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ISO 4210-6

Third edition
2023-01

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).

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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 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.

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.

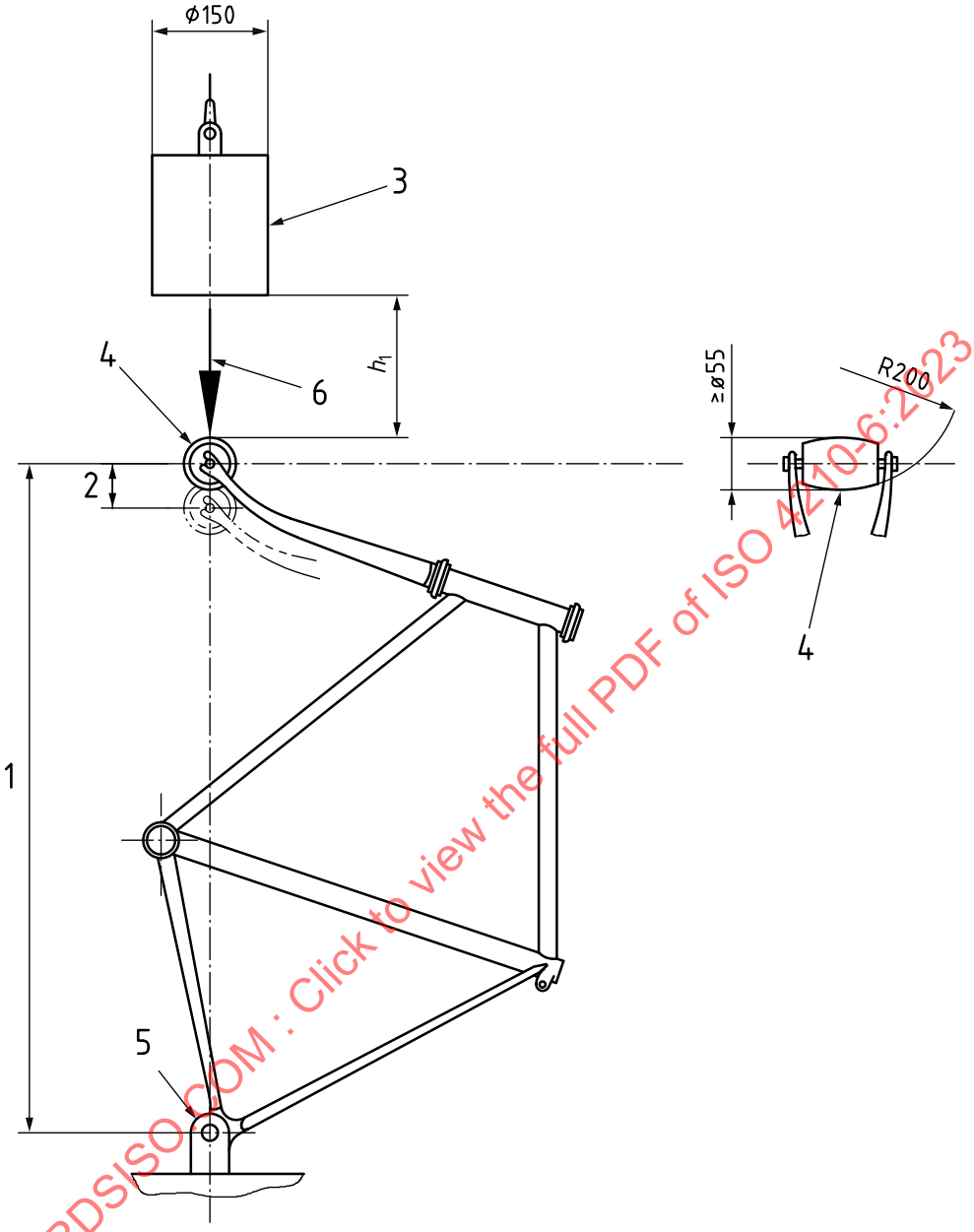
NOTE See ISO 4210-3:2023, Annex B.

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

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.

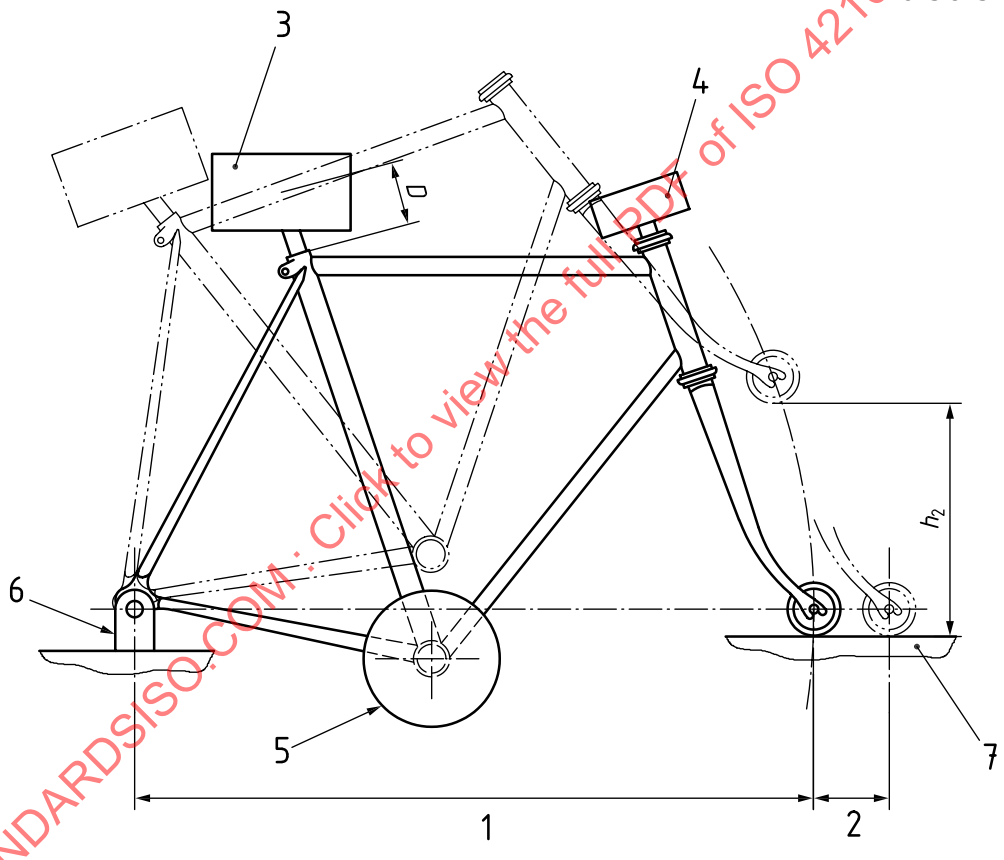
Table 2 — Drop heights and distribution of masses at seat-post, steering head, and bottom bracket

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 ±2,0°) 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 ±2,0°) 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):

$$R_C = \frac{p}{2\sin(\frac{180}{n})} \quad (1)$$

where

n number of teeth (the middle chain wheel of three, the smaller chain wheel of two, or the only chain wheel);

p chain pitch (link length, 12,7 for most bicycles) (mm).

Tolerance for R_c shall be ±5 mm.

The axis of the tie rod shall be parallel to and 50 mm ± 5 mm from the vertical plane through the centreline of the frame.

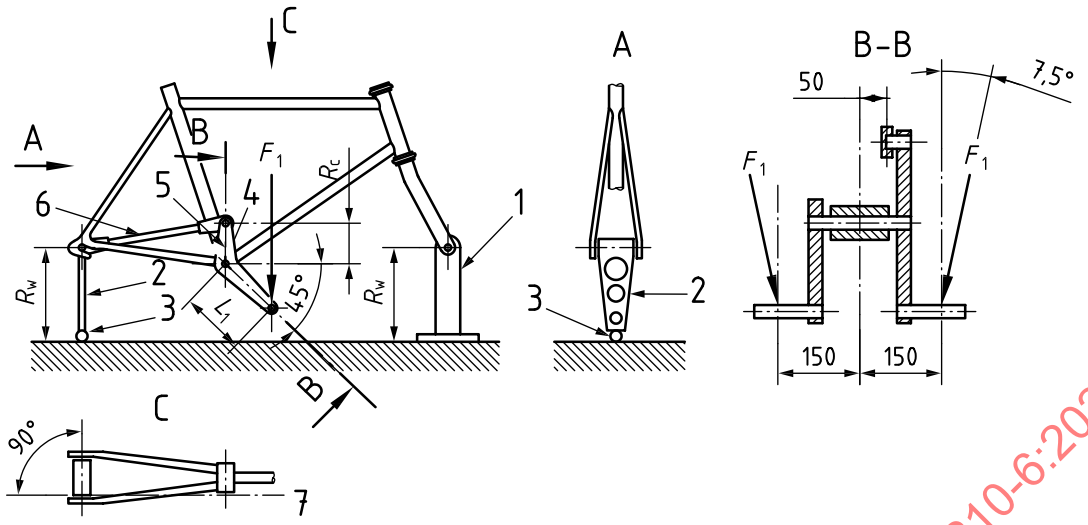
Subject each pedal spindle (or equivalent adaptor component) to a repeated downward force of F_1 at a position 150 mm from the centreline of the frame in a vertical, transverse plane and inclined at 7,5° (accurate to within ±0,5°) to the fore/aft plane of the frame as shown in Table 3 and Figure 3. During application of these test forces, ensure that the force on a "pedal spindle" falls to 5 % or less of the peak force before commencing application of the test force to the other "pedal spindle".

Apply the test forces for 100 000 test cycles, where one test cycle consists of the application and removal of the two test forces. The maximum test frequency shall be maintained as specified in ISO 4210-3:2023, 4.5.

Table 3 — Forces on pedal spindle

Forces in newtons

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Force, F_1	1 000	1 000	1 200	1 100



Key

1	rigid mount
2	vertical link
3	ball joint
4	adaptor assembly
5	vertical arm
6	tie rod
7	centreline of tie rod
F_1	repeated downward force
L_1	length of crank replacement
R_w	height of rigid mount and vertical link
R_c	length of vertical arm

Figure 3 — Frame — Fatigue test with pedalling forces

4.4 Frame — Fatigue test with horizontal forces

4.4.1 General

Where a frame is convertible for male and female riders by the removal of a bar, remove the bar.

It is not necessary for a genuine fork to be fitted, provided that any substitute fork is of the same length as the intended fork (see Annex A) and it is correctly installed in the steering-head bearings. For a suspension fork, lock it at a length which correspond to the manufacturer's recommended sag or 25 % if no specification, either by adjusting the spring/damper or by external means. For a suspension fork without sag adjustment system, lock it 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.

In tests on suspension frames with pivoted joints, lock the moving part of the frame into a position as would occur with the manufacturer's recommended sag or 25 % if no specification. For a shock absorber without sag adjustment system, lock it 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. This can be achieved by locking the suspension unit in an appropriate position or, if the type of suspension system does not permit it to be locked, then the suspension system can be replaced by a solid link of the appropriate compressed size. Ensure that the axes of the front and rear axles are horizontally in line, as shown in Figure 4. 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.

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.

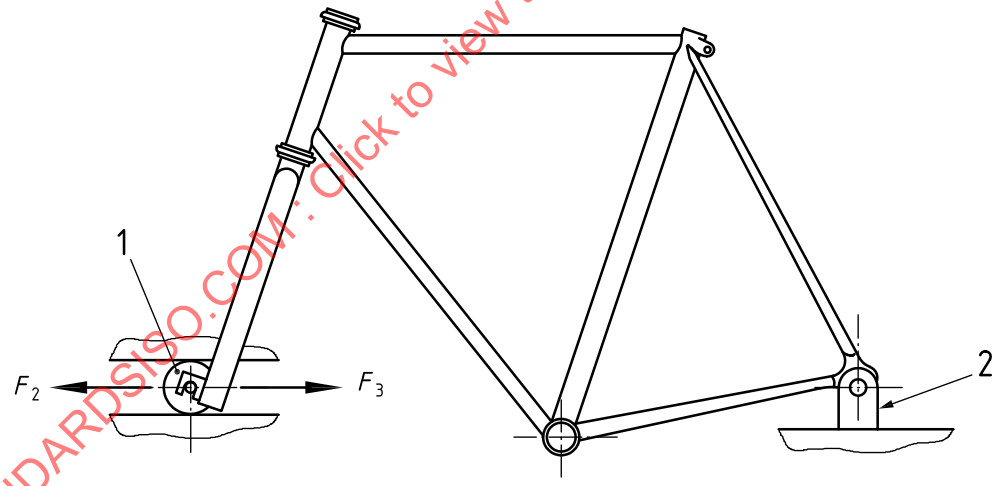
4.4.2 Test method

Mount the frame in its normal attitude and secured at the rear dropouts so that it is not restrained in a rotary sense (i.e. preferably by the rear axle) as shown in Figure 4. Ensure that the axis of the front and rear axles are horizontally in line.

Apply cycles of dynamic, horizontal forces of F_2 in a forward direction and F_3 in a rearward direction to the front fork dropouts for C_1 cycles as shown in Table 4 and Figure 4, with the front fork constrained in vertical direction but free to move in a fore/aft direction under the applied forces. The maximum test frequency shall be maintained as specified in ISO 4210-3:2023, 4.5.

Table 4 — Forces and cycles on front fork dropouts

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Forward force, F_2 N	450	450	1 200	600
Rearward force, F_3 N	450	450	600	600
Test cycles, C_1	100 000	100 000	50 000	100 000



Key

1 free-running guided roller
2 rigid, pivoted mounting for rear-axle attachment point
F_2 dynamic, horizontal force in a forward direction
F_3 dynamic, horizontal force in a rearward direction

Figure 4 — Frame — Fatigue test with horizontal forces

4.5 Frame — Fatigue test with a vertical force

4.5.1 General

Where a frame is convertible for male and female riders by the removal of a bar, remove the bar.

If a dummy fork is used, the fork shall be the same length as the intended fork (see Annex A) and installed with the steering-head bearings as specified by the manufacturer.

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. Secure the rear suspension as described in 4.3.1.

If a suspension fork is fitted, lock it in a position corresponding to 25 % of the maximum travel either by adjusting the spring/damper or by external means.

Secure the rear suspension as described in 4.3.1 in a position corresponding to 25 % compression of the maximum suspension travel.

4.5.2 Test method

Mount the frame in its normal attitude and secured at the rear dropouts so that is not restrained in a rotary sense (i.e. preferably by the rear axle) as shown in Figure 5. Fit a suitable roller to the front axle in order to permit the frame to flex in a fore/aft sense under the test forces.

Insert intended seat-post at minimum insertion depth or a solid steel bar to a depth of 75 mm in the top of the seat tube and secure this according to the manufacturer's instructions by the normal clamp. Securely attach a horizontal, rearward extension (E in Figure 5) to the top of this bar such that its location along the seat-post or steel bar (dimension h_3 in Figure 5) places point H (the intersection of the axes of the seat-post and steel bar and the extension piece E) in a vertical position equivalent to that of the centre of the saddle clamp with the bicycle at its maximum saddle height recommended for the particular frame, or, if the maximum saddle height information is not available, dimension h_3 shall be 250 mm.

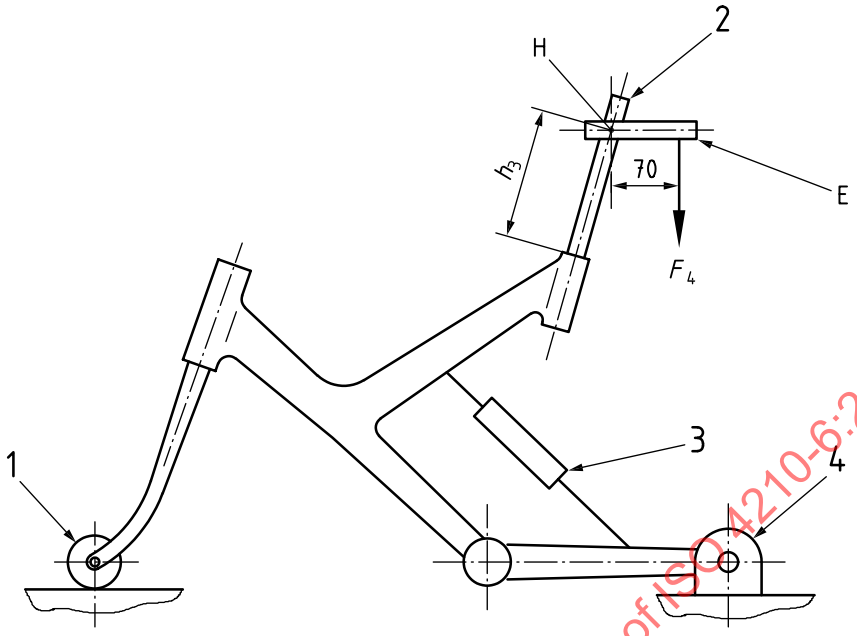
Apply cycles of dynamic, vertically-downward forces of F_4 at a point 70 mm behind the intersection of the axes of the solid steel bar and the extension piece, E, as shown in Figure 5 for 50 000 test cycles. The forces are given in Table 5. The maximum test frequency shall be maintained as specified in ISO 4210-3:2023, 4.5.

Table 5 — Forces on seat stem

Forces in newtons

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Force, F_4	1 000	500	1 200	1 200

Dimensions in millimetres



Key

1 free-running roller
2 solid steel bar
3 locked suspension unit or solid link for pivoted chain stays
4 rigid, pivoted mounting for rear axle attachment point
E horizontal, rearward extension
F_4 dynamic, vertically downward force
H point of intersection of the axes of the seat-post or steel bar and the extension piece
h_3 250 mm or height of centre of seat-post at minimum insertion of intended seat-post

Figure 5 — Frame — Fatigue test with a vertical force

4.6 Rear brake mount tests

4.6.1 General

When a frame is intended for use with a disc brake and whether supplied as original equipment or as an accessory, the frame manufacturer shall provide an attachment point on the frame for the calliper.

4.6.2 Static rear brake torque test

Mount the frame in its normal attitude in a fixture and secured either at the rear wheel axis or at the bottom bracket so that is not restrained in a rotary sense as shown in Figure 6 a) or Figure 6 b). Fit a suitable roller to the front axle in order to permit the frame to flex in a fore/aft sense under the test forces. A dummy fork can be fitted in place of the front fork.

Install a stiff, vertical link with an arm length R_w according to the maximum outer radius of the tyre intended for use with the frame or, if this value is not specified by the manufacturer, according to the maximum wheel diameter as given in Table 7. Further install a rigidly mounted brake disc or representative fixture of appropriate diameter at the rear dropouts by means of an axle being free to swivel about the axis of the axle but providing rigidity in a lateral plane.

The brake torque shall be introduced into the brake mount via the link arm in the same way as the actual calliper would do, i.e.:

a) the link arm can rotate freely on the rear axle;

b) the minimum brake rotor diameter specified by the manufacturer is simulated appropriately and;

c) the link arm is supported by the brake mounts so that only the tangential force, acting on the effective rotor radius in actual use, is introduced into a suitable brake calliper dummy.

Under no circumstances is a rigid connection to be created between link arm and brake calliper mount, as shown in Figure 6 c).

Apply a rearward force of 700 N to the link arm against the direction of travel. Maintain this force for 1 min, then reduce the force to 0 and apply a force of 300 N in direction of travel, again maintain this force for 1 min and release the force.

4.6.3 Rear brake mount fatigue test

Mount the frame in its normal attitude in a fixture in the same manner as for the static rear brake torque test as shown in Figure 6 a) or Figure 6 b).

Apply cycles of dynamic, horizontal forces of F_5 in a rearward direction and F_6 in a forward direction to the link arm for 20 000 test cycles as shown in Table 6 and Figure 6.

Table 6 — Forces at rear disc brake

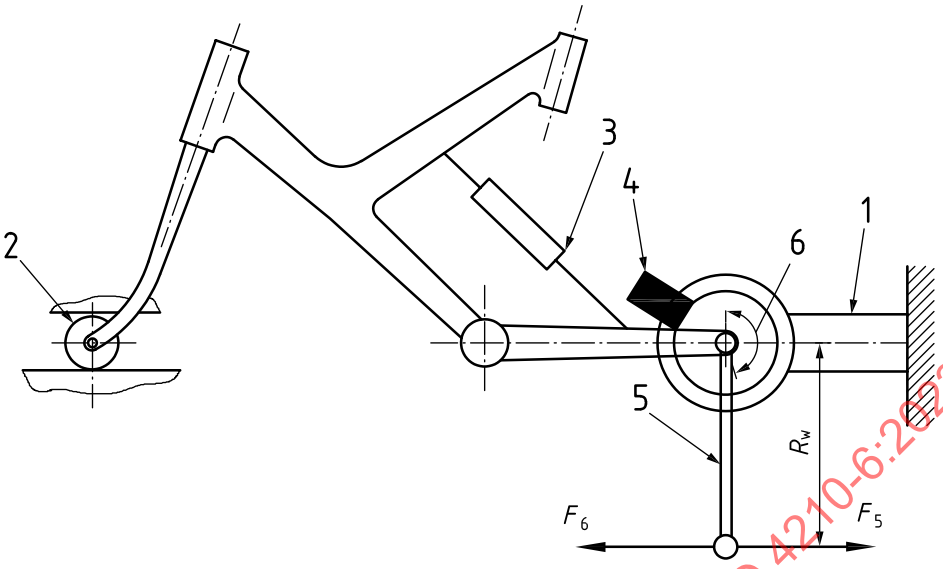
Forces in newtons

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Rearward force, F_5	500	300	500	400
Forward force, F_6	50	50	200	50

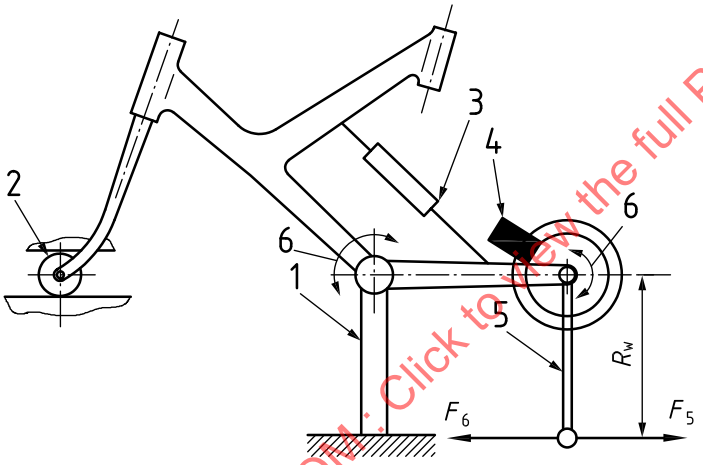
Table 7 — Fixture length

Dimensions in millimetres

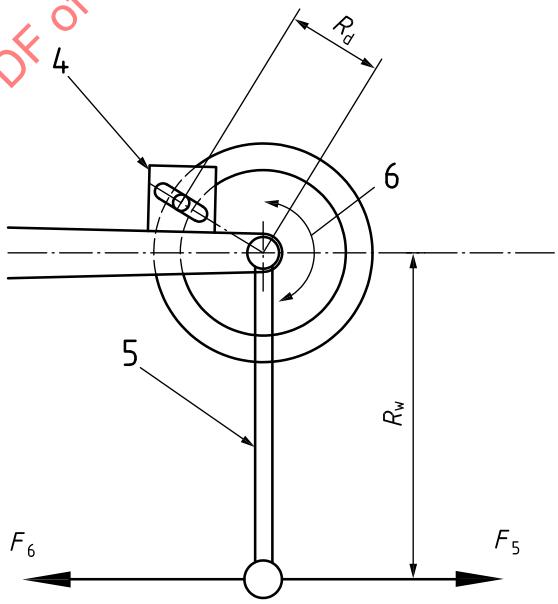
Wheel diameter	20"	24"	26"	650b	29" or 700c
Arm length, R_W	254	305	330	349	368



a) Fixing the frame to the rear wheel axis



b) Fixing the frame to the bottom bracket



c) Applying of the test force via the link arm

Key

1 rigid, pivoted mounting
2 free-running guided roller or similar movable bearing
3 locked suspension unit or solid link for pivoted chain stays
4 locking device on brake mount/calliper dummy
5 test adapter for force attachment, free to rotate around the axis of rotation of the rear wheel
6 rotational degree of freedom
F_5 dynamic, horizontal force in a rearward direction
F_6 dynamic, horizontal force in a forward direction
R_W wheel radius according to the maximum outer radius of the tyre or according to Table 7
R_d disc brake mean radius

Figure 6 — Frames for disc-brakes — Rear brake mount fatigue test

5 Fork test methods

5.1 Suspension forks — Tyre-clearance test

For the tyre-clearance test, a suspension fork shall first be checked and adjusted if necessary according to the items listed in the following:

a) inflate the tyre to the maximum inflation pressure;

b) place the fork in uncompressed condition to have the highest displacement between suspension stanchion legs and suspension lower legs;

c) if the suspension fork can be locked, place the fork in the open position;

d) if the fork has a spring adjust device, place it in the softest position;

e) if the fork has a pneumatic device, inflate the one or the two chambers at their minimum pressures according the manufacturer's instruction;

f) if the fork has a rebound device, place it on the slowest position.

With a wheel and tyre assembly fitted to the fork, apply a force of 2 800 N to the wheel in a direction towards the fork-crown and parallel to the axis of the fork steerer. Maintain this force for 1 min.

5.2 Front fork — Tensile test

5.2.1 Test method — Suspension fork

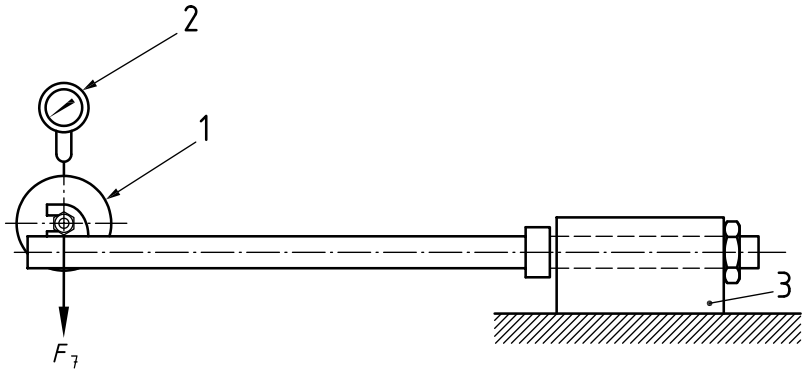
Mount the fork steerer securely in a suitable rigid mount, keeping any clamping forces away from the fork-crown, and apply a tensile force of 2 300 N distributed equally between the two dropouts in a direction parallel to the axis of the fork steerer and in the direction away from the fork crown. Maintain this force for 1 min.

5.2.2 Test method — Rigid, non-welded fork

Mount the fork steerer securely in a suitable rigid mount, keeping any clamping forces away from the fork-crown, and apply a tensile force of 5 000 N distributed equally to both dropouts for 1 min in a direction parallel to the axis of the fork steerer.

5.3 Front fork — Static bending test

Mount the fork in accordance with Annex B and fit a loading attachment and swivel on an axle located in the axle slots of the blades (see Figure 7). Locate a deflection measuring device over the loading attachment in order to measure deflection and permanent deformation of the fork perpendicular to the steerer axis and in the plane of the wheel.



Key

1 loading attachment swivel on axle
2 deflection measuring device
3 rigid mount incorporating head bearings
F_7 static force

Figure 7 — Front fork — Static bending test (typical arrangement)

Apply a static, pre-loading force of 100 N to the roller perpendicular to the steerer axis, against the direction of travel, and in the plane of the wheel. Remove and repeat this loading until a consistent deflection reading is obtained. Adjust the deflection measuring device to zero.

Increase the static force to F_7 and maintain this force for 1 min, then reduce the force to 100 N and record any permanent deformation. The forces are given in Table 8.

Table 8 — Forces on loading attachment

Forces in newtons

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Force, F_7	1 000	1 000	1 500	1 200

5.4 Front fork — Rearward impact test

5.4.1 Test method 1

Mount the fork in accordance with Annex B as shown in Figure 8. Use a fixture which is mounted on the steerer tube to prevent rotation of the fork while permitting flex of the steerer tube in the plane of the load. Assemble a roller of mass less than or equal to 1 kg and with dimensions conforming to those shown in Figure 9 in the fork. The hardness of the roller shall be not less than 50 HRC at impact surface.

Rest a striker of mass 22,5 kg ± 0,1 kg on the roller in the fork dropouts such that it is exerting a force against the direction of travel and in the plane of the wheel. Position a deflection measuring device under the roller and record the position of the roller in a direction perpendicular to the axis of the fork steerer and in the plane of the wheel and note the vertical position of the fork.

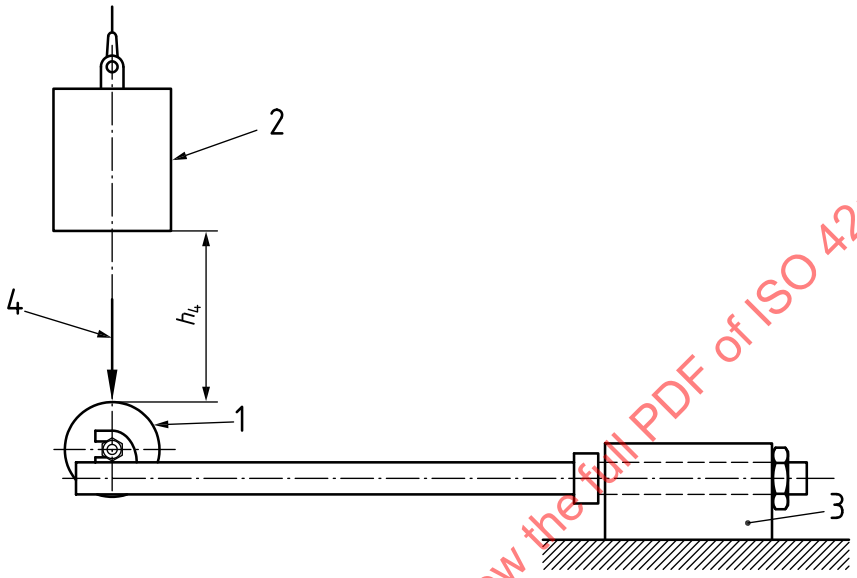
Remove the deflection measuring device, raise the striker through a height of h_4, and release it to strike the roller against the rake of the fork. The drop heights are given in Table 9. The striker will bounce and this is normal. When the striker has come to rest on the roller, measure the permanent deformation under the roller.

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

Table 9 — Drop heights

Dimensions in millimetres

Bicycle type		City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Drop height, h_4	Forks made entirely of metal	180	180	360	360
	Forks which have composite parts	320	320	600	640

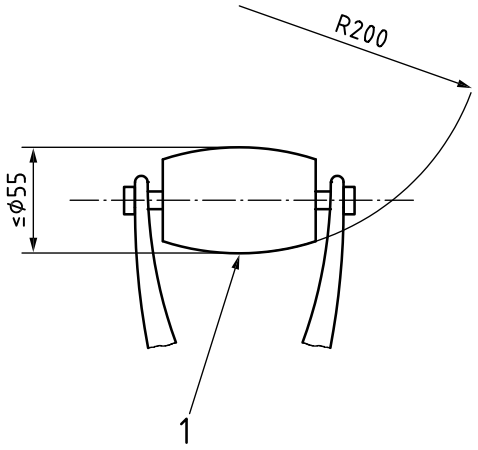


Key

1 low-mass roller (1 kg max.)
2 22,5 kg striker
3 rigid mount incorporating head bearings
4 direction of rearward impact
h_4 drop height

Figure 8 — Front fork — Rearward impact test

Dimensions in millimetres



Key

1 low-mass roller (1 kg max.)

Figure 9 — Low-mass roller

5.4.2 Test method 2 (only for forks made entirely of metal)

This test is similar to that described in 5.4.1 except the dropping height.

As shown in Figure 8, mount the fork used for the test in 5.4.1 and assemble a low-mass roller in the fork. Raise the striker to a height of 600 mm above the roller and release it to strike the roller against the rake of the fork. The section applies to forks in ISO 4210-2:2023, 4.9.6.1.

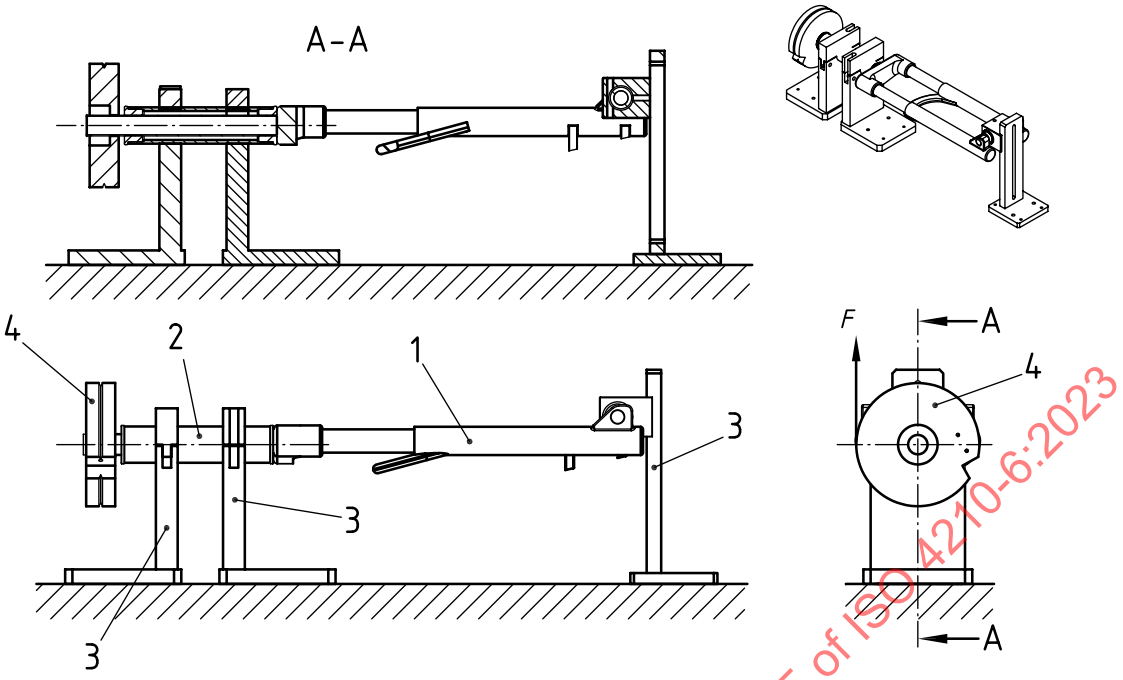
5.4.3 Test method 3

Apply a torque, *M*, to the assembly and maintain for 1 min in each direction of possible rotation about the steerer axis. The torque is given in Table 10, and a typical example of test equipment is illustrated in Figure 10.

Table 10 — Torque on fork

Torques in newton metres

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Torque, *M*	50	50	80	80



Key

1 front fork
2 fork mounting fixture (fixture representative of the head tube)
3 rigid mount
4 test adaptor
F force to produce torque, *M*

Figure 10 — Fork steerer torsional test (a typical example)

5.5 Front fork — Bending fatigue test and rearward impact test

Mount the fork in accordance with Annex B as shown in Figure 11.

Apply cycles of fully reversed, dynamic forces of F_8 in the plane of the wheel and perpendicular to the fork steerer tube to a loading attachment and swivel on an axle located in the axle-slots of the blades for 100 000 test cycles. The forces are given in Table 11. The maximum test frequency shall be maintained as specified in ISO 4210-3:2023, 4.5.

Conclude the test if the running displacement (peak-to-peak value) at the point where the test forces are applied increases by more than 20 % for rigid forks or more than 40 % for suspension forks from the initial values (see ISO 4210-3:2023, 4.6).

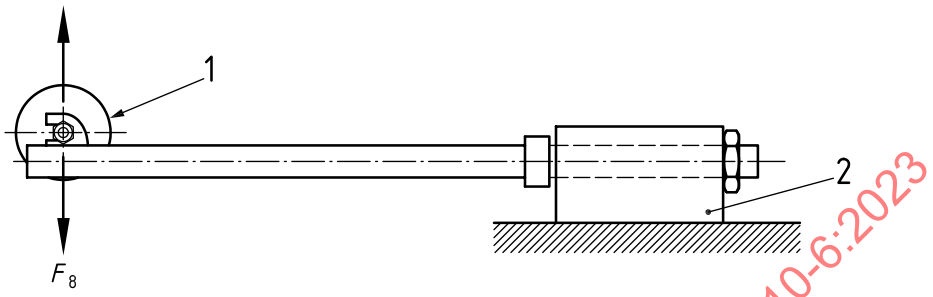
Stop the test after 100 000 cycles and inspect the sample carefully for fractures. If fractures are found, conclude the test.

If the sample completes 100 000 cycles without exceeding the displacement limits noted above, and if no fractures can be observed, perform the impact resistance test described in 5.4.1 (the drop heights are given in Table 9). When the striker has come to rest on the roller, measure the permanent deformation under the roller and inspect the sample carefully for fractures.

Table 11 — Forces on loading attachment

Forces in newtons

Bicycle type	City and trekking bicycle	Young adult bicycle	Mountain bicycle	Racing bicycle
Force, F_8	±450	±450	±650	±620



Key

1 pivoted force attachment

2 rigid mount incorporating head bearings

F_8 fully reversed, dynamic force

Figure 11 — Front fork — Bending fatigue test

5.6 Forks intended for use with hub or disc brakes

5.6.1 General

When a fork is intended for use with a hub or disc brake and whether supplied as original equipment or as an accessory, the fork manufacturer shall provide an attachment point on the fork blade for the torque arm or calliper.

Where more than one mounting point is provided for a hub or disc brake, the following shall apply:

a) where a complete bicycle is supplied, the test adaptor shall be secured to the mounting point used on the bicycle. If bracket is supplied, it shall be used to perform the test;

b) where a fork is supplied as an accessory with more than one mounting point, separate tests shall be conducted on each of the mounting points on separate forks. The smallest rotor size permitted by the manufacturer shall be the rotor size used as a test dimension when conducting the test. The rotor clamp point (size dependent) should be consistent with the test fixture.

5.6.2 Fork for hub/disc brake — Static brake-torque test

Mount the fork in a fixture representative of the head tube in accordance with Annex B and gripped in the normal head-bearings. Use a fixture which is mounted on the steerer tube to prevent rotation of the fork while permitting flex of the steerer tube in the plane of the load.

For forks intended for use with hub brakes, fit an axle to the fork, and mount on the axle a pivoted, straight adaptor as shown in Figure 12 to provide a torque arm of L_2 in length (see Table 12) and a suitable attachment for the brake mounting point. If the wheel size is not listed in Table 12, the length L_2 shall be equal to one-half of the wheel diameter.

For forks intended for use with disc brakes, use the fixture shown in Figure 13 and Figure 14 to provide a torque arm of L_2 in length (see Table 12). If the wheel size is not listed in Table 12, the length L_2 shall be equal to one-half of the wheel diameter.

The point of contact (key item 2 in Figure 13) between the shoulder bolt (key item 2 in Figure 14) and the tongue (key item 4 in Figure 13 and key item 1 in Figure 14), shall be at a distance *R* from the axis of the hub which replicates as closely as possible the distance from the hub axis to the centre of where the piston force is applied to the brake pads.

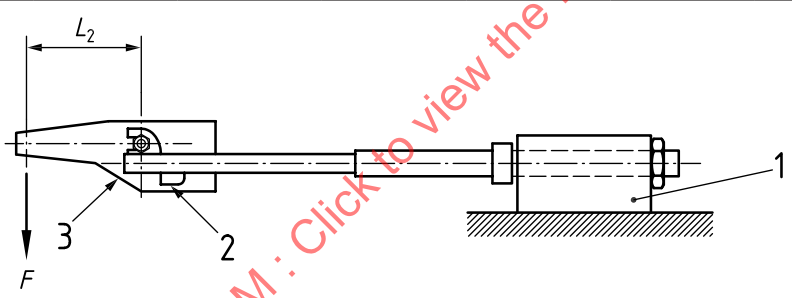
Contact shall be made only on the shoulder of the shoulder bolt (i.e. not on the head of the shoulder bolt) The contact surface of the load tongue shall be radial from the wheel axis.

For both types of fork: locate a deflection-measuring device on the fork at the hub axis in order to measure deflection and permanent deformation of the fork perpendicular to the fork steerer axis and in the plane of the wheel.

Apply a static, pre-loading rearward force of 100 N to the end of the torque arm, perpendicular to the fork steerer axis and in the plane of the wheel. Remove and repeat this loading until a consistent deflection reading is obtained. Adjust the deflection measuring device to zero. Apply a rearward force of 1 000 N to the torque arm perpendicular to the fork steerer axis and in the plane of the wheel. Maintain this force for 1 min, then reduce the force to 100 N and record any permanent deformation.

Table 12 — Fixture length

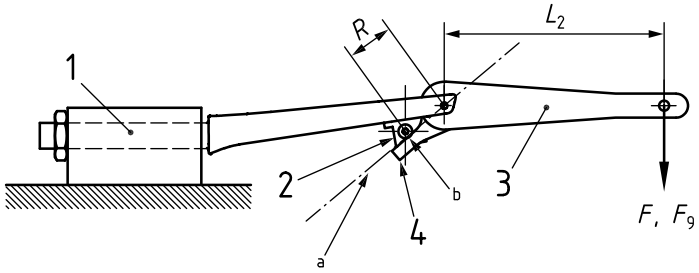
Wheel diameter	16"	18"	20"	22"	24"	26"	650b	29" or 700c
Arm length, L_2 mm	202	228	253	279	305	330	349	368



Key

1 rigid mount incorporating head bearings
2 brake mounting point
3 test adaptor
F rearward force, 1 000 N
L_2 arm length

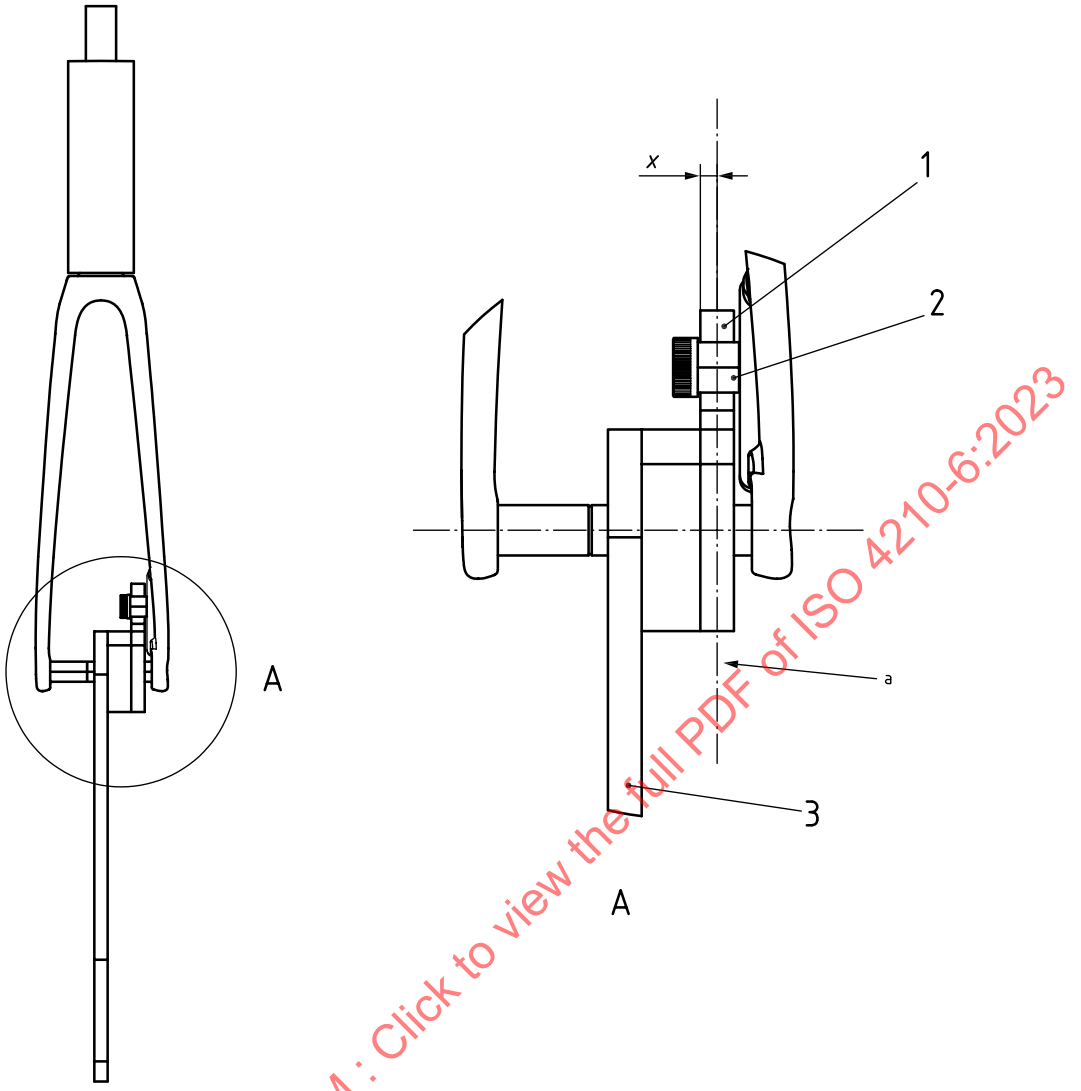
Figure 12 — Fork for hub brake — Static brake-torque test



Key

1 rigid mount incorporating head bearing
2 dummy brake calliper
3 load arm (length depends on wheel size, see Table 12)
4 tang
F rearward force, 1 000 N
F_9 repeated, dynamic forces (see 5.6.4)
L_2 arm length
R disk brake radius measured at the centre of the brake pad contact
a Tang is radial from hub centreline.
b Point of contact between shoulder bolt and tang corresponding to the centre of the brake pads.

Figure 13 — Fork for disc-brake — Static brake-torque test and brake mount fatigue test — Side view



Key

1 tang
2 shoulder bolt
3 load arm (length depends on wheel size, see Table 12)
x half tang thickness
a Centre line of rotor based on manufacturer hub width.

Figure 14 — Fork for disc brake — Static brake-torque test and brake mount fatigue test — Front view

5.6.3 Fork for hub brake — Brake mount fatigue test

Mount the fork in a fixture representative of the head tube in accordance with Annex B and gripped in the normal head-bearings. Use a fixture which is mounted on the steerer tube to prevent rotation of the fork while permitting flex of the steerer tube in the plane of the load. Fit an axle to the fork, and mount on the axle a pivoted, straight adaptor as shown in Figure 15 to provide a torque arm of L_2 in length (see Table 12) and a suitable attachment for the brake mounting point.

Apply repeated, dynamic forces of 600 N rearward to the end of the torque arm, perpendicular to the fork steerer axis and in the plane of the wheel (as shown in Figure 15) for C_2 cycles (see Table 13). The maximum test frequency shall be maintained as specified in ISO 4210-3:2023, 4.5.