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Cycles — Safety requirements for bicycles

Cycles — Exigences de sécurité des bicyclettes

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4210 was prepared by Technical Committee ISO/TC 149, *Cycles*.

This fourth edition cancels and replaces the third edition (ISO 4210:1989), which has been technically revised.

The main changes in this edition are as follows:

a) enhanced brake performance requirements;

b) requirements for wheel quick-release mechanisms;

c) enhanced requirements for chainguards to cover multi-chainwheel assemblies;

d) new requirements for fatigue testing of handlebar assemblies, front forks, pedal crank assemblies and saddle pillars.

Annexes A, B and C of this International Standard are for information only.

Introduction

In producing this International Standard, the aim bas been to ensure that bicycles manufactured in compliance with it 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.

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Cycles — Safety requirements for bicycles

Section 1: General

1.1 Scope

This International Standard specifies safety and performance requirements for the design, assembly and testing of bicycles and sub-assemblies, and lays down guidelines for instructions on the use and care of bicycles.

It applies to bicycles intended for use on public roads, and on which the saddle can be adjusted to provide a saddle height of 635 mm or more.

It does not apply to specialized types of bicycle such as tradesmen's delivery bicycles, tandems, toy bicycles and bicycles designed and equipped for use in sanctioned competitive events.

1.2 Normative references

The following standards contain provisions, which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5775-1:1994, *Bicycle tyres and rims — Part 1: Tyre designations and dimensions.*

ISO 5775-2:1989, *Bicycle tyres and rims — Part 2: Rims.*

ISO 6742-1:1987, *Cycles — Lighting and retro-reflective devices — Photometric and physical requirements — Part 1: Lighting equipment.*

ISO 6742-2:1985, *Cycles — Lighting and retro-reflective devices — Photometric and physical requirements — Part 2: Retro-reflective devices.*

ISO 7636:1984, *Bells for bicycles and mopeds — Technical specifications.*

ISO 9633:1992, *Cycle chains — Characteristics and test methods.*

1.3 Definitions

For the purposes of this International Standard, the following definitions apply.

1.3.1 cycle: Any vehicle that has at least two wheels and is propelled solely by the muscular energy of the person on that vehicle, in particular by means of pedals.

1.3.2 bicycle: Two-wheeled cycle.

1.3.3 delivery bicycle: Bicycle designed for the primary purpose of carrying goods.

1.3.4 tandem: Bicycle with saddles for two or more riders, one behind the other.

1.3.5 saddle height: Dimension from the ground plane to the top of the saddle, measured in the centre of the seating area normal to the ground plane when the bicycle is upright.

1.3.6 braking distance: Distance travelled by a bicycle between the commencement of braking (1.3.7) and the point at which the bicycle comes to rest.

1.3.7 commencement of braking: Point on the test track at which the brake actuating mechanism is moved from its rest position. In tests with two brakes, this point is determined by the first mechanism to operate.

1.3.8 gear development: Distance travelled by a bicycle during one revolution of the pedal cranks.

1.3.9 exposed protrusion: Protrusion that can be contacted by the central 75 mm of the lateral surface of a cylinder 250 mm long and 83 mm in diameter (simulating a limb). See figure 1.

1.3.10 (pedal) tread surface: Surface of a pedal that is presented to the underside of the foot, the design of which incorporates a slip-resistant characteristic.

1.3.11 ferrous component: Component composed of structural members made entirely from ferrous materials excluding any jointing media such as brazing materials or adhesives.

1.3.12 non-ferrous component: Component composed of structural members made entirely from non-ferrous materials excluding any jointing media such as adhesives.

NOTE — For the purposes of the choice of fatigue test forces, any component made from a mixture of ferrous and non-ferrous members shall be classified as non-ferrous.

1.3.13 crank assembly: Crank assembly for fatigue testing consists of the two cranks, the pedal spindles, the bottom bracket spindle, and the first component of the drive system, e.g. chainwheel.

Dimensions in millimetres

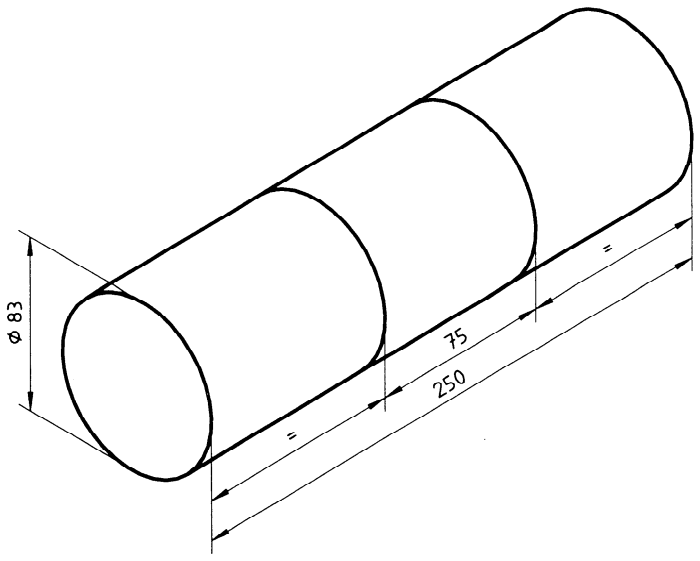

Figure 1 — Exposed protrusion test cylinder

Section 2: Requirements of sub-assemblies

2.1 General

2.1.1 Sharp edges

Exposed edges that could come into contact with the rider's hands, legs, etc., during normal riding or normal handling and normal maintenance shall not be sharp.

2.1.2 Protrusions

Any rigid exposed protrusion longer than 8 mm after assembly shall terminate in a radius of not less than 6,3 mm. Such protrusions shall have a major end dimension greater than 12,7 mm and a minor end dimension greater than 3,2 mm.

There shall be no protrusions on the top tube of a bicycle frame between the saddle and a point 300 mm forward of the saddle, with the exception that control cables no greater than 6,4 mm in diameter and cable clamps made from material no thicker than 4,8 mm may be attached to the top tube.

Foam pads attached to the bicycle frame to act as protective cushions are permitted, provided that the bicycle meets the requirements for protrusions when the pads are removed.

A screw thread that is an exposed protrusion (1.3.9) shall be limited to a protrusion length of one major diameter of the screw beyond the internally threaded mating part.

2.2 Brakes

2.2.1 Braking systems

A bicycle shall be equipped with two braking systems. One shall operate on the front wheel and one on the rear wheel. The braking systems shall operate without binding and shall be capable of meeting the braking performance requirements of 2.2.5.

Brake blocks containing asbestos shall not be permitted.

2.2.2 Hand-operated brakes

2.2.2.1 Brake lever position

Hand brake levers for front and rear brakes shall be positioned according to the legislation or custom and practice of the country in which the bicycle is to be sold.

2.2.2.2 Brake lever dimensions

The maximum grip dimension, d, measured between the outer surfaces of the brake lever and the handlebar, or the handlebar grip or any other covering where present, shall not exceed 90 mm between points A and B, and 100 mm between points B and C (see figure 2).

NOTE — The range of adjustment on the brake lever should permit these dimensions to be obtained.

2.2.2.3 Attachment of brake assembly

The screws used to attach a brake assembly to the frame, fork or handlebar shall be provided with suitable locking devices, for example a lock-washer, lock-nut or stiff-nut.

Cable pinch-bolts shall not sever any of the cable strands when assembled to the manufacturer's instructions. In the event of a brake cable failing, no part of the brake mechanism shall inadvertently inhibit the rotation of the wheel.

The cable end shall either be protected with a cap that shall withstand a removal force of 20 N or be otherwise treated to prevent unravelling.

Dimensions in millimetres

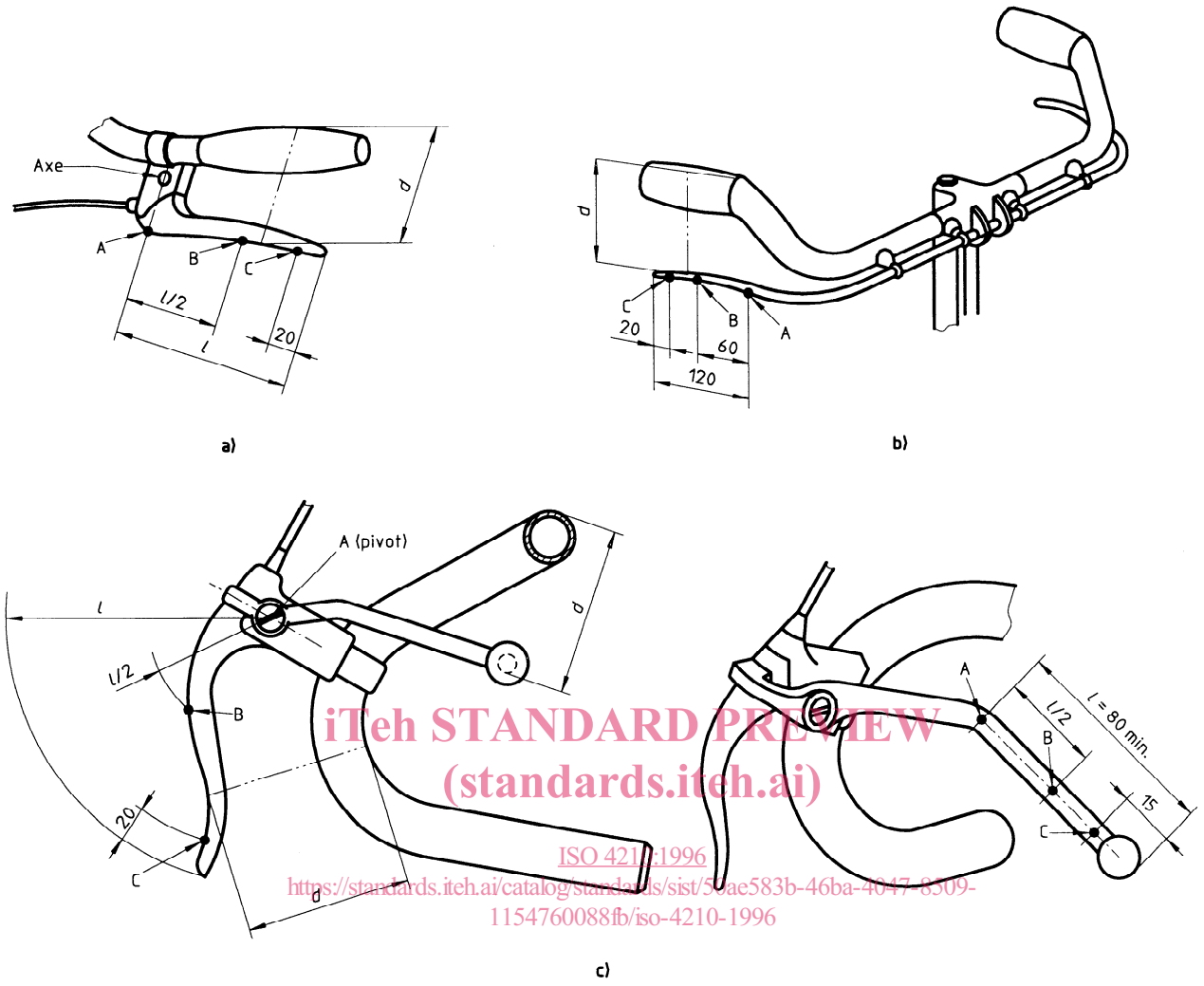

Figure 2 — Brake lever grip dimensions

2.2.2.4 Brake block assembly

The brake block shall be securely attached to the backing plate or holder and there shall be no failure of the block assembly when tested by the method specified in 4.1. The brake system shall be capable of meeting the strength test specified in 2.2.4.1 and the braking performance requirements of 2.2.5.1 and 2.2.5.2 after completion of the test specified in 4.1.

2.2.2.5 Brake adjustment

The brakes shall be capable of adjustment to an efficient operating position until the brake blocks have worn to the point of requiring replacement as recommended in the literature provided by the manufacturer.

When correctly adjusted, the brake block shall not contact anything other than the intended braking surface.

The brake blocks of a bicycle with rod brakes shall not come into contact with the rim of the wheels when the steering angle of the handlebars is set at 60°, nor shall the rods bend, or be twisted after the handlebars are reset to the central position.

2.2.3 Back-pedal brakes

The brake shall be actuated by the operator's foot applying force to the pedal in a direction opposite to that of the drive force. The brake mechanism shall function independently of any drive-gear positions or adjustments. The differential between the drive and brake positions of the crank shall not exceed 60°. The measurement shall be taken with the crank held against each position with a torque of at least 14 N·m.

2.2.4 Strength of brake system

2.2.4.1 Hand-operated brakes

When tested by the method described in 4.2.1, there shall be no failure of the brake system or of any component thereof.

2.2.4.2 Back-pedal brakes

When tested by the method described in 4.2.2, there shall be no failure of the brake system or any component thereof.

2.2.5 Braking performance

2.2.5.1 Braking under dry conditions

When tested by the method described in 4.3, a bicycle shall be brought to a smooth safe stop within the relevant distances and from the relevant velocities given in table 1.

2.2.5.2 Braking under wet conditions

When tested by the method described in 4.3, a bicycle shall be brought to a smooth safe stop within the relevant distances and from the relevant velocities given in table 1.

Table 1 — Brake test velocities and braking distances

Condition	Velocity km/h	Brakes in use	Braking distance m
Dry	25	Both	7
		Rear only	15
Wet	16	Both	9
		Rear only	19

2.2.5.3 Extension levers

Where a bicycle is fitted with extension levers, separate tests shall be conducted for the operation of the extension levers in addition to tests using the normal levers to which the extensions are attached.

2.2.5.4 Linearity of back-pedal brake

When tested by the method described in 4.4, the brake force shall be linearly proportional (within ± 20 %) for a pedal force from 90 N to 300 N and shall be not less than 150 N for a pedal force of 300 N.

2.3 Steering

2.3.1 Handlebars

The handlebars shall have an overall width between 350 mm and 700 mm. The vertical distance between the top of the handlebar grips, when assembled to the highest riding position according to the manufacturer's instructions, and the seat surface of the saddle in its lowest position shall not exceed 400 mm.

The ends of the handlebars shall be fitted with handgrips or end plugs that will withstand a removal force of 70 N.

2.3.2 Handlebar stem

The handlebar stem shall contain a permanent mark that clearly indicates the minimum insertion depth of the handlebar stem into the fork stem, or alternatively a positive and permanent means of ensuring the minimum insertion depth shall be provided. The insertion mark, or insertion depth, shall be not less than 2,5 times the shaft diameter from the lower end of the stem, and there shall be at least one shaft diameter's length of contiguous circumferential shaft material below the mark. An insertion mark shall not affect the strength of the handlebar stem.

2.3.3 Expander bolt for handlebar stem

The minimum failure torque of the bolt shall be at least 50 % greater than the manufacturer's maximum tightening torque.

2.3.4 Steering stability

The steering shall be free to turn through at least 60° either side of the straight-ahead position and shall exhibit no tight spots, stiffness or slackness in the bearings when correctly adjusted.

A minimum of 25 % of the total mass of the bicycle and rider shall act on the front wheel when the rider is holding the handlebar grips and sitting on the saddle, with the saddle and rider in their most rearward positions.

Recommendations for steering geometry are given in annex B.

2.3.5 Strength of steering assembly

The handlebar stem shall be capable of withstanding without fracture the tests described in 4.5.1.1 and 4.5.1.2.

When tested by the method described in 4.5.2, there shall be no movement of the handlebar relative to the stem.

When tested by the method described in 4.5.3, there shall be no movement of the handlebar stem relative to the fork stem other than that movement required to take up tolerances before any locking faces abut. Such movement shall not exceed 5°.

2.3.6 Fatigue test on handlebar and stem assembly

When tested by the method described in 4.5.4, there shall be no fractures or visible cracks in the handlebar or stem.

NOTE — It is recommended that standardized crack inspection methods are used, such as those contained in ISO 3452. This recommendation applies to all crack test requirements in this International Standard.

2.4 Frame-fork assembly

2.4.1 Impact test (falling mass)

When tested by the method described in 4.6.1, there shall be no visible evidence of fracture, and the permanent deformation of the assembly, measured between the centrelines of the wheel axles (wheelbase), shall not exceed 40 mm.

2.4.2 Impact test (falling frame-fork assembly)

When tested by the method described in 4.6.2, there shall be no visible evidence of fracture.

2.5 Front fork

2.5.1 Means of location

The slots or other means of location for the front wheel axle within the front fork shall be such that when the axle or cones are firmly abutting the top face of the slots, the front wheel remains central within the front fork.

2.5.2 Fatigue strength of fork

When tested by the method described in 4.6.3 there shall be no fracture or visible cracks on any part of the fork.

2.6 Wheels

2.6.1 Rotational trueness

Rotational trueness is defined in ISO 1101 in terms of circular run-out tolerance (axial). The run-out tolerances given in 2.6.1.1 and 2.6.1.2 represent the maximum permissible variation of position of the rim (i.e. full indicator reading) of a fully assembled wheel during one complete revolution about the axle without axial movement.

2.6.1.1 Concentricity tolerance

For bicycles equipped with rim brakes, the run-out shall not exceed 2 mm when measured perpendicular to the axle at a suitable point along the rim. (See figure 3.)

For bicycles not equipped with rim brakes, the run-out shall not exceed 4 mm.

2.6.1.2 Squareness tolerance

For bicycles equipped with rim brakes, the run-out shall not exceed 2 mm when measured parallel to the axle at a suitable point along the rim. (See figure 3.)

For bicycles not equipped with rim brakes, the run-out shall not exceed 4 mm.

2.6.2 Clearance

Alignment of the wheel assembly in a bicycle shall allow not less than 2 mm clearance between the tyre and any frame or fork element.

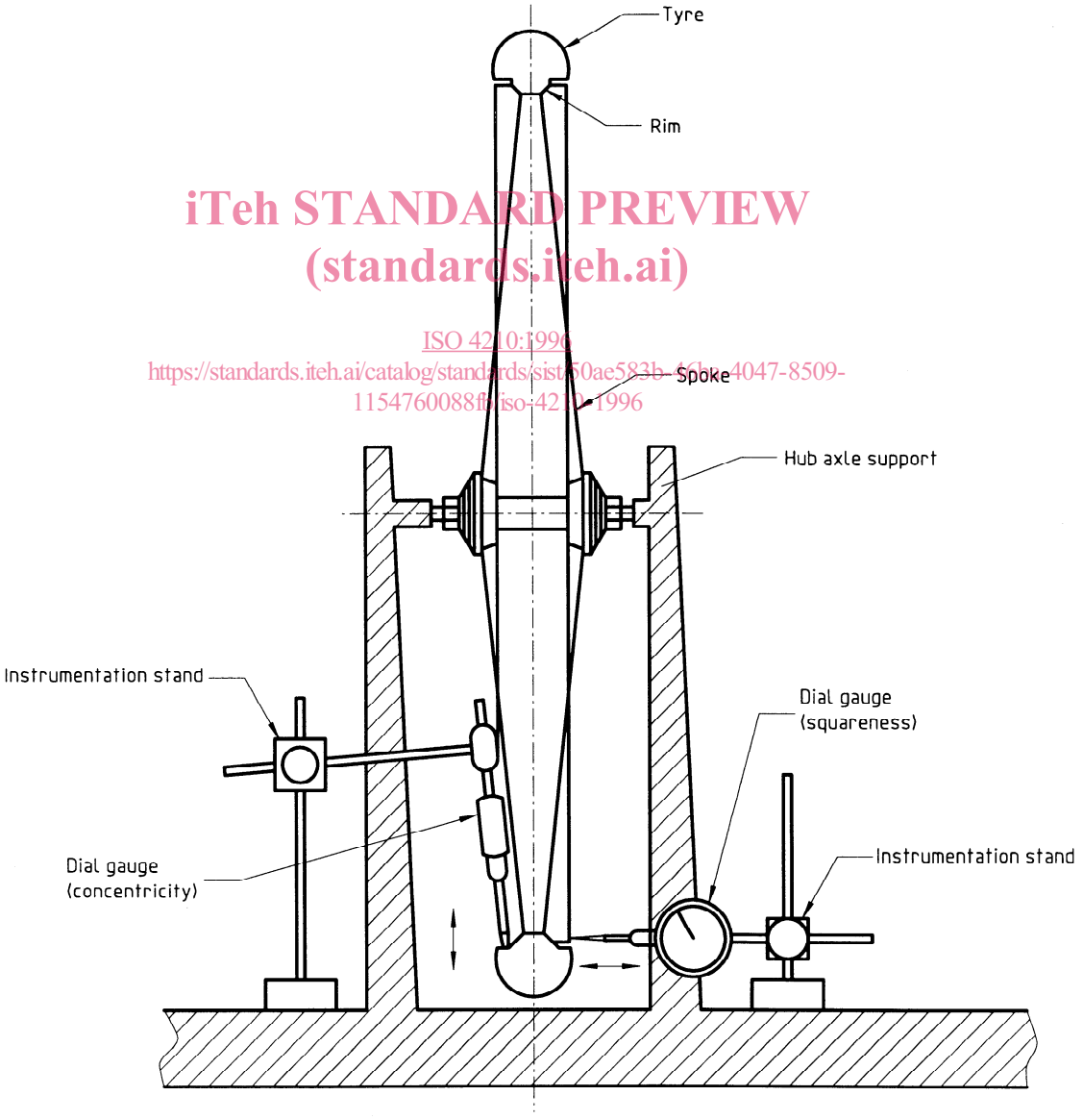

Figure 3 — Wheel rotational trueness

2.6.3 Static load test

When a fully assembled wheel is tested by the method described in 4.7, there shall be no failure of any of the components of the wheel, and the permanent deformation, measured at the point of application of the force on the rim, shall not exceed 1,5 mm.

2.6.4 Wheel retention

2.6.4.1 General

Wheels shall be secured to the bicycle frame and fork such that when adjusted to the manufacturer's recommendations they comply with 2.6.4.2, 2.6.4.3, 2.6.4.4 and 2.6.5.

Wheel nuts shall have a minimum removal torque of 70 % of the manufacturers recommended tightening torque. Where quick-release axle mechanisms are used they shall comply with 2.6.5.

2.6.4.2 Front wheel retention — retention devices secured

There shall be no relative motion between the axle and the front fork when a force of 2 300 N is applied symmetrically to either side of the axle for a period of 30 s in the direction of the removal of the wheel.

2.6.4.3 Rear wheel retention — retention devices secured

There shall be no relative motion between the axle and the frame when a force of 2 300 N is applied symmetrically to either side of the axle for a period of 30 s in the direction of the removal of the wheel.

2.6.4.4 Front wheel retention — retention devices unsecured

Where threaded axles and nuts are fitted, and the nuts are unscrewed by a least 360° from the finger tight condition, the wheel shall not detach from the fork when a force of 100 N is applied radially outwards and in line with the drop out slots.

Where quick release mechanisms are fitted the requirements in 2.6.5.2 shall apply.

2.6.5 Quick release axle mechanisms

2.6.5.1 Operating features

Any quick-release mechanism shall have the following operating features:

a) the quick-release mechanism shall be adjustable to allow setting for tightness [see 2.16 c)];

b) its form and marking shall clearly indicate whether the mechanism is in the open or locked position;

c) if adjustable by a lever, the force required to close a properly set lever shall not exceed 200 N and, at this closing force, there shall be no permanent deformation of the quick-release mechanism;

d) the releasing force of the clamping mechanism when closed shall not be less than 50 N;

e) if operated by a lever, the quick-release mechanism shall withstand without fracture or permanent deformation a closing force of not less than 250 N applied with the adjustment set to prevent full closure under this force;

f) the wheel retention with the quick-release mechanism in the clamped position shall be in accordance with 2.6.4.2 and 2.6.4.3.

If applied to a lever, the forces specified in c), d) and e) shall be applied 5 mm from the tip end of the lever.

2.6.5.2 Removal

It shall be possible to remove and replace the wheel without disturbing the preset condition when secondary devices are not present. When a secondary device is present, and the quick release lever is fully open and the brake system is disconnected or released, the wheel shall not detach from the fork when a force of 100 N is applied to the wheel radially outward and in line with the drop out slots.

NOTE — It is recommended that it be possible to remove and replace the wheel without disturbing the preset condition when secondary devices are present.

2.7 Rims, tyres and tubes

Non-moulded tyres are excluded from the requirements of 2.7.1 and 2.7.2.

2.7.1 Inflation pressure

The maximum inflation pressure recommended by the manufacturer shall be moulded on the sidewall of the tyre so as to be readily visible when the latter is assembled on the wheel.

2.7.2 Compatibility

Tyres shall comply with the requirements of ISO 5775-1 and rims shall comply with the requirements of ISO 5775-2. The tyre and tube shall be compatible with the rim design. When inflated to 110 % of the maximum inflation pressure for a period of not less than 5 min, the tyre shall remain intact on the rim.

2.8 Pedals and pedal/crank drive system

2.8.1 Pedal tread

2.8.1.1 The tread surface of a pedal shall be secured against movement within the pedal assembly.

2.8.1.2 Pedals intended to be used without toe-clips, or for optional use with toe-clips, shall have

a) tread surfaces on the top and bottom surfaces of the pedal, or

b) a definite preferred position that automatically presents the tread surface to the rider's foot.

2.8.1.3 Pedals designed to be used only with toe-clips or shoe retention devices shall have toe-clips or shoe retention devices securely attached and need not comply with the requirements given in 2.8.1.2 a) and b).

2.8.2 Pedal clearance

2.8.2.1 Ground clearance

With the bicycle unladen, the pedal at its lowest point and the tread surface of the pedal parallel to the ground and uppermost where it has only one tread surface, the bicycle shall be capable of being leaned over at an angle of 25° from the vertical before any part of the pedal touches the ground.

When a bicycle is equipped with a sprung suspension, this measurement shall be taken with the suspension in a depressed position such as would be caused by a rider weighing 85 kg.

2.8.2.2 Toe clearance

Bicycles not equipped with positive foot-retaining devices (such as toe-clips) shall have at least 89 mm clearance between the pedal and the front tyre or mudguard (when turned to any position). The clearance shall be measured forward and parallel to the longitudinal axis of the bicycle from the centre of either pedal to the arc swept by the tyre or mudguard, whichever results in the least clearance. (See figure 4.)

Where a bicycle front fork has features that are designed to permit the fitting of a front mudguard, the toe clearance shall be measured with a suitable mudguard so fitted.

2.8.3 Drive system static load test

When tested by the method described in 4.8.1, there shall be no visible fracture of any component of the drive system, and drive capability shall not be lost.