
Wheelchairs —

Part 32:

**Test method for wheelchair castor
assembly durability**

Fauteuils roulants —

*Partie 32: Méthode d'essai pour la durabilité des roues pivotantes des
fauteuils roulants*

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 173, *Assistive products*, Subcommittee SC 1, *Wheelchairs*.

A list of all parts in the ISO 7176 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document has been developed to address the need for evaluation of wheelchair castor assembly quality. Wheelchair castor assemblies come in different sizes and designs. Most castor assembly designs are known to fail within three months to two years of use due to impacts, fatigue, and wear caused by adverse outdoor conditions^[3]. Castor assembly quality issues have been identified. Only a subset of field castor assembly failures is covered in the ISO 7176-8, which include static, impact and fatigue tests^[2]. Failures caused by environmental factors (corrosion, dust, dirt, abrasion on rough surfaces) and heavy impacts while travelling on rocky terrains and transporting wheelchairs are not represented. To reproduce accurately field failures and to predict castor assembly quality in the laboratory, it is recommended to conduct castor assembly testing based on outdoor environmental and use conditions. This document introduces a new wheelchair castor assembly durability testing standard that is developed based on field evidence.

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Wheelchairs —

Part 32: Test method for wheelchair castor assembly durability

1 Scope

This document specifies strength requirements and test methods for wheelchair castor assemblies. The test methods include corrosion, abrasion and fatigue conditions. This document also specifies requirements for disclosure of test results.

It is applicable to castor assemblies of or developed for use in occupant and to assistant-propelled manual wheelchairs and electrically powered wheelchairs.

The test requirements are also applicable to wheelchair castor assemblies not necessarily associated or supplied with a wheelchair.

Castor assemblies including those with anti-tip castor wheels that do not touch the ground during wheelchair travel are outside the scope of this document.

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.

ISO 7176-11, *Wheelchairs — Part 11: Test dummies*

ISO 7176-22, *Wheelchairs — Part 22: Set-up procedures*

ISO 7176-26, *Wheelchairs — Part 26: Vocabulary*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 22877, *Castors and wheels — Vocabulary, symbols and multilingual terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7176-26, ISO 22877 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

castor assembly test load

weight supported by the castor

**3.2
tyre failure**

separation of a tyre from the castor wheel or castor wheel axle (in case, the tyre is mounted directly on the axle) or rupture of the inner tube of a pneumatic tyre, where any of these conditions can lead to a loss of function

**3.3
castor stem assembly**

components in a castor stem housing, which includes the castor stem, nuts, washers, stem bearings, or spacers

**3.4
test cycle**

one revolution of the turntable

Note 1 to entry: The fatigue testing machine specified in this document includes a turntable.

4 Castor assembly classification

Castor assemblies are classified into three types based on the castor wheel diameter as listed in [Table 1](#).

Table 1 — Castor assembly classification by size

Castor Assembly Type	Castor wheel diameter
Type 1	Less than 75,0 mm
Type 2	Greater than or equal to 75,0 mm and less than 150,0 mm
Type 3	Greater than or equal to 150,0 mm

NOTE Based on their wheel sizes, castors experience fatigue differently. Accordingly, the testing methods in this document are based on the castor wheel diameter.

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5 Strength requirements

When tested in accordance with [Clause 8](#), a single castor assembly shall meet all of the following requirements at the conclusion of the tests.

- a) No component shall show evidence of failure caused by visible crack, fracture, and/or detachment of a part that could lead to a loss of function.
- b) No component or assembly of parts shall exhibit permanent deformation, free play or loss of adjustment that could lead to a loss of function.
- c) No tyre failure shall occur.

6 Test apparatus

6.1 Corrosion testing machine

A corrosion testing machine shall be as specified in ISO 9227 for the neutral salt spray method. Provision shall be made for specimens to be oriented such that their wheel bearing faces are horizontal.

6.2 Fatigue testing machine

6.2.1 Testing machine description

A fatigue testing machine shall be used to evaluate the castor assembly specimens against shocks from obstacles and surface abrasion. An example fatigue test machine is shown in [Figures A.1](#) and [A.2](#). The testing machine shall have a horizontal turntable capable of rotating in both directions. Castor assembly test specimens shall roll on the turntable against obstacles. The support arm setup shall be as specified in [Figure 3](#) including a hinged support that allows the castor wheel to bounce in an arc trajectory after an obstacle hit. The castor stem assembly shall be installed in a castor stem assembly holder that accommodates the castor stem assembly design.

The mass, stiffness, durability, corrosion resistance and securement of the testing machine (and its components) shall be sufficient that they do not affect the validity of testing under this document.

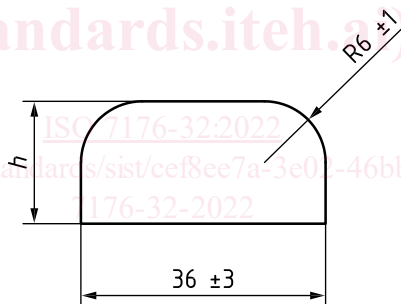
6.2.2 Abrasion surface

An abrasive sheet made with aluminium oxide of grain size 36, at least covering the top surface of the turntable, 1 mm average thickness and having a fully adhesive-back shall be attached to the turntable.

6.2.3 Obstacle profile

The obstacle shown in [Figure 1](#) is placed over the abrasive sheet and clamped to the turntable. The obstacle length shall be greater than twice the castor wheel diameter.

Dimensions in millimetres



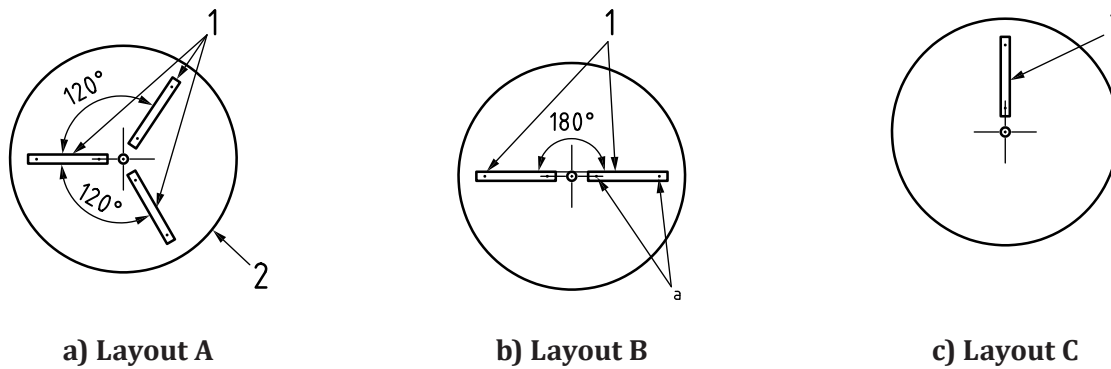
Key

- h* height of the obstacle depends on castor assembly type
See [Table 3](#) for different obstacle heights. Tolerance $\pm 8\%$.

Figure 1 — Sectional view of the obstacle

6.2.4 Obstacle placement

Three obstacle layouts shown in [Figure 2](#) are used for testing. The angle of the obstacles relative to the tyre rolling direction is $90^\circ \pm 10^\circ$.



Key

- 1 obstacle
- 2 turntable
- a Obstacle mounting holes outside of the castor running track.

Figure 2 — Obstacle layouts

6.2.5 Castor assembly loading

Weights shall be used for castor assembly loading. A pull-type hanging spring gauge with suitable load range and accuracy can be connected to the castor stem to measure the castor assembly load on the wheelchair and test load on the fatigue test machine.

7 Test preparation

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7.1 Preparation of the castor stem assembly holder and support arm

During installation of the castor stem assembly in the holder, the assembly shall be tightened to a torque of 2,0 Nm to 5,0 Nm or as specified by the manufacturer. The castor stem assembly holder shall be attached to the support arm at the point such that the castor wheel axle axis coincides with the turntable coordinate axis as specified in [Figure 3](#). The support arm shall be horizontally parallel within $\pm 2^\circ$ with the turntable plane. A bubble level can be used for this purpose.

7.2 Setup of the turntable

Adjust the angular speed of the turntable so that the speed at impact of the castor wheel with obstacles is $1,0 \text{ m/s} \pm 0,1 \text{ m/s}$.

7.3 Abrasion surface

The abrasive sheet shall be discarded following completion of the test sequence in [Table 2](#).

7.4 Environmental conditions

The ambient temperature during fatigue testing shall be $22 \text{ }^\circ\text{C} \pm 12 \text{ }^\circ\text{C}$. The test specimen shall not be artificially cooled during testing.

7.5 Castor assembly loading conditions

7.5.1 Where the castor assembly is specified for use in one or more wheelchairs, the castor assembly test load shall be the maximum weight supported by it +20 %, when mounted on the wheelchair(s) loaded with a test dummy in accordance with ISO 7176-11 and the wheelchair(s) set up in accordance with ISO 7176-22.

7.5.2 Where the castor assembly is not associated or supplied with any wheelchair, the castor assembly test load shall be the rated load declared by the castor manufacturer +20 %.

If a castor assembly is previously tested to meet the strength requirements in 5.1, the castor assembly loading conditions shall be recalculated according to [7.5](#).

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