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# Industrial trucks — Lorry-mounted trucks —

## Part 1: Safety requirements and verification

*Chariots de manutention — Chariots embarqués sur porteur routier —*

*Partie 1: Exigences de sécurité et vérification*

Reference number
ISO 20297-1:2017(E)

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# Contents

Page

**Foreword** ..... **v**
**Introduction** ..... **vi**
**1 Scope** ..... **1**
**2 Normative references** ..... **1**
**3 Terms and definitions** ..... **3**
**4 Safety requirements and/or protective/risk reduction measures** ..... **6**
4.1 General ..... 6
4.1.1 Management of risk ..... 6
4.1.2 Normal operating conditions ..... 6
4.2 Sharp edges and acute angles ..... 7
4.3 Stored energy components ..... 7
4.4 Starting/moving ..... 7
4.4.1 Unauthorized starting ..... 7
4.4.2 Unintended movement ..... 7
4.4.3 Uncontrolled motion ..... 7
4.4.4 Powered travel movement ..... 7
4.4.5 Non-activation of the parking brake ..... 7
4.4.6 Inching pedal ..... 7
4.5 Brakes ..... 7
4.6 Failure of energy supply ..... 8
4.7 Electrical and electronic systems ..... 8
4.7.1 General ..... 8
4.7.2 Degree of protection ..... 8
4.7.3 Electrical connections ..... 8
4.7.4 Over-current protective devices ..... 8
4.7.5 Batteries ..... 8
4.7.6 Battery disconnection ..... 8
4.8 Controls ..... 9
4.8.1 General ..... 9
4.8.2 Controls of trucks accessible from ground level ..... 9
4.8.3 Inadvertent activation ..... 9
4.8.4 Differential locking ..... 9
4.8.5 Steering controls ..... 9
4.8.6 Load-handling controls ..... 10
4.9 Power systems and accessories ..... 10
4.9.1 Exhaust systems ..... 10
4.9.2 Cooling systems ..... 10
4.9.3 Tanks and pressure vessels ..... 11
4.10 Stabilizing devices ..... 11
4.11 Design requirements for maintenance purposes ..... 11
4.12 Systems for lifting, tilting and reaching ..... 12
4.12.1 Chains ..... 12
4.12.2 Hydraulic system ..... 12
4.12.3 Load holding ..... 13
4.12.4 Maximum load-lowering speed ..... 13
4.12.5 Limitation of stroke ..... 13
4.12.6 Fork arms, attachments and attachment brackets ..... 13
4.13 Operator's station ..... 14
4.13.1 General requirements ..... 14
4.13.2 Storage of operator's manual ..... 14
4.13.3 Hot parts ..... 14
4.13.4 Pipes and hoses ..... 14
4.13.5 Operator's station equipped with enclosed cab ..... 14

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4.13.6 Operator's seat ... 16
4.13.7 Control panels and symbols on displays ... 16
4.14 Operator access ... 17
4.14.1 General requirements ... 17
4.14.2 Enclosed cab openings ... 17
4.15 Protective measures and devices ... 17
4.15.1 Hot parts ... 17
4.15.2 Protection against crushing, shearing and trapping ... 17
4.15.3 Guards ... 17
4.15.4 Safety signs ... 18
4.15.5 Engine compartment ... 18
4.15.6 Roll-over protective structures (ROPS) and falling object protective structures (FOPS) ... 18
4.15.7 Audible warning devices ... 18
4.16 Stability ... 18
4.17 Visibility ... 18
4.18 Fire protection ... 18
4.18.1 Fire resistance ... 18
4.18.2 Fire extinguisher ... 19
4.19 Lifting and towing ... 19
4.19.1 General ... 19
4.19.2 Lifting ... 19
4.19.3 Towing ... 19
4.20 Noise ... 19
4.21 Mounting kit ... 19

**5 Verification of the safety requirements and/or protective/risk reduction measures ... 19**
5.1 General ... 19
5.2 Functional verification ... 20
5.3 Structural verification ... 20
5.3.1 Test loads ... 20
5.3.2 Static test ... 20
5.3.3 Dynamic testing ... 20
5.4 Maximum load-lowering speed verification ... 21
5.4.1 General ... 21
5.4.2 Test procedure ... 21

**6 Information for use ... 21**
6.1 General ... 21
6.2 Operator's and maintenance manuals ... 21
6.3 Marking ... 23
6.4 Additional information for truck when mounted for transport ... 24
6.5 Load charts ... 24

**Annex A** (informative) **List of significant hazards ... 26**

**Annex B** (normative) **Attachments and attachment brackets ... 31**

**Annex C** (informative) **Consistency of direction of motion for load-handling controls ... 34**

**Annex D** (informative) **Noise measurement ... 35**

**Bibliography ... 36**

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 4, *Rough-terrain trucks*.

A list of all parts in the ISO 20297 series can be found on the ISO website.

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# Introduction

This document is a type-C standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e.g. for maintenance (small, medium and large enterprises);

— consumers (in the case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

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

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

Lorry-mounted trucks are known by several terms, including “vehicle-mounted trucks” and “piggyback trucks”. They can also be equipped with a variety of attachments. The trucks covered by this document all have design features enabling them to be mounted for transport on a carrier vehicle.


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# Industrial trucks — Lorry-mounted trucks —

# Part 1: Safety requirements and verification

## 1 Scope

This document specifies safety requirements and their verification for industrial and rough-terrain lorry-mounted trucks (hereafter referred to as "trucks").

It is applicable to those trucks capable of self-loading onto a carrier vehicle. It is not applicable to

— trucks that are driven onto the carrier vehicle, or

— trucks that are loaded onto the carrier vehicle with the assistance of external means, i.e. crane or other lifting device.

This document deals with all significant hazards, hazardous situations or hazardous events relevant to machinery, when it is used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer. The significant hazards covered by this document are listed in Annex A.

This document does not address hazards which can occur

— during manufacture,

— when handling suspended loads, which may swing freely,

— when using trucks on public roads,

— when operating in potentially explosive atmospheres,

— with a battery or hybrid as the primary power source.

It does not address the requirements of road safety when the truck is mounted on the carrier vehicle.

It is not applicable to trucks manufactured before the date of its publication.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2330, *Fork-lift trucks — Fork arms — Technical characteristics and testing*

ISO 2860, *Earth-moving machinery — Minimum access dimensions*

ISO 2867:2011, *Earth-moving machinery — Access systems*

ISO 3449, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements*

ISO 3457, *Earth-moving machinery — Guards — Definitions and requirements*

ISO 3471:2008, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements*

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ISO 3691-1:2011, *Industrial trucks — Safety requirements and verification — Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks*

ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 5053-1, *Industrial trucks — Terminology and classification — Part 1: Types of industrial trucks*

ISO 5353, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

ISO 6292, *Powered industrial trucks and tractors — Brake performance and component strength*

ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls*

ISO 6683, *Earth-moving machinery — Seat belts and seat belt anchorages — Performance requirements and tests*

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 9244, *Earth-moving machinery — Machine safety labels — General principles*

ISO 9247, *Earth-moving machinery — Electrical wires and cables — Principles of identification and marking*

ISO 9533, *Earth-moving machinery — Machine-mounted audible travel alarms and forward horns — Test methods and performance criteria*

ISO 10263-4, *Earth-moving machinery — Operator enclosure environment — Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance*

ISO 11112:1995, *Earth-moving machinery — Operator's seat — Dimensions and requirements*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 12508, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

ISO 13564-1, *Powered industrial trucks — Test methods for verification of visibility — Sit-on and stand-on operator trucks and variable-reach trucks up to and including 10 t capacity*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 15817, *Earth-moving machinery — Safety requirements for remote operator control systems*

ISO 15870, *Powered industrial trucks — Safety signs and hazard pictorials — General principles*

ISO 21507, *Earth-moving machinery — Performance requirements for non-metallic fuel tanks*

ISO 22915-3, *Industrial trucks — Verification of stability — Part 3: Reach and straddle trucks*

ISO 22915-7, *Industrial trucks — Verification of stability — Part 7: Bidirectional and multidirectional trucks*

ISO 22915-10, *Industrial trucks — Verification of stability — Part 10: Additional stability test for trucks operating in the special condition of stacking with load laterally displaced by powered devices*

ISO 22915-13, *Industrial trucks — Verification of stability — Part 13: Rough-terrain trucks with mast*

ISO 22915-14, *Industrial trucks — Verification of stability — Part 14: Rough-terrain variable-reach trucks*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*


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## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100, ISO 5053-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**lorry-mounted truck**
wheeled, operator-controlled vehicle with a powered driving mechanism, designed either to carry, stack or tier in racks any kind of load, and capable of self-loading to, and self-unloading from, a carrier vehicle using its load-lifting means

Note 1 to entry: This definition is different from the one given in ISO 5053-1.

**3.1.1**
**industrial lorry-mounted truck**
lorry-mounted truck designed for operation under normal operating conditions on substantially firm, smooth, level, prepared and consolidated surfaces

Note 1 to entry: Normal operating conditions are as described in 4.1.2.

**3.1.2**
**rough-terrain lorry-mounted truck**
lorry-mounted truck designed for operation under normal operating conditions on unimproved natural terrain as well as the disturbed terrain of work sites

Note 1 to entry: Normal operating conditions are as described in 4.1.2.

**3.2**
**rated capacity**
$Q_1$
<truck> maximum load permitted by the manufacturer at the *standard load centre distance* (3.7) that the truck is capable of lifting and transporting on *fork arms* (3.10) in normal conditions with the *boom* (3.11), *mast* (3.12) or forks fully retracted

Note 1 to entry: See Figure 1.

**3.3**
**rated capacity**
<attachment> maximum load that an *attachment* (3.14) is permitted by its manufacturer to handle in normal operation under specified conditions

Note 1 to entry: The rated capacity of the attachment (3.14) can be associated with the load centre distance. See Table 1.

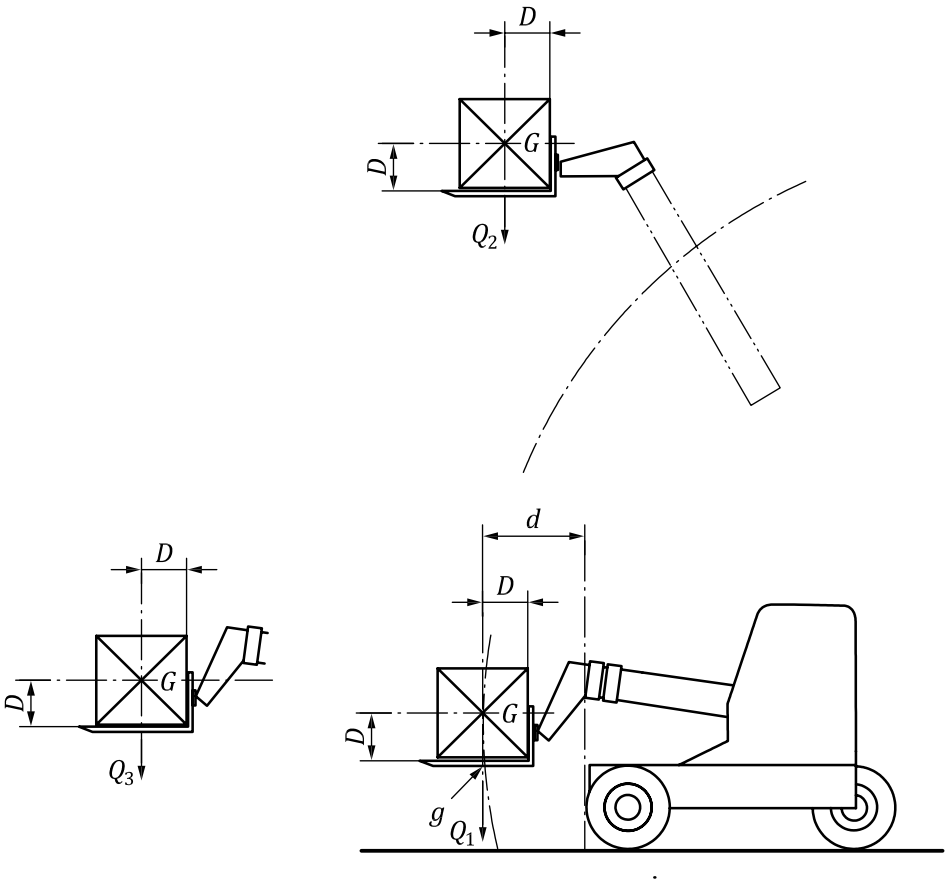
**3.4**
**actual capacity**
maximum load at a specified load centre distance, established by the manufacturer based on component strength and truck stability, that the truck can carry, lift and stack to a specified *lift height* (3.6) and *reach* (3.5), in normal operation

Note 1 to entry: See Figure 1.

Note 2 to entry: The actual capacity depends on the configuration of the truck in respect of variables including *lift height* (3.6), the *reach* (3.5) of the *boom* (3.11), the actual load centre, load-handling devices and *stabilizing devices* (3.9).

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Note 3 to entry: It defines the load-handling ability of the particular truck as equipped. Additional actual capacity with removable *attachments* (3.14), where permitted, may also be established by the appropriate stability test or by calculation verified by empirical data.




**Key**

| | |
|---|---|
| $d$ | reach |
| $D$ | standard load-centre distance |
| $G$ | centre of gravity of the load |
| $g$ | point corresponding to vertical projection of $G$ |
| $Q_1$ | rated capacity |
| $Q_2$ | actual capacity at maximum lift height |
| $Q_3$ | actual capacity at maximum reach |

**Figure 1 — Parameters for determining actual capacity of a truck with fork arms**

**3.5**
**reach**
*d*
distance the load can be moved forward in the horizontal direction

Note 1 to entry: See Figure 1.

**3.6**
**lift height**
height from the ground to the upper face of the *fork arms* (3.10) or underside of the load, whichever is the lower


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**3.7**
**standard load centre distance**
*D*
distance from the centre of gravity of the load, horizontally rearwards to the front of the fork shanks and vertically downwards to the upper faces of the *fork arms* (3.10)

Note 1 to entry: See Figure 1.

Note 2 to entry: Table 1 gives standard load centre distances in relation to *rated capacity* (3.2).

**Table 1 — Standard load centre distances and rated capacities**

| **Rated capacity** $Q_1$ kg | | **Standard load centre distance** $D$ mm | | | | |
|---|---|---|---|---|---|---|
| | | **400** | **500** | **600** | **900** | **1 200** |
| 0 | < 1 000 | X | | X[a] | | |
| ≥ 1 000 | < 5 000 | | X[c] | X[b] | | |
| ≥ 5 000 | < 10 000 | | | X | | |
| ≥ 10 000 | < 20 000 | | | X | X | X |
| ≥ 20 000 | < 25 000 | | | | X | X |
| ≥ 25 000 | | | | | | X |

NOTE Trucks may be rated for special applications with load centres related to those applications.

[a] 600 mm is used in the USA.

[b] 600 mm is used in Asia, Australia and the USA.

[c] 500 mm is typically used in Europe.

**3.8**
**lost load centre**
**LL**
**effective thickness**
**ET**
horizontal shift in the standard load centre that may occur when removable *attachments* (3.14) are added to a truck

**3.9**
**stabilizing devices**
extendable and/or pivoting mechanical supports used to improve the stability of a truck when stationary

**3.10**
**fork arms**
load-supporting structures, each consisting of a shank (vertical portion) and blade (horizontal portion) which are hook or shaft (pin)-mounted, fitted on the carriage and usually laterally adjusted manually

**3.11**
**boom**
pivoting support member that permits horizontal and vertical placement of the load or *attachment* (3.14)

[SOURCE: ISO 10896-1:2012, 3.14.]

**3.12**
**mast**
support member that permits vertical movement of the carriage

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**3.13**
**normal operating position**
position specified by the manufacturer in which the operator is able to control the truck operations, including load-handling functions

**3.14**
**attachment**
component or assembly of components which can be mounted on the attachment bracket for a specific use

**3.15**
**carrier vehicle**
lorry or trailer that is suitable for transporting a *lorry-mounted truck* (3.1) by the fitting of a suitable *mounting kit* (3.16)

**3.16**
**mounting kit**
structure designed to fit a *lorry-mounted truck* (3.1) to a carrier vehicle

**3.17**
**maximum working pressure**
highest pressure at which a hydraulic circuit is intended to operate under normal operating conditions

Note 1 to entry: Normal operating conditions are as described in 4.1.2.

**3.18**
**level ground**
ground with a gradient of 0 ± 2 %

# 4 Safety requirements and/or protective/risk reduction measures

## 4.1 General

### 4.1.1 Management of risk

Trucks shall comply with the safety requirements and/or protective/risk reduction measures of this clause.

In addition, the truck shall be designed according to the principles of ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.

### 4.1.2 Normal operating conditions

Normal operating conditions are considered to be the following:

— driving (travelling and manoeuvring) and load handling on surface conditions on which the truck is designed to operate; such surface conditions shall be specified in the instruction handbook;

— driving with the horizontal load centre of gravity approximately on the longitudinal centre plane of the truck;

— travelling with the load in the lowered (travel) position and with the load tilted backwards, where applicable.

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 4.16.


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