
**Cycles — Safety requirements for
bicycles —**

**Part 3:
Common test methods**

Cycles — Exigences de sécurité pour les bicyclettes —

Partie 3: Méthodes d'essai communes

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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 second edition cancels and replaces the first edition (ISO 4210-3:2014), which has been technically revised.

The main changes are as follows:

- improvement of [4.2.1](#);
- improvement of [4.3](#);
- improvement of [A.2](#);
- addition of [Annex C](#).

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 was developed in response to a demand throughout the world. The aim is to ensure that bicycles manufactured in conformity with this document will be as safe as is practically possible. The tests are 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 is 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 3: Common test methods

1 Scope

This document specifies the common 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 4210-4:2023, *Cycles — Safety requirements for bicycles — Part 4: Braking 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 Test methods

4.1 Brake tests and strength tests

4.1.1 Brake tests to which special requirements apply

Brake tests to which maximum permissible error requirements apply, as in 4.1.4, are those specified in ISO 4210-2:2023, 4.6.3 to 4.6.6 and ISO 4210-4:2023, 4.2 and 4.6.3.3.

4.1.2 Strength tests to which special requirements apply

Strength tests to which maximum permissible error requirements apply, as in 4.1.4, are those involving static, impact, or fatigue loading as specified in ISO 4210-2:2023, 4.7 to 4.12, and ISO 4210-2:2023, 4.13.2, 4.15 and 4.19.2.

4.1.3 Numbers and condition of specimens for the strength tests

In general, for static, impact, and fatigue tests, each test shall be conducted on a new test sample, but if only one sample is available, it is permissible to conduct all of these tests on the same sample with the sequence of testing being fatigue, static, and impact.

When more than one test is conducted on the same sample, the test sequence shall be clearly recorded in the test report or record of testing. It should be noted that if more than one test is conducted on the same sample, earlier tests can influence the results of subsequent tests. Also, if a sample fails when it has been subjected to more than one test, a direct comparison with single testing is not possible.

In all strength tests, specimens shall be in the fully finished condition.

4.1.4 Maximum permissible error tolerances of test conditions for brake tests and strength tests

Unless stated otherwise, maximum permissible error tolerances based on the nominal values shall be as follows:

- Forces and torques: 0/+5 %
- Masses: ± 1 %
- Dimensions: ± 1 mm
- Angles: $\pm 1^\circ$
- Time duration: ± 5 s
- Temperatures: ± 2 °C
- Pressures: ± 5 %

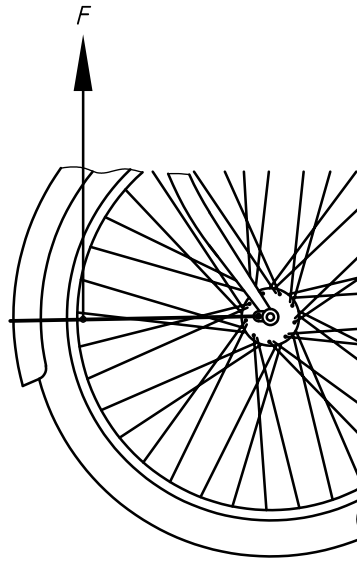
4.2 Front mudguard test methods

4.2.1 Front mudguard with stays test methods

4.2.1.1 Test method — Minimal tangential strength

Insert a 12 mm-diameter steel rod between the spokes, in contact with the rim and below the front mudguard stays. Rotate the wheel to apply a tangentially upward force of 160 N against the front mudguard stays; maintain this force for 1 min, as shown in [Figure 1](#).

Remove the rod and verify the assembly as described in ISO 4210-2:2023, 4.11.

**Key**

F tangentially upward force, 160 N

Figure 1 — Front mudguard — Tangential obstruction test

4.2.1.2 Test method — Mudguard stays impact test

Mount a 12 mm diameter steel rod at one end of a lever arm which is able to rotate freely around the wheel axis, as shown in [Figure 2](#), so that when placed between the spokes, the rod makes contact with the rim. Ensure that the steel rod is long enough to come in contact with both left and right mudguard stay(s).

Ensure that the assembly of steel rod and lever arm is balanced around the wheel axle, so that it is in equilibrium before the mass is applied.

Measure the distance, L_1 , between the rod axis and wheel axis. The release height, h , is the vertical distance from the upper surface of the steel rod to the point where the steel rod hits the mudguard stays.

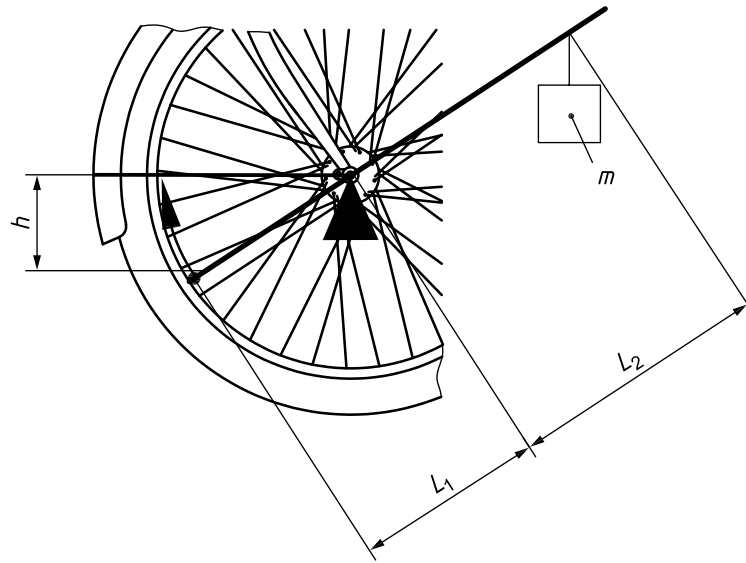
At the other end of the lever arm arrange for a weight with a mass, m , to be attached at distance, L_2 , from the wheel axis, such that the impact has an energy, E of 36,8 J (e.g. $m = 10$ kg, $L_2 = 1,5 \times L_1$, and $h = 250$ mm).

If different dimensions are required, the impact energy can be determined using [Formula \(1\)](#), where h has a minimum value of 100 mm:

$$E = 9,81 \times \frac{L_2}{L_1} \times m \times h \quad (1)$$

Accelerate the rod, together with the wheel, by releasing the mass so that the rod impacts the mudguard stays.

Remove the rod and verify the assembly as described in ISO 4210-2:2023, 4.11.



Key

- h height
- L_1 distance between the rod axis and wheel axis
- L_2 ($L_2 = 1,5 \times L_1$)
- m mass of the weight

Figure 2 — Front mudguard — Mudguard stays impact test

4.2.2 Front mudguard without stays test method

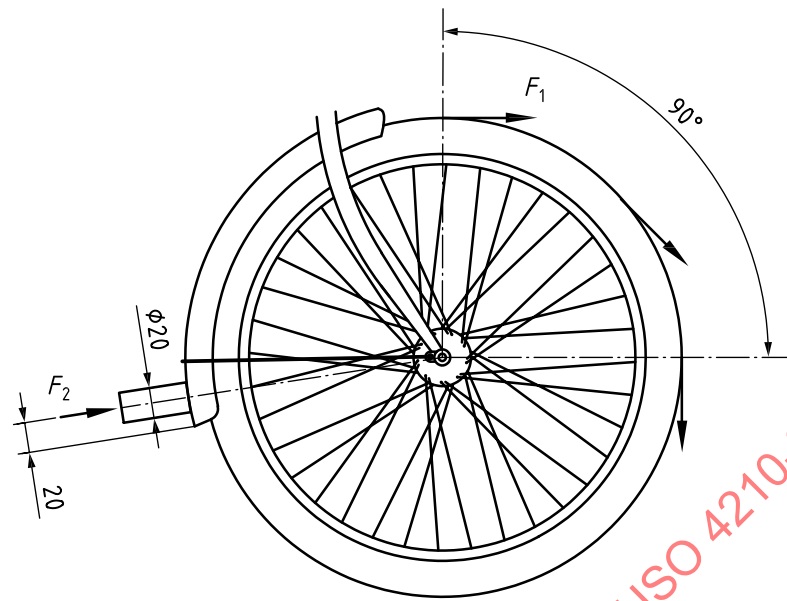
Press the front mudguard at a distance of 20 mm from its free end with a 20 mm diameter, flat-ended tool radially towards the tyre with a force of 80 N as shown in [Figure 3](#).

While the force is maintained, verify the assembly as described in ISO 4210-2:2023, 4.11.

4.2.3 Front mudguard — Wheel blocking verification test

Press the front mudguard with a 20 mm diameter flat-ended tool radially towards the tyre with a force of 80 N. The pressure should be applied with the tool axis 20 mm from the bottom end of the mudguard (not taking the flap into consideration), as shown in [Figure 3](#) (same setup for mudguards without stays).

Dimensions in millimetres

**Key** F_1 force, 100 N F_2 force, 80 N**Figure 3 — Front mudguard — Wheel blocking verification test**

While the force is maintained, apply a tangential force of 100 N for 90° of wheel rotation on the outer circumference of the wheel in the direction of forward movement of the bicycle and determine whether or not any damage to the front mudguard adversely affects wheel rotation (blocking of the wheel) or the steering.

4.3 Road test on a fully assembled bicycle test methods

First, check and adjust, if necessary, each bicycle selected for the road test to ensure that the steering and wheels rotate freely without slackness and that brakes are correctly adjusted and do not impede wheel rotation. Check and adjust wheel alignment and, if necessary, inflate tyres to the maximum inflation pressure. Check and correct, if necessary, transmission-chain adjustment, and check any gear controls for correct and free operation.

Carefully adjust the saddle and handlebar positions to suit the rider.

The test shall be carried out with the permissible total mass specified by the manufacturer in ISO 4210-2:2023, Clause 5 item h). If a luggage carrier is fitted, it shall be loaded with the maximum load as indicated by the manufacturer. Ensure that the bicycle is ridden for at least 1 km.

NOTE 1 For structural integrity of a fully assembled bicycle, see [Annex A](#).

NOTE 2 For steering flutter test, see [Annex C](#).

4.4 Durability test of marking

Rub the marking by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petroleum spirit.

4.5 Fatigue test

The force for fatigue tests is to be applied and released progressively, not to exceed 10 Hz. The tightness of fasteners according to manufacturer's recommended torque can be re-checked not later than 1 000 test cycles to allow for the initial settling of the component assembly. (This is considered applicable to all components, where fasteners are present for clamping.) The test bench shall be qualified to meet the dynamic requirements of [4.1.4](#).

NOTE Examples of suitable methods are listed in Reference [\[1\]](#).

4.6 Fatigue test for composite components

For fatigue test for composite components, the initial value of displacement (peak-to-peak value) is taken after 1 000 cycles and before 2 000 cycles.

4.7 Impact test

For all vertical impact tests, the striker shall be guided in such a way that the efficiency will permit to reach at least 95 % of the free-fall velocity.

NOTE See [Annex B](#).

4.8 Plastic material test ambient temperature

All strength tests involving any plastic materials shall be pre-conditioned for 2 h and tested at an ambient temperature of $23\text{ °C} \pm 5\text{ °C}$.

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Annex A (informative)

Structural integrity of the fully assembled bicycle

A.1 Requirement

When tested by the method described in [A.2](#), there should be no system or component failure and no loosening or misalignment of the saddle, handlebar, controls, lighting equipment, or reflectors.

A.2 Machine test

Mount a fully assembled bicycle on a test machine. The following masses should be applied:

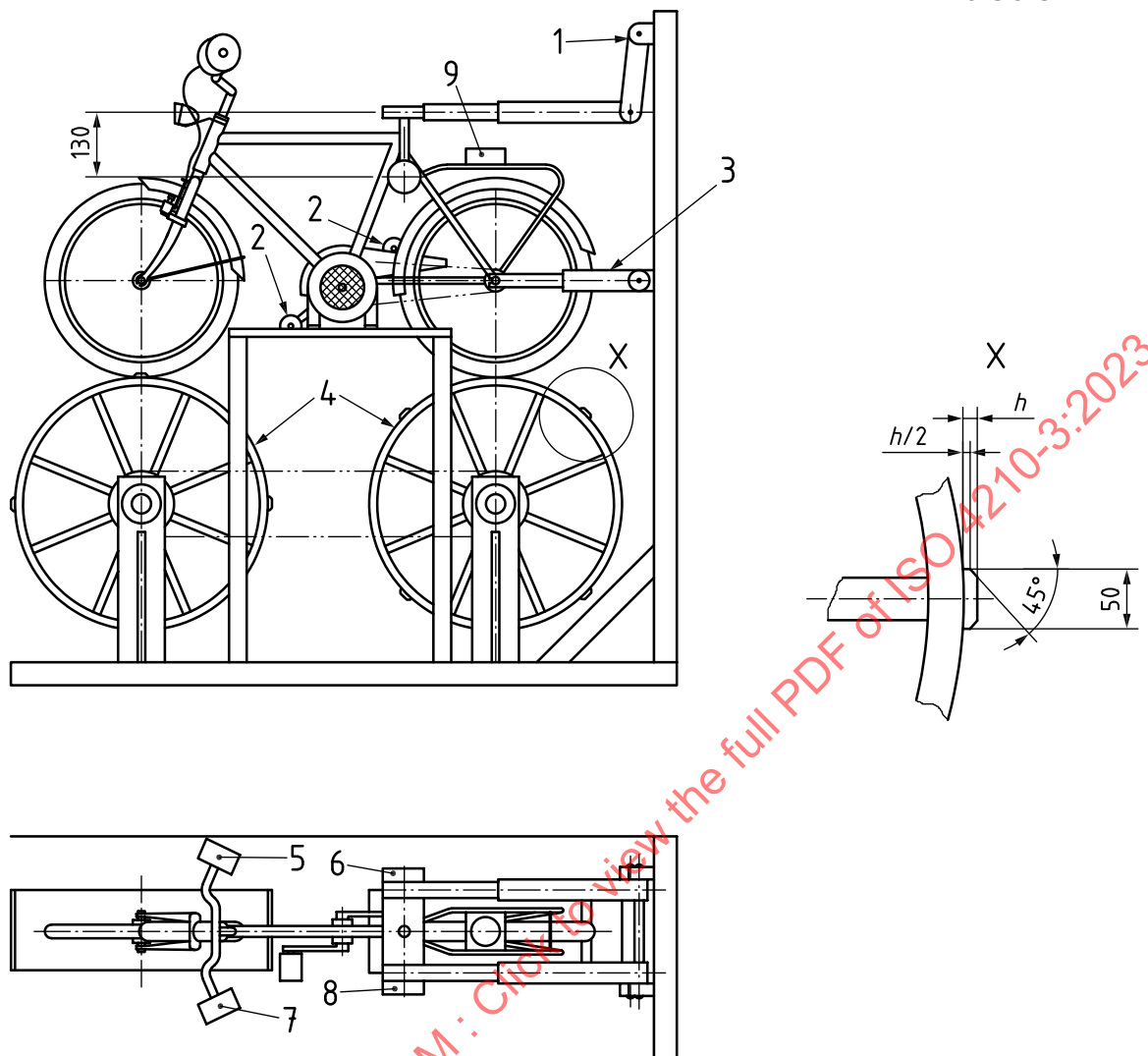
- one 36 kg mass with a pin for insertion in the seat-post and divided into two halves to be hung, one on each side;
- two 18 kg masses with fixtures for attaching them to the cranks in place of the pedals;
- two 6,75 kg masses with fixtures for attaching them to each side of the handlebar;
- one 10 kg, 18 kg, or 25 kg mass with the dimensions 240 mm × 240 mm on the luggage carrier.

An example of a test arrangement is shown in [Figure A.1](#), in which the bicycle is mounted on two drums. The diameter of the drums should be in a range from 500 mm to 1 000 mm, and the slots should have a width of 50 mm ± 2,5 mm, a thickness of 10 mm ± 0,25 mm, and 45° chamfered edges of half their thickness. The circumferential spacing between the centrelines of two consecutive slots should be not less than 400 mm.

The wheel shall be fitted with the appropriate size tyre and inflated according to 90 % of the lower value between maximum inflation pressure recommended on the rim or the tyre.

Rotate the drums to give a linear surface speed of 8 km/h ± 0,8 km/h for a period to provide at least 100 000 impacts between each tyre of the bicycle and the slats.

Dimensions in millimetres



Key

- | | |
|----------|--|
| 1 | adjustable height |
| 2 | mass, 18 kg |
| 3 | height adjustable |
| 4 | drum |
| 5 | mass, 6,75 kg |
| 6 | mass, 18 kg |
| 7 | mass, 6,75 kg |
| 8 | mass, 18 kg |
| 9 | mass on the luggage carrier, more than 10 kg |
| <i>h</i> | height of slats |

Figure A.1 — Dynamic strength test on a fully assembled bicycle

Annex B (informative)

Verification of free-fall velocity

For all vertical impact tests, the striker shall be guided in such a way that the efficiency will permit to reach at least 95 % of the free-fall velocity.

The free-fall velocity is calculated using [Formula \(B.1\)](#):

$$v = \sqrt{2gh} \quad (\text{B.1})$$

where

v is the free-fall velocity (m/s);

g is the gravitational acceleration (m/s²) (i.e. = 9,806 65 m/s²);

h is the falling height (m).

The efficiency is equal to [Formula \(B.2\)](#)

$$\mu = \frac{v_i}{v} \times 100 \quad (\text{B.2})$$

where

μ is the efficiency (%);

v_i is the measured speed at impact (m/s).

Annex C (informative)

Steering flutter

C.1 Requirement

In the test specified in [C.2](#), the bicycle shall not oscillate with increasing frequency and/or amplitude, either with or without excitation at the handlebar.

C.2 Test method

A driving stability test to verify that no steering flutter will occur shall be carried out as follows.

In total three configurations shall be tested:

- a) Rider with maximum permissible total payload (rider plus luggage).

The mass of the test rider shall be determined by the maximum total permissible mass of the bicycle as specified by the manufacturer. The bicycle's own mass and the maximum permissible load of the carrier (as indicated on the carrier) shall be subtracted from the maximum permissible total mass. The difference between the maximum permissible total mass minus the bicycle's own mass and the maximum luggage carrier load results in the rider's mass with a tolerance of ± 5 kg.

EXAMPLE:

Maximum permissible total mass according to manufacturer's specifications: 140 kg.

Bicycle mass: 25 kg.

Permissible maximum load of the carrier (according to the manufacturer's specifications): 25 kg.

Result rider mass: $140 \text{ kg} - (25 \text{ kg} + 25 \text{ kg}) = 90 \text{ kg}$ (± 5 kg tolerance).

The height of the rider shall be between 175 cm and 190 cm. Choose a frame size that fits the rider, taking into account the worst-case regarding frame stiffness.

- b) Same rider as a), but without loading the carrier.
- c) Mass of the rider $60 \text{ kg} \pm 5 \text{ kg}$; rider height between 165 cm and 175 cm; maximum load of the carrier as indicated on the carrier; smallest frame size.

The mass distribution of the load on the carrier shall be 1/3 on the carrier and 1/3 on each side of the carrier of the two panniers. The load shall correspond to the maximum load indicated on the carrier. The masses both in the panniers and on the carrier shall not be rigid masses or containers with liquids, but shall be in granular form; for example, bags with coarse gravel or lead balls.

The test speeds shall be 15 km/h and 25 km/h respectively.

The gradient (descent) of the test track shall be between 1 % and 3 %.

The test rider rides in an upright sitting position (saddle position adjusted to the rider, highest handlebar position).

During the test, a contact between thumb and index finger and handlebar shall be made on one of the handlebar grips. The handlebar shall be vibrated with the other hand on the opposite handlebar