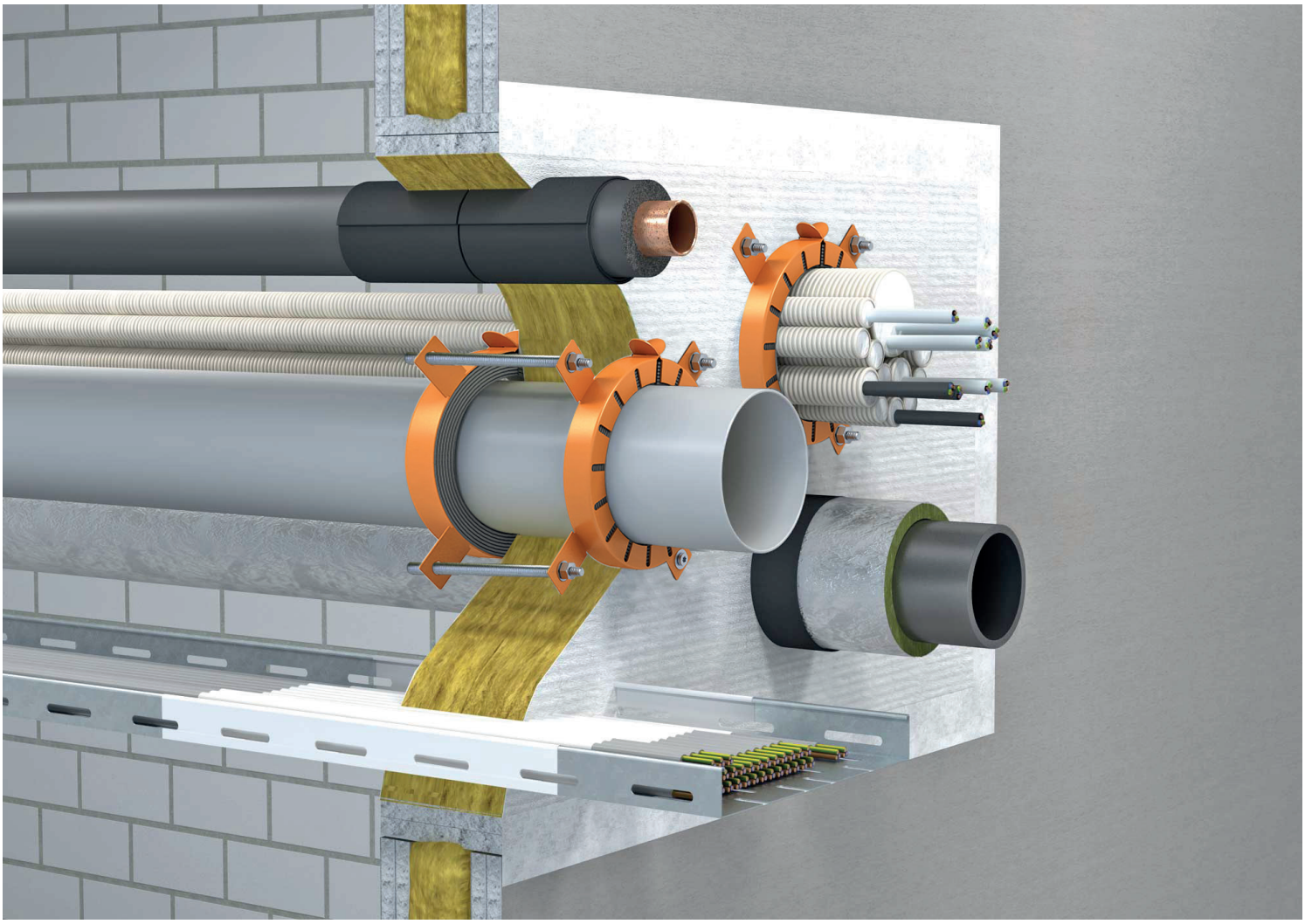
FLAMRO®
KSL combi seal

Ablative penetration seal

Versatile penetration sealing system made of mineral fibre boards and a flexible, intumescent strip, a pipe collar and an ablation coating for all types of electrical cables and lines, electrical installation conduits, combustible/noncombustible pipes, multilayer pipes, various cable support constructions and other configurations in accordance with ETA-16/0320 and ETA-18/0885.

Fire resistance class: maximum EI 120 according to EN 13501-2



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1. Preliminary remarks / Overview

1.1 Target group

The installation instructions are exclusively intended for persons who have been given fire safety training.

1.2 Use of the instructions

Before starting the work please read these installation instructions in their entirety. Pay particular attention to the following safety instructions.

The authorisation holder accepts no liability for damage caused by failure to comply with these instructions.

The illustrations are only intended to be examples. The installation results can differ visually.

Unless otherwise shown, all lengths are given in mm.

All information in this document corresponds to the state of the technology or the valid standards at the time of creation.
The legal and technical framework conditions or manufacturer information relevant for the respective individual case can be made available on request.

1.2.1 Safety information

The safety data sheets must be consulted when processing the sealing components.

Personal protective equipment:

	Wear protective clothing and non-slip shoes.
	Use protective goggles or frame goggles.
	With short-term or minor loads, use the P2 particle filter. Use self-contained breathing apparatus in the event of intensive or prolonged exposure. Only use respiratory protection in accordance with international/national standards.
	Use chemical-resistant protective gloves. Recommended material: Butyl rubber, nitrile rubber, fluororubber, PVC.

Safety instructions for the installation of floor seals

	The area below the floor seal must be cordoned off to prevent entry during the sealing work (warning tape and sign: Warning of possible falling objects, do not enter the area, sealing work is being carried out in the floor component openings!
	The contractor for the production of floor seals must inform the client in writing (to be forwarded to the property developer or his authorised representative) that after the fire seals have been created in the floors, suitable measures must be taken on site to safeguard against loading, in particular against persons walking/standing on the seals (e.g. using fencing or by covering with gratings).

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1.3 Field of application

The usability of the "FLAMRO® KSL" mixed penetration seal has been assessed according to ETAG 026 Part 2 Point 2.4.1 and classified according to EN 13501-1 with regard to the "Fire behaviour", "Fire resistance", "Release of hazardous substances" and "Durability and usability" characteristics.

Fire behaviour

The FLAMRO® BML, FLAMRO® BMS and FLAMRO® BMK ablative components, the FLAMRO® Variant N-RM bandage and the FLAMRO® KSL-W intumescent tape meet fire behaviour class E according to EN 13501-1. The FLAMRO® BSL final-coated fire prevention plate meets fire behaviour class F according to EN 13501-1. The Hardrock 040 and Hardrock II mineral fibre boards meet fire behaviour class A1 according to EN 13501-1.
The FLAMRO® Variant N II A fire protection collar meets fire behaviour class E according to EN 13501-1. The FLAMRO® Variant N II A sheet steel housing was classified as class A1 according to Commission Decision 96/603/EC.

Fire resistance

FLAMRO® KSL meets the requirements of class EI 120 according to EN 13501-2 at a maximum. The -U/U pipe end configuration also covers all other possible endings (-U/C, -C/U and -C/C). The -U/C pipe end configuration also covers pipe end configurations -C/U and C/C. The -C/U pipe end configuration is also valid for -C/C.

The maximum fire resistance class of the penetration seal in vertical or horizontal space-enclosing components depends on the fire resistance class of the implemented elements. The fire resistance class of the penetration seal is reduced to the fire resistance class of the element with the lowest fire resistance classification.

Release of hazardous substances

none

Durability and usability

All FLAMRO® KSL components meet usage category Y_2 according to EOTA TR024.

FLAMRO® KSL is therefore suitable for use at temperatures below 0 °C, but without the effects of rain or UV. As the requirements for type Y_2 are met, the requirements for type Z_1 and Z_2 are also met.

The prerequisite is that the FLAMRO® Variant N II A steel housing is protected sufficiently against corrosion by the powder coating used.

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1.4 Components

Plasterboard walls

Plasterboard walls must have a minimum thickness of ≥ 94 mm and consist of steel supports (U and C profiles; 0.5–1.5 mm thickness) clad with at least two layers of 12.5 mm thick panels with classification A2-s1, d0 or A1 according to EN 13501-1 on both sides. Furthermore, wooden supports may also be used instead of steel supports. It should be noted that there is a minimum distance of 100 mm between the wooden support and the penetration seal. The insulation between the supports must at least correspond to building material class A1 or A2 (according to EN 13501-1) and have a minimum bulk density of 85–115 kg/m³ (according to EN 1363-1).

The opening cladding must be made from steel supports with a thickness of at least 0.6 mm and plates of the same specification as those used for the wall.

The supporting structure must be classified according to EN 13501-2 for the required fire resistance period.

The necessary fire protection measures are shown on the following pages and also apply to subsequent installations.

Solid walls

The wall must have a minimum thickness of ≥ 100 mm and consist of concrete, aerated concrete or masonry. The wall must be classified according to EN 13501-2 for the required fire resistance period.

Solid floors

The floor must have a minimum thickness of ≥ 150 mm and consist of concrete or aerated concrete with a minimum density of 550 kg/m³. The floor must be classified according to EN 13501-2 for the required fire resistance period.

Penetration seals in floors must be safeguarded against loads/walking on using fencing or grating on site.

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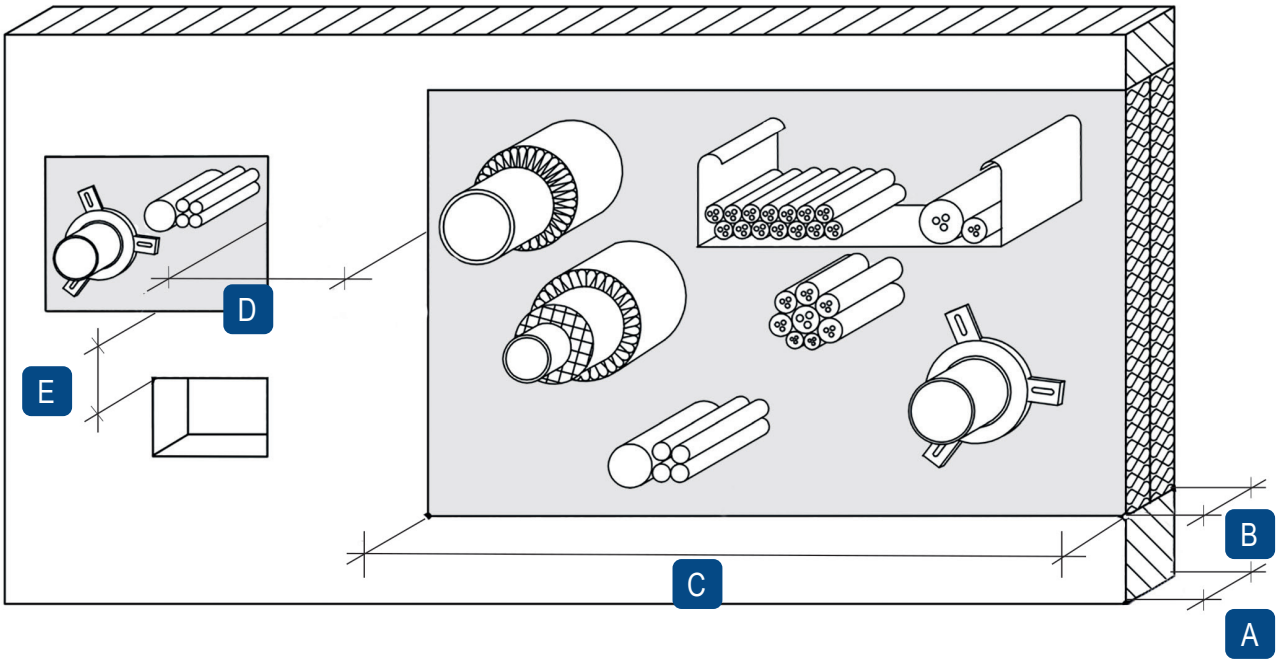
1.5 Component and sealing thickness, sealing spacing

Dimensions				
Item	**Designation**	**Plasterboard wall [mm]**	**Solid wall [mm]**	**Solid floor [mm]**
A	Thickness structural element	≥ 94	≥ 100	≥ 150
B	Sealing thickness	≥ 100	≥ 100	≥ 100
C	Maximum dimension of the component opening (width x height)	≤ 1100 x 2200	≤ 1100 x 2200	∞ x ≤ 1000*
D	Distance to other cable or pipe seals	200	200 mm	200 mm
E	Distance to other openings or fixtures	200	200 mm	200 mm



The total permissible cross section of the installations (external dimensions) is ≤ 60% of the shell opening.

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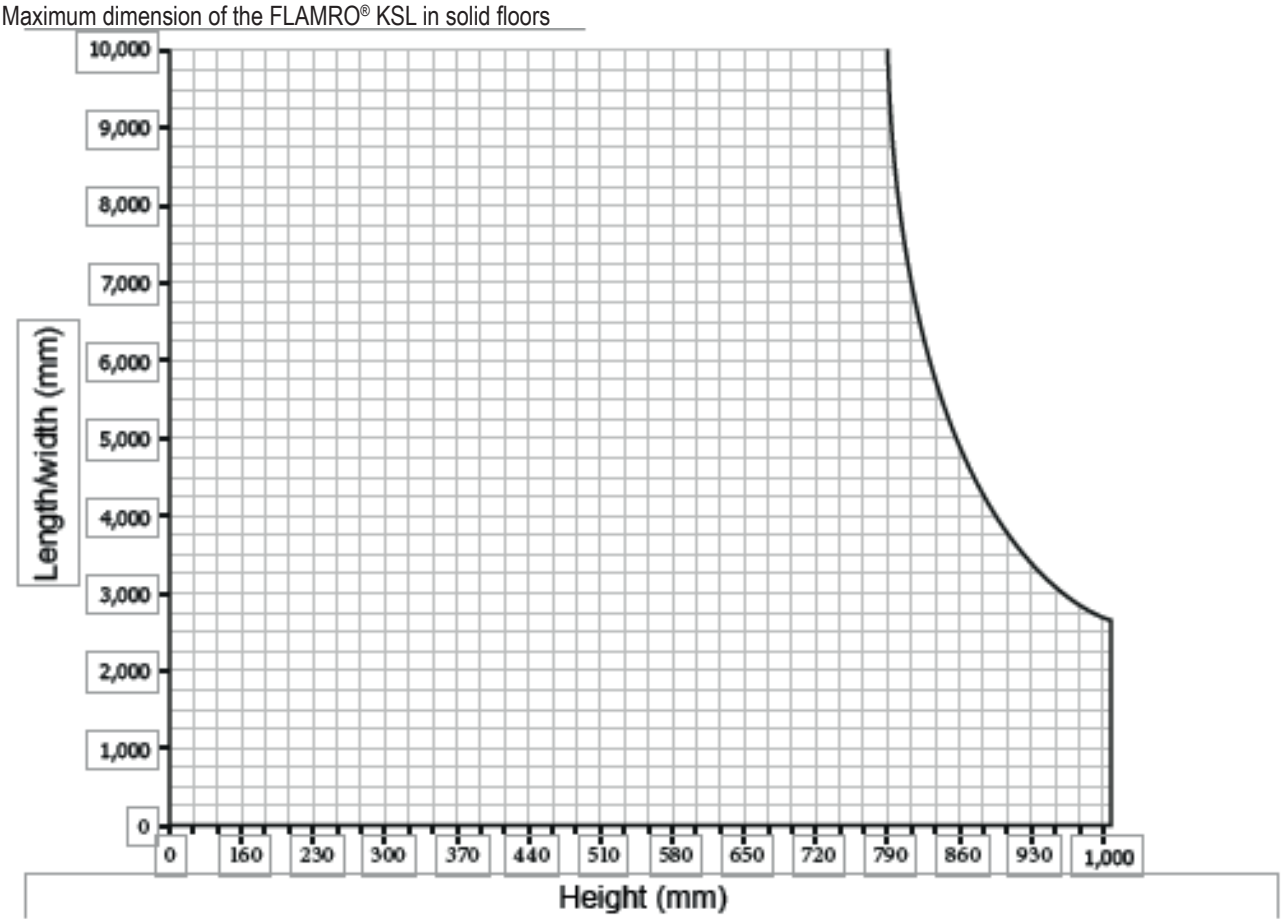
* Maximum dimension of the FLAMRO® KSL in solid floors



The maximum height of the penetration seal in solid floors is 1000 mm.
The maximum length (width) of the penetration seal in solid floors must be calculated as follows:

$$\text{Length (width)} = \frac{\text{Height}}{(((L_{tested.}/2) \times \text{height})-1)}$$

$$C_{tested.} = \frac{\text{Scope}_{tested.}}{\text{Sealing area}_{tested.}} = 2.769\ m/m^2;\ \text{or } 0.002769\ mm/mm^2.$$

The minimum ratio of circumference to area of the opening in solid floors is 2.769 m/m^2 or 0.002769 mm/mm^2.

$C_{tested.}$ was calculated from the dimensions of the tested penetration seal (2600 mm x 1000 mm).

The area on the left side of the diagram provides an overview of all possible combinations of length (width) and height, where the minimum ratio of circumference to area is ≥ C_{tested}. At a length (width) of e.g. 2600, the permissible height is 1000 mm; at a length (width) of e.g. 3500 mm, the permissible height is 910 mm. If the height is less than 724 mm, there is no need to limit the length (width).

Comment: The dimensions of the diagram are not true to size (source: DIN EN 1366-3).

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2. Used products

FLAMRO® BML coating mass

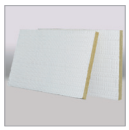
5 kg pail – Art. no. 40050
12.5 kg pail – Art. no. 40125
25 kg pail – Art. no. 40250

FLAMRO® BMS filler

5 kg pail – Art. no. 10500
12.5 kg pail – Art. no. 10125

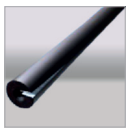
FLAMRO® BMK filler

0.4 kg cartridge – Art. no. 30004
1 kg cartridge – Art. no. 30010



Mineral fibre board

one-side pre-coated with FLAMRO® BML coating mass (DFT = approx. 0.5 mm)
Format 100 x 625 x 50 mm – Art. no. 50050

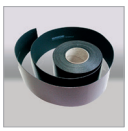


Section and protective insulation

made of flexible elastomer foam (FEF)
Classification: BL-s3. d0 according to DIN EN 13501-1
including self-adhesive AF/Armaflex tape and Armaflex adhesive 520

Alternatively, the following mineral fibre mats and pipe sections can be installed.

Designation	DIN/abZ/abP
Armaflex Protect	(0543-CPR-2016-001 from 01/04/2015)



FLAMRO® Variant N-RM Fire protection fabric

Roll of 10 m x 100 mm, self-adhesive – Art. no. 15015
Roll of 10 m x 100 mm – Art. no. 15115

FLAMRO® Variant N II A Fire protection collar

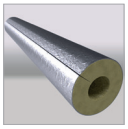
Ø 32–160 mm – Art. no. 15032–15160

FLAMRO® KSL-W Fire protection tape

Roll of 10 m x 50 mm self adhes. – Art. no. 15510
Roll of 20 m x 50 mm self adhes. – Art. no. 15520

Mineral wool A1

Fire behaviour class according to EN 13501-1: A1
melting point ≥ 1000 °C
10 kg bag – Art. no. 01183000



ASTRATHERM® rock wool pipe section, foil-laminated

Classification: $A2_L$-S1, d0 or $A1_L$ according to EN 13501-1
Minimum bulk density: 80 kg/m³

Alternatively, the following mineral fibre mats and pipe sections can be installed.

Product	Bulk density (kg/m³)	Certificate of usability/standard
Klimarock rock wool	≥ 42	EN 14303 / EN 13501-1
ML 3 lamella mat with aluminium cladding	≥ 23	EN 14303 / EN 13501-1

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3. Fire resistance class for wall and floor seals

3.1 Installation in walls

Configuration	Measure	Fire resistance class	Source[1]
Cables, cable bundles and cable support systems			
Cable Ø ≤ 80 mm	Coating on both sides with FLAMRO® BML ≥ 150 mm x ≥ 1.0 mm DFT	EI 90	1
Cable bundle Ø ≤ 100 mm with individual cables Ø ≤ 21 mm		EI 90	
Conductors Ø ≤ 24 mm		EI 90	
Electrical installation conduits (EIC)			
EICs with or without configuration Ø 16 to 63 mm up to a bundle diameter of 115 mm Diameter of the individual cables ≤ 21 mm	FLAMRO® Variant N II A, collar on both sides.	EI 90 U/C	1
Empty plastic EICs Ø ≤ 32 mm[2]	Coating on both sides with FLAMRO® BML ≥ 150 mm x ≥ 1.0 mm DFT	EI 90 C/U (steel) EI 90 U/C (plastic)	
Empty EICs made of plastic or steel, Ø ≤ 16 mm			

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Combustible pipes					
Pipe material	**Outside diameter [mm]**	**Wall thickness [mm]**	**Measure**	**Fire resistance class**	**Source[1]**
PVC-U pipes	≤ 50	1.8–5.6	FLAMRO® KSL-W	**EI 120 U/U**	**2**
	< 50 – ≤ 110	1.8–12.3			
	≤ 50	1.8–5.6	FLAMRO® Variant N II A-, collar on both sides	**EI 90 U/U**	**1**
	> 50–75	> 1.8–12.3			
	> 75-110	1.8–12.3			
	> 110–125	2.5–11.4			
	> 125–160	3.2–11.9			
PE-HD pipes	≤ 50	1.8–4.6	FLAMRO® KSL-W	**EI 120 U/U**	**2**
	< 50 – ≤ 110	1.8–10.0			
	≤ 50	1.8–4.6	FLAMRO® Variant N II A-, collar on both sides	**EI 120 U/U**	**1**
	> 50–75	1.9–10.0		**EI 90 U/U**	
	> 75–110	2.7–10.0			
	> 110–125	3.1–11.4			
	> 125–160	4.0–14.6			
PP pipes	≤ 50	1.8–4.6	FLAMRO® KSL-W	**EI 120 U/U**	**2**
	< 50 – ≤ 110	1.8–10.0			
	≤ 50	1.8–4.6	FLAMRO® Variant N II A-, collar on both sides	**EI 120 UU**	**1**
	> 50–75	1.9–10.0		**EI 90 U/U**	
	> 75–110	2.7–10.0			
	> 110–125	3.1–11.4			
	> 125–160	4.0–14.6			

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Combustible pipes				
Type of pipe	Outside diameter [mm]	Measure	Fire resistance class	Source[1]
Geberit Silent PP	≤ 50	FLAMRO® KSL-W	EI 120 U/U	2
	≤ 110			
Geberit Silent Pro	≤ 75			
	≤ 110		EI 90 / E 120 U/U	
KE KELIT PHON EX AS	≤ 56		EI 120 U/U	
	≤ 110			
Pipelife Master 3	≤ 50			
	≤ 110			
POLO-KAL NG	≤ 50			
	≤ 110			
Conel Drain	≤ 50			
	≤ 110			
Geberit Silent dB 20	≤ 56			
	≤ 110			
Wavin SiTech+	≤ 50			
	≤ 110			
POLO-KAL XS	≤ 50			
	≤ 110			
Rehau Raupiano plus	≤ 50			
	≤ 110			
Rehau Raupiano light	≤ 50			
	≤ 110			
Silenta Premium	≤ 58			
	≤ 110			

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Multilayer pipes					
Type of pipe	Outside diameter [mm]	Wall thickness [mm]	Measure	Fire resistance class	Source[1]
Geberit Mepla	16	2.25	Pipe sections on both sides[3]: ≥ 450 x 20–30 mm	EI 120 U/C	1
			AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W		2
	20	2.5	Pipe sections on both sides[3]: ≥ 450 x 20–30 mm		1
			AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W		2
	26	3.0	Pipe sections on both sides[3]: ≥ 450 x 20–40 mm		1
			AF/Armaflex 350 x 8.5–35.0 mm + FLAMRO® KSL-W		2
	32	3.0	Pipe sections on both sides[3]: ≥ 450 x 20–50 mm		1
			AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		2
	40	3.5	Pipe sections on both sides[3]: ≥ 450 x 20–50 mm		1
			AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		2
	50	4.0	Pipe sections on both sides[3]: ≥ 450 x 20–50 mm		1
			AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		2
	63	4.5	Pipe sections on both sides[3]: ≥ 450 x 20–60 mm		1
			AF/Armaflex 350 x 9.0–39.0 mm + FLAMRO® KSL-W		2
	75	4.7	Pipe sections on both sides[3]: ≥ 450 x 20–80 mm		1
			AF/Armaflex 350 x 9.5 mm + FLAMRO® KSL-W	EI 90 / E 120 U/C	2
			AF/Armaflex 350 x > 9.5–40.5 mm + FLAMRO® KSL-W	EI 120 U/C	

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Multilayer pipes					
Type of pipe	**Outside diameter [mm]**	**Wall thickness [mm]**	**Measure**	**Fire resistance class**	**Source[1]**
Rehau Rautitan Stabil	16	2.6	AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W	**EI 120 U/C**	**2**
	20	2.9	AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W		
	25	3.79	AF/Armaflex 350 x 8.5–35.0 mm + FLAMRO® KSL-W		
	32	4.7	AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		
	40	6.0	AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		
KE KELIT KELOX	16	2.0	AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W		
	18				
	20	2.25			
	25	2.5	AF/Armaflex 350 x 8.5–35.0 mm + FLAMRO® KSL-W		
	32	3.0	AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		
	40	4.0			
	50	4.5			
	63	6.0	AF/Armaflex 350 x 9.0 mm + FLAMRO® KSL-W	**EI 90 / E 120 U/C**	
			AF/Armaflex 350 x > 9.0–39.0 mm + FLAMRO® KSL-W	**EI 120 U/C**	
	75	7.5	AF/Armaflex 350 x 9.5–40.5 mm + FLAMRO® KSL-W		

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Noncombustible pipes					
Pipe material	**Outside diameter [mm]**	**Wall thickness [mm]**	**Measure**	**Fire resistance class**	**Source[1]**
Copper, steel, stainless steel, cast iron	10	1.0–14.2	AF/Armaflex[4] AF-2 on both sides: ≥ 550 x 11.0 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	**1**
	> 10–28	1.0–14.2	AF/Armaflex[4] AF-2 on both sides: ≥ 550 x 11.0–12.5 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	
	> 28–54	1.5–14.2	AF/Armaflex[4] AF-4 on both sides: ≥ 550 x 19.0–21.0 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	
	> 54–89	2.0–14.2	AF/Armaflex[4] AF-6 on both sides: ≥ 550 x 38.5–41.5 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	
Steel, stainless steel, cast iron	10	1.0–14.2	Mineral wool[5]: ≥ 550 x 20 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	
	> 10–76	2.6–14.2	Mineral wool[5]: ≥ 550 x 30 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	
	> 76–160	2.0 – < 4.0	Mineral wool[5]: ≥ 550 x 30 mm + FLAMRO® Variant N-RM	**EI 60 / E 90 C/U**	
			Mineral wool[5]: ∞ x 30 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	
	> 76–160	4.0–14.2	Mineral wool[5]: ≥ 550 mm x 50 mm + FLAMRO® Variant N-RM	**EI 90 C/U**	

[1] 1 → ETA-16/0320 2 → ETA 18/0885

[2] Plastic electrical installation pipes, Ø ≤ 32 mm (with / without cable assignment Ø ≤ 21 mm) according to EN 61386-22, wall thickness 0.3 mm to 0.8 mm (for polyolefins) or 0.3 mm to 0.6 mm (for PVC-U)

[3] Prefabricated pipe sections according to EN 14303 made of rock wool with classification A2L-s1,d0 or A1L according to EN 13501-1, a minimum density of 80 kg/m³, clad with grid-reinforced aluminium foil with a self-adhesive strip (e.g. "ASTRATHERM® foil-laminated rook wool pipe section" made by "Austroflex Rohr-Isoliersysteme GmbH")

[4] Closed-cell, flexible elastomer foam (FEF) insulation in the form of (slit) hoses (can be equipped with a self-adhesive unit) with classification BL-s3,d0, including "Armaflex adhesive 520", according to EN 13501-1 made by "Armacell GmbH" (see Appendix B-2 of the ETA)

[5] Lamella mat with aluminium cladding or prefabricated pipe sections (can be clad with grid-reinforced aluminium foil) according to EN 14303 made of glass wool or rock wool with classification A2-s1,d0 or A1, or A2L-s1,d0 or A1L according to EN 13501-1 and a minimum density of 23 kg/m³ (e.g. "ML 3 lamella mat with aluminium cladding" made by "Saint-Gobain Isover G+H AG")

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3.2 Installation in floors

Cable, cable bundle and cable support systems			
Configuration	**Measure**	**Fire resistance class**	**Source[1]**
Cable Ø ≤ 80 mm	Coating on both sides with FLAMRO® BML ≥ 150 mm x ≥ 1.0 mm DFT	EI 120	1
Cable bundle Ø ≤ 100 mm with individual cables Ø ≤ 21 mm		EI 120	
Conductors Ø ≤ 24 mm		EI 120	
Electrical installation conduits			
EICs with or without configuration Ø 16 to 63 mm up to a bundle diameter of 115 mm Diameter of the individual cables ≤ 21 mm	FLAMRO® Variant N II A, collar on both sides.	EI 90 U/C	1
Empty EICs made of plastic or steel, Ø ≤ 16 mm	Coating on both sides with FLAMRO® BML ≥ 150 mm x ≥ 1.0 mm DFT	Plastic: EI 120 U/C Steel: EI 120 C/U	
Empty plastic EICs Ø ≤ 32 mm[2]		Plastic: EI 90 U/C Steel: EI 90 C/U	

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Combustible pipes					
Pipe material	**Outside diameter [mm]**	**Wall thickness [mm]**	**Measure**	**Fire resistance class**	**Source[1]**
PVC-U pipes	≤ 50	1.8	FLAMRO® KSL-W	**EI 120 / E 180 U/U**	**2**
		1.8–5.6		**EI 120 U/U**	
	> 50 – ≤ 110	1.8			
		1.8–12.3		**EI 90 / E 180 U/U**	
	≤ 50	1.8–5.6	FLAMRO® Variant N II A-, one collar, underside of floor	**EI 90 / E 120 U/U**	**1**
	> 50–75	1.8		**EI 120 U/U**	
	> 50–75	> 1.8–12.3			
	> 75-110	1.8–12.3		**EI 90 U/U**	
	> 110–125	2.5–11.4			
	> 125–160	3.2–11.9			
PE-HD pipes	≤ 50	1.8–4.6	FLAMRO® KSL-W	**EI 180 U/U**	**2**
	> 50 – ≤ 110	1.8–10.0			
	≤ 50	1.8–4.6	FLAMRO® Variant N II A-, one collar, underside of floor	**EI 120 U/U**	**1**
	> 50–75	1.9–10.0			
	> 75–110	2.7–10.0			
	> 110–125	3.1–11.4			
	> 125–160	4.0–14.6		**EI 90 U/U**	
PP pipes	≤ 50	1.8	FLAMRO® KSL-W	**EI 120 / E 180 U/U**	**2**
		1.8–4.6		**EI 120 UU**	
	< 50 – ≤ 110	1.8–2.7		**EI 180 UU**	
		2.7–10.0		**EI 120 UU**	
	≤ 50	1.8–4.6	FLAMRO® Variant N II A-, one collar, underside of floor	**EI 120 UU**	**1**
	> 50–75	1.9 – < 10.0		**EI 90 U/U**	
	> 50–75	10		**EI 120 UU**	
	> 75–110	2.7–10.0		**EI 90 U/U**	
	> 110–125	3.1 –< 11.4			
	> 110–125	11.4		**EI 120 UU**	
	> 125–160	4.0–14.6			

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Combustible pipes				
Type of pipe	Outside diameter [mm]	Measure	Fire resistance class	Source[1]
Geberit Silent PP	≤ 50	FLAMRO® KSL-W	EI 120 / E 180 U/U	2
	≤ 110		EI 180 U/U	
Geberit Silent Pro	≤ 75		EI 180 U/U	
	≤ 110			
KE KELIT PHON EX AS	≤ 56			
	≤ 110			
Pipelife Master 3	≤ 50		EI 90 / E 180 U/U	
	≤ 110		EI 120 U/U	
POLO-KAL NG	≤ 50		EI 180 U/U	
	≤ 110			
Conel Drain	≤ 50			
	≤ 110			
Geberit Silent dB 20	≤ 56			
	≤ 110			
Wavin SiTech+	≤ 50			
	≤ 110		EI 120 / E 180 U/U	
POLO-KAL XS	≤ 50		EI 60 U/U	
	≤ 110		EI 180 U/U	
Rehau Raupiano plus	≤ 50		EI 60 U/U	
	≤ 110		EI 180 U/U	
Rehau Raupiano light	≤ 50		EI 60 U/U	
	≤ 110		EI 180 U/U	
Silenta Premium	≤ 58		EI 90 / E 180 U/U	
	≤ 110		EI 180 U/U	

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Multilayer pipes					
Type of pipe	Outside diameter [mm]	Wall thickness [mm]	Measure	Fire resistance class	Source[1]
Geberit Mepla	16	2.25	Pipe sections on both sides[3]: ≥ 450 x 20–30 mm	EI 120 U/C	1
			AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W	EI 180 U/C	2
	20	2.5	Pipe sections on both sides[3]: ≥ 450 x 20–30 mm	EI 120 U/C	1
			AF/Armaflex 350 x 8.0 mm + FLAMRO® KSL-W	EI 120 / E 180 U/C	2
			AF/Armaflex 350 x > 8.0–32.0 mm + FLAMRO® KSL-W	EI 180 U/C	2
	26	3.0	Pipe sections on both sides[3]: ≥ 450 x 20–40 mm	EI 120 U/C	1
			AF/Armaflex 350 x 8.5–35.0 mm + FLAMRO® KSL-W	EI 180 U/C	2
	32	3.0	Pipe sections on both sides[3]: ≥ 450 x 20–50 mm	EI 120 U/C	1
			AF/Armaflex 350 x 9.0 mm + FLAMRO® KSL-W	EI 180 U/C	2
			AF/Armaflex 350 x > 9.0–35.0 mm + FLAMRO® KSL-W	EI 120 U/C	2
	40	3.5	Pipe sections on both sides[3]: ≥ 450 x 20–50 mm	EI 120 U/C	1
			AF/Armaflex 350 x 9.0 mm + FLAMRO® KSL-W	EI 180 U/C	2
			AF/Armaflex 350 x > 9.0–35.0 mm + FLAMRO® KSL-W	EI 120 U/C	2
	50	4.0	Pipe sections on both sides[3]: ≥ 450 x 20–50 mm	EI 120 U/C	1
			AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W	EI 120 / E 180 U/C	2
	63	4.5	Pipe sections on both sides[3]: ≥ 450 x 20–60 mm	EI 120 U/C	1
			AF/Armaflex 350 x 9.0 mm + FLAMRO® KSL-W	EI 180 U/C	2
			AF/Armaflex 350 x > 9.0–39.0 mm + FLAMRO® KSL-W	EI 120 U/C	2
	75	4.7	Pipe sections on both sides[3]: ≥ 450 x 20–80 mm	EI 120 U/C	1
			AF/Armaflex 350 x 9.5 mm + FLAMRO® KSL-W	EI 90 / E 180 U/C	2
			AF/Armaflex 350 x > 9.5–40.5 mm + FLAMRO® KSL-W	EI 120 U/C	2

FLAMRO®
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Multilayer pipes					
Type of pipe	**Outside diameter [mm]**	**Wall thickness [mm]**	**Measure**	**Fire resistance class**	**Source[1]**
Rehau Rautitan Stabil	16	2.6	AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W	**EI 180 U/C**	**2**
	20	2.9	AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W		
	25	3.79	AF/Armaflex 350 x 8.5–35.0 mm + FLAMRO® KSL-W		
	32	4.7	AF/Armaflex 350 x 9.0 mm + FLAMRO® KSL-W	**EI 120 U/C**	
			AF/Armaflex 350 x >9.0–35.0 mm + FLAMRO® KSL-W	**EI 180 U/C**	
	40	6.0	AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		
KE KELIT KELOX	16	2.0	AF/Armaflex 350 x 8.0–32.0 mm + FLAMRO® KSL-W	**EI 180 U/C**	
	18				
	20	2.25			
	25	2.5	AF/Armaflex 350 x 8.5–35.0 mm + FLAMRO® KSL-W		
	32	3.0	AF/Armaflex 350 x 9.0–35.0 mm + FLAMRO® KSL-W		
	40	4.0			
	50	4.5			
	63	6.0	AF/Armaflex 350 x 9.0–39.0 mm + FLAMRO® KSL-W		
	75	7.5	AF/Armaflex 350 x 9.5–40.5 mm + FLAMRO® KSL-W		

FLAMRO®
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Noncombustible pipes					
Pipe material	**Outside diameter [mm]**	**Wall thickness [mm]**	**Measure**	**Fire resistance class**	**Source[1]**
Copper, steel, stainless steel, cast iron	10	1.0–14.2	AF/Armaflex[4] AF-2 (hose): length ≥ 550 mm, 11.0 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 120 C/U**	**1**
	> 10–28	1.0–14.2	AF/Armaflex[4] AF-2 (hose): length ≥ 550 mm, 11.0 mm–12.5 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 120 C/U**	
	> 28–54	1.5–14.2	AF/Armaflex[4] AF-4 (hose): length ≥ 550 mm, 19.0 mm–21.0 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 120 C/U**	
	> 54–89	2.0–14.2	AF/Armaflex[4] AF-6 (hose): length ≥ 550 mm, 38.5 mm–41.5 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 90 / E 120 C/U**	
	10–88.9	2.0–14.2	Mineral wool[5]: Length ≥ 550 mm, 40 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 90 C/U**	

FLAMRO®
KSL combi seal

Noncombustible pipes					
Pipe material	**Outside diameter [mm]**	**Wall thickness [mm]**	**Measure**	**Fire resistance class**	**Source[1]**
Steel, stainless steel, cast iron	> 10–76	2.6–14.2	Rock wool[5]: length ≥ 550 mm, 30 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 90, E 120 C/U**	**1**
	> 76–88.9	2.0–14.2	Rock wool[5]: length ≥ 550 mm, 40 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 90 C/U**	
	> 88.9–160	4.0–14.2	Rock wool[5]: length ≥ 550 mm, 60 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 120 C/U**	
	10	1.0–14.2	Mineral wool[6]: length ≥ 550 mm, 20 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 120 C/U**	
	> 10–76	2.6–14.2	Mineral wool[6]: length ≥ 550 mm, 30 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 90, E 120 C/U**	
	> 76–88.9	2.0–14.2	Mineral wool[6]: length ≥ 550 mm, 40 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 90 C/U**	
	> 76–160	2.0–14.2	Mineral wool[6]: length ≥ 550 mm, 50 mm thickness on both sides of seal + FLAMRO® Variant N-RM	**EI 90 C/U**	

[1] 1 → ETA-16/0320 2 → ETA 18/0885

[2] Plastic electrical installation pipes, Ø ≤ 32 mm (with / without cable assignment Ø ≤ 21 mm) according to EN 61386-22, wall thickness 0.3 mm to 0.8 mm (for polyolefins) or 0.3 mm to 0.6 mm (for PVC-U)

[3] Prefabricated pipe sections according to EN 14303 made of rock wool with classification A2L-s1,d0 or A1L according to EN 13501-1, a minimum density of 80 kg/m³, clad with grid-reinforced aluminium foil with a self-adhesive strip (e.g. "ASTRATHERM® foil-laminated rook wool pipe section" made by "Austroflex Rohr-Isoliersysteme GmbH")

[4] Closed-cell, flexible elastomer foam (FEF) insulation in the form of (slit) hoses (can be equipped with a self-adhesive unit) with classification BL-s3,d0, including "Armaflex adhesive 520", according to EN 13501-1 made by "Armacell GmbH" (see Appendix B-2 of the ETA)

[5] Lamella mat with aluminium cladding or prefabricated pipe sections (can be clad with grid-reinforced aluminium foil) according to EN 14303 made of rock wool with classification A1 or A1L according to EN 13501-1 and a minimum density of 42 kg/m3 (e.g. "Rockwool Klimarock" made by "Rockwool Mineralwoll GmbH & Co. OHG")

[6] Lamella mat with aluminium cladding or prefabricated pipe sections (can be clad with grid-reinforced aluminium foil) according to EN 14303 made of glass wool or rock wool with classification A2-s1,d0 or A1, or A2L-s1,d0 or A1L according to EN 13501-1 and a minimum density of 23 kg/m³ (e.g. "ML 3 lamella mat with aluminium cladding" made by "Saint-Gobain Isover G+H AG")

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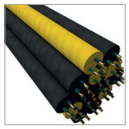
4. Allowed configuration

4.1 Cables / Cable bundles / Cable support constructions / Electrical installation conduits

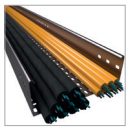
All types of electrical cables and lines

≤ 80 mm
Wave guides are not permitted.



Cable bundles

≤ 100 mm / ≤ 21 mm



Cable support constructions

Steel cable trays (perforated or unperforated) and cable conductors made of steel, with organic coatings if necessary, if the overall fire behaviour corresponds to at least A2 according to EN 13501-1.

Conductors

≤ 24 mm

Electrical installation conduits (EIC), single, made of steel

Outside Ø ≤ 16 mm

Electrical installation conduits (EIC), single, made of plastic

Outside Ø ≤ 32 mm (with / without cable assignment Ø ≤ 21 mm), wall thickness 0.3 mm to 0.8 mm (for polyolefins) or 0.3 mm to 0.6 mm (for PVC-U)Ø ≤ 16 mm, without cable assignment

Electrical installation conduits (EIC), bundle, made of plastic

Outside Ø ≤ 125 mm
EIC according to EN 61386-22 with Ø 16 mm to 63 mm, wall thickness 0.3 mm to 0.8 mm (for polyolefins) or 0.3 mm to 0.6 mm (for PVC-U)

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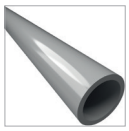
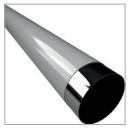
4.2 Combustible pipes



Pipe material	According to standard/approval	External pipe Ø [mm]	Pipe wall thickness [mm]
PVC-U pipes	EN ISO 1452-1, EN ISO 15493, DIN 8061 / DIN 8062	≤ 160	1.8–12.3
PE-HD pipes	EN 1519-1, EN ISO 15494, DIN 8074 / DIN 8075	≤ 160	1.8–14.6
PP pipes	EN 15494, DIN 8077 / DIN 8078	≤ 160	1.8–14.6

Type of pipe	External pipe Ø [mm]
Geberit Silent PP	≤ 110
Geberit Silent Pro	
KE KELIT PHON EX AS	
Pipelife Master 3	
POLO-KAL NG	
Conel Drain	
Geberit Silent dB 20	
Wavin SiTech+	
POLO-KAL XS	
Rehau Raupiano plus	
Rehau Raupiano light	
Silenta Premium	

4.3 Multilayer pipes



Type of pipe	External pipe Ø [mm]	Pipe wall thickness [mm]
Geberit Mepla	16–75	2.25–4.7
Rehau Rautitan Stabil	16–40	2.6–6.0
KE KELIT KELOX	16–75	2.0–7.5

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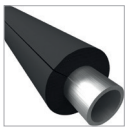
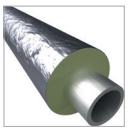
4.4 Noncombustible pipes
4.4.1 Noncombustible pipes with FEF insulation



Pipe material	External pipe Ø [mm]	Pipe wall thickness [mm]
Copper, steel, stainless steel, cast iron	≤ 88.9	1.0–14.2
Steel, stainless steel, cast iron	≤ 160	1.0–14.2

4.4.2 Noncombustible pipes with insulation made of mineral wool



Pipe material	External pipe Ø [mm]	Pipe wall thickness [mm]
Copper, steel, stainless steel, cast iron	≤ 88.9	1.0–14.2
Steel, stainless steel, cast iron	≤ 160	1.0–14.2

5. Distance controls

FLAMRO® KSL combi seal distance control - wall/floor

		Individual cable	Cable bundle	Cable support constructions	Conductors	Electrical installation conduits (EIC), single, made of plastic	Electrical installation conduits (EIC), single, made of steel	Electrical installation conduits (EIC), bundle, made of plastic	Combustible pipes: with Variant N II A	Combustible pipes: with KSL-W	Noncombustible pipes with FEF insulation	Noncombustible pipes with insulation made of mineral wool	Multilayer pipes	Component opening: Top	Component opening: Bottom	Component opening: Lateral
	Individual cable	≥ 35 / ≥ 100 (to each other/on top of each other)			≥ 100	≥ 100	≥ 100	≥ 100	≥ 20	≥ 100	≥ 50	≥ 50	≥ 100	≥ 25	≥ 50	≥ 25
	Cable bundle	≥ 35 / ≥ 100 (to each other/on top of each other)			≥ 100	≥ 100	≥ 100	≥ 100	≥ 20	≥ 100	≥ 50	≥ 50	≥ 100	≥ 25	≥ 50	≥ 25
	Cable support constructions	≥ 35 / ≥ 100 (to each other/on top of each other)			≥ 100	≥ 100	≥ 100	≥ 100	≥ 20	≥ 100	≥ 50	≥ 50	≥ 100	≥ 25	≥ 50	≥ 25
	Conductors	≥ 100			≥ 0	≥ 100	≥ 100	≥ 100	≥ 100		≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100
	Electrical installation conduits (EIC), single, made of plastic	≥ 100			≥ 100	≥ 100	≥ 100	≥ 100	≥ 100		≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100
	Electrical installation conduits (EIC), single, made of steel	≥ 100			≥ 100	≥ 100	≥ 100	≥ 100	≥ 100		≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100
	Electrical installation conduits (EIC), bundle, made of plastic	≥ 100			≥ 100	≥ 100	≥ 100	≥ 0	≥ 100		≥ 100	≥ 100	≥ 100	≥ 50		
	Combustible pipes – with Variant N II A	≥ 20			≥ 100	≥ 100	≥ 100	≥ 100	≥ 35	≥ 100	≥ 100	≥ 100	≥ 100	≥ 50		
	Combustible pipes – with KSL-W	≥ 100														
	Noncombustible pipes with FEF insulation	≥ 50			≥ 100	≥ 100	≥ 100	≥ 100	≥ 100		≥ 0	≥ 0	≥ 100	≥ 45		
	Noncombustible pipes with insulation made of mineral wool	≥ 50			≥ 100	≥ 100	≥ 100	≥ 100	≥ 100		≥ 0	≥ 0	≥ 100	≥ 45		
	Multilayer pipes	≥ 100			≥ 100	≥ 100	≥ 100	≥ 100	≥ 100		≥ 100	≥ 100	≥ 100	≥ 100		

Dimensions in mm

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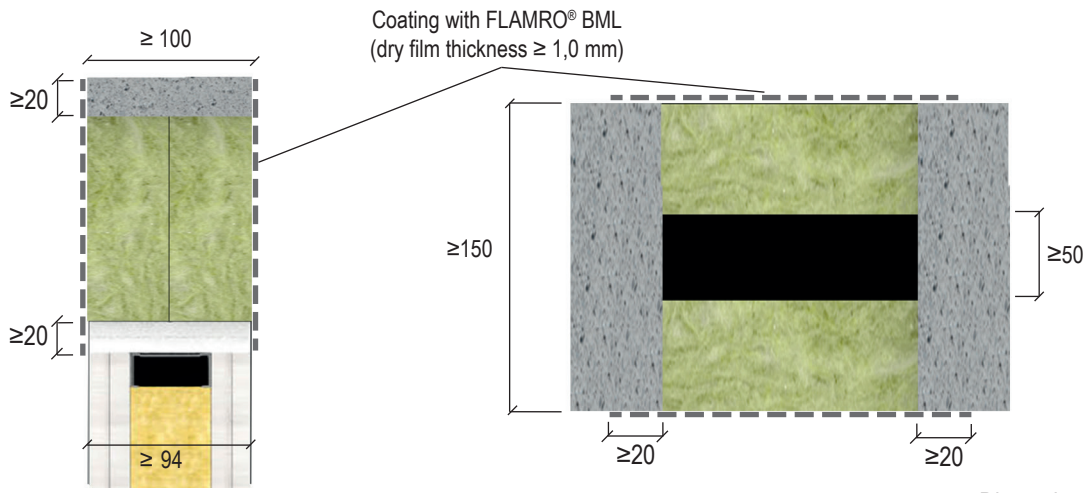
KSL combi seal

6. Design regulations and variants

Variants in walls and floors

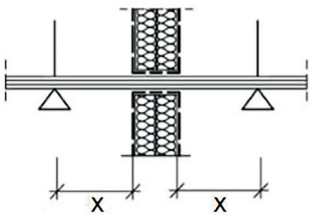


Dimensions in mm

6.1 Initial brackets (supports)

The brackets/supports for the installations in front of the wall seal must be largely noncombustible and arranged at a distance according to the overview.

European technical evaluation ETA-16/0320 is binding for other specifications.

		Wall – X [mm]	Floor – X [mm]
	Cables, cable bundles, cable trays	≤ 500 mm on both sides	≤ 420 mm above
	Electric installation conduits	≤ 500 mm on both sides	≤ 420 mm above
	Combustible pipes	≤ 500 mm on both sides	≤ 420 mm above
	Multilayer pipes	≤ 500 mm on both sides	≤ 420 mm above
	Noncombustible pipes	≤ 500 mm on both sides	≤ 420 mm above

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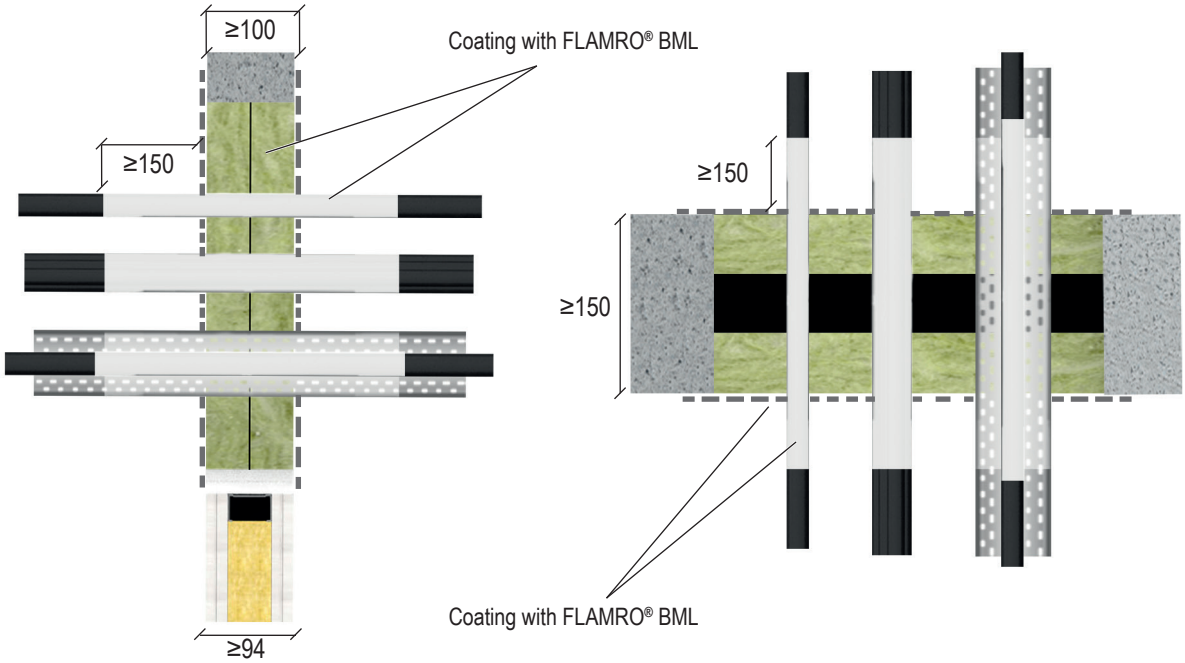
7. Fire protection measures
7.1 Cables, cable bundles and cable support constructions

All cables, cable bundles and cable trays/conductors must be coated with FLAMRO© BML to a length of ≥ 150 mm (measured from the penetration seal's surface) on both sides of the penetration seal.

All cables must be coated in the penetration area (area below and between the mineral wool plates) to a thickness of ≥ 1.5 mm (total dry film thickness).

Steel cable trays can be guided through the penetration seal or end at its surface.

Configuration for wall and floor penetration seals



Component, seal thickness and variants Page 26

Dimensions in mm

FLAMRO®
KSL combi seal

Wall		
Configuration	**Coating on both sides with FLAMRO® BML**	**Fire resistance class**
Cables Ø ≤ 21 mm	150 x 1.0 mm (L x t)	**EI 90**
Cables Ø > 21 mm – ≤ 80 mm	150 x 1.5 mm (L x t)	**EI 90**
Cable bundles Ø ≤ 100 mm with individual cables Ø ≤ 21 mm	150 x 1.0 mm (L x t)	**EI 90**
Conductors Ø ≤ 24 mm		**EI 90**

Floor		
Configuration	**Coating on both sides with FLAMRO® BML**	**Fire resistance class**
Cables Ø ≤ 80 mm	150 x 1.0 mm (L x t) Coating also inside seal	**EI 120**
Cable bundles Ø ≤ 100 mm with individual cables Ø ≤ 21 mm		**EI 120**
Conductors Ø ≤ 24 mm		**EI 120**

FLAMRO®
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7.2 Electrical installation conduits (EIC)

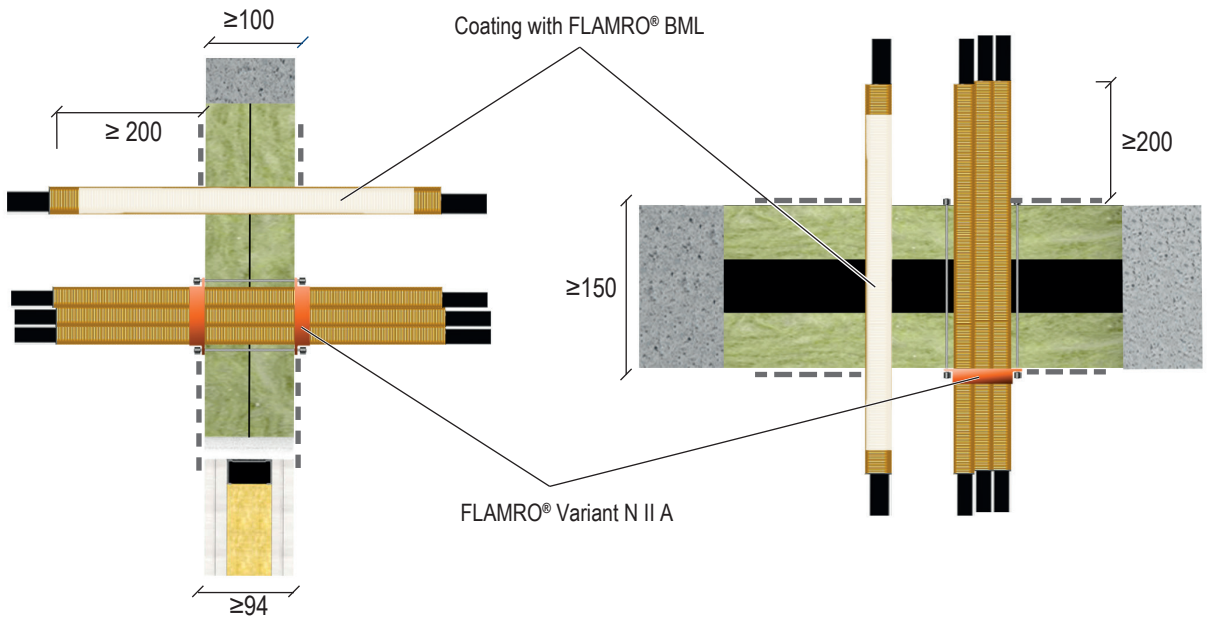
The ends of the EICs must be sealed with FLAMRO© BMS/BMK ≥ 10 mm on one side. Empty EICs must be stuffed with mineral wool ≥ 10 mm and sealed with FLAMRO© BMS/BMK (≥ 1 mm)

The smallest pipe collar suitable for the corresponding diameter of the pipe or bundle of electrical installation conduits to be sealed must be used (space between EIR and collar ≥ 15 mm).

Bundles of electrical installation conduits (minimum length on both sides of the penetration seal of 200 mm) must be affixed with self-adhesive tape or plastic cable ties after a maximum of 100 mm on both sides of the penetration seal.

The pipe collars must be attached with steel threaded rods (thread size M6 to DN 75 or thread size M8 to DN 125) on both sides of the penetration seal with washer and nuts.

Configuration for wall and floor penetration seals



Component, seal thickness and variants Page 26

Dimensions in mm

Electrical installation conduits must be installed at right angles to the penetration seal surface.

Wall and floor

Configuration	Measure	Fire resistance class
EICs with or without configuration Ø 16 to 63 mm up to a bundle diameter of 115 mm Diameter of the individual cables ≤ 21 mm*	Wall: FLAMRO® Variant N II A, collar on both sides Floor: FLAMRO® Variant N II A, collar, underside of floor	**EI 90 U/C**
Empty EICs made of plastic or steel, Ø ≤ 16 mm	150 x 1.0 mm (L x t) in the floor, coating also inside seal	**Wall: EI 90 C/U (steel), EI 90 U/C (plastic) Floor: EI 120 C/U (steel), EI 120 U/C (plastic)**
Empty plastic EICs Ø ≤ 32 mm**		**EI 90 U/C**

* Electrical installation pipes according to EN 61386-22 with Ø 16 mm to 63 mm, wall thickness 0.3 mm to 0.8 mm (for polyolefins) or 0.3 mm to 0.6 mm (for PVC-U).
** Plastic electrical installation pipes, Ø ≤ 32 mm (with / without cable assignment Ø ≤ 21 mm) according to EN 61386-22, wall thickness 0.3 mm to 0.8 mm (for polyolefins) or 0.3 mm to 0.6 mm (for PVC-U)

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7.3 Combustible pipes

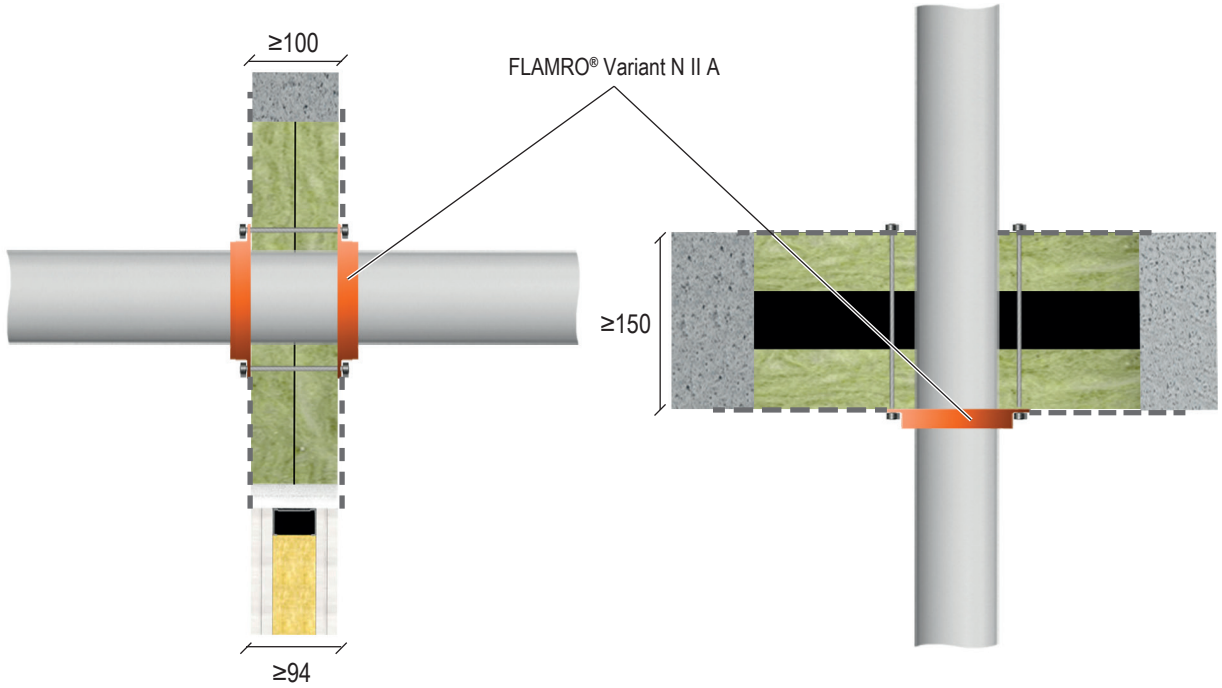
7.3.1 Configuration with pipe collar

In the configuration with a pipe collar, plastic pipes must be equipped with FLAMRO® Variant N II A.

The smallest pipe collar suitable for the corresponding diameter of the pipe to be sealed must be used.

The pipe collars must be attached with steel threaded rods (thread size M6 to DN 75 or thread size M8 to DN 160) and on both sides of the penetration seal with washer and nuts.

Configuration for wall and floor penetration seals



Component, seal thickness and variants Page 26

Dimensions in mm

FLAMRO®
KSL combi seal

Wall				
Pipe material	Outside diameter [mm]	Wall thickness [mm]	Measure	Fire resistance class
PVC-U	32–50	1.8–5.6	FLAMRO® Variant N II A, collar on both sides	EI 90 U/U
	> 50–75	1.8		EI 90 U/U
	> 75-110	1.8–12.3		EI 90 U/U
	> 110–125	2.5–11.4		EI 90 U/U
	> 125–160	3.2–11.9		EI 90 U/U
PE-HD	32–50	1.8–4.6		EI 120 U/U
	> 50–75	1.9–10.0		EI 90 U/U
	> 75–110	2.7–10.0		EI 90 U/U
	> 110–125	3.1–11.4		EI 90 U/U
	> 125–160	4.0–14.6		EI 90 U/U
PP	32–50	1.8–4.6		EI 120 UU
	> 50–75	1.9 – < 10.0		EI 90 U/U
	> 75–110	2.7–10.0		EI 90 U/U
	> 110–125	3.1 –< 11.4		EI 90 U/U
	> 125–160	4.0–14.6		EI 90 UU

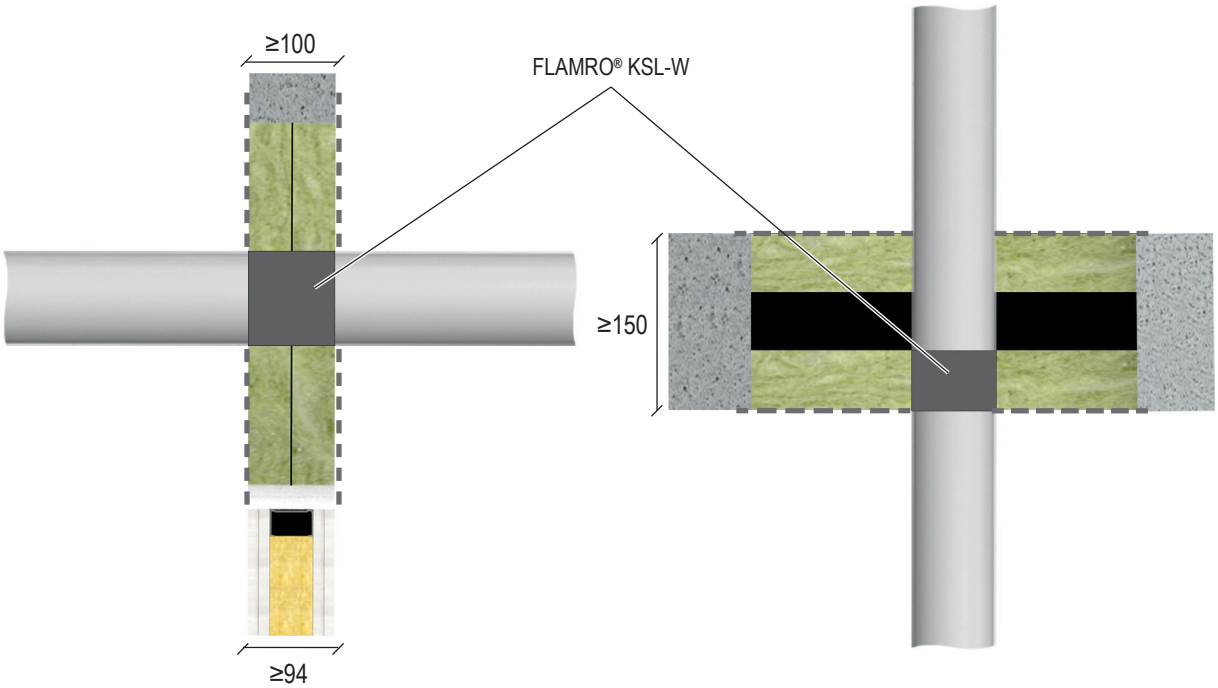
Floor				
Pipe material	Outside diameter [mm]	Wall thickness [mm]	Measure	Fire resistance class
PVC-U	32–50	1.8–5.6	FLAMRO® Variant N II A, one collar, underside of floor	EI 90 / E 120 U/U
	> 50–75	1.8		EI 120 U/U
	> 50–75	> 1.8–12.3		EI 120 U/U
	> 75-110	1.8–12.3		EI 90 U/U
	> 110–125	2.5–11.4		EI 90 U/U
	> 125–160	3.2–11.9		EI 90 U/U
PE-HD	32–50	1.8–4.6		EI 120 U/U
	> 50–75	1.9–10.0		EI 120 U/U
	> 75–110	2.7–10.0		EI 120 U/U
	> 110–125	3.1–11.4		EI 120 U/U
	> 125–160	4.0–14.6		EI 90 U/U
PP	32–50	1.8–4.6		EI 120 UU
	> 50–75	1.9– < 10.0		EI 90 U/U
	> 50–75	10		EI 120 UU
	> 75–110	2.7–10.0		EI 90 U/U
	> 110–125	3.1– < 11.4		EI 90 U/U
	> 110–125	11.4		EI 120 UU
	> 125–160	4.0–14.6		EI 120 UU

FLAMRO®
KSL combi seal

7.3.2 Configuration with fire protection wrap

In the configuration with fire protection wrap, plastic pipes must be equipped with FLAMRO® KSL-W.

Configuration for wall and floor penetration seals



Component, seal thickness and variants Page 26

Dimensions in mm

FLAMRO®
KSL combi seal

Wall								
Pipe materials/ type	Outside diameter [mm]	Wall thickness [mm]	FLAMRO® KSL-W					Fire resistance class
			Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
PVC-U	≤ 50	1.8–5.6	50	2	50	0	2	EI 120 U/U
	< 50 – ≤ 110	1.8–12.3					4	
PE-HD	≤ 50	1.8–4.6					2	
	< 50 – ≤ 110	1.8–10.0					4	
PP	≤ 50	1.8–4.6					2	
	< 50 – ≤ 110	1.8–10.0					4	
Geberit Silent PP	≤ 50	–					2	
	≤ 110	–					4	EI 90 / E 120 U/U
Geberit Silent Pro	≤ 75	–					2	EI 120 U/U
	≤ 110	–					4	
KE KELIT PHON EX AS	≤ 56	–					2	
	≤ 110	–					4	
Pipelife Master 3	≤ 50	–					2	
	≤ 110	–					4	
POLO-KAL NG	≤ 50	–					2	
	≤ 110	–					4	
Conel Drain	≤ 50	–					2	
	≤ 110	–					4	
Geberit Silent dB 20	≤ 56	–					2	
	≤ 110	–					4	
Wavin SiTech+	≤ 50	–					2	
	≤ 110	–					4	
POLO-KAL XS	≤ 50	–					2	
	≤ 110	–					4	
Rehau Raupiano plus	≤ 50	–					2	
	≤ 110	–					4	
Rehau Raupiano light	≤ 50	–					2	
	≤ 110	–					4	
Silenta Premium	≤ 58	–					2	
	≤ 110	–					4	

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Floor								
Pipe materials/ type	Outside diameter [mm]	Wall thickness [mm]	FLAMRO® KSL-W					Fire resistance class
			Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
PVC-U	≤ 50	1.8	50	1	50	0	2	EI 120 / E 180 U/U
		1.8–5.6						EI 120 U/U
	< 50 – ≤ 110	1.8					4	
		1.8–12.3						EI 90 / E 180 U/U
PE-HD	≤ 50	1.8–4.6					2	EI 180 U/U
	< 50 – ≤ 110	1.8–10.0					4	
PP	≤ 50	1.8					2	EI 120 / E 180 U/U
		1.8–4.6						EI 120 UU
	< 50 – ≤ 110	1.8–2.7					4	EI 180 UU
		2.7–10.0						EI 120 UU
Geberit Silent PP	≤ 50	–					2	EI 120 / E 180 U/U
	≤ 110	–					4	EI 180 U/U
Geberit Silent Pro	≤ 75	–					2	EI 180 U/U
	≤ 110	–					4	
KE KELIT PHON EX AS	≤ 56	–					2	
	≤ 110	–					4	
Pipelife Master 3	≤ 50	–					2	EI 90 / E 180 U/U
	≤ 110	–					4	EI 120 U/U
POLO-KAL NG	≤ 50	–					2	EI 180 U/U
	≤ 110	–					4	
Conel Drain	≤ 50	–					2	
	≤ 110	–					4	
Geberit Silent dB 20	≤ 56	–					2	
	≤ 110	–					4	
Wavin SiTech+	≤ 50	–					2	
	≤ 110	–					4	EI 120 / E 180 U/U
POLO-KAL XS	≤ 50	–					2	EI 60 U/U
	≤ 110	–					4	EI 180 U/U
Rehau Raupiano plus	≤ 50	–					2	EI 60 U/U
	≤ 110	–					4	EI 180 U/U
Rehau Raupiano light	≤ 50	–					2	EI 60 U/U
	≤ 110	–					4	EI 180 U/U
Silenta Premium	≤ 58	–					2	EI 90 / E 180 U/U
	≤ 110	–					4	EI 180 U/U

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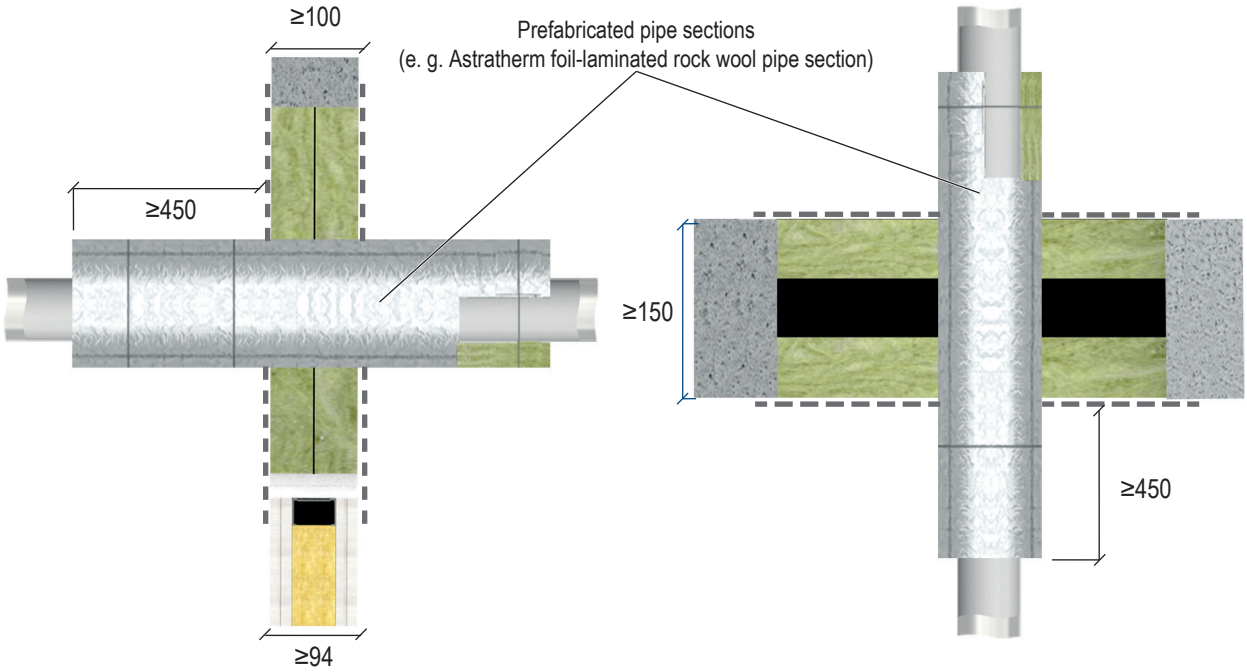
7.4 Multilayer pipes
7.4.1 Configuration with pipe sections

In the configuration with prefabricated pipe sections (e.g. "Astratherm foil-laminated rook wool pipe section"), these must be insulated continuously or permanently along the pipe length.

Configuration for wall and floor penetration seals



Component, seal thickness and variants Page 26

Wall and floor

Pipe material	Outside diameter [mm]	Wall thickness [mm]	Prefabricated pipe sections*		Fire resistance class
			Length [mm]	Thickness [mm]	
Geberit Mepla	16	2.25	≥ 450	20–30	EI 120 U/C
	20	2.5			
	26	3.0		20–40	
	32	3.0		20–50	
	40	3.5			
	50	4.0			
	63	4.5		20–60	
	75	4.7		20–80	

* Prefabricated pipe sections according to EN 14303 made of rock wool with classification A2L-s1,d0 or A1L according to EN 13501-1, a minimum density of 80 kg/m³, clad with grid-reinforced aluminium foil with a self-adhesive strip (e.g. "ASTRATHERM® foil-laminated rook wool pipe section" made by "Austroflex Rohr-Isoliersysteme GmbH")

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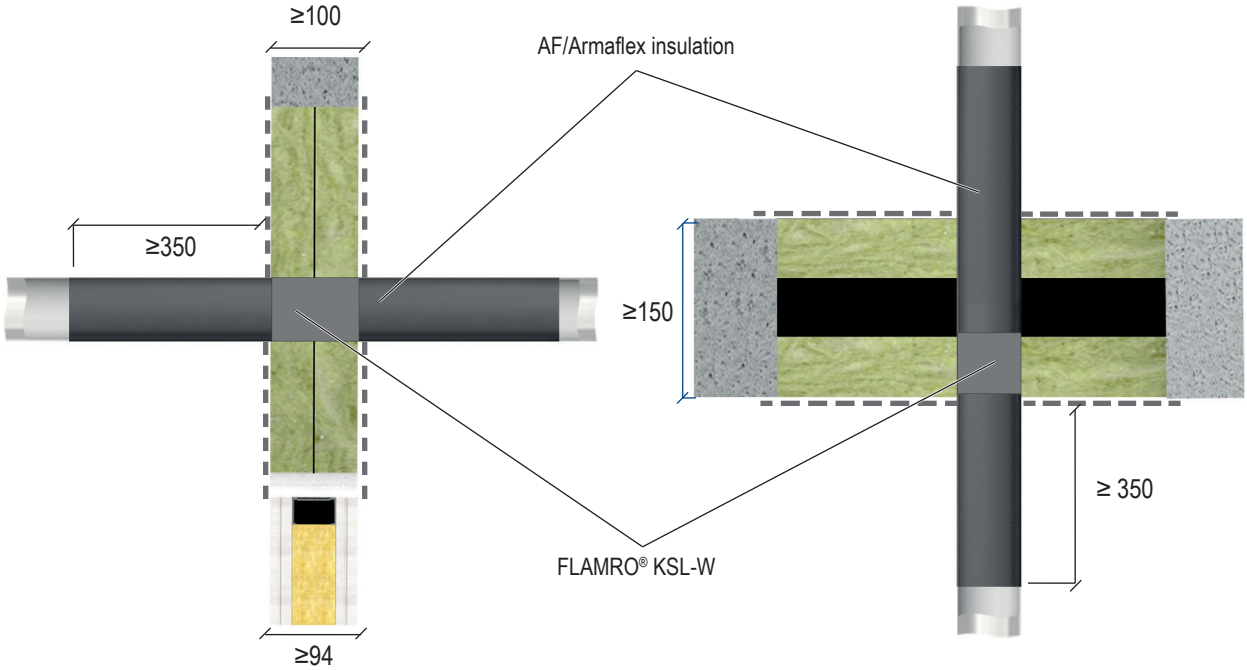
7.4.2 Configuration with fire protection wrap

Configuration for wall and floor penetration seals



Component, seal thickness and variants Page 26

FLAMRO®
KSL combi seal

Wall											
Pipe material/ type	Outside diameter [mm]	Wall thick-ness [mm]	Insulation			FLAMRO® KSL-W					Fire resistance class
			Type	Length L [mm]	Thick-ness D [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
Geberit Mepla	16	2.25	AF/ Armaflex	≥ 350	8.0–32.0	50	2	50	0	1	EI 120 U/C
	20	2.5									
	26	3.0			8.5–35.0						
	32	3.0			9.0–35.0						
	40	3.5								2	
	50	4.0			9.0–35.0						
	63	4.5			9.0–39.0						
	75	4.7			9.5						EI 90 / E 120 U/C
					9.5–40.5						EI 120 U/C
Rehau Rautitan Stabil	16	2.6			8.0–32.0					1	EI 120 U/C
	20	2.9			8.0–32.0						
	25	3.79			8.5–35.0						
	32	4.7			9.0–35.0						
	40	6.0								2	
KE KELIT KELOX	16	2.0			8.0–32.0					1	EI 120 U/C
	18										
	20	2.25									
	25	2.5			8.5–35.0						
	32	3.0			9.0–35.0						
	40	4.0								2	
	50	4.5									
	63	6.0			9.0						EI 90 / E 120 U/C
					9.0–39.0						EI 120 U/C
	75	7.5			9.5–40.5						

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Floor											
Pipe material/ type	Outside diameter [mm]	Wall thick-ness [mm]	Insulation			FLAMRO® KSL-W					Fire resistance class
			Type	Length L [mm]	Thick-ness D [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
Geberit Mepla	16	2.25	AF/ Armaflex	≥ 350	8.0–32.0	50	1	50	0	1	EI 180 U/C
	20	2.5			8.0						EI 120 / E 180 U/C
					8.0–32.0						EI 180 U/C
	26	3.0			8.5–35.0						EI 180 U/C
	32				9.0						EI 180 U/C
					9.0–35.0						EI 120 U/C
	40	3.5			9.0					2	EI 180 U/C
					9.0–35.0						EI 120 U/C
	50	4.0									EI 120 / E 180 U/C
	63	4.5			9.0						EI 180 U/C
					9.0–39.0						EI 120 U/C
	75	4.7			9.5						EI 90 / E 180 U/C
					9.5–40.5						EI 120 U/C
Rehau Rautitan Stabil	16	2.6			8.0–32.0					1	EI 180 U/C
	20	2.9			8.0–32.0						
	25	3.79			8.5–35.0						
	32	4.7			9.0						EI 120 U/C
					9.0–35.0						EI 180 U/C
	40	6.0			9.0–35.0					2	
KE KELIT KELOX	16	2.0			8.0–32.0					1	EI 180 U/C
	18				8.0–32.0						
	20	2.25			8.0–32.0						
	25	2.5			8.5–35.0						
	32	3.0			9.0–35.0						
	40	4.0			9.0–35.0					2	
	50	4.5			9.0–35.0						
	63	6.0			9.0–39.0						
	75	7.5			9.5–40.5						

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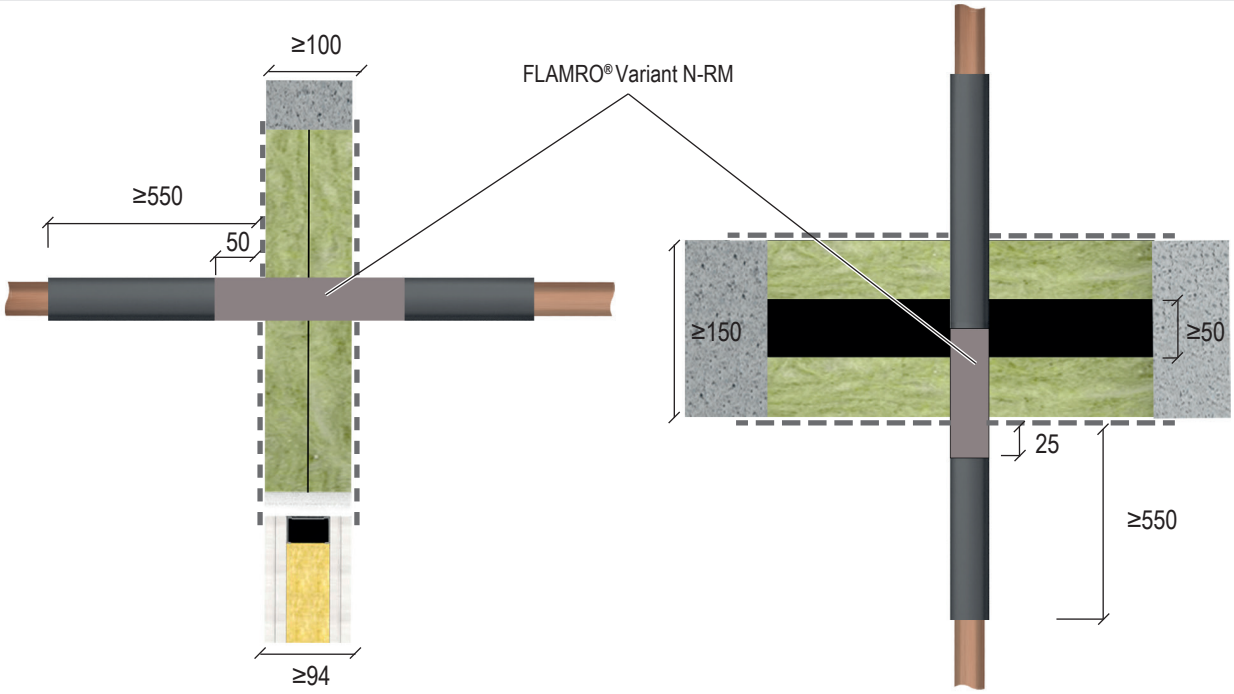
7.5 Noncombustible pipes
7.5.1 Insulation with AF/Armaflex

The AF/Armaflex hose must be installed inside the penetration seal opening so that the penetration seal is continuous on both sides.

When installing AF/Armaflex, all butt seams and longitudinal seams (with the exception of AF/Armaflex with a self-adhesive unit) must be glued with Armaflex adhesive 520 (≤ 300 g / m²) and can be covered with Armaflex self-adhesive tape (50 x 3 mm).

Configuration for wall and floor penetration seals – variant with Armaflex protect



Component, seal thickness and variants Page 26

Dimensions in mm

FLAMRO®
KSL combi seal

Wall											
Pipe material	Outside diameter [mm]	Wall thickness [mm]	Insulation			FLAMRO® Variant N-RM					Fire resistance class
			Type	Length L [mm]	Thick-ness D [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
Copper, steel, stain-less steel, cast iron	10	1.0–14.2	AF/ Armaflex* AF-2 (hose)	≥ 550	11.0	100	2	50	50	2	**EI 90 C/U**
	> 10–28	1.0–14.2	AF/ Armaflex* AF-2 (hose)		11.0–12.5						**EI 90 C/U**
	> 28–54	1.5–14.2	AF/ Armaflex* AF-4 (hose)		19.0–21.0						**EI 90 C/U**
	> 54–89	2.0–14.2	AF/ Armaflex* AF-6 (hose)		38.5–41.5						**EI 90 C/U**

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Floor											
Pipe material	Outside diameter [mm]	Wall thickness [mm]	Insulation			FLAMRO® Variant N-RM					Fire resistance class
			Type	Length L [mm]	Thick-ness D [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
Copper, steel, stain-less steel, cast iron	10	1.0–14.2	AF/ Armaflex* AF-2 (hose)	≥ 550	11.0	100	1	75	25	2	**EI 120 C/U**
	> 10–28	1.0–14.2	AF/ Armaflex* AF-2 (hose)		11.0–12.5						**EI 120 C/U**
	> 28–54	1.5–14.2	AF/ Armaflex* AF-4 (hose)		19.0–21.0						**EI 120 C/U**
	> 54–89	2.0–14.2	AF/ Armaflex* AF-6 (hose)		38.5–41.5						**EI 90 / E 120 C/U**
Steel, stain-less steel, cast iron	10	1.0–14.2	AF/ Armaflex* AF-2 (hose)		11.0						**EI 120 C/U**

* Closed-cell, flexible elastomer foam (FEF) insulation in the form of (slit) hoses (can be equipped with a self-adhesive unit) with classification BL-s3,d0, including "Armaflex adhesive 520", according to EN 13501-1 made by "Armacell GmbH" (see Appendix B-2 of the ETA)

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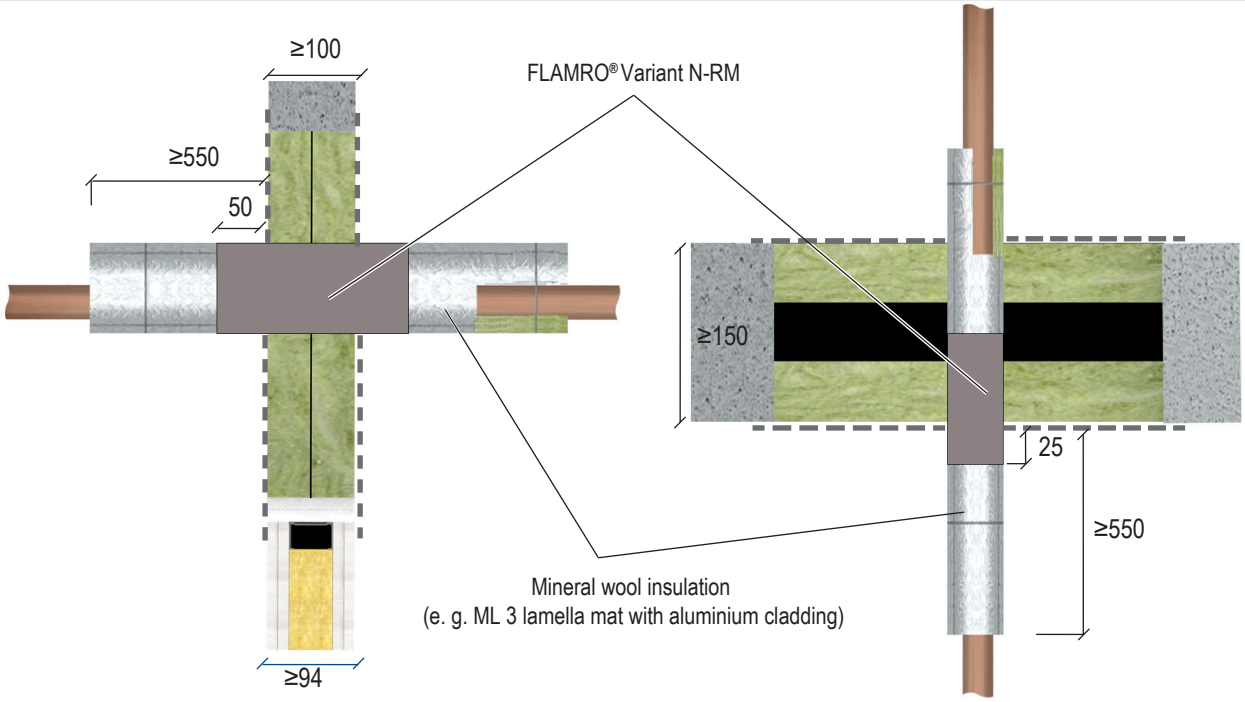
7.5.2 Insulation with mineral wool

The mineral wool insulation (e.g. ML 3 lamella mat with aluminium cladding or Klimarock lamella mat with aluminium cladding) must be wrapped around the pipe to be sealed so that the penetration seal protrudes by ≥ 550 mm on both sides (measured from the penetration seal surface) and is continuous along the required minimum insulation length.

The mineral wool insulation must be fixed in position along the required minimum insulation length using wrapping wire (steel wire with a diameter ≥ 0.8 mm; 5 wraps per metre; e.g. with spacing of 200 mm, 400 mm, etc. - measured from the penetration seal surface).

Configuration for wall and floor penetration seals – variant with mineral wool insulation



Component, seal thickness and variants Page 26

Dimensions in mm

FLAMRO®
KSL combi seal

Wall											
Pipe material	Outside diameter [mm]	Wall thick-ness [mm]	Insulation			FLAMRO® Variant N-RM					Fire resistance class
			Type	Length L [mm]	Thick-ness D [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
Steel, stain-less steel, cast iron	10	1.0–14.2	Mineral wool*	≥ 550	20.0	100	2	50	50	1	EI 90 C/U
	> 10–76	2.6–14.2			30.0						EI 90 C/U
	> 76–160	2.0– <4.0			30.0						EI 60, E 90 C/U
				∞**							EI 90 C/U
	> 76–160	4.0–14.2		≥ 550	50.0						EI 90 C/U

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Floor											
Pipe material	Outside diameter [mm]	Wall thickness [mm]	Insulation			FLAMRO® Variant N-RM					Fire resistance class
			Type	Length L [mm]	Thick-ness D [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
Copper, steel, stainless steel, cast iron	10–88.9	2.0–14.2	Mineral wool*	≥ 550	40.0	100	1	75	25	1	EI 90 C/U
Steel, stainless steel, cast iron	> 10–76	2.6–14.2	Rock wool*		30.0						EI 90, E 120 C/U
	> 76–88.9	2.0–14.2			40.0						EI 90 C/U
	> 88.9–160	4.0–14.2			60.0						EI 120 C/U
	10	1.0–14.2	Mineral wool*		20.0						EI 120 C/U
	> 10–76	2.6–14.2			30.0						EI 90 / E 120 C/U
	> 76–88.9	2.0–14.2			40.0						EI 90 C/U
	> 76–160	2.0–14.2			50.0						EI 90 C/U

* Lamella mat with aluminium cladding or prefabricated pipe sections (can be clad with grid-reinforced aluminium foil) according to EN 14303 made of rock wool with classification A1 or A1L according to EN 13501-1 and a minimum density of 42 kg/m³ (e.g. "Rockwool Klimarock" made by "Rockwool Mineralwoll GmbH & Co. OHG")

** Lamella mat with aluminium cladding or prefabricated pipe sections (can be clad with grid-reinforced aluminium foil) according to EN 14303 made of glass wool or rock wool with classification A2-s1,d0 or A1, or A2L-s1,d0 or A1L according to EN 13501-1 and a minimum density of 23 kg/m³ (e.g. "ML 3 lamella mat with aluminium cladding" made by "Saint-Gobain Isover G+H AG")

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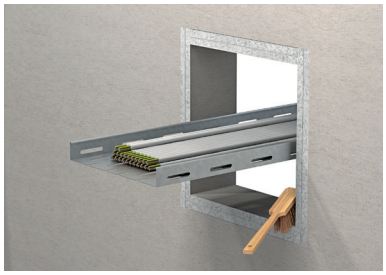
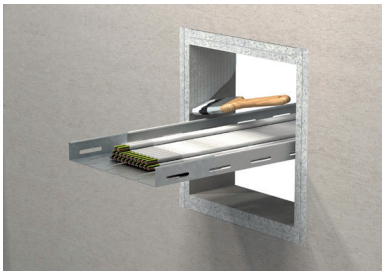
8. Installation steps

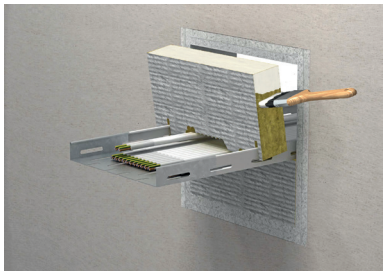
1. Clean the opening of the component and installations.



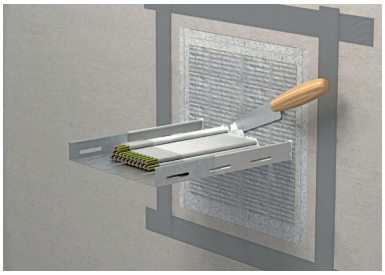
2. Coat the cables, penetration seal area and 150 mm of the penetration seal on each side with FLAMRO® BML.



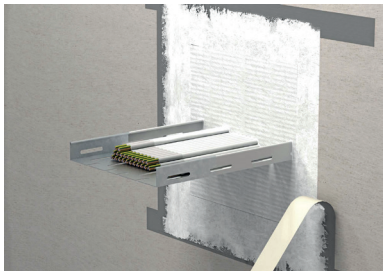
3. Cut the mineral fibre boards to size, coat the surrounding edge areas with FLAMRO® BMS. Seal the openings in two layers.



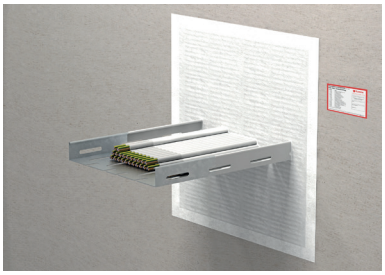
4. Pack the remaining openings with mineral fibre or fill with FLAMRO® BMS.



5. Coat the penetration seal surface.
   Finally, coat a 20 mm wide strip around the installations with FLAMRO® BML.



6. Attach the label.



Declaration of performance

KA-16-0320-FLAMRO® KSL - BML

Date: 26/05/2020
Rev.: 01

Unique product type identification code
FLAMRO® BML

Intended use
Fire protection product for penetration seals

Manufacturer
Flamro Brandschutz-Systeme GmbH,
Gluesinger Strasse 86, D - 21217 Seevetal, Germany

System for evaluating and checking performance consistency
System 1

European evaluation document
ETAG-026, part 2, August 2011

European technical evaluation
ETA-16/0320 from 13/05/2016

Performance consistency certificate
0761-CPR-0523

Technical assessment authority
OIB - Österreichisches Institut für Bautechnik, Vienna

The notified authority
Material testing institute for the building trade, Brunswick, identification number 0761

Performance declaration

Important features	Performance	Harmonised technical specification
Fire behaviour	E	EN 13501-1
Fire resistance	Maximum class EI 120 - U/U - for details see ETA-16/0320	EN 13501-2
Release of hazardous substances	No hazardous substances	ETA 16/0320
Durability and usability	Usage category type X	EOTA TR 024

The performance of the product for which the declaration of performance was issued corresponds to the declared performance.
The above-mentioned manufacturer is solely responsible for the creation of the declaration of performance in accordance with regulation (EU) no. 305/2011.
This declaration of performance is available online at www.flamro.de.
Signed for and on behalf of the manufacturer by:

pp. Christian Meyer-Korte
Product Management Construction

pp. Daniel Bernhardi
Technical Documentation Construction