INTERNATIONAL STANDARD 3691

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Powered industrial trucks — Safety code

Chariots automoteurs — Code de sécurité

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Descriptors : handling equipment, industrial trucks, self-propelled machines, safety requirements, control devices, driving direction, brakes (motion arresters), accident prevention, name plate, maintenance, technical data sheets.

Price based on 31 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3691 was developed by Technical Committee ISO/TC 110, *Industrial trucks*, and was circulated to the member bodies in April 1975.

It was approved by the member bodies of the following countries :

Australia	France	Spain
Austria	India	Sweden
Belgium	Netherlands	Switzerland
Brazil	New Zealand	United Kingdom
Bulgaria	Poland	U.S.A.
Czechoslovakia	Romania	U.S.S.R.
Finland	South Africa, Rep. of	Yugoslavia

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Germany
Japan

This International Standard incorporates draft Addenda ISO/DIS 3691/DAD 1 and 2, which were circulated to the member bodies in July and August 1975 respectively.

Draft Addenda 1 (clauses 14 and 15 and annex B of the present document) and 2 (clause 12 of the present document) were approved by the member bodies of the following countries :

Australia	Japan	Sweden
Belgium	Mexico	Switzerland
Brazil	Netherlands	Turkey
Finland	New Zealand (*DAD 2*)	United Kingdom (*DAD 2*)
France	Poland	U.S.A.
India	Romania	U.S.S.R.
Ireland	South Africa, Rep. of	Yugoslavia
Italy	Spain	

The member bodies of the following countries expressed disapproval of draft Addendum 1 on technical grounds :

New Zealand
United Kingdom

Attention is drawn to the fact that annex A is included for reader information only; owing to the difficulty of updating, it may be omitted from subsequent editions of this International Standard.

Printed in Switzerland

CONTENTS

Powered industrial trucks — Safety code

SECTION ONE : GENERAL

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the safety requirements for the manufacture, application, operation and maintenance of powered industrial trucks.

The term "powered industrial trucks" applies to mobile, power-driven vehicles used to carry, push, pull, lift, stack or tier any type of load, as described in clause 3.

The word "shall" is to be understood as expressing a mandatory requirement and the word "should" as expressing a recommended requirement.

2 REFERENCES

ISO 1074, *Counterbalanced lift trucks — Stability — Basic tests.*

ISO 1084, *Industrial tractors — Definition and nominal rating.*

ISO/R 1214, *Counterbalanced fork lift trucks — Rated capacity.*[1)]

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

ISO 3184, *Reach and straddle fork lift trucks — Stability tests.*

ISO 3287, *Powered industrial trucks — Control symbols.*[2)]

ISO 5766, *Pallet-stackers and high-lift platform trucks — Stability tests.*[2)]

ISO 5767, *Industrial trucks operating in special condition of stacking with mast tilted forward — Stability tests.*[2)]

3 NOMENCLATURE, CLASSIFICATION AND DEFINITIONS

3.1 The nomenclature, classification and definitions for powered industrial trucks are given in ISO . . . (in preparation).

3.2 In addition, for the purposes of this International Standard, the following definitions and classifications apply :

3.2.1 low-lift truck : A self-loading truck equipped with an elevating mechanism designed to raise the load to a height just sufficient to permit horizontal movement.

3.2.2 high-lift truck : Either a self-loading truck equipped with an elevating mechanism designed to permit stacking and tiering or an order-picker truck (whether self-loading or not) equipped with a similar elevating mechanism.

NOTE — Sub-clauses 3.2.1 and 3.2.2 are presented for use pending the publication of ISO . . .

SECTION TWO : FOR THE MANUFACTURER OF POWERED INDUSTRIAL TRUCKS

4 RATED CAPACITY (Capacité nominale)

The manufacturer's rated capacity of a powered industrial platform or lift truck is the maximum load, established by the manufacturer, that a given truck is capable of transporting or lifting in normal operation under conditions as set forth in 4.1 to 4.5, based on the strength of the various components of the truck and, when applicable, also based on the stability requirements and tests as set forth in clause 6 of this International Standard.

1) Under revision.

2) At present at the stage of draft.

Alternative capacity ratings may also be established.

The loads shall be expressed in kilograms (kg) and the dimensions in metres (m) or millimetres (mm) in countries using the International System of Units (SI).

The loads shall be expressed in pounds (lb) and the dimensions in inches (in) in countries using the Imperial System.

The rated capacity of a towing tractor corresponds to the maximum draw-bar pull, established by the manufacturer, that the tractor is capable of developing in normal operation under specified conditions.

4.1 Fixed-platform trucks

The rated capacity of a fixed-platform truck is the maximum load, established by the manufacturer, uniformly distributed over the load-carrying platform, which the truck is capable of transporting under normal conditions of operation.

4.2 High-lift trucks

4.2.1 *Counterbalanced fork lift trucks*

The rated capacity of a counterbalanced fork lift truck is as defined in clause 2 of ISO/R 1214.

The designation of the rated capacity shall correspond to the capacities, defined as a function of the maximum lift height E of the truck, as stated in clause 3 of ISO/R 1214.

The standard load centre distances shall be as defined in clause 4 of ISO/R 1214.

4.2.2 *Reach and straddle trucks*

The rated capacity of a reach truck or of a straddle fork lift truck is the maximum load, established by the manufacturer, which it is capable of transporting and lifting at a distance D measured between the load centre of gravity and the front face of the shank of the fork, with vertical mast and horizontal fork, and for an elevation of 3,3 m (130 in).

The distance D shall be 400, 500 or 600 mm for trucks delivered in countries using the International System of Units (SI), and 16, 20 or 24 in in countries using the Imperial System.

NOTE – The above text is valid until a new International Standard defining the rated capacity of these trucks is available.

4.2.3 *Pallet-stacker and high-lift platform trucks*

The rated capacity of a pallet-stacker or high-lift platform truck is the maximum load, established by the manufacturer, which it is capable of transporting and lifting at a distance D measured between the load centre of gravity and the front face of the shank of the fork or abutment of the platform and for an elevation of 2,5 m (100 in) for trucks having a width over the fork arms or platform up to and including 690 mm (27 in) and for an elevation of 3,3 m (130 in) for trucks having a width over the fork arms or platform greater than 690 mm (27 in).

The distance D shall be 400, 500 or 600 mm for trucks delivered in countries using the International System of Units (SI), and 16, 20 or 24 in in countries using the Imperial System.

NOTE – The above text is valid until a new International Standard defining the rated capacity of these trucks is available.

4.2.4 *Order-picker trucks*

4.2.5 *Side-loading fork lift trucks*

4.3 Low-lift trucks (pallet, stillage and platform)

The rated capacity of a low-lift truck is the uniformly distributed load, established by the manufacturer, which it is capable of transporting.

4.4 Tractors

This term applies to industrial tractors defined in clause 2 of ISO 1084.

The nominal capacity of a tractor is defined in clause 3, "Nominal rating", of ISO 1084.

4.5 Removable attachments

The rated capacity of a removable attachment is the maximum load at a specified load centre distance, established by its manufacturer, that the attachment is capable of handling in normal operation under specified conditions.

5 INFORMATION PLATES

5.1 Powered industrial trucks

Every powered industrial truck shall bear a durable identification plate, permanently attached in a prominent position, which shall indicate the condition of the truck when delivered from the manufacturer and give the following information in indelible characters :

5.1.1 *Engine trucks*

a) name of truck manufacturer (and importer, if required) and also, if desired, the manufacturer's trademark;

b) type;

c) production or serial number;

d) unladen weight in working condition, without removable attachments but complete with fork arms in the case of a fork-lift truck;

e) capacity at maximum elevation.

5.1.2 *Electric trucks*

a) name of truck manufacturer (and importer, if required) and also, if desired, the manufacturer's trademark;

b) type;

c) production or serial number;

d) unladen weight in working condition, without removable attachments but complete with fork arms in the case of fork lift trucks;

e) capacity at maximum elevation;

f) weight of unladen truck without battery;

g) minimum and maximum allowable battery weight;

h) nominal battery voltage for which the truck system is arranged.

5.1.3 *Trucks with front end attachments*

In addition to the information listed in either 5.1.1 or 5.1.2, the identification plate shall also bear the following information :

a) type of attachment;

b) weight of unladen truck in working condition, without fork arms but fitted with the attachment;

c) capacity of the truck and attachment combinations at maximum elevation.

NOTES

1 It is also permissible to indicate the manufacturer's rated capacity on the plate.

2 The load capacity may be indicated on a separate plate, if desired.

3 When a truck or attachment is imported by a person other than the original manufacturer, it is the responsibility of the importer to affix an additional plate bearing his name as well as the requirements of 5.1.1, 5.1.2 and 5.1.3.

5.2 Removable attachments

Every removable attachment shall carry a separate identification plate giving the following information :

a) name of attachment manufacturer (and importer if required);

b) type;

c) production or serial number;

d) weight of the attachment and distance of its centre of gravity from the attachment mounting face;

e) rated capacity of the attachment.

NOTE – The following warning shall be added :

"WARNING. Actual load may be restricted by reference to the capacity of the truck."

5.3 Batteries for electric trucks

The traction batteries shall carry an identification plate showing :

a) name of battery manufacturer;

b) type;

c) serial number;

d) nominal voltage;

e) capacity in ampere hours at the 5-hour rate;

f) weight, in working order with removable container (and ballast) if used.

Alternatively, the battery weight may be stamped on the removable container (and ballast) near the lifting means.

5.4 Special use

If a truck is to be operated under conditions other than the normal working conditions, it shall bear a durable plate, in a prominent position, giving the following information :

a) designation of the special condition(s) of use;

b) capacity for each one of the special conditions of use.

6 STABILITY – REQUIREMENTS AND TESTS

Powered industrial trucks shall meet the requirements for stability when tested in accordance with the relevant ISO publications referred in 6.1 to 6.7. The tests set forth in these publications are intended to ensure that high-lift industrial trucks have satisfactory stability characteristics when properly operated under normal operating conditions. The tests are to be carried out by the manufacturer on prototype trucks which are fully representative of series production trucks.

6.1 Counterbalanced trucks

See ISO 1074.

6.2 Reach (retractable mast or forks) and straddle fork lift trucks (pedestrian and rider controlled)

See ISO 3184.

6.3 Pallet-stacker and high-lift platform trucks (pedestrian and rider controlled)

See ISO 5766.

6.4 Order-picker trucks

See ISO . . . (in preparation).

6.5 Side-loading fork lift trucks

See ISO . . . (in preparation).

6.6 Rough terrain trucks

See ISO . . . (in preparation).

6.7 Trucks operating in the special condition of stacking with the mast tilted forward

See ISO 5767.

NOTE – When available, references to the relevant ISO publication concerning additional stability tests will be added.

7 BRAKE PERFORMANCE

The brakes fitted on a powered industrial truck or tractor shall meet the performance requirements set forth in ISO . . . (in preparation).

8 DIRECTION OF TRAVEL – CONTROLS

8.1 General

The best controls are those which most closely agree with natural human instinct. Such controls are sometimes called "directional" where control movement is in the same direction as the desired movement of the truck or accessory. Some controls such as "forward" and "reverse" are obvious and easy to make "directional".

Other control movements are less obviously directional and call for a thorough study and/or testing to determine the most natural human reaction. Recommendations for preferred motions and placement of controls are intended to establish uniform practices in this area.

Still other controls involve no element of "naturalness", and the naming then has to be done on an arbitrary basis. The arbitrary method should be used only after a thorough study reveals no natural tendency or ease for a given type of direction of control. Such arbitrarily named controls would be one of the greatest areas for lack of uniformity unless co-ordinated by some standards-making body.

8.2 Front-end and forward directions of travel

8.2.1 *Front end of a truck*

The front end of a truck is the end nearest the arrow in figures 1 to 18.

8.2.2 *Rear end, left-hand, and right-hand side of a truck*

The rear end, left-hand, and right-hand side of a truck are in conformity with the definition given in 8.2.1.

8.2.3 *Forward direction of travel*

The forward direction of travel is the direction indicated by the arrow in figures 1 to 18. All sketches show plan views of trucks.

8.2.3.1 SIT-ON TRUCKS

8.2.3.1.1 *Trucks where the load is leading when the truck travels in the forward direction*

a) Counterbalanced fork lift truck

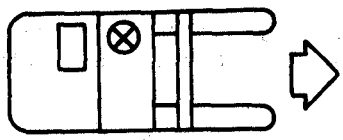


FIGURE 1

b) Straddle or reach (with retractable mast or fork) truck

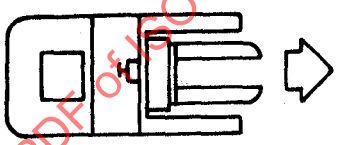


FIGURE 2

c) Shunting tractor

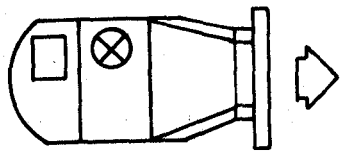


FIGURE 3

8.2.3.1.2 *Trucks where the load is trailing when the truck travels in the forward direction*

a) Straddle or reach (with retractable mast or fork) truck where the operator is seated sideways

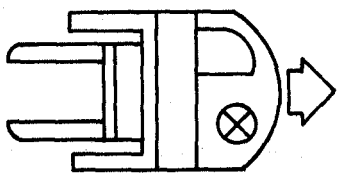


FIGURE 4

b) Towing tractor – Front-end control

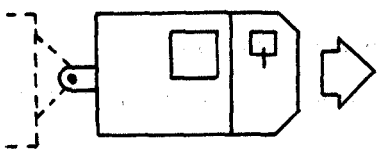


FIGURE 5

c) Towing tractor — Rear-end control

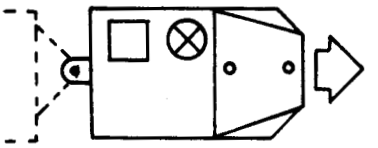


FIGURE 6

d) Fixed-platform truck

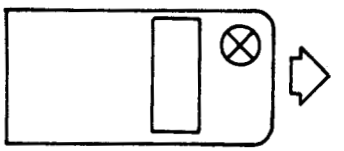


FIGURE 7

8.2.3.2 STAND-ON TRUCKS

8.2.3.2.1 *Centre control*

Trucks where the load is leading when the truck travels in the forward direction

a) Counterbalanced fork lift truck

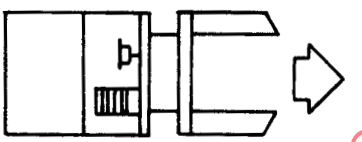


FIGURE 8

8.2.3.2.2 *End control*

8.2.3.2.2.1 *Trucks where the load is leading when the truck travels in the forward direction*

a) Counterbalanced fork lift truck

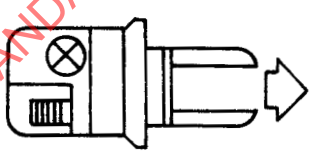


FIGURE 9

b) Straddle or reach (with retractable mast or fork) truck

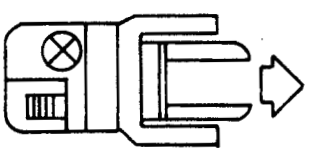


FIGURE 10

8.2.3.2.2.2 *Trucks where the load is trailing when the truck travels in the forward direction*

a) Straddle or reach truck (with retractable mast or fork), with the operator standing sideways

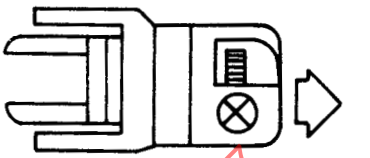


FIGURE 11

b) High-lift or low-lift platform truck

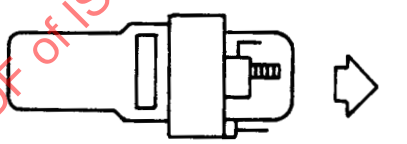


FIGURE 12

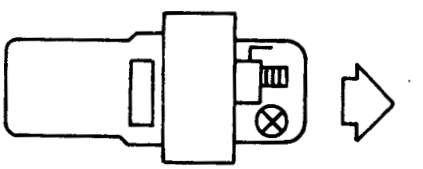


FIGURE 13

c) Fixed-platform truck

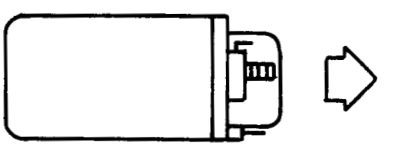


FIGURE 14

d) Order-picker truck

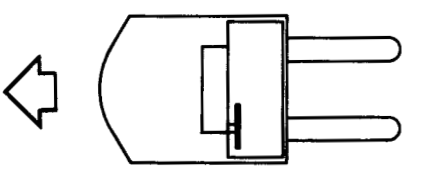


FIGURE 14 a)

8.2.3.3 PEDESTRIAN-CONTROLLED TRUCKS

Trucks where the load is trailing when the truck travels in the forward direction

a) Pallet truck

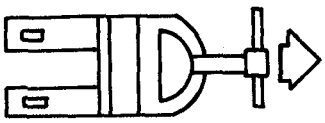


FIGURE 15

b) High-lift or low-lift platform truck

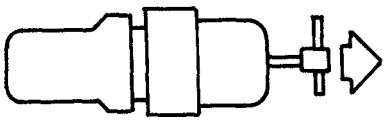


FIGURE 16

c) Counterbalanced fork lift truck

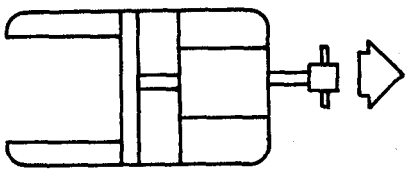


FIGURE 17

d) Tractor

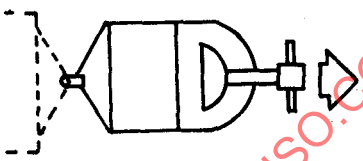


FIGURE 18

8.3 Steering controls

8.3.1 *Steering — Rider trucks*

a) All steering controls shall be confined within the plan view outline of the truck, or guarded to prevent injury to the operator during movement of the controls when passing obstacles, walls, columns, etc.

b) Where steering must be accomplished with one hand, steering knobs are necessary for safe operation. Steering knobs, when used, shall be mounted within the periphery of the steering handwheel and provision shall be made to prevent injury to the operator's hand.

c) When conditions of use would result in steering shocks being generated, the transmission of such shocks to the steering hand wheel shall be limited to the extent necessary to avoid injury to the driver's hand or arm.

d) Where a steering hand wheel and knob are used, either the configuration shall be of a design which will minimize the hazard from a spinning hand wheel due to road reaction feedback, or the steering mechanism shall be of a type which prevents road reactions from causing the steering hand wheel to spin.

e) It is recommended that steering knobs, when used, be of a type which is engaged by the operator's hand from the top, and within the periphery of the steering hand wheel.

8.3.1.1 STEERING WHEELS

8.3.1.1 On all trucks on which the operator faces in the normal line of travel and which are steered by means of a steering wheel (horizontal, inclined or vertical), a clockwise rotation of the steering wheel shall steer the truck to the right in the forward direction of travel.

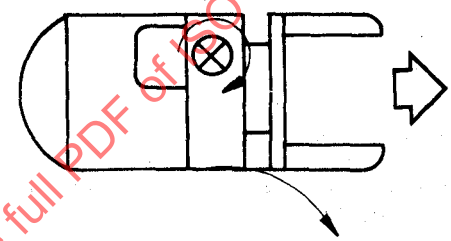


FIGURE 19

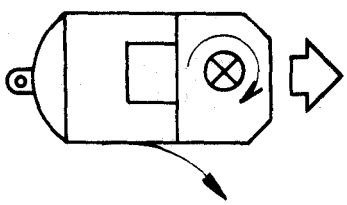


FIGURE 19 a)

NOTE — Considerable numbers of trucks of models 8.2.3.1.2 a) and 8.2.3.2.2 have been built with a steering reverse of the above standard. Such trucks may still be operated, provided that the function and mode of operation of the controls is clearly indicated.

8.3.1.1.2 On all trucks on which the operator faces at a right angle to the normal line of travel and which are steered by means of a steering wheel (horizontal, inclined or vertical), a clockwise rotation of the steering wheel shall steer the truck clockwise when the truck is travelling with the load trailing. (See the note in 8.3.1.1.1, which also applies in this case.)

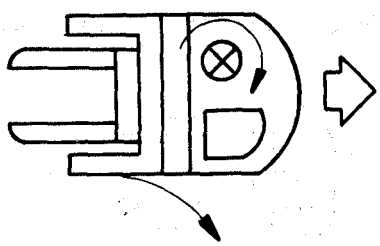


FIGURE 20

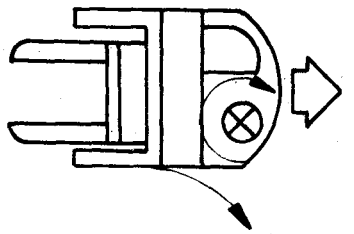


FIGURE 20 a)

8.3.1.2 TILLERS

8.3.1.2.1 *Tillers operating in a horizontal plane*

On trucks steered by a tiller which moves in the horizontal plane and which in the neutral position is parallel to the longitudinal axis of the truck, or on trucks steered by a tiller which rotates on a shaft parallel to the longitudinal axis of the truck and which in the neutral position stands upright, when the driver is facing in the direction of travel, movement of the tiller to his right shall steer the truck to his right.

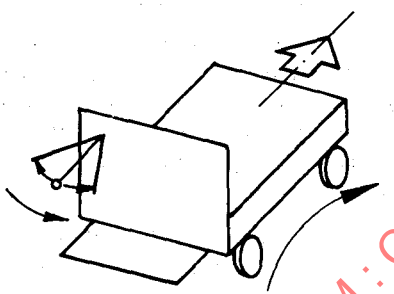


FIGURE 21 a)

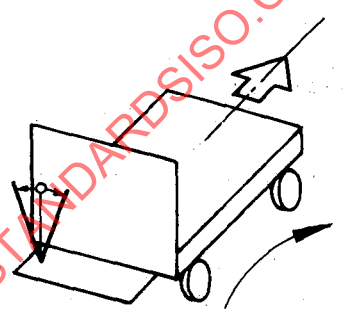


FIGURE 21 b)

8.3.1.2.2 *Tillers operating in a vertical plane*

On stand-on lift platform trucks (8.2.3.2.2.2 b)) and fixed-platform trucks (8.2.3.2.2.2 c)) which are steered by means of a tiller situated on the right of the operator and operating in a vertical plane, raising the tiller (clockwise rotating) shall steer the truck to the right in the forward direction of travel (figure 22). (See the note in 8.3.1.1.1, which also applies in this case.)

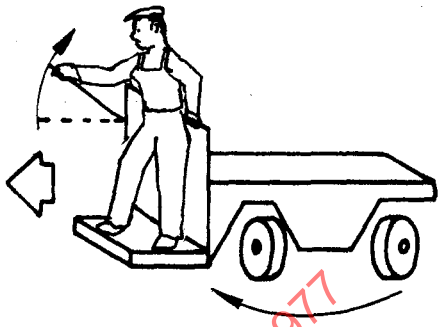


FIGURE 22

8.3.2 *Steering handle — Motorized hand and hand/rider trucks*

8.3.2.1 The handle on the tongue shall be provided with suitable means to protect the operator's hand against injury from swinging doors, walls, columns, etc.

8.3.2.2 Motorized hand/rider trucks employing a steering tongue control which extends beyond the confines of the truck shall steer as follows :

With the walking operator facing in the direction of travel, with the load trailing, clockwise movement of the steering tongue shall steer the truck clockwise.

With the riding operator facing in the direction of travel, with the load trailing, clockwise movement of the steering tongue shall steer the truck clockwise.

8.3.3 *Pivoting steering controls*

On trucks which are steered by means of a pivoting control operated by foot (figure 23) or by hand (figure 24), a clockwise rotation of this control, looking in the forward direction of travel, shall steer the truck to the right.

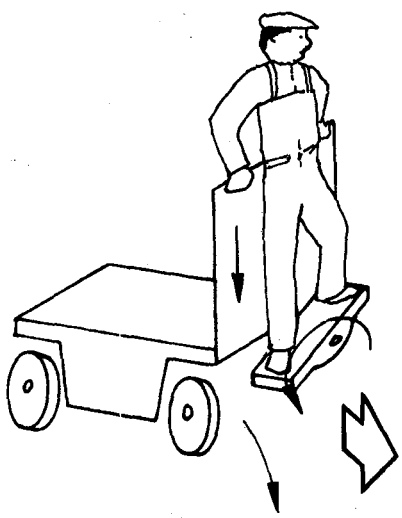


FIGURE 23

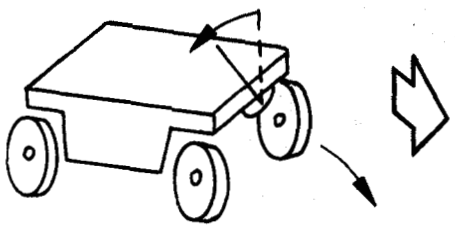


FIGURE 24

8.4 Driving and braking controls

A parking brake (or mechanism) which may be part of or include the service brake shall be provided on all powered industrial trucks. The parking brake (or mechanism) shall be manually or automatically applied, and shall remain applied until intentionally released.

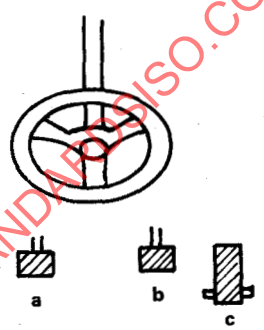
A means shall be provided whereby the control circuit(s) in the case of electric trucks and the ignition and/or starting means in the case of internal combustion engine trucks may be disconnected or rendered inoperative.

8.4.1 *Sit-down rider trucks*

8.4.1.1 PEDALS

The accelerator, brake pedals (and clutch pedal when fitted) of all sit-down ride-trucks shall be arranged as shown in figure 25.

Where the pedal arrangement differs from that shown in figure 25, its function shall be clearly indicated both in the driving instructions and on the truck itself.



a : clutch

b : brake

c : accelerator

View from driver's position

FIGURE 25

8.4.1.2 GEAR-CHANGE LEVER

The positions for gear engagement shall be clearly indicated.

8.4.1.3 DIRECTION-CHANGE LEVERS

The direction levers on internal combustion engine powered trucks and the control levers on electric trucks shall be arranged in such a way that their operation would correspond to the required direction of travel (figure 26).

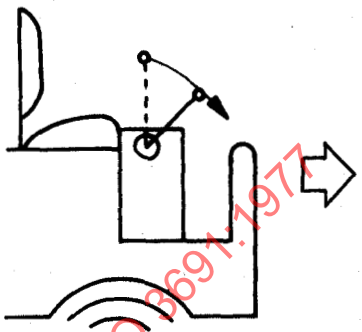


FIGURE 26

8.4.1.4 SAFETY CONTROL AND BRAKES – ELECTRIC-POWERED SIT-DOWN RIDER INDUSTRIAL TRUCKS

Means shall be provided to open automatically the travel circuit when the operator leaves the truck.

Travel control shall be so arranged that the truck will move only when the direction control is actuated and will not move at a speed greater than inching speed unless control has been actuated for both speed and direction. Where no neutral position is provided, the truck shall not move unless the speed control is activated.

The accelerator, if foot operated, shall be located for operation by the right foot and shall increase travel speed when depressed.

Service brakes, if foot operated, shall be applied by depressing the pedal.

When a single pedal is used to control both the above functions (i.e. acceleration and braking), it shall be located for operation by the right foot and shall release the brakes and increase travel speed when depressed. Conversely, it shall reduce travel speed and apply the brakes when released.

8.1.4.5 SAFETY CONTROL AND BRAKES – INTERNAL COMBUSTION ENGINE POWERED SIT-DOWN RIDER INDUSTRIAL TRUCKS

Travel control shall be so arranged that the truck will move only when the direction control is actuated and will not move at a speed greater than inching speed unless control has been actuated for both speed and direction.

Service brakes, if foot operated, shall be energized by depressing the pedal.

If a combination clutch-and-brake pedal is used, the initial pedal movement shall disengage the clutch and the final pedal movement shall apply the brakes, and the pedal shall be operated by the left foot.

The accelerator, if foot operated, shall increase speed when depressed.

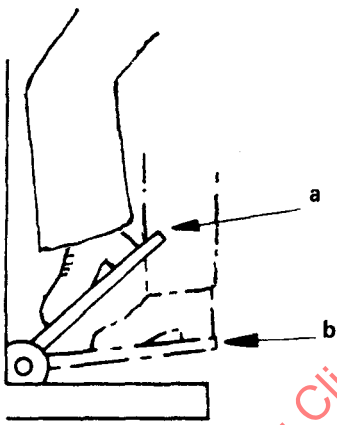
If a combination pedal controls both acceleration and brakes, depressing the accelerator portion shall increase speed and depressing the brake portion shall apply the brakes, and the combination pedal shall be operated by the right foot.

The clutch pedal, if used, shall disengage the clutch when depressed with the left foot.

8.4.2 *Stand-on rider trucks*

8.4.2.1 PEDALS

The depressing of the pedal on which the operator's foot will remain while the truck is in motion shall release the brake and allow the truck to travel (figure 27). The service brake should be applied by lifting the foot. Where the service brake is applied with a downward movement of the pedal, pressing down upon the brake pedal shall apply the service brake.



a : brakes applied

b : brakes released

FIGURE 27

8.4.2.2 LEVERS

The provisions of 8.4.1.2 and 8.4.1.3 apply also to stand-on trucks.

Where a lever is provided, depressing the lever on which the operator's hand will remain while the truck is in motion shall release the brake and allow the truck to travel (figure 28, position b)). Releasing the lever shall apply the brakes (figure 28, position a)).

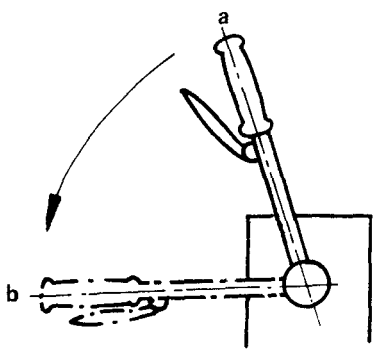


FIGURE 28

8.4.2.3 PUSH-BUTTONS

8.4.2.3.1 When the direction of travel is selected by push-buttons arranged vertically one above the other, pressing the upper button shall drive the truck in the forward direction of travel such as defined in 8.2.3 (figure 29).

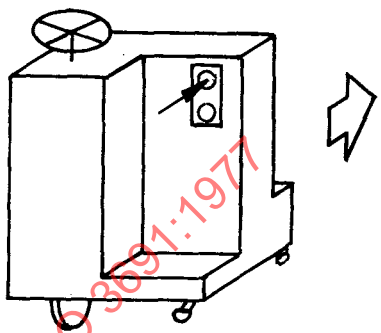


FIGURE 29

8.4.2.3.2 When the direction of travel is selected by push-buttons arranged horizontally, the direction controlled by each button shall be clearly indicated.

8.4.2.3.3 All directional control push-buttons shall return to neutral position when released.

8.4.2.4 SAFETY CONTROL AND BRAKES – ELECTRIC POWERED STAND-ON INDUSTRIAL TRUCKS

Means shall be provided to open automatically the travel circuit when the operator leaves the truck.

Means shall be provided so that the travel circuit can be activated only by releasing the parking brake and resetting the speed and/or directional control(s) when the operator assumes the driving position.

8.4.2.5 SAFETY CONTROL AND BRAKES – INTERNAL COMBUSTION ENGINE POWERED STAND-ON INDUSTRIAL TRUCKS

The accelerator, if foot operated, shall increase the speed when depressed with the right foot.

Travel control shall be so arranged that the truck will not move until the direction control has been actuated and will not move at a speed greater than inching speed unless control has been actuated for both speed and direction.

8.4.3 *Pedestrian controlled trucks*

8.4.3.1 ELECTRIC TRUCKS (PEDESTRIAN)

8.4.3.1.1 Forward and reverse motion of the truck shall be controlled or selected by means of a control device readily

accessible when the handle grip of the steering tongue is grasped. This control device shall operate directionally in one of the following manners :

a) The control shall have a forward motion for forward travel and a rearward motion for reverse travel.

b) The control shall consist of two buttons located at the top of the control handle when the steering tongue is approximately vertical, arranged so that the forward one (F) is for forward travel and the rearward one (R) for reverse travel (figure 30).

c) The control shall have rotary motion, the rotation being in the same direction as drive wheel rotation (figure 31).

The travel control shall be clearly and durably identified to indicate function and direction of motion.

8.4.3.1.2 The tongue shall be movable in a vertical plane. When the brake is mechanically operated, and the tongue is in the vertical (B) or horizontal (B') positions, the brake shall be applied and the power switched off, unless it has already been switched off by the operation of the travel control switch (figure 31 a)).

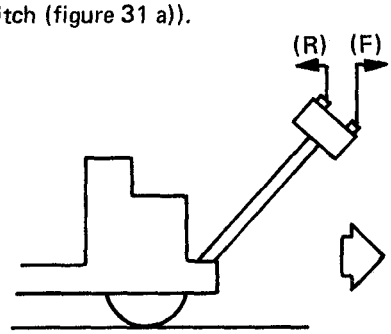


FIGURE 30

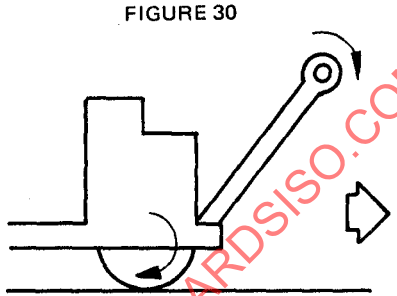
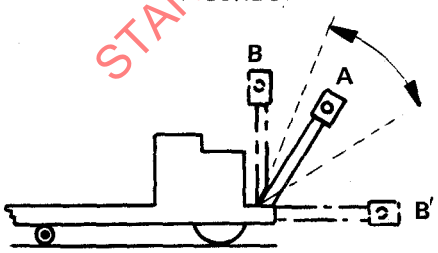


FIGURE 31



A : Brake off. Power available

B : Brake on. Power off.

B' : Brake on. Power off.

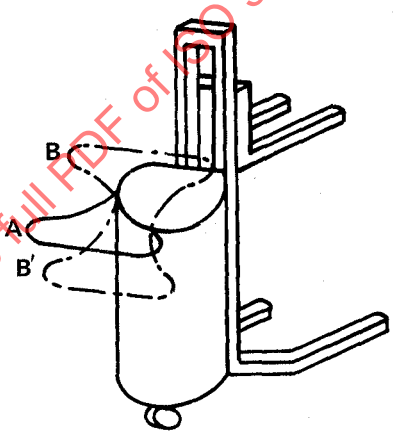
FIGURE 31 a)

When the brake is electrically operated, the release of the tiller or of the travel control switch shall automatically cut off the power and apply the brake (principle of "dead man" control), whatever the position of the handle.

NOTE — The requirements of 8.4.3.1.2 do not preclude controlled "free-wheeling" when the power is off.

8.4.3.2 INTERNAL COMBUSTION ENGINE POWERED TRUCKS (PEDESTRIAN CONTROLLED)

The tiller shall be movable in a vertical plane. Where the driving mechanism between the engine and wheels is mechanical (i.e. not generator motor drive), the brake shall be applied and the engine power disconnected from the wheel(s) when the tiller is moved above or below the horizontal (positions B or B' in figure 32).



B — B' : Brake on Power off

A : Brake off Power on

FIGURE 32

8.4.4 *High-lift order-picker trucks*

8.4.4.1 Controls shall be provided which will de-activate travel controls when the operator leaves the truck.

Means shall be provided to render inoperative all operating controls other than those on the elevatable platform when the controls on the elevatable platform have been selected for use. Only one location of controls shall be capable of being operated at one time.

Means shall be provided for an operator on the elevatable platform to shut off the power to the truck.

Travel controls shall be so arranged that the truck will move only when the direction and speed controls have been actuated. Travel speed shall be such that at all operating platform heights, the stability requirements of the relevant International Standards are complied with.

8.4.5 *Braking performance — All powered industrial trucks except industrial tractors*

See clause 7.

8.5 Controls for the movement of loads

8.5.1 *Control by levers*

8.5.1.1 LOCATION

The levers should preferably be located so as to be operated by the operator's right hand, and clearly separated from the drive controls.

Control levers should be clearly marked to indicate function. When graphic symbols are used they shall conform to ISO 3287 and each symbol shall be affixed on or in close proximity to the control lever to which it applies.

8.5.1.2 VERTICAL LEVERS

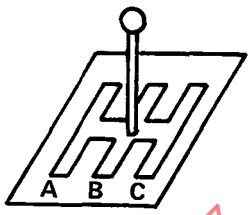
8.5.1.2.1 a) When the control levers are operated in a vertical plane, as shown in figure 33, that nearest to the operator (A) shall be for lifting and lowering the load, and the adjacent one (B) for tilting the load forward and backward. Other levers (C), if necessary, shall be used for controlling auxiliary devices.

Exception : The requirements of this clause do not apply to fork lift trucks equipped with retractable mast or forks. See 8.5.1.2.2.

A: Hoist
B: Tilt
C: Auxiliary

FIGURE 33

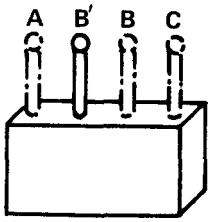
b) In the event of a single lever and gate being used, its sequence of operation shall be as indicated in 8.5.1.2.1 a) (figure 34).



A: Hoist
B: Tilt
C: Auxiliary

FIGURE 34

8.5.1.2.2 On fork lift trucks with retractable mast or fork. The first lever (A) shall be used for lifting and lowering the load and the second lever (B') shall be used for the displacement of the mast or forks. The third lever (B) shall be used for tilting, if provided, and the others (C) for auxiliary devices (figure 35).

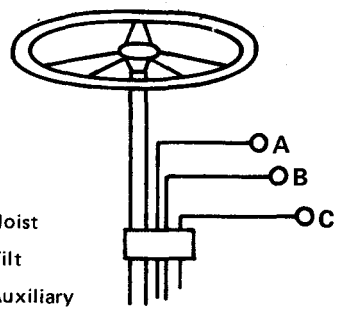


A : Hoist
B : Tilt
B' : Reach
C : Auxiliary

FIGURE 35

8.5.1.3 HORIZONTAL LEVERS

8.5.1.3.1 a) When the control levers are operated in a *horizontal plane* (under the steering wheel for instance), as shown in figure 36, the highest (A) shall be for lifting and lowering the load, that immediately below (B) for tilting the mast, and the others under this (C) for controlling auxiliary devices.



A: Hoist
B: Tilt
C: Auxiliary

FIGURE 36

b) In the event of a single lever and gate being used, its sequence of operation shall be as indicated in 8.5.1.3.1 a).

8.5.1.3.2 On fork lift trucks with retractable mast or fork, the second lever (B′) shall be used for the displacement of the mast or fork. The third lever (B) shall be used for tilting if provided, and the others (C) for auxiliary devices (figure 37).

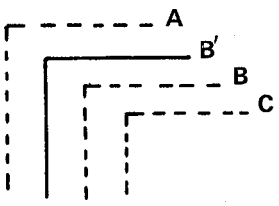


FIGURE 37

8.5.1.4 Movement

8.5.1.4.1 a) In the case of levers located as prescribed in 8.5.1.2 and 8.5.1.3, lifting shall be effected by pulling the lever (A), and lowering by pushing it. Backward tilt shall be effected by pulling the lever (B), and forward tilt by pushing it (figure 38).

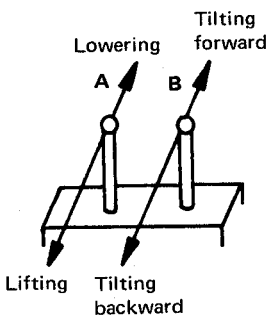


FIGURE 38

b) In the case of a single lever located under the steering wheel and working in a + *type selector gate,* its operation in the vertical plane shall be for lifting (UP (H) for lifting and DOWN (D) for lowering) and in the horizontal plane for tilting (PULL (E) for backward and PUSH (F) for forward tilting) (figure 39).

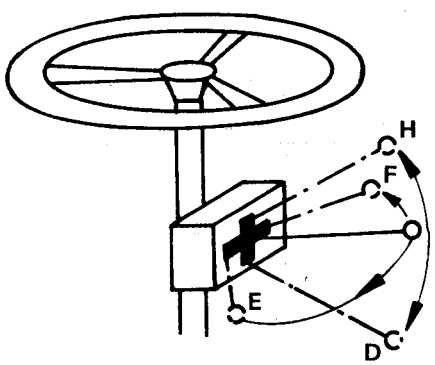


FIGURE 39

Considerable numbers of trucks have been built which are divergent from the prescriptions of 8.5.1.1 to 8.5.1.4. Such trucks may still be operated, provided that the function and mode of operation of the levers is clearly indicated.

8.5.1.4.2 On fork lift trucks with retractable mast or fork, retracting shall be effected by pulling the lever (B′) and extending by pushing it (figure 40).

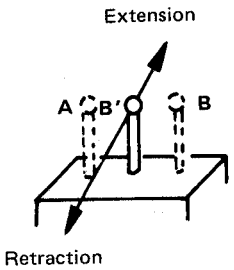


FIGURE 40

8.5.1.5 Auxiliary devices

The operation of control levers for auxiliary devices should be as far as possible instinctive.

Examples :

Clamps : pull lever to close arms, push lever to open arms (figure 41).

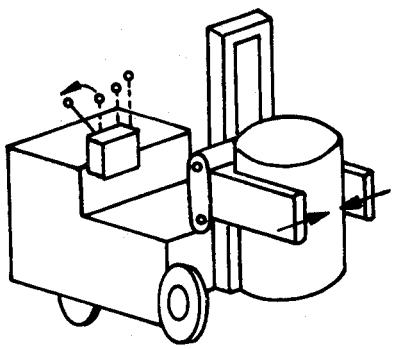


FIGURE 41

Rotating hand : pull lever to see the head rotate clockwise, push lever to see it rotate anti-clockwise (figure 42).

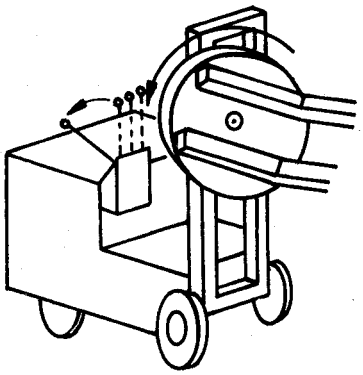


FIGURE 42

Tipping scoop : pull lever to return scoop, push lever to tip scoop (figure 43).

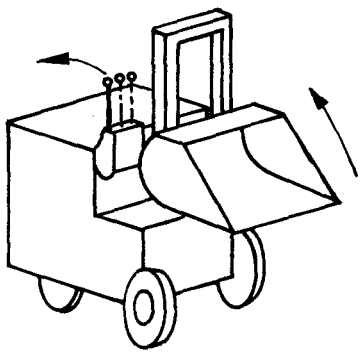


FIGURE 43

Side-shifter : pull lever to see fork shift to the right of the operator (figure 44).

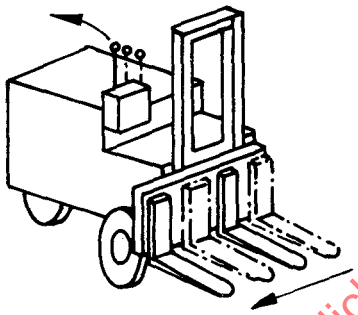


FIGURE 44

8.5.1.6 IDENTIFICATION

When there are several levers, the functions of each lever shall be clearly and durably marked to indicate the individual function.

8.5.1.7 SELF-CENTRING

All levers shall be self-centring.

8.5.2 *Control by push-buttons*

Where the operation of lifting, lowering, tilting and auxiliary devices is controlled by means of push-buttons, these buttons shall be neutralizing upon release and arranged so that pushing a button produces the same effect as moving a lever in that same direction relative to the operator. For example, actuating the rearward button (in relation to the operator's position) of a pair of buttons positioned in a line parallel to the longitudinal axis of the truck shall serve the same function as the motion of a control lever to the rear.

The function of each button shall be clearly and durably indicated.

8.5.3 *Rotary controls*

The upper surface of a rotary control device shall move in the same directional sense as levers.

8.5.4 *Special controls*

Special controls (such as for preselective or automatic devices) shall be identified and should preferably be in accordance with the above prescriptions.

9 CONTROL SYMBOLS

Symbols, when used, on powered industrial trucks shall be in accordance with ISO 3287.

10 REQUIREMENTS FOR POWER SYSTEMS AND ACCESSORIES

10.1 Non-hazardous atmospheres

10.1.1 *Internal combustion engine driven trucks (diesel, petrol and liquid petroleum gas (LPG))*

10.1.1.1 EXHAUST AND COOLING SYSTEMS

The exhaust system shall be arranged with due consideration for the comfort and well-being of the operator and other personnel. The air flow through the cooling system shall also be arranged in a manner to avoid discomfort to the operator.

10.1.1.2 FUEL TANK

A fuel tank shall not be located directly over the engine. If a tank is within or contiguous to the engine compartment, the tank and/or fill arrangement shall be isolated from the electrical and exhaust systems by a separate enclosure or by baffles.

The tank location and the facilities for filling shall be such that spillage or leakage will drain to the ground and not onto the engine or onto electrical or exhaust-system parts, or into the operator's compartment. Fuel spillage shall not be possible under operating conditions.

A fuel tank and fill fitting shall be so located as to minimize the possibility of damage to the tank or its fittings.

10.1.1.3 FUEL-SYSTEM COMPONENTS

All fuel-system components shall be firmly secured to the truck, and the fastenings arranged to minimize the effects of vibration.

10.1.2 *Additional requirements for internal combustion engine driven trucks using LPG*

10.1.2.1 CONTAINERS

10.1.2.1.1 The container(s) for LPG may be either permanently fixed on the truck or quickly removable. The

container(s) shall conform to the rules concerning pressure vessels in force in the country where the trucks are operated.

10.1.2.1.2 Containers shall be fitted on the truck in such a manner as to be protected against atmospheric corrosion, corrosion and from corrosive action of the products handled by the truck.

10.1.2.1.3 The containers shall be firmly secured to the truck, and the fastening shall be unaffected by vibration.

10.1.2.1.4 Containers, whether fixed or removable, shall be equipped with a device to prevent the sudden emission of a large volume of gas, particularly in the case of a pipe failure. The fuel take-off on the container shall be equipped with an easily accessible, manually operated valve. The fuel shall be taken off in liquid form unless the container and the engine are specially equipped for direct vapour withdrawal.

10.1.2.1.5 All containers shall have the following fittings :

a) A suitable safety pressure-relief valve connected to the vapour space of the container. Where such containers are fitted inside compartments of vehicles, the discharge side of the relief valve shall be piped to atmosphere.

b) A fixed maximum-level indicating device.

c) Where containers are fitted inside compartments of vehicles, the discharge side of any maximum-level indicating device which relies on bleeding gas to atmosphere shall terminate at a readily visible position on the outside of the vehicle.

1) The maximum-level indicating device which relies on bleeding to atmosphere shall be designed so that the bleed hole is not larger than 1,5 mm diameter and also that the parts of the device cannot be completely withdrawn in normal gauging operations.

2) All maximum liquid-level devices shall be suitable for the LPG in use and shall indicate the maximum product level which shall not exceed that permitted by regulations or recommendations applying in the country of use.

3) If a liquid-level gauge is fitted, it shall not vent to atmosphere.

10.1.2.1.6 If containers are installed in a compartment, this compartment shall have permanent openings at the top and bottom allowing adequate ventilation to ouside atmosphere.

10.1.2.1.7 When containers are removable, their fastening shall permit easy handling and easy checking of installation after the exchange of containers.

10.1.2.1.8 When removable containers are installed, they shall be so located on the truck that the safety pressure-relief valve (see 10.1.2.1.5) opening is always in communication with the vapour space (top) of the container. This may be accomplished by an indexing pin which positions the container when the container is properly installed.

10.1.2.1.9 If a spare or additional container is carried on the truck, it shall be secured in an approved fitting in accordance with 10.1.2.1.3 and 10.1.2.1.8.

10.1.2.1.10 It is recommended that weatherproof caps be provided in order to protect connections when containers are stored in the open.

10.1.2.2 PIPING

10.1.2.2.1 Connecting piping and all associated parts shall be easily accessible, protected against damage and wear, and flexible enough to withstand vibration and deformation in service. Pipework shall be so arranged that damage or leaks are easily detectable and shall be installed in such a way that it cannot be damaged by the hot parts of the engine. Fully rigid pipes for connecting the container to equipment on the engine shall not be used.

10.1.2.2.2 Hoses and all connections shall be capable of withstanding a pressure of 30 bar[1]. They shall be replaced at the first indication of damage or deterioration.

10.1.2.2.3 The container and its connections shall be installed in such a way that there are no projections outside the overall contour of the truck. Container connections shall be protected by a rigid guard.

10.1.2.2.4 Any section of pipework containing LPG between two shut-off valves, which may be closed, shall be protected against excessive pressure by means of a suitable pressure-relief valve.

1) 1 bar = 10^5 Pa = 10^5 N/m^2

10.1.2.2.5 The use of aluminium piping in the liquid lines is not permissible.

10.1.2.3 EQUIPMENT

10.1.2.3.1 The supply of gas shall be automatically cut off when the engine stops, whether or not the ignition system has been switched off.

10.1.2.3.2 For multi-fuel applications the system shall be designed to avoid the possibility of LPG entering any other fuel container, and each fuel source shall be cut off before the alternative one is opened.

10.1.2.3.3 Equipment shall be installed in such a manner that a safety pressure-relief valve or a liquid-level indicator cannot discharge on truck components which may be a source of ignition.

10.1.2.3.4 If corrosion would interfere with the proper functioning of a part, the part shall be provided with a corrosion-resistant protective coating.

10.1.3 *Electric trucks*

10.1.3.1 BATTERY

10.1.3.1.1 An air space of at least 30 mm shall be provided above the live terminals of the battery, or the cover shall be provided with an insulated lining.

A metal cover (of the battery or the battery compartment) shall have such strength and rigidity that, in conjunction with the air spacing provided between it and the battery terminals, the battery terminals are not short-circuited when a force of 980 N (220 lbf) is applied to an area 300 mm × 300 mm (12 in × 12 in) square located at the geometric centre of the cover.

Insulation, if used, shall be secured to the inner surface of a metal cover for the battery compartment.

10.1.3.1.2 Ventilation holes shall be provided in the battery container or compartment above the cells.

10.1.3.1.3 If there are openings in the cover, they shall be protected against the entrance of foreign bodies. The cover shall be rigid enough to obviate, in normal use, any distortion which might bring it into contact with live parts of the cells.

10.1.3.1.4 Batteries and containers shall be retained in the truck in such a manner as to prevent displacement during normal use.

10.1.3.2 CHARGING CONNECTORS

Charging connectors shall be arranged so that the battery is isolated from the various working circuits of the truck while it is being charged.

10.1.3.3 ELECTRICAL EQUIPMENT

When the truck is in operational condition, live parts shall be protected against accidental short-circuiting.

10.1.3.4 RESISTORS

All resistors shall be located so as to avoid overheating and damage.

10.2 Hazardous atmospheres

10.2.1 All industrial trucks for use in flammable and/or explosive atmospheres, as defined by the rules and regulations applying in the country of use, shall be designed or adapted in accordance with the requirements of such rules and regulations.

10.2.2 Such trucks shall be clearly marked with an appropriate type sign.

11 SYSTEMS AND COMPONENTS FOR LIFTING, TILTING AND OTHER MOVEMENTS

11.1 Lifting devices

11.1.1 *Mechanical lifting devices*

11.1.1.1 CHAINS, WIRE ROPES AND THEIR SECURING ELEMENTS

When used in lifting devices, these shall be of sound material and adequate strength and shall be free from visible defects.

11.1.1.2 EVALUATION OF FORK ARMS

Evaluation of fork arms shall be made on the basis of the following assumptions :

- a single load centrally and equally distributed;
- distribution of the load on the assembly of fork arms according to the laws of statics.

11.1.1.3 TECHNICAL CHARACTERISTICS OF FORK ARMS

Solid-section fork arms shall comply with ISO 2330 concerning technical requirements, methods of testing, etc., of fork arms.

11.1.1.4 SECURING OF FORK ARMS

Fork carriages and fork arms shall be designed and manufactured in such a way that :

- unintentional detachment of the fork arms from the fork carriage is prevented;
- unintentional lateral displacement or lateral detachment of the fork arms is prevented.

11.1.1.5 SECURING OF ATTACHMENTS

Attachments shall be designed and manufactured in such a way that

— unintentional detachment from the fork carriage is prevented;

— lateral displacement is prevented.

11.1.1.6 LIMITATION DEVICES

Power-driven lifting and lowering devices shall be equipped with means to prevent over-travel of the lead-carrier.

11.1.2 *Hydraulic lifting devices*

11.1.2.1 Lifting and lowering speeds shall be variable and under the control of the operator, except when a solenoid control is employed.

11.1.2.2 In the case of a break in the hydraulic tubing system, the lowering speed of the load carriage shall not, under any circumstances, exceed 1,0 m/s (3.3 ft/s).

11.1.2.3 For additional conditions, see clauses 14 and 15.

11.2 Tilting devices

11.2.1 The tilting speed of the mast shall be variable and under the control of the operator, except when a solenoid valve is employed.

11.2.2 For additional conditions, see 11.4.

11.3 Attachments

11.3.1 The movement of the attachment shall be variable and under the control of the operator, except when a solenoid control is employed.

11.3.2 For additional conditions, see 11.4.

11.4 Hydraulic systems

11.4.1 *Hoses, piping and unions*

These shall be of sound material and adequate strength and shall be free from visible defects.

11.4.2 *Relief valve*

All hydraulic systems shall be equipped with a pressure relief valve. If the relief valve is adjustable, it shall include means to protect it against both accidental loosening and unauthorized adjustment.

12 PROTECTIVE DEVICES

12.1 General

This clause specifies requirements for the protection of the operator; they shall apply equally to any passengers' places provided on the truck.

12.1.1 *Operator's location*

The operator's location shall be arranged and designed so that the operator remains within the plan outline of the truck when he is in his normal operating position.

Exception : Trucks having provision for pedestrian control.

The operator's location shall allow easy access and egress for the operator.

The floors and steps shall have slip-resistant surfaces.

NOTE — For the purpose of this clause, the term "operator's location" includes the location for a standing or a seated operator.

12.1.2 *Protection of operator*

Reasonable precautions shall be taken to minimize the risk of injury to the operator from moving parts when he is in his normal operating position. Such precautions shall be designed so that they do not unduly interfere with the operator's vision and/or freedom of movement.

12.2 Overhead guards

High-lift rider trucks shall be equipped with an overhead guard or shall have provisions for the attachment of an overhead guard.

The overhead guard and its attachments shall be capable of meeting the requirements of ISO . . . (in preparation).

12.3 Load backrest extension

High-lift trucks shall be designed so that they may be equipped with a load backrest extension.

12.4 Operator's platform

12.4.1 All operator's platforms on end-controlled trucks shall extend beyond the operator's position and be so designed that they withstand a compression force corresponding to the weight of the laden truck and applied along the longitudinal axis of the truck with the outermost projection of the platform against a flat vertical surface.

NOTE — For the purpose of this clause, the term "operator's platform" includes any surrounding reinforcement or parts of the truck which provide resistance to crushing of the platform.

12.4.2 Operator's platforms which overhang the truck shall be provided with guards at the side or front of the platform.

Exception : Trucks having provision for pedestrian control.

12.4.3 Operator's platforms which fold or pivot shall be equipped with provisions to prevent the unintentional folding or pivoting of this platform when the operator is standing on it.

12.4.4 Operator's platforms[1] which are at or can be elevated to a height greater than 1 m (40 in) above the ground shall be equipped with rails.

Rails shall be not less than 900 mm (36 in) or more than 1 100 mm (42 in) high measured from the upper surface of the rail to the platform and shall be capable of withstanding a force of 900 N (200 lbf) applied in any horizontal direction. Removable or hinged rails shall be constructed in such a manner that proper rail positioning is easily accomplished and a secured position is visibly discernible.

When a supplementary platform[1] (for example order-picking platform) is used, the rail on the open (load) side of the operator's platform may be omitted. When removable or hinged rails are provided or the rail on the open (load) side is omitted, other restraining means to protect the operator from falling shall be provided.

Means shall be provided to protect personnel in their normal working position from those moving parts of the truck which may represent a hazard.

12.5 Work platforms[1] (for maintenance purposes)

Work platforms (such as for maintenance purposes) used for elevating personnel shall be provided with means for attaching and securing the work platform to the elevating device.

12.5.1 Work platforms shall be provided with a slip-resistant surface, rails on the free side which meet the requirements of 12.4.4, toe boards having a minimum height of 100 mm (4 in) on all sides, and a guard against those moving parts of the truck which may represent a hazard.

12.5.2 The work platform shall meet the construction requirements set forth in ISO . . . (in preparation).

12.6 Wheel guards

Tyres which extend substantially beyond the confines of the truck chassis shall be effectively guarded to minimize the risk of injury to the operator, when he is in the normal operating position, from objects thrown up by the tyres.

12.7 Warning devices

Rider controlled industrial trucks shall be equipped with a clearly audible warning device.

13 ERGONOMIC AND OTHER ENVIRONMENTAL FACTORS

[Under study]

SECTION THREE : FOR THE APPLICATION, OPERATION AND MAINTENANCE OF POWERED INDUSTRIAL TRUCKS

14 OPERATING SAFETY RULES AND PRACTICES FOR THE USER AND THE OPERATOR

This clause establishes rules for the satisfactory operation of powered industrial trucks and is divided into two sub-clauses, 14.1 for the user and 14.2 for the operator.

14.1 For the user

The user is defined as the owner or the person or company to whom or to which the truck is hired.

14.1.1 *Operators' qualifications*

Only trained and authorized operators shall be permitted to operate powered industrial trucks.

Operators of powered industrial trucks shall be physically qualified, taking into account the requirements of the national governing body having jurisdiction.

14.1.2 *Operation in flammable and explosive environments*

Only industrial trucks of types approved for use in such environments by a responsible agency or national authority may be used.

Such trucks shall be clearly marked with an appropriate type sign and the building(s) or area(s) involved shall be similarly marked.

Classification of the environmental conditions of buildings or areas shall be determined by the user in consultation with a responsible agency or national authority.

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1) For guidance of the reader, definitions of a work platform, supplementary platform and operator's platform are set out below. It should be noted that they are for information only and will be co-ordinated by TC 110/SC 1.

work platform : A platform designed for mounting on the elevating device of a high-lift fork truck for the purpose of providing a safe working place.

operator's platform : That part of the truck from which the operator normally controls the truck.

supplementary platform : A load-carrying platform accessible from the operator's platform designed for mounting on the elevating device of a high-lift order-picking truck.

14.1.3 *Passengers*

Passengers shall not ride on trucks except where specific provision is made to accommodate them. Riding by passengers on the elevating mechanism or attachments is not permitted, except under the following conditions :

For a truck, other than a high-lift order-picker truck, when fitted with a work platform :

a) The platform construction shall meet the requirements of ISO . . . (under study).

b) The platform shall be secured to the lifting carriage and/or forks.

c) When personnel are on a platform not equipped with elevating controls, the operator shall be in the operator's position on the truck.

d) Only the elevating controls on the platform shall be used when personnel are on a platform equipped with elevating controls.

e) The combined weight of the platform, load and personnel shall not exceed one-half (1/2) the truck lifting capacity as indicated on the truck capacity plate.

f) The truck shall not be used to transport personnel on the platform. This shall not prohibit small positional adjustments necessary for the work in hand.

14.1.4 *Truck operation*

14.1.4.1 Capacity modifications and markings

The manufacturer's rated capacity of the truck shall not be exceeded.

Any design modifications and additions liable to influence capacity and operating safety shall be effected only after approval of the manufacturer.

Modifications arising from application of ancillary attachments shall be performed in such a manner that safety is not reduced and in accordance with the provisions of this safety code. Capacity, operation, and maintenance instruction plate, tags, or decals shall be changed accordingly.

The user shall ensure that all name-plates and markings are in place and are maintained in a legible condition.

14.1.4.2 Stability

The attention of the user is directed to clause 6 of this International Standard dealing with stability for guidance on truck operating conditions.

When properly operated, high-lift trucks which comply with clause 6 are stable. However, improper operation or faulty maintenance may produce a condition of instability.

Some conditions which may affect stability are : ground and floor conditions, grade, speed, loading, battery weight, dynamic and static forces, and the judgement exercised by the operator.

Loads shall be reduced as necessary when a truck is operated in conditions which differ from those designated as the normal operating conditions in the documents specified in clause 6.

Trucks equipped with attachments act as partially loaded trucks when operated without a load.

14.1.4.3 Protective requirements and devices

Trucks shall be of a colour which contrasts with the surroundings.

High-lift rider trucks shall be equipped with an overhead guard, with the exception, however, of high-lift rider trucks used where there is no risk of the load of goods falling on the operator.

When high-lift trucks are used to handle loads likely to fall on the operator (for example high or segmented loads), a load backrest extension having height, width and size of openings sufficient to minimize the risk of the load or parts of it falling towards the operator shall be used.

When operating conditions indicate, the trucks shall be equipped with additional warning devices such as lights and blinkers.

Steering knobs shall not be attached to the steering wheels of industrial trucks not originally provided with such items, unless approved by the manufacturer of the truck.

14.1.4.4 Fuel handling and storage

Trucks shall be refuelled only at locations designed for that purpose. The locations shall be ventilated to minimize the accumulation of flammable fumes. LPG containers shall not be filled, and removable LPG containers shall not be exchanged near open pits, underground entrances, elevator shafts or other similar areas.

Smoking shall be prohibited in refuelling areas; this shall be indicated by signs.

Liquid fuels, not dispensed from approved pumps, shall be handled in closed containers.

LPG containers shall be recharged or exchanged only by trained and designated personnel.

LPG containers shall be stored and transported with the service valve closed and the safety valve in direct communication with the vapour space of the container. The protective caps provided shall be fitted on the connections when containers are stored.

LPG containers shall be inspected to ensure that no vapour leakage exists before recharging and/or reusing. Particular attention shall be given to the valves and connections. Damaged containers shall not be used. Repairs may be made only by authorized films.

14.1.4.5 Battery charging and changing

Battery charging installations shall be located in areas designated for that purpose. Facilities shall be provided for flushing and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries.

Smoking shall be prohibited in charging areas; this shall be indicated by signs.

Only trained and authorized personnel shall change or charge batteries. Personnel maintaining batteries shall wear protective clothing.

All battery changing shall be carried out in accordance with manufacturers' instructions. When reinstalling batteries, means provided for correctly connecting, positioning and securing shall be used. Tools and other metallic objects shall be kept away from the top of uncovered batteries.

The battery of an electric truck shall not be replaced by another battery having a different voltage, weight or size, without specific authorization (by the original manufacturer of the truck, if possible).

Only batteries meeting the truck manufacturer's specifications shall be used. Means shall be provided for the safe changing of batteries. A properly insulated spreader bar shall be provided for use with any overhead hoist.

A chain hoist, if used, shall be equipped with a load-chain container. If a hand hoist is used, uncovered batteries shall be covered with a sheet of plywood or other non-conducting material to prevent the hand chain from shorting on cell connectors or terminals.

14.1.4.6 Defective or damaged trucks

If a powered industrial truck is found to be in any way unsafe or to contribute to an unsafe condition, it shall be removed from service until restored to a safe operating condition.

14.1.4.7 Accidents

The operator shall be required to report any accident involving injury, damage to building structures or equipment to the appropriate person at once.

14.1.5 *Operating conditions*

14.1.5.1 Aisles and stacking areas

Operating surfaces shall have sufficient load-carrying capacity and shall be maintained in such a manner as not to affect adversely the safe operation of the truck.

Transport aisles for trucks shall be arranged to provide good visibility and ease of truck cornering, and shall avoid inclines, steep ramps, narrow passages and low ceilings. Aisles shall be clearly outlined or defined.

In aisles where pedestrian traffic is likely to be encountered, aisle width shall be adjusted accordingly.

It is recommended that gradients do not exceed 10 %. Gradient shall provide for a smooth gradual change at top and bottom to prevent shocks to the load or fouling of the underside of the truck.

When permanent gradients exceed 10 %, it is recommended that markers be installed.

If, under travelling (i.e. transporting) conditions, the load obstructs visibility, trucks shall be driven with the load trailing.

> Exceptions : Under certain conditions (for example stacking or negotiating certain gradients) where movement with the load leading is required, the truck shall be driven with extreme care. Attention shall be given to providing such ancillary (auxiliary) means or additional persons as necessitated by the operating conditions.

Aisles, roadways, passageways, floors or ramps shall be maintained in good operating condition in order to prevent damage to the truck or load and not to impair the stability.

Hazardous conditions, including overhead obstructions, shall be prominently indicated.

Fire aisles, access to stairways, and fire equipment shall be kept clear.

14.1.5.2 Bridge plates and dockboards

All bridge plates or dockboards shall have an adequate safety margin to support loaded trucks. The maximum load shall be shown on the plates, clearly and permanently.

Bridge plates or dockboards shall be secured to prevent accidental movement, rocking or sliding.

Grab handles, or other effective means, shall be provided on bridge plates to permit safe handling. Where possible, fork loops or lugs should be provided for handling by fork trucks.

Bridge plates and dockboards should have a slip-resistant surface.

The sides of all bridge plates and, where practicable, dockboards shall be provided with means to minimize the possibility of trucks running over the edge.

When bridge plates or dockboards are in place, means shall be provided to guard against unintentional movement of the vehicle being boarded.

14.1.5.3 Lighting

Lighting of adequate intensity shall be provided in operating areas.

When lighting in the operating area is less than 32 lx, auxiliary lighting shall be provided on the truck.

14.1.5.4 Slinging of trucks

Slings shall be attached only at the points indicated by the truck manufacturer.

14.1.5.5 Simultaneous use of trucks

The simultaneous use of two trucks for handling heavy or cumbersome loads is a dangerous operation requiring special precautions. It shall be done only in exceptional circumstances, under the supervision of the person responsible for handling operations.

14.1.5.6 Lifts (Elevators)

It shall be ensured that lifts (elevators) used to transport powered industrial trucks will support the total weight of the truck, load, and operator. Such lifts (elevators) shall be designated, and operators instructed to use only designated lifts (elevators).

14.1.5.7 Operation in road vehicles (trailers) and railway cars

Before entering a road vehicle, it shall be confirmed that brakes have been applied and the wheels chocked to prevent movement.

Exception : Wheel chocks may not be required when the road vehicle is equipped with automatic positive locking spring-applied parking brakes.

When powered industrial trucks are driven on and off a semi-trailer not coupled to a tractor, supports may be necessary to prevent up-ending of the trailer.

Communications and procedures shall be instituted to prevent inadvertent movement of railway cars during loading and unloading operations.

It shall be ensured that the flooring system of road vehicles or railway cars will support the total weight of the industrial truck, load, and the operator. The flooring system shall be checked for breaks, holes or other defects.

While being operated on elevated docks and/or platforms, truck(s) shall not be used for moving cars. Truck(s) shall not be used for opening or closing railway car doors unless the truck(s) utilizes a device specifically designed for that purpose and the operator has been trained in its use.

14.2 For the operator

[Under study]

15 MAINTENANCE PRACTICES

15.1 General

The satisfactory operation of powered industrial trucks depends on careful maintenance. When maintenance is neglected, trucks can become a source of danger to personnel and property.

15.2 Maintenance items

Preventive maintenance, lubrication, and inspection of all powered industrial trucks shall be performed according to a scheduled system in conformity with the following items and, in particular, with the manufacturer's recommendations, which should accompany the truck when delivered.

Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect industrial trucks.

15.2.1 Brakes, steering mechanisms, control mechanisms, warning devices, lights, governors, and lift overload devices shall be maintained in a safe operating condition.

15.2.2 All parts of lift and tilt mechanisms and frame members shall be carefully and regularly inspected and maintained in a safe operating condition.

15.2.3 Safety guards and safety devices shall be inspected regularly and shall be maintained on the truck in a safe operating condition.

15.2.4 All hydraulic systems shall be regularly inspected and maintained.

Cylinders, valves and other similar parts shall be checked to ensure that neither internal nor external leakage has developed to the extent that it would create a hazard.

15.2.5 Batteries, motors, controllers and contactors, limit switches, protective devices, electrical conductors and connections shall be inspected and maintained in accordance with generally accepted good practice. Special attention shall be paid to the condition of electrical insulation.

15.2.6 Exhaust system and adjustment of carburettor, evaporator and fuel pump of combustion engine trucks shall be checked with regard to damage and leakage.

Caution : During maintenance, the operation of internal combustion engines in confined areas can produce noxious substances. Adequate ventilation is recommended when internal combustion engines are operated in such confined areas.

15.2.7 Pneumatic tyres shall be checked for deterioration of bearing surface, side walls, and rims. The inflation pressure specified by the truck manufacturer shall be maintained. Before demounting pneumatic tyres on split rims, precautions shall be taken to ensure that the internal pressure has been relieved.

15.2.8 The bonding of solid tyres to the metal bands or the rims shall be checked and foreign matter removed from the treads, if necessary.

15.2.9 All information and instruction plates and tags (decals) shall be maintained in a leglible condition.

15.2.10 The fuel system shall be checked for leaks and the soundness of all fittings. LPG systems shall be checked for leaks by using a soap solution. In the case of leakages in the fuel system, the truck shall be taken out of service and shall not be returned to service until all leaks have been remedied.

All LPG containers shall be examined before recharging, and all removable LPG containers shall be examined before re-use for the following defects or damage :

a) dents, scrapes and gouges;

b) damage to valves and liquid-level gauge;

c) debris in the relief valve;

d) damage to or loss of relief valve cap;

e) indications of leakage at valves or threaded connections;

f) deterioration, damage or loss of flexible seals in the filling or servicing connections.

Where defects and/or damage are discovered, containers shall not be used until all such defects and/or damage has (have) been satisfactorily remedied.

15.2.11 Any design modifications and additions liable to influence capacity and operating safety shall be effected only after approval of the manufacturer. Applicable identification plates and instructions shall be changed.

15.2.12 Special trucks or devices designed for hazardous areas and approved for use in hazardous areas shall receive special attention to ensure that maintenance preserves the original approved safe operating features.

15.2.13 All replacement parts shall be original parts or be of a quality at least equal to that provided in the original equipment.

15.2.14 Industrial trucks shall be kept in a clean condition to prevent fire hazards and ensure the detection of loose or defective parts. Attention shall be given to lifting and load-carrying devices, pedals, footsteps, and truck floor such that they are clean of grease, oil, dirt, etc.

15.3 Inspection

15.3.1 If during an inspection, any fault, wear or damage is observed that can cause a safety hazard, effective measures for correction shall be taken before the truck is placed into operation again.

15.3.2 A scheduled preventative maintenance, lubrication and inspection procedure should be followed. Those records determined to be necessary (or required by national authority) shall be maintained.

Annex B of this International Standard sets forth an example of a check form which may be used when inspecting a truck.

ANNEX A

LIST OF NATIONAL SAFETY REGULATIONS, CODES AND STANDARDS CONCERNING POWERED INDUSTRIAL TRUCKS

[Not part of the standard (see Foreword)]

The following list of National Regulations, Codes and Standards relating to the safety of powered industrial trucks is given for information and guidance, and only reflects information submitted by the country listed. For those countries not listed, contact their national authority or standards-making body.

A.1 BULGARIA

A.1.1 Regulations

Bulgarian Safety Code for the exploitation of industrial trucks, electrical and powered — D-05-002-72.

A.1.2 Standards

BDS — 8886-71, *Industrial trucks — Classification.*

BDS — 5644-70, *Industrial trucks — Series of basic parameters.*

BDS — 6460-72, *Industrial trucks — Technical requirements.*

BDS — 6461-72, *Industrial trucks — Methods of testing.*

BDS — 6481-67, *Industrial trucks — Arrangement of steering and driving devices.*

A.2 FINLAND

A.2.1 Regulations

Document VNP/711/72, *Inspection of industrial trucks.*

A.2.2 Standards approved by the National Board of Labour Protection

SFS 2677, *Industrial trucks. Designation of rated capacities for counterbalanced trucks.*

SFS 2678, *Industrial trucks. Stability test for counterbalanced trucks.*

SFS 2728, *Vehicle safety glasses. Requirements.*

SFS 2729, *Vehicle safety glasses. Test methods.*

SFS 2782, *Design conditions for industrial truck chassis with motors and lifting devices.*

SFS 3071, *Fork-lift trucks. Fork arms. Technical characteristics and testing.*

SFS 3072, *Fork-lift trucks. Hook-on type fork arms. Vocabulary.*

In Finland, all industrial trucks placed in service for the first time after 1974-01-01 must be approved by the National Board for Labour Protection. Inspection concerning overhead guards and measurement of noise is carried out by the Finnish State Technical Research Institute.

A.3 FRANCE

A.3.1 Regulations

Decree of 23 August 1947 setting out the public administration regulation on lifting appliances other than lifts and goods-lifts (elevators and freight elevators), as amended by the decrees of 9 September 1950 and 18 August 1962.

Order of 16 August 1951 establishing the conditions for the verification of lifting appliances other than lifts and goods-lifts (elevators and freight elevators), as amended by the order of 30 March 1962.

Order of 26 July 1961 concerning the safety measures applying to powered rider-controlled industrial trucks.

Circular 31 SS of 22 February 1962 concerning the safety measures applying to powered rider-controlled industrial trucks.

Circular TE 16.73 of 23 May 1973 concerning powered handling equipment with raisable driver's seat.

Technical note SEC/AL No. 12 of 25 April 1969 concerning the application of the provisions of the amended order of 16 August 1951 to lift-trucks.

Order of 20 November 1969 laying down the procedure for applying article R 168 of the Highway Code to special vehicles having a design speed of no more than 25 km/h (in particular, powered industrial trucks).

A.3.2 Safety code

Institut National de Recherche et de Sécurité INRS nº 459, *Utilisation des chariots automoteurs à gaz de pétrole liquéfié.* [*Use of industrial trucks powered by liquid petroleum gas.*]

A.3.3 Standards

NF H 96-101, *Chariots de manutention — Dimensions des chariots élévateurs à bras et des plates-formes.* [*Industrial trucks — Dimensions of hand-operated trucks and platforms.*]

NF H 96-301, *Chariots de manutention automoteurs — Règles générales de construction.* [*Powered industrial trucks — General construction rules.*]

NF H 96-302, *Chariots de manutention — Essais des protège-conducteurs.* [*Industrial trucks — Testing of operators protective devices.*]

NF H 96-401, *Chariots de manutention automoteurs — Chariots élévateurs travaillant en porte-à-faux, à conducteur porté — Règles générales.* [*Powered industrial trucks — Counterbalanced rider-controlled lift trucks — General rules.*]

NF H 96-402, *Chariots de manutention automoteurs — Stabilité des chariots élévateurs à fourche.* [*Powered industrial trucks — Stability of fork-lift trucks.*]

NF H 96-403, *Chariots élévateurs à fourches — Bras de fourche à section pleine — Type à tenons — Terminologie.* [*Fork-lift trucks — Solid section fork arms — Hook-on type — Terminology.*]

NF H 96-404, *Chariots élévateurs à fourches — Bras de fourche à section pleine — Type à tenons — Dimensions.* [*Fork-lift trucks — Solid section fork arms — Hook-on type — Dimensions.*]

NF H 96-405, *Chariots élévateurs à fourches — Bras de fourche à section pleine — Type à tenons — Caractéristiques et essais.* [*Fork-lift trucks — Solid section fork arms — Hook-on type — Requirements and tests.*]

NF H 96-406, *Chariots élévateurs à fourches — Caractéristiques dimensionnelles des tabliers porte-équipements.* [*Fork-lift trucks — Dimensional requirements for fork carriers.*]

NF H 96-502, *Chariots de manutention — Essais de stabilité des chariots rétractables ou à fourche entre longerons.* [*Industrial trucks — Stability tests for reach or straddle fork-lift trucks.*]

NF H 96-503, *Chariots de manutention — Essais de stabilité des chariots élévateurs à fourche recouvrante et des chariots élévateurs à plate-forme à grande levée.* [*Industrial trucks — Stability tests for pallet-stacker and high-lift platform trucks.*]

A.4 GERMANY

A.4.1 National safety regulations

A.4.1.1 *Laws and legal regulations*

Information may be obtained from

Der Bundesminister für Arbeit und Sozialordnung
D-5300 Bonn, Bonner Str. 85

Copies may be obtained from

Bundesanzeiger Verlag GmbH
D-5000 Köln

Gesetz über technische Arbeitsmittel vom 24. Juni 1968.
(Bundesgesetzblatt Teil I, Nr 42 vom 28. Juni 1968, S.717)
[Law on technical equipment, dated June 24, 1968.]

Allgemeine Verwaltungsvorschrift zum Gesetz über technische Arbeitsmittel vom 27. Oktober 1970.
(Bundesanzeiger Nr 205 vom 3. November 1970)
[General administrative order on the law on technical equipment, dated October 27, 1970.]

Verordnung über ortsbewegliche Behälter und über Füllanlagen für Druckgase.
(Druckgasverordnung – Druckgas V) vom 20. Juni 1969)
(Bundesgesetzblatt Teil I, Nr 42, vom 28. Juni 1969, S.730)
[Regulation on movable containers and on filling installations for compressed gases.]

Allgemeine Verwaltungsvorschrift zu § 14, Absatz 2, § 17, Absatz 4, § 18 and 19 der Verordnung über ortsbewegliche Behälter und über Füllanlagen für Druckgase vom 20. Juni 1968.
(Bundesanzeiger Nr 118 vom 29. Juni 1968)
[General administrative order on § 14, clause 2, § 17, clause 4, § 18 and § 19 of the regulation on movable containers and on filling installations for compressed gases, dated June 20, 1968.]

Verordnung über elektrische Anlagen in explosions-gefährdeten Räumen – in der Fassung vom 29. Januar 1968.
(Bundesgesetzblatt Teil I, Nr 8 vom 3. Februar 1968, S. 109)
[Regulation on electrical equipment in explosion-endangered rooms.]

Verordnung über die Beschäftigung von Frauen auf Fahrzeugen vom 2. Dezember 1971.
(Bundesgesetzblatt Teil I, Nr 136 vom 11. Dezember 1971, S.1957)
[Regulation on the occupation of women on vehicles.]

Information may be obtained from

Vereinigung der Technischen Überwachungsvereine
D-4300 Essen, Postfach 1790

Copies may be obtained from

Karl Heymanns Verlag
D-500 Köln

Technische Regeln Druckgase (TRG).
[*Technical rules on compressed gases.*]

Technische Regeln für brennbare Flüssigkeiten (TRbF) – Ausgabe August 1970.
(Beilage zum Bundesarbeitsblatt – Fachteil Arbeitsaschutz – Heft 8/1970.
[*Technical directives for flammable fluids.*]

A.4.1.2 *Safety regulations*

Information may be obtained from

Hauptverband der Gewerblichen Berufsgenossenschaften Zentralstelle für Unfallverhütung
D-5300 Bonn, Langwartweg 103

Copies may be obtained from

Karl Heymanns Verlag
D-5000 Köln

Unfallverhütungs-Vorschrift 12a-*Flurförderzeuge* (VGB 12a).
[Safety regulation 12a – *Industrial trucks.*]

Unfallverhütungs-Vorschrift 1 – *Allgemeine Vorschriften* (VBG 1)
[Safety regulation 1 – *General instructions.*]