149

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Third edition
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Cycles — Safety requirements of bicycles

Cycles — Conditions de sécurité des bicyclettes

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Contents

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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 approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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

This third edition cancels and replaces the second edition (ISO 4210 : 1982), which has been revised to incorporate Amendment 1 of 1984 and draft Amendment 2 of 1986.

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

Introduction

In producing this International 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 test method for braking performance under wet conditions (see 2.2.5.2) are more severe than are encountered in practice; the resulting braking distances are therefore in excess of those that would be obtained under actual rainy conditions.

Notwithstanding the requirements specified in this International Standard, any new designs, constructions, materials and assembly methods which cannot be tested in accordance with the requirements of this International Standard but which give an equivalent degree of safety and durability may be regarded as complying with this International Standard until an amendment or addendum to this International Standard is published.

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

Cycles — Safety requirements of 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 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.*

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

1.3.7 stopping distance : Sum of the braking distance and the distance travelled during the rider's reaction time.

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.

Dimensions in millimetres

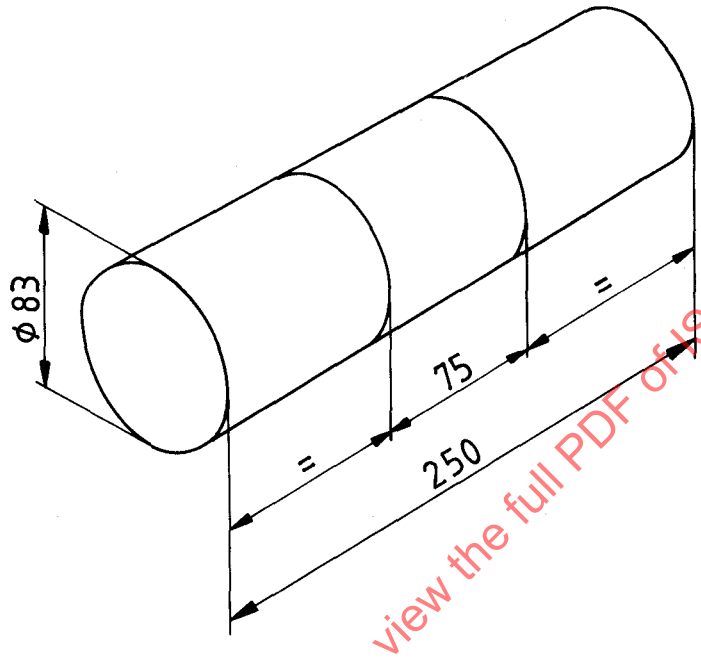


Figure 1 — Exposed protrusion test cylinder

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 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.

A screw thread that is an exposed protrusion (see 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 system

A bicycle shall be equipped with a braking system, or systems, to ensure compliance with 2.2.5. Where one braking system is provided, this shall operate on the rear wheel; where two separate systems are provided, one shall operate on the front wheel and one on the rear wheel.

2.2.2 Hand-operated brakes

2.2.2.1 Brake lever position

The brake levers for front and rear brakes shall be positioned on those sides of the handlebar appropriate to the country in which the bicycle is to be used.

2.2.2.2 Brake lever dimensions

The maximum grip dimension, d (see figure 2) 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.

Dimensions in millimetres

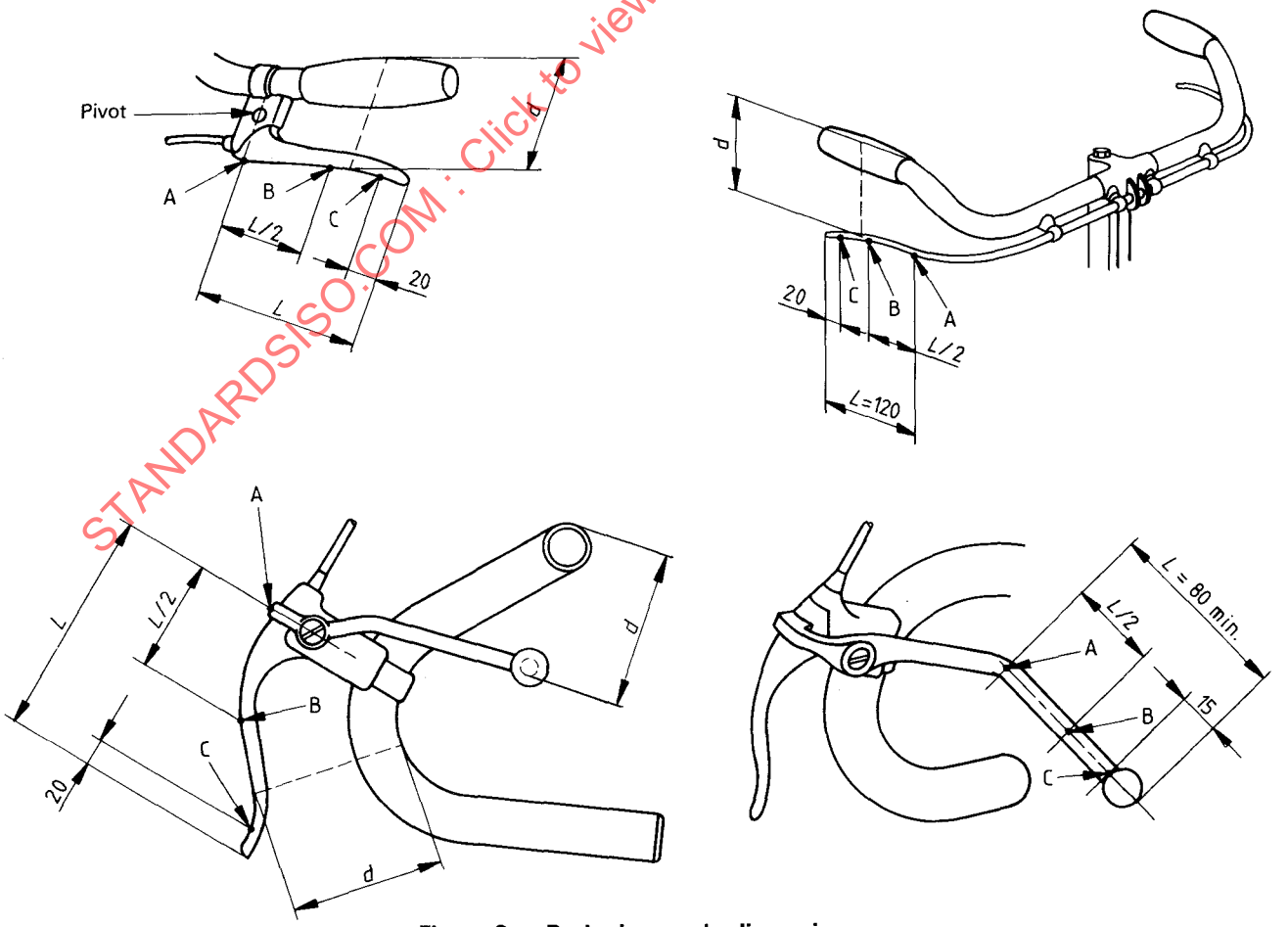


Figure 2 — Brake lever grip dimensions

2.2.2.3 Cable-brake assembly

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

The brake system shall operate without binding.

The cable pinch-bolt shall not cut any of the cable strands, when assembled to the manufacturer's instructions.

2.2.2.4 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 4.1. The brake system shall be capable of meeting 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 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.

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) 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 may be reviewed at a later date in the light of experience gained in testing.

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 a distance of 15 m from a velocity of 16 km/h.

2.2.5.3 Linearity of back-pedal brake

When tested by the method described in 4.4, the brake force shall be linearly proportional (within 20 %) to a pedal force of 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 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.

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 detract from 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°.

2.4 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 centre-lines of the axles, 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

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.

2.6 Wheels

2.6.1 Rotational trueness

This is defined in ISO 1101[1] in terms of circular run-out tolerance (axial). 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.

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.

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.

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.

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

Wheels shall be secured to the bicycle frame with a positive locking device and shall be tightened to the manufacturer's specification.

2.6.4.1 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 removal of the wheel.

2.6.4.2 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 removal of the wheel.

2.7 Tyres and tubes

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.

Non-moulded tyres are excluded from this requirement.

1) ISO 1101 : 1983, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*

2.7.2 Compatibility

The tyre and tube shall be compatible with the rim design. When inflated to 110 % of the recommended 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 shall have toe-clips 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 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.

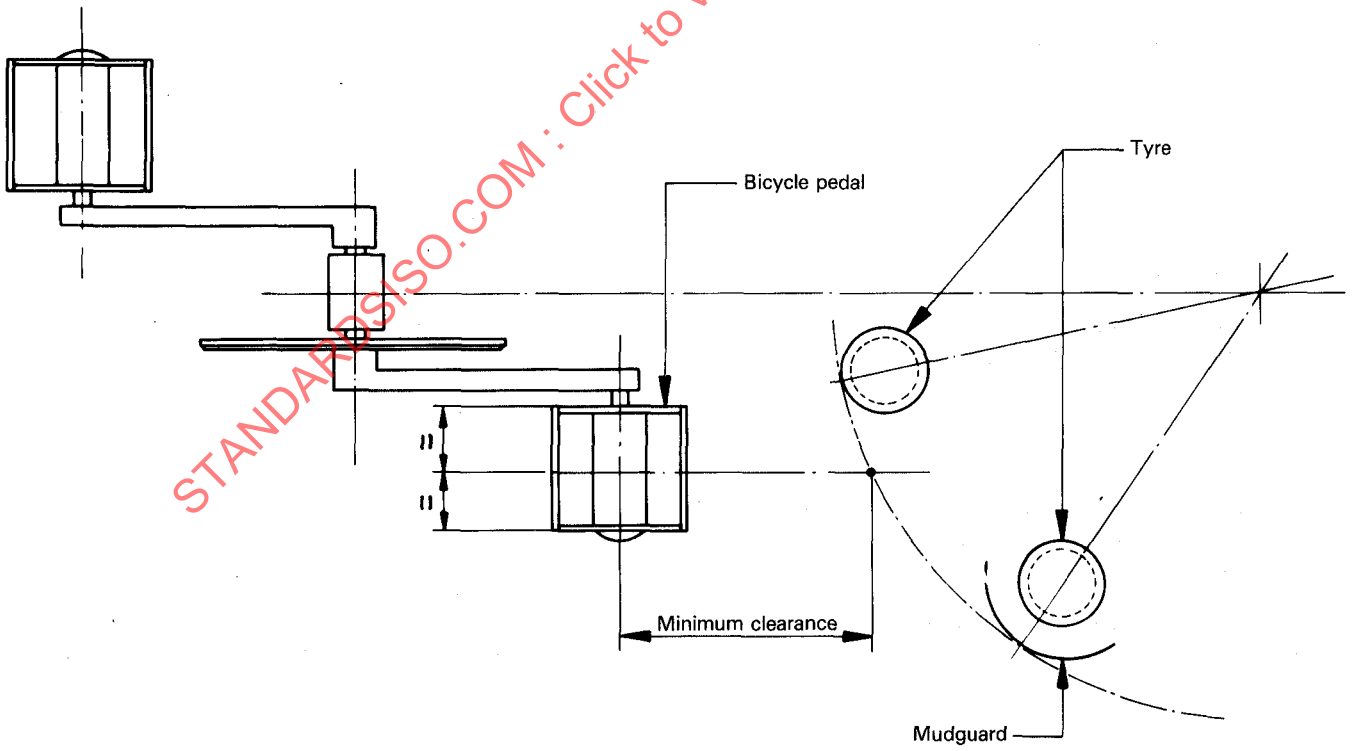


Figure 3 — Toe clearance

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.

2.8.4 Pedal/crank system kinetic test

When tested by the method described in 4.8.2, there shall be no visible fracture of any part of the pedal or of the crank threads.

2.9 Saddle

2.9.1 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.

2.9.2 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.

2.9.3 Saddle adjustment clamps

When tested by the method described in 4.9, 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 4.9 without failure.

2.10 Chain

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

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

2.11 Chainguard

A bicycle shall be equipped with a protective device shielding the upper junction of the chain and chain wheel (drive sprocket) against the entrapment of clothing or body parts. The device shall shield the chain for a distance of at least 25 mm measured prior to the point of engagement of the chain with the chain wheel.

2.12 Lighting and reflectors

2.12.1 Lighting

2.12.1.1 Lighting system

The provision of front or rear lamps, or of a complete lighting system, is not mandatory for the purposes of this International Standard, but where fitted this shall be in accordance with the appropriate legislation of the country in which the bicycle is to be used, or, in the absence of such legislation, shall comply with the requirements of ISO 6742-1 and ISO 6742-2.

2.12.1.2 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.

2.12.2 Reflectors

2.12.2.1 General

Reflectors shall be fitted to comply with the following requirements unless specified otherwise in the legislation of the country in which the bicycle is to be used.

2.12.2.2 Rear reflectors

Bicycles equipped with a rear light in accordance with 2.12.1 shall be additionally equipped with a rear wide-angle reflector, or conventional reflector, meeting the requirements of ISO 6742-2. Bicycles that have no such rear light shall be equipped with a wide-angle reflector. Rear reflectors shall be red in colour.

2.12.2.3 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.

2.12.2.3.1 Wide-angle reflectors shall comply with the requirements of ISO 6742-2. Reflective materials shall comply with the photometric requirements of ISO 6742-2.

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

2.12.2.4 Front reflectors

Bicycles equipped with a front light in accordance with 2.12 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 ISO 6742-2. Front reflectors shall be white (clear) in colour.

2.12.2.5 Pedal reflectors

Each pedal shall have reflectors complying with the requirements of ISO 6742-2, 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.

2.13 Warning device

A bell or other suitable audible warning device may be fitted; where fitted, it shall comply with ISO 7636 and/or appropriate legislation of the country in which the bicycle is to be used.

2.14 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;

b) recommended tightening of fasteners related to handlebar, handlebar stem, saddle and pillar, and wheels;

c) lubrication — where and how often to lubricate, and recommended lubricant;

d) correct chain tension and how to adjust this;

e) adjustment of brakes and recommendations for replacement of brake blocks;

f) adjustment of gears;

g) normal spares, i.e. tyres, tubes, brake-block holder assembly;

h) accessories — where these are offered as fitted, details should be included such as operation, maintenance required (if any) and relevant spares (i.e. light-bulbs);

i) recommendations on safe riding — regular checks on brakes, tyres, steering and lighting; caution concerning increased braking distance in wet weather.

Any other relevant information may be included at the discretion of the manufacturer.

2.15 Marking

Where a manufacturer claims compliance with this International Standard, each bicycle shall be visibly and durably marked with :

a) the number of this International Standard, i.e. ISO 4210;

b) the manufacturer's name or code.

Section 3 : Requirements of complete bicycle

3.1 Road test

When tested by the method described in 4.10, there shall be no system or component failure and no loosening or misalignment of the seat, handlebars, control or reflectors.

The bicycle shall exhibit stable handling in turning and steering, and it shall be possible to ride with one hand removed from the handlebar (as when giving hand signals), without difficulty of operation or hazard to the rider.

Section 4 : Test methods

4.1 Brake block test

The test shall be conducted on a fully assembled bicycle with the brakes adjusted to a correct position, and with a rider weighing 70 kg, or an equivalent mass, on the saddle. Each brake lever shall be actuated with a force of 180 N, which is maintained during the test.

The bicycle shall then be subject to five forward and five rearward movements, each of not less than 75 mm distance.

4.2 Brake system load test

4.2.1 Hand-operated brake

This test shall be conducted on a fully assembled bicycle. After it has been ensured that the braking system is correctly adjusted, a force shall be applied to the brake lever at a point 25 mm from the end of the lever and in a direction normal to the handlebar grip in the plane of travel of the lever, as shown in figure 4. This force shall be 450 N, or such lesser force as is required to bring

a) a cable-brake lever into contact with the handlebar grip, or with the handlebar in the absence of a grip;

b) a cable-brake extension lever level with the upper surface of the handlebars or in contact with the handlebars;

c) a rod-operated brake lever level with the upper surface of the handlebar grip.

This test shall be repeated for a total of ten times on each hand-brake lever.

4.2.2 Back-pedal brake

This test shall be conducted on a fully assembled bicycle. After it has been ensured that the braking system is correctly adjusted, and with the pedal cranks in a horizontal position, as shown in figure 5, a force shall be applied to the centre of the left-hand pedal axle. This force shall be 1 500 N, gradually applied, in a vertical direction, and shall be maintained fully for 15 s.

This test shall be repeated for a total of ten times.

4.3 Braking performance test

Unless otherwise stated, these requirements apply to both dry and wet test conditions.

4.3.1 Test bicycle

This test shall be conducted on a fully assembled bicycle after the brakes have been subjected to the load test detailed in 4.2. The brakes may be re-adjusted to a correct position if necessary and the tyres shall be inflated to the recommended pressure, as marked on the tyre.

4.3.2 Test track

4.3.2.1 An indoor test track shall be used if possible. Where an outdoor track is used, special attention should be paid to ambient conditions throughout the tests.

4.3.2.2 The gradient of the track shall not exceed 0,5 %.

a) If the gradient is less than 0,2 %, all runs shall be carried out in the same direction.

b) If the gradient lies between 0,2 and 0,5 %, alternate runs shall be carried out in opposite directions when testing under wet conditions.

4.3.2.3 The surface shall be hard, of concrete or fine asphalt, free from loose dirt or gravel. The minimum coefficient of friction between the dry surface and the bicycle tyre shall be 0,5.

4.3.2.4 The test track shall incorporate a timing device to provide an accurate measurement of speed at commencement of braking. The inaccuracy of the timing-system shall not exceed 2 %.

4.3.2.5 The track shall be essentially dry at the commencement of tests. When testing to the requirements of 2.2.5.1, the track shall remain dry throughout the tests.

4.3.2.6 The wind speed on the track shall not exceed 3 m/s during the tests.

4.3.3 Instrumentation

The test bicycle shall be instrumented to include the following.

4.3.3.1 **Calibrated speedometer** or **tachometer,** accurate to within 5 %, to indicate the approximate speed at commencement of the test run.

4.3.3.2 **Marker system,** to provide the means for determining the commencement of the braking distance. A separate marker system shall be provided for each braking system, and shall be activated by the handbrake lever or back-pedal brake crank. Each system shall operate to provide a mark on the test surface within 0,025 s from the commencement of movement of the lever or crank in the braking operation. Both marker systems shall be positioned on the same transverse plane of the bicycle.

4.3.3.3 **Stops,** fitted to the handlebar to limit the handgrip force on the brake lever. This also applies to brake extension levers. See 4.3.5.

Dimensions in millimetres

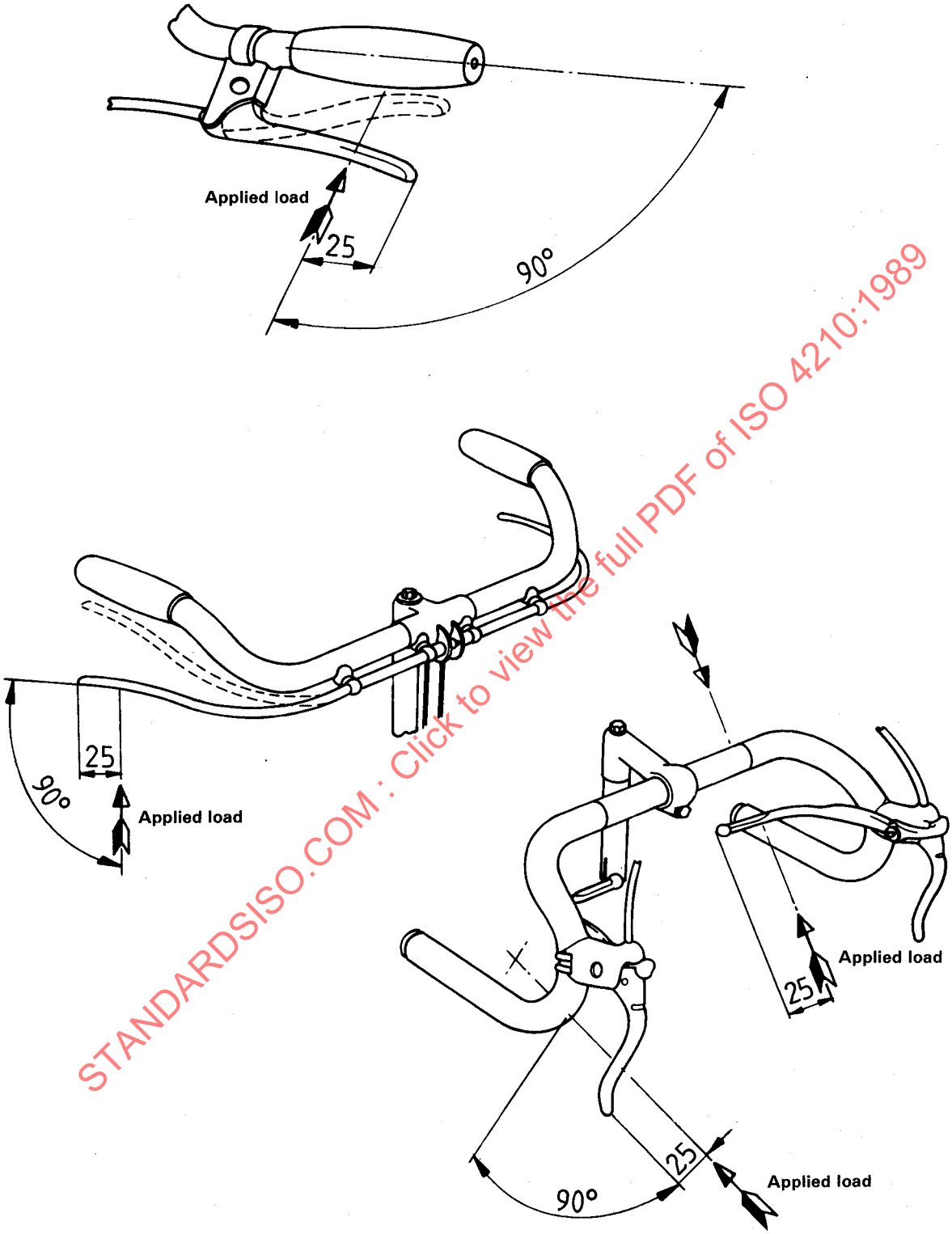


Figure 4 — Applied loads on handbrake levers

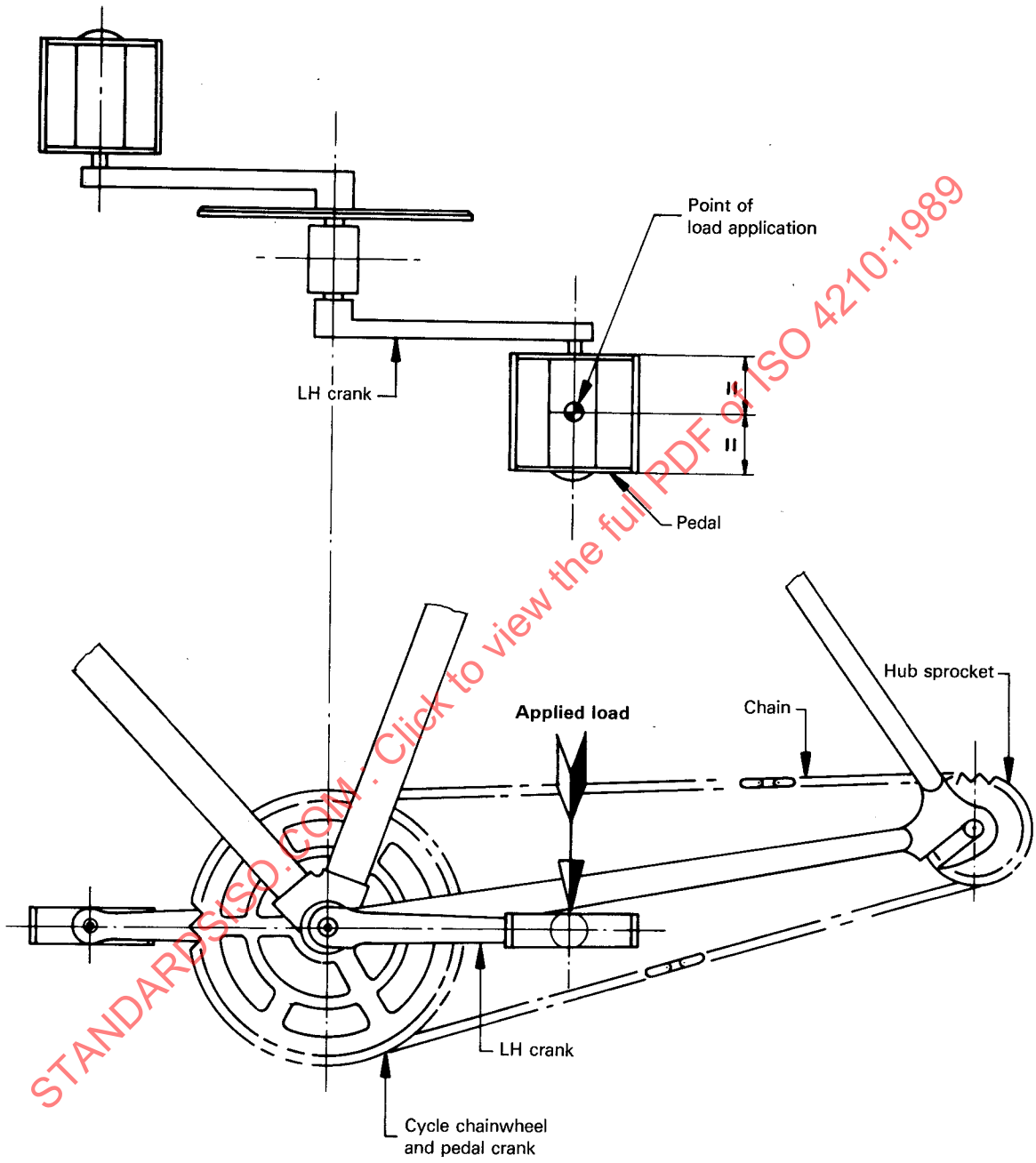


Figure 5 — Back-pedal brake test

4.3.3.4 Water spray system, to provide wetting of the braking surfaces, consisting of a water reservoir connected by tubing to a pair of nozzles on the front wheel and a pair of nozzles on the rear wheel. A quick-acting on/off valve shall be included for control by the rider. Each nozzle shall provide a flow of water of not less than 4 ml/s. Distilled water at ambient temperature shall be used.

Details of the positions and directions of nozzles for caliper, internal expander, band, disc and back-pedal brakes are given in figures 6 to 11.

4.3.4 Rider mass

The combined mass of the rider and instrumentation on the bicycle shall be between 70 kg and 85 kg. Where two separate braking systems are provided, a greater braking distance shall be allowed for masses over 70 kg at the rate of 0,011 × specified braking distance in metres per kilogram. Where a back-pedal brake is the only braking system, no such allowance shall be made.

4.3.5 Force applied to brakes

Bicycles with hand-operated brakes shall be tested using a handgrip force not exceeding 180 N. The handgrip force shall be applied at a point 25 mm from the end of the lever as shown in figure 4. A check shall be carried out before and after each series of test runs to verify the lever load.

No limitation is placed on the force exerted on the pedals with a back-pedal brake.

4.3.6 Method

4.3.6.1 Test runs under dry conditions

The rider shall attain the specified test speed. He shall stop pedalling immediately before passing the timing device, and apply the brake(s) immediately after passing the timing device. The bicycle shall be brought to a smooth, safe stop. The braking distance shall be measured from the first mark to the centre of the marking device.

4.3.6.2 Test runs under wet conditions

The method shall be as given in 4.3.6.1, with the addition that the wetting of the braking system(s) shall commence not less than 25 m prior to application of the brake(s) and terminate not more than 15 m prior to application of brake(s).

4.3.6.3 Number of valid test runs

If the gradient of the track is less than 0,2 %, the following runs shall be made :

a) five consecutive valid runs under dry conditions;

b) two acclimatization runs under wet conditions (results not recorded);

c) five consecutive valid runs under wet conditions.

If the gradient of the track lies between 0,2 % and 0,5 %, the following runs shall be made :

d) five consecutive valid runs under dry conditions;

e) two acclimatization runs under wet conditions (results not recorded);

f) ten consecutive valid runs under wet conditions. Alternate runs in opposite directions.

A rest period not exceeding 3 min may be taken between successive runs.

4.3.7 Speed/distance correction factor

A correction factor shall be applied to the measured braking distance if the speed as checked by the timing device is not precisely that specified in 2.2.5.

The corrected braking distance, s_c, shall be determined from the formula

$$s_c = \left(\frac{v_s}{v_m}\right)^2 \times s_m$$

where

s_m is the measured braking distance;

v_s is the specified test speed;

v_m is the measured test speed.

4.3.8 Validity of test runs

4.3.8.1 A test run shall be considered invalid if

a) excessive side-skid occurs;

b) loss of control occurs.

NOTE — With certain types of braking system, it may not be possible to avoid entirely some skidding of the rear wheel during braking; this is considered acceptable provided that a) or b) above do not occur as a result.

4.3.8.2 If the corrected braking distance exceeds the specified braking distance, a test run may be considered invalid if

a) the speed at the commencement of the test exceeds the specified test speed by more than 1,5 km/h;

b) the front brake is activated after the rear brake as indicated by the marks;[1)]

c) the distance between the marks for the front and rear brakes exceeds 1 m, measured along the surface of the track;[1)]

d) after a test run in which excessive side-skid or loss of control has occurred, a series of braking distances exceeds the specified limit.

1) As the front brake provides a very high percentage of retardation in the prescribed braking tests, it is therefore important that it be applied first. In order that the maximum available braking power is utilized, it is also important that minimum delay occurs in applying the rear brake.

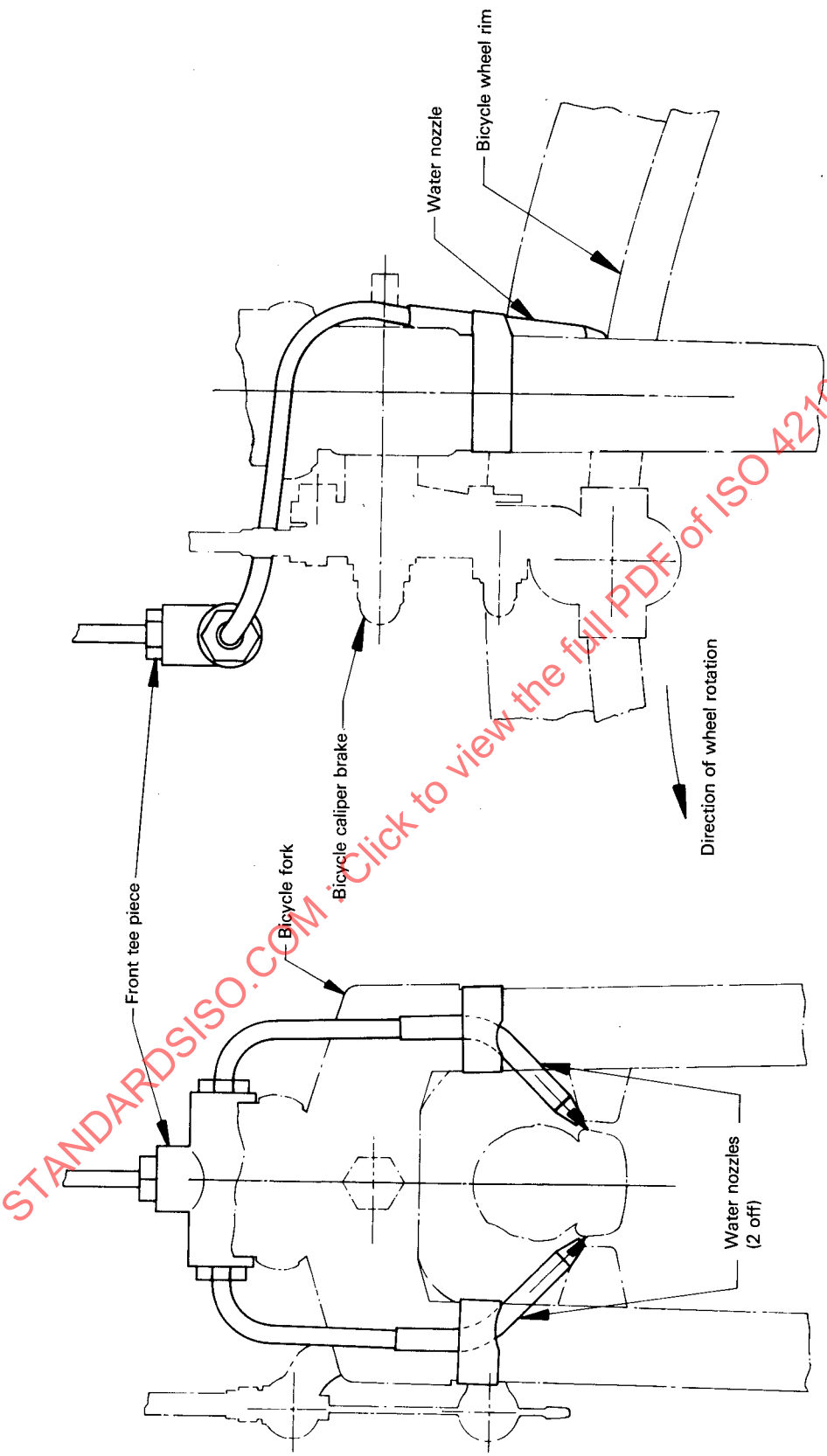


Figure 6 — Water nozzles for caliper brake (front)

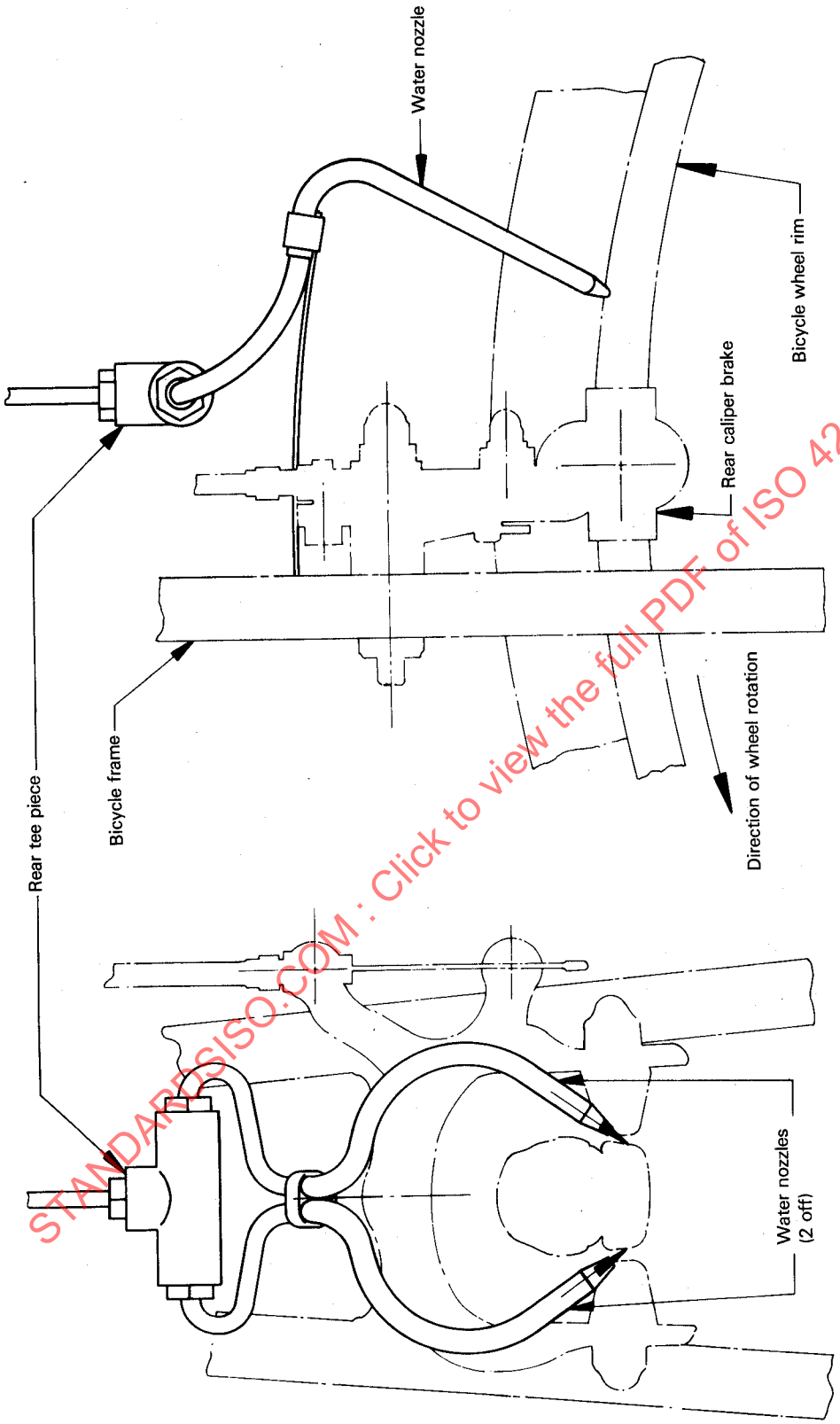
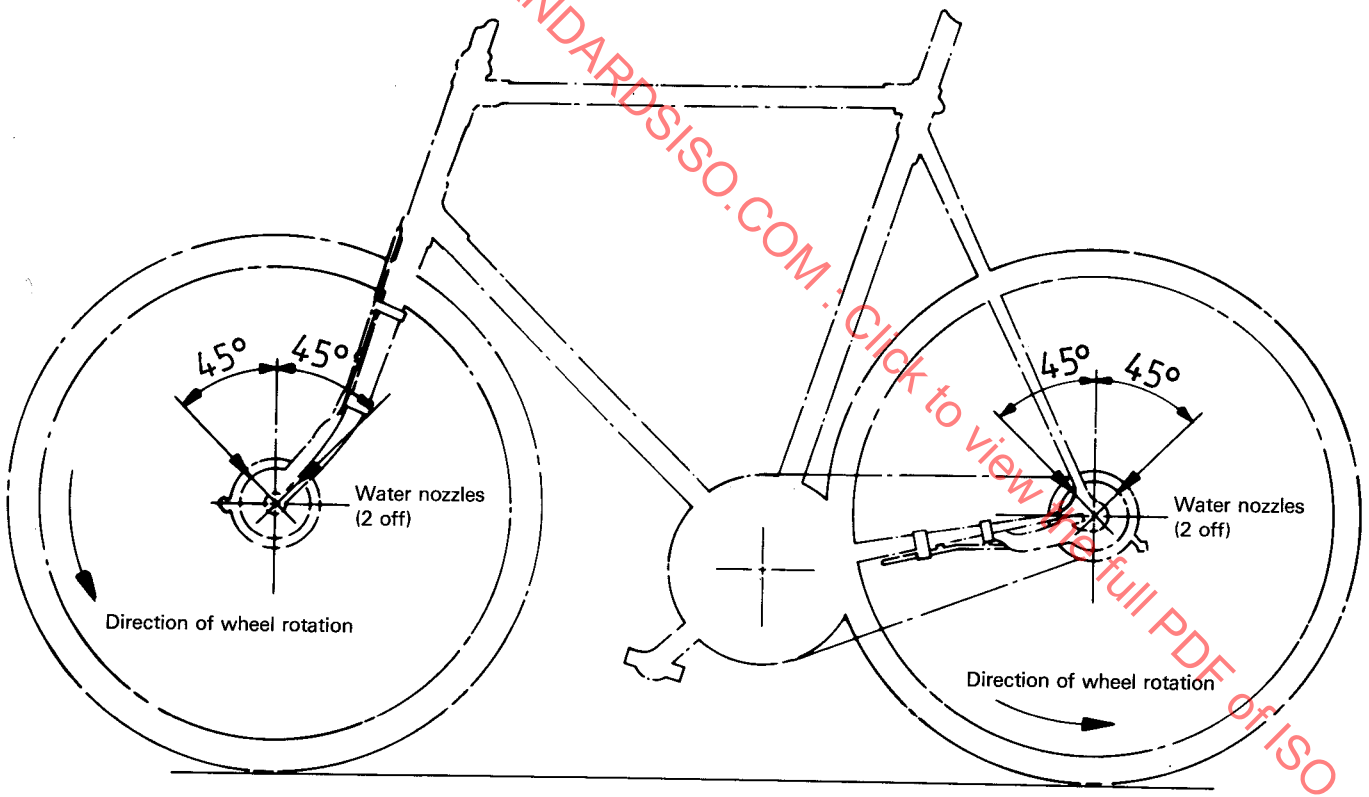


Figure 7 — Water nozzles for caliper brake (rear)



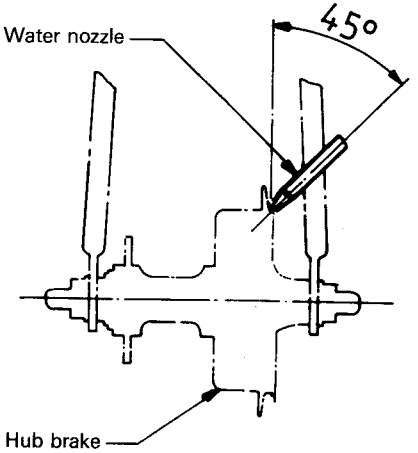


Figure 8 — Water nozzles for internal expanding brake (front and rear)

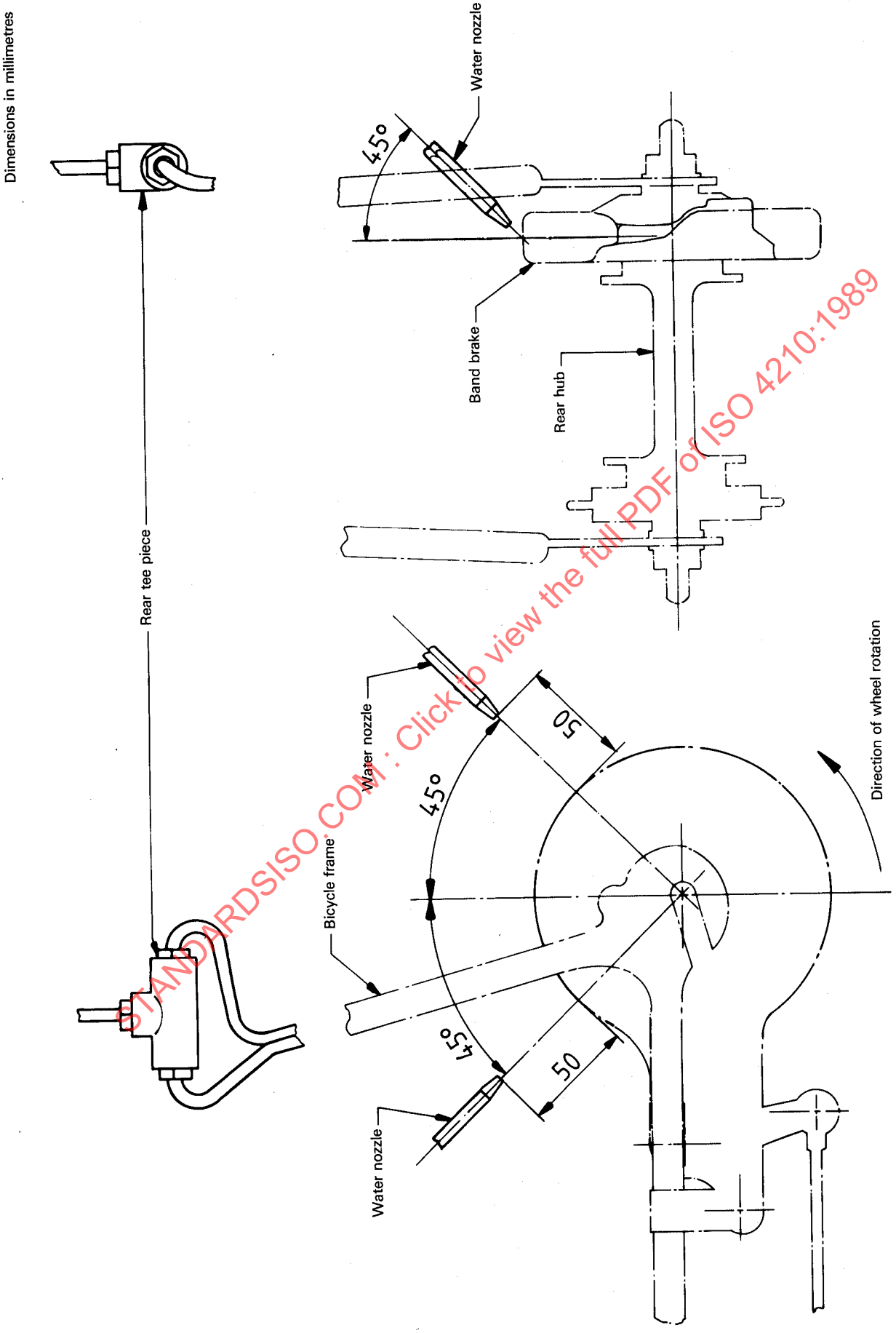


Figure 9 — Water nozzles for band brake

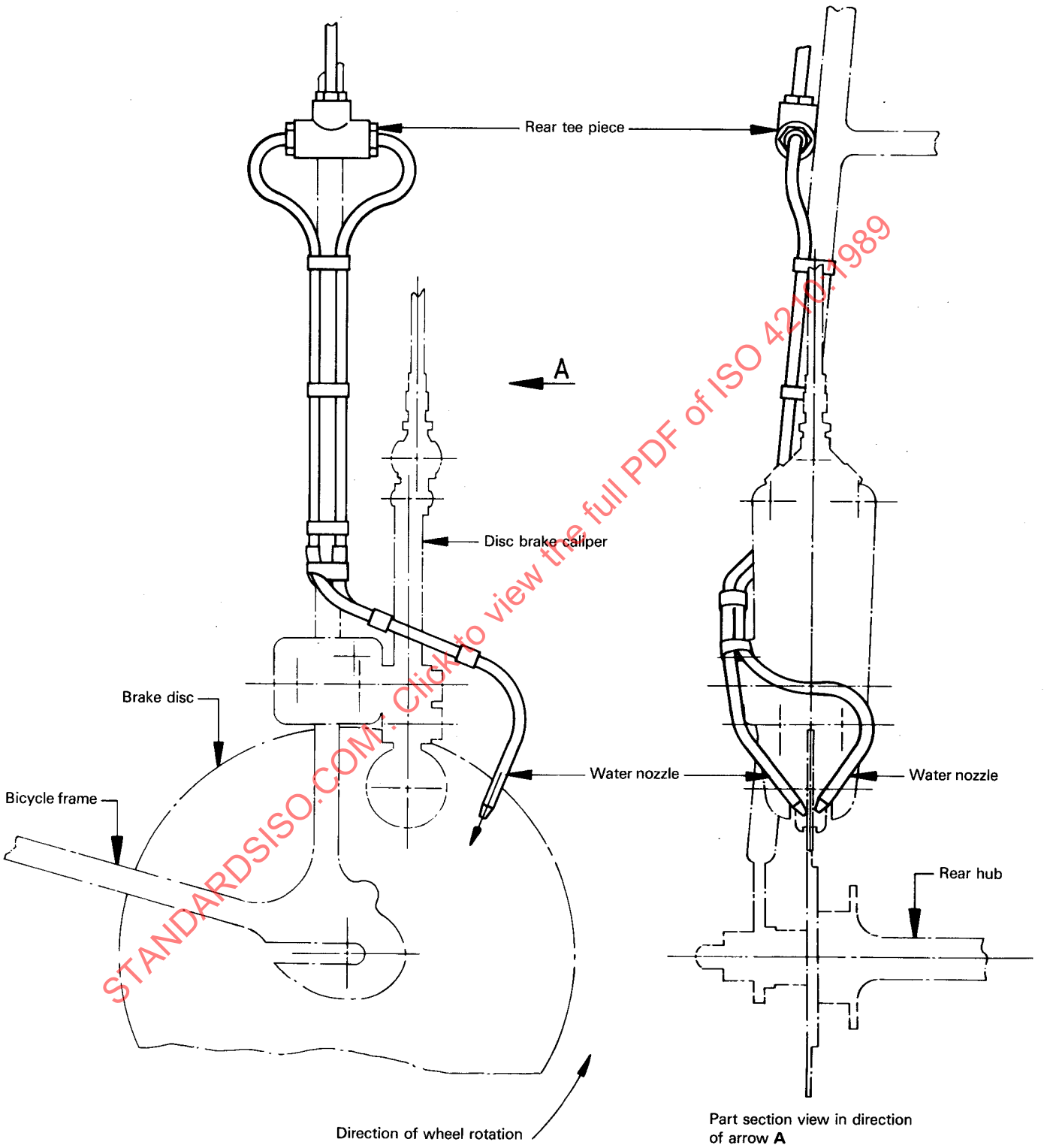


Figure 10 — Water nozzles for disc brake (rear)

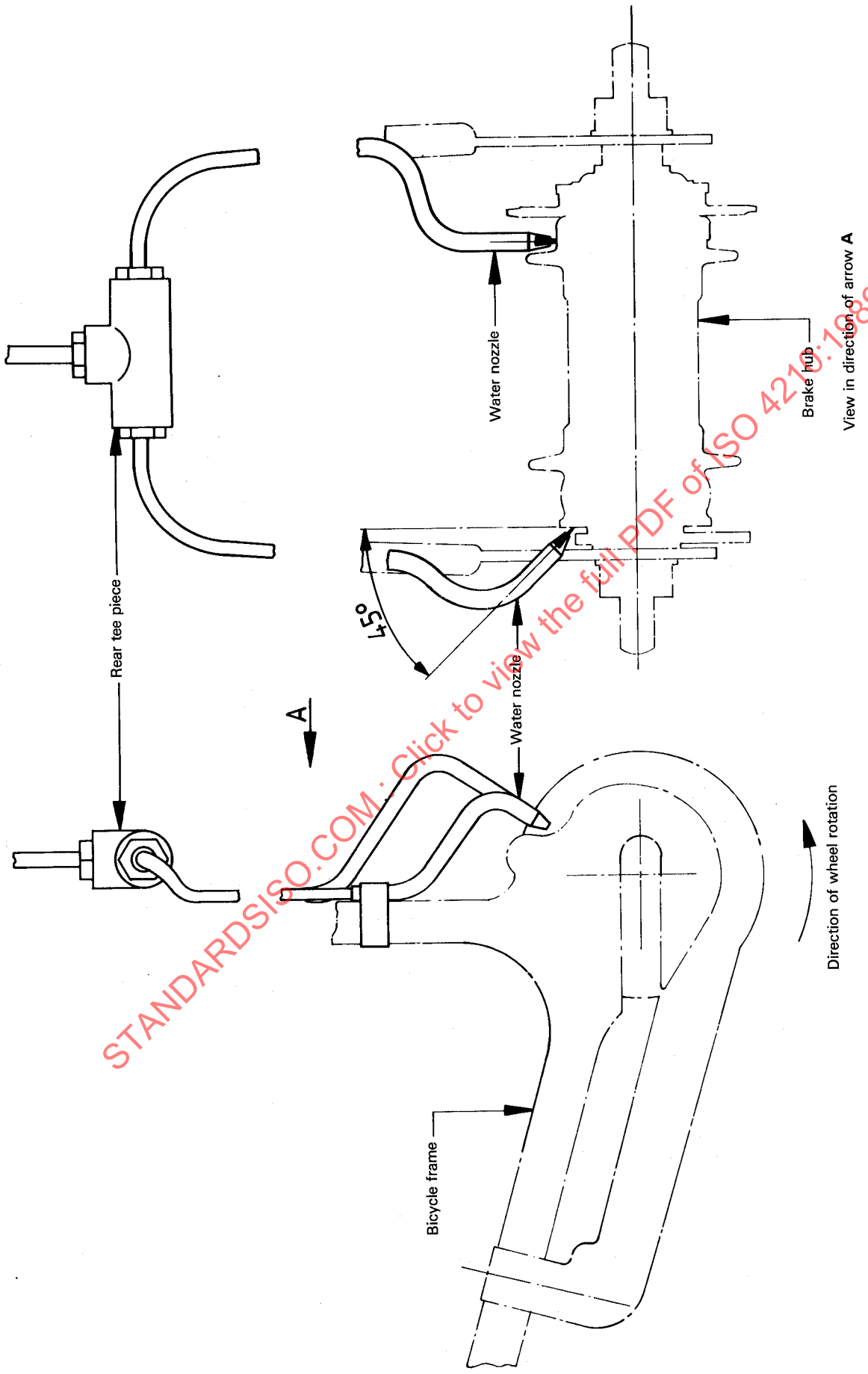


Figure 11 — Water nozzles for back-pedal brake

NOTE — Water nozzle to be directed at hub ingress, both sides.

4.3.8.3 If the corrected braking distance is less than the specified braking distance, a test run shall be considered invalid if

a) the speed at commencement of the test is more than 1,5 km/h below the specified test speed;

b) the distance between the point where the speed is confirmed and the mark for the rear brake exceeds 2 m, measured along the surface of the track.

If the corrected braking distance exceeds the braking distance specified in 2.2.5, the test run shall be considered valid.

4.3.9 Test results

4.3.9.1 Braking under dry conditions

The test result shall be the average value of the corrected braking distances (see 4.3.7) of the test runs of 4.3.6.3 a) or d).

For compliance with the requirements of 2.2.5.1, the above figure shall not exceed the braking distance specified in 2.2.5.1 plus the distance allowed for mass as described in 4.3.4, if applicable.

4.3.9.2 Braking under wet conditions

The test result shall be the average value of the corrected braking distances (see 4.3.7) of the test runs of 4.3.6.3 c) or f).

For compliance with the requirements of 2.2.5.2, the above figure shall not exceed the braking distance specified in 2.2.5.2 plus the distance allowed for mass as described in 4.3.4, if applicable.

4.4 Back-pedal brake linearity test

This test shall be conducted on a fully assembled bicycle. The output force for a back-pedal brake shall be measured tangentially to the circumference of the rear tyre, when the tyre is rotated in the direction of forward movement, whilst a force of between 90 N and 300 N is being applied to the pedal at right angles to the crank and in the direction of braking.

The braking force reading shall be taken during a steady pull and after one revolution of the wheel. A minimum of five results, each at a different pedal force level, shall be taken. Each result shall be the average of three individual readings at the same load level.

The results shall be plotted on a graph, showing the "best fit" line and the ± 20 % limit lines obtained by the "least squares" method outlined in annex A.

4.5 Steering assembly test

4.5.1 Handlebar stem

4.5.1.1 Torque test

With the handlebar stem securely clamped in a fixture to the minimum insertion depth (see 2.3.2), and a test bar or handlebar assembled securely to the stem, a torque of 108 N.m shall be applied to the stem by means of the test bar in a plane parallel to the stem and in the direction of the stem centre-line, as shown in figure 12.

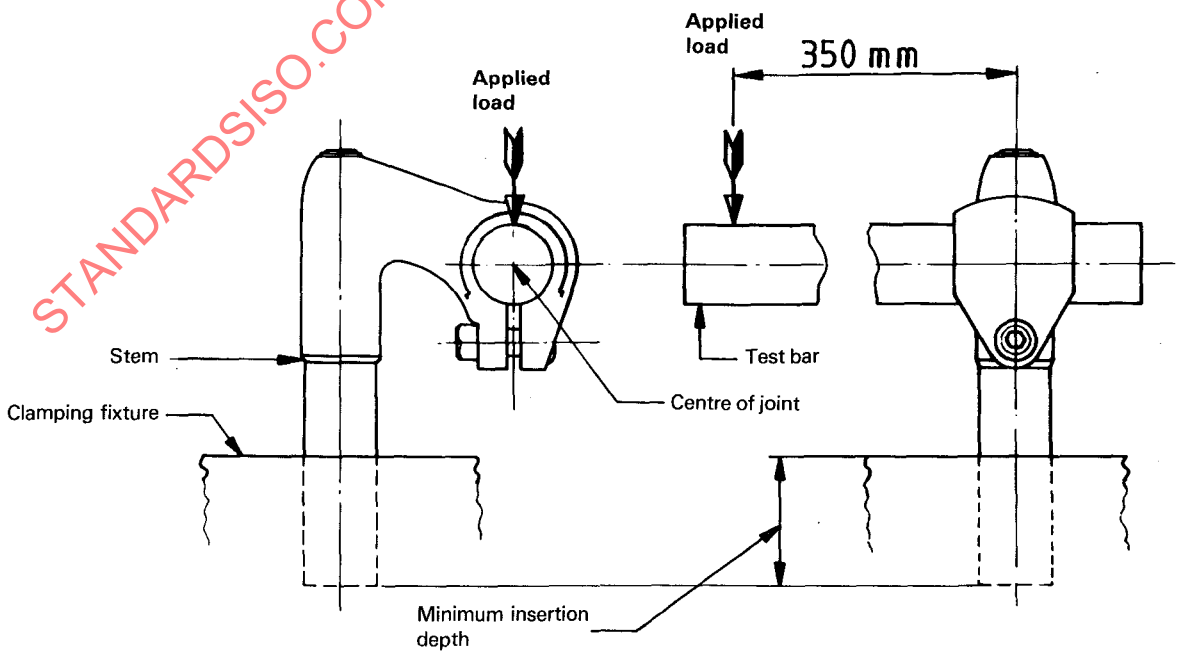


Figure 12 — Torque test on handlebar stem

4.5.1.2 Static load test

With the handlebar stem securely clamped in a fixture to the minimum insertion depth (see 2.3.2), a force of 2 000 N shall be applied through the handlebar attachment point in a forward direction and at 45° from the axis of the stem shank as shown in figure 13.

4.5.2 Torque test, handlebar and stem

With the stem of the handlebar assembly securely clamped to the minimum insertion depth in a fixture, a force of 220 N shall be applied simultaneously to each side of the handlebar in a direction and at the location that will provide a maximum turning moment at the junction of the handlebar and stem. Where this location occurs at the end of the handlebar, the force shall be applied as near to the end as is practicable, and in any case not further than 15 mm from the end. See figure 14.

NOTE — According to the shape of the handlebar, the applied loads might be in a different direction from that illustrated.

Where the handlebar/stem assembly is secured by means of a clamp, the torque applied to the fastener shall not exceed the torque recommended for such fasteners.

4.5.3 Torque test, handlebar stem and fork stem

With the handlebar stem correctly assembled in the frame and fork stem, and the expander bolt tightened in accordance with the manufacturer's instructions, a torque of 25 N·m shall be applied to the handlebar/fork clamping device, as shown in figure 15.

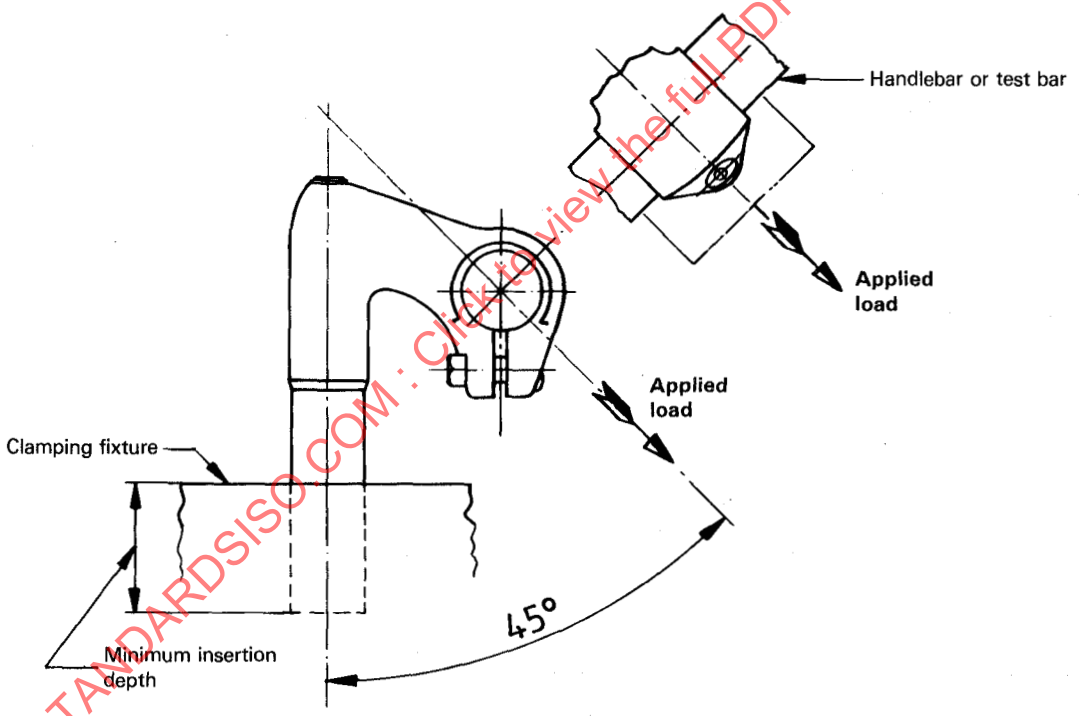


Figure 13 — Static load test on handlebar stem

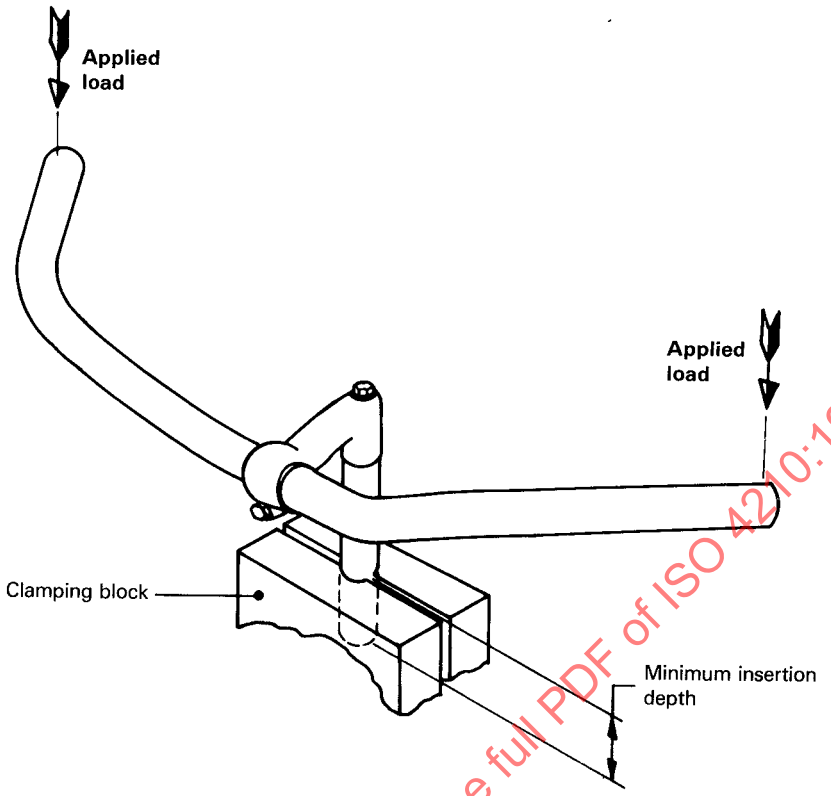


Figure 14 — Torque test on handlebar/stem assembly

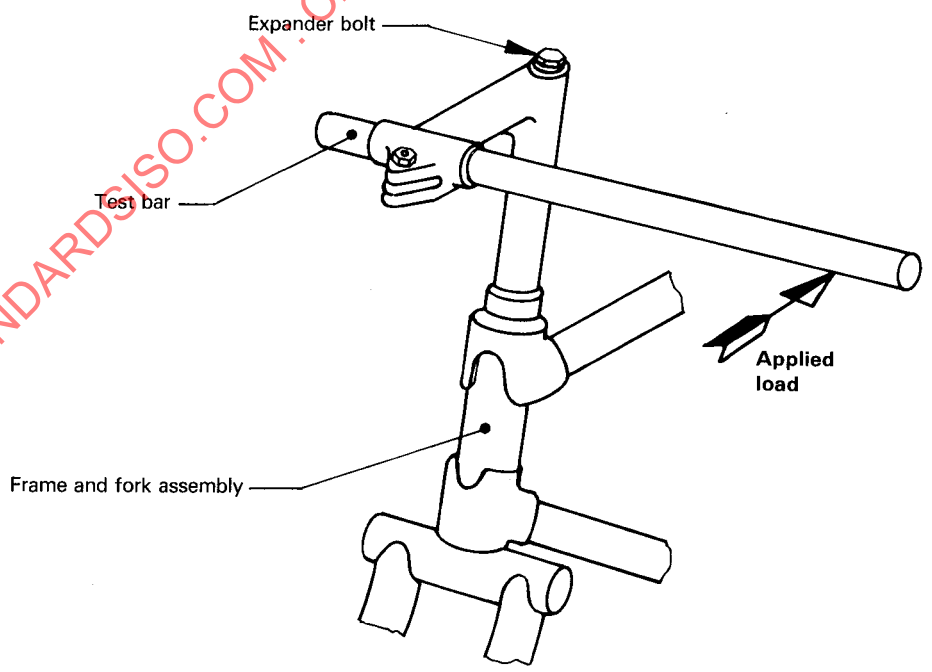


Figure 15 — Torque test on handlebar/fork clamping device

4.6 Impact tests on frame/fork assembly

4.6.1 Falling mass test

This test shall be conducted on a frame and fork assembly. Where a frame is convertible for male and female riders by the removal of a bar, it shall tested with the bar removed.

The distance between the axle centre-lines shall be measured. A low-mass roller shall be assembled in the front fork, and the frame/fork assembly held vertically and clamped to a rigid fixture by the rear axle attachment points as shown in figure 16.

A mass of 22,5 kg shall be dropped vertically through a height of 180 mm so as to strike the low-mass roller at a point in line with the wheel centres and against the direction of the fork rake.

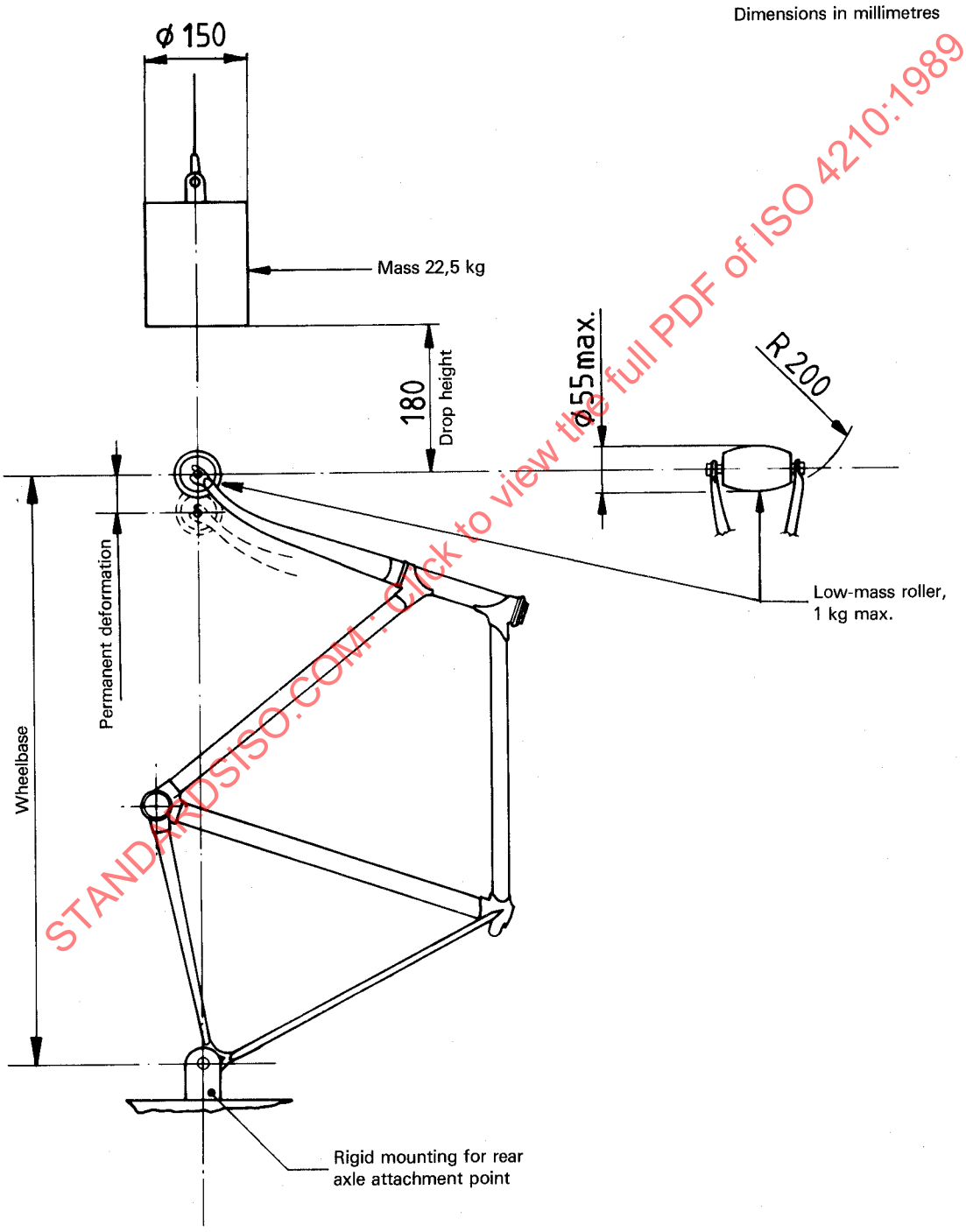


Figure 16 — Impact test (falling mass)