply connection		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	shall be identified clearly		
5.2	Terminal for connection to the external protective earthing system		P
	Shall be in the vicinity of the associated phase conductor terminals		P
	Cross-sectional area of the external protective copper conductor according to table 1		P
	Marking of the external protective conductor with the letters “PE”		P
	Other protective terminals shall be marked with the symbol ⏚		P
	All protective terminals shall be coloured by use of the bicolor combination Green-And-Yellow		P
5.3	Supply disconnecting (isolating) device		P
5.3.1	General		-
	Shall disconnect (isolate) the electrical equipment of the machine from supply when required		P
	If two or more supply disconnecting devices are provided, protective interlocks shall be used		P
5.3.2	Type		-
	1. Switch-disconnector according to en60947-3 2. A disconnector with auxiliary contact 3. Circuit breaker according to EN 60947-2 4. any other switching device in accordance with an IEC product standard 5. a plug/socket combination for a flexible cable supply.	c).	P
5.3.3	Requirements		P
	Have one OFF and one ON position only		P
	Marked clearly with “I” and “O”		P
	Have a reset(tripped) position between “O” and “I”		N
	Have an external operating means		N
	The handle should be Black or Grey		P
	Could be locked in the OFF position		P
	Disconnect all live conductors of its power supply circuit		P
	Sufficient breaking capacity		P
5.3.4	Operating handle		-
	Shall be easily accessible and located:0.6 m~1.9 m		P
5.3.5	Excepted circuits		-
	Following circuits not disconnect by supply disconnecting device:		-
	Lighting circuits during maintenance or repair		P
	Plug/socket outlets exclusively used for		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	maintenance or repair		
	Undervoltage protection circuits used for automatic tripping only at power supply failures		N
	Circuits of equipment to remain normally energised for satisfactory operation		N
	Control circuits for interlocking purposes		N
	Circuits which are not disconnected by supply disconnecting device:		-
	Permanent warning labels placed in proximity of supply disconnectors		N
	Appropriate remark in maintenance manual		N
	Warning label in proximity of circuit concerned		N
	or wiring separated from other wiring		N
	Wiring of safety interlocking circuits installed with different colour of insulation.		N
5.4	Devices for switching off for prevention of unexpected start-up		P
	Means shall be provided to prevent inadvertent and / or mistaken closure of the disconnecting device		P
	Such devices appropriate and convenient for intended use		P
	Suitable placed		P
	Readily identifiable		P
	Disconnecting devices acc. to cl. 5.3.2 used:		P
	Other disconnecting devices for the following situations only:		-
	- no significant dismantling of the machine		N
	- adjustments requiring a relatively short time		N
	No work at the electrical equipment of the machine except:		-
	- no hazard arising of electric shock or burn		N
	- switched-off status cannot be released due to maintenance work		N
	- work of minor nature		N
5.5	Devices provided for disconnecting electrical equipment		P
	Supply-disconnecting device used		P
	Disconnecting device provided for each separated		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	part of the machine or partial machine where necessary		
	Disconnectors, fuse links etc. used only in enclosed electrical operating areas		P
	Such disconnecting devices appropriate and convenient for intended use and		P
	Suitably located and		P
	readily identifiable to which part it serves and		P
5.6	Provided with adequate means to prevent unauthorised, inadvertent and /or mistaken closing		P
	Devices acc. to cl. 5.4 and 5.5 provided with locking means		P
	Other means of protection against unintended energising used for non-lockable disconnecting devices (for electrical operating areas only)		P
	Locking device not necessary for plug/ socket outlet combinations, if located in a suitable manner and under immediate supervision of the person carrying out the work		N
6	**Protection against electric shock**		**P**
6.1	General	See the relevant clauses.	P
6.2	Protection against direct contact		P
6.2.1	General		-
	Either 6.2.2 or 6.2.3 and, where applicable, 6.2.4 shall be applied		P
	When the equipment is located in places open to all persons, measures of either 6.2.3 or 6.2.2 with a min. degree of protection against direct contact corresponding to IP4X or IPXXD shall be applied		N
6.2.2	Protection by enclosures		P
	Min protection degree for live parts: IP2X or IPXXB		P
	Min. protection degree for top surface:IP4X or IPXXD		P
	Opening an enclosure shall only be possible under one of the following conditions:		-
a)	The use of a key or tool is necessary by skilled or instructed persons		P
	Min. protection degree for live parts on the inside of doors:IP1X or IPXXA		P
	live parts likely to be touched during resetting or		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	adjustment with protection degree IP2X or IPXXB		
b)	The disconnection of live parts inside the enclosure before the enclosure may be opened (Use of the supply disconnecting device)		N
	at door interlocking safety circuit, door will open only when main isolator is in open position		N
	For skilled persons a special device provided, to defeat interlocking circuit under following conditions:		
	Special device or tool provided to permit skilled persons to defeat the interlock provided that:		
	- opening of disconnector possible at all times while interlock is defeated		N
	- upon closing the door, interlock is automatically restored		N
	If more than one door allows access to live parts, care must be taken, at implementation of this subclause		N
	All parts remaining live after switching off mains supply to be protected against direct contact with at least IP2X or IPXXB		N
	Such parts marked with warning symbol acc. to cl.17.2		N
	Excepted from this requirement for marking are:		
	- Parts that can be live only due to connection to interlocking circuits, distinguished by colour as potentially live acc. to cl. 14.2.4		N
	- Terminals of supply disconnecting device when latter mounted alone in a separate enclosure		N
c)	Opening without the use of a key or a tool and without disconnection of live parts shall be possible only when the min. protection degree is IP2X or IPXXB		N
6.2.3	Protection by insulation of live parts		P
	Live parts shall be covered by insulation which can only be removed by destruction		P
	Such insulation shall withstand the mechanical, chemical, electrical and thermal stresses under normal service conditions		P
6.2.4	Protection against residual voltages		P
	After disconnecting, any exposed conductive part		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	having a residual voltage that shall be discharged to 60V or less within 5 seconds		
	where pins of plugs or similar devices after withdrawal are exposed, discharge time = 1s		N
	such conductors protected against direct contact by at least IP2X or IPXXB		N
	if above requirements cannot be achieved, additional disconnecting devices or appropriate warning devices shall be applied. (see cl. 13.8.4)		N
6.2.5	Protection by barriers		-
	For protection by barriers, see 412.2 of IEC 60364-4-41		N
6.2.6	Protection by placing out of reach or protection by obstacles	-	-
	For protection by placing out of reach see 412.4 of IEC 60364-4-41		N
	For protection by obstacles see 412.3 of IEC 60364-4-41		N
	For collector wire systems or collector bar systems with a degree of protection less than IP2X see 13.8.1		N
6.3	Protection against indirect contact		P
6.3.1	General		-
	For each circuit or part, at least one of the measures in accordance with 6.3.2 to 6.3.3 shall be applied	See the following descriptions.	P
6.3.2	Measure to prevent the occurrence of a hazardous touch voltage		P
6.3.2.1	General		-
6.3.2.2	use of class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation acc. to EN 60536)		N
	use of switchgear and control gear assemblies with total insulation acc. to EN 60439-1		P
	application of supplementary or reinforced insulation acc. to EN 60364-4-41, 413.2		N
6.3.2.3	Electrical separation of an individual circuit to prevent hazardous touch voltage acc. to EN 60364-4-41, cl. 413.5		P
6.3.3	Protection by automatic disconnection of supply		N
	a) Use of protective device for automatic cut-off in the event of an insulation failure in a TN – or TT-system		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	b) Use of earth fault detection device to initiate automatic disconnection in an IT-System.		N
	initiation of warning signal only in case of first occurrence of a fault permitted		N
6.4	Protection by the use of PELV		P
6.4.1	General requirements		-
	a) nominal voltage not to exceed 25 AC (r.m.s.) or 60 DC (ripple-free) or	DC24V	P
	6VAC or 15VDC for all other cases		N
	b) one side of PELV- circuit or one point of source of supply to be connected to PE- circuit		N
	c) live parts of PELV- circuits to be electrically separated from other live circuits.		N
	Electrical separation equal as required for safety isolating transformers (see IEC 60742)		N
	d) conductors of each PELV circuit to be physically separated from those of any other circuit.		N
	If not practicable, insulation provisions acc. to cl. 14.1.3 shall be applied		
	e) plugs and socket outlets for PELV- circuits shall conform to following requirements:		
	plugs shall not be able to enter socket outlets of other voltage systems		N
	socket outlets shall not admit plugs of other voltage systems		N
6.4.2	Sources for PELV		P
	safety isolating transformers		P
	source of current providing a degree of safety, equivalent to safety isolating transformers		P
	electrochemical or other source, independent of circuit with higher voltage		P
	electronic power supply conforming to appropriate standards		P
7	**Protection of equipment**		**P**
7.1	General		-
7.2	Over current protection		P
7.2.1	Overcurrent protection device provided		P
7.2.2	Supply conductors		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	The supplier is not responsible for providing the over current device for the supply conductors		P
	Installation diagram with data necessary for selection of the over current protective device		P
7.2.3	Power circuits		P
	All conductors shall be protected against over current (except earthed neutral conductor)		P
	Cross-section area of neutral conductor		P
	For neutral earth conductors with cross sections smaller than phase conductors, measures acc. to item b, cl 473.3.2.1 of IEC 60364-4-473 will apply		N
	For IT-systems use of neutral earth conductor (N) is not recommended. Nevertheless if an N-conductor is used, measures acc. to cl. 473.3.2.2 of IEC 60364-4-473 shall apply.		N
7.2.4	Control circuits		P
	Conductors of control circuits directly connected to supply voltage and circuits feeding control voltage transformers protected against overcurrent acc. to cl. 7.2.3		P
	Control circuits fed via transformers of which one end of secondary winding is connected to PE circuit, will require overcurrent protective device only in the other secondary conductor		N
7.2.5	Socket outlets and their associated conductors		N
	Overcurrent protection devices for socket outlets provided for non-earthed live conductors of each circuit feeding such socket outlets		N
7.2.6	Lighting circuits		N
	All unearthed conductors of local lighting circuits protected by overcurrent protective devices		N
7.2.7	Transformers		P
	Transformers shall be protected against overcurrent in accordance with the manufacturer’s instructions	Circuit breaker used	P
	Avoid unnecessary tripping due to overcurrent caused by magnetizing inrush currents		P
	Avoid temperature rise of transformer winding in excess of its permitted of its insulation class of transformer in case of short circuit at secondary terminals		P
	Type and setting of overcurrent protective device acc. to recommendations of transformer		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	manufacturer		
7.2.8	Location of over current protective device		P
	Overcurrent protective device located at point where conductor is connected to the supply		P
	Current carrying capacity of conductors at least equal to that required for electrical load		P
	Each connecting conductor to overcurrent protective devices not longer than 3 meters		P
	Conductor protected by enclosure or duct		P
7.2.9	Over current protective devices		P
	Rated short-circuit breaking capacity at least equal to prospective fault current at point of installation		P
	Current other than those coming from supply side taken into account		P
	Reduced breaking capacity is permitted, where another protective device is installed at supply side with the necessary breaking capacity		P
	Back-up protection carefully checked, no destruction of conductor or overcurrent protective device may result		P
	Co-ordination with other protective devices in circuit required		N
	Overcurrent protective devices in power circuits include fuses and circuit breakers. Electronic current limiting devices may also be used in protected circuits		P
7.2.10	Rating and setting of over current protective devices		P
	Rated current of fuses or overcurrent setting of other protective devices selected as low as possible, but adequate for anticipated overcurrents.		P
	Settings of overcurrent protective devices appropriately listed in technical documentation		P
7.3	Overload protection of motors		P
	Overload protection for all motors provided for ratings of > 0.5 kW in continuous operation.		P
	Protective device may be omitted for motors which cannot be overloaded		P
	Overload protection achieved by current sensing or limiting devices or temperature sensors.		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	Current overload detection provided for each live conductor except for neutral conductor		P
	For motors supplied by single phase AC or DC power supply, current detection in one non-earthed live conductor only is permitted		N
	If overload protection is achieved by switching-off device, all live conductors cut from power supply except neutral conductor		P
	For special duty motors, appropriate protective devices are recommended		N
	For motors where cooling can be impaired, a built-in thermal protection is recommended		N
	Automatic restarting of motors prevented after operation of overload protective device, to avoid cause of a hazardous condition		P
7.4	Abnormal temperature protection		P
	Resistance heating or similar devices which cause excessive heat, equipped with suitable overtemperature detection		P
7.5	Protection against supply interruption or voltage reduction and subsequent restoration		N
	Undervoltage protection provided for applications where loss of supply or undervoltage causes a hazardous condition		N
	If interruption or reduction of supply voltage is allowed for a short period of time, delayed undervoltage protection provided.		N
	Undervoltage protection not impair any stopping control of the machine		N
	Upon restoration of supply voltage, automatic or unexpected restarting of machine prevented		N
	Undervoltage protection to initiate appropriate control responses to ensure co-ordination the groups of machines working together		N
7.6	Motor over speed protection		P
	Overspeed protection provided where overspeeding causes a hazardous condition		P
	Overspeed protection initiates appropriate control response and prevents automatic restarting		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
7.7	Earth fault/residual current protection		N
	To reduce damage to equipment due to earth fault currents below detection level, earth fault/residual protect used		N
	Detection level for earth fault protection set as low as possible		N
7.8	Phase sequence protection		N
	Where an incorrect sequence of the supply voltage can cause a hazardous condition or damage to the machine, protection shall be provided		N
7.9	Protection against over voltage due to lighting and to switching surges		P
	Protective devices for the suppression of overvoltages caused by lightning strikes or switching surges provided		P
	Devices for suppression of overvoltages due to lightning, connected at incoming terminals of the supply disconnecting device		P
	Devices for suppression of overvoltages due to switching surges connected across terminals of all equipment requiring such protection		P
8	**Equipotential bonding**		**P**
8.1	General		-
8.2	Protective bonding circuit		P
8.2.1	General		-
	On mobile machines with on-board power supplies, it shall be connected to a protective bonding terminal to provide protection against electric shock		N
	When a mobile machine is also capable of being connected to an external incoming supply, the protective bonding terminal shall be the connection point for the external protective conductor		N
	All parts of the protective bonding circuit shall be so designed that they are capable of withstanding the highest thermal and mechanical stresses		P
	Any structural part of the electrical equipment or of the machine may be used as part of protective bonding circuit		P
	If an IT distribution system is used, the machine structure shall be sued as part of the protective bonding circuit in conjunction with an earth fault supervision system		N
8.2.2	Protective conductors		P
	Protective conductors shall be identified according		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	to 14.2.2		
	Copper conductors should be used		P
	Where a conductors 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 not be less than 16 mm2 in cross-sectional area		N
	The cross-sectional area of protective conductors shall be determined according to the requirements of: -543 of IEC 60364-5-54; or -7.4.3.1.7 of IEC 60439-1, as appropriate		P
	Relationship between cross-section area of phase conductor and PE acc. to table 1		P
8.2.3	Continuity of the protective bonding circuit		P
	All exposed conductive parts shall be connected to the protective bonding circuit		P
	In case of removal of parts of PE system, remaining parts not to be interrupted		P
	Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influence		P
	Particular consideration should be given if enclosure consists of aluminium and its alloys		P
	Metal ducts of flexible or rigid construction and metallic cable sheathes shall not be used as protective bonding conductors		P
	Where the electrical equipment is mounted on lids, doors, or cover plates, continuity of the protective bonding circuit shall be ensured and it is recommended that a protective conductor is used		N
	Continuity of protective conductor ensured at cables which are exposed to damage		N
8.2.4	Exclusion of switching devices from the protective bonding circuit		P
	Protective bonding circuit not incorporate a switching-/overcurrent protective device nor a means for current detection		P
	Interruption of protective conductors permitted by links, intended to be opened by instructed/skilled persons for test or measurement purposes by using a tool		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
8.2.5	Parts that need not to be connected to the protective bonding circuit		P
	Parts which cannot be touched on large surfaces or grasped by hand due to its small size (less than approx. 50 x 50 mm), small parts such as screws, rivets, nameplates or		P
	are located in such way, that either contact with live parts or an insulation failure is unlikely		P
8.2.6	Protective conductor connecting points		P
	All protective conductors shall be terminated in accordance with 14.1.1		P
	Shall have no other function and shall not be used to attach or connect appliances or parts		P
	Use of earthing symbol ⏚		P
	By the bicolor combination GREEN-AND-YELLOW		P
8.3	Functional bonding		P
	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.	See the following descriptions.	P
	For recommendations regarding functional bonding to avoid maloperation due to electromagnetic disturbances, see 4.4.2.		P
8.4	Measures to limit the effects of high leakage current		N
	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.		N
9	**Control circuits and control functions**		**P**
9.1	Control circuits		P
9.1.1	Control circuit supply		P
	Transformers shall be used for supplying the control circuits		P
	If several transformers used, secondary voltages in phase		N
	DC- control circuits connected to PE circuit supplied from a separate winding of the control circuit transformer or supplied from another control circuit transformer		N
	Transformers not mandatory for machines with a single motor starter and maximum of two control devices		N
9.1.2	Control circuit voltages		P
	The nominal voltage shall not exceed 277 V when		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	supplied from a transformer		
9.1.3	Protection		P
	Over current protection shall be provided according to 7.2.4 and 7.2.10		P
9.2	Control functions		P
9.2.1	Start functions		P
	Start functions shall operate by energizing the relevant circuit		P
9.2.2	Stop functions		P
	Category 0: Stopping by immediate removal of power to machine actuators		P
	Category 1: A controlled stop with power available to machine actuators. Then removal of power when stop condition has been achieved.		P
	Category 2: A controlled stop with power left available to machine actuators		N
9.2.3	Operating modes		P
	When hazardous conditions can arise from mode selection, such selection shall be prevented by suitable means.		N
	Mode selection by itself shall not initiate machine operation (A separate action by the operator shall be required)		P
	Safeguarding shall remain effective for all operating modes		P
	Indication of the selected operating mode shall be provided		P
9.2.4	Suspension of safety functions and/or protective measures		P
	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		P
	-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 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		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	station;		
	-a cableless control station with a device to initiate stop functions in accordance with 9.2.7.3 and, where appropriate, an enabling device.		N
	-limitation of the speed or the power of motion;		N
	-limitation of the range of motion.		N
9.2.5	Operation		P
9.2.5.1	General		P
	The necessary interlocks (see 9.3) shall be provided for safe operation		P
	Measures shall be taken to prevent movement of the machine in an unintended manner after any stopping of the machine		P
9.2.5.2	Start		P
	The start of an operation shall be possible only when all the safeguards are in place and functional (except described in 9.2.4)		P
	Hold-to-run control shall be used for the others machines, as appropriate		N
	Suitable interlocks shall be provided to secure correct sequential starting		N
	The use of more than one control station to initiate a start		P
9.2.5.3	Stop		P
	Category 0, category 1 and/or category 2 stops shall be provided where indicated by the risk assessment and the functional requirements of the machines		P
	Stop functions shall override related start functions		P
	Facilities provided for connection of protective devices / interlocks		P
	If such protective device/ interlock causes a machine stop, it may be necessary to send such condition to the logic of the control system (PLC)		P
	Resetting of stop function must not initiate any hazardous condition		P
9.2.5.4	Emergency operations (emergency stop, emergency switching off)		P
9.2.5.4.1	General		-
9.2.5.4.2	Emergency stop		P
	Shall function either as a category 0 stop or as a category 1 stop		P
	The choice of the emergency stop shall be determined by the risk assessment of the machine		P
	Where a category 0 stop is used for emergency stop		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	function, it shall have only hard-wired electromechanical components		
	Emergency stop has priority over all other functions and over all modes of operation		P
	Power to machine actuators that can cause hazardous condition(s) removed as quickly as possible without creating other hazards		P
	Resetting must not initiate a restart		P
9.2.5.4.3	Emergency switching off	-	
	Functional aspects of emergency switching-off function are given in IEC 60364-4-46 and should be provided where:		N
	Protection against direct contact is achieved only by placing out of reach or by obstacles		N
	There is the possibility of other hazards or damage by electricity		N
	Emergency switching-off is accomplished by disconnecting incoming supply of the machine, effecting in a category 0 stop		N
	When a machine cannot tolerate a category 0 stop, other means of protection is to be provided so that emergency switching-off is not necessary		N
9.2.5.5	Monitoring of command actions		-
	Movement or action of a machine or parts of it, that can result in a hazardous condition be monitored		P
	On manually controlled machines, operators to provide some monitoring		P
	Conditions expected to be unreasonable for monitoring by the operator, require means to monitor such conditions		P
9.2.6	Other control functions		N
9.2.6.1	Hold-to-run controls		N
	Hold-to run controls shall require continuous actuation of the control devices to achieve operation		N
9.2.6.2	Two-hand control		N
	Three types of two-hand control are available, the selection of which is determined by the assessment		N
9.2.6.3	Enabling device		N
	It shall be designed to allow motion when actuated in one position only (In any other position motion		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	shall be stopped)		
9.2.6.4	Combined start and stop controls		N
	Push-buttons and similar devices that, when operated, alternately initiate and stop motion shall only be used for functions which cannot result in a hazardous condition		N
9.2.7	Cableless control		N
9.2.7.1	General		N
	Means shall be provided to readily remove or disconnect the power supply of the operator control station		N
	Means shall be provided, as necessary, to prevent unauthorized use of the operator control station		N
	Each operator control station shall carry an unambiguous indication of which machine is intended to be controlled by that operator control station		N
9.2.7.2	Control limitation		N
	Measures shall be taken to prevent the machine from responding to signals other than those from the intended operator control station		N
	Where necessary, means shall be provided so that the machine can only be controlled from operator control station in one or more predetermined zones or locations		N
9.2.7.3	Stop		N
	Operator control stations shall include a separate and clearly identifiable means to initiate the stop function of the machine or of all the motions that can cause a hazardous condition		N
	The actuating means to initiate this stop function shall not be marked or labeled as an emergency stop device		N
	A machine which is equipped wit cableless control shall have a means of automatically initiating the stopping of the machine and of preventing a potentially hazardous operation		N
9.2.7.4	Use of more than one operator control station		N
	Where a machine has more than one operator control station, measures shall be taken to ensure that only one control station can be enabled at a given time		N
	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		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	the machine		
9.2.7.5	Battery-powered operator control stations		N
	A variation in the battery voltage shall not cause a hazardous condition		N
	If one or more potentially hazardous motions are controlled using a battery-powered operator control station, a clear warning shall be given to the operator when a variation in battery voltage exceeds specified limits		N
	Under those circumstances, the operator control station shall remain functional long enough to put the machine into a non-hazardous condition		N
9.3	**Protective interlocks**		**P**
9.3.1	Reclosing or resetting of an interlocking safeguard		P
	The reclosing or resetting of an interlocking safeguard shall not initiate machine motion or operation		P
9.3.2	Exceeding operating limits		P
	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.		P
9.3.3	Operation of auxiliary functions		N
	The correct operation of auxiliary functions shall be checked by appropriate devices		N
	Use of appropriate interlocking		N
9.3.4	Interlocks between different operations and for contrary motions		P
	Interlocks of contactors, relays, etc. between different operations and for opposite motions, interlocks against such incorrect operation provided		P
	Reversing contactors interlocked in such way, that in normal service no short circuit occurs during switching operation		N
	Where, for safety or for continuous operation, certain functions on the machine are required to be interrelated, proper co-ordination ensured by suitable interlocks		N
	For a group of machines working together in a co-ordinated manner and having more than one controller, provisions made for co-ordination of this controller		N
	If a failure of a mechanical brake actuator can result		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	that the brake, is applied when the associated machine actuator is energised and a hazardous condition results, interlocks be provided to switch off the machine actuator		
9.3.5	Reverse current braking		N
	Reverse current braking on a motor, effective measures taken to avoid motor starting in opposite direction at end of breaking where that reversal causes a hazardous condition, damage to the machine or to the process		N
	Control circuits arranged so, that rotation of a motor shaft, not to result in a hazardous condition		N
9.4	Control functions in the event of failure		P
9.4.1	General requirements		P
	Measures to reduce those risks include but are not limited to:		-
	protective devices on the machine, (e.g. interlocking guards, trip devices)		P
	protective interlocking of electrical circuit	Not used	N
	use of proven circuit techniques and components (see cl. 9.4.2.)		P
	provision of partial or complete redundancy (see cl. 9.4.2.2) or diversity (see cl. 9.4.2.3)		N
	provision for functional tests (see cl. 9.4.2.4)		P
	single failures only are to be considered		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.		N
	Means shall be provided to prevent unauthorized or inadvertent memory alteration by, for example, requiring the use of a key, access code or tool.		P
9.4.2	Measures to minimize risk in the event of failure		P
9.4.2.1	Use of proven circuit techniques and components		P
	bonding of control circuits to protective circuit for operational purposes (see cl. 9.4.3.1)		P
	connection of control devices in accordance with cl. 9.1.4		P
	stopping by de-energising (see cl. 9.2.2)		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	switching of all live conductors to device being controlled (see cl. 9.4.3.1)		P
	use of switching devices having positive (or direct) opening operation (see IEC 60947-5-1)		P
	circuit design to reduce possibility of failures causing undesirable operations		P
9.4.2.2	Provisions of partial or complete redundancy		N
	off-line redundancy for protective functions, effective only when operating function fails		N
	where off-line redundancy is use, suitable measures taken, to ensure that those control circuits are available when required		N
	on-line redundancy for normal operation		N
9.4.2.3	Provision of diversity		N
	Use of control circuits having different principles of operation or using different types of devices may reduce faults and failures. Examples include:		-
	Combination of normally open and normally closed contacts operated by interlocking guards		N
	Use of different types of circuit components in control circuit		P
	Combination of electromechanical and electronic circuits in redundant configurations		N
	Combination of electrical and non-electrical systems (e.g. mechanical, hydraulic, pneumatic) may perform redundant functions and provide diversity		N
9.4.2.4	Provision for functional tests		P
	Automatic functional test carried out by the control system		P
	Manual function tests by inspection		P
	Tests at start-up and at predetermined intervals or as a		P
	Combination as appropriate (see cl.17.2 and 18.6)		P
9.4.3	Protection against maloperation due to earth faults, voltage interruptions and loss of circuit continuity		P
9.4.3.1	Earth faults		P
	Earth faults on any control circuit causes no		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	unintentional starting, potentially hazardous motions or prevent stopping of machine		
	For fulfilment of this requirement, bonding to PE-circuit provided and correct connection of devices ensured		P
	Control circuits fed from transformer and not connected to PE- circuit provided with an insulation monitoring device		N
	Multi-pole control switches which interrupt all live conductors use for START or STOP functions, which could cause hazardous condition or damage to the machine, in the event of unintentional starting or failure to stop.		N
9.4.3.2	Voltage interruptions		P
	Where a memory device is used, proper functioning in the event of power failure shall be ensured to prevent any loss of memory that can result in a hazardous condition		P
9.4.3.3	Loss of circuit continuity		N
	Where the loss of continuity of safety-related control circuits depending upon sliding contacts can result in hazardous condition, appropriate measures shall be taken		N
10	**Operator interface and machine-mounted control devices**		**P**
10.1	General		P
10.1.1	General device requirements		P
	As far as is practicable, those devices shall be selected, mounted, and identified or coded according to IEC 60073and IEC 60447		P
10.1.2	Location and mounting		P
	Machine-mounted control devices readily accessible for service and maintenance and		P
	Mounted to minimize possibility of damage from activities such as material handling		P
	Actuators of hand-operated control devices selected and installed as follows:		
	Mounted not less than 0.6 m above servicing level, and within easy reach for operator (normal working position)		P
	Placed so that operator is not exposed to a hazardous situation when operating them		P
	Possibility of inadvertent operation is minimised		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
10.1.3	Protection		P
	Degree of protection sufficient for expected use against:		-
	Effects of aggressive liquids, vapours or gases in environment of machine		P
	Ingress of contaminants		P
	Operator interface control devices have a minimum degree of protection against direct contact of IPXXD		P
10.1.4	Position sensors		P
	Position sensors shall not be damaged in the event of over travel		P
	Position sensors used in circuits with safety-related functions shall have positive opening operation or shall provide similar reliability		P
10.1.5	Portable and pendant control stations		N
	Portable and pendant 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		N
10.2	Push-buttons		P
10.2.1	Colors	-	
	Push-button actuators shall be color -coded according to table 2		P
10.2.2	Markings		P
	Recommendation that pushbuttons are preferably marked directly on actuator with symbols acc. to table 3		P
10.3	Indicator lights and displays		P
10.3.1	Colours for indication lights: RED, YELLOW, GREEN, BLUE Colours for confirmation: GREEN and WHITE		P
10.3.2	Colors		P
	Color-coded according to table 4 (Unless otherwise agree between the supplier and the user)		P
10.3.3	Flashing lights and displays		N
	Flashing lights for further information may be used for following purposes:		-
	to attract attention or		N
	to request immediate action or		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	to indicate a discrepancy between command and actual state or		N
	to indicate a change in process (flashing during transition)		N
	higher frequency of flashing lights (pulse/pause ratios) recommended for higher priority of information		N
10.4	Illuminated push-buttons		N
	Illuminated push-button actuators colour-coded acc. to tables 2 and 4		N
	WHITE colour shall be use, if it is difficult in assigning an appropriate colour		N
	RED colour shall be use, for emergency stop actuators, not depending upon illumination conditions (ON /OFF status) only		N
10.5	Rotary control devices		P
	Devices having a rotational member shall be mounted to prevent rotation of the stationary member (Friction alone shall not be sufficient)		P
10.6	Start devices		P
	Start devices use to initiate start functions or movement of machine or elements designed and mounted such as to minimize inadvertent operation		P
	Mushroom - type actuators use for two-hand control devices		N
10.7	Devices for emergency stop		P
10.7.1	Location		P
	Devices for emergency stop shall be readily accessible	It is 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		P
10.7.2	Types		P
	Use of type • a push-button operated switch • a pull-cord operated switch • a pedal-operated switch without a mechanical guard		P
	Shall be of the self-latching type and shall have positive opening operation		P
10.7.3	Colour of actuators		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	Actuators of emergency stop devices are coloured RED		P
	Background immediately around actuator is coloured YELLOW		P
10.7.4	Local operation of the supply disconnecting device to effect emergency switching off		N
	Supply disconnecting device may be locally operated to serve as function of emergency stop when:		-
	it is readily accessible to operator		N
	it is of type described in cl. 5.3.2 a), b) or c)		N
	Supply disconnecting device shall meet colour requirements of cl. 10.7.4		N
10.8	Emergency switching off devices		N
10.8.1	Location of emergency switching-off devices normally placed separate from operator control station		N
	Operator control station equipped with separate emergency stop device, since function effects a category 0 emergency stop		N
10.8.2	Types of emergency switching-off devices include: Push-button operated switch or		N
	Pull-cord operated switch		N
	Devices of self-latching type and ensure positive (or direct) opening operation		N
	Push-button operated switch in break-glass enclosure		N
10.8.3	Actuators of emergency switching-off devices are coloured RED		N
	Background immediately around actuator (push-button) coloured YELLOW		N
	Actuators of push-button operated emergency switching-off devices be of palm- or mushroom-head type		N
10.8.4	When supply disconnecting device is locally operated for emergency switching-off, it shall be readily accessible		N
	Supply disconnecting device locally operated for		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	emergency switching-off, shall meet colour requirement acc. to cl. 10.8.3.		
10.9	Enabling control device		N
	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.		N
11	**Control gear: location, mounting, and enclosures**		**P**
11.1	General requirements		P
	All control gear located and mounted so, as to cover the following points: facilitate accessibility and maintain ability	Accessilbe and able	P
	facilitate protection against external influences or operating conditions under which operation is intended		P
	facilitate easy access for operation and maintenance of the machine and its associated equipment		P
11.2	Location and mounting		P
11.2.1	Accessibility and maintenance		P
	all control-gear components placed and oriented so, that identification is possible without moving them or the associated wiring		P
	Components checked for correct operation or possible replacement without dismantling other equipment or parts of the machine		P
	Terminals not associated with control gear also to conform to this requirement		P
	Operation and maintenance of all control gear possible from front of cabinet		P
	Special tools for removal of electronic devices provided with the equipment		P
	Access for regular maintenance or adjustment to equipment, relevant devices located between 0.4m to 2.0 m above servicing level		P
	Terminals located at least 0.2 m above servicing level and placed such, that conductors and cables can be easily connected		P
	No devices mounted on doors, except those for operating, indicating, measuring and cooling purposes on normally removable access-covers of		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	enclosure		
	Plug-in type control devices belonging functionally together, their association made clear by type (shape), marking or reference designation single or in combination (see cl. 14.4.5)		N
	Plug-in type control devices, that are handled during normal operation, shall be designed with non-interchangeable characteristics, where lack of such facility can result in malfunctioning		N
	Use of plug/socket combinations shall be unobstructed access		
	Plug/socket combinations, handled during normal operation, shall be located and mounted so as to provide unobstructed access		N
	If test points are provided, they should be:		
	mounted so as to provide unobstructed access		N
	clearly marked to correspond with the documentation (see cl. 18.3)		N
	adequately insulated		N
11.2.2	Physical separation or grouping		P
	Non-electrical parts and devices, not directly associated with the electrical equipment, not located within enclosures containing control gear		P
	Devices such as solenoid valves separated from other electrical equipment		P
	Control devices mounted at same location and connected to the main supply voltage, or to both main supply and control voltage, are grouped separately from those connected to control voltage only		P
	Terminals separated into groups for: power circuits or		P
	associated control circuits or		P
	other control circuits, fed from external sources		N
	Terminal groups mounted adjacently, providing that each group is readily identified		P
	When arranging the location of devices, clearances and creepage distances specified for them shall be maintained, taking into account external influences		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	or physical conditions of its environment		
11.2.3	Heating effects		P
	Heat generating components shall be located so that the temperature of each component in the cicinity remains within the permitted limit		P
11.3	Degrees of protection		P
	Protection of control gear against ingress of solid foreign objects and liquids shall be adequate. External influences under which the equipment is intended to operate is to be taken into account and is to be		P
	Its protection sufficient against dust, coolants and swarf		P
	Enclosures of control gear provide a degree of protection of at least IP22		P
	Exceptions:		
	a) Where an electrical operating area is use as a protective enclosure for an appropriate degree of protection against ingress of solid bodies and liquids		N
	b) Where removable collectors on collector bar systems are use, and IP22 is not achieved but measures of cl. 6.2.5 are applied		N
11.4	Enclosures, doors and openings		P
	Enclosures to withstand mechanical, electrical and thermal stress as well as effects of humidity during normal service		P
	Fasteners for doors or covers of captive type		P
	Windows for viewing internally mounted indicating devices, made of material suitable to withstand mechanical stress and chemical attack		N
	Doors of enclosure not wider than 0,9 meter		P
	Doors with vertical hinges		P
	Doors with opening angle of at least 95 °		P
	Gaskets of doors, lids, covers and enclosures withstand the chemical effects of aggressive liquids, vapours or gases use on the machine		P
	Means use to maintain degree of protection of an enclosure of doors, lids and covers that require opening or removed for operational or maintenance shall:		-

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	be securely attached to either door, cover or enclosure		P
	not deteriorate due to removal or replacement of door or cover and so impair degree of protection		P
	all openings in enclosure closed by supplier(s), ensuring degree of protection specified for equipment		P
	openings for cable entries at enclosure to be easily re-opened on site		P
	suitable opening in base of enclosure within the machine provided, as to enable drainage of moisture due to condensation		P
	no opening between enclosure containing electrical equipment and compartment containing coolant, lubricating or hydraulic fluids		P
	holes in enclosure for mounting purposes not impair required degree of protection		P
	If equipment could attain a surface temperature sufficient to cause a risk of fire during normal or abnormal operation:		-
	located within an enclosure, that can withstand, without risk of fire or harmful effect, the heat emitted by the equipment or		N
	mounted and located at sufficient distance from adjacent equipment, so as to allow safe dissipation of heat or		N
	otherwise screened by material that can withstand, without risk of fire or harmful effect, the heat emitted by the equipment		N
11.5	Access to control gear	-	
	Minimum dimensions of doors and corridors for access to electrical operating areas: at least 0.7 meter wide and 2.0 meter high		P
	Doors open outwards		P
	Doors equipped with means to allow opening from inside without the use of a key or tool		N
12	**Conductors and cables**		**P**
12.1	General requirements		P
	Conductors and cables selected so as to be suitable for operating conditions and external influences that		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	are existing		
	Requirements not applicable for integral wiring of assemblies, subassemblies and devices that are manufactured and tested acc. to their relevant standard		P
12.2	Conductors		P
	Conductors shall be of copper		P
	Conductors of any other material shall have a nominal cross-sectional area such that, carrying the same current, the max. temperature shall not exceed the value given in table 5		P
	If aluminium is used, the cross-sectional area shall be at least 16mm^2		P
	All conductors that are subject to frequent movement shall have flexible stranding of class 5 or class 6 (see table C.4)		P
12.3	Insulation		P
	Types of insulation include: Polyvinyl chloride (PVC)		P
	Rubber, natural and synthetic		N
	Silicone rubber (SiR)		N
	Mineral		N
	Cross-linked Polyethylene (XLPE)		N
	Ethylene Propylene Rubber compound (EPR)		N
	Poly-Tetra-Fluor-Ethylene (PTFE)		N
	Where insulation of conductors or cables can constitute hazards due to propagation of fire or emission of toxic/ corrosive fumes, guidance from cable supplier to be sought		N
	Special attention to integrity of a circuit having a safety-related function		N
	Dielectric strength of insulation adequate for required test voltage with a min. of 2000VAC for cables operating with voltages >50V AC or >120 VDC		P
	For separate PELV circuits, dielectric strength adequate for test voltage of 500VAC for a duration of 5 minutes		N
	Mechanical strength and thickness of insulation		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	such that, insulation cannot be damaged during cable laying or in operation		
12.4	Current-carrying capacity in normal service		P
	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.		P
	Current-carrying capacities for PVC insulated wiring between enclosures and individual items of equipment under steady-state conditions according to values given in table 6		P
12.5	Conductor and cable voltage drop		P
	The voltage drop for conductors and cables shall not exceed 5% of the nominal voltage		P
12.6	Flexible cables		P
12.6.1	General		P
	Flexible cables shall have class 5 or class 6 conductors	class 5	P
	cables exposed to severe duties shall be of adequate construction to protect against:		-
	abrasion due to mechanical handling and dragging across rough surfaces		P
	kinking to operation without cable guides		P
	stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums		P
12.6.2	Mechanical rating		P
	Cable handling system of machine designed such, as to keep tensile stress of conductors as low as practicable during machine operation		P
	tensile stress for copper conductors not to exceed 15 N/mm^2 of copper cross section area		P
	where tensile stress of conductors is exceeding 15 N/mm^2 , cables of special design are use		N
	maximum stress for flexible cables agreed with the cable manufacturer		P
12.6.3	Current-carry capacity of cables wound on drums		N
	Cables wound on drums selected such, as the maximum allowable conductor temperature is not exceeded		N
	cables for circular cross-section area, installed on		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	drums, max. current-currying capacity in free air as declared acc. to table 7		
12.7	Collector wires, collector bars and slip-ring assemblies		P
12.7.1	Protection against direct contact		P
	They shall be installed or enclosed in such way, that during normal access to the machine, protection against direct contact is achieved by application by one of the following protective measures:		-
	protection by partial insulation of live parts		P
	protection by enclosure or barriers provide a degree of protection of at least IP2X		P
	horizontal top surfaces of barriers or enclosures which are readily accessible provide a degree of protection of at least IP4X		P
	if required degree of protection is not achieved, protection by placing live parts out of reach in combination with emergency switching-off acc. to cl. 9.2.5.4.3 applied		N
	collector wires and bares placed such and / or protected as to prevent contact, especially for unprotected wires and bars, with conductive items such as, cords of pull-cord switches, strain-relief devices and drive chains and		P
	prevent damage from a swinging load		P
12.7.2	Protective conductor circuit		P
	Where collector wires, collector bars and slip-ring assemblies are installed as part of the protective bonding circuit(PE), they shall not carry current in normal operation		P
	The continuity of the protective conductor circuit using sliding contacts shall e ensured by taking appropriate measures	Not use sliding contacts	N
12.7.3	Protective conductor current collectors		N
	Protective conductors of current collectors have a shape or are designed such, so that they are not interchangeable with other current collectors of the sliding contact type		N
12.7.4	Removable current collectors with a disconnect function		N
	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		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	any live conductor is reconnected		
12.7.5	Clearance in air		P
	Clearances between respective conductors and between adjacent systems of collector wires, bars, slip-ring assemblies and their current collectors designed for operation in pollution degree III conditions		P
12.7.6	Creepage distances		P
	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.		P
	In abnormally dusty, moist or corrosive environments, following creepage distances apply:		
	for unprotected collector wires, bars and slip-ring assemblies equipped with insulators, the minimum creepage distance is 60 mm		N
	for enclosed collector wires, insulated multipole collector bars and insulated individual collector bars, the minimum creepage distance is 30 mm		N
	gradual reduction of insulation values due to unfavourable ambient conditions regarded		N
12.7.7	Conductor system sectioning		P
	Suitable design measures taken, in order to prevent energisation of adjacent sections by current collectors themselves		P
12.7.8	Construction and installation of collector wire, collector bar systems and slip-ring assemblies		P
	Collector wires, collector bar systems and slip-ring assemblies use for power circuits kept separately from those use for control circuit applications		P
	above systems capable of withstanding without damage to mechanical forces and thermal effects of short circuit currents		P
	removable covers to above systems, laid underground or under floor, designed that they cannot be opened by one person without the use of a tool		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	collector bars which are installed in a common metal enclosure, the individual section of it bonded together and earthed at several points depending upon their length		P
	Metal covers of collector bars laid underground or under floor, bonded together end earthed		N
	Underground and under floor collector bar ducts have drainage facilities		N
13	**Wiring practices**		**P**
13.1	Connections and routing		P
13.1.1	General requirements		P
	All connections shall be secured against accidental loosening	Fixed by screws	P
	The means of connection shall be suitable for the cross-sectional areas and neutral of the conductors being terminated		P
	The connection of two or more conductors to one terminal is permitted (only when the terminal is designed for that purpose)		P
	One protective bonding circuit conductor shall be connected to one terminal connecting point		P
	Soldered connections shall only be permitted if terminals are suitable for soldering		N
	Terminals on terminal blocks shall be plainly identified to correspond with markings on the diagrams		P
	The installation of flexible conduits and cables shall be such that liquids shall drain away from the fittings		N
	Means to retain stranded conductors together when terminating conductors at terminals/ devices provided		P
	Solder not use for that purpose		N
	Shielded conductors terminated so, as to prevent fraying of strands and to permit easy disconnection		N
	Identification tags shall be legible, permanent, and appropriate for the physical environment		P
	Terminal blocks shall be so mounted and wired, that the internal and external wiring does not cross over the terminals		P
13.1.2	Conductor and cable runs		P
	Shall be run from terminal to terminal without		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	splices or joints		
	If it is necessary to connect and disconnect cables assemblies, a sufficient extra length shall be provided		P
	The terminations of cables shall be adequately supported to prevent mechanical stresses at the terminations of the conductors		P
	The protective conductor shall be placed close to the associated live conductors in order to decrease the impedance of the loop.		P
13.1.3	Conductors of different circuits		P
	Conductors of different circuits laid side by side and occupy the same duct or be in same multiconductor cable, provided that such arrangement does not impair proper functioning of respective circuits		P
	Where circuits operate at different voltage levels, conductors separated by suitable barriers or insulated for maximum voltage to which any conductor within the same duct is subjected		P
13.1.4	Connection between pick-up and pick-up converter of an inductive power supply system		P
	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		P
13.2.1	General requirements		P
	Conductors shall be identifiable at each termination according to the technical documentation (see clause 17)		P
	Conductors are identified by number, alphanumeric, colour (either solid or with one or more stripes), or a combination of colour and numbers or alphanumeric.		P
	When numbers are used, they shall be Arabic; letters shall be Roman (either upper or lower case).		P
13.2.2	Identification of the protective conductor		P
	Shall be really distinguishable by shape, location, marking or color		P
	When identification is by color alone, the bicolor combination GREEN-AND YELLOW shall be used		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	For the bicolor combination GREEN-AND YELLOW : one of the color covers at least 30% and not more than 70% of the surface of the conductor, the other color covering the remainder of the surface		P
	Use of graphical symbol ⏚		P
13.2.3	Identification of the neutral conductor		N
	The color shall be Light Blue		N
	LIGHT BLUE must not be use for identification of any other conductor where confusion is possible		N
	Where bare conductors are use as neutral conductors and identification by colour is use, they either be coloured by LIGHT BLUE stripes, 15 to 100 mm wide in each compartment or unit, or at each accessible position		N
	Bare conductor colour coloured LIGHT BLUE over its full length		N
13.2.4	Identification by colour		P
	Identification of other conductors by colour, number, alphanumeric or a combination of colour and numbers or alphanumeric		P
	When numbers are use, they are in Arabic writing ; letters are in Roman characters		P
13.3	Wiring inside enclosures		P
	Panel wiring supported where necessary to keep it in place		P
	Non-metallic ducts permitted only when they are of flame-retardant insulating material		N
	Electrical equipment mounted inside cabinets, designed to permit modification of wiring from front of cabinet (see cl. 11.2.1)		P
	Where that is not possible, access, doors or swing out panels provided		P
	Connections to devices mounted on doors or to other movable parts made with flexible conductors (acc. to cl.13.2) to allow for frequent movement of those parts		N
	Conductors be anchored to the fixed part and the movable part, independently of the electrical		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	connection		
	Conductors and cables that do not run in ducts are adequately supported		P
	Terminal blocks or plug /socket combinations use for control wiring, that extends beyond the enclosure		P
	Power cables and cables for measuring-circuits are directly connected to terminals of field located devices		P
13.4	Wiring outside enclosures		P
13.4.1	General requirements		P
	The protection degree shall be ensured when cables or ducts are introduced into the enclosure		P
13.4.2	External ducts		-
	Shall be enclosed in suitable ducts as described in 13.5 except for suitably protected cables		P
	Exempt from above requirements are suitably protected cables, installed without ducts and with or without use of open cable trays or cable supporting means		N
	Fittings used with ducts or multiconductor cable shall be suitable for the physical environment		P
	Flexible conduction or flexible multiconductor cable shall be used where it is necessary to employ flexible connections to pendant push-button stations		N
	The weight of the pendant stations shall be supported by means other that the flexible conduit or the flexible multiconductor cable		N
	Flexible conduit or flexible multiconductor cable shall be used for connections involving small or infrequent movements		N
13.4.3	Connection to moving elements of the machine		N
	Connection to frequently moving parts shall be made using conductors according to 12.2 and 12.6		N
	Flexible cable and flexible conduit shall be so installed as to avoid excess flexing and strainging, particularity t the fittings		N
	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		N
	If the requirement mentioned above is achieved by using of a loop, it shall have sufficient length to provide for a bending radius of the cable of at least		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	10 times the diameter of the cable		
	Flexible cables of machines installed or protected in such way, as to minimise the possibility of external damage due to factors, that include the following cable use or potential abuse:		N
	being runned over by the machine itself		N
	being runned over by vehicles or other machines		N
	coming into contact with the machine structure during movements		N
	running in and out of cable baskets or, on / off cable drums		N
	acceleration and wind forces on festoon systems or suspended cables		N
	excessive rubbing by cable collector		N
	exposure to excessive radiated heat		N
	Cable sheath resistant to normal wear expected from normal movement and effects of atmospheric contaminants		N
	If cables subject to movement are close to moving parts, it shall have a space of at least 25 mm between the moving parts and the cables		N
	Where the distance mentioned above is not practicable, fixed barriers shall be provided between the cables and the moving parts		N
	The cable handing system shall be so designed that the lateral cable angles do no exceed 5°, avoiding torsion in the cable		N
	Measures shall be taken to ensure that at least two turns of flexible cables always remain on a drum		N
	Min. permitted bending radii for the forced guiding of flexible cables shall not less than the values given in table 8		N
	The strength section between section between two bends in an S-shaped length or a bend into another plane shall be at least 20 times the diameter of the cable		N
	Where flexible conduit is adjacent to moving parts, the construction and supporting means shall prevent damage to the flexile conduit under all conditions of operation		N
13.4.4	Interconnection of devices on the machine		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	The connections shall be conveniently placed, adequately protected, and shown on the relevant diagrams		P
	Intermediate terminals are adequately protected		P
	Intermediate terminals are indicated on the wiring diagram		P
	This enables easy access for testing purposes		P
13.4.5	Plug/socket combinations		N
	Where plug/socket combinations are provided, they shall fulfil one or more of the following requirements as applicable:		N
	a) When installed correctly in accordance with f), plug/socket combinations shall be of such a type as to prevent unintentional contact with live parts at any time, including during insertion or removal of the connectors. The degree of protection shall be at least IPXXB. PELV circuits are excepted from this requirement.		N
	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
	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
	d) Plug/socket combinations that are rated at more than 16 A shall have a retaining means to prevent unintended or accidental disconnection.		N
	e) Where an unintended or accidental disconnection of plug/socket combinations can cause a hazardous situation, they shall have a retaining means.		N
	The installation of plug/socket combinations shall fulfil the following requirements as applicable:		N
	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
	g) Metallic housings of plug/socket combinations shall be connected to the protective bonding circuit.		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	PELV circuits are excepted from this requirement.		
	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
	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
	j) Plug/socket combinations used in control circuits shall fulfil the applicable requirements of IEC 61984. Exception: see item k).		N
	k) Plug/socket combinations intended for household and similar general purposes shall not be used for control circuits. In plug/socket combinations in accordance with IEC 60309-1, only those contacts shall be used for control circuits which are intended for those purposes.		N
13.4.6	Dismantling for shipment		P
	If wiring needs to be disconnected for shipment, terminals or plug/socket combinations are provided at the disconnecting points		P
13.4.7	Additional conductors		P
	Consideration should be given to providing additional conductors for maintenance or repair. Spare conductors shall be connected to spare terminals or isolated to prevent contact with live parts.		P
13.5	Ducts, connection boxes and other boxes		P
13.5.1	General requirements		P
	Min. protection degree for ducts: IP 33		P
	All sharp edges, flash, burrs, rough surfaces or threads which the insulation of conductors may come into contact, removed from ducts and conduits		P
	In order to avoid confusion between conduits for electrical installation and those for oil, water or air, either physically separated or suitably identified		P
	Ducts or cable trays rigidly supported and positioned at sufficient distance from moving parts		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	Ducts or cable trays mounted at least 2 meters above the working surface in areas where human passage is required		N
	Ducts provided only for mechanical protection (see cl. 8.2.3)		P
	Cable trays which are partially covered, not to serve as cable trays or installation trunking		N
	Conductors and cables suitable for installation in cable trays		P
13.5.2	Percentage fill of ducts		P
	The dimensions and arrangement of the ducts be such as to facilitate the insertion of the conductors and cables		P
13.5.3	Rigid metal conduit and fittings		N
	Shall be of galvanized steel or of a corrosion-resistant material		N
	Conduits shall be securely held in place and supported at each end		N
	Fitting shall be threaded		N
	Where threadless fittings are used, the conduit shall be securely fastened to the equipment		N
	The conduit shall not be damage and the internal diameter of the conduit shall not e effectively reduced when it is bent		N
13.5.4	Flexible metal conduit and fittings		N
	Flexible metallic conduits and fittings consist of flexible metal tubing or wire mesh armour.		N
	They are suitable for its application and environmental conditions		N
13.5.5	Flexible non-metal conduit and fittings		P
	Flexible non-metallic conduits are resistant to buckling and with similar characteristics as the sheath of multicore cables		P
	They shall be suitable for its application and environmental conditions		P
	Joints and fittings compatible with conduits and appropriate for its application		P
13.5.6	Cable trunking systems		N
	Shall be rigidly supported and clear of all moving or contaminating portions of the machine		

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	Covers shall be shaped to overlap the sides; gasket shall be permitted		N
	Covers shall be attached to cable trunking systems gy hinges or chain and held closed by means of captive screws or other suitable fasteners		N
	On horizontal cable trunking systems, the cover shall not be on the bottom		N
	Where the cable trunking system is furnished in sections, the joints between sections shall fit tightly but need not be gasketed		N
	The only openings permitted shall be those required for wiring or for drainage		N
	Cable trunking systems shall not have opened but unused knockouts		N
13.5.7	Machines compartments and cable trunking systems		N
	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
13.5.8	Connection boxes and other boxes		P
	Cable connection boxes and junction boxes use for wiring purposes are readily accessible for maintenance (see cl. 11.3)		P
	They provide protection against ingress of solids or liquids, taking into account external influences during operation of the machine (see cl. 11.3)		P
	Junction boxes not have openings for cable entries and are designed so, as to avoid ingress of entrained dust, lubricants and coolant		N
13.5.9	Motor connection boxes		P
	Shall enclose only connections to the motor and motor-mounted devices		P
14	**Electric motors and associated equipment**		**P**
14.1	General requirements		P
	Electric motor should conform to the requirements of IEC 60034-1		P
	Electric motors and associated equipment protected		-

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	against following risks:		
	overcurrent (see cl. 7.2)		P
	thermal overload (see cl. 7.3)		P
	overspeed (see cl. 7.6)		N
	Compliance ensured with the requirements stated (see clauses 5.3, 5.4, 5.5, 7.5, 7.6 and 9.4)		P
	Motor control equipment shall be located and mounted according to clause 11		P
14.2	Motor enclosures		P
	Selection of motor enclosure recommended acc. to EN 60034-5		P
	Degree of protection at least IP23		P
	Incorporated motors mounted such, as to provide adequate protection against mechanical damage		P
14.3	Motor dimensions		p
	Dimensions of motors conform to those given in IEC regulations (see EN 60072-1 and EN 60072-2)		P
14.4	Motor mounting and compartments		P
	Each motor with associated coupling, belt, pulley or chain mounted such, as to provide adequate protection and easy access for inspection, maintenance, adjustment or alignment, lubrication and replacement		P
	Motors mounted such, as to allow easy access to all terminal boxes		P
	Motors mounted such, as to ensure proper cooling Temperature rise to be within limits of relevant insulation class		P
	Temperature rise within limits of relevant insulation class		P
	If possible, motor compartments stay clean and dry and when required, ventilated directly to the outside of the machine		P
	Motor-vents at an acceptable level and designed such, as to avoid ingress of swarf, dust or water spray		P
	No opening between motor compartment and any		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	other compartment, which does not fulfil the requirement for motor compartments		
14.5	Criteria for motor selection		P
	Electric motors selected acc. to service and environmental conditions		P
	Design criteria for evaluation include: type of motor and		P
	type of duty cycle (see IEC 60034-1) and		P
	fixed speed or variable speed operation and		P
	mechanical vibrations and		P
	type of converter for motor speed control and		P
	influence of the harmonic spectrum of voltage and/or current when supplied from static converter on the temperature rise and		P
	method of starting and possible influence of inrush current		P
	variation of counter torque load with time and speed		P
	influence of loads with large inertia and		P
	influence of constant torque or constant power operation and		P
	possible need of inductive reactors between motor and converter		P
14.6	Protective devices for mechanical brakes		P
	Operation of overload or overcurrent protective devices for mechanical brake-actuators initiate simultaneous de-energisation(release) of associated machine actuators		P
15	**Accessories and lightning**		**N**
15.1	Accessories		N
	Where the machine or its associated equipment is provided with socket-outlets for auxiliary equipment, the following will apply:		N
	the socket-outlets should conform to IEC 60309-1.		N
	if not possible, they are clearly marked with voltage and current ratings		N
	continuity of protective bonding circuit to be ensured		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	all unearthed conductors connected to socket-outlets, protected against overcurrent		N
	when required, protection against overload in accordance with cl. 7.2 and cl. 7.3 separately from protection of other circuits		N
	if power supply to socket-outlets is not disconnected, than requirements of cl.5.3.5 apply		N
15.2	Local lighting of the machine and equipment		N
15.2.1	General		N
	Connections to the protective bonding circuit according to 8.2.2		N
	The ON-OFF switch shall not be incorporated in the lamp holder or in the flexible connecting cords		N
	Stroboscopic effects from lights shall be avoided		N
	Where fixed lighting is provided in an enclosure, electromagnetic compatibility should be taken into account using the principles outlined in 4.4.2.		N
15.2.2	Supply		N
	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
	Lighting circuits supplied from one of the following sources:		-
	from a dedicated isolating transformer connected to load side, overcurrent protection provided in secondary circuit or		N
	a dedicated isolating transformer connected to line side provided, source permitted for maintenance purpose. lighting circuits placed in control enclosures only, overcurrent protection provided in secondary circuit or		N
	from a machine-circuit with dedicated overcurrent protection or		N
	an isolating transformer connected to the line side of the supply disconnecting device, provided with a dedicated primary disconnecting means (see 5.3.5) and secondary overcurrent protection, and mounted within the control enclosure adjacent to the supply disconnecting device (see also 13.1.3);		N
	an externally supplied lighting circuit (for example factory lighting supply).		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
15.2.3	Protection		N
	Local lighting shall be protected according to 7.2.6		N
15.2.4	Fittings		N
	Adjustable lighting fittings shall be suitable for the physical environment		N
	The lamp holders shall be: ▮ According to the relevant IEC publication; ▮ Constructed with an insulating material protection the lamp cap so as to prevent unintended contact		N
	Reflectors shall be supported by a bracket and not by the lamp holder		N
16	**Marking, warning signs and reference designations**		**P**
16.1	General		P
	Warning signs, nameplates, markings, and identification plates of sufficient durability to withstand the physical environment involved		P
16.2	Warning signs		P
16.2.1	Electric shock hazard		P
	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: 		P
	The warning sign shall be plainly visible on the enclosure door or cover		P
	The warning sign may be omitted for:		-
	an enclosures equipped with a supply disconnecting device or		N
	an operator machine interface or for a control station or		P
	a single device with its own enclosure		N
16.2.2	Hot surfaces hazard		P
	Where the risk assessment shows the need to warn against the possibility of hazardous surface temperatures of the electrical equipment, the graphical symbol IEC 60417-5041 (DB:2002-10) shall be used. 		P
16.3	Functional identification		P
	Control devices, visual indicators and displays use for man - machine interfaces clearly and durably		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	marked with regard to their functions either on, or adjacent to it		
	such markings as agreed between user and supplier		P
	preference given to the use of standard symbols		P
16.4	Marking of equipment		P
	Equipment (for example controlgear assemblies) shall be legibly and durably marked in a way that is plainly visible after the equipment is installed.		P
	A nameplate giving the following information shall be attached to the enclosure adjacent to each incoming supply:		-
	name or trade mark of supplier;		P
	certification mark, when required;		P
	serial number, where applicable;		N
	rated voltage, number of phases and frequency (if a.c.), and full-load current for each supply;		P
	short-circuit rating of the equipment;		P
	main document number (see IEC 62023).		N
	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.		P
	Where only a single motor controller is used, that information may instead be provided on the machine nameplate where it is plainly visible.		P
16.5	Reference designations		
	All enclosures, assemblies, control devices, and components shall be plainly identified with the same reference designations as shown in the technical documentation		P
17	Technical documentation		P
17.1	General		P
	The information necessary for installation, operation, and maintenance of the electrical equipment of a machine shall be supplied in the form of drawings, diagrams, charts, tales and instructions		P
	The information shall be in an agreed language		P
	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.		P
17.2	Information to be provided		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	Information provided with 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 about the physical environment		
	4) Overview (block) diagram(s)		P
	5) Circuit / wiring diagram(s)		P
	6) information about:		
	- programming, as necessary for use of the equipment;		N
	- Sequence of operation(s)		P
	-Frequency of inspection		P
	-Frequency and method of functional testing		P
	-Guidance on the adjustment, maintenance and repair, particularly of the protective devices and circuits		P
	-recommended spare parts list; and		P
	-list of tools supplied.		P
	7) Description of safeguards, interlocking functions and interlocking of separating safeguards for dangerous movements of co-ordinated operating machines		P
	8) Description of safeguards and means provided for applications with to suspend the safeguards		P
	9) instructions on the procedures for securing the machine for safe maintenance; (see also 17.8);		P
	10) information on handling, transportation and storage;		
	11) information regarding load currents, peak starting currents and permitted voltage drops, as applicable;		P
	12) information on the residual risks due to the		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	protection measures adopted, indication of whether any particular training is required and specification of any necessary personal protective equipment.		
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;		P
	reference designations shall be in accordance with relevant parts of IEC 61346;		P
	instructions/manuals shall be in accordance with IEC 62079.		P
	parts lists where provided shall be in accordance with IEC 62027, class B.		P
	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		N
	-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		P
	-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
17.4	Installation documents		P
	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.		P
	The recommended position, type, and cross-sectional areas of the supply cables to be installed on site shall be clearly indicated.		P
	The data necessary for choosing the type, characteristics, rated currents, and setting of the overcurrent protective device(s) for the supply conductors to the electrical equipment of the machine shall be stated (see 7.2.2).		P
	Where necessary, the size, purpose, and location of any ducts in the foundation that are to be provided by the user shall be detailed (see Annex B).		N

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	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).		P
	Where necessary, the diagram shall indicate where space is required for the removal or servicing of the electrical equipment.		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.		P
	Where the electrical equipment is intended to be operated from more than one source of electrical supply, the interconnection diagram or table shall indicate the modifications or interconnections required for the use of each supply.		N
17.5	Overview diagrams and function diagrams		P
	Where it is necessary to facilitate the understanding of the principles of operation, an overview diagram shall be provided.		P
	An overview diagram symbolically represents the electrical equipment together with its functional interrelationships without necessarily showing all of the interconnections.		P
	Function diagrams may be provided as either part of, or in addition to, the overview diagram.		P
17.6	Circuit diagrams		P
	Circuit diagrams show the electrical circuits on the machine and its associated electrical equipment		P
	Any graphical symbol not shown in EN 60617 and EN 60417-1 must be separately shown and described on the wiring diagrams or supporting documents		P
	The symbols and identification of components consistent throughout all documents and on the machine		P
	Where appropriate, a diagram provided, showing the interface terminals and connections		P
	The diagram shows a reference to the detailed circuit diagram of each unit		P
	Switch symbols shown on the circuit diagrams with all supplies turned off and with the machine and its electrical equipment in normal starting condition		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	Conductors identified acc. to cl.13.2		P
	Characteristics relating to the function of the control device and components which are not evident from their symbolic representation, included on the diagrams adjacent to the symbol or referenced to a footnote		P
17.7	Operating manual		P
	Technical documentation containing an operating manual, outlining proper procedures for set-up and use of equipment		P
	Particular attention given to safety measures provided and the improper methods of operation, that are anticipated		P
	Detailed information provided on methods for equipment programming, program verification and additional safety procedures		N
17.8	Maintenance manual		P
	Technical documentation to contain a maintenance manual, detailing proper procedures for adjustment, servicing or preventive inspection and repair		P
	Recommendations regarding maintenance or service records are part of it		P
	Methods for the verification of proper operation provided		P
17.9	Parts list		P
	The spare parts list comprises as a minimum information for ordering of spares or replacement of parts which are required for preventive or corrective maintenance and recommended spares		P
18	**Verification**		**P**
18.1	General		
	This part of IEC 60204 gives general requirements for the electrical equipment of machines.		P
	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;		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	b) in case of protection against indirect contact by automatic disconnection, conditions for protection by automatic disconnection shall be verified according to 18.2;		P
	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
18.2	Verification of conditions for protection by automatic disconnection of supply		P
18.2.1	General		P
	The conditions for automatic disconnection of supply (see 6.3.3) shall be verified by tests.		P
	For TN-systems, those test methods are described in 18.2.2; their application for different conditions of supply are specified in 18.2.3.		N
	For TT and IT systems, see IEC 60364-6-61.		N
18.2.2	Test methods in TN-systems		N
18.2.3	Application of the test methods for TN-systems		N
18.3	Insulation resistance tests		P
	Insulation resistance measured with 500VDC between power circuit conductors and PE-circuit is to be =1.0 MΩ		P
	Insulation value must be = 1.0 MΩ		P
	Test made on individual sections of complete electrical installation		P
	For certain parts of the electrical equipment, a lower minimum insulation value is permitted, but not less than 50 kΩ		N
18.4	Voltage tests		P
	Test conditions : ▮ at least 1 second ■ test voltage is twice the raged supply voltage of the equipment or 1000 V, whichever is greater ▮ frequency of 50/60 Hz supplied from a transformer with a min. rating of 500 VA shall not breakdown		P
18.5	Protection against residual voltages		N
	Tests shall be preformed to ensure complacence with 6.2.4		N
18.6	Functional test		P
	The functions of electrical equipment shall be tested		P

EN ISO 12100:2010, EN 60204-1:2018, EN 1570-1:2011+A1:2014, EN 81-31:2010, EN 1493:2010, EN 81-41:2010, EN 280:2013+A1:201			
Clause	Requirement-Test	Result-Remark	Verdict
	(particularly those related to safety and safeguarding)		
18.7	Retesting		N
	Where a portion of the machine and its associated equipment is changed or modified, that portion shall ere verified and retested, as is appropriate		N