Checklist for the identification of mechanical hazards on revolving doors
(accompanying the test principles)
- Draft version: May 2005 -
- This PDF form can be completed on a PC.

IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Site/operator	
Test date	
Persons present	

1 Technical data

Manufacturer	
Model designation	
Design type	
Year of manufacture	
Weight	
Drive	
Test mark	
Last service (date) • Performed by	

2 Dimensions

Number of door wings	
Diameter [cm]	
Door wing length [cm]	
Opening aperture [cm]	
Ceiling height [cm]	
Design features	
Are outer external interlocking doors present? Can the doors be opened sufficiently wide for the protective devices (pressure-sensitive edges, light scanners, etc.) to be fully effective? Are interlocks or limit switches fitted?	

3 Documentation

The following documents must be available at the time of testing:

Document	Available?
Information for use (instruction handbook)	
For pressure-sensitive edges: Declaration of conformity with the Machinery Directive	
For electrosensitive protective equipment (ESPE): Certification by a notified test body of the performance of a type test	
Manual for the control system	
Test book	

4 Descriptions of the hazard points

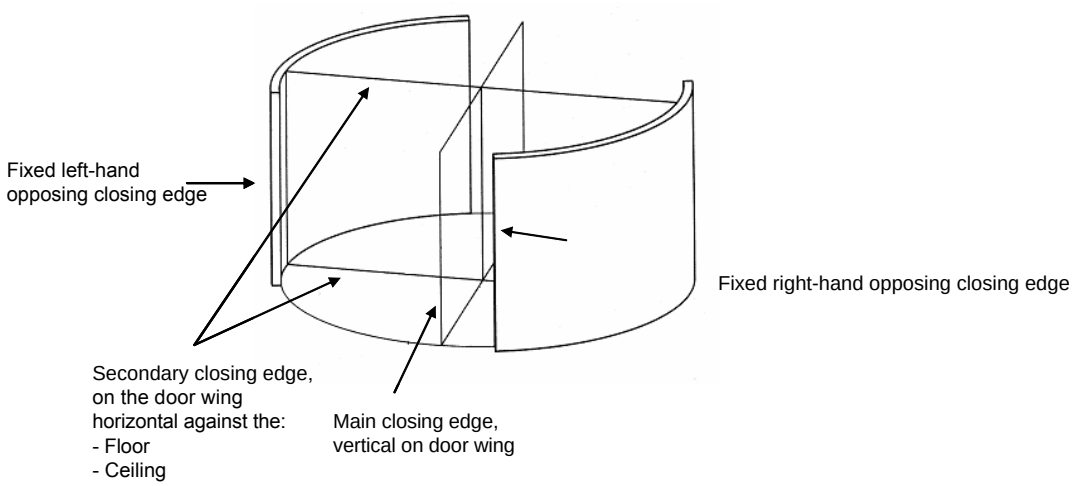


Fig. 1: Schematic diagram of a revolving door, with indication of the closing edges

Hazards identified by the risk assessment dated 09/2004 (refer also to Section 9.2):

A: Access area of the revolving door between the main closing edge of the door wing and the right-hand opposing closing edge. The following hazards may arise here:
- Shear
- Crushing
- Trapping (on two-wing revolving doors)

B: Main closing edge of the door wing against the inner wall. The following hazards may arise here:
- Shear
- Crushing

C: Secondary closing edge of the door wing against the ground. The following hazards may arise here:
- Shear
- Crushing
- Impact by the door wing

D: Secondary closing edge of the door wing against the ceiling. The following hazards may arise here:
- Shear
- Crushing

5 Safeguarding of the hazard point

5.1 Hazard point A

5.1.1 Control measures

Is the door drive speed automatically reduced at the approach of the main closing edge to the opposing closing edge? If so, at what distance does this occur?	

5.1.2 Test of the individual protective devices

5.1.2.1 Right-hand opposing closing edge

Sensor (type, manufacturer, model, dimensions)	**Inside/ outside**	**Behaviour of the door[1]**	**Functional [in accordance with Section 6]**

5.1.2.2 Main closing edge

Sensor (type, manufacturer, model, dimensions)	**Door wings**	**Behaviour of the door[1)]**	**Functional [in accordance with Section 6]**

[1] The door can respond as follows: cessation of the revolving movement (indication of the overtravel)/stop + reversal (indication of the distances)/initiation of a reduced velocity (indication of the velocity and duration)

5.1.3 Overall effectiveness of the protective devices at the hazard point

The effectiveness of all protective devices is tested with the aid of the KMG 2000 force meter. Hold the force meter directly on the opposing closing edge towards the hazard point at a distance of 300 mm between the main closing edge and the opposing closing edge. Repeat measurement twice. Note the resulting mean. Conduct the measurement at three different heights above the ground inside and in the outside access area to the door.

Force measurement [N]	Outside the building	Inside the building
Height above ground: 50 mm		
Height above ground: 800 mm		
Height above ground: 1500 mm		

Are the protective devices fitted also effective against the trapping hazard?	

Evaluation:
The measured forces must not exceed a value of 150 N.

5.2 Hazard point B

5.2.1 Test of the individual protective devices

5.2.1.1 Left-hand opposing closing edge

Sensor (type, manufacturer, model, dimensions)	**Inside/ outside**	**Behaviour of the door**[2]	**Functional [in accordance with Section 6]**

5.2.1.2 Main closing edge

For the main closing edge, refer to Section 5.1.2

5.2.2 Overall effectiveness of the protective devices at the hazard point

Use the test wedge to determine whether the door comes to a halt within the deformation path of the pressure-sensitive edges.
The length of the braking path can be read off on the impressed scale of the test wedge.
Measure at a height of 1,200 mm above the ground by placement of the test wedge on the inner wall of the revolving door.

Does the door come to a halt within the deformation path of the pressure-sensitive edges?	
Distance between main closing edge of the door wing (once on the leading edge of the pressure-sensitive edge, once on the profile) and inner wall [cm]	Leading edge of the pressure-sensitive edge: Profile:
Does the frame profile of the door wing move up to the test wedge?	
Length of the braking distance [cm]	
Are shear points present? (cf. test principles, Section 4.3)	

[2] The door can respond as follows: cessation of the revolving movement (indication of the overtravel)/stop + reversal (indication of the distances)/initiation of a reduced velocity (indication of the velocity and duration)

Evaluation:
If the revolving door comes to a halt within the deformation path of the pressure-sensitive edges, adequate safeguarding is provided against the crushing hazard. If the inner wall profiles take the form described in the package of measures in the section concerning the avoidance of shear points, a shear hazard does not exist.

5.3 Hazard point C

5.3.1 Test of the individual protective devices

Secondary closing edge against the ground:

Sensor (type, manufacturer, model, dimensions)	**Door wings**	**Behaviour of the door**[3]	**Functional [in accordance with Section 6]**

5.3.2 Overall effectiveness of the protective devices at the hazard point

Use the test wedge to determine whether the door comes to a halt within the deformation path of the pressure-sensitive edges. The length of the braking path can be read off on the impressed scale of the test wedge. Measure at the centre of the door wing and in the vicinity of the main closing edge on each door wing.

	Centre	**Extremity**
Does the door come to a halt within the deformation path of the pressure-sensitive edges?		
Distance between secondary closing edge of the door wing (once on the leading edge of the pressure-sensitive edge, once on the profile) and floor [cm]	Leading edge of the pressure-sensitive edge: Profile:	Leading edge of the pressure-sensitive edge: Profile:
Does the frame profile of the door wing move up to the test wedge?		

[3] The door can respond as follows: cessation of the revolving movement (indication of the overtravel)/stop + reversal (indication of the distances)/initiation of a reduced velocity (indication of the velocity and duration)

Length of the braking distance [cm]		

Are protective devices fitted for safeguarding against the impact hazard? (measures are essential on doors of > 3 m diameter)	

Evaluation:
If the revolving door comes to a halt within the deformation path of the pressure-sensitive edges, adequate safeguarding is provided against the crushing hazard. If the floor takes the form described in Section 4.3 of the test principles, no shear hazard exists. Adequate safeguarding is provided against the impact hazard on doors with a diameter of > 3 m (for example by electrosensitive protective equipment with body resolution) when impact by the door wing is prevented. On doors with a diameter of ≤ 3 m, measures must be defined on a case-by-case basis.

5.4 Hazard point D

Is this hazard point still present in consideration of design measures?	
Distance between secondary closing edge of the door wing (once on the leading edge of the pressure-sensitive edge, once on the profile) and ceiling [cm]	Leading edge of the pressure-sensitive edge: Profile:

Evaluation:
If the crushing and shear hazards have been avoided by means of design measures, no further testing is required. If the hazards are still present, test as per Chapter 5.3.

6 Testing of the individual protective devices

The protective devices must also be tested individually with regard to their serviceability. The following test points can be referred to for this purpose:

6.1 Tactile protective devices

6.1.1 Pressure-sensitive edges

Testing of the pressure-sensitive edge by manual actuation

Is the pressure-sensitive edge effective over its entire length?	
Does the pressure-sensitive edge also switch when actuated from the side? (The pressure-sensitive edge must have an actuation range of 180°.)	

6.2 Electro-sensitive protective equipment (ESPE)

6.2.1 Light scanners

Test the effectiveness of each individual light scanner. Use the test wedge for this purpose. In this case, cover the test wedge with cord velvet. Place the wedge on the floor at the opposing closing edge such that it just fails to be caught by the main closing edge of the door wing. It must be detected by the light scanner.

Horizontal light scanners must function as specified by the manufacturer.

Evaluation/comment:
If the test wedge covered with cord velvet is detected by the light scanner, the light scanner is adequately effective.

6.2.2 Through-beam/reflection sensors (single- or multi-beam)

Does the light barrier, fitted vertically, switch when the light beam is broken at any point and at any angle between the transmitter and receiver or transmitter/receiver and reflector by an opaque test body with a diameter of 21 mm?	
Is it possible to reach around the light barrier in the direction of the closing edge?	

Evaluation:
- If the light barrier does not switch over its entire length, reflections of individual light beams may have occurred owing to an inadequate distance from reflective surfaces (where specified by the manufacturer, a minimum distance must be observed).
- If it is possible to reach around the light barrier, further light beams may have to be installed.

6.2.3 Light curtain

Does a light curtain, fitted vertically, switch when broken at any point and at any angle by an opaque test body with a diameter of 21 mm?	

Evaluation:
If the light curtain does not switch over its entire length, it may be defective, or reflections of individual light beams may be occurring owing for example to an inadequate distance from reflective surfaces (where specified by the manufacturer, a minimum distance must be observed).

7 Revolving velocity

What is the maximum revolving velocity during use by the public [revolutions per minute]?	
Does the door feature a fast speed? If so, what is this speed?	
Does the door feature a reduced speed for disabled users? If so, what is this speed? How long does the door run at the reduced speed (number of revolutions)?	

8 Testing of the control devices

8.1 General

Are buttons provided for reduction of the revolving speed (for disabled users)? On the inside and the outside? Height at which fitted [cm]?	

8.2 Emergency stop

How many emergency-stop buttons are fitted?	
Where are they located? Are the emergency-stop buttons within easy reach (height fitted) [cm]?	
Is the emergency-stop button properly marked (red actuator on a yellow background)?	
What is the overtravel following actuation [cm]?	
Can the door be moved manually following actuation? What force is required for this purpose [N]? (Rescue measures in accordance with the Machinery Directive)	

8.3 Emergency open[4]

How many emergency-open buttons are fitted?	
Where are they located? Height at which fitted [cm]?	
What happens in response to actuation?	
Is the emergency-open function, if provided, subordinate to the emergency-stop function?	

9 Electrical properties

What happens in the event of power failure? Can the door be moved manually? What force is required for this purpose [N]?	

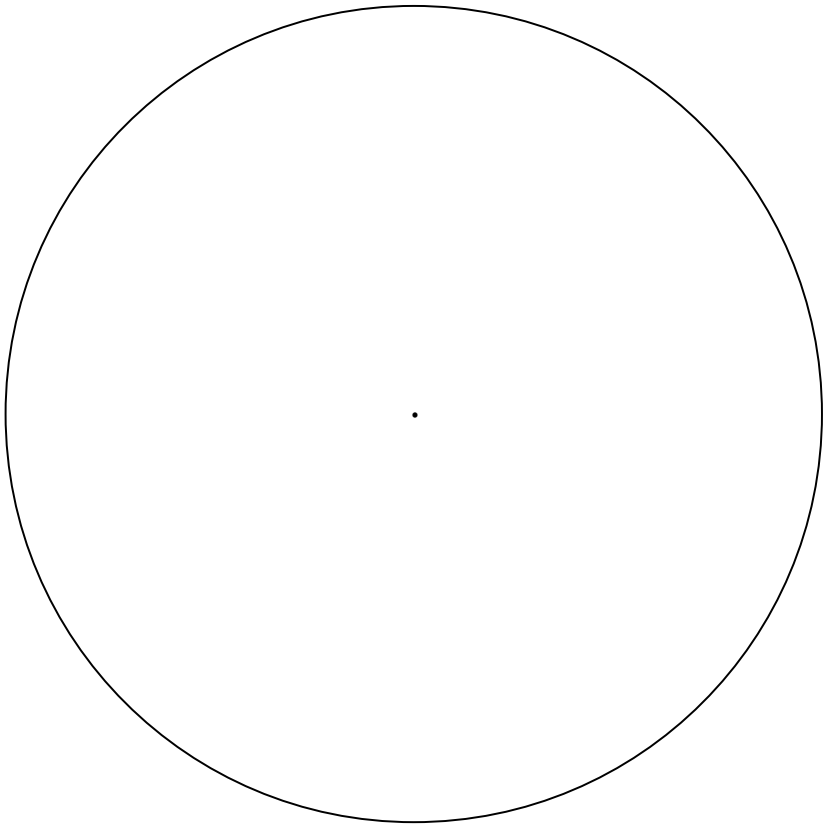
9.1 Operating mode selector switch

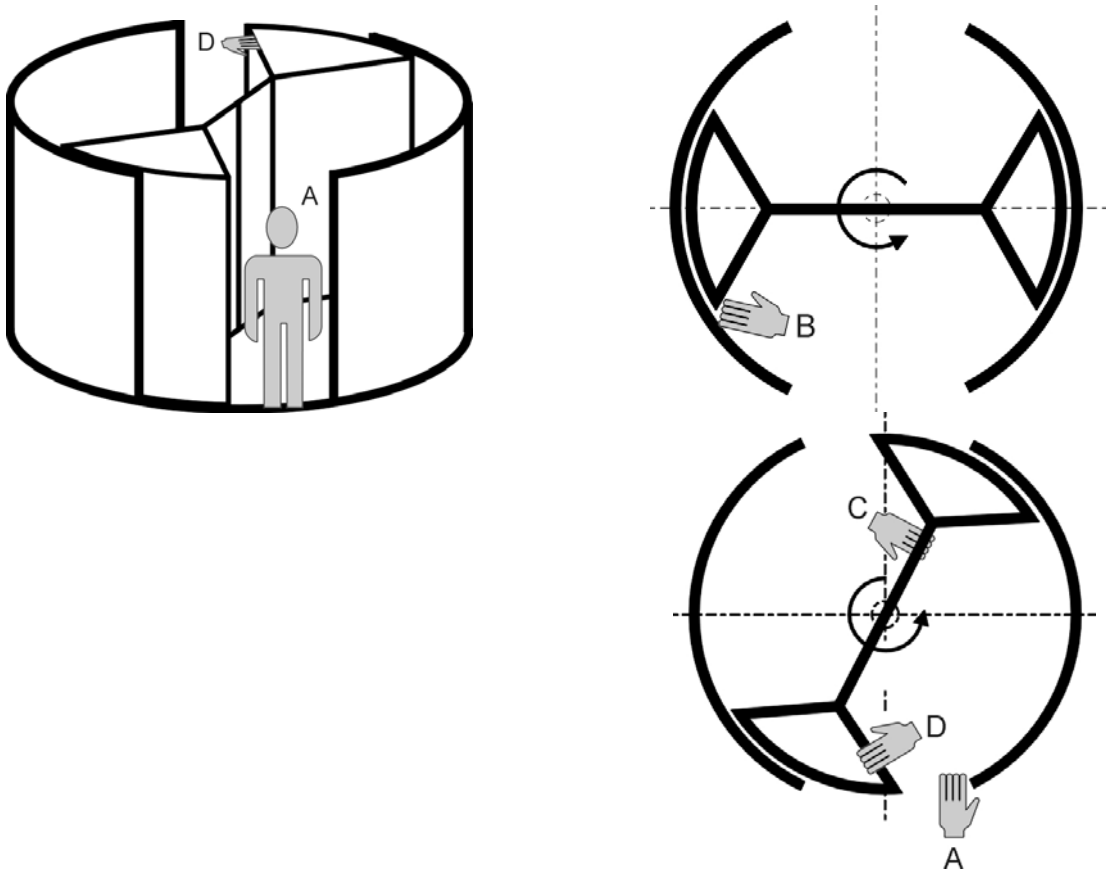
Is an operating mode selector switch fitted? If so, what are its positions?	

[4] Switch for intentional opening of the door in an emergency situation

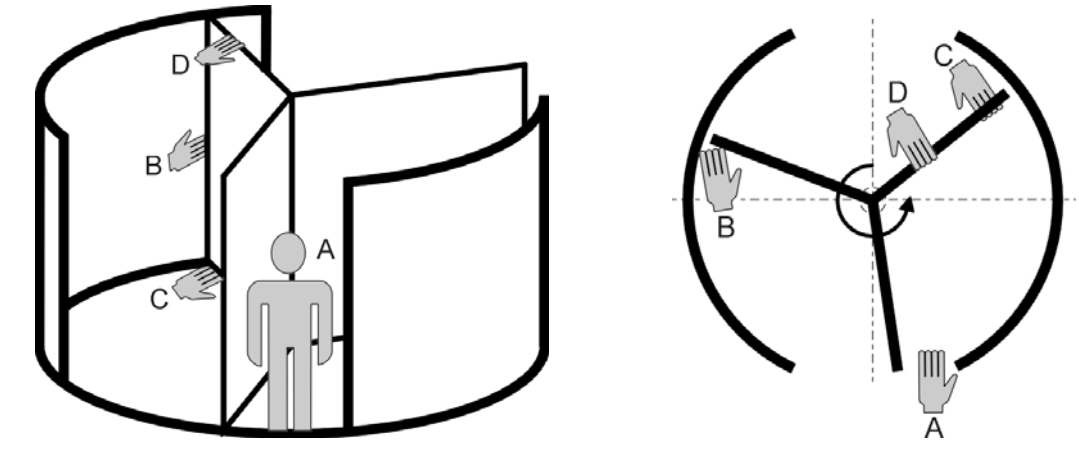
9.2 Sketch of the revolving doors (for illustration of the protective and control devices)

Plan view:

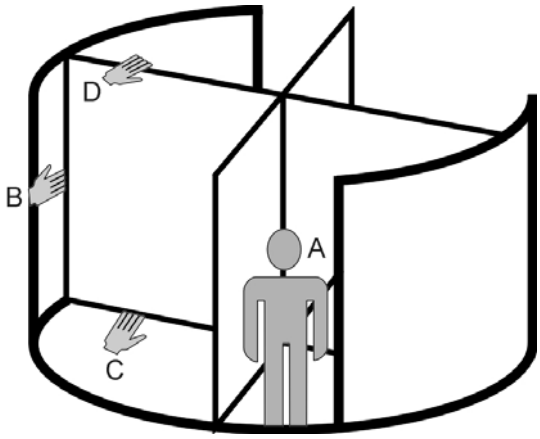


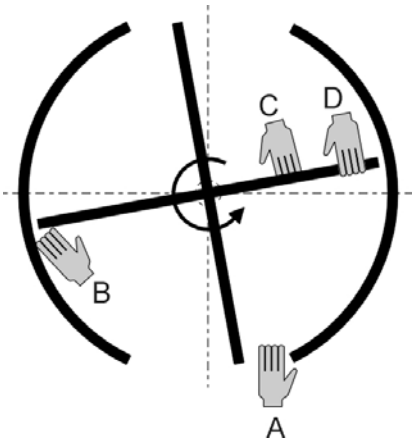


Figs. 2 to 4: Two-wing revolving door



Figs. 5 and 6: Three-wing revolving door





Figs. 7 and 8: Four-wing revolving door

Annex: Test principles

[1] Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery (98/37/EC)
[2] BGR 232 [ZH 1/494]: April 1989, updated version 2003; BG-Regel; Kraftbetätigte Fenster, Türen und Tore
[3] DIN EN 294: August 1992: Safety of machinery – safety distances to prevent danger zones from being reached by the upper limbs; German version EN 294: 1992
[4] DIN EN 349: June 1993: Safety of machinery – minimum gaps to avoid crushing of parts of the human body
[5] DIN EN 954-1: March 1997; Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design; German version EN 954-1: 1996
[6] DIN EN 1050: January 1997; Safety of Machinery – Principles for Risk Assessment; German version EN 1050: 1996
[7] DIN EN ISO 12100-1: April 2004; Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology (ISO 12100-1: 2003); German version EN ISO 12100-1: 2003
[8] DIN EN ISO 12100-2: April 2004: Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles (ISO 12100-2: 2003); German version EN ISO 12100-1: 2003
[9] DIN EN 12978: Sept. 2003; Industrial, commercial and garage doors and gates – Safety devices for power operated doors and gates – Requirements and test methods; German version EN 12978: 2003
[10] DIN EN 60204: Nov. 1998; Safety of machinery – Electrical equipment of machines – Part 1: General requirements; German version EN 60204: Sept. 1997

Product-specific standards:

[11] EN 61496-1: April 2004: Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests; German version EN 61496-1:2004
[12] EN 61496-2: October 2001: Safety of machinery – Electro-sensitive protective equipment – Part 2: Particular requirements for equipment using active opto-electronic protective devices
[13] DIN EN 1760-1: September 1997: Safety of machinery – Pressure sensitive protective devices – Part 1: General principles for the design and testing of pressure sensing mats and pressure sensitive floors; German version EN 1760-1:1997
[14] DIN EN 1760-2: July 2001: Safety of machinery – Pressure sensitive protective devices – Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars; German version EN 1760-2:2001