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Furniture — Chairs — Determination of stability

Part 1:

Upright chairs and stools

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Ameublement — Chaises — Détermination de la stabilité —

Partie 1: Chaises et tabourets droits

ISO 7174-1:1988

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7174-1 was prepared by Technical Committee ISO/TC 136, *Furniture*.

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Furniture — Chairs — Determination of stability

Part 1: Upright chairs and stools

0 Introduction

This International Standard is one of a series being prepared on the strength, durability and stability of furniture. The series currently consists of the following:

ISO 7170, *Furniture — Storage units — Determination of strength and durability.*

ISO 7171, *Furniture — Storage units — Determination of stability.*

ISO 7172, *Furniture — Tables — Determination of stability.*

ISO 7173, *Furniture — Chairs and stools — Determination of strength and durability.*

ISO 7174-1, *Furniture — Chairs — Determination of stability — Part 1: Upright chairs and stools.*

ISO 7174-2, *Furniture — Chairs — Determination of stability — Part 2: Chairs with tilting or reclining mechanism.*

ISO 8019, *Furniture — Tables — Determination of strength and durability.*

Chair stability may be determined by both the experimental method and the calculative method described in this part of ISO 7174. These methods are compatible in that they apply the same forces and application positions, and give similar results.

The calculative method does not deal readily with easy chairs or settees and is not able to compensate for

- a) upholstery items where the springing does not have a constant spring rate;
- b) chairs that undergo changes in their geometry when loaded, e.g. folding chairs, some metal chairs and some plastic chairs.

The calculative method is also invalid for chairs which visibly flex more than 25 mm when loaded. The calculative method is useful, however, in situations where it is not practicable to move heavy masses.

1 Scope and field of application

This part of ISO 7174 describes methods for determining the stability of all types of upright chairs, stools and pouffes. It does not apply to settees and other multiple seating, nor to reclining chairs when they are reclined, chairs with tilting mechanisms when they are tilted, nor to swivelling or rocking chairs. The methods are, however, applicable to testing chairs with reclining, tilting and adjustable back-angle mechanisms when these are used as upright chairs.

Part 2 of ISO 7174 deals with stability for chairs with tilting or reclining mechanisms when fully reclined.

The test results are only valid for the article tested. When the test results are intended to be applied to other similar articles, the test specimen should be representative of the production model.

In the case of designs not catered for in the test procedures, the test should be carried out as far as possible as described, and deviations from the test procedure recorded in the test report.

The annex does not form part of ISO 7174-1. The chart demonstrates how this part of ISO 7174 may be applied to any type or design of adult chair. The stability requirements contained in it should be considered as suggestions only.

2 Reference

ISO 7173, *Furniture — Chairs and stools — Determination of strength and durability.*

3 Definition

stability: Ability to withstand forces that tend to cause the article to overturn.

4 Test equipment

4.1 Loading pad, rigid circular object 200 mm in diameter with a face having a convex spherical curvature of 300 mm radius with a 12 mm edge radius. It shall be designed to remain in position without restricting the freedom of the chair to overturn.

NOTE — This pad is identical to the smaller seat loading pad specified in ISO 7173, with a figure giving full dimensions.

4.2 Force application device, which can apply a force, either at a given value or a gradually increasing value. The device shall not hinder any movement of the article being tested. If a given value is wanted, the device may consist of a mass, e.g. a steel plate. Instruments shall have an accuracy of ± 1 N.

NOTE — The tests are described in terms of the application of forces. In certain cases masses may be used; the relationship $10 \text{ N} = 1 \text{ kgf}$ is suitable for this purpose.

4.3 Stops, to prevent the article from sliding but not overturning, no higher than 12 mm except in cases where the design of the item necessitates the use of higher stops, in which case the lowest that will prevent the item from sliding shall be used.

4.4 Floor surface, horizontal, flat.

5 Conditioning

No prior conditioning of the article is required.

6 General test requirements

6.1 Positioning

Position the chair or stool on a horizontal surface with the legs restrained by stops to prevent it from sliding, but not from overbalancing.

For tests on articles with swivelling bases, rotate the base to the position relative to the seat that is most likely to cause overbalancing.

Tighten any assembly fittings.

Set adjustable height chairs to the height that is most likely to cause overbalancing.

For a chair or stool with a circular base, place it with its edge against a stop in the position commensurate with those specified for four-legged chairs. Position three- or five-star bases so that two feet are against the stops.

6.2 Tolerances

Unless otherwise stated, all forces shall have an accuracy of ± 5 %, all masses an accuracy of $\pm 0,5$ % and all dimensions an accuracy of $\pm 0,5$ mm.

7 Test procedures

7.1 Experimental method — Chairs

7.1.1 Forwards overbalancing and sideways overbalancing for chairs without arms

Position the chair with stops against the front legs and against the legs on one side (as appropriate). Apply a force of 600 N vertically by means of the loading pad so as to act at a point 50 mm from the edge of the seat at those positions along its exposed periphery most likely to result in instability (usually tests on the centreline are sufficient). Apply a force, F , as specified in the annex or in requirement documents horizontally along a horizontal line extended forward from the point where the base of the loading pad meets the upper surface of the seat (see figure 1). Record whether the chair overturns and the force used.

Chairs with adjustable backrests, and reclining and tilting chairs shall be tested with their back assemblies locked or set so as to be inclined rearwards from the vertical by $15 \pm 5^\circ$. Free swivelling backrests shall be loaded on their axis of rotation even when this axis is not adjustable to the above requirement.

7.1.2 Rearwards overbalancing

Position the chair with the stops against the rear legs. Apply a vertical force of 600 N to the seat by means of the loading pad at a point 175 mm forward of the centre of the line of intersection of the seat and back surfaces. Determine the distance, h , between the loaded seat height and the floor by measuring the distance between the horizontal bar and the base of the pad, and subtracting it from the distance between the horizontal bar and the floor.

Apply a force, F , as specified in the annex or in requirement documents horizontally to the back of the chair at a height of 300 mm above the unloaded seat or at the top edge of the backrest, whichever is the lower (see figure 2). Record whether the chair overturns and the force used.

Adjustable angle backrests shall be set at the rearmost point of the working adjustment range. Free swivelling backrests shall be loaded on their axis of rotation.

7.1.3 Sideways overbalancing for chairs with arms

Position the chair with stops against the legs of one side. Apply a vertical force of 250 N at a point 100 mm to one side of the fore and aft centreline of the seat and between 175 mm and 250 mm forward of the rear edge of the seat. Apply a vertical force of 350 N by means of the loading pad at a point 37,5 mm inside the outer edge of the arm at the most adverse position along its length. Apply a horizontal force as specified in the annex or in requirement documents outward at the upper surface of the arm rest and in line with the vertical arm force on the side with restrained feet (see figure 3). Record whether the chair overturns and the force used.

7.2 Experimental method — Stools: all directions

Position the stool so that two feet are resting against the stops. Apply a vertical force of 600 N by means of the loading pad at a

point 50 mm from the edge of the seat nearest the stopped feet. Apply a horizontal force as specified in the annex or in requirement documents through the centre of the seat in a direction towards the stopped feet (see figure 4). Record whether the stool overturns and the force used.

7.3 Calculative method — Chairs

7.3.1 General

In the calculative method, the seat loading pad is not used. Instead, the resistance to overturning that would have been caused by such loading is taken into consideration in the calculation, which is based on the moments about the restrained feet. For this calculation distances a , b and h are measured:

- distance a is the minimum horizontal distance from the line of the stopped feet to the vertical projection of the point of application of the seat load, W , had such been applied;
- distance b is the horizontal distance from the stopped feet to the arm load point;
- distance h is the vertical height of the point of application of the horizontal overturning force above the horizontal surface.

This method is not suitable for chairs with spring suspension seats.

7.3.2 Forwards overbalancing and sideways overbalancing for chairs without arms

Position the chair firstly with the stops against the front legs and then with the stops against the legs on one side. Apply a gradually increasing force, F_o , acting to tilt the chair over the restrained legs horizontally at the intersection of the seat and back surfaces. Record the value of F_o when the unrestrained legs lift off the floor. Measure distances h and a .

Calculate the force F_c required to overturn the chair had it been loaded with a seat load, W , of 600 N from the following formula :

$$F_c = F_o + (Wa/h)$$

7.3.3 Rearwards overbalancing

Position the chair with stops against the rear legs. Apply a gradually increasing force acting towards the rear on the centreline of the backrest at a height of 300 mm above the unloaded seat or at the top edge of the backrest, whichever is the lower, until the front legs of the chair just lift away from the floor.

Record the force, F_o , in newtons, and measure distances a and h .

Set adjustable angle backrests at an angle of $15 \pm 5^\circ$ back from the vertical. Load free swivelling backrests on their axis of rotation even when this axis is not adjustable to the above requirements.

Calculate the force, F_c , required to overturn the chair had it been loaded with a seat load, W , of 600 N from the formula in 7.3.2.

7.3.4 Sideways overbalancing for chairs with arms

Position the unloaded chair with stops against the legs on one side. Apply a gradually increasing force perpendicular to the tipping axis outward on that side at the height of the top of the arm rest at the most adverse position along the length of the arm rest. Record the value of F_o when the unrestrained legs just lift away from the floor. Measure distances a , b and h .

Calculate the force, F_c , required to overturn the chair had it been loaded with a seat load, W , of 600 N from the formula

$$F_c = F_o + (250 a/h \pm 350 b/h)$$

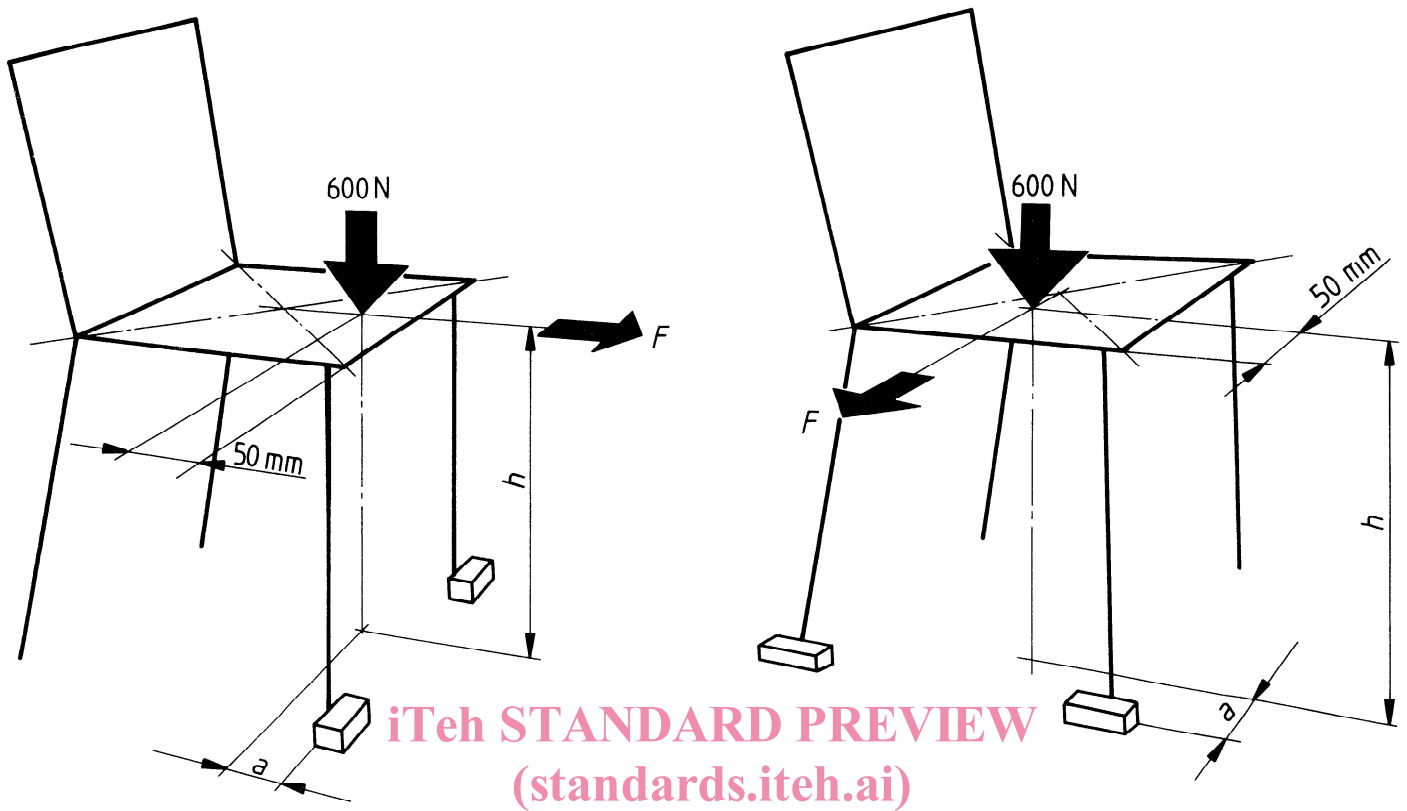
7.4 Calculative method — Stools: all directions

Determine the stability of stools in the manner described in 7.3.2 except that the stopped feet shall be those required to tilt the stool about the axis having the lowest stability.

8 Test report

The test report shall include at least the following information:

- a) a reference to this part of ISO 7174;
- b) the piece of furniture tested (relevant data);
- c) the method of stability test used (experimental/calculative);
- d) the test results, in forces according to clause 7, and whether the item overbalanced during the tests;
- e) details of any deviations from this part of ISO 7174;
- f) the name and address of the test facility;
- g) the date of test.



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Figure 1 — Forward overbalancing and sideways overbalancing for chairs without arms
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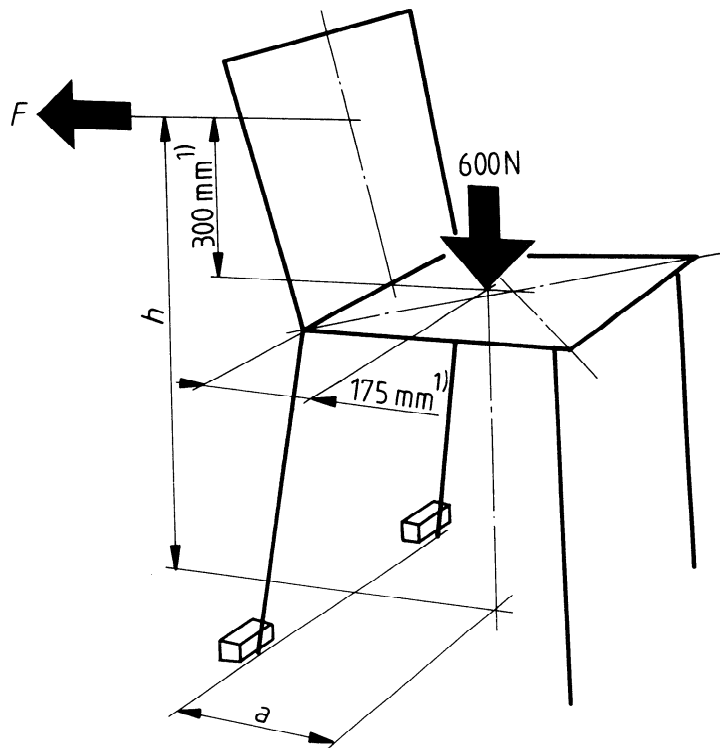
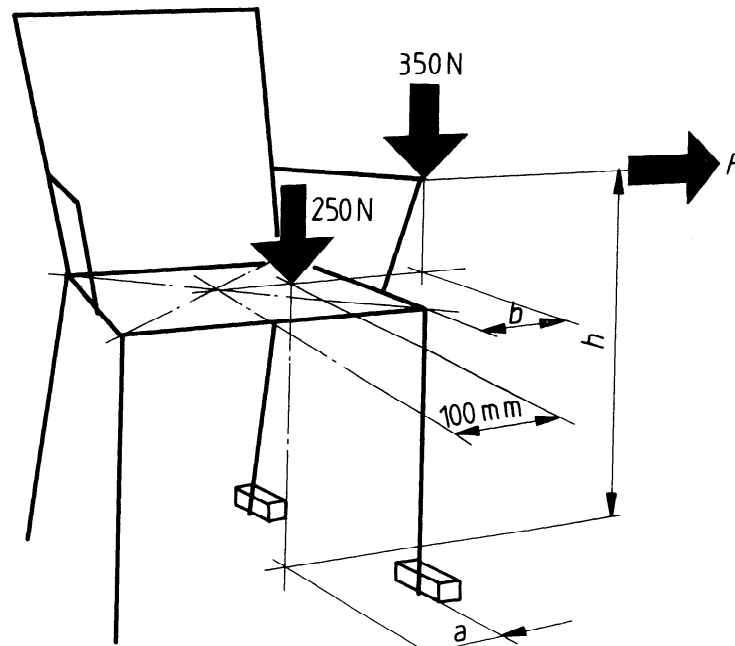


Figure 2 — Rearwards overbalancing



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Figure 3 – Sideways overbalancing for chairs with arms

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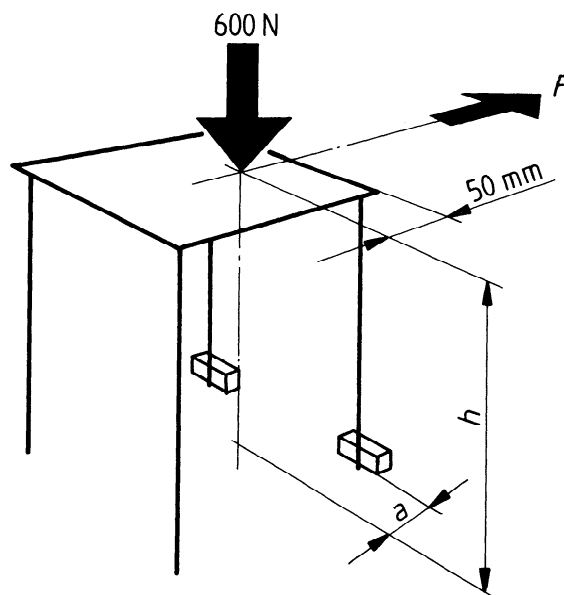


Figure 4 – Stools: all directions