

KMG-2000 G

compliant - according to the **BIA** (Professional Institute for Health and Safety at Work) - with
DIN EN 12445 - "Gates - Safe Use of Power-Operated Gates - Test Procedures"
and **DIN 18650** - "Automatic Door Systems"



**Handheld measuring device for determining the
dynamic and static forces at the closing edges of
doors and gates.**

1. Technical Data

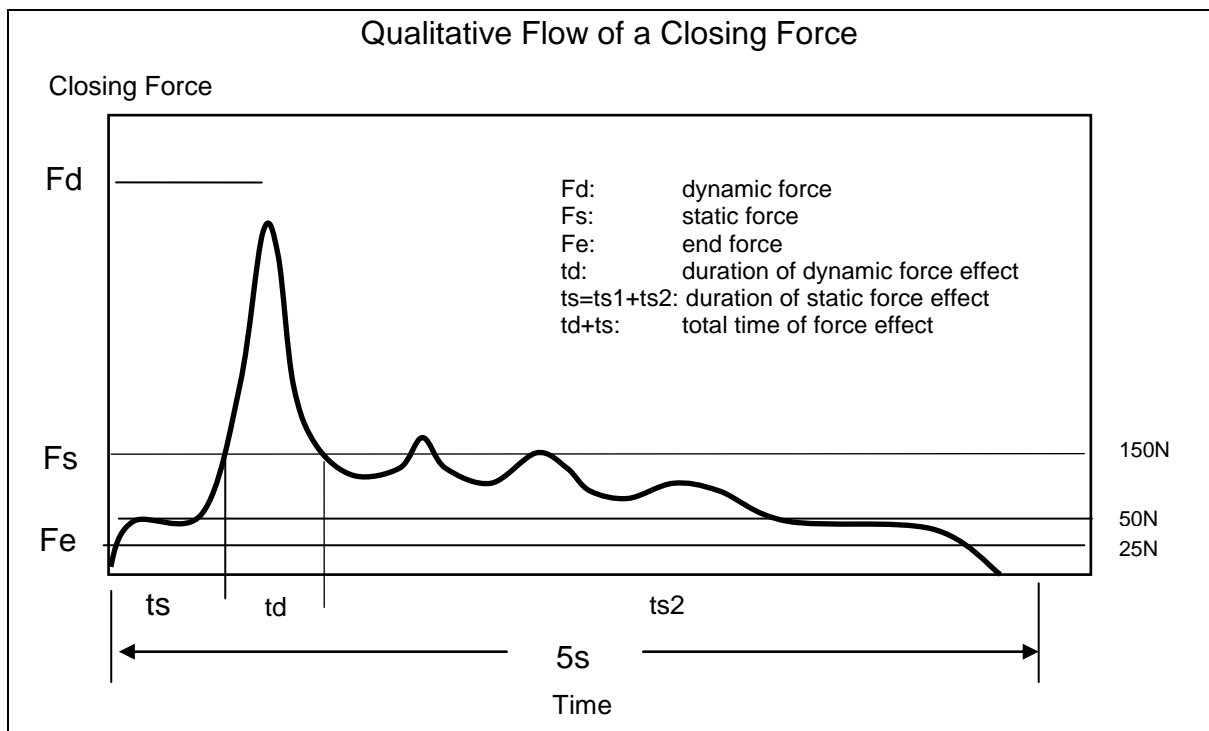
Power supply:	2 x 1.2V NiMH accumulators
Power consumption:	20 mA
Interface:	USB
Number of graphs stored:	500 single measurements equal to 166 normal measurements each with 3 individual measurements
Temperature range:	-10 +60°C
Relative humidity:	20 - 90 % r.h. (non-condensing)
Test surface dimensions:	80 mm \varnothing , height 50 mm
Dimensions incl. handgrip:	310 x 80 x 50 [mm] (l x b x h)
Weight:	1400 g
Measuring range:	25 N - 2000 N
Measuring accuracy:	$\pm 0,2\%$ of 2000N
Spring constant (mech. filter):	500 N/mm
Rise/fall time:	≤ 5 ms
Special accessories for KMG-2000 G:	1 special interface cable (for transferring data) 1 software package for the automatic transfer of the measured values to a laptop or PC (storage of graphs and protocols for Microsoft Windows) Adaptor for mechanically securing the power-measuring device

2. Introduction

The KMG-2000 G force-measuring device is used for the determination of dynamic and static forces as well as the duration of these at the closing edges of doors and gates.

According to the standard, three single measurements must be made at each test point for a normal measurement, the mean value of which then represents the measured value that is relevant for standard purposes. The following four measured values are determined per measuring operation in order to properly assess the closing force in accordance with the standard:

1. **Static force:** F_s
2. **Maximum dynamic force:** F_d
3. **Time in relation to dynamic force range** t_d
4. **End force on expiry of the measuring period of 5 seconds** F_e



Permitted Peak Forces in accordance with DIN EN 12453 (Extract)

The static force is the mean value of all the force values within the static time range.

The force graph must be measured three times for each test point. The mean value is formed from the values obtained for F_d , F_s , F_e and t_d from each force graph. These mean values must not exceed the limiting values set.

Permitted Peak Force	Opening Widths from 50 to 500 mm	Opening Widths > 500 mm
Horizontally-moved gate	400 N	1400N
Gate rotating on an axis perpendicular to the ground	400N	1400N
Vertically-moved gate	400N	400N
Gate rotating on an axis parallel to the ground	400N	400N
Barriers	400N	400N

3. Measuring Device

The measuring device consists essentially of a measuring body complete with the test surface, a centrepiece complete with electronics and a display, and the handgrip complete with a battery compartment (Picture 1).



Picture 1: KMG-2000-G Force-Measuring Device

- 3.1. The KMG-2000 G force-measuring device is used for the routine, on-the-spot checking of the closing forces on gates, e.g. following the installation of a new gate or for the prescribed annual inspection of existing gates, with the result being recorded in the inspection log book relating to each gate. It is possible to transfer the measured values to a laptop or PC via the inbuilt USB interface which allows an accurate analysis of the measured values to be carried out and any deviations from the set values to be identified. The required software can be ordered as an extra.
- 3.2. It is stipulated in EN 12445 and DIN 18650 that each force-measuring device must be sent to the manufacturer at least once a year for the purpose of calibration and adjustment. He will then test that it is compliant and approve the device for use for another year.
- 3.3. The centrepiece of the KMG-2000 G contains an LCD display, on which all the measured values, the force curves, the measured-value memory management function and user guidance are displayed.

- Measured-Value Display

All 4 measured values that are relevant for standard purposes are displayed simultaneously for each individual measurement and, following the third individual measurement, the 4 mean values.

Fd :	325N	28/2
Fs:	51N	< F1
Fe:	0N	> F2
Td:	40ms	F3

Individual Measured Values

Fdm :	275N	28/2
Fsm:	46N	< F1
Fem:	0N	> F2
Tdm:	40ms	F3

Mean Values

- Measured-Value Memory Management Function

All measured values of the individual measurements, up to 500 in number, and the mean values calculated in each case from 3 individual values can be brought up on the display along with their graphic representations.

- User Guidance

During the individual phases of the measurement process appropriate operating advice is displayed, e.g.

Measurement
is calculated
Please wait

4. Measurement of a Force Sequence

4.1 Carrying Out The Force Measurement

- **Switch on (actuate any button as desired)**

After switching on, the “start” display appears for 5 seconds:
 During this time the language selection or the options menu can be selected.

KMG 2000-G GTE	
Options	F1
Language	F2
Exit	F3

After 5 seconds the device is ready to carry out force measurements.
 The current status of the measured-value memory is displayed top left, e.g.:
 2. Normal measurement
 3. Individual measurement

StM: 2	SiM:3	
Options		F1
New StM		F2
Activate		F3

If the current normal measurement No.2 is to be cancelled, then by pressing button F2 it is possible to switch ahead to normal measurement No.4. There will then be 3 individual measurements available once more.

- **Initialise measuring**

A measuring operation is activated by pressing button F3. The device is now ready to take measurements. The measuring operation is started if a force > 20 N is exerted on the test surface. The force/time measuring operation then runs (for a measuring period of 5 seconds).

StM: 2	SiM:3	
Options		F1
New StM		F2
Start:	F > 20N	

- **Carry out measuring operation**

Hold the test area centrally (inner circle) to the measuring points stipulated in the European draft standards. The measuring points are specifically prescribed in relation to the relevant type of gate construction. (see Appendix).



Once the trigger threshold of 20 N has been passed, the force is measured over a period of 5 seconds. During this time the message “Measuring - Please wait” is displayed

Measurement
Please wait

Once measuring has been completed, the force/time graph is analysed automatically and the values that are relevant to the standard are determined.

Measurement
is calculated
Please wait

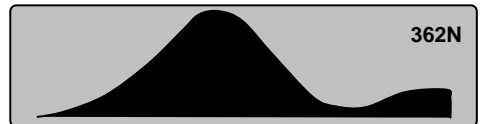
• **Display measured values**

Following evaluation, the course of the force over the measurement period (5secs) is initially displayed and the dynamic force F_d (peak force) displayed as a value.



Normal 5sec. range display

Button F1: To switch between normal display (5sec measuring range) and zoom display of the dyn. range (1sec measuring range)



Zoom display over 1sec dyn. range

Button F2: To switch to display of 4 measured values:

Max. dynamic force:	F_d in N
Static force:	F_s in N
End force after 5 seconds:	F_e in N
Duration of dyn. force range:	t_d in ms

Fd :	369N	3/1
Fs:	82N	< F1
Fe:	17N	> F2
Td:	128ms	F3

Button F3: Cancellation of display mode

Once the third measurement has been taken, the totals of 3 individual measurements required for the normal measurement have been made. Now the display should be switched to indicate the measured values. If button F3 is now actuated, the mean values of the 3 individual measurements are displayed. The mean values are identified by the addition of an "m". Buttons F1 and F2 do not have any function as the graphic representation of the mean values makes no sense.

If the mean values are displayed, the display mode can be cancelled using F3.

Fdm :	237N	3/3
Fsm:	58N	< F1
Fem:	12N	> F2
Tdm:	86ms	F3

• **Additional Measurements**

You can return to the main menu by actuating button “F3”

StM: 2	SiM:3	
Options		F1
New StM		F2
Activate		F3

and to the “Start F>20N” display by actuating button F3 once again

NM: 2	IM:3	
Options		F1
New StM		F2
Start:	F > 20N	

4.3 Storage of the Measurement Data and Graph via a Personal Computer

The KMG-2000 G can be connected to any normal PC via a data link (USB). To do this, the cable supplied is connected to the USB jack on the KMG-2000 G and to a USB interface on the PC. Before data can be read off the KMG-2000-G the device must be switched on and the ‘**KMG-VD 2005**’ program on the computer which has been connected up must be started. The software tests the connection and alerts you to any mistakes in connection or malfunctions.

The KMG-2000 G can store a total of 500 graphs (equivalent to 166 normal measurements with 3 individual measurements). The data is preserved, even after the device has been switched off, with the result that the force graphs can also be read off the KMG-2000 G during a subsequent period.

The individual functions can be called up via the program menu of the software. You can find further explanations in the online help.

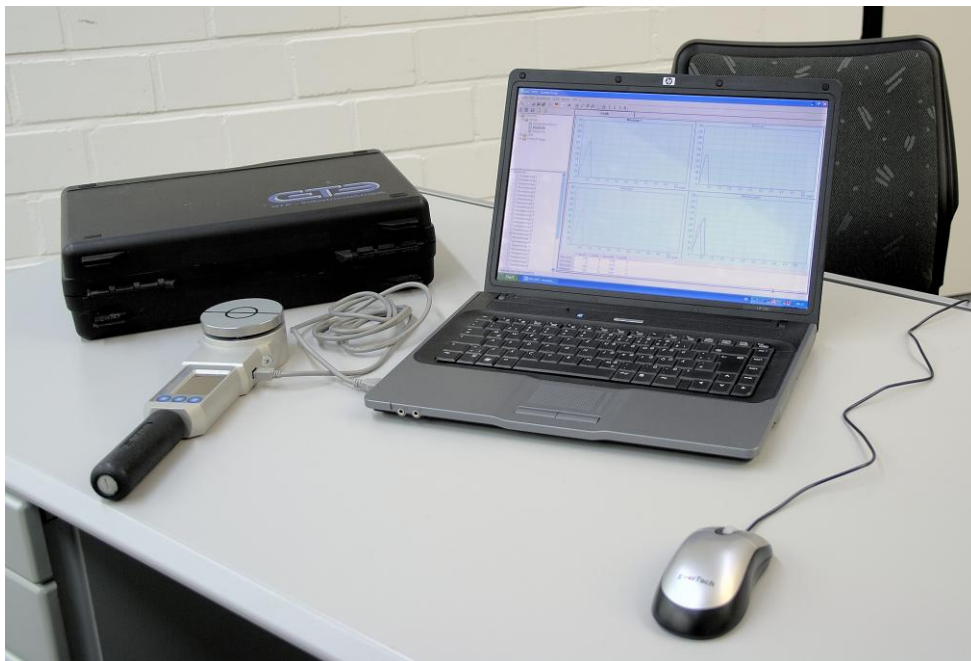


Figure 2: KMG-2000-G force-measuring device with analysis and protocol software

5. Menu Options

5.1 General Advice

The function keys F1, F2 and F3 are used for calling up menu functions and for operating the device. The function of the keys is given by the symbols F1, F2 and F3 on the display. If keys are not represented by these F symbols on the display, then those keys that are not represented have no function or all keys have the same function. For approx. 5 seconds after switching on the KMG a menu is displayed allowing “Options” and “Language” to be selected.

F1:	Options	Call up menu for settings
F2:	New NM	Initiate new normal measurement
F3:	Activate	Activate measuring

The menu points “New NM” and “Activate” have already been explained in Section 4.

5.2 “Options” Menu

The various options can be selected one after the other via button F1. F2 activates the option displayed.

The number of the current option of a total of 6 is displayed top right.

Options	(1/6)
Next function	F1
Activ.-mode	F2
Exit	F3

5.2.1 Option 1: Activation Mode

In the activation mode the type of “ready to measure” mode can be set. Button F1 switches the activation mode between “Automatic” and “Manual” and switches back to the main menu. The illustration shows that the “Manual” activation mode has been selected. Button F3 cancels the activation menu.

Active Mode	
Man (Auto)	F1
Exit	F3

“Auto” Activation Mode: After every measurement the device is automatically switched to “ready to measure”. As soon as a force > 20N acts on the test surface, a new force/time graph is plotted and then the current graphic is displayed and the measured values stored. This mode is used to record several measurements one after the other which should be triggered automatically by kicking the test plate.

'Manual' Activation Mode: Prior to each new measurement the display must be switched from showing the graph to showing the measured values using any button as desired. A new measurement is then activated using button “F3”. At this setting the measurement of the force cannot be triggered inadvertently by kicking the test plate.

5.2.2 Delete Mode = F2

In order to prevent accidental deletion, button F2 must be pressed for longer than 3 seconds.

Options	(2/6)
Next function	F1
Delete results	F2
Exit	F3

The following delete functions can be selected on the delete menu:

Delete results	
all results	F1
Last StM	F2
Last SiM	F3

F1: entire memory is deleted

F2: last individual measurement is deleted

F3: last normal measurement along with its 3 individual measurements is deleted.

After actuating one of the selection buttons relating to the type of measurement values, you are asked once more in a further menu whether the measured values selected should be deleted.

F1 = Yes

F3 = No

Please Note: By actuating F1 the data selected will be deleted.

5.2.3 Check on Measured Values Held in Memory

By actuating button F2 the control display relating to those measured values deposited in the memory is called up.

Options	(3/6)
Next function	F1
Show results	F2
Exit	F3

The item stored ,*normal measurement / single measurement no.*, is displayed top right, e.g. in this case: 2 individual measurements within the 28th normal measurement

Fd :	325N	28/2
Fs:	51N	< F1
Fe:	0N	> F2
Td:	40ms	F3

F1 previous measurement

F2 next measurement

F3 display of the relevant force/time graph

After flicking through 3 individual measurements in each case the relevant mean values appear. These are identified by an “m” on the display.

Fdm :	325N	28/3
Fsm:	51N	< F1
Fem:	0N	> F2
Tdm:	40ms	F3

Undershooting or overshooting the measured value memory is prevented by the internal logic.

5.2.4 Lighting Adjustment

On this menu the lighting of the display can be switched on or off using button F1.

Options	(4/6)
Next function	F1
Illumination	F2
Exit	F3

5.2.5 Annunciator

On this menu the internal annunciator can be switched on or off using button F1.

Options	(5/6)
Next Function	F1
Beeper	F2
Exit	F3

The annunciator gives an audible signal once measuring has been completed.

5.2.6 Switch-Off Time

The device does not have an on/off switch. After the device has been switched on by pressing any button as desired, it switches off automatically after a period of time that can be selected once no more buttons have been actuated or there is no communication.

Options	(6/6)
Next Function	F1
Turn-Off time	F2
Exit	F3

Turn-Off Time:	
6 Minutes	< F1
	> F2
Storage	F3

Using button "F2" the time is increased
Using button "F1" the time is decreased

Different times can be set ranging from 2 - 30 minutes

Please Note: The KMG-2000 G has no on/off switch. The device is switched on by pressing any button as desired and automatically switches off after a set time.

5.3 Language Selection

Language selection is only available after the device is switched on. As the device does not have an off-switch, you must wait until it switches off automatically and then switch the device back on.

You have access to the menu for selecting national languages from the loaded menu after switching the device on by pressing button F2.

Actuating the relevant button selects the desired national language and switches the device over to “ready to measure” mode.

KMG 2007 GTE	
Options	F1
Language	F2
Cancel	F3

German	F1
English	F2
	> F3

French	F1
Italian	F2
	> F3

Spanish	F1
End	> F3

6. Warning and Error Messages

6.1 Battery Monitoring

Whilst in operation the state of the rechargeable battery is checked. If the battery is really low, the following message appears:

With the present level of charge further measurements can still be made.

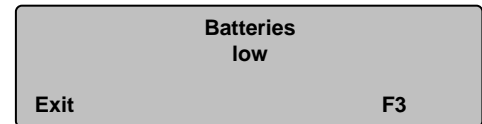
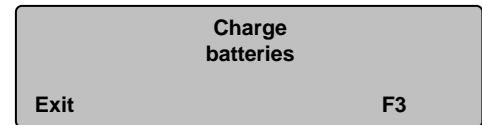
If the “Battery Flat” message appears, the accumulators are depleted and must be charged up.

Changing batteries is not necessary as the device contains 2 rechargeable batteries. Changing batteries is only required in the event of the batteries having sustained damage.

As the batteries are monitored by an integrated charging regulator whilst charging and discharging, exchanging the batteries is only to be expected at the end of their useful life (which is several years).

Charging of the batteries is essentially carried out via the USB jack of the KMG. 3 charging modes are provided for in this connection:

- The power pack included is fitted with a USB jack.
- The measuring device is connected via the USB cable to an adaptor used for car cigarette lighters
- The KMG is charged whilst the USB is connected to a computer via the USB interface.



Charging Adaptor for Mains Operation (230V) and Car Power Supply (12V)

The shortest charging time is achieved using the plug-in power unit. If the batteries are flat, the charging time is approx. 3 - 4 hours

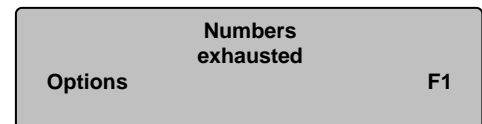
Operating display:

- a) with no KMG connection: LED at green
- b) charging process: LED at red
- c) charging process completed, holding charge: LED at green for 19 secs and at red for 1 sec.

The average power consumption in the case of an unlit display is approximately 20 mA, and in the case of a lit display approximately 40 mA. This gives an operating life of approximately 80 hours in normal display mode and approx . 40 hours in the case of a lit display.

6.2 Storage Space

Whenever the KMG switches to the “ready to measure” mode and the capacity of the memory is exhausted, the following message is displayed:
After actuating F3 branching off to the options menu occurs



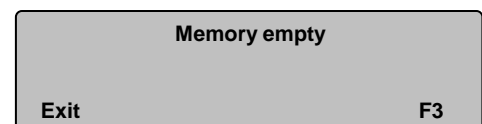
Tip

The device has a measured-value memory capable of storing a total of 500 graphs. This means:

- a) 166 normal measurements @ 3 individual measurements
- b) All 500 ‘normal measurements’ @ 1 single measurement
- c) Other combinations of normal/individual measurements

6.2 Memory Space Empty

If, on the menu in 5.2.3, *Check on Measured Values Held in Memory*, the memory flicks through and no data is found in the memory bank, the following message appears:



Extract from DIN EN 12445

Safety in use of power operated doors – Test methods –

3.2 Measuring Points

A measuring point is the place where the measurement of entrapment forces at doors must be made. Three (3) measurements must be taken at each measuring point. The mean average value obtained at each point has to meet the specified requirements. In the following, measuring points are defined for different door types, taking into consideration:

- Opening width:

Opening width is the clear distance between the primary closing edge and the counter closing edge i.e. between the leaf and surrounding solid parts.

- Direction of measuring force

Direction of measuring force is parallel to the line of application of the spring force of the measuring instrument effected by the leaf during the process of measuring. The line of application synchronises with the centre line of the spring inside the measuring instrument, it also passes the centre points of the head of the measuring instrument.

3.2.1 **Sliding door**

On a sliding door, the entrapment forces will be measured on both primary closing edges and rear edge, as follows:

3.2.1.1 Measuring between the primary closing edge and the counter closing edge should be done in reference to figures 1 and 2 below:

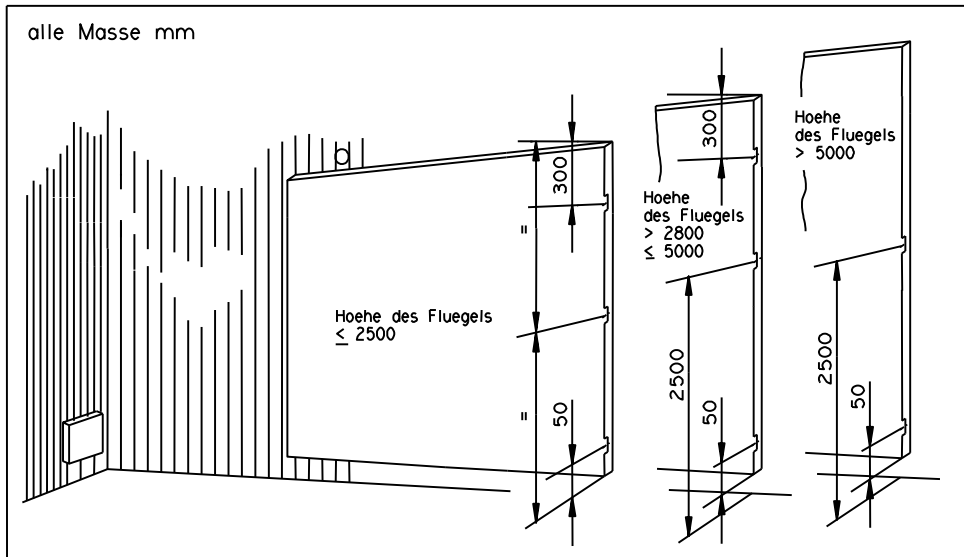


Figure 1: Measuring points at the leaf of a sliding door.

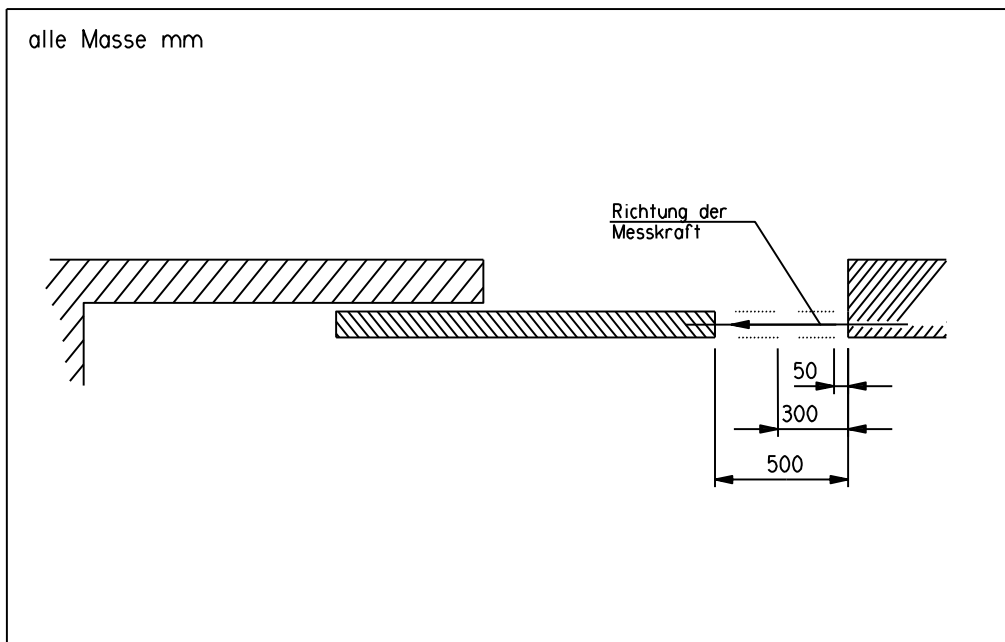


Figure 2: Opening widths between the primary closing edge of a sliding door and the counter edge

3.2.1.1.1 Measuring Points

Measurement of forces shall be carried out at the height of

- 50 mm above the lower edge of the door,
- the middle of the primary closing edge, or, at a height of 2500 mm above the floor in case that length of the primary closing edge is greater than 5000 mm,

and

- 300 mm below the upper edge of the door leaf, or, at a height of 2500 mm above the floor where the length of the primary closing edge is greater than 2800 mm,

and at the opening width of

- 50 mm
- 300 mm

and

500 mm between the primary and the counter closing edge.

3.2.1.1.2 Direction of measuring force

The forces must be measured parallel to the direction of movement of the primary closing edge.

3.2.1.2 Measuring between the rear edge of the leaf and surrounding solid parts.

Measurements should be taken between the rear edge of the leaf and surrounding solid parts in the same way as for the entrapment forces between the primary and counter closing edges (3.2.1.1.).

The opening width should be chosen between the most prominent parts on the rear edge of the door and those on its surroundings.

3.2.2 Hinged doors

On hinged doors, the entrapment forces must be measured on both the primary closing edge and the door leaf itself as shown below, in figures 3 and 4:

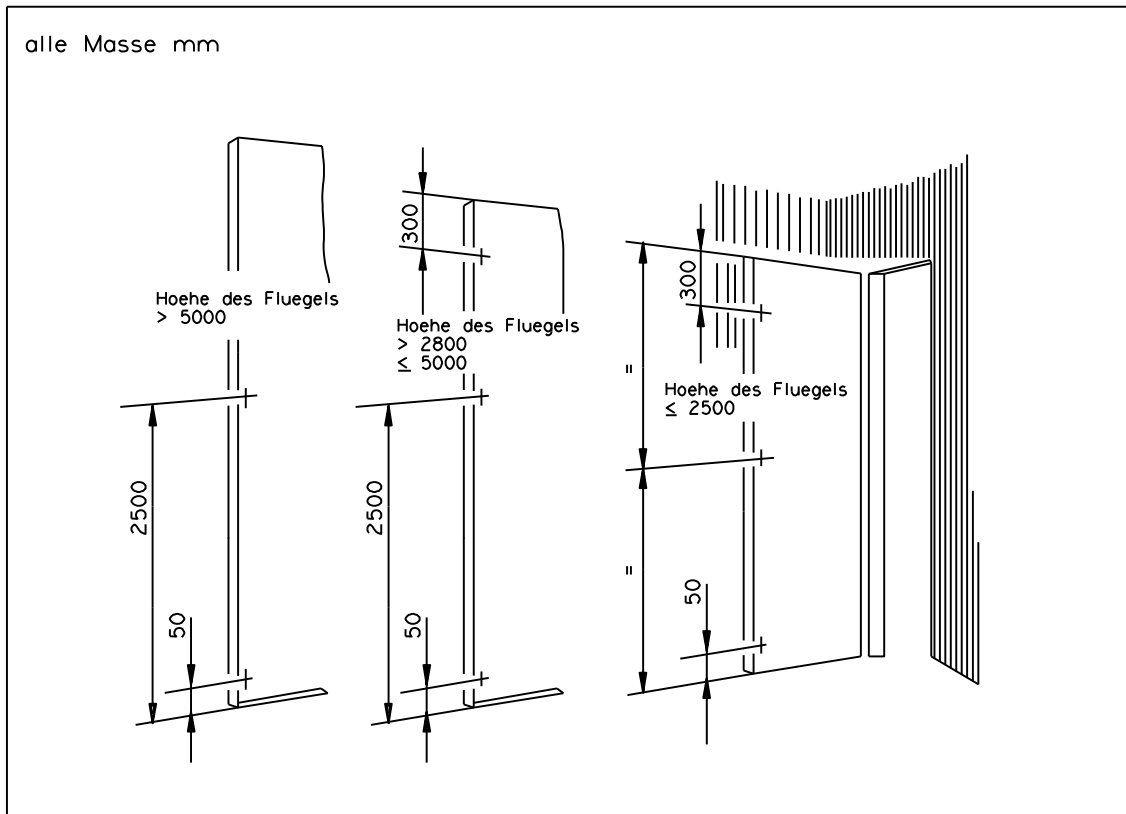


Figure 3: Measuring points at the leaf of a hinged door

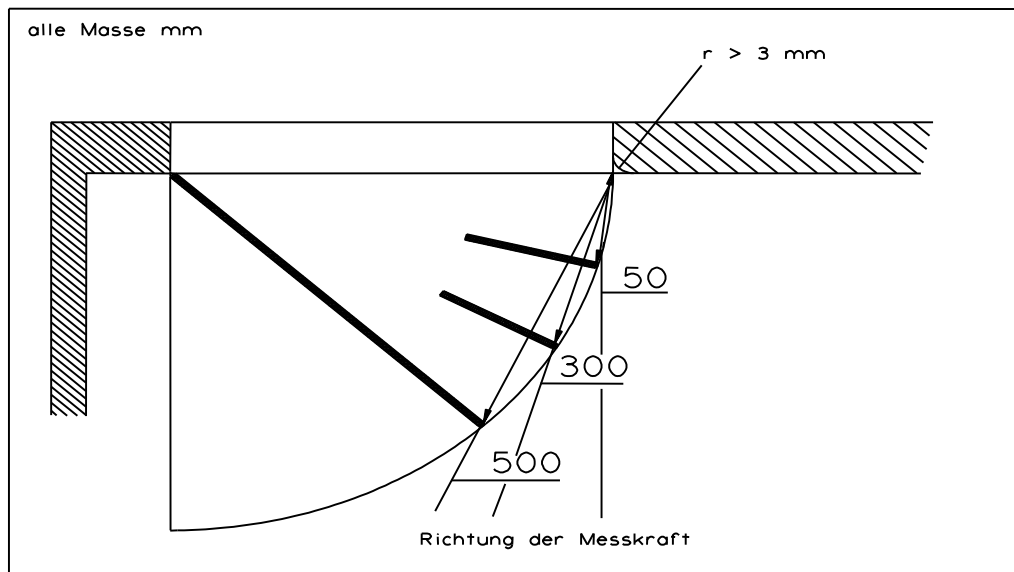


Figure 4: Opening widths between the leaf of a hinged door and the counter closing edge

3.2.2.1 Measuring between the primary and the counter closing edges

3.2.2.1.1 Measuring points:

Measurement should be carried out at the height of

- 50 mm above the floor,
- mid-way up the door leaf, or, at a height of 2500 mm above the floor, where the height of the door leaf is greater than 5000 mm,

and

- 300 mm below the upper edge of the door leaf, or, at a height of 2500 mm above the floor, where the height of the door leaf is greater than 2800 mm,

and at the opening width of

- 50 mm
- 300 mm

and

- 500 mm between the door leaf and the counter closing edge facing the leaf.

3.2.2.1.2 Direction of Measuring Force

The forces are to be measured in the direction orthogonal to the closing edge defined, in the plan, by the closing door edge and the counter closing edge.

NOTE: The counter closing edge facing the leaf has been radiused of more than 3 mm.

3.2.2.2 Measuring between the door leaf and surrounding solid parts

Measuring to be done in reference to figure 5 below:

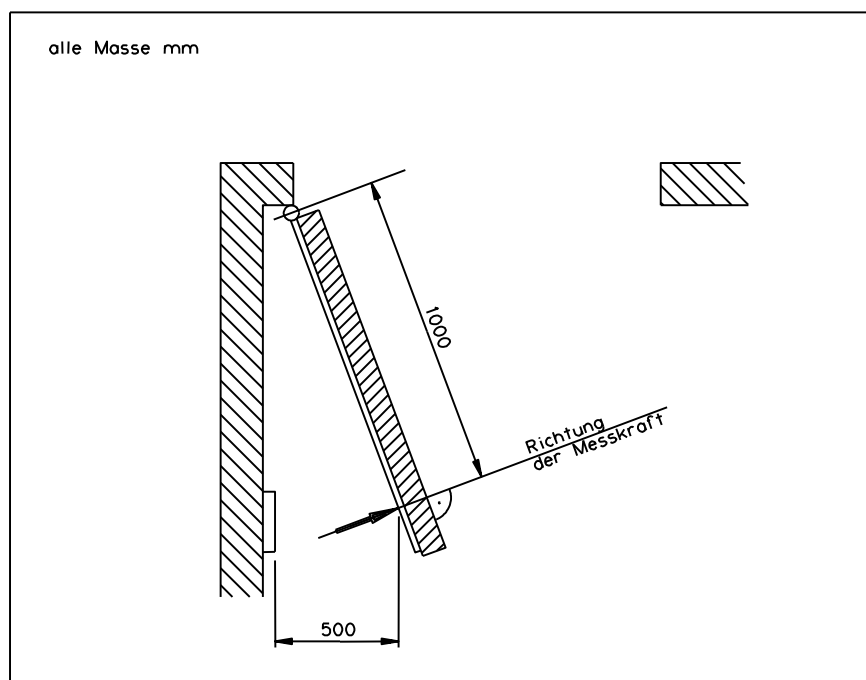


Figure 5: Measuring points at the leaf of a hinged door for the opening width between leaf and surrounding solid parts

3.2.2.2.1 Measuring Points

Measurement must be carried out at a distance of

- 1000 mm from the pivots of the door leaf, or, at the primary closing edge where the width of the leaf is less than 1000 mm,

and at the opening width of

- 500 mm, at a height of 1 m, in case of smooth surfaced door leaf and the neighbouring wall, or, between the most prominent parts of the door and the surrounding solid parts up to a height of 2 m

3.2.2.2.2 Direction of Measuring Force

The direction of measuring forces is orthogonal to the surface of the door leaf.

NOTE: The width of the contact area on protruding parts should not be less than 100 mm and the contact area minimum of 0,1 m. The edges of the parts should be radiused to a value of more than 3 mm.

3.2.3 **Folding door**

On a folding door, measurement of entrapment force should be done in two different locations as specified below:

3.2.3.1 Measuring between the primary and counter closing edges

Measurement of forces between the primary and the counter closing edges should be carried out with regard to the direction of the measured force at the measuring points required for sliding doors (3.2.1).

3.2.3.2 Measuring between the door leaf and surrounding solid parts

Measurement of entrapment forces should be carried out between a folding leaf and the surrounding solid parts with regard to the direction of the measuring force at the measuring points as required for hinged doors (3.2.2.).

3.2.4 **Lifting doors**

3.2.4.1 Measurement Points

Forces should be measured between the primary closing edge and the counter closing edge (floor) at various points on the primary closing edge.

- at a clear distance of 200 mm from the edge of the door space,

and

- in the middle of the door space, as described in figure 6 below:

- 50 mm

- 300 mm

and

- 300 mm below the top of the door space, or, 2500 mm, where the total open door space is greater than 2800 mm.

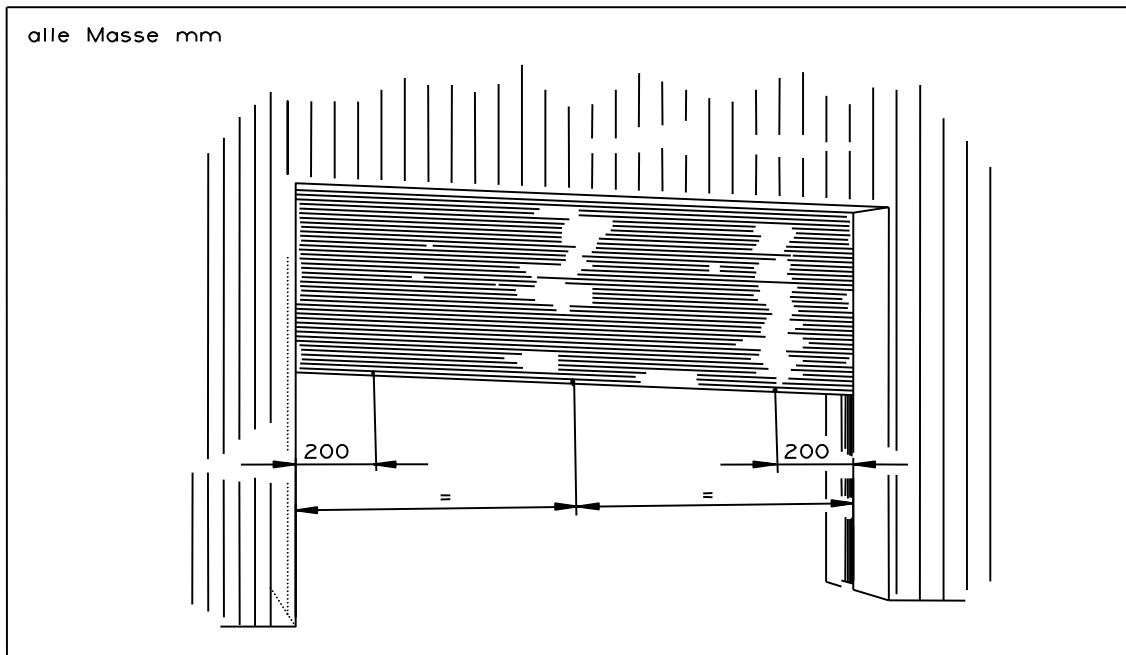


Figure 6: Measuring points at the leaf of a lifting door and in the door space.

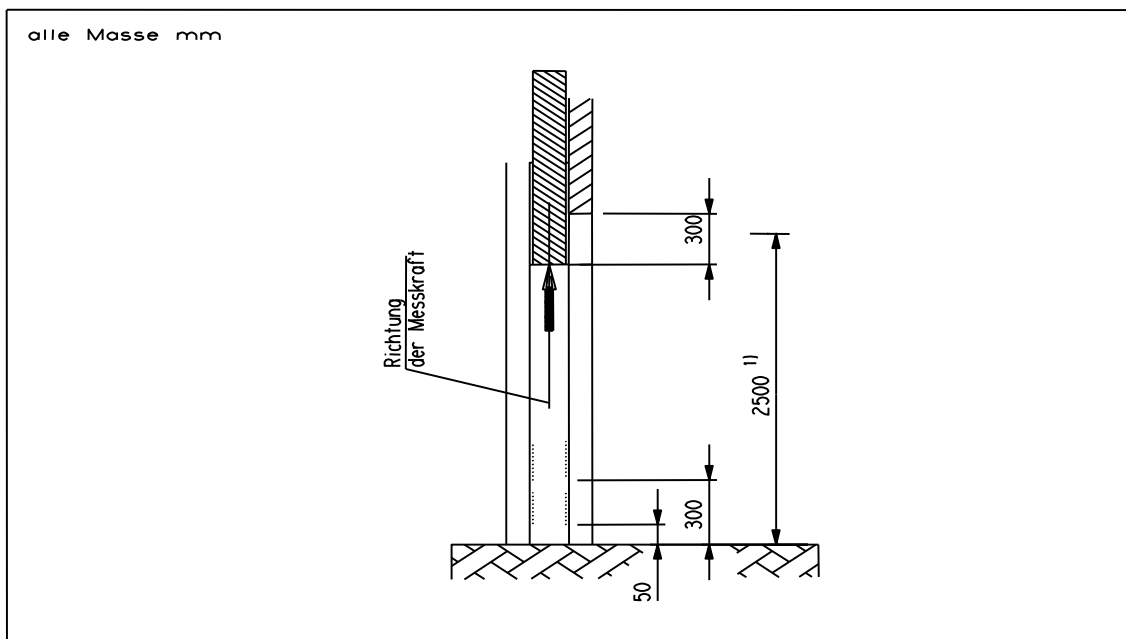


Figure 7: Door space between the primary and counter closing edges of a lifting door

3.2.4.2 Direction of Measuring Force

The force is measured in a direction orthogonal to ground level.

3.2.5 Tilting doors

On tilting doors, the entrapment forces should be measured on the primary and secondary closing edges as follows:

3.2.5.1 Measuring forces between primary closing edge and counter edge

Entrapment forces should be measured between the primary closing edge and the counter closing edge (floor) at the same measuring points as required for a lifting door (3.2.4).

Only the vertical component of the force need to be considered.

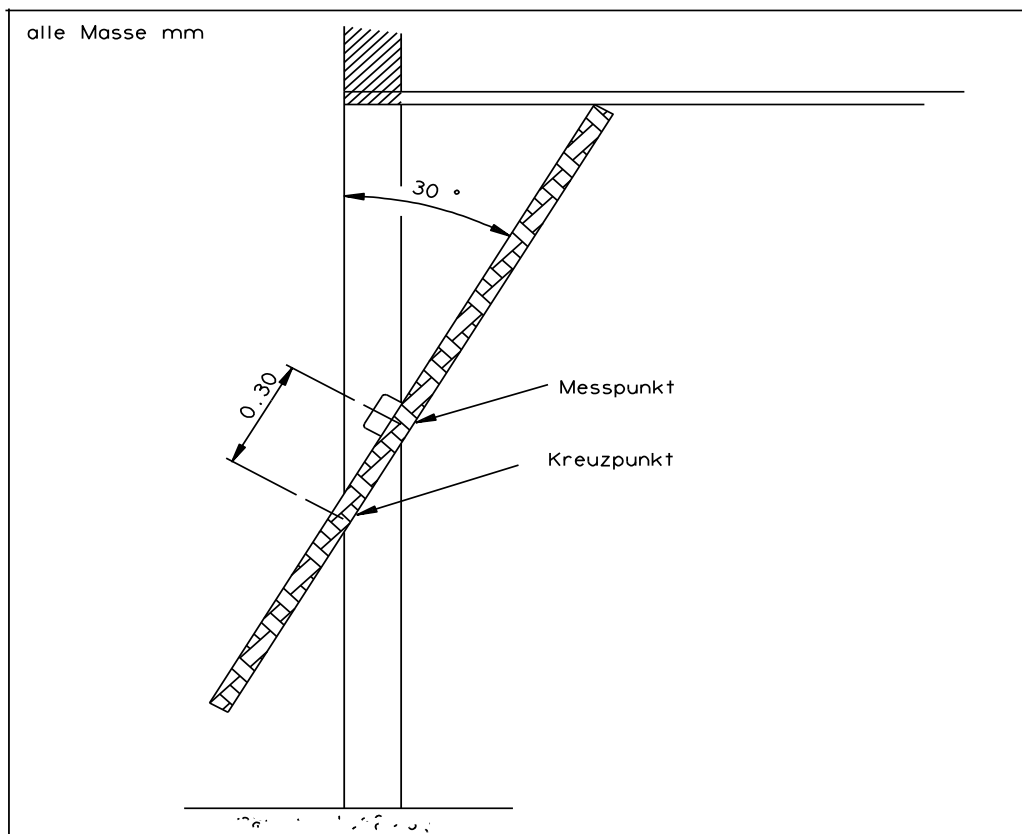


Figure 8: Measuring point on secondary edge of a tilting door

3.2.5.2 Measuring forces between secondary closing edge and counter edge

Entrapment forces have to be measured between closing edge and counter edge (walls, lintel) as stated below:

The entrapment force is measured against the movement, perpendicular to the door leaf, 300 mm from the point where it passes the static edge and when the angle between the door leaf and the fixed edge is 30° (see figure 8).

Measurement of forces on secondary closing edges may be disregarded if the manufacturer of the door can demonstrate that, when measured on the secondary closing edge, they are always below the figures obtained when the measurement is done on the primary closing edge and under the same measuring conditions. Active or passive safety devices should be fitted solid surface to solid.

3.2.6 **Barriers**

On barriers, the forces should be measured at the points and in the direction as stated below:

3.2.6.1 Measuring Points

The impact force will be measured 200 mm from end of the arm, and at a maximum height of 2 metres above the ground, at an maximum angle from the horizontal of 45° (see figure 9).

When gaps between moving parts and the ground or fixed surroundings are decreasing to less than 300 mm, they should be measured at intervals of 300 mm and eventually 50 mm (see figure 9 b).

3.2.6.2 Measuring Direction

The impact force is to be measured perpendicular to the arm's ownwards movement (see figure 9 a, b, c).

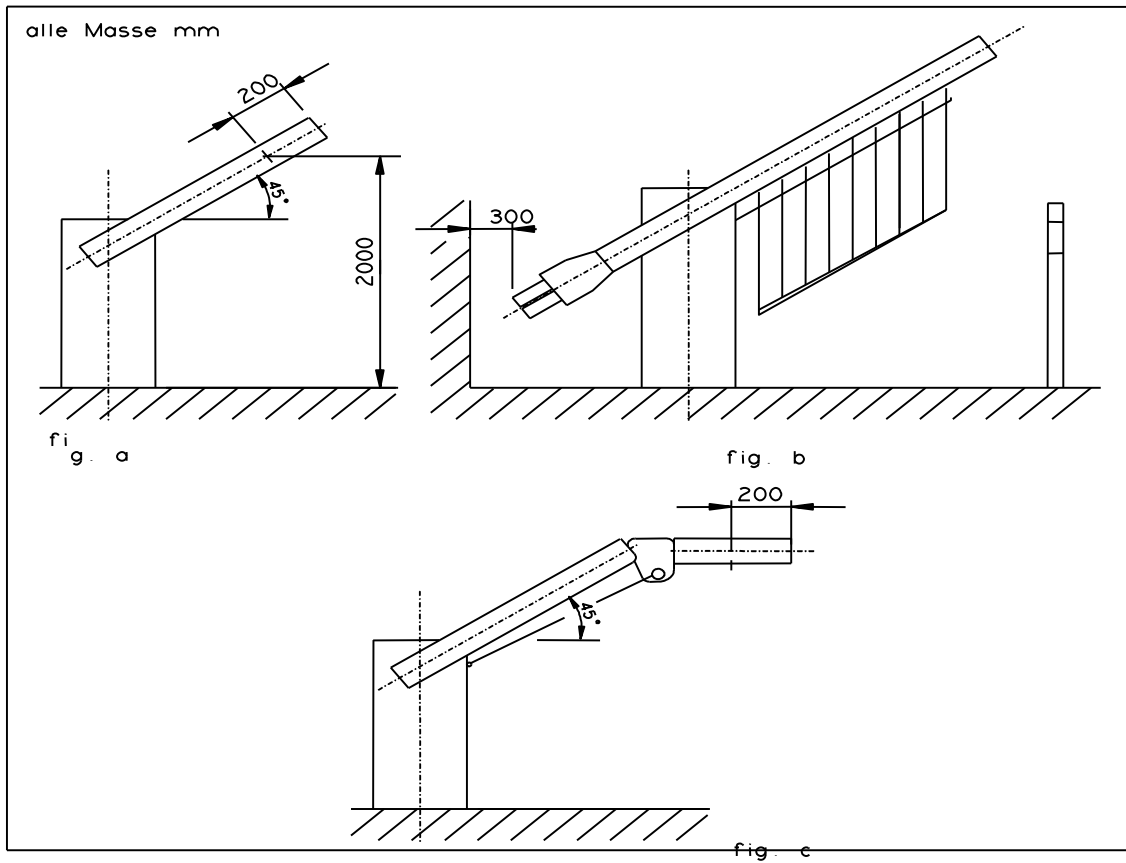


Figure 9: Measuring points of measuring at a barrier