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**Tips for assistive products for walking —  
Requirements and test methods —**

**Part 1:  
Friction of tips**

*Embouts pour produits d'assistance à la marche — Exigences  
et méthodes d'essai —*

*Partie 1: Frottement des embouts*



Reference number  
ISO 24415-1:2009(E)

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 24415-1 was prepared by Technical Committee ISO/TC 173, *Assistive products for persons with disability*.

ISO 24415 consists of the following parts, under the general title *Tips for assistive products for walking — Requirements and test methods*:

— *Part 1: Friction of tips*

The following part is under preparation:

— *Part 2: Durability of tips for crutches*

## Introduction

A frictional performance of the tips attached to the bottom of assistive products for walking is a key concern ensuring user safety. Friction between the tips and the walking surface is an extraordinarily important factor by which a user can confirm his/her motion.

The tips are used on many different assistive products for walking, including canes, walking sticks, crutches, walking frames, rollators and walking tables and are produced in many different sizes and made of many different materials depending on the assistive products for walking to which they are applied. Tips with a variety of bottom shapes for a particular kind of assistive product for walking are also available on the market.

In the friction test method found in this part of ISO 24415, tips of original shape are used. In real situations, not only pure frictional characteristics but also the shape and pattern of the bottom surface against the walking surface can affect the locomotive performance.

This part of ISO 24415 specifies a test with which the frictional force is measured on tip products themselves in order to ensure that the tips with necessarily frictional characteristics are used and it helps to exclude the tips with unacceptably poor frictional characteristics.

# Tips for assistive products for walking — Requirements and test methods —

## Part 1: Friction of tips

### 1 Scope

This part of ISO 24415 specifies requirements and test methods for the friction between the tips for assistive products for walking and the walking surface. This part of ISO 24415 is not applicable to tips manufactured for special purposes. The requirements and test method are based on a usage of tips for ordinary gait on the dry and flat walking surface.

EXAMPLE 1 Examples of assistive products for walking are walking sticks, elbow crutches, forearm crutches, auxillary crutches, walking frames, rollators and walking tables.

EXAMPLE 2 An example of special purposes is ice and/or snow.

### 2 Normative references

The following referenced documents are indispensable for the application 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 9999, *Assistive products for persons with disability — Classification and terminology*

### 3 Terms and definitions

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

#### 3.1

##### **tip**

that part of the assistive product for walking, which is in contact with the walking surface

See Figure 1.

#### 3.2

##### **test track**

surface against which the tip is to be tested

#### 3.3

##### **test velocity**

relative velocity between the tip and the test track

**3.4**

**frictional force**

force required to move the test track and the tip relative to each other

**3.5**

**frictional force to be recorded**

value of the frictional force determined from the test

See Annex A.

**3.6**

**axial loading force**

force exerted on the tips along the longitudinal axis of the loading shaft

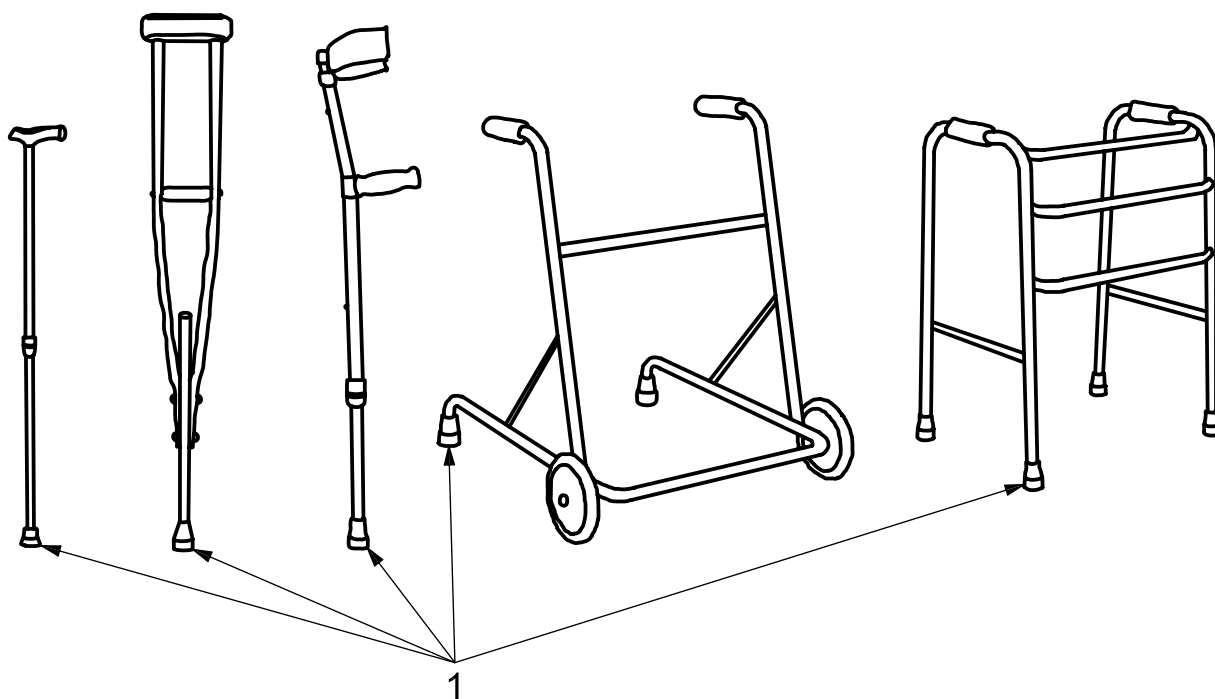
**3.7**

**temperature of test**

temperature of the tip, test apparatus and its environment

**4 Requirements**

The minimum frictional force shall be not less than 25 N when tested in accordance with 6.3.



**Key**

1 tip

**Figure 1 — Tips**

## 5 Test apparatus

### 5.1 Test device

The test device consists of a test track, a loading force mechanism, a pulling mechanism and a recording system. The tip and track shall move relative to each other linearly while the tip is placed on the test track and an axial load applied. The principle of the test apparatus is shown in Figure 2 and additional information is given in Annex B.

The whole test apparatus shall be rigid. All linkages shall be made with rods but not with wire.

### 5.2 Test track

The air side of the float glass shall be used for the test track. The test track shall be moved, relative to the tip, by the pulling mechanism.

### 5.3 Loading force mechanism

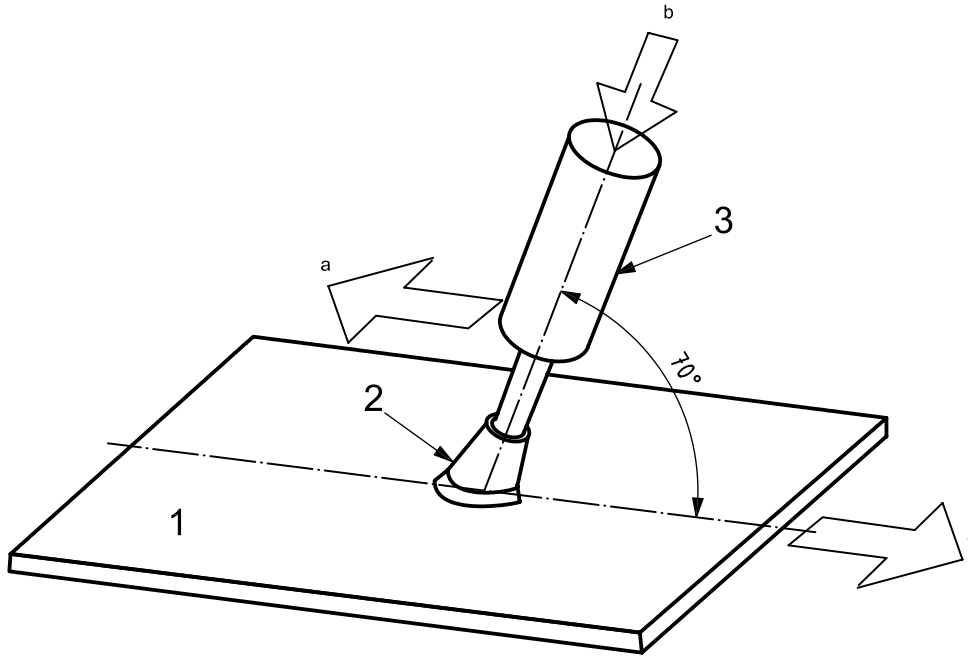
The loading force mechanism consists of a loading shaft having an outside dimension equivalent to the leg dimension as specified by the manufacturer and shall be positioned at an angle of  $(70 \pm 2)^\circ$  to the test track (see Figure 2). The loading mechanism shall exert an axial loading force of  $(50 \pm 1)$  N to the tip along the loading shaft. The mechanism used shall allow for separation of the tip from the test track, while the test track is reset to its initial position.

### 5.4 Pulling mechanism

The pulling mechanism shall give a constant test velocity of  $(500 \pm 25)$  mm/min regardless of the magnitude of the pulling force. The test velocity shall be reached within 0,3 s.

### 5.5 Frictional force measurement

The frictional force shall be recorded by a waveform-viewing device or a data-recording system. The recording shall be of an accuracy of  $\pm 2$  %. The measuring system shall be able to measure at least 200 N.



**Key**

- 1 test track
- 2 tip
- 3 loading force mechanism
- a Direction of movement.
- b Axial loading force.

**Figure 2 — Loading geometry**

**6 Test method**

**6.1 Preparation**

Wash the tip with neutral detergent and rinse with water. Place the tip for at least 3 h in the testing environment.

Three test samples shall be prepared.

**6.2 Testing environment**

The test shall be carried out at a temperature of  $(23 \pm 2) ^\circ\text{C}$  and a relative humidity of  $(50 \pm 10) \%$ .

**6.3 Test procedure**

The test procedure shall be as follows:

- a) wipe the test track with anhydrous ethanol;
- b) fix the sample tip to the shaft;
- c) place the sample tip on the test track at an angle of  $(70 \pm 2)^\circ$ ;
- d) exert a loading force via and normal to the inside base of the tip;



- e) maintain the axial loading force at  $(50 \pm 1)$  N for the duration of the test;
- f) within 5 min, move the sample tip relative to the test track in a linear direction with a speed of  $(500 \pm 25)$  mm/min for at least 3 s;
- g) when returning the test sample tip to the start position, the test sample shall be lifted clear of the test track;
- h) perform the test described in f) and g) three times without recording the frictional force waveforms;
- i) perform the test described in f) and g) five times recording the frictional force waveforms; determine the value of the frictional force to be recorded for these five latter frictional force waveforms and calculate and note the average of these five values (see Annex A);
- j) repeat a) to i) using the other two samples.

The lowest average value obtained from testing the three samples of each tip model shall be the final result.

## 7 Test report

The test report shall contain, but not be limited to, the following information:

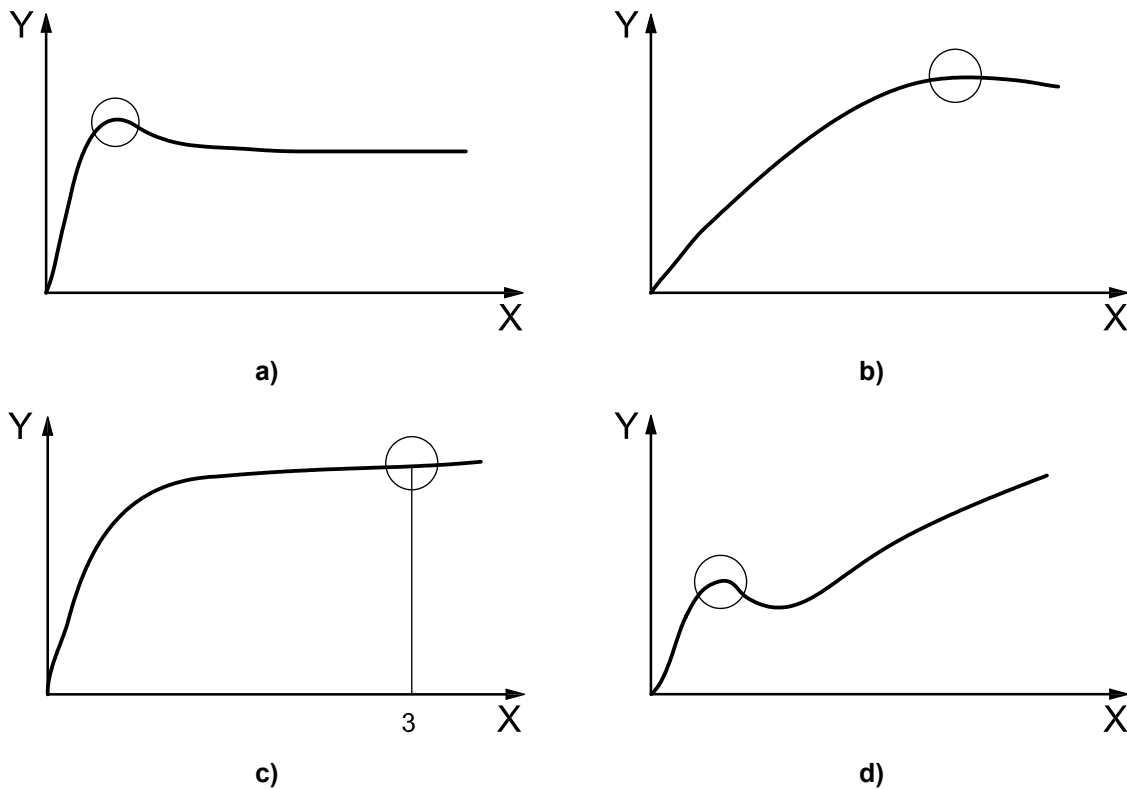
- a) name and address of the manufacturer;
- b) name and address of the supplier of the product for test;
- c) name and address of the testing institution;
- d) classification code and name in accordance with ISO 9999;
- e) manufacturer's product type and model identification name and/or number;
- f) supplier's product type and model identification name and/or number;
- g) maximum outer diameter of the tip measured within 5 mm up from the walking surface when the tip is perpendicular to the walking surface;
- h) inner diameter, internal depth, and photographs to obtain side and bottom shapes;
- i) accuracy of the measurement system, frequency range for the analogue system and sampling rate for the digital system;
- j) the lowest value of the three tests described in 6.3;
- k) month and year when the test was performed;
- l) whether or not the product complies with the requirements of this part of ISO 24415.

## Annex A (normative)

### How to determine the frictional force to be recorded

In the friction test, frictional force data need to be recorded by a measurement device, as waveforms. Characteristics of the friction of tips vary according to their materials, bottom shapes and thickness of bottom, etc. Some waveforms that could be measured in this test are shown in Figure A.1.

Each frictional force to be recorded is defined by circle (○).



**Key**

- X time, in seconds
- Y frictional force, in newtons

**Figure A.1 — Examples of waveforms**

In these measurements, the frictional force is defined as the initial peak, or, when no peak appears within 3 s, as the value recorded after 3 s (or at 3 s).

## Annex B (informative)

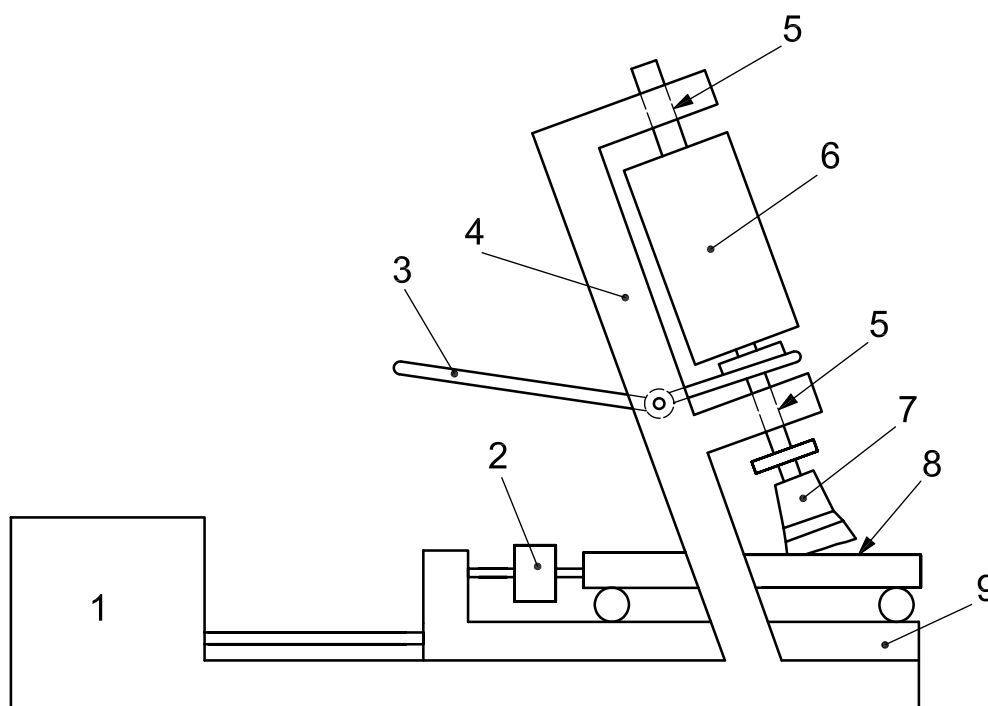
### Examples of test apparatus

Models of test apparatus are illustrated in Figures B.1 and B.2.

The apparatuses as shown in Figure B.1 and B.2 consist of a test track, a load cell, a sliding table, a loading mechanism and a pulling mechanism. The test track is placed on ball bearings and is connected to the load cell which is installed on the sliding table.

In this mechanism, the horizontal movement of the test track is carried out by the movement of the sliding table.

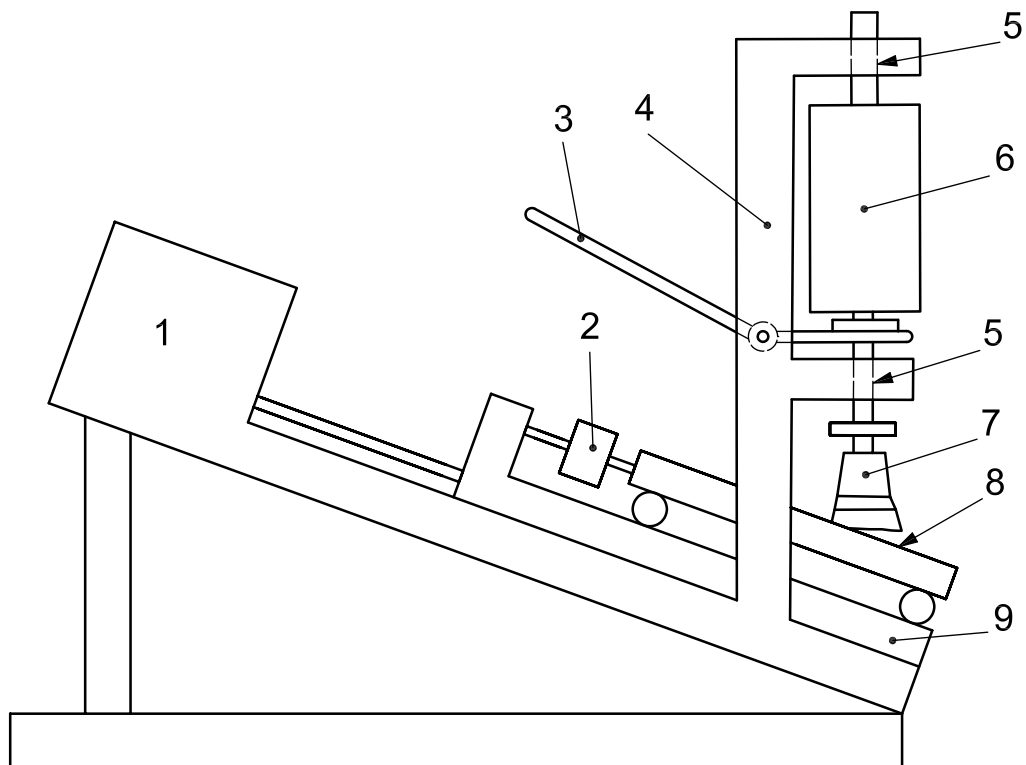
Consequently, the frictional force between the test track and sliding table can be minimized.



#### Key

- 1 pulling mechanism
- 2 load cell
- 3 lever to lift the tip during return movement
- 4 frame
- 5 guide
- 6 loading mechanism
- 7 tip
- 8 test track
- 9 sliding table

Figure B.1 — Example 1



**Key**

- 1 pulling mechanism
- 2 load cell
- 3 lever to lift the tip during return movements
- 4 frame
- 5 guide
- 6 loading mechanism
- 7 tip
- 8 test track
- 9 sliding table

**Figure B.2 — Example 2**

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