
**Cycles — Safety requirements for
bicycles —**

**Part 6:
Frame and fork test methods**

*Cycles — Exigences de sécurité pour les bicyclettes —
Partie 6: Méthodes d'essai du cadre et de la fourche*

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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).

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

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 149, *Cycles*, Subcommittee SC 1, *Cycles and major sub-assemblies*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 333, *Cycles*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 4210-6:2015), which has been technically revised.

The main changes are as follows:

- improvement of [4.3](#);
- improvement of [4.4](#);
- improvement of [4.5](#);
- addition of [4.6](#);
- improvement of [5.4](#);
- improvement of [5.6](#);
- change of test equipment for [5.6](#);
- addition of [5.7](#).

A list of all parts in the ISO 4210 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.

Introduction

This document has been developed in response to demand throughout the world, and the aim has been to ensure that bicycles manufactured in conformity with this document will be as safe as is practically possible. The tests have been designed to ensure the strength and durability of individual parts as well as of the bicycle as a whole, demanding high quality throughout and consideration of safety aspects from the design stage onwards.

The scope has been limited to safety considerations, and has specifically avoided standardization of components.

If the bicycle should be used on public roads, national regulations apply.

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Cycles — Safety requirements for bicycles —

Part 6: Frame and fork test methods

1 Scope

This document specifies the frame and fork test methods for ISO 4210-2.

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 4210-1, *Cycles — Safety requirements for bicycles — Part 1: Vocabulary*

ISO 4210-2:2023, *Cycles — Safety requirements for bicycles — Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles*

ISO 4210-3:2023, *Cycles — Safety requirements for bicycles — Part 3: Common test methods*

ISO 4210-5:2023, *Cycles — Safety requirements for bicycles — Part 5: Steering test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4210-1 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 <https://www.electropedia.org/>

4 Frame test methods

4.1 Frame — Impact test (falling mass)

4.1.1 General

Manufacturers of frames are permitted to conduct the test with a dummy fork (see [Annex A](#)) fitted in place of a front fork.

Where a frame is convertible for male and female riders by the removal of a bar, test it with the bar removed.

Where a suspension fork is fitted, test the assembly with the fork extended to its unloaded free length. Where a rear suspension system is incorporated in the frame, secure the suspension in a position equivalent to that which would occur with an 80 kg rider seated on the bicycle. For young adult bicycles, secure the suspension in a position equivalent to that which would occur with a 40 kg rider seated on the bicycle; if the type of suspension system does not permit it to be locked, then replace the spring/

damper unit by a solid link of the appropriate size and with end fittings similar to those of the spring/damper unit.

4.1.2 Test method

Assemble a roller of mass less than or equal to 1 kg and with dimensions conforming to those shown in [Figure 1](#) in the fork. The hardness of roller shall be not less than 50 HRC at impact surface. If a dummy fork is used in place of a fork, the bar shall have a rounded end equivalent in shape to the roller. Hold the frame-fork or frame-bar assembly vertically with clamping to a rigid fixture by the rear-axle attachment points as shown in [Figure 1](#).

Rest a striker of mass 22,5 kg on the roller in the fork dropouts or on the rounded end of the dummy fork and measure the wheelbase. Raise the striker to a height of h_1 above the low-mass roller and release it to strike the roller or the steel bar at a point in line with the wheel centres and against the direction of the fork rake or rake of the bar. The drop heights are given in [Table 1](#). The striker will bounce and this is normal. When the striker has come to rest on the roller or dummy fork, measure the wheelbase again.

If the fork fails, the frame shall be tested with a dummy fork.

NOTE See ISO 4210-3:2023, Annex B.

Table 1 — Drop heights

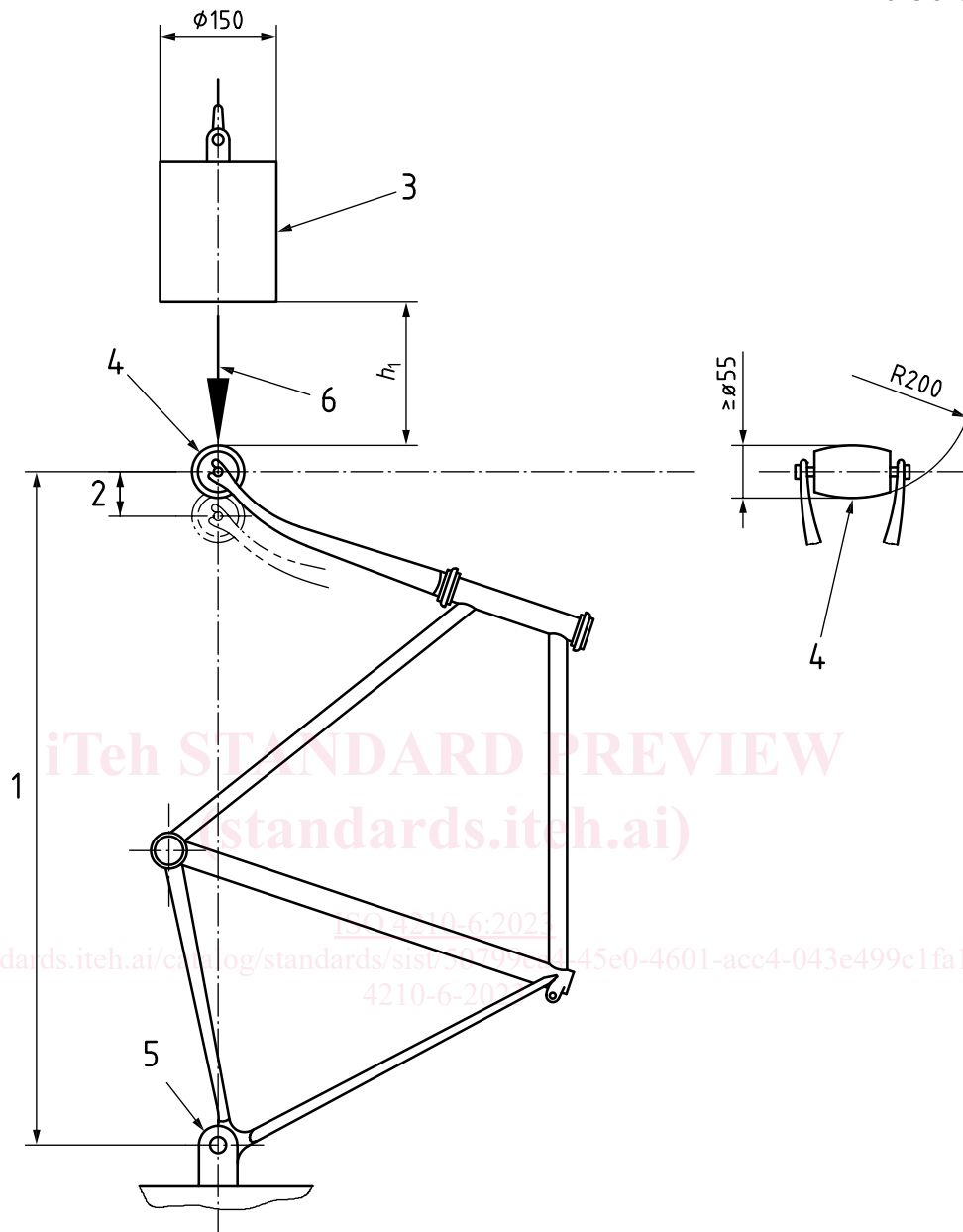
Dimensions in millimetres

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Drop height, h_1	180	180	360	212

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Dimensions in millimetres



Key

- 1 wheelbase
- 2 permanent deformation
- 3 22,5 kg striker
- 4 low-mass roller (1 kg max.)
- 5 rigid mounting for rear-axle attachment point
- 6 direction of rearward impact
- h_1 drop height

Figure 1 — Frame and front fork assembly — Impact test (falling mass)

4.2 Frame and front fork assembly — Impact test (falling frame)

4.2.1 General

Manufacturers of complete bicycles shall conduct the test with the frame fitted with the appropriate front fork.

For manufacturers of frames, where the fork intended for the frame is not available, the test can be conducted with the frame fitted with a fork which meets the requirements of the fork impact test as described in ISO 4210-2:2023, 4.9.6.

Where a frame is convertible for male and female riders by the removal of a bar, test it with the bar removed.

Where a suspension fork is fitted, it shall be at its unloaded length prior to the impact. If the spring/damper unit can be locked, it shall be locked in its unloaded length position. If the spring/damper cannot be locked, use one of the two following alternative procedures:

- secure the fork at its extended length by an external locking method, or
- replace the fork by a rigid fork which is known to meet the requirements of the impact test described in ISO 4210-2:2023, 4.9.6 and of a length which is consistent with an 80 kg (in case of young adult bicycles, apply 40 kg) rider seated in a normal riding position on the bicycle when it is equipped with the suspension fork.

Where a rear suspension system is incorporated in the frame, secure the spring/damper unit in a position equivalent to that which would occur with an 80 kg (in case of young adult bicycles, apply 40 kg) rider seated on the bicycle; if the type of suspension system does not permit it to be locked, then replace the spring/damper unit by a solid link of the appropriate size and with end fittings similar to those of the spring/damper unit.

4.2.2 Test method

Conduct the test on the assembly used for the test in ISO 4210-2:2023, 4.8.2 or, in the case of a frame manufacturer who does not make forks, with the same frame with a suitable fork fitted (see 4.2.1).

As shown in Figure 2, mount the frame-fork assembly at its rear axle attachment points so that it is free to rotate about the rear axle in a vertical plane. Support the front fork on a flat steel anvil so that the frame is in its normal position of use. Securely fix mass m_1 to the seat-post as shown in Figure 2 with the centre of gravity at distance D (= 75 mm) along the seat-post axis from the insertion point, and fix masses of m_2 and m_3 (see Table 2) to the top of the steering head and the bottom bracket, respectively, as shown in Figure 2.

Measure the wheelbase with the three masses in place. Rotate the assembly about the rear axle until the distance between the low-mass roller and the anvil is h_2 , then allow the assembly to fall freely to impact on the anvil.

Repeat the test and then measure the wheelbase again with the three masses in place and the roller resting on the anvil.

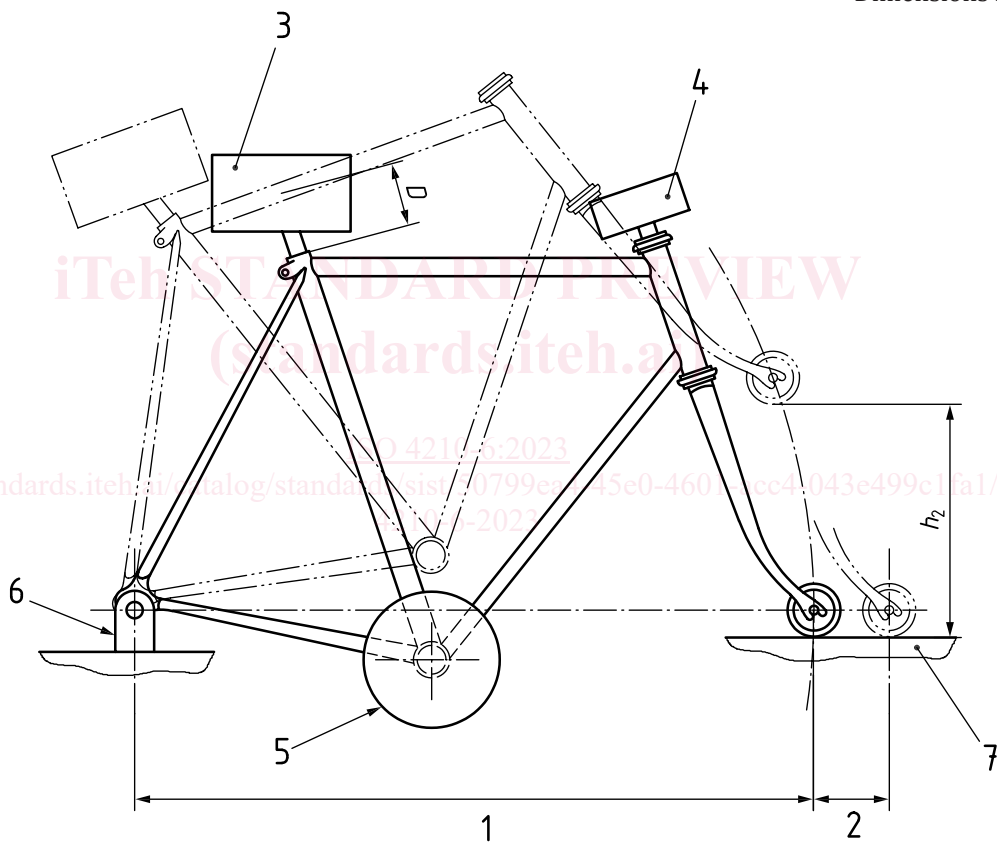
Table 2 — Drop heights and distribution of masses at seat-post, steering head, and bottom bracket

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Mass 1 Seat-post, m_1 kg	50	40	30	30

Table 2 (continued)

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Mass 2 Steering head, m_2 kg	10	10	10	10
Mass 3 Bottom bracket, m_3 kg	30	20	50	50
Drop height, h_2 mm	200	200	300	200

Dimensions in millimetres



Key

- 1 wheelbase
- 2 permanent deformation
- 3 mass 1 (m_1)
- 4 mass 2 (m_2)
- 5 mass 3 (m_3)
- 6 rigid mounting for rear-axle attachment point
- 7 steel anvil
- D distance to the centre of gravity (75 mm)
- h_2 drop height

Figure 2 — Frame and front fork assembly — Impact test (falling frame)

4.3 Frame — Fatigue test with pedalling forces

4.3.1 General

All types of frame shall be subjected to this test.

In tests on suspension frames with pivoted joints, adjust the spring, air pressure, or damper to provide maximum resistance, or, for a pneumatic damper in which the air pressure cannot be adjusted, replace the suspension unit with a rigid link, ensuring that its end fixings and lateral rigidity accurately simulate those of the original unit. For suspension frames in which the chain stays do not have pivots but rely on flexing, ensure that any dampers are set to provide the minimum resistance in order to ensure adequate testing of the frame (see [Annex C](#) for more information).

Where a suspension frame has adjustable brackets or linkages to vary the resistance of the bicycle against the ground-contact forces or to vary the attitude of the bicycle, arrange the positions of these adjustable components to ensure maximum forces in the frame.

4.3.2 Test method

Use a frame/fork assembly fitted with standard head tube bearings for the test. The front fork may be replaced by a dummy fork (see [Annex A](#)) of the same length and at least the same stiffness as the original fork.

NOTE If a genuine fork is used, failures of the fork are possible; therefore, it is recommended that for convenience, a dummy fork stiffer and stronger than the genuine fork be used.

Where a frame is convertible for male and female riders by the removal of a bar, test it with the bar removed.

Mount the frame assembly on a base as shown in [Figure 3](#) with the fork or dummy fork secured by its axle to a rigid mount of height R_w (the radius of the wheel and tyre assembly ± 30 mm) and with the hub free to swivel on the axle. Secure the rear dropouts by means of the axle to a stiff, vertical link of the same height as that of the front, rigid mount, the upper connection of the link being free to swivel about the axis of the axle but providing rigidity in a lateral plane, and the lower end of the link being fitted with a ball-joint.

Fit a crank, chain wheel and chain assembly or, preferably, a strong, stiff, replacement assembly to the bottom bracket as shown in [Figure 3](#).

If the specifications of the fully assembled bicycle are known, either a) or b) shall be selected. In this case, L_1 shall be the same as the crank length of the bicycle.

If the specifications of the fully assembled bicycle are not known (e.g. frame manufacturer), b) shall be selected. In this case, L_1 shall be 175 mm.

- a) If a crank/chain-wheel assembly is used, incline both cranks forwards and downwards at an angle of 45° (accurate to within $\pm 2,0^\circ$) to the horizontal and secure the front end of the chain to the middle chain wheel of three, the smaller chain wheel of two, or the only chain wheel. Attach the rear end of the chain to the rear axle and perpendicular to the axis of the axle.
- b) If an adaptor assembly is used (as shown in [Figure 3](#)), ensure that the assembly is free to swivel about the axis of the bottom-bracket and that both replacement arms are L_1 and that they are both inclined forwards and downwards at an angle of 45° (accurate to within $\pm 2,0^\circ$) to the horizontal. Secure the position of the crank replacement arms by a vertical arm (which replaces the chain wheel) and a tie rod which has ball joints at both ends and which is attached to the rear axle perpendicular to the axis of the rear axle.

The length of the vertical arm (R_c) shall be 75 mm, but if the chain stay and tie rod interfere, the R_c length may be adjusted with the following [Formula \(1\)](#):