Taiwan Bicycle Industry Standard

TBIS

4210-7

Fifth edition (FDTS)

2025.01.01

Cycles — Safety requirements for bicycles —

Part 7:
Wheels and rims test methods

Reference number:
ISO 4210-7:2023

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Foreword

Taiwan Bicycle Industry Standard (TBIS) is approved and announced by Taiwan Bicycle Association (TBA). The preparatory work of "Taiwan Bicycle Industry Standard" is carried out by the technical expert committee from TBIS. When TBA members are interested in the related standard that has been announced, and after they are approved by the R&D and patent committee of TBA, they will become the member of the technical expert committee of TBIS. TBA and Cycling & Health Tech Industry R&D Center (CHC) are in close cooperation to handle all matters applied and established by TBIS.

The structure, establishing process and revising of this standard should be proposed to and get determined by the R&D and Patent Committee of TBA. This standard is implemented after the announcement of TBA. Please be aware, some part of this document may involve patent rights. TBIS has no legal obligation to mark out where all or part of the patent is involved.

Background description:

After 2023, The International Organization for Standardization 4210: 2023 (ISO 4210:2023) will be the most commonly used safety standard in global bicycle industry. Although ISO 4210 is not a mandatory inspection standard in various economic markets, they are still requesting their bicycle products suppliers to follow the basis of ISO 4210 safety requirements. However, this phenomenon represents that they are unable to differentiate the quality and grade differences between bicycles and spare parts. In order to keep up the competitiveness of our bicycle industry in the international market, the technical expert committee of TBIS uses ISO 4210 as their investigation basis and propose a higher level of product safety and standard service, to establish TBIS especially for this purpose. To highlight on the quality, performance and reliability of those components that has passed TBIS inspection, which have already exceeded the international standard. In the meantime, TBIS is developing on the safety standard and testing technology on those bicycle parts that are excluded in ISO 4210, to ensure the product and identify the differences between product performance, which has become an important reference to drive the improvement on Taiwan bicycle industry Research & Design units.

Establishment History

1st: [TBIS General Meeting (rev. NP) Discussion] Total 13 companies and 18 industry experts participate, 2015.06.25.

2nd: [TBIS Working Draft (rev. WD) Discussion] Total 13 companies and 18 industry experts participate, 2015.06.25.

3rd: [TBIS Committee Draft (rev.CD) Discussion] Total 14 companies and 22 industry experts participate, 2015.07.21.

4th: [TBIS Enquiry stage (rev. DTS) Discussion] Total 15 companies and 19 industry experts participate, 2015.09.02.

5th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 17 companies and 19 industry experts participate, 2015.10.28.

6th: [TBIS Subject Meeting] Total 17 companies and 19 industry experts participate, 2015.10.28.

7th: [TBIS Enquiry stage (rev. DTS) Discussion] Total 20 companies and 21 industry experts participate, 2016.04.22.

8th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 18 companies and 18 industry experts participate, 2016.06.24.

9th: [TBIS Subject Meeting] Total 15 companies and 16 industry experts participate, 2016.11.04.

10th: [TBIS Enquiry stage (rev. DTS) Discussion] Total 16 companies and 16 industry experts participate, 2017.04.20.

11th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 13 companies and 13 industry experts participate, 2017.07.28.

12th: [TBIS Enquiry stage (rev. DTS) Discussion] Total 14 companies and 14 industry experts participate, 2018.04.25.

13th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 14 companies and 14 industry experts participate, 2018.09.19.

14th: [TBIS Enquiry stage (rev. DTS) Discussion] Total 16 companies and 17 industry experts participate, 2019.04.25.

15th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 14 companies and 14 industry experts participate, 2019.07.31.

16th: [TBIS Enquiry stage (rev. DTS) Discussion] Total 16 companies and 16 industry experts participate, 2020.04.24.

17th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 13 companies and 13 industry experts participate, 2020.08.20

18th: [TBIS Approval Stage (rev. DTS) Discussion] Total 9 companies and 10 industry experts participate, 2023.04.28

19th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 5 companies and 6 industry experts participate, 2023.06.30

20th: [TBIS Approval Stage (rev. DTS) Discussion] Total 9 companies and 10 industry experts participate, 2024.04.25

21th: [TBIS Approval Stage (rev. FDTS) Discussion] Total 9 companies and 10 industry experts participate, 2024.06.13

Introduction

The purpose of this TBIS is to build the world's leading bicycle industry standards and norms bicycle manufacturing process to ensure product safety and external benefits effectively (including announcing internationally, producing high-valued products, and leading the R&D of bicycle industry, etc.), highlighting the product inspected by TBIS is in compliance with a higher safety requirement. While riding the bicycle on public roads, the laws and regulations of the country will be applicable.

TBIS 4210：2025 consists of the following parts, under the general title *Cycles — Safety requirements for bicycles*:

1 *Part 1: Terms and definitions*

2 *Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles*

3 *Part 3: Common test methods*

4 *Part 4: Braking test methods*

5 *Part 5: Steering test methods*

6 *Part 6: Frame and fork test methods*

7 *Part 7: Wheels and rims test methods*

8 *Part 8: Pedals and drive system test methods*

9 *Part 9: Saddles and seat-post test methods*

Reference

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4210-1:2023, *Cycles — Safety requirements for bicycles — Part 1: Terms and definitions*

ISO 4210-2:2023, *Cycles* — Requirements for city and trekking, young adult, mountain and racing bicycles

ISO 4210-3:2023, *Cycles — Safety requirements for bicycles — Part 3: Common test methods*

ISO 4210-4:2023, *Cycles — Safety requirements for bicycles — Part 4: Braking test methods*

ISO 4210-5:2023, *Cycles — Safety requirements for bicycles — Part 5: Steering test methods*

ISO 4210-6:2023, *Cycles — Safety requirements for bicycles — Part 6: Frame and fork test methods*

ISO 4210-7:2023, *Cycles — Safety requirements for bicycles — Part 7: Wheel and rim test methods*

ISO 4210-8:2023, *Cycles — Safety requirements for bicycles — Part 8: Pedal and drive system test methods*

ISO 4210-9:2023, *Cycles — Safety requirements for bicycles — Part 9: Saddle and seat-post test methods*

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

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

Modify TBIS 4210-7:2017 as follows:
Annex B (normative) Composite wheel — Rim brake endurance test

Modify TBIS 4210-7:2019 as follows:
Annex C (normative) Wheel assembly for mountain bicycle – Energy absorption test

Modify TBIS 4210-7:2021 as follows:
Annex D (normative) Tyre and rim compatibility dynamic test

Modify TBIS 4210-7:2024 as follows:
Annex E (normative) Wheelset (tubeless) airtightness and rolling fatigue

Modify TBIS 4210-7:2025 as follows:
4.5 Wheel — Impact test — Test method

4.6 Wheel and tyre assembly — Overpressure test — Test method

Cycles — Safety requirements for bicycles —

Part 7:
Wheels and rims test methods

1 Scope

This part of TBIS 4210 specifies wheel and rim test methods for TBIS 4210-2.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

TBIS 4210-1, *Cycles — Safety requirements for bicycles — Part 1: Terms and definitions*

TBIS 4210-2, *Cycles — Safety requirements for bicycles — Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles*

TBIS 4210-3, *Cycles — Safety requirements for bicycles — Part 3: Common test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in TBIS 4210-1 apply.

4 Test methods

4.1 Rotational accuracy

The run-out tolerances represent the maximum variation of the position of the rim when measured perpendicular to the axle at a suitable point along the rim (see Figure 1 and Figure 2) (i.e. full indicator reading) of a fully assembled and adjusted wheel during one complete revolution about the axle without axial movement. Both sides of the rim shall be measured and the maximum value shall be taken as result.

For city and trekking, mountain, and young adult bicycles, the measurement of both axial run-out (lateral) and radial run-out (concentricity) shall be done with a tyre fitted and inflated to the maximum inflation pressure, but for rims where concentricity cannot be measured with the tyre fitted, it is permissible to make measurements with the tyre removed.

For racing bicycles, the measurement of both axial run-out (lateral) and radial run-out (concentricity) shall be measured at the same time as shown in Figure 2 and a tyre is not required to be fitted.

Key

A	rim with tyre	5	instrument stand
B	rim without tyre	6	roller indicator
1	dial-gauge (concentricity)	7	rim with tyre
2	instrument stand	8	rim without tyre
3	hub axle support	9	dial-gauge (concentricity; alternative positions)
4	dial-gauge (lateral run-out)	10	instrument stand

Figure 1 — Wheels/tyre assembly— Rotational accuracy for city and trekking, young adult, and mountain bicycles

Key

1	instrument stand	5	hub axle support
2	dial-gauge (concentricity)	6	dial-gauge (lateral run-out)
3	rim	7	instrument stand
4	spoke	8	roller indicator

Figure 2 — Wheel — Rotational accuracy for racing bicycles

4.2 Wheel/tyre assembly — Static strength test — Test method

Clamp and support the wheel suitably as shown in Figure 3. Apply a pre-load of 5 N on the rim at one spoke perpendicular to the plane of the wheel as shown in Figure 3. Record the zero position of the rim at the point of load application as shown. Then apply a static force of *F* given in Table 1 for a duration of 1 min. Reduce the load to 5 N and allow a 1 min settling time. After this settling time and with the 5 N load still applied, re-measure the position of the rim.

The wheel shall be fitted with the appropriate size tyre and inflated to the maximum inflation pressure.

In the case of a rear wheel, apply the force from the sprocket side of the wheel as shown in Figure 3.

Repeat the above measurement once between two spokes.

See Annex A for fatigue testing.

Table 1 — Forces on rim

Forces in newtons

Bicycle type	City and trekking bicycles	Young adult bicycles	Mountain bicycles	Racing bicycles
Force *F*	250	250	370	250

Key

1 clamping fixture

2 wheel/tyre assembly

3 drive sprockets

Figure 3 — Wheel/tyre assembly— Static strength test

4.3 Wheels — Front/rear wheel retention devices secured — 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 front and rear wheel independently.

4.4 Greenhouse effect test for composite wheels — Test method

A fully assembled wheel, fitted with the appropriate size tyre and inflated according to the lower value between maximum inflation pressure recommended on the rim or the tyre, shall be controlled before the test; lateral run-out has to be controlled according to TBIS 4210-2:2017, 4.10.1 and maximum widths of the rim have to be reported.

A specific bench as shown in Figure 5 could be used to measure the maximum width all around the rim with tyre and pressure (continuous measuring).

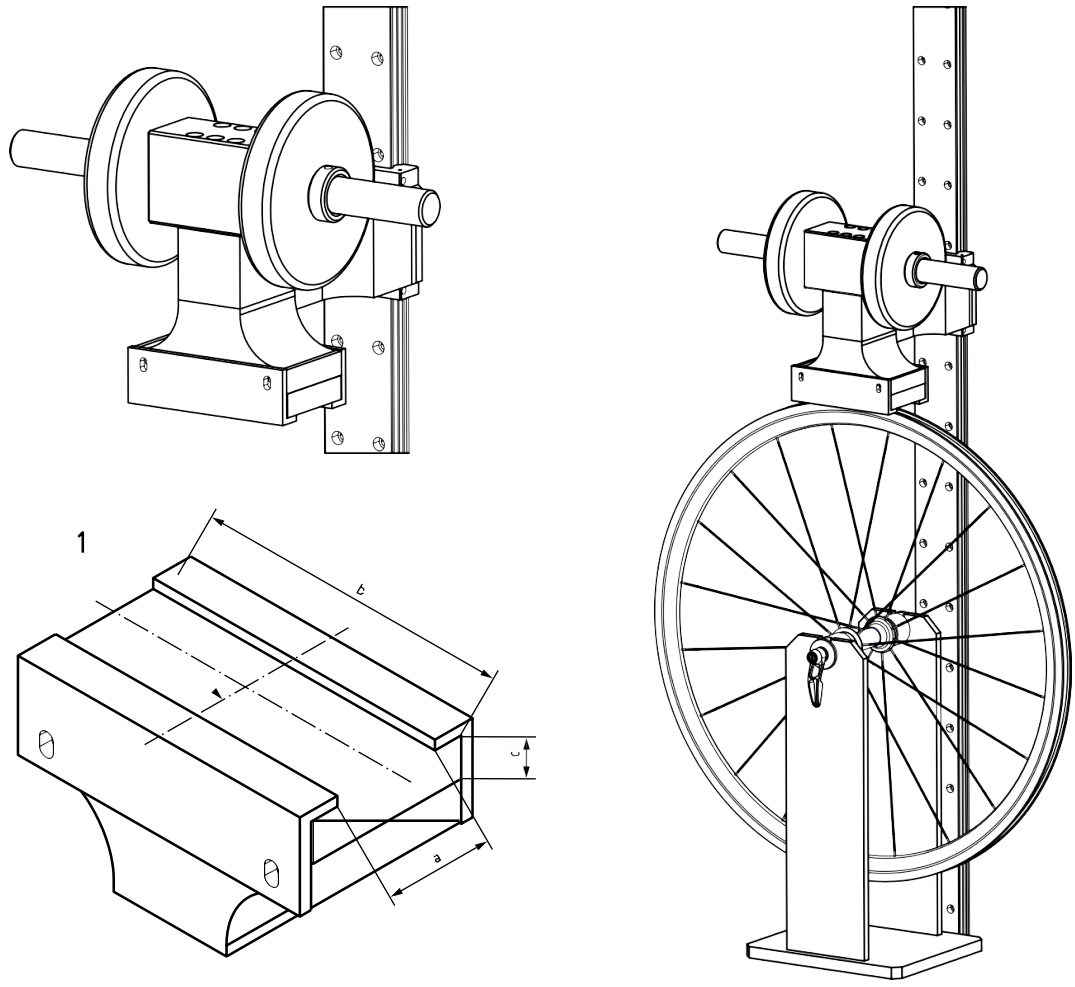
The wheel is laid down on the ground of a climate chamber, which has been pre-heated at 80 °C, leant on axle and tyre support points, sprocket side of the wheel, as shown in Figure 4, during 4 h. At the end of 4 h, the wheel should be taken out of the climate chamber and allowed to cool down at room temperature during 4 h to re-measuring the rim width and its conformance to TBIS 4210-2:2017, 4.11.6.1 and 4.11.6.2.

Figure 4 — Wheel laid down on tire and axle

Figure 5 — Maximum rim's width measuring

4.5 Wheel — Impact test — Test method

Place the wheel in a secure fixture in which it is secured by the wheel hub/axle in a vertical (radial) position, as depicted in Figure 6. The tyre shall be removed from the rim wheel assembly after it has met the requirements in TBIS 4210-2:2025，4.10.7 Orient the wheel so that the valve stem hole is around 90° from the impact location and so the impact location is in between two spokes. The impact energy shall be 40 J ± 2 J of energy, with a velocity per TBIS 4210-3:2025, 4.7, using the specified impact head and 20 mm rubber pad with hardness Shore A = 50 with a tolerance of ±10 %. Raise the impact fixture to a height (height dependent on mass) with a falling mass of (6 kg to 10 kg) and an impact head similar as described in Figure 6. Impact the wheel and allow the impact head to come to a stop (slight bouncing is normal), then verify if the requirements are met.



Key
1 symmetry axis of rubber pad and striker shall be aligned with the wheel axle
a Pad width: outer rim width + minimum 5 mm on both sides.
b Pad lengths: minimum 150 mm.
c Pad thickness: 20 mm.

Figure 6 — Wheel impact test setup

4.6 Wheel and tyre assembly — Overpressure test — Test method

4.6.1 Wheel and tyre assembly preparation

The test shall be carried out with the combination of wheel and tyre assembly parts used on the fully assembled bicycle. Tyre sealant may be used, per manufacturer's instructions.

4.6.2 Test method

Inflate the tyre to 110 % of the minimum of the maximum tyre pressure or maximum wheel pressure.

Maintain the air pressure for a minimum of 5 min.

Annex A
(informative)

Wheel/tyre assembly — Fatigue test

A.1 Wheel/tyre assembly — Fatigue test for city and trekking bicycles

A.1.1 Requirements

When tested by the method described in A.1.2, there should be no fractures, detachments, or visible cracks in any part of the wheel, no loss of air pressure in the tyre due to damage from the wheel to the tyre or the inner tube (when fitted), and the undamaged tyre should remain on the rim, perform the rotational accuracy described in 4.1. And the requirement is show as below:

The values of permanent deformation after fatigue test

Dimensions in millimetres

Bicycle type	City and trekking bicycles	Young adult bicycles	Mountain bicycles	Racing bicycles
Permanent deformation	1,2			1,0

A.1.2 Test method

Assemble the wheel, tyre, and inner tube (when fitted) and inflate the tyre to 90 % of the maximum inflation pressure.

Mount the wheel/tyre assembly free to rotate on its axle, and free to move in a vertical direction. Load the wheel assembly by means of dead weights against a drum equipped with equally spaced, transverse, metallic slats such that the radial force applied to the wheel/tyre assembly is 640 N. The wheel and drum axes shall be vertically aligned.

An example of a test arrangement is shown in Figure A.1, in which the wheel axle is fixed between the free ends of a pair of pivoted arms that extend horizontally with the tyre contacting the drum between the slats.

The diameter of the drum shall be in the range of 500 mm to 1 000 mm, and the slats shall have a width of 50 mm ± 2,5 mm, a thickness of 10 mm ± 0,25 mm, and 45° chamfered edges of half their thickness. The circumferential spacing between the centrelines of two consecutive slats shall be not less than 400 mm.

Rotate the drum to give a linear surface speed of 25 km/h (±10 %) for a period to provide 750 000 impacts between the tyre and the slats.

Dimensions in millimetres

Key

1 total force on the axle, 640 N

h height of slats

Figure A.1 — Wheel/tyre assembly— Fatigue test

Annex B
(normative)

Composite wheel — Rim brake endurance test

B.1 General

1. The test method of the item is applicable to all fork defined in TBIS 4210.
2. The tightening conditions of the fork stem and handlebar-stem assembly should be finished according to the setting values of the manufacturer.

B1.1 Requirement:

When tested by the method described in B.1.2, nor thermal deformation and fractures and cracks in any parts of the sample.

B1.2 Test methods:

This test is made with a test speed of 12.5 km/h +/- 5%

There by the 3,000 cycles brake delay may not remain under a value of 2.2 m/s^2 +/- 10% whereby for the mass to be slowed down 100 kg.

An adjustment or change the wear parts of the brakes is allowed.

A wind speed of a maximum of 12.5 km/h is allowed.

Annex C
(normative)

Wheel assembly for mountain bicycle – Energy absorption test

C.1 General

1. The test method of the item is applicable to wheel assembly for mountain bicycle which defined in TBIS 4210.
2. The tyre should be inflated to the minimum inflation pressure

C1.1 Requirement:

When tested by the method described in C1.2, there should be no fracture or visible cracks, no loss of air pressure in the tyre, and the run-out shall not exceed the values which are given in TBIS 4210-2 Table 7.

C1.2 Test methods:

The wheel set is supported by the axle fastening device, and the impact position is 90 degrees relative to the air nozzle, and then impacted at 40 J (the drop height is calculated from the edge of the rim). The impact cone anvil needs to be iron-based metal with a total mass (including cone anvil) of 22.5 kg. It is allowed to be guided during the fall, and it is necessary to reach the falling speed of 95% or more of the free fall. The geometry of the cone anvil is shown in Figure C.1, and its length must be greater than the width of the tyre.

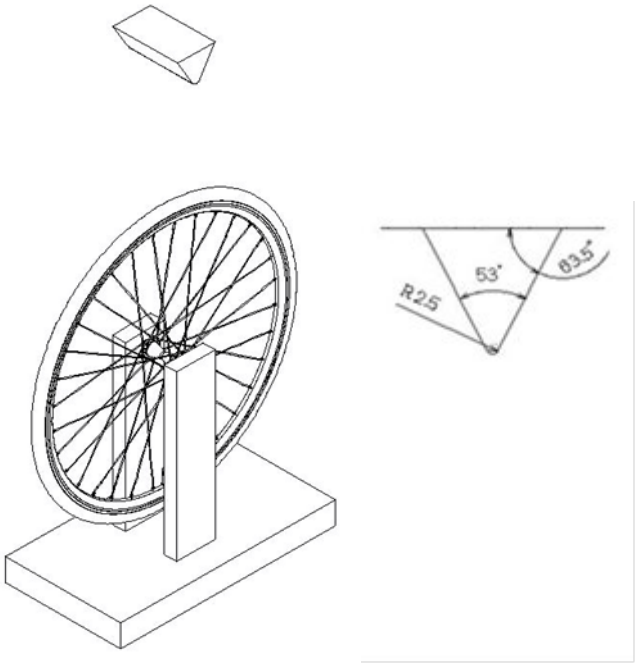


Figure. C.1 Wheel assembly for mountain bicycle – Energy absorption test

Annex D
(normative)

Tyre and rim compatibility dynamic test

D.1 General

The test method of the item is applicable to wheel assembly for bicycle which defined in TBIS 4210.

D1.1 Requirement:

When tested by the method described in D1.2, there should be no movement of the tyre and rim.

D1.2 Test methods:

The method described in TBIS 4210-4：2025, Sec.4.6.

Annex E
(normative)
Wheelset (tubeless) airtightness and rolling fatigue

E.1 General

1. The test method of the item is applicable to mountain wheel assembly for bicycle which defined in TBIS 4210.
2. The tire pressure is set to the highest value in the marked range.

E1.1 Requirement:

1. Carry out the test in accordance with the method detailed in E1.2, (tubeless) wheels must be forced to add tire sealant.
2. Stage 1: The tire pressure loss within 1 hour should not exceed 5 % of the maximum tire pressure. If this loss is exceeded, the compatibility of the rim and tire needs to be rechecked.
3. Stage 2: The tire pressure shall not be lower than 50 % of the minimum tire pressure or the maximum tire pressure marked on the tire.
4. Stage 3: The tire pressure shall not be lower than 50 % of the minimum tire pressure or the maximum tire pressure marked on the tire.

E1.2 Test methods:

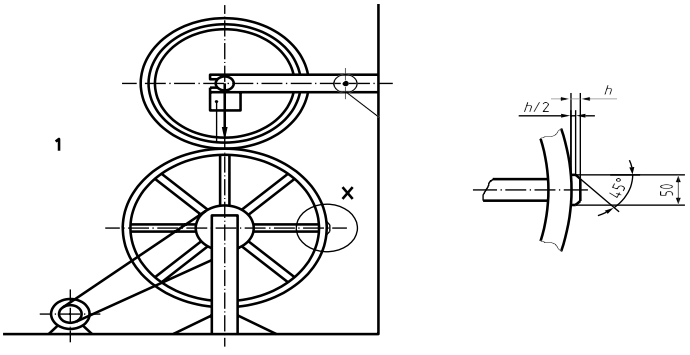
1. Stage 1: Completely assemble the wheels and tires, inflate them to 100 % of the maximum tire pressure for 60 minutes, and measure the tire pressure with a tire pressure gauge.
2. Assemble the wheel, tyre, and inner tube (when fitted) and inflate the tyre to 100 % of the maximum inflation pressure.

   Mount the wheel/tyre assembly free to rotate on its axle, and free to move in a vertical direction. Load the wheel assembly by means of dead weights against a drum equipped with equally spaced, transverse, metallic slats such that the radial force applied to the wheel/tyre assembly is 640 N. The wheel and drum axes shall be vertically aligned.

   An example of a test arrangement is shown in Figure E.1, in which the wheel axle is fixed between the free ends of a pair of pivoted arms that extend horizontally with the tyre contacting the drum between the slats.

   The diameter of the drum shall be in the range of 500 mm to 1 000 mm, and the slats shall have a width of 50 mm ± 2,5 mm, a thickness of 10 mm ± 0,25 mm, and 45° chamfered edges of half their thickness. The circumferential spacing between the centrelines of two consecutive slats shall be not less than 400 mm.

   Rotate the drum to give a linear surface speed of 25 km/h (±10 %) for a period to provide 750,000 impacts between the tyre and the slats.



Key

1 total force on the axle, 640 N

h height of slats

Figure E.1 — Wheel/tyre assembly(tubeless)— Fatigue test

3. Assemble the wheel, tyre, and inner tube (when fitted) and inflate the tyre to 100 % of the maximum inflation pressure.

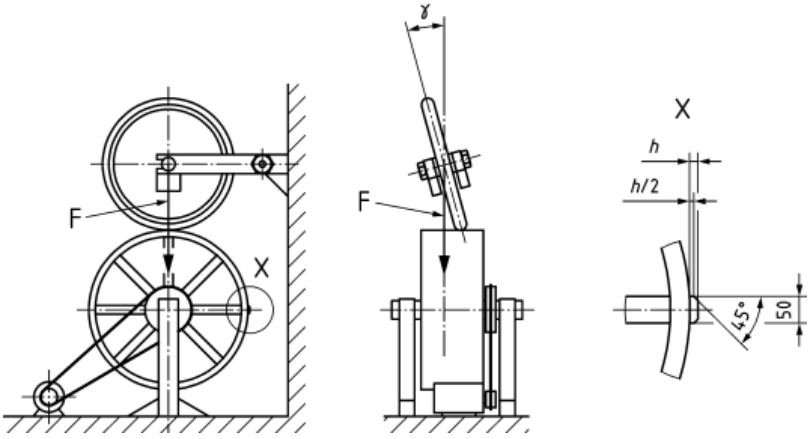
   Mount the wheel/tyre assembly free to rotate on its axle, and free to move in a vertical direction. Load the wheel assembly by means of dead weights against a drum equipped with equally spaced, transverse, metallic slats such that the radial force applied to the wheel/tyre assembly is 640 N. The wheel and drum axes shall be vertically aligned.

   In addition, the wheel should yaw and rotate left and right on a plane with an inclination angle γ relative to the brake drum (camber angle γ=15°), with a cycle frequency of 50 seconds.

   An example of a test arrangement is shown in Figure E.2, in which the wheel axle is fixed between the free ends of a pair of pivoted arms that extend horizontally with the tyre contacting the drum between the slats.

   The diameter of the drum shall be in the range of 500 mm to 1,000 mm, and the slats shall have a width of 50 mm ± 2,5 mm, a thickness of 10 mm ± 0,25 mm, and 45° chamfered edges of half their thickness. The circumferential spacing between the centrelines of two consecutive slats shall be not less than 400 mm.

   Rotate the drum to give a linear surface speed of 25 km/h (±10 %) for a period to provide 500,000 impacts between the tyre and the slats.



Key

F is the total force acting on the shaft

γ camber angle under consideration of external force

h height of slats

Figure E.2 — Wheel/tyre assembly(tubeless) — swing fatigue test