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Office furniture — Tables and desks — Test methods for the determination of stability, strength and durability

Mobilier de bureau — Tables et bureaux — Méthodes d'essai pour la détermination de la stabilité, de la résistance et de la durabilité

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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.

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 21016 was prepared by Technical Committee ISO/TC 136, *Furniture*.

Office furniture — Tables and desks — Test methods for the determination of stability, strength and durability

1 Scope

This International Standard specifies test methods for the determination of the stability, the strength and the durability of all types of office tables designed for use in the seated and/or standing position, e.g. work tables, height-adjustable tables, meeting tables and desks. It applies to tables that are fully assembled and ready for use.

This International Standard does not contain test methods for storage elements, which can be found in ISO 7170.

The tests consist of the application, to various parts of the unit, of loads, forces and velocities simulating normal functional use, as well as misuse, that can reasonably be expected to occur.

With the exception of the deflection of table tops, the tests are designed to evaluate properties without regard to materials, design/construction or manufacturing processes.

The test results are valid only for the unit/component tested. These results can be used to represent the performance of production models provided that the tested model is representative of the production model.

Tests carried out according to this International Standard are intended to demonstrate the ability of the item to give satisfactory service in its intended environment. It is necessary to understand that such tests do not ensure that structural failure will not eventually occur as a result of habitual misuse or after an excessively long period of service. The tests have been developed for units/components that have not been in use. However, when properly justified, they can be used for fault investigation.

This International Standard specifies test methods only. It does not specify requirements. These should be specified in a requirements document. If this is not available, suggested forces and cycles can be found in Annex A.

Assessment of ageing and degradation is not included.

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 7619-2:2004, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 2: IRHD pocket meter method*

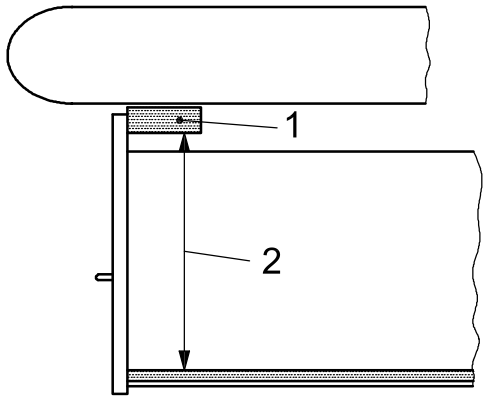
ISO 7170:2005, *Furniture — Storage units — Determination of strength and durability*

3 Terms and definitions

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

3.1
clear height
distance between the top of the extension element bottom and the lower edge of the extension element above, or the structure of the unit

NOTE See Figure 1.



Key

1 structure of unit
2 clear height

Figure 1 — Clear height

3.2
duty cycle
length of time the height-adjustable table's drive system can be operated without impairing its useful life

NOTE The duty cycle includes the amount of time the drive system can be operated and the amount of time it must not be operated to allow the drive system to cool sufficiently before it is activated again.

4 General test conditions

4.1 General

Forces, velocities, masses, dimensions, angles, time and temperatures given in this International Standard shall be targeted at the nominal values specified.

4.2 Preliminary preparation

Pre-assembled table(s) shall be tested as delivered. The unit(s)/component(s) shall be assembled and/or configured according to the instructions supplied with them. The most adverse configuration intended for use shall be used for each test. If mounting or assembly instructions are not supplied, the assembly method shall be recorded in the test report. Fittings shall be tightened before testing and shall not be retightened unless specifically required by the manufacturer. If it is necessary to change the configuration to produce the worst-case conditions, this shall be recorded in the test report.

The tests shall be carried out in indoor ambient conditions. If during a test the temperature is outside of the range of 20 °C ± 5 °C, the maximum and/or minimum temperature shall be recorded in the test report.

For furniture that includes hygroscopic materials, at least one week in normal indoor conditions shall have elapsed between manufacture (or assembly) and testing.

The test for deflection of table tops (see 6.7), except those made from metal, glass and stone, shall be carried out at a relative humidity of (50 ± 5) %. If during a test the relative humidity is outside this range, the maximum and/or minimum shall be recorded in the test report.

NOTE (50 ± 5) % RH and the corresponding wood moisture content is representative of average indoor conditions in Canada, Europe and the USA. Other relative humidities can be appropriate in other parts of the world.

In the case of designs not addressed in the test procedures, the tests shall be carried out as far as possible as described and any deviation shall be recorded in the test report.

Unless otherwise specified, levelling devices shall be opened to their midpoint of adjustment, but not more than 10 mm.

Before beginning the testing, visually inspect the unit thoroughly. Record any defects so that they are not assumed to have been caused by the tests. Carry out measurements if specified.

During testing, the unit shall be placed on the floor and levelled, unless otherwise specified.

4.3 Test equipment

Unless otherwise specified, the tests may be applied by any suitable device because results are dependent only upon correctly applied forces and loads and not upon the apparatus.

The equipment shall not inhibit deformation of the unit/component during the test. It shall be able to move so that it can follow the deformation of the unit/component during testing, so that the forces and loads are always applied at the specified point and in the specified direction.

All loading pads shall be capable of pivoting in relation to the direction of the applied force. The pivot point shall be as close as practically possible to the load surface.

4.4 Application of forces

The forces in the static force tests shall be applied sufficiently slowly to ensure that negligible dynamic force is applied. Unless otherwise specified, each force shall be maintained for a period of (20 ± 10) s.

The forces in durability tests shall be applied at a rate to ensure that excessive heating does not occur. Unless otherwise specified, each force shall be maintained for a period of (2 ± 1) s.

The forces may be applied using masses. The relationship of 10 = 1 kg shall be used.

4.5 Tolerances

Unless otherwise stated, the following tolerances are applicable:

— forces: ± 5 % of the nominal force;

— velocities: ± 5 % of the nominal velocity;

— masses: ± 1 % of the nominal mass;

— dimensions: ± 1 mm of the nominal dimension;

— angles: ± 2° of the nominal angle.

The accuracy for the positioning of loading pads shall be ± 5 mm.

4.6 Sequence of testing

All applicable tests shall be carried out on the same sample and in the same sequence as they appear in this International Standard.

All tests specified for a particular component shall be carried out on the same sample.

4.7 Prevention of movement during test

If a unit tends to slide or roll during the tests specified in Clause 6, the unit shall be restrained by stops (see 5.2).

4.8 Loads in storage components

Unless otherwise specified, all components, including extension elements, intended for storage purposes shall be uniformly loaded according to Table 1.

The volume of extension elements shall be calculated as the internal area of the extension element bottom multiplied by the clear height above it.

Table 1 — Loads in storage components

Part	Load
Shelves	1,5 kg/dm^2
Storage components for suspended filing only [a]	4,0 kg/dm
All other storage components	0,5 kg/dm^3
[a] Dimension measured perpendicular to the plane of the suspended file pockets.	

4.9 Inspection and assessment of results

After completion of each of the tests, visually inspect the unit again.

Record any changes that have taken place since the initial inspection (see 4.2). Inspection may include measurements, e.g. opening or closing forces or deflections. The inspection shall note at least the following:

a) fracture of any component or joint;

b) loosening of any joint intended to be rigid, that can be demonstrated by hand pressure;

c) deformation or wear of any part or component such that its functioning is impaired;

d) loosening of any means of attachment;

e) any wear or deformation of a component that can affect its stability.

Pass and fail criteria should be established in a requirement document.

5 Test apparatus

5.1 Floor surface

The floor surface shall be a rigid, horizontal and flat surface.

For the strength under horizontal static force test (see 6.3), the surface shall be a smooth high-pressure plastic laminate or a smooth steel.

For the durability of tables with castors (see 6.8), the test shall be carried out on a smooth steel surface.

For the drop test (see 6.9), the floor shall be faced with a 3 mm thick layer of rubber with a hardness of (85 ± 10) IRHD in accordance with ISO 7619-2.

5.2 Stops

Devices shall be used to prevent the table from sliding or rolling but not tilting. They shall be no higher than 12 mm except in cases where the design of the table necessitates the use of higher stops, in which case the lowest that prevents the table from moving shall be used. When a stop with a height greater than 12 mm is used, the height shall be recorded in the test report.

5.3 Loading pad

The loading pad is a rigid disc, 100 mm in diameter, with a flat face and a 12 mm front edge blend radius.

5.4 Masses

Masses shall be designed so that they do not reinforce the structure or redistribute the stresses.

6 Test methods

6.1 Stability

6.1.1 Stability under vertical load

Place the table on the floor surface (see 5.1). The test shall be carried out with the storage components unloaded and closed.

Tables that can be set to heights both above and below 950 mm shall be tested to both 6.1.1.1 and 6.1.1.2.

6.1.1.1 Test for tables that are or can be set to a height of 950 mm or less

The table shall be set to the height most likely to overturn the table, but not more than 950 mm.

The specified vertical force shall be applied to the table top through the loading pad (see 5.3) 100 mm from the edge at the point most likely to overturn the table. If the position most likely to cause overturning is not apparent, it can be necessary to carry out this test with the vertical force at additional locations on the table top.

Record whether the table overturns.

6.1.1.2 Test for tables that are or can be set to a height greater than 950 mm

The table shall be set to the height most likely to cause overturning, but not less than 950 mm.

Apply 50 % of the specified vertical force to the table top through the loading pad (see 5.3) 100 mm from the edge at the point most likely to overturn the table. If the position most likely to cause overturning is not apparent, it can be necessary to carry out this test with the vertical force at additional locations on the table top.

Record whether the table overturns.

6.1.2 Stability with extension elements open

Place the table on the floor surface (see 5.1).

Load each extension element with the load specified in 4.8.

Open the two extension elements with the largest loads without overriding the interlock. If an interlock device prevents any two of the extension elements from being opened simultaneously, open the extension element with the largest load. Opening two extension elements simultaneously is not considered overriding the interlocks.

Apply the specified vertical force through the loading pad (see 5.3) 100 mm from the front edge of the table at the point most likely to overturn the table.

Record whether the table overturns.

6.2 Strength under vertical static force

Place the table on the floor surface (see 5.1).

Height-adjustable tables shall be set to their highest position, but not higher than 950 mm.

Load all extension elements as specified in 4.8. Close the extension elements and keep the extension elements closed throughout the test.

Apply to the work surface, by means of the loading pad (see 5.3), the specified downward vertical force 10 times.

Carry out the test at the point(s) most likely to cause failure. If the point most likely to cause failure is not evident, repeat the test at up to four loading positions.

The forces shall be applied 100 mm in from the edge(s). However, if the table overturns before the full force is applied, reposition the load to the nearest point that will accept the load without overturning.

If the force is applied at a position other than 100 mm in from the edge(s), record the loading point locations.

Record and assess defects in accordance with 4.9.

6.3 Strength under horizontal static force

Place the table on the floor surface (see 5.1).

Height-adjustable tables shall be set to their highest position.

Restrain the legs/supports of the table by stops placed around each leg/support at the end opposite that at which the horizontal test force is first applied. Leave the stops in position for all applications of the horizontal test force.

Apply a mass of 50 kg to the approximate centre of the table top.

Apply the specified horizontal force at the work-top level in a direction perpendicular to a line joining the two legs/supports and midway between the legs/supports. See Figures 2 and 4.

If the table tends to tilt when the specified force is applied, reduce the force sufficiently to just prevent tilting. Record the force applied.

Apply the specified force in the opposite direction.

One application of the force in each direction represents one cycle.

Carry out for 10 cycles.

Apply the specified horizontal force at the work-top level along the line joining the two legs/supports. See Figures 3 and 5.

Apply the specified force in the opposite direction.

One application of the force in each direction represents one cycle.

Carry out for 10 cycles.

Repeat this procedure with the force applications until each unique leg design/construction has been tested in each of four quadrants.

Record and assess defects in accordance with 4.9.

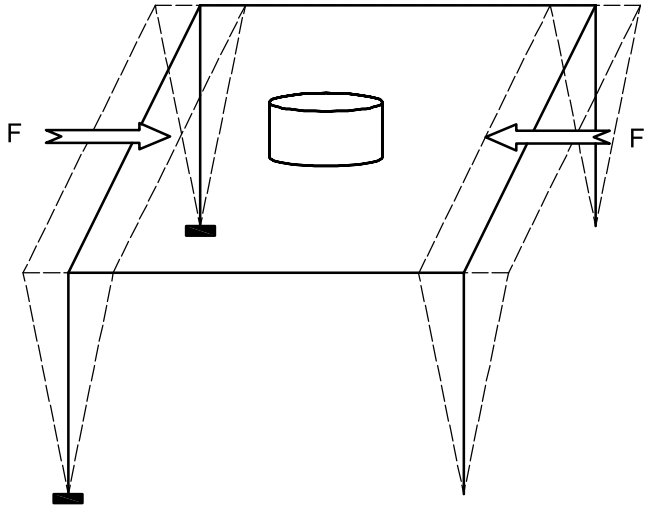


Figure 2 — Strength under horizontal static force test — Rectangular table — First and second directions

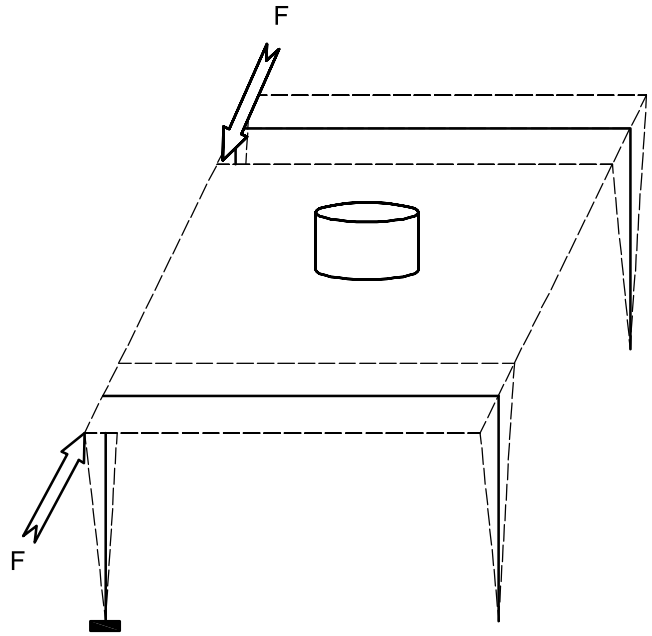


Figure 3 — Strength under horizontal static force test — Rectangular table — Third and fourth directions

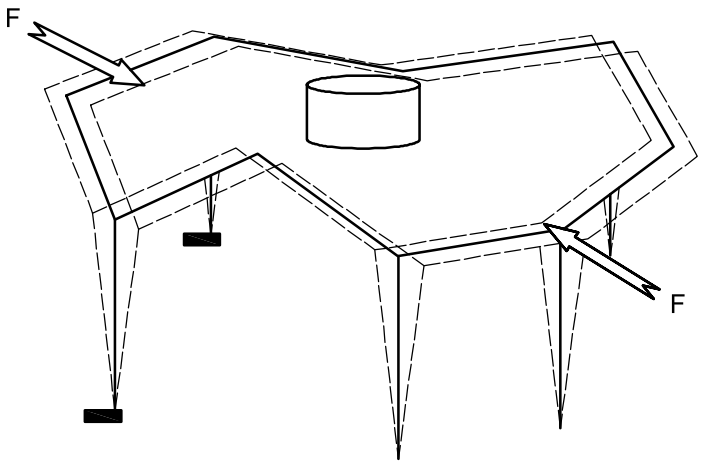


Figure 4 — Strength under horizontal static force test — Irregularly shaped table — First and second directions

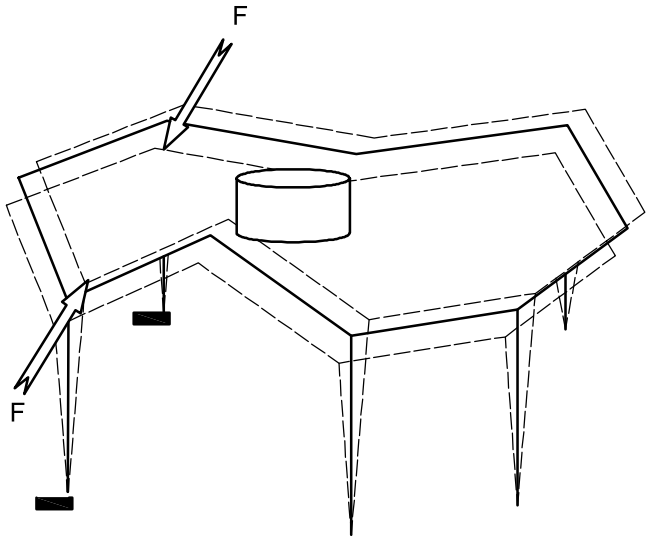


Figure 5 — Strength under horizontal static force test — Irregularly shaped table — Third and fourth directions

6.4 Durability under vertical force

Place the table on the floor surface (see 5.1).

Height-adjustable tables shall be set to their highest position.

If necessary, the legs/supports may be stopped to prevent sliding but the stops shall not inhibit deformation.

Load all extension elements as specified in 4.8. Close the extension elements and keep the extension elements closed throughout the test.

Using the loading pad (see 5.3), apply a vertical force of 400 N at 100 mm from the edge of the table top, at the point most likely to cause failure. If the table tends to tilt when the specified force is applied, move the force towards the centre of the table just enough to prevent tilting.

One application of the force followed by removal of the force shall represent one complete cycle.

Carry out the specified number of cycles with a frequency of not more than 10 cycles per minute.

Record and assess defects in accordance with 4.9.

6.5 Durability and stiffness under horizontal force

6.5.1 General

Place the table on the floor surface (see 5.1).

Height-adjustable tables shall be set to their highest position, but not higher than 950 mm.

Restrain the legs/supports of the table by placing stops (see 5.2) around each leg/support. Apply a mass of 50 kg to the approximate centre of the table top.

6.5.2 Durability

Apply 66 % of the horizontal force specified for 6.3 in a lateral direction, at the work-top level, parallel to the table's longitudinal centreline and 50 mm in from and perpendicular to an edge, towards the opposite side of the table; then reverse the force direction. See Figure 6.

If the table tends to tilt when the specified force is applied, reduce the force sufficiently to just prevent tilting. Record the force applied.

One application of the force in each direction represents one cycle.

Carry out the specified number of cycles with a frequency of not more than 10 cycles per minute.

Repeat the test in the other directions.

If the force(s) applied is/are reduced, record the force applied.

Record and assess defects in accordance with 4.9.

Dimensions in millimetres

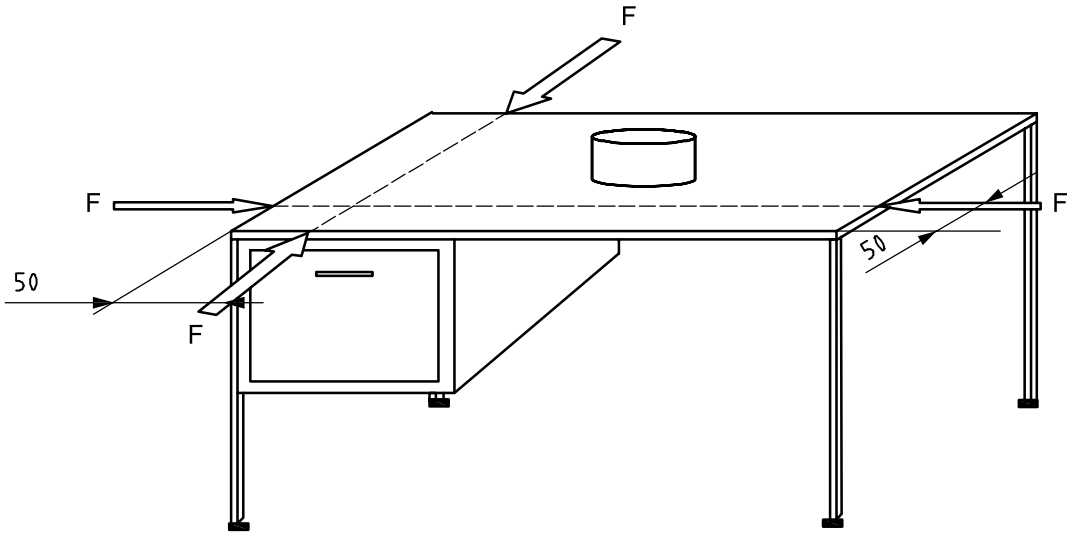


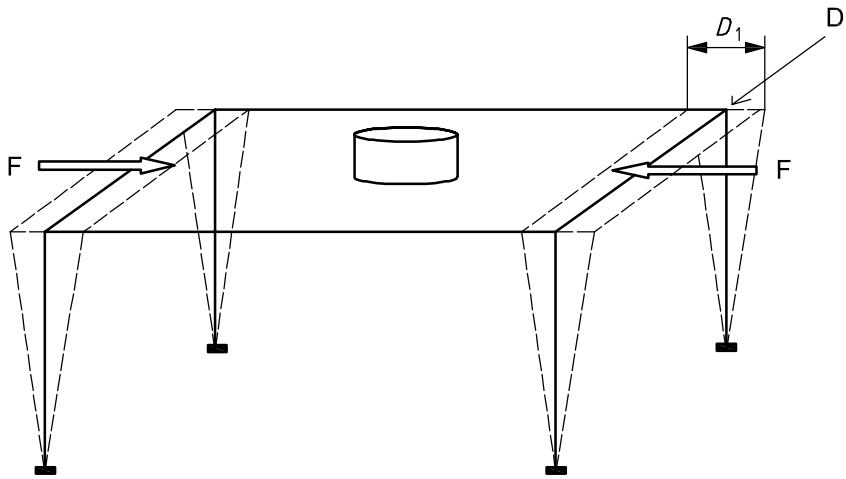
Figure 6 — Durability under horizontal force

6.5.3 Stiffness of the structure

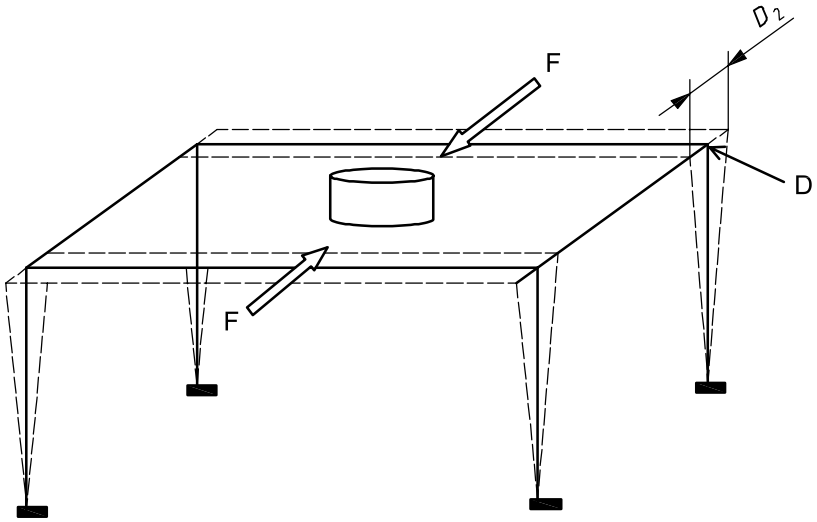
Apply the test force at the work-top level in a direction perpendicular to a line joining two legs/supports and midway between the legs/supports, or midway between the outermost legs for a table with more than two legs in a straight line.

Apply a horizontal force of 300 N at the work-surface level and along its longitudinal centreline, towards the centre of the table. Maintain the force for 2 s and record the position of a point D on the length of the table. Remove the force and repeat it in the opposite direction and record the distance of the horizontal travel of the point. The total distance point D moves, from its location when the force is applied in one direction to its location when the force is applied in the other direction, is D_1. [See Figure 7 a).] Calculate and record D_1.

Repeat the procedure using horizontal forces along the transverse centreline. The total distance point D moves, from its location when the force is applied in one direction to its location when the force is applied in the other direction, is D_2. [See Figure 7 b).] Calculate and record D_2.



a) Longitudinal direction



b) Transverse direction

Figure 7 — Stiffness of the structure

6.6 Durability of the height adjustment mechanism

Place the table on the floor surface (see 5.1).

Load the table top with 45 kg applied on the centre of a line 300 mm in from the rear edge of the surface and at the side to side locations noted below. Load the extension elements according to Table 1.

Cycle the table, including any latches or activation mechanisms for the specified cycles as described below. The test device shall apply only those forces necessary to achieve the required motion and shall not add mass to the table. The latching and/or activating mechanisms may be cycled concurrently or independently for the complete test as follows (see Figure 8).

— First 25 % of cycles: The table shall be cycled its total vertical travel. Position the centre of the load 300 mm in from the left edge of the surface.

— Next 50 % of cycles: The table shall be cycled its total vertical travel. Position the centre of the load in the middle of the surface.

— Last 25 % of cycles: The table shall be cycled its total vertical travel. Position the centre of the load 300 mm in from the right edge of the surface.

One cycle shall be comprised of travel from the lowest position to the highest position and return.

The cycle rate shall not exceed 6 cycles per minute.

The cycle rate for electrically driven tables shall be as recommended by the manufacturer. When a duty cycle is not recommended by the manufacturer, the duty cycle shall be three cycles on and then off for the equivalent time it takes to run 15 cycles.

The duty cycle may be increased when temperature control is agreed with the manufacturer.

Record and assess defects in accordance with 4.9.

Dimensions in millimetres

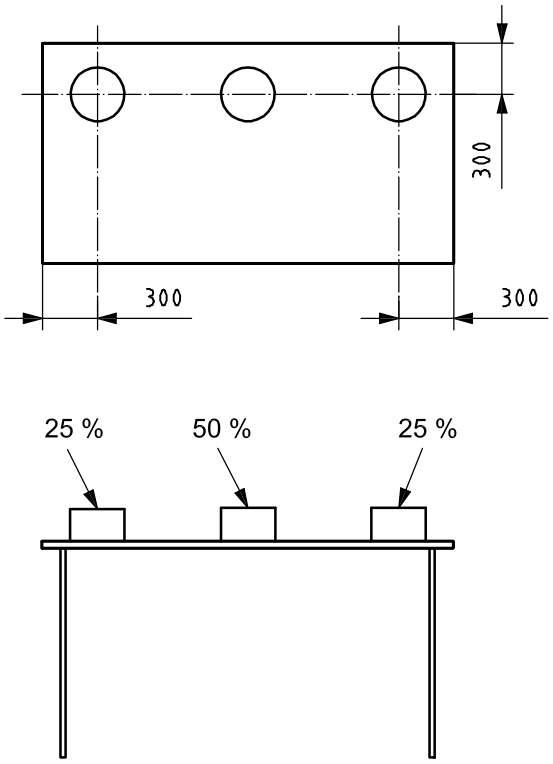


Figure 8 — Durability of the height adjustment mechanism

6.7 Deflection of table tops

Testing of the deflection of table tops that are not made of metal, glass or stone shall be carried out in a relative humidity as specified in 4.2.

The greatest deflection shall be measured and recorded with reference to a straight line to an accuracy of ± 0,1 mm.

Place the table being tested on the floor surface (see 5.1). Load the table top uniformly with the load specified and apply for

— 1 h for table tops made of metal, glass and stone, or

— 1 week for all other table tops.

With the load remaining on the top, measure and record the greatest deflection along the working edge of the surface with reference to a straight edge placed along and extending the entire length of the table top.

6.8 Durability of tables with castors

Place the table unloaded on the floor surface (see 5.1).

The operating force shall be applied no lower than 50 mm from the top surface of the table.

Apply a load of 40 kg centred on the table.

The castors shall be free to rotate and swivel.

Move the table (600 ± 20) mm back and forth at a rate of (10 ± 2) cycles per minute for the specified number of cycles.

One cycle consists of a forward and a backward stroke.

Record and assess defects in accordance with 4.9.

6.9 Drop test

Place the table unloaded on the floor surface (see 5.1) in its normal position of use.

Determine the drop height (see Figure 9) as a percentage of the specified nominal drop height in accordance with the criteria listed in Table 2.

Table 2 — Determination of the drop height for the drop test

Force to lift one end of the table N	Percent of specified nominal drop height
0 to < 200	100
200 to 400	100 – [70 × (force to lift one end of unit – 200)/200]
> 400	30

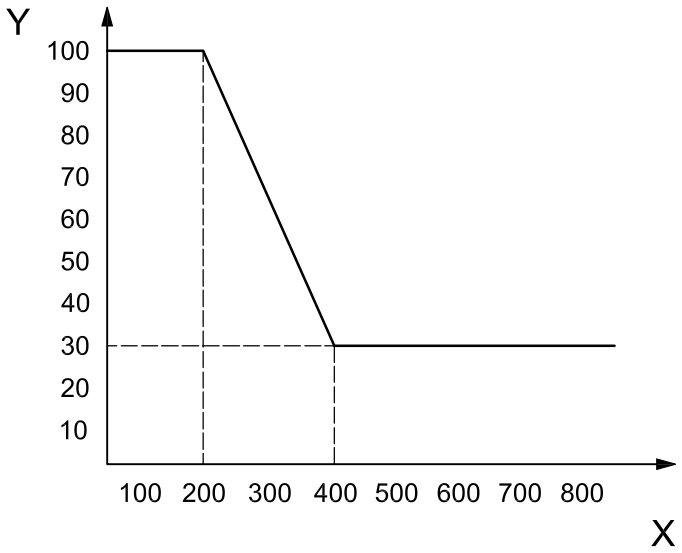
Determine and record the most likely lifting point(s).

Lift one end of the table to the drop height and let it drop freely onto the floor surface (see 5.1). See Figure 10.

Carry out the test six times. Height-adjustable tables shall be tested three times at the lowest position and three times at the highest position.

Determine the drop height for the opposite end of the table and repeat the test on that end.

Record and assess defects in accordance with 4.9.

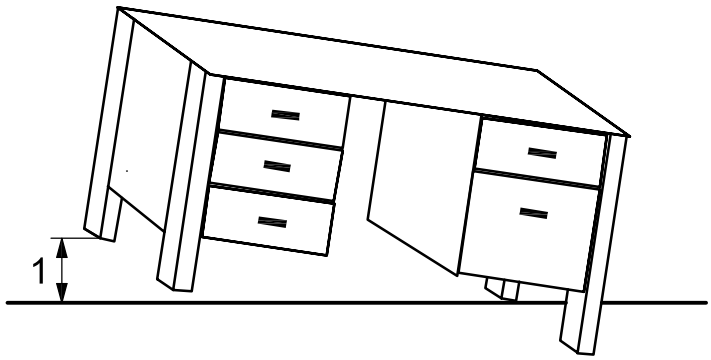


Key

X force to lift one end of the table, expressed in newtons

Y percentage of nominal drop height

Figure 9 — Graphical representation of the equation for drop height



Key

1 calculated drop height

Figure 10 — Drop test

7 Test report

The test report shall include at least the following information:

a) reference to this International Standard;

b) details of the table tested;

c) any defects observed before testing;

d) test results according to Clause 6;

e) details of any deviations from this International Standard;

f) name and address of the test facility;

g) date of the tests.

Annex A
(informative)

Guidance for the choice of cycles, forces and heights for the stability, strength and durability tests

A range of loads, cycles, etc. are suggested in this annex to ensure that the standards are of use where no requirements document is available or to assist in the development of one.

The suggested loads, cycles, etc., are intended to ensure that specifiers can gain experience in the use of strength and durability standards, in a manner that makes it possible to compare the test results with those of other specifiers. For example, without any guidance, one specifier might choose to use a 400 N strength test and a durability test of 10 000 cycles. This would have no meaning to another specifier who had chosen to use a 300 N strength test and a durability test of 20 000 cycles.

It shall be emphasised that test methods for activities affecting the safety of office work tables have not been preselected from the range of stability, strength and durability tests. If required, they should be determined by the specifier because the requirements for safety can be different from the requirements for serviceability.

The suggested range of loads, cycles, etc. are provided to allow specifiers the freedom to carry out the tests in the manner they consider preferable. It is not intended that the tests be carried out at the lowest test level and carried on, increasing in severity until failure occurs, nor that tests should be carried out at a predetermined column, based on the application for which the furniture is intended.

The requirements shall be provided by the specifier. The requirements used in other furniture standards include

— no damage as listed in 4.9,

— no damage affecting the safe use of the product,

— no damage affecting function or appearance, and

— no damage in accordance with 4.9 up to a specified limit; after that, no failure affecting safety.

It is emphasised that the application of this International Standard is useful only if the requirements truly represent the service environment for which the furniture is intended. Requirements that are too severe or insufficiently severe render the results of the testing valueless.

Table A.1 — Stability tests — Suggested forces

Clause/Test		Unit	Suggested forces	
			Work tables [a]	Other [b]
6.1.1	Stability under vertical load	N	750	400
6.1.2	Stability with extension elements open	N	200	—

[a] Work tables include tables used for seated and/or standing office tasks, for example, desks and panel/screen system supported tables.

[b] Other tables include meeting tables, printer tables, etc.

Table A.2 — Tests — Suggested cycles, forces and heights

Clause/Test	Unit	Dimension		Forces		Cycles	
		Work tables [a]	Other [b]	Work tables	Other	Work tables	Other
6.2 Strength under vertical static force	N	—	—	1 000	1 000	—	—
6.3 Strength under horizontal static force	N	—	—	450 max.	350 max.	—	—
6.4 Durability under vertical force	Cycles	—	—	—	—	10 000	5 000
6.5.2 Durability under horizontal force	Cycles	—	—	—	—	5 000	2 500
6.5.3 Stiffness of the structure under horizontal force	N	17 mm/m of height	34 mm/m of height	—	—	—	—
6.6 Durability of the height adjustment mechanism	Cycles	—	—	—	—	5 000 (total)	2 500 (total)
6.7 Deflection of table tops [c]	kg/dm^2	—	—	1,0	1,0	--	--
6.8 Durability of tables with castors	—	—	—	—	—	2 000	2 000
6.9 Drop test	mm	100 nominal	100 nominal	—	—	—	—

[a] Work tables include tables used for seated and/or standing office tasks, for example, desks and panel/screen system supported tables.

[b] Other tables include meeting tables, printer tables, etc.

[c] Specified as a percentage of the table top length.

ICS 97.140

Price based on 16 pages