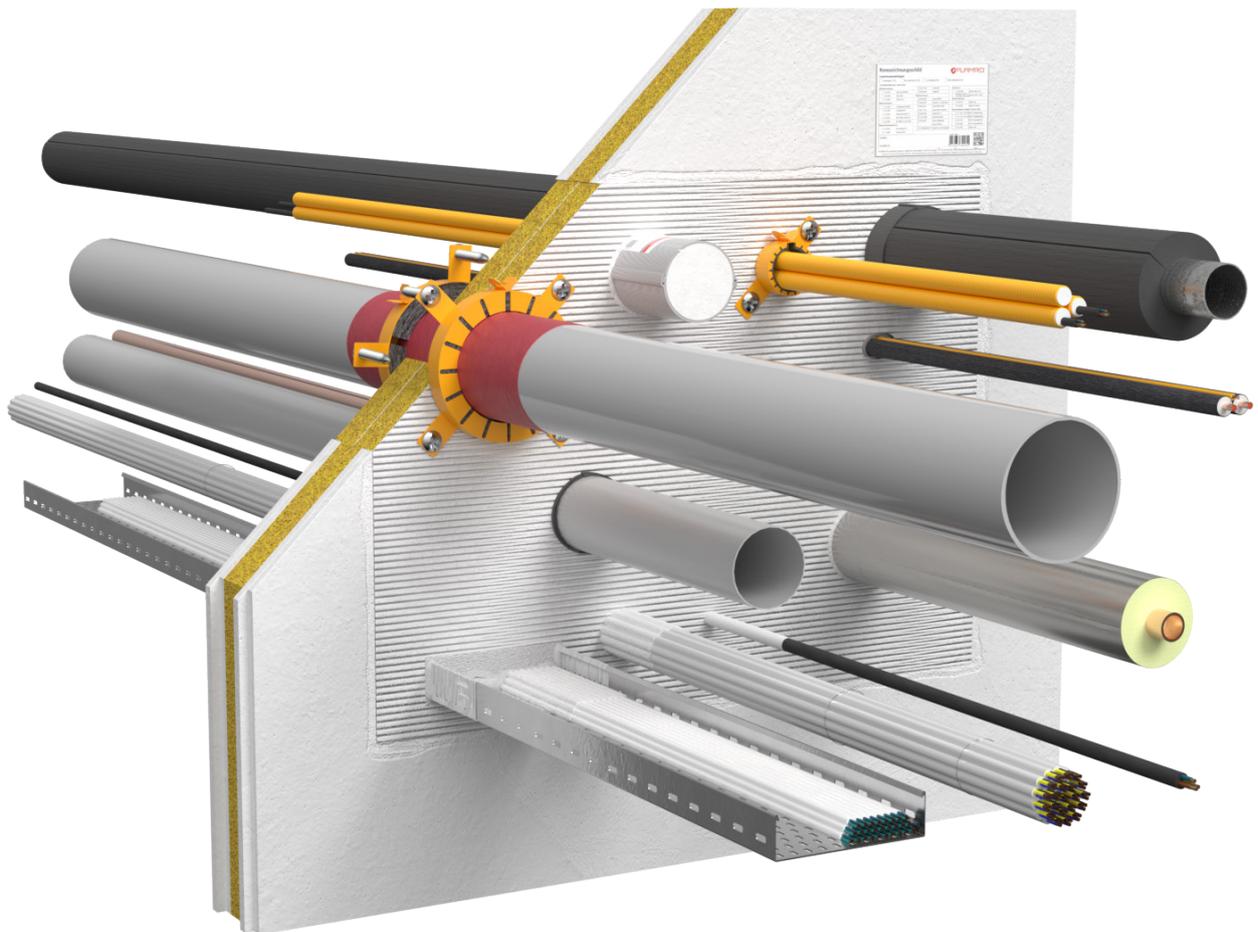


KSL double layer

Ablative mineral fibre board seal

Mixed penetration sealing system made of mineral fibre boards with an ablative coating for electrical installations, combustible / non-combustible pipes and other services in accordance with ETA-16/0320, ETA-18/0885 and KB 321031804-A.

Fire resistance class: maximum EI 120 in accordance with EN 13501-2.



KSL double layer

Table of contents

	Topic	Page
1.	Preliminary remarks / overview	3
1.1	Target group	3
1.2	Use of the instructions	3
1.2.1	Safety instructions	3
1.3	Field of application	4
1.4	Building elements	5
1.5	Thicknesses / penetration seal distances	6
2.	Fire resistance classes	8
2.1	Walls	8
2.2	Floors	14
3.	Allowed services	19
3.1	Cables / cable bundles / cable trays / electrical installation conduits	19
3.2	Combustible pipes	20
3.3	Multilayer pipes	21
3.4	Non-combustible pipes	21
3.4.1	Non-combustible pipes with FEF insulation	21
3.4.2	Non-combustible pipes with insulation made of mineral wool	21
4.	Distances	22
5.	Used Products	23
5.1	Declaration of Performance	24
6.	Design variants	25
6.1	Initial brackets (supports)	26
7.	Fire protection measures	27
7.1	Cables / cable bundles / cable trays	27
7.2	Coaxial cables and wave guides	29
7.3	Cable Tube	30
7.4	Electrical installation conduits (EIC)	31
7.4.1	EIC made of steel	31
7.4.2	EIC made of plastic – installation with fire protection wrap	33
7.4.3	EIC made of plastic – installation with fire protection collar	34
7.4.4	EIC made of plastic – installation with fire protection coating	35
7.5	HVAC split line combinations	36
7.6	Combustible pipes	37
7.6.1	Installation with fire protection collar	37
7.6.2	Installation with endless collar	40
7.6.3	Installation with fire protection wrap	43
7.7	Multilayer pipes	46
7.7.1	Installation with pipe sleeves	46
7.7.2	Installation with fire protection wrap	47
7.7.3	Installation with endless collar	50
7.8	Non-combustible pipes	51
7.8.1	Insulation with FEF and fire protection wrap	51
7.8.2	Insulation with mineral wool	54
8.	Installation steps	56

KSL double layer

1. Preliminary remarks / overview

1.1 Target group

The installation instructions are intended solely for personnel trained in fire protection.

1.2 Use of the instructions

Before starting work, read through these installation instructions completely once. Pay particular attention to the following safety instructions.

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

Pictorial representations serve as examples only. Installation results may differ in appearance.

Unless stated otherwise, all lengths are specified in mm.

All information in this document represents the state of the art at the time of writing or the current version of the standard.

Upon request, flamro will be pleased to provide the relevant legal and technical framework and manufacturer specifications for each individual case.

1.2.1 Safety instructions

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

Personal protective equipment:

	Wear protective clothing and non-slip shoes.
	Use safety goggles, safety glasses.
	P2 particle filter in case of short-term or low level exposure. For intensive or prolonged exposure use a breathing apparatus with independent air supply. Use breathing protection in compliance with international/national standards.
	Use chemically resistant gloves. Recommended materials: butyl rubber, nitrile rubber, fluorinated rubber, PVC.

Safety instructions for the installation of floor penetration seals

	The area below the floor penetration seal must be cordoned off against entry during penetration seal work (barrier tape and warning sign: warning of possible falling objects, do not enter the area, penetration seal work in floor openings).
	The contractor for the production of floor penetration seals must inform the client in writing (for forwarding to the client or appointed representative) that after the production of the fire penetration seals in floors, these must be secured on site against loads, in particular against being stepped on, by suitable measures (e.g. by fencing or by covering with grating).

KSL double layer

1.3 Field of application

The mixed penetration sealing system KSL double-layer in wall and floor openings has been assessed in accordance with ETAG 026-2, 2.4.1 and classified in accordance with EN 13501-1 in terms of the „Reaction to fire“, „Fire resistance“, „Release of dangerous substances“ and „Durability and serviceability“ product characteristics.

Reaction to fire		
Product	Reaction class	In acc. with standard
BML, BMS, BMK, KSL-W	E	EN 13501-1
BSL	F	
Hardrock 040, Hardrock II	A1	
Variant N II A	E	
Variant N II A (steel sheet housing)	A1	
NBR-plus	B-s1, d0	
N EC	E	

Fire resistance				
Tested	Included configurations			
	U/U	C/U	U/C	C/C
U/U	✓	✓	✓	✓
C/U	–	✓	–	✓
U/C	–	✓	✓	✓
C/C	–	–	–	✓

KSL double layer meets the maximum requirements of class EI 120 in accordance with EN 13501-2.
 The maximum fire resistance class of the seal in vertical or horizontal separating elements depends on the fire resistance class of the penetrating services. The fire resistance class of the seal is reduced to the fire resistance class of the penetrating service with the lowest fire resistance class.

Release of dangerous substances
The components of KSL do not contain any substances identified as dangerous in the list of the European Commission. The mineral fibre board, the mineral fibre mats and the mineral wool do not contain any dangerous substances listed in Directive 67/548/EC or Regulation (EC) No. 1272/2008 or the Indicative List on Dangerous Substances.

Durability and serviceability
All components of KSL meet the requirements of type Y ₂ in accordance with EOTA TR024. The intumescent material NBR-plus meets the requirements of type X in accordance with EOTA TR 024. KSL can therefore be used at temperatures below 0 °C but must not be exposed to rain or UV radiation. As the system meets the requirements of type Y ₂ , it also meets those of types Z ₁ und Z ₂ . It is assumed that the steel sheet housing of the Variant N II A is sufficiently protected from corrosion by the coating powder.

KSL double layer

1.4 Building elements

Plasterboard walls

Plasterboard walls must have a thickness of ≥ 100 mm.

Cladding must have at least 1 layer with a thickness of ≥ 12.5 mm. When installing without cladding the seal may have a maximum size of 800×600 mm or 600×800 mm.

Plasterboard walls with wooden studs must be declared and installed with at least the same number of layers as tested. The distance between the opening and the studs and transoms must be ≥ 100 mm and the hollow spaces between the cladding of the wall, studs and transoms and the opening reveal must be tightly sealed to a depth of ≥ 100 mm with mineral wool, reaction to fire class A1 or A2 according to EN 13501-1.

If one or more studs need to be cut because of the seal installation, horizontal girt must be installed.

Standard plasterboard wall construction is not applicable for construction on the basis of sandwich panels or for plasterboard walls with one-sided cladding (shaft walls).

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

The necessary fire protection measures are explained on the following pages and must also be observed during subsequent installations.

Solid walls

Made of concrete or masonry with a thickness of ≥ 100 mm. The walls must be classified for the necessary fire resistance time according to EN 13501-2.

Solid floors

Made of concrete or aerated concrete with a thickness of ≥ 150 mm. The floor must be classified for the necessary fire resistance time according to EN 13501-2. Floors must be secured on site against loads, in particular against being stepped on, by suitable measures (e.g. by fencing or by covering with grating).

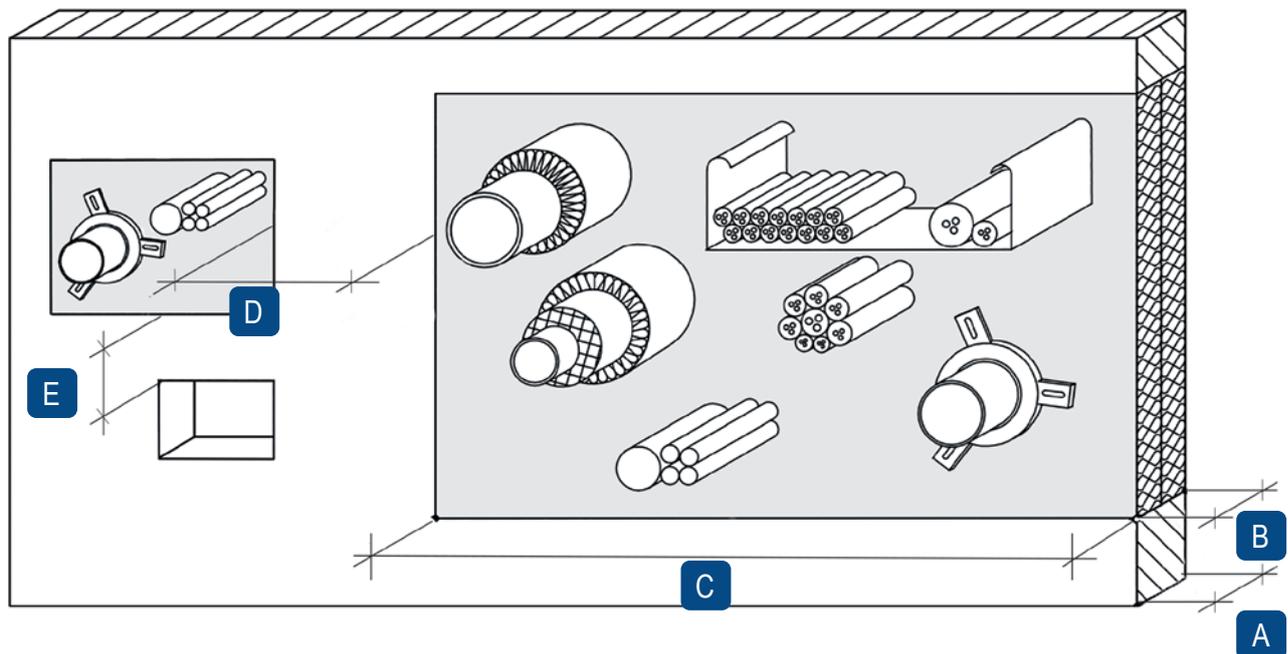
Shaft walls

In stud design with metal substructure and one-sided cladding of at least 2 layers made of building slabs with a thickness of 20 mm. In shaft walls the fire resistance class of the penetration seal is reduced to a maximum of EI 90.

KSL double layer

1.5 Thicknesses / penetration seal distances

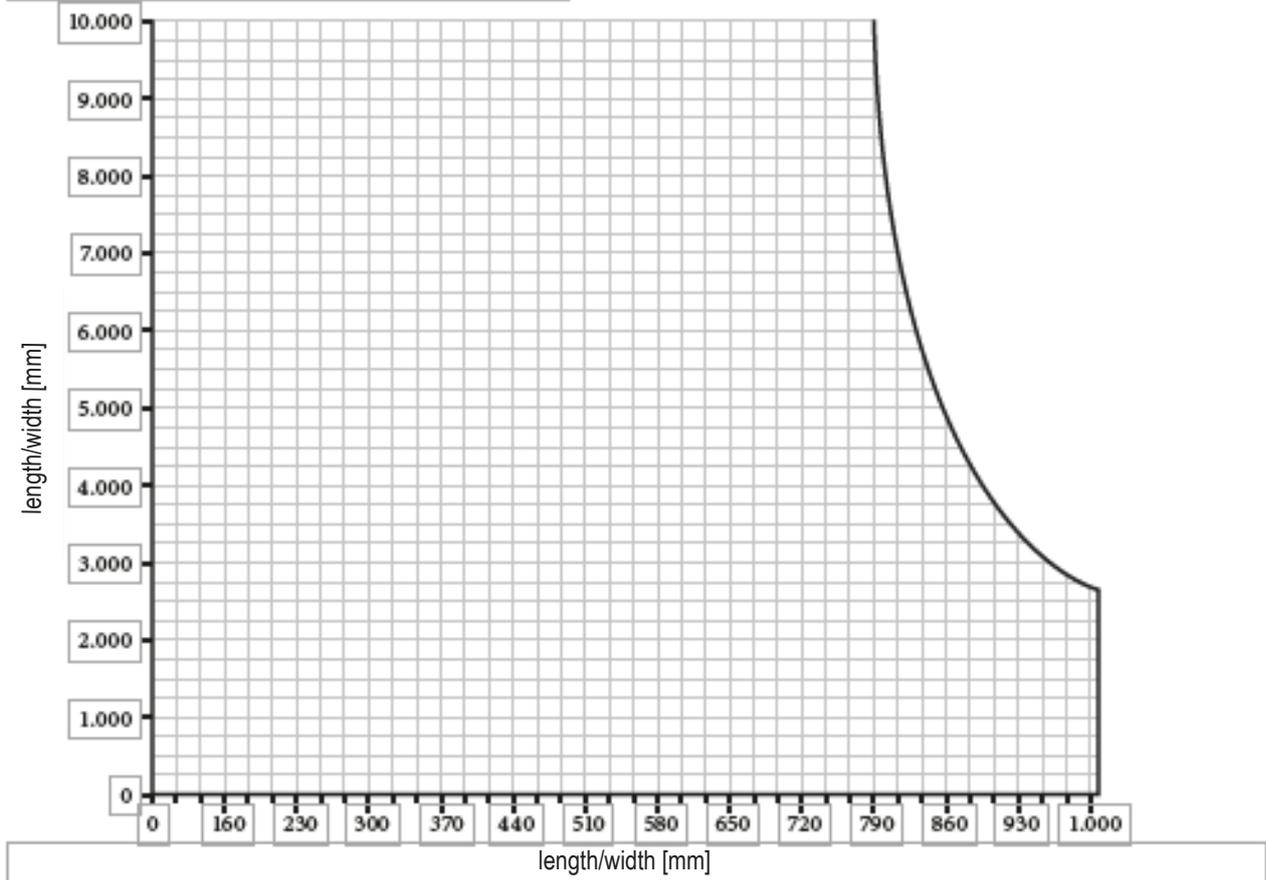
Dimensions					
		Plasterboard wall [mm]	Solid wall [mm]	Shaft wall [mm]	Solid floor [mm]
A	Thickness of building element	≥ 100	≥ 100	≥ 40	≥ 150
B	Thickness of penetration seal	≥ 100	≥ 100	≥ 100	≥ 150
C	Maximum dimensions of the opening (width × height)				
	with reveal cladding	≤ 1100 × 2200 or ≤ 2200 × 1100	≤ 1100 × 2200 or ≤ 2200 × 1100	–	∞ × ≤ 1000*
	without reveal cladding	≤ 800 × 600 or ≤ 600 × 800		≤ 600 × 800	≤ 800 × 600 or ≤ 600 × 800
D	Distance to other cable or pipe penetration seals	200	200	200	200
E	Distance to other openings or installations	200	200	200	200



The total allowable cross section of the installations (outer dimensions) is ≤ 60% of the construction opening.

KSL double layer

* Maximum dimensions of 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:

$$\text{length (width)} = \frac{\text{height}}{\left(\left(\frac{l_{\text{cert}}}{2}\right) \times \text{height} - 1\right)}$$

$$C_{\text{cert}} = \frac{\text{scope}_{\text{cert}}}{\text{sealing area}_{\text{cert}}} = 2.769 \text{ m/m}^2; \text{ or } 0.002769 \text{ mm/mm}^2.$$

The minimum ratio of circumference to the area of the opening in solid floors is 2.769 m/m², or 0.002769 mm/mm².

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

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

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

KSL double layer

2. Fire resistance classes

2.1 Walls

Cables, cable bundles and cable trays	Measure	Fire resistance class	Source ¹
Cables $\varnothing \leq 21$ mm	coating on both sides with BML ≥ 100 mm \times ≥ 1.0 mm dry film thickness	EI 120	3
Cables $\varnothing \leq 50$ mm		EI 90, E 120	3
Cables $\varnothing \leq 80$ mm		EI 90, E 120	3
Cable bundles $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm		EI 120	3

Coaxial cables and wave guides	Measure	Fire resistance class	Source ¹
CommScope HELIAX [®] , $\varnothing \leq 51.1$	coating on both sides with BML ≥ 100 mm \times ≥ 1.0 mm dry film thickness	EI 120 U/C	3
RFS CELLFLEX [®] , $\varnothing \leq 50.3$			
RFS RADIAFLEX [®] , $\varnothing \leq 48.2$			

Cable Tube	Measure	Fire resistance class	Source ¹
Cables $\varnothing \leq 21$ mm	-	EI 90	3
Cable bundles $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm			

Electrical installation conduits (EIC)	Measure	Fire resistance class	Source ¹
EIC made of steel $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm	lamella mat 500 \times 30 mm	EI 120 U/C	3
EIC made of steel bundle 3 \times $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm		EI 90 U/C	
EIC made of plastic $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm	NBR-plus, 1 layer	EI 120 U/U	
EIC made of plastic $\varnothing \leq 32$ mm, bundled to $\varnothing \leq 100$ mm with/without cables $\varnothing \leq 21$ mm	NBR-plus, 2 layers	EI 120 U/U	
EIC made of plastic $\varnothing \leq 63$ mm, with/without cables $\varnothing \leq 21$ mm	Variant N II A / N II KS	EI 90 U/C	1
EIC made of plastic $\varnothing \leq 32$ mm, bundled to $\varnothing \leq 125$ mm with/without cables $\varnothing \leq 21$ mm	Variant N II A / N II KS	EI 90 U/C	
EIC made of plastic $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm	coating on both sides with BML ≥ 150 mm \times ≥ 1.0 mm dry film thickness	EI 90 U/C	

¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A

KSL double layer

Installation in walls					
HVAC split line combinations			Measure	Fire resistance class	Source ¹
up to two copper pipes $\varnothing \leq 18.0$ mm, wall thickness 1.0–14.2 mm, 9 mm PE foam, + 1 pipe PVC-U/PVC-C $\varnothing \leq 25.0$ mm, wall thickness 1.5 mm, + up to 3 cables $\varnothing \leq 14.0$ mm			NBR-plus, 2 layers	EI 120	3
Combustible pipes with/without noise insulation made of PE and endless collar (attached with coarse thread screws)					
Pipe material/type	Pipe outer \varnothing [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
PVC-U, PVC-C	90.0–110.0	1.8	Variant N EC	EI 120 U/U	3
	40.0–160.0	1.8–11.9	Variant N EC	EI 90 U/U	
PE-HD, ABS, SAN + PVC	40.0–50.0	1.8–4.6	Variant N EC	EI 120 U/U	
	40.0–110.0	1.8–4.6	Variant N EC	EI 90 U/U	
PP	90.0–110.0	2.7	Variant N EC	EI 120 U/U	
POLO-KAL NG, POLO-KAL XS*	90.0–160.0	3.0–4.9	Variant N EC*	EI 120 U/U	
Rehau Raupiano plus*	90.0–160.0	2.7–3.9	Variant N EC*	EI 120 U/U	
	75.0–90.0	1.9–2.2	Variant N EC	EI 90 U/U	
Geberit Silent PP	32.0–110.0	2.0–3.6	Variant N EC*	EI 120 U/U	
	90.0–110.0	3.1–3.6	Variant N EC	EI 90 U/U	
Wavin SiTech+	32.0–50.0	2.0–2.1	Variant N EC*	EI 120 U/U	
	32.0–110.0	2.0–3.6	Variant N EC	EI 90 U/U	
* attached with spiral screw					
¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A					

KSL double layer

Installation in walls					
Combustible pipes with/without noise insulation made of PE and fire protection collar (attached with coarse thread screws)					
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
PVC-U, PVC-C	32.0–160.0	1.8–11.9	Variant N II A*	EI 90 U/U	1
PE-HD, ABS, SAN + PVC	32.0–50.0	1.8–4.6	Variant N II A*	EI 120 U/U	
	> 50.0 – 160.0	1.9–14.6	Variant N II A	EI 90 U/U	
PP	32.0–50.0	1.8–4.6	Variant N II A*	EI 120 U/U	
	> 50.0 – 160.0	1.9–14.6	Variant N II A*	EI 90 U/U	
PE-HD, ABS, SAN + PVC	32.0–160.0	2.7–4.6	Variant N II A**	EI 120 U/U	3
PP	110.0	10.0	Variant N II A**	EI 120 U/U	
CONEL DRAIN	40.0–160.0	1.8–3.9	Variant N II A	EI 120 U/U	
Pipelife Master 3	40.0–160.0	1.8–4.4	Variant N II A	EI 120 U/U	
KE KELIT PHON EX AS	58.0–160.0	4.0–5.3	Variant N II A	EI 120 U/U	
Wavin AS	58.0–160.0	4.0–5.3	Variant N II A	EI 120 U/U	
POLO-KAL 3S	90.0–110.0	4.5–4.8	Variant N II A	EI 120 U/U	
POLO-KAL NG, POLO-KAL XS	40.0–110.0	1.8–3.4	Variant N II A	EI 120 U/U	
REHAU RAUPIANO PLUS	50.0–160.0	1.8–3.9	Variant N II A	EI 120 U/U	
REHAU RAUPIANO LIGHT	40.0–160.0	1.8–3.9	Variant N II A	EI 120 U/U	
Geberit Silent-dB20	56.0–110.0	3.2–6.0	Variant N II A	EI 120 U/U	
	56.0–160.0	3.2–7.0	Variant N II A	EI 90 U/U	
Geberit Silent-PP	32.0–160.0	2.0–5.2	Variant N II A	EI 120 U/U	
Geberit Silent-Pro	50.0–160.0	3.0–6.0	Variant N II A	EI 120 U/U	
GF Silenta Premium	58.0–160.0	4.1–5.3	Variant N II A	EI 120 U/U	
Hakan Silenta Premium	58.0–160.0	4.1–5.3	Variant N II A	EI 120 U/U	
Wavin SiTech+	32.0–160.0	1.8–5.0	Variant N II A	EI 120 U/U	
Valsir Triplus	32.0–160.0	1.8–4.9	Variant N II A	EI 120 U/U	

* without noise insulation, attached with threaded rod
 ** attached with spiral screw

¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A

KSL double layer

Installation in walls					
Combustible pipes with/without noise insulation made of PE and fire protection wrap					
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
PVC-U pipes	≤ 50.0	1.8–5.6	KSL-W, 2-layer	EI 120 U/U	2, 4
	> 50.0 – ≤ 110.0	1.8–12.3	KSL-W, 4-layer	EI 120 U/U	
PE-HD pipes	≤ 50.0	1.8–4.6	KSL-W, 2-layer	EI 120 U/U	
	> 50 – ≤ 110	1.8–10.0	KSL-W, 4-layer	EI 120 U/U	
PP pipes	≤ 50	1.8–4.6	KSL-W, 2-layer	EI 120 U/U	
	> 50.0 – ≤ 110.0	1.8–10.0	KSL-W, 4-layer	EI 120 U/U	
Geberit Silent-PP	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
Geberit Silent-Pro	≤ 75.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 90 U/U	
KE KELIT PHON EX AS	≤ 56.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
Pipelife Master 3	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
POLO-KAL NG	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
CONEL DRAIN	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
Geberit Silent-dB20	≤ 56.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
Wavin SiTech+	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
POLO-KAL XS	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
REHAU RAUPIANO PLUS	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
REHAU RAUPIANO LIGHT	≤ 50.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	
GF Silenta Premium	≤ 58.0		KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0		KSL-W, 4-layer	EI 120 U/U	

¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A

KSL double layer

Installation in walls						
Multilayer pipes						
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹	
Geberit Mepla	16.0	2.25	pipe sleeve*: ≥ 450.0 × 20.0–30.0 mm	EI 120 U/C	1	
	20.0	2.5	pipe sleeve*: ≥ 450.0 × 20.0–30.0 mm	EI 120 U/C		
	26.0	3.0	pipe sleeve*: ≥ 450.0 × 20.0–40.0 mm	EI 120 U/C		
	32.0	3.0	pipe sleeve*: ≥ 450.0 × 20.0–50.0 mm	EI 120 U/C		
	40.0	3.5	pipe sleeve*: ≥ 450.0 × 20.0–50.0 mm	EI 120 U/C		
	50.0	4.0	pipe sleeve*: ≥ 450.0 × 20.0–50.0 mm	EI 120 U/C		
	63.0	4.5	pipe sleeve*: ≥ 450.0 × 20.0–60.0 mm	EI 120 U/C		
	75.0	4.7	pipe sleeve*: ≥ 450.0 × 20.0–80.0 mm	EI 120 U/C		
	Geberit Mepla	16.0	2.25	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W	EI 120 U/C	2, 4
		20.0	2.5	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W	EI 120 U/C	
		26.0	3.0	AF/Armaflex 350.0 × 8.5–35.0 mm + KSL-W	EI 120 U/C	
		32.0	3.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C	
		40.0	3.5	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C	
		50.0	4.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C	
		63.0	4.5	AF/Armaflex 350.0 × 9.0–39.0 mm + KSL-W	EI 120 U/C	
		75.0	4.7	AF/Armaflex 350.0 × 9.5 mm + KSL-W	EI 90 U/C	
REHAU RAUTITAN stabil	16.0	2.6	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W	EI 120 U/C	2, 4	
	20.0	2.9	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W	EI 120 U/C		
	25.0	3.79	AF/Armaflex 350.0 × 8.5–35.0 mm + KSL-W	EI 120 U/C		
	32.0	4.7	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C		
	40.0	6.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C		
KE KELIT KELOX	16.0	2.0	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W	EI 120 U/C	2, 4	
	18.0	2.0	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W	EI 120 U/C		
	20.0	2.25	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W	EI 120 U/C		
	25.0	2.5	AF/Armaflex 350.0 × 8.5–35.0 mm + KSL-W	EI 120 U/C		
	32.0	3.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C		
	40.0	4.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C		
	50.0	4.5	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W	EI 120 U/C		
	63.0	6.0	AF/Armaflex 350.0 × 9.0 mm + KSL-W	EI 90 U/C		
	63.0	6.0	AF/Armaflex 350.0 × > 9.0–39.0 mm + KSL-W	EI 120 U/C		
75.0	7.5	AF/Armaflex 350.0 × 9.5–40.5 mm + KSL-W	EI 120 U/C			
FRÄNKISCHE alpex L FRÄNKISCHE alpex F50	16.0–20.0	2.0	FEF insulation 8.0–30.0 mm + Variant N EC, 2-layer	EI 120 U/C	3	

* Prefabricated pipe sleeves in accordance with EN 14303 made of rock wool with classification A2L-s₁,d₀ or A1L in accordance with EN 13501-1 and a minimum density of 80 kg/m³.

¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A

KSL double layer

Installation in walls					
Non-combustible pipes with insulation made of mineral wool					
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
Copper, steel, stainless steel or cast iron	≤ 22.0	0.6–14.2	lamella mat on both sides ≥ 450.0 × 20.0–100.0 mm	EI 120 U/C	3
			lamella mat on both sides ≥ 200.0 × 30.0–100.0 mm	EI 120 U/C	
	> 22.0 – ≤ 60.0		lamella mat on both sides ≥ 450.0 × 30.0–100.0 mm	EI 120 U/C	
	> 60.0 – ≤ 88.9		lamella mat on both sides ≥ 450.0 × 100.0 mm	EI 120 U/C	
Steel, stainless steel or cast iron	≤ 42.0	1.8–14.2	lamella mat on both sides ≥ 200.0 × 30.0–100.0 mm	EI 120 U/C	3
	> 42.0 – ≤ 114.3	1.8/3.2–14.2	lamella mat on both sides ≥ 450.0 × 30.0–100.0 mm	EI 120 U/C	
	> 114.3 – ≤ 159.0	3.2/4.0–14.2	lamella mat on both sides ≥ 1200.0 × 100.0 mm	EI 120 U/C	
	> 114.3 – ≤ 219.1	3.2/4.5–14.2	lamella mat on both sides ≥ 1200.0 × 30.0–100.0 mm	EI 90 U/C	
Non-combustible pipes with insulation made of FEF in acc. with EN 14304					
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
Copper, steel, stainless steel or cast iron	≤ 15.0, insulation thickness 10.0 mm	0.8–14.2	NBR-plus, 1-layer	EI 120 U/C	3
	> 15.0 – ≤ 54.0, insulation thickness 19.0–38.0 mm		NBR-plus, 2-layer	EI 120 U/C	
	> 54.0 – ≤ 88.9, insulation thickness 25.0 mm		NBR-plus, 2-layer	EI 120 U/C	
	≤ 42.0, insulation thickness 10.0 mm		NBR-plus, 1-layer	EI 90 U/C	
	> 42.0 – ≤ 88.9, insulation thickness 19.0–38.0 mm		NBR-plus, 2-layer	EI 90 U/C	
Steel, stainless steel or cast iron	≤ 15.0, insulation thickness 10.0–38.0 mm	0.8–14.2	NBR-plus, 2-layer	EI 120 U/C	3
	> 15.0 – ≤ 88.9, insulation thickness 19.0–38.0 mm		NBR-plus, 2-layer	EI 120 U/C	
	> 88.9 – ≤ 114.3, insulation thickness 19.0–38.0 mm		NBR-plus, 2-layer + protective insulation FEF 250.0 × 19.0 mm	EI 120 U/C	
	> 114.3 – ≤ 159.0, insulation thickness 25.0–38.0 mm		NBR-plus, 2-layer + protective insulation FEF 250.0 × 19.0 mm	EI 120 U/C	
	> 159.0 – ≤ 219.1, insulation thickness 25.0–38.0 mm		NBR-plus, 2-layer + protective insulation FEF 600.0 × 38.0 mm	EI 120 U/C	
¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A					

KSL double layer

2.2 Floors

Cables, cable bundles and cable trays	Measure	Fire resistance class	Source ¹
Cables $\varnothing \leq 21$ mm	coating on both sides with BML ≥ 100 mm \times ≥ 1.0 mm dry film thickness	EI 120	3
		EI 90, E 120	3
Cables $\varnothing \leq 50$ mm	coating on both sides with BML ≥ 150 mm \times ≥ 1.0 mm dry film thickness	EI 120	
Cables $\varnothing \leq 80$ mm	coating on both sides with BML ≥ 100 mm \times ≥ 1.0 mm dry film thickness	EI 90, E 120	3
	coating on both sides with BML ≥ 150 mm \times ≥ 1.0 mm dry film thickness	EI 120	
Cable bundles $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm	coating on both sides with BML ≥ 100 mm \times ≥ 1.0 mm dry film thickness	EI 120	3

Cable Tube	Measure	Fire resistance class	Source ¹
Cables $\varnothing \leq 21$ mm	-	EI 120	3
Cable bundles $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm			

Electrical installation conduits (EIC)	Measure	Fire resistance class	Source ¹
EIC made of steel $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm	lamella mat 500.0 mm \times 30.0 mm	EI 120 U/C	3
EIC made of steel, bundle $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm			
EIC made of plastic $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm	NBR-plus 1-layer	EI 120 U/U	3
EIC made of plastic $\varnothing \leq 32$ mm, bundled to $\varnothing \leq 100$ mm with/without cables $\varnothing \leq 21$ mm	NBR-plus 2-layer	EI 120 U/U	3
EIC made of plastic $\varnothing \leq 63$ mm, with/without cables $\varnothing \leq 21$ mm	Variant N II A / N II KS	EI 90 U/C	1
EIC made of plastic $\varnothing \leq 32$ mm, bundled to $\varnothing \leq 125$ mm with/without cables $\varnothing \leq 21$ mm	Variant N II A / N II KS	EI 90 U/C	1
EIC made of plastic $\varnothing \leq 32$ mm, with/without cables $\varnothing \leq 21$ mm	coating on both sides with BML ≥ 150 mm \times ≥ 1.0 mm dry film thickness	EI 90 U/C	1

KSL double layer

Installation in floors					
HVAC split line combinations			Measure	Fire resistance class	Source¹
up to two copper pipes $\varnothing \leq 18.0$ mm, wall thickness 1.0–14.2 mm, 9 mm PE foam, + 1 pipe PVC-U/PVC-C $\varnothing \leq 25.0$ mm, wall thickness 1.5 mm, + up to 3 cables $\varnothing \leq 14.0$ mm			NBR-plus, 2-layer	EI 120	3
¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A					
Combustible pipes with/without noise insulation made of PE and endless collar (attached with coarse thread screws)					
Pipe material/type	Pipe outer \varnothing [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
PVC-U, PVC-C	40.0–160.0	1.8–5.6	Variant N EC	EI 120 U/U	3
PE-HD, ABS, SAN + PVC	90.0–110.0	2.7	Variant N EC	EI 120 U/U	
	40.0–110.0	2.7–4.6	Variant N EC	EI 90 U/U	
PP	40.0–110.0	1.8–10.0	Variant N EC	EI 120 U/U	
Rehau Raupiano plus	75.0–90.0	1.9–2.2	Variant N EC	EI 120 U/U	
Geberit Silent PP	32.0–50.0	2.0	Variant N EC*	EI 90 U/U	
Wavin SiTech+	32.0–50.0	2.0–2.1	Variant N EC*	EI 90 U/U	
* attached with spiral screw					
Combustible pipes with/without noise insulation made of PE and fire protection collar (attached with coarse thread screws)					
Pipe material/type	Pipe outer \varnothing [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
PVC-U, PVC-C	32.0–50.0	1.8–5.6	Variant N II A*	EI 120 U/U	1
	> 50.0 – 160.0	1.8–12.3	Variant N II A*	EI 90 U/U	
PE-HD, ABS, SAN + PVC	32.0–125.0	1.8–14.6	Variant N II A*	EI 120 U/U	
PP	32.0–50.0	1.8–4.6	Variant N II A*	EI 120 U/U	
	> 50.0 – 160.0	1.9–14.6	Variant N II A*	EI 90 U/U	
PE-HD, ABS, SAN + PVC	160.0	4.0	Variant N II A**	EI 90 U/U	
CONEL DRAIN	75.0–110.0	1.9–2.7	Variant N II A	EI 90 U/U	
POLO-KAL NG, POLO-KAL XS	90.0–160.0	3.0–4.9	Variant N II A	EI 90 U/U	
REHAU RAUPIANO LIGHT	160.0	1.9–2.7	Variant N II A	EI 90 U/U	
Geberit Silent-PP	40.0–110.0	2.0–3.6	Variant N II A	EI 90 U/U	3
Geberit Silent-Pro	50.0–110.0	3.0–4.5	Variant N II A	EI 90 U/U	
GF Silenta Premium	58.0–110.0	4.1–5.3	Variant N II A	EI 90 U/U	
Hakan Silenta Premium	58.0–110.0	4.1–5.3	Variant N II A	EI 90 U/U	
Wavin SiTech+	32.0	1.8	Variant N II A	EI 90 U/U	
	75.0–160.0	2.6–5.0	Variant N II A	EI 90 U/U	
Valsir Triplus	32.0–50.0	1.8	Variant N II A	EI 90 U/U	
* without noise insulation, attached with threaded rod					
**attached with spiral screw					
¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A					

KSL double layer

Installation in floors					
Combustible pipes with/without noise insulation made of PE and fire protection wrap					
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
PVC-U, PVC-C	≤ 50.0	1.8–5.6	KSL-W, 2-layer	EI 120 U/U	2, 4
	≤ 110.0	2.8–12.3	KSL-W, 4-layer	EI 90 U/U	
PE-HD, ABS, SAN + PVC	≤ 50.0	1.8–4.6	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	1.8–10.0	KSL-W, 4-layer	EI 120 U/U	
PP	≤ 50.0	1.8–4.6	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	1.8–10.0	KSL-W, 4-layer	EI 120 U/U	
Geberit Silent-PP	≤ 50.0	–	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
Geberit Silent-Pro	≤ 75.0	–	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
KE KELIT PHON EX AS	≤ 56.0	–	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
Pipelife Master 3	≤ 50.0	–	KSL-W, 2-layer	EI 90 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
POLO-KAL NG	≤ 50.0	–	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
CONEL DRAIN	≤ 50.0	–	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
Geberit Silent-dB20	≤ 56.0	–	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
Wavin SiTech+	≤ 50.0	–	KSL-W, 2-layer	EI 120 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
POLO-KAL XS	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
REHAU RAUPIANO PLUS	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
REHAU RAUPIANO LIGHT	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	
GF Silenta Premium	≤ 58.0	–	KSL-W, 2-layer	EI 90 U/U	
	≤ 110.0	–	KSL-W, 4-layer	EI 120 U/U	

¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A

KSL double layer

Installation in floors						
Multilayer pipes						
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹	
Geberit Mepla	16.0	2.25	Pipe sleeve*: ≥ 450.0 × 20.0–30.0 mm	EI 120 U/C	1	
	20.0	2.5	Pipe sleeve*: ≥ 450.0 × 20.0–30.0 mm	EI 120 U/C		
	26.0	3.0	Pipe sleeve*: ≥ 450.0 × 20.0–40.0 mm	EI 120 U/C		
	32.0	3.0	Pipe sleeve*: ≥ 450.0 × 20.0–50.0 mm	EI 120 U/C		
	40.0	3.5	Pipe sleeve*: ≥ 450.0 × 20.0–50.0 mm	EI 120 U/C		
	50.0	4.0	Pipe sleeve*: ≥ 450.0 × 20.0–50.0 mm	EI 120 U/C		
	63.0	4.5	Pipe sleeve*: ≥ 450.0 × 20.0–60.0 mm	EI 120 U/C		
	75.0	4.7	Pipe sleeve*: ≥ 450.0 × 20.0–80.0 mm	EI 120 U/C		
	Geberit Mepla	16.0	2.25	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W, 1-layer	EI 120 U/C	2, 4
		20.0	2.5	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W, 1-layer	EI 120 U/C	
		26.0	3.0	AF/Armaflex 350.0 × 8.5–35.0 mm + KSL-W, 1-layer	EI 120 U/C	
		32.0	3.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 1-layer	EI 120 U/C	
		40.0	3.5	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 2-layer	EI 120 U/C	
		50.0	4.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 2-layer	EI 120 U/C	
63.0		4.5	AF/Armaflex 350.0 × 9.0–39.0 mm + KSL-W, 2-layer	EI 120 U/C		
75.0		4.7	AF/Armaflex 350.0 × 9.5 mm + KSL-W, 2-layer	EI 90 U/C		
REHAU RAUTITAN stabil	16.0	2.6	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W, 1-layer	EI 120 U/C	2, 4	
	20.0	2.9	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W, 1-layer	EI 120 U/C		
	25.0	3.79	AF/Armaflex 350.0 × 8.5–35.0 mm + KSL-W, 1-layer	EI 120 U/C		
	32.0	4.7	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 1-layer	EI 120 U/C		
	40.0	6.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 2-layer	EI 120 U/C		
KE KELIT KELOX	16.0	2.0	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W, 1-layer	EI 120 U/C	2, 4	
	18.0	2.0	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W, 1-layer	EI 120 U/C		
	20.0	2.25	AF/Armaflex 350.0 × 8.0–32.0 mm + KSL-W, 1-layer	EI 120 U/C		
	25.0	2.5	AF/Armaflex 350.0 × 8.5–35.0 mm + KSL-W, 1-layer	EI 120 U/C		
	32.0	3.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 1-layer	EI 120 U/C		
	40.0	4.0	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 2-layer	EI 120 U/C		
	50.0	4.5	AF/Armaflex 350.0 × 9.0–35.0 mm + KSL-W, 2-layer	EI 120 U/C		
	63.0	6.0	AF/Armaflex 350.0 × 9.0 mm + KSL-W, 2-layer	EI 120 U/C		
75.0	7.5	AF/Armaflex 350.0 × 9.5–40.5 mm + KSL-W, 2-layer	EI 120 U/C			
FRÄNKISCHE alpex L FRÄNKISCHE alpex F50	16.0–75.0	2.0–5.0	FEF insulation 16.0–75.0 mm + Variant N EC, 2-layer	EI 90 U/C	3	

* Prefabricated pipe sleeves in accordance with EN 14303 made of rock wool with classification A2L-s1,d0 or A1L in accordance with EN 13501-1 and a minimum density of 80 kg/m³.

¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A

KSL double layer

Installation in floors					
Non-combustible pipes with insulation made of mineral wool					
Pipe material/ type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
Copper, steel, stainless steel or cast iron	≤ 22.0	0.6–14.2	lamella mat on both sides ≥ 425.0 × 20.0–100.0 mm	EI 120 U/C	
	> 22.0 – ≤ 42.0		lamella mat on both sides ≥ 175.0 × 30.0–100.0 mm	EI 120 U/C	
	> 42.0 – ≤ 88.9		lamella mat on both sides ≥ 425.0 × 30.0–100.0 mm	EI 120 U/C	
	> 42.0 – ≤ 88.9		lamella mat on both sides ≥ 675.0 × 30.0–100.0 mm	EI 90 U/C	
Steel, stainless steel or cast iron	≤ 42.0	1.8–14.2	lamella mat on both sides ≥ 125.0 × 30.0–100.0 mm	EI 120 U/C	3
	> 42.0 – ≤ 114.3		lamella mat on both sides ≥ 425.0 × 30.0–100.0 mm	EI 120 U/C	
	> 114.3 – ≤ 159.0		lamella mat on both sides ≥ 1175.0 × 30.0–100.0 mm	EI 120 U/C	
	> 114.3 – ≤ 219.1		lamella mat on both sides ≥ 1175.0 × 30.0 mm	EI 120 U/C	
	> 114.3 – ≤ 219.1		lamella mat on both sides ≥ 1175.0 × 30.0–100.0 mm	EI 90 U/C	
Non-combustible pipes with insulation made of FEF in acc. with EN 14304					
Pipe material/ type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Measure	Fire resistance class	Source ¹
Copper, steel, stainless steel or cast iron	≤ 60.0, insulation thickness 13.0–40.0 mm	0.6–14.2	NBR-plus, 2-layer	EI 120 U/C	3
	> 60.0 – ≤ 88.9, insulation thickness 25.0 mm		NBR-plus, 2-layer	EI 120 U/C	
	≤ 42.0, insulation thickness 10.0 mm		NBR-plus, 1-layer	EI 90 U/C	
	≤ 42.0, insulation thickness 9.0–40.0 mm		NBR-plus, 2-layer	EI 90 U/C	
	> 42.0 – ≤ 60.0, insulation thickness 13.0–40.0 mm		NBR-plus, 2-layer	EI 90 U/C	
	> 60.0 – ≤ 88.9, insulation thickness 19.0–38.0 mm		NBR-plus, 2-layer	EI 90 U/C	
	> 60.0 – ≤ 88.9, insulation thickness 19.0–38.0 mm		NBR-plus, 2-layer	EI 90 U/C	
Steel, stainless steel or cast iron	≤ 159.0, insulation thickness 25.0–38.0 mm	NBR-plus, 2-layer + protective insulation FEF 250.0 × 25.0 mm	EI 90 U/C		
	> 159.0 – ≤ 219.1, insulation thickness 25.0–38.0 mm	NBR-plus, 2-layer + protective insulation FEF 250.0 × 38.0 mm	EI 90 U/C		
¹ 1 → ETA-16/0320 2 → ETA 18/0885 3 → KB 321031804-A 4 → KB 320011408-A					

KSL double layer

3. Allowed services

3.1 Cables / cable bundles / cable trays / electrical installation conduits



Electrical cables and lines of all types

Outer $\varnothing \leq 80$ mm



Cable bundles

Outer $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm



Cable trays

Cable trays and ladders made of steel



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

Outer $\varnothing \leq 32$ with/without cables $\varnothing \leq 21$ mm



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

Outer $\varnothing \leq 63$ mm, (with/without cables $\varnothing \leq 21$ mm), wall thickness 0.3 mm to 0.8 mm (for polyolefins) or 0.3 mm to 0.6 mm (for PVC-U) $\varnothing \leq 16$ mm



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

Outer $\varnothing \leq 125$ mm

EIC in accordance with EN 61386-22 with $\varnothing 16$ 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)



HVAC split line combinations

up to 2 copper pipes $\varnothing \leq 18.0$ mm, pipe wall thickness 1.0–14.2 mm, 9 mm PE foam,
1 pipe PVC-U/PVC-C $\varnothing \leq 25.0$ mm, pipe wall thickness 1.5 mm, up to 3 cables $\varnothing \leq 14.0$ mm

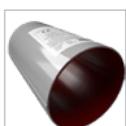


Coaxial cables and wave guides

CommScope HELIAX®, $\varnothing \leq 51.1$

RFS CELLFLEX®, $\varnothing \leq 50.3$

RFS RADIAFLEX®, $\varnothing \leq 48.2$



CT Cable Tube

with cables $\varnothing \leq 21$ mm and cable bundles $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm

KSL double layer

3.2 Combustible pipes

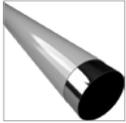


Pipe material	According to standard	Pipe outer Ø [mm]	Pipe wall thickness [mm]
PVC-U pipes	EN 1329-1, EN ISO 1452-1, EN 1452-2, EN 1453-1, EN ISO 15493, DIN 8061 / DIN 8062	≤ 160.0	1.8–12.3
PVC-C pipes	EN 1566-1, EN ISO 15493, EN ISO 15877	≤ 160.0	1.8–12.3
PE-HD pipes	EN 1519-1, EN 12201-2, EN ISO 15494, EN 12666-1 DIN 8074 / DIN 8075	≤ 160.0	1.8–14.6
PP pipes	EN 1451-1, EN ISO 15874, EN 15494, DIN 8077 / DIN 8078	≤ 160.0	1.8–14.6
ABS pipes	EN 1455-1, EN ISO 15493	40.0–110.0	2.7–4.6
SAN + PVC pipes	EN 1565-1	40.0–110.0	2.7–4.6

Type of pipe	Pipe outer Ø [mm]
POLO-KAL 3S	≤ 110.0
Geberit Silent-PP	≤ 160.0
Geberit Silent-Pro	
KE KELIT PHON EX AS	
Pipelife Master 3	
POLO-KAL NG	
CONEL DRAIN	
Geberit Silent-dB20	
Wavin SiTech+	
Wavin AS	
POLO-KAL XS	
REHAU RAUPIANO PLUS	
REHAU RAUPIANO LIGHT	
GF Silenta Premium	
Hakan Silenta Premium	
Valsir Triplus	

KSL double layer

3.3 Multilayer pipes



Type of pipe	Pipe outer Ø [mm]	Pipe wall thickness [mm]
Geberit Mepla	16.0–75.0	2.25–4.7
REHAU RAUTITAN stabil	16.0–40.0	2.6–6.0
KE KELIT KELOX	16.0–75.0	2.0–7.5
FRÄNKISCHE alpex L, FRÄNKISCHE alpex F50	16.0–75.0	2.0–5.0

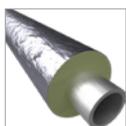
3.4 Non-combustible pipes

3.4.1 Non-combustible pipes with FEF insulation



Pipe material	Pipe outer Ø [mm]	Pipe wall thickness [mm]
Copper, steel, stainless steel or cast iron	≤ 88.9	0.6–14.2
Steel, stainless steel or cast iron	≤ 219.1	0.6–14.2

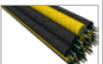
3.4.2 Non-combustible pipes with insulation made of mineral wool



Pipe material	Pipe outer Ø [mm]	Pipe wall thickness [mm]
Copper, steel, stainless steel or cast iron	≤ 88.9	0.6–14.2
Steel, stainless steel or cast iron	≤ 219.1	0.6–14.2

4. Distances

KSL double layer – distances in wall and floor

																	Seal edge		
		Cables	Cable bundles	Cable trays	Wave guides / coaxial cables	with NBR-plus	with N II KS	EIR, single, made of steel	with Variant N II A	with Variant N EC	with KSL-W	Non-combustible pipes with FEF insulation	Non-combustible pipes with insulation made of mineral wool	Multilayer pipes	HVAC split line combinations	CT Cable Tube	Upper	Lower	Side
	Cables		≥ 0		≥ 100	≥ 75	≥ 100	≥ 75	≥ 20	≥ 100	≥ 100	≥ 50	≥ 50	≥ 100	≥ 100	≥ 100	≥ 0		
	Cable bundles		≥ 0		≥ 100	≥ 75	≥ 100	≥ 75	≥ 20	≥ 100	≥ 100	≥ 50	≥ 50	≥ 100	≥ 100	≥ 100	≥ 0		
	Cable trays		≥ 0 / ≥ 100 (adjacent / one above the other)		≥ 100	≥ 75	≥ 100	≥ 75	≥ 20	≥ 100	≥ 100	≥ 50	≥ 50	≥ 100	≥ 100	≥ 100	≥ 0		
	Wave guides / coaxial cables		≥ 100		≥ 50	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 25		
	EIR, single/bundled, made of plastic	with NBR-plus			≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 75	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 25		
		with N II KS			≥ 100	≥ 100	≥ 0	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 25		
	EIR, single, made of steel		≥ 75		≥ 100	≥ 100	≥ 100	≥ 0	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 75	≥ 0		
	Combustible pipes	with Variant N II A			≥ 100	≥ 100	≥ 100	≥ 100	≥ 50	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 50	≥ 25		
		with Variant N EC			≥ 100	≥ 75	≥ 100	≥ 100	≥ 100	≥ 50	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 50	≥ 25		
		with KSL-W			≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 25		
	Non-combustible pipes with FEF insulation		≥ 0		≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 0	≥ 0	≥ 100	≥ 100	≥ 100	≥ 25		
	Non-combustible pipes with insulation made of mineral wool		≥ 0		≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 0	≥ 0	≥ 100	≥ 100	≥ 100	≥ 25		
	Multilayer pipes		≥ 100		≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 40	≥ 100	≥ 100	≥ 20		
	HVAC split line combinations		≥ 100		≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 0	≥ 0	≥ 100	≥ 50	≥ 100	≥ 25		
	CT Cable Tube		≥ 100		≥ 100	≥ 100	≥ 100	≥ 75	≥ 50	≥ 50	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 10		

Dimensions in mm

KSL double layer

5. Used Products



BML fire stop compound

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



BMS fire stop filler

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



BMK filler

0.4 kg cartridge – Art. no. 30004



Section and protective insulations

made of flexible elastomeric foam (FEF)
in accordance with EN 14304



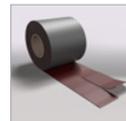
Variant N II A fire protection collar

Ø 32–160 mm – Art. no. 15032–15160



KSL-W fire protection wrap

Roll à 20 m × 50 mm self-adhesive
– Art. no. 15520
Roll à 10 m × 100 mm self-adhesive
– Art. no. 15530



NBR-plus fire protection wrap

in accordance with ETA-21/0461
Roll à 10 m × 125 mm
pre-slotted (separable into 2x 62.5 mm)
– Art. no. 01261941



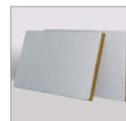
Variant N EC fire protection collar

10 m fire protection wrap, 3 m metal strip,
18 hooks, 6 labels
– Art. no. 15103



Mineral wool A1

Reaction to fire class acc. to EN 13501-1: A1
Melting point ≥ 1000 °C
10 kg bag – Art. no. 01183000



BSL mineral fibre board

Pre-coated on one side with BML fire stop
compound
(dry film thickness = approx. 1.0 mm)
Dimensions 1000 × 625 × 50 mm –
Art. no. 50050



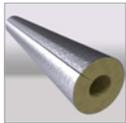
Mineral fibre board

Bulk density: ≥ 150 kg/m³
Melting point ≥ 1000 °C
Thickness: ≥ 500 mm
e.g. Rockwool Hardrock 040 or PAROC
Pyrotech Slab 160

for example:

Name	DIN/abZ/abP
Armaflex Protect	(0543-CPR-2016-001 of 01.04.2015)
AF/Armaflex	0543-CPR-2016-001 of 01.04.2015
SH/Armaflex	0543-CPR-2013-013 of 01.01.2015
NH/Armaflex	0552-CPR-2013-015 of 08.08.2018
FEF Kaiflex KKplus s1	DoP KKplus s1 01032018001 of 01.03.2018
FEF Kaiflex HTplus	DoP HTplus s1 01032018001 of 01.03.2018
K-Flex R90	P-2300/871/16-MPA BS of 04.10.2016
flexen Heizungskautschuk	LE_5258006015_00_M_flexen_Heizungskautschuk of 30.06.2013
flexen Kältekautschuk	LE_0869806006_00_M_flexen_Kältekautschuk of 30.06.2013

KSL double layer



Mineral fibre lamella mat or pipe sleeves

Classification: A2-S1, d0 or A1 in accordance with EN 13501-1

Minimum bulk density: 35 kg/m³

Melting point ≥ 1000 °C

for example:

Bezeichnung	Nominal bulk density [kg/m ³]	DIN/ abZ/abP
Rockwool lamella mat KLIMAROCK Roll à 3.05 m ² – Art. no. 01187100	40-50	DE0628031801 of 14.03.2018
Rockwool ProRox PS 960 (formerly ROCKWOOL Lapimus Pipe sleeve 880)	95-150	PROPS960NL-03
Rockwool 800	90-115	DE0721011801 of 15.01.2018
Rockwool ProRox WM 950 (formerly WM 80/RTD-2)	85	PROWM950D-03 of 04.05.2017
Rockwool ProRox WM WM 960 (formerly WM 100/ RBM)	100	PROWM960D-03 of 04.05.2017
Rockwool Conlit 150 U	150	P-NDS04-417
Isover Schalen Protect 1000 S, Isover Schalen Protect 1000 S Alu	70-90	DE0002-Pi-pe_Sections 001 of 10.06.2013
Isover mineral fibre mat MD2 and MD2/A	80	DE0002-Pro-rect_EN14303 002 of 09.02.2015
Isover mineral fibre mat MDD and MDD/A	115	

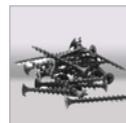


CT Cable Tube

consisting of CT Cable Tube and two soft foam plugs

Ø 90 mm / L 300 mm – Art. no. 01279300

Ø 120 mm / L 300 mm – Art. no. 01281300



Fastening devices for fire protection collars

Coarse thread screws:

WÜRTH ASSY-D 8x70 mm

HECO-TOPIX 8x80 mm

SPAX T-STAR plus 8x80 mm

or equivalent

Spiral screws:

Bohl Fireprotect Screw 60 mm

Rockwool Conlit Screw 65 mm

or equivalent

5.1 Declaration of Performance

The Declaration of Performance for the featured product is available for download on our website:

<https://svt-global.com/downloads>

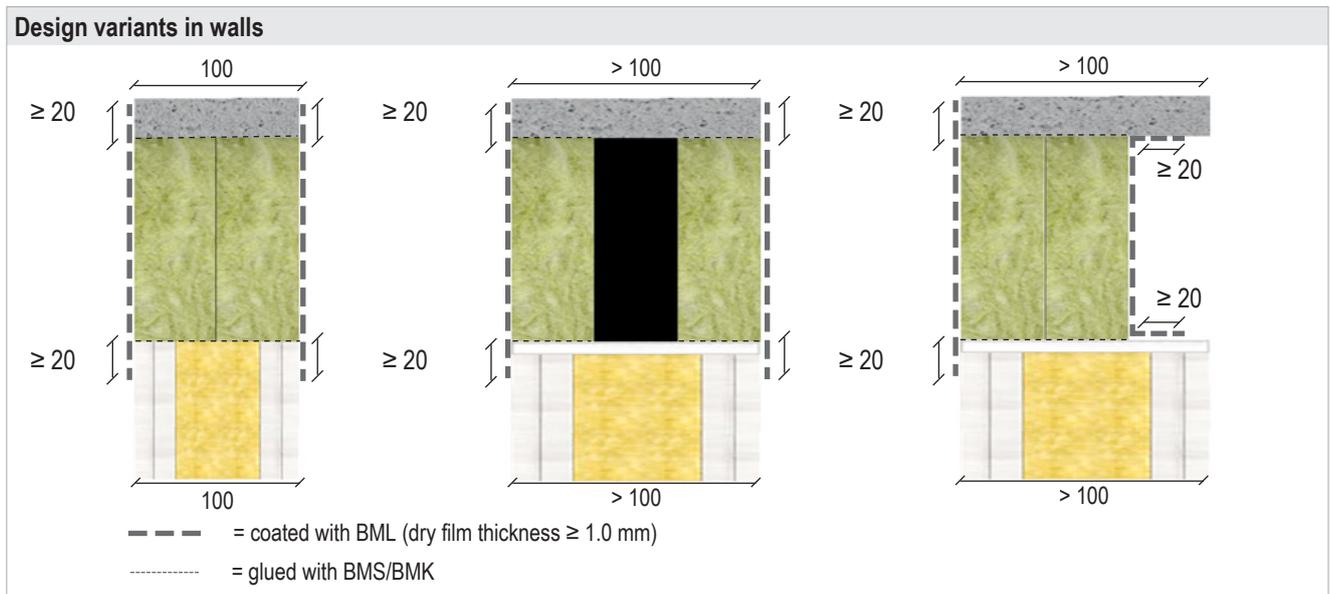
KSL double layer

6. Design variants

Remaining annular gaps (≤ 25 mm) must be completely tightly filled with mineral wool and sealed with BMS, BMK oder BML (dry film thickness ≥ 1.0 mm).

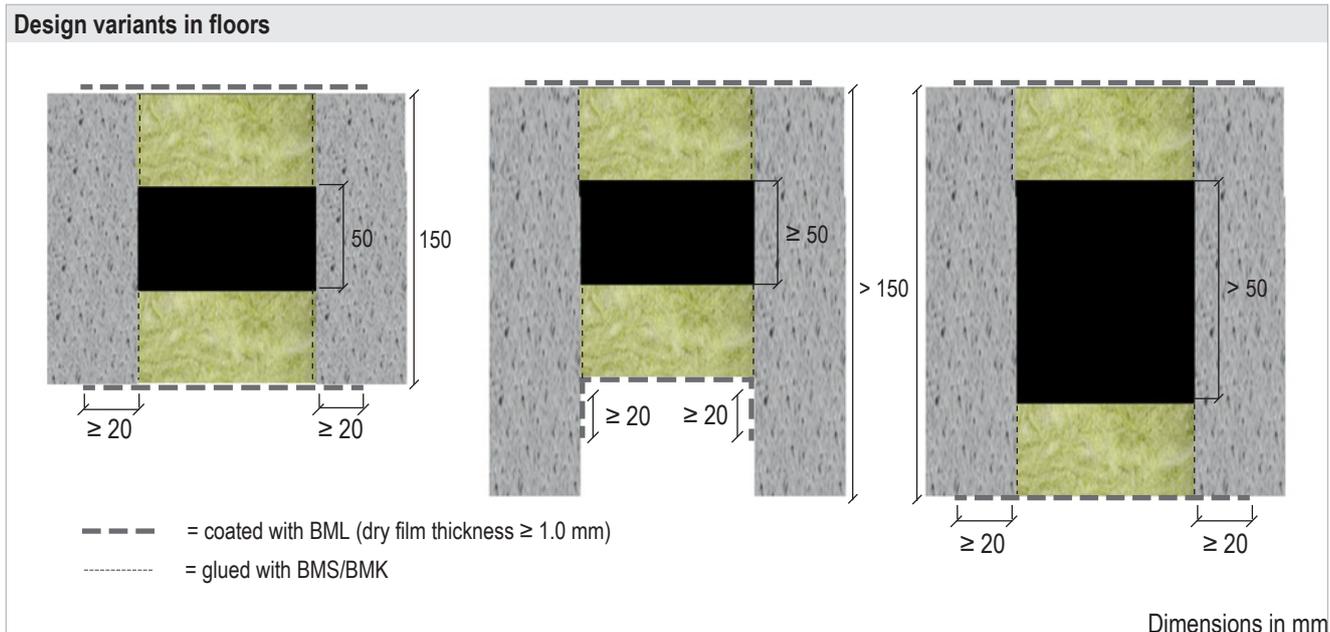
The mineral fibre boards must be glued with BML, BMS or BMK along all edges.

The mineral fibre boards must be glued to the seal edge using BMS/BMK.



When installing in plasterboard walls without reveal cladding, the fire resistance class of the penetration seal is reduced to max. EI 90.

Dimensions in mm



KSL double layer

Design variants in shaft walls

When installing in shaft walls, the fire resistance class of the penetration seal is reduced to max. EI 90. Dimensions in mm

6.1 Initial brackets (supports)

Essential parts of the brackets/supports for the installations in front of the wall penetration sealing system must be non-combustible and must be configured with a spacing as per the overview on both sides.

		wall – X [mm]	floor – X [mm]
	Cables, cable bundle, cable trays	≤ 650 mm on both sides	≤ 650 mm above
	Coaxial cables, wave guides	≤ 250 mm on both sides	≤ 250 mm above
	Cable Tubes	≤ 250 mm on both sides	≤ 250 mm above
	Electrical installation conduits (installation with NBR-plus)	≤ 250 mm on both sides	≤ 250 mm above
	Electrical installation conduits (installation with N II KS)	≤ 500 mm on both sides	≤ 500 mm above
	HVAC split line combinations	≤ 250 mm on both sides	≤ 250 mm above
	Combustible pipes	≤ 500 mm on both sides	≤ 650 mm above
	Multilayer pipes	≤ 650 mm on both sides	≤ 650 mm above
	Non-combustible pipes with non-combustible section insulation	≤ 500 mm on both sides	≤ 850 mm above
	Non-combustible pipes with fire protection wrap	≤ 500 mm on both sides	≤ 500 mm above

KSL double layer

7. Fire protection measures

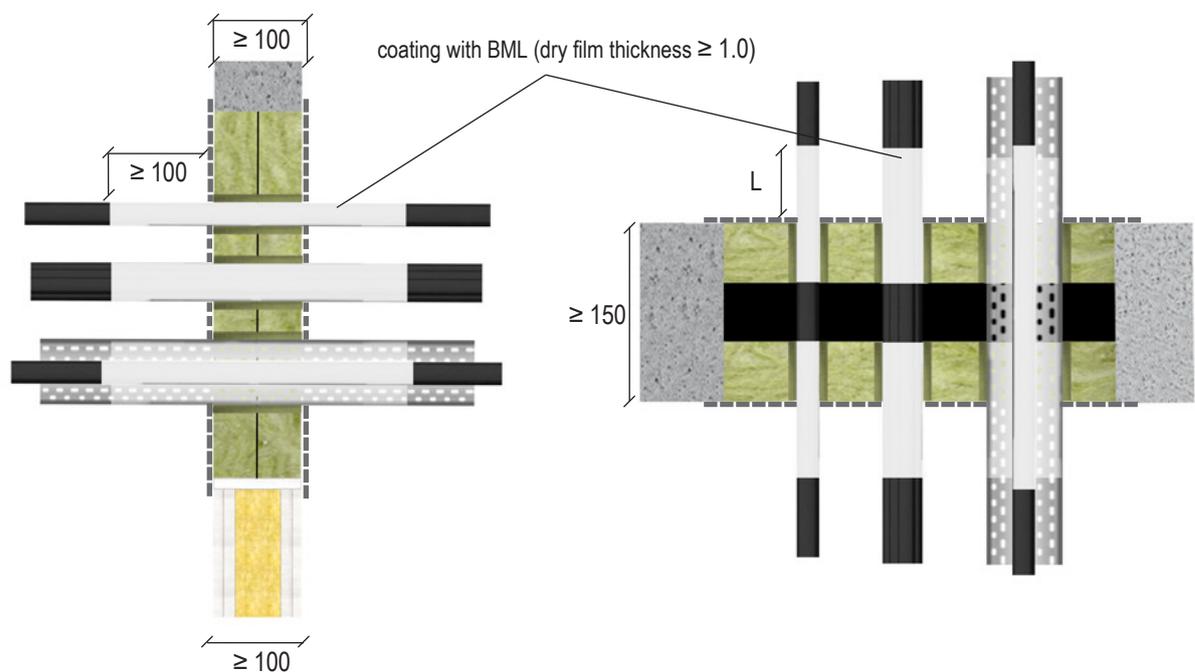
7.1 Cables / cable bundles / cable trays

All cables, cable bundles and cable trays (as measured from the seal surface) must be coated over a length of ≥ 100 mm with BML on both sides of the penetration seal.

All cables must be coated inside the penetration area (below the mineral fibre boards) with a thickness of ≥ 1.0 mm (total dry film thickness).

Cable trays made of steel may either penetrate the seal or end at the seal surface.

Design for wall and floor penetration seals



For thicknesses and design variants, see page 25

Dimensions in mm

KSL double layer

Wall		
Service	Coating with BML on both sides	Fire resistance class
Cables $\varnothing \leq 21$ mm	100 × 1.0 mm (L × TSD)	EI 120
Cables $\varnothing \leq 50$ mm		EI 90 / E 120
Cables $\varnothing \leq 80$ mm		EI 90 / E 120
Cable bundles $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm		EI 120

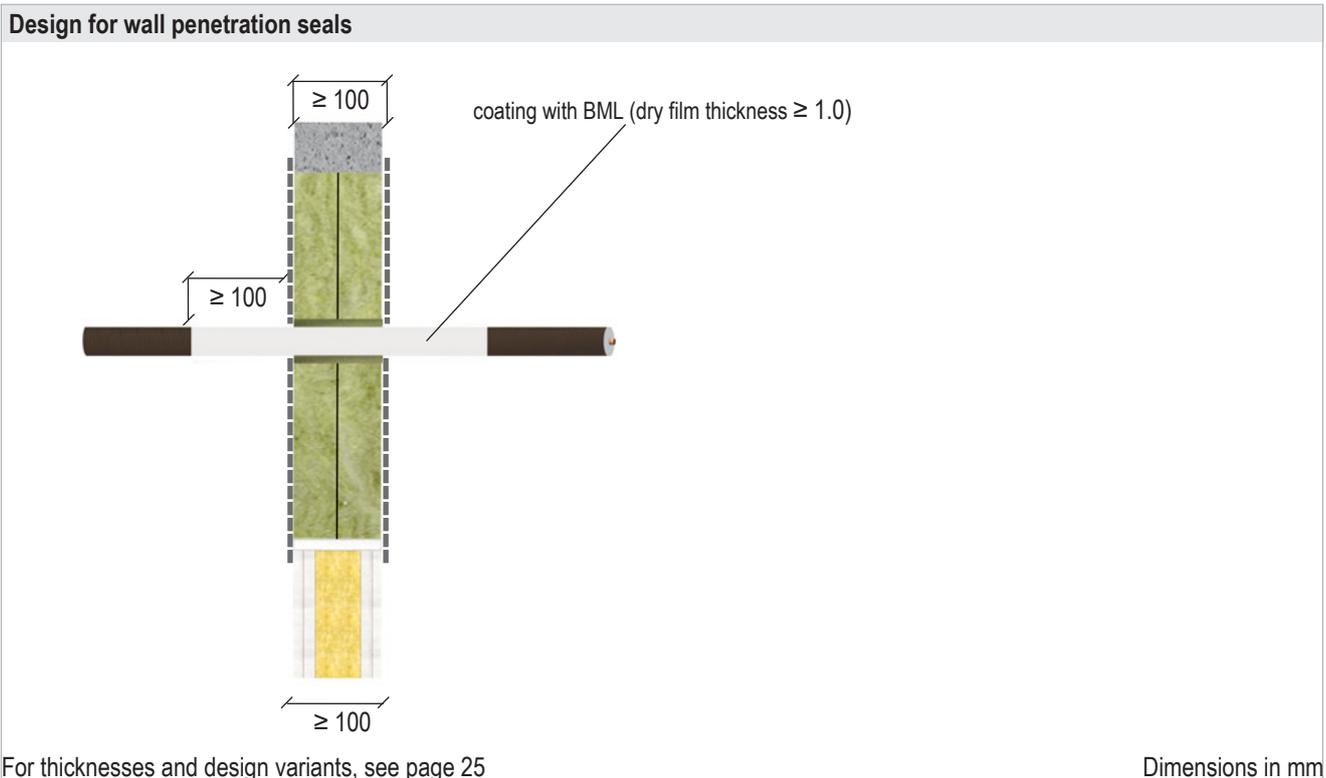
Floors		
Service	Coating with BML on both sides	Fire resistance class
Cables $\varnothing \leq 21$ mm	100 × 1.0 mm (L × dry film thickness)	EI 120
Cables $\varnothing \leq 50$ mm		EI 90 / E 120
		150 × 1.0 mm (L × dry film thickness)
Cables $\varnothing \leq 80$ mm	100 × 1.0 mm (L × dry film thickness)	EI 90 / E 120
	150 × 1.0 mm (L × dry film thickness)	EI 120
Cable bundles $\varnothing \leq 100$ mm with single cables $\varnothing \leq 21$ mm	100 × 1.0 mm (L × dry film thickness)	EI 120

KSL double layer

7.2 Coaxial cables and wave guides

All coaxial cables and wave guides (as measured from the seal surface) must be coated with BML over a length ≥ 100 mm of on both sides of the penetration seal.

All coaxial cables and wave guides must be coated inside the penetration area (below the mineral fibre boards) with a thickness of ≥ 1.0 mm (total dry film thickness).

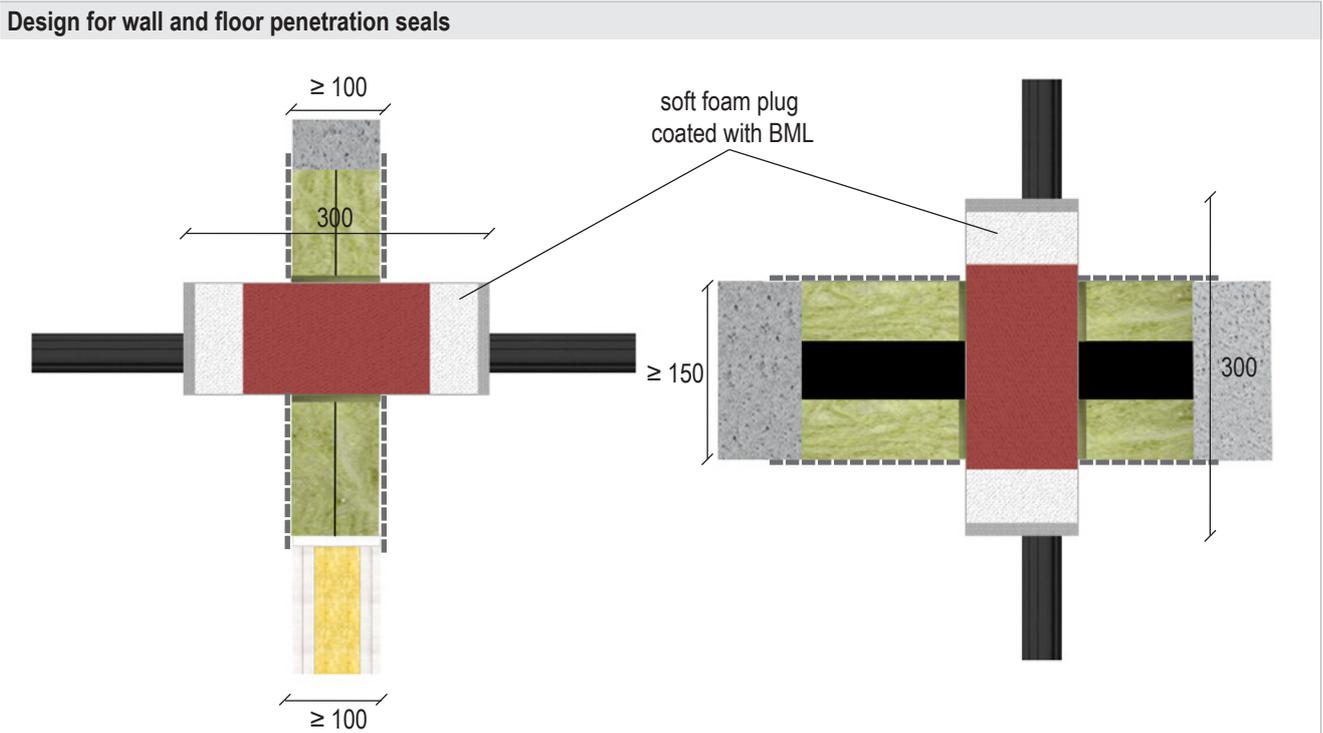


Wall		
Service	Coating with BML on both sides	Fire resistance class
CommScope HELIAX®, $\varnothing \leq 51.1$	100 × 1.0 mm (L × dry film thickness)	EI 120 U/C
RFS CELLFLEX®, $\varnothing \leq 50.3$		
RFS RADIAFLEX®, $\varnothing \leq 48.2$		

KSL double layer

7.3 Cable Tube

The Cable Tube must be installed centrally in the penetration seal.



For thicknesses and design variants, see page 25

Dimensions in mm

Wall		
Service	Outer Ø [mm]	Fire resistance class
Cables	≤ 21	EI 90
Cable bundles	≤ 100	

Floors		
Service	Outer Ø [mm]	Fire resistance class
Cables	≤ 21	EI 120
Cable bundles	≤ 100	

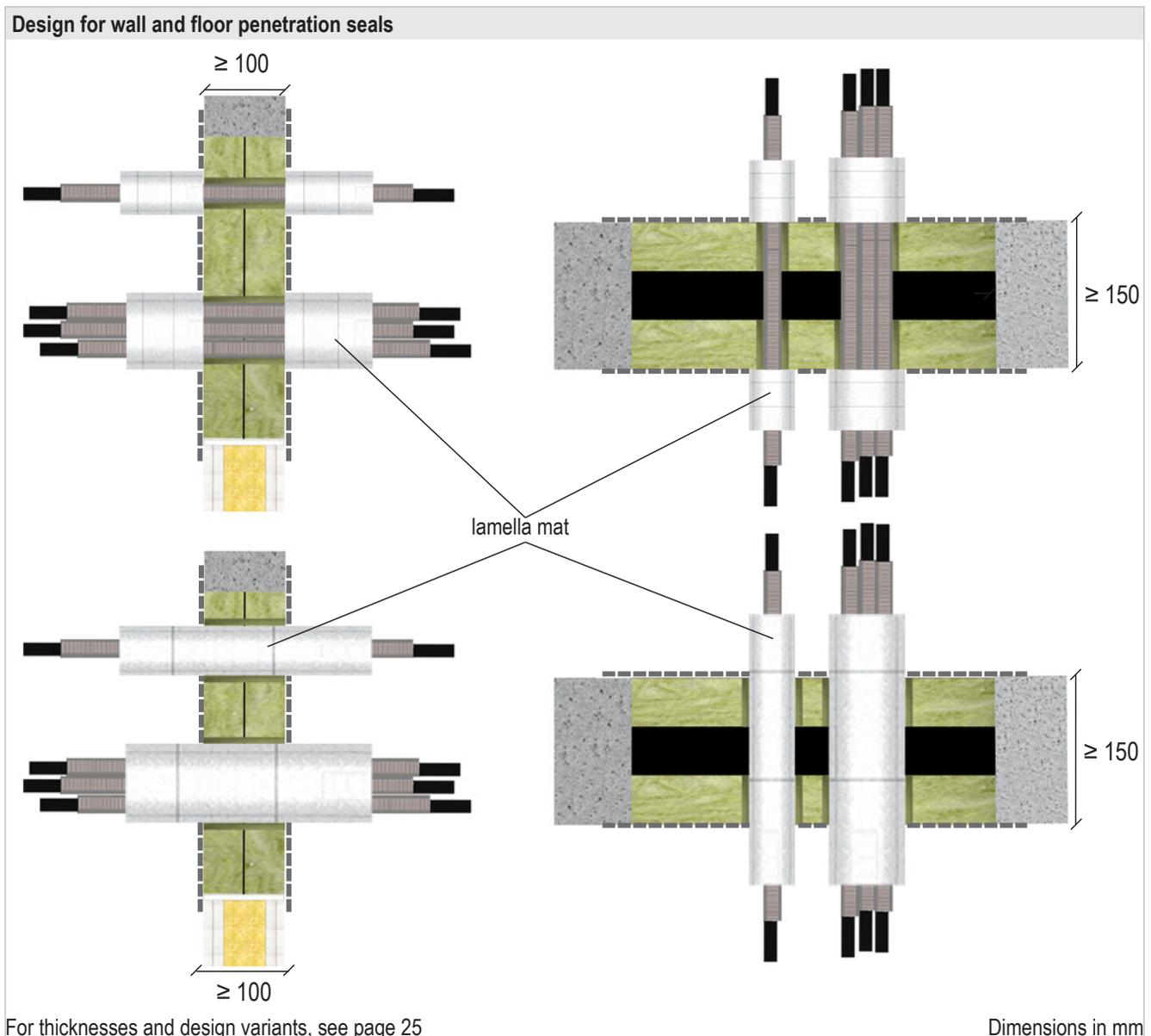
KSL double layer

7.4 Electrical installation conduits (EIC)

7.4.1 EIC made of steel

Electrical installation conduits (EIC) made of steel must protrude at least 350 mm from the penetration seal.

Empty electrical installation conduits (EIC) made of steel must be sealed with a depth of 15 mm deep using mineral wool and BMS/BML/BMK on both sides when installing in walls, on the upper side when installing in floors.



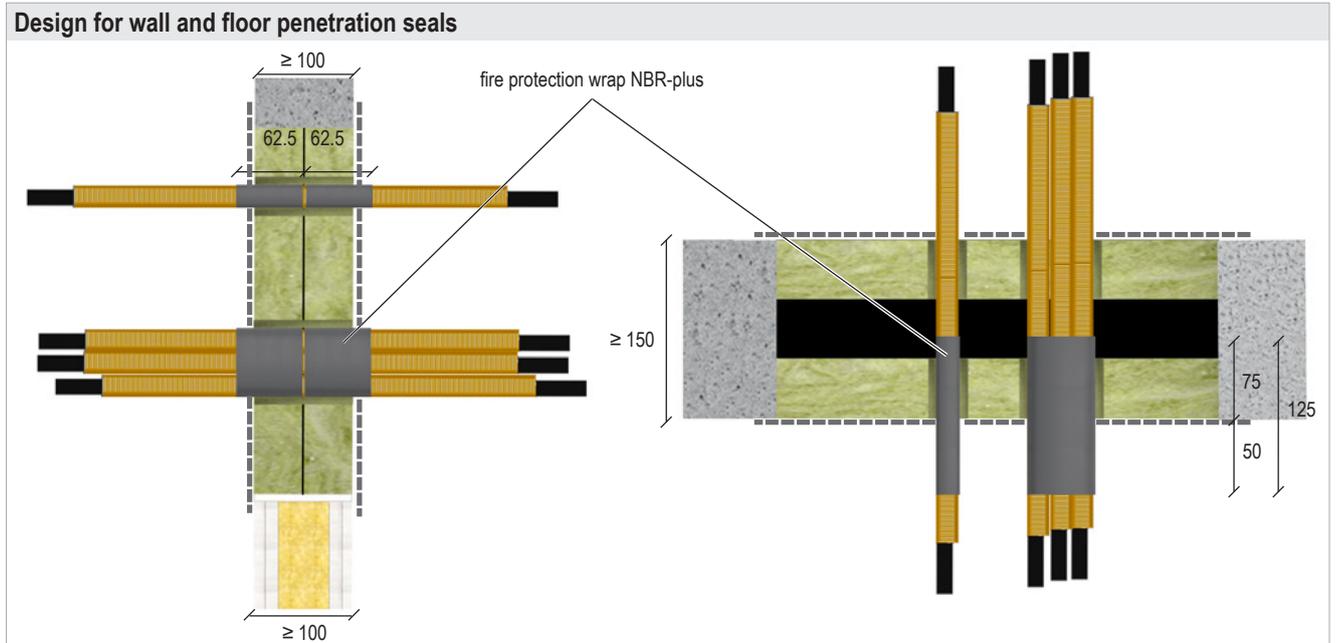
KSL double layer

Wall				
Service	Outer Ø [mm]	Lamella mat		Fire resistance class
		Insulation thickness [mm]	Insulation length [mm]	
Electrical installation conduits made of steel, single, with/without cables ≤ 21 mm	≤ 32	30	500	EI 120 U/C
Electrical installation conduits made of steel, bundle, with/without cables ≤ 21 mm	3 × ≤ 32	30	500	EI 90 U/C

Floor				
Service	Outer Ø [mm]	Lamella mat		Fire resistance class
		Insulation thickness [mm]	Insulation length [mm]	
Electrical installation conduits made of steel, single, with/without cables ≤ 21 mm	≤ 32	30	500	EI 120 U/C
Electrical installation conduits made of steel, bundle, with/without cables ≤ 21 mm	3 × ≤ 32	30	500	EI 90 U/C

KSL double layer

7.4.2 EIC made of plastic – installation with fire protection wrap



For thicknesses and design variants, see page 25

Dimensions in mm

Wall								
Service	Outer Ø [mm]	fire protection wrap NBR-plus						Fire resistance class
		Wrap width [mm]	Number of wraps [n]	Number of layers [n]	Overlap [mm]	Inside seal [mm]	Outside seal [mm]	
Electrical installation conduits made of plastic, single, with/without cables ≤ 21 mm	≤ 32	62.5	2	-	47.5–50.0	12.5–15.0	1	EI 120 U/U
Electrical installation conduits made of plastic, bundle, with/without cables ≤ 21 mm	≤ 32, bundled to ≤ 100						2	

Floor								
Service	Outer Ø [mm]	Fire protection wrap NBR-plus						Fire resistance class
		Wrap width [mm]	Number of wraps [n]	Number of layers [n]	Overlap [mm]	Inside seal [mm]	Outside seal [mm]	
Electrical installation conduits made of plastic, single, with/without cables ≤ 21 mm	≤ 32	125	1	-	75	50	1	EI 120 U/U
Electrical installation conduits made of plastic, bundle, with/without cables ≤ 21 mm	≤ 32, bundled to ≤ 100						2	

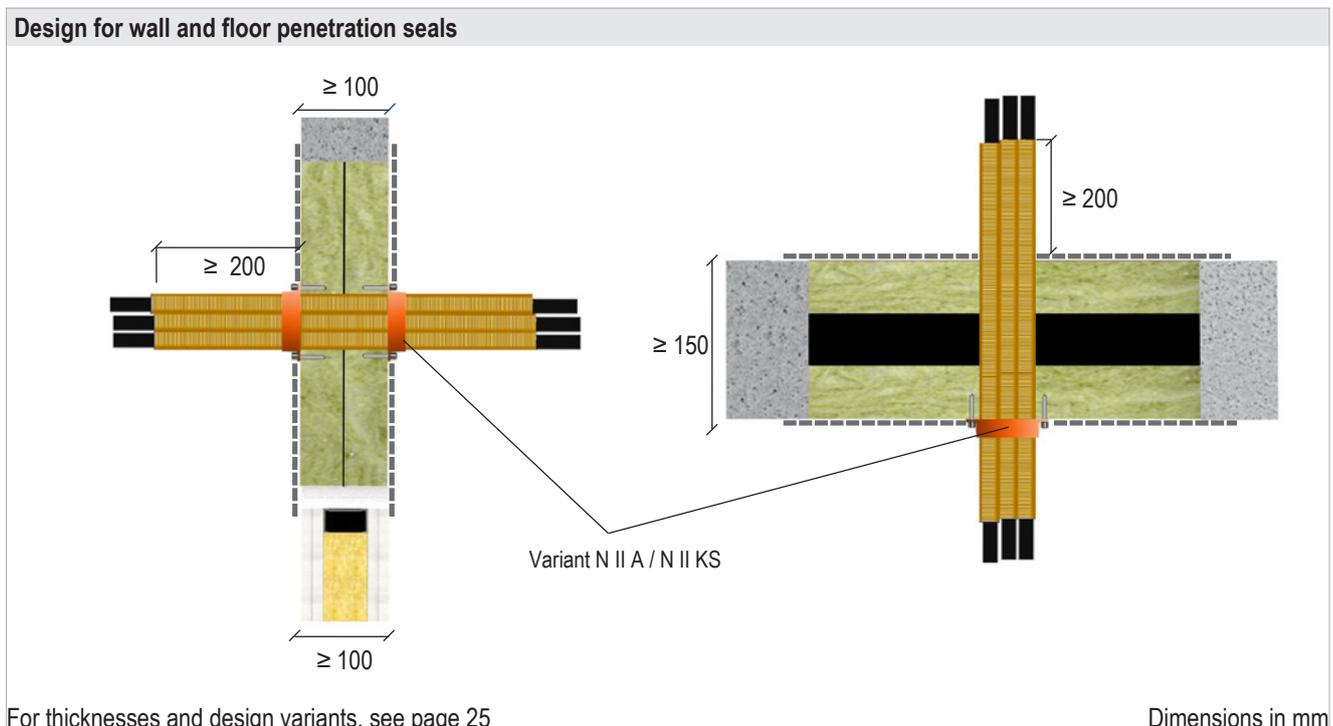
KSL double layer

7.4.3 EIC made of plastic – installation with fire protection collar

EIC ends must be sealed with BMS/BMK with a depth of ≥ 10 mm on one side. Empty EICs must be filled with mineral wool with a depth of ≥ 10 mm and sealed with BMS/BMK (≥ 1 mm).

Always use the smallest possible pipe collar in relation to the diameter of the EIC bundle (distance between EIC and collar ≤ 15 mm). Pipe collars are fastened with coarse thread screws or threaded rods.

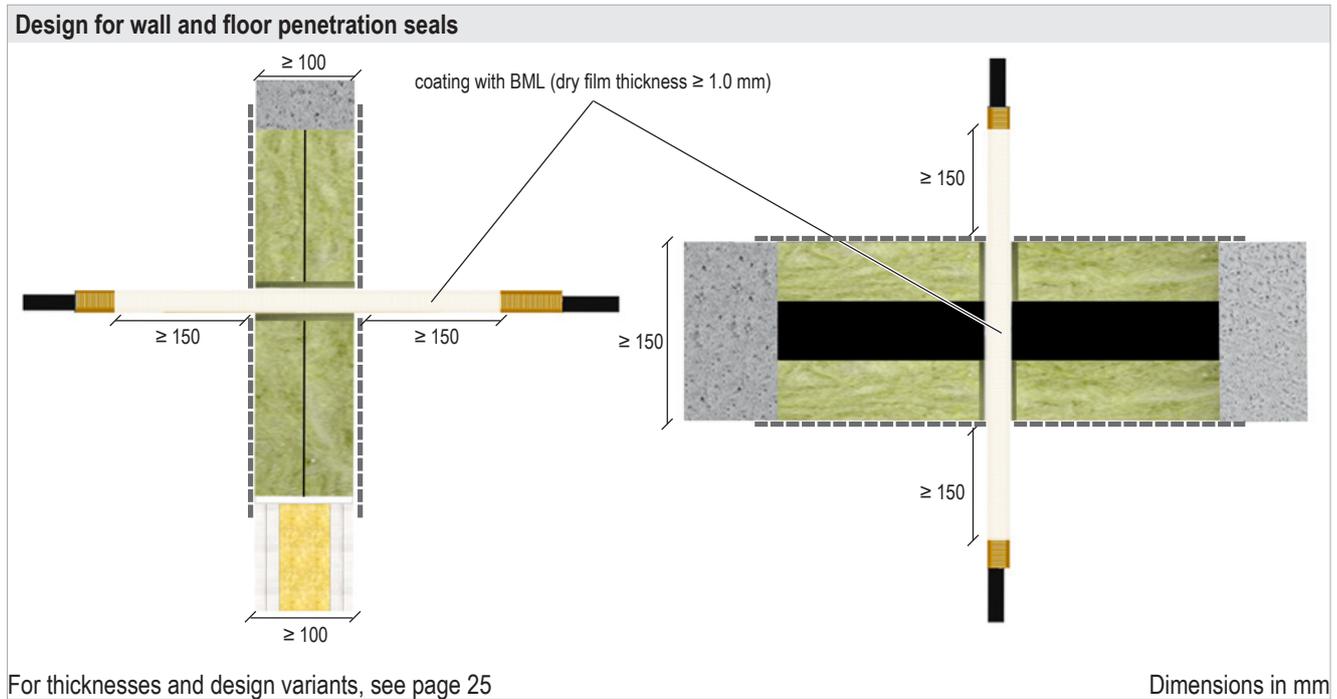
EIC bundles (minimum length on both sides of the seal 200 mm) must be fixed on both sides of the seal with e.g. self-adhesive tape or plastic cable ties at max. 100 mm.



Wall and floor			
Service	Outer Ø [mm]	Measure	Fire resistance class
Electrical installation conduits made of plastic, single, with/without cables ≤ 21 mm	≤ 63	wall: Variant N II A / N II KS collar on both sides	EI 90 U/C
Electrical installation conduits made of plastic, bundle, with/without cables ≤ 21 mm	≤ 32 , bundled to ≤ 125	floor: Variant N II A / N II KS collar on lower side	

KSL double layer

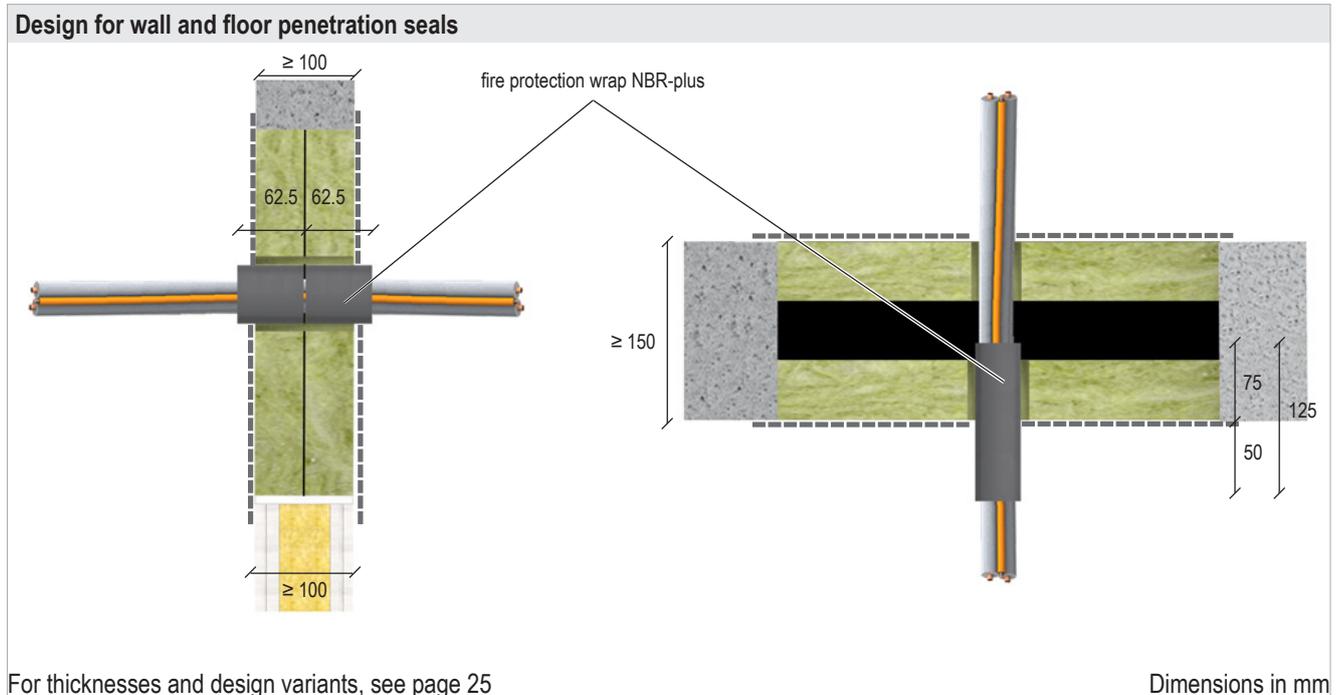
7.4.4 EIC made of plastic – installation with fire protection coating



Wall and floor			
Service	Outer Ø [mm]	Coating with BML on both sides	Fire resistance class
Electrical installation conduits made of plastic, single, with/without cables ≤ 21 mm	≤ 32	$\geq 150 \times \geq 1.0$ mm (L x dry film thickness)	EI 90 U/C

KSL double layer

7.5 HVAC split line combinations



Wall							
Service	Fire protection wrap NBR-plus						Fire resistance class
	Wrap width [mm]	Number of wraps [n]	Number of layers [n]	Overlap [mm]	Inside seal [mm]	Outside seal [mm]	
Up to 2 copper pipes $\varnothing \leq 18.0$ mm, pipe wall thickness 1.0–14.2 mm, 9 mm PE foam, 1 pipe PVC-U/PVC-C $\varnothing \leq 25.0$ mm, pipe wall thickness 1.5 mm, up to 3 cables $\varnothing \leq 14.0$ mm	62.5	2	0	47.5–50.0	12.5–15.0	2	EI 120

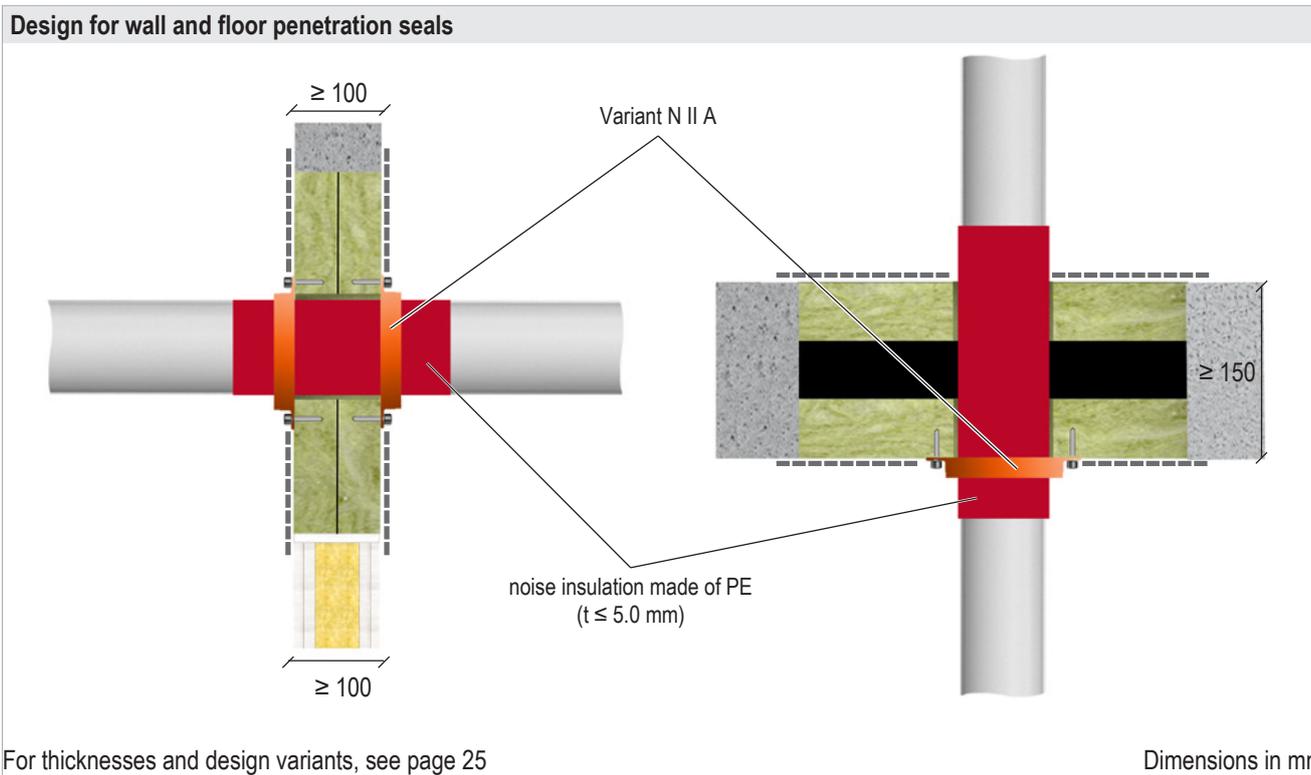
Floor							
Service	Fire protection wrap NBR-plus						Fire resistance class
	Wrap width [mm]	Number of wraps [n]	Number of layers [n]	Overlap [mm]	Inside seal [mm]	Outside seal [mm]	
up to 2 copper pipes $\varnothing \leq 18.0$ mm, pipe wall thickness 1.0–14.2 mm, 9 mm PE foam, 1 pipe PVC-U/PVC-C $\varnothing \leq 25.0$ mm, pipe wall thickness 1.5 mm, up to 3 cables $\varnothing \leq 14.0$ mm	125	1	0	75	50	2	EI 120

KSL double layer

7.6 Combustible pipes

7.6.1 Installation with fire protection collar

Always use the smallest possible pipe collar in relation to the diameter of the pipe. Pipe collars are fastened with coarse thread screws or threaded rods.



KSL double layer

Wall (attached with coarse thread screws)				
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Fire protection collar	Fire resistance class
PVC-U, PVC-C	32.0–160.0	1.8–11.9	Variant N II A on both sides*	EI 90 U/U
PE-HD, ABS, SAN + PVC	32.0–50.0	1.8–4.6	Variant N II A on both sides*	EI 120 U/U
	> 50.0 – 160.0	1.9–14.6	Variant N II A on both sides	EI 90 U/U
PP	32.0–50.0	1.8–4.6	Variant N II A on both sides*	EI 120 U/U
	> 50.0 – 160.0	1.9–14.6	Variant N II A on both sides	EI 90 U/U
PE-HD, ABS, SAN + PVC	32.0–160.0	2.7–4.6	Variant N II A on both sides**	EI 120 U/U
PP	110.0	10.0	Variant N II A on both sides**	EI 120 U/U
CONEL DRAIN	40.0–160.0	1.8–3.9	Variant N II A on both sides	EI 120 U/U
Pipelife Master 3	40.0–160.0	1.8–4.4	Variant N II A on both sides	EI 120 U/U
KE KELIT PHON EX AS	58.0–160.0	4.0–5.3	Variant N II A on both sides	EI 120 U/U
Wavin AS	58.0–160.0	4.0–5.3	Variant N II A on both sides	EI 120 U/U
POLO-KAL 3S	90.0–110.0	4.5–4.8	Variant N II A on both sides	EI 120 U/U
POLO-KAL NG, POLO-KAL XS	40.0–110.0	1.8–3.4	Variant N II A on both sides	EI 120 U/U
REHAU RAUPIANO PLUS	50.0–160.0	1.8–3.9	Variant N II A on both sides	EI 120 U/U
REHAU RAUPIANO LIGHT	40.0–160.0	1.8–3.9	Variant N II A on both sides	EI 120 U/U
Geberit Silent-dB20	56.0–110.0	3.2–6.0	Variant N II A on both sides	EI 120 U/U
	56.0–160.0	3.2–7.0	Variant N II A on both sides	EI 90 U/U
Geberit Silent-PP	32.0–160.0	2.0–5.2	Variant N II A on both sides	EI 120 U/U
Geberit Silent-Pro	50.0–160.0	3.0–6.0	Variant N II A on both sides	EI 120 U/U
GF Silenta Premium	58.0–160.0	4.1–5.3	Variant N II A on both sides	EI 120 U/U
Hakan Silenta Premium	58.0–160.0	4.1–5.3	Variant N II A on both sides	EI 120 U/U
Wavin SiTech+	32.0–160.0	1.8–5.0	Variant N II A on both sides	EI 120 U/U
Valsir Triplus	32.0–160.0	1.8–4.9	Variant N II A on both sides	EI 120 U/U

* without noise insulation, attached with threaded rod
**attached with spiral screw

KSL double layer

Floor (attached with coarse thread screws)				
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Fire protection collar	Fire resistance class
PVC-U, PVC-C	32.0–50.0	1.8–5.6	Variant N II A below floor*	EI 120 U/U
	> 50.0 – 160.0	1.8–12.3	Variant N II A below floor*	EI 90 U/U
PE-HD, ABS, SAN + PVC	32.0–125.0	1.8–14.6	Variant N II A below floor*	EI 120 U/U
PP	32.0–50.0	1.8–4.6	Variant N II A below floor*	EI 120 U/U
	> 50.0 – 160.0	1.9–14.6	Variant N II A below floor*	EI 90 U/U
PE-HD, ABS, SAN + PVC	160.0	4.0	Variant N II A below floor**	EI 90 U/U
REHAU RAUPIANO LIGHT	75.0–110.0	1.9–2.7	Variant N II A below floor	EI 90 U/U
CONEL DRAIN	75.0–110.0	1.9–2.7	Variant N II A below floor	EI 90 U/U
POLO-KAL NG, POLO-KAL XS	90.0–160.0	3.0–4.9	Variant N II A below floor	EI 90 U/U
Geberit Silent-PP	40.0–110.0	2.0–3.6	Variant N II A below floor	EI 90 U/U
Geberit Silent-Pro	50.0–110.0	3.0–4.5	Variant N II A below floor	EI 90 U/U
GF Silenta Premium	58.0–110.0	4.1–5.3	Variant N II A below floor	EI 90 U/U
Hakan Silenta Premium	58.0–110.0	4.1–5.3	Variant N II A below floor	EI 90 U/U
Wavin SiTech+	32.0	1.8	Variant N II A below floor	EI 90 U/U
	75.0–160.0	2.6–5.0	Variant N II A below floor	EI 90 U/U
Valsir Triplus	32.0–50.0	1.8	Variant N II A below floor	EI 90 U/U

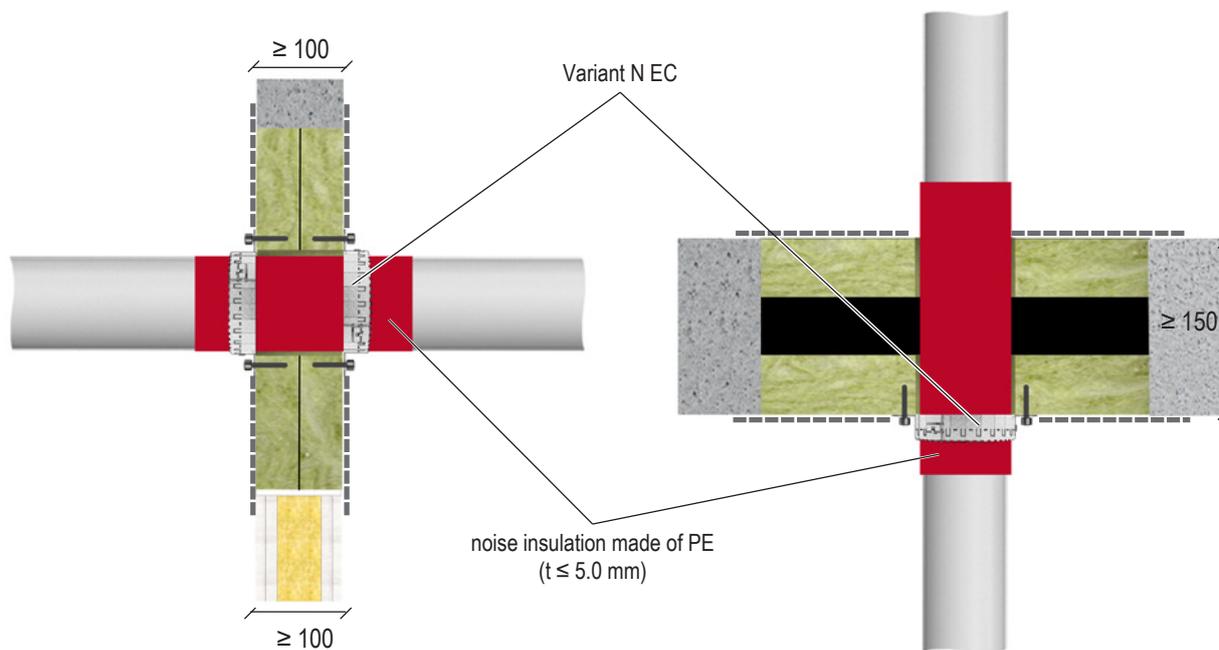
* without noise insulation, attached with threaded rod
 **attached with spiral screw

KSL double layer

7.6.2 Installation with endless collar

Pipe collars are fastened with coarse thread screws, spiral screws or threaded rods.

Design for wall and floor penetration seals



For thicknesses and design variants, see page 25

Dimensions in mm

KSL double layer

Wall (attached with coarse thread screws)				
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Variant N EC	Fire resistance class
			Number of layers [n]	
PVC-U, PVC-C	90.0–110.0	1.8	4	EI 120 U/U
	40.0–50.0	2.0–5.6	2	EI 90 U/U
	50.0 – < 75.0	1.9–7.0	3	
	75.0–110.0	1.8–9.0	4	
	110.0–125.0	1.8–9.8	5	
	125.0–160.0	2.3–11.9	6	
PE-HD, ABS, SAN+PVC	40.0–50.0	1.8–4.6	2	EI 120 U/U
	50.0–75.0	1.8–3.8	3	EI 90 U/U
	63.0–75.0	2.2–3.8		
	90.0	2.7	4	
	110.0	2.7		
PP	90.0–110.0	2.7	4	
POLO-KAL NG, POLO-KAL XS	90.0–110.0	3.0–3.4	4*	EI 120 U/U
	110.0–125.0	3.4–3.9	5*	
	125.0–160.0	3.9–4.9	6*	
REHAU RAUPIANO PLUS	75.0–90.0	1.9–2.2	4	EI 90 U/U
	90.0–110.0	2.2–2.7	4*	EI 120 U/U
	110.0–125.0	2.7–3.1	5*	
	125.0–160.0	3.1–3.9	6*	
Geberit Silent-PP	32.0–50.0	2.0	2	EI 120 U/U
	50.0–75.0	2.0–2.6	3*	EI 120 U/U
	75.0–90.0	2.6–3.1	4*	
	90.0–110.0	3.1–3.6	4*	
			4	EI 90 U/U
Wavin SiTech+	32.0–50.0	2.0–2.1	2*	EI 120 U/U
	50.0–75.0	2.1–2.6	2	EI 90 U/U
			3	
			4	
			4	

* attached with spiral screw

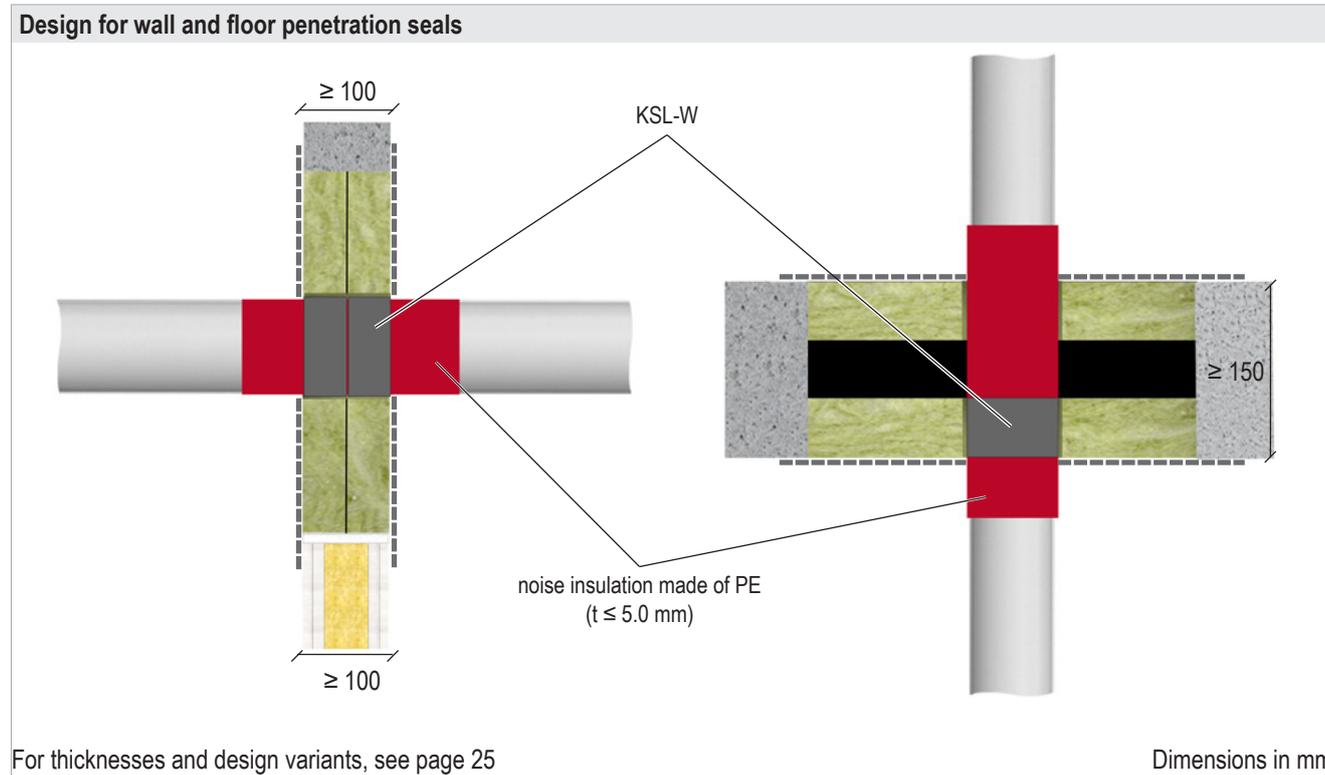
KSL double layer

Floor (attached with coarse thread screws)				
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Variant N EC	Fire resistance class
			Number of layers [n]	
PVC-U, PVC-C	40.0–50.0	1.8–5.6	2	EI 120 U/U
	50.0–75.0	2.1–5.1	3	
	75.0–110.0	2.1–4.3	4	
	110.0–125.0	2.6–4.0	5	
	125.0	2.8–4.0	5	
	140.0–160.0	3.2	6	
PE-HD, ABS, SAN+PVC	40.0–50.0	4.6	2	EI 90 U/U
	50.0–63.0	3.8–4.6	3	
	63.0–75.0	3.8	4	
	75.0–90.0	2.7–3.8	4	
	90.0–110.0	2.7–4.6	4	EI 120 U/U
			4	
PP	40.0–50.0	1.8–4.6	2	EI 120 U/U
	50.0–63.0	4.6–5.2	3	
	63.0–75.0	5.2–6.8	3	
	75.0–90.0	5.2–10.0	4	
	90.0–110.0	10.0	4	
REHAU RAUPIANO PLUS	75.0–90.0	1.9–2.2	4	EI 120 U/U
Geberit Silent-PP	32.0–50.0	2.0	2*	EI 90 U/U
Wavin SiTech+	32.0–50.0	2.0–2.1	3*	EI 90 U/U

* attached with spiral screw

KSL double layer

7.6.3 Installation with fire protection wrap



KSL double layer

Wall								
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	KSL-W				Fire resistance class	
			Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]		Number of layers [n]
PVC-U	≤ 50.0	1.8–5.6	50	2	45–50	0–5	2	EI 120 U/U
	> 50.0 – ≤ 110.0	1.8–12.3					4	
PE-HD	≤ 50.0	1.8–4.6					2	
	> 50.0 – ≤ 110.0	1.8–10.0					4	
PP	≤ 50.0	1.8–4.6					2	
	> 50.0 – ≤ 110.0	1.8–10.0					4	
Geberit Silent-PP	≤ 50.0	–					2	
	≤ 110.0	–					4	
Geberit Silent-Pro	≤ 75.0	–					2	
	≤ 110.0	–					4	
KE KELIT PHON EX AS	≤ 56.0	–					2	
	≤ 110.0	–					4	
Pipelife Master 3	≤ 50.0	–					2	
	≤ 110.0	–					4	
POLO-KAL NG	≤ 50.0	–					2	
	≤ 110.0	–					4	
CONEL DRAIN	≤ 50.0	–					2	
	≤ 110.0	–					4	
Geberit Silent-dB 20	≤ 56.0	–					2	
	≤ 110.0	–					4	
Wavin SiTech+	≤ 50.0	–	2					
	≤ 110.0	–	4					
POLO-KAL XS	≤ 50.0	–	2					
	≤ 110.0	–	4					
REHAU RAUPIANO PLUS	≤ 50.0	–	2					
	≤ 110.0	–	4					
REHAU RAUPIANO LIGHT	≤ 50.0	–	2					
	≤ 110.0	–	4					
Silenta Premium	≤ 58.0	–	2					
	≤ 110.0	–	4					
							2	EI 120 U/U
							4	
							2	
							4	
							2	
							4	
							2	
							4	
							2	
							4	

KSL double layer

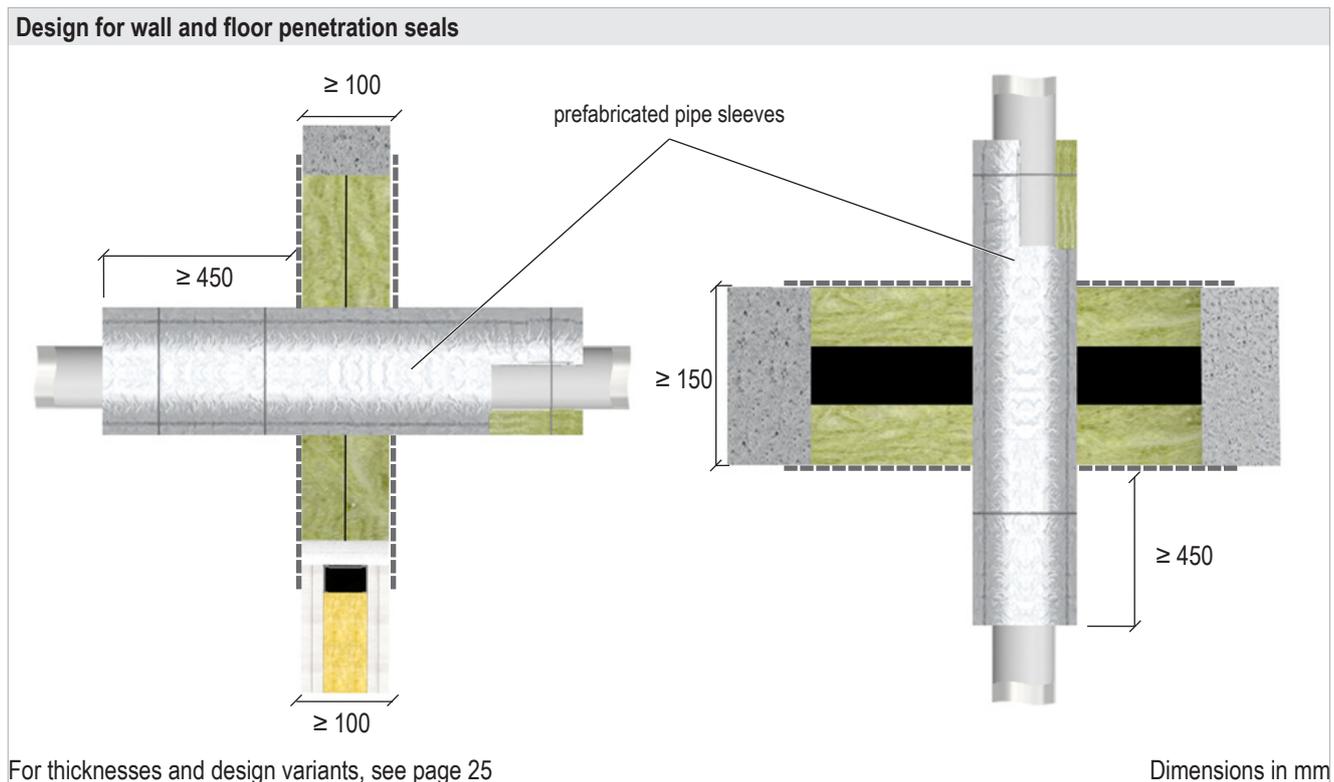
Floor								
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	KSL-W				Fire resistance class	
			Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]		Number of layers [n]
PVC-U, PVC-C	≤ 50.0	1.8–5.6	50	1	45–50	0–5	2	EI 120 U/U
	≤ 110.0	1.8–12.3					4	EI 90 U/U
PE-HD, ABS, SAN + PVC	≤ 50.0	1.8–4.6					2	EI 120 U/U
	≤ 110.0	1.8–10.0					4	EI 120 U/U
PP	≤ 50.0	1.8–4.6					2	EI 120 U/U
	≤ 110.0	1.8–10.0					4	EI 120 U/U
Geberit Silent-PP	≤ 50.0	–					2	EI 120 U/U
	≤ 110.0	–					4	EI 120 U/U
Geberit Silent-Pro	≤ 75.0	–					2	EI 120 U/U
	≤ 110.0	–					4	EI 120 U/U
KE KELIT PHON EX AS	≤ 56.0	–					2	EI 120 U/U
	≤ 110.0	–					4	EI 120 U/U
Pipelife Master 3	≤ 50.0	–					2	EI 90 U/U
	≤ 110.0	–					4	EI 120 U/U
POLO-KAL NG	≤ 50.0	–					2	EI 120 U/U
	≤ 110.0	–					4	EI 120 U/U
CONEL DRAIN	≤ 50.0	–					2	EI 120 U/U
	≤ 110.0	–					4	EI 120 U/U
Geberit Silent-dB 20	≤ 56.0	–					2	EI 120 U/U
	≤ 110.0	–					4	EI 120 U/U
Wavin SiTech+	≤ 50.0	–					2	EI 120 U/U
	≤ 110.0	–					4	EI 120 U/U
POLO-KAL XS	≤ 110.0	–					4	EI 120 U/U
REHAU RAUPIANO PLUS	≤ 110.0	–					4	EI 120 U/U
REHAU RAUPIANO LIGHT	≤ 110.0	–	4	EI 120 U/U				
Silenta Premium	≤ 58.0	–	2	EI 90 U/U				
	≤ 110.0	–	4	EI 120 U/U				

KSL double layer

7.7 Multilayer pipes

7.7.1 Installation with pipe sleeves

When installing prefabricated pipe sleeves, they must be insulated either locally (LS) or continuously over the entire length of the pipe (CS).

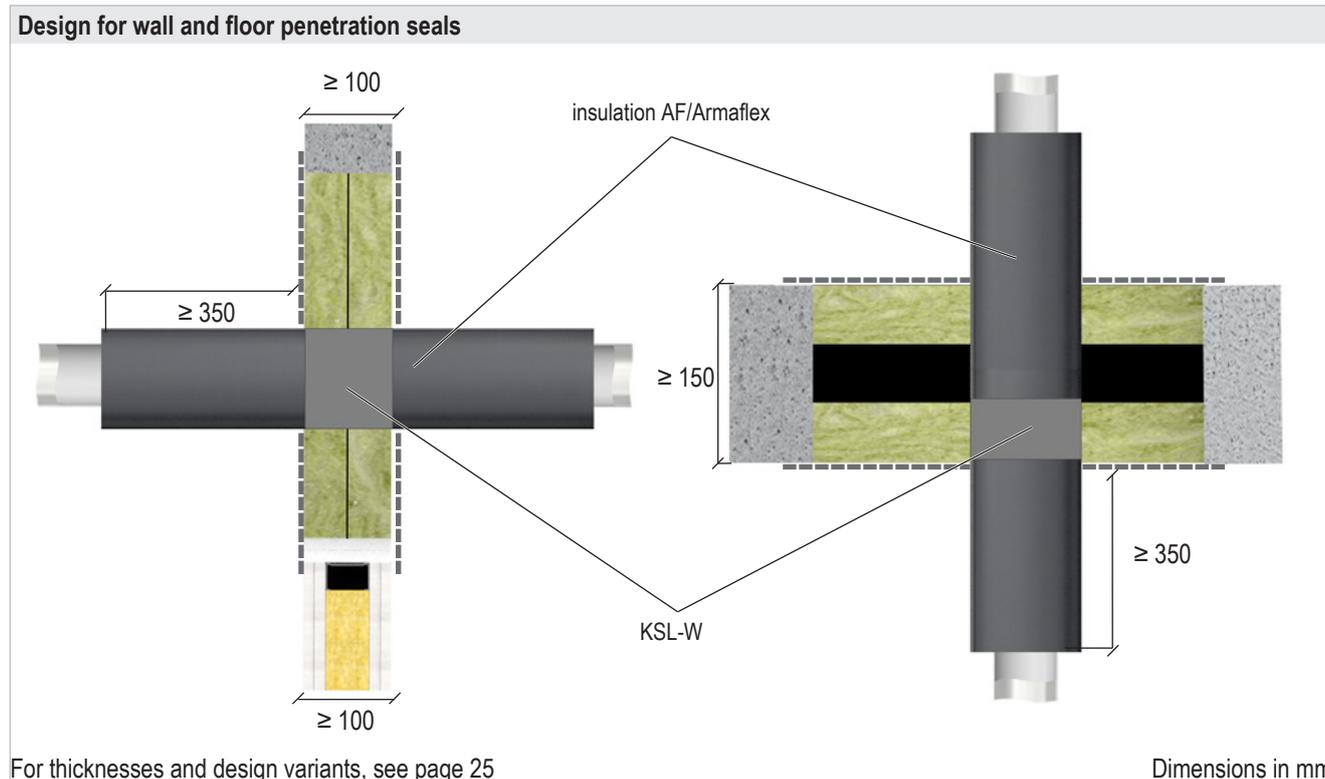


Wall and floor					
Pipe material/type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Prefabricated pipe sleeves*		Fire resistance class
			Length [mm]	Thickness [mm]	
Geberit Mepla	16.0	2.25	≥ 450.0	20.0–30.0	EI 120 U/C
	20.0	2.5		20.0–40.0	
	26.0	3.0		20.0–50.0	
	32.0	3.0		20.0–60.0	
	40.0	3.5		20.0–80.0	
	50.0	4.0			
	63.0	4.5			
	75.0	4.7			

* Prefabricated pipe sleeves in accordance with EN 14303 made of mineral wool with the classification A2L-s1,d0 or A1L in accordance with EN 13501-1, a minimum thickness of 80 kg/m³, laminated with reinforced aluminium foil with a self-adhesive strip.

KSL double layer

7.7.2 Installation with fire protection wrap



KSL double layer

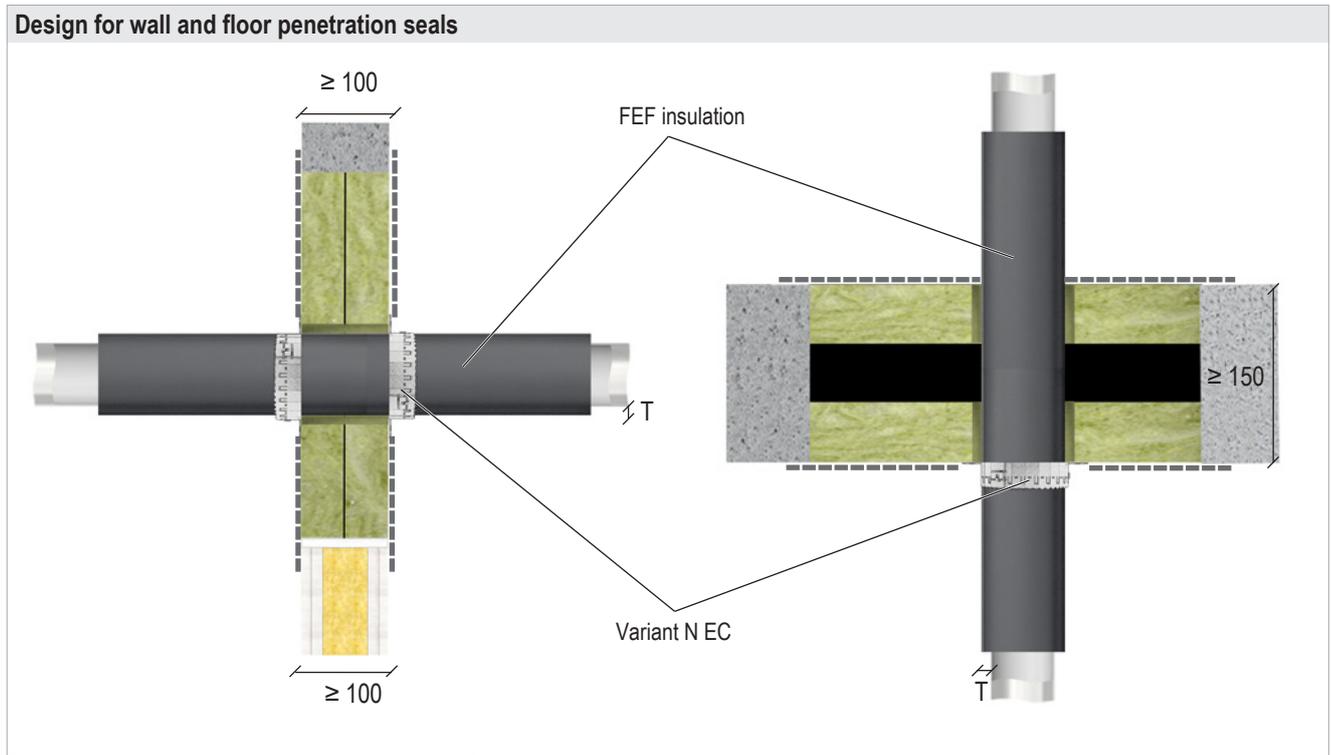
Wall												
Pipe material/ type	Pipe outer Ø [mm]	Pipe wall thick- ness [mm]	Insulation type	Insulation length L [mm]	Insulation thickness T [mm]	KSL-W					Fire resistance class	
						Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]		
Geberit Mepla	16.0	2.25	AF/ Armaflex	≥ 350	8.0–32.0	50	2	50	0	1	EI 120 U/C	
	20.0	2.5			8.5–35.0							
	26.0	3.0			9.0–35.0							
	32.0	3.0										
	40.0	3.5			9.0–39.0							
	50.0	4.0										
	63.0	4.5			9.5					2		EI 90 U/C
	75.0	4.7			9.5–40.5							EI 120 U/C
REHAU RAUTITAN stabil	16.0	2.6	AF/ Armaflex	≥ 350	8.0–32.0	50	2	50	0	1	EI 120 U/C	
	20.0	2.9			8.5–35.0							
	25	3.79			9.0–35.0							
	32	4.7										
	40	6.0			2							
KE KELIT KELOX	16.0	2.0	AF/ Armaflex	≥ 350	8.0–32.0	50	2	50	0	1	EI 120 U/C	
	18.0				8.5–35.0							
	20.0	2.25			9.0–35.0							
	25.0	2.5										
	32.0	3.0			9.0							
	40.0	4.0										
	50.0	4.5			9.0–39.0					2		EI 90 U/C
	63.0	6.0										EI 120 U/C
	75.0	7.5			9.5–40.5							

KSL double layer

Floor															
Pipe material/ type	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Insulation type	Insulation length L [mm]	Insulation thickness T [mm]	KSL-W					Fire resistance class				
						Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]					
Geberit Mepla	16.0	2.25	AF/ Armaflex	≥ 350.0	8.0–32.0	50	1	50	0	1	EI 120 U/C				
	20.0	2.5			8.0–32.0						EI 120 U/C				
	26.0	3.0			8.5–35.0						EI 120 U/C				
	32.0				9.0–35.0						EI 120 U/C				
	40.0	3.5			9.0–35.0					2	EI 120 U/C				
	50.0	4.0			9.0–35.0						EI 120 U/C				
	63.0	4.5			9.0–39.0						EI 120 U/C				
	75.0	4.7			9.5						EI 90 U/C				
REHAU RAUTITAN stabil	16.0	2.6			8.0–32.0					1	EI 120 U/C				
	20.0	2.9			8.0–32.0						EI 120 U/C				
	25.0	3.79			8.5–35.0						EI 120 U/C				
	32.0	4.7			9.0–35.0						EI 120 U/C				
	40.0	6.0			9.0–35.0						2	EI 120 U/C			
KE KELIT KELOX	16.0	2.0			≥ 350.0					50	1	50	0	1	EI 120 U/C
	18.0														8.0–32.0
	20.0	2.25													8.0–32.0
	25.0	2.5	8.5–35.0	EI 120 U/C											
	32.0	3.0	9.0–35.0	EI 120 U/C											
	40.0	4.0	9.0–35.0	2		EI 120 U/C									
	50.0	4.5	9.0–35.0			EI 120 U/C									
	63.0	6.0	9.0–39.0			EI 120 U/C									
75.0	7.5	9.5–40.5	EI 120 U/C												

KSL double layer

7.7.3 Installation with endless collar



For thicknesses and design variants, see page 25

Dimensions in mm

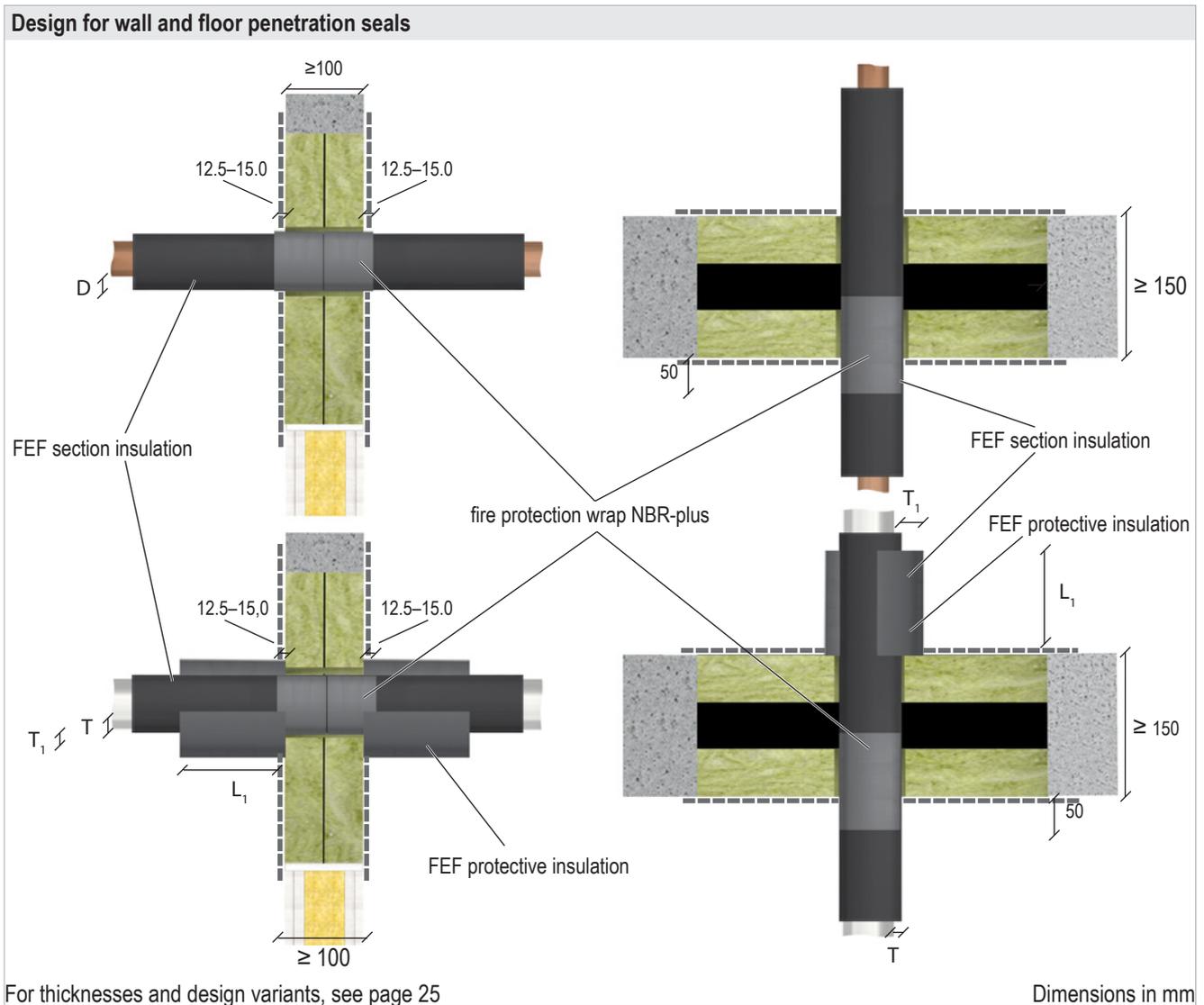
Wall							
Pipe material/type	Pipe outer \varnothing [mm]	Pipe wall thickness [mm]	Insulation type	Insulation length L	Insulation thickness T [mm]	Variant N EC	Fire resistance class
						Number of layers [n]	
FRÄNKISCHE alpex L / FRÄNKISCHE alpex F50	16.0–20.0	2.0	FEF B-s3,d0 (e.g. AF/Ar- maflex)	CS	8.0–30.0	2	EI 120 U/C

Floor							
Pipe material/type	Pipe outer \varnothing [mm]	Pipe wall thickness [mm]	Insulation type	Insulation length L	Insulation thickness T [mm]	Variant N EC	Fire resistance class
						Number of layers [n]	
FRÄNKISCHE alpex L / FRÄNKISCHE alpex F50	16.0–75.0	2.0–5.0	FEF B-s3,d0 (e.g. AF/Ar- maflex)	CS	9.0–38.0	2	EI 90 U/C

KSL double layer

7.8 Non-combustible pipes

7.8.1 Insulation with FEF and fire protection wrap



KSL double layer

Wall													
Pipe material	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Section insulation		Protective insulation		NBR-plus					Fire resistance class	
			Insulation length	Insulation thickness T [mm]	Insulation length L ₁ [mm]	Insulation thickness T ₁ [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]		
Copper, steel, stainless steel or cast iron	≤ 15.0	0.8–14.2	CS	10.0	–	–	62.5	2	50	15.5	1	EI 120 U/C	
	> 15.0 – ≤ 54.0			19.0–38.0	–	–					2		
	> 54.0 – ≤ 88.9			25.0	–	–					2		
	≤ 42.0			10.0	–	–					1		EI 90 U/C
	> 42.0 – ≤ 88.9			19.0–38.0	–	–					2		
Steel, stainless steel or cast iron	≤ 15.0	0.8–14.2	CS	10.0–38.0	–	–	62.5	2	50	15.5	2	EI 120 U/C	
	> 15.0 – ≤ 88.9			19.0–38.0	–	–					2		
	> 88.9 – ≤ 114.3			19.0–38.0	250.0	19.0					2		
	> 114.3 – ≤ 159.0			25.0–38.0	250.0	19.0					2		
	> 159.0 – ≤ 219.1			25.0–38.0	600.0	38.0					2		

KSL double layer

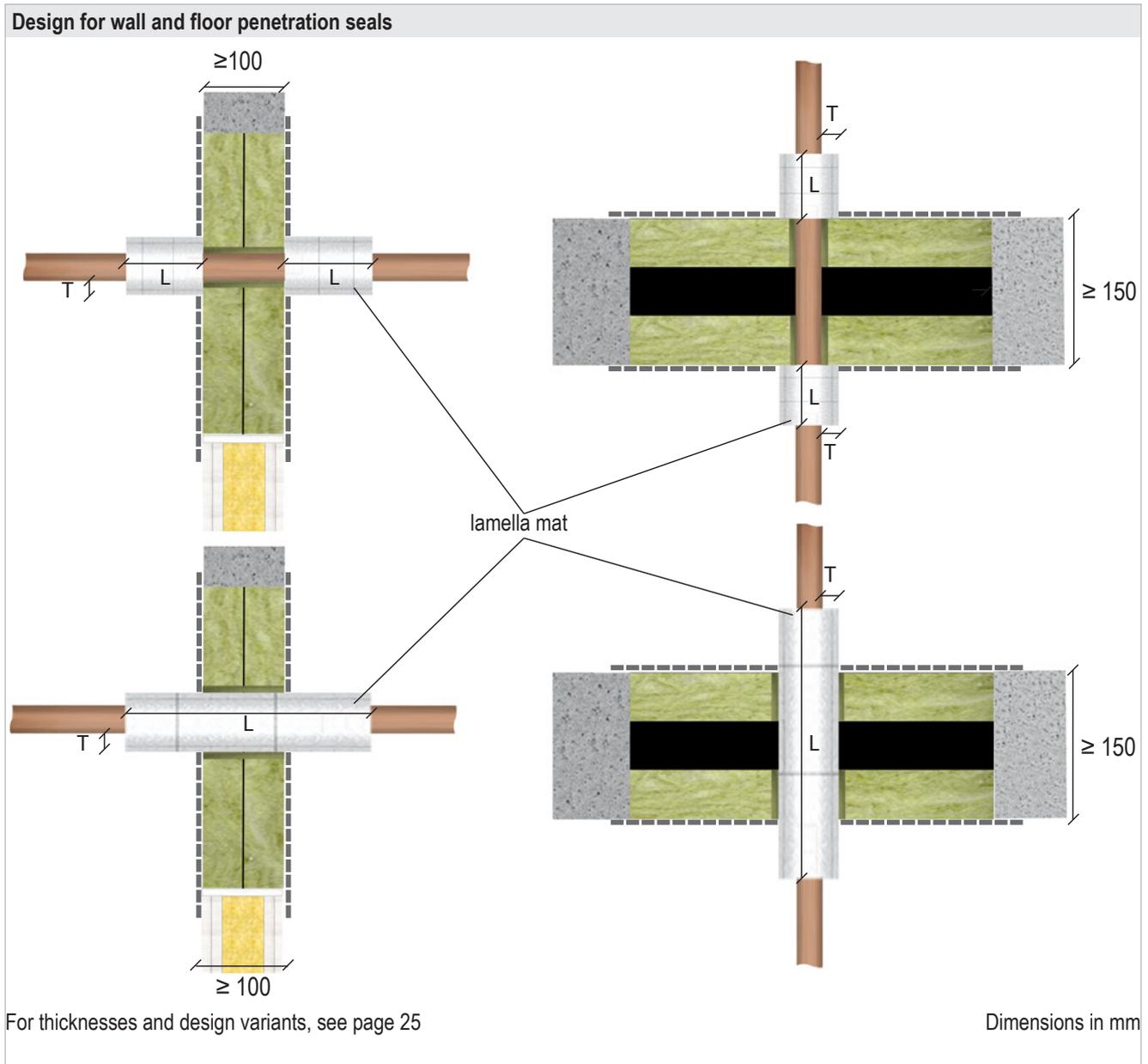
Floor												
Pipe material	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Section insulation		Protective insulation		NBR-plus					Fire resistance class
			Insulation length	Insulation thickness T [mm]	Insulation length L ₁ [mm]	Insulation thickness T ₁ [mm]	Wrap width [mm]	Number of wraps [n]	Inside seal [mm]	Outside seal [mm]	Number of layers [n]	
Copper, steel, stainless steel or cast iron	≤ 60.0	0.6–14.2	CS	13.0–40.0	–	–	125	1	75	50	2	EI 120 U/C
	> 60.0 – ≤ 88.9			25.0	–	–					2	
	≤ 42.0			10.0	–	–					1	EI 90 U/C
	≤ 42.0			9.0–40.0	–	–					2	
	> 42.0 – ≤ 60.0			13.0–40.0	–	–					2	
	> 60.0 – ≤ 88.9			19.0–38.0	–	–					2	
Steel, stainless steel or cast iron	≤ 159.0			25.0–38.0	250.0	25.0					2	
	> 159.0 – ≤ 219.1			25.0–38.0	250.0	38.0					2	

KSL double layer

7.8.2 Insulation with mineral wool

The insulation may either penetrate the seal (LS, CS) or end at the seal surface (LI, CI).

Pipes may be installed at all angles between 90° und 45°.



KSL double layer

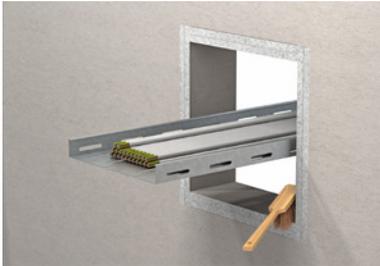
Wall					
Pipe material	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Lamella mat		Fire resistance class
			Insulation length L [mm]	Insulation thickness T [mm]	
Copper, steel, stainless steel or cast iron	≤ 22.0	0.6–14.2	on both sides ≥ 450.0	20.0–100.0	EI 120 U/C
			on both sides ≥ 200.0	30.0–100.0	
	> 22.0 – ≤ 60.0		on both sides ≥ 450.0	30.0–100.0	
	> 60.0 – ≤ 88.9		on both sides ≥ 450.0	100.0	
	> 60.0 – ≤ 88.9		on both sides ≥ 700.0	30.0–100.0	EI 90 U/C
Steel, stainless steel or cast iron	≤ 42.0	1.8–14.2	on both sides ≥ 200.0	30.0–100.0	EI 120 U/C
	> 42.0 – ≤ 114.3	1.8/3.2–14.2	on both sides ≥ 450.0	30.0–100.0	
	> 114.3 – ≤ 159.0	3.2/4.0–14.2	on both sides ≥ 1200.0	100.0	
	> 114.3 – ≤ 219.1	3.2/4.5–14.2	on both sides ≥ 1200.0	30.0–100.0	EI 90 U/C

Floor					
Pipe material	Pipe outer Ø [mm]	Pipe wall thickness [mm]	Lamella mat		Fire resistance class
			Insulation length L [mm]	Insulation thickness T [mm]	
Copper, steel, stainless steel or cast iron	≤ 22.0	0.6–14.2	on both sides ≥ 425.0	20.0–100.0	EI 120 U/C
			on both sides ≥ 175.0	30.0–100.0	
	> 22.0 – ≤ 42.0		on both sides ≥ 425.0	30.0–100.0	
	> 42.0 – ≤ 88.9		on both sides ≥ 675.0	30.0–100.0	
	≤ 42.0		on both sides ≥ 425.0	30.0–100.0	EI 120 U/C
> 42.0 – ≤ 114.3	on both sides ≥ 1175.0	30.0–100.0			
> 114.3 – ≤ 159.0	on both sides ≥ 1175.0	30.0–100.0			
> 114.3 – ≤ 219.1	on both sides ≥ 1175.0	30.0	EI 120 U/C		
Steel, stainless steel or cast iron	> 114.3 – ≤ 219.1	on both sides ≥ 1175.0	30.0–100.0	EI 90 U/C	

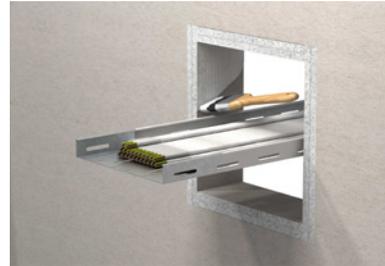
KSL double layer

8. Installation steps

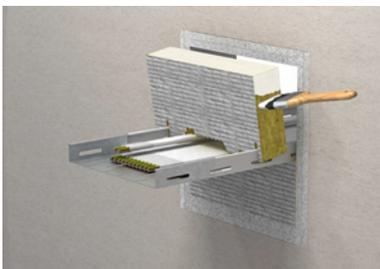
1. Clean reveal and installations and mask them with crepe tape.



2. Coat cables, penetration seal area and 100 mm of the installations on both sides outside the seal with BML.



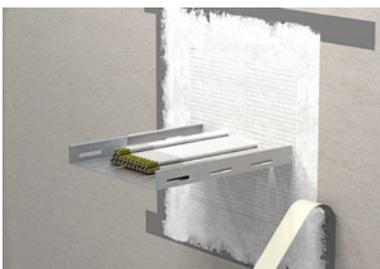
3. Cut the mineral fibre boards to size and coat the surrounding edges with BMS. Close the openings with two layers.



4. Seal the remaining openings with mineral fibre or fill them with BMS.



5. Coat the seal surface. Finally coat a 20 mm wide area around the installations with BML.



6. Label the penetration seal.

