

Swiss Door Force Measuring Tool User's guide



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Swiss Door Force Measuring Tool – At a glance

Intended usage and application

The Swiss Door Force Measuring Tool - referred to as measuring device in this User's Guide - was developed in Switzerland in cooperation with the Swiss National Accident Insurance Institution (SUVA). This measuring device is used to determine the forces acting around elevator doors, as described in Standard EN 81-20/50.

The device is used for measuring:

- the closing force of automatic power-operated car and landing doors
- · the kinetic energy of automatic power-operated car and landing doors
- the mechanical strength of elevator car and landing doors, and of car walls, aprons, etc.

The device can be converted by means of simple handgrips so that closing forces and kinetic energy can be measured both within < 250 mm (185 mm) and outside the measuring distance > 250 mm (500 mm). In addition, the device enables measuring mechanical deformations on constructions. All measurements are purely mechanical and the values are read via the drag pointer. The measuring accuracy is within +/-5%.

Interpretation of average closing speed

Excerpt from the Standard EN 81-20

5.3.6.2.2.1 Automatic power operated doors

The following applies:

a) the kinetic energy of the landing and/or car door and the mechanical elements which are rigidly connected to it, calculated or measured at the average closing speed shall not exceed 10 J.

The average closing speed of a sliding door is calculated over its whole travel, less:

1) 25 mm at each end of the travel in the case of centrally closing doors;

2) 50 mm at each end of the travel in the case of side closing doors;

Let us assume that these doors are telescopic sliding doors with a door width of 900 mm. The drive is a linear drive. Let us assume that the deceleration and acceleration distances together are 150 mm. We can now remove 50 mm at each end of the closing travel, i.e., together, 100 mm. If we remove the 100 mm from the deceleration and acceleration distance of 150 mm, there remains a distance of 50 mm, which can influence the average closing speed. With large doors, such as those used for freight elevators, the deceleration and acceleration distance is no longer relevant at all.

In this case, the practice of the theory must clearly prevail. As previously explained, the average closing speed is negligibly lower than the maximum speed. In any case, the measurement is on the safe side.

Proper use and warranty

The measuring device must be used as intended, otherwise no warranty claims can be made.

Intended use excludes everything, except the measuring of the closing force and kinetic energy of automatic power-operated car and landing doors, and the mechanical strength of door panels, car walls and aprons, as described in this User's Guide. These measurements may only be carried out by a qualified person.

Accordingly, these applications are also applicable to other Standards.

Product contents

- 1 Carrying case (I x w x h) 326 x 222 x 77
- 2 Documents
 - User's Guide
 - Calibration protocol
- 3 Open-end spanner
- 4 Measuring device
- 5 Holder
- 6 Plate 100 cm²
- 7 Allen key

Note

The measuring device should be kept in the carrying case during transport, and when it is not in use.



Technical Data

F max	Scale 1	1000 N
E _{Kin} max	Scale 2	20 J
Spring constant c		25 N/mm
Scale 1, graduation		50 N
Scale 2, graduation		1 J
Weight holder		820 g
Impact area		5 cm ²
Impact area		100 cm ²
Measuring device length	without holder	185 mm
Measuring device length	with holder	500 mm

Deviation from the nominal value

The tolerance of measuring accuracy is \pm 5%.

Measuring the closing force (opening force) Standards EN 81-20

The following standards apply to the measurement of the closing force, or opening force, of automatic power-operated landing and car doors:

- 5.3.6.2.2 Horizontally sliding doors
- 5.3.6.2.2.1 Automatic power operated doors

The following applies:

- c) the effort needed to prevent the door closing shall not exceed 150 N excluding the first third of the travel of the door;
- e) the effort needed to prevent a folding door from opening shall not exceed 150 N. This measurement shall be made with the door collapsed such that the adjacent outer edges of the folded panels or equivalent, e.g. door frame, are at a distance of 100 mm;
- h) doors made from glass, with the exception of vision panels to 5.3.7.2.1 a), shall be provided with means to limit the opening force to 150 N and to stop the door in the event of an obstruction.
- 5.3.15 Opening the car door

5.3.15.1 If the lift stops for any reason in the unlocking zone (5.3.8.1), it shall be possible with a force not greater than 300 N, to open the car and landing door by hand from:

- a) the landing after the landing door has been unlocked with the emergency unlocking key or being unlocked by the car door;
- b) within the car.

5.3.15.2 In order to restrict the opening of the car door by persons inside the car a means shall be provided such that:

- a) when the car is moving the opening of the car door shall require a force of more than 50 N, and
- b) when the car is outside of the zone defined in 5.3.8.1, it shall not be possible to open the car door more than 50 mm with a force of 1000 N, at the restrictor mechanism nor shall the door open under automatic power operation.

Measuring distance < 250 mm (185 mm)

For this distance, the measuring device (4) is used with or without holder (3), depending on the space. If necessary, the guide pin (5) is removed from the holder.

Preparation

- A Push the measuring device (4) into the hole of the holder (3).
- **B** Carefully fix the measuring device (4) by means of the hexagon socket screw (2).



Measuring the closing force (continued)

Measuring

- **C** Position the measuring device (4), mounted alone or, as shown, in the holder (3) between the door panels (6) for centrally opening doors (Figure 1), or between the door panels (6) and door frames (7) for side opening doors (Figure 2). Move the door panel manually to the measuring device (4).
- **D** Activate the door drive with the door close command.
- E Read the force indicated by the drag pointer (8) in Newton on the scale 0-1000 N (9).

Note

At right angles look at the scale in front of the drag indicator, and read the value displayed. For centrally opening doors, the measuring device indicates half of the actual force. If, at the start of the closing process, the force is greater than 150 N, then the closing force measurement must not be carried out as shown. In this case, the door panel must be continuously slowed down during the approach. The protective device must be rendered ineffective. Measure to about 1600 mm above the sill (shoulder height). Always carry out the measurement at the car door.



Centrally opening doors Measuring distance < 250 mm (185 mm)



Side opening doors Measuring distance < 250 mm (185)

Measuring distance > 250 mm (500 mm)

Preparation

- A Unscrew the rubber buffer (10) from the end of the measuring device (4).
- **B** Remove the cap nut (11) from the end of the holder (3).
- **C** Screw the measuring device (4) onto the holder (3).



Measuring

- D Position the measuring device (4), with the assembled holder (3) between the door panel (6) for centrally opening doors (Figure 3) or between door panel (6) and door frames (7) for side opening doors (Figure 4). Move the door panel manually to the measuring device (4).
- **E** Activate the door drive with the door close command.
- F Read the force indicated by the drag pointer (8) in Newton on the scale 0-1000 N (9).

Note

At right angles look at the scale in front of the drag indicator, and read the value displayed. For centrally opening doors, the measuring device indicates half of the actual force. If, at the start of the closing process, the force is greater than 150 N, then the closing force measurement must not be carried out as shown. In this case, the door panel must be continuously slowed down during the approach. The protective device must be rendered ineffective. Measure to about 1600 mm above the sill (shoulder height). Always carry out the measurement at the car door.



Centrally opening doors Measuring distance > 250 mm (500 mm)

Side opening doors Measuring distance > 250 mm (500 mm)

Measuring the kinetic energy

Standards EN 81-20

The following standards apply to the measurement of kinetic energy for automatic power-operated landing and car doors. See also the interpretation of "average closing speed" page 3.

5.3.6.2.2 Horizontally sliding doors

5.3.6.2.2.1 Automatic power operated doors

The following applies:

- a) the kinetic energy of the landing and/or car door and the mechanical elements which are rigidly connected to it, calculated or measured at the average closing speed shall not exceed 10 J. The average closing speed of a sliding door is calculated over its whole travel, less:
 - 1) 25 mm at each end of the travel in the case of centrally closing doors;
 - 2) 50 mm at each end of the travel in the case of side closing doors;
- b) a protective device shall automatically initiate re-opening of the door(s) in the event of a person crossing the entrance during the closing movement. The protective device may be rendered inoperative in the last 20 mm of door closing gap;
 - 4) in case of failure, or deactivation of the protective device, the kinetic energy of the doors shall be limited to 4J, if the lift is kept in operation, and an acoustic signal shall operate at any time the door(s) is (are) closing.

5.3.6.2.2.2 Non-automatic power operated doors

When the closing of the door is carried out under the continuous control and supervision of the user, by continuous pressure on a button or similar (hold-to-run control), the average closing speed of the fastest panel shall be limited to 0,30 m/s, when the kinetic energy, calculated or measured as stated in 5.3.6.2.2.1 a), exceeds 10 J.

Measuring distance < 250 mm (185 mm)

The measuring device (4) is used with or without holder (3), depending on space. If necessary, the guide pin (5) is removed from the holder.

Preparation for use with holder (similar to the closing force measurement)

- A Push the measuring device (4) into the hole of the holder (3).
- B Carefully fix the measuring device (4) by means of the hexagon socket screw (2).

Measuring

- C Fully open the car and landing doors (Figure 5).
- D1 Centrally opening landing and car doors Activate the door drive with the door close command. Place the measuring device on the approaching door panel (6), allow it to move with it, and let it collide with the oncoming door panel (6).

D2 Side-opening landing and car doors (Figure 6).

Place the measuring device on the door frame (7), activate the door drive with the door close command. Let the approaching door panel (6) collide with the measuring device.

E Read the J value, indicated by the drag pointer (8), on the joule scale 0-20 J (9).

Note

At right angles look at the scale in front of the drag indicator, and read the value displayed. Always carry out the measurement at the car door. The protective device must be rendered ineffective. Apply a measuring distance < 250 mm only for door widths of < 700 mm, or it is necessary to be able to demonstrate forces, as they are partly required by old standards. Measure to about 1600 mm above the sill (shoulder height).



Centrally opening doors Measuring distance < 250 mm (185 mm)

Figure 5

7



Figure 6

Side opening doors Measuring distance < 250 mm (185 mm)

Measuring the kinetic energy (continued)

Measuring distance > 250 mm (500 mm)

Preparation (similar to the closing force measurement)

- A Remove the rubber buffer (10) from the end of the measuring device (4).
- B Remove the cap nut (11) from the end of the holder (3).
- C Screw the measuring device (4) onto the holder (3).

Measuring

- D Fully open car und landing doors.
- E1 Centrally opening landing and car doors (Figure 7)

Activate the door drive with the door close command. Place the measuring device (4) with holder (5) on the approaching door panel (6), allow it to move with it, and let it collide with the oncoming door panel (6)

- **E2** Side-opening landing and car door (Figure 8) Place the measuring device on the door frame (7), activate the door drive with the door close command. Let the approaching door panel (6) collide with the measuring device (4) with holder (5).
- F Read the J value, indicated by the drag pointer (8), on the joule scale 0-20 J (9).

Note

At right angles look at the scale in front of the drag indicator, and read the value displayed. Always carry out the measurement at the car door. The protective device must be rendered ineffective. Measure to about 1600 mm above the sill (shoulder height).



Centrally opening doors Measuring distance > 250 mm (500 mm)

Figure 7



Figure 8

Side opening doors Measuring distance > 250 mm (500 mm)

Section 4

Measuring the mechanical strength

Standards EN 81-20

The following standards underlie the measurement of the mechanical strength of automatic poweroperated landing and car doors, car walls und aprons.

5.2.5.2.2. Any horizontal projection from a wall into the well or horizontal beam greater than 0,15 m width, including separator beams, shall be protected from a person standing there, unless access is prevented by a car top balustrade in accordance with 5.4.7.4.

Protection shall be such as:

- a) the projection, where greater than 0,15 m, shall be chamfered to at least 45° to the horizontal, or
- b) a deflector forming an inclined surface of minimum 45° to the horizontal, capable of resisting a force of 300 N applied at right angles to the deflector at any point, distributed evenly over a surface of 5 cm² in round or square section, such that it shall resist:
 - without permanent deformation;
 - without elastic deformation greater than 15 mm.

5.2.5.3.2 Below each landing door sill the wall of the well shall comply with the following requirements:

- a) it shall form a vertical surface which is directly connected to the landing door sill, whose height is at least half the unlocking zone plus 50 mm and whose width is at least the clear opening of the car access plus 25 mm on both sides;
- b) this surface shall be continuous and be composed of smooth and hard elements, such as metal sheets, and shall be capable of withstanding a force of 300 N applied at a right angle to the wall at any point, being evenly distributed over an area of 5 cm2 in round or square section, it shall resist:
 - 1) without permanent deformation;
 - 2) without elastic deformation greater than 15 mm;

5.2.5.5 Protection in the well

5.2.5.5.1 The travelling area of the counterweight or the balancing weight shall be guarded by means of a screen, which comply with the following:

g) the screen shall have sufficient rigidity to ensure that when a force of 300 N being evenly distributed over an area of 5 cm2 in round or square section is applied at right angles at any point of the screen, it shall not deflect to cause the counterweight or balancing weight to collide with it; **5.2.5.5.2** Where the well contains several lifts there shall be a partition between the moving parts of different lifts.

If this partition is perforate, EN ISO 13857:2008, 4.2.4.1 shall be respected.

The partition shall have sufficient rigidity to ensure that when a force of 300 N being evenly distributed over an area of 5 cm2 in round or square section, is applied at right angles at any point of the partition, it shall not deflect to cause the moving parts to collide with it.

5.4.5 Apron

5.4.5.3 When a force of 300 N, being evenly distributed over an area of 5 cm² in round or square section, is applied at right angles from the landing side to the apron at any point along the lower edge of the vertical section, the apron shall resist without:

- a) permanent deformation greater than 1 mm;
- b) elastic deformation greater than 35 mm.

5.3.5.3 Mechanical strength

5.3.5.3.1 Complete landing doors, with their locks, and car doors shall have a mechanical strength such that in the locked position of landing doors and closed position of car doors:

- a) when a static force of 300 N, being evenly distributed over an area of 5 cm² in round or square section, is applied at right angles to the panel/frame at any point on either face they shall resist without:
 - 1) permanent deformation greater than 1 mm;
 - 2) elastic deformation greater than 15 mm;

After such a test the safety function of the door shall not be affected.

b) when a static force of 1000 N, being evenly distributed over an area of 100 cm² in round or square section, is applied at right angles at any point of the panel or frame from the landing side for landing doors or from the inside of the car for car doors they shall resist without significant permanent deformation affecting functionality and safety (See 5.3.1.4 [max. clearance 10 mm] and 5.3.9.1).

For glass doors see 5.3.6.2.2.1 i) 3).

NOTE For a) & b), the probe surface used to apply the test forces may be of soft material to avoid damage to the door coating.

Example

Testing the car wall with an effective force of 1000 N on an area of 100 \mbox{cm}^2

5.4.3.2.2 Each wall of the car shall have a mechanical strength such that:

- a) when a force of 300 N, being evenly distributed over an area of 5 cm² in round or square section, is applied at right angles to the wall at any point from the inside of the car towards the outside, it shall resist without:
 - any permanent deformation greater than 1 mm;
 - elastic deformation greater than 15 mm.
- b) when a force of 1000 N, being evenly distributed over an area of 100 cm² in round or square section, is applied at right angles to the wall at any point from the inside of the car towards the outside it shall resist without permanent deformation greater than 1 mm.

NOTE These forces could be applied on the "structural" wall, excluding mirrors, decorative panels, car operating panel(s), etc.



- F = 1000 N, without permanent deformation
- X Deflection, X = Z Y, max. 15 mm and without permanent deformation
- Y Perpendicular to the car wall unloaded
- Z Perpendicular to the car wall loaded

- F = 1000 N, ohne bleibende Verformung
- X Durchbiegung, X = Z Y, max. 15 mm und ohne bleibende Verformung
- Y Lot zur Kabinenwand unbelastet
- Z Lot zu Kabinenwand belastet

Accordingly, this application can also be used for landing and car doors!

Measuring the mechanical strength (continued)

Applications

Preparation (similar to the closing force measurement)

- A Remove the rubber buffer (10) from the end of the measuring device (4).
- B Remove the cap nut (11) from the end of the holder (3).
- C Screw the measuring device (4) onto the holder (3).

Measuring

- **D** Place the measuring device (4), with the assembled holder (3) at any position perpendicular to the wall (12) (Figure 9), or to the door panel (6) (Figure 10).
- **E** Apply a force of 300 N to the wall (2) (Figure 9), or door panel (6) (Figure 10).
- **F** Press until the drag pointer (8) shows the force of 300 Newton on the scale (9) 0-1000 N.

Note

At right angles look at the scale in front of the drag indicator, and read the value displayed.



Figure 9



Figure 10

Measuring the mechanical strength (continued)

Standards

5.3.5.3.3 Under the application of a manual force of 150 N in the direction of the opening of the leading landing door panel(s) of horizontally sliding doors and folding doors, at the most unfavourable point, the clearances defined in 5.3.1 may exceed 6 mm, but they shall not exceed:

- a) 30 mm for side opening doors;
- b) 45 mm in total for centre opening doors

Applications

Preparation

A Use measuring device (4) without holder.

Measuring

C1 Side opening landing doors (Figure 11)

Close and lock the landing doors. Attention! Take all necessary safety precautions!

Place the measuring device (4) – at the most unfavourable point (N) (at the bottom of the door) - in the direction of opening.

If there is no suitable point of application, then one needs to be created using a suitable tool (2). On the door panel (6), apply a force of 150 N on the scale (9), indicated by the drag pointer (8). Measure gap N (< 30 mm).

C2 Centrally opening landing doors (Figure 12)

Place the measuring device (4) – at the most unfavourable point (U) (below, between the door panels).

Draw the door panel together at the top using a tool (for example, a collet), until 150 N is indicated on the scale (9) by the drag pointer (8).

Measure gap above (O) and below (U) and determine the difference between the two values. Formula: U - O < 45 mm

Note

At right angles look at the scale in front of the drag indicator, and read the value displayed.





Care and maintenance

Care, Maintenance

The measuring device and the holder are virtually maintenance-free. Nevertheless, the parts should be maintained as follows:

- The measuring device and the holder should be cleaned periodically, or with heavy soiling, using a lint-free cotton cloth.
- Lightly apply an acid-free grease on the scale part of the measuring instrument.

Re-calibration

The measuring device should be re-calibrated every 3 years.

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