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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 20957-2 was prepared by Technical Committee ISO/TC 83, *Sports and recreational equipment.*

ISO 20957 consists of the following parts, under the general title *Stationary training equipment*:

— *Part 1: General safety requirements and test methods*

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

— *Part 4: Strength training benches, additional specific safety requirements and test methods*

— *Part 5: Pedal crank training equipment, additional specific safety requirements and test methods*

— *Part 6: Treadmills, additional specific safety requirements and test methods*

— *Part 7: Rowing machines, additional specific safety requirements and test methods*

— *Part 8: Steppers, stairclimbers and climbers — Additional specific safety requirements and test methods*

— *Part 9: Elliptical trainers, additional specific safety requirements and test methods*

Stationary training equipment —

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

1 Scope

This part of ISO 20957 specifies additional safety requirements for strength training equipment in addition to the general safety requirements of ISO 20957-1.

This part of ISO 20957 is applicable to stationary training equipment type strength training equipment with stack weight resistance or other means of resistance like weight discs, elastic cords, hydraulic, pneumatic and magnetic systems and springs (type 2) (hereinafter referred to as training equipment) with the classes S and H.

Any attachments provided with the training equipment for the performance of additional exercises are subject to the requirements of ISO 20957-1.

2 Normative references

The following referenced documents are indispensable for the application 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 20957-1:2005, *Stationary training equipment — Part 1: General safety requirements and test methods*

EN 294, *Safety of machinery — Safety distance to prevent danger zones being reached by the upper limbs*

3 Terms and definitions

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

4 Classification

Clause 4 of ISO 20957-1:2005 applies.

5 Safety requirements

5.1 General

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

5.2 Loading

5.2.1 Intrinsic loading

Each piece of equipment loaded with the user's body mass shall withstand a force F:

— for class H 2,5 × the body mass (100 kg) without breakage;

— for class S 2 × the body mass (100 kg) without permanent deformation.

When tested according to 6.2, supports (e.g. load-bearing surfaces) shall not be deformed by more than f = 1/100, cantilever supports (cantilever surfaces) by more than f = 1/150 and other dimensions by more than 1 %. The training equipment shall not break when a static load of 4 × the body mass is applied.

5.2.2 Extrinsic loading

5.2.2.1 Class H

When tested according to 6.3 and loaded with the user's body mass and/or reaction forces or moments of the user, each piece of equipment shall withstand, without breakage, a load, F in newtons according to Equation (1):

$$F = [G_k + 1{,}5\ G] \times 2{,}5 \times 9{,}81 \quad (1)$$

where:

G is the maximum load in kilograms indicated by the manufacturer (see 6.8 of ISO 20957-1:2005);

G_k is the force in kilograms determined by the proportional body mass (100 kg);

1,5 is the dynamic coefficient;

2,5 is the safety coefficient.

5.2.2.2 Class S

When tested according to 6.3 and loaded with the user's body mass and/or reaction forces or moments of the user, each piece of equipment shall withstand a load F according to Equation (2):

$$F = [G_k + 1{,}5\ G] \times 2 \times 9{,}81 \quad (2)$$

where:

G is the maximum load in kilograms indicated by the manufacturer (see 6.8 of ISO 20957-1:2005). The torques as specified in Table 1 are to be taken as basis for the calculation of G, if greater than the manufacturer's stated maximum load;

G_k is the force in kilograms determined by the proportional body mass (100 kg);

1,5 is the dynamic coefficient;

2 is the safety coefficient.

After the test, supports (load bearing surfaces) shall not be deformed by more than f = 1/100, cantilever supports (cantilever surfaces) by not more than f = 1/150 and other dimensions by not more than 1 %.

If greater than manufacturer's maximum stated load, the equipment shall be capable of accepting a minimal torque load as specified in Table 1, throughout the range of movement of each exercise for which the equipment is designed. The training equipment shall not break when a static load according to Equation (2) with a safety coefficient of 4 is applied.

5.3 Endurance load

When tested according to 6.4, the training equipment shall be capable of normal functioning.

When the training equipment consists of two or more separate functional units, each shall withstand the endurance load test.

When more than one function is tested, which involve use of common components e.g.: ropes, pulleys and bearings, these can be replaced before each separate test.

5.4 Stacked weights

5.4.1 Access to squeeze and/or shear points

5.4.1.1 General

The uncontrolled access by third parties to squeeze and/or shear points of stacked weights shall be prevented.

Weights that can only be lifted as a whole block shall not come closer than 60 mm during movement to any part of the equipment or the ground.

5.4.1.2 Class H

This can be achieved by either:

a) surrounding by a casing in conformance with EN 294 with the exception of a maximum 75 mm wide gap for setting of the weights;

or

b) by locking the machine to prevent moving of the stacked weights when the equipment is not in use and by utilizing the training area to deny access to third parties [see 3.2 and 9 c) of ISO 20957-1:2005].

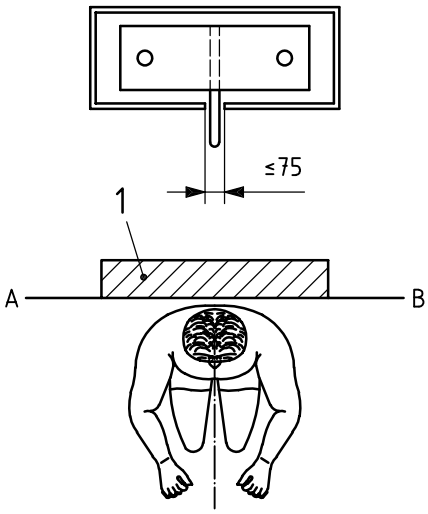
5.4.1.3 Class S

5.4.1.3.1 Encasing

Where stacked weights are behind the user in the normal exercise position as described in the user's manual (see Figure 1, vertical plane AB) they shall be encased on all sides except one side where a gap of 75 mm maximum is allowed for selection of the weights. Stacked weights that are encased shall fulfill the following requirement:

— up to 1 800 mm the encasing shall be at least 60 mm higher than the upper edge of the block of weights in its highest position.

Dimensions in millimeters



Key

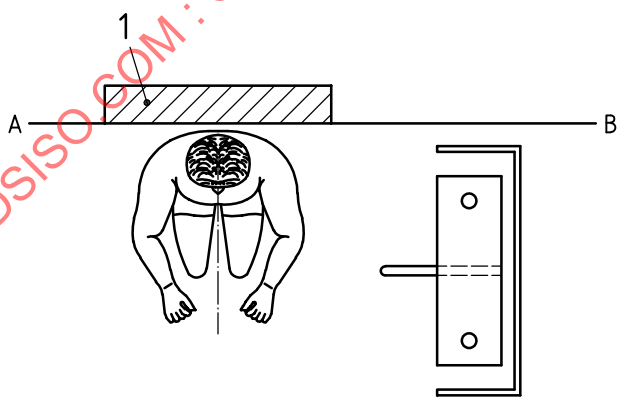
1 head, chest or back support

Figure 1 — Weight stack behind the user

Where the whole of the stacked weights are at the side of the user and in front of AB (see Figure 2) they shall be encased on the 3 sides furthest from the user. Test in accordance with 6.1.1. Selection of the weights shall be from the open side.

If any part of the weight stack projects behind AB (see Figure 3) it shall be encased on all sides. AB is the line drawn laterally from the head, chest or back support in its most onerous position. If there is no support the line is drawn laterally from the most onerous user position.

Dimensions in millimeters

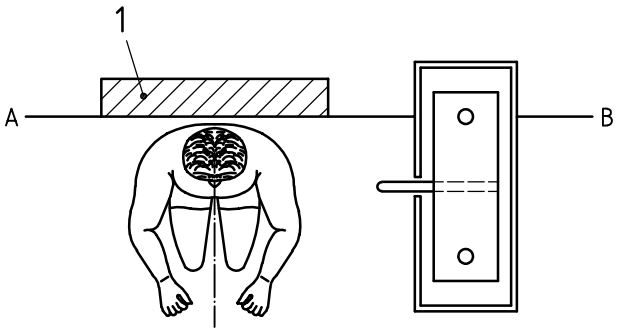


Key

1 head, chest or back support

Figure 2 — Weight stack in front of AB

Dimensions in millimeters



Key

1 head, chest or back support

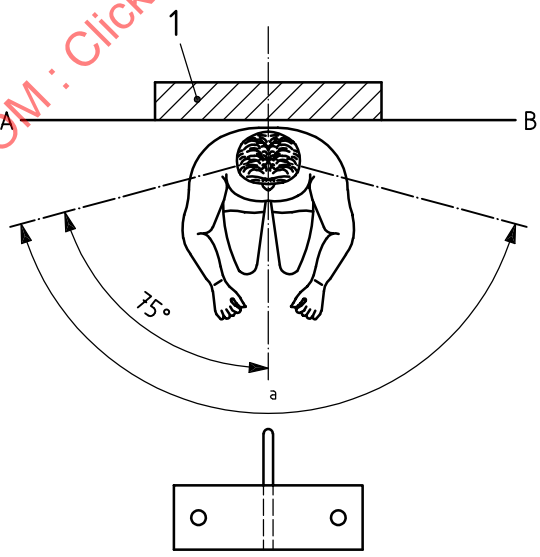
Figure 3 — Weight stack behind AB

Multiweight stack machines do not require guarding on the 3 sides furthest from the user provided there is a framework on these sides which prevents uncontrolled access by third parties. On the side adjacent to the user the requirements apply as in 5.4.1.2.

5.4.1.3.2 No encasing

Where the stacked weights are always in front of the user and visible throughout the exercise without any important obstruction (see Figure 4), weights need not be encased.

NOTE Encasing is not necessary because the negative forces exceed the positive forces and thus the user can always interrupt the movement of the stacked weights if a third party unintentionally enters the area of the stacked weights.



Key

1 head, chest or back support

[a] Field of vision.

Figure 4 — Weight stack in front of the user

5.5 Weight discs

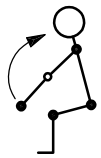
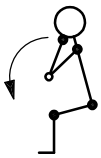
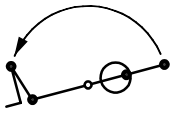
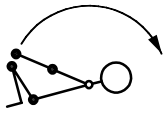
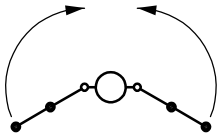
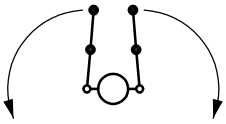
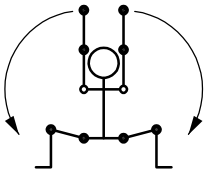
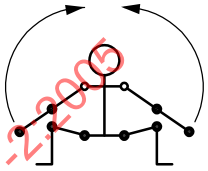
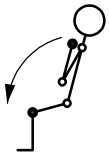
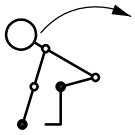
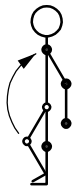
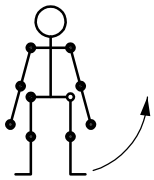
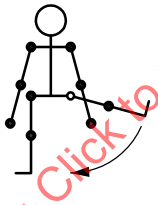
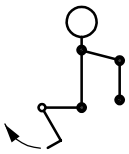
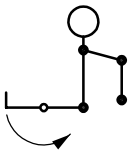
The maximum load ability of each weight support shall be indicated on the machine. Locking mechanisms shall be provided according to 5.4 of ISO 20957-1:2005 which prevent weight discs from falling off. Methods of attachment or loading of other forms of resistance (e. g. elastic cords, springs) shall comply with 5.4 of ISO 20957-1:2005. Test in accordance with 6.1.2 and 6.1.4.

5.6 Minimum achievable training loads

Machines which perform following biomechanical functions should meet the minimum torque values shown in Table 1.

Test in accordance with 6.1.4.

Table 1 — Mean torque values for single-joint movement

 **Elbow flexion** 170 N·m (*B*)	 **Elbow extension** 170 N·m (*B*)	 **Pull over** 260 N·m (*B*)	 **Arm lifting** 130 N·m (*B*)
 **Arms forwards** 110 N·m each	 **Arms backwards** 110 N·m each	 **Shoulder adduction** 110 N·m each	 **Shoulder abduction** 50 N·m each
 **Trunk flexion** 280 N·m	 **Trunk extension** 450 N·m	 **Hip extension** 450 N·m each	 **Hip flexion** 190 N·m each
 **Hip abduction** 140 N·m each	 **Hip adduction** 200 N·m each	 **Knee extension** 600 N·m (*B*)	 **Knee flexion** 300 N·m (*B*)

(*B*) Both sides and both legs respectively.

❍ Joint in motion.

• Joint without motion.

6 Test methods

6.1 General

6.1.1 Dimensional check

6.1.2 Visual examination

6.1.3 Tactile examination

6.1.4 Performance test

6.1.5 Manufacturer's certificate

6.2 Testing of intrinsic loading

Carry out the test quasi-statically.

Apply the load, F (see 5.2.1) in the most onerous position of normal use on a surface area of 300 mm × 300 mm for 5 min on the training equipment without fixing its legs during the test.

Carry out the deformation test of class S according to Figure 5.

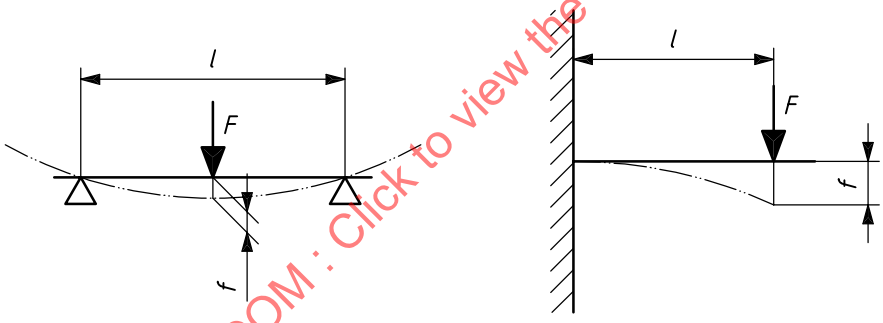


Figure 5 — Permanent deformation test

6.3 Testing of extrinsic loading

Test as specified in 6.2 but place the determined load on the equipment as in normal practice and in a position which imposes greatest strain on the equipment.

When the load bearing surface is divided, apply the test load to each part in proportion to the total surface area at the same time.

6.4 Testing of the weight discs support

Apply a vertical force in the direction of gravity in the centre of the usable support length

— for class H 2,5 × the maximum specified load without breakage;

— for class S 2 × the maximum specified load without permanent deformation and 4 × the maximum specified load without breakage.