

# Cycles —

## Part 1: Specification for safety requirements for bicycles

UDC 629.118.3:614.8

# Cooperating organizations

The Nursery, Schools and Sports Equipment Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

- British Baby Products Association
- British Educational Equipment Association
- British Sports and Allied Industries Federation
- British Toy and Hobby Manufacturers' Association Ltd.
- Consumer Standards Advisory Committee of BSI\*
- Consumers' Association\*
- Department of Education and Science
- Department of Health and Social Security
- Department of Trade
- Local Authorities Management Services and Computer Committee
- Royal Society for the Prevention of Accidents\*

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

- Bicycle Association of Great Britain
- British Cycling Federation
- British Rubber Manufacturers' Association
- Cyclists' Touring Club
- Department of the Environment — Transport and Road Research Laboratory
- Department of Transport
- National Association of Cycle and Motor Cycle Traders Limited
- Manufacturer of cycles

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# Foreword

This Part of this British Standard has been prepared under the direction of the Mechanical Engineering Standards Committee.

This standard follows very closely the presentation and technical content of the corresponding International Standard ISO 4210 “*Cycles — Safety requirements of bicycles*” published by the International Organization for Standardization. This standard is not, however, identical in every respect with ISO 4210. The two main technical differences are as follows.

- a) The ISO standard allows a bicycle to have only one braking system, but BS 6102-1 requires a bicycle to have two braking systems.
- b) The ISO standard 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 standard specifies a limit of 7.5 m braking distance under wet conditions.

Members of the Technical Committee responsible for this standard believe that the requirements specified for braking performance represent the most advanced and practicable specifications for this aspect of safety of bicycles.

Attention is drawn to the following UK legislation relevant to bicycles.

The Electrically Assisted Pedal Cycles Regulations 1983 (SI No. 1168)

The Pedal Bicycles (Construction and Use) Regulations 1983 (SI No. 1176)

The Pedal Cycles (Safety) Regulations 1984 (SI No. 145)

The Road Vehicles, Lighting Regulations 1984 (SI No. 812)

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

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.**

## Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 32, 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.



## Section 1. General

### 0 Introduction

In producing this Part of this British Standard, the aim has 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 test conditions specified for the method of test for braking performance under wet conditions (see 6.5.2) 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.

Notwithstanding the requirements specified in this Part of this British Standard, any new designs, constructions, materials and methods of assembly which give an equivalent degree of safety and durability may be regarded as complying with this Part of this British Standard subject to approval by a representative and recognized authority and pending the issue of an amendment to, or extension of, this Part of this British Standard.

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

### 1 Scope

This Part of this British Standard 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.

### 2 Field of application

This Part of this British Standard 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.

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

### 3 References

The titles of the publications referred to in this standard are listed on the inside back cover.

## 4 Definitions

For the purposes of this British Standard the following definitions apply.

### 4.1 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

### 4.2 bicycle

a two-wheeled cycle

### 4.3 delivery bicycle

a bicycle designed for the primary purpose of carrying goods

### 4.4 tandem

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

### 4.5 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

### 4.6 braking distance

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

### 4.7 stopping distance

the sum of braking distance and the distance travelled during the rider's reaction time

### 4.8 gear development

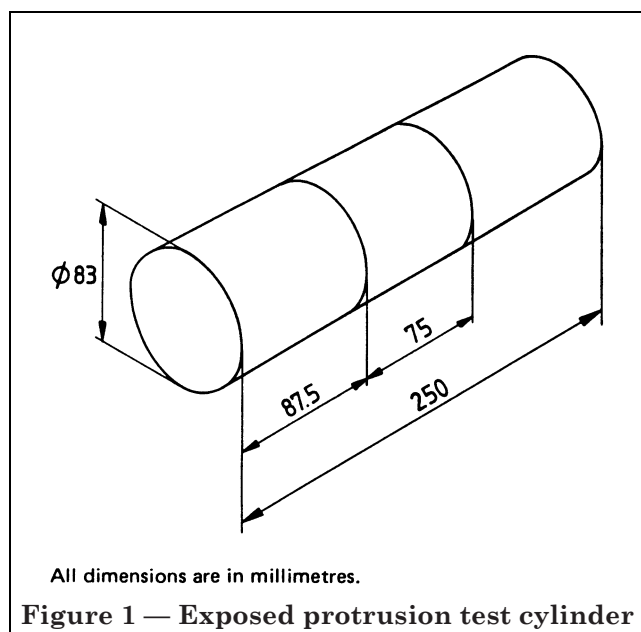
the distance travelled by a bicycle during one revolution of the pedal cranks

### 4.9 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). See Figure 1

### 4.10 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



## Section 2. Requirements of sub-assemblies

### 5 General

**5.1 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.

#### 5.2 Protrusions

**NOTE** Guidance on the applicability of the requirements on protrusions is given in Appendix C.

**5.2.1 Exposed protrusion.** Except as specified in 5.2.2, any 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.

**5.2.2 Exemptions.** The requirements of 5.2.1 do not apply to the following:

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

#### 5.2.3 Protrusions on the frame

**NOTE** On a circular member the transverse plane on the longitudinal axis is taken as the dividing line between the upper and lower surfaces.

**5.2.3.1** There shall be no protrusions on the upper surface or sides of the uppermost frame member within a zone bounded by the following:

- a) a vertical plane at the forward tip of the saddle when the saddle is in its rearmost position;
- b) a vertical plane 300 mm forward of the forward tip of the saddle when the saddle is in its foremost position;
- c) a horizontal plane at the top of the crank when in an upright position, where applicable.

**5.2.3.2** There shall be no adjacent fixed protrusions that protrude into the zone of 5.2.3.1.

**5.2.3.3** Protrusions situated on the underside of the uppermost frame member shall not project beyond the width of the member.

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

**5.2.4 Screw threads.** A screw thread that is an exposed protrusion (see 4.9) shall be limited to a protrusion length of one major diameter of the screw beyond the internally threaded mating part.

### 6 Brakes

**6.1 Braking system.** A bicycle shall be equipped with two braking systems, to ensure compliance with the requirements of 6.5. One shall operate on the front wheel and one on the rear wheel.

The braking system shall operate without binding.

The braking system shall be capable of meeting the braking performance requirements of 6.5.

#### 6.2 Hand-operated brakes

**6.2.1 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.

**6.2.2 Brake lever dimensions.** The maximum dimension between the brake lever and the handlebar grip measured to the outside surfaces of lever and grip shall not exceed 90 mm at any point between the cable end of the lever and the lever's midpoint. The dimension may increase toward the open end of the lever but shall not exceed 100 mm except for the last 20 mm of the lever.

**6.2.3 Cable-brake assembly.** When a bicycle is equipped with cable brakes of whatever type, the screws for 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 cut any of the cable strands, when assembled to the manufacturer's instructions.

**6.2.4 Brake pad assembly.** The brake friction pad shall be securely attached to the backing plate or holder and there shall be no failure of the friction pad assembly when tested by the method specified in clause 21. The brake block test (clause 21) shall be performed before other braking tests.

**6.2.5 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.

**6.3 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.

**NOTE** At the time of publication of this standard, UK legislation recognizes that the fixed rear wheel on cycles with fixed rear wheel can be used as a braking system in place of a hand- or foot-operated brake, and that only a front brake system would need to be additionally fitted. It has not been found possible to interpret the methods of test for braking systems to cover fixed wheel braking and, therefore, no requirements are included for such cycles in this standard. It should be pointed out that fixed wheel braking was not one of the systems recognized in ISO 4210.

## 6.4 Strength of brake system

**6.4.1 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.

**6.4.2 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.

## 6.5 Braking performance

**6.5.1 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 velocity 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 velocity of 16 km/h.

**NOTE** The braking distance of 5.5 m includes a margin of human and instrument error associated with current test methods, and is being reviewed in the light of experience gained in testing.

**6.5.2 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 velocity of 16 km/h.

**6.5.3 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.

## 7 Steering

**7.1 Handlebars.** The handlebars shall have an overall width between 350 mm and 700 mm. The vertical distance between the top of the handlebar grips in their highest position 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.

**7.2 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 detract from the strength of the handlebar stem.

**7.3 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.

**7.4 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.

Recommendations for steering geometry are given in Appendix B.

**7.5 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°.

## 8 Frame/fork assembly

**8.1 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.

**8.2 Impact test (falling frame/fork assembly).** When tested by the method described in **26.2**, there shall be no visible evidence of fracture.

## 9 Front fork

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, the front wheel remains central within the front fork.

## 10 Wheels

**10.1 Rotational trueness.** This is defined in BS 308-3 in terms of the measurement of run-out under rotation. The run-out tolerances given below 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.

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

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

**10.2 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.

**10.3 Static load test.** When a fully assembled wheel is tested by the method described in clause **27**, 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.

## 10.4 Wheel retention

**10.4.1 General.** Wheels shall be secured to the bicycle frame and fork such that when adjusted to the manufacturer's recommendations they comply with **10.4.2** and **10.4.3**.

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

When lever-operated quick release mechanisms are adjusted to the manufacturer's recommendations, they shall have a positive locked position. When in the locked position, the clamp action shall emboss the frame or fork end plates.

**10.4.2 Front wheel retention.** There shall be no relative motion between the axle and the front fork when a force of 500 N is applied symmetrically to the axle for a period of 30 s in the direction of the removal of the wheel.

**10.4.3 Rear wheel retention.** There shall be no relative motion between the axle and the frame when a force of 1 780 N is applied symmetrically to the axle for a period of 30 s in the direction of the removal of the wheel.

## 11 Tyres and tubes

**11.1 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.

Non-moulded tyres are excluded from this requirement.

**11.2 Compatibility.** The tyre and tube shall be compatible with the rim design. When inflated to 110 % of the recommended maximum inflation pressure for a period of not less than 5 min, the tyre shall remain intact on the rim.

## 12 Pedals and pedal/crank drive system

### 12.1 Pedal tread

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

**12.1.2** 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 a tread surface to the rider's foot.

**12.1.3** Pedals designed to be used only with toe-clips shall have toe-clips securely attached, and need not have tread surfaces.

## 12.2 Pedal clearance

**12.2.1** *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.

**12.2.2** *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 2.

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.

**12.3** *Drive system static load test.* When tested by the method described in 28.1, there shall be no visible fracture of any component of the drive system, and drive capability shall not be lost.

**12.4** *Pedal/crank system kinetic test.* When tested by the method described in 28.2, there shall be no visible fracture of any part of the pedal or of the crank threads.

## 13 Saddle

**13.1** *Limiting dimensions.* No part of the saddle, saddle supports, or accessories attached to the saddle shall be more than 125 mm above the top saddle surface at the point where the saddle surface is intersected by the seat post axis.

**13.2** *Saddle pillar.* The saddle pillar shall contain a permanent mark that clearly indicates the minimum insertion depth of the pillar into the frame. The insertion mark shall be not less than two diameters of the pillar, measured from the bottom of the full diameter of the pillar, and it shall not detract from the strength of the pillar.

**13.3** *Saddle adjustment clamps.* When tested by the method described in clause 29, there shall be no movement of the saddle clamp in any direction with respect to the pillar, or of the pillar with respect to the frame.

Saddles which are not clamped, but are designed to pivot in a vertical plane with respect to the pillar, shall be allowed to move within the parameters of the design and shall withstand the test described in clause 29 without failure.

## 14 Chain

Where a chain drive is used as a means of transmitting the motive force, the chain shall operate over front and rear sprockets without binding.

The chain shall have a minimum breaking load of 8 010 N.

## 15 Chainguard

A bicycle shall be equipped with a chainwheel disc or other protective device to shield the outside face of the upper junction of the chain and chainwheel. A chainwheel disc shall exceed in diameter the outside surface of the chain when the chain is fully positioned on the chainwheel. A protective device other than a chainwheel disc shall shield the chain for a distance of at least 25 mm measured along the chain prior to the point where the chainwheel teeth first pass between the side plates of the chain.

## 16 Lighting and reflectors

### 16.1 Lighting

**16.1.1** *Lighting system.* The provision of front or rear lamps, or of a complete lighting system, is not mandatory for the purposes of this British Standard, but where fitted these shall comply with the requirements of current legislation (see foreword).

**16.1.2** *Lamp bracket.* Where a blade-type mounting bracket for a lamp is fitted, the dimensions of the blade shall be as given in Figure 23.

**16.1.3** *Wiring harness.* When a wiring harness is fitted, it shall be positioned to avoid damage by contact with moving parts or sharp edges. All connections shall withstand a tensile force in any direction of 10 N.

### 16.2 Reflectors

**16.2.1** *General.* Reflectors shall be fitted to comply with the requirements of current legislation (see foreword), and additionally with the requirements of 16.2.2 to 16.2.5.

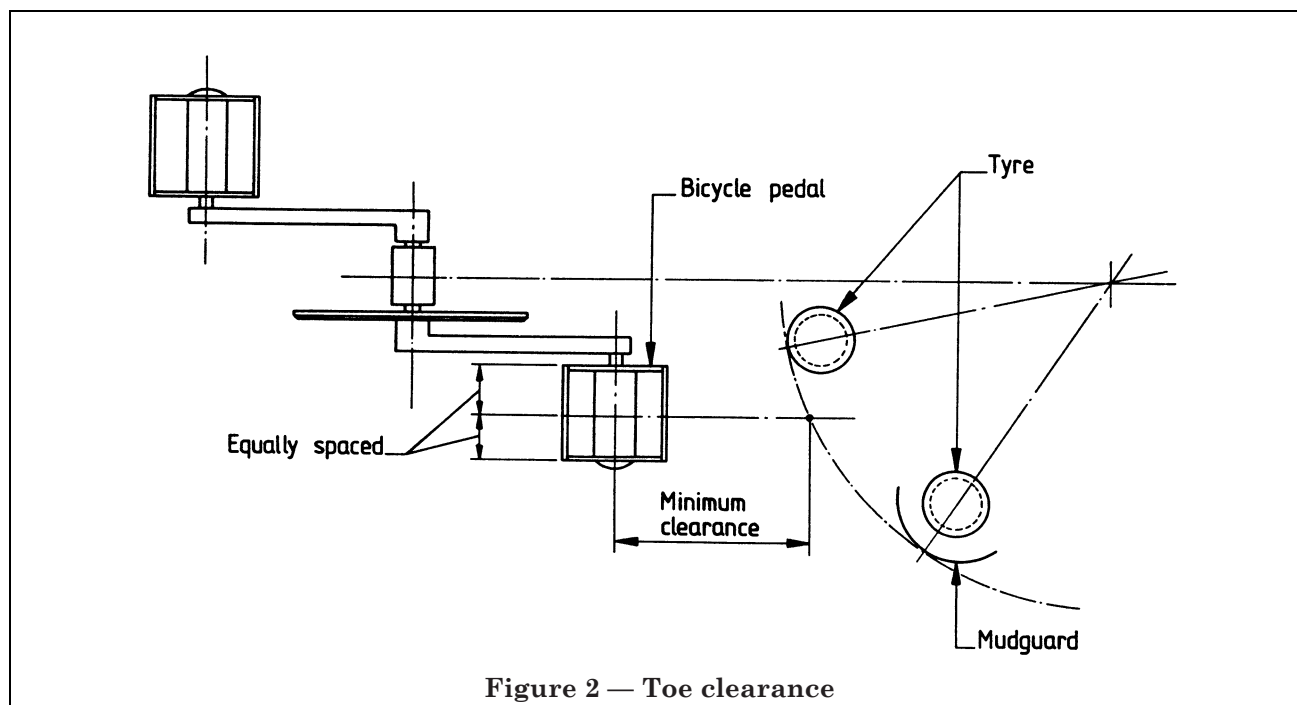


Figure 2 — Toe clearance

**16.2.2 Rear reflectors.** Bicycles equipped with a rear light in accordance with 16.1 shall be additionally equipped with a rear wide-angle reflector, or conventional reflector, complying with the requirements of BS 6102-2. Bicycles that have no such rear light shall be equipped with a wide-angle reflector complying with the requirements of BS 6102-2. Rear reflectors shall be red in colour.

**16.2.3 Side reflectors.** Bicycles shall be equipped with two side reflectors each visible from both sides. The reflectors shall be in one of the following forms:

- a) wide-angle reflectors fitted on the front half and on the rear half of the bicycle. At least one of these shall be mounted on the spokes of the wheel. Where a bicycle incorporates features at the rear wheel other than the frame and mudguard stays, the moving reflector shall be mounted on the front wheel; or
- b) a continuous circle of reflective material applied to both sides of each wheel within 10 cm of the outer diameter of the tyre.

**16.2.3.1** Wide-angle reflectors shall comply with the requirements of BS 6102-2. Reflective materials shall comply with the photometric requirements of BS 6102-2.

**16.2.3.2** All side reflectors shall be of the same colour, either white (clear) or yellow.

**16.2.4 Front reflectors.** Bicycles equipped with a front light in accordance with 16.1 are not required to have a front reflector. Bicycles that have no such front light shall be equipped with a wide-angle reflector complying with the requirements of BS 6102-2. Front reflectors shall be white (clear) in colour.

**16.2.5 Pedal reflectors.** Each pedal shall have reflectors complying with the requirements of BS 6102-2 located on the front and rear surfaces of the pedal. The reflector elements may be either integral with the construction of the pedal or mechanically attached, but shall be sufficiently recessed from the edge of the pedal, or of the reflector housing, to prevent contact of the reflector element with a flat surface placed in contact with the edge of the pedal. Pedal reflectors shall be yellow in colour.

## 17 Warning device

A bell or other suitable warning device may be fitted.

## 18 Instructions

Each bicycle shall be provided with a set of instructions containing information on:

- a) preparation for riding — how to measure and adjust the seat height and handlebar height to suit the rider, with an explanation of the warning marks on seat pillar and handlebar stem;