BRITISH STANDARD

BS EN
1757-1:2001

Safety of industrial trucks — Pedestrian propelled trucks —

Part 1: Stacker trucks

The European Standard EN 1757-1:2001 has the status of a British Standard

ICS 53.060

National foreword

This British Standard is the official English language version of EN 1757-1:2001.

The UK participation in its preparation was entrusted to Technical Committee MHE/7, Industrial trucks — Safety, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 July 2001

Summary of pages

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EUROPEAN STANDARD

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EN 1757-1

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English version

Safety of industrial trucks - Pedestrian propelled trucks - Part 1: Stacker trucks

Sécurité des chariots de manutention - Chariots manuels - Partie 1: Gerbeurs

Sicherheit von Flurförderzeugen - Handbetriebene Flurförderzeuge - Teil 1 : Stapler

This European Standard was approved by CEN on 19 April 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 150 "Industrial Trucks - Safety", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2001, and conflicting national standards shall be withdrawn at the latest by Novemeber 2001.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive(s).

For relationship with EC Directive(s), see informative Annex Z, which is an integral part of this standard.

This European Standard is one of a series of European Standards for the safety of Industrial trucks. This series of standards includes :

EN 1175 -1	Safety of industrial trucks - Electrical requirements - Part 1 : General requirement for battery powered trucks
EN 1175-2	Safety of industrial trucks - Electrical requirements - Part 2 : General requirements for internal combustion engine powered trucks
EN 1175-3	Safety of industrial trucks - Electrical requirements - Part 3 : Specific requirements for the electrical power transmission systems of internal combustion engine powered trucks
EN 1459	Safety of industrial trucks - Self-propelled variable reach trucks
EN 1525	Safety of industrial trucks - Driverless trucks and their systems
EN 1526	Safety of industrial trucks - Additional requirements for automated functions on trucks
EN 1551	Safety of industrial trucks – Self propelled trucks over 10 000 kg capacity
EN 1726-1	Safety of industrial trucks – Self-propelled trucks up to and including 10 000 kg capacity and industrial tractors with a draw bar pull up to and including 20 000 N - Part 1 : General requirements
EN 1726-2	Safety of industrial trucks – Self-propelled trucks up to and including 10 000 kg capacity and industrial tractors with a draw bar pull up to and including 20 000 N - Part 2 : Additional requirements for trucks with elevating operator position and trucks specifically designed to travel with elevated loads
EN 1755	Safety of industrial trucks - Operation in potentially explosive atmospheres – Use in flammable gas, vapour, mist and dust
EN 1757-1	Safety of industrial trucks - Pedestrian propelled trucks - Part 1 : Stacker trucks
EN 1757-2	Safety of industrial trucks - Pedestrian propelled trucks - Part 2 : Pallet trucks
prEN 1757-3:1997	Safety of industrial trucks - Pedestrian propelled trucks - Part 3 : Platform trucks
prEN 1757-4:1997	Safety of industrial trucks - Pedestrian propelled trucks - Part 4 : Scissor lift pallet trucks
prEN 12053:2000	Safety of industrial trucks - Test methods for measuring noise emissions
EN 12895	Industrial trucks - Electromagnetic compatibility

prEN 13059:1997	Safety of industrial trucks - Test methods for measuring vibration
prEN ISO 13564:1996	Test methods for measuring visibility from self-propelled trucks (ISO/DIS 13564:1996)

The annexes A and B are normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

0 Introduction

This standard has been prepared to be a harmonised standard to provide one means of conforming with the essential safety requirements of the Machinery Directive and associated EFTA Regulations.

This European standard is a type C standard as stated in EN 1070.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

With the aim of clarifying the intention of the standard and avoiding doubts when reading it, the following assumptions were made when producing it :

- only competent persons operate the machine
- components without specific requirements are designed in accordance with usual engineering practice and calculation code, including all failure modes.

1 Scope

1.1 This standard applies to straddle, pallet and platform pedestrian propelled stacking industrial trucks as defined in 3.1 with capacities not exceeding 1 000 kg, hereinafter referred to as "trucks" equipped with fork arms or platform or other attachment.

This standard applies to trucks provided with either manual or electrical battery powered lifting.

On board battery chargers are part of the truck.

1.2 Attachments and fork arms are not dealt with in this standard.

1.3 This standard deals with the technical requirements to minimise the hazards listed in clause 4 which can arise during commissioning, operation and maintenance of trucks when carried out in accordance with the specifications as intended by the manufacturer.

In addition trucks shall comply, for the hazards not covered by this standard, with the applicable companion standards and as appropriate with EN 292.

1.4 This standard does not establish the additional requirements for :

- operation in severe conditions (e.g. extreme environmental conditions such as : freezer applications, high temperatures, corrosive environment, strong magnetic fields),
- operation subject to special rules (e.g. potentially explosive atmospheres),
- electromagnetic compatibility (emission - immunity),
- handling of loads the nature of which could lead to dangerous situations (e.g. molten metal, acids/alcalies, radiating materials, specially brittle loads),
- hazards occurring during construction, transportation, decommissioning and disposal,
- hazards occurring when using to handle suspended loads which may swing freely,
- hazards occurring when using on public roads,
- wind pressure in and out of use,
- direct contact with foodstuffs,
- operation on gradients or on surfaces other than smooth, level, hard surfaces,
- winch operated trucks,
- lifting systems using belts,
- lifting of persons,
- trucks with overturning moment greater than 40 000 N m.

1.5 Other possible limitations of the scope of other standards referred to that also apply to this standard.

1.6 Hazards relevant to noise, vibration, visibility and static electricity are not dealt with in this standard.

1.7 This standard applies to trucks manufactured after the date of issue.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 292-1 : 1991	Safety of machinery - Basic concepts, general principles for design - Part 1 - Basic terminology, methodology
EN 292-2 : 1991	Safety of machinery - Basic concepts, general principles for design - Part 2 - Technical principles and specifications
EN 1050 : 1996	Safety of machinery - Principles for risk assessment
EN 1175-1	Safety of machinery - Electrical requirements - Part 1 - General requirements for battery powered trucks
EN 1726-1 : 1998	Safety of industrial trucks - Self-propelled trucks up to and including 10 000 kg capacity and industrial tractors with a draw bar pull up to and including 20 000 N - Part 1 - General requirements
ISO 2328	Fork lift trucks - Hook-on type fork arms and fork arm carriages - Mounting dimensions
ISO 2330	Fork lift trucks - Fork arms - Technical characteristics and testing
ISO 15870	Powered industrial trucks - Safety signs and hazard pictorials - General principles
ISO 5053	Powered industrial trucks - Terminology
ISO 10658	Industrial truck operating in special conditions of stacking with load laterally displayed by powered devices - Additional stability test

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply and for the main components, ISO 5053 applies.

3.1
pedestrian propelled stacking truck
truck with a vertical mast without tilt, with load bearing outriggers, equipped with fork arms or platform or other attachment. The truck is designed to be manually pushed, pulled and steered by one pedestrian operator on a smooth, level, hard surface

The load may be raised by either manual means or electrical battery power.

3.1.1
straddle stacker
stacking truck with outriggers, equipped with fork arms which are located between the outriggers

3.1.2
pallet stacker
stacking truck where the fork arms extend over the frame structure

3.1.3
platform stacker
stacking truck with a load platform extending over the frame structure

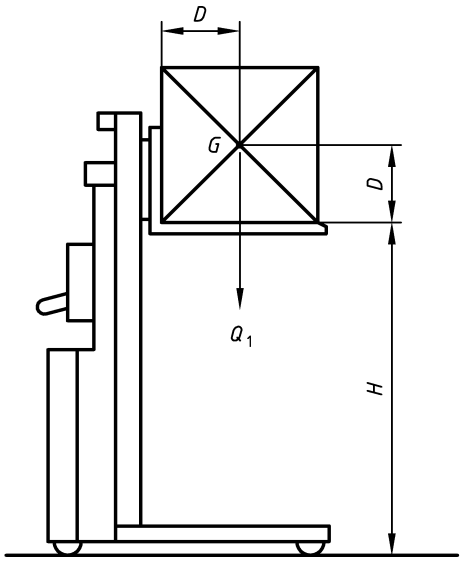
3.2
rated capacity
load in kilograms given by the manufacturer, the truck can lift and transport under the following specific conditions

The rated capacity is defined for a load uniformly distributed and covering entirely the width of the fork arms or platform.

It is equal to the load "Q_1" which the truck type is designed to carry and stack, on fork arms or platform, the maximum lift height of which is equal to the standard lift height "H" (see 3.2.1) and with a standard load centre distance "D" (see 3.2.2).

The centre of gravity “G” shall be on the centre line of the truck.

Where a truck does not lift to the standard lift height "H", it is given a rated capacity at its maximum lift height.



Key

D = Standard load centre distance
G = Centre of gravity
H = Standard lift height
Q_1 = Load

Figure 1 - Rated capacity

3.2.1
standard lift height
height "H" from the ground to the upper face of the fork arms or load platform, as shown in Figure 1 and Table 1

3.2.2
standard load centre distance
distance "D" in millimetres from the centre of gravity "G" of the load measured horizontally to the front face of the fork arms shank and vertically to the upper face of the fork arms, as shown in Figure 1and Table 1

Table 1 - Load centre distance and lift height for rated capacity

Rated capacity Q_1 kg	Standard lift height H m	Standard load centre distance D		
		Straddle Stacker mm	Pallet Stacker mm	Platform Stacker mm
$Q_1 \leq 250$	1,5	250	--	--
$251 < Q_1 \leq 500$	1,5	350/500	600	350
$501 < Q_1 \leq 750$	2,0	500	600	--
$751 < Q_1 \leq 1\,000$	2,5	500	600	350

3.3
actual capacity
maximum load in kilograms (depending on its attachment and elevating height) given by the manufacturer that the subject truck is capable of transporting or lifting under intended operation

Actual capacity will vary with the different types and heights of mast fitted, changes of fork arms or attachments and the different load centre distances (see 3.2.2) used in rating.

Additional actual capacity ratings with attachments may also be established within the range of the appropriate tests.

3.4
rated capacity of removable attachments
maximum load in kilograms and load centre distance, where applicable, given by the manufacturer of the attachment, that the attachment is capable of handling under intended operating conditions as specified by the manufacturer of the attachment

3.5
intended operating position
position in which the operator may control all operational functions as intended by the manufacturer

3.6
intended operation
the use for which the truck is designed according to the manufacturer's handbook

3.7
operator
a designated person, suitably trained (see EN ISO 9001, 4.18) qualified by knowledge and practical experience, and provided with the necessary instructions to enable the required (operation, test and/or examination) to be carried out safely

4 List of hazards

The following hazards from Annex A of EN 1050:1996 are applicable in the situations described and could involve risks to persons if not reduced or eliminated. The corresponding requirements are designed to limit the risk or reduce these hazards in each situation.

Hazards		Corresponding requirements	
4.1	**MECHANICAL HAZARDS**		
4.1.1	Crushing	5.3 5.4 5.5 5.6 5.7 5.8 5.9 5.11 6.2.2 7	Propelling, steering Load handling controls Lifting systems Protection devices Parking brake Stability Protection against crushing, shearing and entanglement points Additional requirements for trucks with battery powered lifting Structural test Information for use
4.1.2	Shearing	5.6.2 5.9 5.10	Glass guards or screens Protection against crushing, shearing and entanglement points Edges and angles
4.1.3	Entanglement	5.6.2 5.9	Glass guards or screens Protection against crushing, shearing and entanglement points
4.1.4	Impact	5.3 5.10 5.11 7	Propelling, steering Edges and angles Additional requirements for trucks with battery powered lifting Information for use
4.1.5	Friction or abrasion	5.3	Propelling, steering
4.1.6	High pressure fluid ejection	5.5.3.4 7	Hydraulic circuit Information for use
4.2	**ELECTRICAL HAZARDS**	5.11	Additional requirements for trucks with battery powered lifting
4.3	**HAZARDS GENERATED BY NEGLECTING ERGONOMIC PRINCIPLES**		
4.3.1	Unhealthy postures or excessive efforts	5.2 5.3 5.4 7	Design and construction forces for truck Propelling, steering Load handling controls Information for use
4.3.2	Inadequate consideration of hand-arm or foot-leg anatomy	5.3 5.4	Propelling, steering Load handling controls
4.3.3	Neglected use of personal protection equipment	7	Information for use
4.3.4	Human error	5.4 5.11.1 7	Load handling controls Lifting Information for use
4.3.5	Inadequate design, location or identification of manual controls	5.3 5.4	Propelling, steering Load handling controls
4.4	**HAZARDS DUE TO FUNCTIONAL DISORDERS**		
4.4.1	Failure of energy supply	5.5.3.6 5.11.2	Failure of energy supply or hydraulic circuit Electrical systems and equipment
4.4.2	Unexpected ejection of machine parts or fluids	5.5.3.4	Hydraulic circuit
4.4.3	Failure of control systems	5.5.3.5	Lowering speed limitation

Hazards		Corresponding requirements
4.5	**HAZARDS DUE TO FAILURES**	5.5 Lifting systems 6.2.2 Structural test 7 Information for use
4.6	**ADDITIONAL HAZARDS DUE TO MOBILITY**	
4.6.1	Insufficient ability of machinery to remain immobilised	5.7 Parking brake 7 Information for use
4.6.2	Contact with the wheels	5.3.2 Tiller 5.6.1 Wheel guards 7 Information for use
4.6.3	Impact hazard	5.10 Edges and angles 7 Information for use
4.7	**ADDITIONAL HAZARDS DUE TO LIFTING**	
4.7.1	Lack of stability	5.8 Stability 7 Information for use
4.7.2	Overload	5.5.3 Hydraulic circuit 7 Information for use
4.7.3	Amplitude of movement	5.5.3 Hydraulic system 5.5.5 Fork carrier 5.5.6 Load handling attachments
4.7.4	Falling of loads	5.5 Lifting system 5.6.3 Load backrest extension 5.8 Stability 7 Information for use
4.8	**HAZARD COMBINATIONS**	Covering each individual hazard is sufficient for covering combinations of hazards

5 Requirements

5.1 General

All the requirements from 5.2 to 5.10 apply to trucks with both manual or powered lifting.

5.11 applies only to powered lifting trucks.

5.2 Design and construction forces for truck

The design and construction of the truck shall be such that the maximum forces required for truck function (propelling, lifting, steering) shall not exceed the values given in Table 2 below (see 6.2.3).

Table 2 - Maximum allowed forces

TEST LOAD	PROPELLING		LIFTING (manual lifting only)		STEERING
	STARTING	ROLLING	HAND POWERED	FOOT POWERED	
kg	N	N	N	N	N
250	150	75	200	300	150
500	200	100	200	300	200
750	250	150	200	300	250
1 000	300	200	200	300	300

NOTE The values in Table 2 are pure design values for the truck and should not be confused with actual operating forces in the work place (see 7.1.3)

5.3 Propelling, steering

5.3.1 A push/pull handle(s) either vertical or horizontal and/or a tiller shall be provided to allow an operator to push, pull and steer the truck and, should such be the case to lift the load.

5.3.2 Tiller

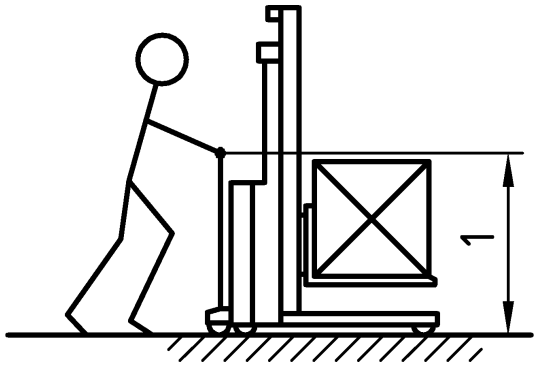
The tiller shall be provided with a handle of the closed loop type or otherwise designed to ensure lateral protection of the operator's hands.

The hand grips shall be of a cross section enclosed within the space between two concentric circles of 25 mm inside diameter and 35 mm outside diameter and provide a minimum span of 100 mm for each hand.

The upper part of the tiller handle shall conform to the dimensions shown in Figures 2 and 3.

When pulling the horizontal distance between the end of the tiller and the front of the wheel (Figure 3) shall be more than 500 mm, the handle axis being positioned within 700 mm to 1 000 mm height.

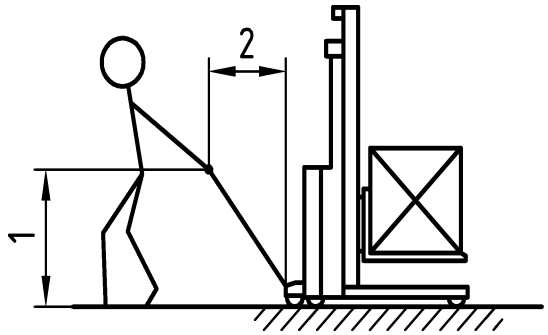
The tiller shall automatically and gently return to the upper rest position when released.



Key

1 1 100 mm to 1 300 mm

Figure 2 – Tiller (Pushing)



Key

1 700 mm to 1 000 mm
2 500 mm minimum

Figure 3 – Tiller (Pulling)

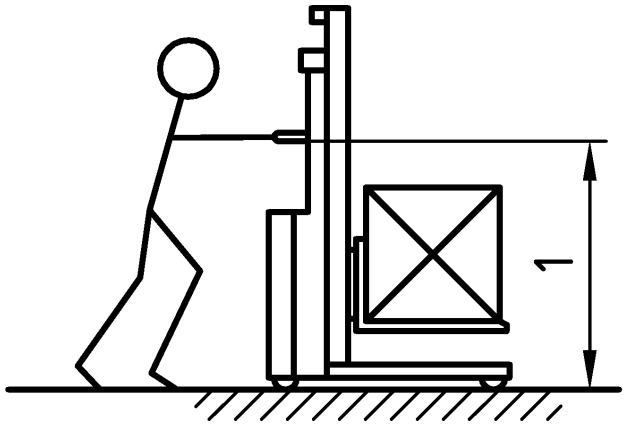
5.3.3 Push/pull bars

The height from ground to centre of push/pull bar shall be 1 100 mm to 1 300 mm, see Figures 4 and 5.

Vertical bars shall have a vertical length of at least 300 mm, see Figure 5.

A minimum distance of 50 mm shall be provided between the outside of the push/pull bars and the lateral extremities of the truck.

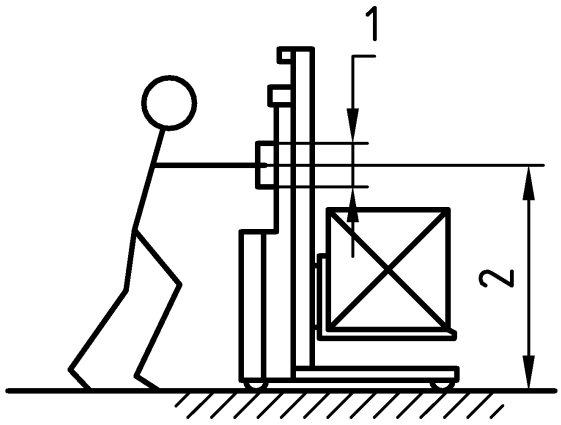
The hand grips shall be of a cross section enclosed within the space between two concentric circles of 25 mm inside diameter and 35 mm outside diameter.



Key

1 1 100 mm to 1 300 mm

Figure 4 - Horizontal push/pull handle



Key

1 300 mm minimum
2 1 100 mm to 1 300 mm

Figure 5 - Vertical push/pull handle

5.4 Load handling controls

5.4.1 General

Lift and lower controls may be located on the tiller, when fitted, or may be by a separate device.

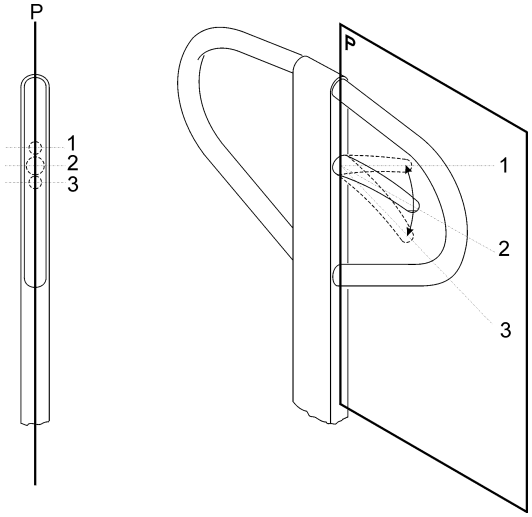
5.4.2 Control with a device located on the tiller

If the lift and lower controls are on the tiller, they shall be located ergonomically and shall enable the operator to activate the controls without releasing hold of the hand grip.

The lowering control shall stop lowering movement when released.

The actuating force on selection devices shall not exceed 150 N at rated capacity.

Where the movements of selection device for lifting and lowering take place in a plane parallel to the tiller plane, the lift control shall be selected by pushing the selection devices towards the tiller articulation point, and the lower control by pulling the selection device in the opposite direction (Figure 6).



Key

1 Lower
2 Neutral
3 Raise
P Tiller plane

Figure 6 – Example of selection control lever in the plane of the tiller

5.4.3 Control with a device not located on the tiller

Lift can be by a separate device e.g. : hand pump lever, foot operated lever or rotating handle.

Lowering control can be by a separate device e.g. : hand operated lever, foot operated lever or screw type valve, all of which return to neutral or closed position when released.

5.5 Lifting systems

5.5.1 Chains system

Only leaf and roller mechanical chains shall be used. When the lifting mechanism includes chains, the truck manufacturer shall select chains which, in relation to the minimum breaking load certified by the manufacturer of the chain, will provide a factor of at least 5/1 in relation to the static load that would exist in a single chain or equally loaded chains, when the load equal to the rated capacity is in the transporting position, assuming no friction in the mast structure.

Pulley or sprocket wheel diameters shall be at least three times the pitch of the chains.

Where more than one chain is used, means shall be provided to limit excessive uneven loading in the chains e.g. by adjustment.

5.5.2 Wire ropes system

When the lift mechanism includes one or more wire ropes, the truck manufacturer shall select wire ropes which, in relation to the minimum guaranteed breaking load certified by the manufacturer of the wire rope will provide a factor of at least 5/1 in relation to the static load that would exist in a single wire rope or equally loaded wire ropes to the rated capacity when the load is in the transporting position, assuming no friction in the mast structure.

The minimum diameter of the wire rope guide pulleys, measured from the bottom of the groove, shall be equal to 16 times the diameter of the wire rope.

Where more than one wire rope is used, means shall be provided to limit excessive uneven loading in the wire ropes e.g. by adjustment.

5.5.3 Hydraulic system

5.5.3.1 *Limitation of stroke*

The lift assembly shall be fitted with stops of adequate strength to prevent over-travel. In addition, means shall be provided to prevent the fork carrier and moving elements of the mast structure accidentally disengaging from the upper end of the mast.

5.5.3.2 *Load supporting*

The descent of a load equal to the rated capacity caused by an internal leakage in the hydraulic system shall not exceed 25 millimetres during the first 10 minutes, under intended operation and with oil at the ambient temperature.

5.5.3.3 *Pressure relief valves*

All hydraulic systems shall include a device which shall limit the pressure in the system from exceeding a preset value which shall be less than 115 % of the maximum working pressure under intended operation.

The device shall be so designed it cannot work loose by itself and so that a tool or key is required to alter the pressure setting.

It shall be positioned so that it will not cause the fork arms or platform to descend out of control if an overload is placed in a raised position.

It shall not be possible for the hydraulic fluid to drain out of the cylinders if the fork arms or platform descent is blocked and the lowering control still actuated.

5.5.3.4 *Hydraulic circuit*

All hoses, piping and connections subject to internal pressure shall be capable of withstanding without bursting a pressure equal to at least three times the operating pressure to which the hydraulic circuit may be subjected.

On trucks with powered lifting the hydraulic system shall be protected against hazards resulting from hydraulic fluid contamination (e.g. a filter and/or collecting magnet).

5.5.3.5 *Lowering speed limitation*

A control device shall be incorporated in the lift circuit which, even in the event of a failure of the hydraulic circuit, excluding the hydraulic lift cylinder, shall restrict the rate of descent speed of the lifting mechanism loaded with its rated capacity. In no case shall the speed exceed 0,6 m/s.

5.5.3.6 *Failure of energy supply or hydraulic circuit*

In the case of an interruption of the supply of energy, the design of the hydraulic installation shall be such that the hydraulic pressure in the system does not cause the pump to function as a hydraulic motor.

5.5.4 Fork arms and platforms

5.5.4.1 Fork arms whose mounting dimensions conform to ISO 2328 shall be tested in accordance with ISO 2330.

Other types of fork arms and the load platforms shall be tested in line with ISO 2330 except with a load equal to twice the rated capacity of the truck.

5.5.4.2 Disengagement of the fork arms from the fork carrier shall only be possible with intentional manual action.

5.5.5 Fork carrier

5.5.5.1 Disengagement of the fork arms at the extremities of the fork carrier shall only be possible with intentional manual action.

5.5.5.2 If a fork arm removal slot is provided at the bottom of the carrier, it shall not be positioned opposite a slot at the top of a carrier unless disengagement shall only be possible with intentional manual action.

5.5.5.3 Means shall be provided to prevent unintentional lateral displacement of the fork arms on the fork carrier.

5.5.6 Load handling attachments

5.5.6.1 Disengagement of the attachments (e.g. clamps, tilted fork carrier, fork extensions, etc.) shall only be possible with intentional manual action.

Movements of the attachment and its parts shall be mechanically limited at the extreme positions.

5.5.6.2 Clamping devices shall be so designed that the clamping pressure is automatically sustained for at least 10 min by means of non-return valves or any other effective system when the truck's control mechanisms are in the neutral position or in the event of a malfunction in the power system of the attachment.

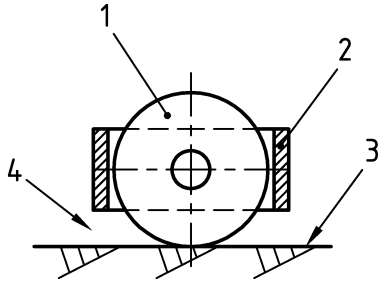
5.5.6.3 If an attachment has its own separate hydraulic system, this shall comply with the provisions of 5.5.3.4.

5.5.6.4 If an attachment has a hydraulic system which is connected to the truck hydraulic system then the two systems shall be compatible and the combined system shall comply with the provisions of 5.5.3.4.

5.6 Protective devices

5.6.1 Wheel guards

Trucks fitted with push-pull handles shall have a chassis profile which conforms to Figure 37 of EN 1726-1:1998 or shall be provided with devices to protect the operator's feet when he is in his intended operating position (see Figure 7).



Key

1 Wheel
2 Deflector
3 Ground (floor)
4 35 mm maxi

Figure 7 - Example of wheel guard

5.6.2 Glass guards or screens

If glass is used for guards or screens, it shall be of the "safety glass" type e.g. toughened or laminated glass.

5.6.3 Load backrest extension

Trucks with a lift height of 1 800 mm and higher shall be designed so that they may be equipped with a load backrest extension.

5.7 Parking brake

The truck shall be provided with a parking brake which can be controlled by a lever located on the tiller or by a foot pedal, and be able to maintain the truck at a standstill on a level ground.

5.8 Stability

The truck shall be designed and constructed in order to restrict hazards of forward, backward and lateral overturning during intended operation.

5.9 Protection against crushing, shearing and entanglement points

Relative moving parts on the truck within reach of operator in his intended operating position shall be adequately guarded or shall comply with the following minimum distance requirements :

- Places where the operator's fingers can be trapped: 25 mm
- Places where the operator's hands or feet can be trapped: 50 mm
- Places where the operator's arms or legs can be trapped: 100 mm

5.10 Edges and angles

External parts of the truck which may impact parts of the body shall be free of sharp edges and sharp angles.

5.11 Additional requirements for trucks with battery powered lifting

5.11.1 Lifting

Controls shall be designed to reduce the risk of unintentional operation and shall return to "neutral" when released and stop movement.

5.11.2 Electrical Systems and Equipment

All electrical systems and equipment shall comply with EN 1175-1.

6 Verifications of safety requirements and/or measures

6.1 General

The manufacturer shall verify and record that the requirements of clause 5 are complied with.

The verification of safety requirements shall be carried out by design verification on truck type plus manufacturing arrangements (not described here) plus functional routine verification on each truck to verify its fitness for purpose.

The verifications may be as follows :

- By design e.g. for verification of drawings and documents.
- By measures e.g. of propelling, lifting and steering forces as shown in Table 2 and annex A and tests described in 6.2.2 and 6.3.

Tests shall either be performed by operating the truck in the manner prescribed below or, where practicable, be simulated by any method giving an equivalent effect and producing substantially the same results.

The test load, where applicable, shall be applied according to 3.2 except if specified differently hereunder.

6.2 Design verification on truck type

6.2.1 General

These tests shall be performed on a sample which is representative of series production or on individual truck in case of unit production.

6.2.2 Structural test

Static loads of 1,33 Q_1 and 1,33 Q_2 shall be applied to the truck and its integrated attachments at the corresponding height for a period of 15 min.

Q_2 is the actual capacity at maximum lift height in accordance with the data on the capacity plate.

The truck shall be on substantially firm and level ground and may be anchored to prevent overturning

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.

6.2.3 Verification of design and construction forces

The design and construction forces for truck shall be measured in accordance with annex A.

The test is successful if measured values do not exceed those laid down in Table 2.

6.2.4 Verification of the parking brake

The parking brake shall maintain the truck at a standstill with its rated capacity in the travelling position on a 3,5 % gradient with a hard smooth surface.

6.2.5 Verification of the stability

The type truck shall undergo the platform tests described in annex B without overturning.

6.2.6 Verification of means to equalise chains and ropes

The manufacturer shall verify that the chains and wire ropes may be adjusted evenly .

6.2.7 Hydraulic lift leakage test

The permissible lowering should be tested in accordance with 5.5.3.2.

6.3 Functional routine verification

6.3.1 General

The functional verification shall be carried out on each truck to verify that it is able to safely perform the tasks for which it is designed.

6.3.2 Inspection before tests

6.3.2.1 Each truck shall be inspected to verify that the brake and load handling controls and foreseen combined functions are appropriately identified.

6.3.2.2 The information plates for the truck, for the battery and the attachment, when fitted, shall be inspected to verify that they contain the information listed in 7.2.

6.3.3 Dynamic tests

6.3.3.1 *Travelling and manoeuvring test*

This test shall be carried out with a load equal to Q_1 if the truck is of the truck type and to the maximum value of the actual capacity, if not..

a) Pick up the load, raise it to a height of about 300 mm or up to maximum height if this is less than 300 mm.
b) Push and pull the truck, in both directions to verify that wheels and castors are working properly.
c) Steer the truck in both directions to verify that tiller or steering mechanism is working properly.
d) Deposit the load on the ground.
e) Apply and release parking brake to verify correct operation.

In case of incorrect operation, the truck shall be adapted until the test is successful.

6.3.3.2 *Stacking test*

This test shall be carried out with load Q_2. Pick up the load from ground level and elevate it to maximum height. Lower to ground level at maximum lowering speed, making several stops during descent, and deposit the load on the ground.

6.3.3.3 *Lowering speed test*

The maximum lowering speed shall be measured with load Q_2 to verify that it does not exceed 0,6 m/s. This may be determined by dividing the total lowering distance in metres by the number of seconds required for the total descent.

6.4 Inspection after tests

Following the tests, the truck shall be examined visually to ensure that there are no defects.

7 Information for use

An instruction handbook complying with the specifications of 5.5 of EN 292-2:1991 and drawn up in the language or languages of the country in which the truck is to be used shall be provided with each truck.

7.1 Instruction handbook

The handbook shall include, if applicable, at least the following :

7.1.1 General obligation

The truck shall be used, serviced and repaired according to the instructions of the manufacturer and shall not be modified or have attachments fitted without ensuring that the truck is still safe.

7.1.2 Instructions concerning the suitability of the truck with the application

- applications which need a load backrest,
- requirements for the floor (non slip, hard, level and without holes or obstacles),
- requirements for ambient lighting (recommended 50 lux at least),
- environmental conditions for which the truck is designed.

7.1.3 Instructions to operate the truck and non removable attachments - Intended uses

- description of the truck and its accessories,
- information on load backrest,
- description of the safety devices and warning labels,
- attachments which are fitted on the truck and their assembly procedure,
- information listed in 7.2 - Minimum marking (serial number not mandatory),
- function of operating controls,
- information on pallets to be used,
- instructions for safe handling by the operator e.g. when changing attachments or moving fork arms,
- instructions for parking the truck,
- daily checks before putting the truck into operation,
- instructions for travelling (height $\leq$ 300 mm) and manoeuvring safely by the operator,

- instructions for handling loads, specially large loads,
- information about wearing safety shoes and gloves,
- instructions in case of emergency stopping for electric lifting,
- instructions to secure the truck when travelling on lorries,
- de-energising of stored energy components,
- instructions for stability e.g. : to avoid impairing the truck stability, special precautions shall be taken when operating the truck, loaded or unloaded, with the fork arms or platform in the upper position :

  - the truck shall be moved slowly and smoothly,
  - while moving no part of the fork arms or platform or of the load shall come into contact with an obstacle
  - during lowering neither the fork arms or platform nor the load shall rest upon an obstacle.

  It may occasionally be necessary to negotiate small slopes for the purposes of moving the truck between buildings etc. In such cases the gradient shall be no more than 2 % and the truck shall be unladen, with the fork arms or platform facing downgrade.

7.1.4 Residual risks

The manufacturer shall give warnings on residual risks during the use of the truck and integrated attachments, for example :

- risks when handling heavy loads (see note),
- crushing risk of the feet under the load while the operator is in the intended operating position,
- overturning risk on one side,
- overturning risk backwards especially in case of the fork arms or platform resting on an obstruction,
- crushing, shearing and entanglement points.

NOTE The forces to operate the truck are varying with the value of the load, the ground conditions and the truck conditions. The frequency of the load handling cycle should also be taken into account.

7.1.5 Prohibited uses

The manufacturer shall give warnings on prohibited uses, for example :

- a truck shall not be used on gradients due to possible excessive efforts and loss of control except when unladen according to last paragraph of 7.1.3,
- a truck shall not be used in places insufficiently illuminated,
- the tiller shall not be turned at right angles to stop the truck,
- a truck shall not be used to lift or to transport persons,
- a truck shall not be used as a vehicle jack,
- the extremity of fork arms shall not be used as a lever to lift a load,
- a truck shall not be used in applications where a risk of exceeding the rated capacity exists,
- a truck shall not be used in applications where a risk of unintentional movement exists,
- a truck shall not be used for handling free swinging loads,
- a truck shall not travel with its fork arms in the upper position except for loading and unloading operations,
- a truck shall not have direct contact with foodstuffs,
- a truck shall not be used in a potentially explosive atmosphere.

7.1.6 Instructions for battery powered trucks

- specification of approved batteries and battery chargers,
- service mass of battery including ballast when required,
- procedure for safe handling of batteries, including installation, removal and secure mounting on the truck,
- warning of risks of accumulation of hydrogen under covers.

7.1.7 Instructions for service and maintenance of the truck

The instruction handbook shall give information on maintenance operations to be carried out by the operator.

NOTE The maintenance operations that only the manufacturer or personnel appointed by him may operate, are not dealt with in this standard.

The instructions may be selected from in the list below and complemented where necessary :

- qualification and training of operators
- contents of the logbook, if the latter is not supplied with the truck (contents and frequency of inspections and maintenance operations, instructions for replacement of wear parts),
- drawings and diagrams necessary for truck servicing and maintenance,
- instructions for verification of marking and warnings,

- use of approved spare parts,
- instructions for disposing of waste material (e.g. fluid and battery).

7.1.8 Instructions for transportation, commissioning, storage and disposal

- mass and overall dimensions of the truck,
- procedures for transporting, including loading and unloading,
- functional tests on completion of commissioning.

7.2 Minimum marking

7.2.1 Information plates

7.2.1.1 *Trucks with manual or powered lifting*

Trucks shall be marked legibly and indelibly (e.g. weather proof) with the following minimum details :

- name and address of the manufacturer or the authorised representative,
- designation of series or type,
- serial number and year of manufacture,
- unladen mass of the truck in working order without removable attachment nor battery, for battery powered trucks, but with fork arms or integrated attachments. The mass may vary from the figure shown by up to ± 10%,
- rated capacity,
- actual capacity at maximum lift height with standard load centre distance,
- actual capacity at other lift heights and other load centre distances where applicable,
- actual capacity with each removable attachment fitted at the manufacturer's authorised lift height(s) and load centre(s).

The rated and actual capacities shall be easily readable by the operator.

7.2.1.2 *Removable attachments*

Removable attachments shall be marked legibly and indelibly (e.g. weather proof) with the following minimum details :

- name of the attachment manufacturer or authorised representative,
- model or type,
- serial number and year of manufacture,
- mass of attachment which may vary from the figure shown by up to ± 5%,
- distance of the centre of gravity of the attachment from its mounting face on the truck,
- rated capacity,
- in the case of hydraulically or pneumatically operated attachments, the maximum operating pressure recommended by the attachment manufacturer,
- the warning "The capacity of the truck and attachment combination shall be complied with".

7.2.1.3 *Identification plates for batteries and containers*

Each container shall bear a durable identification plate in a prominent position giving the following information :

- name and address of battery manufacturer,
- type,
- nominal voltage,
- capacity in ampere • hours at the 5 or 20 hour rate,
- service mass (with ballast if used to compensate for lack of battery mass). It shall be possible to stamp the mass on the removable container, when fitted, near the lifting means.

7.2.2 Other marking

The function of controls shall be legibly and indelibly marked with graphic symbols indicating the function. Each symbol shall be affixed on or in close proximity to the control to which it applies.

Location for slinging shall be clearly indicated on the truck.

7.2.3 Warnings

Warnings shall be affixed to the truck or attachments in close proximity to the hazards concerned.

Symbols shall comply with ISO 15870, where available.

7.2.4 Languages

If any of the information in 7.2.2 and 7.2.3 is in writing, it shall be in the language or languages of the country where the truck is to be used.

Annex A
(normative)

Method for measurement of forces (F)

A. 0 Conditions for test

The tests shall be carried out with a new truck, chosen according to 6.2.1, on a smooth, dry, level, troweled finish concrete floor in good condition. The tests shall be conducted in an ambient temperature of between 15°C and 28°C.

The measuring instrument used shall indicate maximum values with ± 3 % accuracy.

The efforts shall be measured in accordance with the methods described below for all the values of load indicated in Table 2 which are less or equal to the rated capacity and applied according to 6.1.

A. 1 Measurement of starting force and rolling force

With the truck in starting position and stationary, the wheels are positioned in the direction that they naturally take when moving the truck in the test direction.

The force shall be applied horizontally along the truck's axis on the tiller handle or bar. The tiller shall be maintained in vertical position along the truck's axis (Figure A.1).

Two tests in both the forward and reverse directions shall be carried out and the average result recorded.

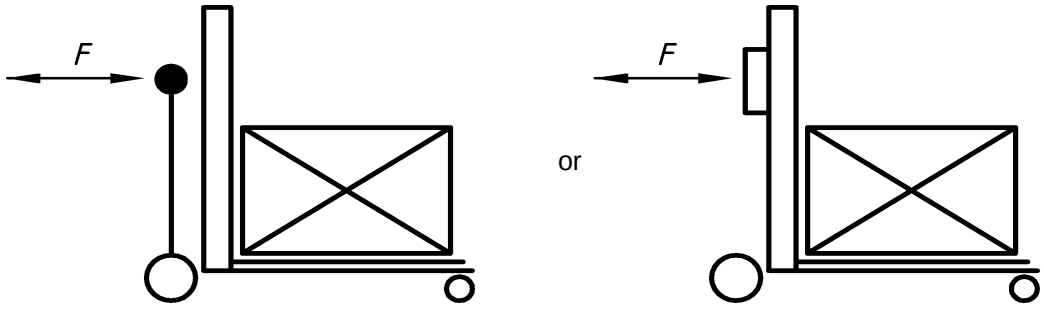


Figure A.1

A. 1.1 Starting force : the maximum value necessary to start the truck shall be recorded.

A. 1.2 Rolling force : the maximum value necessary to maintain the truck at a stabilized speed of 0,5 m/s (± 20%) shall be recorded.

The maximum starting force ED_{max} or the maximum rolling force ER_{max} is the average of the maximum values recorded in each direction of travel, forward AV and reverse AR, during two successive tests.

$$ED_{max} = \frac{ED_{max}\,AV1 + ED_{max}\,AV2 + ED_{max}\,AR1 + ED_{max}\,AR2}{4}$$

$$ER_{max} = \frac{ER_{max}\,AV1 + ER_{max}\,AV2 + ER_{max}\,AR1 + ER_{max}\,AR2}{4}$$

A. 2 Measurement of load lifting force

A. 2.1 Lifting using a tiller

Engage fork arms into the pallet with its load and lift until they touch the underside of the pallet or, in case of a platform put the load on the platform in its lowered position.

Actuate the tiller with full swing as many times as necessary to lift the load to its maximum height (Figure A.2).

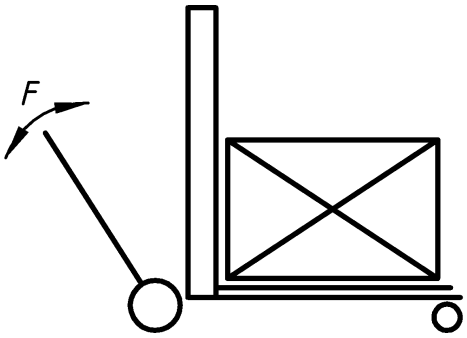


Figure A.2

The maximum force value is measured perpendicularly to the tiller at each pumping cycle.

The maximum lifting force EL_{max} is the average of the maximum values measured for each pumping cycle:

$$EL_{max} = \frac{\sum_1^n EL_{max\,i}}{n}$$

$EL_{max\,i}$ = Maximum lifting force for cycle i

n = Number of measurement cycles

A. 2.2 Lifting using a hand lever or a pedal

The maximum force value is recorded during a lever or pedal cycle.

The maximum lifting force EL_{max} is the average of the maximum values recorded at each lever or pedal cycle during one complete lifting.

A. 2.3 Lifting using a rotating handle hydraulic pump

The maximum force value is recorded during each turn.

The maximum lifting force EL_{max} is the average of the maximum values recorded at each turn during one complete lifting.

A. 3 Measurement of the steering force

A. 3.1 Steering by means of a tiller

With the truck stationary and lifted up to its travel position, measurement consists of recording the maximum force applied tangentially in the middle of the handle throughout the steering lock in one direction from the tiller's axial position (Figure A.3).

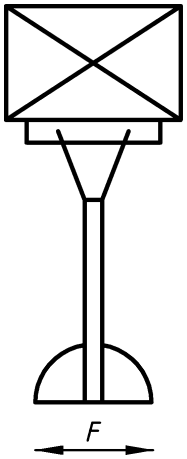


Figure A.3

During measurement, the lower surface of the tiller handle is maintained at a height of 950 mm above the ground.

Two measurements are recorded in each direction of tiller steering.

The maximum steering force EB_{max} is the average of the four recorded measurements on the left hand side G and on the right hand side D.

$$EB_{max} = \frac{EB_{max}\ G1 + EB_{max}\ G2 + EB_{max}\ D1 + EB_{max}\ D2}{4}$$

A. 3.2 Steering by means of horizontal or vertical bars :

With the truck travelling at 1 km/h and lifted up to its travel position, measurement consists of recording the maximum force applied tangentially in the middle of the horizontal bar or between the vertical bars during 90° steering in one direction.

Two measurements are recorded in each direction of bar steering.

The maximum steering force EB_{max} is the average of the four recorded measurements on the left hand side G and on the right hand side D.

Annex B
(normative)

Stability tests for pedestrian propelled industrial stacker trucks

B. 1 Conditions of validity

The following stability tests in these requirements ensure that the truck of the specified type has satisfactory stability when used under intended operating conditions, namely : operating (travelling and stacking) on hard, substantially smooth, level and prepared surface, with the load centre of gravity on the longitudinal centre line of the truck.

B. 2 Conditions for tests

B. 2.1 Equipment and method

Stability of the truck shall be verified by means of the tests described hereafter using a test platform which can be tilted along one side.

The truck under test shall be placed on the platform, which is initially in the horizontal plane, sequentially in the positions described in the Table B. 2. For each of the truck positions, the platform shall be tilted slowly and smoothly to the slope indicated in the table.

For the purpose of these tests, the overturning value of the test platform's slope is that which, if increased, would produce complete overturning of the truck. It is permissible in lateral tests for one wheel to loose contact with the platform, and it is acceptable for parts of the structure or other feature of the truck to make contact with the test platform.

B. 2.2. Condition of the truck

The test shall be carried out with a new truck chosen according to 6.2.1 and ready for use with fork arms or platform or other attachment and with the test load where applicable.

Where applicable, tyres shall be inflated to the pressure specified by the manufacturer, and where tyre ballast is permitted it shall be used in accordance with the manufacturer's instructions.

B. 2.3 Location of the truck on the test platform

The specified position of the truck on the test platform shall be maintained during each test (Table B. 2).

Wheel rotation shall be prevented by application of the parking brake, which shall be secured in the 'on' position. Additionally, the wheels may be wedged against the truck frame but in such a way that any axle/frame articulation is not affected.

It is permissible to use chocks or blocks between the wheels and the test platform to prevent the truck sliding out of position. The height of the chocks or blocks shall not exceed the values indicated in the following Table B. 1 :

Table B.1

Outside diameter (d) of the wheel	Maximum height of chocks or blocks
Up to 250 mm	25 mm
Over 250 mm	0,1 d

B. 2.4 Test load

The test load shall be equal to

- either Q_1
- or to the actual capacities at the corresponding heights and to Q_2 corresponding to the maximum height.

The test load, where applicable, shall be applied according to 6.1 and Table B. 2.

B. 2.5 Safety measures

Precautions shall be taken to prevent the overturning of the truck or the displacement of test load during the tests.

Where lashings are used to prevent the truck overturning, they shall be sufficiently supple and arranged with sufficient slack so that no appreciable restriction is imposed on the truck until the overturning movement starts.

Displacement of the load may be prevented by means such as :

(a) firmly securing the load
(b) suspending near the ground by a rope, chain, etc., in such a manner that the upper end of the suspension means acts at the point G where the centre of gravity of a fixed test load would otherwise be located.

B. 3 Test procedure

The truck shall be positioned in accordance with the figures of Table B. 2.

In all the tests the MN axis is parallel to the test platform articulation axis XY.

Points M and N actually correspond to the points of contact between the platform and the two wheels or castors considered for the test. These two wheels or castors are selected and positioned in such a way that the truck's stability on the platform is minimal.

B. 4 Test for trucks fitted with fixed or removable attachment

Trucks fitted with fixed or removable attachments shall be subjected to the foregoing stability tests, except where the attachment can bring the centre of gravity of the load out of the longitudinal centre line of the truck which shall comply with ISO 10658.

The test load and its position shall be those specified on the capacity plate(s) of the truck fitted with the attachment and used in compliance with the instructions of the manufacturer.

The lift heights required in the test shall be measured between the surface of the tilting platform and the underside of the load or attachment or upper surface of the fork arms, whichever is the smaller.

Table B.2 - Tests

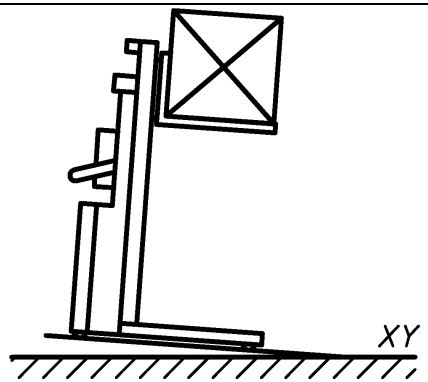
<table>
<tr><td>Test n°</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>Test for stability</td><td>forward longitudinal</td><td>reverse longitudinal</td><td>lateral</td></tr>
<tr><td>Test load</td><td>with</td><td>without</td><td>with</td></tr>
<tr><td>Load centre distance</td><td>see Table 1</td><td>-</td><td>see Table 1</td></tr>
<tr><td>Lift height</td><td colspan="3">maximal</td></tr>
<tr><td>Test platform slope</td><td>5%</td><td>16%</td><td>3,5%</td></tr>
<tr><td rowspan="2">Position on test platform</td><td> 

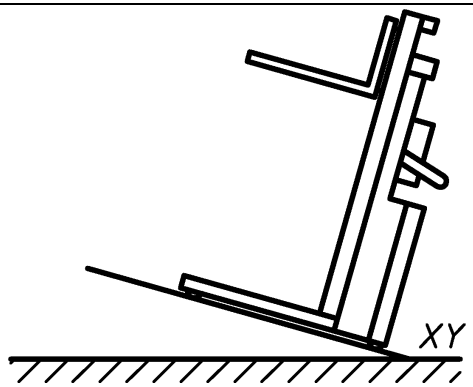
Figure 2</td><td> 

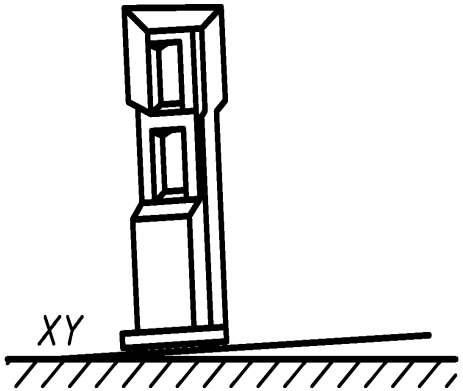
Figure 4</td><td> 

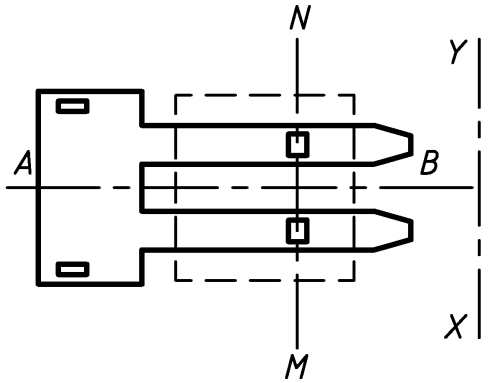
Figure 6</td></tr>
<tr><td> 

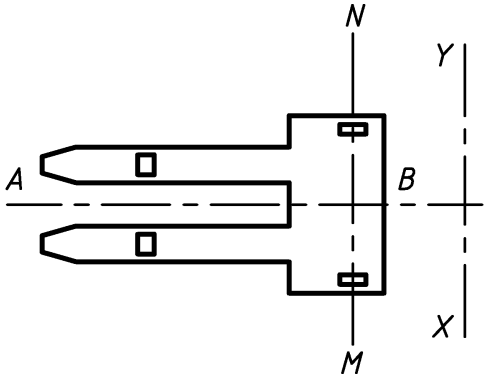
Figure 3</td><td> 

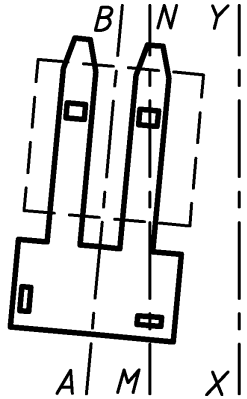
Figure 5</td><td> 

Figure 7</td></tr>
</table>

Annex Z
(informative)

Relationship of this document with EC Directives.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EC Directive :

Machinery Directive 98/37/EC, amended by Directive 98/79/EC.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned.

WARNING : Other requirements and other EC Directives may be applicable to the product(s) falling within the scope of this standard.

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