BRITISH STANDARD

BS EN
1494:2001
Incorporating
Corrigendum No. 1

Mobile or movable jacks and associated lifting equipment

The European Standard EN 1494:2000 has the status of a British Standard

ICS 53.020.99

National foreword

This British Standard is the official English language version of EN 1494:2000, including corrigendum April 2001. It supersedes BS AU 172:1990 and BS AU 154:1989 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MHE/12, Lifting platforms, which has the responsibility to:

— aid enquirers to understand the text;

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

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

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

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 44, an inside back cover and a back cover.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1494

November 2000

ICS 53.020.10; 53.020.99

Incorporating corrigendum April 2001

English version

Mobile or movable jacks and associated lifting equipment

Crics mobiles ou déplacables et équipements de levage associés

Fahrbare oder ortsveränderliche Hubgeräte und verwandte Einrichtungen

This European Standard was approved by CEN on 18 October 2000.

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

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

Ref. No. EN 1494:2000 E

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 98, Lifting platforms, the Secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by May 2001, and conflicting national standards shall be withdrawn at the latest by May 2001.

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

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

Generally any standards/draft standards that are published after June 1995 are not referred to in this standard. Excepted are revisions of (draft) standards in case the original (draft) standards had been published before that date.

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

Introduction

This standard is a type C standard as stated in EN 292.

This standard has been prepared to be a harmonized standard to provide one means of conforming with the essential Safety Requirements of the Machinery Directive and associated EFTA Regulations.

The object of this European Standard is to define rules for safeguarding persons against the risk of accidents associated with the operation of mobile or movable jacks.

The extent to which hazards are covered is indicated in the scope of this standard. In addition, machinery should comply as appropriate with EN 292 for hazards which are not covered by this standard.

While producing this standard it was assumed that:

- only trained persons operate the lifting equipment;
- the working area is adequately lit;
- harmful materials such as asbestos are not used;
- components are kept in good repair and working order;

- by design of the load bearing elements a safe operation of the machine is assured for loads up to 100 % of the rated load and during the tests under the conditions given by the manufacturer;
- a negotiation for special uses took place between the user and the manufacturer;
- components without specific requirements are;
    a) designed in accordance with the usual engineering practice and calculation methods, including all failure modes;
    b) of sound mechanical and electrical construction;
    c) made of materials with adequate strength and of suitable quality.

1 Scope

This European Standard specifies technical safety requirements and measures for mobile or movable jacks (see 3.6) and associated lifting equipment.

This European Standard deals with all significant hazards pertinent to mobile or movable jacks and associated lifting equipment when they are used as intended and under the conditions foreseen by the manufacturer. This European Standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards.

This standard applies to lifting equipment (see 3.1) which is mobile or movable and designed to operate under the load, whether operated singulary or in multiples, to partially or totally raise and lower loads or vehicles at one or more lifting points (excluding the lifting of persons) where working under the raised load is not permitted unless additional means of securing the load in position are in place.

Note: Associated lifting equipment means lifting equipment which is similar to those defined in 3.1, but which does not fully comply with these definitions.

This standard does not establish additional requirements for:

- power drive by an internal combustion machine;
- stability of the mobile or movable jacks and associated lifting equipment;
- operation in severe conditions (e.g. extreme climates, freezer application, strong magnetic fields);
- operation subject to special rules (e.g. potentially explosive atmospheres, mines);
- supply by electrical networks where the tolerances in voltage, frequency, etc., differ from those in the public supplies;
- static electric problems;
- handling of loads, the nature of which could lead to dangerous situations (e.g. molten metal, acids, radiating materials, especially brittle loads);
- hazards occurring during production and decommissioning;
- hazards occurring when using the lifting equipment on public roads;
- wind pressure in and out of use;

- direct contact with foodstuffs;
- operation on sea ships.

This standard applies, for example, to the following lifting equipment:

- mechanical jacks with or without claws;
- hydraulic jacks with or without claws and with or without intergrated pumps, e.g. hydraulic trolley jacks, hydraulic transmission jacks, hydraulic pit jacks;
- pneumatic jacks.

This standard does not apply to:

a) jacks or stabilizers which are permanently fixed to a trailer or a container to support a trailer or container without the tractor-unit;
b) hydraulic cylinders which are permanently fixed to the vehicle for tipping and/or tilting parts of it;
c) support stands with the possibility for changing the lift height only without the load;
d) hydraulic lifting equipment working with a maximum pressure exceeding 500 bar and where pump and cylinder are not intergrated parts of the same equipment;
e) jacks that are delivered with road vehicles for helping when a break-down occurs (including delivery of original spare parts).

2 Normative references

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

EN 292-1:1991 *Safety of machinery — Basic concepts, general principles of design — Part 1: Basic terminology, methodology.*

EN 292-2:1991 *Safety of machinery — Basic concepts, general principles of design — Part 2: Technical principles and specifications.*

EN 349 *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body.*

EN 811 *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs.*

EN 954-1:1996 *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design.*

EN 1070:1998 *Safety of machinery — Terminology.*

EN 60204-32 *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:1998).*

EN 60947-5-1:1997 *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices (IEC 60947-5-1:1997).*

EN 61496-1:1997 *Safety of machinery — Electro-sensitive protective devices — Part 1: General requirements and tests (IEC 61496-1:1997).*

EN ISO 4871 *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996).*

EN ISO 11201:1995 *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995).*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1
lifting equipment
device which permits a load to be raised, lowered or moved

Lifting equipments within the meaning of this standard are:

3.1.1
mechanical jack
jack in which the load is moved by means of mechanical devices, e.g. rack and pinion jack, screw type bottle jack or mechanical elevator such as a mechanical transmission jack. The jack can also be equipped with claws

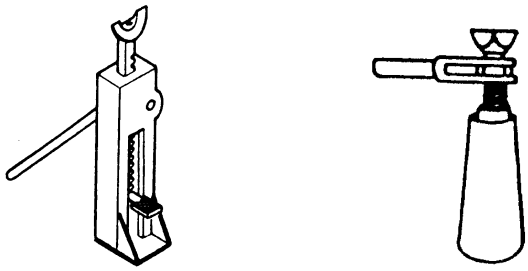


Figure 1 — Examples of mechanical jacks

3.1.2

hydraulic jack
jack in which the load is moved by means of hydraulics

Note: All types of hydraulic jacks can also exist, in principle, as pneumatic jacks.

3.1.2.1

hydraulic jack with integrated pump
hydraulic jack where the pump is integrated into the jack

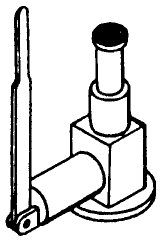


Figure 2 — Example of hydraulic jack with integrated pump

3.1.2.2

hydraulic jack without integrated pump
hydraulic jack where the pump is not integrated into the jack

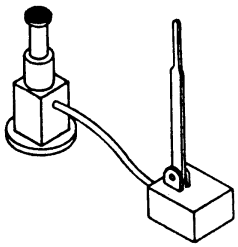


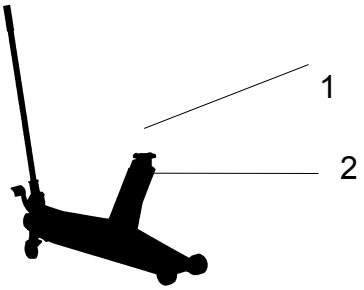
Figure 3 — Example of hydraulic jack without integrated pump

3.1.2.3

hydraulic claw jack
hydraulic jack equipped with a claw. This does not exclude an additional lift pad

3.1.2.4

hydraulic trolley jack
manually movable trolley device of which the carried load is set in vertical movement by a hydraulic system



Key
1 lift pad
2 lifting beam

Figure 4 — Example of hydraulic trolley jack

3.1.2.5

hydraulic transmission jack
hydraulic jack, mobile freely on the ground, designed to lift loads or to partially lift vehicles

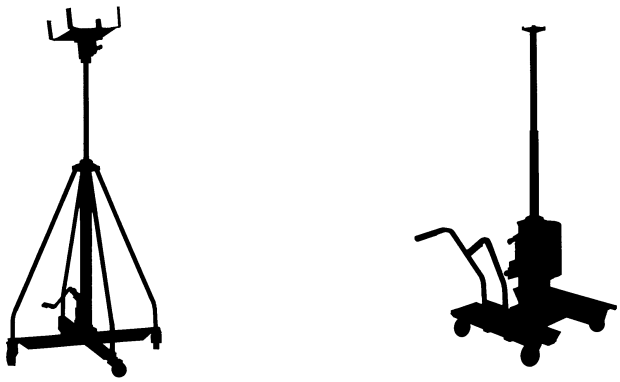


Figure 5 — Examples of hydraulic transmission jacks

3.1.2.6

hydraulic pit jack
rail guided hydraulic jack on cradle designed to lift loads or to partially lift vehicles

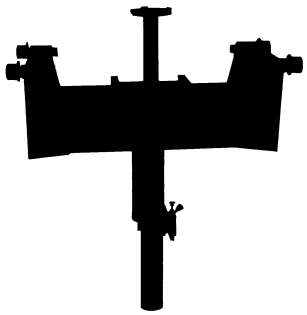


Figure 6 — Example of hydraulic pit jack

3.1.3

pneumatic jack
jack of which the carried load is set in vertical movement by a pneumatic system (see note in 3.1.2)

3.2 power sources for lifting equipment

3.2.1

manual
drive results on muscular force

3.2.2

pneumatic
drive results on gaseous substances under pressure

3.2.3

hydraulic
drive results on hydraulic fluid under pressure

3.2.4

electric
drive results on electrical energy

3.3

power driven jack
jack in which the drive does not result on muscular force

3.4

stroke
maximum powered vertical distance that the lifting point can cover

3.5 loads

3.5.1

rated load
maximum load that a lifting equipment has been designed to carry throughout the whole stroke when operated as intended by the manufacturer and which is marked on the load plate

3.5.2

maximum possible load
maximum load that a lifting equipment complying with the requirements of this standard is able to carry due to the setting of the load limiting device

3.6 change of place

3.6.1

movable
jack designed not to move or to be moved whilst under load (will when unloaded)

3.6.2

mobile
jack designed to move or be moved whilst under load

3.6.3

restraint guided
mobile or movable jack which only can be moved within a guiding

3.7

hold to run control
control device which initiates and maintains operation of machine elements only as long as the manual control (actuator) is actuated and the manual control (actuator) automatically returns to the stop position when released (see 3.23.2 of EN 292-1:1991 and 3.26.3 of EN 1070:1998)

3.8 braking of the load supporting device

3.8.1

automatic brake
braking device which is normally held on and which is released only by application of power. Operation is also instigated automatically by releasing the controls of the jack and by interruption of the power supply

3.8.2

self braking drive
drive to stop automatically the movement of the load supporting device, unloaded as well as loaded with rated load, also after running-in, e.g. by a self braking spindle

3.8.3

load pressure brake
braking force depends on the load and increases proportionally to the load

3.9

lift pad
load carrying part of the jack

3.10

claw
side fitted load bearing point

4 List of hazards

The following hazards from annex A of EN 414 are applicable in the situation described and could involve risks to persons if not reduced or eliminated. The corresponding requirements are designed to limit the risk or reduce these hazards in each situation.

Table 1 — List of hazards

Hazards		Corresponding requirement
1	Mechanical hazards:	
1.1	crushing hazards	5.6.1, 5.6.2, 5.14
1.2	shearing hazard	5.6.1, 5.6.2, 5.14
1.3	cutting or severing hazard	5.6.1, 5.6.2, 5.14
1.4	entanglement hazard	not applicable
1.5	drawing-in or trapping hazard	not applicable
1.6	impact hazard	5.6.6, 5.7
1.7	stabbing or puncture hazard	not applicable
1.8	friction or abrasion hazard	not applicable
1.9	high pressure fluid injection hazard	5.5.3.7, 5.5.3.8
1.10	ejection of parts (of machinery and processed materials / workpieces)	not applicable
1.11	loss of stability (of machinery and machine parts)	5.9, 5.10, 5.11, 5.20.1, 5.20.6
1.12	slip, trip and fall hazards in relationship with machinery (because of their mechanical nature)	not applicable
2	Electrical hazards:	
2.1	electrical contact direct or indirect	5.15
2.2	electrostatic phenomena	not applicable
2.3	thermal radiation or other phenomena such as ejection of molten particles, and chemical effects from short-circuits, overloads, etc.	5.15
2.4	external influences on electrical equipment	5.15

Table 1 — List of hazards *(continued)*

Hazards		Corresponding requirement
3	Thermal hazards resulting in:	
3.1	burns and scalds, by a possible contact of persons, by flames or explosions and also by the radiation of heat sources	5.12
3.2	health-damaging effects by hot or cold work environment	not applicable
4	Hazards generated by noise:	
4.1	hearing losses (deafness), other physiological disorders (e.g. loss of balance, loss of awareness, etc.)	annex A
4.2	interference with speech communication, acoustic signals, etc.	annex A
5	Hazards generated by vibration (resulting in a variety of neurological and vascular disorders).	not applicable
6	Hazards generated by radiation, especially by:	
6.1	electrical arcs	not applicable
6.2	lasers	not applicable
6.3	ionizing radiation sources	not applicable
6.4	machines making use of high frequency electromagnetic fields	not applicable
7	Hazards generated by materials and substances processed, used or exhausted by machinery:	0, 5.10
7.1	hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dust	not applicable
7.2	fire or explosion hazard	not applicable
7.3	biological and microbiological (viral or bacterial) hazards	not applicable

Table 1 — List of hazards *(continued)*

Hazards		Corresponding requirement
8	Hazards generated by neglecting ergonomic principles in machine design (mismatch of machinery with human characteristics and abilities) caused for example by:	
8.1	unhealthy postures or excessive efforts	5.13, 5.16
8.2	inadequate consideration of human hand-arm or foot-leg anatomy	not applicable
8.3	neglected use of personal protection equipment	not applicable
8.4	inadequate area lighting	0
8.5	mental overload or underload, stress, etc.	not applicable
8.6	human error	5.6.1, 5.6.2, 5.6.3, 5.6.4, 5.6.5, 5.6.6
9	Hazards combinations	not applicable
10	Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders:	
10.1	failure of energy supply (of energy and/or control circuits)	5.8.4
10.2	unexpected ejection of machine parts or fluids	5.5.3.1, 5.5.3.7, 5.5.3.8
10.3	failure/disorder of control system (unexpected start up, unexpected overrun)	5.6.1, 5.8.1, 5.8.3
10.4	errors of fitting	7.1.3
10.5	overturn, unexpected loss of machine stability	7.1.2

Table 1 — List of hazards *(continued)*

Hazards		Corresponding requirement
11	Hazards caused by (temporary) missing and/or incorrect positioned safety related measures/means:	
11.1	all kinds of guard	not applicable
11.2	all kinds of safety related (protection) devices	7.1.2, 7.1.3
11.3	starting and stopping devices	7.1.2, 7.1.3
11.4	safety signs and tags	5.6.3
11.5	all kinds of information or warning devices	7.1, 7.2
11.6	energy supply disconnecting devices	5.15
11.7	emergency devices	5.1.4, 5.6.7
11.8	feeding/removal means of workpieces	not applicable
11.9	essential equipment and accessories for safe adjusting and/or maintaining	5.8.1, 5.17.2
11.10	equipment evacuating, gases, etc.	not applicable
	Hazards due to mobility	
12	Inadequate lighting of moving/working area	0
13	Hazards due to sudden movement, instability, etc., during handling	5.20.6
14	Inadequate/inergonomic design of driving/operating position:	
14.1	hazards due to dangerous environments (contact with moving parts, exhaust gases, etc.)	not applicable
14.2	inadequate visibility from driver's/operator's position	5.6.5
14.3	inadequate seat/seating (seat index point)	not applicable
14.4	inadequate/inergonomic design/positioning of controls	5.13
14.5	starting/moving of self-propelled machinery	not applicable
14.6	road traffic of self-propelled machinery	not applicable
14.7	movement of pedestrian controlled machinery	not applicable

Table 1 — List of hazards *(concluded)*

Hazards		Corresponding requirement
15	Mechanical hazards:	
15.1	hazards to exposed persons due to uncontrolled movement	not applicable
15.2	hazards due to break-up and/or ejection of parts	5.8.2, 5.8.4
15.3	hazards due to rolling over (deflection limiting volume; DVL)	not applicable
15.4	hazards due to falling objects	5.18.1
15.5	inadequate means of access	not applicable
15.6	hazards caused due to towing, coupling, connecting, transmission, etc.	5.13
15.7	hazards due to batteries, fire, emissions, etc.	not applicable
	Hazards due to lifting operation	
16.1	Lack of stability.	5.9
16.2	Derailment of machinery.	5.5.1, 5.5.2
16.3	Loss of mechanical strength of machinery and lifting accessories.	5.5.3.1, 5.5.4.1, 5.10
16.4	Hazards caused by uncontrolled movement.	5.1, 5.2
16.5	Hazards due to falling loads	5.18.1
17	Inadequate view of trajectories of the moving parts	5.6.5
18	Hazards caused by lighting	not applicable
19	Hazards due to loading/overloading	5.4

5 Safety requirements

5.1 Braking device

5.1.1 General

Jacks shall be designed or equipped in a way that the load can be restrained and held. Unintentional descent shall be prevented.

This requirement may be fulfilled, for example, by:

a) self-blocking drives for manually driven jacks and self braking drives for power driven jacks;
b) automatic brakes;
c) a load pressure brake in conjunction with a blocking device, e.g. automatically engaging pawls;
d) non-return valves at the supporting cylinder.

“Automatically engaging” means that a pawl is forced to drop into place by reason of its design or through the force of a spring. For the use of springs see 5.8.4.

Note: Descent of the load when the supply of energy is interrupted or irregular is regarded as unintentional descent. Lowering the load, e.g. by opening the brake with the control device is regarded as intentional descent.

5.1.2 Dimensioning

Braking mechanisms shall be constructed in a way that the forces generated during braking can be safely restrained by the jack in any position of the load carrying device.

5.1.3 Interruption of the power flow

There shall be no device between the load carrying device and the braking device which can interrupt the power flow.

5.1.4 Automatic operation

Braking mechanisms shall operate automatically after the control device has returned to the “Off” position or when the drive power is interrupted or when the mechanisms described in 5.4 and 5.5.2.2 have responded.

Note: Return to the “Off” position means for manually driven jacks when no operating force is applied.

5.1.5 Alterations

Braking mechanisms shall be designed in a way that the operator cannot alter their constructionally defined effect without the aid of tools.

5.2 Security against dropping

On manually driven hydraulic and pneumatic jacks it shall be possible for the operator to regulate the lowering speed or stop the lowering at any load up to the rated load.

5.3 Speeds
The maximum admissible average speed of descent for a jack, loaded with the rated load, is 0,15 m/s.

5.4 Security against overloading
Hydraulic and pneumatic jacks with a rated load of more than 100 kg and power driven mechanical jacks with a rated load of 1 000 kg at least shall be fitted with security devices against overloading.

This requirement can be fulfilled, for example, by:

a) torque limiters;
b) pressure relief valves;
c) limitation of driving energy.

These devices shall be set to the lowest possible value between 100 % and 125 % of the rated load. These devices shall be protected against unauthorized adjustment.

5.5 Transmission systems

5.5.1 Security of guides
Jacks shall be so equipped that rackstrips, spindles or pistons cannot unintentionally loosen from their guides.

This requirement shall be fulfilled in the case of cylinders if the piston is mechanically prevented from coming out of the cylinder.

5.5.2 End stops

5.5.2.1 Limitation of end positions
Each end position of jacks shall be limited mechanically or hydraulically. The forces generated when reaching the end positions shall be absorbed safely by the jacks. It shall not be possible to put these end-stop mechanisms unintentionally out of action.

5.5.2.2 End-stop mechanism
If power-driven jacks are provided with an automatic end-stop mechanism to limit the upwards and downwards travel, the movement in the opposite direction shall still be possible when the automatic mechanism has responded.

Such end-stop mechanisms may be, for example:

a) end-stop switches fulfilling the requirements of chapter 3 of EN 60947-5-1:1997 which are fitted in such a way that overshoot is taken into account; or
b) slip clutches which are fitted to limit the working travel safely; or
c) pressure relief valves which are fitted in hydraulic or pneumatic systems to limit the working travel.

5.5.2.3 Height adaption spindle
Load carrying devices fitted with a height adaption spindle shall be provided with an automatic operating spindle travel stop which prevents turning out.

5.5.3 Additional requirements for hydraulic jacks

5.5.3.1 Dimensioning
Cylinders, pipes and their connections which can be exposed to the maximum pressure limited by the pressure relief valve shall resist at least two times this pressure without showing permanent deformations. Hoses and their connections shall be dimensioned to resist a bursting pressure that is at least three times the set pressure of the pressure relief valve.

5.5.3.2 Pressure relief valve
A pressure relief valve shall be fitted between the pump and the non-return valve. The adjustment of the pressure relief valve only shall be possible by means of tools and it shall be secured against unauthorized adjustment. The allowed tolerance of the adjustment is between 100 % and 125 % of the rated load. The pressure relief valve shall be adjusted to the lowest possible value.

5.5.3.3 Bleeding the hydraulic system
In the hydraulic system, means shall be provided to remove entrapped air.

5.5.3.4 Cleanliness of system medium
Every refillable hydraulic system shall have adequate means (e.g. filters) to aid the proper and continued working of the safety devices.

5.5.3.5 Refilling hydraulic fluid
Hydraulic jacks shall be provided with refilling openings to enable refilling without the spillage of hydraulic fluid.

5.5.3.6 Fluid tank
To prevent gas cushion in the hydraulic cylinders the fluid tank shall contain the maximum displaced volume necessary to operate the cylinder at its full stroke, +10 % at least.

5.5.3.7 Protection against escaping hydraulic fluid
Apertures in jacks, for example, those serving to limit the piston movement, and from which hydraulic fluid can escape during operation, shall be secured in such a way that persons cannot be injured by the escaping hydraulic fluid.

5.5.3.8 Allocation of hoses and pipes
All connecting parts the failure of which can endanger persons by escaping hydraulic fluid shall be adequately covered.

5.5.4.1 Additional requirements for pneumatic jacks

5.5.4.1 Dimensioning
Cylinders, pipes and their connections which can be exposed to the maximum pressure limited by the pressure relief valve shall resist at least two times this pressure without showing permanent deformations. Hoses and their connections shall be dimensioned to resist a bursting pressure that is at least three times the adjusted pressure of the pressure relief valve.

5.5.4.2 Pressure relief valve

A pressure relief valve shall be fitted between the compressor and the non-return valve. The adjustment of the pressure relief valve shall only be possible by means of tools and it shall be secured against unauthorized adjustment. The allowed tolerance of the adjustment is between 100 % and 125 % of the rated load. The pressure relief valve shall be adjusted to the lowest possible value.

5.5.4.3 Pressure reduction

If the pressure of the compressed air supply is greater than the adjusted pressure of the pressure relief valve, a device that will reduce adequately the generated pressure automatically shall be installed.

5.5.4.4 Cleanliness of system medium

Every pneumatic system shall have adequate means (e.g. filters) to aid the proper and continued working of the safety devices.

5.5.4.5 Drive by exhaust fumes

Jacks driven by exhaust fumes of internal combustion machines shall resist the special stresses (especially temperature and chemical influences).

5.6 Control devices

5.6.1 Hold to run control

Control devices for setting power driven jacks in motion shall be of the hold to run type.

5.6.2 Unintentional operation

Control devices for power driven jacks shall be protected against unintentional operation.

5.6.3 Identification

The direction of movement caused by the control device shall be identified in a durable, unambiguous and easily recognizable manner.

The direction of motion can be identified by symbols or words. The identification can be attached to the control device itself or immediately alongside it.

5.6.4 Obviousness

For power driven jacks and, wherever possible for manually driven jacks, the direction of operation of the controls and of the movements they cause shall be arranged in an obvious relationship to one another.

Preferably this requirement may be fulfilled, for example, for raising and lowering movements:

a) in the case of buttons, if the button for the raising movement is arranged above the button for the lowering movement, or if the button for the raising movement is arranged on the right and the button for the lowering movement on the left (see Figure 7);

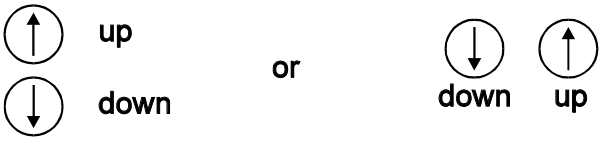


Figure 7 — Arrangement of buttons

b) in the case of foot-control, if the control device for the raising movement is on the right and for the lowering movement on the left (see Figure 8);

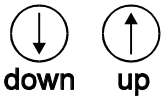
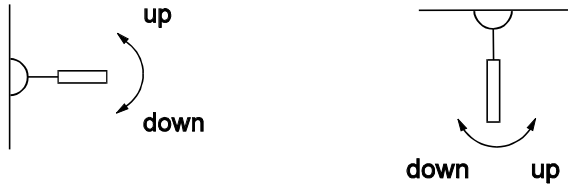


Figure 8 — Arrangement of foot controls

c) in the case of horizontal levers;

- if the upwards movement of the lever generates the raising movement and the downwards movement of the lever the lowering movement (see Figure 11);

- if the movement of the lever to the right generates the raising movement and the movement of the lever to the left the lowering movement (see Figure 9);



Side elevation Plan view

Figure 9 — Movement of horizontal levers

d) in the case of vertical levers, if the movement of the lever towards the human body generates the raising movement and the movement of the lever away from the human body the lowering movement (see Figure 10);

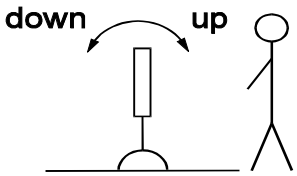


Figure 10 — Movement of vertical levers

e) in the case of wheels, if turning the wheel to the right generates the raising movement and turning it to the left generates the lowering movement (see Figure 11).

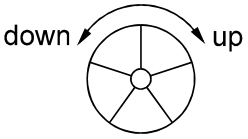


Figure 11 — Movement of hand wheels

5.6.5 Visibility

The operator's position shall give the operator a clear view of the hazardous parts of the jack and its load at all times through its vertical movement. If the operator's position is not determined by the manufacturer, see clause 7.

5.6.6 Control devices of manually operated jacks

Control devices of manually operated jacks shall be equipped in such a way that:

a) winding handles, levers, or wheels cannot turn back under load more than 15 cm, measured at the greatest radius of the control (reversal security). Reversal security shall not be necessary for hand-wheels if these take the form of complete smooth disc wheels shut and without any other handles;
b) the direction of rotation of winding handles remains the same regardless of gearing; and
c) removable winding handles, levers, and hand-wheels shall be secured against slipping and unintentional removal from the drive shaft.

Requirement c) may be fulfilled, for example:

- if securing mechanisms such as snap-in latches or locking springs are fitted; or

- for winding handles or levers up to a length of 250 mm if they can be pushed into their shafts at least to one-fifth of their own lengths (see Figure 12).

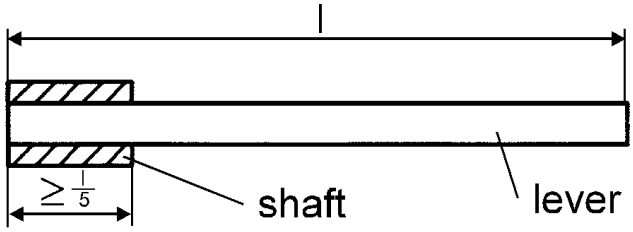


Figure 12 — Minimum length of lever in a shaft

5.6.7 External power supply

If an external power supply is used there shall be means to disconnect the power and to secure them against unallowed re-connection.

5.7 Combined manual and power-operated jacks

Jacks capable of being both manually operated and driven by power shall be designed in such a way that no-one can be put in danger by movements of the manual controls when the power drive is on.

This requirement may be fulfilled if:

a) the manual drive is automatically uncoupled when the power drive is on; or
b) power and manual operation are covered by an interconnected locking mechanism; or
c) completely smooth discs without any other handles are fitted.

5.8 Requirements for safety mechanisms

5.8.1 Adjustments

The braking device mentioned in 5.1, the security device against overloading mentioned in 5.4 and the reversal security device mentioned in 5.6.6 shall be designed and constructed in such a way that adjustment is impossible without the aid of tools.

This requirement is, for example, fulfilled in the case of jacks with removable winding handles or levers if a reversal and a braking device are integrated parts of the jack.

This requirement is fulfilled on safety devices with safety catches in case the safety catch cannot be brought out of operation, e.g. by a special styling or by the use of covers.

5.8.2 Materials

Ratchet pawls, fixing wheels, and similar locking mechanisms shall be so constructed that neither a breakage after a period of time or through brittleness need be feared nor plastic deformations occur by reason of the toughness of the material used.

5.8.3 Effects of weather and dirt

The safety devices on jacks shall be constructed and fitted in such a way that they cannot be put out of action by the effects of the weather or by dirt when used as intended by the manufacturer.

This requirement may be fulfilled, for example, by:

a) encapsulating;
b) choise of material;
c) design.

5.8.4 Breakage of springs

Failure of a spring shall not make safety devices inoperative.

This requirement may be met, for example, by:

a) the installation of a number of springs if, in the event of one spring failing, the remaining springs provide sufficient retaining power;
b) the use of compression springs with both ends fixed or by selection of springs such that the wire diameter is greater than the distance between the coils, hence preventing the two pieces from winding into each other in the event of a breakage. Furthermore, compression springs shall be guided to prevent them buckling or the ends becoming displaced during use.

Note: In the case of springs that are under static pressure, e.g. in slip clutches, it is assumed that no spring breakage will occur.

5.9 Lift pad

The lift pad shall have a rough surface or be designed in such a way to counteract any tendency of the load to slip off.

By design the projection of the lift pad shall always be within the tipping lines of the jack. This requirement does not apply to claws at the side of the jack.

5.10 Structural design

All manually operated mechanical jacks defined within the scope of this standard shall be designed to withstand at least 150 % of the rated load in all critical modes at ambient temperature without showing permanent deformation of any part. For all other jacks the same requirement is valid with the exception that 150 % of the maximum possible load shall be taken into consideration.

5.11 Climatic Conditions

The jacks shall be designed to work at rated load in a temperature range of −20 °C to +50 °C.

Note: If in other applicable standards there are more restricted temperature ranges, the manufacturer needs to take this into account when negotiating with the supplier of the relevant components.

5.12 Hot surfaces

If any parts of the driving system (e.g. hydraulic tanks, motors, etc.) are designed to operate at a high temperature of above 55 °C, these parts shall be protected or positioned to avoid contact of persons.

5.13 Forces

Maximum admissible forces for operating and translating the jack and methods to measure it are detailed in annex C.

5.14 Protection against pinching and shearing

Generally pinching and shearing shall be avoided by minimum gaps according to EN 349 and EN 811 between moving parts and between moving and fixed parts. As an alternative to these minimum gaps other safety measures can be taken to avoid the operator or any other persons being endangered, e.g. screens, barriers, deflectors, non-mechanically actuated trip devices complying with EN 61496-1:1997, mechanically actuated trip systems complying with Category 1 of EN 954-1:1996, multiple controls requiring simultaneous operation. Some of these examples will not be sufficient by themselves in particular cases.

The pinching and shearing points between parts of the jack are considered as secured if they cannot be reached due to the lifted load foreseen by the manufacturer.

These requirements are not valid for manually operated jacks. There it is sufficient that there exists no possibility to reach pinching and shearing points with the part of the body which operates the jack.

Note: Due to the wide range of application of this standard it is not possible to cover all details. According to each situation, several measures could be necessary to provide a sufficient protection. As it depends on the construction and the purpose, the manufacturer should decide which measures are necessary to achieve the required safety.

5.15 Electricity

If an electrical power supply is used it shall conform to EN 60204-32.

5.16 Transport and installation equipment

Movable jacks shall be so equipped that they can be transported and set up or fixed safely.

The requirement that jacks can be transported safely shall be met if such devices with a weight of 10 kg or more are provided with handles, carrying hooks, attachment loops or other means of attachment. The requirement shall also be met if the design of the jacks inherently guarantees safe handling and transport.

5.17 Provisions for maintenance

5.17.1 Accessibility

All bearing parts and all moving parts that require regular inspection shall be easily accessible.

5.17.2 Adjustment

All screws, pins, bolts and similar parts shall have means for preventing self loosening. They shall allow adjustment if necessary.

5.18 Special requirements for hydraulic transmission jacks

5.18.1 Holding device

The hydraulic transmission jack shall be provided with a load carrying device which has as an integrated part means of securing the load in any position of the load carrying part.

5.18.2 Lowering speed

In case of leakage in the line a higher speed than described in 5.3 is accepted, but the load shall then stop within a range of 100 mm.

5.19 Special requirements for trolley jacks

5.19.1 Guidance of the lift pad

The lift pad shall remain horizontal throughout the travel of the lifting beam (see Figure 4) and be free to rotate through 360° about a vertical axis.

5.19.2 Lowering of the load

The lift pad shall return to its lowest position with no load and with no form of activation other than the control device.

5.20 Special requirements for pit jacks

5.20.1 Overturning protection

Overturning of the lifting unit when operated as intended by the manufacturer shall be avoided by its design.

5.20.2 Lowering speed

In case of leakage in the line a higher speed than described in 5.3 is accepted, but the load shall then stop within a range of 100 mm.

5.20.3 Adjustments

It shall be possible to secure adjustable connections at the cradle of a pit jack by interlocking means.

5.20.4 Hold to run control

Each control device shall be of the hold to run type.

5.20.5 Unintentional operation

Control devices shall be protected against unintentional operation.

5.20.6 Crash protection

Measures against derailing and/or dropping shall be provided. Measures may be:

- supporting devices in case of breakage of rollers or axles;
- designs of rails; or
- underguarding.

5.21 Special requirements for jacks without integrated pump

In case of rupture of the connection between cylinder and pump a higher speed than described in 5.3 is accepted, but the load shall then stop within a range of 100 mm.

6 Verification

6.1 General

6.1.1 Tests

The checks and tests to ensure that the jack complies with this standard shall consist of:

a) design check (see 6.1.2);
b) manufacturing check (see 6.1.3);
c) visual verification (see 6.1.4);
d) practical tests (see 6.1.5);
e) electrical tests (see 6.1.6);
f) final inspection before despatch (see 6.2).

A type verification shall consist of 6.1.2, 6.1.3, 6.1.4, 6.1.5 and 6.1.6.

An individual machine verification shall consist of 6.2.

The result of the examinations and tests shall be recorded in a dated and signed report with the name and position of the person(s) who has signed it and the name and address of the company or organization who made the tests.

6.1.2 Design check

The design check shall verify that the requirements of this standard are fulfilled. It shall also be checked that:

a) the drawings are available and complete and give the main dimensions of the jack;
b) there is a description of the jack with the necessary information about it's capabilities;
c) information is given concerning the materials and proprietary components used;
d) diagrams of the hydraulic, pneumatic and electrical circuits are available and complete;

e) instructions covering installation, commissioning, operating, maintenance and dismantling are available and complete.

The documents shall give all the necessary information to enable the check of the calculation requirements.

6.1.3 Manufacturing check

The manufacturing check shall verify that:

a) the jack has been manufactured in accordance with the checked documents and drawings;
b) test certificates are available, e.g. for wire ropes, chains and hoses if used.

6.1.4 Visual verification

It shall be visually verified that:

a) all the marking specified in 7.2 have been affixed to the jack;
b) the jack is in accordance with all the documentation provided by the manufacturer;
c) the means of transport and installation conform to 5.16;
d) there is no evidence of external leakage of hydraulic fluid;
e) the instruction handbook described in 7.1 is provided.

6.1.5 Practical tests

Practical tests, as detailed in B.1 for type testing and B.2 for individual machine final verification, shall be carried out to verify that:

a) the jack is stable;
b) the jack is structurally sound;
c) all the functions of the jack can be safely and correctly carried out.

6.1.6 Electrical tests

The electrical tests shall be carried out according to EN 60204-32, where applicable.

6.2 Individual final verification before despatch

6.2.1 Before despatch of each jack, a verification shall show that the jack satisfies the safety requirements of this standard. The results of this verification shall be recorded.

6.2.2 If a type test for the jack model has been carried out, then it is only necessary to functionally test:

- each individual jack without load throughout its full travel;
- each individual hydraulic/pneumatic jack with rated load throughout its full travel and also the correct functioning of the pressure relief valve;
- on manually driven mechanical jacks at least 10 % of the series with the rated load throughout its full travel;
- each individual power driven mechanical jack with 110 % of the rated load throughout its full travel.

6.2.3 Where the jack has not been type tested, the final verification shall consist of tests and verifications according to 6.1.2, 6.1.3, 6.1.4, 6.1.5 and 6.1.6.

7 Informations for use

7.1 Instruction for use and instruction handbook

An operating and instruction handbook complying with 5.5 of EN 292-2:1991 shall be delivered by the manufacturer with each jack.

7.1.1 General

The instruction handbook shall clearly describe the type and scope of the jack and state the standard to which it conforms. Further, it shall include at least the rules according to 7.1.2 to be followed by the user. Further, the following restrictions given in this standard and hints necessary according to this standard shall be contained:

a) limitation of range of application as;

- operation in severe conditions (e.g. extreme climates, freezer application, strong magnetic fields);
- operation subject to special rules (e.g. potentially explosive atmospheres, mines);
- supply by electrical networks where the tolerances in voltage, frequency, etc., differ from those in the public supplies;
- life time of the jack;
- prohibition of lifting of persons;

b) static electric problems;

c) handling of loads, the nature of which could lead to dangerous situations (e.g. molten metal, acids, radiating materials, especially brittle loads);

d) hazards occurring during decommissioning;

e) wind pressure in and out of use;

f) direct contact with foodstuffs;

g) limits of use in relation to the actual IP-level;

h) limits of use in relation to the actual IK-level;

i) operation on sea ships;

j) hint to spillage of oil;

k) hint that in case the generated efforts exceed the values given in annex C, the efforts shall be lowered by additional persons.

7.1.2 Rules for operating

The rules for operating shall include the following:

– the user shall work in accordance with the instruction handbook;
– it is necessary that the operator can watch the lifting device and the load during all movements;
– it is not allowed to work under the raised load until it is secured by suitable means;
– the operator shall be provided with all necessary information about training and about pumping and translating forces.

7.1.3 Maintenance and repair

The rules for maintenance and repair shall include the following:

– when refilling the hydraulic system the characteristics of the hydraulic fluid used in the jack and the level of the hydraulic fluid as it is given by the manufacturer shall be observed;
– information about hoses;
– need to check the state of the markings and that the markings remain as the initial one;
– jacks shall be maintained and repaired in accordance with the manufacturers instructions. Such maintenance and repair shall be carried out by qualified persons;
– no modifications shall be carried out which adversly affect the compliance of the jack with this standard.

7.2 Minimum marking

Every jack shall be marked permanently and legibly on a non removable part of the device with the following information:

– manufacturer name and address;
– product code;
– serial number or batch code;
– year of manufacture;
– rated load;
– where the rated load depends on the configuration of the jack the rated loads shall be shown for each configuration on a load plate, preferably in diagrammatic form or by means of tables;
– all necessary hydraulic supply information if an external hydraulic power supply is used;
– all necessary pneumatic supply information if an external pneumatic power supply is used;
– all necessary electrical supply information if an external electric power supply is used;
– hint to residual risks.

Annex A
(normative)

Noise

For most machinery dealt with in this standard noise is not considered to be a significant hazard. This does not, however, absolve manufacturers of machines of the responsibility to provide information about the noise emission in the information for use of the machine.

The A-weighted, time averaged emission sound pressure level at the work station shall be measured according to EN ISO 11201 throughout one complete cycle (lifting from ground position to maximum height and then lowering to ground position) with the jack loaded with rated load. The position of the work station shall be defined in accordance with 11.5 of EN ISO 11201:1995. If this value does not exceed 70 dB(A) this fact shall be stated in the manual. If this value exceeds 70 dB(A), the value declared in accordance with EN ISO 4871, using the dual-number format, shall be specified in the manual.

Annex B
(normative)

Test procedures

B.1 Practical tests for type testing procedure

B.1.1 General

a) Check the correct operation of the controls.

b) Check that the safety devices are functioning as intended.

c) Operate the unloaded jack through one complete cycle.

d) Place the rated load distributed as specified by the manufacturer on the jack and operate it through one complete cycle. Record the maximum operating pressure in steady state for hydraulic and pneumatic drives.

e) Record the time taken to fully lower the jack while carrying the rated load. The average speed shall not exceed 0,15 m/s.

f) Leave the jack, still carrying the rated load, fully raised for 10 min. Measure and record the vertical descent of the jack in this time. Generally this descent shall not exceed 2 mm. On hydraulic jacks using mechanical linkages (e.g. trolley jacks) a maximum descent of 5 mm is admissible.

g) Static overload.

Lift the lift pad without the load to half stroke position. Expose the jack positioned vertically to a vertical load of:

- 150 % of the rated load in case of manually operated mechanical jacks;
- 150 % of the maximum possible load in all other cases.

Under this condition (height adaptation spindle turned to the highest position) it shall be posible to carry the load, to sustain it for a period of 15 min and to lower it.

After this test the tested jack shall be dismantled to prove that no permanent deformation has occured in any part.

h) Dynamic overload.

For the following test, the pressure relief valve of hydraulic and pneumatic jacks shall be neutralized.

Position the jack vertically and apply a vertical load of:

- 125 % of the rated load in case of manually operated mechanical jacks;
- 125 % of the maximum possible load in all other cases.

The jack shall then be capable of lifting and lowering this load through its entire stroke as for intended use.

After this test the tested jack shall be dismantled to prove that no permanent deformation has occured in any part.

i) Manual forces.

Manual forces shall be measured according to annex C.

j) Over travel device.

Operate the jack without load 10 times to the upper position until the over travel device is operating. No permanent deformation of any part is permissible.

k) Test the load limiting device.

l) Check satisfactory operation of braking or holding devices according to the design, where fitted.

B.1.2 Additional tests for hydraulic jacks

All types of hydraulic jacks can exist in principle also as pneumatic jacks. For the pneumatic jacks the same additional tests as stated in B.1.2 shall be performed.

a) Static test.

Store the jack at an ambient temperature of +(23 $\pm$ 5) °C for at least 12 h. Then expose it to its maximum possible load at nominal full stroke specified by the manufacturer, for at least 30 min.

Within that time, generally a maximum lift pad lowering movement of 2 mm is admissible. On hydraulic jacks using mechanical linkages (e.g. trolley jacks) a maximum descent of 5 mm is admissible. The measurement is to start 5 min after applying the load.

If an auxiliary load point is fitted, then the jack or cylinder shall be subjected additionally to the above tests using the auxiliary load point to apply the load. Any lower maximum possible load of the auxiliary load point shall be used instead of the maximum maximum possible load to which it is attached.

b) Pressure relief valve.

Expose the jack to a load accoring to the set pressure of the pressure relief valve plus 5 %. Then the jack shall not be capable to lift this load but shall be able to sustain it.

Then, pump the jack up to its full stroke without the load until the pressure relief valve operates. This pressure shall be recorded and shall not exceed 125 % of the rated load. This test shall be performed 10 times in a row. No failure of the pressure relief valve is admissible.

On devices with hydraulic limitation of the end position the test shall be performed at 2/3 of the full stroke. At this test the piston shall be blocked by application of an external force. On devices with telescopic cylinder the stage with the smallest diameter shall be partially extended.

c) Safety device against pipe damage.

On jacks a breaking of the connection between cylinder and pump (hose, pipe) shall be simulated. The non-return valve on the jack shall respond. The load shall not come down more than 100 mm. It shall not be possible to reoperate the jack by the normal controls until proper measures are taken.

B.1.3 Additional tests for hydraulic jacks for road vehicles

In addition to the tests according to B.1.1 and B.1.2 the following tests shall be performed.

a) Behaviour at temperatures.

Store the jack at +(50 ± 5) °C for a minimum period of 12 h. No visible leakage is admissible during this test.

Then store the jack at −(20 ± 2) °C for a minimum period of 12 h. No visible leakage is admissible during this test.

The jack shall be placed in its operating position on the test rig immediately after each of the above conditionings and shall be able to lift the rated load at each of the above temperatures through the full stroke specified by the manufacturer.

Use the test rig as shown in Figure B.1.

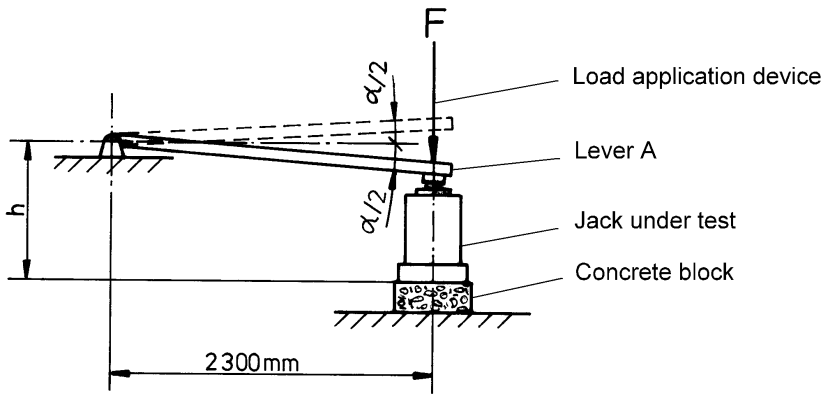


Figure B.1 — Test rig

Lever A is intended to simulate the travel of the axle to be lifted. Dimension h shall be adjusted in the way that lever A is horizontal when the jack is in the middle of its stroke.

The area on lever A where the head of the jack is applied shall have a hardness of at least 285 HB and a surface roughness of Ra 6,3 μm, to avoid slipping off.

b) Strength test.

The jack shall be capable of lifting, stopping and lowering the rated load 50 times over the full stroke at a temperature of (23 ± 5) °C, with the height adaptation spindle turned to the lowest position. Between each lift, there shall be a pause of 5 min.

Lubrication after 10 strokes is allowed.

After maintaining the rated load for 2 min, the height shall be checked after the last lift.

This height shall be such that it proves that the nominal stroke quoted by the manufacturer is achieved with an acceptable tolerance of −2 mm.

c) Stability test.

Hydraulic jacks shall be placed on a 6° plate as Figure B.2 and a load equivalent to 125 % of its rated load applied in the middle of the lift pad at 80 % of its maximum stroke, spindle not extended, for a period of 5 min. The jack shall show no permanent deformation and no failure of any part.

Further, it shall be verified by calculation that the vertically projected area of the lift pad is within the tipping lines when the jack is inclined by 6° in the worst condition.

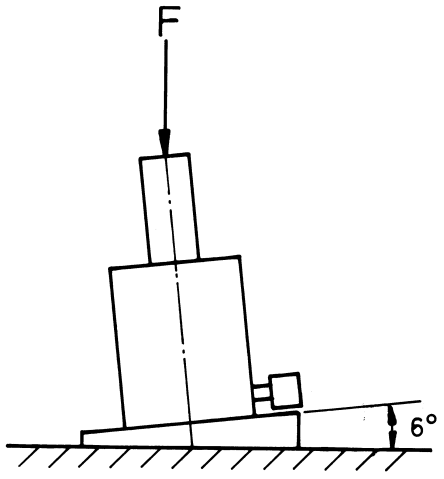


Figure B.2 — Stability Test

B.1.4 Additional tests for trolley jacks
In addition to the tests according to B.1.1 and B.1.2 and instead of the tests according to B.1.3 the following tests shall be performed.

1. Test
Operate the unloaded jack through one cycle.

The lift pad shall remain horizontal over the whole stroke. It shall return to its lowest position without load by operating the normal controls for lowering.

2. Test
Point-load outside the centre of the lift pad with the load displaced in transverse direction of the jack.

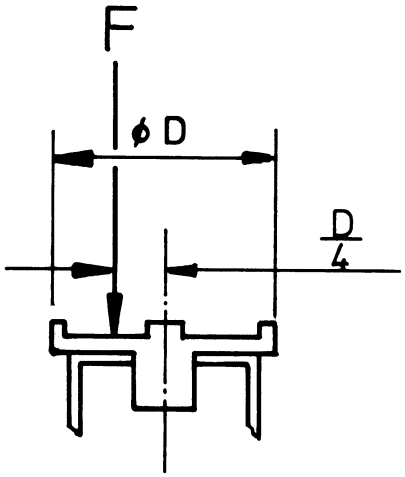


Figure B.3 — Load application for second test

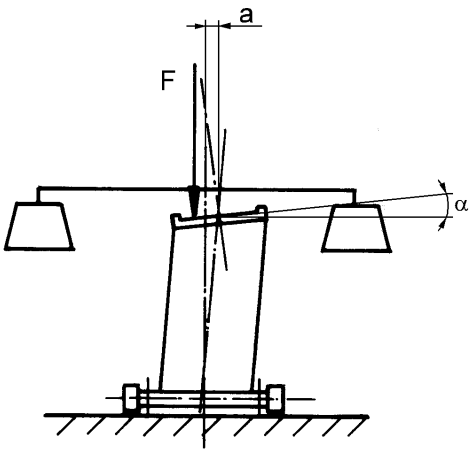


Figure B.4 — Load application for second test

Lift the load from the lowest to the highest position. The test shall be performed twice while changing the load from one side to the other.

Load: F = 0,5 × rated load

Check under load in lowest, highest and mid-position of the lift pad that:

- the trolley jack functions without restrictions
- $\alpha \leq 6°$
- $a \leq 5$ mm

α: inclination of the lift pad against the horizontal
a: lateral distance between the centre of the lift pad and the vertical centre line of the jack

Check after removing the load that no permanent deformations are existing.

3. Test
Centric applied load on the trolley jack which is located with one front wheel on a 15 mm high sheet.

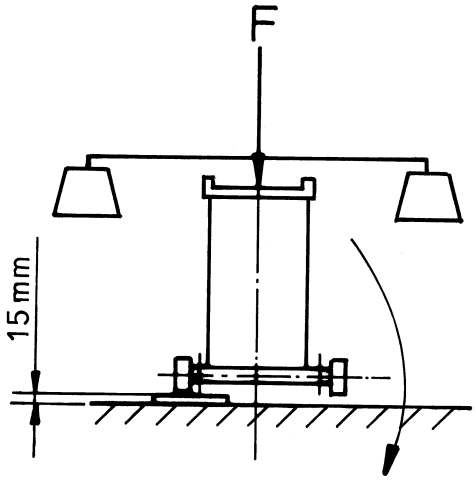


Figure B.5 — Load application for third test

Lift the load from the lowest to the highest position. The test shall be performed twice while the sheet is once located below the right and once below the left front wheel.

Load: F = 0,75 $\times$ rated load

Check under load that the trolley jack functions without restrictions.

Check after removing the load that no permanent deformations are existing.

4. Test
Centric applied load on the trolley jack which is on one side located with one front wheel and one rear wheel on a 15 mm high sheet.

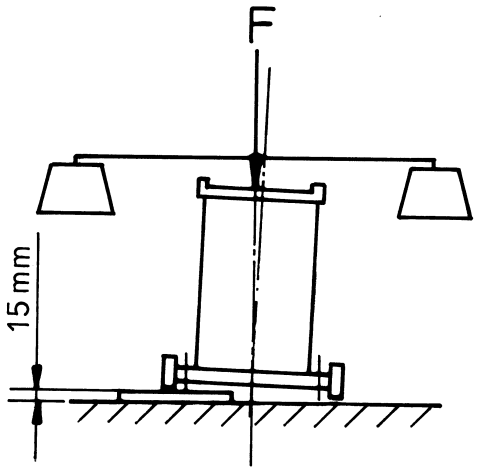


Figure B.6 — Load application for forth test

Lift the load from the lowest to the highest position. The test shall be performed twice while the sheet is once located below the right and once below the left side of the jack.

Load: F = 0,75 × rated load

Check under load that the trolley jack functions without restrictions.

Check after removing the load that no permanent deformations are existing.

5. Test
Point-load outside the centre of the lift pad with the load displaced in longitudinal direction of the jack.

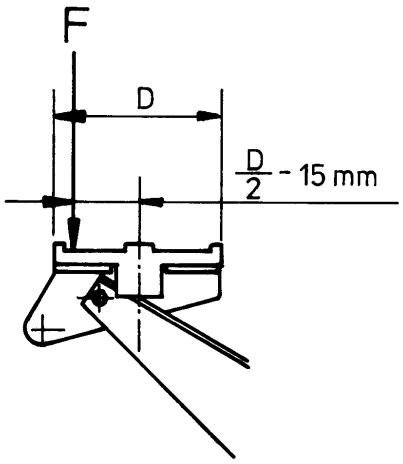


Figure B.7 — Load application for fifth test

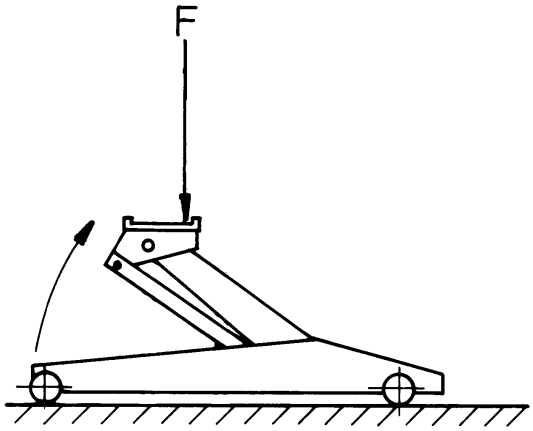


Figure B.8 — Load application for fifth test

The load is lifted from the lowest to the highest position. The test shall be performed twice while changing the load from the front side to the rear side.

Load: F = rated load

Check under load in lowest, highest and mid-position of the lift pad that:
- the trolley jack functions without restrictions
- declination of the lift pad ≤ 6°

Check after removing the load that no permanent deformations are existing.

6. Test
Centric applied load on the trolley jack.

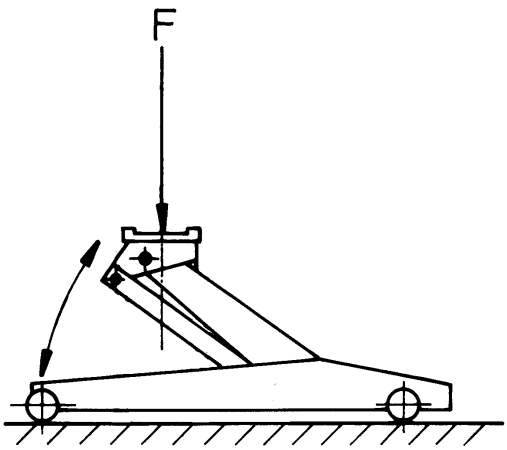


Figure B.9 — Load application for 6th test

Lift the load from the lowest to the highest position and then lower it to the lowest position. The test shall be performed 50 times. Lubrication during the tests is admissible.

Load: F = rated load

Check under load that:
- the trolley jack functions without restrictions
- 10 min after the last lifting the stroke shall not be less than the nominal stroke given by the manufacturer minus 5 mm

Check after removing the load that no permanent deformations are existing.

B.2 Practical tests for fitness for purpose test when the jack has been type tested

a) Check the correct operation of the controls.

b) Check that the emergency stop and other safety devices (if fitted) are correctly functioning.

c) Operate the unloaded jack through at least one complete cycle.

d) Load the jack with 10 % more than the rated load and operate it through one complete cycle.

e) Test the load limiting device.

Annex C
(normative)

Manual forces and manual force measurement methods

C.1 Maximum allowed forces

The maximum manual forces required for jack operations (unloaded respectively loaded with rated load) shall not exceed the following figures.

To start moving an unloaded movable or mobile jack:	300 N
To maintain the movement of the unloaded jack:	200 N
To start moving a loaded mobile jack:	400 N
To maintain the movement of the loaded mobile jack:	300 N
To raise the loaded jack using the lever of a hand pump:	400 N
To raise the loaded jack using a foot pump:	400 N
To raise the loaded jack with a rated load $\leq$ 5 t using a crank:	250 N
To raise the loaded jack with a rated load > 5 t using a crank:	400 N

If the generated efforts exceed these values, the efforts shall be lowered by additional persons.

C.2 Conditions for test

The tests shall be carried out with a new jack on a smooth, dry, level, trowelled finish concrete floor in good condition. The tests shall be carried out in an ambient temperature of between 15 °C and 28 °C. The measuring instrument used shall have a range of error of $\pm$3 %.

The forces required are measured in accordance with the methods described below. Two tests in both the forward and reverse directions shall be carried out and the average result recorded.

C.3 Measurement of starting force and rolling force

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

The force shall be applied horizontally along the jack's axis, on the handle or bar in the test direction.

C.4 Starting force

The maximum value necessary to start the jack moving shall be recorded.

C.5 Rolling force

The maximum value necessary to maintain the jack at a stabilized speed of 0,5 m/s shall be recorded.

C.6 Average forces

The maximum starting force or the maximum rolling force is the average of the maximum values recorded in each direction of travel, forward and reverse, during two successive tests.

C.7 Hand or foot forces

Actuate the handle or foot pedal as many times as necessary to raise the fully loaded jack to its maximum height.

The maximum force value is measured perpendicularly to the handle or pedal during each pumping cycle.

The maximum force value is the average of the maximum values recorded at each handle or pedal cycle during one complete lifting.

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of following EU Directive 98/37/EC, amended by Directive 98/79/EC.

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

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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