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Carrier Cycles - Part 4: Heavy weight carrier cycles - Mechanical and functional aspects

Lastenfahrräder - Teil 4: Schwere Lastenfahrräder - Mechanische und funktionale Aspekte

Cycles utilitaires Partie 4 : Cycles utilitaires lourds Aspects mécaniques

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Lastenfahrräder - Teil 4: Schwere Lastenfahrräder -
Mechanische Aspekte

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 333.

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European foreword

This document (prEN 17860-4:2024) has been prepared by Technical Committee CEN/TC 333 “Cycles”, the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

This document is part of standard series consisting of the following parts, users are invited to check which parts are applicable to their situation:

- FprEN 17860-1:2023, Carrier Cycles — Part 1: Vocabulary
- FprEN 17860-2:2023, Carrier Cycles — Part 2: Lightweight single track carrier cycles – Mechanical aspects
- FprEN 17860-3:2023, Carrier Cycles — Part 3: Lightweight multi track carrier cycles – Mechanical aspects
- prEN 17860-4, Carrier Cycles — Part 4: Heavyweight multi track carrier cycles – Mechanical and functional aspects
- prEN 17860-5:2023, Carrier Cycles — Part 5: Electrical aspects
- prEN 17860-6, Carrier Cycles — Part 6: Passenger transport
- prEN 17860-7:2023, Carrier Cycles — Part 7: Cargo trailers

Examples of carrier cycle configurations can be found in FprEN 17860-2:2023, Annex A. FprEN 17860-2:2023, Annex B provides a reading guide for parts 2,3 and 4 of this standard series.

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prEN 17860-4:2024**Introduction**

This document gives requirements and test methods for mechanical and functional aspects for heavyweight carrier cycles.

This document has been developed in response to demand throughout Europe. Its aim is to provide a standard for the assessment of mechanical aspects for multi track carrier cycles of a type which are excluded from type approval by Regulation (EU) No. 168/2013.

Because of the diversity of geometries and solutions of carrier cycles not all requirements and test methods in this document may apply to every carrier cycle.

Annex A in FprEN 17860-2:2023 gives an overview of vehicle configurations.

Annex B in FprEN 17860-2:2023 provides a reading guide for the parts of this standard series.

Annex J in FprEN 17860-2:2023 contains a rationale explaining the choices made when developing the standard series.

This document is based on a risk analysis, the focus is on mechanical aspects for multi track carrier cycles. This document is a type C standard as specified in EN ISO 12100:2010. The machinery concerned and the extent to which hazards, hazardous situations and hazardous events are covered are indicated in the scope of this document.

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1 Scope

This document is applicable to carrier cycles with or without electric assistance with a minimum gross vehicle weight that is bigger than 300 kg and a maximum gross vehicle weight of 600 kg.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

FprEN 17860-1:2023, *Carrier Cycles — Part 1: Vocabulary*

FprEN 17860-2:2023, *Carrier Cycles — Part 2: Lightweight single track carrier cycles – Mechanical aspects*

FprEN 17860-3:2023, *Carrier Cycles — Part 3: Lightweight multi track carrier cycles – Mechanical aspects*

prEN 17860-7:2023, *Carrier Cycles — Part 7: Cargo trailers*

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

EN ISO 4210-6:2023, *Cycles - Safety requirements for bicycles - Part 6: Frame and fork test methods (ISO 4210-6:2023, Corrected version 2023-08)*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in FprEN 17860-1:2023 and EN ISO 12100:2010 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses: 17860-4-2024

— ISO Online browsing platform: available at <https://www.iso.org/obp/>

— IEC Electropedia: available at <https://www.electropedia.org/>

4 Use cases: commercial/professional use or low mileage use

The requirements in the main part of this standard refer to carrier cycles for commercial/professional use. In case the manufacturer defines the carrier cycles to be intended for low mileage use, lower test values for dynamic tests apply. Annex A gives the lower test values for the relevant fatigue tests.

With typical low mileage use the expected yearly mileage is less than 5 000km; typical use cases are bikes for landscaping, vending bikes and special needs rickshaw bikes.

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5 General vehicle requirements

5.1 Numbers and condition of specimens for the strength tests

FprEN 17860-2:2023, 5.1 applies.

5.2 Accuracy tolerances of test conditions for brake tests and strength tests

FprEN 17860-2:2023, 5.2 applies.

5.3 Protrusions

FprEN 17860-2:2023, 5.3 applies.

5.4 Sharp edges

FprEN 17860-2:2023, 5.4 applies.

5.5 Securing and strength of safety-relevant fasteners

FprEN 17860-2:2023, 5.5 applies.

5.6 Steering function

FprEN 17860-2:2023, 5.6 applies.

5.7 Shimmy

FprEN 17860-2:2023, 5.7 applies.

5.8 Requirements for loading areas/load securing

FprEN 17860-3:2023, 5.7 applies.

5.9 Parking and stability

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FprEN 17860-3:2023, 5.8.1 applies.

5.9.2 Tipping stability of multi track carrier cycles

FprEN 17860-3:2023, 5.8.2 applies.

5.9.3 Parking stability while loading

FprEN 17860-3:2023, 5.8.3 applies.

5.9.4 Dynamic tipping stability of multi track carrier cycles

FprEN 17860-3:2023, 5.8.4 applies.

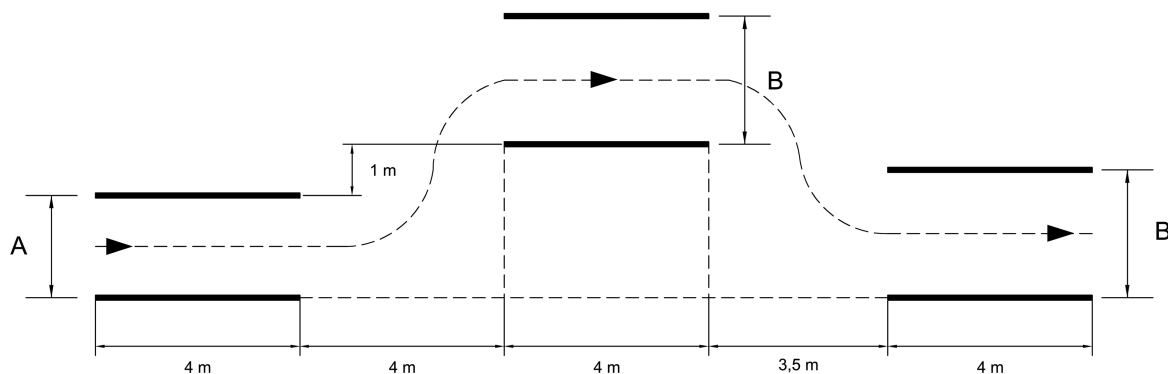
5.9.5 Double lane change test

5.9.5.1 Requirement

A double-lane-change manoeuvre shall be used to evaluate the dynamic stability.

5.9.5.2 Test method

The specifications of a double-lane-change manoeuvre test track are given in Figure 1.

**Key**

A $1,1 \times \text{vehicle width} + 0,25 \text{ m}$

B $\text{vehicle width} + 1 \text{ m}$

Figure 1 — Dynamic tipping stability test track layout

The carrier cycle enters the course shown in Figure 1 from left to right entering at the test track width “A” at a speed of at least 10 km/h and shall maintain the speed throughout the test, upon which the rider negotiates the course without deviating from the track.

It is recommended the testing speed should be gradually increased and the test should be performed by an experienced and skilled rider.

The test shall be carried out with an unladen carrier cycle and at maximum gross vehicle weight. For the fully laden carrier cycle the test loads in the cargo areas shall be applied in accordance with the manufacturer's load distribution resulting in the highest allowable centre of gravity.

5.9.6 Dynamic tipping stability on slopes

FprEN 17860-3:2023, 5.8.5 applies.

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5.9.7 Prevention of wheel jamming of multi track carrier cycles

FprEN 17860-3:2023, 5.8.6 applies.

5.10 Pedal clearance

5.10.1 Ground clearance

FprEN 17860-3:2023, 5.9.1 applies.

5.10.2 Toe clearance

FprEN 17860-2:2023, 5.10.2 applies.

5.11 Wheel and tyre assembly – clearance

FprEN 17860-2:2023, 5.11 applies.

5.12 Wheel retention

FprEN 17860-3:2023, 5.11 applies.

5.13 Vibrations, ergonomics and design

FprEN 17860-2:2023, 5.14 applies.

prEN 17860-4:2024**6 Brakes****6.1 General**

FprEN 17860-2:2023, 6.1 applies.

6.2 Hand-operated brakes**6.2.1 Brake lever position**

FprEN 17860-2:2023, 6.2.1 applies.

6.2.2 Brake-lever grip dimension

FprEN 17860-2:2023, 6.2.2 applies.

6.2.3 Attachment of brake assembly and cable requirements

FprEN 17860-3:2023, 6.2.3 applies.

6.2.4 Brake-lever – Position of applied force

FprEN 17860-3:2023, 6.2.4 applies.

6.2.5 Brake-block and brake-pad assemblies – Safety test

FprEN 17860-3:2023, 6.2.5 applies.

6.2.6 Hand-operated braking-system – Strength test

FprEN 17860-3:2023, 6.2.6 applies.

6.2.7 Back-pedal braking system – Strength test

FprEN 17860-3:2023, 6.2.7 applies.

6.3 Requirements of the test method on a test track

FprEN 17860-2:2023, 6.3 applies with the following addition to point b):

- b) Under consideration of its intended use and the skills of the anticipated rider, the carrier cycle shall exhibit uniform, safe braking behaviour. When testing on the test track, the characteristics of uniform, safe stopping shall be taken to mean that the following shall not occur when stopping within the required, specified distance:
- increased juddering;
 - locking-up of the front wheel(s);
 - loss of control over the carrier cycle due to excessive skidding which may cause the rider to place his/her foot on the ground in order to regain control or departure from the track by more than 5 % of the braking distance length of the multi track carrier cycle. Active counter-steering is not permissible in this case. If the carrier cycle at any time during brake tests pulls sideways, then the brake system has failed, and the test shall be interrupted.

With some brake systems, it will not be possible to completely prevent a wheel from skidding during braking; this is regarded as permissible as long as the situation described in b) 3 does not occur.

NOTE 1 The requirement in point 3 regarding the departure from the track by more than 5 % can be checked by tensioning a guide line or using a straight chalk mark on the road.

NOTE 2 The requirement for the vehicle to swerve by a maximum of 5 % refers to a lateral deviation from the centre line during braking of either the front axle or the rear axle. Example: with a measured braking distance of 6 m, one of the axles may move sideways by a maximum of 0,3 m.

6.4 Requirements of the test method on a test bench

6.4.1 Requirement for the minimum braking force

FprEN 17860-2:2023, 6.4 applies with the following addition to point a):

During the test, the carrier cycle shall meet the requirements listed in Table 3 of FprEN 17860-2:2023, 6.4.

Additionally, in order to test the uniform braking effect of both brakes on an axle of a multi track carrier cycle in order to avoid sideways skidding while braking, the braking forces shall be measured simultaneously on a test bench.

6.4.2 Requirement for the uniformity of braking forces.

In the upper 2/3 of the test range, the difference in braking forces on the wheels of an axle shall not be more than 25 % based on the higher measured value. During the evaluation, it shall be ensured that the measured value at the time a wheel was blocked is not included in the evaluation.

Compliance with this requirement shall be checked axle by axle when testing on a brake test bench as follows, see Formula (1):

$$\frac{\text{Difference in braking forces}}{\text{greater braking force}} \times 100 \leq \Delta_{Br(max)} \text{ in } \% \quad (1)$$

where:

$\Delta_{Br(max)}$ is the maximum permissible difference in braking forces

6.5 Tests

FprEN 17860-2:2023, 6.5 applies.

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7 Steering

FprEN 17860-3:2023, 7 applies.

8 Frame

8.1 Suspension frames — Special requirements

FprEN 17860-2:2023, 8.1 applies.

8.2 Requirements for all frame types

In the test in accordance with 8.3 to 8.9, no visible cracks or fractures shall occur on any part of the frame, and no suspension system components shall become detached.

For carrier cycles with electrically power assistance using a drive unit located at the bottom bracket (mid-drive motor) for the frame tests that either use a fixation at the bottom bracket or where a force is applied to the bottom bracket instead of the original drive unit a dummy unit can be used with the same position of the pedal axis. The dummy shall use the same mounting points as the original motor and the use of the dummy shall not alter the outcome of the test.

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In systems made of composite materials, the values of the maximum deflection shall not increase by more than 20 % in comparison with the initial values over the test time (range between two peak values) at the force application points (see EN ISO 4210-3:2023, 4.6).

8.3 Frame – Dynamic test with pedalling forces

8.3.1 General

In tests on suspension frames with hinged joints, the springs, air pressure and dampers shall be adjusted such that the maximum possible resistance is achieved; or the spring unit shall be replaced with a rigid connector, where it shall be ensured that the attachments on the frame and the lateral rigidity of the original design are represented precisely.

8.3.2 Test method

For multi track three wheel carrier cycles with the single wheel at the front mounted to a fork the front wheel fork can be replaced with a dummy front fork (see FprEN 17860-2:2023 Annex G) with the same length and at least the same rigidity as those of the original front fork.

The frame unit shall be clamped in a device in accordance with Figure 2 a), where the front wheel axle of the front fork or the dummy front fork is fastened in a rigid attachment with a height of R_w (radius of the wheel/tyre unit ± 30 mm), where the hub can be rotated freely around the axle. The rear axis or the rear wheels shall be attached to a suitable device such that the frame is able to extend or shorten the wheelbase under the action of the test loads.

For multi track three wheel carrier cycles with the single wheel at the rear the frame unit shall be clamped in a device according to Figure 2 b), where both front wheels are fastened in a rigid attachment with a height of R_w (radius of the wheel/tyre unit ± 30 mm), where the hubs can be rotated freely around the axle. The rear fork dropouts are fastened on the axle in a rigid, perpendicular support with a height of R_w (radius of the wheel/tyre unit ± 30 mm). Here, the upper attachment of the support shall be freely rotatable around the rear wheel axle but rigidly clamped laterally, and the lower end of the support shall be fitted with a ball joint.

For multi track four wheel carrier cycles the frame unit shall be clamped in a device according to Figure 2 c), where both front wheels are fastened in a rigid attachment with a height of R_w (radius of the wheel/tyre unit ± 30 mm), where the hubs can be rotated freely around the axle. The rear axis or the rear wheels shall be attached to a suitable device such that the frame is able to extend or shorten the wheelbase under the action of the test loads.

Either a crank/chain-wheel set unit or preferably a fixed, rigid dummy unit with the dimensions of the original parts shall be fastened on the crank hanger in accordance with Figure 2 and according to Point a) or Point b).

- a) If a crank/chain-wheel set unit is used, both cranks shall be inclined forwards and 45° (to $\pm 2,0^\circ$) downwards from the horizontal in case the carrier cycle is equipped with a saddle, for carrier cycles where the rider is placed on a seat and the pedalling movement is forward and downward, both cranks shall be inclined upwards and 45° (to $\pm 2,0^\circ$) forwards from the direction of the pedalling force as shown in Figure 2 c). The front end of the chain shall be placed on the middle chain-wheel set in the case of three chain-wheel sets or on the smaller chain-wheel in the case of two chain-wheel sets or on the only chain-wheel in the case of single chain-wheel sets. The rear end of the chain shall be fastened at a right angle on the rear wheel axle.
- b) If an adapter unit (as shown in Figure 2) is used, it shall be fastened so that it can rotate freely around the axis of the crank hanger, and the length, L , of the two dummy cranks shall be 175 mm; where both dummy cranks shall be mounted facing forwards and inclined 45° (to $\pm 2,0^\circ$) downwards from the horizontal in case the carrier cycle is equipped with a saddle, for carrier cycles where the rider is placed on a seat and the pedalling movement is forward and downward, both dummy cranks shall be inclined upwards and 45° (to $\pm 2,0^\circ$) forwards from the direction of the pedalling force as shown in Figure 2 c). The dummy cranks shall be fixed in position by a vertical lever arm (which replaces the chain-wheel set) and a draw bar with