
Hoists for the transfer of disabled persons — Requirements and test methods

Lève-personnes pour transférer des personnes handicapées — Exigences et méthodes d'essai



Foreword

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

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10535 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 173, *Technical systems and aids for disabled or handicapped persons*, Subcommittee SC 6, *Hoists for transfer of persons*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Annexes C and ZZ form a normative part of this International Standard.

Annexes A and B are for information only.

Annex ZZ provides a list of corresponding International and European Standards for which equivalents are not given in the text.

For the purposes of this International Standard, the CEN annex regarding fulfilment of European Council Directives has been removed.

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Printed in Switzerland

	Contents	Page
	Foreword	v
	Introduction	vi
1	Scope	1
2	Normative references	1
3	Definitions	3
4	General requirements and test methods	5
4.1	General requirements	5
4.1.1	Risk analysis	5
4.1.2	Ergonomics factors etc.	5
4.1.3	Sound level	6
4.2	General test conditions	6
4.2.1	Test conditions	6
4.2.2	Test equipment	6
4.2.3	Tolerances	7
4.2.4	Test report	7
4.3	General safety requirements	7
4.4	Test methods for general safety requirements	9
4.5	Requirements for performance	11
4.6	Test methods for performance	11
4.7	Requirements for rate (velocity) of lifting and lowering	12
4.8	Test methods for rate (velocity) of lifting and lowering	12
4.9	Requirements for operating forces	12
4.10	Test methods for operating forces	12
4.11	Information supplied by the manufacturer	12
4.11.1	General	12
4.11.2	Marking	13
4.11.3	Instructions for use	13
4.12	Requirements for durability	14
4.13	Test methods for durability	14
5	Mobile Hoists - Specific requirements and test methods	15
5.1	Requirements for static strength	15
5.2	Test methods for static strength	15
5.3	Requirements for static stability	16
5.4	Test methods for static stability	16
5.5	Requirements for immobilizing device (brakes)	17
5.6	Test methods for immobilizing device (brakes)	17
5.7	Requirements for moving forces	17
5.8	Test methods for moving forces	17
5.9	Instructions for use	18

Contents (cont.)		Page
6	Stationary Hoists - Specific requirements and test methods	18
6.1	Specific safety requirements	18
6.2	Test methods for specific safety requirements	19
6.3	Requirements for static strength for all other stationary hoists	19
6.4	Requirements for static strength (free-standing stationary hoists only)	19
6.5	Test methods for static strength (free-standing stationary hoists only)	19
6.6	Requirements for static stability (free-standing stationary hoists only)	19
6.7	Test methods for static stability (free-standing stationary hoists only)	20
6.8	Requirements for static strength for all other stationary hoists	20
6.9	Test methods for static strength for all other stationary hoists	20
6.10	Instructions for use	21
7	Non-rigid body support units - Specific requirements and test methods	21
7.1	General	21
7.2	Requirements for the central suspension point	21
7.3	Test method for the central suspension point	21
7.4	Requirements for the spreader bar	21
7.5	Test methods for the spreader bar	22
7.6	Requirements for the non-rigid body support unit	22
7.7	Material and seams of the non-rigid body support unit	22
7.8	Test methods for non-rigid body support unit	22
7.9	Marking	23
7.10	Instructions for use	23
8	Rigid body support units - Specific requirements and test methods	23
8.1	General	24
8.2	Requirement for backrest	24
8.3	Requirements and test methods for durability	24
8.4	Marking	24
8.5	Instructions for use	25
9	Free-standing hoists for use in bath tubs	25
Figures		25
Annex A (Informative) -	Periodic inspection	32
Annex B (Informative) -	Applications	33
Annex C (Normative) -	Hydraulic and pneumatic components	34
	- requirements and test methods	
Annex ZZ (Normative) -	Corresponding International and European Standards for which equivalents are not given in the text	36

Foreword

The text of EN ISO 10535:1998 has been prepared by Technical Committee CEN/TC 293 "Technical aids for disabled persons", the secretariat of which is held by SIS, in collaboration with Technical Committee ISO/TC 173 "Technical systems and aids for disabled or handicapped persons".

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 April 1999, and conflicting national standards shall be withdrawn at the latest by April 1999.

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).

There are three levels of European Standards dealing with technical aids for disabled persons. These are as follows, with level 1 being the highest:

- Level 1: General requirements for technical aids
- Level 2: Particular requirements for families of technical aids
- Level 3: Specific requirements for types of technical aids.

Where standards for particular aids or groups of aids exist (level 2 or 3), the requirements of lower level standards take precedence over higher level standards. Therefore, to address all requirements for a particular aid, it is necessary to start with standards of the lowest available standard.

This is a combined level 2- and 3-standard (lowest possible) for hoists for the transfer of disabled persons, as specified in the scope.

Clause 4 of this standard contains requirements and test methods applicable to all relevant types of hoists.

Clause 5 contains additional requirements and test methods for mobile hoists.

Clause 6 contains additional requirements and test methods for stationary hoists.

Clause 7 contains additional requirements and test methods for non rigid body supports units.

Clause 8 contains additional requirements and test methods for rigid body supports units

Clause 9 contains additional and modified requirements and test methods for hoists that are intended to be free standing within the bathtub.

NOTE 1: Clause 9 is under consideration.

Annex A is included to offer information regarding the periodic examination and inspection of hoist equipment.

Annex B is included to assist the manufacturer and purchaser with regard to the category into which certain hoists can fall.

Annex C is included to give specific requirements and testing for hydraulics and pneumatics.

NOTE 2: This standard is valid as a combined level 2/3-standard within the 3-level system used in the European standardization for medical devices concerning technical aids for disabled persons. This standard is an International Standard as well (ISO 10535). The use or the status as an International Standard is not affected by the European 3-level system.

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

It appears from studies that the nursing and caring profession involves many physically burdening factors in the caring for and nursing of disabled persons. A hoist may constitute a useful means for preventing overloading of the attendant and the disabled person.

1 Scope

This European standard specifies requirements and test methods only for hoists and body support units intended for the transfer of disabled persons as classified in EN ISO 9999:1998:

12 36 03	Wheeled hoists with sling seats
12 36 06	Wheeled hoists with solid seats
12 36 09	Hoist trolleys
12 36 12	Stationary hoists fixed to the wall/walls, floor and/or ceiling
12 36 15	Stationary hoists fixed to, mounted in or on another product
12 36 18	Stationary free standing hoists
12 36 21	Body-support units for hoists

This standard does not apply to devices that transports persons between two levels (floors) of a building.

This standard does not include methods for determination of ageing or corrosion of such hoists and units.

The requirements of this standard are formulated with regard to the needs of both the disabled persons being hoisted and the attendant using the hoist.

2 Normative references

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

EN 292	Safety of machinery. Basic concepts, general principles for design Part 1: Basic terminology, methodology Part 2: Technical principles and specification
EN 614-1	Safety of machinery. Ergonomic principles Part 1: Terminology and general principles
EN 853	Rubber hoses and hose assemblies - Wire braid reinforced hydraulic type - Specification
EN 854	Rubber hoses and hose assemblies - Textile reinforced hydraulic type - Specification

EN 980	Graphical symbols for the use in the labelling of medical devices
EN 1021-1:1993	Assessment of the ignitability of upholstered furniture - Part 1: Ignition source: Smouldering cigarette
EN 1041	Information supplied by the manufacturer with medical devices
EN 1441	Medical devices - Risk analysis
EN ISO 9999:1998	Technical aids for disabled persons - Classification
EN 60601-1	Medical electrical equipment - Part 1: General requirements for safety
EN 60601-1-2	Electromagnetic compatibility - Requirements and tests
prEN 12182:1997	Technical aids for disabled persons - General requirements and test methods
ISO 3741:1988	Acoustics - Determination of sound power levels of noise sources - Precision methods for broad band sources in reverberation rooms
ISO 3744:1988	Acoustics - Determination of sound power levels of noise sources - Methods for free field conditions over a reflecting plane
ISO 3758	Textiles - Care labelling code using symbols
DIN 2413	Steel pipes Part 1: Design of steel pressure pipes Part 2: Design of elbows and bends for steel pressure pipes

3 Definitions

For the purposes of this standard the following definitions apply:

- 3.1 Adverse condition:** The condition in which failure is most likely to occur and which is based on continual trial and error.
- 3.2 Attendant:** The person who operates the hoist if not the lifted person.
- 3.3 Backrest:** The part of the body support unit that supports the back of the person being lifted, moved or transferred (e.g. sling, seat, stretcher etc.) along with the associated attachment structure.
- 3.4 Backwards:** 180° to the forwards direction of travel.
- 3.5 Body support unit:** The part of the hoist that supports the person being lifted, moved or transferred (e.g. sling, seat, stretcher etc.) along with its associated attachment structure.
- 3.6 Ceiling hoist:** An overhead mounted hoist system fixed to the ceiling or wall(s), including the tracking system.
- 3.7 Central Suspension Point (CSP):** A reference point on the hoist to be used for measurements (this point may be a connecting point).
- 3.8 Connecting point(s):** The part(s) to which the body support unit attaches.
- 3.9 Control devices:** That part or parts of the hoist which operates the lifting and lowering mechanisms of the CSP as well as other functions, e.g. leg opening of the mobile base.
- 3.10 End limiting device:** A device that stops any movement at a predetermined end position.
- 3.11 Flexible device:** A component along with any associated joining components that functions as a lifting device (e.g. chain, tape, rope).
- 3.12 Footrest:** The part of the body support unit that supports the feet.
- 3.13 Forwards:** The intended direction of travel, as stated by the manufacturer, in relation to the person who is moving the hoist.
- 3.14 Hoisting range:** The vertical difference between the maximum and minimum heights of the CSP (see figures 7 and 8)
- 3.15 Hoisting reach:** The unimpeded horizontal distance between the structure and a vertical line through the CSP at a given height within the hoisting range (see figure 7).

- 3.16 Hold to run control device:** Control device(s) which initiates and maintains operation of the hoist elements only as long as the manual control is actuated. The manual control automatically returns to the 'Stop' or 'Off' position when released.
- 3.17 Legrest:** The part of the body support unit that supports the legs.
- 3.18 Lifted person:** The person who is transferred by the hoist.
- 3.19 Lifting cycle:** The raising and lowering of the lifting machinery for the same distance in both directions.
- 3.20 Lifting device:** Means of lifting and lowering the body support unit.
- 3.21 Lifting machinery:** Device that performs the lifting function, e.g. the hydraulic, mechanical or electrical apparatus.
- 3.22 Locking gate:** A device that ensures a hoist cannot move from one track to another unless both tracks are in the correct position.
- 3.23 Locking system:** The means by which the rigid body support unit is secured to the hoist.
- 3.24 Maximum load:** The greatest permissible load, excluding the body support unit, that can be applied to the hoist.
- 3.25 Mobile hoist:** A hoist fitted with a devices or devices (e.g. wheels) that is freely movable and propellable along the floor, and with which a disabled person is lifted, transferred or moved independently of a fixed installation or other allied device.
- 3.26 Multi-purpose hoist:** A hoist that can be assembled, possibly with the use of different parts, to provide a variety of operations.
- 3.27 Non-rigid body support unit:** A device that is manufactured from flexible materials which adapts to the body shape, with the associated connecting means for attaching to the lifting device of the hoist.
- 3.28 Rigid body support unit:** A preformed seat or recumbent device, manufactured from rigid materials (if necessary padded), or flexible materials encased by a frame, with associated connecting means for attaching to the lifting device of the hoist.
- 3.29 Single fault condition :** Condition in which a single means for protection against a safety hazard in equipment is defective or a single external abnormal condition is present.
- 3.30 Sitting part:** Part of the body support unit that is available for sitting on.

- 3.31 Spreader bar:** A rigid construction with more than one connection point, onto which the body support unit is attached (for example see figures 8 and 9).
- 3.32 Stationary hoist:** A hoist with which a person is lifted, transferred or moved within a pre-defined area and which is fixed to a wall, ceiling or floor or is mounted in or on other allied devices, or is free standing.
- 3.33 Turning radius:** The radius of the narrowest circle encompassing the extreme points of the hoist, when it is turned 360° without being reversed.

4 General requirements and test methods

4.1 General requirements

4.1.1 Risk analysis

The requirements of EN 1441 apply.

4.1.2 Ergonomics factors etc

The ergonomics of the hoist shall be based on the requirements of EN 614-1.

Grips and handles shall suit the functional anatomy of the hands and meet with the following requirements:

- the distance between any handle (part intended to be grabbed) requiring an operating force of more than 10 N and any construction part of the hoist shall not be less than 35 mm;
- the distance between any upper surface of a pedal (in its operating position) and any other part of the hoist shall have a vertical toe clearance of not less than 75 mm;
- the diameter of any operating handles and or knobs requiring an operating force of more than 10 N shall be between 19 mm and 43mm.
- pedals shall be placed not more than 300 mm above the surface of the floor;
- hand operated controls shall be placed at a height of 800 mm to 1200 mm above the floor;
- handles for pushing and/or pulling shall be placed at a minimum height of 900 mm.

NOTE: Operating controls used by the lifted person may require other positions.

4.1.3 Sound level

The maximum sound level of any hoist shall not exceed 65 dB(A) as measured in accordance with ISO 3741:1998 and/or ISO 3744:1998 during one raising or lowering lifting cycle with the hoist loaded with the maximum load.

4.2 General test conditions

4.2.1 Test conditions

The hoist shall be tested as it is delivered to the customer. However, if of a multi-functional design and can be assembled in different formats, it shall be assembled according to the instructions supplied by the manufacturer. If the hoist is intended to be used in different combinations, then all combinations shall be tested in the most adverse condition.

The tests shall be carried out under normal indoors conditions.

All tests shall be carried out in the order stated.

The test report referred to in 4.2.4 shall be placed in the manufacturers technical file.

4.2.2 Test equipment

- 4.2.2.1 Test surface, rigid, flat, inclinable and with stops preventing the hoist from sliding but not tilting.
- 4.2.2.2 Stops not smaller than half of the wheel diameter and not greater than the wheel diameter.
- 4.2.2.3 Cylindrical load(s), made of steel, with rounded edges, (not less than R25) and with diameter 350 mm. For the testing of non-rigid body support unit the load can be made to represent the proposed body to be lifted.
- 4.2.2.4 Equipment capable of simulating use in practice (e.g. test fingers).
- 4.2.2.5 Equipment for applying loads, with negligible dynamic factor.
- 4.2.2.6 Sound level meter in accordance with ISO 3741:1998 or ISO 3744:1998.

4.2.3 Tolerances

The following tolerances on measurements apply.

Forces/Loads	$\pm 5\%$	
Velocities	$\pm 5\%$	
Angles	$\pm 0,25^\circ$	
Dimensions	$\leq 150 \text{ mm}$	$\pm 0,5 \text{ mm}$
	$> 150 \text{ mm}$	$\pm 5,0 \text{ mm}$
Time	$\pm 0,1 \text{ s/m}$	

4.2.4 Test report

The test report shall include at least the following information:

- a) a reference to this standard;
- b) a description of the product, including type and designation;
- c) name and address of the manufacturer;
- d) a photograph of the hoist equipment as presented during test;
- e) the name and address of the testing laboratory;
- f) the stability values to the nearest $0,5^\circ$ rounded downwards;
- g) result of tests including record of maintenance, if any;
- h) any deviations from the standardized test procedure;
- i) date of test.

4.3 General safety requirements

The following requirements apply.

- 4.3.1** Every hoist shall be capable of lifting a lifted person of 120 kg mass excluding the mass of any body support unit.
- 4.3.2** Electrically operated hoists shall conform to EN 60601-1 regarding electrical safety.
- 4.3.3** All load-bearing fasteners shall be either self-locking or fitted with a locking device to prevent inadvertent detachment.

- 4.3.4** Single use components (eg.self-tapping screws), shall not be used to secure any component that can be deemed to be load-bearing. In addition they shall not be used for the assembly of any component(s) that is intended to be removed for the purpose of dismantling for transport or storage.
- 4.3.5** Handgrips shall be fixed in such a manner as to prevent inadvertent detachment.
- 4.3.6** Unless required for a specific function of the hoist, all accessible edges, corners and surfaces shall be smooth and have no burrs or sharp edges. All projections shall be avoided or fitted with adequate protection to prevent damage or injury.
- 4.3.7** It shall not be possible to assemble the hoist in a manner which affects the overall safety of the unit. If the lifting device incorporates a mast, it shall be so located in relation to its base that it can only be assembled in the correct working position.
- 4.3.8** Protection against shearing, crushing, trapping and abrading shall be provided and shall be in accordance with the requirements of EN 292.
- 4.3.9** The hoist shall include in its design some means (e.g. limiting switches, the principal of free-wheeling etc.) that will ensure that, when lowering, should the body support unit, spreader bar or lifting arm come into contact with the lifted person, the total load imposed on the lifted person shall not be greater than the total mass of those parts.
- 4.3.10** When operated, the means provided in 4.3.9 shall not allow the hoist to become unsafe.
- 4.3.11** All controls, for lowering or raising the lifted person, shall be easily accessible and operable by the person operating the hoist.
- 4.3.12** Electrically operated hoists shall be provided with an emergency device which is readily accessible and is wired to isolate the power supply and to stop any electrically produced mechanical movement which could cause a safety hazard.
- 4.3.13** On all battery-powered hoists, to ensure that a full range lifting cycle with maximum load can be completed once started, a warning device shall be provided
- 4.3.14** On all battery-powered hoists, a warning device(s) shall be provided that will indicate when the battery(ies) require charging.
- When this device operates there shall be sufficient power available to complete one (1) full lifting cycle with maximum load.
- 4.3.15** All controls shall be of the 'hold to run' type.
- 4.3.16** Any hoist shall be designed in such a way so that it shall not lift more than 1,5 times the maximum load.

- 4.3.17** Hoists shall be provided with a safety device that shall ensure that the lifted person does not fall in the event of a single-fault condition of the lifting machinery.
- 4.3.18** After the static test, in accordance with 4.4.18, any flexible lifting device and associated lifting joints shall show no sign of damage that will effect the function of the hoist as stated by the manufacturer.
- 4.3.19** A connection point shall be so designed that the body support unit shall not become inadvertently detached.
- 4.3.20** Where necessary, all precautions shall be taken (e.g. by the fitting of a safety devices(s)) to protect the lifted person from inadvertently falling off/from the body support unit.
- 4.3.21** Electrically operated hoists shall conform to EN 60601-1-2.
- 4.3.22** The connection point(s) shall be smooth thus avoiding excessive wear of any connectors.

4.4 Test methods for general safety requirements

- 4.4.1** The requirements described in 4.3.1 shall be confirmed through practical test and inspection.
- 4.4.2** The requirements described in 4.3.2 shall be determined by verification in accordance with EN 60601-1.
- 4.4.3** The requirements described in 4.3.3 shall be determined through inspection .
- 4.4.4** The requirements described in 4.3.4 shall be determined through inspection .
- 4.4.5** The requirement described in 4.3.5 shall be determined by testing as follows according to the following procedure:
- a) with the hoist standing on a horizontal and smooth test plane, set up the 'loading method' in accordance with figure 10;
 - b) prevent the hoist from tipping and/or moving;
 - c) if necessary, fit some means of restraint that will support the handle and prevent it flexing under the test load. This restraint shall not touch the handgrip being tested;
 - d) slowly apply a force to each handgrip in the direction that simulates the pushing of the hoist until a maximum of 750 N is reached;
 - I maintain the load for a period of between 5 s and 10 s;
 - II remove the load;

e) repeat the above test with the load applied in the direction that simulates the pulling of the hoist.

- 4.4.6** The requirements described in 4.3.6 shall be determined through inspection .
- 4.4.7** The requirements described in 4.3.7 shall be determined through inspection and functional test.
- 4.4.8** The requirements described in 4.3.8 shall be determined through inspection and/or manufacturer's technical documentation and in accordance with the requirements in EN 292.
- 4.4.9** The requirements described in 4.3.9 shall be determined through inspection and functional test.
- 4.4.10** The requirements described in 4.3.10 shall be tested by driving the spreader bar (or other part of the hoist that is used to support the body support unit) with no load, down and onto a solid surface which incorporates a load-sensing device. The hoist must not impart a load that is in excess of the combined mass of the body support unit, the spreader bar and the lifting arm.
- 4.4.11** The requirements described in 4.3.11 shall be determined through inspection, functional test and judgement.
- 4.4.12** The requirements described in 4.3.12 shall be determined through inspection, functional test and judgement.
- 4.4.13** Using a new and fully charged battery or batteries the warning device described in 4.3.13 shall not show an unsatisfactory condition. A discharge which shall ensure that the battery or batteries charge capacity is greatly reduced shall be made and the warning device shall operate.
- The hoist shall then be loaded with maximum load and a full lifting cycle completed.
- 4.4.14** The requirements described in 4.3.14 shall be determined through inspection.
- 4.4.15** The requirements described in 4.3.15 shall be determined through inspection.
- 4.4.16** When loaded with a mass as described in 4.3.16, the hoist shall be prevented from operating.
- 4.4.17** The requirement described in 4.3.17 shall be determined by verification and, where possible, inspection.

4.4.18 The requirement described in 4.3.18 shall be determined as follows.

Lifting tape(s), wires, chains, including joints and other attachments used for lifting shall be tested separately. They shall be loaded statically with 6 times maximum load for 20 min. Terminal fittings used in the lifting process shall be tested separately. They shall be loaded statically with four (4) times the maximum load for 20 min and the results determined by inspection.

4.4.19 The requirements described in 4.3.19 shall be determined through inspection and functional test.

4.4.20 The requirements described in 4.3.20 shall be determined through inspection and judgement.

4.4.21 The requirements described in 4.3.21 shall be determined through verification in accordance with EN 60601-1-2.

4.4.22 The requirements described in 4.3.22 shall be determined through inspection.

4.5 Requirements for performance

4.5.1 The hoist shall be designed for the purpose of transferring a disabled person according to the field of application, as stated by the manufacturer (see annex B) and it shall be able to be operated by one person. If not, this shall be stated in the instructions for use.

NOTE: When being used in the designated manner the hoist should enable the disabled person to be positioned in such a way as to minimise the need for attendant repositioning.

4.5.2 There shall be no cavities in which liquid could accumulate.

4.5.3 When loaded with the maximum load (3.24), the CSP shall have a stopping distance of not more than 50 mm.

4.6 Test methods for performance

4.6.1 The requirements described in 4.5.1 shall be determined through inspection and judgement.

4.6.2 The requirements described in 4.5.2 shall be determined through inspection and functional test.

4.6.3 The requirements described in 4.5.3 shall be determined in the following manner:

a) load the hoist with maximum load;

b) set the CSP to top position;

- c) lower the CSP at full speed;
- d) at a position approximately equal to the middle of the lifting range, remove the energy source from the hoist by either releasing the relevant control button, closing the relevant hydraulic valve(s) or by ceasing to wind manually;
- e) measure the vertical distance from this point to the point where the lowering stops.

4.7 Requirements for rate (velocity) of lifting and lowering

- 4.7.1** The rate of raising or lowering shall not exceed 0,15 m/s when loaded.
- 4.7.2** The rate of raising or lowering shall not exceed 0,25 m/s when unloaded.

4.8 Test methods for rate (velocity) of lifting and lowering

- 4.8.1** When measured unloaded in the upward direction and loaded with the maximum load (3.24) in the downward direction, the hoist rate shall not exceed the velocity stated in 4.7.1.
- 4.8.2** When measured unloaded in the downward direction, the hoist rate shall not exceed the velocity stated in 4.7.2.

4.9 Requirements for operating forces

The operating forces of required for those parts of the hoist that are designed to be operated by fingers, hands or feet shall not exceed the following values:

- a) operation by using a finger: 5 N
- b) operation by using a hand: 105 N
- c) operation by using a foot: 300 N
- d) operation by a turning: 1,9 Nm

4.10 Test methods for operating forces

With the hoist loaded with the maximum load (3.24), the operating forces of all the controls stated in 4.9, shall be measured. These measurements shall be taken at the mid-point of intended use as stated by the manufacturer.

4.11 Information supplied by the manufacturer

4.11.1 General

The requirements of EN 980 and EN 1041 apply.

4.11.2 Marking

All operating controls shall be marked for their intended function.

Every hoist (and any main part of a multi-purpose hoist) and body support unit shall be permanently marked with the following information as a minimum:

- a) name, and address of the responsible person who places the product on the market;
- b) model definition;
- c) lot or batch and/or serial number;
- d) year and month of manufacture;
- e) electrical details as per EN 60601-1, if and where applicable;
- f) details of any other energy source used (e.g. water/air pressure);
- g) maximum load.

4.11.3 Instructions for use

The purchaser of any hoist and/or body support unit shall be provided with an instruction leaflet which shall include the following information (where applicable) as a minimum:

- name, address and telephone number of the manufacturer, supplier or agent if different;
- full operating, installation and assembly instructions;
- the intended use of the hoist (see annex B);
- periodic inspection and servicing requirements (see guidance given in annex A);
- name, address and telephone number to contact for service;
- cleaning and maintenance information;
- details for trouble shooting/assistance;
- technical specifications:
 - a) dimensions (to include those shown in Figures 4,5,6,7 and 8, where appropriate)
 - b) maximum load
 - c) safety precautions

- d) total weight of the unladen hoist and where appropriate the weights of any main parts that can be dismantled (e.g. for transportation)
- electrical information in accordance with EN 60601-1;
- limits of accuracy of any measuring device (e.g. weighing scale) any warning/attention marks used on the product shall be explained in more detail in the operating instructions.

A list of spare parts shall be available on request.

4.12 Requirements for durability

- 4.12.1** After testing in accordance with the requirements of 4.13, the hoist shall function as intended with the maximum load (3.24) and shall show no signs of permanent deformation or wear that may affect its function.

4.13 Test methods for durability

- 4.13.1** The hoist shall be placed on a horizontal surface with the base locked in the most adverse position. The hoist shall be secured against moving on the surface.
- 4.13.2** In the case of fixed stationary hoists, they shall be fixed, in accordance with the manufacturer's instructions, to a horizontal surface and in the most adverse condition.
- 4.13.3** For manually operated hydraulic hoists, the stroke of the pump lever shall be as long as possible but the end stops of the pump shall not be activated at any time.
- 4.13.4** The working/pause ratio (duty cycle) during test shall be 15/85 if not otherwise stated by the manufacturer.
- 4.13.5** If necessary, it is permissible to use an alternative power supply instead of the battery for the purpose of durability test only, as agreed with the manufacturer of the hoist.
- 4.13.6** Maintenance during testing shall only be carried out if specifically required by the manufacturer in his service manual.
- 4.13.7** Position the load on the hoist according as shown in figures 2 and 3. Raise and lower the hoist 250 mm or 25% of the vertical movement, whichever is the greater, in the middle of the lifting range except for that stated below. Ensure that the pause in the lifting cycle and the loading and unloading always occur when the hoist is at the lowest position of the lifting cycle.

4.13.8 Repeat the lifting cycle of the hoist for 10000 lifting cycles, according to the following schedule, and conduct the tests in the order shown:

- a) 1000 lifting cycles with the maximum load at the lower-end of the lifting range of the hoist. For electrical hoists, activate the lower end limiting device for approximately 1 s in every lifting cycle.
- b) 1000 lifting cycles with 80% of the maximum load but not less than 100 kg at the top of the lifting range of the hoist. For electrical hoists activating the top-end limiting device for approximately 1 s in every lifting cycle.
- c) 3000 lifting cycles with 80% of the maximum load but not less than 100 kg, in the middle of the lifting range of the hoist.
- d) 5000 lifting cycles with 60% of the maximum load but not less than 90 kg, in the middle of the lifting range of the hoist.

4.13.9 During the lifting cycle the load shall be allowed to adjust to the vertical in such a way that the swing induces only a negligible dynamic element.

5 Mobile hoists - Specific requirements and test methods

This clause specifies requirements and test methods for mobile hoists which are additional to those specified in 4.

5.1 Requirements for static strength

After the static test as defined in 5.2, the hoist shall function as defined by the manufacturer. There shall be no deformation or wear that may affect its function.

5.2 Test methods for static strength

The hoist and lifting devices shall be loaded statically according to the procedures and order described below.

The hoist shall be placed on an inclined surface and secured against tipping but not against deformation. The lifting boom/actuator shall be set in the most adverse position. The hoist shall then be loaded with 1,25 times maximum load for 5 min in the following directions:

- a) 10° forwards;
- b) 10° backwards;
- c) 5° sideways in the most adverse direction (both left and right sides where applicable).

The test is then performed with the surface horizontal and with 1,5 times maximum load (3.24) for 20 min.

5.3 Requirements for static stability

During the static stability test according to 5.4, both unloaded and loaded with the maximum load (3.24), the hoist shall not lose its equilibrium (balance) at the following angles:

- a) forward and backward directions 10° with the chassis in the intended travelling position;
- b) forward and backward directions 7° with the chassis in the most adverse condition;
- c) any other direction, 5° .

5.4 Test methods for static stability

- a) The tests shall be carried out in the forward and backward travelling directions and with the chassis in the travelling position as indicated by the manufacturer and with the load placed in the most adverse position.
- b) The tests shall be carried out in the forward and backward directions and in the most adverse direction. If there is more than one intended direction of travel (forwards) they shall all be regarded as forwards.
- c) The tests shall be carried out with the hoist in its most adverse position regarding the position of the wheels, CSP, base and brakes.

Unloaded

Position the unloaded hoist on the test surface with the wheels towards the stop(s) (see figure 1).

Incline the test plane gradually until the hoist loses its equilibrium (balance). Record the angle of inclination.

Repeat the test in the backward and sideways directions.

Loaded

Attach the maximum load to the hoist's CSP in such a way that the load is able to move freely. Repeat the procedure as for the unloaded hoist. For hoists with rigid patient supports the centre of gravity of the load shall be placed in relation to the back rest according to figure 2, but not more than 350 mm from the front edge of the seat.

For stretchers apply the loads as shown in figure 3.

5.5 Requirements for immobilizing device (brakes)

An immobilizing device shall be provided for mobile hoists. When tested in accordance with 5.6 a maximum movement of 10 mm in any direction is allowed.

5.6 Test methods for immobilizing device (brakes)

To ensure that the requirement described in 5.5 above is fulfilled, a hoist shall be positioned on a 1° slope with the immobilizing device(s) activated. The maximum load shall be applied to the hoist in the most adverse position.

5.7 Requirements for moving forces

The maximum forces required for moving the hoist shall be as follows when tested with the maximum load on the hoist:

- a) starting/turning: 160 N
- b) driving (pushing/pulling): 85 N

5.8 Test methods for moving forces

The test shall be carried out on a flat, smooth and horizontal steel plate.

The hoist shall be loaded with the maximum load (3.24) with the lifting arm set to obtain the maximum reach.

The castors shall be set at 180° to the direction of pulling/pushing.

Using a dynamometer, a starting force is gradually applied to the push handle until the hoist begins to move. Repeat five (5) times. The highest force noted during these tests shall be recorded as the starting force.

The starting force shall be applied and recorded as follows:

- a) in the forward direction
- b) in the backward direction
- c) in the direction that begins to turn the hoist.

5.9 Instructions for use

This clause specifies information required for mobile hoists additional to that specified in 4.11.

The manufacturer shall provide the following information as a minimum:

- daily check list
- functional dimensions, including:
 - a) the height of the base, in accordance with figure 4;
 - b) the maximum/minimum external/internal width, in accordance with figures 5 and 6;
 - c) the under-base clearance, in accordance with figure 4;
 - d) the maximum and minimum hoisting reach (see figure 7 for example);
 - e) the hoisting range in relation to the hoisting reach, in accordance with figure 7;
 - f) the turning radius;
 - g) the total mass of the hoist excluding body support unit;
 - h) the number of parts and the identification of those parts into which the hoist can be disassembled;
 - i) the mass of the heaviest part of the hoist.

6 Stationary hoists - Specific requirements and test methods

This clause specifies requirements and test methods for stationary hoists additional to those specified in 4.

6.1 Specific safety requirements

6.1.1 With regard to ceiling hoists, that are able to move from one 'system' to another via a 'points or switch' system, shall incorporate a safety device which shall ensure that the hoist can only move from one rail system to the other when all relevant connections are safe. This safety device shall be fitted with an interlock device that only allows the hoist to move in a lateral direction when the tracks are in their correct position.

6.1.2 If a hoist is able to produce powered horizontal movement, then its linear velocity shall be limited to 0,15 m/s.

- 6.1.3** After the test specified in 6.2.3, the hoist and end stop shall not be adversely affected.
- 6.1.4** If the vertical movement of the CSP is limited by using electrical switches then an additional device shall be fitted to ensure that any failure of the limiting switches does not create a dangerous situation.
- 6.1.5** All hoists shall incorporate an emergency lowering device.
- 6.2 Test methods for specific safety requirements**
- 6.2.1** The requirements of 6.1.1 shall be determined through functional test and verification of the manufacturer's installation instructions and by inspection.
- 6.2.2** The requirements of 6.1.2 shall be determined by measurement.
- 6.2.3** The unloaded hoist shall be driven into the end stop of the track 100 times at 1,5 m/s for manually operated hoists and 0,15 m/s for hoists that are moved horizontally with the use of motors.
- 6.2.4** The requirements of 6.1.4 shall be determined by rendering the normal limit switch inoperative and checking that the second device operates.
- 6.3 Requirements for static strength for all other stationary hoists**
- Maximum deflection of any horizontal track used in the construction of a hoist system, shall not be more than 1 mm in every 200 mm of track length.
- 6.4 Requirements for static strength (free-standing stationary hoists only)**
- After the static test as defined in 6.5 the hoist shall function as defined by the manufacturer. There shall be no deformation or wear that may affect its function.
- 6.5 Test methods for static strength (free-standing stationary hoists only)**
- The hoist and lifting devices shall be loaded statically according to the procedures and order described below.
- The hoist shall be placed on a 10° inclined surface and secured against tipping but not against deformation. The hoist shall be set in the most adverse position. The hoist shall then be loaded with 1,25 times maximum load for a period of 5 min in the most adverse condition.
- The test is then performed with the surface horizontal and with 1,5 times maximum load (3.24) for 20 min.

6.6 Requirements for static stability (free-standing stationary hoists only)

During the static stability test according to 6.7, both unloaded and loaded with the maximum load, the hoist shall not lose its stable equilibrium at the following angle:

any direction 10°

6.7 Test methods for static stability (free-standing stationary hoists only)

Positioning

The tests shall be carried out in the most adverse direction with the hoist in its most unstable position with regards the position of the CSP and supporting structure.

Unloaded

Position the unloaded hoist on the test surface (see figure 9).

Incline the test plane gradually until the hoist loses its stable equilibrium. Record the angle of inclination.

Repeat the test in the other three directions.

Loaded

Attach the maximum load to the CSP in such a way that the load is able to move freely. Repeat the procedure as for the unloaded hoist.

For hoists with rigid body support units the centre of gravity of the load shall be placed in relation to the back rest according to figure 2 but not more than 350 mm from the front edge of the seat.

For stretchers apply the loads as shown in figure 3.

6.8 Requirements for static strength for all other stationary hoists

6.8.1 Maximum deflection of any horizontal track used in the construction of a hoist system, shall not be more than 1 mm in every 200 mm of track length.

6.8.2 After the static test as described in 6.9.2, the hoist shall function as defined by the manufacturer. There shall be no deformation or wear that may affect its function.

6.9 Test methods for static strength for all other stationary hoists

6.9.1 When a track, installed in accordance with the manufacturer's instructions, is loaded with the maximum load (3.24), the deflection shall be recorded.

- 6.9.2** The hoist shall be fixed to a building structure in accordance with the manufacturer's instructions. The hoist shall then be loaded with 1,5 times maximum load for a period of 20 min.

6.10 Instructions for use

This clause specifies requirements for stationary hoists in addition to those specified in 4.11.3.

The manufacturer shall provide the installer of the hoist with details of the loads being applied to the attachment points.

7 Non-rigid body support units - Specific requirements and test methods

This clause specifies requirements and test methods for non-rigid body support units additional to those specified in 4.

7.1 General

The manufacturer of the body support unit shall indicate which hoist(s) and spreader bar(s) it is compatible with.

The method by which the body support unit can be adjusted or removed shall be clearly stated in the accompanying operating instructions.

7.2 Requirements for the central suspension point

The central suspension point (CSP) shall be constructed in such a way as to prevent inadvertent detachment of the spreader bar during normal usage.

7.3 Test method for the central suspension point

The requirements of 7.2 shall be verified by functional test.

7.4 Requirements for the spreader bar

- 7.4.1** If the width of the spreader bar is designed to be adjustable in use then a safety device(s) shall be incorporated to ensure that the spreader bar or body support unit can not become inadvertently detached.

- 7.4.2** The spreader bar shall be capable of supporting at least 1,5 times the maximum load of the hoist on which it is mounted.

- 7.4.3** The spreader bar shall be provided with a label, showing the type/s and design/s of slings which may be used in combination with the spreader bar. This information may be given in the instructions for use.

7.4.4 Detachable spreader bars shall be marked with the maximum load of the hoist.

7.5 Test methods for the spreader bar

7.5.1 The requirements of 7.4.1 shall be determined through inspection and functional test.

7.5.2 The requirements of 7.4.2 shall be confirmed after the static strength test.

7.5.3 The requirements of 7.4.3 shall be determined through inspection.

7.5.4 The requirements of 7.4.4 shall be determined through inspection.

7.6 Requirements for the non-rigid body support unit

After being tested according to 7.9, the body support unit shall show no signs of damage or loss of function.

It shall be provided with an indication showing the types and design of spreader bar which may be used. This information may be given in the instruction for use.

7.7 Material and seams of the non-rigid body support unit

7.7.1 If the material used in the construction of the body support unit is claimed to be flame retardant by the manufacturer, then the material shall not exhibit progressive ignition or flaming ignition when subjected to the test methods in EN 1021-1:1993.

7.7.2 When cleaned and/or disinfected according to the manufacturer's instructions the body support unit shall not shrink more than 5% of length and width.

7.8 Test methods for non-rigid body support unit

If the body support unit is designed to be laundered, it shall be cleaned and dried ten (10) times in accordance with the manufacturer's instructions and then tested with a static load of 1,5 times the maximum load (3.24) for 20 min.

After the test it shall be subjected to an extensive inspection during which attention shall be given to all parts, i.e. fabric, seams, stitching, loops, loop fixations, fabric at the positions in which rigid parts are received in the fabric. After the test no part shall show any sign of damage or wear.

Any dimensional change shall be determined by measurement.

7.9 Marking

This clause specifies requirements for non-rigid body support units additional to those specified in 4.11.2.

The manufacturer shall provide the following information on a label that is permanently fixed to the body support unit:

- the size of the sling;
- a warning/attention mark which will refer the carer to the operating instructions of the hoist and/or body support unit;
- if the body support unit is designed only to be used on one dedicated type of spreader bar, a marking shall indicate this;
- an indication of the method by which the body support unit shall be cleaned and/or disinfected. Any symbols used shall comply with ISO 3758;

NOTE: It may not be possible to include all of the following information on the body support unit. It is suggested that any other information is given in the operating instructions.

- Field of application, directions for use for each design of the body support unit (see annex B);
- the method of lifting, particularly the attitude, namely sitting, sitting/recumbent or recumbent, and also any other important information regarding choice of type, design and application method, shall be indicated on the label;
- if a body support unit is unsuitable for a specific handicap, this shall be stated;
- a warning not to use a damaged or badly worn body support unit.

7.10 Instructions for use

This clause specifies additional requirements to those specified in 4.11.3.

The method by which the body support unit can be adjusted or removed shall be clearly stated in the accompanying instructions.

8. Rigid body support units - Specific requirements and test methods

This clause specifies requirements and test methods for rigid body support units additional to those specified in 4.

8.1 General

Should the body support unit not be permanently attached to the hoist, then the design shall prevent inadvertent detachment. If the material used in the construction of the body support unit is claimed to be flame-retardant by the manufacturer, then the material shall not exhibit progressive ignition or flaming ignition when subjected to the test methods in EN 1021-1:1993.

8.2 Requirement for backrest

The angle between the sitting part and the backrest shall be a minimum of 90°.

8.3 Requirements and test methods for durability

The rigid body support unit, in combination with the hoist, shall be subjected to the same tests as for the complete lifting-device.

The locking system of detachable body support units shall be function tested for at least 1000 cycles.

After the durability test, the locking system shall still function as specified by the manufacturer.

8.4 Marking

This clause specifies additional requirements for rigid body support units additional to those specified in 4.11.2.

The manufacturer shall provide the following information on a label that is permanently fixed to the body support unit:

- a warning/attention mark which will refer the carer to the operating instructions of the hoist and/or body support unit;
- if the body support unit is designed only to be used on one dedicated type of hoist, a marking shall indicate this;
- an indication of the method by which the body support unit shall be cleaned and/or disinfected. Any symbols used shall comply with ISO 3758;

NOTE: It may not be possible to include all of the following information on the body support unit. It is suggested that any other information is given in the operating instructions.

- Field of application, directions for use for each design of the body support unit (see annex B);
- the method of lifting, particularly the attitude, namely sitting, sitting/recumbent or recumbent, but also other important Information regarding choice of type, design and application method, shall be indicated on the label;
- if a body support unit is unsuitable for a specific handicap this shall be stated;
- a warning not to use a damaged or badly worn body support unit.

8.5 Instructions for use

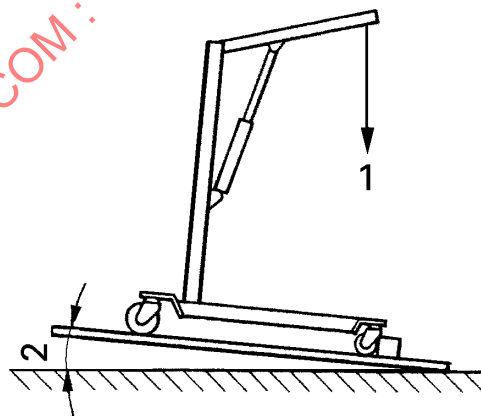
This clause specifies additional requirements to those specified in 4.11.3.

The method by which the body support unit can be adjusted or removed shall be clearly stated in the accompanying instructions.

The manufacturer shall indicate in the instruction for use the method by which it shall be cleaned and/or disinfected.

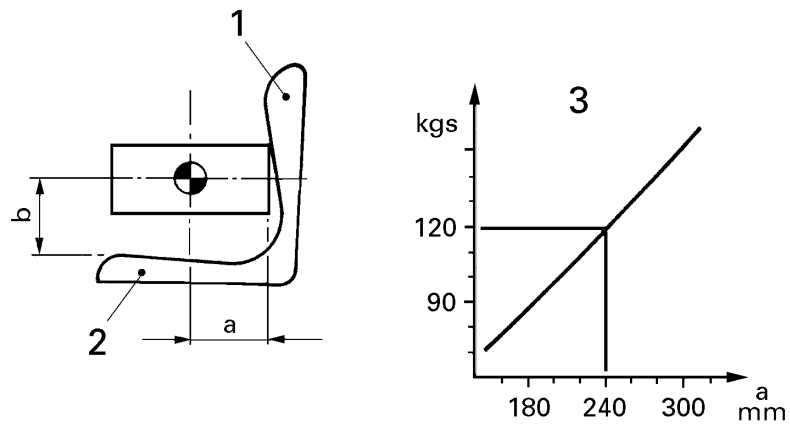
9 Free-standing hoists for use in bathtubs

Under consideration.



- 1 Test load
- 2 Stability angle

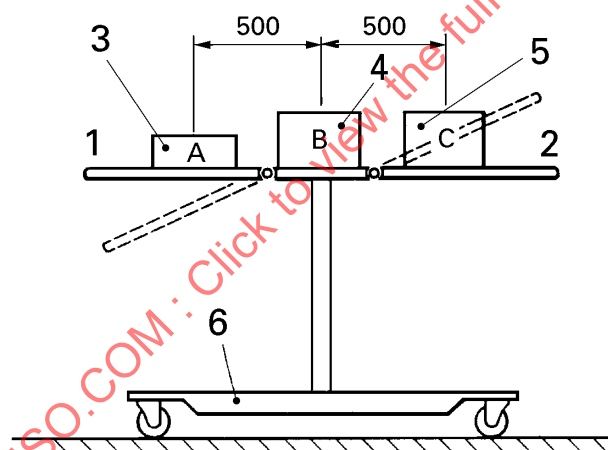
Figure 1 - Example of forward stability test



- 1 Backrest
- 2 Rigid body support
- 3 $a \text{ (mm)} = 2 \times \text{Max. Load}$
 $b \text{ (mm)} = 200$

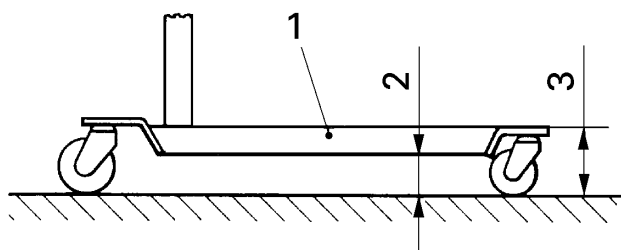
Figure 2 - Placing of loads on rigid body supports

Dimensions in millimetres



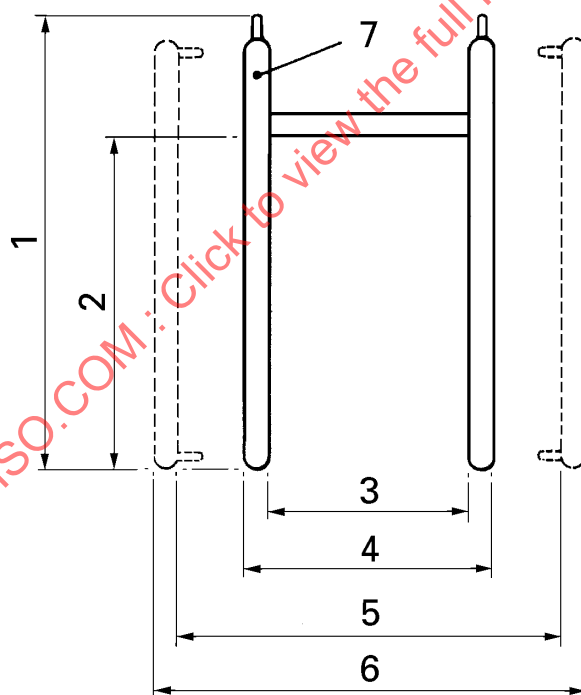
- 1 Feet
- 2 Head
- 3 Load A = 16 % of max. load
- 4 Load B = 42 % of max. load
- 5 Load C = 42 % of max. load
- 6 Base

Figure 3 - Placing of loads on stretcher



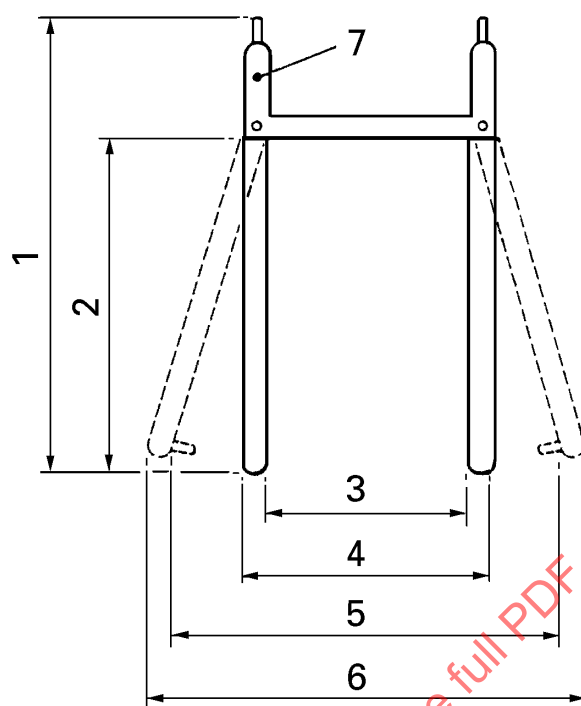
- 1 Base
- 2 Min. clearance
- 3 Max. Height

Figure 4 - Base height/clearance



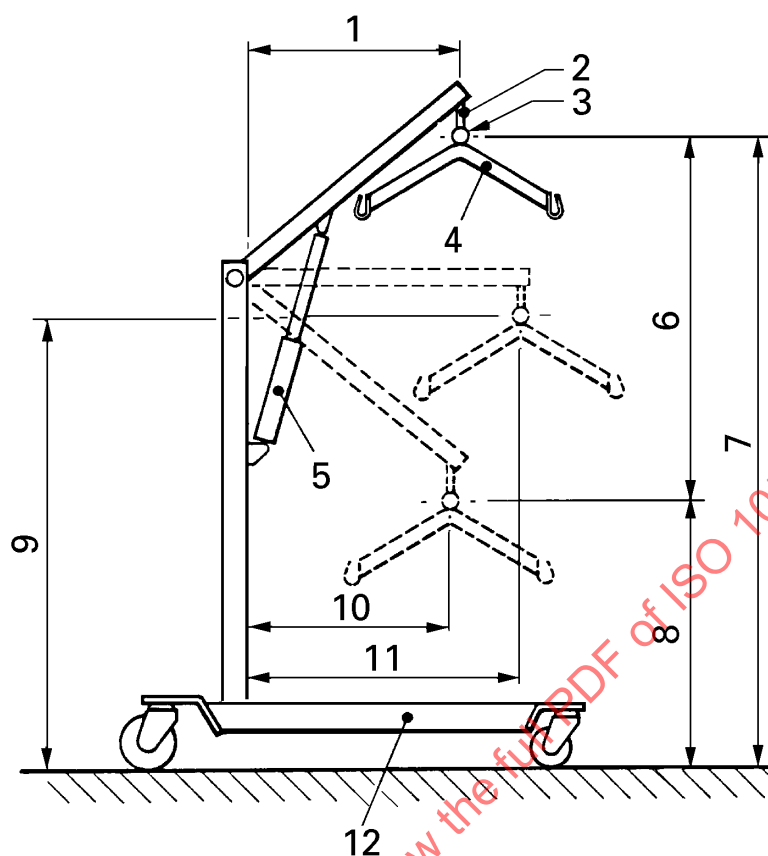
- 1 Max. external length
- 2 Max. internal length
- 3 Min. internal width
- 4 Min. external width
- 5 Max. internal width
- 6 Max. external width
- 7 Base

Figure 5 - Base (Parallel type)



- 1 Max. external length
- 2 Max. internal length
- 3 Min. internal width
- 4 Min. external width
- 5 Max. internal width
- 6 Max. external width
- 7 Base

Figure 6 - Base (Radial type)



- 1 Hoisting reach at max. height of C.S.P.
- 2 Flexible device
- 3 C.S.P.
- 4 Spreader bar
- 5 Lifting machinery
- 6 Hoisting range
- 7 Max. height of C.S.P.
- 8 Min. height of C.S.P.
- 9 Height of C.S.P. at max. hoisting reach
- 10 Hoisting reach at min. height of C.S.P.
- 11 Max. hoisting reach
- 12 Base

Figure 7 - Hoisting range/reach