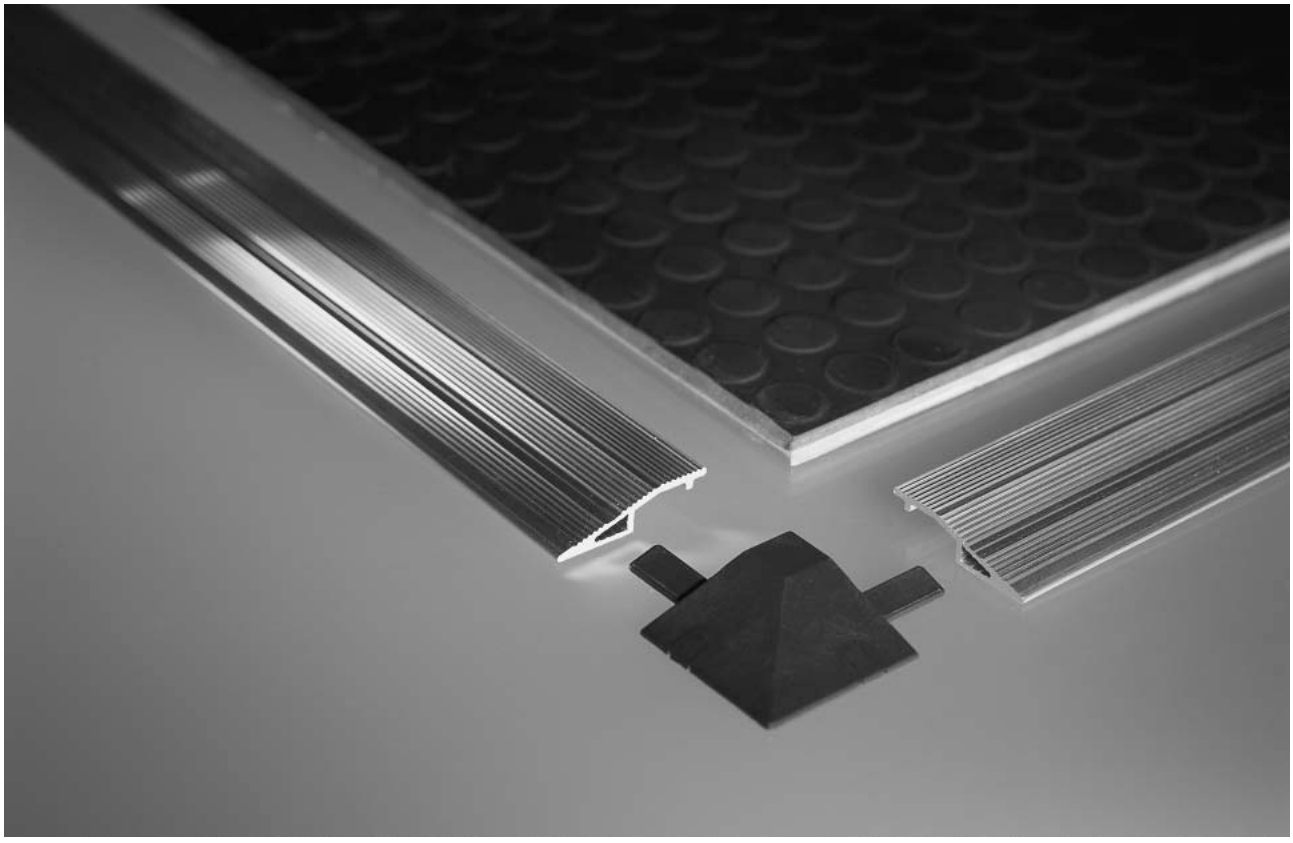
MAYSER®

Product information



Safety Steps TS

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Table of contents

Important information
Read through the product information carefully. It contains important information on operation, safety and maintenance of the product. Retain the product information for later reference.
Always observe the safety instructions on the following pages under **ATTENTION.** Only use the product for the purpose described in the product information.

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Definitions

See Definitions and Operation Principles in chapter 1 of the catalogue.

Intended use

A safety step detects a person that is standing on or stepping onto it. It is a protective device covering a certain area and monitoring thepresence of a person on it as a safety function. Its purpose is to prevent possible hazardous situations for personnel within a danger zone.
Typical applications are in the area of moving units on machines and plants.
Safe operation of a safety step depends entirely on

- the surface condition of the mounting surface,
- the correct selection of size and resistance as well as
- correct installation.

Tip
See Annex B of ISO 13856-1, especially Figures B.1 and B.2.

Limits

- max. 10 sensors on one Control Unit
- System size max. 15 m^2
  = max. number × max. sensor size

Exclusions

An individual sensor is not suitable for detecting people weighing under 20 kg.
Combination of sensors are not suitable for detecting people weighing under 35 kg.
It is also not suitable for driving over with forklifts or other handling equipment.

Programme selection

Sensors in the TS Safety Steps programme are only available in fixed, predefined sizes. The surface is resistant to a certain extent to external influences and normal chemical influences.
If you require sensors that meet higher requirements, our SM Safety Mats programme may be right for you.

Tip
Special shapes and protection of ATEX zones are only possible in the SM Safety Mats programme

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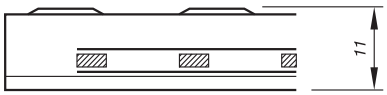
Subject to technical modifications.

Design



Standard version
Moulded onto a plastic plate. The surface structure created during casting ensures the necessary non-slip protection as well as mechanical protection.
Load capacity: max. 800 N/cm²
Degree of protection: IP65

Note
Physical and chemical resistance:
See table on page 6 and page 7.

Available sizes

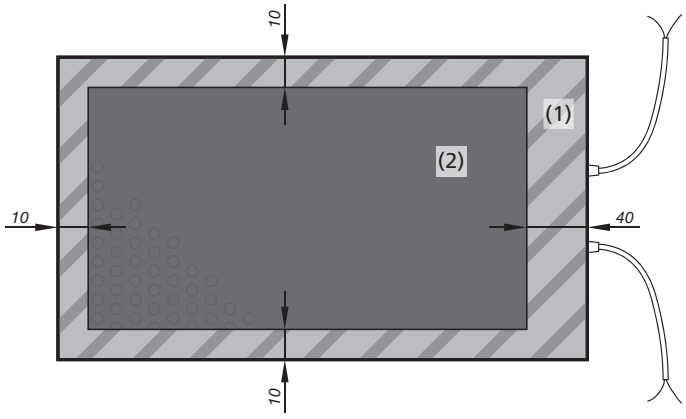
TS sensors are only available in fixed sizes:

5000776	TS/BK 1600 × 1000 mm
5001005	TS/BK 1600 × 750 mm
5000777	TS/BK 1600 × 500 mm
5001238	TS/BK 1200 × 1000 mm
5001882	TS/BK 1200 × 750 mm
5001881	TS/BK 1200 × 500 mm

Non-sensitive zone along edges

A non-sensitive edge (1) surrounds the effective actuation area (2):
- 40 mm = on cable exit side
- 10 mm = on remaining three sides

Note
Where several sensors make up one contact area only the mat sides with 10 mm edges should lie next to one another.



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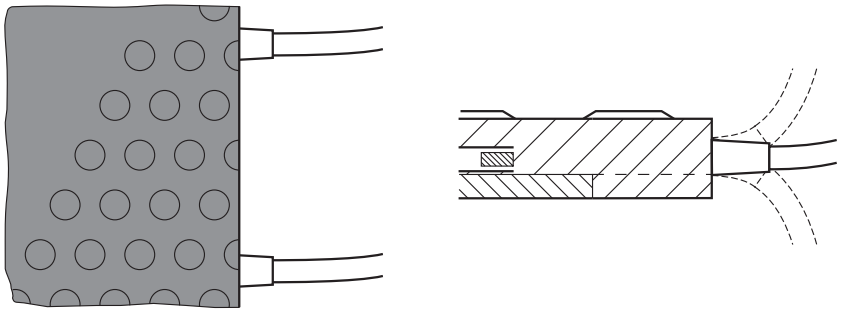
Connection

Cable exit

The cable exit is only available in the centre of the narrow side.
Lay the cables in the attached cable conduit. They can only be laid upwards or downwards to a limited extent.



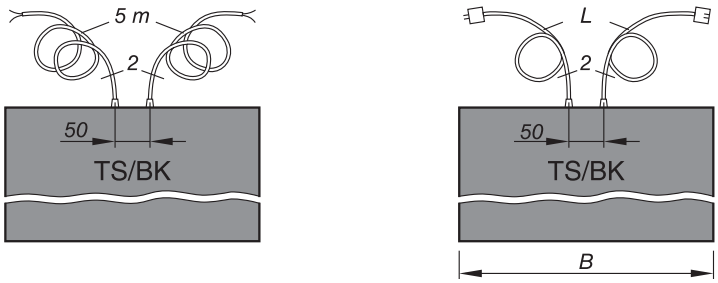
Cable connection

Without plug (standard)
- Universally applicable
- Variable cable length

With plug
- Service-friendly
- Easy assembly
- Safe connection
- Watertight plug connection possible

- Standard cable lengths
  L = W/2 + 200 mm
  Other cable lengths available on request.

ATTENTION
The maximum overall cable length up to signal processing is 200 m.



- As a feed-through sensor type BK
- Without resistor
- 2 two-wire cable (Ø 5 mm; 2× 0.5 mm² Cu)

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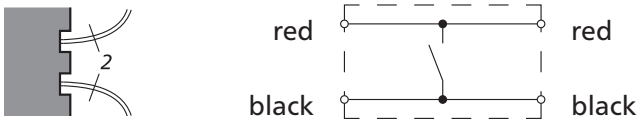
Wire colours

Sensor type BK with 2 lines



Surface toppings

The surface structure is created during casting. No further sensor cover is required.

Resistances

The condition for the resistances listed in the following (at room temperature 23 °C) is a sensor with an undamaged surface.

Physical resistance

Surface topping	PUR
Degree of protection (IEC 60529)	IP65
Hardness as per Shore A	60 +3
Abrasion (DIN 53516)	100 to150 mg
Max. load capacity (8 h)	800 N/cm²
Behaviour in fire (DIN 4102)	B2
Stress when subjected to climate changes	resistant
UV-resistance	yes

Chemical resistance

The sensor is resistant against normal chemical influences such as diluted acids and alkalis as well as alcohol over an exposure period of 24 hrs.

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Subject to technical modifications.

The values in the table are results of tests carried out in our laboratory to the best of our knowledge and belief. The suitability of our products for your special area of application must always be verified with your own practical tests.

Surface topping	PUR
Acetone	-
Formic acid 5%	+
Ammonia	+
ATF gear oil	+
Brake fluid DOT 4	-
Cutting emulsion	+
Demineralised water	+
Diesel	±
Acetic acid 10%	+
Ethanol	-
Greases	-
Hydraulic oil	+
Caustic potash solution 10%	+
Saline solution 5%	+
Cooling lubricant	±
Metal working oil	+
Methanol	-
Mineral oil	+
Caustic soda 10%	±
Cellulose thinner	-
Hydrochloric acid 10%	±
Salt water 10%	+
Suds 5%	+
White spirit (ethyl alcohol)	-
Universal thinner	-
Water	+
Petroleum ether / petrol	-
Citric acid 10%	+
Drawing compound	-

Explanation of symbols:
+ = resistant
± = resistant to a certain extent
- = not resistant

Note:
Tests are carried out at room temperature (+23 °C).

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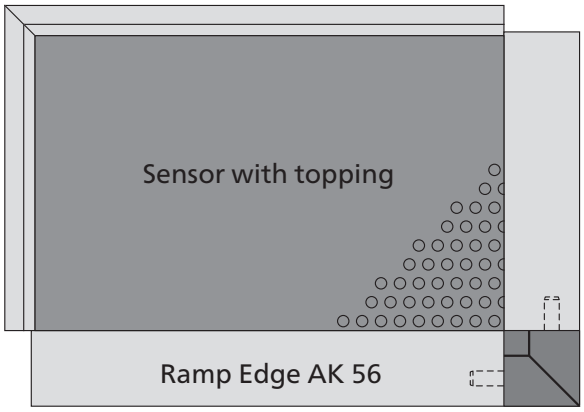
Subject to technical modifications.

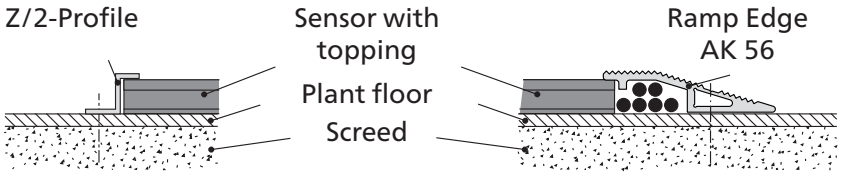
Fixing sensors

Ramp Edges can be installed quickly and easily.

Z/2-Profile or cable conduit (machine side)

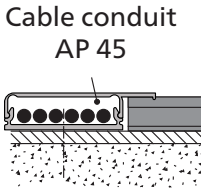


Ramp Edge AK 56



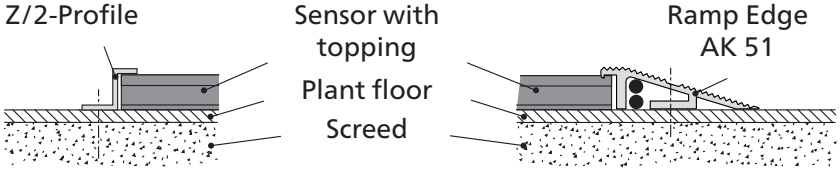
- Not suitable for plug-in cable connections
- Cable conduit for max. 6 cables

Cable conduit AP 45



- Cable conduit AP 45 instead of Z/2-Profile
- Suitable for plug-in cable connections
- Cable conduit for max. 6 cabels

Ramp Edge AK 51



- Not suitable for plug-in cable connections
- Cable conduit for max. 2 cables
- Corner joints are only available with mitre cuts (not suitable for corner connectors and wedge connectors)

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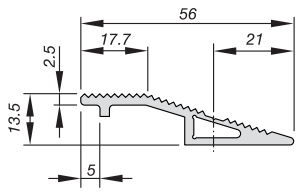
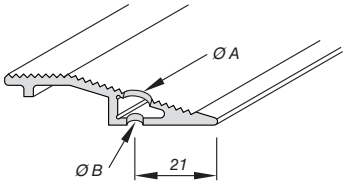
Subject to technical modifications.

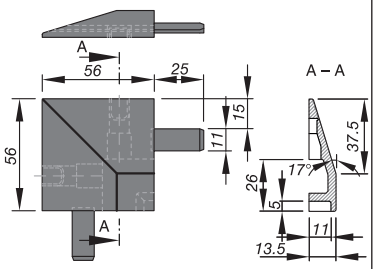
Aluminium Ramp Edge AK 56
1-part with cable conduit
- For combination of several sensors
- Sensors with or without plugs
- Rod 3 m (7501014), Rod 6 m (1002684) or fixed length



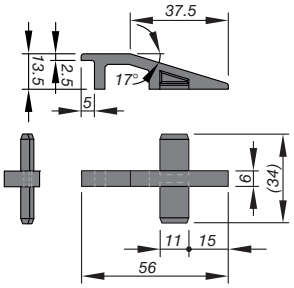
Threaded hole for AK 56
- For fixing Ramp Edge AK 56



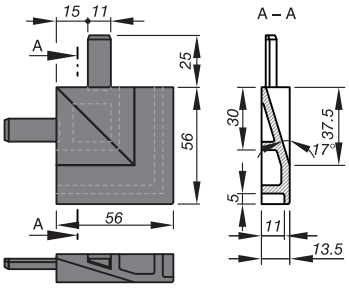
Corner conector E1 AK 56 outer
- For corner conectors Ramp Edge AK 56
- Material: plastic black (1002751)



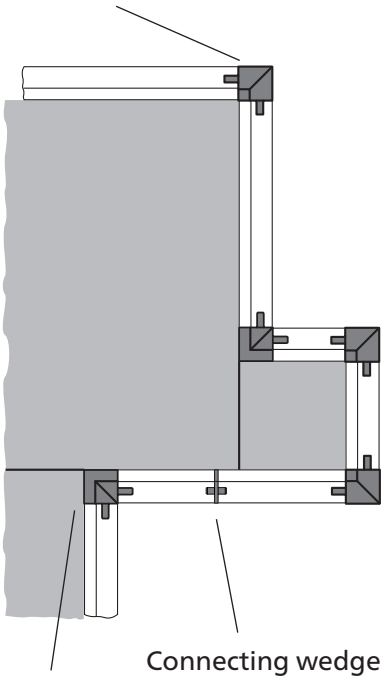
Connecting wedge Vk AK 56
- For longitudinal connection of Ramp Edge AK 56
- Material: plastic black (1002996)



Corner connector E2 AK 56 inner
- For corner conectors Ramp Edge AK 56
- Material: plastic black (1002752)



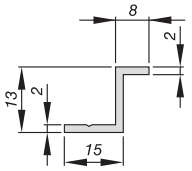
Example
Corner conector outer



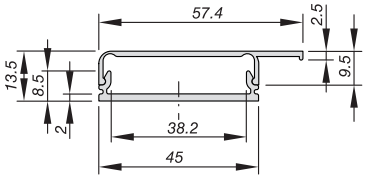
Note
Corner conector and connecting wedge are not suitable for Ramp Edge AK 51.

Subject to technical modifications.

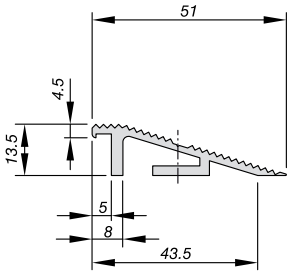
Aluminium-Z/2-Profile
- Edging at the machine or wall side
- Rod 3 m (7500385), Rod 6 m (1001666) or fixed length



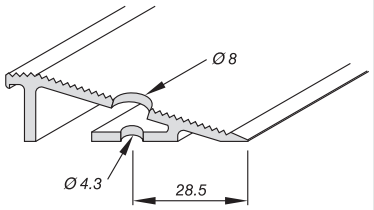
Aluminium cable conduit AP 45
- 2-part with cable conduit
- For combination of several sensors
- Sensors with or without plugs
- Upper section is clipped into lower section
- Rod 3 m upper part (1002546), Rod 3 m bottom part (1002547) or fixed length upper and bottom part



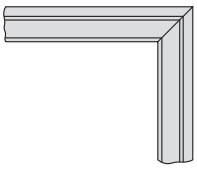
Aluminium Ramp Edge AK 51
- 1-part with cable conduit
- Combinations up to max. 2 sensors
- Sensor without plug
- Rod 3 m (7500384), Rod 6 m (1001667) or fixed length



Threaded hole for AK 51
- For fixing Ramp Edge AK 51



Mitre cut
- For corner connections



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Subject to technical modifications.

Calculation of the necessary actuation area

In accordance with ISO 13855, the necessary effective actuation area in relation to the danger area is calculated according to the followling formula:

$S = (K \times T) + C$ where: $K = 1600$ mm/s, $T = t_1 + t_2$, $C = 1200$ mm - 0.4H

With installation at floor level

H = 0; hence:

$S = (1600 \text{ mm/s} \times T) + 1200 \text{ mm}$

With installation on a step

H ≠ 0; hence:

$S = (1600 \text{ mm/s} \times T) + (1200 \text{ mm} - 0.4H)$

S = Minimum distance between the danger zone and the furthest edge of the sensor [mm]
K = Approximation parameters [mm/s]
T = Follow-through of the complete system [s]
t_1 = Response time of the protective device
t_2 = Stopping time of the machine
C = Safety tolerance [mm]
H = Step height [mm]

Calculation examples

Example 1

A safety mat detects non-permitted access to the danger zone of an automated movement. The mat is installed flush to the floor, i.e. H = 0.
The follow-through time of the movement is 250 ms, the response time of the protective device is 38 ms.

$S = (1600 \text{ mm/s} \times (250 \text{ ms} + 38 \text{ ms})) + 1200 \text{ mm}$
$S = 461 \text{ mm} + 1200 \text{ mm}$
$S = 1661 \text{ mm}$

Example 2

The same conditions as Example 1, however, a step with a height of 150 mm must be negotiated to the danger zone.

$S = (1600 \text{ mm/s} \times (250 \text{ ms} + 38 \text{ ms})) + (1200 - (0.4 \times 150)) \text{ mm}$
$S = (1600 \text{ mm/s} \times 0.288 \text{ s}) + (1200 - 60) \text{ mm}$
$S = 461 \text{ mm} + 1140 \text{ mm}$
$S = 1601 \text{ mm}$

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Safety aspects

Without reset function
When a safeguard without reset function is used (automatic reset), the reset function must be made available in some other way.

Performance Level (PL)
The PL was determined during a simplified procedure according to ISO 13849-1.
Fault exclusion according to ISO 13849-2 Table D.8: Non-closing of contact by pressure-sensitive equipment according to ISO 13856. In this case the sensor will no longer be taken into account in determining the PL. The entire pressure sensitive safety mat (PSPD) system can reach PL d at maximum.

Is the safeguard appropriate?
The PL required for the hazard must be decided by the integrator. This is followed by the choice of safeguard.
Finally, the integrator needs to check whether the category and PL of the safeguard chosen are appropriate.

Maintenance and servicing

The sensor is maintenance-free.
The control unit also monitors the sensor.

Regular inspection
Depending on the load, the sensors are to be tested at regular intervals (at least monthly) for correct function and visible signs of damage by activation or by applying the relevant test piece (cylinder).

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Technical Data

Safety Mat:	TS/BK with SG-EFS 104/4L
Testing basis:	ISO 13856-1
Switching characteristics at v_{test} = 250 mm/s	
Switching operations at 0.1 A	> 4× 10^6
Actuation forces	
Test piece (cylinder) Ø 11 mm	< 300 N
Test piece (cylinder) Ø 80 mm	< 300 N
Test piece (cylinder) Ø 200 mm	< 600 N
Response time with Control Unit	38 ms
Safety classifications	
ISO 13856: Reset function	with/without
ISO 13849-1:2006	category 3 PL d
$MTTF_d$ (PSPD)	65 a
$MTTF_d$ (sensor)	1142 a
B_{10d} (sensor)	6× 10^6
n_{op} (acceptance)	52560/a
Mechanical operating conditions	
Sensor size	max. 1.6 m^2
Static load (up to 8 h)	max. 800 N/cm^2
Driving on with industrial trucks	not suitable
Weight	13.5 kg/m^2
IEC 60529: Degree of protection	IP65
max. humidity (23 °C)	95% (not-condensing)
Operating temperature	
individual sensor	-5 to +55 °C
combined sensor	+5 to +55 °C
Storage temperature	-20 to +55 °C
Electrical operating conditions	
Connection cable	Ø 5.0 mm PVC 2× 0.5 mm^2
Sensor	DC 24 V / max. 100 mA
Number of sensors	max. 10 in series
Dimensional tolerances	
Length dimension	ISO 2768-c
Perpendicularity	ISO 2768-c

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Request for quotation

Submitted by

Company

Department

Surname, first name

P.O. Box | Postcode | Town/city

Street | Postcode | Town/city

Phone | Fax | E-mail

Fax:
+49 731 2061-222

Area of application

(e.g. metalworking, textile machines, timber processing, tube drawing, local public transport, ...)

⇩ Please do not write ⇩
in this column!
For internal notes only

Protection of the danger zone with:

- ❑ TS/BK 1600 × 1000 Quantity: _____
- ❑ TS/BK 1600 × 750 Quantity: _____
- ❑ TS/BK 1600 × 500 Quantity: _____
- ❑ TS/BK 1200 × 1000 Quantity: _____
- ❑ TS/BK 1200 × 750 Quantity: _____
- ❑ TS/BK 1200 × 500 Quantity: _____

Fixing with:

- ❑ Ramp Edge AK 56
- ❑ Aluminium-Z/2-Profile
- ❑ Aluminium cable conduit AP 45
- ❑ Ramp Edge AK 51

Area to be secured:

(Diagram incl. edge profiles and cable routing)

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