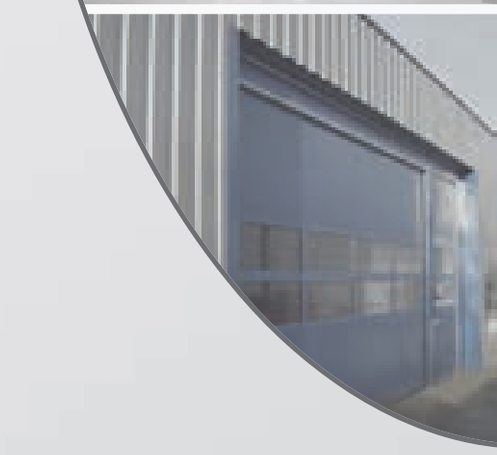
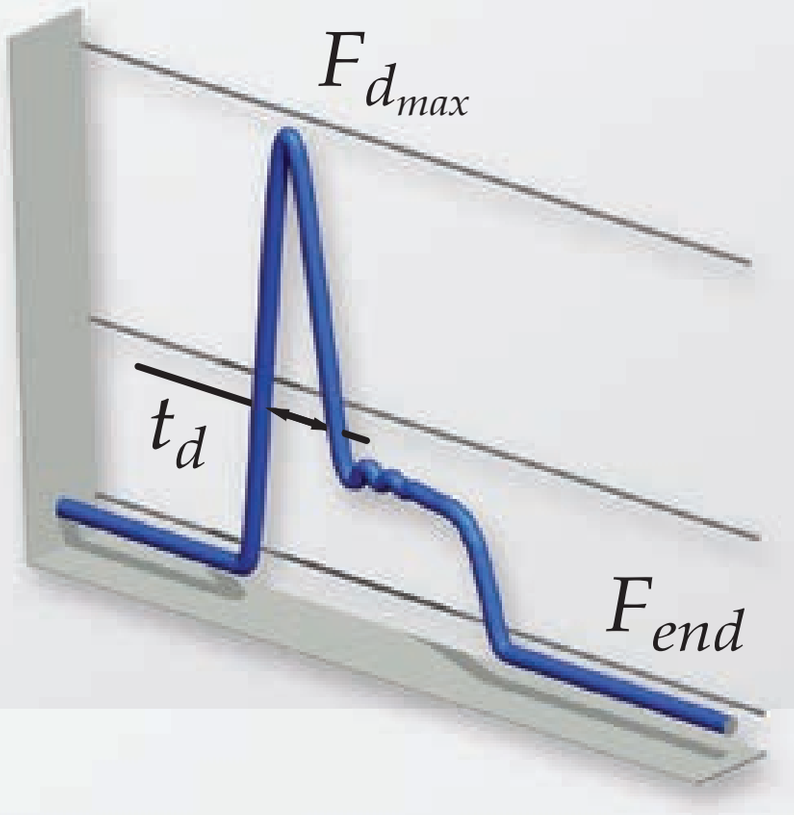
GTE Electronics
Product unit measurement technology





FORCE MEASUREMENT GUIDE

for power-operated doors and gates

DHF
Door & Hardware Federation


12:34

Contents

Revision: 07/2013

Picture: Seuster KG

Introduction

Power-operated doors and gates are becoming state of the art and their numbers are constantly rising. More and more companies, as well as private households, are enjoying the benefits of automated entrance gates and garage doors.

In industry high-speed doors are paving the way for a new pattern of logistics working as companies strive for greater efficiency.

At the same time technical advances and mass production by gate manufacturers has led to falling prices, stimulating sales growth in both the commercial and residential markets.


2,1m
STOP
10

Gate Safety Awareness

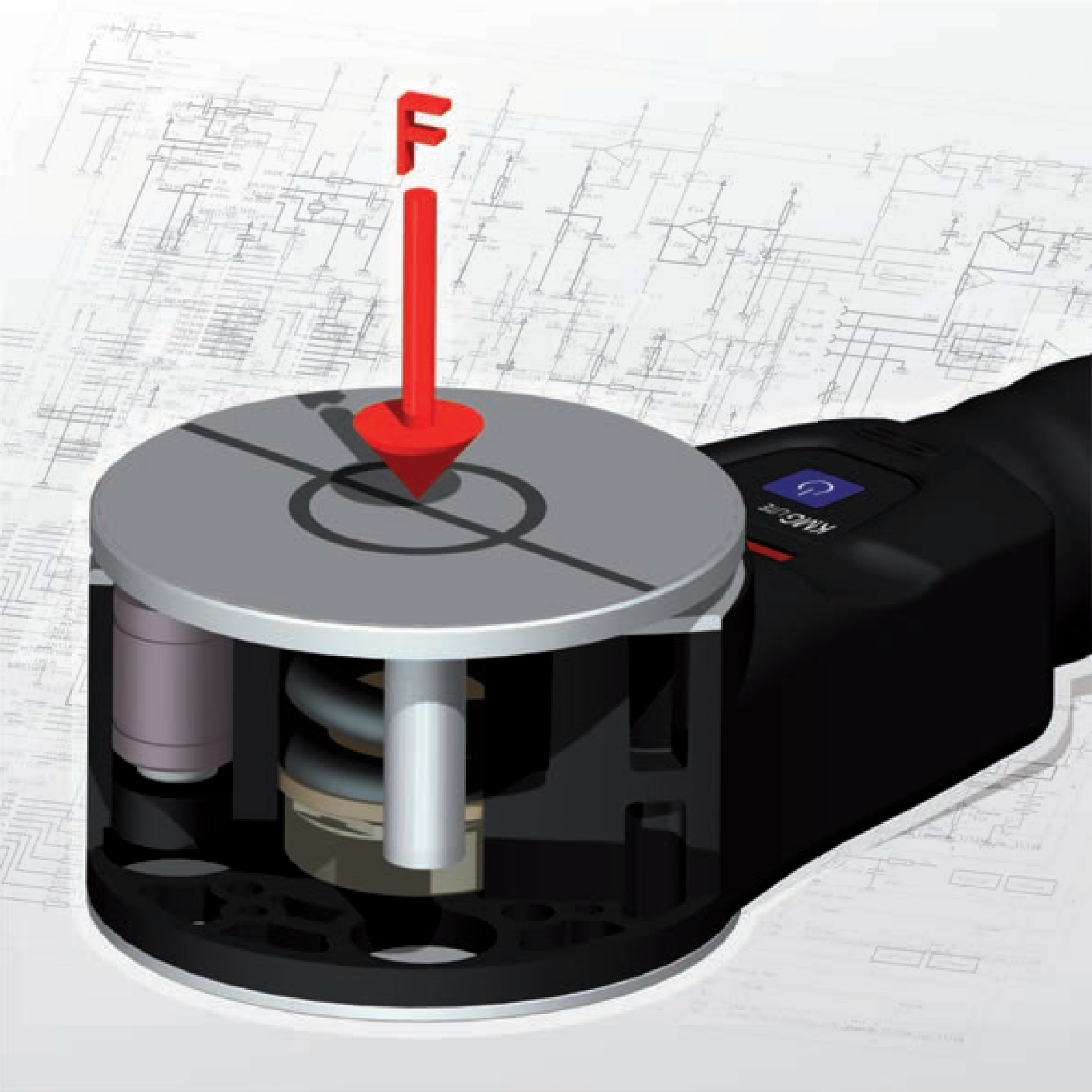
A fact that is often underestimated is that automatic door and gate systems are machines, which need responsible engineering, careful installation and regular servicing. Today's high quality components however can lead to maintenance being viewed as less of a priority in the drive to be price competitive.

This inevitably leads to complacency with potential risks and dangers being underestimated or even overlooked. It is therefore essential that gate safety awareness is heightened among operators, service and installation companies, manufacturers and end-users.

Why Force Measurement?

Among other requirements BS-EN12445:2001 and BS-EN12543:2001 define the obligation to measure the closing forces of automatic doors and gates. The standards specify test points and max. permissible force and reaction time values. A gate system needs to detect an impact and reverse its drive releasing the ‘crush’ zone within a very short time and force range. Only if it reacts accordingly can the risks of automatic operation can be reduced to an absolute minimum.

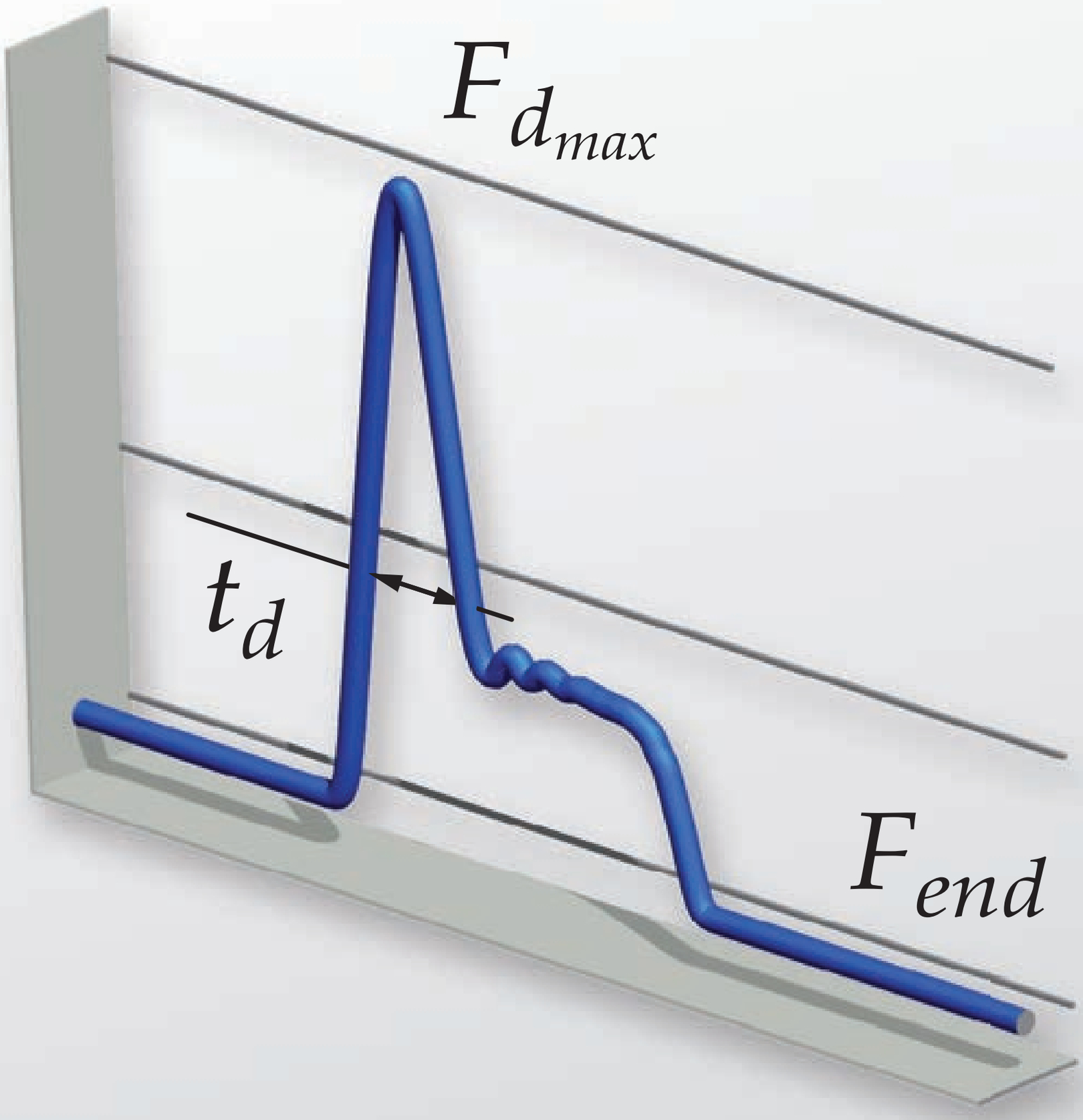
Force measurement enables immediate and comprehensive evaluation of a gate as a system as with the motto: *„The whole is greater than the sum of its parts.“*


F

Force Measurement Technology

Force testers consist of a circular measurement plate, which is mechanically connected to a highly accurate force sensitive cell. Four linear bearings ensure that the kinetic energy of the door leaf is vertically applied to the cell.
A spring with a rate of 500 N/mm is used to cussion the impact in the same way as a human body would.

The electric signal of the force sensitive cell is amplified and recorded by a microcontroller. This processor unit is also responsible for the subsequent evaluation and display of the force and time paramaters.


$F_{d_{max}}$
t_d
F_{end}

Force and Time Evaluation

BS EN 12453 defines parameters of force and time, which help to evaluate the reversing process of the door leaf.

In most cases three parameters are sufficient for a reproducible assessment of the force limitation capabilities:

F_{dyn} - *Highest force peak after impact*

t_{dyn} - *Duration of the force exceeding 150N*

F_{end} - *Static force remaining 5s after impact*


WARNING

Standard Test Series

As defined in BS EN 12453 manufacturers of power operated door and gate systems need to measure opening and closing forces to ensure proper force limitation.

The EN describes a complex measuring series of 9 test points with 3 single measurements to be taken at each point. The average force and time parameters of each point of measuring are then compared with admissible limiting values, which are given in the standard as well.

Standard Test Series

Admissible force values

Admissible dynamic forces	Between closing edges and counterclosing edges		between flat areas other than closing edges and counterclosing edges, > 0,1 m² with no side < 100 mm
	in gaps from 50 to 500 mm	in gaps > 500 mm	
horizontally moving door	*400 N*	*1400 N*	*1400 N*
door rotating around an axis perpendicular to the floor	*400 N*	*1400 N*	*1400 N*
vertically moving door	*400 N*	*400 N*	*1400 N*
door rotating around an axis parallel to the floor – barriers	*400 N*	*400 N*	*1400 N*

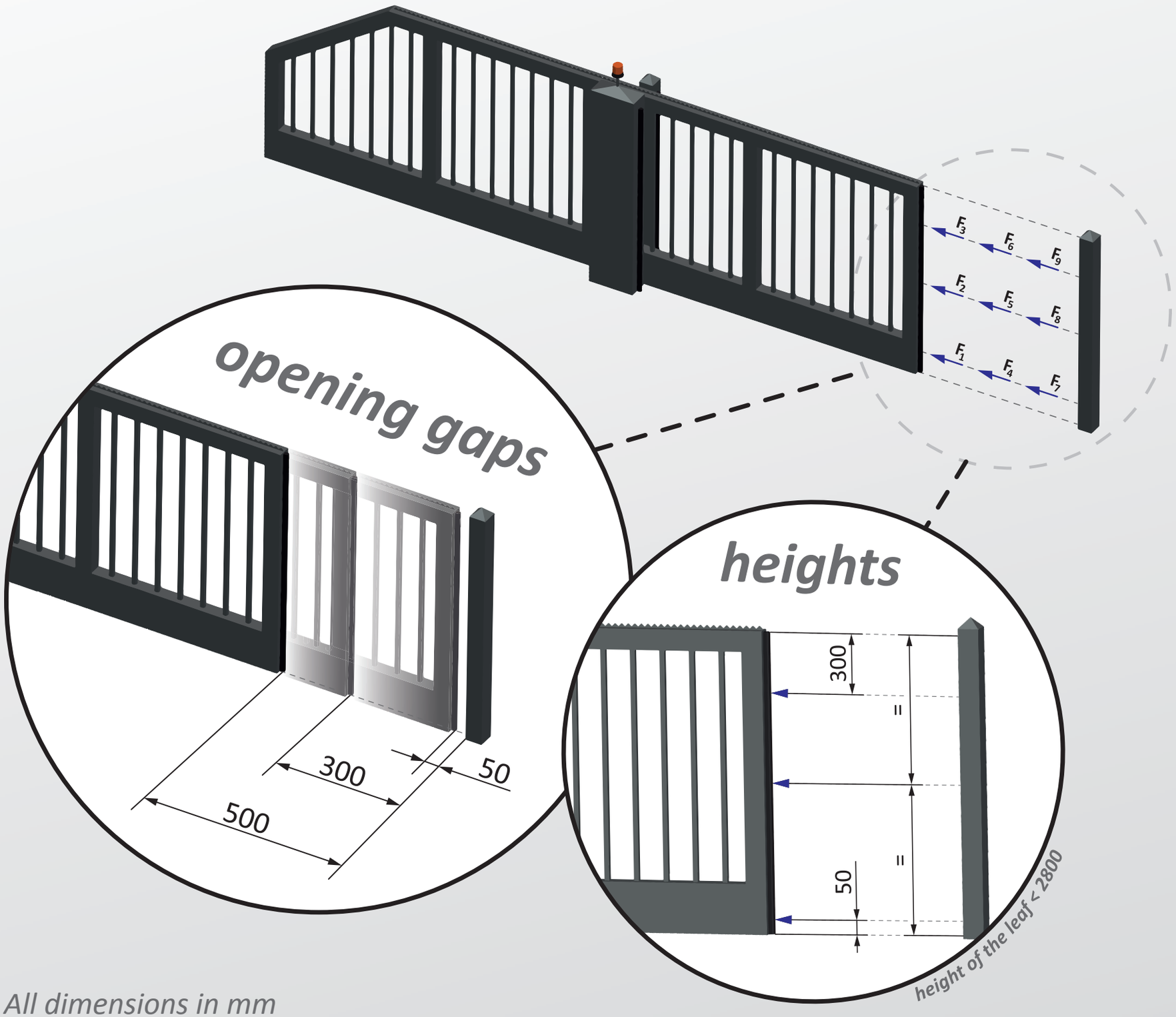
Admissible time values

$$t_{dyn} \leq 0,75\ s$$

The following pages describe the required points of measuring according to the EN.

Points of measuring

sliding gates

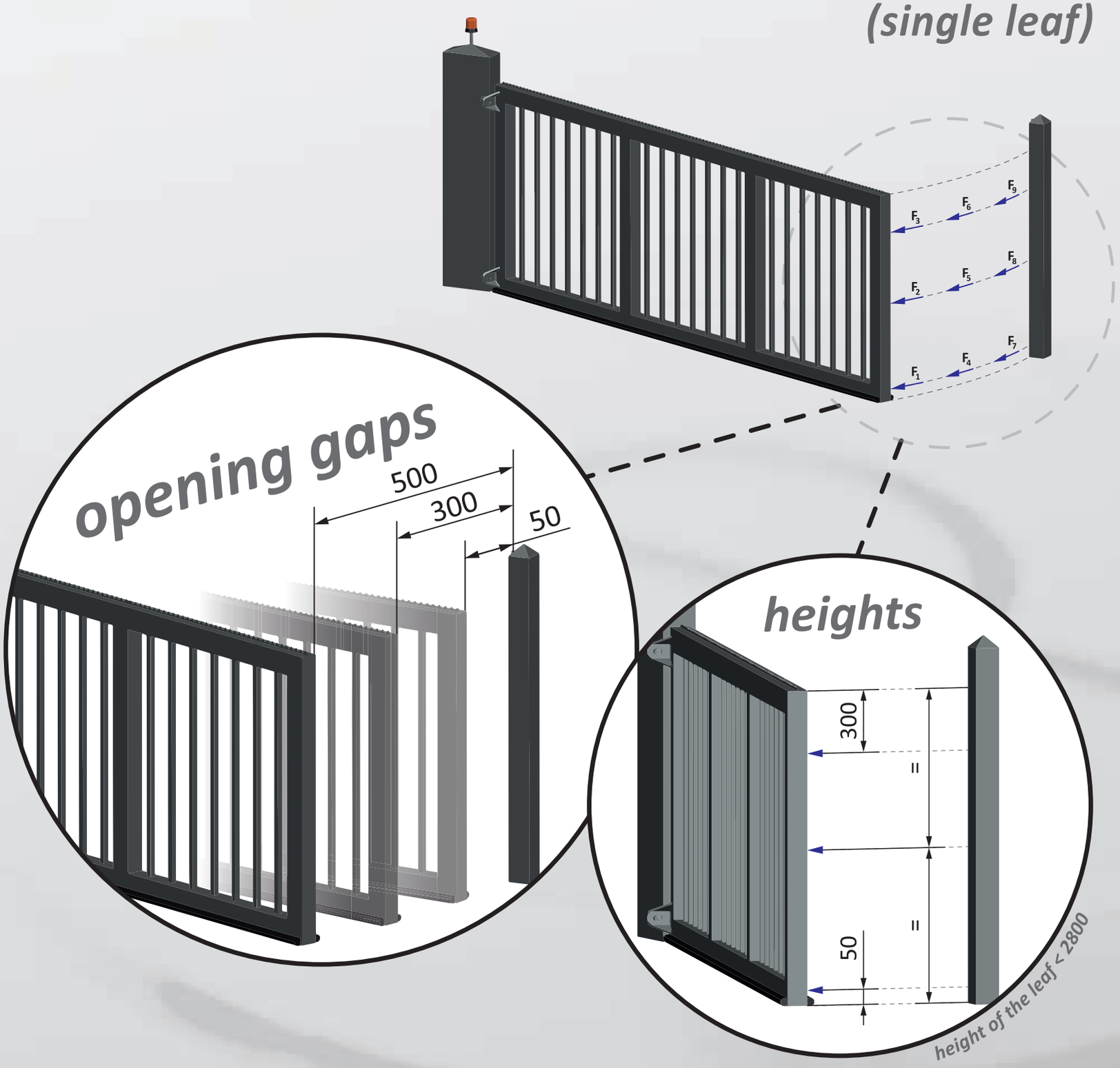


All dimensions in mm

Points of measuring

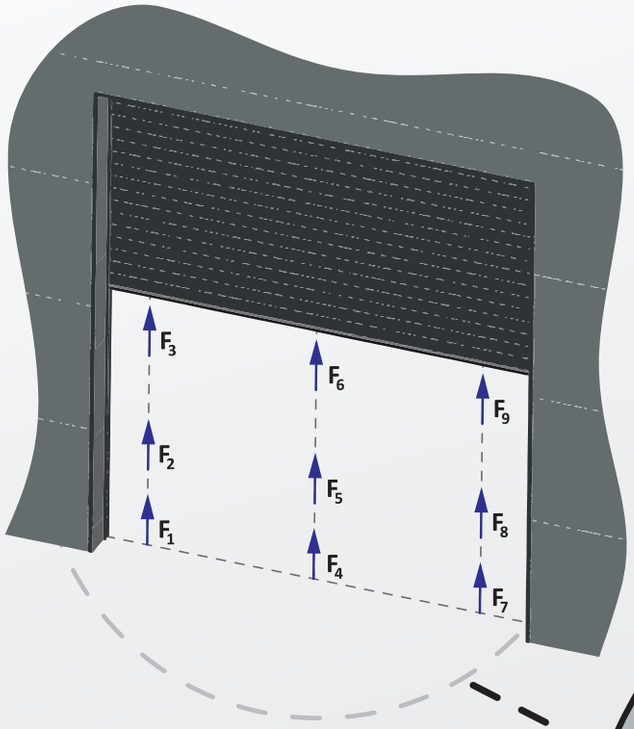
swing gates

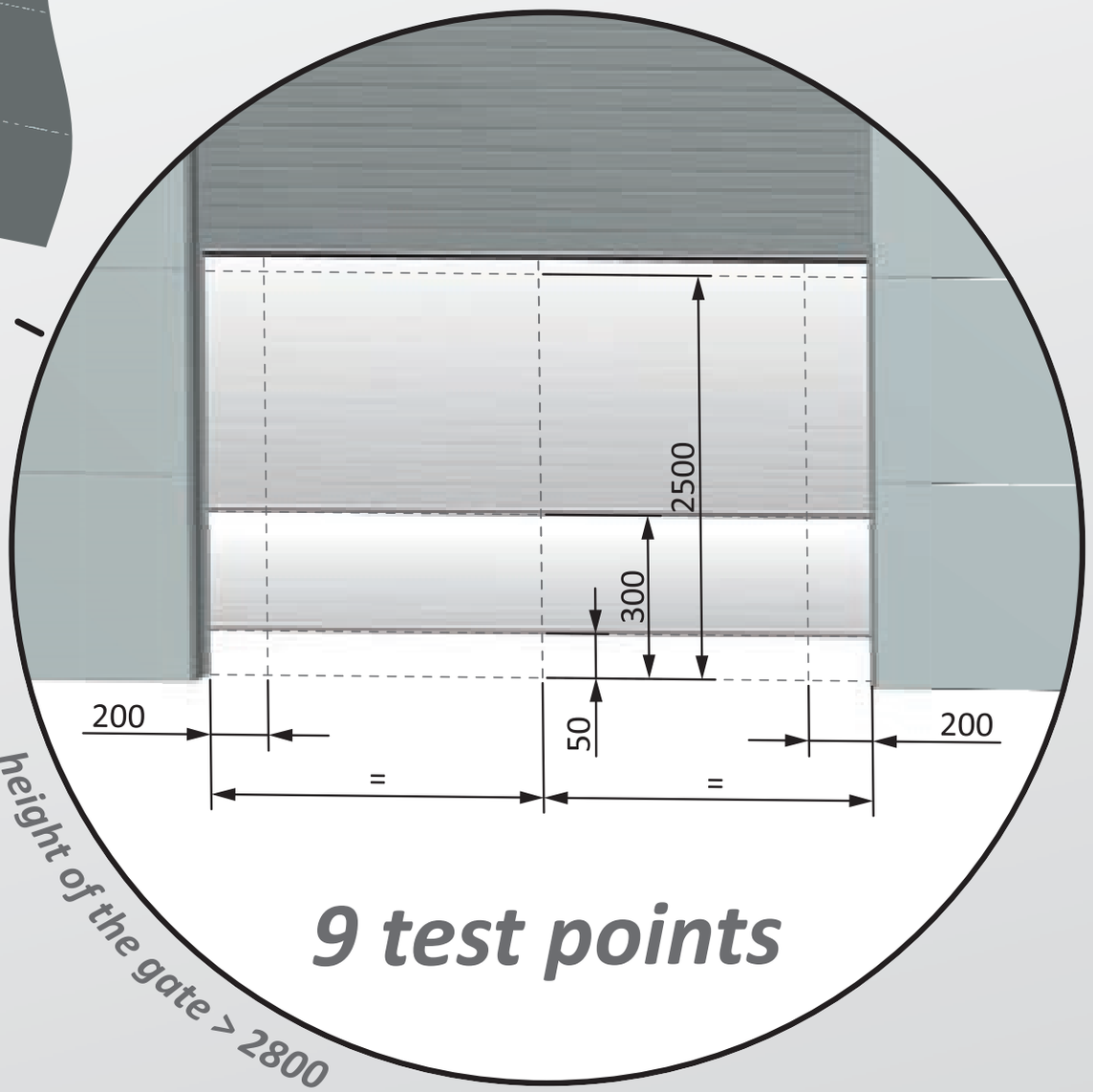
(single leaf)



Points of measuring

vertical doors

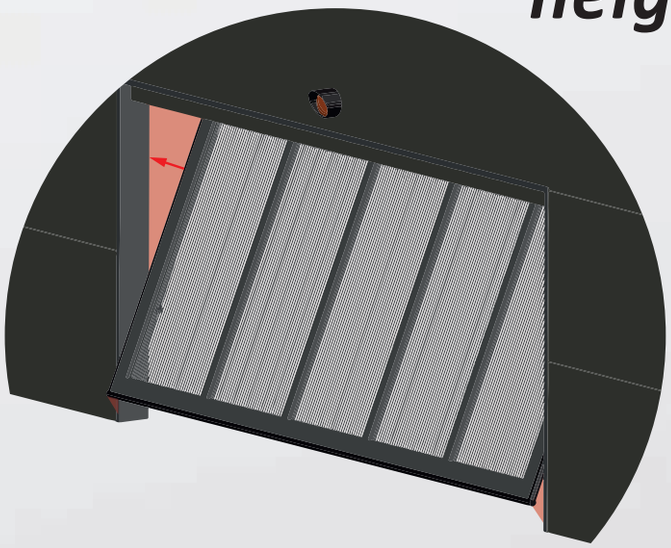


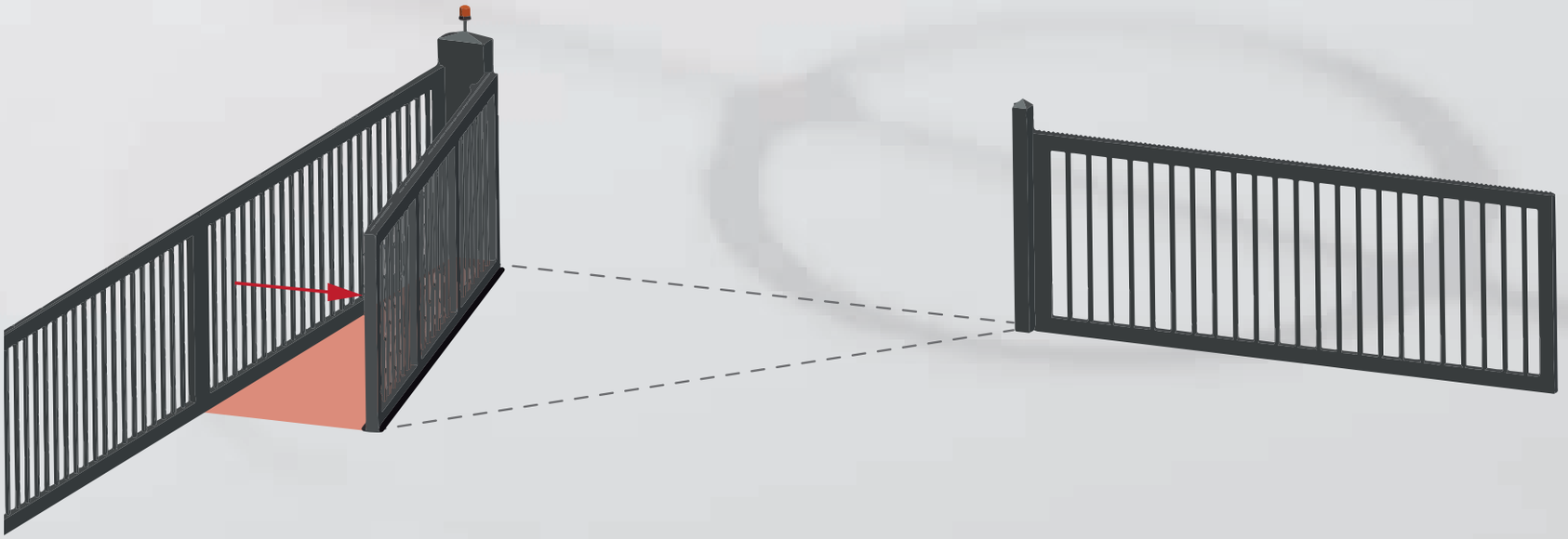


9 test points

Points of measuring

Rear edges neighbouring stiff parts





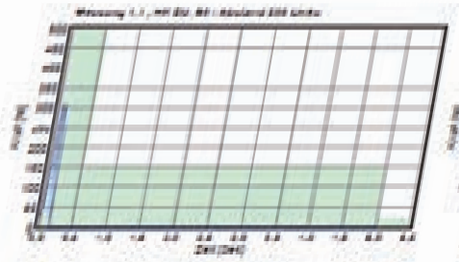
Protokoll der Schließkraftmessung
gem. EN 12445
Nutzungssicherheit kraftbetätigter
Tore - Prüfverfahren

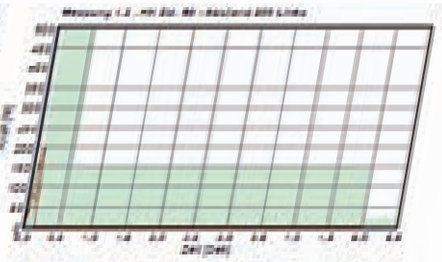
Details der Normmessungen 1 - 45

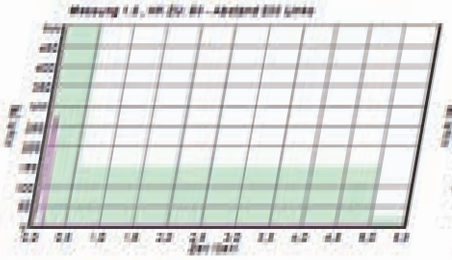
Messpunkt	Messung	F max [N]	F stat [N]	t dyn [ms]	F ges [N]
HK ZU: 50 Abstand 200 Links	1.1	507	1	0.05	0
	1.2	504	1	0.04	0
	1.3	512	1	0.05	0
vom: 07/07/xy - markiert: 17.05.2010	Mittelwert	508	1	0.05	0
HK ZU: 50 Mitte	1.1	508	1	0.04	0
	1.2	502	1	0.05	0
	1.3	513	1	0.05	0
vom: 02/02/xx - markiert: 17.05.2010	Mittelwert	508	1	0.05	0
HK ZU: 50 Abstand 200 Rechts	1.1	506	1	0.06	
	1.2	500	1	0.07	
	1.3	512	1	0.05	
vom: 09/09/xx - markiert: 17.05.2010	Mittelwert	506	1	0.06	
HK ZU: 300 Abstand 200 Links	4.1	519	1	0.11	
	4.2	510	1	0.06	
	4.3	504	1	0.04	
vom: 02/02/xx - markiert: 17.05.2010	Mittelwert	511	1	0.06	
HK ZU: 300 Mitte	5.1	504	1	0.06	
	5.2	507	1	0.06	
	5.3	510	1	0.06	
vom: 02/02/xx - markiert: 17.05.2010	Mittelwert	507	1	0.06	
HK ZU: 300 Abstand 200 Rechts	6.1	503	1	0.07	
	6.2	500	1	0.07	
	6.3	512	1	0.05	
vom: 07/07/xy - markiert: 17.05.2010	Mittelwert	505	1	0.06	
HK ZU: 2000 Abstand 200 Links	7.1	510	1	0.06	
	7.2	505	1	0.05	
	7.3	512	1	0.05	
vom: 02/02/xx - markiert: 17.05.2010	Mittelwert	509	1	0.05	
HK ZU: 2000 Mitte	8.1	500	1	0.0	
	8.2	498	1	0.0	
	8.3	515	1	0.0	
vom: 02/02/xx - markiert: 17.05.2010	Mittelwert	504	1	0.0	
HK ZU: 2000 Abstand 200 Rechts	9.1	507	1	0.0	
	9.2	500	1	0.0	
	9.3	505	1	0.0	
vom: 02/02/xx - markiert: 17.05.2010	Mittelwert	504	1	0.0	
Abstand 200 Links	10.1	503	1	0.0	
	10.2	498	1	0.0	
	10.3	510	1	0.0	
vom: 07/07/xy - markiert: 17.05.2010	Mittelwert	504	1	0.0	

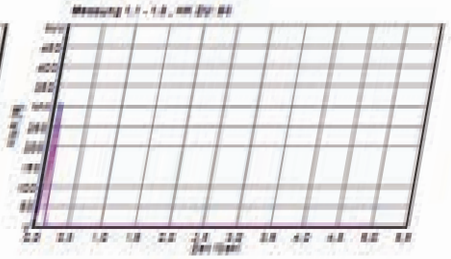
Druck-Vorlage Nr.: 62052 , Ausgedruckt am: 16.11.2010

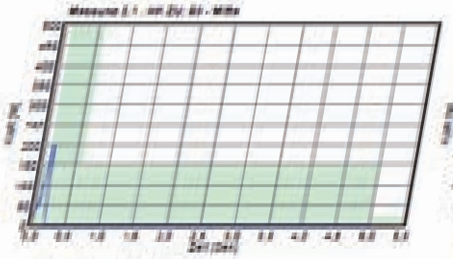
Protokoll der Schließkraftmessung
gem. EN 12445
Nutzungssicherheit kraftbetätigter
Tore - Prüfverfahren

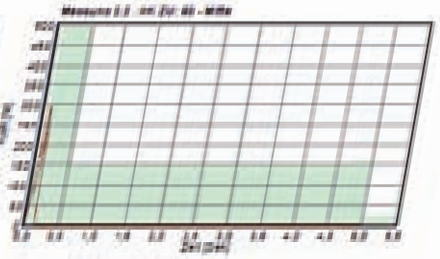


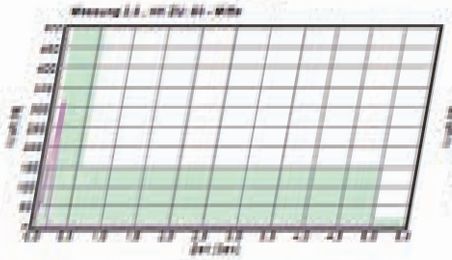


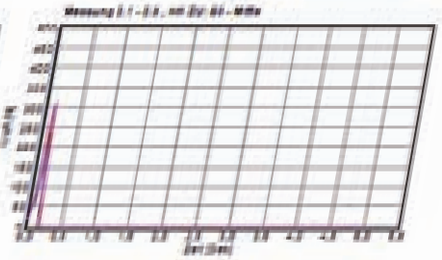












Documentation

The documentation of a standard test series should contain the following results:

- general information about the door/gate configuation
- date of the measurement
- type and calibration date of the force tester
- all single result parameters
- average values for each measuring point
- the force versus time diagrams
- the averaged force versus time diagrams

Quick Force Test

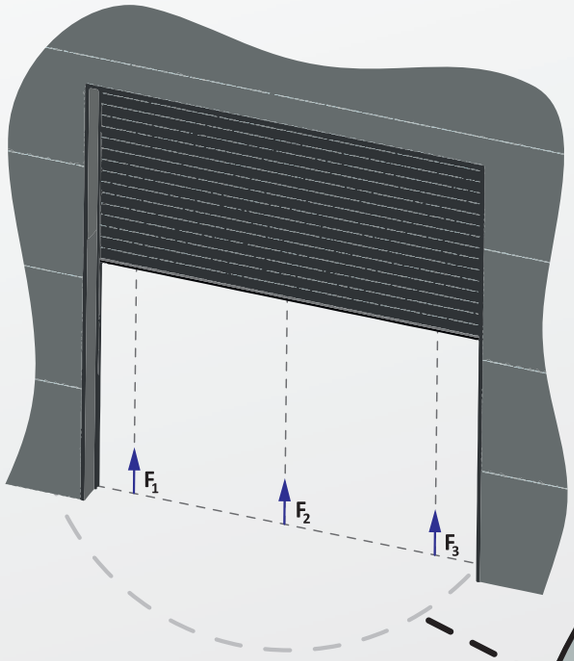
When it comes to annual maintenance of power operated door/gate systems experience has shown that the time-consuming standard test procedure is unnecessarily complex for assuring sufficient force limitation capabilities. The complexity as well as the increasing costs might cause that no force measuring is done after all.

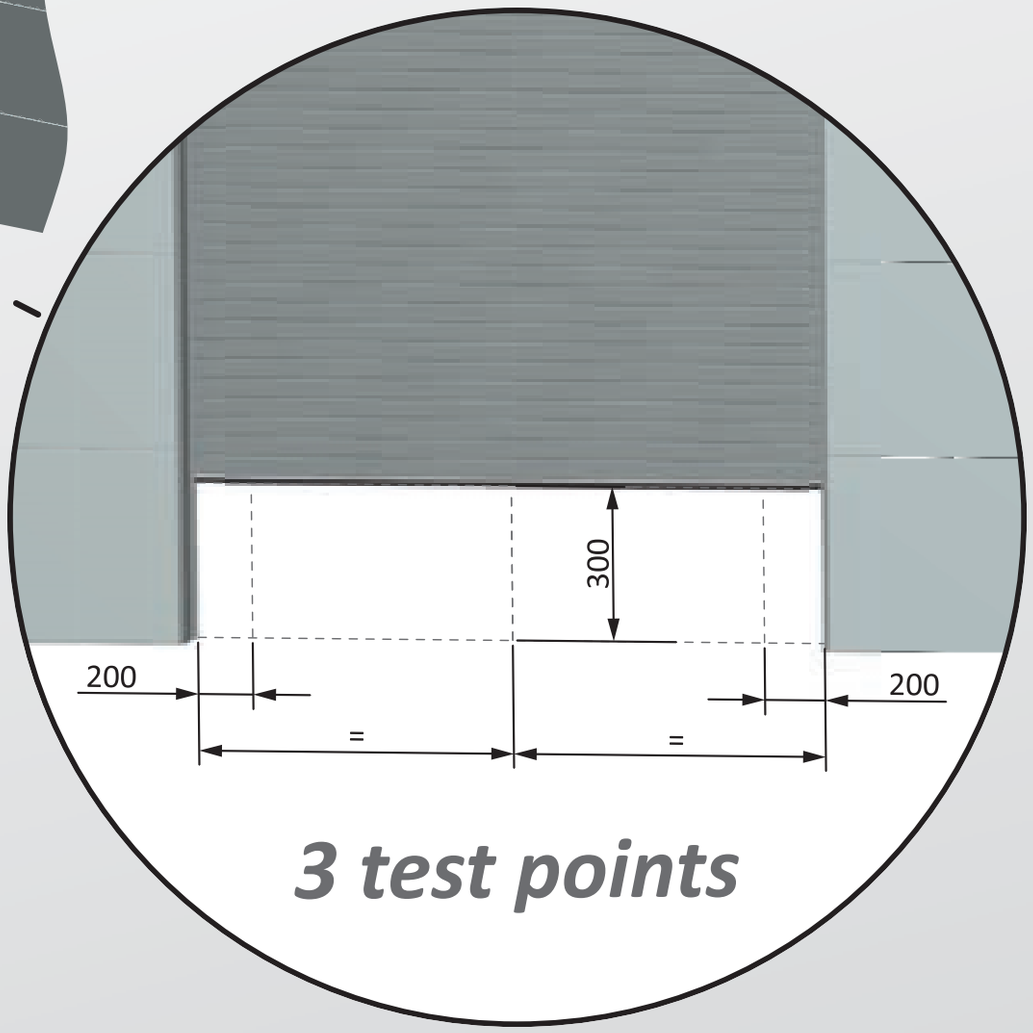
As a compromise, GTE recommends a ‚quick force test' which is less time-consuming, but provides a reliable and reproducible way of assessing the reversing process of a door/gate system. GTE suggests that three measuring points chosen to provide direct comparison to the standard limiting values (without averaging).

Quick force test points

(suggestion)

vertical doors





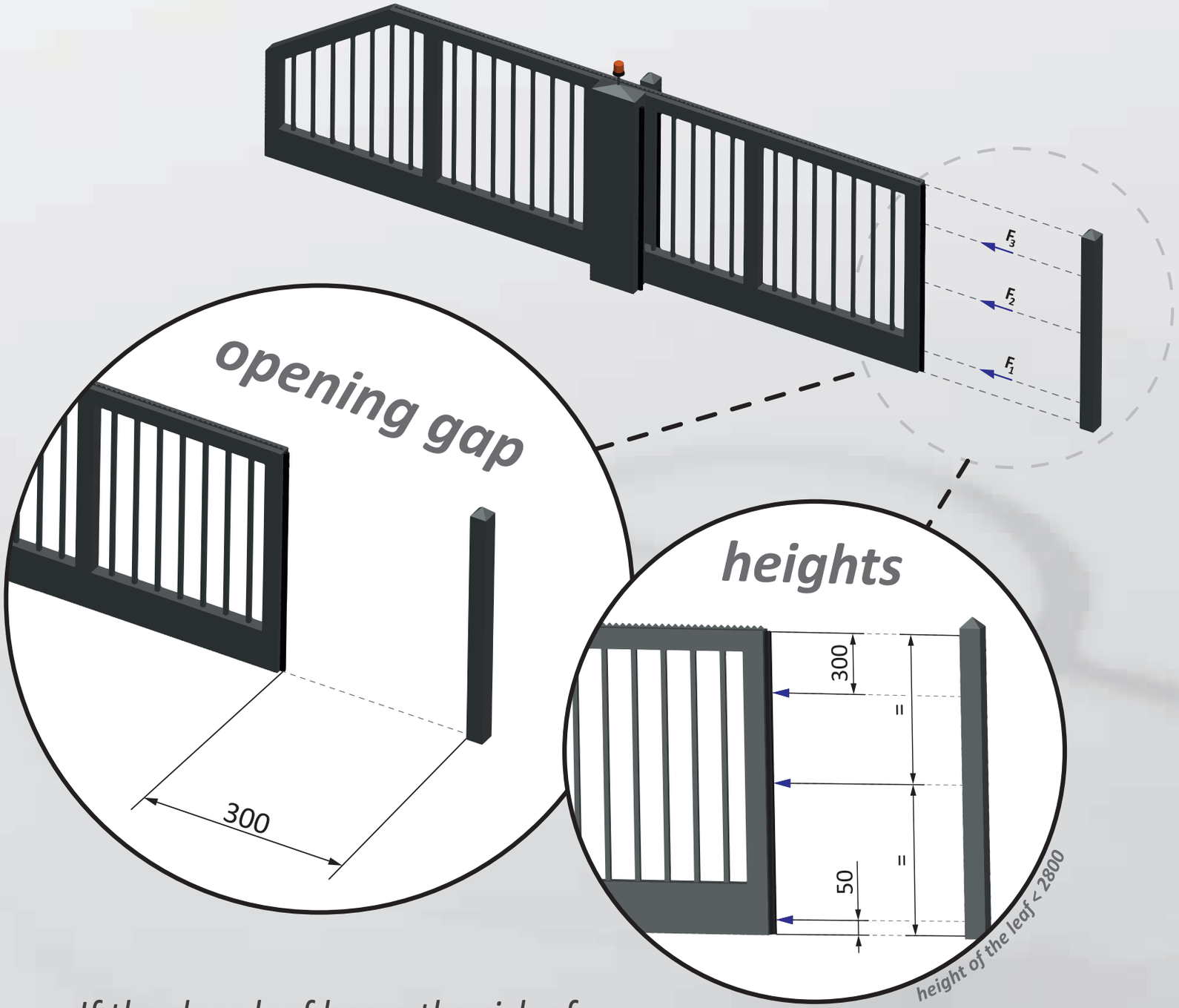
3 test points

Choose measuring points according to the greatest potential hazard.

Quick force test points

(suggestion)

horizontal doors



If the door leaf bears the risk of entrapment, crushing or drawing-in between the leaf and neighbouring stiff parts of the surroundings, choose additional measuring points!


www.force-test-tool.com
Free online-tool for
mobile and desktop use!

Documentation

The documentation of a quick force test should contain the following information:

- reference to the door / gate
- date of the measurement
- name of the tester
- all resultant parameters
- remarks, if force is out of admissible range
- signature of the tester

For a professional documentation GTE offers report paper pads as well as a free online tool, which helps you to create PDF-reports from your test results:

www.force-test-tool.com


320N

Force Measurement Instruments

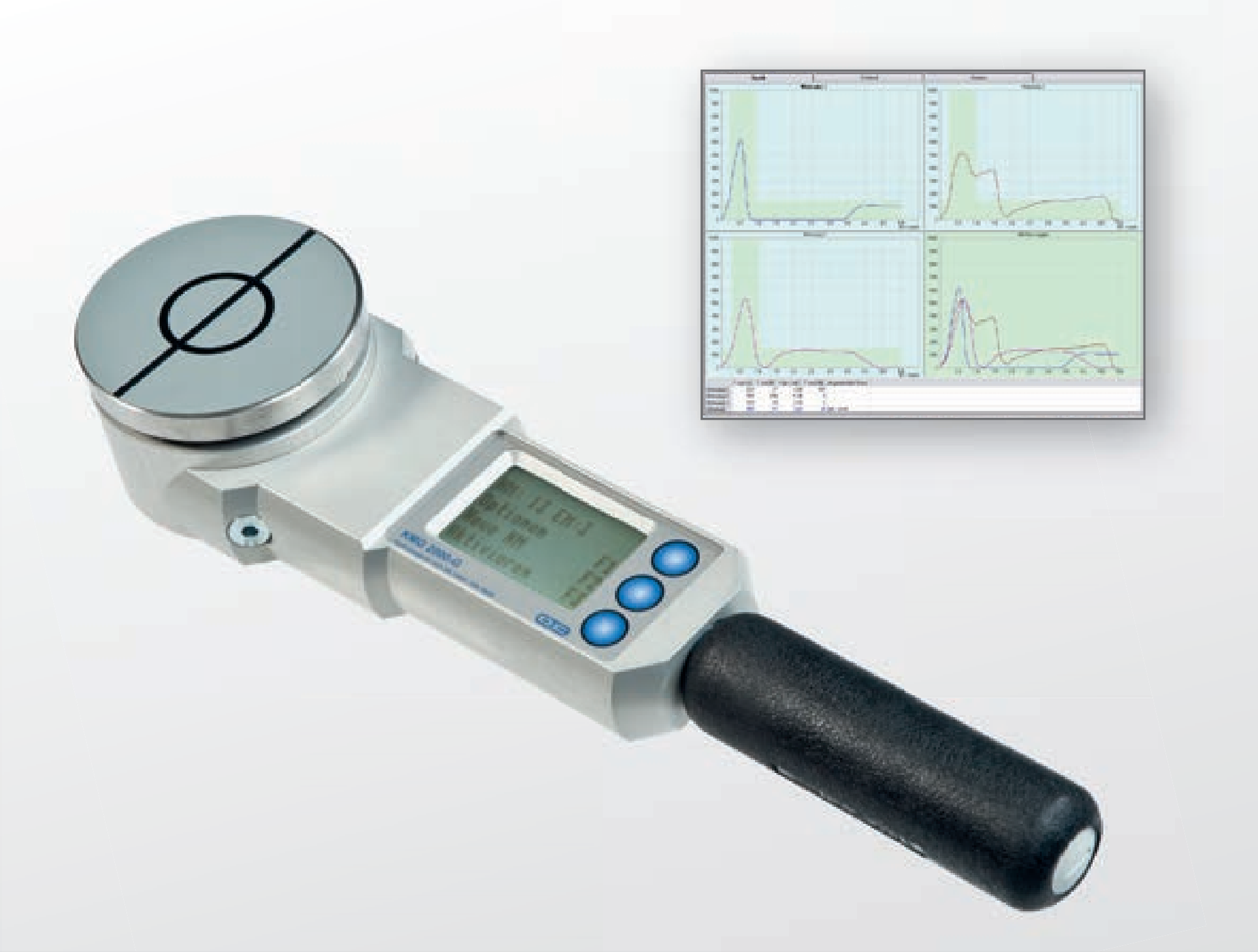
Two measurement procedures...

... two measurement devices

For optimized measurement performance GTE has designed two separate specialist devices.

KMG-2000-G is intended for the complex standard test series and is suitable for manufacturers and authorised inspectors.

KMG-Lite is an easy measuring tool for quick force tests in-situ. It is designed for use by both installation and maintenance companies.




320N
KMG 2000-C

KMG-2000-G

The graphical force measuring instrument.

Measurement-range: 0 ... 2000 N

- ***Illuminated graphical display with diagram view***
- ***Multi-lanuage service menu***
- ***High grade robust metal casing***
- ***Internal memory for 500 measurements***
- ***Automatic averaging***
- ***USB-Interface for PC connection***
- ***PC-Software for visualization, archiving and printing of measurement protocols***

KMG2000


GT3
KMG-LITE DS

KMG-Lite

The easy to use in-situ force tester.

Measurement-range: 0 ... 1600 N

- ***Intuitive handling***
- ***Automatic standard conforming evaluation***
- ***Numeric display of parameters F_{dyn}, t_{dyn} and F_{End}***
- ***Long-lasting battery supply***
- ***Transport case with protocol sheets included***
- ***Distance-Set with tripod and spacers available***
- ***Best value force tester on the market***

KMG LITE

GTE Electronics

Helmholtzstr. 21, 38 - 40
41747 Viersen, GERMANY

Tel.: 0049 (0)2162 3703 0
Fax.: 0049 (0)2162 3703 25

E-mail: info@gte.de
Internet: www.gte.de
www.force-test-tool.com