भारतीय मानक

Indian Standard

IS 19034 : 2023

बीएमएक्स बाईसाईकल — सुरक्षा आवश्यकताएँ और परीक्षण पद्धतियाँ

BMX Bicycles — Safety Requirements and Methods of Test

ICS 43.150

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

December 2023 **Price Group 14**

Bicycles Sectional Committee, TED 16

FOREWORD

This Indian Standard was adopted by Bureau of Indian Standards, after the draft finalized by the Bicycles Sectional Committee had been approved by the Transport Engineering Division Council.

In preparation of this Indian Standard considerable assistance has been taken from EN 16054 : 2012 'BMX bicycles — Safety requirements and test methods' published by European Committee for Standardization (CEN).

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this Standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this Standard.

Notwithstanding what is stated in this standard, applicable national, state, local bodies, regulations shall apply. In case of exports corresponding regulations of exporting countries shall apply.

Indian Standard

BMX BICYCLES — SAFETY REQUIREMENTS AND TEST METHODS

1 SCOPE

This standard specifies safety and performance requirements for the design, assembly and testing of BMX bicycles and sub-assemblies intended for use in any type of location such as roads and/or tracks and/or ramps. It applies to specialized types of bicycles designed and equipped for activities such as acrobatic ground maneuvers, stunting and aerobatic maneuvers and lays down guidelines for instructions on the use and care of such BMX bicycles.

It applies to BMX bicycles on which the saddle height can be adjusted to provide a minimum saddle height of 435 mm or more.

This standard is applicable for the following:

a) Category 1, BMX designed for a rider mass of 45 kg or less; and
b) Category 2, BMX designed for a rider mass more than 45 kg.

It does not apply to BMX bicycles for use in sanctioned competition events.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMS AND DEFINITIONS

For the purposes of this standard, the following terms and definitions shall apply.

3.1 Bicycle — Two-wheeled cycle.

3.2 BMX — Bicycle designed for use in any type of location such as roads, tracks and/or ramps and equipped with single speed freewheel transmission, no suspension systems and no back pedal brake.

3.3 Braking Distance — Distance travelled by a bicycle between the commencement of braking (*see* 3.5) and the point at which the bicycle comes to rest.

3.4 Braking Force F_{Br} — Tangential rearward force between the tyre and the ground or the tyre and the drum or belt of the test machine.

3.5 Commencement of Braking — Point on the test track or test machine at which the brake actuating device operated directly by the rider's hand or by a test mechanism starts to move from its rest position, on the test track. This point being determined by the first brake actuating device (front or rear) to operate.

3.6 Crank Assembly — Assembly which, for fatigue testing, consists of the two cranks, the pedal-spindles (possibly with adaptors), the bottom-bracket spindle, and the first component of the drive system, for example, the chain-wheel cluster.

3.7 Cycle — Vehicle that has at least two wheels and is propelled solely or mainly by the muscular energy of the person on that vehicle, in particular by means of pedals.

3.8 Exposed Protrusion — Protrusion which, through its location and rigidity, could present a hazard to the rider either through heavy contact with it in normal use or should the rider fall onto it in an accident.

3.9 Fracture — Unintentional separation into two or more parts.

3.10 Free-Wheel Transmission — Gearing mechanism which is designed to disengage the wheel from the pedal mechanism in one rotating direction.

3.11 Fully-Assembled Bicycle — Bicycle fitted with all components necessary for its intended use.

3.12 Maximum Inflation Pressure — Maximum tyre pressure recommended by the tyre manufacturer.

3.13 Maximum Saddle Height — Vertical distance from the ground to the top of the seat surface, measured with the seat in a horizontal position and with the seat-pillar set to the minimum insertion depth.

3.14 Pedal Tread-Surface — Surface of a pedal that is presented to the underside of the foot.

3.15 Peg — Component that allows the rider to stand during aerobatic maneuvers or to slide on static objects.

3.16 Quick-Release Device — Device to fix or release a part without a tool.

3.17 Rim-Brake — Brake in which brake-shoes act on the rim of the wheel.

3.18 Rotor — Part of the brake system that allows an infinite rotation of the steering system around its axis.

3.19 Visible Crack — Crack which results from a test where that crack is visible to the naked eye.

3.20 Wheel — Assembly or combination of hub, spokes or disc, and rim, but excluding the tyre.

3.21 Wheel-Base — Distance between the axes of the front and rear wheels of an unladen bicycle.

4 REQUIREMENTS AND TEST METHODS

4.1 Numbers and Condition of Test Specimens

In general, for static, impact and fatigue tests, each test shall be conducted on a new test sample, but if only one sample is available, it is permissible to conduct all of these tests on the same sample with the sequence of testing shall be fatigue, static and impact.

If more than one test is conducted on the same sample, the test sequence shall be clearly recorded in the test report or record of testing.

In all strength tests, specimens shall be in the fully finished condition.

NOTE — It should be noted that if more than one test is conducted on the same sample, earlier tests can influence the results of subsequent tests. In addition, if a sample fails when it has been subjected to more than one test, a direct comparison with single testing is not possible.

4.2 Accuracy Tolerances and Test Conditions

4.2.1 *Accuracy — Tolerances*

Unless stated otherwise, accuracy tolerances based on the nominal values shall be as follows:

a) Force and Torque 0/+ 5 percent;
b) Mass and Weight ± 1 percent;
c) Dimension ± 1 mm;
d) Angle ± 1°;
e) Time duration ± 5 s;
f) Temperature ± 2 °C; and
g) Pressure ± 5 percent.

4.2.2 *Test Conditions — Fatigue Tests*

The shape of the signal is not specified in the standard. However, the intention is for the force to be applied and released progressively.

Unless stated otherwise, the frequency shall be adapted to ensure a good application of the loading and shall not exceed 10 Hz.

To allow for the initial settling of carbon-fibre components, the initial value has to be taken on the mean of 10 cycles after 1 000 load cycles.

4.3 Crack Detection Methods

Standardized methods should be used to emphasize the presence of cracks where visible cracks are specified as criteria of failure in tests specified in **3.19**.

NOTE — For example, suitable dye-penetrant methods are specified in ISO 3452 series.

4.4 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.

4.5 Protrusions

4.5.1 *Requirements*

4.5.1.1 *Exposed protrusions*

Any rigid exposed protrusion longer than 8 mm (*see* L in Fig. 1) after assembly except:

a) Rim-brake mechanism at the front and rear wheels;
b) A lamp-bracket fitted on the head tube;
c) Reflectors;
d) Clipless attachment mechanism;
e) Chainwheels and sprockets;
f) Bottle carrier;
g) Brake rotor; and
h) Pedal tread.

shall terminate in a radius, R (*see* Fig. 1), of not less than 6.3 mm. Such protrusions shall have a major end dimension, A (*see* Fig. 1), not less than 12.7 mm and a minor dimension, B (*see* Fig. 1), not less than 3.2 mm.

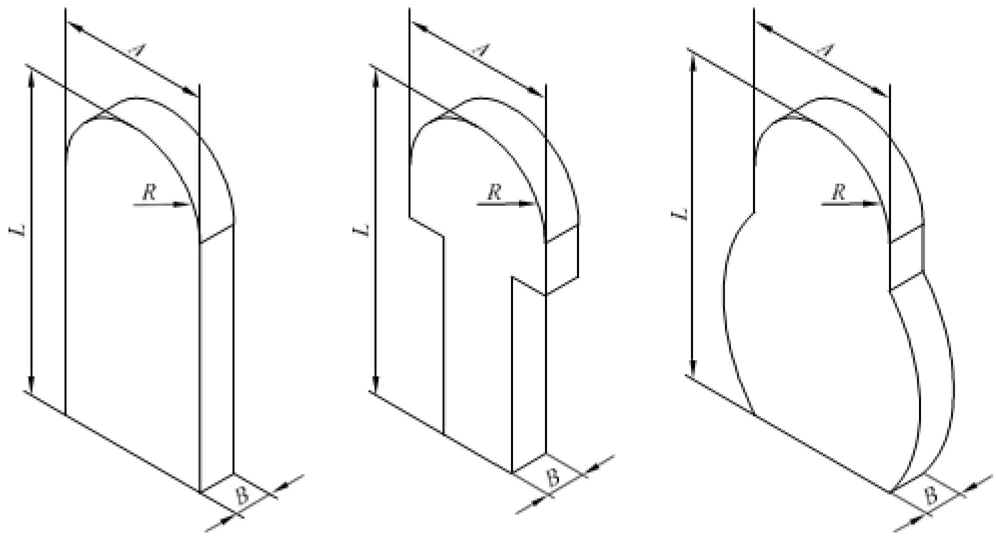
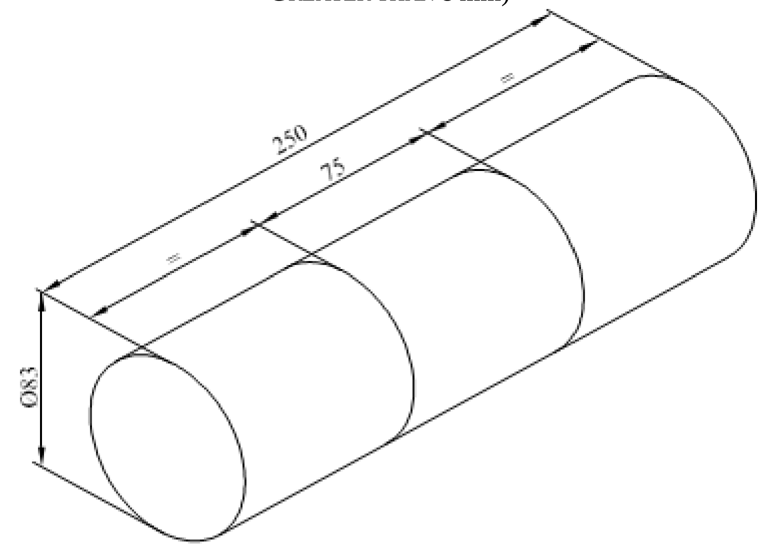


FIG. 1 EXAMPLES OF MINIMUM DIMENSIONS OF EXPOSED PROTRUSIONS (WHICH APPLY ONLY WHEN L IS GREATER THAN 8 mm)



All dimensions in millimetres.

FIG. 2 EXPOSED PROTRUSION TEST CYLINDER

4.5.1.2 *Exclusion zone, protective devices and screw threads*

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 outer cable casing no greater than 6.4 mm in diameter and cable guides and outer cable stops made from material no thicker than 4.8 mm may be attached to the top tube.

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

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

4.5.2 *Test Method*

Conduct the test with a protrusion test cylinder (which simulates a limb) having the dimensions shown in Fig. 2.

Manoeuvre the test cylinder in all possible attitudes towards any rigid protrusion on the bicycle. If the central 75 mm long section of the cylinder contacts the protrusion that protrusion shall be considered to be an exposed protrusion and it shall comply with **4.5.1.1**.

Examples of protrusions which need and do not need to comply with the requirements are shown in Fig. 3.

4.5.3 *Pegs*

External extremities of the pegs (*see* Fig. 4) shall have a chamfer or a fillet of at least 1.6 mm and an angle from 30° *Min* to 45° *Max*. The dimension A (*see* Fig. 4) shall be at least 1.6 mm.

4.6 Security and Strength of Safety-Related Fasteners

4.6.1 *Security of Screws*

Any screws used to attach brake-mechanisms to the frame or fork, and the saddle to the seat-pillar shall be provided with suitable locking devices, for example, lock-washers, lock-nuts, or stiff nuts.

4.6.2 *Minimum Failure Torque*

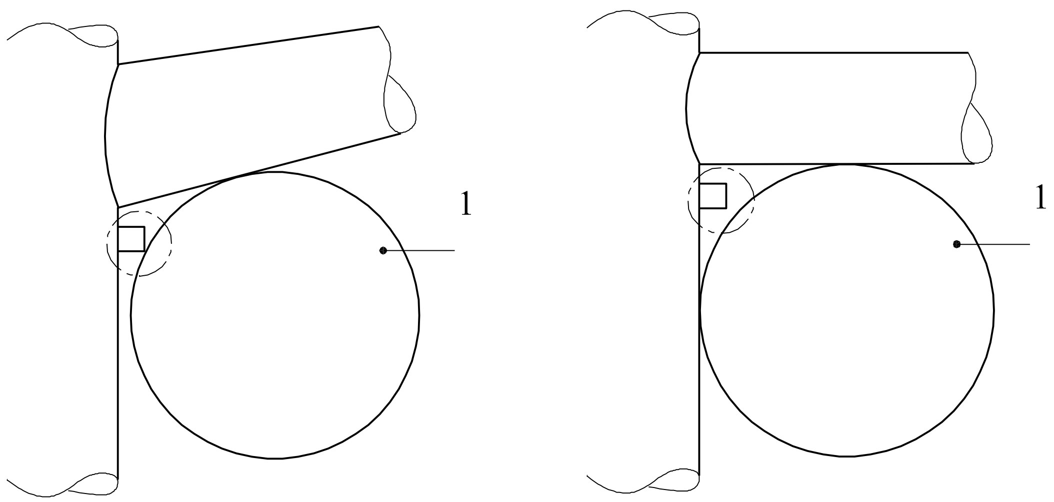
The minimum failure torque of bolted joints for the fastening of handlebars, handlebar stems, seats and seat pillars shall be at least 50 percent greater than the manufacturer's recommended tightening torque.

4.6.3 *Folding Bicycle*

Folding mechanisms shall be designed so that the bicycle can be locked for use in a simple, stable, safe way and when folded no damage shall occur to any cables. No locking mechanism shall contact the wheels or tyres during riding, and it shall be impossible to unintentionally loosen or unlock the folding mechanisms during riding.

4.6.4 *Quick Release Devices*

No form of quick release system shall be permitted for wheel axle retention.



a) Prtorusion shall comply

b) Protrusion need not to comply

Key

1 Test cylinder

FIG. 3 EXAMPLES OF PROTRUSIONS

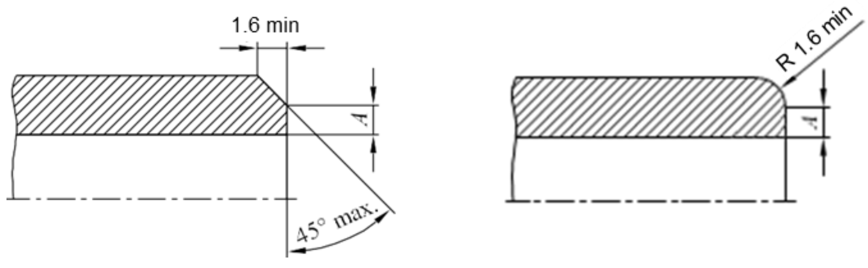


FIG. 4 EXTREMITY OF PEG

4.7 Pegs/Axles Assembly

4.7.1 *Pegs — Resistance to Loosening*

4.7.1.1 *Test method*

Apply a tangential force of 700 N at the midpoint of each peg, in such a way to produce the maximum unscrewing torque as shown in Fig. 5. Apply the load for 1 min and check if the requirements are met.

In case of noncircular cross section, apply the tangential load at the longer side.

4.7.1.2 *Requirements*

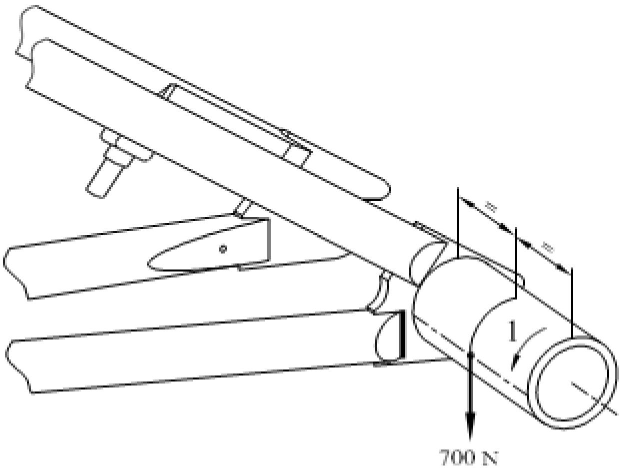
When tested according to test method as described in **4.7.1.1**, pegs shall not unscrew.

4.7.2 *Resistance to Deflection*

4.7.2.1 *Test method*

Perform a separate static test on each pair of front and back peg/axle assembly of a complete bike with the pegs supported at their midpoint.

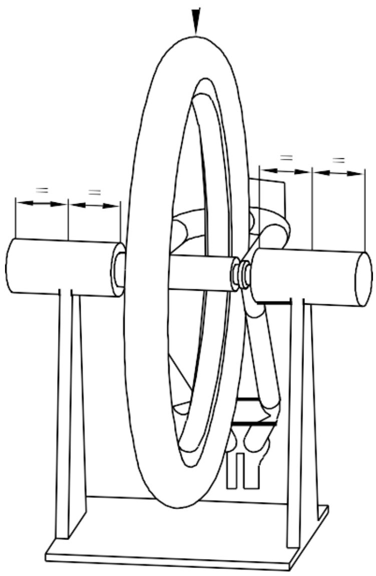
Apply a vertical force, F, of 3 000 N on the wheel, in a direction normal to the peg longitudinal axis and corresponding to the vertical direction, with the bicycle standing on the ground, as shown in Fig. 6. Apply the load for 1 min and check if the requirements are met before removing the load.



Key

1 Unscrewing

FIG. 5 PEGS — RESISTANCE LOOSENING



Key

F = 3 000 N

FIG. 6 PEGS — RESISTANCE TO DEFLECTION (EXAMPLE OF TEST CONFIGURATION)

4.7.2.2 *Requirements*

Pegs shall not show a total deflection under load, greater than 30° (measured on the pegs) to the axle axis when tested according to test method described in **4.7.2.1**.

4.8 Brakes

4.8.1 *Braking-Systems*

4.8.1.1 A bicycle shall be equipped with at least two independent braking-systems.

4.8.1.2 At least one brake system shall operate on the front wheel and one on the rear wheel. The braking-systems shall operate without binding and shall be capable of meeting the braking-performance requirements of **4.8.7**.

NOTE — The inner cable should be protected from corrosion, for example, by suitable impervious liner to the outer casing.

4.8.2 *Hand-Operated Brakes*

4.8.2.1 *Brake-lever position*

The handbrake levers for front and rear brakes shall be positioned according to the legislation or custom and practice of the country in which the bicycle is to be sold, and the bicycle manufacturer shall state in the manufacturer's instructions which lever operates the front brake and which lever operates the rear brake [*see also* 5(b)].

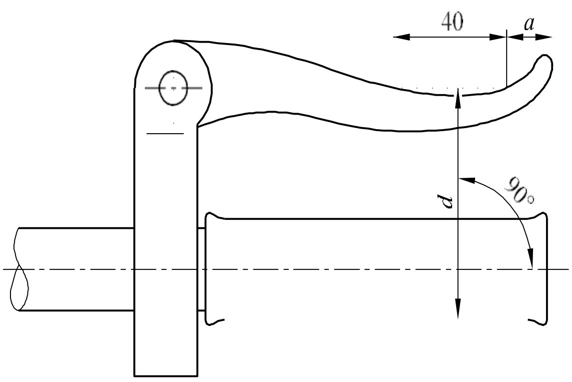
Conformance shall be established by the method detailed in **4.8.2.2**.

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

The dimension *a*, as shown in Fig. 7 which is used in **4.8.2.3** to establish the position for applying test loads, shall be established by the method detailed in **4.8.2.2**.

4.8.2.2 *Test method*

Fit the gauge illustrated in Fig. 8 over the handlebar-grip or the handlebar (where the manufacturer does not fit a grip) and the brake-lever as shown in Fig. 9 so that the face A (*see* Fig. 8) is in contact with the handlebar or grip and the side of the brake-lever. Ensure that the face B (*see* Fig. 8) spans an area of that part of the brake-lever that is intended for contact with the rider's fingers without the gauge causing any movement of the brake-lever towards the handlebar or grip. Measure the distance, *a*, the distance between the last part of the lever intended for contact with the rider's fingers and the end of the lever (*see* **4.8.2.1**, Fig. 7, Fig. 8 and **4.8.2.3**).

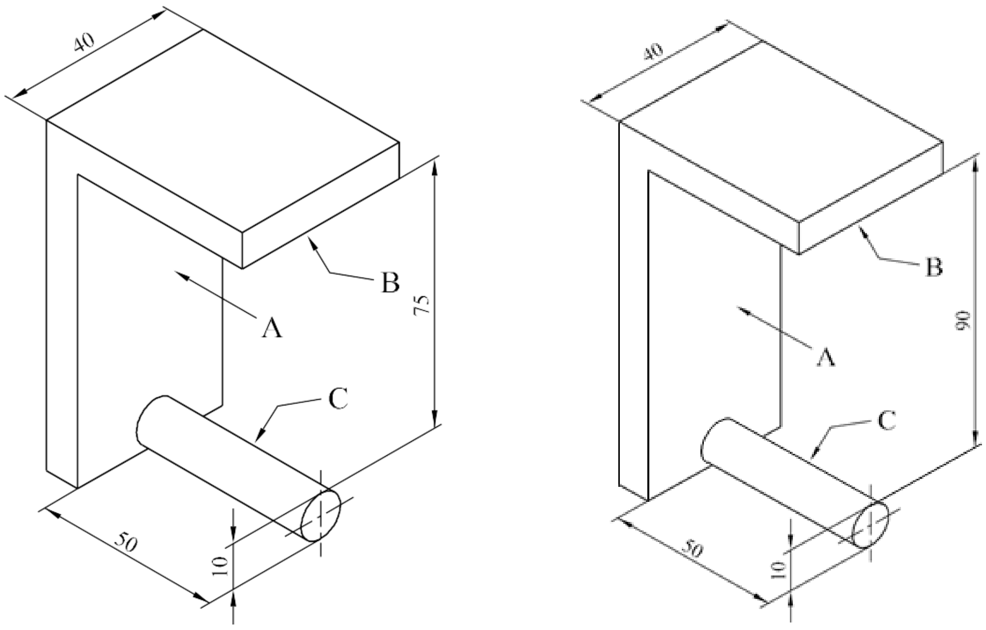


All dimensions are in millimetres.

FIG. 7 HANDBRAKE-LEVER GRIP DIMENSIONS

Key

a = Distance between the last part of the lever intended for contact with the rider's fingers and the end of the lever
d = Maximum grip dimension



CATEGORY 1 CATEGORY 2

Key

A = face A
B = face B
C = rod

FIG. 8 HANDBRAKE-LEVER GRIP-DIMENSION GAUGES

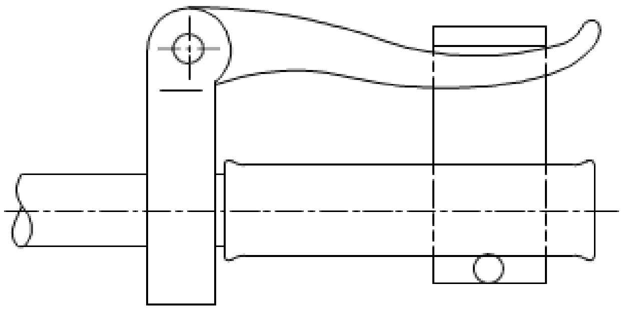
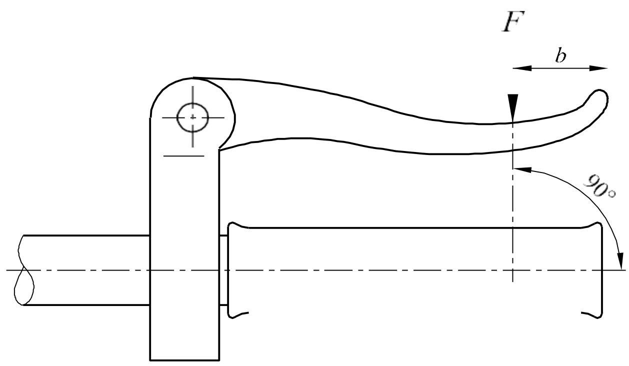


FIG. 9 METHOD OF FITTING THE GAUGE TO THE HANDBRAKE-LEVER AND HANDLEBAR



Key

F = applied force
b ≥ 25 mm

FIG. 10 POSITION OF APPLIED FORCE ON THE HANDBRAKE-LEVER (*see also* Fig. 7)

4.8.2.3 *Handbrake-levers — Position of applied force*

For the purposes of all braking tests in this standard the test force shall be applied at a distance, a, which is equal to either dimension *a* as determined in **4.8.2.2** or 25 mm from the free end of the brake-lever, whichever is the greater (*see* Fig. 10).

4.8.3 *Attachment of Brake Assembly and Cable Requirements*

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

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

NOTES

1 *See* **4.6** in relation to fasteners.
2 The inner cable should be protected from corrosion, for example, by a suitable impervious liner to the outer casing.

4.8.4 *Brake Adjustment*

4.8.4.1 Each brake shall be capable of adjustment without the use of a tool to an efficient operating position until the friction material has worn to the point of requiring replacement as recommended in the manufacturer's instructions.

4.8.4.2 In addition, when correctly adjusted, the friction material shall not contact anything other than the intended braking surface.

4.8.5 *Brake-Block and Brake-Pad Assemblies — Security Test*

4.8.5.1 *Test method*

Use a machine such as those described in **4.8.7.2.4.2** at a velocity of 12.5 km/h.

With a vertical force applied to the bicycle sufficient to prevent skidding of the tyre on the wheel under test, accelerate the driving mechanism to the specified velocity in a rearward direction, and then apply an operating-force of 180 N. Repeat the operation 5 times.

4.8.5.2 *Requirement*

The friction material shall be securely attached to the holder, backing-plate, or shoe and there shall be no failure of the assembly when tested by the method specified in **4.8.5.1**. The brake system shall be capable of meeting the strength test specified in **4.8.6** and braking performance requirements of **4.8.6.2** after completion of the test specified in **4.8.5.1**.

4.8.6 *Hand-operated Braking-System — Strength Test*

4.8.6.1 *Test method*

Conduct the test on a fully assembled bicycle.

After it has been ensured that the braking system is correctly adjusted according to recommendations in the manufacturer's instructions, apply a force to the brake-lever at the point specified in **4.8.2.3**.

This force shall be 450 N, or such lesser force as is required to bring a brake-lever into contact with the handlebar grip or the handlebar where the manufacturer does not fit a grip.

Repeat the test for a total of 10 times on each hand-brake lever.

4.8.6.2 *Requirement*

When tested by the method described in **4.8.6.1**, there shall be no failure of the braking-system or of any component (including brake rotor if any) thereof.

4.8.7 *Braking Performance*

4.8.7.1 *General*

Two test methods are specified, that is, machine test method and track test method. Experience has shown that the test track method is not suitable for category 1 due to the required size of the rider.

4.8.7.2 *Machine test method*

4.8.7.2.1 *Principle*

The braking force F_{Br} is measured on a test machine. The progressive characteristics of the brake are determined by linearity measurements. A final, simple track test checks for smooth, safe, stopping characteristics.

4.8.7.2.2 *Test bicycle*

Conduct the braking-performance test on a fully assembled bicycle after the brakes have been subjected to the strength test detailed in **4.8.6**.

Before testing the bicycle, inflate the tyres and adjust the brakes all according to the manufacturer's instructions.

4.8.7.2.3 *Requirements*

4.8.7.2.3.1 *Braking performance*

The bicycle shall fulfil the requirements as specified in Table 1.

Table 1 Braking Forces

(*Clause* 4.8.7.2.3.1)

Sl No.	Condition	Brakes in use	Braking force Category 1 F_{Br} N	Braking force Category 2 F_{Br} N
(1)	(2)	(3)	(4)	(5)
i)	Dry	Front	160	280
ii)		Rear	130	240
iii)	Wet	Front	100	180
iv)		Rear	85	150

4.8.7.2.3.2 *Linearity*

When tested by the methods described in 4.8.7.2.4.4(c), the braking force F_{Br} *average* shall be linearly proportional (within + 20 percent) to the progressively increasing intended operating forces F_{Op} *intend*. The requirement applies to braking forces F_{Br} *average* equal to and greater than 80 N for category 1 and excluding wet conditions.

4.8.7.2.3.3 *Ratio between wet and dry braking performance*

In order to ensure safety for both wet and dry braking, the ratio of braking performance wet/dry shall be greater than 2 : 5.

The methods for calculating this ratio are given in 4.8.7.2.4.4(d).

4.8.7.2.3.4 *Smooth, safe-stop characteristics*

The bicycle shall show smooth, safe-stop characteristics.

4.8.7.2.4 *Test methods*

4.8.7.2.4.1 *Symbols*

F_{Op} = Operating force (that is, force applied on handbrake lever)

F_{Op} *intend* = Intended operating force (for example, 60 N, 80 N)

F_{Op} *rec* = Recorded operating force (for example, 61 N, 79 N)

F_{Br} = Braking force

F_{Br} *rec* = Recorded braking force

F_{Br} *corr* = Corrected braking force (Corrected for difference between *FOp intend* and *FOp rec*)

F_{Br} *average* = The arithmetic mean of the three F_{Br} *corr* at one level of F_{Op} *intend*

F_{Br} *Max* = The maximum F_{Br} *average*

F_{DBr} = Dry braking-force

F_{WBr} = Wet braking-force

4.8.7.2.4.2 *Test machine*

The test machine shall enable measurements of the individual braking forces of the front and rear brakes on a drum or belt.

The test machine shall incorporate a system which drives the wheel under test by tyre contact and a means of measuring the braking-force and typical examples of two types of machines are illustrated in Fig. 11 and 12.

Fig. 11 shows a machine in which a roller drives the individual wheels, and Fig. 12 shows a machine in which a driven belt contacts both wheels. Other types of machines are permitted, provided they meet the specific requirements listed below.

The specific requirements are as follows:

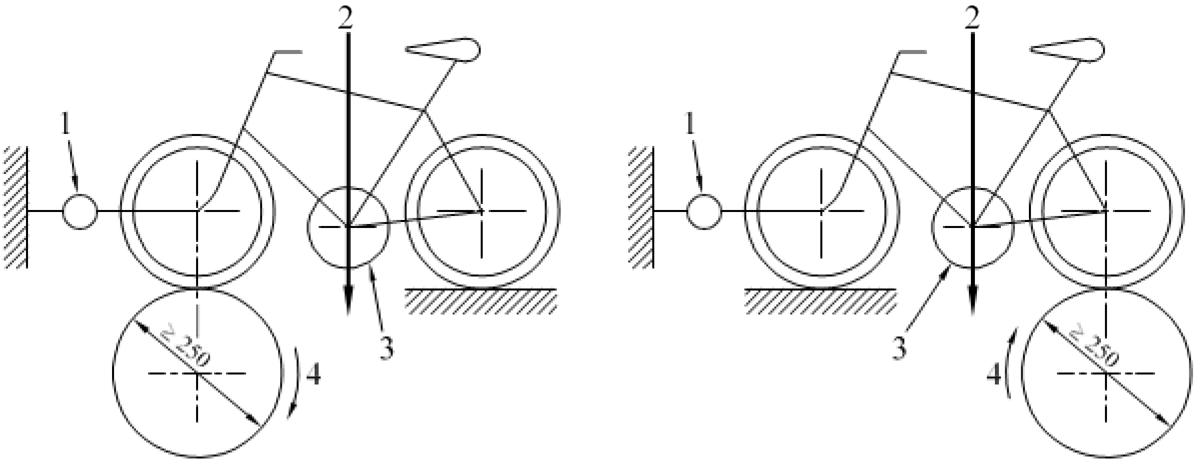
a) The linear surface velocity of the tyre shall be 12.5 km/h and shall be controlled within ± 5 percent;

b) A means of laterally restraining the wheel under test shall be provided which does not create any fore/aft restraint;

c) A means of laterally applying forces to the hand-brake levers at the point specified in 4.8.2.3 shall be provided, with the width of the contact on the lever not greater than 5 mm;

d) A water spray system, to provide wetting of the brakes of the bicycle, consisting of a water reservoir connected by tubing to a pair of nozzles arranged as shown in Fig. 13. Each nozzle shall provide a flow of water at ambient temperature to ensure that, in addition to the rim, any hub-or disc-brake is thoroughly wetted before a test begins; and

e) A system for loading the wheels.

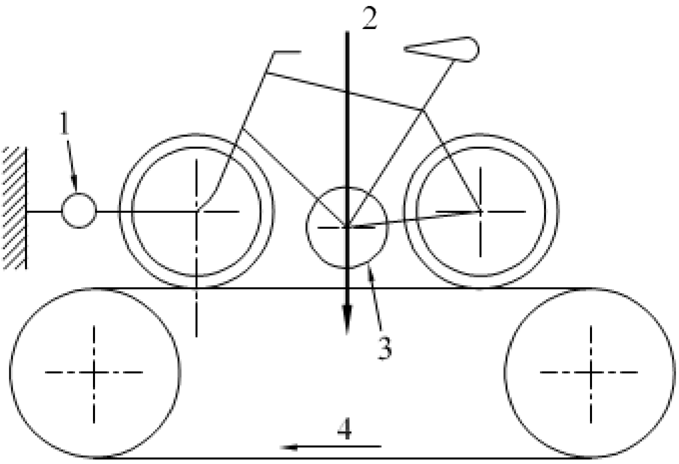


a) TESTING THE FRONT BRAKE b) TESTING THE REAR BRAKE

Key

1 = Braking-force transducer;
2 = Applied force;
3 = Additional mass; and
4 = Direction of drum rotation.

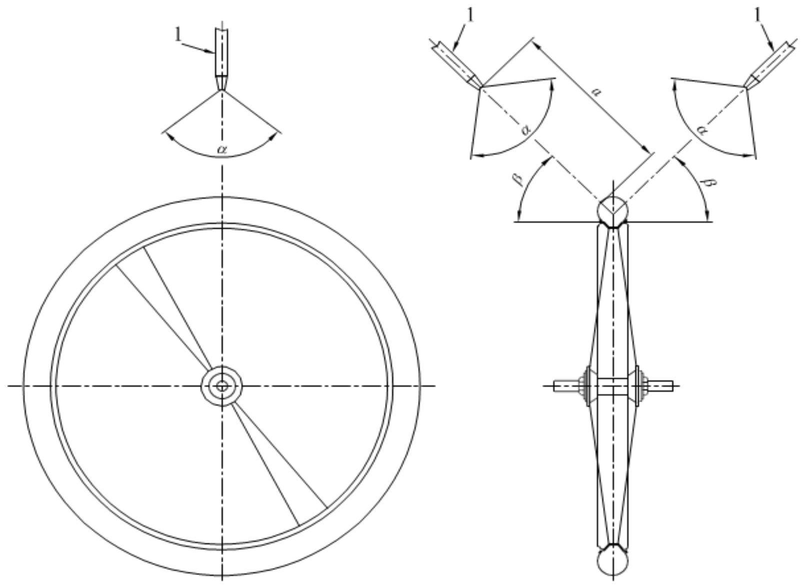
FIG. 11 BRAKING PERFORMANCE TEST MACHINE — SINGLE DRUM TYPE



Key

1 = Braking-force transducer;
2 = Applied force;
3 = Additional mass; and
4 = Direction of belt travel.

FIG. 12 BRAKING PERFORMANCE TEST MACHINE — DRIVEN-BELT TYPE



Key

α = 90° to 120°;
β = 30° to 60°;
a = 150 mm to 200 mm; and
1 = Water nozzles.

FIG. 13 WATER NOZZLE ARRANGEMENT FOR THE WET BRAKING TEST (APPLICABLE TO ALL TYPES OF BRAKE)

4.8.7.2.4.3 *Instrumentation*

The test machine shall be instrumented to include the following:

a) A device to record the surface velocity of the tyre, accurate to within ± 2 percent;

b) A device to record the braking force (*see* Fig. 11 and 12, for example), accurate to within ± 5 percent; and

c) A device to record the force applied to the hand-lever, accurate to within ± 5 percent.

4.8.7.2.4.4 *Test method*

Test the front and rear wheels individually. The wheel to be tested shall be forced vertically downwards so that no skidding of the wheel occurs when tested according to **4.8.7.2.4.4**(a) and **4.8.7.2.4.4**(b). Conduct a running-in process on every brake before carrying out the performance test.

In order to determine the operating force to be used during the running-in process, mount and load the bicycle on the test machine with the belt or drum running at the specified speed and apply an operating force to the handbrake lever that is high enough to achieve 50 percent of the dry braking force ± 10 percent. Maintain this operating force for at least 2.5 s and note the value of the applied operating force.

Repeat the procedure (applying the operating force determined as above accurate to within ± 5 percent) ten times, or, with more repetitions, if necessary, until the mean braking force from anyone of the three latest tests does not deviate by more than ± 10 percent from the mean braking force from these same three tests.

NOTE — The necessary force may be applied anywhere on the bicycle (wheel-axle, bottom bracket, seat-post, etc) provided that it is exerted vertically downwards.

a) Testing under dry conditions:

With a vertical force applied to the bicycle sufficient to prevent skidding of the tyre on the wheel under test, accelerate the driving mechanism to the specified velocity, then apply the operating force in a series of 20 N increments from 60 N to either 180 N or to the force necessary to achieve a braking force of at least 700 N, whichever is the lesser. However, if the wheel locks, if any possible brake-overload device is actuated, or if the hand-lever comes into contact with the handlebar, do not increase the force further. For each increment of applied operating force, perform three tests within 1 min. Before applying the next level of operating force, allow the brake to cool for 1 min.

The applied operating forces shall lie within ± 10 percent of the intended operating forces. The operating forces shall be applied as specified in **4.8.2.3**, shall be recorded with an accuracy of ± 1 percent and shall be fully applied within 1 s of the commencement of braking.

For each increment of hand-lever force, record the braking force value, F_{Br} *rec*, for a period of between 2.0 s and 2.5 s, with measurement starting 0.5 s to 1.0 s after the commencement of braking (*see* **3.10**). Record F_{Br} *rec* as the average braking force during this measurement period.

The time at which the measurement of the braking force is started shall be related to the speed at which the operating force is applied. If the operating force is fully applied in less than 0.5 s after the commencement of braking, start the measurement after 0.5 s. However, if the operating force is fully applied between 0.5 s and 1.0 s after the commencement of braking, start the measurement when the operating force is fully applied.

b) Testing under wet conditions:

For testing under wet conditions, the method shall be as given in **4.8.7.2.4.4**, with the addition that wetting of the brake system shall commence not less than 5 s before the commencement of braking for each increment of operating force and shall continue until the measurement period has ended.

Water nozzles shall be arranged according to Fig. 13.

c) Linearity

Plot the calculated F_{Br} *average* values (the arithmetic mean of the three corrected braking forces at each level of operating force) against the equivalent operating force values, F_{Op} *intend*, in order to assess the linearity against the requirement given in **4.8.7.2.3.2**. Plot the results on a graph, showing the line of best fit and the ± 20 percent limit lines obtained by the method of least squares.

d) Ratio between wet and dry braking:

For any operating force (F_{Op}) for which the measured dry braking-force (F_{DBr} *average*) is greater than 200 N, the ratio between the measured braking-force in wet conditions (F_{WBr} *average*) and the measured braking-force in dry conditions (F_{DBr} *average*) shall be greater than 40 percent.

For each F_{Op} where F_{DBr} *average* is > 200 N, determine (using the following formula) whether or not the requirements of have been met:

F_{WBr} *average*/F_{DBr} *average* > 2 : 5

e) Simple track test:

After completion of the machine test, conduct a brief, simple track test with progressively increasing operating forces to determine whether or not the brakes bring the bicycle to smooth, safe stop.

4.8.7.3 *Track test method — Category 2 only*

4.8.7.3.1 *Principle*

In track method braking test, braking performance is determined by the distance to stop (the braking distance). The progressive characteristics of the brakes are directly tested by the rider.

NOTES

1 Track test methods are not given for category 1 BMX due to the size of the bicycle and rider and are still under evaluation.

2 When carrying out track test method, the rider may wear protective equipment.

4.8.7.3.2 *Test bicycle*

Conduct the braking-performance test on a fully assembled bicycle after the brakes have been subjected to the strength test detailed in **4.8.6**. Before testing the bicycle, inflate the tyres and adjust the brakes all according to the manufacturer's instructions.

4.8.7.3.3 *Requirements*

4.8.7.3.3.1 *Braking performance*

The bicycle shall fulfil the requirements as specified in Table 2.

Table 2 Brake Test Velocities and Braking Distances (Category 2)

(*Clause* 4.8.7.3.3.1, 4.8.7.3.3.3, 4.8.7.3.3.4, 4.8.7.3.3.5 *and* 4.8.7.3.4.6)

Sl No.	Condition	Velocity (km/h)	Brakes in Use	Braking Distance (m)
(1)	(2)	(3)	(4)	(5)
i)	Dry	20	Both Rear only	4.50 8.50
ii)	Wet	13	Both Rear only	3.00 6.00

4.8.7.3.3.2 *Smooth safe stop characteristics*

The bicycle shall show smooth, safe stop characteristics with regard to the intended use of the bicycle and the ability of the expected user of the bicycle. Safe-stop characteristics are defined as stopping within the required distances without occurrence of any of the following:

a) Excessive juddering; or
b) Front wheel locking; or
c) Bicycle overturning (rear wheel lifting uncontrollably); or
d) Rider's loss of control; or
e) Excessive side-skid causing the rider to put his foot to the ground to retain control.

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 **4.8.7.3.3.**2(d) or (e) above do not occur as a result.

4.8.7.3.3.3 *Velocity/distance correction factor*

A correction factor shall be applied to the measured braking distance if the velocity as checked by the timing device is not precise as that specified in Table 2.

The corrected braking distance shall be determined from the formula:

$$S_C = \left(\frac{(V_S)^2}{(V_m)}\right) S_m$$

where

S_c = corrected braking distance (m);
V_s = specified test velocity (m/s);
V_m = measured test velocity (m/s); and
S_m = measured braking distance (m).

4.8.7.3.3.4 *Validity of test runs*

a) A test run shall be considered invalid if:

   1) Excessive side-skid causing the rider to put his foot to the ground to retain control, or
   2) Loss of control occurs.

   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 **4.8.7.3.3.4**(a)(1) or (2) above do not occur as a result.

b) If the corrected braking distance exceeds the braking distance specified in Table 2, a test run shall be considered invalid if the velocity at the commencement of the test exceeds the specified test velocity by more than 1.5 km/h from what is specified in Table 2.

c) If the corrected braking distance is less than the braking distance specified in Table 2, a test run shall be considered invalid if the velocity at the commencement of braking is more than 1.5 km/h below the specified test velocity.

   If the corrected braking distance exceeds the braking distance specified in Table 2, the test run shall be considered valid.

4.8.7.3.3.5 *Test results*

a) Braking under dry conditions

   Depending on the gradient of the test track, the test result shall be the average value of the corrected braking distance (*see* **4.8.7.3.4.8**) of the test results.

   For compliance with the requirements of **4.8.7.3.3.1** the above average values shall not exceed the relevant braking distances specified in Table 2.

b) Braking under wet conditions

   Depending on the gradient of the test track, the test result shall be the average value of the corrected braking distances (*see* **4.8.7.3.4.8**) of the test results.

   For compliance with the requirements of **4.8.7.3.3.1**, the above average values shall not exceed the relevant braking distance specified in Table 2.

4.8.7.3.4 *Test method*

4.8.7.3.4.1 *Test track*

a) Use an indoor test-track if possible. If an outdoor test-track is used, pay special attention to ambient conditions throughout the test.
b) The gradient of the track shall not exceed 0.5 percent. If the gradient is less than 0.2 percent carry out all runs in the same direction. If the gradient lies between 0.2 percent and 0.5 percent carry out alternate runs in opposite directions.
c) 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 0.75.
d) The track shall be essentially dry at the commencement of tests. When testing to the requirements of 4.8.7.3.3.1, the track shall remain dry throughout the tests.

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

4.8.7.3.4.2 *Instrumentation*

The test bicycle or the test track shall be instrumented to include the following:

a) A calibrated speedometer or tachometer (accurate to within ± 5 percent) to indicate to the rider the approximate speed at the commencement of braking (*see* **3.10**).

b) A velocity recording device (accurate to within ± 2 percent) to record the velocity at the commencement of braking (*see* **3.10**).

c) A distance recording system (accurate to within ±1 percent) to record the braking distance (*see* **3.9**).

d) A water spray system, to provide wetting of the braking surface, consisting of a water reservoir connected by tubing to a pair of nozzles at the front wheel and a pair of nozzles at the rear wheel. A quick-acting on/off valve shall be included for control by the rider. Each nozzle shall provide a flow water at ambient temperature of not less than 4 ml/s. Details of the positions and directions of nozzles are given in Fig. 13.

e) A brake-actuation indicating system to record independently when each lever or pedal is actuated.

4.8.7.3.4.3 *Mass of bicycle, rider and instrumentation*

The combined mass of the bicycles, the rider, and the instrumentation shall be 100 kg ± 2 Kg.

When wet condition braking tests are performed, the combined mass can decrease throughout the test due to water consumption, but it shall not be less than 95 kg at the end of the valid test runs.

Where a manufacturer specifies that his bicycle can carry a mass such that the total of that mass plus that of the bicycle is in excess of 100 kg, the bicycle shall be tested at that greater total mass and it shall meet the specified braking distances.

4.8.7.3.4.4 *Force applied to the handbrake-levers*

To check magnitude and position of force on handbrake-levers, apply a handgrip force not exceeding 180 N at the point as specified in **4.8.2.3**. Check before and after each series of test runs to verify the lever force.

To check the optional brake-force application device, it is permissible to use a test mechanism to operate the hand brake-lever. When such a device is used, it shall meet the requirements of **4.8.7.3.4.2** (a) and shall additionally control the rate of application of the handbrake-lever force such that 63 percent of the intended lever force is applied in not less than 0.2 s.

4.8.7.3.4.5 *Running-in the braking surfaces*

A running-in process shall be conducted on every brake before performance testing is carried out.

Apply the brakes for not less than three seconds to maintain steady deceleration whilst the bicycle is being ridden at a speed of approximately 16 km/h. Repeat this operation 10 times.

4.8.7.3.4.6 *Test method — Test runs under dry conditions*

Pedal the test bicycle until the specified test velocity is attained (*see* Table 2). Then stop pedalling and apply the brakes. The bicycle shall be brought to a smooth, safe stop (*see* **4.8.7.3.3.2**).

4.8.7.3.4.7 *Test method — Test runs under wet conditions*

The method shall be as given in **4.8.7.3.4.6**, with the addition that wetting of the brake system(s) shall commence not less than 25 m prior to the commencement of braking (*see* **3.10**) and shall continue until the bicycle comes to rest.

NOTE — Excessive amounts of water may be swept from the test-track surface between runs.

4.8.7.3.4.8 *Number of valid test runs*

a) If the gradient of the track is less than 0.2 percent, the following runs shall be made:
   1) Five consecutive valid runs under dry conditions;
   2) Two acclimatization runs under wet conditions (results not recorded); and
   3) Five consecutive valid runs under wet conditions.

b) If the gradient of the track lies between 0.2 percent and 0.5 percent, the following runs shall be made:
   1) Six consecutive valid runs under dry conditions with alternate runs in opposite directions;
   2) Two acclimatization runs under wet conditions (results not recorded); and
   3) Six consecutive valid runs under wet conditions with alternate runs in opposite directions.

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

4.9 Steering

4.9.1 *Handlebar Dimensions*

The handlebar shall have an overall width between

350 mm and 1 000 mm unless national regulations dictate otherwise.

4.9.2 *Handlebar Grips and Plugs*

4.9.2.1 *Test method*

Apply a force of 70 N to the grip or plug in the loosening direction. Maintain the force for 1 min.

4.9.2.2 *Requirement 1*

The ends of the handlebar shall be fitted with handgrips or end plugs. When tested by the method described in **4.9.2.1**, the handgrips or plugs shall withstand a removal force of 70 N.

4.9.2.3 *Test method 2*

Install the handlebar with the grip or plug on the test fixture as shown in Fig. 14. Raise the test fixture to have a height of 100 mm between the solid and flat contact surface and the end of the grip or plug.

Release the fixture. Repeat the operation 10 times.

4.9.2.4 *Requirement 2*

When tested by the method described in **4.9.2.3**, Handlebar tube end shall not be visible.

4.9.3 *Handlebar-Stem with Quill — Insertion-Depth Mark or Positive Stop*

The handlebar-stem shall be provided with one of the two following alternative means of ensuring a safe insertion depth into the fork-stem:

a) It shall contain a permanent, transverse mark, of length not less than the external diameter of the stem that clearly indicates the minimum insertion-depth of the handlebar-stem into the fork-stem; the insertion mark shall be located at a position not less than 2.5 times the external diameter of the handlebar-stem from the bottom of the stem, and there shall be at least one stem diameter's length of contiguous, circumferential stem material below the mark;

b) It shall incorporate a permanent stop to prevent it from being drawn out of the fork-stem such as to leave the insertion less than the amount specified in a) above.

4.9.4 *A-head Set Stem Handlebar Stem-Extension to Fork-Stem — Clamping Requirements*

The distance g (*see* Fig. 15) between the upper, external part of the handlebar stem clamp and the upper, inner part of the fork stem to which the handlebar is clamped shall not be greater than 5 mm.

The upper part of the fork-stem to which the stem-extension is clamped shall not be threaded.

The dimension *g* shall also ensure that the proper adjustment of the steering system can be achieved.

NOTE — For aluminum and carbon-fibre fork-stem, the avoidance of any internal device that could damage the internal surface of the fork-stem is recommended.

4.9.5 *Steering Stability*

The steering shall be free to turn through at least 180° either side of the straight-ahead position and shall exhibit no tight spots, stiffness or slackness in the bearings when correctly adjusted.

4.9.6 *Handlebar and Stem Assembly*

4.9.6.1 *Handlebar and stem assembly — Lateral bending test*

4.9.6.1.1 *Test method*

Assemble the handlebar and stem in accordance with the manufacturer's instructions and, unless the handlebar and stem are permanently connected, for example, by welding or brazing, align the grips portion of the handlebar in a plane perpendicular to the stem axis (*see* Fig. 16). For stems which have a quill for insertion in to a fork-stem, clamp the quill securely in a fixture to the minimum insertion depth, or, for stem extensions which clamp directly onto an extended fork-stem attach the extension to a fork-stem according to the manufacturer's instructions and clamp this fork-stem securely in a fixture to the appropriate height. Apply a force, F, of 600 N for category 1 and 1 000 N for category 2 at a distance of 50 mm from the free end of the handlebar as shown in Fig. 17. Maintain this force for 1 min.

4.9.6.1.2 *Requirement*

When tested by the method described in **4.9.6.1.1**, there shall be no cracking or fracture of the handlebar, stem or clamp-bolt and the permanent set measured at the point of application of the test force shall not exceed 15 mm.

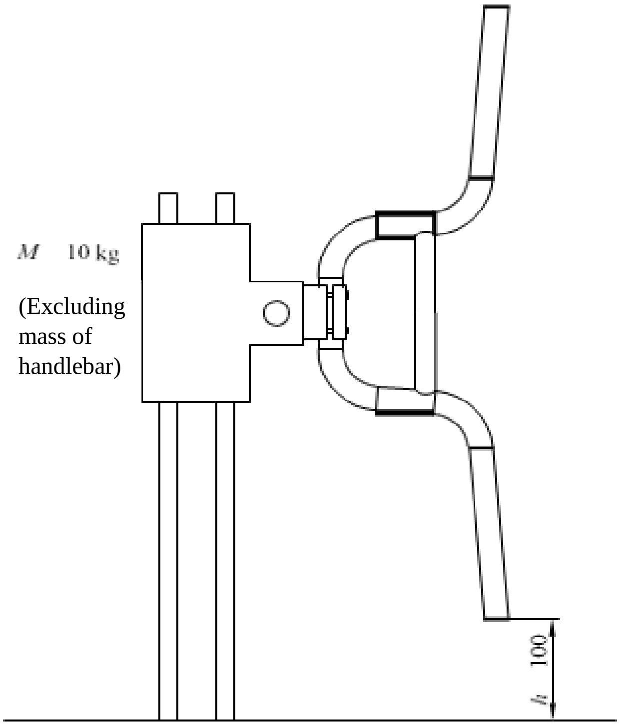
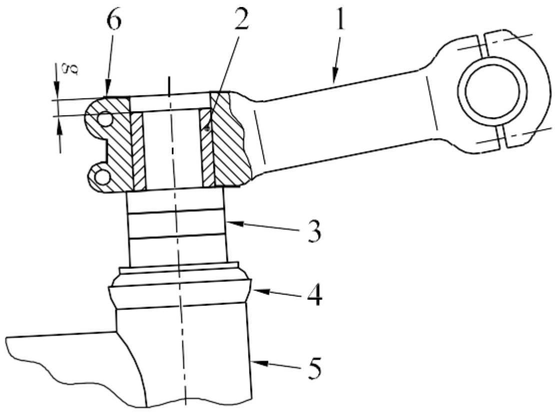


FIG. 14 HANDLEBAR WITH THE GRIP OR PLUG TEST FIXTURE (EXAMPLE OF TYPICAL ARRANGEMENT)



Key

g distance between the upper external part of the handlebar-stem clamp and the upper part of the fork-stem;
1 Stem extension;
2 Extended fork-stem;
3 Spacer rings;
4 Bearing assembly;
5 Head-tube; and
6 Stem-extension to stem clamp.

FIG. 15 CLAMPING BETWEEN THE HANDLEBAR STEM-EXTENSION AND FORK-STEM

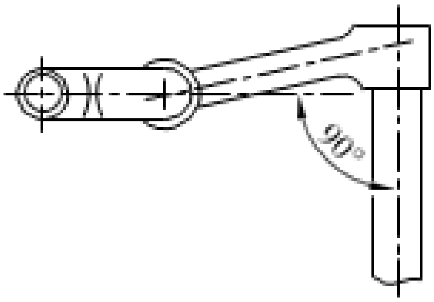
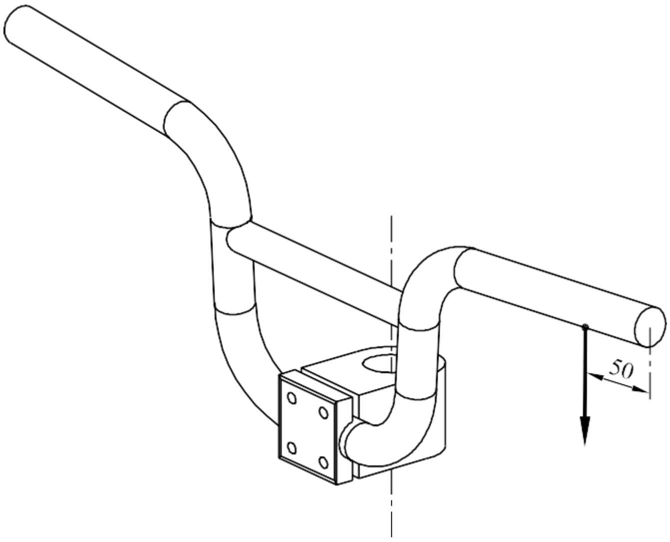


FIG. 16 ADJUSTABLE HANDLEBARS: ORIENTATION FOR TESTS



All dimensions in millimeters.

FIG. 17 POSITION AND DIRECTION OF FORCE

4.9.6.2 *Handlebar-stem — Forward bending test*

4.9.6.2.1 *General*

Conduct the test on the same assembly as follows.

4.9.6.2.2 *Test method*

For stems which have a quill for insertion in to a fork-stem, clamp the quill securely in a fixture to the minimum insertion depth, or, for stem extensions which clamp directly on to an extended fork-stem attach the extension to a fork-stem according to the manufacturer's instructions and clamp this fork-stem securely in a fixture to the appropriate height. Clamp a dummy handle bar securely into the handlebar stem.

NOTE — The length of the dummy handlebar is not critical.

Apply a force, F, of 1 600 N for category 13 000 N for category 2 through the handlebar attachment point in a forward and downward direction and at 45° to the axis of the quill or steel bar as shown in Fig. 18 and maintain this force for 1 min. Release the test force and measure any permanent set (*see* **4.9.6.2.3**).

4.9.6.2.3 *Requirement*

When tested by the method described in **4.9.6.2.2**, there shall be no visible cracks or fractures and the permanent set measured at the point of application of the test force and in the direction of the test force shall not exceed 10 mm.

4.9.6.3 *Handlebar/handlebar stem — Torsional security test*

4.9.6.3.1 *Test method*

Assemble the handlebar and stem in accordance with the manufacturer’s instructions. Clamp the handlebar stem, with its axis vertical, securely in a fixture to the minimum insertion depth. Apply a force, *F*, of 400 N for category 1 and 800 N for category 2 at a distance of 50 mm from each free end of the handlebar and in direction giving the maximum lever arm with respect to the clamp axis. An example is shown in Fig. 19. Maintain this force for 1 min.

4.9.6.3.2 *Requirements*

When tested by the method described in **4.9.6.3.1**, there shall be no cracking or fracture or movement of the handlebar relative to the handlebar stem clamp. Permanent deformation shall not exceed 15 mm.

4.9.7 *Handlebar-Stem to Fork-Stem — Torsional Security Test*

4.9.7.1 *Test method*

Assemble the fork-stem correctly in the frame and attach the handlebar-stem to the fork-stem with the locking system tightened in accordance with the manufacturer's instructions, and apply a torque of 50 Nm once in each direction of possible rotation in a plane perpendicular to the axis of the fork/handlebar-stem. Maintain each torque for 1 min. The exact method of applying the torque may vary, and an example is shown in Fig. 20.

4.9.7.2 *Requirement*

When tested by the method described in **4.9.7.1**, there shall be no movement of the handlebar-stem relative to the fork-stem.

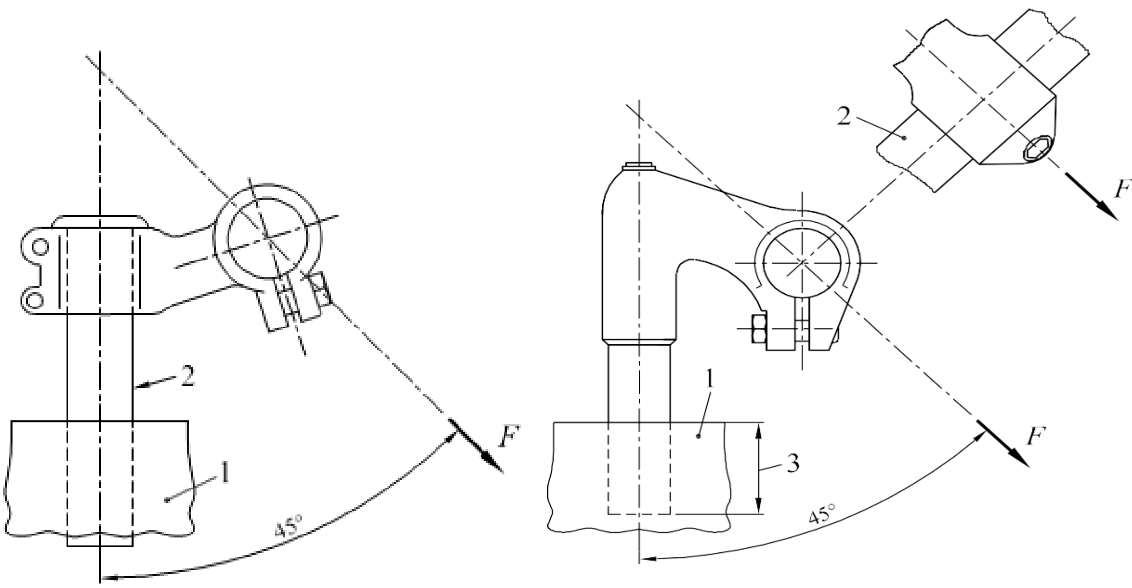
4.9.8 *Handlebar and Stem Assembly — Fatigue Test*

4.9.8.1 *General*

Handlebar-stems can influence test failures of handlebars and for this reason, a handlebar shall always be tested mounted in a stem, but it is permitted to test a stem with a solid bar in place of the handlebar with dimensions corresponding to handlebars suitable for that stem.

When the fatigue test is for the stem only, the manufacturer of the stem shall specify the types and sizes of handlebar for which the stem is intended and the test shall be based on the most severe combination.

Test shall be conducted in two stages on the same assembly in accordance with **4.9.8.2** to **4.9.8.5**.



a) STEM EXTENSION

b) COMBINED STEM AND QUILL

Key

1 Clamping fixture
2 Solid steel bar
3 Minimum insertion depth

FIG. 18 HANDLEBAR STEM: FORWARD BENDING TEST

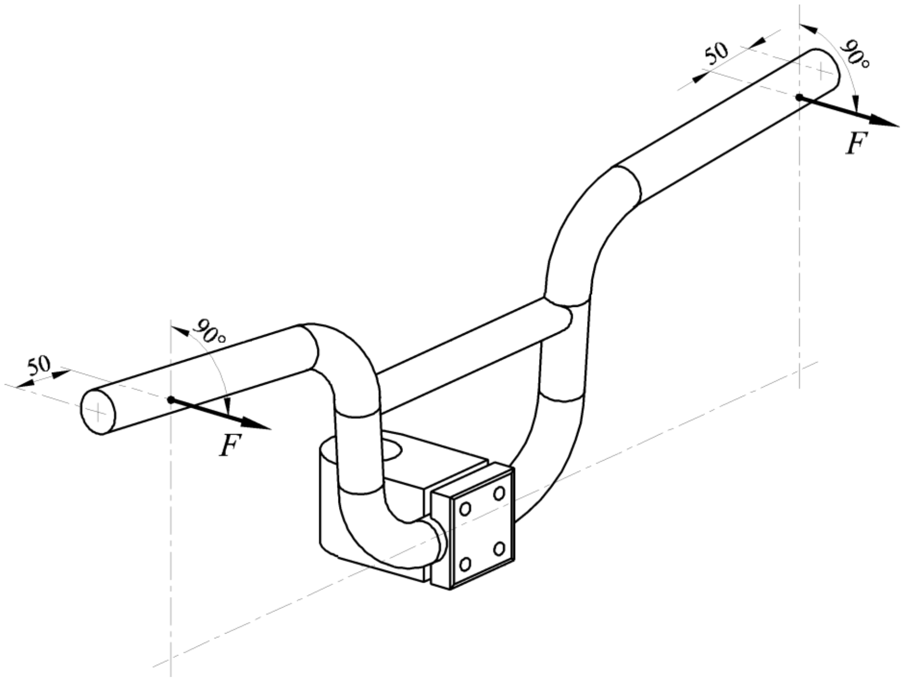
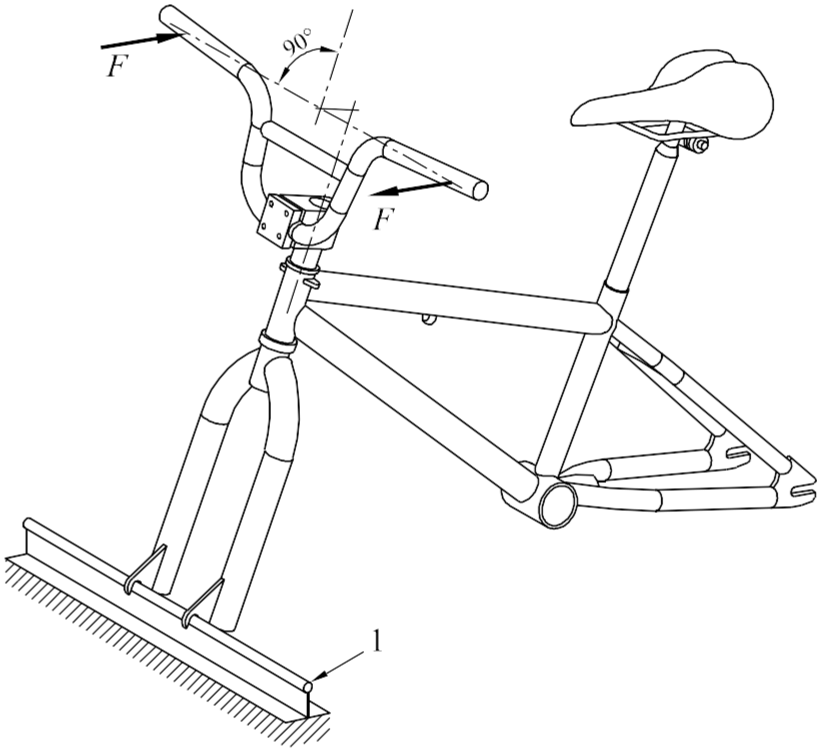


FIG. 19 HANDLEBAR/HANDLEBAR STEM — TORSIONAL SECURITY TEST



Key

1 Fork clamping to prevent fork rotation

FIG. 20 APPLICATION OF THE TORQUE — EXAMPLE

4.9.8.2 *Test method for Stage 1*

Align the grip portion of the handlebar in a plane perpendicular to the stem axis [*see* Fig. 21 (a)], and secure the handlebar to the stem according to the manufacturer's instructions.

Clamp the handlebar stem securely in a fixture to the minimum insertion depth (*see* **4.9.3**), or in the case of a stem extension which is intended to be clamped to an extended fork-stem secure the extension using the manufacturer's recommended tightening procedure to an extended fork-stem which is secured in fixture to the appropriate length. For handlebars, apply fully reversed forces F according to Table 3 at a position 50 mm from the free end each side of the handlebar for 100 000 cycles, with the forces at each end of the handlebar being out of phase with each other and parallel to the axis of handlebar stem as shown in Fig. 21 (a).

4.9.8.3 *Requirement for Stage 1*

When tested by the method described in **4.9.8.2**, there shall be no visible cracks or fractures in any part of the handlebar and stem assembly.

For carbon-fibre handlebars or stems, the peak deflections during the test in either direction from the mean position shall not increase by more than 20 percent of the initial values.

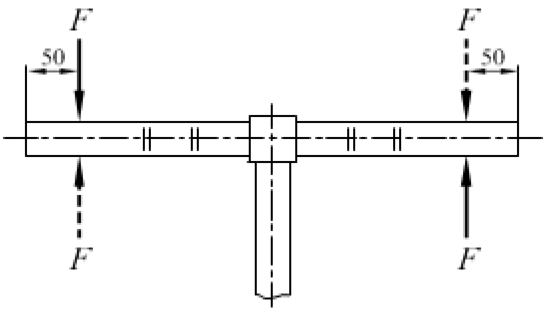
4.9.8.4 *Test method for Stage* 2

Apply fully-reversed forces F according to Table 3 at a position 50 mm from the free end each side of the handlebar for 100 000 cycles, with the forces at each end of the handlebar being in phase with each other and parallel to the axis of the handlebar stem as shown in Fig. 21 (b).

4.9.8.5 *Requirement for Stage* 2

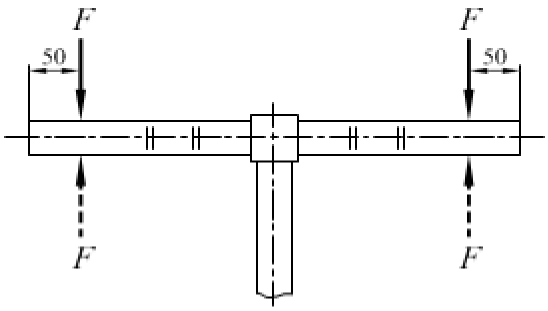
When tested by the method described in **4.9.8.4**, there shall be no visible cracks or fractures in any part of the handlebar and stem assembly.

For carbon-fibre handlebars or stems, the peak deflection during the test in direction from the mean position shall not increase by more than 20 percent of the initial values.



All dimensions in millimeters.

(a) STAGE 1- OUT-OF-PHASE LOADING



All dimensions in millimeters.

(b) STAGE 2- IN-PHASE LOADING

FIG. 21 HANDLEBAR AND STEM: FATIGUE TESTS

Table 3 Value of Forces

(*Clauses* 4.9.8.3 *and* 4.9.8.5)

Sl No. (1)	(2)	Category 1 (3)	Category 2 (4)
i)	Out-of-phase	200 N	270 N
ii)	In-phase	250 N	450 N

4.9.9 *Handlebar/stem assembly impact test*

4.9.9.1 *Test method*

Assemble the handlebar and stem in accordance with the manufacturer's instructions.

Impact the handlebar 50 mm from the handlebar end. Position the handlebar in such a way that the plane defined by the clamping axis and the impact point shall be vertical. The impactor shall be according to Fig. 22.

Drop the impactor on the impact point from a height of 500 mm according to Fig. 22.

4.9.9.2 *Requirements*

4.10 Frame

4.10.1 *Dummy fork characteristics*

The dummy fork shall be designed to mount in a manner similar to the original fork, or in a manner using typical procedures.

The dummy fork when mounted, shall be of the same length, *L*, as the longest fork designed for use with the frame.

The deflection of the dummy fork, δ, is measured at the front axle centre, resulting from the application of a vertical load of 1200 N load at that point. The fork is fixed in position only at the fork stem by a clamping device with minimum length of 75 mm. The steering stem axis is fixed horizontally with the crown race seat adjacent to the clamping device.

The deflection, δ, for the test fork for horizontal and vertical loading fatigue test impact test shall not exceed the value:

$$\delta \leq \frac{L^3}{\mathrm{K} \times 10\,000}$$

where

K is constant, is equal to 1 417;
L and δ are length and deflection in millimeters.

For example, for a fork length of 460 mm, the maximum acceptable fork deflection (δ) would be 6.9 mm. Similar for a fork length of 330 mm, the maximum is 2.5 mm.

4.10.2 *Frame — Impact Test (Falling Mass)*

4.10.2.1 *Test method*

Assemble a roller of mass less than or equal to 1 kg and with dimensions conforming to those shown in Fig. 23 in the fork. Hold the frame-fork assembly vertically with clamping to a rigid fixture by the rear-axle attachment points as shown in Fig. 23.

Rest a striker of mass 22.5 kg on the roller in the fork drop-outs and measure the wheel-base. Raise the striker to a height of 180 mm for category 1 and 360 mm for category 2 above the low-mass roller and release it to strike the roller at a point in line with the wheel centres and against the direction of the fork rake. The striker will bounce and this is normal. When the striker has come to rest on the roller, measure the wheel-base again.

4.10.2.2 *Requirement*

When tested by the method described in **4.10.2.1**, there shall be no visible cracks or fractures in the frame.

The permanent set measured between the axes of the wheel axles (the wheel-base, *see* **3.17** and Fig. 23) shall not exceed the following values:

a) 30 mm where a fork is fitted (when tested with the original combination of frame and fork);

b) 10 mm where a dummy fork is fitted in place of a fork (when tested as a component).

4.10.3 *Frame — Impact Test (Falling Frame)*

4.10.3.1 *Test method*

Conduct the test on the assembly used for the test specified in **4.10.2.2**.

As shown in Fig. 24, mount the frame-dummy fork assembly at its rear axle attachment points so that it is free to rotate about the rear axle in a vertical plane. Support the dummy fork on a flat steel anvil so that the frame is in its normal position of use. Securely fix masses of 10 kg, 30 kg, and 50 kg to the top of the steering head, the seat-post, and the bottom bracket respectively, as shown in Fig. 24.

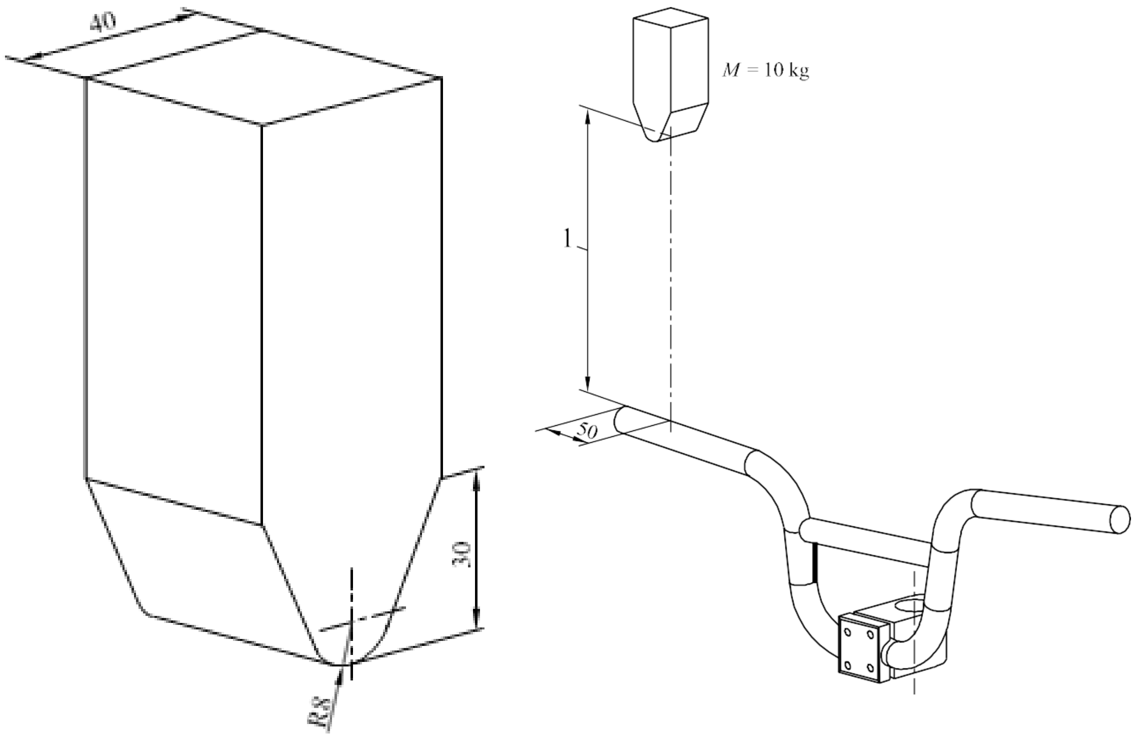


FIG. 22 HANDLEBAR/STEM ASSEMBLY IMPACT TEST — IMPACTOR

Measure the wheel-base with the three masses in place. Rotate the assembly about the rear axle until the distance between the low-mass roller and the anvil is 300 mm, and then allow the assembly to fall freely to impact on the anvil. Repeat the test and then measure the wheel-base again with the three masses in place and the roller resting on the anvil.

4.10.3.2 *Requirement*

When tested by the method described in **4.10.3.1**, there shall be no visible cracks or fractures in the frame and the permanent set of the wheel-base shall not exceed 60 mm.

4.10.4 *Frame — Fatigue Test with Pedalling Forces*

4.10.4.1 *Test method*

Mount the frame assembly on a base as shown in Fig. 25 with the dummy fork defined in **4.10.1** secured by its axle to a rigid mount of height R_w (the radius of the wheel/tyre assembly ± 30 mm) and with the hub free to swivel on the axle.

Secure the rear drop-outs by means of an axle to a stiff, vertical link of the same height as that of the front, rigid mount, the upper connection of the link being free to swivel about the axis of the axle but providing rigidity in a lateral plane, and the lower end of the link being fitted with a ball-joint.

Fi t a crank, chain-wheel or chain-wheel set and chain assembly or, preferably, a strong, stiff, adaptor assembly to the bottom-bracket as shown in Fig. 25 and described in **4.10.4.1** (a) or **4.10.4.1** (b) below:

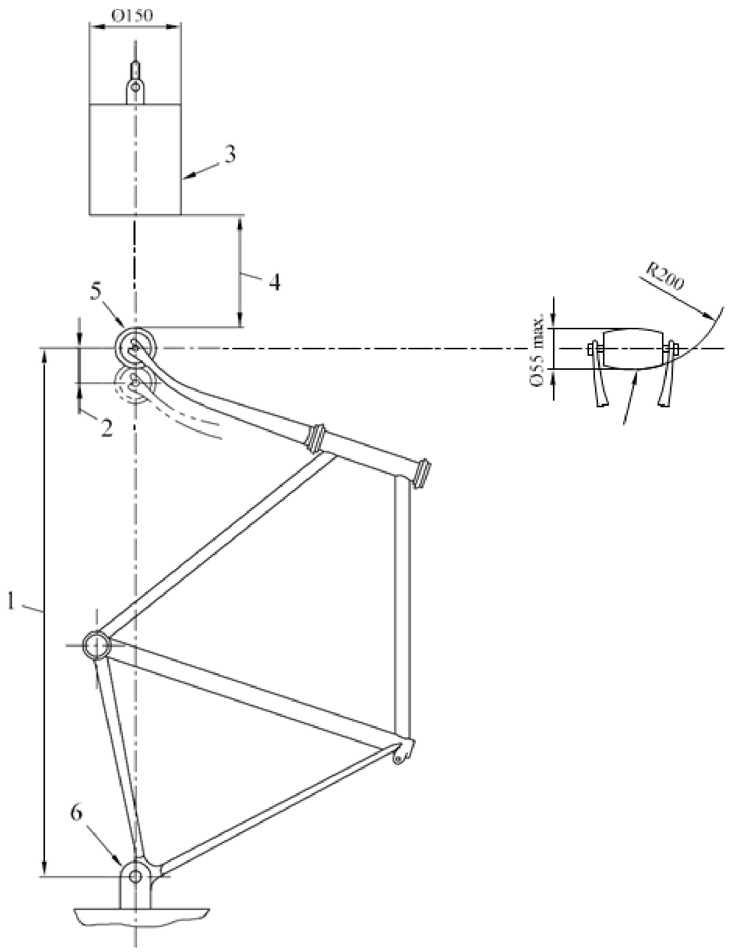
a) If a crank/chain-wheel assembly is used, incline both cranks forwards and downwards at an angle of 45° to the horizontal and secure the front end of the chain to the chain-wheel and attach the rear end of the chain to the rear axle and perpendicular to the axis of the axle.

b) If an adaptor is used as shown in Fig. 25 ensure that the assembly is free to swivel about the axis of the bottom-bracket and that both replacement arms are 175 mm long (L) and that they are both inclined forwards and downwards at an angle of (45 ± 2)° to the horizontal. Secure the position of the crank replacement arms by a vertical arm (which replaces the chain wheel) and a tie-rod which has ball-joints at both ends and which is attached to the rear axle perpendicular to the axis of the rear axle. The length of the vertical arm (R_c) shall be 75 mm, and the axis of the tie-rod shall be parallel to and 50 mm from the vertical plane through the centre-line of the frame.

If by design the axis of the tie-rod cannot be set parallel, minimize the angle.

Subject each dummy pedal-spindle to a repeated downward force of 900 N for category 1 and 1 200 N for category 2 at a position 150 mm from the centre-line of the frame in a vertical, transverse plane and inclined at 7.5º (accurate to within ± 0.5°) to the fore/aft plane of the frame as shown in Fig. 25.

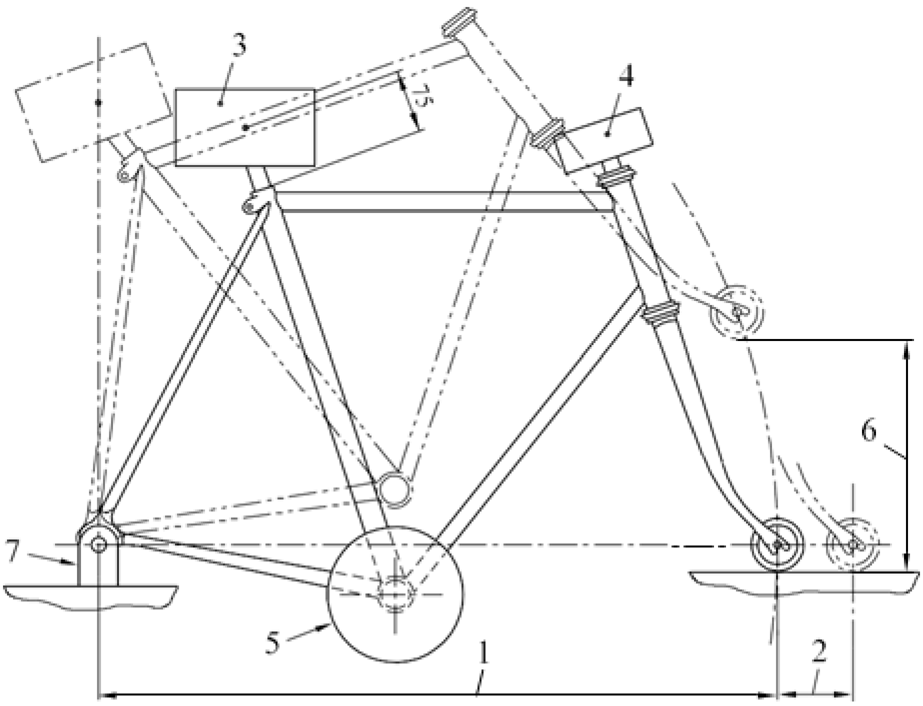
During application of these test forces, ensure that the force on a 'dummy pedal-spindle' falls to 5 percent or less of the peak force before commencing application of the test force to the other 'pedal-spindle'. Apply the test forces for 100 000 test cycles where one test cycle consists of the application and removal of the two test forces.



Key

1 Wheel-base
2 Permanent set
3 Striker (22.5 kg)
4 Drop height (360 mm)
5 Low mass roller (1 kg *Max*)
6 Rigid mounting for rear axle attachment point

FIG. 23 FRAME AND FRONT FORK ASSEMBLY — IMPACT TEST (FALLING MASS)



Key

1 Wheel-base
2 Permanent set
3 Mass (30 kg)
4 Mass (10 kg)
5 Mass (50 kg)
6 Drop height (300 mm)
7 Rigid mounting for rear axle attachment point

FIG. 24 FRAME: IMPACT TEST (FALLING FRAME)

4.10.4.2 *Requirement*

When tested by the method described in **4.10.4.1**, there shall be no visible cracks or fractures in the frame. For carbon-fibre frames, the peak deflections during the test at the points where the test forces are applied shall not increase by more than 20 percent of the initial values.

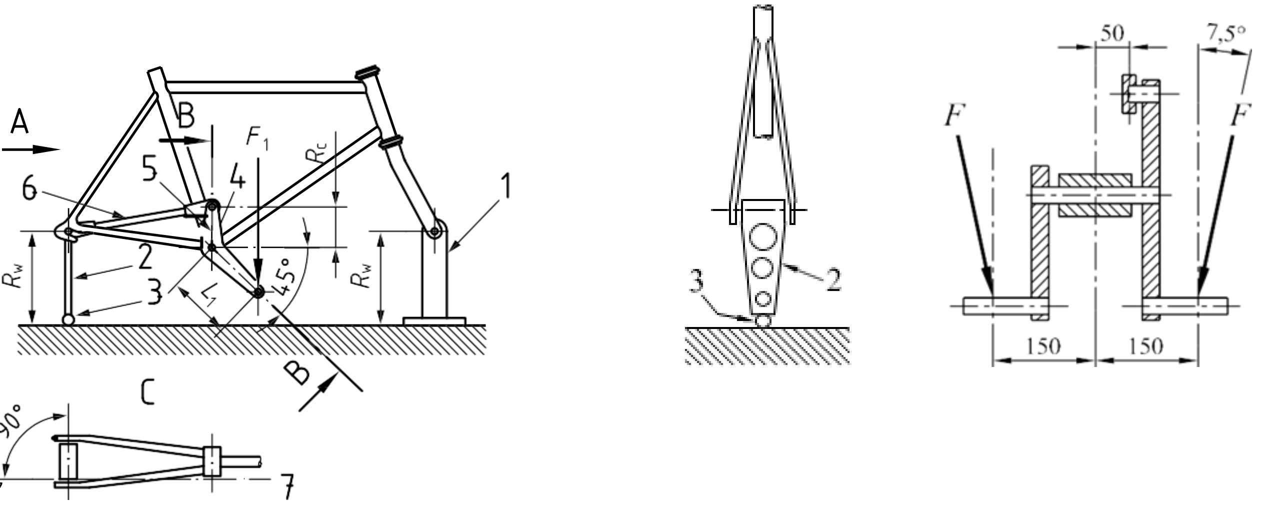
4.10.5 *Frame — Fatigue Test with Horizontal Forces*

4.10.5.1 *Test method*

Mount the frame in its normal attitude and secured at the rear drop-outs so that it is not restrained in a rotary sense, that is, preferably by the rear axle as shown in Fig. 26. Ensure that the axes of the front and rear axles are horizontally in line.

a) For Category 1: Apply cycles of dynamic, horizontal forces, F, of + 450 N in a forward direction and - 450 N in a rearward direction to the front fork drop-outs for 50 000 cycles as shown in Fig. 26, with the front fork constrained in vertical direction but free to move in a fore/aft direction under the applied forces.

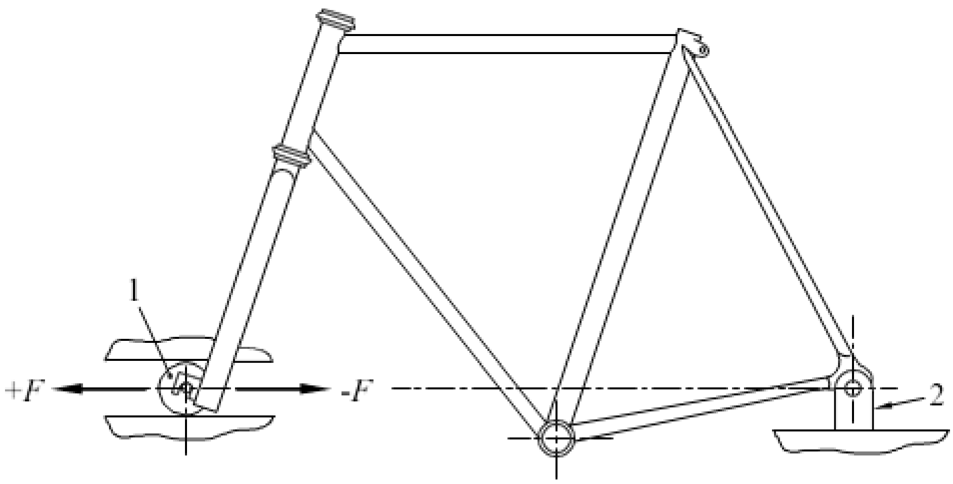
b) For Category 2: Apply cycles of dynamic, horizontal forces, F, of + 650 N in a forward direction and - 650 N in a rearward direction to the front fork drop-outs for 50 000 cycles as shown in Fig. 26 with the front fork constrained in vertical direction but free to move in a fore/aft direction under the applied forces.



Key

R_w height of rigid mount and vertical link
R_c length of vertical arm (75 mm)
L   length of crank replacement (175 mm)
1   Rigid mount
2   Verticl link
3   Ball-joint
4   Vertical arm
5   Tie-rod
6   Centre-line of tie-rod

FIG. 25 FRAME: FATIGUE TEST WITH PEDALLING FORCES



Key

1 Free-running guided roller
2 Rigid, pivoted mounting for rear axle attachment point

FIG. 26 FRAME: FATIGUE TEST WITH HORIZONTAL FORCES

4.10.5.2 *Requirement*

When tested by the method described in **4.10.5.1**, there shall be no visible cracks or fractures in the frame. For carbon-fibre frames, the peak deflections during the test in either direction from the mean position shall not increase by more than 20 percent of the initial values.

4.10.6 *Frame and Fork Assembly — Vibration Test*

4.10.6.1 *Test Method*

With a Frame-Fork assembly mounted on the stand so as the ground contact points of both intended wheels are horizontal as shown in Fig. 27, test shall be made by application of vertical up and downward vibrations under the conditions given in Table 4. The front wheel attachment shall be freely movable in the lengthwise orientation.

Using a seat pillar to be combined with the frame-fork assembly, fix the seat pillar at the position of the minimum insertion mark. Secure the saddle-shape support as shown in Fig. 27 onto the seat area and suspend the circular weights dividedly on both sides through the hanger metals so that the total mass of the weight support, hanger metals, and weights is applied to the seat assembly. The weight support shall be secured to the seat pillar on the axis at 20 mm below the upper extreme of the by a fastening metal. For a frame-fork assembly a combined seat pillar, the test may be performed by replacing the combined seat pillar with a unit pillar having the same. If the bar connecting the right-hand and left-hand weights contacts with the battery or other parts, test shall be performed with connecting bar removed. For applying load to the bottom bracket assembly, fix circular weight to the bottom bracket area dividedly on both sides. The weight support to which the weight is fixed shall not be heavier than 2 kg.

For applying load to the head assembly, fix the weight at the position where there is no clearance between the under surface of weight support (of mass not more than 0.5 kg) and the upper surface of the head lock nut by using a metal fitting as shown in Fig. 27. For a frame-fork assembly using a handlebar stem consisting of a stem only, in which the fork stem is clamped from outside, the test shall be performed with the weight fixed to the upper end of the fork stem by means of a jig which clamps the fork stem from outside or by means of handlebar stem.

The Frequency of vibration shall be selected arbitrarily in the range of 5 Hz to 12 Hz avoiding a resonance.

For testing a frame-fork assembly motor assist cycles, fix the battery, the drive unit, control unit or other that are to be mounted under the test conditions in Table 4, or weights of equivalent masses thereof, on positions where they are actually mounted so that the test assembly simulates the actual application of load on the frame-fork. In this case, the battery, drive unit and control unit themselves are not the subjects of evaluation for the vibration proof performance. When the drive unit housing or other of the frame-fork assembly for motor assist cycles constitute a of the frame-fork assembly, the test shall be with all such attached.

4.10.6.2 *Requirement*

When tested by the method described in **4.10.6.1** there shall be no visible fractures, deformation and distortion.

4.11 Fork

4.11.1 *Front Fork — Means of Location of the Axle and Wheel Retention*

The slots or other means of location for the wheel-axle within the front fork shall be such that when the axle or cones are firmly abutting the top face of the slots, the front wheel remains central within the fork. The front fork and wheel shall also fulfil the requirements of **4.12.4**.

4.11.2 *Front Fork — Static Bending Test*

4.11.2.1 *Test method*

Mount the fork in a fixture representative of the head-tube and gripped in the normal head-bearings and fit a loading-attachment and swivel on an axle located in the axle-slots of the blades (*see* Fig. 28). Locate a deflection measuring device under the loading-attachment in order to measure deflection and permanent set of the fork perpendicular to the stem axis and in the plane of the wheel.

Apply a static, pre-loading force of 100 N to the roller perpendicular to the stem axis, against the direction of travel, and in the plane of the wheel. Remove and repeat this loading until a consistent deflection reading is obtained. Adjust the deflection measuring device to zero. Increase the static force to 800 N for Category 1 and1 500 N for Category 2 and maintain this force for 1 min then reduce the force to 100 N and record any permanent set.

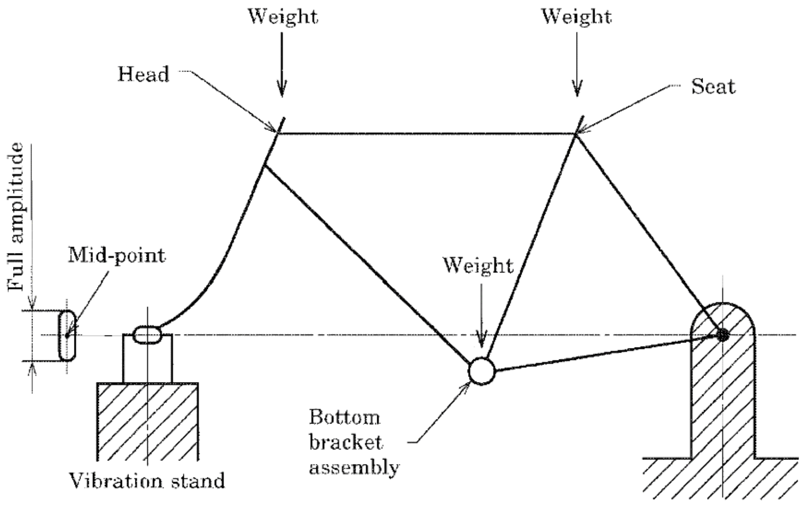
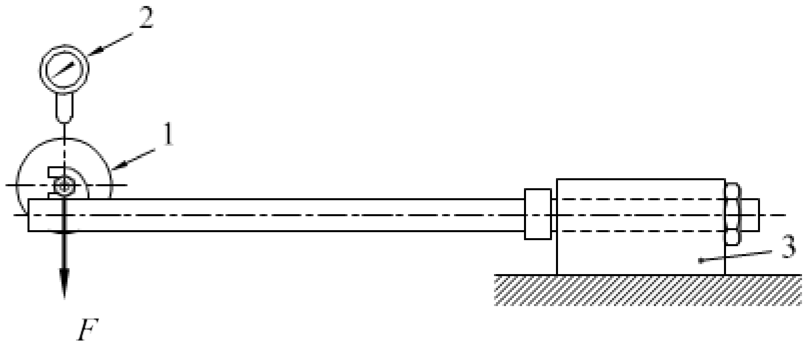


FIG. 27 VIBRATION TEST OF FRAME AND FORK ASSEMBLY

Table 4 Test Condition for Vibration Test of Frame — Fork Assembly

(*Clause* 4.10.6.1)

Sl No.	BMX Bicycle Category	Weight (mass) kg		Bottom Bracket Assembly	Total	Frequency of Vibration Hz	Acceleration of Vibrating Part m/s²	Number of Vibrations
		Head assembly	Seat assembly					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(i)	1	5	50	20	75	5 to 12	19.6	100 000
(ii)	2	10	50	25	85		22	150 000



Key

1 Loading-attachment to swivel on axle;
2 Deflection measuring device; and
3 Rigid mount incorporating head bearings.

FIG. 28 FRONT FORK: STATIC BENDING TEST (TYPICAL ARRANGEMENT)

4.11.2.2 *Requirement*

When tested by the method described in **4.11.2.1**, there shall be no fractures or visible cracks in any part of the fork, and the permanent set, measured as the displacement of the axis of the wheel-axle or simulated axle in relation to the axis of the fork-stem, shall not exceed 5 mm for Category 1 and 2.

4.11.3 *Front fork — Rearward impact test*

4.11.3.1 *Crown/stem joint assembled by welding or brazing*

4.11.3.1.1 *Test method*

Mount the fork in a fixture representative of the head-tube and gripped in the normal bearings as shown in Fig. 29. Assemble a roller of mass less than 1 kg and with dimensions conforming to those shown in Fig. 23 in the fork.

Rest a striker of mass 22.5 kg on the roller in the fork drop-outs such that it is exerting a force against the direction of travel and in the plane of the wheel. Position a deflection measuring device under the roller and record the position of the underside of the roller in a direction perpendicular to the axis of the fork-stem and in the plane of the wheel and note the vertical position of the fork.

Remove the deflection measuring device, raise the striker through a height (d) of 180 mm for Category 1 and 360 mm for Category 2 and release it to strike the roller against the rake of the fork. The striker will bounce and this is normal. When the striker has come to rest on the roller, measure the permanent set under the roller.

4.11.3.1.2 *Requirement*

When tested by the method described in **4.11.3.1.1**, there shall be no fractures or visible cracks in any part of the fork, and the permanent set, measured as the displacement of the axis of the wheel-axle or simulated axle in relation to the axis of the fork-stem, shall not exceed 45 mm for Category 1 and 2.

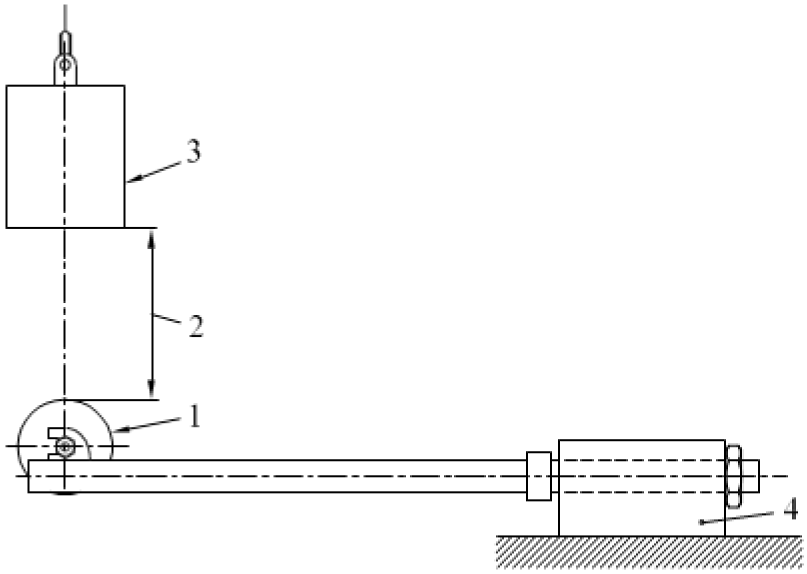
4.11.3.2 *Crown/stem joint assembled by press-fitting, bonding, or clamping*

4.11.3.2.1 *Test method*

a) Test as described in **4.11.3.1.1** shall be undertaken for both categories.

b) For categories 2 only, a second test similar to that described in **4.11.3.1.1** with drop height of 600 mm, shall also be undertaken.

c) Apply a torque of 80 Nm applied and maintained for 1 min in each direction of possible rotation about the stem axis.



Key

1 Low-mass roller (*see* Fig. 23)
2 Drop height: 180 mm for Category 1 360 mm Category 2
3 Striker (22.5 kg)
4 Rigid mount incorporating head bearing

FIG. 29 FRONT FORK— REARWARD IMPACT TEST

4.11.3.2.2 *Requirement*

When tested by the method described in **4.11.3.2.1** (a), if there are any fractures or visible cracks in any part of the fork, and the permanent set, measured as the displacement of the axis of the wheel-axle or simulated axle in relation to the axis of the fork-stem, exceeds 45 mm for Category 1 and 2, the fork shall be considered to have failed.

For the Category 2 if the fork meets these criteria, then it shall be subjected to a second test as described in **4.11.3.2.1** (b), after which, it shall exhibit no fractures or visible cracks.

For both categories, there shall be no relative movement between the stem and the crown when the assembly is subjected to **4.11.3.2.1** (c).

4.11.4 *Front Fork — Bending Fatigue Test*

4.11.4.1 *Test method*

Mount the fork in a fixture representative of the head-tube and gripped in the normal bearings as shown in Fig. 30.

Apply cycles of fully reversed, dynamic force, F, of ± 450 N for category 1 and ± 650 N for Category 2 in the plane of the wheel and perpendicular to the stem-tube to a loading attachment and swivel on an axle located in the axle-slots of the blades for 100 000 test cycles.

4.11.4.2 *Requirement*

When tested by the method described in **4.11.4.1**, there shall be no fractures or visible cracks in any part of the fork. For carbon-fibre forks, the peak deflections during the test in either direction from the mean position shall not increase by more than 20 percent of the initial values.

4.12 Wheels and Wheel/Tyre Assemblies

4.12.1 *Rotational Accuracy*

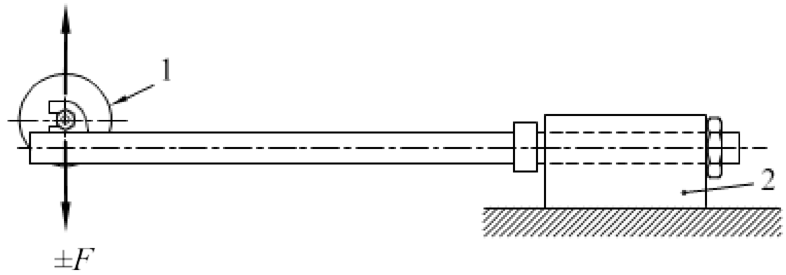
4.12.1.1 *General*

Rotational accuracy shall be as defined in IS 8000 (Part 1)/ISO 1101 in terms of axial run-out tolerance (lateral). The run- out tolerances given in **4.12.1.2** and **4.12.1.3** represent the maximum variation of position of the rim, that is, full indicator reading of a fully assembled and adjusted wheel during one complete revolution about the axle without axial movement.

For measurement of axial run-out the wheel shall be fitted with a tyre inflated to the maximum pressure as moulded on the tyre. Concentricity may be checked with or without the tyre.

4.12.1.2 *Wheel/tyre assembly — Concentricity tolerance*

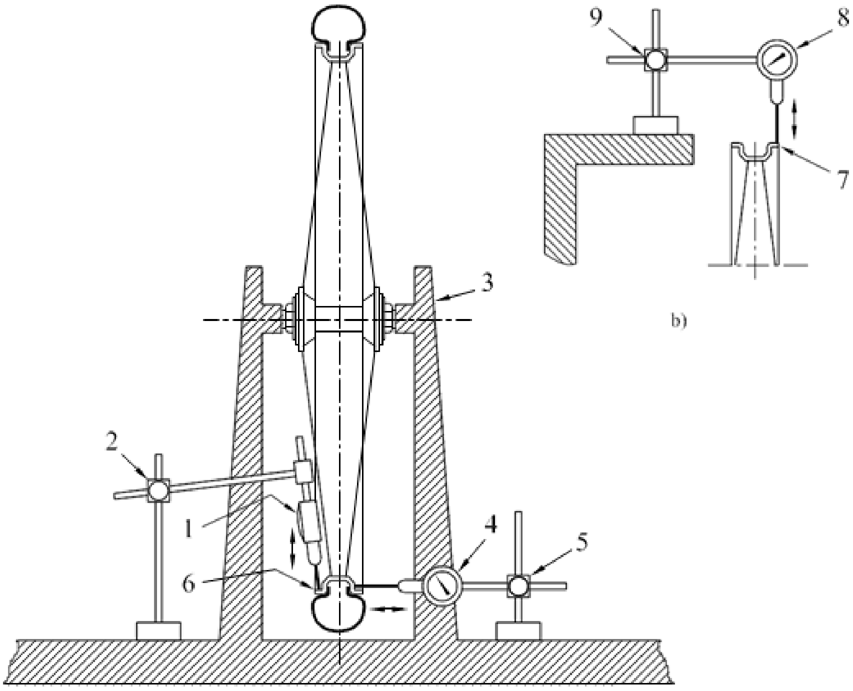
For wheels intended for rim-brakes, the run-out shall not exceed 1 mm when measured perpendicular to the axle at a suitable point along the rim (*see* Fig. 31).



Key

1 Pivoted force application device
2 Rigid mount incorporating head bearings

FIG. 30 FRONT FORK — BENDING FATIGUE TEST



Key

a) rim with tyre
b) rim without tyre
1 Dial-gauge (concentricity)
2 Instrument stand
3 Hub axle support
4 Dial-gauge (lateral run-out)
5 Instrument stand
6 Rim with tyre
7 Rim without tyre
8 Dial gauge (concentricity) (alternative position)
9 Instrument stand

FIG. 31 WHEEL/TYRE ASSEMBLY — CONCENTRICITY AND LATERAL TOLERANCE

4.12.1.3 *Wheel/tyre assembly — Lateral tolerance* For wheels intended for rim-brakes, the run-out shall not exceed 1 mm when measured parallel to the axle at a suitable point along the rim (*see* Fig. 31).

4.12.2 *Wheel/Tyre Assembly — Clearance*

Alignment of the wheel/tyre assembly in a bicycle shall allow not less than 6 mm clearance between the tyre and any frame or fork element.

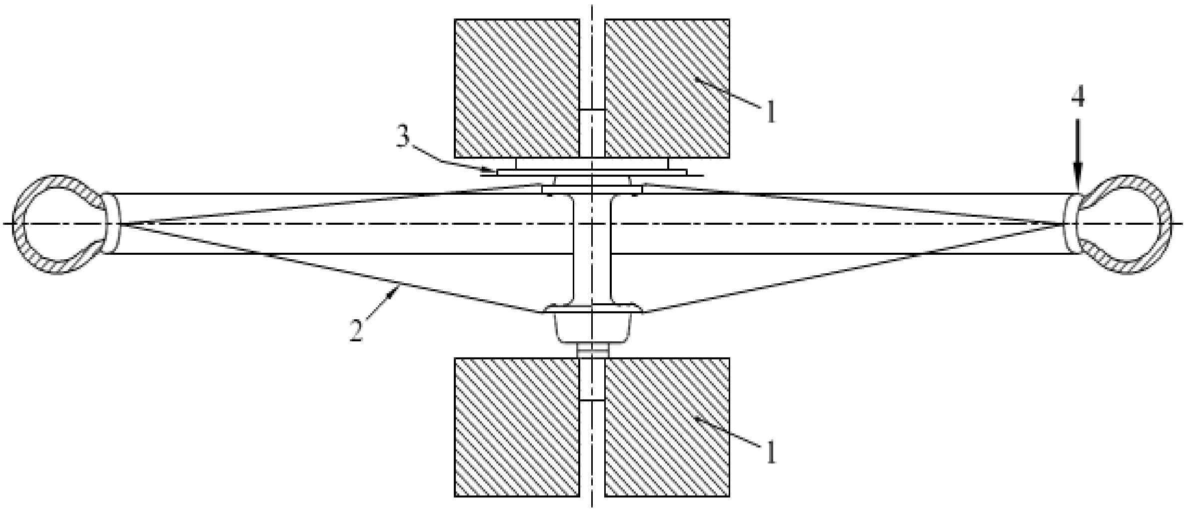
4.12.3 *Wheel/Tyre Assembly — Static Strength test*

4.12.3.1 *Test method*

Clamp and support the wheel suitably as shown in Fig. 32. Apply a 50 N pre load at one point on the rim, perpendicular to the plane of the wheel. Adjust the deflection measuring device to zero. Increase the static force according to Table 5. Apply the force once only for a duration of 1 min. In the case of a rear wheel apply the force from the sprocket side of the wheel as shown in Fig. 32.

4.12.3.2 *Requirement*

When a fully assembled wheel fitted with a tyre inflated to the maximum pressure as permanently marked on the tyre is tested by the method described in **4.12.3.1**, there shall be no failure of any of the components of the wheel, and the permanent set, measured at the point of application of the force on the rim, shall not exceed 1.5 mm for both categories.



Key

1 Clamping fixture
2 Wheel/tyre assembly
3 Drive sprocket
4 -Load

FIG. 32 WHEEL/TYRE ASSEMBLY: STATIC STRENGTH TEST

Table 5 Static Forces

(*Clause* 4.12.3.1)

Loading	Category 1	Category 2
	300 N	500 N

4.12.4 *Wheel Retention*

4.12.4.1 *General*

Wheel retention safety is related to the combination of wheel, retention device, and drop-out design. Wheels shall be secured to the bicycle frame and fork such that, when adjusted to the manufacturer's recommendations, they comply with **4.12.4.2**, **4.12.4.3** and **4.12.4.4**.

4.12.4.2 *Front Wheel Retention - Retention Devices Secured*

4.12.4.2.1 *Test method*

Apply a force of 2 300 N distributed symmetrically to both ends of the axle for a period of 1 min in the direction of the removal of the wheel.

4.12.4.2.2 *Requirement*

When tested by the method described in **4.12.4.2.1**, there shall be no relative motion between the axle and the front fork.

4.12.4.3 *Rear Wheel Retention - Retention Devices Secured*

4.12.4.3.1 *Test method*

Apply a force of 2 300 N distributed symmetrically to both ends of the axle for a period of 1 min in the direction of the removal of the wheel.

4.12.4.3.2 *Requirement*

When tested by the method described in **4.12.4.3.1**, there shall be no relative motion between the axle and the frame.

4.12.4.4 *Front Wheel Retention — Retention Devices Unsecured*

Where threaded axles and nuts are fitted, and the nuts are unscrewed by at least 360º from the finger tight condition and the brake system disconnected or released, the wheel shall not detach from the fork when a force of 100 N is applied radially outwards for a period of 1 min, in line with the drop-out slots.

4.13 Rims, Tyres and Tubes

4.13.1 *General*

Non-pneumatic tyres are excluded from the requirements of **4.13.2** and **4.13.3**.

4.13.2 *Tyre Inflation Pressure*

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

NOTE — It is recommended that the minimum inflation pressure specified by the manufacturer also be permanently marked on the sidewall of the tyre.

4.13.3 *Tyre and Rim Compatibility*

The tyre, tube and tape shall be compatible with the rim design.

When inflated to 150 percent of the maximum inflation pressure for a period of not less than 5 min, the tyre shall remain intact on the rim.

NOTE — Tyres should comply with the requirements of ISO 5775-1 and rims should comply with the requirements of ISO 5775-2. In the absence of suitable information from these International Standards, other publications may be used.

4.13.4 *Rim-Wear*

In the case where the rim forms part of the braking system and there is a danger of failure due to wear, the manufacturer shall make the rider aware of this danger by durable and legible marking on the rim in an area not obscured by the tyre [*see* **5** (r) and **6.1**].

4.13.5 *Wheel/Tyre Assembly – Impact Test*

4.13.5.1 *Test method*

The wheels shall be fitted with a tyre inflated to the lowest pressure as moulded on the tyre or 80 percent of the maximum tyre pressure if the lowest pressure is not indicated.

The impactor shall have a flat surface covering the foot print of the tyre during impact with mass of 225 kg.

NOTE — For example, a plate of (200 x 200) mm is appropriate.

The impact shall be carried out at the weakest point on the wheel, that is, rim joint. For plastic wheels, the test shall be performed at mid-span including the valve hole (*see* Fig. 33).

4.13.5.2 *Requirement*

On impact, inner tube (if present) or tyre shall not burst when tested by the method described in **4.13.5.1**.

NOTE — Instantaneous deflation is considered as a burst.

On impact no element of the wheel shall become detached or expelled outwards. If the wheel breaks, it shall not present any shattered, or any sharp or serrated surfaces that could harm users and shall not cause the hub to become separated from the rim in such a way that the wheel becomes detached from the forks.

4.14 Pedals and Pedal/Crank Drive System

4.14.1 *Pedal Tread*

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

Any protrusion from the base of the tread surfaces which is made by screws shall be limited to a length of one major diameter of the screw beyond the internally threaded mating part.

Any other protrusion less than 8 mm in length shall terminate in a rounding-off radius not less than 2 mm.

4.14.2 *Pedal Clearance*

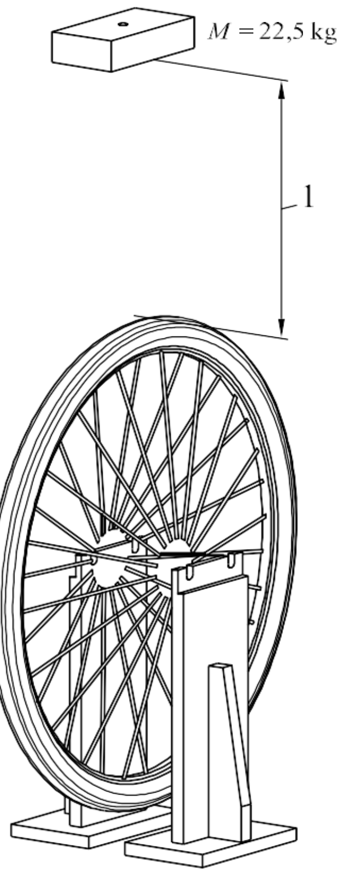
4.14.2.1 *Ground clearance*

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.

Table 6 Mass of the Impactor and Falling Height

(*Clause* 4.13.5 *and* Fig. 33)

	Category 1	**Category 2**
Mass (kg)	22.5	
Drop height (mm)	400	1 000



Key

1 Drop height (*see* Table 6)

FIG. 33 WHEEL/TYRE ASSEMBLY IMPACT TEST RIG

4.14.2.2 *Toe Clearance*

Bicycles shall have at least 100 mm clearance between the pedal and front tyre. 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 when turned either side of the forward riding direction (*see* Fig. 34).

4.14.3 *Pedal/Pedal-Spindle Assembly — Static Strength Test*

4.14.3.1 *Test method*

Screw the pedal-spindle securely into a suitable rigid fixture with its axis horizontal, as shown in Fig. 35, and apply a vertically-downward force of 1 500 N for 1 min to the centre of the pedal as shown in Fig. 35. Release the force and examine the pedal assembly and the spindle.

4.14.3.2 *Requirement*

When tested by the method described in **4.14.3.1**, there shall be no fractures, visible cracks, or distortion of the pedal or spindle that could affect the operation of the pedal and pedal-spindle.

4.14.4 *Pedal/Pedal-Spindle — Dynamic Durability Test*

4.14.4.1 *Test method*

Screw each pedal securely into a threaded hole in a rotatable test-shaft as shown in Fig. 36 and suspend a mass of 90 kg at the centre of the pedal-width by means of a tension-spring to each pedal as shown in Fig. 36, the object of the springs being to minimize oscillations of the load. Drive the shaft at a speed not exceeding 100 min^{-1} for a total of 100 000 revolutions. If the pedals are provided with two tread surfaces, rotate them through 180º after 50 000 revolutions.

4.14.4.2 *Requirement*

When tested by the method described in **4.14.4.1**, there shall be no fractures or visible cracking of any part of the pedal, the pedal-spindle nor any failure of the bearing system.

4.14.5 *Crank/Pedal Assembly Impact Test and Plastic Pedal Impact Test*

4.14.5.1 *Crank/Pedal assembly impact test*

4.14.5.1.1 *Test method*

Mount the pedal assembly and crank in a fixture with a housing representative of the bottom-bracket with the crank axis vertical and the pedal axis horizontal as shown in Fig. 37. Impact the pedal at its centre with an impact force of 100 J.

The impactor shall be according to Fig. 22.

4.14.5.1.2 *Requirements*

When tested by the method described in **4.14.5.1.1**, there shall be no fractures or visible cracking of any part of the crank, pedal, the pedal-spindle or any failure of the bearing system.

4.14.5.2 *Plastic Pedal Impact Test*

4.14.5.2.1 Test method

Screw the pedal securely into a suitable rigid fixture with its axis horizontal as shown in Fig. 38 and release the impactor of the design shown in Fig. 22 for achieving the appropriate energy.

4.14.5.2.2 *Requirements*

When tested by the method described in **4.14.5.2.1** there shall be no fractures or visible cracking of any part of the pedal body.

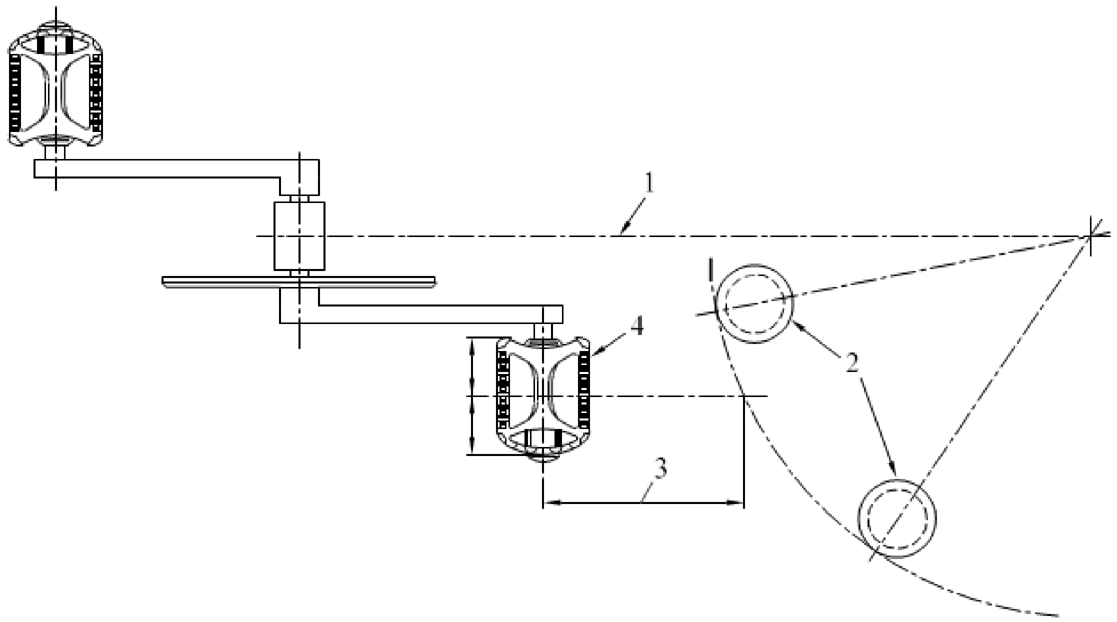
4.14.6 *Drive-System — Static Strength Test*

4.14.6.1 *Test method*

Conduct the drive system static load test on an assembly comprising the frame, pedals, transmission system, rear wheel assembly. Support the frame with the central plane vertical and with the rear wheel held at the rim to prevent the wheel rotating.

With the left-hand crank in the forward, horizontal position, apply a force, F, increasing progressively to 1 500 N vertically downwards to the centre of the left-hand pedal. Maintain this force for 1 min. should the system yield or the drive-sprockets tighten such that the crank rotates while under load to a position more than 30º below the horizontal, remove the test force, return the crank to the horizontal position or some appropriate position above the horizontal to take account of yield or movement and repeat the test.

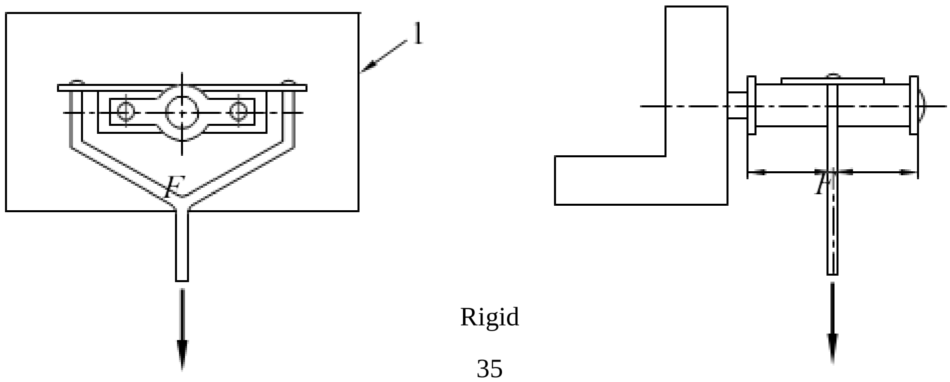
On completion of the test on the left-hand crank, repeat the test with the right-hand crank in the forward position and with the force applied to the right-hand pedal.



Key

1 Longitudinal axis
2 Front tyre
3 Clearance
4 Pedal

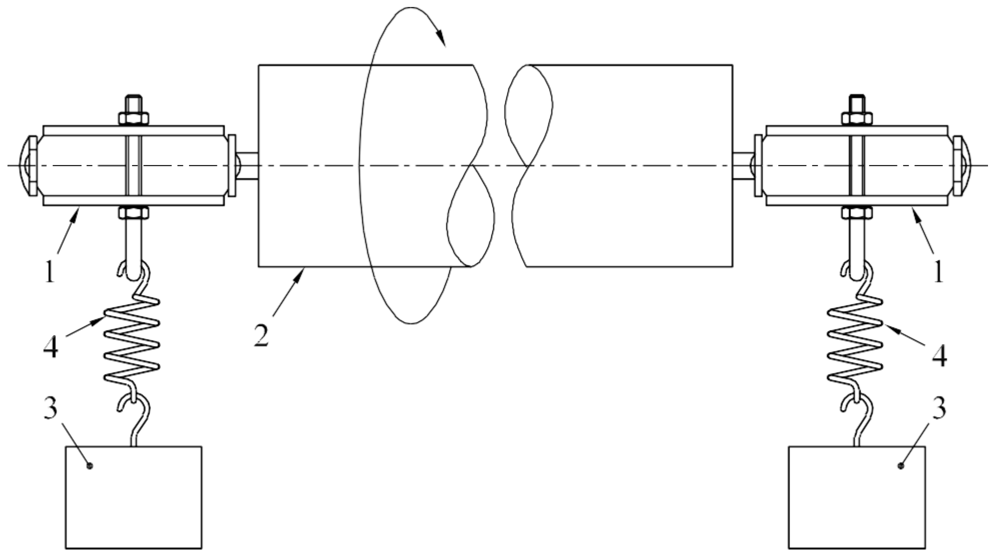
FIG. 34 PEDAL TO WHEEL TOE CLEARANCE



Rigid mount

35

FIG. 35 PEDAL/PEDAL-SPINDLE ASSEMBLY: STATIC STRENGTH TEST



Key

1 Pedal
2 Test-shaft
3 Mass (90 kg)
4 Tension-spring

FIG. 36 PEDAL/PEDAL-SPINDLE: DYNAMIC DURABILITY TEST

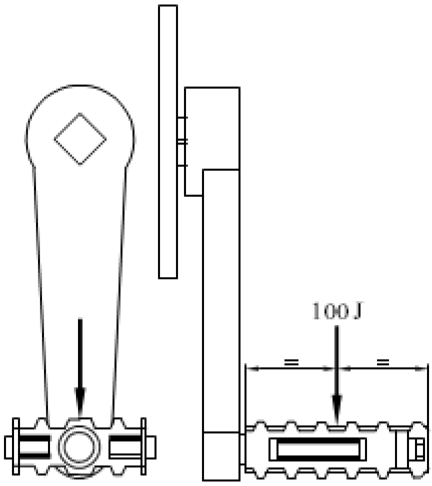


FIG. 37 CRANK/PEDAL BODY IMPACT TEST — APPLICATION OF THE IMPACT FORCE

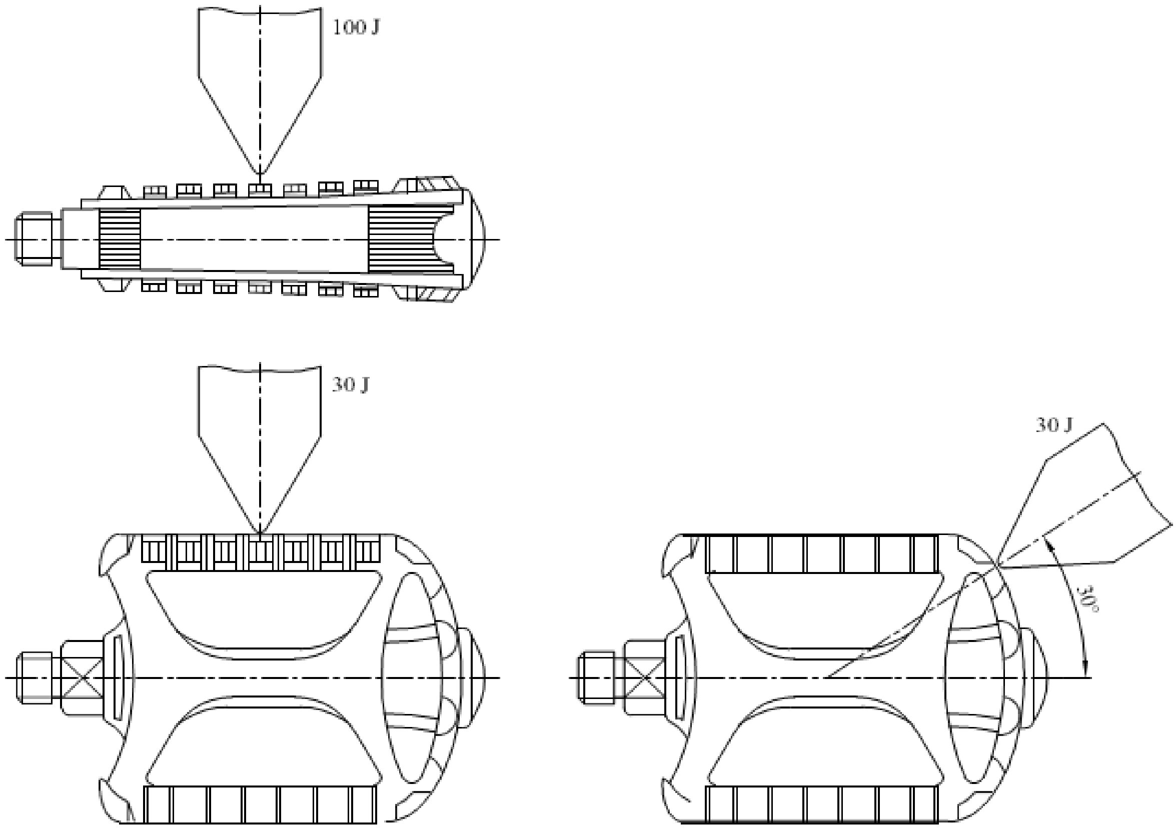


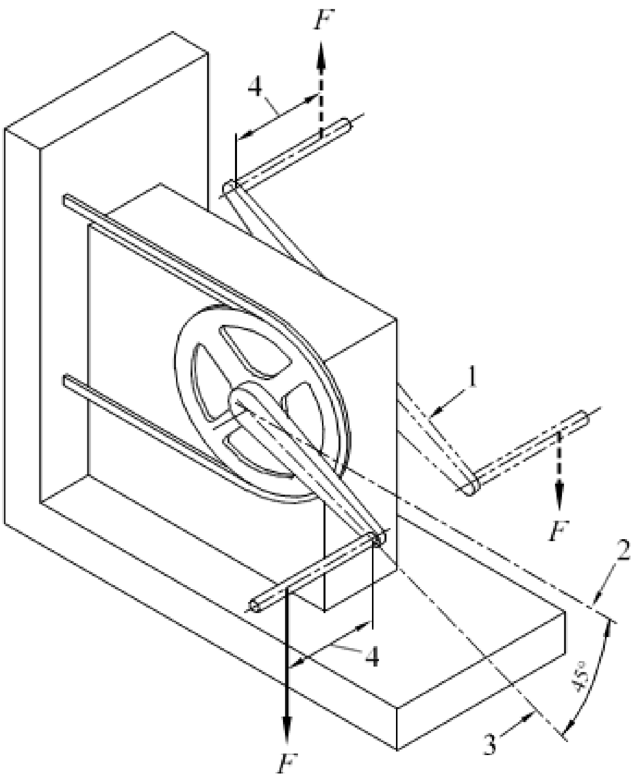
FIG. 38 APPLICATION OF THE IMPACTS

4.14.7.2 *Test method with the cranks at* 45 *degrees to the horizontal*

Mount the assembly of the two pedal spindle adaptors, the two cranks, the chain-wheel set (or other drive component), and the bottom-bracket spindle located on its normal-production bearings in a fixture with bearing-housings representative of the bottom-bracket, as shown in Fig. 39. Incline the cranks at 45º to the horizontal. Prevent rotation of the assembly by locating a suitable length of drive-chain around the largest or only chain-wheel and securing it firmly to a suitable support, or, for any other type of transmission (for example, belt- or shaft-drive) by securing the first stage of the transmission.

NOTE — It is permissible to have the left crank in either of the two positions shown in Fig. 39, provided the test force is applied in the appropriate direction as specified in the next paragraph.

Apply repeated, vertical, dynamic forces of 1 300 N alternately to the pedal-spindles of the left and right-hand cranks at a distance of 65 mm from the outboard face of each crank (as shown in Fig. 39) for 50 000 cycles (where one test cycle consists of the application of the two forces). The direction of the force on the right-hand crank shall be downwards and that on the left-hand crank shall be upwards for a rearward-pointing crank or downwards for a forward-pointing crank. During applications of these test forces, ensure that the force on a pedal-spindle falls to 5 percent or less of the peak force before commencing application of the test force to the other pedal-spindle.



Key

1 Alternative left crank arrangement
2 Horizontal axis
3 Axis of crank
4 Distance from outboard face of crank (65 mm)

FIG. 39 CRANK ASSEMBLY: FATIGUE TEST WITH CRANKS AT 45O (TYPICAL TEST ARRANGEMENT)

4.14.7.3 *Test method with the cranks at* 30° *to the horizontal*

Mount the assembly of the two pedal spindle adaptors, the two cranks, the chain-wheel cluster (or other drive component), and the bottom-bracket spindle located on its normal-production bearings in a fixture with bearing-housings representative of the bottom-bracket, as shown in Fig. 40. Incline the cranks at 30º to the horizontal as shown in Fig. 40. Restrain the left-hand crank to the base of the test machine by a device attached to the pedal-spindle at a distance of 65 mm from the outboard face of the crank. Apply a repeated, vertically-downward, dynamic force, F, of 1 300 N to the pedal-spindle of the right-hand crank at a distance of 65 mm from the outboard face of the crank (*see* Fig. 40) for 50 000 cycles.

4.14.7.4 *Requirement*

When tested by the methods described in **4.14.7.2** and **4.14.7.3**, there shall be no fractures or visible cracks in the cranks, the bottom-bracket spindle or any of the attachment features, or loosening or detachment of the chain-wheel from the crank. For carbon-fibre cranks, the peak deflection of either crank during the test shall not increase by more than 20 percent of the initial value.

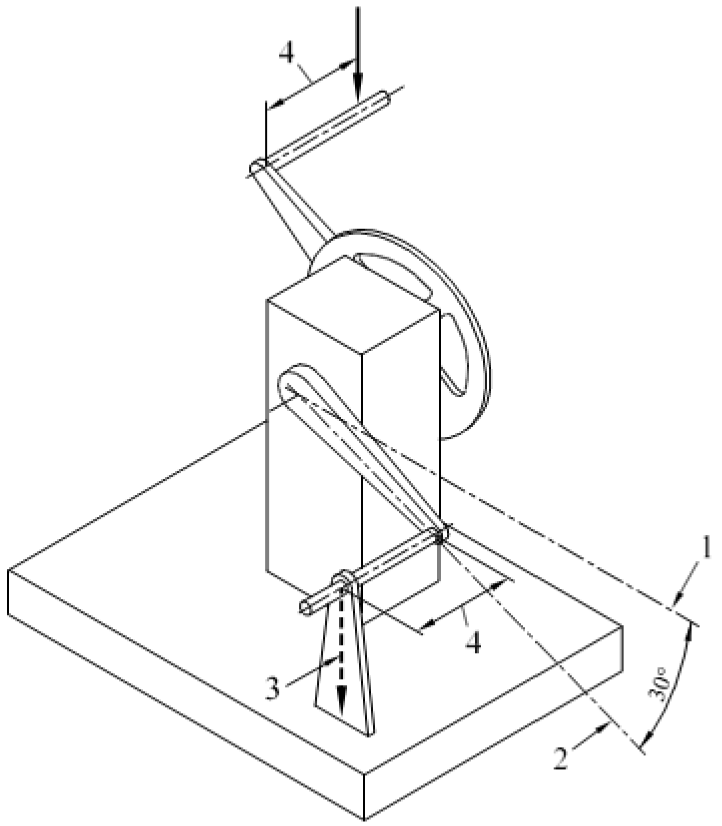
4.15 Saddle and Seat-Pillars

4.15.1 *General*

All strength tests involving the saddle or any plastic materials shall be performed at an ambient temperature in the range 20 ºC ± 5 °C.

4.15.2 *Limiting Dimensions*

No part of the saddle, saddle supports, or accessories 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-pillar axis.



Key

1 Horizontal axis
2 Axis of crank
3 Reactive force (equal and opposite to test force)
4 Distance from outboard face of crank (65 mm)

FIG. 40 CRANK ASSEMBLY: FATIGUE TEST WITH CRANKS AT 300 (TYPICAL TEST ARRANGEMENT)

4.15.3 *Seat-pillar — Insertion-Depth Mark or Positive Stop*

The seat-pillar shall be provided with one of the two following alternative means of ensuring a safe insertion-depth into the frame:

a) It shall contain a permanent, transverse mark of length not less than the external diameter or the major dimension of the cross-section of the seat-pillar that clearly indicates the minimum insertion-depth of the pillar into the frame. For a circular cross-section, the mark shall be located not less than two diameters of the pillar from the bottom of the pillar, that is, where the diameter is the external diameter. For a non-circular cross-section, the insertion-depth mark shall be located not less than 65 mm from the bottom of the pillar, that is, where the seat-pillar has its full cross-section).

b) It shall incorporate a permanent stop to prevent it from being drawn out of the frame such as to leave the insertion less than the amount specified in **4.15.3** (a) above.

4.15.4 *Saddle/Seat Pillar — Security Test*

4.15.4.1 *Saddles with Adjustment-Clamps*

4.15.4.1.1 *Test method*

With the saddle and seat-pillar correctly assembled to the bicycle frame, and the clamps tightened to the torque recommended by the bicycle manufacturer, apply a force of 650 N vertically downwards at a point 25 mm from the front and the rear of the saddle at its maximum rearward and forward position in the clamp whichever produces the greater torque on saddle-clamp.

Remove this force and apply a lateral force of 250 N horizontally at a point 25 mm from either the front or rear of the saddle, whichever produces the greater torque on the clamp (*see* Fig. 41).

4.15.4.1.2 *Requirement*

When tested by the method described in **4.15.4.1.1**, there shall be no movement of the saddle adjustment clamp in any direction with respect to the pillar, or of the pillar with respect to the frame.

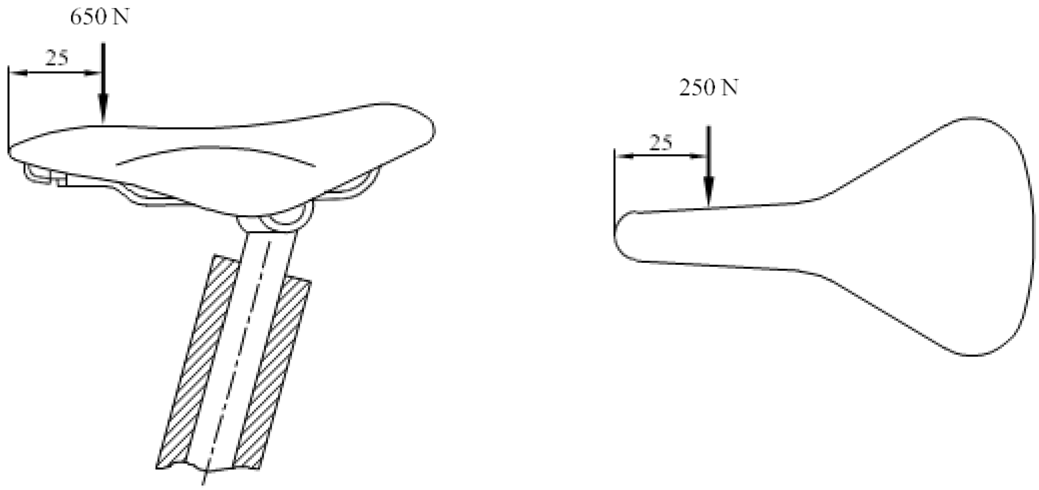
4.15.4.2 *Saddles without Adjustment-Clamps*

Saddles which are not clamped, but are designed to pivot in a vertical plane with respect to the pillar, shall be tested by the method described in **4.15.4.1.1**.and shall be allowed to move within the parameters of the design without failure of any components.

4.15.5 *Saddle-Static strength test*

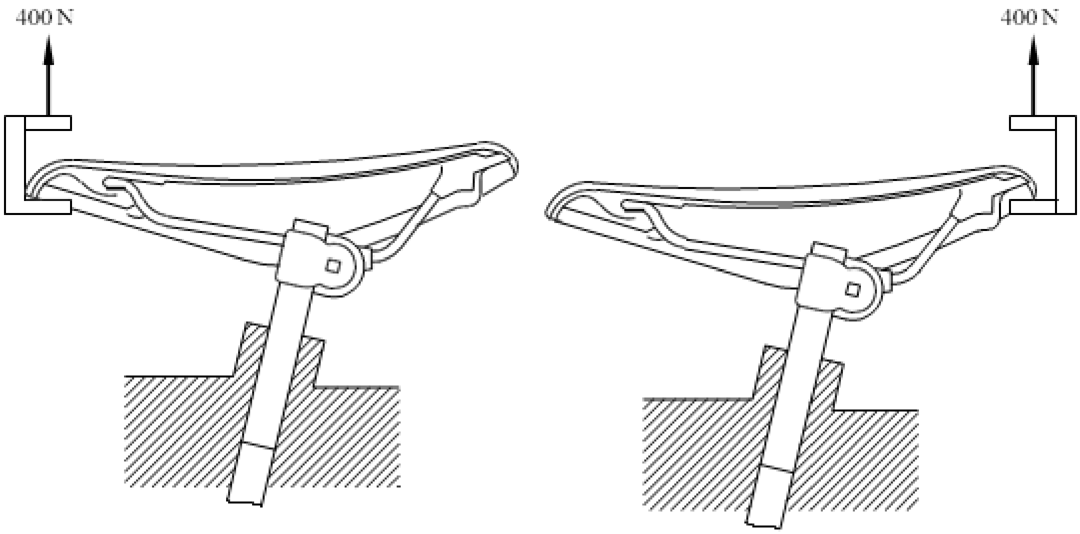
4.15.5.1 *Test method*

With the saddle clamped to a suitable fixture representative of a seat-pillar and the clamps tightened to the torque recommended by the bicycle manufacturer, apply forces of 400 N in turn under the rear and nose of the saddle cover longitudinal plane, as shown in Fig. 42, ensuring that the force is not applied to any part of the chassis of the saddle.



a) VERTICAL FORCE b) HORIZONTAL FORCE

FIG. 41 SADDLE/SEAT-PILLAR: SECURITY TEST



a) FORCE UNDER NOSE b) FORCE UNDER REAR

FIG. 42 SADDLE — STATIC STRENGTH TEST

4.15.5.2 *Requirement*

When tested by the method described in **4.15.5.1**, the saddle cover and/or plastic moulding shall not disengage from the chassis of the saddle, and there shall be no cracking or permanent distortion of the saddle assembly.

4.15.6 *Saddle and Seat-Pillar Clamp — Fatigue Test*

4.15.6.1 *General*

Seat-pillars can influence test failures of saddles and, for this reason, a saddle shall always be tested in combination with a seat-pillar of a type recommended by the saddle manufacturer.

4.15.6.2 *Test method*

Insert the seat-pillar to its minimum insertion depth (*see* **4.15.3**) in a rigid mount representative of that on the bicycle and with its axis at 73º to the horizontal. Mount the saddle on the seat-pillar, adjust the saddle to have its upper surface in a horizontal plane and to be at its maximum rearward position in the clamp, and tighten the clamp to the torque recommended by the bicycle manufacturer. Apply a repeated, vertically-downward force F of 1 000 N for 100 000 cycles, in the position shown in Fig. 43 by means of a suitable pad shown in Fig. 43 to prevent localized damage of the saddle cover. The test frequency shall not exceed 4 Hz.

4.15.6.3 *Requirement*

When tested by the method described in **4.15.6.2**, there shall be no fractures or visible cracks in the seat-pillar or saddle, and no loosening of the clamp.

4.15.7 *Seat-Pillar Clamp-Static Test*

4.15.7.1 *Test method*

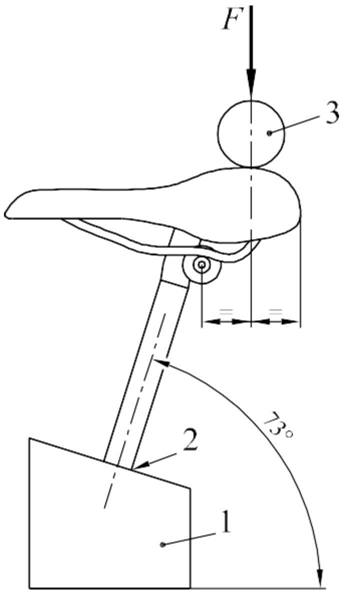
Mount the frame in its normal attitude and secured at the rear drop-outs so that is not restrained in a rotary direction (that is, preferably by the rear axle) as shown in Fig. 44. Fit a suitable roller to the front axle in order to permit the frame to flex in a fore/aft sense under the test forces.

Insert the seat-pillar to its minimum insertion depth in the frame. Mount the saddle on the seat-pillar, adjust the saddle to have its upper surface in a horizontal plane and to be at its maximum rearward position in the clamp, and tighten the clamp to the torque recommended by the bicycle manufacturer. Apply for 1 min a vertically- downward force of 800 N for category 1 and 1 300 N for category 2, at 25 mm from the rear of the saddle by means of a cylinder (diameter 80 mm).

4.15.7.1 *Requirements*

When tested by the method described in **4.15.7.1**, no cracks or fracture shall appear in the saddle assembly. No movements shall appear between saddle and seat pillar, seat pillar and frame.

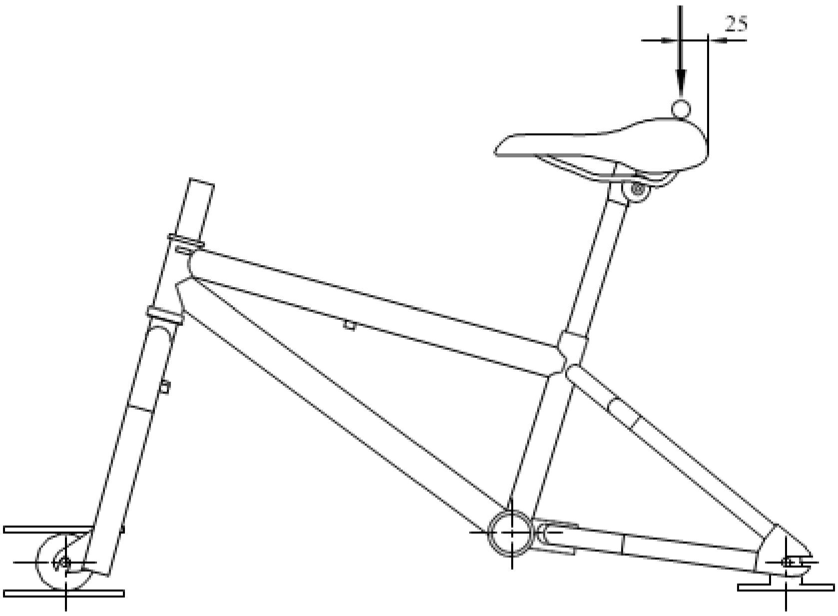
Permanent distortion is acceptable provided that the saddle assembly does not exhibit complete failure.



Key

1 Rigid mount
2 Minimum insertion depth
3 Pad (length = 300 mm, diameter = 80 mm)

FIG. 43 SADDLE AND SEAT-PILLAR CLAMP: FATIGUE TEST



Key

1 Category 1: 800 N, Category 2: 1 300 N

FIG. 44 SEAT PILLAR STATIC TEST

4.16 Drive-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 conform to the mechanical requirements of IS 15511/ISO 9633.

4.17 Chain Guard

4.17.1 *Requirement*

A bicycle shall be equipped with one of the following:

a) A chain-wheel disc which conforms to **4.17.2**; or

b) A protective device which conforms to **4.17.3**.

4.17.2 *Chain-wheel disc diameter*

A chain-wheel disc shall exceed the diameter of the outer chain-wheel, when measured across the tips of the teeth, by not less than 10 mm (*see* Fig. 45).

NOTE — Where the design is such that the pedal-crank and chain-wheel are too close together to accommodate a full disc, a partial disc can be fitted which closely abuts the pedal-crank.

4.17.3 *Chain Protective Device*

A protective device shall, as a minimum, shield the side-plates and top surface of the chain and the chain- wheel for a distance of at least 25 mm rearwards along the chain from the point where the chain-wheel teeth first pass between the side-plates of the chain and forwards round the outer chain-wheel to a horizontal line passing through the bottom-bracket axle centre (*see* Fig. 46).

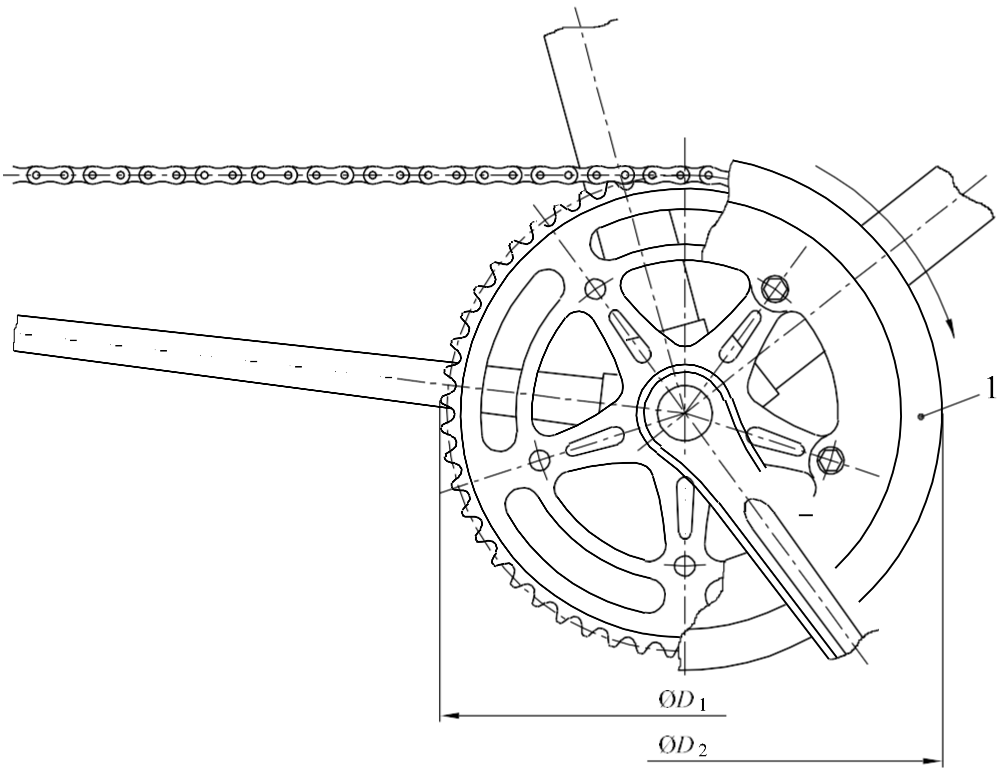
4.18 Lighting Systems and Reflectors

4.18.1 *Lighting and Reflectors*

Lighting systems and reflectors shall meet the requirements as specified for the same in IS 10613. Manufacturer's instructions shall also advise the user to take note of national regulations for the country in which the bicycle is to be used [*see* **5** (f)].

4.18.2 *Wiring Harness*

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



Key

$D_2 \geq D_1 + 10$
1 - Chain wheel disc

FIG. 45 CHAIN-WHEEL DISC

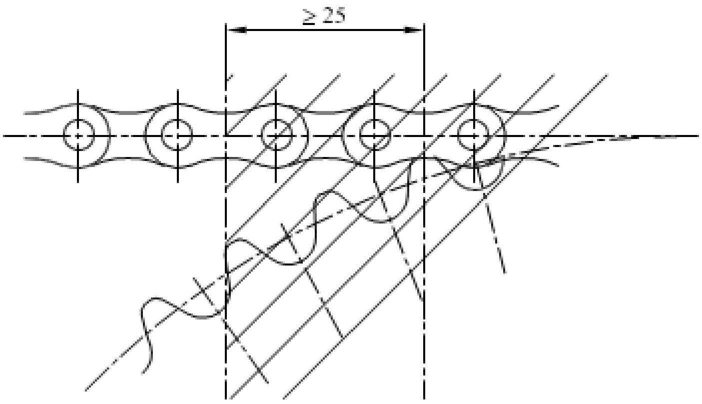


FIG. 46 CHAIN AND CHAIN-WHEEL JUNCTION

4.19 Warning Device

Where a bell or other suitable device is fitted, it shall comply with national regulation.

4.20 Toxicity

All items which come into intimate contact with the rider shall comply with the toxicity requirements as specified in IS 10613.

4.21 Durability Test for Marking

4.21.1 *Test method*

Rub the marking by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petroleum spirit.

4.21.2 *Requirement*

When tested by the method described in **4.21.1**, the marking shall remain easily legible. It shall not be easily possible to remove any label nor shall any label show any sign of curling.

5 MANUFACTURER'S INSTRUCTIONS

Each bicycle shall be provided with a set of instructions in the language of the country to which the bicycle will be supplied, containing information on:

a) The type of use for which the bicycle has been designed, that is, the type of terrain for which it is suitable, detailed information of the capability of the product with a warning about the hazards of incorrect use;

b) Preparation for riding — how to measure and adjust the saddle height to suit the rider with an explanation of the insertion-depth warning marks on the seat-pillar and handlebar-stem; clear information on which lever operates the front brake, which lever operates the rear brake, with an explanation of their function, including the function of the rotor system if fitted, and adjustment;

c) Indication of minimum saddle height and the way to measure it;

d) Recommendations for safe riding – Use of a bicycle helmet and others protectors, regular checks on brakes, tyres, steering, rotor, pegs, rims, and caution concerning possible increased braking distances in wet weather;

e) The permissible total weight of the rider plus luggage, that is, backpack;

f) An advisory note to draw attention to the rider concerning possible national legal requirements when the bicycle is to be ridden on public roads (for example, lighting and reflectors);

g) Recommended tightening of fasteners related to the handlebar, handlebar-stem, saddle, seat-pillar, and wheels, with torque values for threaded fasteners;

h) The method for determining the correct adjustment of quick-release devices;

j) The correct method of assembling any parts supplied unassembled;

k) Lubrication — where and how often to lubricate, and the recommended lubricants;

m) The correct chain tension and how to adjust it (if appropriate);

n) Adjustment of brakes, including rotor if any, and recommendations for the replacement of the friction components;

p) Recommendations on general maintenance;

q) The importance of using only genuine replacement parts for safety-critical components;

r) Care of the wheel-rims and a clear explanation of any danger of rim-wear (*see* **4.13.4** and **6.1**);

s) Appropriate spares, that is, tyres, tubes, and brake friction-components;

t) Accessories – where these are offered as fitted, details should be included such as operation, maintenance required (if any — including pegs if fitted) and any relevant spares (for example, light bulbs);

u) An advisory note to draw the attention of the rider to possible damage due to intensive use and to recommend periodic inspections of the frame, fork etc; and

v) An advisory note to draw the attention of the rider to the suitability of the bicycle for the fitment of pegs.

NOTE — Any other relevant information can be included at the discretion of the manufacturer.

WARNINGS:

1) BMX pedals are designed to provide greater grip capability of the pedal tread surface than that provided by an ordinary bicycle pedal. This can result in the pedal tread surface being very rough and containing sharp edges. Riders should therefore wear adequate safety protection.

2) As with all mechanical components, the bicycle is subjected to wear and high stresses. Different materials and components may react to wear or stress fatigue in different ways. If the design life of a component has been exceeded, it may suddenly fail possibly causing injuries to the rider. Any form of crack, scratches or change of colouring in highly stressed areas indicate that the life of the component has been reached and it should be replaced.

6 MARKING

6.1 General Marking Requirements

6.1.1 Each frame shall be visibly and permanently marked with the following information in a readily accessible place:

a) Manufacturer’s name or trade-mark;

b) Frame number;

c) Category; and

d) Maximum rider weight 45 kg (marking required for category 1 only).

6.1.2 Any legal requirement concerning marking of bicycles shall be followed. For components, there may not be any specific requirements, but it is recommended that the following safety- critical components should be clearly and permanently marked with traceable identification, such as a manufacturer's name and a part number:

a) Front fork;
b) Handlebar and handlebar-stem;
c) Seat-pillar;
d) Brake-levers, rotor, brake-blocks and/or brake-block holders;
e) Outer brake-cable casing;
f) Hydraulic-brake tubing;
g) Disc-brake callipers, brake-discs, and brake pads;
h) Chain;
j) Pedals and cranks;
k) Bottom-bracket spindle;
m) Wheel-rims; and
n) Pegs.

6.2 BIS Certification Marking

BMX Cycles may also be marked with the Standard Mark.

6.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

ISNo./Other Standards	*Title*
IS 8000 (Part 1) : 2019/ISO 1101 : 2017	Geometrical Product Specifications (GPS) — geometrical tolerancing: Part 1 Tolerances of form, orientation, location and run-out
IS 10613 : 2023	Cycles — Safety and performance requirements for bicycles (*third revision*)
IS 15511 : 2004/ ISO 9633 : 2001	Cycle chains — Characteristics and test methods
ISO 3452-1 : 2021	Non-destructive testing — Penetrant testing — Part 1: General principles
ISO 3452-2 : 2021	Non-destructive testing — Penetrant testing — Part 2: Testing of penetrant materials
ISO 3452-3 : 2013	Non-destructive testing — Penetrant testing — Part 3: Reference test blocks
ISO 3452-4 : 1998	Non-destructive testing — Penetrant testing — Part 4: Equipment
ISO 3452-5 : 2008	Non-destructive testing — Penetrant testing — Part 5: Penetrant testing at temperatures higher than 50 ºC
ISO 3452-6 : 2008	Non-destructive testing — Penetrant testing — Part 6: Penetrant testing at temperatures lower than 10 ºC
ISO 5775-1 : 2014	Bicycle tyres and rims — Part 1: Tyre designations and dimensions
ISO 5775-2 : 2021	Bicycle tyres and rims — Part 2: Rims

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Bicycles Sectional Committee, TED 16

Organization	*Representative(s)*
Research and Development Centre for Bicycle and Sewing Machine, Ludhiana	SHRI H. S. BAINS **(*Chairperson*)**
All India cycle Manufacturers Association, New Delhi	DR K. B. THAKUR SHRI ZOHEB KHAN (*Alternate*)
Amar Wheels Pvt Ltd Ludhiana	SHRI KARAN AGGARWAL
Atlas Cycles, Ghaziabad	SHRI VIKRAM KAPUR SHRI GIRISH KAPUR (*Alternate*)
Avon Cycles Limited, New Delhi	SHRI ONKAR SINGH PAHWA
Department of Industries of Commerce Chandigarh	SHRI VINOD KUMAR KAUSHIK SHRI AMAR SINGH SOLANKI (*Alternate*)
Development Commissioner Micro-Small and Medium Enterprises Karnal	SHRI P. RAMESH SHRI K. L. RAO (*Alternate* I) SHRI K. K. FUNDA (*Alternate* II) SHRI K. N. L. MURTHY (*Alternate* III)
G-13 Bicycle Forum, Ludhiana	SHRI UMESH KUMAR NARANG SHRI RAJINDER JINDAL (*Alternate*)
Hartex Rubber Private Limited, Ludhiana	SHRI NAVNEET CHABRA SHRI MANOJ MISHRA (*Alternate*)
Hero Cycles, Ludhiana	SHRI S. K. RAI SHRI K. C. SHARVA (*Alternate*)
Hero Ecotech Limited, Ludhiana	SHRI LOKESH MALHOTRA SHRI PRITPAL SINGH RANDHAWA (*Alternate*)
Institute for Auto Parts and Hand tools Technology, Ludhiana	SHRI SANJEEV KATOCH
Lucky Exports, Kolkata	SHRI SOHRAB CHHABRA SHRI HARSIMER JIT SINGH (*Alternate*)
Metro Tyres Limited, Hyderabad	SHRI SAMIR MAYRA SHRI JITENDAR SINGH PAL (*Alternate*)
Milton Cycles Industries Limited, New Delhi	SHRI I. D. CHUGH SHRI DINESH KUMAR (*Alternate*)
Ministry of Commerce and Industry, Department for Promotion of Industry and Internal Trade, New Delhi	SHRI MARGARATE GANGTE SHRI ANSHU MAULI KUMAR (*Alternate*)
MS Bhogal and Sons, Ludhiana	SHRI NAGINDER SINGH BHOGAL

Organization	*Representative*(*s*)
	SHRI R. S. BHOGAL (*Alternate*)
MSME Tool Room, Kolkata	SHRI AMIT PRAKASH SHARMA SHRI SHARNPAL SINGH TAGGAR (*Alternate*)
National Institute of Technology, Jalandhar	DR RAMAN BEDI
Nova Bicycle Indutries, Ludhiana	SHRI HARMINDER SINGH PAHWA
Ralson India Limited, New Delhi	SHRI SANJEEV PAHWA SHRI S. P. PANDEY (*Alternate*)
Research and Development Centre for Bicycle and Sewing Machine, Ludhiana	SHRI VISHWAS MEHTA
S. K. Bikes Private Limited, Ludhiana	SHRI SACHIN LAKRA SHRI MUKESH KUMAR (*Alternate*)
Sebco Enterprises, Ludhiana	SHRI RAJEEV JAIN SHRI LALIT SHARMA (*Alternate*)
Spark Engineering Private Limited, Ghaziabad	SHRI ANOOP AGGARWAL SHRI PRADEEP KUMAR AGGARWAL (*Alternate*)
Tube Investments of India Limited, Chennai	SHRI VELMURUGAN P. SHRI PRAKASH V. (*Alternate*)
United Cycle and Parts Manufacturers Association, Ludhiana	PRESIDENT GENERAL SECRETARY (*Alternate*)
Vishal Cycles Private Limited, Ludhiana	SHRI SANJEEV MAHINDRU SHRI K. K. PATHAK (*Alternate*)
BIS Directorate General	SHRI R. R. SINGH, SCIENTIST 'E'/DIRECTOR AND HEAD (TRANSPORT ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI SHIVAM AGGARWAL
SCIENTIST 'C'/DEPUTY DIRECTOR
(TRANSPORT ENGINEERING), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.:TED 16 (18837).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi