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Stationary training equipment —

Part 2: Strength training equipment, additional specific safety requirements and test methods

Équipement d'entraînement fixe —

Partie 2: Équipement d'entraînement de force, exigences spécifiques de sécurité et méthodes d'essai supplémentaires

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Foreword

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

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

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

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

This document was prepared by Technical Committee ISO/TC 83, *Sports and other recreational facilities and equipment*, Subcommittee, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 136, *Sports, playground and other recreational facilities and equipment*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 20957-2:2005), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the formulation has been aligned with ISO 20957-1;

— Clause 3 has been updated;

— Clause 5 has been specified and restructured;

— Clause 6 has been specified and restructured;

— additional requirements for externally loaded equipment have been added to Clauses 5 and 6.

A list of all parts in the ISO 20957 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Stationary training equipment —

Part 2:
Strength training equipment, additional specific safety requirements and test methods

1 Scope

This document specifies additional safety requirements for stationary strength training equipment.

This document is intended to be read in conjunction with the general safety requirements of ISO 20957-1.

This document is applicable to stationary training equipment type strength training equipment with stacked weight resistance or other means of resistance, such as elastic cords, hydraulic, pneumatic, electrical, magnetic, springs and externally loaded weights (type 2) (hereinafter referred to as training equipment) with the classes H, S and I according to ISO 20957-1.

NOTE Free-weight barbell racks are subject to the requirements of ISO 20957-4 and ISO 20957-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 20957-1, *Stationary training equipment — Part 1: General safety requirements and test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20957-1 and the following apply.

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

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

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

3.1
selectorized equipment
strength training equipment where the resistance means is a load that is an integral part of the device that can be varied by the user without adding or removing components to and from the equipment

Note 1 to entry: An example of equipment where this component is relevant is shown in Figure 1.

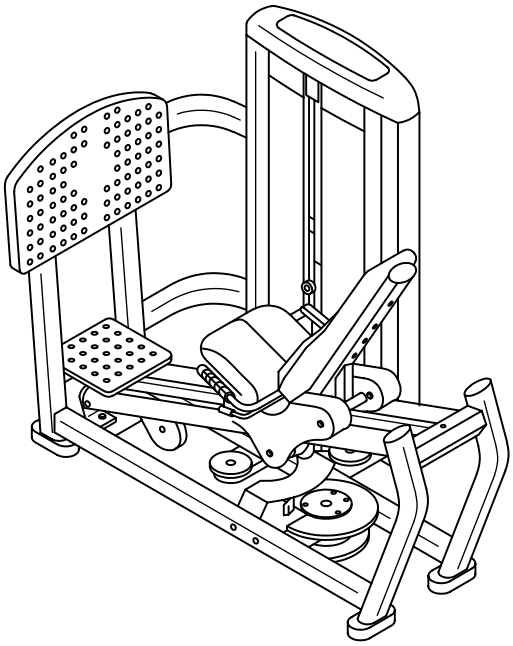


Figure 1 — Example of selectorized guided type equipment

3.2
externally loaded equipment
strength training equipment where the main resistance means is a load that is not an integral part of the device which can be varied by the user by adding or removing components to and from the equipment

Note 1 to entry: Components to be added or removed are, for example, weight discs or bands.

3.3
drop stop
permanent or adjustable constructive element creating a pre-set minimum stop position that provides the user with clearance to avoid entrapment without any further action of the user

3.4
catch mechanism
rest or holder for a barbell or for a carriage on *guided equipment* (3.9), which needs to be engaged by the user, from which the user can begin the exercise motion or end at the completion of the exercise

3.5
work arm
component of strength training equipment that allows the user to activate resistance means for a specific exercise

Note 1 to entry: An example of equipment where this component is relevant is shown in Figure 2 a).

3.6
training resistance
force or torque exerted by the user to perform the exercise

3.7
weight post
structure protruding from the frame of *externally loaded equipment* (3.2) for the purpose of holding weight either for a resistance means or for storage

Note 1 to entry: An example of equipment where this component is relevant is shown in Figure 2 b) and 2 c).

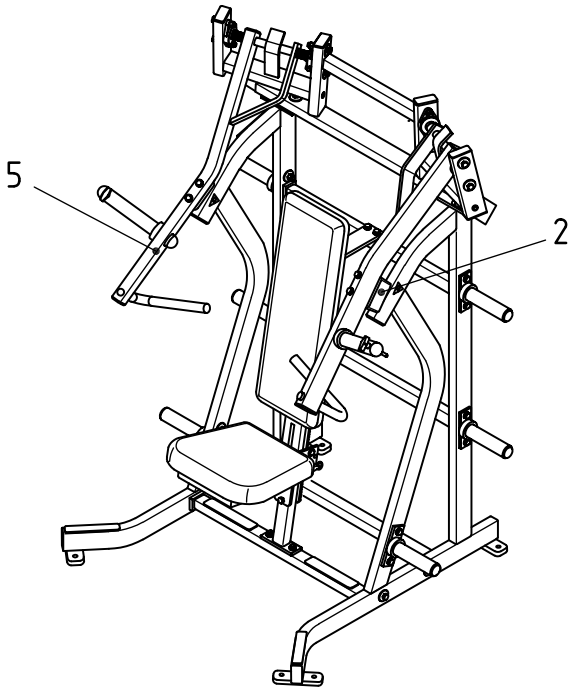
3.8
work arm actuated equipment
equipment where the external load is attached directly or indirectly to a movement mechanism that is displaced intentionally by the user

Note 1 to entry: An example is shown in Figure 2 a).

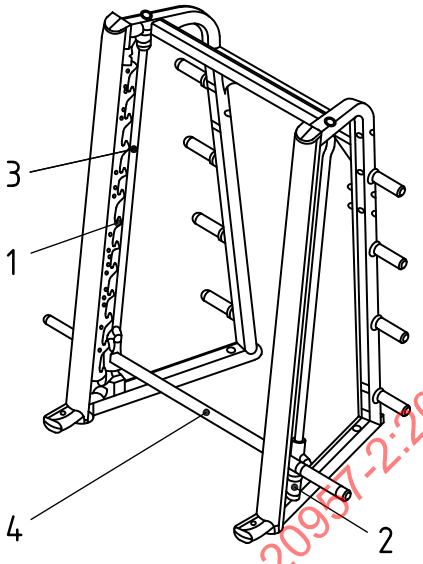
3.9
guided equipment
equipment where the external load is placed on a *weight post* (3.7) affixed to a carriage that is moving on a guided path

Note 1 to entry: Examples are shown in Figure 2 b) and 2 c). Commonly used names for this equipment are "Smith press", "Smith Machine" and "multi-press".

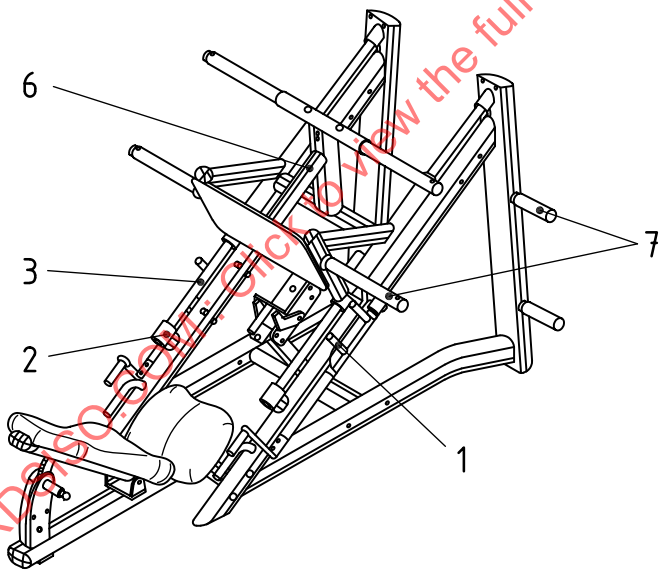
Note 2 to entry:



a) Chest press



b) Multi press



c) Leg press

Key

1	catch mechanism	5	work arm
2	adjustable drop stop	6	carriage
3	guide	7	weight post
4	barbell		

Figure 2 — Examples for different types of externally loaded guided strength training equipment

3.10
stacked weights
stacked guided weights used as a selectable training load

3.11
user-defined motion equipment
equipment where the workout motion is solely defined by the user

Note 1 to entry: Example is shown in Figure 3.

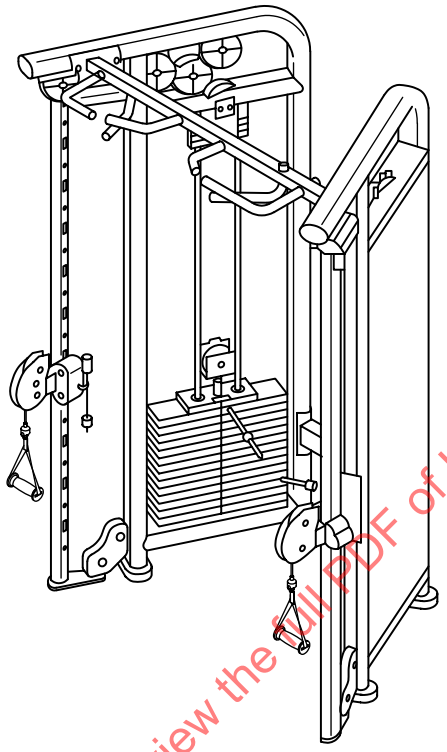


Figure 3 — Example of user-defined motion equipment

4 Classification

The classification given in ISO 20957-1 shall apply.

5 Safety requirements

5.1 General

Depending on the design of the training equipment, the following requirements shall apply as appropriate.

5.2 Stability

5.2.1 General

The equipment shall be stable in any direction and loading condition in training, folding and storage positions.

Test in accordance with the stability test in ISO 20957-1.

5.2.2 Externally loaded equipment

The equipment shall be stable when loaded as specified by the manufacturer either symmetrically or asymmetrically.

Test in accordance with 6.2.2.

5.2.3 User-defined motion equipment

The equipment shall be stable with maximum load selected as provided by the equipment and with its stacked weights at its highest point of the range of travel.

Test in accordance with 6.2.3.

5.3 Loading

5.3.1 Selectorized equipment and alternative resistance training equipment

For equipment classes H, S and I, the intrinsic loading and the extrinsic loading shall be in accordance with ISO 20957-1.

5.3.2 Externally loaded equipment

5.3.2.1 General

In addition to ISO 20957-1 the loading requirements given in 5.3.2.2 to 5.3.2.5 shall apply.

5.3.2.2 Weight posts intended for training

For classes S and I, the training weight posts shall withstand a static load of 6 times the maximum load, as specified by the manufacturer for the training weight post being evaluated.

For class H, the training weight posts shall withstand a static load of 4 times the maximum load, as specified by the manufacturer for the training weight post being evaluated.

Test in accordance with 6.3.1.

After the test, the training equipment shall not be broken and shall still function as intended by the manufacturer.

5.3.2.3 Weight posts intended for storage

For classes S and I, the storage weight posts shall withstand a single static load of 4 times the maximum load, as specified by the manufacturer for the storage weight post being evaluated.

For class H, the storage weight posts shall withstand a single static load of 2,5 times the maximum load as specified by the manufacturer for the storage weight post being evaluated.

Test in accordance with 6.3.2.

After the test, the training equipment shall not be broken and shall still function as intended by the manufacturer.

5.3.2.4 Extrinsic loading

The equipment shall withstand an extrinsic load F_{test} as calculated in accordance with Formula (1).

$$F_{test} = S(W_p + 1{,}5F_a) \quad (1)$$

where

F_{test} is the total reactionary load to be applied during the test, in newton;

S is the safety factor of 4 for classes S and I, and 2,5 for class H;

W_p is the user's body weight portion of the load applied to the part of the equipment being evaluated, of either 100 kg or the maximum user mass as specified by the manufacturer, whichever is greater, in newton;

1,5 is the dynamic coefficient;

F_a is the load applied to the part of the equipment being evaluated, derived from the maximum specified load while performing exercise, in newton.

Test in accordance with 6.3.3.

After the test, the training equipment shall not be broken and shall still function as intended by the manufacturer.

5.3.2.5 Catch mechanisms for guided equipment

For classes S and I, the catch mechanism shall withstand a single static load of 6 times the maximum load as specified by the manufacturer.

For class H, the catch mechanism shall withstand a single static load of 4 times the maximum load as specified by the manufacturer.

Test in accordance with 6.3.4.

After the test, the training equipment shall not be broken and shall still function as intended by the manufacturer.

5.4 Endurance

5.4.1 General

The equipment shall withstand the endurance requirements in accordance with ISO 20957-1 with a load of the maximum user's body mass as specified in the user's manual or 100 kg, whichever is greater, and the maximum training load, considering the following:

If the user's body weight is a factor in the loading of the equipment during operation, then the applicable portion of the maximum user's body mass, as specified in the user's manual, or 100 kg, whichever is greater, shall be applied to the user support surface at the point of user contact.

Test in accordance with 6.4.1.

After the test, the equipment shall not be broken and shall still function as intended by the manufacturer.

5.4.2 Additional requirements for externally loaded equipment

5.4.2.1 General

In addition to ISO 20957-1 and 5.4.1, the requirements given in 5.4.2.2 to 5.4.2.4 shall be applied to work arm actuated equipment and guided equipment.

5.4.2.2 Work arm actuated equipment

The equipment shall withstand

a) one impact for class H, and

b) ten impacts for classes S and I

of the maximum training load as specified by the manufacturer where the user interfaces with the work arm travels through a distance of (460 ± 5) mm. If this distance is not achievable, the maximum range of motion shall be used.

Test in accordance with 6.4.2.1.

After the test, the training equipment shall not be broken and shall still function as intended by the manufacturer.

5.4.2.3 Catch mechanisms of guided equipment

The catch mechanism shall withstand

a) one impact for class H, and

b) ten impacts for classes S and I, each time on the same catch mechanism

of the maximum training load as specified by the manufacturer. The carriage or barbell shall be dropped (150^{+5}_{-0}) mm along the guided path. If this distance is not achievable, the maximum range of motion shall be used.

Test in accordance with 6.4.2.2.

After the test, the training equipment shall not be broken and shall still function as intended by the manufacturer.

5.4.2.4 Drop stop for guided equipment

The drop stop shall withstand

a) one impact for class H, and

b) ten impacts for classes S and I

of the maximum training load as specified by the manufacturer. The carriage or barbell shall be dropped (460^{+5}_{-0}) mm along the guided path. If this distance is not achievable, the maximum range of motion shall be used.

Test in accordance with 6.4.2.3.

After the test, the training equipment shall not be broken and shall still function as intended by the manufacturer.

5.5 Access to squeeze and/or shear points

5.5.1 Stacked weights or alternative means of resistance

The requirements in 5.5.1.1 and 5.5.1.2 do not apply to externally loaded equipment.

5.5.1.1 Class H

The unintended access by users and/or third parties to squeeze and/or shear points of stacked weights or other means of resistance shall be prevented by either

a) being fully surrounded by a guard with the exception of a ≤75 mm wide gap for selection of the stacked weights or other means of resistance, or

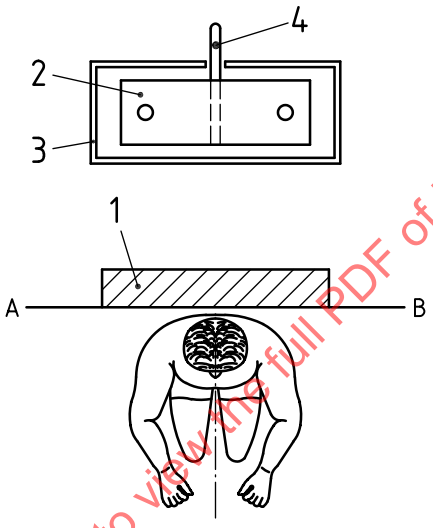
b) locking, securing or deactivating the stacked weights or other means of resistance of the training equipment to prevent movement when the training equipment is not in use.

Test in accordance with 6.1.2 and 6.1.4.

5.5.1.2 Classes S and I

5.5.1.2.1 Guarding for stacked weights

Where stacked weights are behind the user (see Figure 4, vertical plane A-B) in any exercise position as described in the user's manual, they shall be guarded on all vertical sides. On the side where the weight is selected, a gap of ≤75 mm is allowed. The guarding shall be ≥60 mm higher than the upper edge of the stacked weights in its highest position unless the guarding and the top structure form an enclosure.



Key

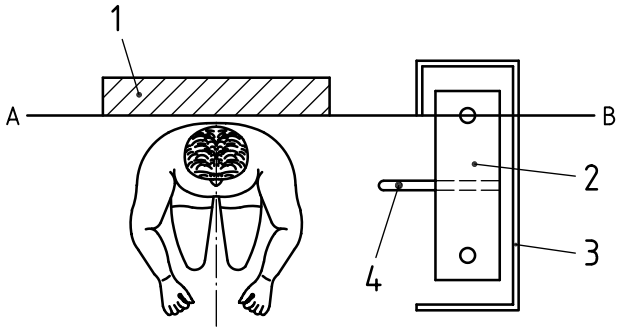
1 head, chest or back support
2 stacked weights
3 guarding
4 pin

NOTE 1 A-B is the line drawn laterally from the head, chest or back support in its most onerous position.

NOTE 2 The opening for the pin can be on any of the 4 sides.

Figure 4 — Stacked weights behind the user

If any part of the stacked weights project behind the line A-B, it shall be guarded in accordance with Figure 5.



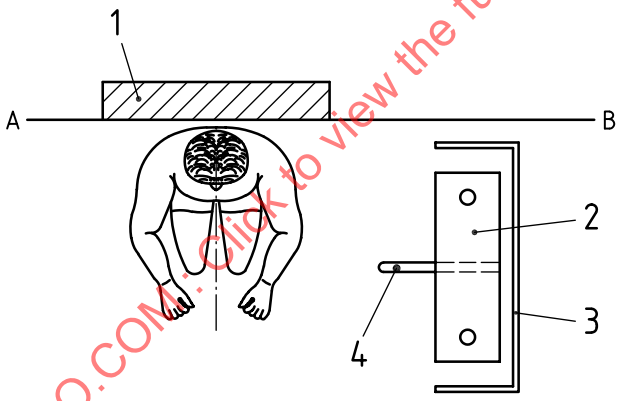
Key

1 head, chest or back support
2 stacked weights
3 guarding
4 pin

NOTE A-B is the line drawn laterally from the head, chest or back support in its most onerous position.

Figure 5 — Stacked weights partially behind of A-B

When the totality of the stacked weights is at the side of the user and in front of A-B (see Figure 6), it shall be guarded at least on the 3 sides furthest from the user.



Key

1 head, chest or back support
2 stacked weights
3 guarding
4 pin

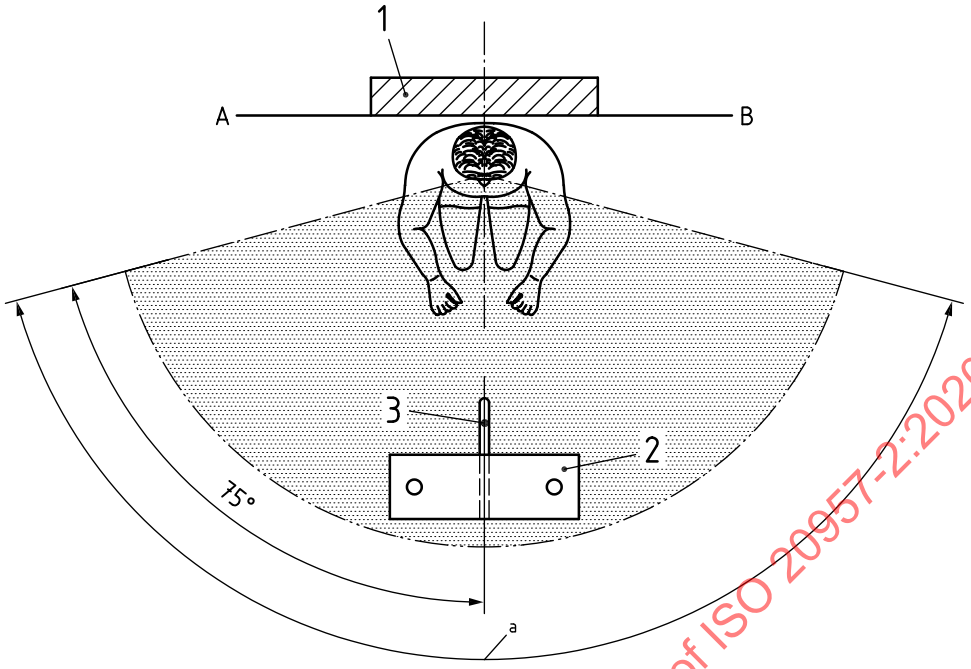
NOTE A-B is the line drawn laterally from the head, chest or back support in its most onerous position.

Figure 6 — Stacked weights in front of A-B

Test in accordance with 6.1.1 and the selection of the stacked weights shall be from the open side.

5.5.1.2.2 No guarding

Where the stacked weights are always in front of the user and visible throughout the exercise without any important obstruction (see Figure 7), no guarding is required.



Key

1 head, chest or back support
2 stacked weights
3 pin
[a] Field of vision.

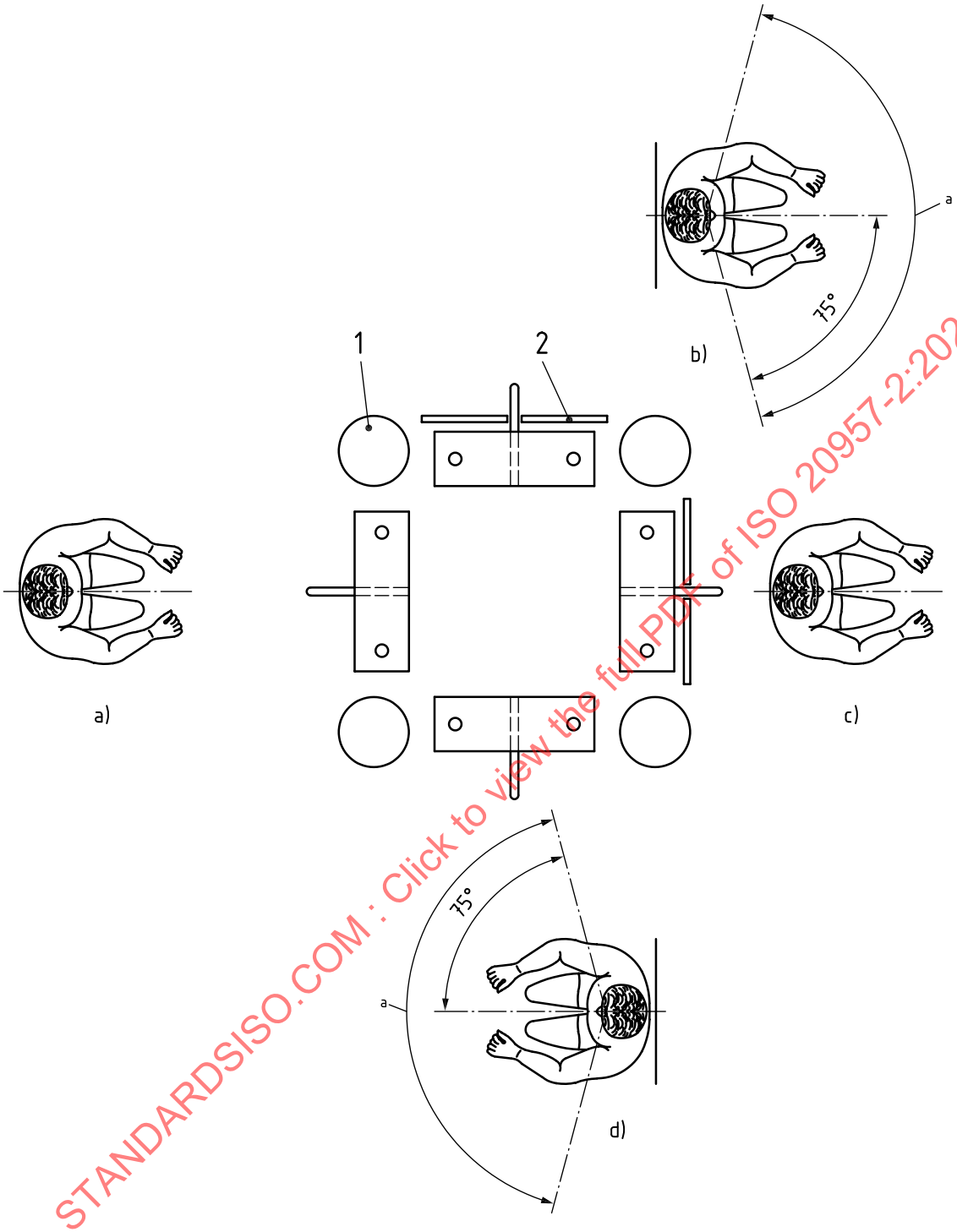
NOTE A-B is the line drawn laterally from the head, chest or back support in its most onerous position.

Figure 7 — Stacked weights in front of the user

Test in accordance with 6.1.1.

5.5.1.2.3 Guarding for multiple stacked weight training equipment

For classes S and I only, multiple stacked weight training equipment does not require guarding on the 3 sides furthest from the user provided there is a framework and/or guard on these sides which prevents unintended access by the user and/or third parties. On the side adjacent to the user, the requirements shall be in accordance with the examples of the guarding shown in Figure 8.



Key

1 framework and/or guard

2 guarding

[a] Field of vision.

NOTE 1 The framework can act as a part of the guarding.

NOTE 2 For example a) stacked weights in front of the user; b) stacked weights at the side of the user, outside field of vision; c) stacked weight behind the user; and d) stacked weights at the side of the user, in the field of vision.

Figure 8 — Multiple stacked weight training equipment

Test in accordance with 6.1.1

5.5.2 Weight disc clearance for externally loaded weights

The distance between weight discs and other movable or fixed parts shall be in accordance with ISO 20957-1. This requirement does not apply to weight discs on the same weight post.

Test in accordance with 6.1.1 and 6.1.2.

5.6 Weight disc retention

All weight posts used for application of the training resistance shall contain a retention means. Acceptable means include, e.g. detent pins, clips or angling of the weight post above horizontal. If angling is used, the weight post shall be angled ≥2° with respect to horizontal throughout the entire range of motion.

Test in accordance with 6.1.1, 6.1.2 and 6.1.4.

5.7 Entrapment

In addition to the requirements for entrapment of the user according to ISO 20957-1, all guided equipment shall be provided with a drop stop.

Squat-type exercise equipment shall have drop stop positions that set the barbell at a distance of ≥710 mm from the floor.

Sled type exercise equipment shall have a permanent stop to set a minimum distance of 266 mm between the front edge of the seat and the foot platform.

Test in accordance with 6.1.1, 6.1.2 and 6.1.4.

5.8 Pull-in points

Pull-in points of rope or belt drives present on the equipment shall be protected.

If any of the following requirements are met, the area between the pulley groove and the rope or belt is not considered a hazard and does not require additional guarding:

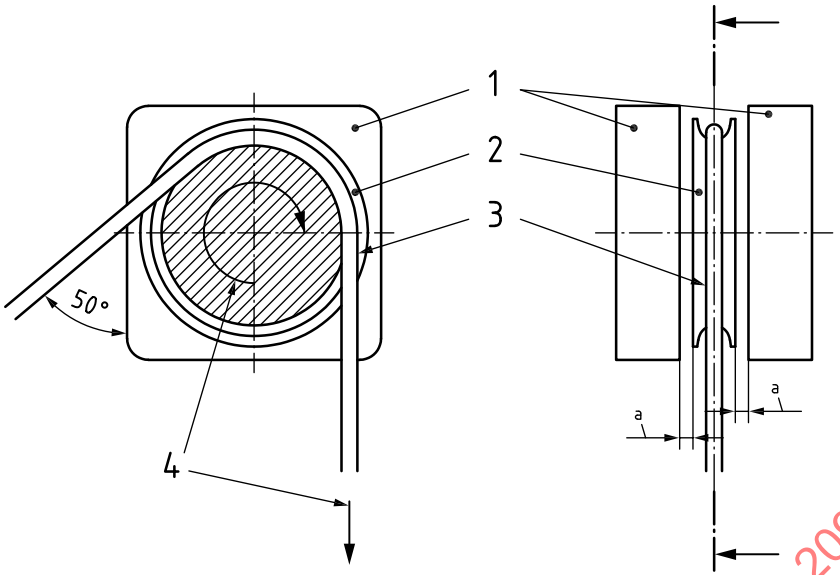
a) Potential pull-in points of rope or belt drives present on the equipment at a height of >1 800 mm.

b) The surface pressure at considered pull-in point is ≤90 N/cm^2.

c) Access to the considered pull-in point is prevented by the user's body during exercising.

d) The angle between the rope or belt and the guarding and/or pulley is ≥50° in all directions during intended use, see Figure 9. The guarding shall not rotate together with the pulley.

Pull-in points for chains, gears and sprockets shall be protected in accordance with ISO 12100.



Key

1 guarding
2 pulley
3 rope or belt
4 direction of movement
a Finger probe (9,5 mm) in accordance with ISO 20957-1.

Figure 9 — Pull-in point

Test in accordance with 6.1.1, 6.1.2 and 6.1.4.

5.9 Additional instructions for use

In addition to ISO 20957-1, the following information shall be given in the instructions for use:

a) that the owner shall provide the user with all warnings and instructions;

b) for classes S and I, that the training equipment shall only be used in areas where access, supervision and control is specifically regulated by the owner;

c) for classes S and I, where the training equipment is designed to 5.5.1.2.2 (stacked weights unguarded), that the person exercising should face the training equipment at all times during the exercise. The stacked weights should remain within the field of vision of the user throughout the exercise to prevent danger to a third party;

d) for classes S and I, short instructions describing the main exercises affixed directly or provided to be affixed on or close to the training equipment (e.g. as graphic symbols);

e) for training equipment externally loaded with weight discs/plates, instructions regarding the bore size and dimensional capacity of the weight discs/plates;

f) for guided equipment, information on how to pre-set the height of adjustable drop stop(s) to provide sufficient space to avoid crushing injuries;

g) information for the function and appropriate set up of all catch mechanisms and drop stops;

h) instructions for loading and unloading external weight on the equipment;

i) instructions for using weight retention devices on barbells and weight posts;

j) information on equipment weight plate size restrictions;

k) instructions for special attention to drop stops and catch mechanisms during maintenance checks;

l) if pictograms or graphical symbols are used in the marking, an explanation shall be given.

5.10 Additional marking

In addition to ISO 20957-1, the following markings shall be included for classes S and I:

a) for externally loaded equipment, maximum load capacity for each weight post;

b) warning that using the equipment for support during stretching or allowing resistance straps, ropes or other means to be attached to it can result in injury;

c) warning that adjustable drop stops shall be positioned and used appropriately for the specific exercise;

d) for all squat-type exercise equipment, warning labels shall be affixed to each side of the equipment at a height which maintains a minimum distance between the barbell and the floor or base of 710 mm;

NOTE Squat-type exercise equipment are for example Smith Machines, Hack Squat, Squat Racks and Lifting/Power Cages.

e) instructions describing the main exercise shall be affixed on the equipment.

6 Test methods

6.1 General

6.1.1 Dimensional check

The measurement shall be done with appropriate measurement devices.

6.1.2 Visual examination

The visual examination shall be done under proper lighting.

6.1.3 Tactile examination

The tactile examination shall be done without gloves.

6.1.4 Performance test

The tested mechanism shall be actuated as intended by the manufacturer.

6.2 Stability testing

6.2.1 General

If the equipment is required by the manufacturer to be anchored, it shall be anchored for the test. All other equipment shall not be anchored for the testing.

6.2.2 Externally loaded equipment

Place the equipment on a $(10^{+2}_{-0})°$ incline surface in the most onerous position.