BS EN ISO 20957-5:2016

BSI Standards Publication

Stationary training equipment

Part 5: Stationary exercise bicycles and upper body crank training equipment, additional specific safety requirements and test methods (ISO 20957-5:2016)

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National foreword

This British Standard is the UK implementation of EN ISO 20957-5:2016. It supersedes BS EN 957-5:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee SW/136/4, Sports, Playground and other Recreational Equipment - Stationary Training Equipment.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Stationäre Trainingsgeräte - Teil 5: Stationäre Trainingsfahrräder und Kurbel-Trainingsgeräte für den Oberkörper, zusätzliche besondere sicherheitstechnische Anforderungen und Prüfverfahren (ISO 20957-5:2016)

This European Standard was approved by CEN on 6 November 2016.

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

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European foreword

This document (EN ISO 20957-5:2016) has been prepared by Technical Committee ISO/TC 83 "Sports and other recreational facilities and equipment" in collaboration with Technical Committee CEN/TC 136 “Sports, playground and other recreational facilities and equipment” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 957-5:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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Endorsement notice

The text of ISO 20957-5:2016 has been approved by CEN as EN ISO 20957-5:2016 without any modification.

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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).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

ISO 20957-5 was prepared by the European Committee Standardization (CEN) Technical Committee CEN/TC 136, *Sports, playground and other recreational facilities and equipment*, in collaboration with ISO Technical Committee TC 83, *Sports 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 20957-5:2005), which has been technically revised with the following changes:

— publication as an EN ISO;

— formulation aligned with ISO 20957-1;

— Clause 5 "Safety requirements" specified and restructured;

— Clause 6 "Test methods" specified and restructured;

— normative references updated.

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

Introduction

This document concerns the safety of crank training equipment. It amends and supplements ISO 20957-1. The requirements of this document take priority over those in the general standard.

Stationary training equipment —

Part 5: Stationary exercise bicycles and upper body crank training equipment, additional specific safety requirements and test methods

1 Scope

This document specifies safety requirements for stationary exercise bicycles and upper body crank training equipment in addition to the general safety requirements of ISO 20957-1.

This document is applicable to stationary training equipment type stationary exercise bicycles and upper body crank training equipment (type 5) as defined in Clause 3 within the classes S, H, I and A, B, C according to ISO 20957-1.

Any attachment provided with the stationary exercise bicycles and upper body crank training equipment for the performance of additional exercises are subject to the requirements of ISO 20957-1.

This document is not applicable to roller stands as they cannot be made safe in a reasonable way.

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 4210-8:2014, *Cycles — Safety requirements for bicycles — Part 8: Pedal and drive system test methods*

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

EN 71-1, *Safety of toys — Part 1: Mechanical and physical properties*

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:

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

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

3.1
crank training equipment
stationary apparatus on which work is carried out by turning a crank mechanism either by using the lower body or the upper body or both

3.2
freewheel
mechanism which is designed to disengage the flywheel from the crank mechanism in one direction

3.3
seat pillar
connection between the frame and the seat provided to adjust the height of the seat

3.4
seat tube
part of the frame where the *seat pillar* (3.3) is inserted

3.5
handlebar stem
connection between the frame and the handlebar provided to adjust the height of the handlebar

3.6
display
device that provides information to the user

3.7
load adjustment
device to change the level of resistance felt by the user

3.8
constant power mode
programme that allows the user to maintain a predetermined equipment power level independent of pedalling revolutions per minute and can be adjustable to different levels

Note 1 to entry: $P = 2 \cdot M \cdot \pi \cdot {}^{n}\!/_{60}$

where

P is the power, in Watts;

M is the torque at the crank axle, in Newton metre;

n is the crank speed, in revolutions per minute.

3.9
adjustable torque
torque that allows the user to maintain a pre-determined equipment resistance level

Note 1 to entry: The power is only dependent upon the pedalling revolutions per minute and the chosen resistance level ($M = F \cdot L$)

where

M is the torque at the crank axle, in Newton metre;

F is the linear force applied, in Newton;

L is the length of the crank arm, in metre.

3.10
inertia factor
sum of the inertia moments of all rotating parts of the drive train multiplied by the square of the appropriate gear ratio

Note 1 to entry: The gear ratio is the rotational speed of the flywheel divided by the rotational speed of the relevant shaft beginning by the crank shaft.

3.11
protective cover
cover provided to protect the user from inadvertent access to hazardous parts of the *crank training equipment* (3.1)

Note 1 to entry: Hazardous parts include moving parts, gear systems, hot surfaces, etc.

3.12
adjustable handlebar
handlebars which can be adjusted for different training positions

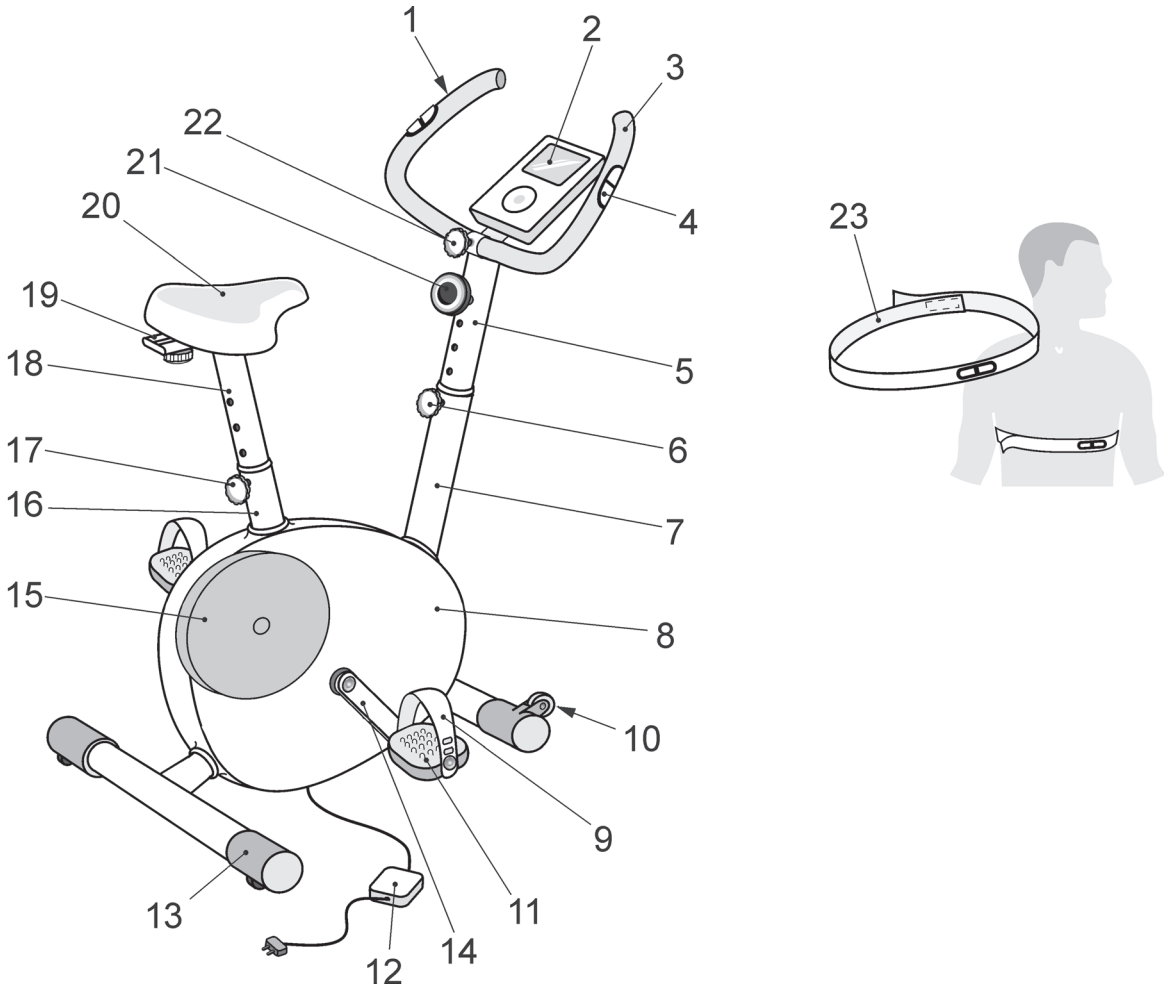
3.13
heart rate control mode
programme that allows the user to maintain training with a predetermined pulse level by adjusting the resistance automatically

3.14
seat system
system that consists of seat, seat back rest, adjustment and mounting components

4 Classification

The classification shall be according to ISO 20957-1.

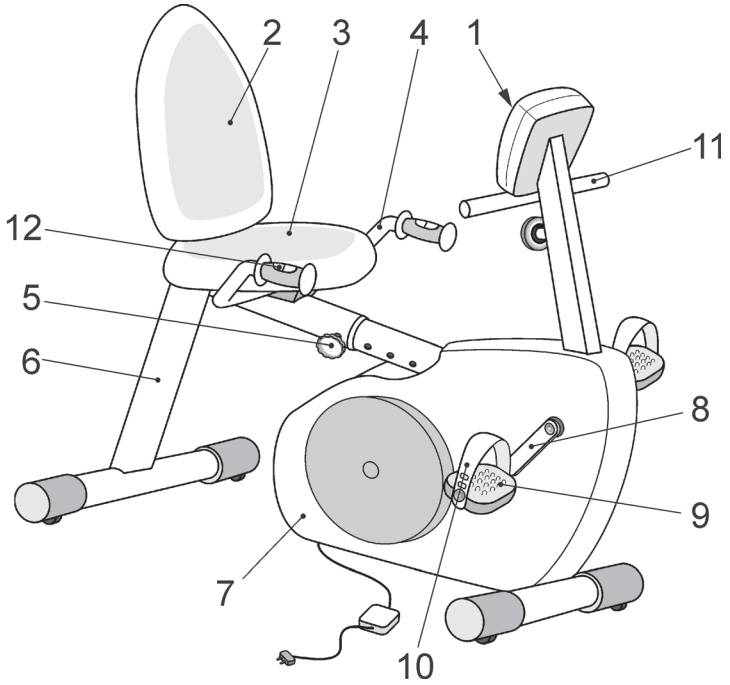
NOTE Figure 1 to Figure 3 are intended only to give examples and to illustrate the names of the components.



Key

1	handlebar	13	foot
2	display	14	crank
3	hand grip	15	flywheel
4	contact heart rate sensor	16	seat tube
5	handlebar stem	17	seat height adjustment
6	handlebar height adjustment	18	seat pillar
7	frame	19	horizontal seat adjustment
8	protective cover	20	seat
9	pedal strap	21	load adjustment
10	transport wheel	22	handlebar adjustment device
11	pedal	23	heart rate belt
12	power supply		

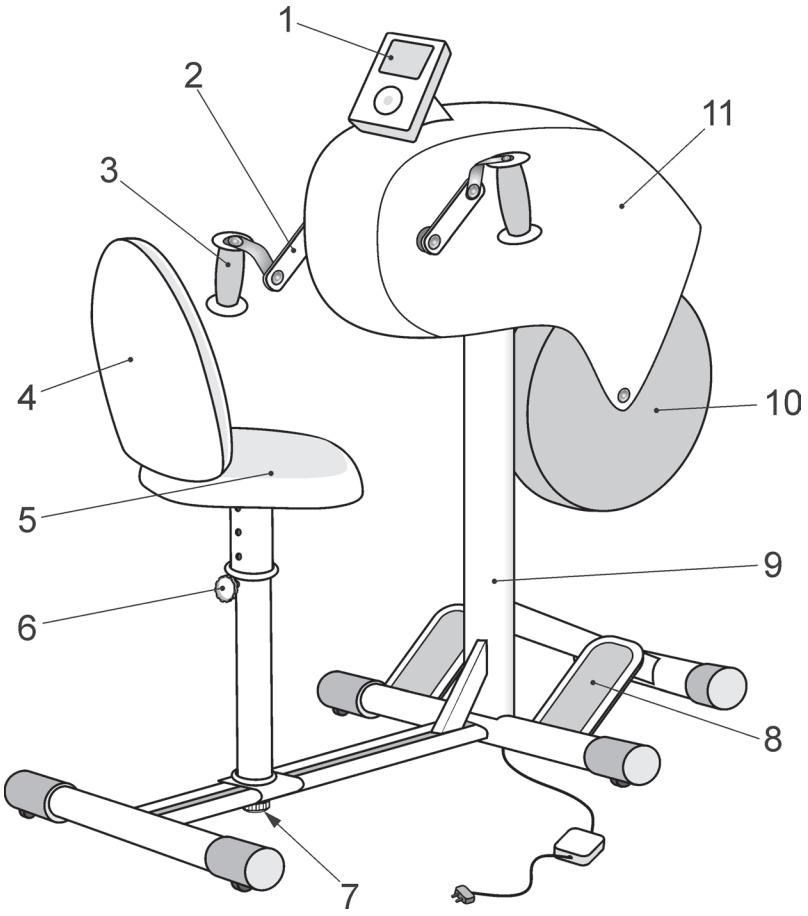
Figure 1 — Example of upright stationary exercise bicycle



Key

1 display
2 seat back rest
3 seat
4 seat handlebar
5 seat adjustment
6 frame
7 protective cover
8 crank
9 pedal
10 pedal strap
11 front handlebar
12 heart rate hand sensor

Figure 2 — Example of recumbent stationary exercise bicycle



Key

1 display
2 crank
3 handle
4 seat back rest
5 seat
6 vertical seat adjustment
7 horizontal seat adjustment
8 foot rest
9 frame
10 flywheel
11 protective cover

Figure 3 — Example of upper body crank training equipment

5 Safety requirements

5.1 General

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

5.2 External construction

5.2.1 Transmission elements and rotating parts

The finger probe shall not become entrapped.

Test in accordance with 6.3.1.

In addition, if the crank extends beyond the protective cover at any point during rotation, then the distance between the crank and the protective cover shall not be less than 10 mm.

Test in accordance with 6.1.1.

Transmission elements, fans and flywheels shall be protected, so that the test finger cannot be trapped or touch moving parts which have no smooth surface.

Test in accordance with 6.3.2.

5.2.2 Temperature rise

Accessible parts of the crank training equipment shall not have a temperature greater than 65 °C.

Test in accordance with 6.2.

5.3 Intrinsic loading

5.3.1 Seat pillar and frame

The crank training equipment shall withstand a load of 2,5 times the maximum user's body mass ±5 % as specified by the manufacturer or 2 500 N, whichever is greater. During the test, the crank training equipment shall not tip over and the slippage of the adjusted seat pillar into the seat tube shall be ≤5 mm.

Test in accordance with 6.4.1.

5.3.2 Handlebar and frame

The handlebars shall withstand a load of 0,3 times the maximum user's body mass ±5 % specified by the manufacturer or (300 ± 15) N, whichever is greater for class H; for classes S and I, a load of 0,3 times the maximum user's body mass specified by the manufacturer or (450 ± 15) N, whichever is greater.

For recumbent bikes, the seat handlebars shall withstand a vertical load of 2,5 times the maximum user's body mass ±5 % specified by the manufacturer or 2 500 N, whichever is greater.

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

Test in accordance with 6.4.2.

5.3.3 Pedal and frame

Pedals shall be in accordance with ISO 4210-8. After the test, the crank training equipment shall not be broken and shall still function as intended by the manufacturer.

Test in accordance with 6.4.3.

5.4 Seat pillar — Seat

5.4.1 Insertion depth

The seat pillar shall have a permanent mark indicating the minimum insertion depth of ≥1,5 times the cross section reference dimension (e.g. diameter or longest diagonal use of a rectangular tube) into the seat tube. The mark is not required if the minimum insertion depth is given by the design.

Test in accordance with 6.1.1 and 6.1.2.

5.4.2 Seat adjustment

Except for classes HB and HC, the height adjustment system shall work without a tool.

Test in accordance with 6.1.4.

5.4.3 Seat tilting

The seat shall withstand a load of 2/3 times the maximum user's body mass as described in the manufacturer's instructions for use without tilting >2° from its position in relation to the seat tube. After the test, the crank training equipment shall not be broken and shall still function as intended by the manufacturer.

Test in accordance with 6.5.

5.5 Handlebar stem

The handlebar stem shall be adjustable or different grip positions shall be provided.

If the vertical height is adjustable, the handlebar stem shall have a permanent mark indicating the minimum insertion depth of ≥1,5 times the cross section reference dimension (e.g. diameter or the longest diagonal of a rectangular tube). The mark is not required if the minimum insertion depth is given by the design.

Test in accordance with 6.1.1 and 6.1.2.

5.6 Stability

The crank training equipment shall not tip over when standing on a slope of $(10^{+1}_{0})°$.

Test in accordance with 6.7.

5.7 Additional requirements for recumbent stationary exercise bicycles, upper body crank training equipment and combined crank training equipment

5.7.1 Combined crank training equipment

If the crank training equipment has upper and lower body rotational crank systems, there shall be a mechanism to disengage either the upper or lower crank when only one crank is in use.

Inadvertent entrapment of the hands and the fingers shall be prevented.

Test in accordance with 6.1.4.

5.7.2 Seat system

The seat back rest shall withstand a load of

— 1 times the maximum user's body mass ±5 % specified by the manufacturer or 1 000 N, whichever is greater for class H, and

— 1,5 times the maximum user's body mass ±5 % specified by the manufacturer or 1 500 N, whichever is greater for classes S and I.

After releasing the load, the seat system shall not be broken and shall still function as intended by the manufacturer.

Test in accordance with 6.6.

5.8 Additional classified requirements

For speed independent systems, classes A, B and C shall fulfil the requirements in accordance with Table 1. For speed dependent systems, classes A, B and C shall fulfil the requirements in accordance with Table 2.

Table 1 — Classified requirements for speed independent systems

Requirement	Class A	Class B	Class C
Freewheel Test in accordance with 6.1.4.	Yes	Yes	Yes Unless the inertia factor is <0,6 kg·m^2 (see Annex A)
Power display Test in accordance with 6.1.2.	Shall display power in watts	Shall not display power in watts Adjustment by repeatable resistance steps	Shall not display power in watts
Accuracy for the power display Test in accordance with 6.11.	The accuracy of the power display shall be within the tolerance of ±10 % or ±5 W for values <50 W.	Not applicable	Not applicable
Power or resistance adjustment Test in accordance with 6.1.4 for class A Test in accordance with 6.12 for class B.	Steps of ≤10 W at (60 ± 1) min^{-1}.	Repeatable resistance steps. Between adjustments, returning to a given value, shall not vary by >±25 %.	An adjustment system able to change the resistance is required
Inertia factor[a]	5 kg·m^2 to 16 kg·m^2	1,3 kg·m^2 to 16 kg·m^2	<16 kg·m^2
Minimum braking torque at maximum resistance setting at speed of (60 ± 1) min^{-1} Test in accordance with 6.1.4 and 6.8.	40 Nm (for lower body crank training equipment) (approx. 250 W) 20 Nm (for upper body crank training equipment) (approx. 125 W)	28 Nm (for lower body crank training equipment) (approx. 175 W) 14 Nm (for upper body crank training equipment) (approx. 90 W)	No requirements

[a] The manufacturer should provide sufficient data regarding the inertia factor to the test house.

Table 1 *(continued)*

Requirement	Class A	Class B	Class C
Maximum braking torque at minimum resistance setting at speed of (60 ± 1) min^{-1} for lower body crank training equipment and at (40 ± 1) min^{-1} for upper body crank training equipment Test in accordance with 6.1.4 and 6.8	8 Nm (for lower body crank training equipment) (approx. 50 W) 6 Nm (for upper body crank training equipment) (approx. 25 W)	13 Nm (for lower body crank training equipment) (approx. 80 W) 9,5 Nm (for upper body crank training equipment) (approx. 40 W)	No requirements
Constant power mode Test in accordance with 6.9	Constant power mode is required. The constant power mode shall guarantee that the power is maintained within the tolerance of ±10 %.	Constant power mode is not required. If a constant power mode is available, it shall guarantee that the power is maintained within the tolerance of ±20 %.	Constant power mode is not allowed.
Heart rate controlled resistance programme (if applicable) Test in accordance with 6.10.	The proper function of the heart rate system shall be indicated on the display, e.g. by a blinking heart or any other means. The loss of heart rate signal shall result in resistance remaining at same level for ≤60 s and then decrease continuously until the minimum resistance is reached or the signal recovers. The rate of decrease shall be between 50 W/min and 100 W/min.	The proper function of the heart rate system shall be indicated on the display, e.g. by a blinking heart or any other means. The loss of heart rate signal shall result in resistance remaining at same level for ≤60 s and then decrease continuously until the minimum resistance is reached or the signal recovers. The rate of decrease shall be between 50 W/min and 100 W/min.	The proper function of the heart rate system shall be indicated on the display, e.g. by a blinking heart or any other means.

[a] The manufacturer should provide sufficient data regarding the inertia factor to the test house.

Table 2 — Classified requirements for speed dependent systems

Requirement	Class A	Class B	Class C
Freewheel	Not required for dual action where the upper body system can assist with stopping the equipment.	Not required for dual action where the upper body system can assist with stopping the equipment.	Not required for dual action where the upper body system can assist with stopping the equipment.
Flywheel	Yes	Yes	Yes
Power display	Shall display power in watts. Shall be accurate to within ±10 % above 50 W. If resistance is derived from an "air fan" device, it shall be capable of being calibrated for altitude or barometric pressure.	No display in Watts.	No display in Watts.
Drivetrain inertia factor[a]	Shall be between 5 kg·m^2 and 16 kg·m^2.	Shall be between 1,3 kg·m^{2}and 16 kg·m^2.	<16 kg·m^2
Min. braking torque at (90 ± 1) min^{-1} **Test in accordance with 6.1.4 and 6.8**	32 Nm (for lower body crank training equipment) (approx. 300 W) 16 Nm (for upper body crank training equipment) (approx. 150 W)	21 Nm (for lower body crank training equipment) (approx. 200 W) 10,5 Nm (for upper body crank training equipment) (approx. 100 W)	No requirements
Display	Shall display Watts and crankshaft min^{-1}	Shall display crankshaft min^{-1}	No requirements
Maximum power at minimum resistance setting	Shall produce less than 80 W at (45 ± 1) min^{-1} for lower body equipment and combined equipment, and 40 W at (45 ± 1) min^{-1} for upper body equipment and combined equipment where the upper body equipment and the lower body equipment is isolated.	Shall produce less than 80 W at (45 ± 1) min^{-1} for lower body equipment and combined equipment, and 40 W at (45 ± 1) min^{-1} for upper body equipment and combined equipment where the upper body equipment and the lower body equipment is isolated.	No requirements

[a] The manufacturer should provide sufficient data regarding the inertia factor to the test house.

5.9 Endurance

The crank training equipment shall function properly as intended by the manufacturer.

Test in accordance with 6.13.

5.10 Additional instructions for use

In addition to the general instructions for use in ISO 20957-1, the manufacturer shall provide instructions for the safe use of crank training equipment including at least the following information, depending on the class:

a) adjustment of seat and handlebars;

b) indication of the minimum insertion depth of adjustable seat and adjustable handlebars;

c) adjustment of training resistance and power settings;

d) additional information, such as notes on the correct posture;

e) notice that class B and class C crank training equipment are not suitable for high accuracy purposes;

f) information on braking system (speed dependent or speed independent).

5.11 Additional warnings

For classes B and C, a warning shall be placed on the equipment indicating that it is not suitable for high accuracy purposes: "WARNING — This stationary training equipment is not suitable for high accuracy purposes."

If a heart rate system exists, for classes S and I, a warning with the following content shall be placed: "WARNING — Heart rate monitoring systems may be inaccurate. If you feel faint, stop exercising immediately."

The heart rate warning shall be placed in a conspicuous position on the console or the warning shall be shown on the display at any time while the heart rate system is active. All other warnings shall be placed in a conspicuous position on the crank training 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 Testing of temperature rise

Apparatus: temperature measuring device with an accuracy of ±1 °C.

Pedal the training equipment at (200 ± 10) W with (60 ± 1) min^{-1} for three periods of (20 ± 1) min. After each period, rest for (5 ± 1) min.

Within 2 min after the third period, measure the temperature of all exposed surfaces.

See also ISO 13732-1.

6.3 Testing of transmission elements and rotating parts

6.3.1 Crank and protective cover finger probe examination

A test finger according to ISO 20957-1, shall be inserted parallel to the axis of rotation with a tolerance of ±5°, in contact with the crank and the protective cover. The test shall be carried out in the most onerous position with the crank rotated fully in both directions. Determine whether the test finger becomes entrapped. If the angle allows the test finger to be pushed away, it is not considered to be an entrapment.

If the protective cover is smaller than the rotated diameter of the crank at any point, the dimensional test according to 6.1.1 shall be carried out.

6.3.2 Other moving parts finger probe examination

For class H, a test finger probe B in accordance with EN 71-1 shall be approached from all sides to all moving parts.

For class S and class I, a test finger according to ISO 20957-1 shall be approached to all moving parts.

Determine whether the test finger becomes entrapped or whether it touches moving parts which are not smooth.

6.4 Testing of intrinsic loading

6.4.1 Seat pillar and frame

The crank training equipment shall be free standing on a flat surface. The seat pillar shall be adjusted as specified in the manufacturer's instructions for use to its most onerous position.

Mark the position of the seat pillar compared to the seat tube. Apply a test load as described in 5.3.1 with a (300 ± 5) mm × (300 ± 5) mm plate on the seat for 3 min. After the release of the test load, measure the slippage of the seat pillar.

6.4.2 Handlebar and frame

Set the crank training equipment in a position to prevent tilting and/or slipping.

Adjust the front handlebars to their most onerous position.

For adjustable handlebars, if a screw is used to tighten, then apply a torque to the adjustment mechanism of

$M = F \cdot r$

where

- M is the torque to tighten the adjustment mechanism, in Newton metres;
- F is the force of (140 ± 7) N;
- r is the radius of the adjustment mechanism, in metres.

All other adjustment mechanisms shall be set as described in the manufacturer's instructions for use. For both adjustable and fixed front handlebars, load the handlebars with a (80 ± 5) mm wide band or sleeve. Apply the test load as described in 5.3.2 for (3 ± 1) min on the left or the right side in a direction which creates the highest torque moment applied to the adjustment mechanism.

For seat handlebars, apply 50 % of the test load as described in 5.3.2 simultaneously to each handle in the downward direction for (3 ± 1) min by using a (80 ± 5) mm wide band or sleeve.

6.4.3 Pedal and frame

The test shall be done according to ISO 4210-8:2014, 4.1 and 4.6.3, but with the complete pedals and crank mounted to the frame of the crank training equipment.

6.5 Testing of seat tilting

The seat shall be fixed to the seat pillar in horizontal position. The seat pillar shall be fixed in the seat tube.

Apply on an area of 100 mm^2 a vertical load as described in 5.4.3 at (25 ± 5) mm from the front of the saddle and then (25 ± 5) mm from the rear of the saddle.

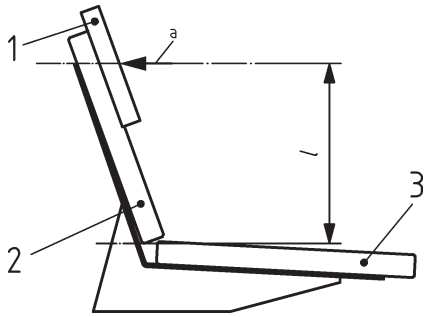
Arrange the test rig in such a way that the maximum torque is applied to the saddle adjustment mechanism.

The duration of the test shall be (5 ± 1) min.

6.6 Testing of seat back rest

Set the crank training equipment in a position to prevent tilting and/or slipping.

Using a (300 ± 5) mm × (300 ± 5) mm plate, apply a load as described in 5.7.2, horizontally, at l = (500 ± 25) mm from the upper seat level or 50 mm below the upper end (see Figure 4) for 3 min.



Key

1 plate, (300 ± 5) mm × (300 ± 5) mm
2 back rest
3 seat
l load application height
a Horizontally applied load.

Figure 4 — Testing of seat back rest

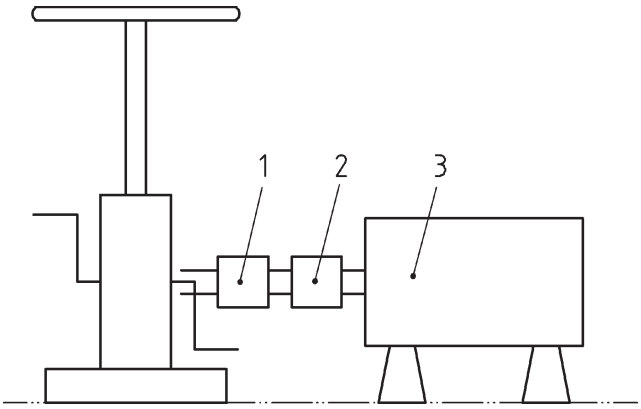
6.7 Testing of stability

Carry out the stability test according to ISO 20957-1 while operating the crank training equipment at (60 ± 6) min^{-1} for 1 min.

6.8 Description of the test device

The maximum error of the test device shall not exceed 2 % for values ≥100 W or 2 W for values <100 W. The maximum error of the rotational frequency shall not exceed 0,5 min^{-1} for the measuring device.

The power is obtained by applying a drive to the crank axis.



Key

1 torque transducer
2 speed transducer
3 motor

Figure 5 — Test device for power, speed and torque measurement

6.9 Testing of constant power mode

Use the test device as shown in Figure 5. Set the crank training equipment to a constant power mode of (100 ± 5) W, displayed on the test device, with a speed of (50 ± 1) min^{-1}. Set the time (t) to 0. Change the speed to (90 ± 1) min^{-1} within a maximum time of 5 s after $t = 0$. Measure the power once again 15 s after $t = 0$ with the test device, the power shall be

a) ±10 % of the power measured at $t = 0$ for class A, and

b) ±20 % of the power measured at $t = 0$ for class B.

Then reduce the speed to (70 ± 1) min^{-1} and measure the power once again following the same procedure.

Repeat the test with a power level of (50 ± 2,5) W and (150 ± 7,5) W.

6.10 Testing of heart rate control mode

Set the crank training equipment to the heart rate control mode at a power of (150 ± 25) W or equivalent speed. Use a heart pulse simulator or a person to activate the control mode. Operate using the test device shown in Figure 5. Cut off the signal and then check that the power reduces according to the requirements shown in 5.9. If there are different heart rate control systems, each system shall be tested.

6.11 Testing of power accuracy for class A

6.11.1 General

The mechanical power can be measured directly at the crank axis and a test device according to 6.8 shall be used.

6.11.2 Speed dependent crank training equipment

Carry out the test as follows.

a) Pedal the crank training equipment at a speed of (70 ± 1) min^{-1} for 1 h.

b) Cool down the crank training equipment to room temperature.

c) Pedal the crank training equipment at a speed of (40 ± 1) min^{-1}.

d) Compare the power of the test device with the power read out on the crank training equipment display.

e) Pedal for 15 min. After 15 min, measure the power and compare again to the reading on the display without stopping the crank training equipment.

f) Cool down the crank training equipment to room temperature.

Carry out the above procedure for the following values by repeating steps c) to f):

— at (50 ± 1) min^{-1};

— at (60 ± 1) min^{-1};

— at (70 ± 1) min^{-1};

— a non-tested free chosen value in the range of 40 min^{-1} and 70 min^{-1}.

6.11.3 Speed independent crank training equipment

6.11.3.1 Stationary exercise bicycles

Carry out the test as follows.

a) Pedal the crank training equipment for 1 h at the maximum power (resistance) at a speed of (60 ± 1) min^{-1}.

b) Cool down the crank training equipment to room temperature.

c) Adjust the training equipment to (25 ± 2,5) W at (40 ± 1) min^{-1}.

d) Compare the power of the test device with the power read out on the crank training equipment display.

e) Pedal for 15 min. After 15 min, measure the power and compare again to the reading on the display without stopping the crank training equipment.

f) Cool down the crank training equipment to room temperature.

Then carry out the above procedure with the following values by repeating steps c) to f):

— (50 ± 2,5) W at (50 ± 1) min^{-1};

— (100 ± 5) W at (50 ± 1) min^{-1};

— (150 ± 7,5) W at (60 ± 1) min^{-1};

— (200 ± 10) W at (60 ± 1) min^{-1};

— a non-tested free chosen value in the range of 25 W and 200 W at the speed between 40 min^{-1} and 80 min^{-1}.

6.11.3.2 Upper body crank training equipment

Carry out the test as follows:

a) Pedal the crank training equipment for 1 h at the maximum power (resistance) at a speed of (60 ± 1) min^{-1}.

b) Cool down the crank training equipment to room temperature.

c) Adjust the crank training equipment to (25 ± 2,5) W at (40 ± 1) min^{-1}.

d) Compare the power of the test device with the power read out on the crank training equipment display.

e) Pedal for 15 min. After 15 min, measure the power and compare again to the reading on the display without stopping the crank training equipment.

f) Cool down the training equipment to room temperature.

Then carry out the above procedure with the following values by repeating steps c) to f):

— (50 ± 2,5) W at (50 ± 1) min^{-1};

— (75 ± 5) W at (60 ± 1) min^{-1};

— (100 ± 7,5) W at (70 ± 1) min^{-1};

— a non-tested free chosen value in the range of 25 W and 100 W at the speed between 40 min^{-1} and 70 min^{-1}.

6.12 Testing of power repeatability for class B

Use a test device as in Figure 5 for measuring and setting speed and torque or speed and power.

Carry out the test as follows.

a) Operate the crank training equipment for at least 1 h at (100 ± 5) W at (60 ± 1) min^{-1}. After conditioning, cool down the crank training equipment to room temperature.

b) Set the load adjustment system of the crank training equipment to the position so that the power is closest to 70 W when operated at (60 ± 1) min^{-1}.

c) Measure the power within 30 s.

d) Set the load adjustment system of the crank training equipment to the position so that the power is closest to 200 W when operated at (70 ± 1) min^{-1}.

e) Operate the crank training equipment for at least 15 min.

f) Return to the same measurement position as in point b).

g) Measure again the power within 30 s.

Compare the values measured in c) and g). The value in g) shall not vary by more than ±20 % of the value in c).

6.13 Endurance test

6.13.1 Speed independent crank training equipment

Subject the crank training equipment to an interval test (10 min loading, 5 min cooling down) for ≥2 h at the closest setting that is ≥80 % of the maximum power at (60 ± 1) min^{-1}.

After the test, check whether the crank training equipment functions correctly.

6.13.2 Speed dependent crank training equipment

Subject the crank training equipment to an interval test (10 min loading, 5 min cooling down) for ≥2 h at (100 ± 1) min^{-1}.

After the test, check whether the crank training equipment functions correctly.

7 Test report

The test report shall include at least the information according to ISO 20957-1 and a reference to this document, i.e. ISO 20957-5, and ISO 20957-1.

Annex A
(informative)

Example of determining the moment of inertia *J* (looking from the driving axis into a system)

See Figure A.1.

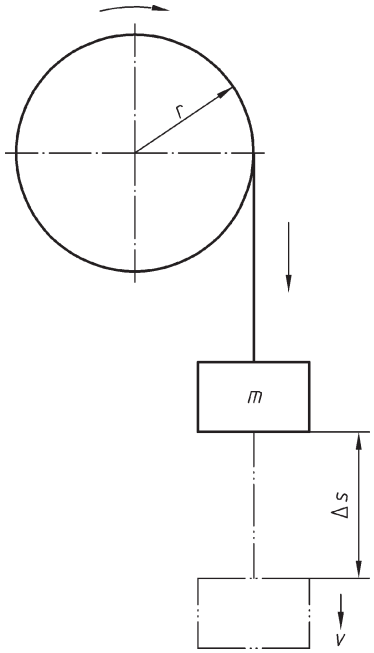


Figure A.1 — Schematic diagram

$$\Delta E_{\text{pot}} = \Delta E_{\text{kin}} + \Delta E_{\text{rot}} \tag{A.1}$$

$$m \cdot g \cdot \Delta s = \frac{1}{2} m v^2 + \frac{1}{2} J w \tag{A.2}$$

From Formula (A.2):

$$J = (m \cdot g \cdot \Delta s - \frac{1}{2} m v^2) \cdot \frac{2}{w^2} \tag{A.3}$$

$$w = \frac{v}{r} \tag{A.4}$$

$$v = b \cdot t (b < g)$$

$$\Delta s = \frac{1}{2} b \, \Delta t^2 \tag{A.5}$$

$$b = \frac{2 \cdot \Delta s}{\Delta t} \tag{A.6}$$

Inserted in Formula (A.5) results in:

$$b = \frac{2 \cdot \Delta s}{\Delta t} \tag{A.7}$$

Formula (A.4) and Formula (A.7) inserted in Formula (A.3) results in:

$$J = m \cdot r^2 \left(\frac{g \cdot \Delta t^2}{2 \cdot \Delta s} - 1 \right) \tag{A.8}$$

where

m is the mass of the test weight in kg;

r is the radius in m;

t is the time in s;

Δs is the travel of the test weight in m;

g is the acceleration due to gravity in m/s^2;

v is the velocity in m/s;

J is the moment of inertia in kg·m^2.

Table A.1 is applicable if the test arrangement is as follows:

$m = 11$ kg

$g = 9,81 \frac{m}{s^2}$

$r = \frac{0,075}{2} m$

$\Delta s = 0,5\ m$

Table A.1 — Selected values

Δt s	J kg·m^2
1,0	0,136 28
1,5	0,325 90
2,0	0,590 00
2,5	0,932 95
3,0	1,350 00
3,5	1,843 40
4,0	2,412 50
4,5	3,057 00
5,0	3,778 20

Bibliography

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

[2] ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

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