Technical Construction File

File No.: FTCF1027-MD/EMC

Type of Equipment:	**Forklift**
Model No.:	**LTY30, LTY35, LTY40, LTY50, LTY60, LTY70, LTY80, LTY100, LTY35H, LTY50H, LTP15, LTP20, LTP25, LTP30, LTP35, LTP40, LTP45, LTP50, LTP60, LTP70, LTP80, LTE10, LTE15, LTE20, LTE25, LTE30, LTE35, LTE40, LTE50, LDD10, LDD15, LDD20**
Issued Date:	**2023-10-29**
Brand Name/Trade mark:	**---**
Directive(S)	**Machinery Directive 2006/42/EC Electromagnetic Compatibility Directive 2014/30/EU**
standard(s):	**EN ISO 12100:2010, EN ISO 3691-1:2015/A1:2020,EN 1175:2020, EN 16307-1:2020,EN IEC 61000-6-4:2019, EN IEC 61000-6-2:2019**

CE

Presented by

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1. Risk assessment

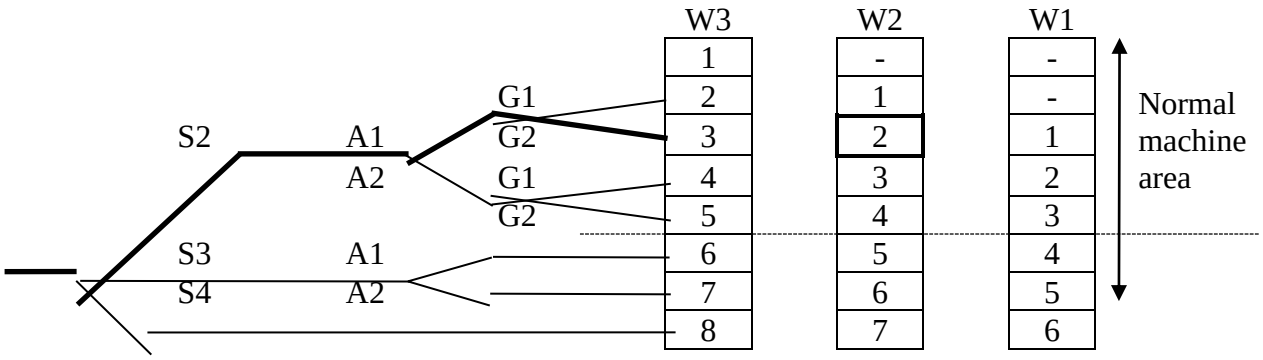
This risk assessment report is based on the methods in the EN ISO 12100:2010 and EN ISO 14121-2 standards, and the 4 factors S-A-G-W have been used for evaluating the level of risks.

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	***1***	***1***	***1***	***1***	**-**
1.2	Shearing					
1.3	Cutting or severing					
1.4	Entanglement	***1***	***1***	***1***	***1***	**-**
1.5	Drawing-in or trapping	***1***	***1***	***1***	***1***	**-**

1.6	Impact	***1***	***1***	***1***	***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***	***1***	***1***	***1***	***1***
2.2	Contact with parts which have become live under faulty conditions	***2***	***1***	***1***	***1***	***1***
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	***1***	***1***	***1***	***1***	**-**
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					
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					
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	***1***	***1***	***1***	***1***	**-**
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					
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					
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	***1***	***1***	***1***	***1***	**-**
Where	Near machine					
When	*loading/unloading,maintenance*					
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 guards.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.4	Entanglement	***1***	***1***	***1***	***1***	**-**
Where	Contact with roller of the machine					
When	*during operation, inspection and maintenance of machine*					
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 guards.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**

1.5	Drawing-in or trapping	***1***	***1***	***1***	***1***	**-**
Where	Contact with the conveyor of the machine					
When	*during operation, inspection and maintenance of machine*					
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 guards.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
1.6	Impact	***1***	***1***	***1***	***1***	**-**
Where	*moving/rotating tool*					
When	*during operation, inspection and maintenance of machine*					
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 guards.*		***1***	***1***	***1***	***1***	**-**

NO.	**Hazards source**	**S**	**A**	**G**	**W**	**Level**
2.1	Contact with live parts	***2***	***1***	***1***	***1***	***1***
Where	*contact with live parts or connections*					
When	*During commissioning,maintenance*					
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**
2.2	Contact with parts which have become live under faulty conditions	***2***	***1***	***1***	***1***	***1***
Where	*contact with live parts or connections*					
When	*during operation, inspection and maintenance of machine*					
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*		***1***	***1***	***1***	***1***	**-**

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.*					

NO.	Hazards source	S	A	G	W	Level
4.1	Hearing loss (deafness), other physiological disorders	***1***	***1***	***1***	***1***	**-**
Where	*Near machine*					
When	*during operation, inspection and maintenance of machine*					
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
4.2	Interference with speech communication, acoustic signals, etc.	***1***	***1***	***1***	***1***	**-**
Where	*Near machine*					
When	*during operation, inspection and maintenance of machine*					
Improvement result						
Method		**S**	**A**	**G**	**W**	**Level**
1. *Only operation by training/authorized persons.* *2.Use of warning label.* *3.Use the PPE.*		***1***	***1***	***1***	***1***	**-**

NO.	Hazards source	S	A	G	W	Level
8.6	Human error, human behavior	***1***	***1***	***1***	***1***	**-**
Where	*At load/unload, tool mounting positions*					
When	*Reasonably foreseeable misuse, inadvertent operation of controls, incorrect work material and cutter handling and setting during loading/ unloading, process control, tool handling.*					
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	*the control system of the machine*					
When	*Mechanical hazards associated with selected machine movement 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
14	Failure of the control circuit	***1***	***1***	***1***	***1***	**-**
Where	*In the wireway*					
When	*Unexpected movements of machine during setting, cleaning or maintenance*					
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
15	Errors of fitting	***1***	***1***	***1***	***1***	**-**
Where	*At machine*					
When	*machine elements fail or swing unexpectedly during process control, tool mounting, maintenance*					
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***	**-**

2. EN ISO 12100:2010 part 6-7

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
6	**Risk reduction**		**P**
6.1	General		P
	The objective of risk reduction can be achieved by the elimination of hazards, or by separately or simultaneously reducing each of the two elements that determine the associated risk: -severity of harm from the hazard under consideration; - probability of occurrence of that harm. All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2).	Appropriate machine design has been performed by the manufacturer	P
6.2	Inherently safe design measures		P
6.2.1	General		P
	Inherently safe design measures are the first and most important step in the risk reduction process because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding may fail or be violated and information for use may not be followed.	Appropriate machine design has been performed by the manufacturer.	P
	Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine. NOTE See 6.3 for safeguarding and complementary measures that can be used to achieve the risk reduction objectives in the case where inherently safe design measures are not sufficient (see 6.1 for the three-step method).	Appropriate machine design has been performed by the manufacturer.	P
6.2.2	Consideration of geometrical factors and physical aspects		P
6.2.2.1	Geometrical factors		P
	Such factors include the following.		
	a) The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position — reducing blind spots, for example — and choosing and locating means of indirect vision where necessary (mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the operator, for example:	Reducing blind spots	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	-the travelling and working area of mobile machines; -the zone of movement of lifted loads or of the carrier of machinery for lifting persons; -the area of contact of the tool of a hand-held or hand-guided machine with the material being worked. The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zones.		
	b) The form and the relative location of the mechanical components parts: for instance, crushing and shearing hazards are avoided by increasing the minimum gap between the moving parts, such that the part of the body under consideration can enter the gap safely, or by reducing the gap so that no part of the body can enter it (see ISO 13854 and ISO 13857).	By increasing the minimum gap between the moving parts or by reducing the gap.	P
	c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can "trap" parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed, and open ends of tubes which can cause a "trap" shall be capped.	No sharp edges, no sharp angles, no rough surfaces, no protruding parts.	P
	d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).	Suitable working position,accessible manual controls.	P
6.2.2.2	Physical aspects		P
	Such aspects include the following:		
	a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard;	The actuating force has been limited to be a sufficiently low value.	P
	b)limiting the mass and/or velocity of the movable elements, and hence their kinetic energy;	The mass of the tool has been limited.	P
	c) limiting the emissions by acting on the characteristics of the source using measures for reducing: 1) noise emission at source (see ISO/TR 11688-1), 2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for hand-held and hand-guided machinery, see CR 1030-1)], 3) the emission of hazardous substances, including the use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding), and 4) radiation emissions, including, for example, avoiding		P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	the use of hazardous radiation sources, limiting the power of radiation to the lowest level sufficient for the proper functioning of the machine, designing the source so that the beam is concentrated on the target, increasing the distance between the source and the operator or providing for remote operation of the machinery [measures for reducing emission of non-ionizing radiation are given in 6.3.4.5 (see also EN 12198-1 and EN 12198-3)].		
6.2.3	Taking into account the general technical knowledge regarding machine design		P
	This general technical knowledge can be derived from technical specifications for design (e.g. standards, design codes, calculation rules).These should be used to cover :		
	a) mechanical stresses such as - stress limitation by implementation of correct calculation, construction and fastening methods as regards, e.g. bolted assemblies, welded assemblies - stress limitation by overload prevention, (e.g. “fusible” plugs, pressure-limiting valve, breakage points, torque-limiting devices); - avoiding fatigue in elements under variable stresses (notably cyclic stresses); - static and dynamic balancing of rotating elements;	The appropriate technical knowledge of mechanical has been taken into account.	P
	b) materials and their properties such as - resistance to corrosion, ageing, abrasion and wear; - hardness, ductility, brittleness; - homogeneity; - toxicity; - flammability.	The materials have been treated by appropriate methods.	P
	c) emission values for : - noise; - vibration; - hazardous substances; - radiation.		P
	When the reliability of particular components or assemblies is critical for safety (e.g. ropes, chains, lifting accessories for lifting loads or persons), stress values shall be multiplied by appropriate working coefficients.	Appropriate working coefficients have been taken into account during design and calculation.	P
6.2.4	Choice of an appropriate technology		N
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certain		-

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	applications, e.g. :		
	a) on machines intended for use in explosive atmospheres: - fully pneumatic or hydraulic control system and machine actuators; - “intrinsically safe” electrical equipment (see IEC 60079-11)		N
	b) for particular products to be processed such as a solvent: equipment assuring that the temperature will remain far below the flash point.		N
	c) alternative equipment to avoid high noise level, e.g.: - electrical instead of pneumatic equipment - in certain conditions, water cutting instead of mechanical equipment.		N
6.2.5	Applying the principle of the positive mechanical action		P
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5-1 and ISO 14119).		P
6.2.6	Provisions for stability		P
	Machines shall be designed to have sufficient stability to allow them to be used safely in their specified conditions of use.	These machines have been designed to have sufficient stability .	P
	Factors to be taken into account include		-
	- geometry of the base;	The factor has been taken into account during design.	P
	- weight distribution, including loading;	The factor has been taken into account during design.	P
	- dynamic forces due to movements of parts of the machine, of the machine itself, or of elements held by the machine which may result in an overturning moment;	The factor has been taken into account during design.	P
	- vibration	The factor has been taken into account during design.	P
	- oscillations of the centre of gravity;	The factor has been taken into account during design	P
	- characteristics of the supporting surface in case of	The factor has been taken into account	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	traveling or installation on different sites (e.g. ground conditions, slope);	during design.	
	- external forces (e.g. wind pressure, manual forces)	The factor has been taken into account during design.	P
	Stability shall be considered in all phases of the life of the machine, including handling, traveling, installation, use, de-commissioning and dismantling.	The factor has been taken into account during design.	P
	Other protective measures for stability relevant to safeguarding are given in 6.3.2.6	Please see the related clause.	P
6.2.7	Provision for maintainability		P
	When designing a machine, the following maintainability factors shall be taken into account:		-
	- accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used;	These factors have been taken into account during design.	P
	- ease of handling, taking into account human capabilities;	The factor has been taken into account during design.	P
	- limitation of the number of special tools and equipment;	The factor has been taken into account during design.	P
6.2.8	Observing ergonomic principles		P
	Ergonomic principles shall be taken into account in designing machinery to reduce mental or physical stress and strain of the operator.	Appropriate ergonomic principles have been taken into account in designing machinery.	P
	These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design.	These principles have been taken into account during allocating functions to operator and machine.	P
	Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2)	All these factors have been taken into account during design.	P
	All elements of the “operator-machine” interface such as controls, signaling or data display elements, shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible.(see EN 614-1, ISO 6385, EN 13861	All arrangement and design of manual controls have been checked in compliance with.	P

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	and IEC 61310-1)		
	Designer’s attention is especially drawn to following ergonomic aspects of machine design		-
	a) Avoiding stressful postures and movements during use of the machine (e.g. by providing facilities to adjust the machine to suit the various operators).	Stressful postures and movements during use of the machine have been avoided.	P
	b) Designing machines, and more especially hand-held and mobile machines to enable them to be operated easily taking into account human effort, actuation of controls and hand, arm and leg anatomy.	This machine has been adjusted to the human strength and convenient movement.	P
	c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures.	This machine has been designed with low noise, vibration.	P
	d) Avoid linking the operator's working rhythm to an automatic succession of cycles.	This situation has been avoided.	P
	e) Select, locate and identify manual controls (actuators) so that		-
	- they are clearly visible and identifiable and appropriately marked where necessary (see6.4.4)	Clearly visible and appropriately marked	P
	- they can be safely operated without hesitation or loss of time and without ambiguity (e.g. a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation)	Standard layout of controls. See the photos.	P
	- their location(for push-buttons) and their movement (for levers and handwheels) are consistent with their effect (see IEC 61310-3)		P
	- their operation cannot cause additional risk		P
	Where a control is designed and constructed to perform several different actions, namely where there is no one-to-one correspondence (e.g. keyboards), the action to be performed shall be clearly displayed and subject to confirmation where necessary.	one-to-one correspondence	N
	Controls shall be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles.	Taking account of ergonomic principles	P
	Constraints due to the necessary or foreseeable use of personal protective equipment(such as footwear, gloves)shall be taken into account.		P
	f) Select, design and locate indicators, dials and visual display units so that		-

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	- they fit within the parameters and characteristics of human perception		P
	- information displayed can be detected, identified and interpreted conveniently, i.e. long lasting, distinct, unambiguous and understandable with respect to the operator's requirements and the intended use;	All the information displayed comply with this requirement.	P
	- the operator is able to perceive them form the control position		P
6.2.9	Preventing electrical hazard		P
	For the design of the electrical equipment of machines EN 60204-1 gives general provisions, especially in clause 6 for protection against electric shock.	See the test report of EN 60204-1	P
	For requirements related to specific machines, see corresponding IEC standards (e.g. series of IEC 61029, IEC 60745, IEC 60335).		N
6.2.10	Preventing and hydraulic hazards		N
	Pneumatic and hydraulic equipment of machinery shall be designed so that :		-
	- the maximum rated pressure cannot be exceeded in the circuits (e.g. by means of pressure limiting devices)		N
	- no hazard results from pressure surges or rises, pressure losses or drops or losses of vacuum;		N
	- no hazardous fluid jet or sudden hazardous movement of the hose (whiplash)results from leakage or component failures;		N
	- air receivers, air reservoirs or similar vessels (e.g. in gas loaded accumulators) comply with the design rules for these elements;		N
	- air elements of the equipment, and especially pipes and hoses, be protected against harmful external effects;		N
	- as far as possible, reservoirs and similar vessels (e.g. in gas loaded accumulators)are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if it is not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, clause 5)		N
	- all elements which remain under pressure after isolation of the machine from its power supply be provided with clearly identified exhaust devices, and a warning label drawing attention to the necessity of depressurizing those elements before any setting or		N

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	maintenance activity on the machine. See also ISO 4413 and ISO4414		
6.2.11	Applying inherently safe design measures to control system		P
6.2.11.1	General		P
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount of risk reduction (see ISO 13849-1 or IEC 62061)	Inherently safe design measures to control system have applied.	P
	The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behaviour.	Inherently safe design measures to control system have applied.	P
	Typical causes of hazardous machine behavior are :		-
	- an unsuitable design or modification (accidental or deliberate) of the control system logic;	No this kind of hazard in this machine	N
	- a temporary or permanent defect or a failure of one or several components of the control system;		N
	- a variation or a failure in the power supply of the control system;	No this kind of hazard in this machine	N
	- inappropriate selection, design and location of the control devices;	No this kind of hazard in this machine	N
	Typical examples of hazardous machine behaviour are :		-
	- unintended/unexpected start-up(see ISO 14118)	No this kind of hazard in this machine	N
	- uncontrolled speed change;	Speed monitor	N
	- failure to stop moving parts;	Emergency stop devices	N
	- dropping or ejection of a mobile part of the machine or of a workpiece clamped by the machine;		P
	- machine action resulting from inhibition (defeating or failure) of protective devices	No this kind of hazard in this machine	N
	In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause 6.2.11 and in 6.2.12.	See the related clause	P
	These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1 and EN 60204-1and IEC 62061).	See the test report of EN 60204-1	P
	Control systems shall be designed to enable the operator	The operator interact	P

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	to interact with the machine safely and easily; this requires one or several of the following solutions;	with the machine safely and easily.	
	- systematic analysis of start and stop conditions;	Systematic analysis have been applied.	P
	- provision for specific operating modes (e.g. start-up after normal stop, restart after cycle interruption or after emergency stop, removal of the workpieces contained in the machine, operation of a part of the machine in case of a failure of a machine element)	Enough provisions have been provided.	P
	- clear display of the faults;		P
	- measures to prevent accidental generation of unexpected start commands (e.g. shrouded start device) likely to cause dangerous machine behaviour (see ISO 14118:2000, figure 1)	Main switch with lock and related devices are provided.	P
	- maintained stop commands(e.g. interlock) to prevent restarting that could result in dangerous machine behaviour (see ISO 14118:2000, figure 1)	This requirement is complied with.	P
	An assembly of machines may be divided into several zones for emergency stopping, for stopping as a result of protective devices and/or for isolation and energy dissipation.		P
	The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone.		P
	Likewise it shall be obvious which control devices (e.g. emergency stop devices, supply disconnecting devices)and/or protective devices belong to which zone.		P
	The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention.		P
	Control systems shall be designed to limit the movements of parts of the machinery, the machine itself, or workpieces and/or loads held by the machinery, to the safe design parameters(e.g. range, speed, acceleration, deceleration, load capacity). Allowance shall be made for dynamic effects (e.g. the swinging of loads).	The max. speed	P
	For example:		-
	- the traveling speed of mobile pedestrian controlled machinery other than remote-controlled shall be compatible with walking speed.		N
	- the range, speed, acceleration and deceleration of movements of the person-carrier and carrying vehicle for		N

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	lifting persons shall be limited to non-hazardous values, taking into account the total reaction time of the operator and the machine.		
	- the range of movements of parts of machinery for lifting loads shall be kept within specified limits.		P
	When machinery is designed to use synchronously different elements which can also be used independently the control system shall be designed to prevent risks due to lack of synchronization.		N
6.2.11.2	Starting of internal power source/switching on an external power supply		P
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation. For example: -starting the internal combustion engine shall not lead to movement of a mobile machine; -connection to mains electricity supply shall not result in the starting of working parts of a machine. See EN 60204-1:2006, 7.5 (see also Annexes A and B).	Not result in the starting of working parts of a machine	P
6.2.11.3	Starting/stopping of a mechanism		P
	The primary action for starting or accelerating the movement of a mechanism should be performed by application or increase of voltage or fluid pressure, or, if binary logic elements are considered, by passage from state 0 to state 1(if state 1 represents the highest energy state)	This requirement has been taken into account during design.	P
	The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or, if binary logic elements are considered, by passage from state 1 to state 0 (if state 1 represents the highest energy state).	The type of stopping of this machine belongs to state 1 and state 0.	P
	When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (e.g. a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system	No such situation exist.	N
6.2.11.4	Restart after power interruption		P
	If it may generate a hazard, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (e.g. by use of a self-maintained relay, contactor or valve).	A self-maintained relay	P
6.2.11.5	Interruption of power supply		P
	Machinery shall be designed to prevent hazardous		P

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	situations resulting from interruption or excessive fluctuation of the power supply. At least the following requirements shall be met:		
	- the stopping function of the machinery shall remain;		P
	- all devices whose permanent operation is required for safety shall operation an effective way to maintain safety (e.g. locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery);		P
	- parts of machinery or workpieces and/or loads held by machinery which are liable to move as a result of potential energy shall be retained for the time necessary to allow them to be safely lowered.		N
6.2.11.6	Use of automatic monitoring		P
	Automatic monitoring is intended to ensure that a safety function(s) implemented by a protective measure do(es) not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed in such a way that hazards are generated.		P
	Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function.		P
	In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (e.g. the beginning of the machine cycle.) The protective measures may be , e.g.:		P
	- the stopping of the hazardous process;		P
	- preventing the re-start of this process after the first stop following the failure;		
	- the triggering of an alarm		N
6.2.11.7	Safety functions implemented by programmable electronic control systems		P
6.2.11.7.1	General		P
	A control system including programmable electronic equipment (e.g. programmable controllers) can be used to implement safety functions t machinery.		P
	Where a programmable electronic control system is used it is necessary to consider its performance requirements in relation to the requirements for the safety functions.		P
	The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic	Comply with the requirement	P

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	failures that can adversely affect the performance of the safety-related control function(s) are sufficiently low.		
	Where a programmable electronic control system performs a monitoring function, the system behaviour on detection of a fault shall be considered (see also IEC 61508 series for further guidance)		P
	The programmable electronic control system should be installed and validated to ensure that the specified performance (e.g. safety integrity level (SIL) in IEC 61508 series) for each safety function has been achieved.	Comply with the requirement	P
	Validation comprises testing an analysis (e.g. static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.		P
6.2.11.7.2	Hardware aspects		P
	The hardware (including e.g. sensors, actuators, logic solvers) shall be selected (and/or designed) and installed to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of :	Logic solvers	P
	- architectural constraints (e.g. the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault);		P
	- selecting (and/or designing) equipment and devices with an appropriate probability of dangerous random hardware failure;		P
	-Incorporating measures and techniques within the hardware to avoid systematic failures and control systematic faults.		P
6.2.11.7.3	Software aspects		P
	The software (including internal operating software (or system software) and application software) shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3)	Satisfy the performance specification for the safety functions	P
	Application software		-
	Application software should not be re-programmable by the user.		P
	This may be achieved by use of embedded software in a non re-programmable memory (e.g. micro-controller, application specific integrated circuit (ASIC)		N
	When the application requires reprogramming by the user, the access o the software dealing with safety functions should be restricted e.g. by : - locks; - passwords for the authorized persons		N

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6.2.11.8	Principles relating to manual control		P
	a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8	See the photo.	P
	b) A stop control device shall be placed near each start control device. Where the start/stop function is performed by means of a hold-to-run control, a separate stop control device shall be provided when a risk can result from the hold-to-run control device failing to deliver a stop command when released.	A stop control device has been placed near each start control device.	P
	c) Manual controls shall be located out of reach of the danger zones (see IEC 61310-3), except for certain controls where, of necessity, they are located within a danger zone, such as emergency stop or teach pendant.	Manual controls have been located out of reach of the danger zones.	P
	d) Whenever possible, control devices and control positions shall be located so that the operator is able to observe the working area or hazard zone.	The operator is able to observe the working area or hazard zone.	P
	The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions.	Not a ride-on mobile machine	N
	On machinery intended for lifting persons, controls for lifting and lowering and, if appropriate, for moving the carrier, shall generally be located in the carrier. If safe operation requires controls to be situated outside the carrier, the operator in the carrier shall be provided with the means of preventing hazardous movements.	Not for lifting persons.	N
	e) if it is possible to start the same hazardous element by means of several controls, the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means among others of a portable control unit (teach pendant, for instance), with which the operator may enter danger zones.	Only one control.	N
	f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1 and ISO 447)		P
	g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be taken to ensure the presence of the operator at the control position , e.g. by the design and location of control devices.		N
	h) For cableless control an automatic stop shall be performed when correct control signals are not received,		P

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	including loss of communication (see EN 60204-1)		
6.2.11.9	Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance		P
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to displaced or removed and/or a protective device has to be disabled, and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put in operation, safety of the operator shall be achieved using a specific control mode which simultaneously:		N
	- disables all other control modes;		N
	- permits operation of the hazardous elements only by continuous actuation of an enabling device, a hold-to-run control device or a two-hand control device;		N
	- permits operation of the hazardous elements only in reduced risk conditions (e.g. reduced speed, reduced power/force, step-by-step operation, e.g. with a limited movement control device)		N
	prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.		N
	This control mode shall be associated with one or more of following measures:		-
	- restriction of access to the danger zone as far as possible.		P
	- emergency stop control within immediate reach of the operator;		P
	- portable control unit (teach pendant) and/or local controls allowing sight of the controlled elements.(see EN 60204-1:2006, 9.2.4)		P
6.2.11.10	Selection of control and operating modes		P
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (e.g. to allow for adjustment , setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position.	Fitted with a mode selector which can be locked in each position.	P
	Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode.		P
	The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (e.g. access codes for certain numerically controlled functions).		P
6.2.11.11	Applying measures achieve electromagnetic compatibility (EMC)		P
	For guidance on electromagnetic compatibility, see EN	EN 61000-6 series	P

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	60204-1, and IEC 61000-6 series.		
6.2.11.12	Provision of diagnostic systems to aid fault-finding		P
	Diagnostic systems to aid fault finding should be included in the control system so that there is no need to disable any protective measures.		P
6.2.12	Minimizing the probability of failure of safety functions		P
6.2.12.1	General		P
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine.The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by :		P
6.2.12.2	Use of reliable components		P
	“Reliable components” means components which are capable of withstanding all disturbances and stresses associated with the usage of the equipment in the conditions of intended use (including the environmental conditions), for the period of time or the number of operations fixed for the use, with a low probability of failures generating a hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above(see also 6.213)	Reliable components have been used.	P
6.2.12.3	Use of “oriented failure mode” components		P
	“Oriented failure mode” components or systems are those in which the predominant failure mode is known in advance and which can be used so that such a failure leads to a non-hazardous alteration of the machine function.		P
	The use of such components should always be considered, particularly in cases where redundancy is (see 6.2.12.4) not employed.		P
6.2.12.4	Duplication (or redundancy) of components or subsystems		-
	In the design of safety-related parts of the machine, duplication (or redundancy) of components may be used so that, if one component fails, another component (or other components) continue(s) to perform its (their) function, thereby ensuring that the safety function remains available.	No duplication (or redundancy) of components	N
	In order to allow the proper action to be initiated, component failure shall be preferably detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection,	Be preferably detected by automatic monitoring	P
	provided that the inspection interval is shorter than the expected lifetime of the components.		P
	Diversity of design and/or technology can be used to avoid common cause failures (e.g. from electromagnetic		P

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	disturbance) or common mode failures.		
6.2.13	Limiting exposure to hazards through reliability of equipment		
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring rectification, thereby reducing exposure to hazards.	This requirement is complied with.	P
	This applies to power systems (operative part) as well as to control systems, to safety functions as well as to other functions of machinery.	This requirement is complied with.	P
	Safety-critical components (as e.g. certain sensors) with a known reliability shall be used.	Safety-critical components are used .	P
	The elements of guards and of protective services shall be particularly reliable, as their failure can expose persons to hazards, and also as poor reliability would encourage attempts to defeat them.		P
6.2.14	Limiting exposure to hazards through mechanization or automation of loading(feeding) /unloading (removal) operations		P
	Mechanization and automation of machine loading/unloading operations and more generally of handling operations (of workpieces, materials, substances) limit the risk generated by these operations by reducing the exposure of persons to hazards at the operating points.		P
	Automation can be achieved e.g. by robots, handling devices, transfer mechanisms, air blast equipment.		N
	Mechanization can be achieved, e.g. by feeding slides, push rods, hand-operated indexing tables.		N
	While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being rectified.		N
	Care shall be taken to ensure that the use of these devices does not introduce further hazards (e.g. trapping, crushing) between the devices and parts of the machine or workpieces/materials being processed.		N
	Suitable safeguards (see 6.3) shall be provided if this cannot be ensured.		N
	Automatic feeding and removal devices with their own control systems and the control systems of the associated machine shall be interconnected after thoroughly studying how all safety functions are performed in all control and operation modes of the whole equipment.	Comply with the requirement	P
6.2.15	Limiting exposure to hazards through location of the setting and maintenance points outside of danger zones.		N
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.		N

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6.3	Safeguarding and complementary protective measures		P
6.3.1	General		P
	Guards and protective devices shall be used to protect persons whenever inherently safe design does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (e.g. emergency stop equipment) may have to be implemented.	Appropriate guards and protective devices have been used to protect persons	P
	Certain safeguards may be used to avoid exposure to more than one hazard (e.g. a fixed guard preventing access to a zone where a mechanical hazard is present being used to reduce noise level and collect toxic emissions)	fixed guard is used.	P
6.3.2	Selection and implementation of guards and protective devices		P
6.3.2.1	General	-	
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against hazard generated by moving parts, according to the nature of those parts (see figure 4) and to the need for access to the danger zone(s).	Please see the related clause.	P
	The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine.		P
	In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where access of an operator to the danger zone is not required during normal operation (operation without any malfunction) of the machinery.		P
	As the need for frequency of access increase this inevitably leads to the fixed guard not being replaced.		P
	This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment.)		P
	A combination of safeguards may sometimes be required. For example , where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device may be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard.		P
	Consideration shall be given to the enclosure of control	This requirement has	P

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	positions or intervention zones to provide combined protection against several hazards which may include:	been taken into consideration.	
	- hazards from falling or ejected objects (e.g. falling object protection structure)		P
	- emission hazards (e.g. protection against noise, vibration, radiation , harmful substances)		P
	- hazards due to the environment (e.g. protection against heat, cold, foul weather)		P
	- hazards due to tipping over or rolling over of machinery (e.g. roll-over or tip-over protection structure)	No such hazards exist in this machine.	N
	The design of such enclosed work stations (e.g. cabs and cabins) shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.	No enclosed work stations.	N
6.3.2.2	Where access to the hazard zone is not required during normal operation		P
	Where access to the hazard zone is not required during normal operation of the machinery, safeguard should be selected from the following:		-
	a) fixed guard (see also ISO 14120)	Fixed guards are provided.	P
	b) interlocking guard with or without guard locking (see also 6.3.3.2.3, ISO 14119, ISO 14120);		N
	c) self-closing guard (see ISO 14120:2002, 3.3.2)		P
	d) sensitive protective equipment, e.g. electro-sensitive protective equipment (see IEC 61496) or pressure sensitive mat (see ISO 13856)	No sensitive protective equipment	N
6.3.2.3	Where access to the hazard zone is required during normal operation		P
	Where access to the hazard zone is required during normal operation of the machinery , safeguards should be selected from the following:		-
	a) interlocking guard with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this standard);		N
	b) sensitive protective equipment, e.g electro-sensitive protective equipment (see IEC 61496)	No sensitive protective equipment	N
	c) adjustable guard;		N
	d) self-closing guard (see ISO 14120:2002, 3.3.2)		N
	e) two-hand control device (see ISO 13851)		N
	f) interlocking guard with a start function (control guard) (see 6.3.3.2.5 of this standard)		N
6.3.2.4	Where access to the hazard zone is required for machine setting, teaching, process changeover, fault finding, cleaning or maintenance.		P
	As far as possible, machines shall be designed so that the safeguards provided for the protection of the production		P

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	operator may ensure also the protection of personnel in charge of setting, teaching, process changeover, fault finding, cleaning or maintenance without hindering them in performing their task.		
	Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2)		P
6.3.2.5	Selection and implementation of sensitive protective equipment	No sensitive protective equipment	N
6.3.2.5.1	Selection		N
	Due to the great diversity of the technologies on which their detection function is based, all types of sensitive protective equipment are far from being equally suitable for safety applications.		N
	The following provisions are intended to provide the designer with criteria for selecting , for each application , the most suitable device(s).		N
	Types of sensitive protective equipment include, e.g.:		-
	- light curtains;		N
	- scanning devices as, e.g. laser scanners;		N
	- pressure sensitive mats;		N
	- trip bars, trip wires.		N
	Sensitive protective equipment can be used:		-
	- for tripping purposes;		N
	- for presence sensing;		N
	- for both tripping and presence sensing		N
	- to re-initiate machine operation, a practice which is subject to stringent conditions.		N
	The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment:		N
	- tendency for the machinery to eject materials or component parts;		N
	- necessity to guard against emissions (noise, radiation, dust, etc.)		N
	- erratic or excessive machine stopping time;		N
	- inability of a machine to stop part-way through a cycle.		N
6.3.2.5.2	Implementation		N
	consideration should be given to :		-
	a) - size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment)		N
	b) - reaction of the device to fault conditions (see IEC 61496for electro-sensitive protective equipment)		N
	c)- possibility of circumvention		N

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	d)- detection capability and its variation over the course of time (e.g. as a result of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources, sunlight or impurities in the air.		N
	sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that:		N
	- a command is given as soon as a person or part of a person is detected;		N
	- the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function (s); therefore, the command given by the sensitive protective equipment shall be maintained by the control system until a new command is given;		N
	- restarting the hazardous machine function(s) results from the voluntary actuation , by the operator, of a control device placed outside the hazard zone, where this zone can be observed by the operator;		N
	- he machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases,;		N
	- the position and the shape of detection field prevents, ,possibly together with fixed guards, a person or part of a person from entering the hazard zone, or being present in it, without being detected.		N
6.3.2.5.3	Additional requirements for sensitive protective equipment when used for cycle initiation.		N
	In this exceptional application, starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control.		N
	Cycle initiation by sensitive protective equipment shall be subject to the following conditions:		-
	a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used;		N
	b) the requirements for an AOPD used as a tripping and presence-sensing device (see IEC 61496) are satisfied — in particular, location, minimum distance (see ISO 13855), detection capability, reliability and monitoring		N

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	of control and braking systems;		
	c) the cycle time of the machine is short and the facility to re-initiate the machine upon clearing of the sensing field is limited to a period commensurate with a single normal cycle;		N
	d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone;		N
	e) if there is more than one AOPD safeguarding the machine, only one of the AOPD（s） is capable of cycle re-initiation;		N
	f) with regard to the higher risk resulting from automatic cycle initiation, the AOPD and the associated control system comply with a higher safety-related performance than under normal conditions.		N
6.3.2.6	Protective measures for stability		P
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 4.6), it will be necessary to maintain it by protective measures such as the use of :		P
	- anchorage bolts;		P
	- locking devices;		P
	- movement limiters or mechanical stops;		N
	- acceleration or deceleration limiters;		N
	- load limiters;		N
	- alarms warning of the approach to stability or tipping limits;		N
6.3.2.7	Other protective devices		N
	When a machine requires continuous control by the operator(e.g. mobile machines, cranes) and an error of the operator can generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits , in particular:		N
	- when the operator has insufficient visibility of the hazard zone;		N
	- when the operator lacks knowledge of the actual value of a safety –related parameter (e.g. .a distance, a speed, the mass of a load, the angle of a slope)		N
	- when hazards may result from operations other than those controlled by the operator;		N
	The necessary devices include:		-
	- devices for limiting parameters of movement (distance, angle, velocity , acceleration)		N
	- overloading and moment limiting devices:		N
	- devices to prevent collisions or interference with other		N

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	machines;		
	-device for preventing hazards to pedestrian operators of mobile machinery or other pedestrians;		N
	- torque limiting devices, breakage points to prevent excessive stress of components and assemblies;		N
	- devices for limiting pressure, temperature;		N
	- devices for monitoring emissions;		N
	- devices prevent operation in the absence of the operator at the control position;		N
	- device to prevent lifting operations unless stabilizers are in place;		N
	- devices to limit inclination of the machine on a slope;		N
	- devices to ensure that components are in a safe position before traveling;		N
	Automatic protective measures triggered by such devices which take operation of the machinery out of the control of the operator (e.g. automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3)		N
6.3.3	Requirements for the design of guards and protective devices		P
6.3.3.1	General requirements		P
	Guards and protective devices shall be designed to be suitable for the intended use, taking into account mechanical and other hazards involved. Guards and protective devices shall be compatible with the working environment of the machine and designed so that they cannot be easily defeated. They shall provide the minimum possible interference with activities during operation and other phases of machine life, in order to reduce any incentive to defeat them.	Guards and protective devices have been appropriately designed.	P
	Guards and protective devices shall :		-
	- be of robust construction.	Steel	P
	- not give rise to any additional hazard;	No additional hazard	P
	- not be easy to by-pass or render non-operational;	not be easy to by-pass	P
	- be located at an adequate distance from the danger zone (see ISO 13857 and ISO 13855).	an adequate distance from the danger zone	P
	- cause minimum obstruction to the view of the production process;		P
	- enable essential work to be carried out on installation and/or replacement of tools and also for maintenance by allowing access only to the area where the work has to be done, if possible without the guard or protective device having to be moved;		P
	For openings in the guards see ISO 13857		P

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Clause	Requirement-Test	Result-Remark	Verdict
6.3.3.2	Requirements for fixed guards		P
6.3.3.2.1	Functions of guards		P
	The functions that guards can achieve are:		P
	- prevention of access to the space enclosed by guard and/or - containment/capture of materials, workpieces, chips, liquids which may be ejected or dropped by the machine and reduction of emissions(noise, radiation, hazardous substances such as dust, fumes, gases) which may be generated by the machine.	The space enclosed. Containment of workpieces, chips, liquids which may be ejected by the machine	P
	Additionally, they may need to have particular propertied relating to electricity, temperature, fire, explosion, vibration, visibility(see ISO 14120) and operator position ergonomics(e.g. usability, operator's movements, posture, repetitive movements).		P
6.3.3.2.2	Requirements for fixed guards		P
	Fixed guards shall be securely held in place:		-
	- either permanently (e.g. by welding) - or by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120)	All the fixed guards are securely held in place by appropriate fasteners.	P
6.3.3.2.3	Requirements for movable guards		P
	a) movable guards which provide protection against hazards generated by moving transmission parts shall :		-
	- as far as possible remain fixed to the machinery or other structure (generally by means of hinges or guides) when open;	by means of guides or hinges	P
	- be interlocking guards (with guard locking when necessary) (see ISO 14119)		N
	b) movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that:		-
	- moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up ; this can be achieved by interlocking guards, with guard locking when necessary.		N
	- they can be adjusted only by an intentional action , such as the use of a tool or a key;		N
	- the absence or failure of one of their components prevents starting of the moving parts or stops them; this can be achieved by automatic monitoring (see 4.11.6)		N
6.3.3.2.4	Requirements for adjustable guards		N
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely		N

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	enclosed;		
	They shall :		-
	- be designed so that the adjustment remains fixed during a given operation;		N
	- be readily adjustable without the use of tools;		N
6.3.3.2.5	Requirements for interlocking guards with a start function (control guards)		N
	An interlocking guard with a start function may be used provided that		-
	- all requirements for interlocking guards are satisfied (see ISO 14119)		N
	- the cycle time of the machine is short		N
	- the maximum opening time of the guard is present to a low value (e.g. equal to the cycle time). When this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine.		N
	- the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120)		N
	- all other guards whether fixed (removable type) or movable are interlocking guards;		N
	- the interlocking device associated with the interlocking guard with a start function is designed in such a way – e.g. by duplication of position detectors and use of automatic monitoring (see 4.11.6)- that its failure cannot lead to an unintended/unexpected start-up;		N
	- the guard is securely held open (e.g. by a spring or counterweight)such that it cannot initiate a start while falling by its own weight;		N
6.3.3.2.6	Hazards from guards		P
	Care shall be taken to prevent hazards which might be generated by :		-
	- the guard construction (e.g. sharp edges or corners, material);	No harp edges and corners.	P
	- the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall)		N
6.3.3.3	Technical characteristics of protective devices		P
	Protective devices shall be selected or designed and connected to the control system so as to ensure correct implementation of their safety function (s) is ensured.		P
	Protective devices shall be selected on the basis of their having met the appropriate product standard (for		P

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	example, IEC 61496 for active optoelectronic protective devices) or shall be designed according to one or several of the principles formulated in ISO 13849-1 or IEC 62061.		
	Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.		P
6.3.3.4	Provisions for alternative types of safeguards.		N
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it s known that this fitting will be necessary because the work to be done on it will vary.		N
6.3.4	Safeguarding for reducing emissions		P
6.3.4.1	General		
	If the measures for the reduction of emissions at source mentioned in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).		P
6.3.4.2	Noise		P
	Additional protective measures include, for example: - enclosures (see ISO 15667) - screens fitted to the machine; - silencers (see ISO 14163)	Enclosures	P
6.3.4.3	Vibration		N
	Additional protective measures include, for example, damping devices for vibration isolation between the source and the exposed person such as resilient mounting or suspended seats.		N
	For measures for vibration isolation of stationary industrial machinery see EN 1299		N
6.3.4.4	Hazardous substances		P
	Additional protective measures include, for example:		-
	- encapsulation of the machine (enclosure with negative pressure);	Encapsulation of the machine	P
	- local exhaust ventilation with filtration.		N
	- wetting with liquids;		N
	- special ventilation in the area of the machine (air curtains , cabins for operators)		N
6.3.4.5	Radiation		N
	Additional protective measures include, for example:		-
	- use of filtering and absorption;		N
	- use of attenuating screens or guards		N
6.3.5	Complementary protective measures		P
6.3.5.1	General		P

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	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use may have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine.Such measures include, but are not limited to , the ones dealt with in 6.3.5.2 to 6.3.5.6		P
6.3.5.2	Components and elements to achieve the emergency stop function		P
	If following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function to enable actual or impending emergency situations to be averted, the following requirements apply:		-
	- the actuators shall be clearly identifiable, clearly visible and readily accessible		P
	- the hazardous process shall be stopped as quickly as possible without creating additional hazards . If this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution;		N
	- the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary.		P
	Once active operation of the emergency stop device has ceased following an emergency stop command, the effect of this command shall be sustained until it is reset.		P
	This reset shall be possible only at that location where the emergency stop command has been initiated.The reset of the device shall not restart the machinery , but only permit restarting.		P
	More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in EN 60204 series.		P
6.3.5.3	Measures for the escape and rescue of trapped persons		P
	Measures for the escape and rescue of trapped persons may consist e.g. of :		-
	- escape routes and shelters in installations generating operator-trapping hazards		P
	- arrangements for moving some elements by hand, after an emergency stop		N
	- arrangements for reversing the movement of some elements		N
	- anchorage points for descender devices;		N
	- means of communication to enable trapped operators to call for help		P
6.3.5.4	Measures for isolation and energy dissipation		P

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Clause	Requirement-Test	Result-Remark	Verdict
	Especially with regard to their maintenance and repair , machines shall be equipped with the technical means to achieve the isolation from power supply(ies) and dissipation of stored energy as a result of following actions:		P
	a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;		P
	b) locking (or otherwise securing) all the isolating units in the isolating position;		P
	c) dissipating or , if this is not possible or practicable, restraining (containing) any stored energy which may give rise to a hazard;		N
	d) verifying, by means of a safe working procedure, that the actions taken according to a), b) and c) above have produced the desired effect.		P
	See ISO 14118:2000, clause 5 and EN 60204-1:2006, 5.5 and 5.6	See the test report of EN 60204-1.	P
6.3.5.5	Provisions for easy and safe handling of machines and their heavy component parts		P
	Machines and their component parts which cannot be moved or transported by hand shall be provided or capable of being provided with suitable attachment devices for transport by means of lifting gear.	Provided with suitable attachment devices for transport by means of lifting gear.	P
	These attachments may be, among others,		-
	- standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing;	slings	P
	- appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground.		N
	- guiding grooves for machines to be transported by a fork truck;		N
	- lifting gear and appliances integrated into the machine.		N
	Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement; See also 6.4.4c)（ item 3).	Not removed manually in operation	N
6.3.5.6	Measures for safe access to machinery		N
	Machinery shall be so designed as to enable operation and all routine tasks relating to setting and/or maintenance, to be carried out, as far as possible, by a person remaining at ground level.	Comply with requirements	P
	Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks, but care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery.		N
	The walking areas shall be made from materials which remain as slip resistant as practicable under working	Comply with requirements	P

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	conditions and, depending on the height from the ground, suitable guard-rails (see ISO 14122-3) shall be provided.		
	In large automated installations, particular attention shall be given to safe means of access such as walkways, conveyor bridges or crossover points.		N
	Means of access to parts of machinery located at a height shall be provided with collective means of protection against falls (e.g. guard-rails for stairways, stepladders and platforms and/or safety cages for ladders)		N
	As necessary , anchorage points for personal protective equipment against falls from a height shall also be provided (e.g. in carriers of machinery for lifting persons or with elevating control sations)		N
	Openings shall whenever possible open towards a safe position. They shall be designed to prevent hazards due to unintended opening.		N
	The necessary aids for access shall be provided (e.g. steps, handholds). Control devices shall be designed and located to prevent their being used as aids for access.		N
	When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards preventing falls when the platform is not present at the level.		P
	Movement of the lifting platform shall be prevented while the guards are open.		P
	For detailed provisions see ISO 14122.		N
6.4	Information for use		P
6.4.1	General requirements		P
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see figure 2).		P
	Information of use consists of communication links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. It is directed to professional and/or non-professional users.		P
6.4.1.2	Information shall be provided to the user about the intended use of the machine, taking into account, notably, all its operating modes.	See the instruction	P
	The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it shall inform and warn the user about residual risk.	See the instruction	P
	The information shall indicate, as appropriate,		-
	- the need for training,	See the instruction	P
	- the need for personal protective equipment,		P

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	- the possible need for additional guards or protective devices (see Figure 2, Footnote d).	See the instruction	P
	It shall not exclude uses of the machine that can reasonably be expected from its designation and description and shall also warn about the risk which would result from using the machine in other ways than the ones described in the information, especially considering its reasonably foreseeable misuse.	See the instruction	P
6.4.1.3	Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use of the machine (setting, teaching/programming or process changeover, operation, cleaning, fault-finding and maintenance) and, if necessary, dismantling, disabling and scrapping.	See the instruction	P
6.4.2	Location and nature of the information for use		P
	Depending on the risk , the time when the information is needed by the user and the machine design , it shall be decided whether the information – or parts thereof – are to be given:		P
	- in /on the machine itself (see 6.3 and 6.4.4)	Adequate information is stated in the machine itself.	P
	- in accompanying documents (in particular instruction handbook , see 6.4.5)	See the instruction	P
	- on the packaging	Adequate information is stated on the packaging	P
	- by other means such as signals and warnings outside the machine.	Signals and warnings outside the machine.	P
	Standardized phrases shall be considered where important messages such as warnings need to be given (see also IEC 62079)		P
6.4.3	Signals and warning devices		P
	Visual signals (e.g. flashing lights) and audible signals (e.g. sirens) may be used to warn of an impending hazardous event such as machine start-up or overspeed.	Signals and warning devices are provided.	P
	Such signals may also be used to warn the operator before the triggering of automatic protective measures (see last paragraph of 5.2.7)	Please the related clause.	P
	It is essential that these signals:		-
	- be emitted before the occurrence of the hazardous event; - be unambiguous; - be clearly perceived and differentiated from all other signals used; - be clearly recognized by the operator and other persons.	Unambiguous, clearly perceived, clearly recognized	P

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Clause	Requirement-Test	Result-Remark	Verdict
	The warning devices shall be designed and located such that checking is easy.		N
	The information for use shall prescribe regular checking of warning devices.		P
	The attention of designers is drawn to the risks from “sensorial saturation” which results from too many visual and/or acoustic signals, which may also lead to defeating the warning devices.		P
6.4.4	Markings, signs (pictograms), written warnings		P
	Machinery shall bear all markings which are necessary:		-
	a) for its unambiguous identification, at least :		-
	- name and address of the manufacturer; - designation of series or type; - serial number, if any.		P
	b) in order to indicate its compliance with mandatory requirements; - marking; - written indications (e.g. for machines intended for use in potentially explosive atmosphere)		N
	c) for its safe use, e.g. :		-
	- maximum speed of rotating parts;		N
	- maximum diameter of tools;		N
	- mass (expressed in kilograms) of the machine itself and/or of removable parts		N
	- maximum working load;		N
	-necessity of wearing personal protective equipment;		P
	- guard adjustment data;		P
	- frequency of inspection.	See the instruction	P
	Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine.	Permanent and remain legible	P
	Signs or written warnings only saying “danger” shall not be used.		P
	Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine which they are related to.		P
	Readily understandable signs (pictograms) should be used in preference to written warnings.		P
	Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be used.		P
	Markings shall comply with recognized standards (see ISO 2972, ISO 7000, particularly for pictograms,	All the markings are standard.	P

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	symbols , colours) See EN 60204 series as regards marking of electrical equipment.		
6.4.5	Accompanying documents (in particular, instruction handbook)		P
6.4.5.1	Contents		P
	The instruction handbook or other written instructions (e.g. on the packaging) shall contain among others:		-
	a) information relating to transport, handling and storage of the machine e.g. : - storage conditions for the machine; - dimensions , mass value(s), position of the centre (s) of gravity; - indications for handling (e.g. drawings indicating application points for lifting equipment)	All the related information is stated in the instruction handbook	P
	b) information relating to installation and commissioning of the machine, e.g. - fixing/anchoring and vibration dampening requirements; - assembly and mounting conditions; - space needed for use and maintenance; - permissible environmental conditions (e.g. temperature, moisture, vibration, electromagnetic radiation); - instructions for connecting the machine to power supply (particularly about protection against electrical overloading); - advice about waste removal /disposal; - if necessary, recommendations about protective measures which have to be taken by the user; e.g. additional safeguards, safety distances, safety signs and signals.	All the related information is stated in the instruction handbook	P
	c) information relating to the machine itself, e.g. : - detailed description of the machine, its fittings, its guards and/or protective devices; - comprehensive range of applications for which the machine is intended, including prohibited usages, if any , taking into account variations of the original machine if appropriate. - diagrams ; - data about noise and vibration generated by the machine, about radiation , gases, vapours, dust emitted by it, with reference to the measuring methods used. - technical documentation about electrical equipment - documents attesting that the machine complies with mandatory requirements;	All the related information is stated in the instruction handbook	P

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	d) information relating to the use of the machine, e.g. about: - intended use; - description of manual controls (actuators); - setting and adjustment; - modes and means for stopping - risks which could not be eliminated by the protective measures taken by the designer; - particular risks which may be generated by certain applications, by the use of certain fittings, and about specific safeguards which are necessary for such applications. - reasonably foreseeable misuse and prohibited usages; - fault identification and location , repair, and re-starting after an intervention; - personal protective equipment which need to be used and training required.	All the related information is stated in the instruction handbook	P
	e) information for maintenance e.g. - nature and frequency of inspections for safety functions; - instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence should be carried out exclusively by skilled persons (e.g. maintenance staff, specialists) - instructions relating to maintenance actions (e.g. replacement of parts) which do not require specific skills and hence may be carried out by users (e.g. operators) - drawings and diagrams enabling maintenance personnel to carry out their task rationally	All the related information is stated in the instruction handbook	P
	f) information relating to de-commissioning , dismantling and disposal;	See the instruction handbook	P
	g) information for emergency situations , e.g. : - type of fire-fighting equipment to be used. - warning about possible emission or leakage of harmful substance(s), and if possible, indication of means to fight their effects.		N
	h) maintenance instructions provided for skilled persons (second dash in e))and maintenance instructions provided for unskilled persons (third dash in e)), that should appear clearly separated from each other.	All the related information is stated in the instruction handbook	P
6.4.5.2	Production of the instruction handbook		P
	a) type and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized the use of colours, symbols and/or large print.	Legibility.	P

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Clause	Requirement-Test	Result-Remark	Verdict
	b) information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language are to be used, each language should be readily distinguished from the other(s), and efforts should be made to keep the translated text and the relevant illustration together.	English	P
	c) whenever helpful to the understanding, text should be supplemented with written details enabling , for instance, manual controls (actuators) to be located and identified; they should not be separated from the accompanying text and should follow sequential operations.	See the Instruction handbook.	P
	d) consideration should be given to presenting information in tabular form where this will aid understanding. Tables should be adjacent to the relevant text.	See the Instruction handbook.	P
	e) the use of colours should be considered, particularly in relation to components requiring quick identification.		N
	f) when information for use is lengthy, a table of contents and/or an index should be given.		P
	g) safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.		P
6.4.5.3	Drafting and editing information for use		P
	a) relationship to model : the information shall clearly relate to the specific model of machine and, if necessary, other appropriate identification (for example, by serial number).	See the difference between the models	P
	b) communicate principles : when information for use is being prepared, the communication process “see-think-use” should be followed in order to achieve the maximum effect and should follow sequential operations. The questions “how ?” and “why ?” should be anticipated and the answers provided.		P
	c) information for use shall be as simple and as brief as possible, and should be expressed in consistent terms and units with a clear explanation of unusual technical terms.		P
	d) when it is foreseen that a machine will be put to non-professional use, the instructions should be written in a form that is readily understood by the non-professional users. If personal protective equipment is required for the safe use of the machine, clear advice should be given, e.g. on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale.	Not for non-professional use	N

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	e) durability and availability of the documents : documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It may be useful to mark them “keep for future reference”. Where information for use is kept in electronic form (e.g. CD, DVD, tape) information on safety-related issues that need immediate action shall always be backed up with a hand copy that is readily available.	Kept in electronic form	P
7	Documentation of risk assessment and risk reduction		P
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of		-
	a) the machinery for which the risk assessment has been made (for example, specifications, limits, intended use);		P
	b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.);		P
	c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment;		P
	d) the information on which risk assessment was based (see 5.2):		-
	1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.);		P
	2) the uncertainty associated with the data used and its impact on the risk assessment;		P
	e) the risk reduction objectives to be achieved by protective measures;		P
	f) the protective measures implemented to eliminate identified hazards or to reduce risk;	Warning sign and wear PPE	P
	g) residual risks associated with the machinery;		P
	h) the result of the risk assessment (see Figure 1);	See the risk assessment report.	P
	i) any forms completed during the risk assessment.		P
	Standards or other specifications used to select protective measures referred to in f) above should be referenced.		P

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Clause	Requirement-Test	Result-Remark	Verdict
4	**Safety requirements and/or protective measures**		**P**
4.1	General		P
4.1.1	Overall requirements		P
	The truck shall comply with the safety requirements and/or protective measures of this clause.		P
	In addition, the truck shall be designed according to the principles of ISO 12100 for relevant but not significant hazards which are not dealt with by this document.	See the related clause of the ISO 12100.	P
4.1.2	Normal climatic conditions		P
	For truck operation, the following climatic conditions apply:		-
	-average ambient temperature for continuous duty: + 25 °C;		P
	-maximum ambient temperature, short term (up to 1 h): + 40 °C;		P
	-lowest ambient temperature for trucks intended for use in normal indoor conditions: + 5 °C;		P
	-lowest ambient temperature for trucks intended for use in normal outdoor conditions:-20 °C;		P
	-altitude: up to 2 000 m.		P
4.1.3	Normal operating conditions		P
	Normal operating conditions are the following:		-
	-driving (travelling and lifting) on substantially firm, smooth, level and prepared surfaces — the surface conditions on which the truck is designed to operate shall be specified in the instruction handbook (see 6.2);		P
	-driving with the horizontal load centre of gravity approximately on the longitudinal centre plane of the truck;		P
	-travelling with the mast or fork arms tilted backwards, where applicable, and the load in the lowered (travel) position.		P
	If the above is not sufficient to allow the conditions for stability of a particular truck type to be specified, then the operating conditions shall be according to the International Standards referenced for stability in 4.8.		N
4.1.4	Electrical requirements		P
	Electrical requirements are subject to regional requirements. See ISO/TS 3691-7:2011 and ISO/TS 3691-8.		P
4.1.5	Edges or angles		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	There shall be no sharp edges or angles posing a hazard in the area of the operator in the normal operating position or in the area of access and egress during normal operation and daily checks.	No sharp edges and angles	P
4.1.6	Stored energy components		P
	Components which store energy and that would cause a risk during removal or disassembly, e.g. Hydraulic accumulator or spring-applied brakes, shall be provided with a means to release the energy before removal or disassembly.		P
4.2	Starting/moving		P
4.2.1	Unauthorized starting		P
	Trucks shall be provided with a device (e.g. key, code, magnetic card) which prevents starting without its use.	Key	P
	Such devices for pedestrian-controlled and rider-controlled trucks manufactured by the same manufacturer shall not be interchangeable between the two truck types. Where devices, e.g. magnetic cards, are destined for an individual operator, one device may be used on both truck types but shall not allow starting by unauthorized persons.		P
4.2.2	Unintended movement and inadvertent activation		P
	Truck movement from the holding position, other than by actuation of the controls by the operator, due to drift or creep (e.g. by leakage), shall be avoided.		P
4.2.2.1	Parking brakes		P
	A parking brake complying with 4.3.1 shall be provided.		P
	For sit-on rider trucks, the parking brake system should be manually operable by hand or foot from the normal operating position or automatically applied by leaving the normal operating position. Trucks with only non-automatically applied parking brake(s) shall have a warning to the operator to apply the brakes before leaving the truck.	manually operable by hand	P
	Failure of the control system of an automatically applied parking brake shall be indicated to the operator.		P
4.2.2.2	Internal-combustion-engine powered trucks		P
	Internal-combustion-engine powered trucks shall be fitted with a device which prevents the engine being started while the transmission is engaged.	Internal-combustion-engine powered truck	P
4.2.2.3	Travel controls		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	Travel controls on internal-combustion-engine powered trucks shall be so arranged that on level ground the truck will not move from rest until the transmission has been engaged.		P
4.2.2.4	Powered travel movement		P
	Powered travel movement of the truck with a ride-on operator shall be possible only if the operator is in the normal operating position.		P
	Powered travel shall not occur automatically when the operator returns to the normal operating position without an additional operation, e.g. by requiring a resetting of the direction control or reactivation of the speed control.		P
4.2.2.5	Manual gearbox and manually operated clutch pedal		P
	A truck with an automotive-type manual gearbox and manually operated clutch pedal satisfies the requirements of 4.2.2.2 and 4.2.2.4.		P
4.2.3	Travel speed		P
4.2.3.1	Pedestrian-controlled trucks		N
	Single-speed pedestrian-controlled trucks operating on level ground shall not exceed a travel speed of 4 km/h and an acceleration of 0,5 m/s2 and shall be designed for low-lift only.	Not pedestrian-controlled truck	N
	Variable-speed pedestrian-controlled trucks operating on level ground shall be controllable by the operator to be aligned with their walking speed.		N
	The maximum speed is subject to regional requirements, additional to the requirements of this part of ISO 3691. See ISO/TS 3691-7:2011 and ISO/TS 3691-8.		N
4.2.3.2	Stand-on trucks and pedestrian-controlled trucks with foldable platform	No foldable platform	N
	The maximum speed on level ground of stand-on trucks and pedestrian-controlled trucks fitted with a foldable platform when the operator is on the platform is subject to regional requirements, additional to the requirements of this part of ISO 3691. See ISO/TS 3691-7:2011 and ISO/TS 3691-8.		N
	For trucks with a foldable operator platform, see 4.7.3.3.		N
	For trucks with stand-on options, see 4.7.3.2 and 4.7.3.4.		N
4.2.3.3	Travel with mast raised		N
	Travel with mast raised is subject to regional requirements. See ISO/TS 3691-8.		N
4.3	Brakes		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
4.3.1	General		P
	All industrial trucks shall be designed with service and parking brakes. Brakes shall comply with ISO 6292.		P
	The parking brake shall be equipped with a system preventing unintentional release. The parking brake force shall be applied by mechanical means.		P
	Braking requirements are subject to regional requirements, additional to the requirements of this part of ISO 3691. See ISO/TS 3691-7:2011 and ISO/TS 3691-8.		P
4.3.2	Failure of energy supply to service brake		P
	Failure of the energy supply to the service brake shall not result in a total loss of braking and shall enable a controlled stop.	not result in a total loss of braking	P
4.3.3	Stand-on and pedestrian-controlled trucks		N
	Stand-on and pedestrian-controlled trucks shall be equipped with a brake system that will automatically engage upon release of the brake actuating control by the operator. This system may serve as the service and parking brake.		N
4.4	Manual control actuators		P
4.4.1	General		P
4.4.1.1	Consistency with the truck motions		P
	Movement of these controls shall be consistent with the motions of the truck being operated, wherever practicable. They shall be confined within the plan view outline of the truck or tiller.		P
4.4.1.2	Multiple operators	Only one operator	N
	If additional operating positions are fitted, e.g. for more than one operator, the operation of these controls shall only be possible from one operating position at a time, excepting the emergency disconnect switch, which shall be operable from all positions.		N
4.4.1.3	Multiple operating positions	Only one operating position.	N
	If more than one operating position is fitted for a single operator, the use of the controls for one of these operating positions shall preclude the use of the controls of another operating position. The exception to this is the emergency disconnect switch, which shall be operable from all positions.		N
4.4.2	Travel and braking controls		P
4.4.2.1	General		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	The motion of the speed operating control shall be so designed that an increase in the movement of the control increases the travel speed. When the control is released, it shall return to the neutral position of the control actuator.		P
4.4.2.2	Sit-on trucks		P
	Trucks with pedal-operated travel and braking controls shall comply with ISO 21281.		P
4.4.2.3	Stand-on trucks	Sit-on trucks	N
	The requirements for travel and braking controls for a stand-on truck are as follows.		N
	a)Travel control functions		N
	-Where a tiller is used, it shall be fitted with control devices for travel direction and speed.		N
	-Where a steering wheel or similar control is used, the controls for travel direction and speed shall be positioned in close proximity to the steering control.		N
	The service brake function shall be engaged		N
	-automatically when the tiller is released, if operated by the tiller,		N
	-automatically when the travel-control is released, if operated by the travel-control,		N
	-automatically when releasing the pedal, if the brake function is foot-operated,		N
	-when activating the hand actuator, if the brake function is hand-operated.		N
	b)Trucks with elevating operator platform up to 1200 mm		N
	Means shall be provided to prevent travel while the platform is elevated more than 500 mm, unless the controls are elevated with the platform.		N
4.4.2.4	Pedestrian-controlled trucks	Not pedestrian-controlled trucks	N
	The requirements for pedestrian-controlled trucks are as follows.		N
	a) The tiller shall be fitted with control devices for travel direction and speed.		N
	b) When the tiller is released, it shall automatically return to its upper rest position, cut off traction power in the travel direction and engage the brake.		N
	c)When the tiller is in its lowered position, the traction power in the travel direction shall be cut off and the brake shall be engaged.		N
d)	The tiller shall be fitted with a device to energize the direction of travel away from the operator until		N

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	pressure on the device is relieved, or that stops the truck by applying the brakes, if the head of the tiller in its operating position comes into contact with a solid body (e.g. the operator's body).		
4.4.2.5	Differential locking		P
	It shall be possible to unlock the differential when the truck is moving.		P
	For trucks fitted with a pedal-operated differential lock, depression of the pedal shall lock the differential and shall be released when releasing the pedal.		P
4.4.2.6	Additional operation from outside the truck		N
	If travel control from outside the truck is provided for the operator of sit-on or stand-on trucks and tractors, when operated from the outside the travel speed shall be limited to 6 km/h. These controls may be attached to the truck or a remote control may be provided, and the operating system shall be made operable by means of a separate switch or automatically when the operator leaves the normal operating position.		N
	a)General		-
	1) If the control actuator is released, the drive unit shall switch off automatically and the brake shall be engaged automatically. Simultaneous operation from the operating positions shall be excluded.		N
	2) Controls fitted at the outside of the truck shall be secured against unintentional activation.		N
	b)Additional requirements for cable-connected remote controls	No cable-connected remote controls	N
	1) The length and layout of the cables shall allow the operator to operate from outside of the area of hazard of the truck and have visibility of the path of travel. It shall not be possible for the cable to become entangled with the wheels.		N
	2) On a portable control panel, the control elements, with the exception of the emergency stop, shall be guarded against unintentional operation. The portable control panel shall be fitted with an emergency stop device in accordance with ISO 13850.		N
	c)Additional requirements for cableless control	No cableless control	N
	1) The transmission range shall be adequate to allow the operator to operate from outside the area of hazards of the truck and have visibility in the path of travel.		N

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	2) On the portable control panel, the control elements for operation, with the exception of the emergency stop, shall be guarded against unintentional operation.		N
	3) The reliability level shall be at least 10^{-9} and the Hamming distance shall be 2. The remote control shall be in accordance with ISO 13849-1, performance level (PL) c.		N
	4) The truck shall stop automatically when outside of the operator's direct view (90°) and/or out of range of the remote control.		N
	5) No control interference shall be possible when more than one truck is operating under remote control at the same time.		N
	d) Additional requirements for trucks with trailer coupling	No trailer coupling	N
	1) The controls (e.g. rear touch device) shall be arranged so that the operator does not have to step between the truck and the trailer in order to operate them.		N
	2) The rear touch device shall be secured against unintentional operation.		N
	3)During operation of the rear touch device, the travel speed of the truck shall not exceed 2,5 km/h.		N
4.4.2.7	Additional operation from alongside pedestrian-controlled and stand-on trucks (coasting)		N
	The additional operation of pedestrian-controlled and stand-on trucks while the operator is walking alongside the truck shall only be possible with the truck's fork arms trailing.		N
	The additional operation of such trucks while the operator is walking alongside the truck, and the use of low-lift order-picking trucks provided with a system that allows for operation while walking alongside the truck, are subject to regional requirements, additional to the requirements of this part of ISO 3691. See ISO/TS 3691-7:2011 and ISO/TS 3691-8.		N
4.4.3	Steering controls		P
4.4.3.1	Steering direction		P
	The following applies.		-
	a) For stand-on or sit-on trucks, when travelling in the forward direction, clockwise rotation of the steering wheel, or equivalent movement of the steering control, shall steer the truck to the right.		P
	b) For trucks with an operator control position	control position not	N

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	rotatable by more than 90°, or having duplicated control positions, in order to facilitate the operator facing in the opposite direction, clockwise rotation of the steering wheel, or equivalent movement of the steering control, shall steer the truck to the right as viewed from the new position — i.e. the steering control sense is reversed beyond 90° to facilitate the operator acing in the opposite direction.	rotatable	
	c) Trucks with continuous 360° steering — i.e. the steering/drive wheel can move through 360° to propel the truck in the direction selected by the steering control — shall operate in the same sense as a), above, when travelling in the forward direction.		N
	d) For pedestrian-operated trucks fitted with a tiller, when travelling in the forward direction, clockwise movement of the tiller shall steer the truck to the right.		N
	e) Exceptionally, when requested by the user, end-control trucks may be equipped with “reverse steering” —i.e. clockwise rotation of the steering control will steer the truck to the left. Such trucks should be clearly dentified.		N
4.4.3.2	Failure of power supply		P
	In the event of an interruption of the power supplied to the steering system (including a dead motor or engine), it shall be possible to maintain the path being steered until the truck is brought to a controlled stop.		P
4.4.4	Load-handling controls		P
4.4.4.1	Controls		P
	Controls shall return to the neutral position when released and stop the corresponding load movement. When single levers are used to control a function on trucks other than reach trucks with retractable mast or forks, the lever closest to the operator shall control lifting and lowering, the second closest lever should control the tilt function, the third closest lever should control the side shift and the fourth closest lever should be for auxiliary functions.		P
	When single levers are used to control a function on reach trucks with a retractable mast or forks, the lever closest to the operator shall control lifting and lowering, the second closest lever should control the displacement of the mast or forks, the third closest lever should control the tilt function, the		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	fourth closest lever should control side shift and the fifth closest lever should be for auxiliary functions.		
	Trucks equipped with attachments which hold the load by power (e.g. paper clamp) shall feature control(s) with a secondary action to prevent unintentional release of the load.		P
4.4.4.2	Manual-lift systems		P
	The hand power forces and the layout of controls of manually operated lifting systems shall comply with ISO 3691-5.		P
4.4.5	Multi-function controls		N
	Where a control is designed and constructed to perform more than one function, each separate function shall be clearly marked. Each control function shall return to the neutral position when released and stop the corresponding load movement.		N
4.4.6	Controls for automated functions		P
	The controls for automated functions shall comply with ISO 24134.	Meet the EN 1526.	P
4.4.7	Marking		P
	Graphic symbols used for marking controls shall comply with 6.3.1.4.		P
4.5	Power systems and accessories		P
4.5.1	Exhaust and cooling systems		P
4.5.1.1	Exhaust systems		P
	The exhaust system shall be designed in accordance with 4.7.6 and such that engine exhaust is directed away from the operator position. Materials used in the vicinity of exhaust systems shall be non-flammable and shall be chosen and protected such that they are not adversely affected by heat from the exhaust system.		P
4.5.1.2	Cooling systems		P
	The air flow through the cooling system shall be arranged so as to avoid discomfort to the operator.		P
4.5.2	Fuel tank		P
4.5.2.1	Tank isolation		P
	If a fuel tank is within or adjacent to the engine compartment and excessively high temperatures can occur, the tank and/or filling arrangement shall be isolated from the electrical and exhaust systems by suitable protection, e.g. a separate enclosure or baffles. The tank location and facilities for filling shall be such that spillage or leakage will not drain into the engine or operator's compartment or onto	separate enclosure	P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	electrical or exhaust system parts.		
4.5.2.2	Fuel spillage		P
	Fuel spillage shall not be possible under normal operating conditions.		P
4.5.3	Access to engine and other compartments		P
4.5.3.1	Engine covers		P
	An enclosed engine compartment shall satisfy fan guarding requirements when the manufacturer's recommended routine maintenance is performed with the engine off. If a fan can start (e.g. temperature switch) when the engine is off, the fan shall be guarded. A safety warning sign shall be provided, and included in the instruction handbook (see 6.2). Warnings shall comply with 6.3.3.4.		P
	Access from underneath is considered guarded if the access ground clearance is less than 600 mm between the underside of the truck and level ground.		P
4.5.3.2	Unintentional closure		P
	Where unintentional closure could cause injury, access covers (i.e. traction battery or engine covers) shall be provided with means for preventing unintentional closure. Those means shall be permanently affixed to the truck or stored in a safe place on the truck.		P
4.5.4	Liquefied petroleum gas (LPG)-powered trucks	Engine Counterbalanced Forklift Truck With LPG	P
4.5.4.1	Containers		P
	The following applies to the containers of trucks powered by LPG.		P
	a) LPG containers shall be either permanently fixed to the truck or removable.	permanently fixed to the truck	P
	b) When LPG containers are removable, their fastenings shall permit easy handling and checking of the installation after the exchange of containers.		N
	c) Removable LPG containers that incorporate a pressure-relief valve shall be so positioned on the truck that the pressure-relief valve opening is always in communication with the vapour space at the top of the container. This may be accomplished, for example, by an indexing pin which positions the container when the container is properly installed.		N
	d)LPG containers shall be securely mounted to the truck to prevent movement. Fastening shall		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	withstand static loading of four times the filled container weight in any direction without permanent visible deformation.		
	e)LPG containers shall be fitted on the truck such that exposure to abrasion, shock and the corrosive action of the products handled by the truck is reduced.		P
	f)LPG containers and their connections shall be installed such that there are no projections outside the plan view outline of the truck.		P
	g)If LPG containers are installed in a compartment, this compartment shall have permanent openings at the bottom. The total surface area of these ventilation openings shall be at least 200 cm^2 allowing adequate ventilation to outside the truck.		N
	h)If an additional LPG container is carried on the truck, it shall be secured in the same manner as the main container.		N
	i)LPG containers, whether fixed or removable, shall be equipped with a device to prevent unintentional emission of gas or liquid, e.g. in the case of a pipe system failure. This does not apply to pressure-relief valves.		P
	j)Pipe fittings and accessories on LPG containers shall be protected against mechanical damage when used as specified by the manufacturer.		P
	k)The fuel take-off on the LPG container shall be equipped with an easily and quickly accessible manually operated valve. The position and method of operation of this valve shall be clearly marked on the valve handle or on the outside of the truck near the valve.		N
	l)The fuel take-off shall be in a liquid form, unless the LPG container and engine are specially equipped for a direct vapour withdrawal.		N
	m)Permanently mounted LPG containers to be filled by the user shall be fitted with the following:		P
	1)a pressure-relief valve connected to the vapour space of the container that, when fitted inside the compartments of trucks, shall have the discharge side of the relief valve piped to the atmosphere away from the operator and that shall comply with 4.5.4.3 d);		P
	2)an 80 % fill stop valve;		N
	3)maximum liquid level devices suitable for the LPG in use, indicating the maximum product level and which shall not vent to the atmosphere.		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	n)LPG containers shall be positioned such that they are not exposed to the damaging effects of heat, particularly heat from the engine or the exhaust system. If it is necessary to fit a heat shield, this shall not inhibit ventilation.		P
4.5.4.2	Piping		P
	The following applies to the piping used on trucks powered by LPG.		P
	a)Connecting piping and all associated parts shall be easily accessible, protected against excessive heat radiation, damage and wear, and shall be flexible enough to withstand vibration and deformation in service, as follows:		P
	- piping shall be so arranged that damage or leaks are easily detectable and that checks and maintenance can be carried out;		P
	- piping shall be installed such that it cannot be damaged by any excessive heat radiation from hot parts of the truck;		P
	-fully rigid pipes shall not be used for connecting the container to equipment on the engine;		P
	- piping shall be so arranged that there are no projections outside the plan view outline of the truck.	there are no projections	P
	b)Pressure hoses operating above 1 bar shall be supported at least every 500 mm. Rigid pipes shall be supported at least every 600 mm.		P
	c)Hoses, pipes and all connections operating at pressures above 1 bar shall be suitable for a working pressure of 25 bar and shall withstand without bursting a test pressure of 75 bar. Hoses, pipes and all connections operating below 1 bar shall withstand without bursting a test pressure of five times the maximum working pressure.		P
	d)Pressure shall not exceed the working pressure rating of components in any section of pipe work containing LPG in liquid form between two shut-off valves that are closed; a pressure-relief valve, for example, or other suitable means, may be used if necessary.		P
	e)Aluminium piping shall not be used.		N
	f) Hoses shall be as short as practical.		P
	g)Pressure unions and joints operating above 1 bar shall be made of metal, except for any constrained sealing washers.		P
4.5.4.3	Equipment		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	The following applies to the equipment used on trucks powered by LPG.		P
	a)The supply of gas shall be automatically cut off when the engine stops, irrespective of whether or not the ignition system has been switched off.		P
	b)For multi-fuel applications, the system shall be designed to avoid the possibility of LPG entering any other fuel container and to shut off each fuel source before the alternative one is opened.		P
	c)If the truck is equipped with two or more containers to supply fuel, they shall be connected via a multi-way valve or other suitable means, so that LPG can only be drawn from one container at a time. The use of two or more containers at the same time shall not be possible.		N
	d) Pressure-relief valves or liquid-level indicators shall be installed such that they cannot discharge in the direction of the operator or onto truck components that could be a source of ignition.		P
	e) If corrosion of a part would interfere with its proper functioning, that part shall be provided with a corrosion-resistant protective coating.		P
	f) All fuel system components shall be firmly secured to the truck.		P
	g) Pressure-reducing valves shall be readily accessible for inspection and maintenance.		P
	h)The engine compartment shall be designed in accordance with 4.5.4.1 g), in order to avoid any LPG accumulation.		P
4.5.4.4	Regional requirements		P
	LPG-powered trucks are subject to regional requirements, additional to the requirements of this part of ISO 3691. See ISO/TS 3691-8.		P
4.6	Systems for lifting and tilting		P
4.6.1	Lift chains		P
	The truck or mast manufacturer shall have on record a certificate from the chain manufacturer giving the breaking load of the chains used.	See the certificate.	P
	When the lifting mechanism includes a chain or chains, the truck manufacturer shall only use leaf or roller chains. These shall provide a minimum factor, K_1, when supporting the maximum capacity load and assuming no friction in the mast structure, which is given by the following equation: $K_1 = (L_c \times n)/(R + w)$	Roller chain, 9.3	P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	The K_1 factor is subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
	Pulley diameters shall be in accordance with the chain manufacturer's instructions.		P
4.6.2	Mechanical lifting systems		P
4.6.2.1	General		P
	The lifting system shall comply with the requirements of 4.6.3.3.		P
4.6.2.2	Failure of lifting/lowering mechanism		P
	In the event of failure of a single lifting/lowering part of the mechanism (e.g. gearwheel, chainwheel or spindle), it shall not cause the elevated load or operator's platform to descend uncontrolled.	not cause the elevated load to descend uncontrolled.	P
4.6.2.3	Lowering speed		P
	The lowering speed of the lifting mechanism with its rated load shall not exceed 0,6 m/s.	0.402m/s.	P
4.6.3	Hydraulic lifting and tilting systems		P
4.6.3.1	Hydraulic lifting systems		P
	The hydraulic lifting system shall be designed such that, with the hydraulic fluid at normal operating temperature, the mast substantially vertical and carrying rated capacity load, the descent of the load caused by internal leakage in the first 10 min shall not exceed		P
	-100 mm for trucks up to and including 10 000 kg rated capacity,	46mm/10 min	P
	-200 mm for trucks over 10 000 kg rated capacity.	<10 000kg	N
4.6.3.2	Lowering speed limitation		P
	A device shall be incorporated in the lift circuit which, in the event of a failure of the hydraulic circuit —excluding the hydraulic lift cylinder(s) — shall restrict the rate of descent of the lifting mechanism with its rated load to 0,6 m/s maximum. The device shall be fitted directly at the lifting cylinder(s).		P
4.6.3.3	Limitation of stroke		P
	The lift assembly shall be fitted with a positive means to prevent over-travel. In addition, positive means (e.g.mechanical stop) shall be provided to prevent the fork carrier and moving elements of the mast structure from unintentionally disengaging from the upper end of the mast.		P
4.6.3.4	Hydraulic tilting systems		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	The internal leakage rate of the complete hydraulic tilting system (i.e. cylinder, valve, etc.), with the oil at normal operating temperature, shall allow no more than 5° forward movement of the mast in 10 min from the vertical mast position, when the rated load is at a height of 2 500 mm or, in the case of trucks with lift heights less than 2 500 mm, at their maximum lift height. The average tilting speed allowed by internal leaks shall not exceed 0,5°/min for trucks with a maximum forward tilt of less than 5°.	0.4°/min	P
4.6.3.5	Mast tilt and carriage isolation		P
	For ride-on trucks, mast tilt and carriage movement shall not be possible through operation of the primary load-handling control when the operator is not in the normal operating position.		P
	Isolation of attachment movement is subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
4.6.4	Hydraulic systems		P
4.6.4.1	Hydraulic circuits		P
	Hoses, piping and connections subjected to internal pressure shall be capable of withstanding, without bursting or permanent deformation, a pressure equal to at least three times the operating pressure. Pipes and hoses shall be located and, if necessary, restrained, so that deterioration, sharp edges and other damage-causing sources are minimized.	19MPa	P
4.6.4.2	Pressure controls		P
	All hydraulic systems shall include a device which prevents the pressure in the system from exceeding a preset level. The device shall be so designed and fitted that unintentional loosening or adjustment is avoided and so that a tool or key is required to alter the pressure setting.		P
4.6.4.3	Failure of energy supply to hydraulic circuits		P
	In the case of a fault or interruption of the supply of energy, the design of the hydraulic system shall be such that it does not allow any uncontrolled motion of equipment or attachment.		P
4.6.4.4	Fluid purification		P
	The hydraulic system(s) shall be protected against the risk of contamination of the hydraulic fluid, e.g. by means of magnet(s) or filter(s).		P
4.6.5	Load-handling and -stacking attachments		P
4.6.5.1	Unintentional displacement or detachment		P

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Clause	Requirement-Test	Result-Remark	Verdict
	Means shall be provided to prevent the unintentional lateral displacement or unintentional detachment of attachments from the truck. Movement of the attachment and its parts shall be mechanically limited at the extreme positions.		P
4.6.5.2	Malfunction in the power supply system		P
	Attachments that hold the load by power shall be designed such that the maximum load they are intended to handle is automatically retained for at least 10 min when the truck's manual controls are in the neutral position or in the event of a malfunction in the power supply system for the attachment.		P
4.6.5.3	Hydraulic system for attachment		N
	If an attachment has its own separate hydraulic system, it shall comply with 4.6.4.		N
4.6.5.4	Combined hydraulic systems		N
	If an attachment has a hydraulic system connected to the truck hydraulic system, the two systems shall be compatible and the combined systems shall comply with 4.6.4.		N
4.6.5.5	Attachments for lifting freight containers		N
	An attachment for lifting freight containers shall be equipped with indicator lights according to ISO 15871. The attachment shall have a device(s) to prevent unintentional disengagement of a container. Means shall be provided to prevent lifting of the container for transport unless all interface mechanisms are fully engaged and locked. If multiple containers are lifted at the same time, the same requirements are valid for all containers. Travel speed shall be restricted to a maximum of 10 km/h if the container is not locked to the attachment in a manner that will prevent unintentional drop (e.g. lifting with grapple arms).		N
4.6.5.6	Fork arms		P
4.6.5.6.1	Solid-section fork arms shall be manufactured and tested in accordance with ISO 2330, except with respect to safety factors. The safety factors are subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
4.6.5.6.2	The total capacity of all fork arms fitted to a truck shall not be less than the actual capacity of the truck.	3500kg	P
4.6.5.6.3	Means shall be provided to prevent unintentional lateral displacement of the fork arms on the fork carrier.		P

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Clause	Requirement-Test	Result-Remark	Verdict
4.6.5.6.4	Fork-arm extensions shall be designed to prevent accidental disengagement from the fork arms, and shall be in accordance with ISO 13284.		N
4.6.5.7	Fork carriers		N
	Hook-on type fork carriers shall be in accordance with ISO 2328.		N
4.7	Operator positions		P
4.7.1	Dimensions		P
	The operator's seat or standing position shall be so located that the operator has sufficient room while operating the truck so as to remain within the plan view outline of the truck. The dimensions shall be of suitable and ergonomic shape to accommodate at least a 5th percentile to a 95th percentile of the population, as shown in ISO 3411:2007, Figures 1 to 3, within the plan view outline of the truck. The seat shall not extend beyond the plan view outline of the truck.		P
	The minimum distance from the top edge of the seat back to the plan view outline shall be 50 mm (see Figures 1 and 2).	>50mm	P
	For stand-on pedestrian- and centre-controlled ride-on trucks employing a tiller, the tiller steering control movement may extend beyond the plan view.		P
4.7.2	Operator access and egress		P
4.7.2.1	General		P
	Trucks shall be designed to permit safe and easy access and egress and to minimize the risk of slipping,falling and tripping. Steps, running boards and hand holds (grab handles, fixed parts of the truck structure,etc.) shall be provided above a step height of 350 mm to give three-point contact at all heights (i.e. one hand and two feet or two hands and one foot). Step width, instep clearance and toe clearance shall comply with ISO 2867.	step.	P
4.7.2.2	Steps		P
	Steps shall have slip-resistant surfaces or covering (e.g. expanded metal, abrasive coating). The first step shall be not more than 550 mm from the ground and succeeding steps shall be 250 mm to 350 mm, preferably at equal intervals.	<550mm	P
4.7.2.3	Compartment floors		P
	The compartment floor frequented by the operator, steps and walkways shall be free of obstacles and		P

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Clause	Requirement-Test	Result-Remark	Verdict
	shall have a slip-resistant surface, e.g. ribbed mats, abrasive coating, expanded metal.		
4.7.2.4	Walkways		N
	Walkways more than 2 000 mm from the ground shall have guard rails. The guard rails shall have a height of 900 mm to 1 100 mm and shall be capable of withstanding, without permanent deformation, a force of 900 N applied in a horizontal direction from the inside to the outside.		N
4.7.2.5	Hand holds		P
	For access to, and egress from, the normal operating position with a floor height above 300 mm, hand hold(s) shall be provided; these may be part of the truck structure. The clearance dimension for a hand hold shall be at least of 45 mm width, 130 mm length and diameter of 15 mm (see Figure 3).		P
4.7.3	Platforms	No platform	N
4.7.3.1	General		N
	Operator stand-on platforms on pedestrian-controlled and stand-on end-controlled trucks shall be dimensioned in accordance with 4.7.1 and shall be capable of withstanding a compression force corresponding to 2,5 times the mass of the laden truck applied along the longitudinal axis of the truck with the outermost projection of the platform against a flat vertical surface. For the purpose of this requirement, the operator platform includes any surrounding reinforcement or parts of the truck which provide resistance to crushing of the platform, except for pedestrian-controlled stand-on trucks employing a tiller.		N
4.7.3.2	Platforms overhanging the truck chassis		N
	Platforms overhanging the truck chassis on tiller-operated stand-on trucks, capable of travelling more than 6 km/h, shall, in addition to 4.7.3.1, be provided with a guard at either the sides or the front of the platform. The guards shall be capable of withstanding a horizontal force of 900 N acting from inside to outside applied in line with the centre of the operator's standing position without permanent deflection. The side guards shall be at a minimum height of 700 mm above the platform in its protective position.		N
4.7.3.3	Pedestrian-controlled trucks with foldable platforms		N
	Operator stand-on platforms that are fitted to pedestrian-controlled trucks and overhang the truck's chassis may be capable of being folded or		N

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Clause	Requirement-Test	Result-Remark	Verdict
	pivoted to an upright position when the operator leaves the platform; this may be done automatically.		
	For platforms which do not act automatically, devices shall be provided to prevent the truck manoeuvring or travelling unless the operator is standing on the platform or the platform is in its upper rest position.		N
	Travelling of more than 6 km/h shall only be possible when the platform is pivoted down and guards are in their protective position.		N
4.7.3.4	Stand-on platforms		N
	Operator stand-on platforms which are built within the plan view outline of pedestrian-controlled trucks, where the operator stands to the side of the motor housing, shall be equipped with an additional grab rail for operator stability when riding. This grab rail shall be capable of withstanding a horizontal force of 900 N applied in line with the operator's standing position, without permanent deformation. The requirements of 4.7.3.2 do not apply for this configuration of pedestrian-controlled truck.		N
4.7.3.5	Trucks with foldable platforms and foldable side guards		N
	On trucks with side guards and platforms of the folding or pivoting type as described in 4.7.3.2 and 4.7.3.3, travelling movement shall only be possible when the side guard or platform is in a protective position or an inactive rest position. No travelling movement is allowed with the platform or side guard in an intermediate position.		N
4.7.4	Operator's seat		P
	The seat shall be designed and located to provide easy access to the controls, shall provide a position for the truck operator in accordance with ergonomic principles and shall meet the following requirements.		P
	a)If the seat has a facility allowing fore and after adjustment, this shall be possible without the use of tools.		P
	b)If a weight-adjustable seat is fitted to reduce vibration transmitted to the operator, the adjustment shall accommodate operator weights of 55 kg to 110 kg. Manual adjustment of the weight mechanism shall be possible without the use of tools.		N
	c) If a seat has a facility allowing it to swivel about	Not swivel	N

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Clause	Requirement-Test	Result-Remark	Verdict
	a vertical axis, this shall be possible at all seat adjustment positions without unintentional operation of the controls.		
	d) The seat mounting shall be able to withstand the forces which can occur during operation, e.g. braking forces, as well as the forces imposed by the operator restraint specified in 4.7.8.		P
	e) The requirements of a) to d), above, also apply to additional operator's seats.		P
	f) When using an auxiliary seat on a stand-on industrial truck, a padded seat surface and backrest is sufficient. If the operating space of the stand-on operator is restricted, the auxiliary seat shall be capable of being folded or pivoted.		N
	f)The seat anchorage to the battery cover or engine cover of sit-on counterbalanced trucks, as well as the latching method of the cover to the truck chassis, shall have sufficient strength in the event of a backwards tip-over of the truck from a loading dock. The seat anchorage shall be able to withstand a force of 2 250 N at a 45° ±5° angle, as shown in Figure 4.		P
	Verification of this requirement shall be by means of a type test carried out using a strap wrapped around the seat as shown in Figure 4.		P
	The specification and marking of the operator's seat is subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
4.7.5	Protection from road wheels and objects thrown up by the wheels		P
4.7.5.1	Ride-on trucks		P
	In the normal operating position, the operator shall be protected against contact with the truck wheels and against objects thrown up by the wheels (e.g. mud, gravel, debris). The protection device for the steered wheels need only cover the wheels when in a straight-line position.		P
4.7.5.2	Pedestrian-controlled trucks		N
	The operator in the normal operating position shall be protected against contact with the drive and stabilizing wheels. The position of these wheel protections shall be in accordance with Figure 5.		N
	If, for pedestrian-controlled trucks, the driving and stabilizing wheel protection specified in 4.7.5.2 cannot be complied with, a wheel guard (deflector) as shown in Figure 6 shall be installed. For castors, the deflector need only be mounted on the side on		N

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Clause	Requirement-Test	Result-Remark	Verdict
	which the conditions specified in 4.7.5.2 are not met.		
4.7.6	Protection from burning		P
	All parts of the truck within reach of the operator in the normal operating position or when the operator is entering or leaving the operating position shall be insulated or shielded so that the surface temperature, generated by heat sources in the truck, of bare metal parts does not exceed 65 °C, and that of painted or plastic parts does not exceed 83 °C. The temperature of the air at the heater outlet, where fitted, shall not exceed 60 °C.	<85°C	P
4.7.7	Protection against crushing, shearing and trapping		P
4.7.7.1	General		P
	Parts that move relative to one another and that are within reach of the operator in the normal operating position shall be adequately guarded. If hazards still exist, they shall be identified according to 6.2 and on the truck in accordance with 6.3.3.4.	Warning signs	P
	Fixed guards and their mounting systems and fixed and/or removable guard systems are subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
4.7.7.2	Minimum distances		P
	Parts separated by the following minimum distances satisfy the adequate guarding requirements of 4.7.7.1:		P
	a) places where only the operator's fingers can be trapped: min. 25 mm;	40mm	P
	b) places where only the operator's hands or feet can be trapped: min. 50 mm;	85mm	P
	c) places where the operator's arms or legs can be trapped: min. 100 mm.	360mm	P
	Moving parts that need to be in contact with, or move in close proximity to, one another shall be guarded. Any openings in such guarding shall be small enough to prevent an 8 mm diameter probe from passing through them. If such hazards still exist, they shall be identified on the truck in accordance with 6.3.3.4.		P
4.7.7.3	Attachments		P
	Crushing and shearing hazards to the operator in the normal operating position associated with attachments, except at the load supporting points, shall also meet the relevant requirements of 4.7.7.1. If such hazards still exist, they shall be identified according to 6.2 and on the attachment by a		P

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Clause	Requirement-Test	Result-Remark	Verdict
	warning sign in accordance with 6.3.3.4.		
4.7.7.4	Foot protection		N
	Trucks with a side-facing seated or standing operator shall be so built that when travelling, the operator cannot unintentionally place his feet outside the confines of the truck; or, alternatively, the truck shall be equipped with a traction cut off (e.g. dead-man switch), enabled whenever an operator's foot is not in the safeguarded position.		N
4.7.8	Operator restraint		P
	Sit-on counterbalanced lift trucks with a rated capacity up to and including 10 000 kg and sit-on, single side-loading trucks shall have a restraint device, system or enclosure intended to reduce the risk of entrapment of the operator's head and/or torso between the truck and the ground in the event of a tip-over. Such means shall not unduly restrict the operation of the truck, e.g. the operator's access, egress, and/or visibility. Warnings and instructions on the purpose, use and action to be taken in the event of a tip-over, so as to reduce the risk associated with the operator's head impacting a solid surface, shall be provided on the truck and described in the instruction handbook (see 6.2). If a restraint system with a belt is used, this system shall be in accordance with ISO 24135-1.	Safty belt	P
	Operator restraint requirements for sit-on counterbalanced trucks are subject to regional requirements, additional to the requirements of this part of ISO 3691, including requirements for counterbalanced lift trucks having a centre control, sit-on, non-elevating operator and a rated capacity up to and including 10 000 kg, and sit-on, single side-loading trucks. See ISO/TS 3691-8.		P
4.7.9	Additional operator positions		N
	Additional operator position(s) shall be in accordance with 4.7.1 to 4.7.8.		N
4.8	Stability		P
4.8.1	General		P
	In order to reduce the hazards of longitudinal and lateral tip-over in the operating conditions foreseen by the manufacturer, the trucks specified below shall comply with the stability requirements given in the applicable part of ISO 22915, without permanent deformation of the structure (see 5.2):	According to the EN 16203:2014.	P
	-basic test criteria and requirements for all applicable truck types, ISO 22915-1;	According to the EN	P

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Clause	Requirement-Test	Result-Remark	Verdict
		16203:2014.	
	-counterbalanced trucks with mast, ISO 22915-2;	According to the EN 16203:2014.	P
	-reach and straddle trucks, ISO 22915-3;		N
	-pallet stackers, double stackers and order-picking trucks with operator position elevating up to and including 1 200 mm lift height, ISO 22915-4;		N
	-bidirectional and multidirectional trucks, ISO 22915-7;		N
	-industrial variable-reach trucks, ISO 22915-11;		N
	-order-picking trucks with operator position elevating above 1 200 mm, ISO 22915-21.		N
	The stability of trucks lifting less than 500 mm shall be tested according to the test requirements defined for travelling by the appropriate International Standard for stability for a similar truck design equipped with a mast.	3000 mm.	N
	Stability requirements are subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
4.8.2	Specific operating conditions		N
	For specific operating conditions foreseen by the manufacturer, additional stability tests shall be carried out in accordance with the following parts of ISO 22915, as applicable:		N
	-trucks operating in the special condition of stacking with mast tilted forward and load elevated,ISO 22915-8;		N
	-trucks operating in the special condition of stacking with load laterally displaced by powered devices, ISO 22915-10;		N
	-trucks operating in the special condition of offset load, offset by utilization, ISO 22915-20.		N
4.8.3	Levelling indicator for rough-terrain trucks		N
	Rough-terrain trucks shall be equipped with a levelling indicator to permit the operator in the operating position to keep the truck within the tilt limitations (for longitudinal and lateral axes) foreseen by the manufacturer.		N
4.9	Protective devices		P
4.9.1	Overhead guard		P
4.9.1.1	General		P
	Ride-on trucks with a maximum lift height of more than 1 800 mm above the floor shall be fitted with an overhead guard complying with ISO 6055 to protect the operator from falling objects.	fitted with an overhead guard	P

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Clause	Requirement-Test	Result-Remark	Verdict
	Trucks with an elevating operator position up to and including 1 200 mm that feature a lift height of the load of more than 1 800 mm above the operator platform shall be fitted with an overhead guard complying with ISO 6055 to protect the operator from falling objects.	fitted with an overhead guard.	P
4.9.1.2	Additional fitting against falling small objects		P
	The overhead guard specified in 4.9.1.1 shall, when handling a load above 1 800 mm lift height, be constructed in such a manner that it can be provided with an additional fitting making it possible in those special cases to increase the protection of the operator against falling small objects.		P
4.9.1.3	Pedestrian-controlled trucks with foldable platform		N
	Pedestrian-controlled trucks with a foldable platform as specified in 4.7.3.3 shall be provided with means to prevent lifting over 1 800 mm from the floor when the side guards are in their protective position. This does not apply if an overhead guard as specified in 4.9.1.1 is fitted on the truck.		N
4.9.2	Load backrest extension		P
4.9.2.1	Provision for load backrest extension		P
	Trucks fitted with fork arms with a lift height of more than 1 800 mm shall be designed so that they can be fitted with a load backrest extension.	3000 mm	P
4.9.2.2	Size of openings		P
	Load backrest extensions, if provided, shall have height, width, and size openings sufficient to minimize the possibility of the load falling toward the mast when the mast is in a position of maximum rearward tilt.		P
	The size of openings in the load backrest extension, if provided, shall not exceed 150 mm in one of the two dimensions.		P
4.9.3	Warning device		P
	Trucks shall be equipped with an operator-controlled audible warning device.	Waring light	P
4.9.4	Wheels with split wheel rims for inflatable tyres		N
	When split wheel rims are used with pneumatic tyres, the truck shall be provided with means to prevent the user from separating the halves of the wheel before removing it from the axle. Information on the proper means of removing the tyre from the wheel shall be provided in the instruction handbook (see 6.2).		N
4.9.5	Traction battery compartment	internal combustion engine powered truck	N

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Clause	Requirement-Test	Result-Remark	Verdict
4.9.5.1	Unauthorized access		N
	On trucks with a nominal battery voltage exceeding 120 V d.c., if a lockable cover is not present on the battery enclosure, facilities shall be provided to enable the battery compartment to be secured so as to prevent unauthorized access to the battery.		N
4.9.5.2	Metal cover		N
	A metal cover for a battery compartment or battery enclosure shall have either		N
	a) sufficient strength and rigidity, in conjunction with an air spacing of at least 30 mm provided between it and the battery terminals, so that the battery terminals are not short-circuited when a 980 N force is applied to any area 300 mm × 300 mm of the cover, or		N
	b)an air space reduced to a minimum of 10 mm, provided covers or live parts of the battery are insulated in such a way that disintegration and/or displacement of the insulation is prevented.		N
4.9.5.3	Non-metallic cover		N
	For non-metallic covers of battery compartments, the following applies.		N
	a) The cover shall have a burn rating of V0 or V1 in accordance with IEC 60695-11-10.		N
	b) The cover shall comply with an impact test of 136 J, the impact being produced by dropping a steel sphere having a diameter of 100 mm and mass of 4,11 kg from a height of 3,3 m. If the battery is located under an overhead guard, the impact may be reduced to 68 J, produced by dropping a steel sphere having a diameter of 100 mm and mass of 4,11 kg from a height of 1,65 m. There shall be no live parts exposed or impact that causes physical damage to the battery.		N
	c) If metallic parts project into the battery compartment, then 4.9.5.2 applies.		N
4.9.5.4	Ventilation		N
	The compartment and enclosure that houses a battery shall be provided with means for ventilation that reduce the likelihood of accumulation of explosive hydrogen-air mixture during truck operation.		N
	When openings are positioned such that gases can escape freely, these shall be located away from the operator's position. Ventilation openings are usually satisfactory if they provide a cross-section, in square millimetres, equal to half the number of		N

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Clause	Requirement-Test	Result-Remark	Verdict
	cells, multiplied by the rated capacity in Ampere-hours. This level of ventilation is not intended to cover the charging condition.		
4.9.5.5	Resistance to electrolyte		N
	The battery enclosure, in accordance with ISO 20898, shall be resistant to the chemical effects of the electrolyte.		N
4.9.6	Battery-restraint devices		N
	On battery-powered trucks, means shall be provided to retain the battery from moving more than 15 mm in a horizontal direction.	internal combustion engine powered truck	N
	In addition, on ride-on type trucks — where the displacement of the traction battery may pose a risk of injury to the operator due to a tip-over — a battery-restraint device(s) shall restrict the battery displacement to no more than 100 mm into the space normally occupied by the operator or from moving more than 100 mm in a lateral direction beyond the limits of the battery compartment. A tip-over may be simulated by allowing a static truck to fall free from its critical balance point impacting on a horizontal plane. A complete truck is not required for this test, but all battery compartment related parts shall be fitted. The movement of the battery shall not interfere with the operator's egress from the truck.		N
	The battery housing shall be constructed, located and the battery installed so as to avoid electrolyte being spilled onto the operator in the event of tip-over and/or to avoid the accumulation of vapours in places occupied by the operator.		N
	The battery cover, if any, of a compartment that is an integral part of the truck, or a separate enclosure such as a tray and cover, shall be secured.		N
4.9.7	Starter battery requirements		P
	The starter battery on engine-powered trucks shall be restrained from movement.		P
4.9.8	Handling of batteries		N
	Battery-powered trucks should be designed such that batteries with a mass in excess of 25 kg can be easily removed using a means which supports the weight of the battery during removal, e.g. an opening for slings in	internal combustion engine powered truck	N
4.10	Visibility and lighting		P
4.10.1	Visibility		P

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Clause	Requirement-Test	Result-Remark	Verdict
	Requirements for all-round visibility from unladen trucks up to and including 10 000 kg rated capacity shall be in accordance with ISO 13564-1.		P
	For visibility with load, see 6.2.2, considering that, if direct visibility is limited by the load, aids can be used.		P
	Visibility requirements are subject to regional requirements, additional to the requirements of this part of ISO 3691. See ISO/TS 3691-7:2011.		P
4.10.2	Lighting		P
	Ride-on trucks shall be so designed that it is possible, referring to the manufacturer's instructions, to equip them with travel lights, working lights and signal lights.		P
4.11	Environmental conditions		P
4.11.1	Operator's cab		P
4.11.1.1	General		P
	If a cab is fitted in lieu of an overhead guard, it shall comply with 4.9.1.	Used the overhead guard	P
4.11.1.2	Fire resistance		P
	All material and components of the cab shall be fire-resistant, with a maximum burning speed of 250 mm/min when the standard test piece is tested in accordance with ISO 3795.		P
4.11.1.3	Ventilation		P
	If a totally enclosed cab is fitted, provision shall be made for efficient ventilation.		P
4.11.1.4	Heater, demister and defroster		N
	If a totally enclosed cab is fitted with a heater/demister, the air intake should be connected to a fresh air inlet; recycling of the air is permissible. The heater shall be securely fixed. The heater shall be so designed that the requirements of 4.7.6 can be met. A demist/defrost capability shall be provided for the windscreen and rear window.		N
4.11.1.5	Wipers and washers		N
	Windscreen wiper(s) and washer(s) shall be fitted to allow the operator a clear view of the operating area. Wiper(s) and washer(s) for the rear window may be omitted if the truck is driven predominantly in the forward direction, e.g. tow tractors. Wiper(s) and washer(s) may be omitted entirely if the truck only operates within an enclosed area. If glass is used in the window apertures, it shall be toughened		N

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Clause	Requirement-Test	Result-Remark	Verdict
	or laminated.		
4.11.1.6	Access and emergency exit		P
	The cab shall have an access and an emergency exit complying with ISO 2867. The emergency exit, which may be a window, shall allow escape in a different direction than that of the normal exit.		P
4.11.1.7	Storage of instruction handbook		P
	Provision shall be made for the storage of the instruction handbook (see 6.2) so that it does not obstruct the normal operating position.	See the instruction	P
4.11.1.8	Additional operator's position		N
	If an additional operator's position is equipped within a cab, it shall meet the requirements of 4.11.1.1 to 4.11.1.6.		N
4.11.2	Noise emissions		P
	Noise emissions are subject to regional requirements. See ISO/TS 3691-7:2011.	Accordance to the EN 12053.	P
4.11.3	Vibration		P
	Whole-body vibrations transmitted to the operator are subject to regional requirements. See ISO/TS 3691-7:2011.	Accordance to the EN 13059.	P
4.11.4	Electromagnetic compatibility (EMC)		P
	EMC is subject to regional requirements. See ISO/TS 3691-7:2011 and ISO/TS 3691-8.	Accordance to the EN 12895.	P
4.11.5	Transport		P
4.11.5.1	Location for lifting and/or slinging points		P
	When a truck can be lifted without disassembling, locations for lifting and/or slinging points shall be provided and shall be indicated on the truck and/or in the instruction handbook (see 6.2).	See the drawings	P
	When individual assemblies of the truck can be removed for normal operation and/or transport, then lifting and/or slinging points shall be provided and these shall be indicated on the assemblies and/or in the instruction handbook.		P
	Slinging points for transportation of the truck shall be arranged such that there is no possibility of sudden movement.		P
4.11.5.2	Tie-down points		P
	Tie-down points for transportation of the assembled truck shall be provided and indicated on the truck or in the instruction handbook (see 6.2).		P
4.11.5.3	Slinging of removable attachments		P

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Clause	Requirement-Test	Result-Remark	Verdict
	Locations for the slinging of a removable attachment shall be provided and shall be indicated on the attachment (see 6.3.1.2) and/or in the instruction handbook.	See the instruction	**P**
	Slinging points for transportation of the attachment shall be arranged such that there is no possibility of sudden movement.		P
4.12	Devices for towing		N
	Trucks used for towing trailers shall be fitted with towing or coupling devices designed, constructed and arranged to reduce hazards of connection and disconnection and to prevent accidental disconnection during use.		N
5	**Verification of safety requirements and/or protective measures**		**P**
5.1	General		P
	The manufacturer shall have verification that the safety requirements and/or protective measures given in Clause 4 have been incorporated into the design and manufacture of the truck. Either one or a combination of the following shall be used to achieve verification:		P
	a) by design, e.g. verification of drawings and documents, or calculation;	See the drawings.	P
	b) by measurement, e.g. tests of travelling and lowering speed or lift and tilt leakage;		P
	c) by visual examination, e.g. no permanent deformation after tests, verification of the marking of the truck;		P
	d) by further testing.		P
5.2	Structural tests		P
	These tests are to be performed on a sample that is representative of series production. The structural components of the truck and its attachments shall carry static loads of 1,33 Q_1 and 1,33 Q_2 for 15 min each, where		P
	Q_1 is the rated capacity at the standard lift height and standard load centre distance in accordance with the information on the capacity plate;		P
	Q_2 is the actual capacity at maximum lift height in accordance with the information on the capacity plate.		P
	The truck shall be on substantially level ground with the mast in the substantially vertical position and may be anchored to prevent tip-over.		P
	The loads may be applied at the corresponding	No any visual permanent	P

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Clause	Requirement-Test	Result-Remark	Verdict
	height by means independent of the truck. The test shall not result in any visual permanent deformation or damage.	deformation and damage.	
5.3	Functional verification		P
	Functional verification shall be carried out on each truck to verify that it is able to perform the tasks for which it was designed. These tests shall be done according to the manufacturer's instructions. They shall be performed by trained persons either operating and testing the truck according to the manufacturer's instructions or simulating these tests by any method giving an equivalent effect and producing substantially the same result.		P
	Each truck shall be inspected to ensure that the travelling, braking, steering, load-handling controls and combined functions, if any, are appropriately identified and operate correctly. The correct operation of warning devices, safety devices and lighting, if any, shall also be checked.		P
6	**Information for use**		**P**
6.1	General		P
	Each truck and removable attachment shall be supplied to the user with an instruction handbook(s), covering operating and regular servicing and addressing all identified hazards, printed in the language(s) of the country in which the truck is to be used, where required by national law. See also ISO 12100:2010, 6.4.5.	See the EN ISO 12100.	P
	There is no need for the workshop and parts handbooks intended for use by specialized personnel employed by the manufacturer or his authorized representative to be supplied with each truck, and these can be printed in the language of the country where the truck is to be used, as required by national law. In other cases, the instructions shall be in a language agreed between the truck supplier and purchaser.		P
6.2	Instruction handbook		P
6.2.1	Truck/attachments		P
	The instruction handbook(s) shall include, as applicable, at least the following information:		P
	a) name and address of the manufacturer or authorized representative;		P
	b) designation of type, e.g. counterbalanced, side-loading truck;		P
	c) description of the truck and accessories;	See the instruction	P
	d) attachments supplied with the truck and their	See the instruction	P

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Clause	Requirement-Test	Result-Remark	Verdict
	assembly precautions;		
	e) details of use of a removable load backrest extension;	See the instruction	P
	f) details for the installation of a fire extinguisher, if required by the application of the truck;		N
	g) admissible wheel rims and tyres with inflation pressures for pneumatic tyres;	See the instruction	P
	h) description of safety devices and warning labels.	See the instruction	P
	Instructions on truck/attachments are subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
6.2.2	Operation of truck		P
	The instruction handbook(s) shall include, as applicable, at least the following information:		P
	a) intended uses of the truck and attachments, and examples of hazardous misuse;	See the instruction	P
	b)training requirements for the operator;	See the instruction	P
	c)function of operating controls and displays;	See the instruction	P
	d)pre-shift checks before the truck is put into operation;	See the instruction	P
	e)instructions for adjustment of the operator's seat;	See the instruction	P
	f)instructions for operation with/without cab, with/without doors;	See the instruction	P
	g)instructions for access and egress;	See the instruction	P
	h) instructions for safe handling by the operator, e.g. when changing attachments or moving fork arms;	See the instruction	P
	i) requirements of the ground/floor where the truck is to be used;	See the instruction	P
	j)instructions for starting, driving and stopping the truck;	See the instruction	P
	k)instructions for handling loads, warning about the hazards due to the action of wind forces;	See the instruction	P
	l) instructions when operating on a gradient;	See the instruction	P
	m) instructions for towing the truck;		N
	n) instructions for parking the truck;	See the instruction	P
	o) warning of risks during the use of the truck and its attachments, including crushing and shearing hazards;	See the instruction	P
	p) climatic conditions in which the truck is designed to operate;	See the instruction	P
	q)information about the direction of turning of the truck in relation to rotation of the steering wheel for end-controlled trucks;	See the instruction	P

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Clause	Requirement-Test	Result-Remark	Verdict
	r)information about operating the truck with loads causing insufficient visibility;	See the instruction	P
	s)information on the use of any visual aid that may be provided;	See the instruction	P
	t)information and conditions for the use of the drawbar;		N
	u)instructions when operating a rear touch device;		N
	v)information or instructions on action to be taken in the event of a malfunction;	See the instruction	P
	w)information for operation of the truck by a remote control device, e.g. visibility;	See the instruction	P
	x)the normal operating conditions as defined by the manufacturer, i.e. those for which the truck has been designed and the manner in which the truck will be used;	See the instruction	P
	y)instructions on the use of the operator-restraint device, system or enclosure, and guidance on the operator's behaviour in the event of a tip-over;	See the instruction	P
	z)information about lighting of the working area;	See the instruction	P
	aa) the procedure for movement of inoperative trucks;	See the instruction	P
	bb)instructions against operating truck with guarding removed;	See the instruction	P
	cc)lift height for travelling;	See the instruction	P
	dd) crushing and shearing hazards for the operator of pedestrian-controlled trucks featuring foldable platforms and reach trucks, between parts of the environment and the truck during travelling forward;	See the instruction	P
	ee) instructions to the operator of a stand-on end-control truck to step off and away from the truck in the event of a tip-over or off-dock accident;	See the instruction	P
	ff) information and instructions for using attachments, e.g. load bearing clamp.	See the instruction	P
	Instructions on the operation of the truck are subject to regional requirements, additional to the requirements of this part of ISO 3691.	See the instruction	P
6.2.3	Details for battery-powered trucks	internal combustion engine powered truck	N
	The instruction handbook(s) shall include, as applicable, at least the following information:		N
	a) specification of approved batteries and on-board battery chargers;		N
	b)procedure for safe handling of batteries, including installation, removal and secure mounting on the		N

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Clause	Requirement-Test	Result-Remark	Verdict
	truck;		
	c)warning of risks of accumulation of hydrogen under covers;		N
	d)battery charging procedures and instructions;		N
	e) service mass of battery and ballast when required.		N
6.2.4	Details for internal-combustion-engine powered trucks		P
	The instruction handbook(s) shall include at least the following information:		P
	a) approved fuels;	Petrol oil or LPG	P
	b) procedure for safe handling of fuels;	See the instruction	P
	c) procedure for refuelling;	See the instruction	P
	d) warning of the effect of exhaust emissions in confined spaces;	See the instruction	P
	e) warning of the effect of exhaust emissions for the operator.	See the instruction	P
6.2.5	Service and maintenance		P
	The instruction handbook(s) shall include, as applicable, at least the following information:		P
	a)training and qualifications needed for service and maintenance staff;	See the instruction	P
	b) safe procedure for the identification, detection and correction of faults;	See the instruction	P
	c) instructions for changing tyres or wheels;	See the instruction	P
	d) instructions for verification that markings, e.g. decals, are in place and legible;	See the instruction	P
	e) instructions for de-energizing of stored energy components;	See the instruction	P
	f) access to maintenance while working at height;	See the instruction	P
	g) servicing operations for which no specific skills are required;	See the instruction	P
	h) use of approved spare parts;		P
	i) drawings and diagrams necessary for truck service and maintenance;	See the instruction	P
	j) instructions for disposing of waste material (e.g. oils and battery);	See the instruction	P
	k) type and frequency of inspections and maintenance operations, with particular attention to the replacement and durability of wear and serviceable parts, emissions, and to the user's logbook (e.g. filter, brakes, chains, hydraulic hoses);		P
	l) instructions for removing and reattaching guarding;	See the instruction	P

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Clause	Requirement-Test	Result-Remark	Verdict
	m) instructions for regular verification of seat belt related to	See the instruction	P
	1) cut or frayed straps,		P
	2) worn or damaged hardware, including anchor points,		P
	3) buckle or retractor malfunction,		P
	4) loose stitching.		P
6.2.6	Transportation, commissioning and storage		P
	The instruction handbook(s) shall include, as applicable, at least the following information:		P
	a) mass and overall dimensions of the truck and dismantled parts for transport, commissioning and storage;	4730kg	P
	b) procedures for transporting, including loading and unloading;	See the instruction	P
	c) procedure for truck reassembly and mounting of attachments;	See the instruction	P
	d) functional tests on completion of commissioning;		P
	e) procedure for movement of inoperative trucks;	See the instruction	P
	f) procedure for prolonged shut down and storage of trucks.	See the instruction	P
	Transportation, commissioning and storage are subject to regional requirements, additional to the requirements of this part of ISO 3691.	See the instruction	P
6.2.7	Truck modification		P
6.2.7.1	Unauthorized truck modification is not permitted. The text of 6.2.7.3 shall be included in the instruction handbook and the workshop handbook.		P
6.2.7.2	Except where provided in 6.2.7.3, no modifications or alterations to a powered industrial truck, which could affect, for example, capacity, stability or safety requirements of the truck, shall be made without the prior written approval of the original truck manufacturer, its authorized representative, or a successor thereof. This includes changes affecting, for example, braking, steering, visibility and the addition of removable attachments. When the manufacturer or his successor approves a modification or alteration, the manufacturer or successor shall also make and approve appropriate changes to the capacity plate, decals, tags and operation and maintenance handbooks.		P
6.2.7.3	Only in the event that the truck manufacturer is no longer in business and there is no successor in the interest to the business, may the user arrange for a		P

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Clause	Requirement-Test	Result-Remark	Verdict
	modification or alteration to a powered industrial truck, provided, however, that the user		
	a) arranges for the modification or alteration to be designed, tested and implemented by an engineer(s) expert in industrial trucks and their safety,		P
	b) maintains a permanent record of the design, test(s) and implementation of the modification or alteration,		P
	c) approves and makes appropriate changes to the capacity plate(s), decals, tags and instruction handbook, and		P
	d) affixes a permanent and readily visible label to the truck stating the manner in which the truck has been modified or altered, together with the date of the modification or alteration and the name and address of the organization that accomplished those tasks.		P
6.3	Marking		P
6.3.1	Information plates		P
6.3.1.1	Trucks		P
	Trucks shall be marked legibly and indelibly (e.g. weather-proofed, profiled letters) with at least the following details:		P
	a) name and address of the manufacturer or his authorized representative;		P
	b) designation of series or type and compliance with the requirements of this part of ISO 3691;		P
	c) serial number and year of manufacture;		P
	d) unladen mass of the truck in working order and without removable attachments, and without battery in the case of battery-powered trucks, but with fork arms or integral attachments, the actual mass being permitted to vary from the stated mass by up to ±5 % or 1 000 kg, whichever is the lower of the two;	4730kg	P
	e) actual capacity at maximum lift height with load centre distance; where a secondary lift is fitted to a truck, the capacity at maximum lift shall be determined with the secondary mast fully elevated;	3500kg	P
	f) actual capacities at other lift heights and load centre distances, if applicable;	3000mm, 500mm	P
	g) actual capacity with each removable attachment fitted at the manufacturer's authorized lift height(s) and load centre(s), these actual capacities being easily readable by the operator in the normal operating position;		P

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Clause	Requirement-Test	Result-Remark	Verdict
	h) on battery-powered trucks, the authorized maximum and minimum battery mass and the system voltage;		n
	i) if fitted, the maximum supporting force on the towing point connection, in newtons;	17KN	P
	j) if fitted, the drawbar pull on the towing point connection, in newtons;		N
	k) the nominal power in kilowatts, e.g. marked on the engine or electric motor.	37KW	P
	Marking requirements are subject to regional requirements, additional to the requirements of this part of ISO 3691.		P
6.3.1.2	Removable attachments		P
	Removable attachments shall be marked legibly and indelibly (e.g. weather-proofed, profiled letters) with at least the following details:		P
	a) name and address of the attachment manufacturer or his authorized representative;		P
	b) model or type;		P
	c) serial number and year of manufacture;		P
	d) mass of attachment, which may vary from the stated figure by up to ±5 % or 200 kg, whichever is the lower of the two;		P
	e) distance of the centre of gravity of the attachment from its mounting face on the truck;		P
	f) rated capacity;	3500kg	P
	g)in the case of hydraulically or pneumatically operated attachments, the maximum operating pressure recommended by the attachment manufacturer;	hydraulical	P
	h) load centre, if applicable;	500mm	P
	i) lost load centre distance;		P
	j) the instruction “The capacity of the truck and attachment combination shall be complied with”.		P
6.3.1.3	Tractors		P
	Tractors shall be marked legibly and indelibly (e.g. weather-proofed, profiled letters) with at least the following details:		P
	a) name and address of the manufacturer or the authorized representative;		P
	b) designation of series or type;		P
	c) unladen mass of the tractor in working order without battery for battery-powered tractors; the mass may vary from the figure shown by up to ± 5 % or 1 000 kg, whichever is the lower;		P
	d) serial number and year of manufacture;		P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	e) on battery-powered tractors, the authorized minimum and maximum battery mass and the system of voltage;		N
	f) the nominal power in kilowatts, e.g. marked on the engine or electric motor;		P
	g) the maximum supporting force on the tow-hook, in newtons;		P
	h) the drawbar pull, in newtons, and the period of time during which this pull can be exerted.		N
6.3.1.4	Marking of controls		P
	Controls shall be legibly and indelibly marked (e.g. weather-proofed, profiled letters) with graphic symbols indicating the function(s), except where these are obvious, e.g. accelerator pedal. Each symbol shall be affixed on, or in close proximity to, the control to which it applies. Control symbols shall comply with ISO 3287, for existing symbols.		P
6.3.2	Information plate for trucks operating in special conditions		P
	If a truck is designed to operate in special conditions (see 4.1.1. and 4.8.2), the manufacturer shall provide, where appropriate, and in addition to the information provided in the instruction handbook, an information plate on the truck identifying those special conditions of use, including capacity if different from the capacity during normal operation (see 4.1.2).		P
6.3.3	Other information		P
6.3.3.1	Marking for slinging of trucks		P
	Locations for slinging shall be clearly indicated on the truck or shall be declared in the instruction handbook (see 6.2).	See the instruction	P
6.3.3.2	Pneumatic tyre inflation pressure		P
	The specified inflation pressures shall be clearly indicated on the truck.	See the instruction	P
6.3.3.3	Filling points		P
	Filling points for fuel and hydraulic fluid shall be clearly indicated on the truck in accordance with ISO 3287.		P
6.3.3.4	Warning signs		P
	Symbols giving warnings of remaining hazards shall be affixed to the truck and attachments on, or in close proximity to, the hazard concerned. On stored energy devices (see 4.1.6), a warning label and the method for removing any stored energy shall be affixed to that component and noted in the	See the instruction	P

EN ISO 3691-1:2015/A1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	service handbook. Warnings shall be in accordance with ISO 15870.		
6.3.4	Languages		P
	If any of the information in 6.3.1 to 6.3.3 is in words, it shall be written in the language(s) of the country in which the truck is to be used, in accordance with national law. In other cases, the instructions shall be in a language agreed between the truck supplier and purchaser.	English	P
6.3.5	Operator restraint		P
	Information or symbols giving instructions for the use of the operator restraint system or enclosure shall be easily readable by the operator in the normal operating position.	See the instruction	P

4. Airborne Noise Test result (EN 12053:2001+A1:2008)

Loading Mode					Mean Value	
Background	53.5	53.6	53.3	53.5	**53.42**	dB LAeq
Reading 1	56.6	56.2	58.9	59.1	**56.31**	
Reading 2	55.4	56.2	59.9	59.6	**56.78**	
Reading 3	55.9	56.3	59.3	59.6	**56.78**	
			Average Level from 2 Highest Values		**56.78**	dB LAeq
			Corrected level for Background		**54.095**	dB LAeq

Forward Mode					Mean Value	
Background	53.4	53.5	53.1	53.3	**53.42**	dB LAeq
Reading 1	55.3	56.6	55.9	56.6	**56.11**	
Reading 2	55.9	56.6	57.4	56.9	**56.73**	
Reading 3	55.9	57.3	57.8	56.6	**56.91**	
			Average Level from 2 Highest Values		**56.82**	dB LAeq
			Corrected level for Background		**54.168**	dB LAeq

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Reverse Mode					Mean Value	
Background	53.4	53.5	53.6	53.4	**53.44**	dB LAeq
Reading 1	57.3	55.4	56.8	57.3	**56.70**	
Reading 2	55.9	56.5	57.6	56.1	**56.53**	
Reading 3	57.5	55.3	56.6	56.4	**56.45**	
			Average Level from 2 Highest Values		**56.61**	dB LAeq
			Corrected level for Background		**53.766**	dB LAeq
Measurement Radius				10	m	

Mean Level (LpAeq,3 Drive)	55.557	dB (L_A)
Mean Level (dB $L_{AeqLoad\ Drive}$)	54.887	dB (L_A)
Correction for Area	28.0	dB
Calculated Sound Power Level	**82.869**	dB (L_{WA})
Rounded Sound Power Level	82.9	dB (L_{WA})

Measurement Positions:

Truck Length l m	Hemisphere Radius r m	Microphone height m	Microphone offset m a	Measurement surface ratio 10 lg S/S_0
$l \leq 1{,}5$	4,00	1,50	2,80	20,00
$1{,}5 < l \leq 4$	10,00	1,50	7,10	28,00
$l > 4$	16,00	1,50	11,40	32,00
S = measurement surface in m² S_0 = reference surface = 1 m²				

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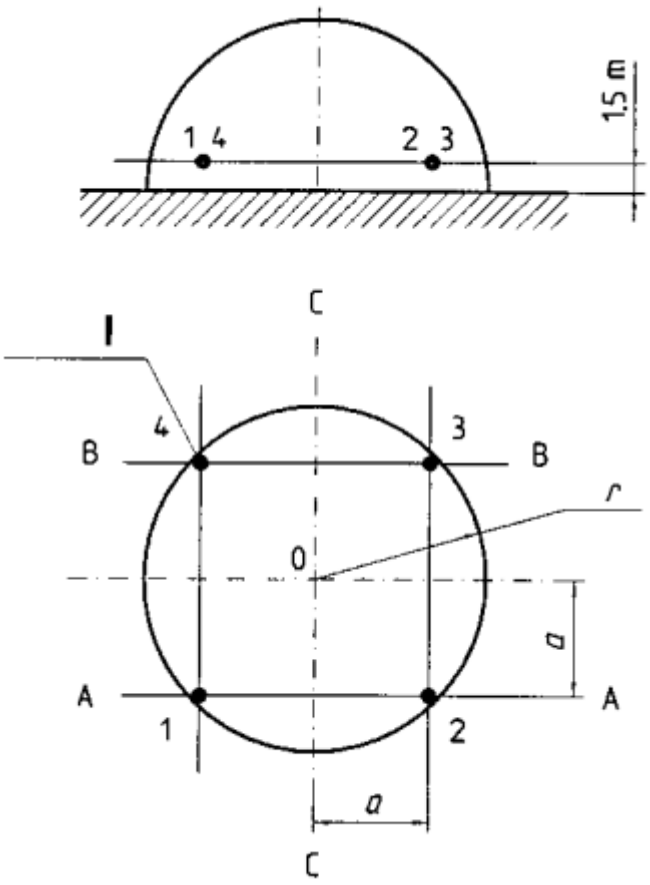


4 Metre Hemisphere

Position	1	2	3	4
x	2.8	-2.8	-2.8	2.8
y	2.8	2.8	-2.8	-2.8
z	1.5	1.5	1.5	1.5

Surface Area = 100.5m^2 10log S/S_o = 20dB

10 Metre Hemisphere

Position	1	2	3	4
x	6	-6	-6	6
y	6	6	-6	-6
z	1.5	1.5	1.5	1.5

Surface Area = 628m^2 10log S/S_o = 28dB

16 Metre Hemisphere

Position	1	2	3	4
x	11.2	-11.2	-11.2	11.2
y	11.2	11.2	-11.2	-11.2
z	1.5	1.5	1.5	1.5

Surface Area = 1608m^2 10log S/S_o = 32.1dB

The average sound pressure level at the operator's position in an operational cycle is determined from the values of different conditions of operation in accordance with the equation:

$$L_{pAZ} = 10 \lg \left[1/(a+b+c) \times (a \times 10^{0,1 L_{pa}} + b \times 10^{0,1 L_{pb}} + c \times 10^{0,1 L_{pc}})\right] \text{ dB}$$

where:
a is the time proportion factor - LIFTING
b is the time proportion factor - IDLING
c is the time proportion factor - DRIVING
Lpa is the sound pressure level at the operator's position during LIFTING
Lpb is the sound pressure level at the operator's position during IDLING
Lpc is the sound pressure level at the operator's position during DRIVING

Acoustical Data

A Weighted Sound Power Level:	82.9	dB (L_{WA})
Measurement Shape:	Hemisphere	
Area S of Measurement Surface:	628m^2	
Environmental Correction k_2:	Not applicable	
Surface Sound Pressure Level $L_{pf,x}$:	54.9	dB (L_{Aeq})

EN 1175:2020			
Clause	Requirement-Test	Result-Remark	Verdict
1	**Scope**		**P**
	This standard specifies the electrical and related mechanical safety requirements for the design and construction of the electrical installation in internal combustion engine powered trucks (hereinafter referred to as "trucks") with starter battery nominal voltages up to and including 24 V.	internal combustion engine powered trucks	P
2	**Normative references**		**P**
3	**Definitions**		**P**
4	**List of hazards**	**See the risk assessment test report.**	**P**
5	**General requirements**		**P**
5.1	Starter battery		P
5.1.1	Insulation		P
	Any live parts of the battery not connected to the frame shall be insulated	be insulated	P
5.1.2	Constraining		P
	Batteries of all trucks shall be constrained to prevent displacement which may give rise to danger.	hold.	P
5.1.3	Disconnection		P
	Truck shall be so designed and constructed that the battery can be electrically disconnected with the aid of an easily accessible device e.g. a switch or connector.	Be disconnected. Connector.	P
	Disconnectable battery terminals satisfy this requirement providing the terminals are accessible without the use of a key or tool.	Use of tool.	P
5.2	Protection of circuits		P
	Control and auxiliary circuits shall be fuse protected against short circuit conditions and dangerous excess current. Several auxiliary circuits in parallel, with combined rated current not exceeding 12 A, may be protected by a single device.	Fuse.	P
5.3	Safety related control systems		P
5.3.1	Low voltage		P
	Electrical control systems shall be so designed that all functions operate and safety is not jeopardized if the voltage should fall below the nominal battery voltage by as much as 15%.	all functions operate and safety is not jeopardized.	P
5.3.2	Frame faults		P
	The electric circuits shall be so designed or protected, that frame faults shall not cause inadvertent movements that cannot be controlled by the driver.		P
5.3.3	Load handling control		P
	Electrical and electronic control load handling systems, shall be arranged so that in case of a fault the load	category 1	P

EN 1175:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	handling movement can be stopped. The safety related parts shall be in accordance with category 1 in EN ISO 13849-1:2008, 6.2.		
	This requirement is not necessary where the movements are controlled by some other means, e.g. Direct manually operated hydraulic valves.		N
5.3.4	Speed limitation		P
	For limiting or reducing the speed of a function on trucks designed to travel with an elevated operator and/or load for stability reasons the following shall apply.		P
	a) The electrical and electronic circuits shall be so designed and fitted that in the event of an electrical fault, the speed limitation is preserved or the motion shall be brought to a controlled stop. Restarting shall not be possible until the circuit has been restored. Where it is not possible to satisfy the above requirements by a simple electrical or electronic circuit, the electrical or electronic circuits may be duplicated. Facilities shall be provided to check the correct functioning at service intervals in accordence with the manufacturer's instructions. The safety related parts shall be in accordance with category 2 in EN 954-1:1996.		P
	b) Mechanically operated switches shall be of a positive opening type that disconnect the circuit. These shall be in accordance with EN 60947-5-1:1991. Other switches can be used providing the system meets the safety requirements in a) (above).		P
5.3.5	Steering control		P
	Electrical and electronic steering control systems shall be arranged so as to avoid operation of the steering system unrelated to the manual input during travel. Any electrical or electronic fault capable of producing the above condition shall be detected and the steering assistance de-energized within 0,1 s. Where the power steering system is fully dependent on the electrical power source, the truck shall also be brought to a controlled stop automatically. It shall be possible to check the operation of the safety circuit of this system at service intervals in accordance with the manufacturers instruction. The safety related parts shall be in accordance with category 3 in EN ISO 13849-1:2008, 6.2.	category 3	
5.3.6	Parameter		P
	Any uncontrolled change of the electronic system parameter shall maintain the safe operation and correct		P

EN 1175:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	function of the truck.		
	Any change of parameter values controlled by the operator shall not result in a hazardous situation. The system shall ensure safe operation and correct function of the truck.		P
5.4	Wiring practices, conductors and electrical components		P
	One pole of the electrical system may be connected to the truck frame.		P
5.4.1	Protection		P
	All conductors shall be either effectively insulated and where necessary protected against mechanical damage or shall be so placed and safeguarded as to avoid danger when the truck is in its normal operating condition.	be effectively insulated	P
5.4.2	Cross-sectional area		P
	The cross-sectional area shall be so selected that during operation of the truck the temperature does not exceed the temperature rating of insulation used.		P
5.4.3	Specification		P
	Copper conductors external to enclosures (excluding short connections between electric or electronic components and wires that are an integral part of a proprietary component) shall be:		P
	a) flexible; b) of cross-sectional area not less than: 1) for control wiring 0,50 mm^2; 2) for signal wiring 0,30 $mm^{2;}$ 3) for data communication wiring and for conductors of adequately supported copper multicore cables and wiring harnesses 0,08 mm^2; c) of cross-sectional area not less than 1,00 mm^2 for single wires not incorporated into a harness or extending from the harness more than 250 mm. Conductors of other materials shall be selected and sized to give equivalent performance.	It meets the requirement.	P
5.4.4	Fuel leakage		P
	Wiring and electrical components shall be designed, placed or protected to minimize hazards arising from leakage from the fuel system, such as contamination and fire.		P
5.4.5	Mechanical protection		P
	Where wiring passes through metal parts of the frame or enclosures, the holes shall be fitted with insulating bushes or the wiring protected by some other equivalent means.	Insulating bushes	P
5.4.6	Wiring that flexes		P

EN 1175:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	Wiring that flexes during normal operation of the truck functions shall be relieved of mechanical strain at their electrical termination.		P
5.4.7	Identification		P
	Wires, cables, terminals etc. shall be identified by codings in accordance with the electrical diagram included in the service manual.	See the drawing	P
5.5	Protection against electric shock		P
	Exposed high tension ignition terminals on trucks shall be protected against direct contact by barriers or insulated caps.		P
5.6	Electromagnetic radiations		P
5.6.1	Non ionising radiations		N
	Where trucks are fitted with functional related non-ionising radiation devices (e.g. radio transmitter, RFID reader, data collection system), the radiation shall be minimized with consideration to influence to persons, in particular with active or non-active implantable medical devices.		N
5.6.2	Electromagnetic compatibility		P
	Any functional electromagnetic emission and the immunity of the electric/electronic systems shall be within the limits of EN 12895:2000.	See the EN 12895.	P
6	**Information for use**		**P**
6.1	Electrical diagram		P
	An electrical diagram (which shall include nominal battery voltage and where applicable, frame polarity) shall be included in the service manual. Connection points for auxiliary lighting shall be indicated.	See the electrical drawing	P
6.2	Safety checks		P
	Methods and intervals for checking safety systems shall be included in the service manual or instruction handbook.	See the service manual.	P
6.3	Non-ionising radiation		N
	If the truck, after the commissioning, can be equipped with devices (e.g. radio transmitter, RFID reader, data collection system) that are likely to emit non-ionising radiation which can cause harm to persons, in particular persons with active or non-active implantable medical devices, a warning shall be given in the instruction manual. If those auxiliary devices are installed by the user, the user itself shall ensure that the supplier instructions are fulfilled and/or no harm for the persons has risen.	No such device.	N
	Where trucks are fitted with non-ionising radiation devices warning signs shall be installed.		N

EN 16307-1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
4	**Safety requirements and/or protective measures**		**P**
4.1	General		P
	The following applies to the self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks, dealt with in EN ISO 3691-1. These are additional to the requirements of EN ISO 3691-1 and, in certain instances, replace them.	Engine counterbalanced forklift truck	P
4.2	Electrical requirements		P
	Electrical systems and equipment shall be in accordance with the relevant part(s) of EN 1175.	See the EN 1175-2 and EN 1175-3.	P
4.3	Travel speed		P
	The requirements of EN ISO 3691-1:2012, 4.2.3 shall apply, except the reference to ISO/TS 3691-8, with the following addition:	See the EN ISO 3691-1.	P
	The travel speed of variable-speed pedestrian-controlled trucks operating on level ground shall not exceed 6 km/h.	Not pedestrian- controlled truck	N
	The maximum speed on level ground of stand-on trucks and pedestrian-controlled trucks fitted with a foldable platform when the operator is on the platform shall not exceed 16 km/h.	Not pedestrian- controlled truck	N
4.4	Brakes		P
	The requirements of EN ISO 3691-1:2012, 4.3.1 shall apply, except the reference to ISO/TS 3691-8, with the following addition:	See the EN ISO 3691-1.	P
	The parking and service brakes of trucks that can travel with an elevated operator position and/or elevated load above 500 mm, and up to and including 1 200 mm, are subject to the following requirements:		P
	-for travel speeds up to and including 9 km/h, parking brakes shall be in accordance with ISO 6292:2008, 6.1.2 a), and service brakes shall comply with the specifications of ISO 6292:2008, Table 2, Group C;	20km/h.	N
	-for travel speeds above 9 km/h, parking brakes shall be in accordance with ISO 6292:2008, 6.1.2 b) and service brakes shall comply with the specifications of ISO 6292:2008, Table 2, Group A1.		P
4.5	Additional operation from alongside pedestrian-controlled and stand-on trucks	Not pedestrian- controlled truck	N
	The requirements of EN ISO 3691-1:2012, 4.4.2.7 shall apply, except the reference to ISO/TS 3691-8, with the following addition:		N
	Low-lift order-picking trucks provided with a		N

EN 16307-1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	system that allows operating while walking alongside the truck are subject to the following requirements:		
	-activation of the travel control device from outside of the truck shall only be possible when the truck is stationary;		N
	-the travel control shall be a hold-to-run control and the speed shall not exceed 4 km/h while operating the travel control from outside of the truck;		N
	-braking function shall be automatically applied when travel control device is released.		N
4.6	Lift chains		P
	The requirements of EN ISO 3691-1:2012, 4.6.1 shall apply, except the reference to ISO/TS 3691-8, with the following addition:	See the EN ISO 3691-1.	P
	The minimum safety factor of the lifting mechanism, K_1, shall be as follows:		P
	— for trucks ≤ 10 000 kg rated capacity: $K_1 \geq 5$ — for trucks > 10 000 kg rated capacity: $K_1 \geq 5 - 0{,}2(Q' - 10)$, but not less than 4 where Q' is the rated capacity of the truck, in tonnes.	3 500kg K_1=9.3.	P
4.7	Mast tilt and carriage isolation		P
	The requirements of EN ISO 3691-1:2012, 4.6.3.5 shall apply, with the following addition:	See the EN ISO 3691-1.	P
	For ride-on trucks, the movement of powered attachments shall not be possible through operation of the control when the operator is not in the normal operating position.		P
4.8	Operator's seat		P
	The requirements of EN ISO 3691-1:2012, 4.7.4 shall apply with the following addition:	See the EN ISO 3691-1.	P
	The operator's seat shall be specified and marked in accordance with EN 13490.		P
4.9	Protection against crushing, shearing and trapping		P
4.9.1	General		P
	The requirements of EN ISO 3691-1:2012, 4.7.7.1 shall apply with the following addition:	See the EN ISO 3691-1.	P
	Where fixed and/or removable guard systems are needed, the requirements of EN 953 shall be met.	Fixed guard is used.	P
	When a fixed guard is removed, its fixing system shall remain on the guard or on the truck. This requirement applies to any fixed guards that are		P

EN 16307-1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	liable to be removed by the user with a risk of loss of the fixings, e.g. fixed guards that are liable to be removed during routine maintenance or setting operations carried out at the place of use.		
4.9.2	Pedestrian and stand-on end-controlled trucks with mast		N
	The mast shall be guarded at the side facing the operating controls, e.g. by a transparent cover. The guard shall, as a minimum, cover the whole width of the hazardous zone and the full length of the non-elevated mast,or up to 2,2 m from the ground, whichever is less.		N
4.10	Load control		P
4.11	Lateral stability		P
	The requirements of EN ISO 3691-1:2012, 4.8.1 shall apply.	See the EN ISO 3691-1.	P
4.12	Visibility		P
	The requirements of EN ISO 3691-1:2012, 4.10.1 shall apply with the following modifications:	See the EN ISO 3691-1.	P
	Replace the requirement given in ISO 13564-1:2012, 9.2.2 a) with the following:		-
	forward direction		-
	25 % of the vertical surface of the test body		P
	rearward direction		-
	20 % of the vertical surface of the test body		P
	Replace the required minimum illuminated area of test surface as required by ISO 13564-1:2012, Table 3,Test No.1, with the following:		P
	25 % of the vertical surface of the test body		P
	ISO 13564-1:2012 will be replaced by a European visibility standard which is under development based on ISO 13564-1:2012.		P
4.13	Reduction of noise by design		P
4.13.1	General		P
	Industrial trucks shall be designed and constructed such that risks resulting from the emission of airborne noise are reduced according the state of the art.		P
	When noise is a significant hazard, there is need for a low-noise design. In this case, the methodology for low-noise design given in EN ISO 11688-1 shall be considered.		P
	Normally, noise is not a significant hazard for battery-powered trucks.		P
4.13.2	Main source of noise		P
	On industrial trucks, the main sources of noise are components, such as the following, in a high-speed operation mode:		-

EN 16307-1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
	-combustion engines, including air intake, cooling fan and exhaust system;		P
	-hydraulic pumps/motors.		P
4.13.3	Measures to reduce noise at the operator's position		P
	Typical measures to reduce noise include:		-
	-selection of low-noise components;		P
	-use of elastic mountings that prevent the transmission of structure born noise from the components to the structures;		P
	-the use of improved noise insulation in the cabin, if fitted.		P
	These and other measures of identical or better efficiency may be used.		N
4.13.4	Determination of noise emission values		P
	The value of noise emission shall be measured using the test method given in EN 12053.	82.9dB.	P
4.14	Vibration		P
	Whole body vibration shall be measured using the test method given in EN 13059.		P
4.15	Electromagnetic compatibility (EMC)		P
	The truck's EMC shall comply with EN 12895.	See the EN 12895 Test Report.	P
4.16	Operation in potentially explosive atmospheres	Not used in potentially explosive atmospheres	N
	Trucks operating in potentially explosive atmospheres shall comply with EN 1755.		N
5	**Verification of safety requirements and/or protective measures**		P
	The requirements specified in Clause 4 shall be verified in accordance with the referenced standard and the principles defined in EN ISO 3691-1:2012, Clause 5.	See the EN ISO 3691-1.	P
6	**Information for use**		P
6.1	Instruction handbook(s)		P
6.1.1	Truck/attachments		P
	The requirements of EN ISO 3691-1:2012, 6.2.1 shall apply with the following addition:		-
	The instruction handbook(s) shall include, as applicable, the following:		-
	-information on stability;	See the Type test.	P
	-the noise value in accordance with EN 12053;		P
	-the vibration value in accordance with EN 13059;		P
	-the static test coefficient used for lifting accessory.		P

EN 16307-1:2020			
Clause	Requirement-Test	Result-Remark	Verdict
6.1.2	Operation of truck		P
	The requirements of EN ISO 3691-1:2012, 6.2.2 shall apply with the following addition:		-
	In addition, the instruction handbook(s) shall include, as applicable, the following:		-
	-information about specific protective devices (e.g. protective screen) and their use.	See the instruction.	P
6.1.3	Transportation, commissioning and storage		P
	The requirements of EN ISO 3691-1:2012, 6.2.6 shall apply with the following addition:		-
	Further to EN ISO 3691-1:2012, 6.2.6 c), the instruction handbook(s) shall include, as applicable, the procedure for truck mounting.	See the instruction.	P
6.2	Marking		P
6.2.1	Information plates		P
	The requirements of EN ISO 3691-1:2012, 6.3.1 shall apply, except the reference to ISO/TS 3691-8, with the following modifications:		-
	Replace EN ISO 3691-1:2012, 6.3.1.1 b) with the following:		-
	-designation of the machinery, designation of series or type and the mandatory marking[1)].		P

TABLE OF CONTENTS

1. TEST SUMMARY

Test procedures according to the technical standards:

EMC Emission(EN IEC 61000-6-4:2019)				
Standard	Test Item	Limit	Judgment	Remark
EN IEC 61000-6-4:2019	Conducted Emission	Class B	PASS	
	Radiated Emission	Class B	PASS	
EN IEC 61000-3-2:2019	Harmonic Current Emission	Class A or D NOTE (2)	PASS	
EN 61000-3-3:2013+A1:2019	Voltage Fluctuations & Flicker	------	PASS	
EMC Immunity(EN IEC 61000-6-2:2019)				
Standard	Test Item	Performance Criteria	Judgment	Remark
EN 61000-4-2:2009	Electrostatic Discharge	B	PASS	
EN 61000-4-3:2010	RF electromagnetic field	A	PASS	
EN 61000-4-4:2012	Fast transients	B	PASS	
EN 61000-4-5:2006	Surges	B	PASS	
EN 61000-4-6:2009	Injected Current	A	PASS	
EN 61000-4-8:2010	Power Frequency Magnetic Field	A	PASS	
EN 61000-4-11:2004	Volt. Interruptions Volt. Dips	B/C/C NOTE (3)	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) The power consumption of EUT is less than 75W and no Limits apply.

(3) Voltage dip: 100% reduction – Performance Criteria B
Voltage dip: 30% reduction – Performance Criteria C
Voltage Interruption: 100% Interruption – Performance Criteria C

(4) For client's request and manual description, the test will not be executed.

A. Conducted Measurement :

Test Site	Method	Measurement Frequency Range	U，(dB)	NOTE
NTEKC01	ANSI	150 KHz ~ 30MHz	3.2	

B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	U，(dB)	NOTE
NTEKA01	ANSI	30MHz ~ 1000MHz	4.7	
		1GHz ~6GHz	5.0	

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

The product that manufactured by **Shandong LEITE Machinery Co.,Ltd.**

The "EUT" as referred to in this report is **No. 2-5, Nanzhang Industrial Park, Nanzhang Street, Rencheng District, Jining City, Shandong Province**

2.2 MEASUREMENT INSTRUMENTS LIST

2.2.1 CONDUCTED TEST SITE

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	LISN	R&S	ENV216	101313	Oct.12,2018
2	LISN	EMCO	3816/2	00042990	Oct.12,2018
3	50Ω Switch	ANRITSU CORP	MP59B	6200983704	Oct.12,2018
4	Test Cable	N/A	C01	N/A	Oct.12,2018
5	Test Cable	N/A	C02	N/A	Oct.12,2018
6	Test Cable	N/A	C03	N/A	Oct.12,2018
7	EMI Test Receiver	R&S	ESCI	101160	Oct.12,2018
8	Passive Voltage Probe	ESH2-Z3	R&S	100196	Oct.12,2018
9	Triple-Loop Antenna	EVERFINE	LIA-2	11020003	Oct.12,2018
10	Absorbing Clamp	R&S	MDS-21	100423	Oct.12,2018

2.2.2 RADIATED TEST SITE

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Bilog Antenna	TESEQ	CBL6111D	31216	Oct.12,2018
2	Test Cable	N/A	R-01	N/A	Oct.12,2018
3	Test Cable	N/A	R-02	N/A	Oct.12,2018
4	EMI Test Receiver	R&S	ESCI-7	101318	Oct.12,2018
5	Antenna Mast	EM	SC100_1	N/A	N/A
6	Turn Table	EM	SC100	060531	N/A
7	50Ω Switch	Anritsu Corp	MP59B	6200983705	Oct.12,2018
8	Spectrum Analyzer	Aglient	E4407B	MY45108040	Oct.12,2018
9	Horn Antenna	EM	EM-AH-1018	2011071402	Oct.12,2018
10	Amplifier	EM	EM-30180	060538	Oct.12,2018

2.2.3 HARMONICS AND FILCK

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Harmonic &	EM TEST	DPA500	0303-04	Oct.12,2018
2	AC Power Source	EM TEST	ACS500	0203-01	Oct.12,2018

2.2.4 ESD

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until

1	ESD TEST GENERATOR	EVERFINE	EMS61000-2 A-V200	11040001T	Oct.12,2018

2.2.5 RS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	R&S	SMT 06	832080/007	Oct.12,2018
2	Log-Bicon	Schwarzbeck	VULB9161	4022	Oct.12,2018
3	Power Amplifier	AR	150W1000M	320946	Oct.12,2018
4	Microwave Horn Antenna	AR	AT4002A	321467	Oct.12,2018
5	Power Amplifier	AR	25S1G4A	308598	Oct.12,2018

2.2.6 SURGE, EFT/BURST, VOLTAGE INTERRUPTION/DIPS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Surge Generator	EVERFINE	EMS61000-5 A	1101002	Oct.12,2018
2	DIPS Generator	EVERFINE	EMS61000-1 1K	1011002	Oct.12,2018
	EFT/B Generator	EVERFINE	EMS61000-4 A-V2	1012005	Oct.12,2018

2.2.7 INJECTION CURRENT

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	IFR	2023A	202301/368	Oct.12,2018
2	Power Amplifier	AR	75A250AM	0320709	Oct.12,2018
3	CDN	FCC	FCC-801-M	06043	Oct.12,2018
4	EM Clamp	FCC	F-203I-23M	504	Oct.12,2018

2.2.8 MF

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Generator	EVERFINE	EMS61000-8 K	1007001	Oct.12,2018

3.EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

The following table is the setting of the receiver:

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz

Stop Frequency	30 MHz
IF Bandwidth	9 kHz

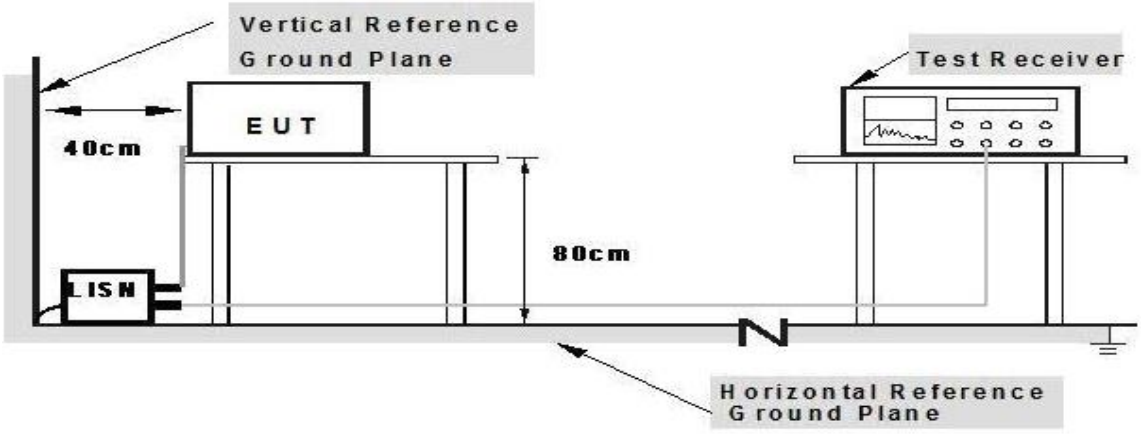
3.1.2 TEST PROCEDURE

a. The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP
3.1.4 EUT OPERATING CONDITIONS
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

3.1.5 TEST RESULTS

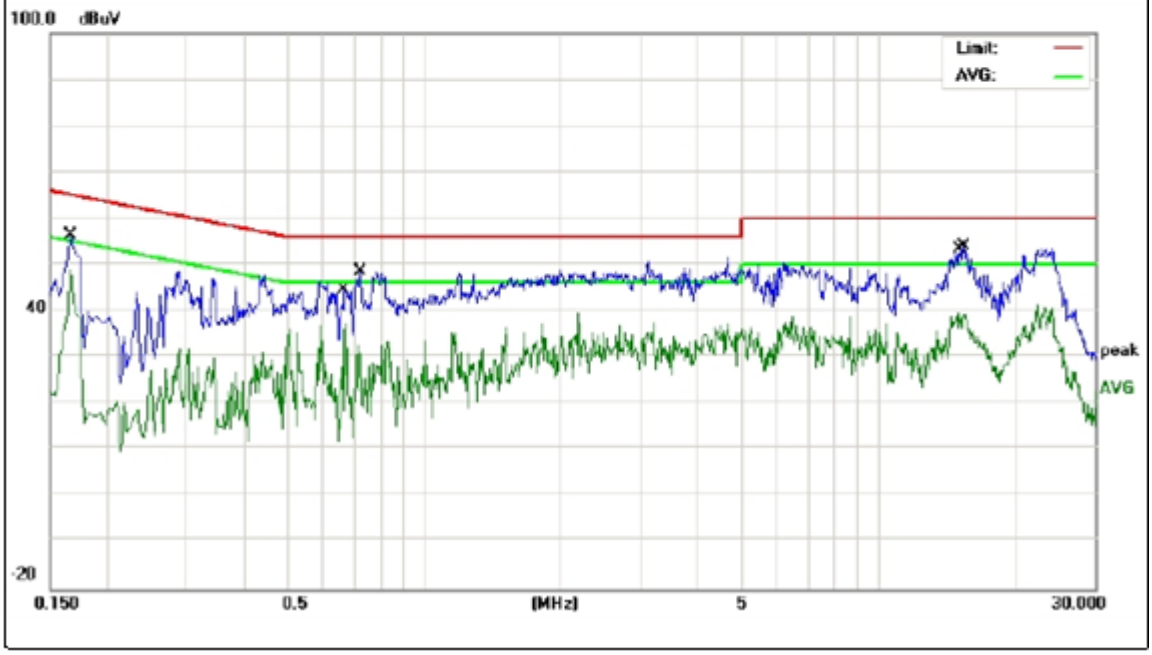
EUT：	FORKLIFT	Model Name.：	LTY30
Temperature：	26 ℃	Relative	54%
Pressure：	1010hPa	Test Date：	2023-10-29
Test Mode：	Full Load	Phase：	L
Test Voltage：			



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

Freq. (MHz)	Reading (dBuV)	Factor (dBuV)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector
0.166	45.79	10.45	56.24	65.15	-8.91	QP
0.166	38.31	10.45	48.76	55.15	-6.39	AVG
0.67	26.65	10.41	37.06	46	-8.94	AVG
0.7259	38.09	10.41	48.5	56	-7.5	QP
14.9539	28.84	10.71	39.55	50	-10.45	AVG
15.4539	43.18	10.71	53.89	60	-6.11	QP

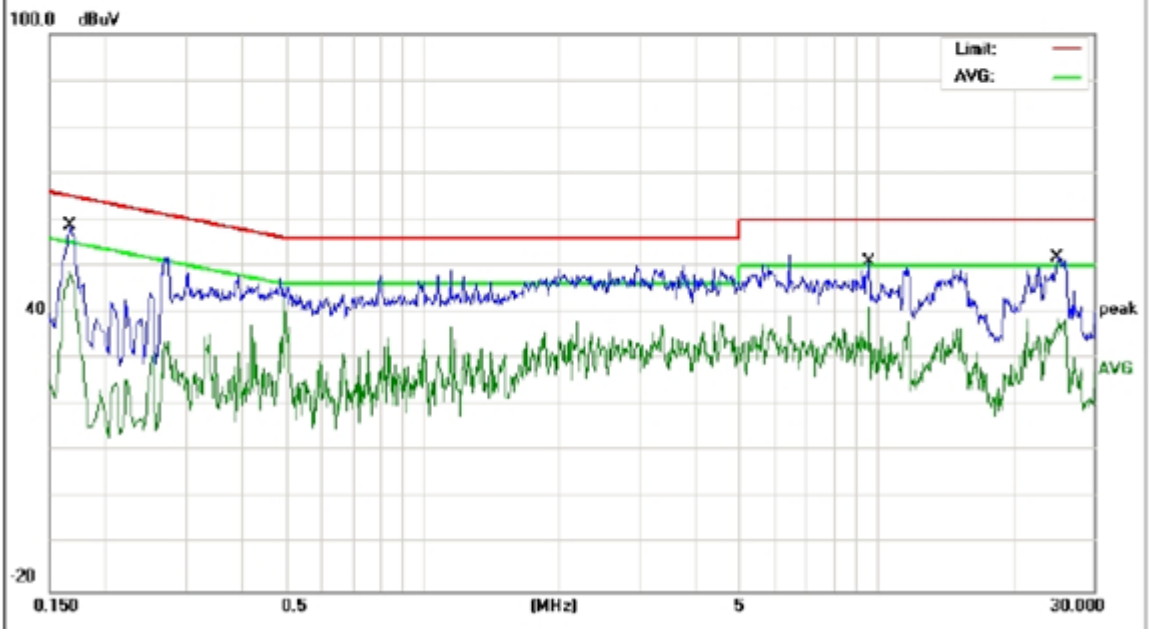
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. N/A means All Data have pass Limit



EUT：	FORKLIFT	Model Name.：	LTY30
Temperature：	26 ℃	Relative	54%
Pressure：	1010hPa	Test Date：	2023-10-29
Test Mode：	Full Load	Phase：	N
Test Voltage：			

Freq. (MHz)	Reading (dBuV)	Factor (dBuV)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector
0.166	48.18	10.45	58.63	65.15	-6.52	QP
0.166	38.45	10.45	48.9	55.15	-6.25	AVG
9.6457	40.53	10.57	51.1	60	-8.9	QP
9.6457	30.62	10.57	41.19	50	-8.81	AVG
24.942	41.27	10.73	52	60	-8	QP
24.942	27.99	10.73	38.72	50	-11.28	AVG

Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. N/A means All Data have pass Limit



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT (Below 1000MHz)

FREQUENCY (MHz)	Class A		Class B	
	At 10m	At 3m	At 10m	At 3m
	dBuV/m	dBuV/m	dBuV/m	dBuV/m
30 – 230	40	50	30	40
230 – 1000	47	57	37	47

3.2.2 LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

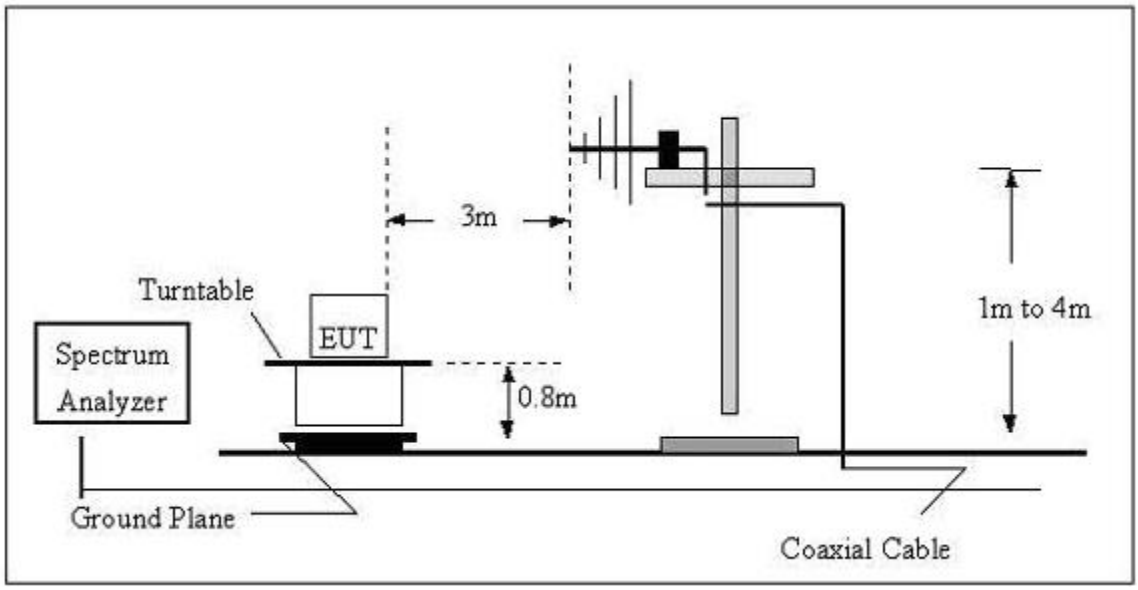
FREQUENCY (MHz)	Class A (at 3m) dBuV/m		Class B (at 3m) dBuV/m	
	Peak	Avg	Peak	Avg
1000-3000	76	56	70	50
3000-6000	80	60	74	54

3.2.3 TEST PROCEDURE

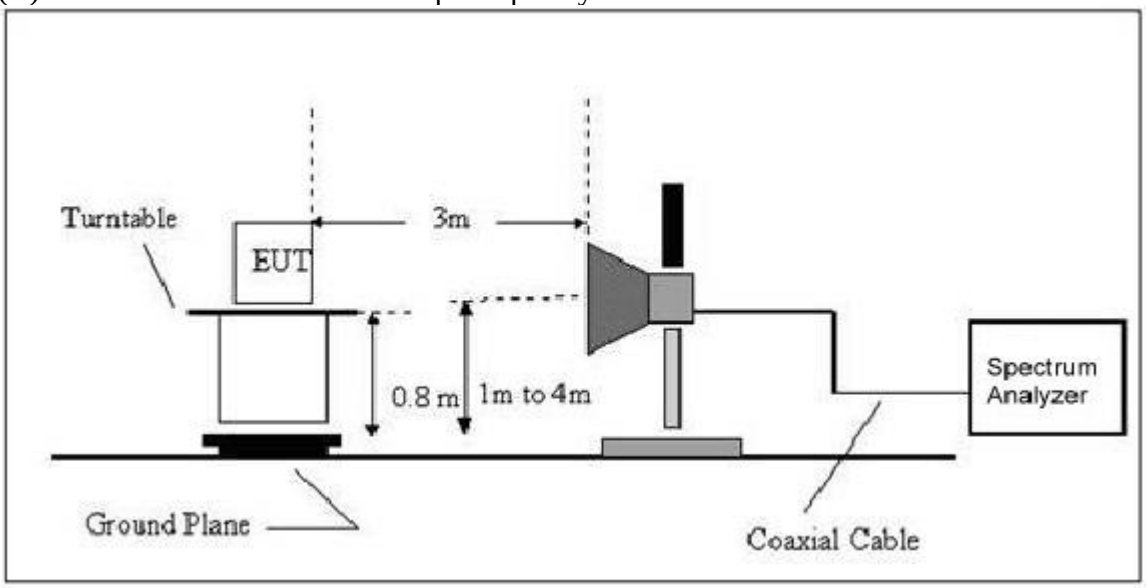
a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz.For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured, above 1G Average detector mode will be instead.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP(AV) Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.2.4 TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

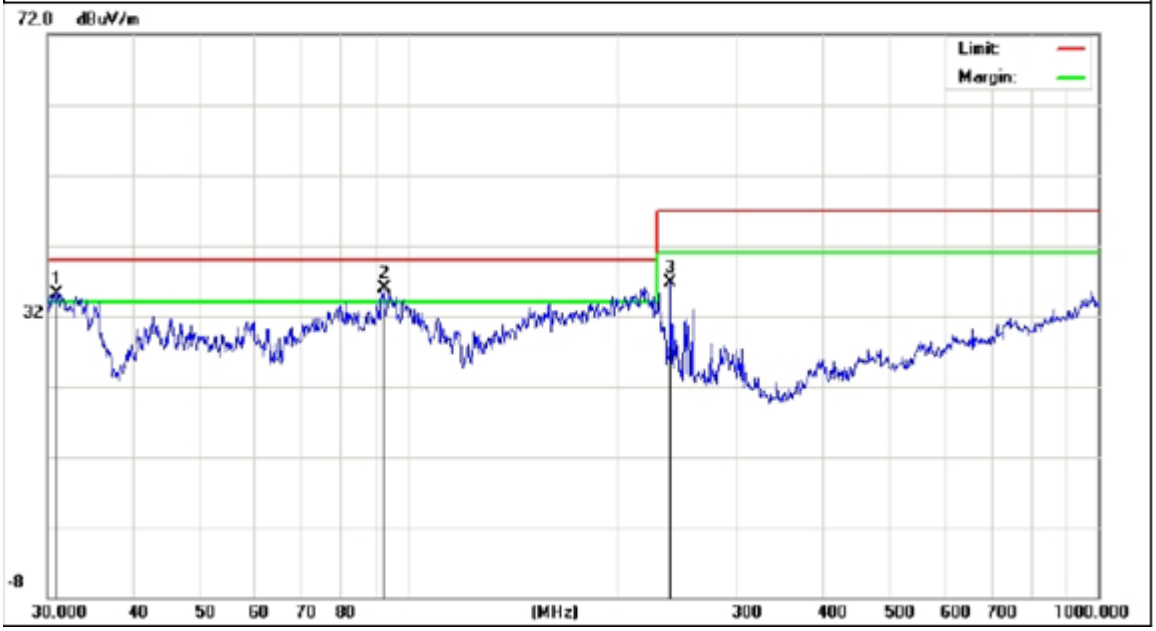
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing

3.2.6 TEST RESULTS

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	24 ℃	Relative Humidity：	54%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	Full Load	Polarization：	Horizontal
Test Power：			

Freq. (MHz)	Reading (dBuV)	Factor (dBuV)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector
30.9618	17.33	17.87	35.2	40	-4.8	QP
92.1388	26.26	9.64	35.9	40	-4.1	QP
239.9874	25.43	11.36	36.79	47	-10.21	QP

Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Antenna Factor + Cable Loss.
3. N/A means All Data have pass Limit



EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	24 ℃	Relative Humidity：	54%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	Full Load	Polarization：	Vertical
Test Power：			

Freq. (MHz)	Reading (dBuV)	Factor (dBuV)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector
32.634	19.51	16.99	36.5	40	-3.5	QP
74.6568	28.9	6.7	35.6	40	-4.4	QP
300.3672	21.63	14.57	36.2	47	-10.8	QP

Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Antenna Factor + Cable Loss.
3. N/A means All Data have pass Limit

3.2.7 TEST RESULTS(1000~6000MHz)

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	24 ℃	Relative Humidity：	54%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	N/A	Polarization：	N/A
Test Power：	N/A		

3.3 VOLTAGE FLUCTUATION AND FLICKERS

3.3.1 LIMITS OF VOLTAGE FLUCTUATION AND FLICKERS

Tests	Limits		Description
	IEC555-3	IEC/EN 61000-3-11	
Pst	≤1.0, Tp=10min.	≤1.0, Tp=10min.	Short Term Flicker Indicator
Plt	N/A	≤0.65,Tp=2hr.	Long Term Flicker Indicator
dc	≤3%	≤3.3%	Relative Steady-State V-Change
dmax	≤4%	≤4%	Maximum Relative V-Change
d(t)	N/A	≤3.3%for>500ms	Relative V-Change Characteristic

3.3.2 TEST PROCEDURE

a. Harmonic Current Test:

Test was performed according to the procedures specified in Clause 5.0 of IEC555-2 and/or Sub-clause 6.2 of IEC/EN EN 61000-3-12 depend on which standard adopted for compliance measurement.

b. Fluctuation and Flickers Test:

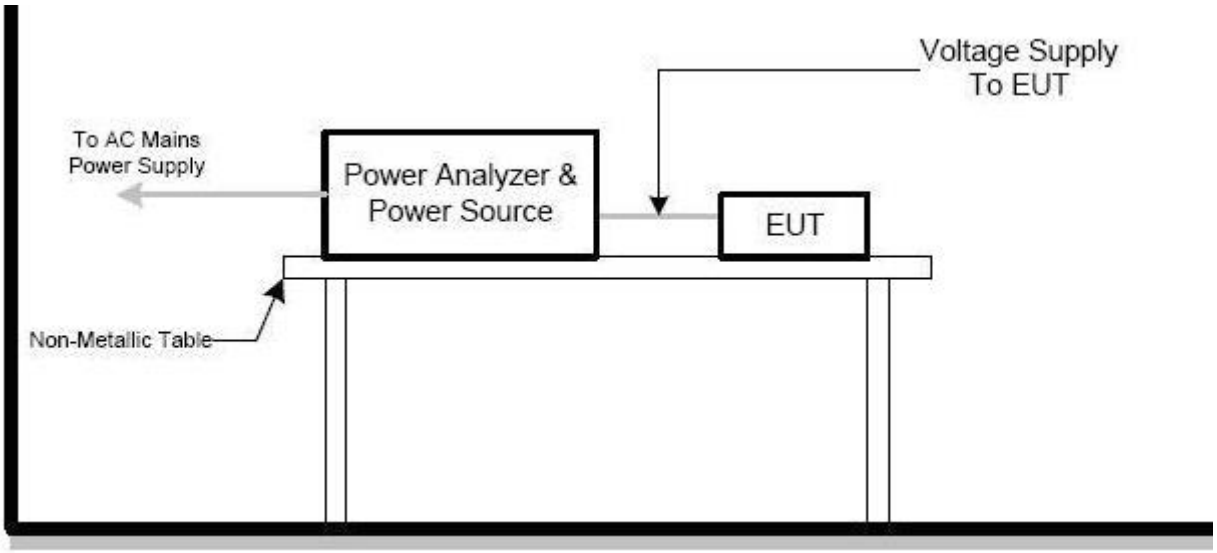
Tests was performed according to the Test Conditions/Assessment of Voltage Fluctuations specified in Clause 5.0/6.0 of IEC555-3 and/or Clause 6.0/4.0 of IEC/EN 61000-3-11 depend on which standard adopted for compliance measurement.

c. All types of harmonic current and/or voltage fluctuation in this report are assessed by direct measurement using flicker-meter.

3.3.3 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

3.3.4 TEST SETUP



3.3.5 TEST RESULTS

EUT：	FORKLIFT	Model Name ：	LTY30
Temperature：	24 ℃	Relative Humidity ：	54%
Pressure：	1010 hPa	Test Date ：	2023-10-29
Test Mode ：	Full Load		
Test Power ：			

4. EMC IMMUNITY TEST

4.1 STANDARD COMPLIANCE/SERVRITY LEVEL/CRITERIA

Tests Standard No.	TEST SPECIFICATION	Test Mode Test Ports	Perform. Criteria
1. ESD IEC/EN 61000-4-2	8KV air discharge 4KV contact discharge	Direct Mode	B
	4KV HCP discharge 4KV VCP discharge	Indirect Mode	B
2. RS IEC/EN 61000-4-3	80 MHz to 1000 MHz, 1000Hz, 80%, AM modulated	Enclosure	A
3. EFT/Burst IEC/EN 61000-4-4	5/50ns Tr/Th 5KHz Repetition Freq.	Power Supply Port	A
	5/50ns Tr/Th 5KHz Repetition Freq.	CTL/Signal Data Line Port	A
4. Surges IEC/EN 61000-4-5	1.2/50(8/20) Tr/Th us	L-N	A
	1.2/50(8/20) Tr/Th us	L-PE N-PE	B
5 Injected Current IEC/EN 61000-4-6	0.15 MHz to 80 MHz, 1000Hz 80% , AM Modulated 150 source impedance	CTL/Signal Port	A
	0.15 MHz to 80 MHz, 1000Hz 80% , AM Modulated 150 source impedance	AC Power Port	A
	0.15 MHz to 80 MHz, 1000Hz 80% , AM Modulated 150 source impedance	DC Power Port	A
6. Power Frequency Magnetic Field IEC/EN 61000-4-8	50 Hz,	Enclosure	A
7. Volt. Interruptions Volt. Dips IEC/EN 61000-4-11	Voltage dip 100% Voltage dip 30% Interruption 100%	AC Power Port	B C

4.2 GENERAL PERFORMANCE CRITERIA

According to EN 55011 standard, the general performance criteria as following:

Criterion A	The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Criterion B	After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test.
Criterion C	Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

4.3 GENERAL PERFORMANCE CRITERIA TEST SETUP

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

4.4 ESD TESTING

4.4.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Required Performance	B
Discharge Voltage:	Air Discharge：2kV/4kV/8kV (Direct) Contact Discharge：2kV/4kV (Direct/Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Air Discharge: min. 20 times at each test point Contact Discharge: min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum

4.4.2 TEST PROCEDURE

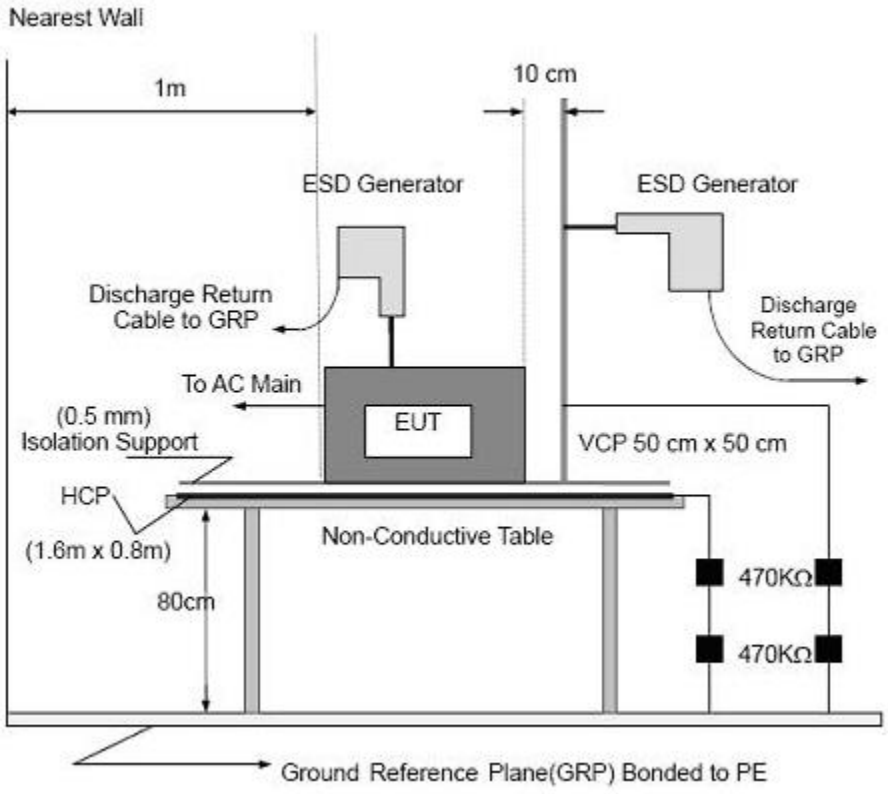
The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

a. Contact discharge was applied to conductive surfaces and coupling planes of the EUT.

During the test, it was performed with single discharges. For the single discharge time between successive single discharges was at least 1 second. The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the

test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges.
If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.
Vertical Coupling Plane (VCP):
The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from, the EUT, with the Discharge Electrode touching the coupling plane.
The four faces of the EUT will be performed with electrostatic discharge.
Horizontal Coupling Plane (HCP):
The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.
The four faces of the EUT will be performed with electrostatic discharge.
b. Air discharges at insulation surfaces of the EUT.
It was at least ten single discharges with positive and negative at the same selected point.

4.4.3 TEST SETUP



Note:
TABLE-TOP EQUIPMENT
The configuration consisted of a wooden table 0.8 meters high standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A Horizontal Coupling Plane (1.6m x 0.8m) was placed on the table and attached to the GRP by means of a cable with 940k total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC/EN 61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5mm thickness. A distance of1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.
FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC/EN 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides

4.4.4 TEST RESULTS

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	Full Load		
Test Power：			

Mode	Air Discharge								Contact Discharge								Criterion	Result
Test level (kV)	4		8		10		15		2		4		6		8			
Test Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-		
HCP									A	A	A	A					A	PASS
VCP									A	A	A	A						PASS

Note:

1) +/- denotes the Positive/Negative polarity of the output voltage.

2) Test condition:

Direct / Indirect (HCP/VCP) discharges: Minimum 50 times (Positive/Negative) at each point. Air discharges: Minimum 10 times (Positive/Negative) at each point.

3) Test location(s) in which discharge (Air and contact discharge) to be applied illustrated by photos

4) The Indirect (HCP/VCP) discharges description of test point as following:
1.left side 2.right side 3.front side 4.rear side

5) N/A - denotes test is not applicable in this test report

4.5 RS TESTING

4.5.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-3
Required Performance	A
Frequency Range:	80 MHz - 1000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation

Frequency Step:	1 % of fundamental
Polarity of Antenna:	Horizontal and Vertical
Test Distance:	3m
Antenna Height:	1.5 m
Dwell Time:	at least 3 seconds

4.5.2 TEST PROCEDURE

The EUT and support equipment, which are placed on a table that is 0.8 meter above ground and the testing was performed in a fully-anechoic chamber. The testing distance from antenna to the EUT was 3 meters.

The other condition as following manner:

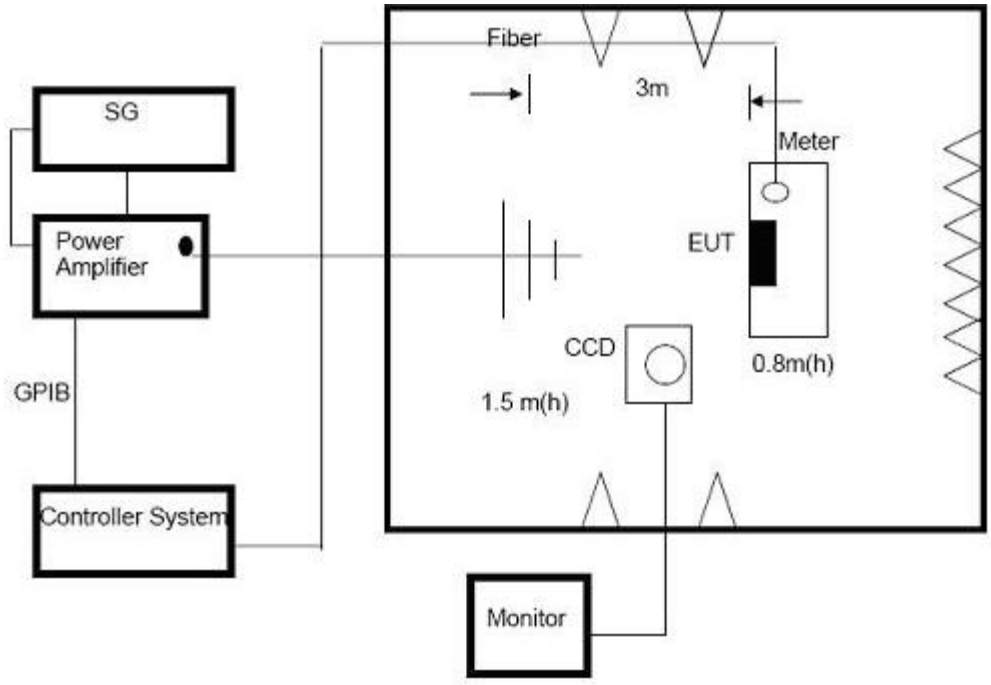
a. The frequency range is swept from 80 MHz to 1000 MHz, & 1400MHz - 2700MHz with the signal 80%amplitude modulated with a 1kHz sine wave. The rate of sweep did not exceed 1.5x 10-3 decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.

b. Sweep Frequency 900 MHz, with the Duty Cycle:1/8 and Modulation: Pulse 217 Hz(if applicable)

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

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

4.5.3 TEST SETU



Note:

TABLE-TOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-3 was

placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

4.5.4 TEST RESULT

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	Full Load		
Test Power：			

Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Perform. Criteria	Results	Judgment
80MHz - 1000MHz	H/V	3 V/m (rms) AM Modulated 1000Hz, 80%	Front	A	A	PASS
			Rear			
			Left			
			Right			

Note:
1) N/A - denotes test is not applicable in this test report.
2) Criteria A: There was no change operated with initial operating during the test.
3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
4) Criteria C: The system shut down during the test.

4.6 EFT/BURST TESTING

4.6.1 TEST SPECIFICATION

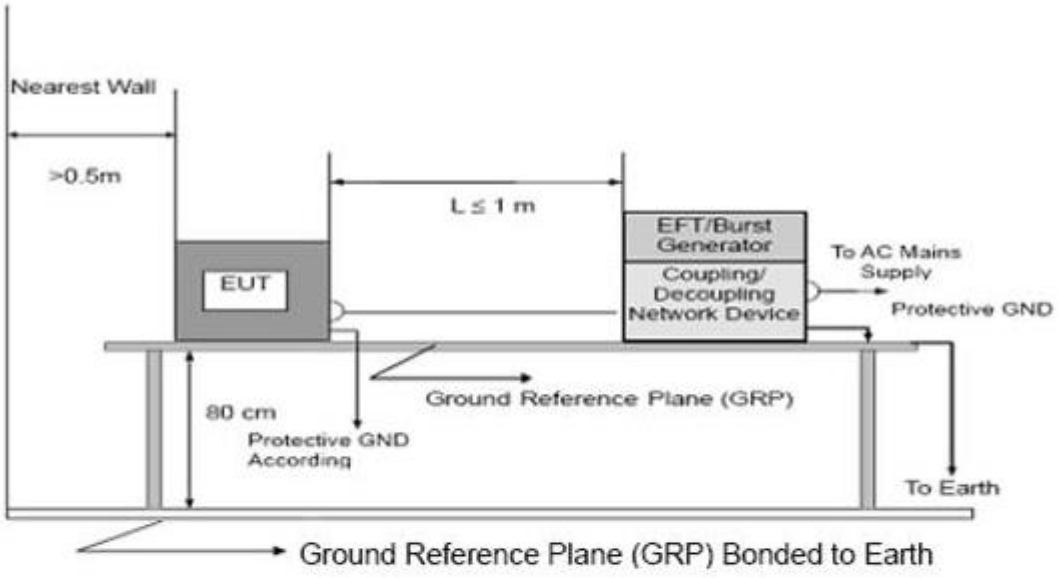
Basic Standard:	IEC/EN 61000-4-4
Required Performance	B
Test Voltage:	Power Line：1 kV Signal/Control Line：0.5 KV
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave shape :	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	Not less than 1 min.

4.6.2 TEST PROCEDURE
The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.The other condition as following manner:
a. The length of power cord between the coupling device and the EUT should not exceed 1 meter.
b. Both positive and negative polarity discharges were applied.

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

4.6.3 TEST SETU

Note:



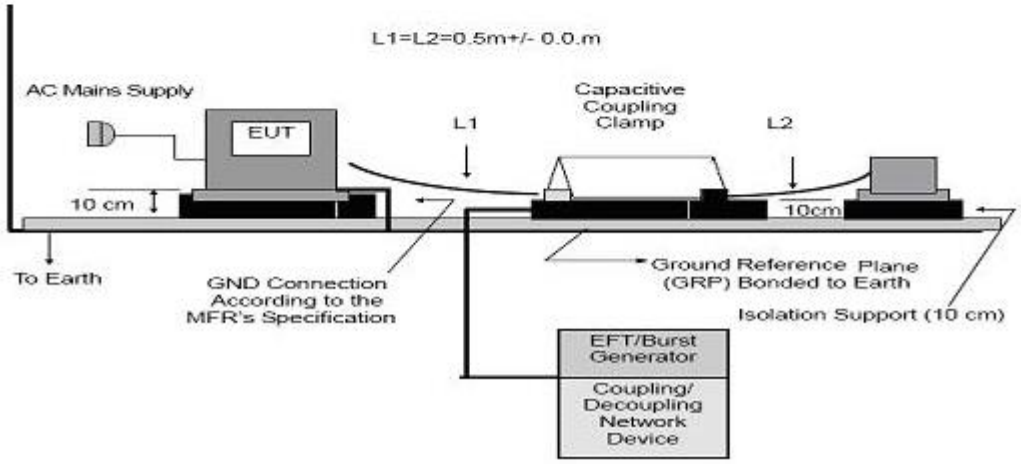


TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table (0.8m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.

4.6.4 TEST RESULTS

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	Full Load		
Test Power：			

Coupling Line		Test level (kV)								Criterion	Result
		0.5		1		2		4			
		+	-	+	-	+	-	+	-		
AC line	L	A	A	A	A					A	PASS
	N	A	A	A	A						PASS
	PE										
	L+N	A	A	A	A						PASS
	L+PE										
	N+PE										
	L+N+PE										
DC Line											
Signal Line											

Note:

1) +/- denotes the Positive/Negative polarity of the output voltage.
2) N/A - denotes test is not applicable in this test report
3) Criteria A: There was no change operated with initial operating during the test.
4) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
5) Criteria C: The system shut down during the test.

4.7 SURGE TESTING

4.7.1 TEST SPECIFICATION

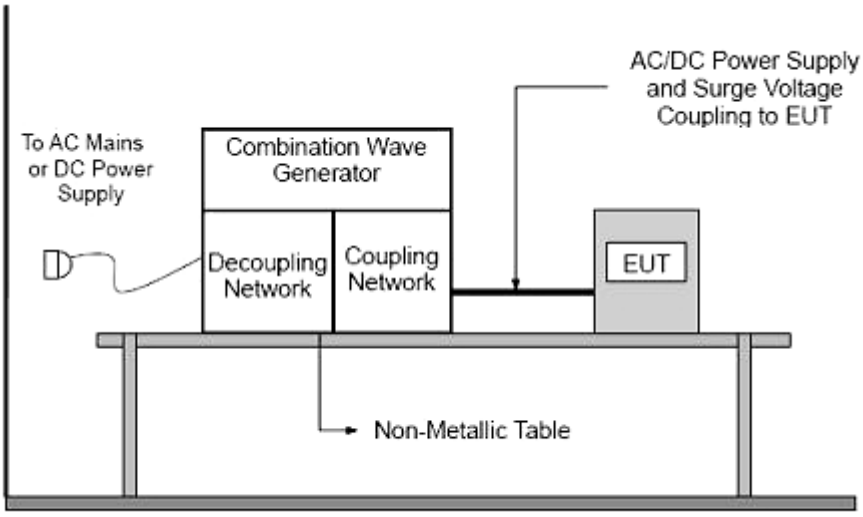
Basic Standard:	IEC/EN 61000-4-5
Required Performance	A
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8 /20 us Short Circuit Current
Test Voltage:	Power Line：0.5 kV, 1 kV, 2 kV
Surge Input/Output:	L-N, L-PE, N-PE
Generator Source:	2 ohm between networks

Impedance:	12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0 /90/180/270°
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points

4.7.2 TEST PROCEDURE

a. For EUT power supply:
The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2meters in length (or shorter).
b. For test applied to unshielded unsymmetrically operated interconnection lines of EUT:The surge is applied to the lines via the capacitive coupling. The coupling /decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).
c. For test applied to unshielded symmetrically operated interconnection /telecommunication lines of EUT:
d. The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter)

4.7.3 TEST SETU



4.7.4 TEST RESULTS

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1010 hPa	Test Date:	2023-10-29
Test Mode：	Full Load		
Test Power：			

Coupling Line			Test level								Criterion	Result
			0.5 kV		1 kV		2 kV		4 kV			
			+	-	+	-	+	-	+	-		
AC line	L-N	0°	A	A	A	A					A	PASS
		90°	A	A	A	A						
		180°	A	A	A	A						
		270°	A	A	A	A						
	L-PE	0°										
		90°										
		180°										
		270°										
	N-PE	0°										
		90°										
		180°										
		270°										
DC Line												
Signal Line												

Note:

1) Polarity and Numbers of Impulses：5 Pst / Ngt at each tested mode
2) N/A - denotes test is not applicable in this Test Report
3) Criteria A: There was no change operated with initial operating during the test.
4) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
5) Criteria C: The system shut down during the test.

4.8 INJECTION CURRENT TESTING

4.8.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-6
Required Performance	A
Frequency Range:	0.15 MHz - 80 MHz
Field Strength:	3 Vr.m.s.
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of fundamental
Dwell Time:	at least 3 seconds

4.8.2 TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min. The other condition as following manner:

a. The frequency range is swept from 150 KHz to 80 MHz, with the signal 80%amplitude modulated with a 1kHz sine wave. The rate of sweep did not exceed 1.5x 10-3 decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.

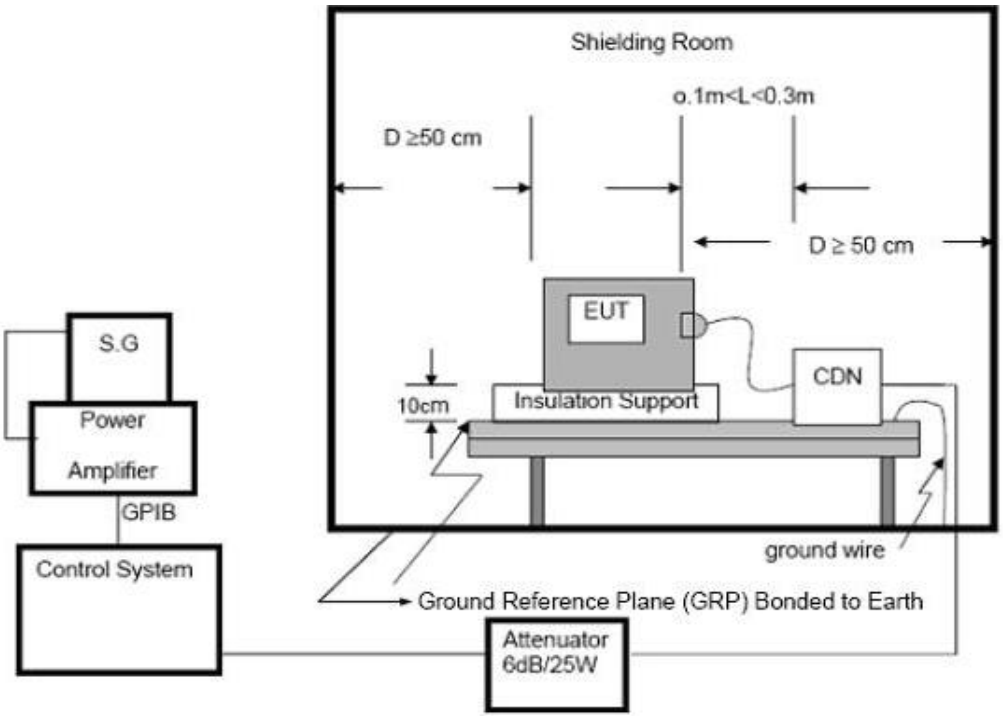
b. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

4.8.3 TEST SETUP

NOTE:

FLOOR-STANDING EQUIPMENT

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane



4.8.4 TEST RESULTS

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1010 hPa	Test Date:	2023-10-29
Test Mode：	Full Load		
Test Power：			

Test Ports (Mode)	Freq. Range MHz)	Field Strength	Perform. Criteria	Results	Judgment
Input/ Output AC. Power Port	0.15 ---80	3V(rms) AM Modulated 1000Hz, 80%	A	A	PASS
Input/ Output DC. Power Port	0.15 --- 80		A	N/A	N/A
Signal Line	0.15 --- 80		A	N/A	N/A

Note:

1) N/A - denotes test is not applicable in this Test Report.
2) Criteria A: There was no change operated with initial operating during the test.
3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
4) Criteria C: The system shut down during the test.

4.9 POWER FREQUENCY MAGNETIC FIELD TESTING

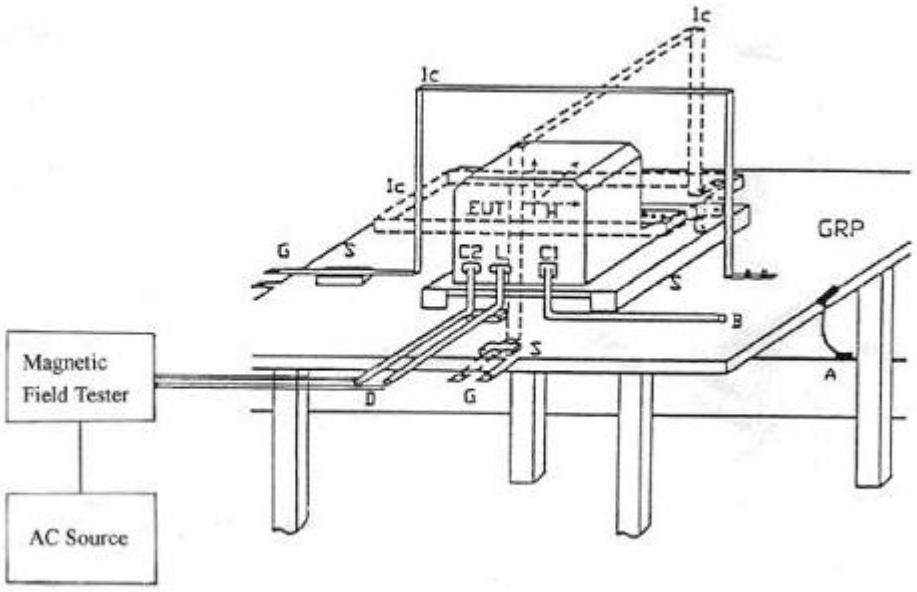
4.9.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-8
Required Performance	A
Frequency Range:	50Hz
Field Strength:	1 A/m
Observation Time:	1 minute
Inductance Coil:	Rectangular type, 1mx1m

4.9.2 TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.
The other condition as following manner:
a. The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
b. The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.

4.9.3 TEST SETUP



4.9.4 TEST RESULTS

EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	Full Load		
Test Power：			

Test Mode	Test Level	Antenna aspect	Duration (s)	Perform Criteria	Results	Judgment
Enclosure	1 A/m	X	300 s	A	A	Pass
Enclosure	1 A/m	Y	300 s	A	A	Pass
Enclosure	1 A/m	Z	300 s	A	A	Pass

Note:

1) N/A - denotes test is not applicable in this test report
2) Criteria A: There was no change operated with initial operating during the test.
3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
4) Criteria C: The system shut down during the test.

4.10 VOLTAGE INTERRUPTION/DIPS TESTING

4.10.1 TEST SPECIFICATION

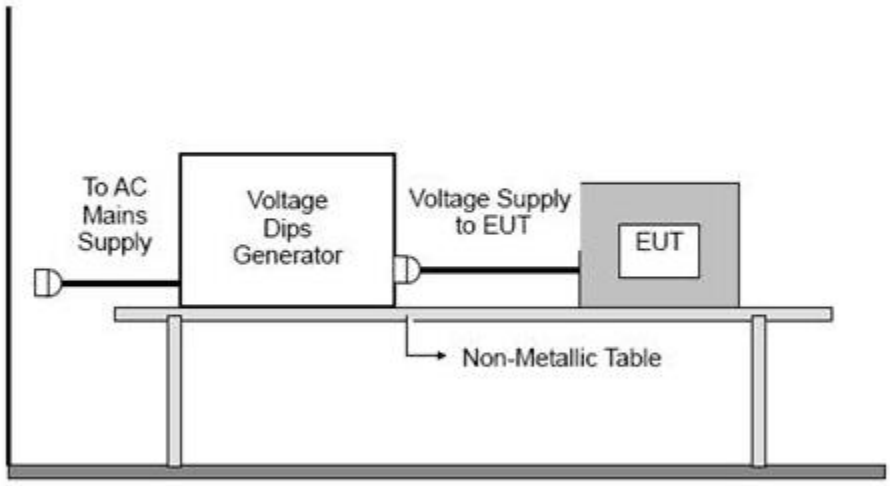
Basic Standard:	IEC/EN 61000-4-11
Required Performance	B (For 100% Voltage Dips) C (For 30% Voltage Dips) C (For 100% Voltage Interruptions)
Test Duration Time:	Minimum three test events in sequence
Interval between Event:	Minimum ten seconds
Phase Angle:	0°/45°/90°/135°/180°/225°/270°/315°/360°
Test Cycle:	3 times

4.10.2 TEST PROCEDURE

The EUT shall be tested for each selected combination of test levels and duration with a sequence of three dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform

4.10.3 TEST SETUP

4.10.4 TEST RESULTS



EUT：	FORKLIFT	Model Name：	LTY30
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1010 hPa	Test Date：	2023-10-29
Test Mode：	Full Load		
Test Power：			

Interruption & Dips	Duration (T)	Perform Criteria	Results	Judgment

Voltage dip 0%	10	B	B	PASS
Voltage dip 70%	500	C	B	PASS
Voltage dip 0%	5000	C	C	PASS

Note:

1). N/A - denotes test is not applicable in this test report.
2) Criteria A: There was no change operated with initial operating during the test.
3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
4) Criteria C: The system shut down during the test.

Annex：Technical Information

(1) Product Photos

A.1

A.2

A.3

A.4