

Cycles —

Part 1: Specification for safety requirements for bicycles

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the General Mechanical Engineering Standards Policy Committee (GME/-) to Technical Committee GME/25 upon which the following bodies were represented:

- Association of Consulting Scientists
- Association of Cycle Traders
- Bicycle Association of GB
- British Battery Manufacturers' Association
- British Cycling Federation
- British Rubber Manufacturers' Association Ltd.
- Consumer Policy Committee of BSI
- Consumers' Association
- Cyclists Touring Club
- Department of Transport
- Institute of Trading Standards Administration
- Royal Society for the Prevention of Accidents
- Small Electrical Appliances Marketing Association
- Coopted members

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Foreword

This Part of BS 6102 has been prepared under the direction of the General Mechanical Engineering Standards Policy Committee.

This Part of BS 6102 is a revision of BS 6102-1:1981 which will be withdrawn (see notes below). It continues to follow closely the international standard ISO 4210:1989 *Cycles — Safety requirements of bicycles*, but differs in respect of braking requirements, in that the ISO standard:

- a) allows a bicycle to have only one braking system, whereas this Part of BS 6102 requires a bicycle to have two braking systems, and
- b) specifies a limit of 15 m braking distance under wet conditions. In the UK, braking technology now provides wet braking performance comparable with that of dry braking performance. Consequently, this Part of BS 6102 specifies a limit of 7.5 m braking distance under wet conditions.

Other areas where developments in this Part have resulted in deviations from the ISO standard include requirements for protrusions, wheel quick-release mechanisms, chainguards, fork fatigue tests and saddle strength tests.

Development work continues on requirements for protrusions, braking and fatigue testing, the latter two under the sponsorship of the ISO committee. The long term aim is to match the requirements of this Part, the ISO standard and other national standards, so that the need for separate national standards ceases.

On the question of protrusions the requirements in BS 6102-1:1981 as amended by Amendment No. 2 have proved unworkable. A new working group has therefore been formed in the UK to consider the problem afresh. In the meantime this revision returns broadly to the text as amended by Amendment No. 1, except for the control cable requirement in 4.2.3.

NOTE 1 This Part of BS 6102 will only become effective, and the 1981 edition withdrawn, after the Secretary of State for Transport has given his approval for the current regulations to be amended.

NOTE 2 Upon publication of this revision, BSI Sales Department will respond to purchase orders for BS 6102-1 by supplying copies of this new edition. Copies of the 1981 edition may still be obtained by quoting BS 6102-1:1981, until the new edition becomes effective.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Attention is drawn to the following statutory regulations relevant to bicycles.

The Electricity Assisted Pedal Cycles Regulations 1983 (SI No. 1168) [1]

The Pedal Cycles (Construction and Use) Regulations 1983 (SI No. 1176) [2]

The Pedal Bicycles (Safety) Regulations 1984 (SI No. 145) [3]

The Road Vehicles Lighting Regulations 1989 (SI No. 1796) [4]

(Copies of these publications may be obtained from HMSO.)

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

The aim of this Part of BS 6102 is to ensure that bicycles manufactured in compliance with it will be as safe as is practicable. 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. However, it should be noted that the requirements in this Part are intended for pedal cycles used on the public roads, and may not provide an adequate degree of safety and durability for other uses, particularly off road uses, which may place the pedal cycle or its components under additional strain.

The test conditions specified for the method of test for braking performance under wet conditions (see 5.5.2) are similar to those obtained in heavy rain; the resulting braking distances are, however, likely to be in excess of those that would be obtained in light showers.

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

1 Scope

This Part of BS 6102 specifies safety and performance requirements for the design, assembly and testing of bicycles and sub-assemblies, and specifies the information to be included on the use and care of bicycles.

This Part of BS 6102 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 bicycles such as tradesmen's delivery bicycles, tandems, toy bicycles and bicycles designed and equipped for use in sanctioned competitive events.

NOTE Requirements for toy bicycles are given in BS 5665-1.

2 References

2.1 Normative references

This Part of BS 6102 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 6102 only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 6102 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this Part of BS 6102 the following definitions apply.

3.1 bicycle

a two-wheeled cycle

3.2 braking distance

the distance travelled in bringing a bicycle to rest from the moment of application of the brakes

3.3 correct adjustment

the adjustment specified by the manufacturer's instructions

NOTE This phrase appears in the text in some places as "correctly adjusted".

3.4 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

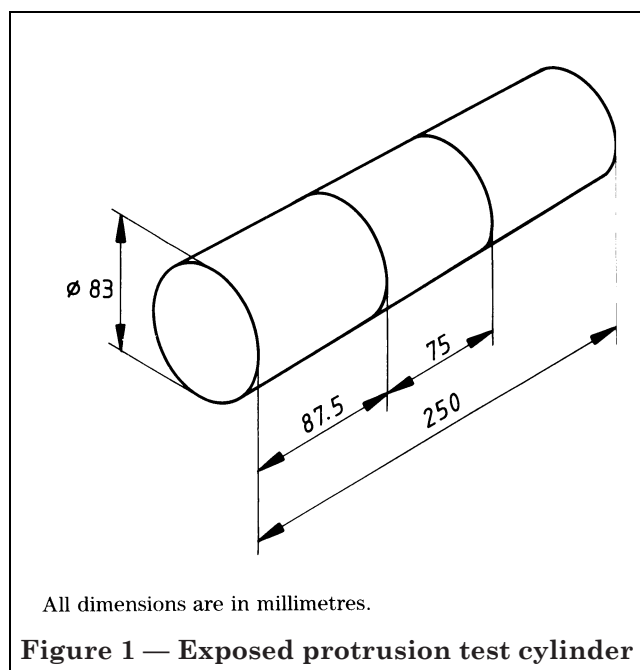
3.5 delivery bicycle

a bicycle designed for the primary purpose of carrying goods

3.6 exposed protrusion

a 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)

NOTE Figure 1 shows an exposed protrusion test cylinder.



3.7 fixed rear wheel

a rear wheel that is incapable of rotating independently of the pedals

3.8 gear development

the distance travelled by a bicycle during one revolution of the pedal cranks

3.9 inflation pressure

the maximum pressure recommended by the tyre manufacturer

3.10 saddle height

the 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 in the upright position

3.11 tandem

a bicycle with saddles for two or more riders, one behind the other

3.12 tread plane (pedal)

the plane that is adopted by a 70 mm × 100 mm rectangular flat plate, with the shortside aligned with the pedal axis, laid centrally on the tread surface of the pedal

3.13 tread surface (pedal)

the surface of a pedal that is presented to the underside of the foot, and whose design incorporates a slip-resistant characteristic

4 General

4.1 Sharp edges

Exposed edges that could come into contact with parts of the rider's body during normal riding or normal handling and normal maintenance shall not be sharp.

4.2 Protrusions

4.2.1 Exposed protrusions

Except as specified in 4.2.2, any rigid exposed protrusion longer than 8 mm after assembly shall terminate in a radius of not less than 6.3 mm. The end of such protrusions shall have a major dimension greater than 12.7 mm and a minor dimension greater than 3.2 mm.

4.2.2 Exemptions

The requirements of 4.2.1 do not apply to the following:

- the front gear change mechanism at the chainwheel;
- the rear gear change mechanism below the chain stay;
- the rim brake mechanisms at the front and rear wheels;
- a lamp bracket fitted on the head tube;
- reflectors;
- toe-clips and toe-straps.

4.2.3 Control cables

Control cables attached to the top tube or main frame tube shall be no greater than 6.5 mm in diameter and any cable clamps shall be made from material no thicker than 5 mm. Where cable clamps incorporate threaded components, these shall be situated on the underside of the tube.

Cable ends shall be protected with a cap that shall withstand a removal force of 20 N.

4.2.4 Screw threads

A screw thread that is an exposed protrusion (see 3.6) shall be limited to a protrusion length of one major diameter of the screw beyond the internally threaded mating part.

5 Brakes

5.1 Braking system

A bicycle shall be equipped with two braking systems, to ensure conformity to 5.5. One shall operate on the front wheel and one on the rear wheel.

The braking system shall operate without binding. The braking system shall conform to the braking performance requirements of 5.5.

5.2 Hand-operated brakes

5.2.1 Brake lever position

The brake lever for the front brake shall be positioned on the right-hand side of the handlebar, and that for the rear brake on the left-hand side.

5.2.2 Brake lever dimensions

The grip dimension, d , shown in Figure 2 and measured between the outer surfaces of the brake lever and the handlebar, or handlebar grip or other covering where present, shall not exceed 90 mm between points A and B, and 100 mm between points B and C.

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

5.2.3 Cable-brake assembly

When a bicycle is equipped with cable brakes of whatever type, the screws or bolts attaching the cable-brake assembly to the frame or fork shall be provided with a suitable locking device, for example lockwasher, locknut or stiffnut.

The cable pinch-bolt 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 wheels.

5.2.4 Brake block and holder assembly

The brake block shall be securely attached to the holder and there shall be no failure of the brake block and holder assembly when tested by the method described in clause 21. The brake block test shall be performed before other braking tests.

5.2.5 Brake adjustment

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

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

5.3 Back-pedal brakes

The brake shall be actuated by the rider'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.

5.4 Strength of brake system

5.4.1 Hand-operated brakes

When tested by the method described in 22.1, there shall be no failure of the brake system or of any component thereof.

5.4.2 Back-pedal brakes

When tested by the method described in 22.2, there shall be no failure of the brake system or of any component thereof.

5.5 Braking performance

5.5.1 Braking under dry conditions

When tested by the method described in clause 23:

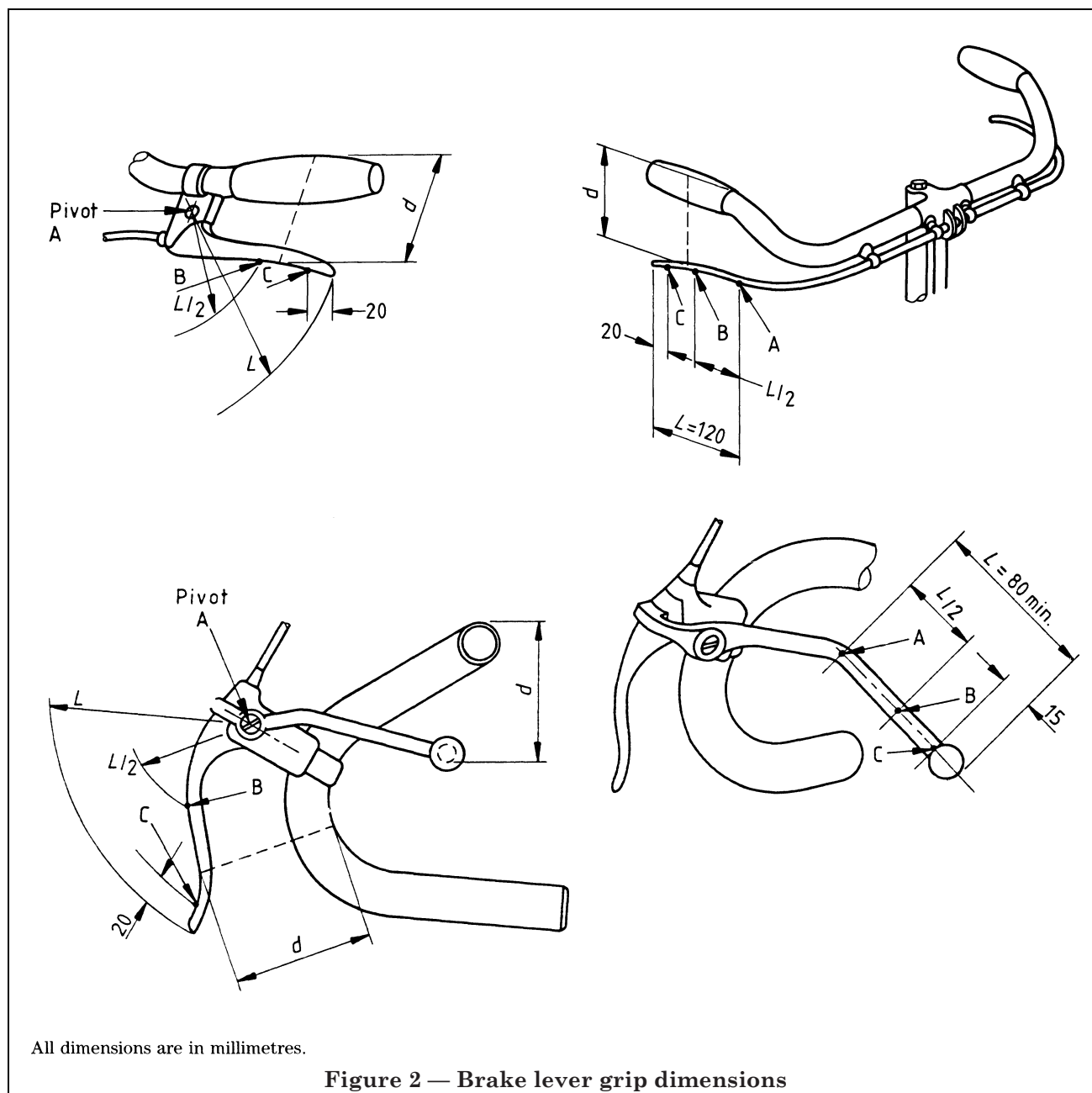
- a) a bicycle having a gear development, in its highest gear, of 5 m or more shall be brought to a smooth safe stop within a distance of 5.5 m from a speed of 24 km/h;
- b) a bicycle having a gear development, in its highest gear, of less than 5 m shall be brought to a smooth safe stop within a distance of 5.5 m from a speed of 16 km/h.

5.5.2 Braking under wet conditions

When tested by the method described in clause 23 a bicycle shall be brought to a smooth, safe stop within a distance of 7.5 m from a speed of 16 km/h.

5.5.3 Linearity of back-pedal brake

When tested by the method described in clause 24, the brake force shall be linearly proportional (within 20 %) to a pedal force of from 150 N to 300 N and shall be not less than 150 N for a pedal force of 300 N.



6 Steering

6.1 Handlebars

The handlebars shall have an overall width of between 350 mm and 700 mm. The vertical distance between the top of the handlebar grips in their highest position and the saddle height when the saddle is 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.

6.2 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.

6.3 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.

6.4 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 weight 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.

NOTE Recommendations for steering geometry are given in Annex B.

6.5 Strength of steering assembly

The handlebar stem shall be capable of withstanding without fracture the tests described in 25.1.1 and 25.1.2.

When tested by the method described in 25.2, there shall be no movement of the handlebar relative to the stem.

When tested by the method described in 25.3, 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°.

7 Frame/fork assembly

7.1 Impact test (falling mass)

When tested by the method described in 26.1, there shall be no visible evidence of fracture, and the permanent deformation of the assembly, measured between the centre-lines of the axles, shall not exceed 40 mm.

7.2 Impact test (falling frame/fork assembly)

When tested by the method described in 26.2, there shall be no visible evidence of fracture.

8 Front fork

8.1 Location

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

8.2 Fatigue test

8.2.1 Applicability

The test shall apply to the front fork of a bicycle having a front wheel greater than 600 mm in diameter.

NOTE Whilst smaller forks could be tested in the same manner, the loads and angles of this test method may not be appropriate for the size or normal usage of smaller wheeled bicycles.

8.2.2 Test requirement

When tested by the method described in clause 27:

- a) each fork shall be subjected to 40 000 load cycles;
- b) there shall be no evidence of cracking in any of the forks following the test.

9 Wheels

9.1 Rotational trueness

NOTE This is defined in BS 308-3 in terms of the measurement of run-out under rotation. The run-out tolerances given in 9.1.1 and 9.1.2 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.

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

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

9.2 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.

9.3 Static load test

When a fully assembled wheel is tested by the method described in clause 28, 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.

9.4 Wheel retention

9.4.1 General

Wheels shall be secured to the bicycle frame and fork such that when adjusted in accordance with the manufacturer's recommendations they conform to 9.4.2 and 9.4.3.

Wheel axle nuts shall have a minimum removal torque of 17 N m when tightened to the manufacturer's recommended tightening torque.

9.4.2 Front wheel retention

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

9.4.3 Rear wheel retention

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

9.4.4 Quick-release axle mechanisms

9.4.4.1 Mechanical features

Any quick-release mechanism shall have the following common mechanical features.

- a) The quick-release mechanism shall be adjustable to allow setting for tightness.
- b) Its form and marking shall clearly indicate whether the mechanism is in the open or locked position.
- c) If operated by a lever, the force required to close a properly set lever shall not exceed 200 N. At this closing force, there shall be no permanent deformation of the quick-release mechanism.
- d) If operated by a lever, the quick-release mechanism shall withstand without fracture or permanent deformation a closing force of not less than 300 N applied with the adjustment set to prevent full closure under this load.
- e) The releasing force of the clamping mechanism when closed shall be not less than 50 N.
- f) If applied to a lever, the forces in c) to e) shall be applied 5 mm from the outer end of the lever.

9.4.4.2 Wheel retention with open quick-release

With the quick-release mechanism fully open and the brake system disconnected or released, the wheel shall not detach from the fork when a force of 100 N is applied to the wheel radially outwards and in line with the drop out slots.

9.4.4.3 Operating instruction

Operating instructions [see clause 19 b)] shall indicate to the operator a means to determine the correct adjustment of the quick-release mechanism (such as: “the mechanism shall emboss the fork ends when closed to the locked position”).

10 Tyres and tubes

NOTE Non-moulded tyres are excluded from these requirements.

10.1 Inflation pressure

The inflation pressure (see 3.9) shall be moulded on the sidewall of the tyre so as to be readily visible when the latter is assembled on the rim.

10.2 Compatibility

The tyre and tube shall be compatible with the rim design in accordance with BS 6102-5:1990 and BS 6102-6:1990.

11 Pedals and pedal/crank drive system

11.1 Pedal tread

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

11.1.2 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.

11.1.3 Pedals designed to be used only with toe-clips shall have toe-clips securely attached, and need not conform to the requirements given in items a) and b) of 11.1.2.

11.2 Pedal clearance

11.2.1 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.

11.2.2 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 3.

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.

11.3 Drive system static load test

When tested by the method described in 29.1, there shall be no visible fracture of any component of the drive system, and drive capability shall not be lost.