



## Innovative fire protection products for railway vehicles



**Company****3–5**

/ Company profile	3
/ Construction materials & components	4
/ Certified safety	5

**Special application information****6–9**

/ Fire protection standards for railway traffic	6
/ Principles of EN 45545/Protection targets	7
/ EN 45545-3/Fire barriers	8
/ EN 45545-2/Material requirements	9

**Products for railway vehicle construction****10–25**

/ Overview of potential areas of use	10
/ Fire protection casting compound	12
/ 2-component in-situ foam for fire protection seals	14
/ Moulded components for fire protection seals	16
/ Fire protection joint seals	18
/ Functional integrity of connectors and sensors	20
/ Elastic moulded components for wall and ceiling linings	22
/ Air transfer grilles	24

**Legal notice****26**



## Innovative fire protection products for railway vehicles

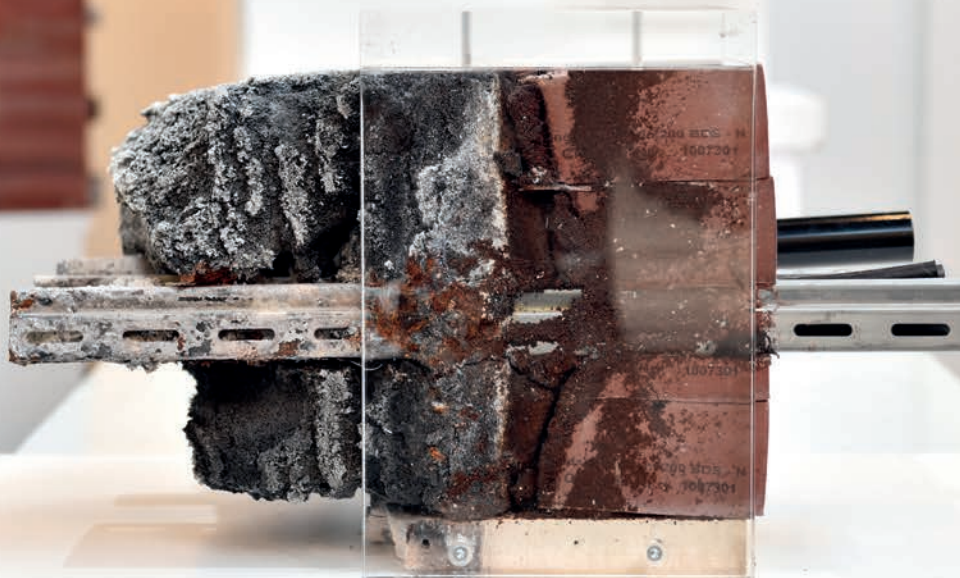
Railway vehicles are subject to stringent fire protection requirements, in order to ensure the safety and evacuation of people in the railway event of a fire. ZAPP-ZIMMERMANN GmbH has offered innovative fire protection systems for this application for more than 25 years. The Company specialises in the areas of cable, pipe and mixed penetration seals, as well as fire protection joint seals that are already being used in many national and international railway traffic projects.

The broad product spectrum includes the right solution for every application, ready to install and use. Existing fire protection products can be specially adapted to the particular area of application and manufactured even in small series with consistently high quality. In addition, the 2-component fire protection foams enable fast and simple closing of component openings, even if they are irregular and hard to reach. This means that through penetration fire protection systems with suitable fire resistance classes can be created for different constructions.

ZAPP-ZIMMERMANN markets 3-dimensional moulded elements for diverse geometries used in railway vehicles: The individual through penetration fire protection systems for wall and ceiling constructions in the interior of the railway vehicles are ideal for batch production of prefabricated fire protection systems. The dimensionally accurate moulded elements ensure safe application and fast installation. Elastic fire protection joint seals guarantee smoke gas tight joints, for example in externally produced technical components or dividing walls of passenger areas to the outer shell of the railway vehicle. In addition, fire-resistant fire protection enclosures ensure the functionality of safety-related electronic components and sensor technology (such as vehicle and brake controllers as well as door controls).

All products used in railway traffic have been classified by an independent testing institute with respect to their fire protection properties and fulfil the stringent requirements of EN 45545 Part 2 for the intended area of application. For international projects, many of the products have been validated to comply with the "Standard for Fixed Guideway Transit and Passenger Rail Systems" in accordance with NFPA 130.

**You can count on the expertise of competent ZAPP-ZIMMERMANN employees for individual consultation and training.**



## Construction materials & components

ZAPP-ZIMMERMANN GmbH specialises in the field of intumescent construction materials.

The company works in close cooperation with Karl Zimmermann GmbH, which develops, tests and produces intumescent construction materials and products.

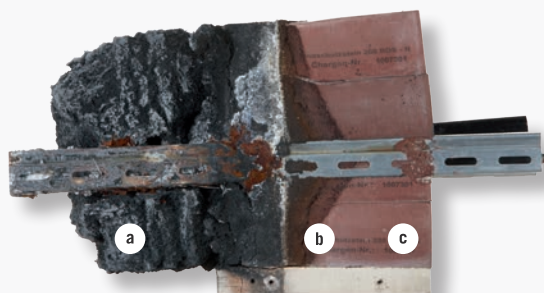
The term intumescence means expansion or swelling and is used in the fire protection industry for substances that increase their volume under the effect of heat. If an intumescent building material is charged with heat, a physiochemical reaction starts, which in parallel with decomposition of the construction material and formation of an insulating layer, results in an increase of the volume. For the most part, intumescent construction materials are based on organic substances.

**Depending on the application area and required purpose of the construction material or component, it is possible to influence the intumescence with reference to numerous parameters:**

- / Level of intumescence
- / Temperature-dependent start of intumescence
- / Direction of intumescence
- / Stability of the insulating layer
- / Expansion pressure (i.e. the force with which the intumescence develops)

This is achieved by adding specific flame-retardants and additives to the construction material. No flame retardants that contain halogen are used.

### Effect of intumescent construction materials



- a Intumescence/carbon layer
- b Softening area/decomposition area
- c Base polymer

#### Development of intumescence

1. Softening/decomposition of the base polymer (e.g. PUR, rubber, acrylate, silicone)
2. Release of the inorganic acid
3. Carbonisation
4. Gas formation through activation of the expanding agent
5. Intumescence through foaming of the system
6. Solidification of the intumescence through cross-linking reactions of the fire protection powder and its synergists





## Certified safety



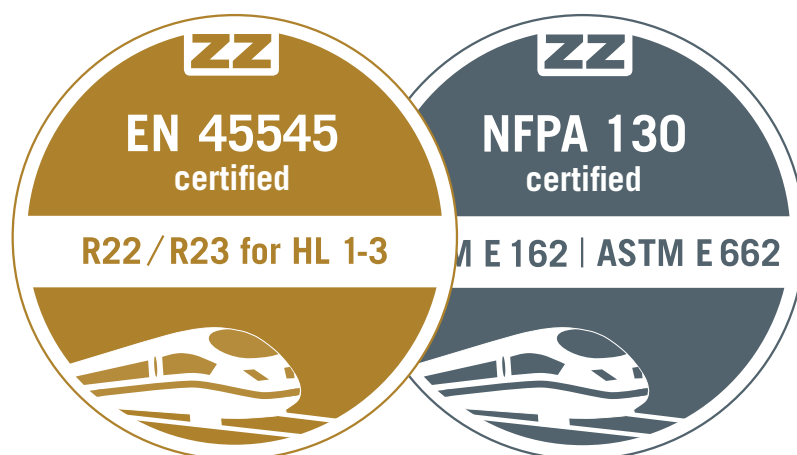
ZAPP-ZIMMERMANN GmbH is certified in accordance with DIN ISO 9001. Successful annual surveillance audits, conducted by TÜV Rheinland, demonstrate the high priority placed on quality management within the Company and our ongoing commitment to premium quality.



All ZAPP-ZIMMERMANN products used in railway traffic have been classified by an independent testing institute with respect to their fire protection properties and fulfil the stringent requirements of DIN EN 45545 Part 2 for the intended area of application.



For international projects, fire protection foams used by ZAPP-ZIMMERMANN have been validated to comply with the "Standard for Fixed Guideway Transit and Passenger Rail Systems" in accordance with NFPA 130.



## EN 45545

The standard series EN 45545 “Railway Application – Fire protection on railway vehicles” contains several parts that regulate the fire protection requirements placed on railway vehicles. The EN 45545 standard was introduced with the directive (EU) no. 1302/2014 (TSI LOC&PAS) and, after the transition period, is binding for all new vehicles throughout Europe since 01/01/2018.

The main goal of the standard series EN 45545 is to protect passengers and personnel within railway vehicles in the event of a fire, so that they can leave the railway vehicle quickly and get themselves to safety. The requirements expressly stipulate the protection of life and limb, and not preservation and protection of the vehicle.

**The standard series EN 45545 contains the following parts:**

**Part 1:** General

**Part 2:** Requirements for fire behaviour of materials and components

**Part 3:** Fire resistance requirements for fire barriers

**Part 4:** Fire safety requirements for rolling stock design

**Part 5:** Fire safety requirements for electrical equipment

**Part 6:** Fire control and management systems

**Part 7:** Fire safety requirements for flammable liquid and flammable gas installations

## NFPA 130

In addition to EN 45545 which is applied in Europe, the NFPA 130 “Standard for Fixed Guideway Transit and Passenger Rail Systems” defining the material requirements for compliance of products used in railway vehicles especially in North America, is also applied.





Polyurethane fire protection foams from Karl Zimmermann GmbH have been validated to comply with the test standards ASTM E 162 and ASTM E 662 for use in railway vehicles.

## EN 45545 – Basic principles

EN 45545 expressly defines personal safety as an essential protection target. In the event of a fire, effective rescue and evacuation measures must be possible. To achieve this goal, the potential for the occurrence of fires must be minimised by means of constructional and organisational measures. The materials used in a railway vehicle must reduce the spread of fire and smoke in the event of a fire and minimise the effects on the people in the railway vehicle (e.g. from toxic smoke fumes).





In EN 45545, railway vehicles are classified in different operation categories (OC 1 through OC 4) with respect to their utilisation and the subsequent conditions. Especially relevant in this respect are the options for evacuation of the passengers.

### Operation categories

Operation category	Operation in tunnels, on underground and/or elevated track sections	Railway stations/rescue stations Safe area can be reached	Lateral evacuation
<b>OC 1</b> 	No	Direct	Possible
<b>OC 2</b> 	Tunnel up to length of 5 km	Within short trip time	Possible
<b>OC 3</b> 	Tunnel > 5 km length	Within extended trip time	Possible
<b>OC 4</b> 	Tunnel up to length of 5 km	Within short trip time	Not possible

Depending on the operation categories – and the subsequent evacuation options – railway vehicles are classified in different hazard levels (HL) based on their utilisation. These levels are used for determining the additional requirements placed on the materials used within the railway vehicles.

### Hazard level

Operation category		Design category			
		N Standard	A Automatic trains without personnel	D Double-decker vehicles	S Sleeping and slumber cars
<b>OC 1</b> 	No tunnel operation	HL1	HL1	HL1	HL2
<b>OC 2</b> 	Tunnel max. 5 km	HL2	HL2	HL2	HL2
<b>OC 3</b> 	Tunnel > 5 km	HL2	HL2	HL2	HL3
<b>OC 4</b> 	No lateral evacuation	HL3	HL3	HL3	HL3



## EN 45545 Part 3

Part 3 of EN 45545 defines the requirements (based on the operation category) and test conditions for fire barriers in railway vehicles. The fire resistance tests must be conducted in accordance with EN 1363-1 in order to ensure compliance with requirements E (integrity) and I (heat insulation).

Fire source	Protected area	Operating class OC	Requirement
Underfloor technical cabinet containing a power transmission line or a traction circuit (except for brake resistor)	Passenger and personnel area including driver's cab	1, 2, 4 3	E 15 E 15, I 15
Underfloor transformer or inductor filled with liquid dielectric	Passenger and personnel area including driver's cab	1, 2 3, 4	E 15 E 15, I 15
Underfloor internal combustion engine (including heating equipment, fuel tank and conduits)	Passenger and personnel area including driver's cab	1, 2 3, 4	E 15 E 15, I 15
Passenger area	Adjoining passenger area	1, 2, 4 3	– E 15 (every 30 m)
Passenger area	Driver's cab	1, 2 3 4	– E 15, I 15 <sup>a</sup> E 10
Within a baggage container	Outside of a baggage container	1, 2, 3, 4	E 15
Baggage compartments	Passenger and personnel area including driver's cab	1 2 3 4	– E 15 E 30 E 30 (all areas)
Technical cabinet within the coach body containing the high-power electrical circuits	Passenger and personnel area including driver's cab	1, 2, 4 3	E 15 E 15, I 15
Technical cabinet within the coach body containing an internal combustion engine (including heating equipment with tank and conduits)	Passenger and personnel area including driver's cab	1, 2 3, 4	E 15 E 15, I 15

a: I 15 is required for vehicles that fall under directive 2008/57/EC. For other vehicles, W 15 is required instead of I 15.

## Preliminary tests of fire barriers

The in-house testing installation of Karl Zimmermann GmbH can be used to conduct fire resistance tests for special fire barriers. This allows us to support you throughout the entire development process and to offer you the right product for your railway vehicle application.



## Requirements for fire behaviour of materials and relevant technical fire properties

EN 45545-2 defines the requirements for technical fire properties of all materials and components installed in railway vehicles. **Relevant technical fire properties (FIRST):**

<b>F</b> lame spread
<b>I</b> gnitability
<b>R</b> elease of heat
<b>S</b> moke emission
<b>T</b> oxic fume emission

The single test procedures and stipulated threshold values are based on the hazard level and the intended utilisation of the material (see requirement sets).

## Requirement sets and validations according to EN 45545-2

EN 45545-2 allocates the construction materials and components used in the railway vehicle an requirement set (R1 bis R26) on the basis of the application. The phrases define the necessary technical fire properties and test procedures that must be validated as proof of the usability of a material.

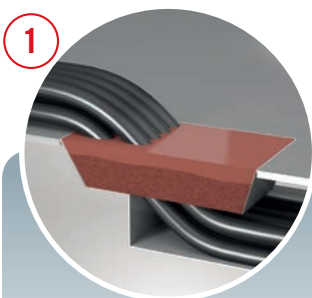
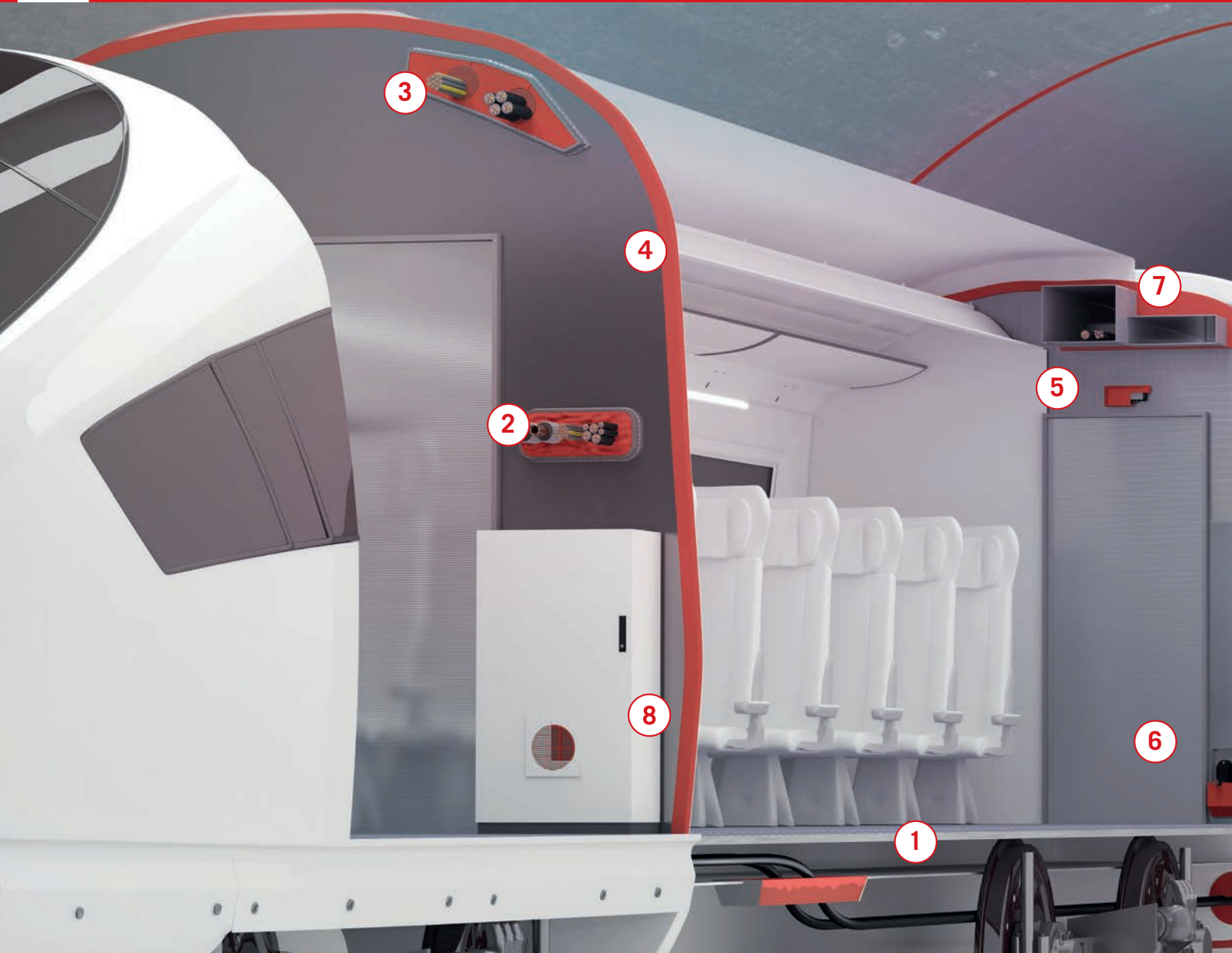
### Examples of listed components:

Component no.	Name	Description	R phrase
<b>IN16</b>	Interior seals	Seals installed longitudinally, such as window and door seals or between panels	R22
<b>IN1A</b>	Interior vertical surfaces	Components in the interior (structural and covering) such as side walls, separating walls, room dividers, flaps, boxes, etc. Insulating materials and interior surfaces of the coach body	R1
<b>IN1D</b>	Internal surfaces in hollow spaces	The surfaces can be horizontal or vertical	R1

For non-listed components (such as penetration fire protection systems) the exposed surface is used as a basis for analysis. If it is larger than 0.2 m<sup>2</sup> compliance with R1 for components within the coach body and R7 for components outside the vehicle body is required. Components with an exposed surface ≤ 0.2 m<sup>2</sup> must be analysed individually within the classification rules of EN 45545-2. (These components generally require validation of compliance with R22 for use within the vehicle body and R23 for use outside of the vehicle body.)

### Validations of requirement sets R22/R23

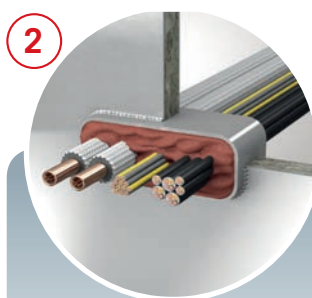
Karl Zimmermann GmbH has validated compliance of all products used in railway traffic in accordance with the requirements of R22 and R23. The products are used as connecting seals, cable and pipe penetration seals and for lining wall surfaces with an area ≤ 0.2 m<sup>2</sup>.



### **ZZ® Fire protection casting compound**

Sealing horizontal openings in the vehicle floor is fast and easy with the watertight fire protection casting compound. It is fully cured and provides a reliable seal after only 2 minutes.

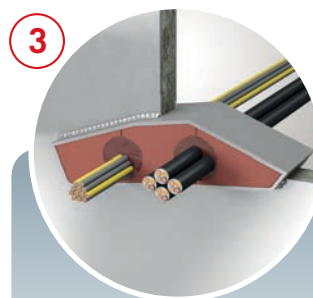
⇒ Page 12



### **ZZ® 2-component in-situ foam for fire protection seals**

Fire Protection Foam ZZ 383 can be used for the fast and easy sealing of component openings even if they are irregular or hard to reach. Fire barriers for cables and pipes up to fire resistance class EI 30 are possible.

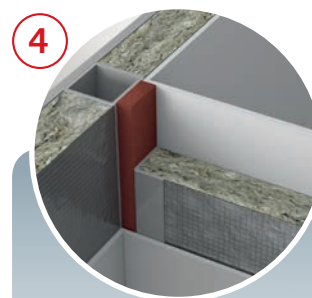
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### **ZZ® Moulded components for fire protection seals**

Enjoy the advantages of moulded components manufactured in batch production (also for small series): safe application and fast “plug and play” installation.

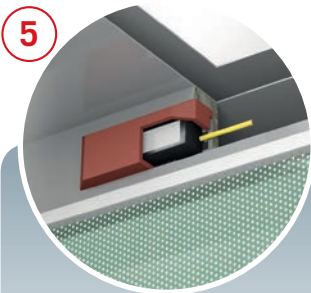
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### **ZZ® Fire protection joint seals**

Use Fire Protection Foam ZZ 18-A pre-cut blanks to produce smoke gas tight joints between railway vehicle modules or for separating the railway vehicle from the outer shell. Compensate for dimensional tolerances in third-party railway vehicle modules in the coach body.

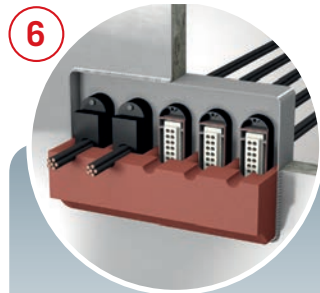
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**ZZ® Functional integrity of sensors**

Use fire protection enclosures to ensure the functional integrity of safety-related electrical vehicle components (such as the control of doors and emergency exits) in the event of a fire.

⇒ Page 20



**ZZ® Functional integrity of connectors**

Use fire protection enclosures to ensure the functional integrity of safety-related electronic vehicle components, such as the vehicle and brake controllers.

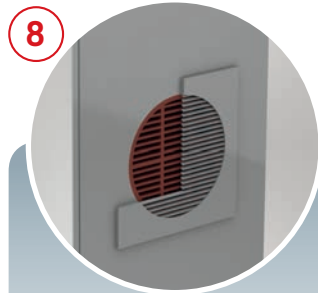
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**ZZ® Elastic moulded components for wall and ceiling linings**

In difficult installations, such as the partial lining of walls and ceilings, you can use cut-to-size mats consisting of Fire Protection Foam ZZ 18-A to compensate for dimensional tolerances within the penetrations in separating elements.

⇒ Page 22



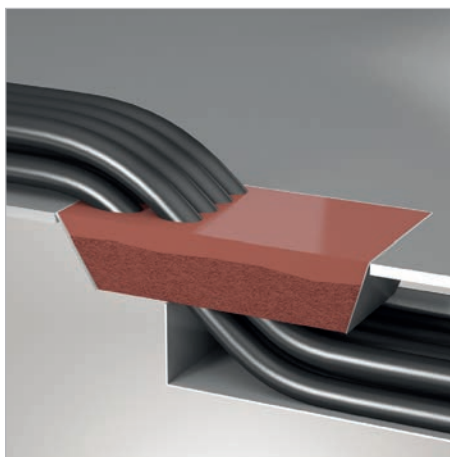
**ZZ® Air transfer grilles**

Use Air Transfer Grille ZZ 681 or ZZ 682 as maintenance-free, fire-resistant seals for openings in air circulation and heat dissipation vents in control cabinets, machine rooms, doors and ducts.

⇒ Page 24

## ZZ® Fire protection casting compound

Waterproof fire protection compound for fire protection seals up to EI 30 in penetrations through the vehicle floor.



Fire Protection Casting Compounds ZZ 380-p and ZZ 381-f Sealing of openings in the vehicle floor

### Especially suited for:

Waterproof sealing of horizontal openings in the vehicle floor

Fast-curing 2-component polyurethane casting compounds in a closed cartridge system. After only 2 minutes the compound is fully cured and provides a reliable seal.

### Additional services:

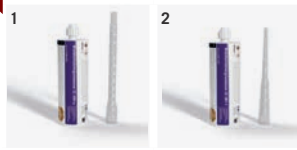
Fire resistance test, change in formulation, adaptation of density and processing properties of the product

### Properties

<b>Validations</b>	EN 45545 R22/R23 HL1, HL2, HL3
<b>Bulk density</b>	ZZ 380: $\rho \geq 650 \text{ kg/m}^3$ ZZ 381: $\rho \geq 1100 \text{ kg/m}^3$
<b>Colour</b>	Red-brown
<b>Work interruption</b>	ZZ 380: about 8 sec ZZ 381: about 90 seconds (at 22 °C material temperature and ambient temperature)
<b>Storage/transport temperature</b>	5 °C to 30 °C
<b>Processing temperature</b>	15 °C to 30 °C, recommended: 20 °C to 25 °C
<b>Storage stability</b>	6 months at 23 °C/50 % rel. humidity; for shelf life, see imprint on cartridge
<b>Setting time</b>	ZZ 380: about 20 sec ZZ 381: about 120 sec
<b>Impermeability</b>	0.5 bar (at $\geq 60 \text{ mm}$ fill depth)
<b>Pressure tightness</b>	0.5 bar (at $\geq 60 \text{ mm}$ fill depth)
<b>Reaction temperature</b>	$\leq 85 \text{ °C}$
Please observe the safety data sheet.	



## System components



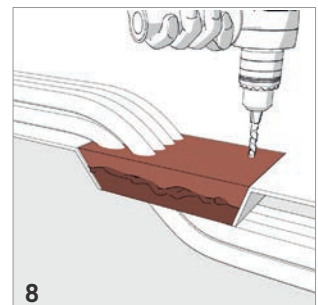
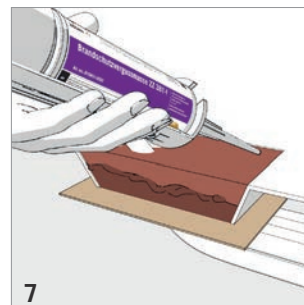
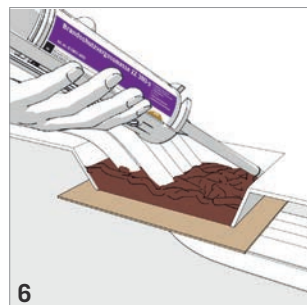
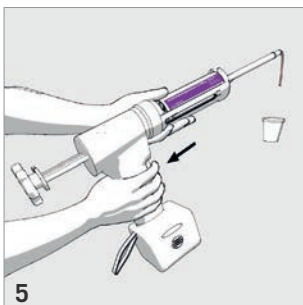
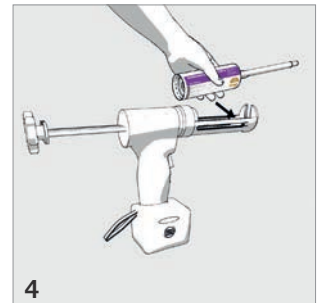
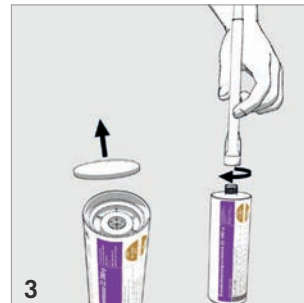
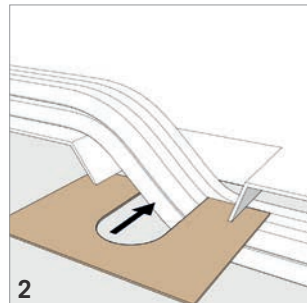
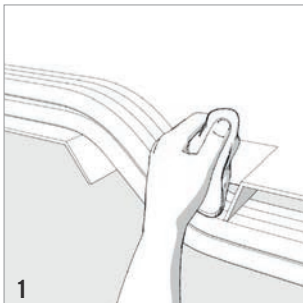
	Designation	Art. no.	PU
1	<b>Fire Protection Casting Compound ZZ 380-p, 380 ml</b> 8 pc. set, including 16 mixing nozzles	B15N01-0152	1
2	<b>Fire Protection Casting Compound ZZ 381-f, 380 ml</b> 6 pc. set, including 12 mixing nozzles	B15N01-0153	1

## Accessories



	Designation	Art. no.	PU
3	<b>Duct tape</b> Width 50 mm, 20 m on roll	B99V01-0008	1
4	<b>PowerMax battery-operated dispensing gun (2-component)</b> For 380 ml cartridges (5:1)	B16H00-0060	1
5	<b>Mixing nozzle, 12 pc. set</b> For fire protection casting compound ZZ 381-f	B99H00-0112	1
6	<b>Mixing nozzle, large, 16 pc. set</b> For fire protection casting compound ZZ 380-p	B99H00-0259	1
7	<b>OTTO Primer 1225, 100 ml</b> For improved adhesion on metal materials	B99H00-0260	1
8	<b>OTTOPUR Cleaner 500 ml</b> For easy removal of fresh, non-hardened PUR foams	B99H00-0165	1
9	<b>Tempering box WAECO</b> with digital temperature display, temperature regulator fixed at 20 °C and voltage monitor	B99H00-0163	1

## Installation steps



1. Clean component aperture. The metal surfaces of the apertures must be pre-treated with a wash primer (such as OTTO Primer 1225). All penetrating installations in the vicinity of the penetration seal must be degreased.
2. Mounting of underside formwork (e.g. sheet metal).
3. Hold the cartridge vertically with the tip pointing upward, unscrew the cap and remove cover at bottom of cartridge, then firmly screw on the provided mixing nozzle.
4. Insert the cartridge into the intended dispensing gun.
5. Start pressing and remove non-uniform initial material.

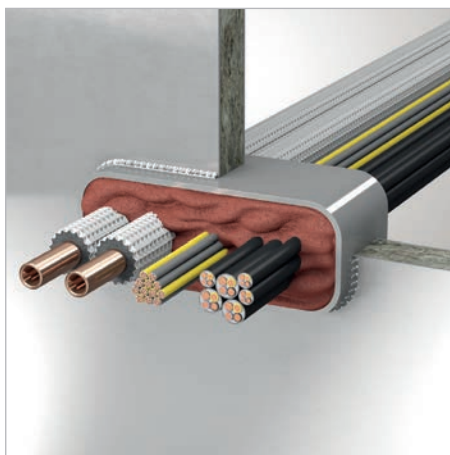
6. Starting from the bottom, fill the opening evenly with ZZ 380-p no more than halfway.
7. Starting at the bottom and working your way up, fill the opening previously prepared with ZZ 380-p evenly with ZZ 381-f.
8. Cables that will be installed retroactively can be routed through the compound. This requires that you carefully drill a hole in the casting compound. Fill resulting gaps with ZZ 381-f or ZZ 380-p.

## ZZ® 2-component in-situ foam for fire protection seals

Cable or pipe penetration seal for dividing walls in passenger and personnel areas. Through penetration fire protection system for electrical cables, telecommunication cables and optical fibre cables, electrical installation conduits, as well as flammable and non-flammable pipes (including the corresponding pipe insulation).



Fire Protection Foam ZZ 383



Railway vehicle separating wall/surface uncut

### Especially suited for:

1. Fast and easy sealing of component openings
2. Hard to reach and irregular openings

/ Fire barrier up to fire resistance class EI 30. The required seal thickness must be verified based on the construction.

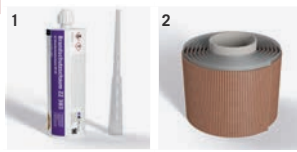
### Additional services:

Fire resistance test, change in formulation, adaptation of density and processing properties of the product

### Properties

<b>Validations</b>	EN 45545 R22/R23 HL1, HL2, HL3 ASTM E 162, ASTM E 662
<b>Classification of the fire protection behaviour according to DIN EN 13501-1</b>	Class E
<b>Thermal conductivity</b>	$\lambda = 0.088 \text{ W/(m}^{\circ}\text{K)}$ Test standard: DIN EN 12667
<b>Bulk density</b>	$\rho \geq 215 \text{ kg/m}^3$ (material has fully reacted)
<b>Colour</b>	Red-brown
<b>Processing temperature</b>	15 °C to 30 °C, recommended: 20 °C to 25 °C
<b>Storage/transport temperature</b>	5 °C to 30 °C
<b>Work interruption</b>	Approx. 50 seconds (at 22 °C material temperature and ambient temperature)
<b>Setting time</b>	90 seconds (at 22 °C material temperature and ambient temperature)
<b>Storage stability</b>	12 months at 23 °C/50 % rel. humidity See imprint on cartridge for shelf life
<b>Please observe the safety data sheet.</b>	

## System components



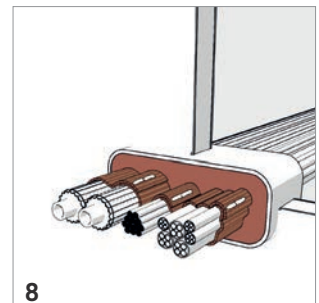
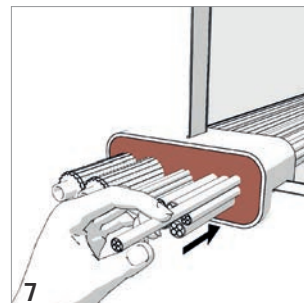
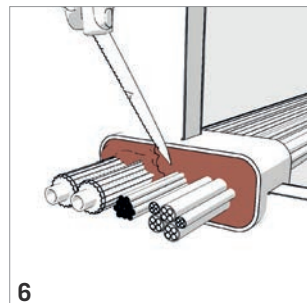
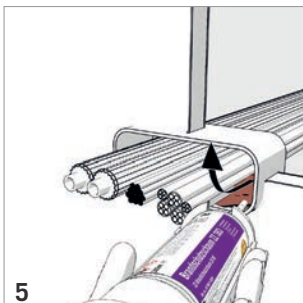
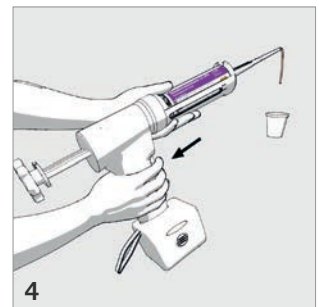
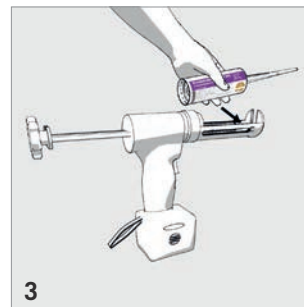
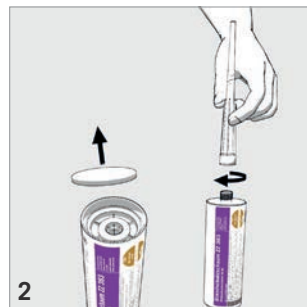
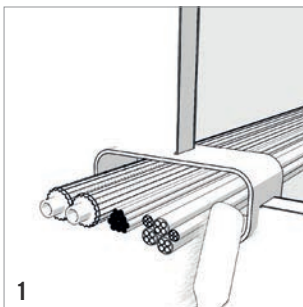
	Designation	Art. no.	PU
1	<b>Fire Protection Foam ZZ 383, 380 ml</b> 6 pc. set, including 12 mixing nozzles	B15N01-0156	1
2	<b>Fire Protection Bandage ZZ 481</b> 150 mm, 5 m on roll	B04N00-0011	1

## Accessories



	Designation	Art. no.	PU
3	<b>Knife with serration, narrow</b>	B16H00-0042	1
4	<b>Knife with serration, wide</b>	B16H00-0043	1
5	<b>Duct tape</b> Width 50 mm, 20 m on roll	B99V01-0008	1
6	<b>PowerMax battery-operated dispensing gun (2-component)</b> For 380 ml cartridges (5:1)	B16H00-0060	1
7	<b>Mixing nozzle, 12 pc. set</b> for 380 ml cartridges (5:1)	B99H00-0112	1
8	<b>Extension for mixing nozzle, 12 pc. set</b> For mixer nozzle, length 20 cm	B99H00-0172	1
9	<b>OTTOMUR Cleaner 500 ml</b> For easy removal of fresh, non-hardened PUR foams	B99H00-0165	1
10	<b>Tempering box WAECO</b> with digital temperature display, temperature regulator fixed at 20 °C and voltage monitor	B99H00-0163	1

## Installation steps



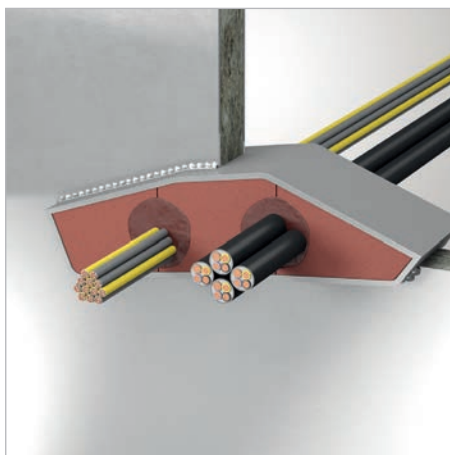
1. Clean component aperture.
2. Hold the cartridge vertically with the tip pointing upward, unscrew the cap and firmly screw on the provided mixing nozzle.
3. Insert the cartridge into the intended dispensing gun.
4. Start pressing out and discard non-uniform initial material.
5. Fill the opening from back to front. Build up the foam working from bottom to top.
6. After about 2 minutes you can cut off any projecting foam residue with a suitable knife.
7. Cables that will be installed retroactively can be routed through the existing foam.
8. For increased fire resistance, wiring can be provided with Fire Protection Bandage ZZ 481

## ZZ® Moulded components for fire protection seals

Cable and pipe penetration fire protection systems for wall and ceiling constructions inside railway vehicles. Through penetration fire protection system for electrical cables, telecommunication cables and optical fibre cables, electrical installation conduits, as well as flammable and non-flammable pipes (including the corresponding insulation).



Moulded component of Fire Protection Foam ZZ 18-A



Cable penetration seal between passenger areas

### Especially suited for:

1. Batch production of prefabricated system penetration seals
  2. Safe application and fast "plug and play" installation
- / Fire barriers up to fire resistance class EI 30. The required seal thickness must be verified based on the construction.

### Additional services:

3D mould making, fire-resistance test, single component marking, single part picking, pre-cut blanks, water-jet cutting  
**All services are offered also for small series.**

### Properties

<b>Validations</b>	EN 45545 R22/R23 HL1, HL2, HL3 ASTM E 162, ASTM E 662
<b>Classification of the fire protection behaviour in accordance with DIN EN 13501-1</b>	Class E
<b>Thermal conductivity</b>	$\lambda = 0.103 \text{ W/(m}^{\circ}\text{K)}$ Test standard: DIN EN 12667
<b>Bulk density</b>	$\rho \geq 230 \text{ kg/m}^3$
<b>Colour</b>	Red-brown
<b>Storage/transport temperature</b>	5 °C to 30 °C
<b>Please observe the safety data sheet.</b>	



### System components

	Designation	Art. no.	PU
1	<b>Fire Protection Block ZZ 280/200.60.1000</b> 200 mm x 60 mm x 1000 mm	B06N00-0083	1
	<b>Fire Protection Block ZZ 280/120.50.1000</b> 120 mm x 50 mm x 1000 mm	B06N00-0084	1
	<b>Fire Protection Block ZZ 280/170.40.1000</b> 170 mm x 40 mm x 1000 mm	B06N00-0085	1
2	<b>Fire Protection Sealant ZZ 385, 310 ml</b>	B15N00-0024	12
3	<b>Fire Protection Bandage ZZ 481</b> 150 mm, 5 m on roll	B04N00-0011	1

**Note:** Other dimensions/geometries and pre-cut blanks on request

### Accessories

	Designation	Art. no.	PU
4	<b>Knife with serration, narrow</b>	B16H00-0042	1
5	<b>Knife with serration, wide</b>	B16H00-0043	1
6	<b>PowerMax battery-operated dispensing gun (1-component)</b> For 310 ml cartridge and 580 ml tubular bag	B16H00-0053	1

### Product photos: moulded component



**Custom blanks** from 2-dimensional moulded components offer a high level of pre-fabrication. This facilitates the implementation of modular barriers manufactured in batch production. Various processes enable precise cutting of moulded components to the required size. Water-jet cutting makes it possible to cut rounded components, even with a small radius, from blocks.



**Standard 3-dimensional moulded components** with difficult geometries can be produced also with large dimensions. The moulded components are foamed in special moulds without the use of silicone and delivered to the production facility just in time, which prevents the need for conventional warehousing. The use of moulded components substantially reduces installation times. Complicated cutting of blanks is eliminated entirely.



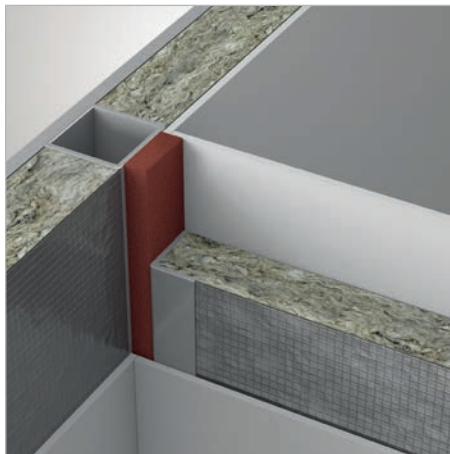
**High level of prefabrication.** The cut-to-size moulded components are installed in the railway vehicle according to the "plug and play" principle. The elasticity of Fire Protection Foam ZZ 18-A compensates for dimensional tolerances. The openings can be adapted to the planned cross section of the installations, so that the only additional step is to seal the annular gap with Fire Protection Sealant ZZ 385. Pre-manufactured fire penetration seals are easy to install and virtually fail-safe.

## ZZ® Fire protection joint seals

*Elastic fire protection joint seal for smoke gas tight joints of third-party railway vehicle modules or for separating the railway vehicle from the outer shell.*



Pre-cut blanks of Fire Protection Foam ZZ 18-A



Connecting seals between the railway vehicle and the outer shell

### Especially suited for:

1. Smoke gas tight connecting joints between railway vehicle modules or for separation of the railway vehicle from the outer shell
2. Compensation for dimensional tolerances in third-party railway vehicle modules in the coach body

### Additional services:

Custom blanks, adaptation of density and compressibility of the product

### Properties

<b>Validations</b>	EN 45545 R22/R23 HL1, HL2, HL3
<b>Classification of the fire protection behaviour in accordance with DIN EN 13501-1</b>	Class E
<b>Thermal conductivity</b>	$\lambda = 0.103 \text{ W/(m}^{\circ}\text{K)}$ Test standard: DIN EN 12667
<b>Bulk density</b>	$\rho \geq 230 \text{ kg/m}^3$
<b>Colour</b>	Red-brown
<b>Storage/transport temperature</b>	5 °C to 30 °C
<b>Please observe the safety data sheet.</b>	

## System components

1&amp;2



	Designation	Art. no.	PU
1	<b>Fire Protection Joint Seal ZZ 581-16</b> Ø 16 mm x length 1000 mm	B08N02-0024	1
	<b>Fire Protection Joint Seal ZZ 581-24</b> Ø 24 mm x length 1000 mm	B08N02-0025	1
	<b>Fire Protection Joint Seal ZZ 581-30</b> Ø 30 mm x length 1000 mm	B08N02-0026	1
	<b>Fire Protection Joint Seal ZZ 581-39</b> Ø 39 mm x length 1000 mm	B08N02-0027	1
	<b>Fire Protection Joint Seal ZZ 581-49</b> Ø 49 mm x length 1000 mm	B08N02-0028	1
	<b>Fire Protection Joint Seal ZZ 581-60</b> Ø 60 mm x length 1000 mm	B08N02-0029	1
	<b>Fire Protection Joint Seal ZZ 581-70</b> Ø 70 mm x length 1000 mm	B08N02-0030	1
	<b>Fire Protection Joint Seal ZZ 581-80</b> Ø 80 mm x length 1000 mm	B08N02-0031	1

	Pre-cut blanks (other sizes on request)	Art. no. (*)	PU
2	<b>Fire Protection Joint Seal ZZ 582-10</b> 10 mm x 10 mm x 1000 mm	B03N01-0331	1
	<b>Fire Protection Joint Seal ZZ 582-20</b> 20 mm x 20 mm x 1000 mm	B03N01-0332	1
	<b>Fire Protection Joint Seal ZZ 582-30</b> 30 mm x 30 mm x 1000 mm	B03N01-0333	1
	<b>Fire Protection Joint Seal ZZ 582-40</b> 40 mm x 40 mm x 1000 mm	B03N01-0334	1
	<b>Fire Protection Joint Seal ZZ 582-50</b> 50 mm x 50 mm x 1000 mm	B03N01-0335	1

(\*) The article numbers refer to pre-cut blanks, not to articles formed in a mould

## Accessories

3



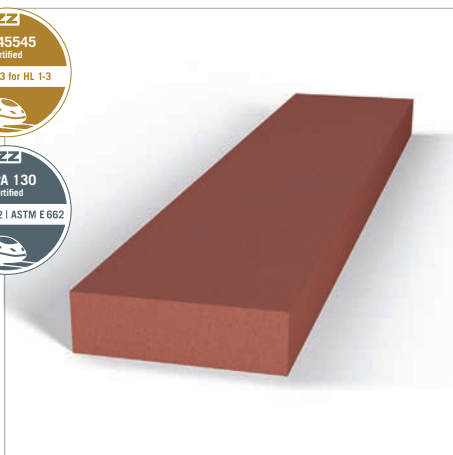
4



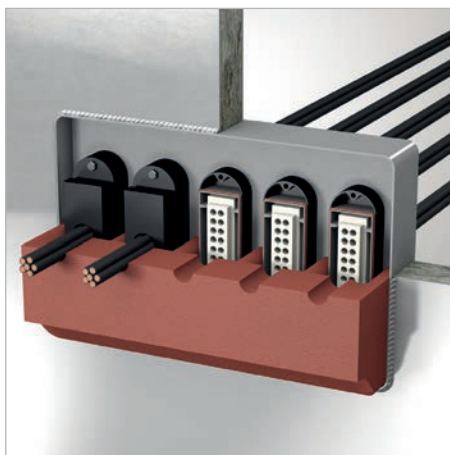
	Designation	Art. no.	PU
3	<b>Knife with serration, narrow</b>	B16H00-0042	1
4	<b>Knife with serration, wide</b>	B16H00-0043	1

## ZZ® Functional integrity of connectors and sensors

*Fire-resistant fire protection enclosure for ensuring the functional integrity of safety-related electronic components and sensor technology (such as vehicle controllers, brake controllers, controls for doors and emergency exits).*



Fire Protection Block ZZ 280



Functional integrity of plug-type connections

### Especially suited for:

Functional integrity of safety systems and control electronics over a period of up to 30 minutes.

In accordance with EN 45545-5 safety-related electronic vehicle components must be designed so that in the event of a fire their functional integrity is fully ensured until the time of evacuation.

### Additional services:

3D mould making, fire-resistance test, single component marking, single part picking, pre-cut blanks, water-jet cutting

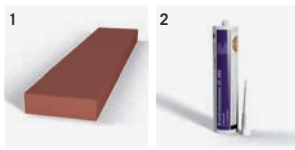
**All services are offered also for small series.**

### Properties

<b>Validations</b>	EN 45545 R22/R23 HL1, HL2, HL3 ASTM E 162, ASTM E 662
<b>Classification of the fire protection behaviour in accordance with DIN EN 13501-1</b>	Class E
<b>Thermal conductivity</b>	$\lambda = 0.103 \text{ W/(m}\cdot\text{K)}$ Test standard: DIN EN 12667
<b>Bulk density</b>	$\rho \geq 230 \text{ kg/m}^3$
<b>Colour</b>	Red-brown
<b>Storage/transport temperature</b>	5 °C to 30 °C
<b>Please observe the safety data sheet.</b>	



## System components



	Designation	Art. no.	PU
1	<b>Fire Protection Block ZZ 280/200.60.1000</b> 200 mm x 60 mm x 1000 mm	B06N00-0083	1
	<b>Fire Protection Block ZZ 280/120.50.1000</b> 120 mm x 50 mm x 1000 mm	B06N00-0084	1
	<b>Fire Protection Block ZZ 280/170.40.1000</b> 170 mm x 40 mm x 1000 mm	B06N00-0085	1
2	<b>Fire Protection Sealant ZZ 385, 310 ml</b>	B15N00-0024	12

**Note:** Other dimensions/geometries and pre-cut blanks on request

## Accessories



	Designation	Art. no.	PU
3	<b>Knife with serration, narrow</b>	B16H00-0042	1
4	<b>Knife with serration, wide</b>	B16H00-0043	1
5	<b>PowerMax battery-operated dispensing gun (1-component)</b> For 310 ml cartridge and 580 ml tubular bag	B16H00-0053	1

## Product photos: plugs and sensors



**3-dimensional moulded components** can be custom-manufactured for your application. They can be prefabricated as coverings for plug-type connectors to allow installation according to the “plug and play” principle with no further adaptation. Dimensional tolerances are compensated by the elastic Fire Protection Foam ZZ 18-A.



**Factory foaming** of sensor technology ensures high quality of the coverings. The sensor technology requiring protection is enveloped with Fire Protection Foam ZZ 18-A in special 3-dimensional moulds at the production facilities. The low reaction temperature of the fire protection foam therefore makes it possible to protect even the most sensitive sensors.



**Dimensionally accurate fire protection coverings** for electronic components protect them from heat in the event of a fire and ensure the functional integrity of the safety-related equipment. The coverings are custom-manufactured for the components requiring protection and can be simply slipped on, with no need for additional screws or gluing.

## ZZ® Elastic moulded components for wall and ceiling linings

*Partial wall and ceiling linings up to  $\leq 0.2 \text{ m}^2$  for situations in which dimensional tolerances have to be compensated with flexible foams, as well as for difficult installations.*



Pre-cut mat of Fire Protection Foam ZZ 18-A



Partial lining of surfaces within a compartment

### Especially suited for:

1. Partial lining for wall and ceiling constructions
2. Compensation of dimensional tolerances within the penetrations through the separating element

### Additional services:

Pre-cut fire protection mats

### Properties

<b>Validations</b>	EN 45545 R22/R23 HL1, HL2, HL3 ASTM E 162, ASTM E 662
<b>Classification of the fire protection behaviour in accordance with DIN EN 13501-1</b>	Class E
<b>Thermal conductivity</b>	$\lambda = 0.103 \text{ W/(m}^{\circ}\text{K)}$ Test standard: DIN EN 12667
<b>Bulk density</b>	$\rho \geq 230 \text{ kg/m}^3$
<b>Colour</b>	Red-brown
<b>Storage/transport temperature</b>	5 °C to 30 °C
<b>Please observe the safety data sheet.</b>	

## System components

1



	Designation	Art. no.	PU
1	<b>Fire Protection Block ZZ 280/200.60.1000</b> 200 mm x 60 mm x 1000 mm	B06N00-0083	1
	<b>Fire Protection Block ZZ 280/120.50.1000</b> 120 mm x 50 mm x 1000 mm	B06N00-0084	1
	<b>Fire Protection Block ZZ 280/170.40.1000</b> 170 mm x 40 mm x 1000 mm	B06N00-0085	1

**Note:** Other sizes and pre-cut blanks on request

## Product photos: elastic moulded components



**Easy cutting** of mats with a conventional insulating material cutter for easy installation. Alternatively, moulded components can be cut to size at the factory. Single mats can be glued together to create larger surfaces. The elasticity of the mats allows them to adapt and compensate for dimensional tolerances.



**Filigree cutting** of fire protection mats can be configured. The mats are cut to the required geometry by means of a band knife or water-jet cutter. Curves and small circles are also possible. This allows precise cutting of the mats, which can then easily be installed in the railway vehicle with no further processing, thus reducing installation times and eliminating the possibility of errors.

# ZZ® Air transfer grilles

Fire-resistant seal for openings in air circulation and heat dissipation vents within control cabinets, machine rooms, doors and ducts; intumescent.



Air Transfer Grille ZZ 681 and 682



Air vent openings in control cabinets

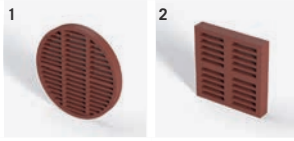
## Especially suited for:

Maintenance-free opening seal for round and square air vent openings in control cabinets, machine rooms, doors, and ducts for air circulation and heat dissipation

## Properties

Validations	EN 45545 R22/R23 HL1, HL2, HL3
Classification of the fire protection behaviour in accordance with DIN EN 13501-1	Class E
Bulk density	$\rho \geq 1150 \text{ kg/m}^3$ to $1410 \text{ kg/m}^3$
Colour	Red-brown
Storage/transport temperature	5 °C to 30 °C
Please observe the safety data sheet.	

## System components

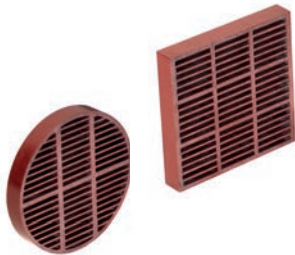


	Designation (round air transfer grilles)	Art. no.	PU
1	<b>Air Transfer Grille ZZ 681/100.20</b> Ø 100 x 20 mm	B16N00-0263	1
	<b>Air Transfer Grille ZZ 681/125.20</b> Ø 125 x 20 mm	B16N00-0264	1
	<b>Air Transfer Grille ZZ 681/160.20</b> Ø 160 x 20 mm	B16N00-0265	1
	<b>Air Transfer Grille ZZ 681/200.20</b> Ø 200 x 20 mm	B16N00-0266	1

	Designation (square air transfer grilles) (*)	Art. no.	PU
2	<b>Air Transfer Grille ZZ 682/93.93.20</b> 93 mm x 93 mm x 20 mm	B16N00-0258	1
	<b>Air Transfer Grille ZZ 682/93.186.20</b> 93 mm x 186 mm x 20 mm	B16N00-0259	1
	<b>Air Transfer Grille ZZ 682/150.150.20</b> 150 mm x 150 mm x 20 mm	B16N00-0260	1
	<b>Air Transfer Grille ZZ 682/150.200.20</b> 150 mm x 200 mm x 20 mm	B16N00-0261	1
	<b>Air Transfer Grille ZZ 682/150.300.20</b> 150 mm x 300 mm x 20 mm	B16N00-0262	1

(\*) Other sizes and pre-cut blanks on request

## Product photos: air transfer grilles



**Large selection** of existing diameters. Custom versions can be cut and glued to create the perfect air transfer grille for your application. The material is “intumescent”, which means that it foams in the event of a fire to completely seal the cross section. The non-wearing reactive material eliminates the need for regular maintenance.



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