Taiwan Bicycle Industry Standard

TBIS

4210-8

First edition

2016.01.01

Cycles — Safety requirements for bicycles —

Part 8:

Pedal and drive system test methods

Reference number:
TBIS 4210-8:2015 (FDTS)

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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 2015, The International Organization for Standardization 4210: 2014 (ISO 4210:2014) 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.

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

— *Part 1: Terms and definitions*

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

— *Part 3: Common test methods*

— *Part 4: Braking test methods*

— *Part 5: Steering test methods*

— *Part 6: Frame and fork test methods*

— *Part 7: Wheels and rims test methods*

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

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

ISO 4210-3:2014, *Cycles — Safety requirements for bicycles — Part 3: Common test methods*

ISO 4210-4:2014, *Cycles — Safety requirements for bicycles — Part 4: Braking test methods*

ISO 4210-5:2014, *Cycles — Safety requirements for bicycles — Part 5: Steering test methods*

ISO 4210-6:2014, *Cycles — Safety requirements for bicycles — Part 6: Frame and fork test methods*

ISO 4210-7:2014, *Cycles — Safety requirements for bicycles — Part 7: Wheel and rim test methods*

ISO 4210-8:2014, *Cycles — Safety requirements for bicycles — Part 8: Pedal and drive system test methods*

ISO 4210-9:2014, *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*

Cycles — Safety requirements for bicycles —

Part 8:
Pedal and drive system test methods

1 Scope

This part of TBIS 4210 specifies pedal and drive system test methods for TBIS 4210-2:2016.

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 4210-1:2016, *Cycles – Safety requirements for bicycles – Part 1: Terms and definitions*

TBIS 4210-3:2016, *Cycles – Safety requirements for bicycles – Part 3: Common test methods*

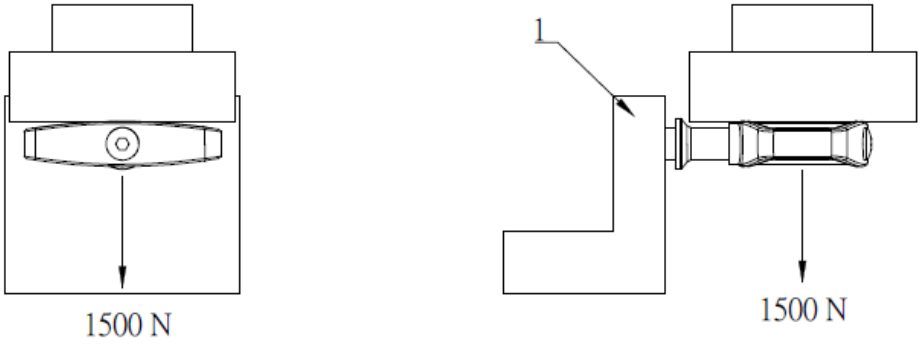
3 Terms and definitions

For the purposes of this document, the terms and definitions given in TBIS 4210-1:2016 apply.

4 Test methods

4.1 Pedal — Static strength test

Screw the pedal-spindle securely into a suitable rigid fixture with its axis horizontal, as shown in Figure 1, and apply a vertically downward force of 1 500 N for 1 min to the centre of the pedal, but not to the spindle directly as shown in Figure 1. Release the force and examine the pedal assembly and the spindle.



Key

1 rigid mount

Figure 1 — Pedal/pedal-spindle assembly — Static strength test

4.2 Pedal — Impact test

Screw the pedal-spindle securely into a suitable rigid fixture with its axis horizontal as shown in Figure 3 and release a striker of the design shown in Figure 2 and mass of 15 kg from a height of 400 mm to strike the pedal at the centre of the pedal. The width of the striker shall be wider than the width of the tread surface.

NOTE See TBIS 4210-3:2016, Annex B.

Dimensions in millimetres

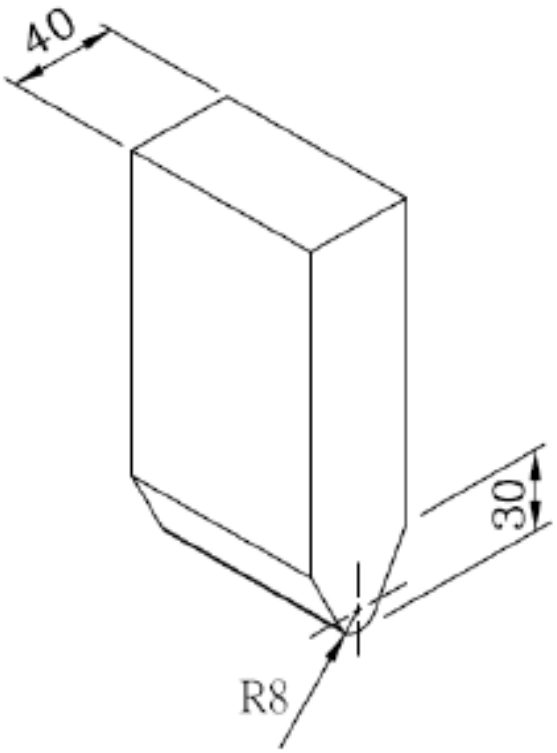


Figure 2 — Striker dimensions

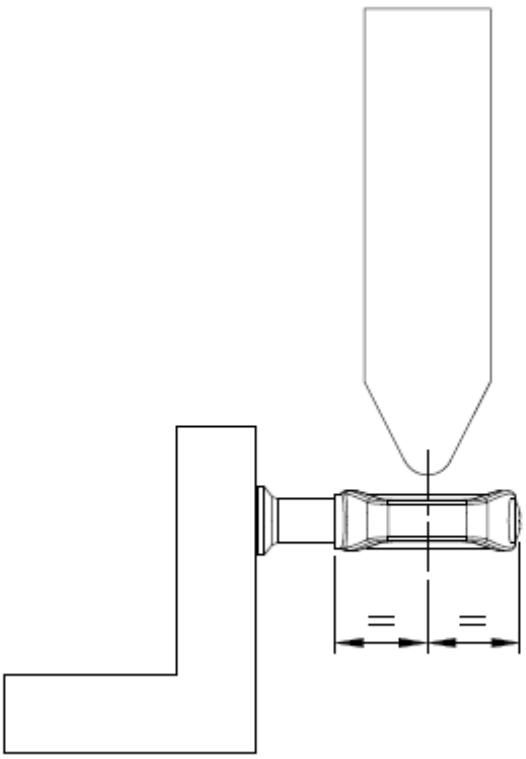


Figure 3 — Position of impact

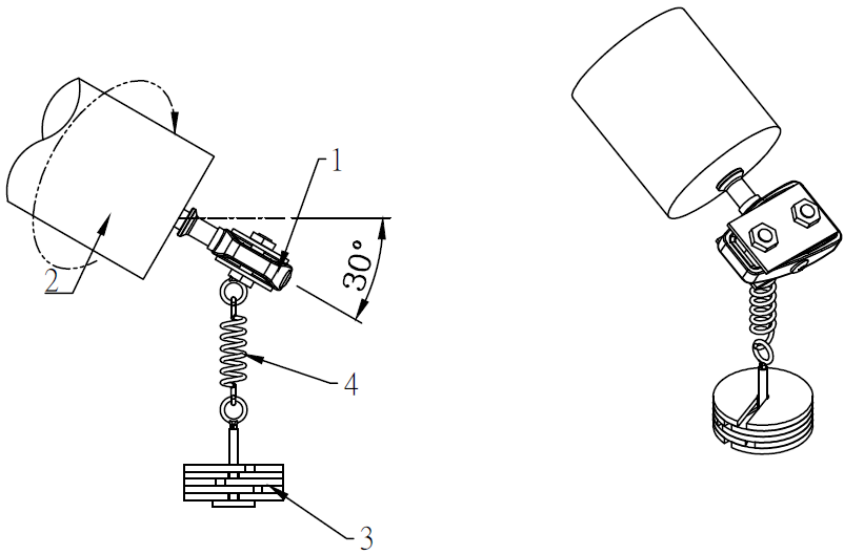
4.3 Pedal — Dynamic durability test

Screw each pedal securely into a threaded hole in a rotable test shaft at 30° to the horizontal as shown in Figure 4 and suspend a mass of *M* at the centre of the pedal width by means of a tension spring to each pedal, the object of the springs being to minimize oscillations of the load. The masses are given in Table 1.

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, they shall be turned through 180° after 50 000 revolutions.

Table 1 — Masses on pedal

Bicycle type	City and trekking bicycles	Young adult bicycles	Mountain bicycles	Racing bicycles
Mass, *M* kg	80	80	90	90



Key

1 pedal
2 test shaft
3 mass
4 tension spring

Figure 4 — Pedal/pedal-spindle — Dynamic durability test

4.4 Drive system — Static strength test

4.4.1 Test method for drive system with chain

4.4.1.1 General

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

4.4.1.2 Single-speed system

With the non-drive side crank in the forward position, apply a force, F_1, increasing gradually to 1 500 N vertically downwards to the centre of the non-drive side 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 30° 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 non-drive side crank, repeat the test with the drive side crank in the forward position and with the force applied to the drive side pedal.

4.4.1.3 Multi-speed system

a) Conduct the tests described in 4.4.1.2 with the transmission correctly adjusted in its highest gear.

b) Conduct the tests generally as described in 4.4.1.2 with the transmission correctly adjusted in its lowest gear but, where appropriate, with the maximum force, F_1, adjusted to suit the particular gear ratio. Thus:

The maximum force, F_1, shall be a function of the lowest gear ratio, N_c/N_s,

where

F_1 is the force applied to the pedal, expressed in newton (N);

N_c is the number of teeth on the smallest chain wheel (front);

N_s is the number of teeth on the largest sprocket (rear).

Where the ratio N_c/N_s has a value equal to or greater than 1, the force, F_1, shall be 1 500 N; but where the ratio N_c/N_s has a value less than 1, the force, F_1, shall be reduced in proportion to the lowest gear ratio. Thus:

F_1 is $1\,500 \times N_c/N_s$.

4.4.2 Test method for drive system with belt

The sample in its fully finished condition (with teeth, if any) shall be submitted to a water spray conditioning equivalent to IPX4 specified in IEC 60529:2001, 14.2.4 during 10 min. Application of the loading shall be done within 20 min after conditioning.

a) If the drive system is a single-speed system, conduct the tests as described in 4.4.1.2.

b) If the drive system is a multi-speed system, conduct the tests as described in 4.4.1.3.

4.5 Drive belt — Tensile strength test

Set up a fixture with two drive pulleys that are similar or identical as shown in Figure 5. At least one pulley should be free to rotate. Increase the tensile load gradually until the tension load of the belt reaches 4 000 N.

NOTE 4 000 N is the tension load within the belt and requires a load F of 8 000 N to achieve this tension load.

Figure 5 — Drive belt — Tensile strength test

4.6 Crank assembly — Fatigue test

4.6.1 General

Two types of fatigue test are specified for mountain bicycles: the first test with the cranks positioned at 45° to the horizontal to simulate the forces due to pedalling, and the second test with the cranks positioned at 30° to the horizontal, which has been found to simulate the forces due the rider standing on the pedals during the descent of hills. The two tests shall be conducted on separate assemblies.

4.6.2 Test method with the cranks at 45° to the horizontal

Mount the assembly of the two pedal-spindle adaptors, the drive side and non-drive side crank, 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 Figure 6). Incline the cranks at 45° to the horizontal.

Prevent rotation 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 (e.g. belt- or shaft-drive) by securing the first stage of the transmission.

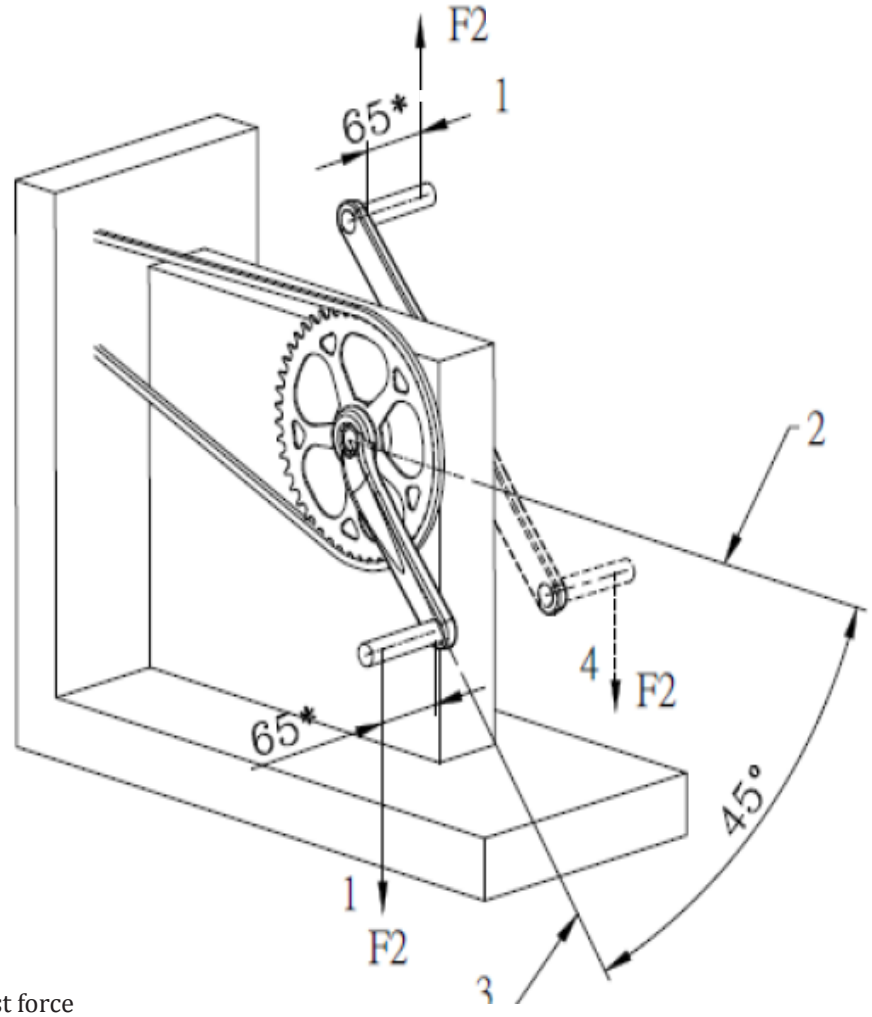
NOTE It is permissible to have the non-drive side crank in either of the two positions shown in Figure 6, provided the test force is applied in the appropriate direction as specified in the next paragraph.

4.6.2.1 Stage 1
Apply repeated, vertical, dynamic forces of stage 1 F_2 alternately to the pedal-spindle adaptors of the drive side and non-drive side crank at a distance of 65 mm from the outboard face of each crank (as shown in Table 2 and Figure 6) for *C* test cycles (where one test cycle consists of the application of the two forces). The direction of the force on the drive side crank shall be downwards and that on the non-drive side crank shall be upwards for a rearward-pointing crank, or downwards for a forward-pointing crank. During application of these test forces, ensure that the force on a pedal-spindle adaptor falls to 5 % or less of the peak force before commencing application of the test force to the other pedal-spindle adaptor. The maximum test frequency shall be maintained as specified in TBIS 4210-3:2016, 4.5.
4.6.2.1 Stage 2
With the same mounted as in 4.6.2.1, repeated, vertical, dynamic forces of stage 2 F_2 as shown in Tab. 2 and Fig. 6 for C test cycles, where one test cycle consists of the application and removal of the two test forces. The direction of the force on the drive side crank shall be downwards and that on the non-drive side crank shall be upwards for a rearward-pointing crank, or downwards for a forward-pointing crank. During application of these test forces, ensure that the force on a pedal-spindle adaptor falls to 5 % or less of the peak force before commencing application of the test force to the other pedal-spindle adaptor. The maximum test frequency shall be maintained as specified in TBIS 4210-3:2016, 4.5.

Table 2 — Forces on pedal-spindle and test cycles

Bicycle type		City and trekking bicycles	Young adult bicycles	Mountain bicycles	Racing bicycles
Force F_2	Stage 1	1300	1300	1800	1800
	Stage 2	1400	1400	1900	1900
Test cycles, C	Stage 1	120000	120000	60000	120000
	Stage 2	100000	100000	50000	100000

Dimensions in millimetres



Key

1 repeated test force
2 horizontal axis
3 axis of crank
4 alternative left crank arrangement
[a] From outboard face of crank.

Figure 6 — Crank assembly — Fatigue test with cranks at 45° (typical test arrangement)

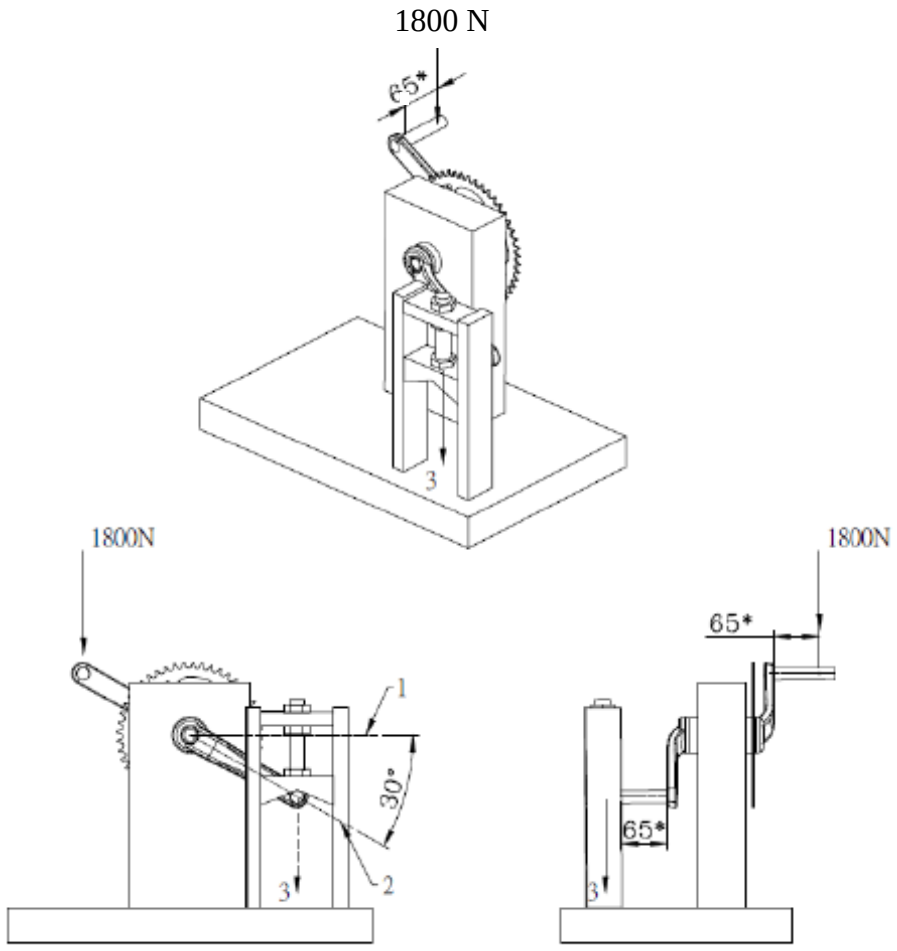
4.6.3 Test method with the cranks at 30° to the horizontal for mountain bicycles

Mount the assembly of the two pedal-spindle adaptors, the drive side and non-drive side crank, 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 Figure 7. Incline the cranks at 30° to the horizontal as shown in Figure 7. Restrain the non-drive side 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.

4.6.3.1 Stage 1
Apply a repeated, vertically downward, dynamic force of 1 800 N to the pedal-spindle of the drive side crank at a distance of 65 mm from the outboard face of the crank (as shown in Figure 7) for 60 000 cycles. The maximum test frequency shall be maintained as specified in TBIS 4210-3:2016, 4.5.

4.6.3.2 Stage 2
Apply a repeated, vertically downward, dynamic force of 1 900 N to the pedal-spindle of the drive side crank at a distance of 65 mm from the outboard face of the crank (as shown in Figure 7) for 50 000 cycles. The maximum test frequency shall be maintained as specified in TBIS 4210-3:2016, 4.5.

Dimensions in millimetres



Key

1 horizontal axis
2 axis of crank
3 reactive force (equal and opposite to test force)

Figure 7 — Crank assembly — Fatigue test with cranks at 30° (typical test arrangement)

Bibliography

[1] TBIS 4210-2:2016, *Cycles — Safety requirements for bicycles — Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles*