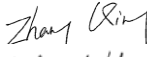




TEST REPORT EN ISO 3691-1:2015+A1:2020 Industrial trucks - Safety requirements and verification - Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks EN 16307-1:2020 Industrial trucks - Safety requirements and verification - Part 1: Supplementary requirements for self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks EN 1175:2020 Safety of industrial trucks - Electrical / electronic requirements	
Report Reference No.	TASH-240302914-R02
Compiled by (+ signature)	Zhang Qing 
Approved by (+ signature)	Hack He 
Date of issue	2024-03-18
Testing Laboratory	TÜV AUSTRIA (SHANGHAI) CO., LTD.
Address	Room 12D, Orient Century Building, No.345 Xian Xia Road, Shanghai, P/C 200336, P.R. China.
Testing location/procedure	Changxing Qiangsheng Machinery Co., Ltd.
Address	NO.2 Shangzhuang Road, Taihu Street, Changxing County, Huzhou City, Zhejiang Province.
Applicant's name	Changxing Qiangsheng Machinery Co., Ltd.
Address	NO.2 Shangzhuang Road, Taihu Street, Changxing County, Huzhou City, Zhejiang Province.
Test specification:	
Standard	EN ISO 3691-1:2015+A1:2020, EN 16307-1:2020, EN 1175:2020
Test procedure	CE-MD
Non-standard test method	N/A
Test Report Form No.	TTRF_ENISO3691_1&EN16307_1&EN1175A
TRF Originator	TÜV AUSTRIA (SHANGHAI) CO., LTD.
Master TRF	Dated 2022-08
Test item description	Electric Stacker
Trade Mark	
Manufacturer	Same as applicant
Model/Type reference	QES10E, QES12E, QES15E, SES10, SES12, SES15, QES16P, QES20P, QES10E-SL, QES12E-SL, QES15E-SL, QES10, QES12, QES15
Ratings	See below item "General products information"
Remark	None

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Test item particulars:	
Classification of installation and use	: N/A
Supply Connection	: N/A
Possible test case verdicts:	
- test case does not apply to the test object	: N/A
- test object does meet the requirement	: P(ass)
- test object does not meet the requirement	: F(ail)
Testing:	
Date of receipt of test item	: 7/11/2023
Date (s) of performance of tests	: 9/11/2023-10/11/2023
General remarks:	
<p>"(see remark #)" refers to a remark appended to the report.</p> <p>"(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a comma is used as the decimal separator.</p> <p>The test results presented in this report relate only to the object tested.</p> <p>This report shall not be reproduced except in full without the written approval of the testing laboratory.</p> <p>Determination of the test result include consideration of measurement uncertainty from the test equipment and methods.</p>	
Testing Environment:	
Ambient Temperature:	16-21 °C
Relative Humidity:	69-81 %
Atmospheric Pressure:	101.7 KPa
Additional remarks:	
<p>All the models of this product have the same working characteristics and circuit. All tests performed on the representative model QES20P.</p> <p>All the models of this product have the same working characteristics and circuit. All tests performed on the representative model QES20P.</p> <p>These trucks use the same mechanical, hydraulic and electrical structure; It uses the same electrical, hydraulic and mechanical principles. Use the same system, the same type of battery, motor, controller, scram device, harness, instrument, warning light. The difference is that the motor power and battery voltage, capacity is inconsistent.</p> <p>The QES20P was chosen as the test model because it is the most representative model with the largest load capacity and the largest self-weight in this series.</p>	

General products information:

Table 1:

Model		QES10E	QES12E	QES15E
Rated capacity	kg	1000	1200	1500
Load center	mm	600	600	600
Lift height	mm	3000	3000	3000
Turning radius	mm	1440	1440	1440
Wheelbase	mm	1210	1210	1235
Travel Speed (Load/Unload)	km/h	3.8/4.5	3.8/4.5	3.8/4.5
Lifting Speed (Load/Unload)	mm/s	78/132	78/132	85/132
Lowering Speed (Load/Unload)	mm/s	122/105	122/105	122/85
Battery voltage/capacity	V/Ah	Lead-acid: 2*12/70 Lithium battery: 24/50	Lead-acid: 2*12/70 Lithium battery: 24/50	Lead-acid: 2*12/75 Lithium battery: 24/50
Driving motor power	kW	2.2	2.2	2.2
Lifting motor power	kW	0.75	0.75	0.75
Overall Dimension (LxWxH)	mm	1775×820×2009	1775×820×2009	1748×800×2250
Service Weight	kg	390	390	450
Fork	Mm	1575×245×35	1575×245×35	1575×245×35

Table 2:

Model		SES10	SES12	SES15
Rated capacity	kg	1000	1200	1500
Load center	mm	400	400	400
Lift height	mm	900/1100/1300/ 1500	900/1100/1300/ 1500	900/1100/1300/ 1500
Max. Lifting height	mm	2480/2680/2880/ 3080	2480/2680/2880/ 3080	2480/2680/2880/ 3080
Turning radius	mm	1180	1180	1180
Wheelbase	mm	965	965	965
Travel Speed (Load/Unload)	km/h	3.9/4.5	3.9/4.5	3.9/4.5
Lifting Speed (Load/Unload)	mm/s	48/55	48/55	48/55
Lowering Speed (Load/Unload)	mm/s	130/88	130/88	130/88
Battery voltage/capacity	V/Ah	48/25 (30Ah As Option)	48/25 (30AH As Option)	48/25 (30AH As Option)
Driving motor power	kW	0.75	0.75	0.75
Lifting motor power	kW	2	2	2
Overall Dimension (LxWxH)	mm	1750×600×1650	1750×600×1650	1750×600×1650
Service Weight	kg	400	400	400
Fork	mm	1575×245×40	1575×245×40	1575×245×40

Table 3:

Model		QES16P	QES20P
Rated capacity	kg	1600	2000
Load center	mm	600	600
Lift height	mm	4500	4500
Max. Lifting height	mm	4500	4500
Turning radius	mm	1560	1560
Wheelbase	mm	1350	1350
Travel Speed (Load/Unload)	km/h	5/5.1	5.5/6
Lifting Speed (Load/Unload)	mm/s	50/70	102/122
Lowering Speed (Load/Unload)	mm/s	150/70	105/122
Battery voltage/capacity	V/Ah	Lead-acid: 24/210 Lithium battery: 24/160	Lead-acid: 24/270 Lithium battery: 24/200
Driving motor power	kW	1.5	1.5
Lifting motor power	kW	2.2	2.2
Overall Dimension (LxWxH)	mm	2080×820×2010	2080×820×2010
Service Weight	kg	1000	1000
Fork	mm	1680×250×30	1680×250×30

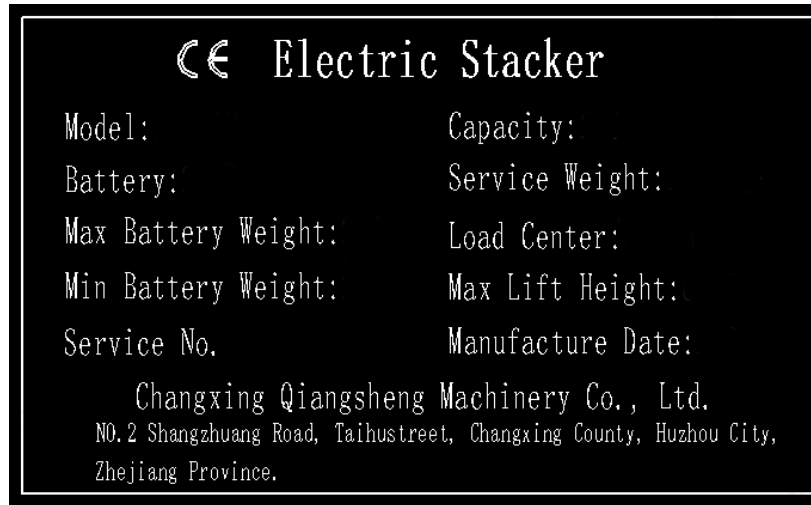
Table 4:

Model		QES10E-SL	QES12E-SL	QES15E-SL
Rated capacity	kg	1200	1200	1500
Load center	mm	600	600	600
Lift height	mm	3000	3000	3000
Turning radius	mm	1440	1440	1440
Wheelbase	mm	1210	1210	1235
Travel Speed (Load/Unload)	km/h	3.5/4.0	3.5/4.0	3.5/4.0
Lifting Speed (Load/Unload)	mm/s	75/130	75/130	81/130
Lowering Speed (Load/Unload)	mm/s	120/100	120/100	130/80
Battery voltage/capacity	V/Ah	Lead-acid: 2*12/70 Lithium battery: 24/50	Lead-acid: 2*12/70 Lithium battery: 24/50	Lead-acid: 2*12/75 Lithium battery: 24/50
Driving motor power	kW	2.2	2.2	2.2
Lifting motor power	kW	0.75	0.75	0.75
Overall Dimension (LxWxH)	mm	1775×820×2009	1775×820×2009	1748×800×2250
Service Weight	kg	410	410	510
Fork	mm	2005×250×35	2005×250×35	1575×245×30

Table 5:

Model		QES10	QES12	QES15
Rated capacity	kg	1000	1200	1500
Load center	mm	600	600	600
Lift height	mm	3000	3000	3000
Turning radius	mm	1440	1440	1440
Wheelbase	mm	1235	1235	1235
Working pressure of hydraulic circuit	MPa	18	18	18
Travel (Laden/Unladen)	km/h	3.2~3.8/4.0~4.5	3.2~3.8/4.0~4.5	3.2~3.8/4.0~4.5
Lifting (Laden/Unladen)	mm/s	80~85/128~132	80~85/128~132	80~85/128~132
Lowering (Laden/Unladen)	mm/s	128~122/80~85	128~122/80~85	128~122/80~85
Battery voltage/capacity	V/Ah	Lead-acid2*12/75 Lithium battery24/50	Lead-acid2*12/75 Lithium battery24/50	Lead-acid2*12/75 Lithium battery24/50
Battery Weight (Max./Min.)	kg	Lead-acid40 Lithium battery20	Lead-acid40 Lithium battery20	Lead-acid40 Lithium battery20
Driving motor power	kW	2.2	2.2	2.2
Lifting motor power	kW	0.75	0.75	0.75
Controller		DC-Speed control	DC-Speed control	DC-Speed control
Overall Dimension (L*W*H)	mm	1775*820*2280	1775*820*2280	1748*800*2250
Service Weight	kg	390	390	450
Fork	mm	2005×250×35	2005×250×35	2005×250×35

Copy of marking plate (as a representative):



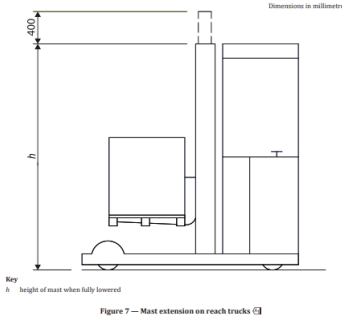
Summary of testing:

All tests are carried out in according to the EN ISO 3691-1:2015+A1:2020, EN 16307-1:2020, EN 1175:2020, and the test results meet the requirements specified in the above-mentioned standards.

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
1	Scope		-
2	Normative references		-
3	Terms and definitions		-
4	Safety requirements and/or protective measures		-
4.1	General		-
4.1.1	Overall requirements		-
	The truck shall comply with the safety requirements and/or protective measures of this clause.	Please refer to the following test result.	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.		P
4.1.2	Normal climatic conditions		-
	For truck operation, the following climatic conditions apply:		P
	-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		-
	Normal operating conditions are the following:	The operation condition meets the requirements.	P
	-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 center of gravity approximately on the longitudinal center 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.		P
4.1.4	Electrical requirements		-
	Electrical requirements are subject to regional	Evaluated according	P

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	requirements.	with EN 1175.	
4.1.5	Edges or angles		-
	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.	There are no sharp edges and angles.	P
4.1.6	Stored energy components		-
	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.	No such components.	N/A
4.2	Starting/moving		-
4.2.1	Unauthorized starting		-
	Trucks shall be provided with a device (e.g. key, code, magnetic card) which prevents starting without its use. 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.	The truck is equipped with a key which can prevent starting without using it.	P
4.2.2	Unintended movement and inadvertent activation		-
	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.	The truck can be only moved by actuation of the controls by the operator.	P
4.2.2.1	Parking brakes		-
	A parking brake complying with 4.3.1 shall be provided.		N/A
	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.		N/A
	Failure of the control system of an automatically applied parking brake shall be indicated to the operator.		N/A
4.2.2.2	Internal-combustion-engine powered trucks		-
	Internal-combustion-engine powered trucks shall be fitted with a device which prevents the engine being started while the transmission is engaged.		N/A

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
4.2.2.3	Travel controls		-
	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.		N/A
4.2.2.4	Powered travel movement		-
	Powered travel movement of the truck with a ride-on operator shall be possible only if the operator is in the normal operating position.		N/A
	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		-
	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.		N/A
4.2.3	Travel speed		-
4.2.3.1	Pedestrian-controlled trucks		-
	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/s ² and shall be designed for low-lift only.		P
	Variable-speed pedestrian-controlled trucks operating on level ground shall be controllable by the operator to be aligned with their walking speed.		N/A
	The maximum speed is subject to regional requirements, additional to the requirements of this part of ISO 3691.		N/A
4.2.3.2	Stand-on trucks and pedestrian-controlled trucks with foldable platform		-
	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. For trucks with a foldable operator platform, see 4.7.3.3. For trucks with stand-on options, see 4.7.3.2 and 4.7.3.4.	No foldable platform.	N/A
4.2.3.3	Travel with mast raised		-
	The speed of reach trucks shall be reduced automatically without causing a hazard to $v_{max} \leq 6$ km/h as determined by the manufacturer when the elevated section of the mast is more than 400 mm above the height of the mast when fully lowered (see Figure 7).	Not reach trucks.	N/A

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	 <p>Travel with mast raised is subject to regional requirements.</p>		
4.3	Brakes		-
4.3.1	General		-
	All industrial trucks shall be designed with service and parking brakes. Brakes shall comply with ISO 6292.	Brakes value 1.8m/s.	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.		P
4.3.2	Failure of energy supply to service brake		-
	Failure of the energy supply to the service brake shall not result in a total loss of braking and shall enable a controlled stop.		P
4.3.3	Stand-on and pedestrian-controlled trucks		-
	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.	The truck has tiller, can close automatically, and can be used as a parking brake.	P
4.4	Manual control actuators		-
4.4.1	General		-
4.4.1.1	Consistency with the truck motions		-
	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 If additional operating positions are fitted, e.g. for more than one operator, the operation of these controls shall only be	No additional operating position.	N/A

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	possible from one operating position at a time, excepting the emergency disconnect switch, which shall be operable from all positions.		
4.4.1.3	Multiple operating positions		-
	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.	No additional operating position.	N/A
4.4.2	Travel and braking controls		-
4.4.2.1	General		-
	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		-
	Trucks with pedal-operated travel and braking controls shall comply with ISO 21281.		N/A
4.4.2.3	Stand-on trucks		-
	The requirements for travel and braking controls for a stand-on truck are as follows.		P
	a) Travel control functions -Where a tiller is used, it shall be fitted with control devices for travel direction and speed. [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. The service brake function shall be engaged -automatically when the tiller is released, if operated by the tiller, -automatically when the travel-control is released, if operated by the travel-control, -automatically when releasing the pedal, if the brake function is foot-operated, -when activating the hand actuator, if the brake function is hand-operated.		P
	b) Trucks with elevating operator platform up to 1 200 mm Means shall be provided to prevent travel while the platform is elevated more than 500 mm, unless the controls are elevated with the platform.	It's not this type of truck.	N/A
4.4.2.4	Pedestrian-controlled trucks		-

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	The requirements for pedestrian-controlled trucks are as follows.		P
	a) The tiller shall be fitted with control devices for travel direction and speed.		P
	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.		P
	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.		P
	d) The tiller shall be fitted with a device to energize the direction of travel away from the operator until 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).		P
4.4.2.5	Differential locking		-
	It shall be possible to unlock the differential when the truck is moving.	No differential lock fitted.	N/A
	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.		N/A
4.4.2.6	Additional operation from outside the truck		-
	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.	No additional operation from outside the truck.	N/A
	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. 2) Controls fitted at the outside of the truck shall be secured against unintentional activation.		N/A
	b) Additional requirements for cable-connected remote controls 1) The length and layout of the cables shall allow the operator to operate from outside of the area of hazard of		N/A

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>the truck and have visibility of the path of travel. It shall not be possible for the cable to become entangled with the wheels.</p> <p>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.</p>		
	<p>c) Additional requirements for cableless control</p> <p>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.</p> <p>2) On the portable control panel, the control elements for operation, with the exception of the emergency stop, shall be guarded against unintentional operation.</p> <p>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.</p> <p>4) The truck shall stop automatically when outside of the operator's direct view (90°) and/or out of range of the remote control.</p> <p>5) No control interference shall be possible when more than one truck is operating under remote control at the same time.</p>		N/A
	<p>d) Additional requirements for trucks with trailer coupling</p> <p>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.</p> <p>2) The rear touch device shall be secured against unintentional operation.</p> <p>3) During operation of the rear touch device, the travel speed of the truck shall not exceed 2,5 km/h.</p>		N/A
4.4.2.7	Additional operation from alongside pedestrian-controlled and stand-on trucks (coasting)		-
	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.	No additional operation.	N/A
	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		N/A

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	part of ISO 3691.		
4.4.3	Steering controls		-
4.4.3.1	Steering direction		-
	The following applies.		P
	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 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 facing in the opposite direction.	The operator position of the truck is fixed.	N/A
	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.	The steering wheel cannot move through 360°.	N/A
	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.		P
	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 identified.	The truck cannot be steered reversely. Without “Reverse Steering”.	N/A
4.4.3.2	Failure of power supply		-
	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.	Steering is controlled manually by the operator.	N/A
4.4.4	Load-handling controls		-
4.4.4.1	Controls		-
	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	Meet the requirement.	N/A

EN ISO 3691-1:2015+A1:2020

Clause	Requirement + Test	Result - Remark	Verdict																																																																	
	lever should be for auxiliary functions.																																																																			
	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 fourth closest lever should control side shift and the fifth closest lever should be for auxiliary functions.		N/A																																																																	
	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.		N/A																																																																	
	<p style="text-align: center;">Table 1 — Levers or handle-type controls with single operation, sequence of location and direction of movement</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Function (listed in sequence of location)</th> <th colspan="2">Direction of movement</th> </tr> <tr> <th>Motion of load or equipment</th> <th>Predominant motion of operator's hand when actuating control handle while facing load</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Hoist</td> <td>Up</td> <td>Rearward or up</td> </tr> <tr> <td>Down</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Reach</td> <td>Retract</td> <td>Rearward</td> </tr> <tr> <td>Extend</td> <td>Forward</td> </tr> <tr> <td rowspan="2">Tilt</td> <td>Rearward</td> <td>Rearward or up</td> </tr> <tr> <td>Forward</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Side shift</td> <td>Right</td> <td>Rearward or up</td> </tr> <tr> <td>Left</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Push-pull</td> <td>Rearward</td> <td>Rearward</td> </tr> <tr> <td>Forward</td> <td>Forward</td> </tr> <tr> <td rowspan="2">Rotate laterally</td> <td>Clockwise</td> <td>Rearward or up</td> </tr> <tr> <td>Counter clockwise</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Rotate longitudinally</td> <td>Rearward</td> <td>Rearward or up</td> </tr> <tr> <td>Forward</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Load stabilizer</td> <td>Down</td> <td>Rearward or up</td> </tr> <tr> <td>Up</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Fork position</td> <td>Together</td> <td>Rearward or up</td> </tr> <tr> <td>Apart</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Grip</td> <td>Engage</td> <td>Rearward or up</td> </tr> <tr> <td>Release</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Truck stabilizer</td> <td>Raise</td> <td>Rearward or up</td> </tr> <tr> <td>Lower</td> <td>Forward or down</td> </tr> <tr> <td rowspan="2">Clamp</td> <td>Clamp</td> <td>Rearward or up</td> </tr> <tr> <td>Release</td> <td>Forward or down</td> </tr> </tbody> </table>			Function (listed in sequence of location)	Direction of movement		Motion of load or equipment	Predominant motion of operator's hand when actuating control handle while facing load	Hoist	Up	Rearward or up	Down	Forward or down	Reach	Retract	Rearward	Extend	Forward	Tilt	Rearward	Rearward or up	Forward	Forward or down	Side shift	Right	Rearward or up	Left	Forward or down	Push-pull	Rearward	Rearward	Forward	Forward	Rotate laterally	Clockwise	Rearward or up	Counter clockwise	Forward or down	Rotate longitudinally	Rearward	Rearward or up	Forward	Forward or down	Load stabilizer	Down	Rearward or up	Up	Forward or down	Fork position	Together	Rearward or up	Apart	Forward or down	Grip	Engage	Rearward or up	Release	Forward or down	Truck stabilizer	Raise	Rearward or up	Lower	Forward or down	Clamp	Clamp	Rearward or up	Release	Forward or down
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4.4.4.2	Manual-lift systems		-																																																																	
	The hand power forces and the layout of controls of manually operated lifting systems shall comply with ISO 3691-5.	Use electric lifting.	N/A																																																																	
4.4.5	Multi-function controls		-																																																																	
	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.		P																																																																	
4.4.6	Controls for automated functions	No automated functions.	N/A																																																																	
	The controls for automated functions shall comply with ISO 24134.																																																																			

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Clause	Requirement + Test	Result - Remark	Verdict
4.4.7	Marking		-
	Graphic symbols used for marking controls shall comply with 6.3.1.4.	Graphic symbols are marked on the controls.	P
4.5	Power systems and accessories		-
4.5.1	Exhaust and cooling systems		-
4.5.1.1	Exhaust systems		-
	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.	Trucks use electricity for energy.	N/A
4.5.1.2	Cooling systems		-
	The air flow through the cooling system shall be arranged so as to avoid discomfort to the operator.		N/A
4.5.2	Fuel tank		-
4.5.2.1	Tank isolation		-
	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 electrical or exhaust system parts.		N/A
4.5.2.2	Fuel spillage		-
	Fuel spillage shall not be possible under normal operating conditions.		N/A
4.5.3	Access to engine and other compartments		-
4.5.3.1	Engine covers		-
	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.	The engine compartment guard can be locked.	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

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Clause	Requirement + Test	Result - Remark	Verdict
4.5.3.2	Unintentional closure		-
	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		-
4.5.4.1	Containers		-
	The following applies to the containers of trucks powered by LPG.	The truck is not LPG trucks.	N/A
	a) LPG containers shall be either permanently fixed to the truck or removable.		N/A
	b) When LPG containers are removable, their fastenings shall permit easy handling and checking of the installation after the exchange of containers.		N/A
	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/A
	d) LPG containers shall be securely mounted to the truck to prevent movement. Fastening shall withstand static loading of four times the filled container weight in any direction without permanent visible deformation.		N/A
	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.		N/A
	f) LPG containers and their connections shall be installed such that there are no projections outside the plan view outline of the truck.		N/A
	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/A
	h) If an additional LPG container is carried on the truck, it shall be secured in the same manner as the main container.		N/A
	i) LPG containers, whether fixed or removable, shall be equipped with a device to prevent unintentional emission of		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	gas or liquid, e.g. in the case of a pipe system failure. This does not apply to pressure-relief valves.		
	j) Pipe fittings and accessories on LPG containers shall be protected against mechanical damage when used as specified by the manufacturer.		N/A
	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/A
	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/A
	m) Permanently mounted LPG containers to be filled by the user shall be fitted with the following: 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); 2) an 80 % fill stop valve; 3) maximum liquid level devices suitable for the LPG in use, indicating the maximum product level and which shall not vent to the atmosphere.		N/A
	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.		N/A
4.5.4.2	Piping		-
	The following applies to the piping used on trucks powered by LPG.		N/A
	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: - piping shall be so arranged that damage or leaks are easily detectable and that checks and maintenance can be carried out; - piping shall be installed such that it cannot be damaged by any excessive heat radiation from hot parts of the truck; - fully rigid pipes shall not be used for connecting the		N/A

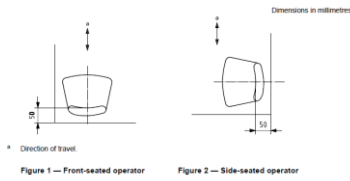
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Clause	Requirement + Test	Result - Remark	Verdict
	container to equipment on the engine; - piping shall be so arranged that there are no projections outside the plan view outline of the truck.		
	b) Pressure hoses operating above 1 bar 3) shall be supported at least every 500 mm. Rigid pipes shall be supported at least every 600 mm.		N/A
	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.		N/A
	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.		N/A
	e) Aluminium piping shall not be used.		N/A
	f) Hoses shall be as short as practical.		N/A
	g) Pressure unions and joints operating above 1 bar shall be made of metal, except for any constrained sealing washers.		N/A
4.5.4.3	Equipment		-
	The following applies to the equipment used on trucks powered by LPG.		N/A
	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.		N/A
	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.		N/A
	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/A
	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.		N/A

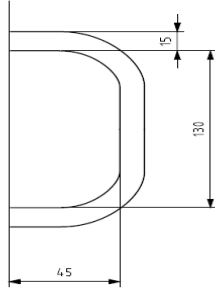
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Clause	Requirement + Test	Result - Remark	Verdict
	e) If corrosion of a part would interfere with its proper functioning, that part shall be provided with a corrosion-resistant protective coating.		N/A
	f) All fuel system components shall be firmly secured to the truck.		N/A
	g) Pressure-reducing valves shall be readily accessible for inspection and maintenance.		N/A
	h) The engine compartment shall be designed in accordance with 4.5.4.1 g), in order to avoid any LPG accumulation.		N/A
4.5.4.4	Regional requirements		-
	LPG-powered trucks are subject to regional requirements, additional to the requirements of this part of ISO 3691.		N/A
4.6	Systems for lifting and tilting		-
4.6.1	Lift chains		-
	The truck or mast manufacturer shall have on record a certificate from the chain manufacturer giving the breaking load of the chains used.		P
	<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, K1, when supporting the maximum capacity load and assuming no friction in the mast structure, which is given by the following equation:</p> $K_1 = (I_c \times n) / (R + w)$ <p>where</p> <ul style="list-style-type: none"> K_1 is the safety factor of the lifting mechanism; I_c is the minimum breaking load for new chain; n is the number of chains; R is the maximum load capacity of the truck; w is the dead weight of the lifting mechanism supported by the chains. <p>The K1 factor is subject to regional requirements, additional to the requirements of this part of ISO 3691.</p>	K1=7.3	P
	Pulley diameters shall be in accordance with the chain manufacturer's instructions.		N/A
4.6.2	Mechanical lifting systems		-
4.6.2.1	General		-
	The lifting system shall comply with the requirements of 4.6.3.3.		P
4.6.2.2	Failure of lifting/lowering mechanism		-

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	Meet the requirements.	P
4.6.2.3	Lowering speed		-
	The lowering speed of the lifting mechanism with its rated load shall not exceed 0,6 m/s.		P
4.6.3	Hydraulic lifting and tilting systems		-
4.6.3.1	Hydraulic lifting systems		-
	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 -100 mm for trucks up to and including 10000 kg rated capacity, -200 mm for trucks over 10 000 kg rated capacity.	According to the test results is 1mm.	P
4.6.3.2	Lowering speed limitation		-
	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).	Safety valve provided.	P
4.6.3.3	Limitation of stroke		-
	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		-
	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°.		N/A
4.6.3.5	Mast tilt and carriage isolation		-

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Clause	Requirement + Test	Result - Remark	Verdict
	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. 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		-
4.6.4.1	Hydraulic circuits		-
	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.		P
4.6.4.2	Pressure controls		-
	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		-
	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		-
	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).	Meet the requirements.	P
4.6.5	Load-handling and -stacking attachments		-
4.6.5.1	Unintentional displacement or detachment		-
	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.	The trucks have fork limit and locking device.	P
4.6.5.2	Malfunction in the power supply system		-
	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		N/A

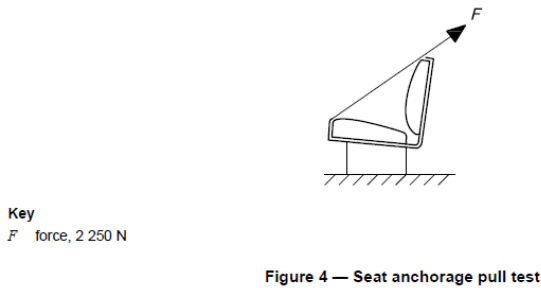
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Clause	Requirement + Test	Result - Remark	Verdict
	manual controls are in the neutral position or in the event of a malfunction in the power supply system for the attachment.		
4.6.5.3	Hydraulic system for attachment		-
	If an attachment has its own separate hydraulic system, it shall comply with 4.6.4.		N/A
4.6.5.4	Combined hydraulic systems		-
	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.	No combined hydraulic systems.	N/A
4.6.5.5	Attachments for lifting freight containers		-
	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).	No such attachments.	N/A
4.6.5.6	Fork arms		-
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.		P
4.6.5.6.3	Means shall be provided to prevent unintentional lateral displacement of the fork arms on the fork carrier.		P
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.	No fork arm extension.	N/A
4.6.5.7	Fork carriers		-
	Hook-on type fork carriers shall be in accordance with ISO 2328.		N/A
4.7	Operator positions		-
4.7.1	Dimensions		-
	The operator's seat or standing position shall be so located		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		
	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). 		N/A
	For stand-on pedestrian- and centre-controlled ride-on trucks employing a tiller, the tiller steering control movement may extend beyond the plan view.		N/A
4.7.2	Operator access and egress		-
4.7.2.1	General		-
	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.		P
4.7.2.2	Steps		-
	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.		N/A
4.7.2.3	Compartment floors		
	The compartment floor frequented by the operator, steps and walkways shall be free of obstacles and shall have a slip-resistant surface, e.g. ribbed mats, abrasive coating, and expanded metal.	With such parts.	N/A
4.7.2.4	Walkways		-

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	No such walkways.	N/A
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 (refer to Figure 3 of the standard).</p>  <p style="text-align: center;">Figure 3 — Hand hold</p>	Without hand holds.	N/A
4.7.3	Platforms		-
4.7.3.1	General		-
	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.	Without platforms.	N/A
4.7.3.2	Platforms overhanging the truck chassis		-
	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	Without platforms.	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	deflection. The side guards shall be at a minimum height of 700 mm above the platform in its protective position.		
4.7.3.3	Pedestrian-controlled trucks with foldable platforms		-
	Operator stand-on platforms that are fitted to pedestrian-controlled trucks and overhang the truck's chassis may be capable of being folded or pivoted to an upright position when the operator leaves the platform; this may be done automatically.		P
	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.		P
	Travelling of more than 6 km/h shall only be possible when the platform is pivoted down and guards are in their protective position.		P
4.7.3.4	Stand-on platforms		-
	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/A
4.7.3.5	Trucks with foldable platforms and foldable side guards		-
	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/A
4.7.4	Operator's seat		-
	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.	Without seat.	N/A
	a) If the seat has a facility allowing fore and aft adjustment, this shall be possible without the use of tools.		N/A
	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		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	adjustment of the weight mechanism shall be possible without the use of tools.		
	c) If a seat has a facility allowing it to swivel about a vertical axis, this shall be possible at all seat adjustment positions without unintentional operation of the controls.		N/A
	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.	Without seat.	N/A
	e) The requirements of a) to d), above, also apply to additional operator's seats.		N/A
	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/A
	g) 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 $45^\circ \pm 5^\circ$ angle, as shown in Figure 4.		N/A
	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. 	Without seat.	N/A
	The specification and marking of the operator's seat is subject to regional requirements, additional to the requirements of this part of ISO 3691.		N/A
4.7.5	Protection from road wheels and objects thrown up by the wheels		-
4.7.5.1	Ride-on trucks		-
	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).		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The protection device for the steered wheels need only cover the wheels when in a straight-line position.		
4.7.5.2	Pedestrian-controlled trucks		-
	<p>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 of the standard.</p> <p>Dimensions in millimetres</p> <p>Either: $h < 35 \text{ mm}; l_{\text{min}} = 10 \text{ mm}$ Or: $h = 35 \text{ mm to } 70 \text{ mm}; l_{\text{min}} = 2.57 \times h - 80 \text{ mm}$ $h = 70 \text{ mm to } 120 \text{ mm}; l_{\text{min}} = 1.60 \times h - 12 \text{ mm}$</p> <p>Key 1 frame 2 foot space 3 ground/floor 4 wheel 5 frame edge A height from ground or floor to frame edge l horizontal distance from end of frame to point on wheel 35 mm above ground or floor</p>	Checked	P
	<p>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 which the conditions specified in 4.7.5.2</p> <p>Key 1 wheel 2 deflector 3 ground (floor)</p> <p>Figure 6 — Foot protection</p>		N/A
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.</p>	The truck without high temperature parts.	P
4.7.7	Protection against crushing, shearing and trapping		-
4.7.7.1	General		-

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Clause	Requirement + Test	Result - Remark	Verdict
	<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.</p> <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>	Those parts are well protected.	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> <p>a) places where only the operator's fingers can be trapped: min. 25 mm;</p> <p>b) places where only the operator's hands or feet can be trapped: min. 50 mm;</p> <p>c) places where the operator's arms or legs can be trapped: min. 100 mm.</p> <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>	Measured.	P
4.7.7.3	Attachments		-
	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 warning sign in accordance with 6.3.3.4.	Checked.	P
4.7.7.4	Foot protection		-
	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.	Checked.	P
4.7.8	Operator restraint		-
	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	The trucks is not sit-on counterbalanced lift trucks with a rated	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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. 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.	capacity up to and including 10 000 kg and sit-on, single side-loading trucks.	
4.7.9	Additional operator positions		-
	Additional operator position(s) shall be in accordance with 4.7.1 to 4.7.8.	No additional operator positions.	N/A
4.8	Stability		-
4.8.1	General		-
	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):	Tests have been conducted according to ISO 22915-1 and ISO 22915-4.	P
	-basic test criteria and requirements for all applicable truck types, ISO 22915-1; -counterbalanced trucks with mast, ISO 22915-2; - reach and straddle trucks, ISO 22915-3; - pallet stackers, double stackers and order-picking trucks with operator position elevating up to and including 1 200 mm lift height, ISO 22915-4; - bidirectional and multidirectional trucks, ISO 22915-7; -industrial variable-reach trucks, ISO 22915-11; - order-picking trucks with operator position elevating above 1 200 mm, ISO 22915-21.		P
	The stability of trucks lifting less than 500 mm shall be tested according to the test requirements defined for		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	travelling by the appropriate International Standard for stability for a similar truck design equipped with a mast.		
	Stability requirements are subject to regional requirements, additional to the requirements of this part of ISO 3691.		N/A
4.8.2	Specific operating conditions		-
	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: -trucks operating in the special condition of stacking with mast tilted forward and load elevated, ISO 22915-8; -trucks operating in the special condition of stacking with load laterally displaced by powered devices, ISO 22915-10; - trucks operating in the special condition of offset load, offset by utilization, ISO 22915-20.	No specific operating conditions.	N/A
4.8.3	Levelling indicator for rough-terrain trucks		-
	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.	Not rough-terrain trucks.	N/A
4.9	Protective devices		-
4.9.1	Overhead guard		-
4.9.1.1	General		-
	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. 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.	Without overhead guard.	N/A
4.9.1.2	Additional fitting against falling small objects		-
	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.		N/A
4.9.1.3	Pedestrian-controlled trucks with foldable platform		-
	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		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		
4.9.2	Load backrest extension		-
4.9.2.1	Provision for load backrest extension		-
	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.	Without load backrest extension.	N/A
4.9.2.2	Size of openings		-
	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. The size of openings in the load backrest extension, if provided, shall not exceed 150 mm in one of the two dimensions.	Without load backrest extension.	N/A
4.9.3	Warning device		-
	Trucks shall be equipped with an operator-controlled audible warning device.	The truck is equipped with a horn.	P
4.9.4	Wheels with split wheel rims for inflatable tyres		-
	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/A
4.9.5	Traction battery compartment		-
4.9.5.1	Unauthorized access		-
	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.	The voltage does not exceed 120V and is protected by a cover.	P
4.9.5.2	Metal cover		-
	A metal cover for a battery compartment or battery enclosure shall have either 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 x 300 mm of the cover, or	The battery cover plate is insulated from the battery belt.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		
4.9.5.3	Non-metallic cover		-
	For non-metallic covers of battery compartments, the following applies. a) The cover shall have a burn rating of V0 or V1 in accordance with IEC 60695-11-10. 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. c) If metallic parts project into the battery compartment, then 4.9.5.2 applies.		N/A
4.9.5.4	Ventilation		-
	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. 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 cells, multiplied by the rated capacity in Ampere-hours. This level of ventilation is not intended to cover the charging condition.	Meet requirements.	P
4.9.5.5	Resistance to electrolyte		-
	The battery enclosure, in accordance with ISO 20898, shall be resistant to the chemical effects of them electrolyte.	Meet requirements.	P
4.9.6	Battery-restraint devices		-
	On battery-powered trucks, means shall be provided to retain the battery from moving more than 15 mm in a horizontal direction.	Meet requirements.	P
	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		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		
	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.		P
	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.		P
4.9.7	Starter battery requirements		-
	The starter battery on engine-powered trucks shall be restrained from movement.		N/A
4.9.8	Handling of batteries		-
	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 the overhead guard or rollers.	Meet the requirements.	P
4.10	Visibility and lighting		-
4.10.1	Visibility		-
	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.	Appropriate light provided for operation.	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.		N/A
	NOTE Visibility requirements for trucks over 10 000 kg were being developed at the time of publication of this part of ISO 3691.		P
4.10.2	Lighting		-
	Ride-on trucks shall be so designed that it is possible, referring to the manufacturer's instructions, to equip them		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	with travel lights, working lights and signal lights.		
4.11	Environmental conditions		-
4.11.1	Operator's cab		-
4.11.1.1	General		-
	If a cab is fitted in lieu of an overhead guard, it shall comply with 4.9.1	No cab installed.	N/A
4.11.1.2	Fire resistance		-
	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.		N/A
4.11.1.3	Ventilation		-
	If a totally enclosed cab is fitted, provision shall be made for efficient ventilation.		N/A
4.11.1.4	Heater, demister and defroster		-
	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/A
4.11.1.5	Wipers and washers		-
	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 or laminated.		N/A
4.11.1.6	Access and emergency exit		-
	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.		N/A
4.11.1.7	Storage of instruction handbook		-
	Provision shall be made for the storage of the instruction handbook (see 6.2) so that it does not obstruct the normal operating position.		N/A
4.11.1.8	Additional operator's position		-
	If an additional operator's position is equipped within a cab,		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	it shall meet the requirements of 4.11.1.1 to 4.11.1.6.		
4.11.2	Noise emissions		-
	Noise emissions are subject to regional requirements. See ISO/TS 3691-7:2011, namely, the values of noise emissions shall be measured using the test method given in EN 12053.	Sound pressure level: 60.3dB(A) Sound power level: 87.0dB(A) Uncertainty: U(K=2) =0.2dB	P
4.11.3	Vibration		-
	Whole-body vibrations transmitted to the operator are subject to regional requirements.	Vibration value 1.25m/s. Uncertainty: Urel(K=2) =2.0%	P
4.11.4	Electromagnetic compatibility (EMC)		-
	EMC is subject to regional requirements.		P
4.11.5	Transport		-
4.11.5.1	Location for lifting and/or slinging points		-
	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).	Lifting and slinging points are marked and described in the user manual.	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		-
	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		-
	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. Slinging points for transportation of the attachment shall be arranged such that there is no possibility of sudden movement.	No such attachments.	N/A
4.12	Devices for towing		-

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
5	Verification of safety requirements and/or protective measures		-
5.1	General		-
	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: a) by design, e.g. verification of drawings and documents, or calculation; b) by measurement, e.g. tests of travelling and lowering speed or lift and tilt leakage; c) by visual examination, e.g. no permanent deformation after tests, verification of the marking of the truck; d) by further testing.		P
5.2	Structural tests		-
	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 Q1 and 1,33 Q2 for 15 min each, where Q1 is the rated capacity at the standard lift height and standard load centre distance in accordance with the information on the capacity plate; Q2 is the actual capacity at maximum lift height in accordance with the information on the capacity plate.	The standard door frame and the highest door frame were tested respectively, and no adverse phenomenon appeared, and the test passed.	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 height by means independent of the truck. The test shall not result in any visual permanent deformation or damage.		P
5.3	Functional verification		-
	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	Functional tests and dynamic tests have been performed and passed.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	producing substantially the same result.		
	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		-
6.1	General		-
	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.	Checked.	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		-
6.2.1	Truck/attachments		-
	The instruction handbook(s) shall include, as applicable, at least the following information: a) name and address of the manufacturer or authorized representative; b) designation of type, e.g. counterbalanced, side-loading truck; c) description of the truck and accessories; d) attachments supplied with the truck and their assembly precautions; e) details of use of a removable load backrest extension; f) details for the installation of a fire extinguisher, if required by the application of the truck; g) admissible wheel rims and tyres with inflation pressures for pneumatic tyres; h) description of safety devices and warning labels.		P
	Instructions on truck/attachments are subject to regional requirements, additional to the requirements of this part of ISO 3691.		P

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Clause	Requirement + Test	Result - Remark	Verdict
6.2.2	Operation of truck		-
	<p>The instruction handbook(s) shall include, as applicable, at least the following information:</p> <ul style="list-style-type: none"> a) intended uses of the truck and attachments, and examples of hazardous misuse; b) training requirements for the operator; c) function of operating controls and displays; d) pre-shift checks before the truck is put into operation; e) instructions for adjustment of the operator's seat; f) instructions for operation with/without cab, with/without doors; g) instructions for access and egress; h) instructions for safe handling by the operator, e.g. when changing attachments or moving fork arms; i) requirements of the ground/floor where the truck is to be used; j) instructions for starting, driving and stopping the truck; k) instructions for handling loads, warning about the hazards due to the action of wind forces; l) instructions when operating on a gradient; m) instructions for towing the truck; n) instructions for parking the truck; o) warning of risks during the use of the truck and its attachments, including crushing and shearing hazards; p) climatic conditions in which the truck is designed to operate; q) information about the direction of turning of the truck in relation to rotation of the steering wheel for end-controlled trucks; r) information about operating the truck with loads causing insufficient visibility; s) information on the use of any visual aid that may be provided; t) information and conditions for the use of the drawbar; u) instructions when operating a rear touch device; v) information or instructions on action to be taken in the event of a malfunction; 		P
	<ul style="list-style-type: none"> w) information for operation of the truck by a remote control device, e.g. visibility; 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; y) instructions on the use of the operator-restraint device, system or enclosure, and guidance on the operator's 		P

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Clause	Requirement + Test	Result - Remark	Verdict
	<p>behaviour in the event of a tip-over;</p> <p>z) information about lighting of the working area;</p> <p>aa) the procedure for movement of inoperative trucks;</p> <p>bb) instructions against operating truck with guarding removed;</p> <p>cc) lift height for travelling;</p> <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;</p> <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;</p> <p>ff) information and instructions for using attachments, e.g. load bearing clamp.</p> <p>Instructions on the operation of the truck are subject to regional requirements, additional to the requirements of this part of ISO 3691.</p>		
6.2.3	Details for battery-powered trucks		-
	<p>The instruction handbook(s) shall include, as applicable, at least the following information:</p> <p>a) specification of approved batteries and on-board battery chargers;</p> <p>b) procedure for safe handling of batteries, including installation, removal and secure mounting on the truck;</p> <p>c) warning of risks of accumulation of hydrogen under covers;</p> <p>d) battery charging procedures and instructions;</p> <p>e) service mass of battery and ballast when required.</p>		N/A
6.2.4	Details for internal-combustion-engine powered trucks		-
	<p>The instruction handbook(s) shall include at least the following information:</p> <p>a) approved fuels;</p> <p>b) procedure for safe handling of fuels;</p> <p>c) procedure for refuelling;</p> <p>d) warning of the effect of exhaust emissions in confined spaces;</p> <p>e) warning of the effect of exhaust emissions for the operator.</p>		P
6.2.5	Service and maintenance		-
	<p>The instruction handbook(s) shall include, as applicable, at least the following information:</p>		P

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Clause	Requirement + Test	Result - Remark	Verdict
	a) training and qualifications needed for service and maintenance staff; b) safe procedure for the identification, detection and correction of faults; c) instructions for changing tyres or wheels; d) instructions for verification that markings, e.g. decals, are in place and legible; e) instructions for de-energizing of stored energy components; f) access to maintenance while working at height; g) servicing operations for which no specific skills are required; h) use of approved spare parts; i) drawings and diagrams necessary for truck service and maintenance; j) instructions for disposing of waste material (e.g. oils and battery); 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); l) instructions for removing and reattaching guarding;		
	m) instructions for regular verification of seat belt related to 1) cut or frayed straps, 2) worn or damaged hardware, including anchor points, 3) buckle or retractor malfunction, 4) loose stitching.		P
6.2.6	Transportation, commissioning and storage		-
	The instruction handbook(s) shall include, as applicable, at least the following information: a) mass and overall dimensions of the truck and dismantled parts for transport, commissioning and storage; b) procedures for transporting, including loading and unloading; c) procedure for truck reassembly and mounting of attachments; d) functional tests on completion of commissioning; e) procedure for movement of inoperative trucks; f) procedure for prolonged shut down and storage of trucks. Transportation, commissioning and storage are subject to regional requirements, additional to the requirements of this part of ISO 3691.		P

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
6.2.7	Truck modification		-
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.	Trucks are not allowed to be modified.	N/A
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.		N/A
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 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, b) maintains a permanent record of the design, test(s) and implementation of the modification or alteration, c) approves and makes appropriate changes to the capacity plate(s), decals, tags and instruction handbook, and 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.		N/A
6.3	Marking		-
6.3.1	Information plates		-
6.3.1.1	Trucks		-
	Trucks shall be marked legibly and indelibly (e.g. weather-proofed, profiled letters) with at least the following details:	Checked.	P
	a) name and address of the manufacturer or his authorized representative; b) designation of series or type and compliance with the		P

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>requirements of this part of ISO 3691;</p> <p>c) serial number and year of manufacture;</p> <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 $\pm 5\%$ or 1 000 kg, whichever is the lower of the two;</p> <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;</p>		
	<p>f) actual capacities at other lift heights and load centre distances, if applicable;</p> <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> <p>h) on battery-powered trucks, the authorized maximum and minimum battery mass and the system voltage;</p> <p>i) if fitted, the maximum supporting force on the towing point connection, in newtons;</p> <p>j) if fitted, the drawbar pull on the towing point connection, in newtons;</p> <p>k) the nominal power in kilowatts, e.g. marked on the engine or electric motor.</p> <p>Marking requirements are subject to regional requirements, additional to the requirements of this part of ISO 3691.</p>		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> <p>a) name and address of the attachment manufacturer or his authorized representative;</p> <p>b) model or type;</p> <p>c) serial number and year of manufacture;</p> <p>d) mass of attachment, which may vary from the stated figure by up to $\pm 5\%$ or 200 kg, whichever is the lower of the two;</p> <p>e) distance of the centre of gravity of the attachment from its mounting face on the truck;</p> <p>f) rated capacity;</p> <p>g) in the case of hydraulically or pneumatically operated</p>		P

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>attachments, the maximum operating pressure recommended by the attachment manufacturer;</p> <p>h) load centre, if applicable;</p> <p>i) lost load centre distance;</p> <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> <p>a) name and address of the manufacturer or the authorized representative;</p> <p>b) designation of series or type;</p> <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 $\pm 5\%$ or 1 000 kg, whichever is the lower;</p> <p>d) serial number and year of manufacture;</p> <p>e) on battery-powered tractors, the authorized minimum and maximum battery mass and the system of voltage;</p> <p>f) the nominal power in kilowatts, e.g. marked on the engine or electric motor;</p> <p>g) the maximum supporting force on the tow-hook, in newtons;</p> <p>h) the drawbar pull, in newtons, and the period of time during which this pull can be exerted.</p>		N/A
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>		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>		P
6.3.3	Other information		-
6.3.3.1	Marking for slinging of trucks		-

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	Locations for slinging shall be clearly indicated on the truck or shall be declared in the instruction handbook (see 6.2).		P
6.3.3.2	Pneumatic tyre inflation pressure		-
	The specified inflation pressures shall be clearly indicated on the truck.		N/A
6.3.3.3	Filling points		-
	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		-
	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 service handbook. Warnings shall be in accordance with ISO 15870.		P
6.3.4	Languages		-
	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.		P
6.3.5	Operator restraint		-
	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.		P
A	Annex A		-
A.1	Forward-driving direction		-
	The forward-driving or forward direction is dependent on the type of truck. a) For sit-on trucks where the operator is facing the line of travel, load leading is the forward direction. b) For sit-on trucks where the operator is facing approximately at a right angle to the line of travel, load trailing is the forward direction. c) For side-loading trucks (one side only) where the operator is facing towards the line of travel, the direction in which the operator is facing is the forward direction. d) For side-loading trucks (one side only) where the operator is facing approximately at right angles to the line of travel, the forward direction is the end at which the operator is positioned.		P

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>e) For trucks with an elevated operator position, the forward direction is the direction in which the operator is oriented when facing the travel controls.</p> <p>f) For pedestrian-controlled trucks and low-lift order-picking trucks, load trailing is the forward direction.</p> <p>g) For stand-on, end-controlled trucks where the operator is facing the line of travel, load leading is the forward direction.</p> <p>h) For stand-on, end-controlled trucks where the operator is facing at a right angle to the line of travel, the travel direction is defined only by load trailing or load leading.</p>		
A.2	Rated capacity		-
A.2.1	Specification		-
A.2.1.1	High-lift trucks with masts		-
	<p>For the rated load, Q, the following conditions apply (see Figure A.1):</p> <ul style="list-style-type: none"> -load centre of gravity, G, positioned at the standard load centre distance, D (see A.2.3); -load Q vertically lifted to the standard lift height, H (see A.2.2); -a truck equipped with a two-stage mast that has a maximum lift equal to the standard lift height. <p>When the truck does not utilize a two-stage mast, it should be given a rated capacity at the standard lift height as if the mast were available.</p> <div style="text-align: center;"> <p>Key D standard load centre distance G load centre of gravity, positioned in the longitudinal plane of symmetry between the mast uprights H standard lift height Q rated load</p> <p>Figure A.1 — Rated load configuration</p> </div>		P
A.2.1.2	Pedestrian-controlled, pallet-stacker trucks		-
	<p>For the rated load, Q, the following conditions apply (see Figure A.1):</p> <ul style="list-style-type: none"> -load centre of gravity, G, positioned at the standard load centre distance, D (see A.2.3); -load Q vertically stacked to the standard lift height, H (see A.2.2). 		P
A.2.1.3	Pedestrian-controlled scissor-lift pallet trucks		-

EN ISO 3691-1:2015+A1:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	For these trucks, the maximum load, given by the manufacturer, expressed in kilograms and uniformly distributed over the length of the fork arms, is the load that the truck is capable of carrying and lifting in normal operation.		N/A
A.2.1.4	Low-lift-height and fixed-platform trucks		-
	For these trucks, the maximum load, given by the manufacturer, expressed in kilograms and uniformly distributed over the load-carrying platform or device is the load that the truck is capable of carrying and — if applicable — lifting in normal operation.		P
A.2.1.5	Removable attachments		-
	For such attachments, the maximum load, in kilograms, at a specified load centre that the attachment is capable of handling in normal operation is as specified by the attachment manufacturer.		P
A.2.2	Standard lift height, H		-
	Standard lift height values, expressed in millimetres, are measured from the ground to the upper face of the fork blades or lifting platform, and are as follows for the trucks covered by this part of ISO 3691:		P
	-for pallet-stacking trucks and high-lift platform trucks having a width across fork arms or platform up to and including 690 mm, and for counterbalanced trucks below 1 000 kg rated load, H=5000mm -all other types of trucks, up to and including 10 000 kg rated load, H = 3 300 mm; -for all other types of trucks, above 10 000 kg rated load, H = 5 000 mm.		P
A.2.3	Standard load centre distance, D		-
	Distance D, expressed in millimetres, is measured from the centre of gravity, G, of the load measured horizontally to the front face of the fork arm shank and vertically to the upper face of the fork arm blade.		P
	-For counterbalanced trucks, the values of D are according to Table A.1. -For single side-loading trucks and lateral- and front-stacking trucks, D is as specified by the manufacturer. -For trucks where the load centre distances differ from those specified in Table A.1 for special applications, the respective rated capacity should be defined. -For all other types of trucks, up to and including 10 000 kg		P

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Clause	Requirement + Test	Result - Remark	Verdict																																																
	<p>rated load, $D = 600$ mm. NOTE Some Asian countries use a load centre distance of 500 mm for reach trucks and high-lift order-picking trucks with a rated capacity up to and including 3 000 kg.</p> <table border="1"> <caption>Table A.1</caption> <thead> <tr> <th rowspan="2">Rated load, Q kg</th> <th rowspan="2">Standard load centre distance, D mm^a</th> <th>400</th> <th>500</th> <th>600</th> <th>900</th> <th>1 200</th> </tr> </thead> <tbody> <tr> <td>X</td> <td></td> <td>X^b</td> <td></td> <td></td> <td></td> </tr> <tr> <td>> 1 000 < 5 000</td> <td></td> <td></td> <td>X</td> <td>X^b</td> <td></td> <td></td> </tr> <tr> <td>> 5 000 < 10 000</td> <td></td> <td></td> <td></td> <td>X</td> <td>X</td> <td></td> </tr> <tr> <td>> 10 000 < 20 000</td> <td></td> <td></td> <td></td> <td>X</td> <td>X</td> <td>X</td> </tr> <tr> <td>> 20 000 < 25 000</td> <td></td> <td></td> <td></td> <td></td> <td>X</td> <td>X</td> </tr> <tr> <td>> 25 000</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>X</td> </tr> </tbody> </table> <p>^a 600 mm is used in the USA. ^b 600 mm is used in the USA, Asia and Australia.</p>	Rated load, Q kg	Standard load centre distance, D mm ^a	400	500	600	900	1 200	X		X ^b				> 1 000 < 5 000			X	X ^b			> 5 000 < 10 000				X	X		> 10 000 < 20 000				X	X	X	> 20 000 < 25 000					X	X	> 25 000						X		
Rated load, Q kg	Standard load centre distance, D mm ^a			400	500	600	900	1 200																																											
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> 10 000 < 20 000				X	X	X																																													
> 20 000 < 25 000					X	X																																													
> 25 000						X																																													
A.3	Rated drawbar pull of tractors		-																																																
	<p>The horizontal drawbar pull at the coupling, in newtons, given by the manufacturer, is that which the industrial tractor can develop at a specified coupling height while travelling on a smooth, dry and horizontal concrete surface as follows:</p> <ul style="list-style-type: none"> -for tractors powered by an internal combustion engine, while moving at a uniform speed of not less than 10 % of the rated no-load speed; -for battery-powered tractors, that which can be sustained continuously for a period of 1 h. <p>For ride-on tractors the rated drawbar pull should be established using an operator mass of 90 kg (ballasted accordingly).</p>		N/A																																																
	<p>The requirements for the quality of the driving surface can differ for the floor used indoors and outdoors. This floor quality depends on the operating conditions of the tractor, and these conditions should be specified in the instruction handbook [see 6.2.2 i)].</p>		N/A																																																
B	Annex B List of significant hazards		-																																																
	<p>This list contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this part of ISO 3691, identified by risk assessment of industrial trucks and which require action to eliminate or reduce the risk. See Table B.1.</p>		INFO.																																																
	<p>NOTE The structure of the table is based on that of ISO 14121-1:2007, Table A.14). The order of lines within a group corresponds to the truck functionalities.</p>		INFO																																																

BS EN 16307-1:2020			
Clause	Requirement – Test	Result - Remark	Verdict
4	Safety requirements and/or protective measures		-
4.1	General		-
	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.		P
4.2	Electrical requirements		-
	Electrical systems and equipment shall be in accordance with the relevant part(s) of EN 1175.	Please refer to the test report of EN1175.	P
4.3	Travel speed		-
	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:		P
	The travel speed of variable-speed pedestrian-controlled trucks operating on level ground shall not exceed 6 km/h.		P
	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.		N/A
4.4	Brakes		-
	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:		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;		P
	— 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

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Clause	Requirement – Test	Result - Remark	Verdict
4.5	Additional operation from alongside pedestrian-controlled and stand-on trucks		-
	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/A
	Low-lift order-picking trucks provided with a system that allows operating while walking alongside the truck are subject to the following requirements:		N/A
	— activation of the travel control device from outside of the truck shall only be possible when the truck is stationary;		N/A
	— 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/A
	— braking function shall be automatically applied when travel control device is released.		N/A
4.6	Lift chains		-
	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:	Please refer to the same part in EN ISO 3691-1.	P
	The minimum safety factor of the lifting mechanism, K_1 , shall be as follows:		P
	— for trucks $\leq 10\,000$ kg rated capacity: $K_1 \geq 5$		P
	— 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.		P
4.7	Mast tilt and carriage isolation		-
	The requirements of EN ISO 3691-1:2012, 4.6.3.5 shall apply, with the following addition:		N/A
	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.		N/A
4.8	Operator's seat		-
	The requirements of EN ISO 3691-1:2012, 4.7.4 shall apply with the following addition:		N/A
	The operator's seat shall be specified and marked in accordance with EN 13490.		N/A
4.9	Protection against crushing, shearing and trapping		-

BS EN 16307-1:2020			
Clause	Requirement – Test	Result - Remark	Verdict
4.9.1	General		-
	The requirements of EN ISO 3691-1:2012, 4.7.7.1 shall apply with the following addition:	Checked.	P
	Where fixed and/or removable guard systems are needed, the requirements of EN 953 shall be met.		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 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.		P
4.9.2	Pedestrian and stand-on end-controlled trucks with mast		-
	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.		P
4.10	Load control		-
	NOTE Taking into account the state of the art, it is not possible to meet the objectives for load control and load moment indicators.		P
4.11	Lateral stability		-
	The requirements of EN ISO 3691-1:2012, 4.8.1 shall apply.		N/A
	In addition, counterbalanced lift trucks that have a centre control, sit down, non-elevating operator, with a rated capacity up to and including 5 000 kg shall comply with EN 16203:2014.		N/A
4.12	Visibility		-
	The requirements of EN ISO 3691-1:2012, 4.10.1 shall apply with the following modifications		P
	Replace the requirement given in ISO 13564-1:2012, 9.2.2 a) with the following:		N/A
	forward direction 25 % of the vertical surface of the test body		N/A
	rearward direction 20 % of the vertical surface		N/A

BS EN 16307-1:2020			
Clause	Requirement – Test	Result - Remark	Verdict
	of the test body		
	Replace the required minimum illuminated area of test surface as required by ISO 13564-1:2012, Table 3, Test No.1, with the following: 25 % of the vertical surface of the test body		N/A
4.13	Reduction of noise by design		-
4.13.1	General		-
	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.	Considered.	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
4.13.2	Main source of noise		-
	On industrial trucks, the main sources of noise are components, such as the following, in a high-speed operation mode:		P
	— combustion engines, including air intake, cooling fan and exhaust system;		N/A
	— hydraulic pumps/motors.		P
4.13.3	Measures to reduce noise at the operator's position		-
	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.		P
4.13.4	Determination of noise emission values		-
	The value of noise emission shall be measured using the test method given in EN 12053.	Sound pressure level: 60.3dB(A) Sound power level: 87.0dB(A) Uncertainty: U(K=2) =0.2dB	P
4.14	Vibration		-
	Whole body vibration shall be measured using the test method given in EN 13059.		P
4.15	Electromagnetic compatibility (EMC)		-

BS EN 16307-1:2020			
Clause	Requirement – Test	Result - Remark	Verdict
	The truck's EMC shall comply with EN 12895.		P
4.16	Operation in potentially explosive atmospheres		-
	Trucks operating in potentially explosive atmospheres shall comply with EN 1755.	Have Operation in potentially explosive atmospheres.	N/A
5	Verification of safety requirements and/or protective measures		-
	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.	Checked	P
6	Information for use		-
6.1	Instruction handbook(s)		-
6.1.1	Truck/attachments		-
	The requirements of EN ISO 3691-1:2012, 6.2.1 shall apply with the following addition:		P
	The instruction handbook(s) shall include, as applicable, the following:		P
	— information on stability;		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
6.1.2	Operation of truck		-
	The requirements of EN ISO 3691-1:2012, 6.2.2 shall apply with the following addition:		P
	In addition, the instruction handbook(s) shall include, as applicable, the following: — information about specific protective devices (e.g. protective screen) and their use.		P
6.1.3	Transportation, commissioning and storage		-
	The requirements of EN ISO 3691-1:2012, 6.2.6 shall apply with the following addition:		P
	Further to EN ISO 3691-1:2012, 6.2.6 c), the instruction handbook(s) shall include, as applicable, the procedure for truck mounting.		P
6.2	Marking		-
6.2.1	Information plates		-
	The requirements of EN ISO 3691-1:2012, 6.3.1 shall apply, except the reference to ISO/TS 3691-8, with the following		P

BS EN 16307-1:2020			
Clause	Requirement – Test	Result - Remark	Verdict
	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 marking1).		P
Annex A	List of significant hazards		INFO
Annex ZA	Relationship between this European Standard and the Essential Requirements of EC Directive 2006/42/EC		INFO

BS EN 1175:2020			
Clause	Requirement - Test	Result - Remark	Verdict
4	Requirements		-
4.1	Introduction Trucks shall comply with the safety requirements and/or protective measures of this clause. In addition, the truck shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.		P
4.2	Validation of safety functions		-
	The design of safety functions shall be validated in accordance with EN ISO 13849-1:2015, Clause 8.	Meet requirement.	P
4.3	General requirements		-
4.3.1	Low voltage/high voltage		-
	Safety shall not be compromised at any voltage level that can occur. Electrical systems of trucks powered by lead-acid batteries shall be designed so that all functions operate in the voltage range from 70 % up to 120 % of the nominal battery voltage. These limits shall be adapted to other energy sources technologies by the manufacturer. NOTE Limits set by the manufacturer for other energy sources are outside the scope of this document.	The trucks run on lithium batteries.	N/A
4.3.2	Frame fault		-
	The electric circuits shall be so designed or protected, that frame faults shall not cause hazardous inadvertent movements that cannot be corrected or compensated by the operator. Compliance shall be verified by means of the type test of 4.10.4.		P
4.3.3	Protection from ingress of water and dust		-
	The electrical installation of the trucks in operating condition shall be designed and constructed such that the protection from harmful ingress of water and dust is in accordance with the environmental conditions in which the truck is designed to operate, including reasonably foreseeable misuses, as defined in the instruction handbook (see EN ISO 3691-1:2015, 6.2.2). NOTE Standardised degrees of protection provided by the enclosure of the electrical equipment are given in EN 60529:1991.	The power supply and circuit system of the truck have been insulated. dust and water will not enter the battery compartment and circuit system under normal operation.	P
4.3.4	Protection against electric shock		-
	Non-insulated live parts of trucks in the operating condition shall be protected to a degree of IPXXB	The start battery are protected by electrical	P

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Clause	Requirement - Test	Result - Remark	Verdict
	<p>preventing direct contact. For top surfaces, the minimum degree shall be IPXXD in accordance with EN 60529:1991.</p> <p>Access to an electrical enclosure containing uninsulated live parts in excess of nominal voltage 60 V DC or 25 V AC shall be possible only using a tool.</p> <p>Indirect contact with live parts shall be avoided by electric separation of the protection devices in accordance with EN 60204-1:2006, 6.3.2.3.</p> <p>It shall be possible to electrically disconnect the energy sources for maintenance and replacement operations.</p> <p>An easily accessible switch, connector or disconnectable battery terminals meets the intent of this requirement.</p> <p>For energy sources with nominal voltage greater than 60 V DC or 25 V AC live parts shall be protected against direct contact.</p>	enclosure can't be touch directly.	
4.3.5	Connection to the frame		-
4.3.5.1	Battery powered trucks		-
	<p>There shall be no electrical connection to the truck frame, except for:</p> <ul style="list-style-type: none"> A) frame fault detection system; B) electric/electronic circuits with a nominal voltage not greater than 60 V DC which are galvanically separated from the energy source; C) connection to the earthing terminal of on-board chargers, D) suppression capacitors. If the nominal battery voltage exceeds 60 V DC, minimum requirement for the capacitor shall be Class Y in accordance with EN 60384-14; E) the screen of shielded cables and components. This condition shall meet the requirements of the insulation resistance testing in 4.10.2; F) suppression resistor for ESD reduction, the system shall meet the requirements of 4.10.2. 	No electrical connection to the truck frame.	N/A
4.3.5.2	IC trucks		-
	<p>a) Electrical system with nominal voltage not greater than 48 V (starter battery): —one pole of the electrical system may be connected to the truck frame;</p>		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	<p>—all conductors not connected to the truck frame shall be effectively insulated and where necessary protected against thermal and mechanical damage;</p> <p>—there shall be means to disconnect both poles of the starter battery from the truck for service purposes.</p>		
	<p>b) electrical system with nominal voltage greater than 48 V (hybrid drive system)</p> <p>—electrical systems with nominal voltage greater than 48 V shall be electrically insulated and galvanically separated from frame, with the exceptions listed in 4.3.5.1 a), b), d), e) and f);</p> <p>—control and auxiliary circuits shall have a maximum voltage not greater than 120 V DC or 50 V AC. Where the energy source maximum voltage is greater, control and auxiliary circuits shall be electrically and galvanically separated from the energy source;</p> <p>—for maximum voltages greater than 120 VDC and 50 VAC, equipotential bonding shall be provided between the frame of the vehicle and conductive enclosures, e.g. motor frames.</p>		N/A
4.3.6	Protection from residual voltages		-
	<p>After disconnecting energy sources, the voltage of the capacitors in power circuits shall be less than 60 V DC after 10s.</p> <p>If the above condition is not technically achievable or practicable a warning/safety label shall be provided. This warning label shall be permanent and indelible and shall be affixed on, or in close proximity to, the enclosure containing the capacitors.</p> <p>NOTE Safety signs EN ISO 7010 wo01 and EN ISO 7010 W012 can be used.</p>	There is no case where the voltage is still greater than 60VDC after 10S of power failure.	N/A
4.3.7	Overcurrent protection		-
	Power, control and auxiliary circuits shall be provided with overcurrent protection that is sized to prevent overheating of the smallest size conductor.		N/A
	Overcurrent protective devices shall be capable of interrupting the maximum fault current without creating a fire hazard.		P
	Overcurrent protective devices in the control and power circuits shall be as close as practicable to the energy source. Non-resettable overcurrent protective devices shall be identified according to the replacement rating of the device.		P

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Clause	Requirement - Test	Result - Remark	Verdict
	If the overcurrent protection is realized by electronic systems, e.g. by inverters or DC/DC converters, this function shall be in accordance with PL, as defined in Table 6.		N/A
	Overcurrent protective devices shall be identified, and rating of these devices shall be indicated on the electrical diagram.		P
	Replaceable overcurrent protective devices shall be provided with rating which shall be located on the truck, adjacent or close to the device itself. NOTE For further information regarding location of overcurrent protective devices see EN 602041:2006, 7.2.8 and EN 60204-1:2006, Annex D (informative).	No such devices.	N/A
4.3.8	Fire and heat hazards (installation of arcing and sparking parts)		-
	Any arcing part in a power circuit shall be enclosed or installed to adequately reduce the " possibility of flame or molten material causing a risk of fire. Relevant parts shall be accessible for servicing and inspection.	The circuit has no parts that can produce arcing and sparks.	N/A
4.3.9	Sparking or heat dissipating electrical components		-
	Sparking components and components which can reach a temperature of 300 °C or more under normal operating conditions, shall not be located where potentially explosive gas/air mixtures can be present. Battery connectors shall be accepted as non-sparking components if they are not used as an emergency switching-off device.		N/A
4.3.10	Electromagnetic radiation		-
4.3.10.1	Non-ionising radiation		-
	Where trucks are fitted with non-ionising radiation devices related to the operation of the truck the radiation shall be minimized with consideration to the influence on persons, in particular with the effect on active or non-active implantable medical devices by complying with EN 12895:2015+A1:2019, 4.1, 5.1 and 5.2.	There are no non-ionizing radiation devices.	N/A
4.3.10.2	External radiation		-
	Operation of trucks shall not be hazardously influenced by external radiation and for that purpose trucks shall at least comply with EN 12895:2015+A1:2019, 4.2, 5.1 and 5.3.NOTE For detailed information regarding electromagnetic compatibility refer to EN 12895:2015+A1:2019.		P

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Clause	Requirement - Test	Result - Remark	Verdict
4.4	Energy sources		-
4.4.1	General		-
	Energy sources shall conform to Annex C.		N/A
	Connectors used for connecting energy sources to industrial trucks and to the charging equipment shall conform to the requirements of Annex A.		N/A
4.4.2	Connection to the mains		-
4.4.2.1	Battery charging		-
	When external charging supply cables are connected to the truck, truck movement shall be prevented. This safety function shall be in accordance with PL, as defined in Table 6. This does not apply to trucks designed only for permanent charging during operation. The requirement is not intended for starter batteries.		N/A
4.4.2.2	On board charger and/or additional components		-
	When trucks are fitted with on-board chargers or other devices connected to the mains, e.g. heaters, the requirements of EN 60204-1:2006, 6.3, 7.2.1 and Clause 8 up to and including 8.2 shall apply.	Without such parts.	N/A
	Enclosures containing equipment connected to the mains supply shall be in accordance with IPXXB of EN 60529:1991. However, for top surfaces the degree of protection shall be in accordance with at least IPXXD.		N/A
	When the mains supply cables are connected to the truck it shall not be possible to induce any truck movement. This safety function shall be in accordance with PL as defined in Table 6.		N/A
	NOTE 21 A position shall be provided on the truck to safely and properly store the cable, where permanently attached.		N/A
	NOTE 2 The protective earth conductor of the on-board charger and additional components connected to the mains is essential for the protection against electrical shock in case of insulation fault.		N/A
4.4.3	Electrical energy sources for IC trucks (hybrid systems)		-
	Energy sources based on capacitors, e.g. electric double layer capacitors, shall be equipped with warning signs for residual voltage.	No hybrid systems.	N/A
	Energy sources based on battery technology shall be equipped with a switching off device in accordance		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	with 4.9.1.3. They shall be manually disconnectable and shall be automatically disconnected in case of an electrical fault related to the power system. They shall be provided with warning signs referring to high stored energy at high voltage. The warning signs shall be permanent and indelible.		
4.4.4	Connectors		-
	Connectors for energy sources shall conform to Annex A. Connectors not fitted with locking devices as defined in A.3.9 shall be arranged so that dead weight and environmental effects e.g. vibration or acceleration do not lead to an unintended disconnection of the connector.		P
4.4.5	Direct current contactors		-
	Contactors shall be designed and manufactured to withstand the stresses occurring during installation and normal use. For additional information see the relevant part of EN 60947.	Contactors are designed and manufactured to withstand stresses during installation and normal use.	P
	Electromagnetic contactors used for performing safety functions shall conform to Annex B.		P
	Truck manufacturers shall select and install contactors, and provide information for maintenance with the instruction handbook, in accordance with the specifications and instructions of the contactor manufacturer.		P
4.4.6	Electric drive system		-
	Motors, converters, generators and energy sources shall conform to Annex D.		P
4.4.7	Electrical Components		-
	Conductors and cables shall conform to Annex G.		P
4.5	Travel and brake control systems		-
	For the drive system the following are considered as safe and can be used to achieve a safe state e.g. in case of a failure in the drive system:		P
	a) no driving torque, on the condition that the truck has an additional braking system which can be activated by the operator;		P
	c) automatic braking by the drive system and/or by the braking system till and during standstill;		N/A
	c) automatic speed reduction to a specific limit based on type, application and condition of the truck so long		P

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Clause	Requirement - Test	Result - Remark	Verdict
	as the operator has full control and release of the speed control leads to the stopping of powered movement.		
	Failures of the electrical system leading to behaviour as mentioned in a), b) or c) or any combination thereof may be treated as a non-safety relevant failures.		P
	NOTE1 Control actions to achieve a safe state are only required for safety-related parts of control systems of Category 2 and higher as defined in EN ISO 13849-1.		P
	NOTE 2 Additional information regarding the correspondence between requirements of 4.5 and most common causes of hazard can be found in Annex).		P
	NOTE 3 Experience shows that safe conditions designed in accordance with a) lead to an approximate braking effect which is 50 % of that achieved by options b) or c).		P
	NOTE 4 Limitation in the use of a), b) and c) to achieve a safe state is indicated in the appropriate subclauses.		P
4.5.2	Travel control system		-
	The travel control system shall be so arranged that on level ground the truck will start from standstill only when the control(s) for speed and direction are activated. For IC trucks, after engaging direction control, low speed is allowed without activation of the speed control.		P
	Means shall be provided to avoid any truck movement when: —switching on the travel control system; —starting the engine of an IC truck.		P
	Any initial activation of the drive system shall only be possible from the neutral position of the speed and/or directional control(s) These safety functions shall be in accordance with the PL as defined in Table 2.		P
	NOTE Restart of the engine by a start/stop system is not considered as starting the engine.		N/A
4.5.3	Monitoring of operating position		-
	On sit-on rider-controlled trucks a separate device (OPC), independent of the speed control (accelerator), shall automatically bring an active drive system to a safe state, as defined in 4.5.1 a or b) when the operator leaves the normal operating position.		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	On stand-on rider-controlled trucks a separate device (OPC), independent of the speed control (accelerator), shall automatically bring an active drive system to a safe state, as defined in 4.5.1 b hen the operator leaves the normal operating position.		N/A
	Nuisance deactivation of the OPC due to operating conditions, such as rough ground, shall be prevented. The safe state shall be initiated not later than 2,0 s after deactivation of the OPC. This time delay shall be reduced to maximum 0,2 s when the speed control device is released. In addition to the deceleration provided by the OPC, the braking system shall be available to the operator.		N/A
	Powered travel movement from standstill after the operator returns to the normal operating position shall occur only when the traction control device is activated from the neutral position.		N/A
	During deceleration following release of the OPC while travelling, powered travel movement can be restored automatically provided that the speed control is active. Restoring the powered travel movement shall not cause hazardous accelerations which cannot be controlled by the operator.		N/A
	Where separate travel controls other than those at the normal operating position are provided according to EN ISO 3691-1:2015, 4.4.2.6 the OPC can be overridden when this system is used. It shall not be possible to override the OPC when operation is from the normal operation position e.g. interlock).		N/A
	It shall be ensured that the resulting hazards when an additional control remote from the driving position is used are sufficiently reduced by additional measures, e.g. safe speed/acceleration limitation and/or personal detection means, where trucks are designed for travel controlled from outside and the detection device of operator position overridden. These safety functions shall be in accordance with the PLr as defined in Table 2.		N/A
4.5.4	Tiller controlled trucks		-
4.5.4.1	Tiller brake function for pedestrian controlled trucks		N/A
	If the tiller brake function with tiller in upper or lower end position according to EN ISO 3691-1:2015, 4.4.2.4		P

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Clause	Requirement - Test	Result - Remark	Verdict
	b/c is realized using an electrical/electronic system, the safety function shall be in accordance with the PL as defined in Table 2.		
	If the tiller brake function can be overridden by a travel control device, additional measures shall be applied for travelling at the upper end position of the tiller, for example speed limitation or sustained action. These additional safety functions shall be in accordance with the PL, as defined for the tiller brake function.		P
4.5.4.2	Tiller head safety device		-
	The function of the tiller head safety device shall be in accordance with EN ISO 3691-1:2015, 4.4.2.4. d.		P
	The tiller head safety device may be disabled when the truck is travelling away from the operator. Activation and deactivation shall be automatic and not accessible to the operator to ensure that the tiller head safety device is not disabled while the truck is travelling towards the operator.		P
	For trucks designed to operate with the tiller in its upper and/or lower rest position, the braking function shall be initiated by activating the tiller head safety device. This safety function shall be in accordance with the PL as defined in Table 2.		P
4.5.4.3	Tiller head safety device on platform trucks		-
	On trucks with foldable operator platform the tiller head safety device may be automatically deactivated when the platform is folded down.	Without platform.	N/A
	Means can be provided to allow the operator to deactivate the tiller head safety device when the platform is folded down if the function is restored automatically to active mode by the operator presence system as well as by switching on the truck. Permanent activation and deactivation shall not be accessible to the operator.		N/A
	The mode of the tiller head safety device (active or inactive) shall be indicated to the operator if it can be deactivated in accordance with the requirements of the first paragraph of this subclause. If such indication is realized by electric/electronic means, this safety function shall be in accordance with the PL as defined in Table 2.		N/A
4.5.5	Automatic restoration of drive system		-

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Clause	Requirement - Test	Result - Remark	Verdict
	The automatic release of the drive system from a limited mode shall not cause an unsafe movement.		N/A
	If the truck speed near or equal to zero is caused by a speed limitation and the limitation is exceeding a time specified by the manufacturer, a release of the speed limitation shall be possible only after return to neutral position of the speed control. Speed and time duration can depend on truck type and acceleration rate.		N/A
	The return to neutral is not required if the operator activates a function that cancels the limiting condition, e.g. release of the speed limitation by lowering the load below a specific lift height. This safety function shall be in accordance with the PLr as defined in Table 2.		N/A
4.5.6	Deviation from setpoint		-
4.5.6.1	General		-
	The drive system shall be so designed that any deviation from operator setpoint caused by an electrical fault which could result in hazardous truck movement that cannot be controlled by the operator in the normal operating position is prevented.		P
4.5.6.2	Uncontrolled acceleration from standstill on level ground		-
	The drive system shall be so designed that uncontrolled hazardous acceleration from standstill on level ground is prevented. This safety function shall be in accordance with the PL as defined in Table 2.	Meet requirements	P
	Any uncontrolled acceleration caused by an electrical failure is treated as hazardous when the criteria defined in Table 1 are exceeded Movement from rest in the wrong direction shall be considered hazardous.		P
4.5.6.3	Unintended truck behaviour while truck is moving		-
	The drive system shall be so designed that unintended hazardous truck behaviour while truck is moving is prevented. This safety function shall be in accordance with the PL, as defined in Table 2.	Meet the requirements.	P
	The following behaviour caused by an electrical failure is considered hazardous: a) no reaction of reverse or neutral travel direction when demanded by the operator; b) acceleration unrelated to the operator input and uncontrollable by operator adjustment of speed control (accelerator) during travel operation on level ground that:		P

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Clause	Requirement - Test	Result - Remark	Verdict
	<p>—is higher than 30 % of the maximum acceleration achievable by the truck under no fault condition and/or</p> <p>—which results in a speed that exceeds the operator requested speed setpoint by more than 20 % of maximum speed achievable by the truck under no fault condition.</p> <p>NOTE List item a) is only relevant for trucks with separate direction selector.</p>		
4.5.7	Unintended deceleration		-
	Under normal operating conditions as defined in EN ISO 3691-1:2015, 4.1.3, unintended deceleration caused by an electric/electronic failure of the electronic controlled service brake, parking brake or the drive system shall not lead to tip-over. Inherently safe design of electronic controlled service brake shall be considered as satisfying this requirement.	Considered.	P
	This safety function shall be in accordance with the PL, as defined in Table 2.		N/A
4.5.8	Electrically/electronic controlled service brake		-
	Electrical and electronic control systems of the service brake shall be designed to ensure the required brake function operates correctly or fail safe.	Tiller return automatic brake.	N/A
	The design shall ensure that an electrical failure will not increase the risk of brake failure e.g. because of friction caused by a permanently partly released brake. This safety function shall be in accordance with the PL as defined in Table 2.		N/A
	NOTE Examples of supervision of the correct functioning of a non-inherently safe mechanical brake are the monitoring of the braking pressure, the position of the brake cylinder or the current of the braking coil.		N/A
4.5.9	Parking brake systems		-
4.5.9.1	Trucks with automatic parking brake		-
	<p>a) Automatic operation of parking brakes shall not result in hazardous situations. The control system of the parking brake shall be designed to prevent the automatic release of the parking brake not intended by the operator.</p> <p>Where activating the travel control device can result in automatic release of the parking brake, it shall not result in hazardous truck movements which cannot be</p>	Not automatic parking brake.	N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	controlled by the operator. These safety functions shall be in accordance with the PL as defined in Table 2.		
	b) With the truck at standstill, the parking brake shall be applied if the operator is not in the normal operating position. This safety function shall be in accordance with the PL as defined in Table 2.		N/A
	c) When the truck is designed to hold the truck on a ramp stationary or at low speed by the drive system and the travel control is released, the parking brake shall be activated automatically before the drive system loses the ability to hold the truck. This safety function shall be in accordance with the PL, as defined in Table 2		N/A
	d) Failure of the control system of an automatically applied parking brake shall be indicated to the operator (see EN ISO 3691-1:2015, 4.2.2.1). The safety function of failure detection shall be in accordance with PL as defined in Table 2.		N/A
4.5.9.2	Trucks without automatically applied parking brake		-
	If the movement of a truck without an automatically applied parking brake is actively controlled or minimized by the drive system, measures shall be taken so that the operator becomes aware of this situation, e.g. creeping of the truck on a ramp at low speed.	Meet requirements	P
	Measures shall be taken to warn the operator before leaving the truck (see EN ISO 3691-1:2015, 4.2.2.1) without applying the brake as long as the power supply of the truck is not switched off by the operator.		N/A
	If the required warning is realized by an electric/electronic system, it shall be in accordance with the PL, as defined in Table 2.		P
4.5.9.3	Indication of parking brake state		-
	Automatically or manually applied parking brake state shall be indicated to the operator when engaged. The exceptions to this requirement are brake systems fitted to stand-on and pedestrian controlled trucks equipped with a brake system that will automatically engage upon release of the brake actuating control in		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	accordance with EN ISO 3691-1:2015, 4.3.3.		
	An electrical indication of the parking brake state is not required when power supply of the truck has been switched off (see EN ISO 3691-1:2015, 4.2.2.1).		N/A
	This safety function shall be in accordance with the PL as defined in Table 2.		N/A
4.5.10	Speed limitation		-
	The electrical system limiting truck speed shall be so designed that the admissible maximum speed on level ground is not exceeded. In the event of an electrical fault the transition to the safe state, as defined in 4.5.1 a) and c) shall be initiated.		P
	The following speed limitation functions shall be in accordance with the PL, as defined in Table 2:		P
	<ul style="list-style-type: none"> a) lateral- and front-stacking trucks in accordance with EN ISO 3691-3:2016, 4.4.1; b) travel speed limitation to comply with braking and stability requirements, e.g. trucks specifically designed to travel with elevated loads; c) reach trucks with elevated mast in accordance with EN ISO 3691-1:2015, 4.2.3.3; d) speed limit of counterbalance trucks to ensure dynamic stability in accordance with EN 16307-1:2013+A1:2015, 4.11;. e) pedestrian controlled trucks in accordance with EN 16307-1:2013+A1:2015, 4.3; f) if triggered by platform and/or side guards' position in accordance with EN ISO 3691-1:2015, 4.7.3.3; g) operating from outside the truck in accordance with EN ISO 3691-1:2015, 4.4.2.6; h) trucks with attachments for freight containers in accordance with EN ISO 3691-1:2015, 4.6.5.5; i) stand-on and foldable platform trucks in accordance with EN 16307-1:2013+A1:2015, 4.3. 	(e) and (i)	P
	NOTE See Annex E for speed limitation as operator assistance.		P
4.5.11	Interface for speed limitation		-
	If trucks are provided with interfaces for external speed	No interface for external	N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	limitation, changes of speed caused by the external system shall be limited by the truck logic to a level that can be controlled by the operator (for instance see 4.5.5, 4.5.7).	speed limitation.	
	The external speed limitation shall not exceed the limit set by the truck controller		N/A
	NOTE Systems for speed limitation installed by the person responsible for the operation of a truck, giving the maximum speed setpoint to the truck control unit via an electrical interface are outside the scope of this document. Suitable requirements consistent with this document, can be determined by risk assessment by the responsible person	No interface for external speed limitation.	N/A
4.6	Electrical load handling system		-
4.6.1	General		-
	A stationary LHS is considered as a safe state. NOTE 1 The stationary condition can be achieved by taking the LHS to one or more of the following states, as applicable considering the type of truck and the technology used:	Meet the requirements.	P
	a) electric motor which powers the load handling system directly, switched off; b) oil supply system deactivated; c) electrical actuated valves switched off, where the hydraulic system is possibly kept under pressure.		P
	Even when the LHS is controlled by manually operated valves, the requirements regarding LHS safety functions realized by an electric/electronic system shall be fulfilled.		P
	NOTE 2 Additional information regarding the correspondence between requirements of 4.6 and most common causes of hazard can be found in Annex J.		P
4.6.2	Movement from standstill		-
	Movement of a function of the LHS from standstill shall be possible only by operating the dedicated control for an LHS function, e.g. joysticks.		P
	Means shall be provided to avoid any movement of a function of the LHS: —while switching on the system; —while starting the engine of an IC truck.		P
	After switching on the LHS control system and/or after		P

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Clause	Requirement - Test	Result - Remark	Verdict
	starting the engine, initial activation of the LHS shall only be possible from the neutral position of the controls intended for LHS.		
	This safety function shall be in accordance with the PL, as defined in Table 3.		P
	NOTE 1 Restart of the engine by a start/stop system is not considered as starting the engine.		P
	NOTE 2 Movement of LHS functions caused by a non-electric fault is not part of this safety requirement, e.g. creeping of lifting system caused by leakage of hydraulic valves.		P
4.6.3	Monitoring of operating position		-
	On sit-on and stand-on trucks a separate device (OPC) independent of the LHS controls shall automatically bring an active LHS to a safe state, as defined in 4.6.1, if the operator leaves the normal operating position. Nuisance deactivation of the OPC due to operating conditions, such as rough ground, shall be prevented. The safe state shall be initiated not later than 2,0 s after deactivation of the OPC.		N/A
	If the LHS function is electric/electronic controlled this time delay shall be reduced to maximum 0,2 s when the LHS control device is released.		N/A
	Powered LHS movement after the operator returns to the normal operating position shall occur only when the LHS control device is activated from the neutral position.		N/A
	This safety function shall be in accordance with the PL, as defined in Table 3.		N/A
	Where separate LHS controls remote from the normal operating position are provided, separate device for detecting the normal operating position can be overridden when the remote controls are selected.		N/A
4.6.4	Deviation from setpoint		-
	The LHS shall be so designed that deviation from operator setpoint, caused by an electrical fault which could result in hazardous truck movement is prevented.		P
	The following behaviour is considered as hazardous: a) movement from standstill, longer than a time of 0,2 s, without activating LHS controls; b) unintended hazardous deviation from setpoint		P

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Clause	Requirement - Test	Result - Remark	Verdict
	of an active LHS function. The level of deviation depends on the LHS function. Hazardous deviations are those deviations from setpoint that the operator is not able to control, and which lead to loss of load or stability.		
	For specific applications a time less than 0,2 s can be required, e.g. electric/electronic controlled load clamp devices.		P
	These safety functions shall be in accordance with the PL, as defined in Table 3.		P
4.6.5	Load clamp devices		-
	Trucks equipped with attachments which hold the load by power (for instance, paper clamps) shall feature controls with a secondary action to prevent unintentional release of the load in accordance with EN ISO 3691-1:2015, 4.4.4.1.	No load clamp devices.	P
	If the prevention of unintentional release is realized by an electric/electronic system this safety function shall be in accordance with the PLr as defined in Table 3.		P
4.6.6	Limitation of load movement functions		-
	Electrical/electronic speed - and/or position - control and limitation systems shall be in accordance with the PL, shown in Table 3.		P
	For limitation of load movement as operator assistance see Annex E		P
	An LHS limiting function shall be considered a safety function if it is required for passing the truck stability type tests, e.g. tilting angle limitation, maximum reach of the mast, limitation of the side shift displacement.		P
4.7	Steering		-
4.7.1	General		--
	The hazards resulting from failures of electric or electric assisted steering systems are dependent on the type of the steering system. The following safety functions shall be applied to the corresponding steering system. NOTE 1 To define when a redundant backup steering system in addition to electric steering is required is out of the scope of this document. NOTE 2 Additional information about steering systems can be found in Annex F.		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	NOTE 3 Additional information regarding the correspondence between requirements of 4.7 and most common causes of hazard can be found in Annex J.		
4.7.2	Electrical/electronic steering		-
4.7.2.1	General		-
	Electrical/electronic steering control systems shall be designed to avoid hazardous deviations not controllable by the operator.	The trucks have steering motors, and motors meet the standard.	P
4.7.2.2	Unintended steering movements		-
	<p>A single electrical/electronic fault shall not lead to a risk of an unintended operation caused by the steering system.</p> <p>Within 0,1 s from the start of an unintended steering movement:</p> <p>a) on trucks not provided with backup steering, the fault shall be detected, the stop of the unintended steering operation and a controlled stop shall be initiated;</p> <p>b) on trucks provided with backup steering, the fault shall be detected, the stop of the unintended steering operation shall be initiated, the backup steering system shall be activated automatically.</p> <p>These safety functions shall be in accordance with PL, shown in Table 4</p>		P
4.7.2.3	Supervision of steering system		-
	An electrical/electronic fault potentially leading to loss of steering functions (for instance breakdown of steering controller or output stage, loss of power supply) shall on trucks:		P
	<p>a) without a backup steering system initiate a controlled stop; or</p> <p>b) with backup (secondary) system initiate an automatic activation of the backup (secondary) system.</p> <p>This safety function shall be in accordance with PL, shown in Table 4.</p>		P
	NOTE For additional information about steering systems see Annex F.		P
4.7.2.4	Backup steering warning		-
	A single electrical/electronic fault as described in 4.7.2.2 and 4.7.2.3 on trucks provided with backup		P

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Clause	Requirement - Test	Result - Remark	Verdict
	steering shall activate a warning to the operator. This safety function shall be in accordance with PLr as defined in Table 4.		
4.7.2.5	Deviation from setpoint		-
	The steering control system shall detect potentially hazardous deviations between setpoint and actpoint. Hazardous deviations are those deviations from setpoint that the operator is not able to control. In case of hazardous deviations, one of the conditions defined in 4.5.1 shall be initiated within 0,1 s. This safety function shall be in accordance with PL, as defined in Table 4.		P
4.7.3	Electric powered assisted steering systems		-
	Any failure of the electrical part of an electric powered assisted steering system shall not prevent the truck from maintaining the path being steered.		P
	A failure of the electric powered assisted steering system shall be signalled to the operator. This "safety function shall be in accordance with the PL as defined in Table 4.		P
	NOTE When a failure of the electrical part of an electric powered assisted steering system causes reduced steering performance, the truck may be automatically brought to one of the conditions defined in 4.5.1.		P
4.8	Software design		-
4.8.1	General		-
	Safety-related embedded or application software shall be designed according to the requirements of EN ISO 13849-1:2015, 4.6.		N/A
4.8.2	Symbols and languages for user interfaces, service interfaces and keypads		-
	Symbols shall be in accordance with ISO 3287. When symbols do not exist in ISO 3287 for functions, alternative symbols shall be derived from ISO 7000/IEC 60417.		P
	If text is used in the interface, it shall be in the language(s) of the country in which the truck is to be used.		P
	NOTE In addition, the manufacturer can at the request of the user provide the information in other language(s) understood by operators.		P

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Clause	Requirement - Test	Result - Remark	Verdict
	The information shall be readable in the intended working conditions.		P
4.8.3	Parameters		-
	<p>Uncontrolled change of the electronic system parameters shall not lead to hazardous situations. The probability of storage device faults that can affect the change of the critical parameters shall be included in the calculation of the PL of the corresponding safety function.</p> <p>Any change of parameter values controlled by the operator shall not result in a hazardous situation.</p> <p>Parameter modification outside the range permitted to the operator shall conform to EN ISO 13849-1:2015, 4.6.4</p>		N/A
4.9	Other protective measures		-
4.9.1	Switching off		-
4.9.1.1	Access		-
	An emergency switching off control or controls shall be provided which shall always be accessible to the operator whilst in any of the operating positions specified by the manufacturer.	The truck has an emergency switching off control.	P
4.9.1.2	Function		-
4.9.1.2.1	In accordance with EN 60204-1:2006, 9.2.5.4.3 actuation of the emergency switching off control shall initiate within 0,2s the stop of all potentially hazardous movements that are electrically/electronically powered or controlled. This safety function shall be in accordance with the PL as defined in Table 6.		P
4.9.1.2.2	<p>For electrically powered trucks, the actuation of the switching off control shall initiate the interruption of the electrical power supplies to all power circuits:</p> <ul style="list-style-type: none"> —within 0,2 s for stop category 0; —within 5 s for stop category 1. <p>This safety function shall be in accordance with the PLr as defined in Table 6.</p> <p>If the switching off function of electrically powered trucks is realized by an electric/electronic control system, it shall be independent from other potentially hazardous systems.</p> <p>NOTE "independent" means that any other truck control system cannot disable the switching off function. Category 3 control systems according to EN</p>		P

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Clause	Requirement - Test	Result - Remark	Verdict
	ISO 13849-1:2015 are an example that achieves independency.		
4.9.1.3	Switching off device		-
	The switching off device shall be capable of interrupting the normal maximum current by one of the following methods:		P
	a) for nominal voltages not greater than 96 V a connector specified in Annex A, Range 1; b) manually actuated power switch directly disconnecting one line of power circuit; c) manually actuated control switch disconnecting the power supply to the coil of one contactor in one line of the power supply and disconnecting or disabling the electronic power switching circuit, e.g. inverter or controller for AC motors. In trucks driven by series-wound DC motors with mechanical commutator, two independent contactors are required to switch off the battery supply; d) manually actuated control switch disconnecting one line of the power supply by a solid-state switch. This technical solution shall be applicable only for trucks with main drive system designed with AC technology		P
	When methods b), c) or d) are used, switching off devices shall be of positive action type complying with EN 60947-5-5 and the control coloured red.		P
	When method c) is used, electromagnetic contactors shall be in conformance with Annex B.		P
	It shall be possible to re-establish the supply to the power transmission systems only by manual resetting of the switching off control followed by the normal operation of the controls.		P
	For IC trucks the device that activates/deactivates the main electrical system, e.g. the ignition switch, may be used as the switching off device if it deactivates truck movements.		N/A
4.9.2	General purpose devices		-
4.9.2.1	Warning/indicator devices		-
	Where the truck is fitted with warning/indicator devices, the output shall be unambiguous and easily perceived.		P
	Where warning/indicator devices are part of a safety		P

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Clause	Requirement - Test	Result - Remark	Verdict
	function they shall comply with the PL of that function.		
	Where warning/indicator devices are not part of a safety function, means shall be provided to check the operation of such devices without the use of tools. If this check is intended to be carried out by the operator, the instruction manual shall contain the exact procedure.		P
4.9.2.2	Assistance systems		-
	Assistance systems shall conform to Annex E.		N/A
4.9.2.3	Electrical coupling control for towing		-
	The following additional requirements shall apply to devices for towing in accordance with EN ISO 3691-1:2015, 4.12:		N/A
	<p>a) Unintended decoupling caused by a fault of the electric/electronic system shall be avoided. This safety function shall be in accordance with the PLr as defined in Table 6</p> <p>b) Decoupling of the trailer by the operator while travelling shall be avoided. This safety function shall be in accordance with the PL as defined in Table 6</p> <p>c) The control device for the operator shall be recognizable and measures shall be taken against unintended activation</p>		N/A
4.9.2.4	Slack wire-ropes or chains		-
	Safety function detecting slack wire-ropes and chains and stopping movements on trucks designed to travel with elevated operator shall be in accordance with the PL as defined in Table 6.		N/A
4.9.2.5	Interlocking of guards		-
	If access gates/doors are provided with electrical interlocking, in accordance with EN ISO 36913, this safety function shall be in accordance with the PLr as defined in Table 6.	Access gates/doors are provided with mechanical lock.	N/A
4.9.2.6	Unauthorised starting		-
	If trucks are provided with an electric/electronic control system for operator authorization in accordance with EN ISO 3691-1:2015, 4.2.1, e.g. key code unit or magnetic card, the safety function to prevent Unauthorised starting shall be in accordance with the PLr as defined in Table 6	The trucks is equipped with a key, and only with the key the trucks can be started.	P

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Clause	Requirement - Test	Result - Remark	Verdict
4.9.3	Other safety functions		-
	This document specifies at Table 2, Table 3, Table 4 and Table 6 minimum required performance levels (PL) for the common safety functions of industrial trucks realized by safety-related parts of control systems. While these PL, may give guidance for the determination of PL, for other safety functions, this would be outside the scope of this document.	Safety function is realized by control system.	N/A
	NOTE PL for other safety functions can be defined in other truck specific standards or determined by the manufacturer using risk assessment. Also, the following are considered a minimum for the three main hazards: —Tipping over: PLr=C —Unintended hazardous movement (drive system, LHS): PLr=c —Unintended steering while driving: PLr=d		N/A
4.10	Electrical verifications		-
4.10.1	Dielectric test (type test)		-
	The dielectric test shall be performed to battery driven trucks with traction battery disconnected and to IC trucks equipped with electric power transmission systems. Trucks shall be designed to conform to a type test performed on a new, dry truck using an AC or DC test voltage in accordance with Table 5. The test voltage shall be supplied from a power source with a minimum rating of 500 VA. Test voltage shall be the applied between truck frame and each active part of the power circuits. The elements of these active parts may be tested in common, if they are connected with low impedance e.g. by the free-wheeling diodes of a converter or the motor windings.	Tested	P
	If control circuits and low power auxiliary circuits 10 can be damaged by the test voltage, they may be excluded from the test, i.e. disconnected or bypassed. The test voltage shall be applied for 1 min. During this time no dielectric breakdown shall occur.		P

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Clause	Requirement - Test	Result - Remark	Verdict																					
	<p style="text-align: center;">Table 5 — Test voltage</p> <table border="1"> <thead> <tr> <th>Nominal voltage (U_n) [V]</th> <th>AC test voltage RMS¹¹ [V]</th> <th>DC test voltage [V]</th> </tr> </thead> <tbody> <tr> <td>$U_n \leq 48$</td> <td>500</td> <td>700</td> </tr> <tr> <td>$48 < U_n \leq 96$</td> <td>1 000</td> <td>1 400</td> </tr> <tr> <td>$96 < U_n \leq 240$</td> <td>1 500</td> <td>2 100</td> </tr> <tr> <td>$240 < U_n \leq 550$</td> <td>1 890</td> <td>2 670</td> </tr> <tr> <td>$550 < U_n \leq 800$</td> <td>2 200</td> <td>3 110</td> </tr> <tr> <td>$800 < U_n \leq 1 200$</td> <td>3 000</td> <td>3 820</td> </tr> </tbody> </table>	Nominal voltage (U_n) [V]	AC test voltage RMS ¹¹ [V]	DC test voltage [V]	$U_n \leq 48$	500	700	$48 < U_n \leq 96$	1 000	1 400	$96 < U_n \leq 240$	1 500	2 100	$240 < U_n \leq 550$	1 890	2 670	$550 < U_n \leq 800$	2 200	3 110	$800 < U_n \leq 1 200$	3 000	3 820		
Nominal voltage (U_n) [V]	AC test voltage RMS ¹¹ [V]	DC test voltage [V]																						
$U_n \leq 48$	500	700																						
$48 < U_n \leq 96$	1 000	1 400																						
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$550 < U_n \leq 800$	2 200	3 110																						
$800 < U_n \leq 1 200$	3 000	3 820																						
4.10.2	Insulation test (routine test)		-																					
4.10.2.1	General		-																					
	<p>The insulation test shall be applied to battery driven trucks with traction battery disconnected and to IC trucks equipped with electric power transmission systems.</p> <p>The insulation resistance of the truck and traction battery shall be checked separately.</p> <p>Test voltage can be either DC or AC. DC test voltage shall be greater than 50 V. AC test voltage shall be greater than $35 V_{RMS}$.</p>	<p>Nominal voltage: 24V Test voltage: 500V Test time: 60s Leakage current: 2.75 mA</p>	P																					
4.10.2.2	Insulation of truck		-																					
	<p>The test voltage shall be applied between the truck frame and each active part of the power circuits. The elements of these active parts may be tested in common if they are connected by low impedance circuits, e.g. by the free-wheeling diodes of a converter or the motor windings.</p> <p>The insulation resistance between the active parts of the power circuits and the frame shall be at least 1 000 Ω multiplied by the nominal voltage of the truck system.</p> <p>The test shall be repeated if electric components connected to the electric power circuits are installed subsequently</p>	<p>Nominal voltage: 24V Test voltage: 500V Insulation resistance: 1.16MΩ</p>	P																					
4.10.2.3	Insulation of battery		-																					
	<p>The insulation resistance of the disconnected, filled and charged traction battery mounted on the truck shall be at least 50 Ω multiplied by the nominal voltage of the truck system between the positive and negative pole of the battery and the frame of the truck. Where the battery is fitted into more than one container this test shall be carried out with the sections (including metal battery containers) electrically connected.</p>	<p>Nominal voltage: 24V Test voltage: 500V Insulation resistance: 550 MΩ</p>	P																					

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Clause	Requirement - Test	Result - Remark	Verdict
4.10.3	Insulation test (routine test) for high voltage trucks		-
4.10.3.1	General		-
	The insulation test shall be applied to battery driven trucks with traction battery disconnected and to IC trucks equipped with electric power transmission systems.	The trucks is not high voltage trucks.	N/A
	The insulation resistance of the truck and traction battery shall be checked separately. The test voltage shall be greater than the nominal voltage up to a limit of 500 v.		N/A
4.10.3.2	Insulation resistance of truck.		-
	The insulation resistance between live parts of all electric components and the frame of the t industrial truck except for the battery shall be at least 1 000 \$2 multiplied by the nominal voltage of the truck system.		N/A
4.10.3.3	Insulation resistance of battery		-
	The insulation resistance of the disconnected, filled and charged traction battery mounted on the truck shall be at least 500 Ω multiplied by the nominal voltage of the truck system between the live parts and the frame of the truck. Where the battery is fitted into more than one container this test shall be carried out with the sections (including metal battery containers) electrically connected.		N/A
4.10.4	Frame fault test		-
	The frame fault test simulates a frame fault at each electric motor which is fed by a pulse control e.g. by a converter. Low power motors, for example wiper or fan motors, are excluded from this test.		P
	When introducing the frame fault the motor shall be set to a minimum of 20 % of the maximum operational speed for duration of 5 s. Inadvertent movement shall not occur.		P
	During the test of the drive system the truck shall be jacked up (idled drive wheels).		P
5	Additional requirements for high voltage trucks		-
5.1	General		-
	The following requirements apply to high voltage trucks.	The truck is not high voltage truck.	N/A
5.2	Battery		-
5.2.1	General		-

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Clause	Requirement - Test	Result - Remark	Verdict
	Batteries shall conform to Annex C.		N/A
5.2.2	Charger switching		-
	For batteries with an end-of-charge voltage exceeding 120 V, switching of external chargers shall be controlled via the connector auxiliary contacts or other devices to prevent arcing at the connector and to ensure that the charger is not energised until it is connected to the battery.		N/A
	NOTE The end-of-charge voltage of a 96 V lead acid battery is below 120 V.		N/A
5.2.3	Requirements		-
	Connectors shall conform to Annex A, Range 2.		N/A
5.2.4	Emergency disconnection		-
	Provision shall be made to prevent the use of battery connectors for emergency disconnection purposes.		N/A
5.3	Protection against electric shock		-
5.3.1	Electrical enclosures		-
	Accessible electrical enclosures containing uninsulated live parts shall be rated at least IPXXD in accordance with EN 60529:1991.		N/A
	It shall not be possible to open these enclosures without a key or a tool.		N/A
	Warning signs shall be applied to all electrical enclosures.		N/A
5.3.2	Circuits		-
	Control and auxiliary circuits shall not exceed 120 V DC nominal voltage and shall be galvanically separated from the energy source. Circuits for heating purposes and voltage sensing are excluded, e.g. state of charge instrumentation.		N/A
5.3.3	Bonding		-
	Equipotential bonding shall be provided between the frame of the vehicle and metallic electrical enclosures e.g. motor frames. The equipotential bonding shall ensure the same electric potential under all conditions which can be caused by the electrical system of the truck.		N/A
	The status of the equipotential bonding shall be part of the routine test.		N/A
5.3.4	Detection of frame fault		-
	An automatic device for frame fault detection for		N/A

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	circuits directly connected to the energy source shall give an audible and/or visual signal, or alternatively bring the truck to a controlled stop and de-energize the truck in the event of a fault. This safety function shall be in accordance with the PL: as defined in Table 6.		
	If a frame fault can be excluded by technical measures a detection device is not required.		N/A
	Trucks designed for replaceable batteries shall be equipped with a frame fault detection device in any case.		N/A
6	Information for use		-
6.1	General		-
	The following requirements shall apply in addition to those of the applicable industrial trucks' safety standards of EN ISO 3691 series and EN 16307 series.	OK	P
6.2	Electrical diagram		-
	Circuit diagrams shall comply with EN 60204-1:2006, Clause 17. If the truck is provided with power outlets or connection points/ports for auxiliary lighting, on-board computers, assistance systems etc. the instruction handbook shall give clear indication of location, usage, interface specifications and scope.		P
6.3	Electrical interface for external systems		-
	The interface specification for the external system shall be included in the truck instruction handbook. If applicable, the achievable performance level of the functions provided by the interface shall be specified in the instructions.		N/A
	Warning shall be given in the service manual that field modification and installation of electrical accessories shall be carried out and documented by trained personal only, and the requirements of this document shall be maintained.		N/A
6.4	Safety checks		-
	Methods and intervals for checking safety systems shall be included in the service manual and/or instruction handbook		P
6.5	Capacitors		-
	Methods for discharging capacitors or equivalent components that present a risk shall be included in the service and instruction handbook.		P

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Clause	Requirement - Test	Result - Remark	Verdict
6.6	Marking		-
6.6.1	General		-
	Electrical enclosures for trucks with nominal voltages greater than of 120 V shall bear a durable warning sign conforming to EN 60204-1:2006, 16.2.		N/A
6.6.2	Electronic controller		-
	Electronic controllers implementing safety functions shall be marked legibly and indelibly with the following information: —name or trademark of manufacturer; —type or part number; —serial number.		P
6.7	Non-ionising radiation		-
	Warning shall be given in the instruction manual if after the commissioning the truck can be equipped with devices that are likely to emit non-ionising radiation which can cause harm to persons, in particular those with active or non-active implantable medical devices, e.g. radio-transmitters, RFID readers or data collection systems. Where trucks are fitted with non-ionising radiation devices which can cause harm to persons warning signs shall be installed.		N/A
6.8	Interoperability of energy sources		-
	Detailed information shall be provided concerning the interoperability of the truck with different battery technologies and with batteries of different rating of current and voltage, if applicable.		P
Annex A	Connectors for energy sources		P
Annex B	Electromagnetic contactors		P
Annex C	Energy sources		P
Annex D	Electric drive system (motors, converters, generators, energy sources)		P
Annex E	Assistance systems		P
Annex F	Steering systems	informative	INFO
Annex G	Electrical components		N/A
Annex H	Cross reference with industrial truck types of ISO 5053-1	informative	INFO
Annex I	List of significant hazards	informative	INFO
Annex J	Explanations of safety functions	informative	INFO

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Clause	Requirement - Test	Result - Remark	Verdict
Annex ZA	Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered	informative	INFO

End of the report