

COMPREHENSIVE COMPENDIUM

# ArmaProtect<sup>®</sup> Systems

With our integrated fire protection systems you can seal off service penetrations of pipes and cables securely and easily. ArmaProtect systems ensure effective and reliable fire protection for almost all structural elements in buildings and thus extend the time to safely evacuate in the event of a fire. Discover more about the technical features of the ArmaProtect components and the professional installation of our systems. **ArmaProtect. Install fire protection.**

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 **armacell**<sup>®</sup>  
ArmaProtect<sup>®</sup>



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In the event of a fire, service equipment has a significant impact on safety in buildings. Pipes, ducts and electric cables penetrate separating building elements and thus form a path via which flames and smoke can spread. Passive fire protection systems are built-in components, which compartmentalise a building using fire barriers (fire-rated walls, floors and ceilings).

ArmaProtect systems facilitate your fire protection project. We provide you with a versatile range for nearly all types of pipes and structural elements. Properly installed, our integrated systems ensure that wall and floor penetrations reliably pass building inspections thus contributing to a smooth construction process. Within ArmaProtect systems, we offer seven passive fire protection products

providing solutions for pipes and also for a wide variety of electrical aperture penetrations. Our state-of-the-art product portfolio is covered by European Technical Assessments (ETAs). They are easy to use and deliver time and cost savings.

This document focuses specifically on passive fire protection applications for pipe penetrations. The information provided is largely compiled from the relevant European Technical Assessments and summarised for your convenience.

For queries related to electrical aperture solutions, please see the relevant literature or consult your local Armacell contact. The following ArmaProtect products are covered in this manual:

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This document describes the passive fire protection applications of products in the ArmaProtect portfolio. It is divided into three sections:

**Section A: Plastic pipe penetrations**

**Section B: Metal pipe penetrations**

**Section C: Composite pipe penetrations**

Please refer to the relevant product ETAs for applications that are not covered by this manual and also as the general source of information provided within this document. Please note that information provided in the relevant European Technical Assessments is decisive.



**ARMAFLEX® PROTECT**

// Flexible firestop seal and insulation based on flexible elastomeric foam with intumescent components

// **ETA-11/0454**



**ARMAPROTECT WRAP**

// Highly intumescent wrap

// **ETA 19/0714**



**ARMAPROTECT BOARD**

// Mineral fibre board, ablative-coated on both sides, for applications with large openings

// **ETA 19/0712**



**ARMAPROTECT SEAL**

// Fire-resistant acrylic sealant

// **ETA 19/0711**



**ARMAPROTECT SEAL X**

// Highly intumescent graphite sealant

// **ETA 19/0715**



**ARMAPROTECT COLLAR**

// Intumescent collar

// **ETA 19/0713**



**ARMAPROTECT 1000-HS**

// High-strength fire-resistant mortar

// **ETA 19/0716**

**Notes:**

- (a) ArmaFlex Protect acts as both a thermal insulation and passive fire protection solution
- (b) with ArmaProtect Seal
- (c) with ArmaProtect Board
- (d) for all applications with ArmaProtect Board, ArmaProtect Seal must be used to seal all surfaces
- (e) only with non-combustible insulation

- stand-alone solution
- system

		Thermal insulation		ArmaFlex Protect (a)	ArmaProtect Wrap
Metal pipes	Steel	No	Wall	●	
			Floor	●	
	Steel	Yes	Wall	●	● (b)+(c)
			Floor	●	
	Copper	No	Wall	●	
			Floor	●	
	Copper	Yes	Wall	●	● (b)+(c)
			Floor	●	
Plastic pipes	PE	No	Floor		● (b)
			Wall		● (b)
	PP	No	Floor		● (b)
			Wall		● (b)
	PVC	Yes	Wall		● (b)+(c)
			Floor		● (b)
	ABS	No	Wall		● (b)
Composite pipes	Alpex	No	F50 Profi Wall/Floor	●	
			L Wall/Floor	●	
	Uponor MLC	No	Floor		
			Wall		
Electrical apertures			Floor		
			Wall		

ArmaProtect Board (d)	ArmaProtect Seal	ArmaProtect Seal X	ArmaProtect Collar	ArmaProtect 1000-HS
	●			
● (b)(e)		● or ● (c)		
		●		● (e)
	●			
● (b)(e)		● or ● (c)		
		●		● (e)
		●	● (b)	
		●	● (b) or ● (b)+(c)	
		●	● (b)	
		●	● (b) or ● (b)+(c)	
		● or ● (c)	● (b)	
		● or ● (c)	● (b) or ● (b)+(c)	
		●		
		● (c)		
		● (c)		
		● or ● (c)		● (e)
● (b)	●	● (c)		



## ArmaFlex Protect

ArmaFlex Protect is a unique multi-purpose, flexible fire-stopping seal based on ArmaFlex technology that also provides reliable condensation control and thermal insulation. In the event of a fire, ArmaFlex Protect provides fire resistance of up to EI 120 for

metal and composite pipe penetrations. ArmaFlex Protect is available in 500 mm or 1000 mm lengths and can be used with all types of adjoining thermal insulation up to Ø 88.9 mm (floor applications) and Ø 108 mm (wall applications) for metal pipes. ArmaFlex Protect can be used with all types of adjoining thermal insulation for composite pipe penetrations.

### TECHNICAL DATA – ARMAFLEX PROTECT

Description	Result	Test standards
Fire resistance	up to EI 120	EN 1366-3, EN 13501-2
Use category	Type Y <sub>2</sub> – intended for use at temperatures below 0°C, but with no exposure to rain or UV	EOTA TR 024
Service temperature	-50°C to + 85°C	EN 14706, EN 14707
Thermal conductivity	$\lambda$ at 0 °C $\leq$ 0.056 W/(m·K)	EN 12667, EN ISO 8497
Water vapour diffusion resistance	$\mu \geq$ 7000	EN 12086, EN 13469

Range: Tube, Length 1.0 m, Code	Pipe max. outer Ø mm	Insulation thickness mm	m/carton
PRO-AX-16X006	6	16	34
PRO-AX-16X008	8	16	30
PRO-AX-19X010	10	19	18
PRO-AX-19X012	12	19	17
PRO-AX-19X015	15	19	16
PRO-AX-20X016	16	20	14
PRO-AX-20X018	18	20	13
PRO-AX-20X020	20	20	12
PRO-AX-20X022	22	20	12
PRO-AX-20X025	25	20	11
PRO-AX-25X028	28	25	9
PRO-AX-25X032	32	25	8
PRO-AX-25X035	35	25	8
PRO-AX-25X040	40	25	6
PRO-AX-25X042	42	25	6
PRO-AX-25X048	48	25	5
PRO-AX-25X050	50	25	5
PRO-AX-25X054	54	25	5
PRO-AX-25X060	60	25	4
PRO-AX-25X063	64	25	4
PRO-AX-25X076	76	25	4
PRO-AX-25X089	89	25	4

Sheets endless, Code	Roll length m	Width m	Insulation thickness mm	m <sup>2</sup> /carton	Rolls/carton
PRO-AX-13MM/E	6	0.5	13	2 x 3	2



## ArmaProtect Wrap

ArmaProtect Wrap is a halogen-free, non-toxic, reactive intumescent wrap that is designed and tested to maintain the fire resistance performance of service penetrations using thermoplastic composites based on graphite intumescent technology. Developed to provide high volume expansion and pressure seal

during fire, ArmaProtect Wrap provides fire resistances of up to EI 120 according to EN 13501-2. Available as a convenient 2 mm (thickness) x 40 mm (width) x 25 m (length) roll that ensures ease of application even in the tightest of working conditions and also in pre-cut, ready-to-use strips.

### TECHNICAL DATA – ARMAPROTECT WRAP

Description	Result	Test standards
Fire resistance	up to EI 120	EN 1366-3, EN 13501-2
Use category	Type X – intended for use in conditions exposed to weathering	EOTA TR 024
Density	approx. 1.2 g/cm <sup>3</sup>	ISO 2811-1
Volume expansion	approx. 25 times at 450°C	EOTA TR 024
Expansion pressure	up to max. 1.30 N/mm <sup>2</sup>	EOTA TR 024
Storage and shelf-life	N/A, for further details please see Safety Data Sheet	EC 1907/2006 (REACH) EC 1272/2008 (CLP)

### Halogen-free, non-toxic, graphite intumescent wrap, as a roll

Range, code	Width mm	Length m	Thickness mm	Rolls/carton
PRO-WR-240	40	25	2	1

**ArmaProtect Wrap Strips provide passive fire protection solutions specifically for non-insulated plastic pipes. Halogen-free, non-toxic, graphite intumescent wrap; pre-cut and bagged in ready-to-use strips**

Code	Height mm	Outer Ø pipe or insulation mm	Pieces/carton
PRO-WS-032	N/A	32/34	20
PRO-WS-040	N/A	40/42	20
PRO-WS-055	N/A	55/57	20
PRO-WS-063	N/A	63/65	20
PRO-WS-075	N/A	75/77	20
PRO-WS-082	N/A	80/82	20
PRO-WS-090	N/A	90/92	20
PRO-WS-110	N/A	110/112	20
PRO-WS-125	N/A	125	20
PRO-WS-140	N/A	140	20
PRO-WS-160	N/A	160	20

## ArmaProtect Board

ArmaProtect Board is an ablative-coated mineral fibre board that is designed and tested to maintain the fire resistance performance of wall / floor constructions which have been provided with apertures for the penetration of single or multiple services. ArmaProtect Board may be used to provide a penetration seal with pipes

and cables, cable trays and ladders. Pipes must be installed individually, cables require no minimum separation. ArmaProtect Board can be used with other ArmaProtect portfolio products to provide solutions for large openings. ArmaProtect Board is 50 mm (thickness) x 600 mm (width) x 1200 mm (length).

### TECHNICAL DATA – ARMAPROTECT BOARD

Description	Result	Test standards
Fire resistance	up to EI 120	EN 1366-3, EN 13501-2
Use category	Type Z <sub>1</sub> – intended for use in internal conditions with humidity ≥ 85 %, excluding temperatures below 0°C, without exposure to rain or UV	EOTA TR 024
Thermal conductivity	0.034 W/(m·K) at 10°C	EN ISO 13787
Density	140 kg/m <sup>3</sup> (mineral wool)	
Coating thickness (dry)	0.7 ± 0.1 mm nominal	
ArmaProtect Seal coverage	2.15 kg spread	EOTA TR 024
Maximum aperture size* (width x height)	730 mm x 1200 mm 600 mm x 600 mm	EN 14706, EN 14707
Acoustic performance	R <sub>w</sub> (C;Ctr) = 24 [-2;-3]	EN ISO 10140
Storage and shelf-life	Store in dry conditions off the floor between +5°C and +25°C, for further details please see Safety Data Sheet	EC 1907/2006 (REACH) EC 1272/2008 (CLP)

\* The total amount of cross sections (including insulation) should not exceed 60% of the penetration area.

Range, code	Article description	Pieces/carton
PRO-B0-50	Ablative-coated mineral fibre board, Surface colour: white	1

## ArmaProtect Seal

ArmaProtect Seal is a fire-resistant, acrylic-based sealant with acoustic insulation properties. It can be either gunned or trowelled as the application requires. The application of ArmaProtect

Seal is a critical finishing step when installing other products in the ArmaProtect portfolio. It is used to fill in gaps or coat joints and interfaces.

### TECHNICAL DATA – ARMAPROTECT SEAL

Description	Result	Test standards
Fire resistance	up to EI 120	EN 1366-3, EN 13501-2
Use category	Type Z <sub>1</sub> – intended for use in internal conditions with humidity ≥ 85 %, excluding temperatures below 0°C, without exposure to rain or UV	EOTA TR 024
Colour	white	
Slump	5 mm after 1 hours in 30 mm joints	
Cure rate	3 mm ± 1 mm per 24 hours at 50% relative humidity and 23 °C ambient temperature	
Hardness after curing (Shore A)	Initial: 33 After 5s: 7	ISO 7619-1
Density of uncured material	1610 kg/m <sup>3</sup> ± 50 kg/m <sup>3</sup>	ISO 2811-1
Application temperature	+5°C to +40°C	
Tack free	30 min. at 50% relative humidity and 23°C ambient temperature	
Acoustic performance	Rw (C;Ctr) = 38 (-2;-7)	EN ISO 10140
Storage and shelf-life	18 months unopened, store in dry conditions off the floor between +5°C and +25°C, for further details please see Safety Data Sheet	EC 1907/2006 (REACH) EC 1272/2008 (CLP)

Range, code	Article description	Pieces/carton
PRO-SE-310W	310 ml cartridge	12

## ArmaProtect Seal X

ArmaProtect Seal X is a highly intumescent graphite sealant used to reinstate the fire resistance performance of wall and floor constructions where they have been provided with apertures for

multiple-service penetrations.

ArmaProtect Seal X has a strong expansion ratio, expanding to up to 20 times its original volume upon contact with heat.

### TECHNICAL DATA – ARMAPROTECT SEAL X

Description	Result	Test standards
Fire resistance	up to EI 120	EN 1366-3, EN 13501-2
Use category	Type Z <sub>1</sub> – intended for use in internal conditions with humidity ≥ 85 %, excluding temperatures below 0°C, without exposure to rain or UV	EOTA TR 024
Colour	grey	
Cure rate	1.7 mm per 24 hours at 50 % relative humidity and 23 °C ambient temperature	
Skin time	15 min.	
Hardness after curing (Shore A)	Initial: 68	ISO 7619-1
Density of uncured material	1280 kg/m <sup>3</sup> ± 50 kg/m <sup>3</sup>	ISO 2811-1
Volume expansion	approx. 20 times at 180°C	EOTA TR 024
Expansion pressure	0.7 N/mm <sup>2</sup>	
Application temperature	+5°C to +35°C	
Acoustic performance	R <sub>w</sub> [C;Ctr] = 52 [-1;-6]	EN ISO 10140
Storage and shelf-life	12 months unopened, store in dry conditions off the floor between +5°C and +25°C, for further details please see Safety Data Sheet	EC 1907/2006 (REACH) EC 1272/2008 (CLP)

Range, code	Article description	Pieces/carton
PRO-SX-310	310 ml cartridge	12

## ArmaProtect Collar

ArmaProtect Collar is a passive fire protection collar that consists of several layers of highly intumescent material incorporated in a steel case.

In the event of a fire, the intumescent material expands with high pressure, thus hermetically sealing the opening against flames and smoke.

### TECHNICAL DATA – ARMAPROTECT COLLAR

Description	Result	Test standards
Fire resistance	up to EI 240	EN 1366-3, EN 13501-2
Use category	Type X – intended for use in conditions exposed to weathering	EOTA TR 024
Colour	Steel: green Intumescent material: grey	
Expansion rate	20:1	EOTA TR 024
Expansion pressure	1.30 N/mm <sup>2</sup>	EOTA TR 024
Storage and shelf-life	N/A, for further details please see Safety Data Sheet	EC 1907/2006 (REACH) EC 1272/2008 (CLP)

#### Floors:

PVC pipes, up to 160 mm, EI 240 U/C  
PP pipes, up to 160 mm, EI 240 U/C  
PE pipes, up to 160 mm, EI 240 U/C

#### Walls:

PVC pipes, up to 160 mm, EI 120 U/C  
PP pipes, up to 160 mm, EI 120 U/C  
PE pipes, up to 160 mm, EI 120 U/C

Range, code	Height mm	Outer Ø pipe or insulation mm	Pieces/carton
PRO-COL-032	30	32/34	100
PRO-COL-040	30	40/42	100
PRO-COL-055	30	55/57	30
PRO-COL-063	30	63/65	30
PRO-COL-075	30	75/77	30
PRO-COL-082	30	80/82	20
PRO-COL-090	30	90/92	20
PRO-COL-110	30	110/112	20
PRO-COL-125	40	125	20
PRO-COL-140	40	140	12
PRO-COL-160	40	160	12
PRO-COL-200	40	200	6
PRO-COL-250	40	250	3

## ArmaProtect 1000-HS

ArmaProtect 1000-HS is a non-shrinking, fast-setting, gypsum-based mortar that is specifically designed for passive fire

protection applications. ArmaProtect 1000-HS is provided in 20 kg bags in free-flowing powder form.

### TECHNICAL DATA – ARMAPROTECT 1000-HS

Description	Result	Test standards
Fire resistance	up to EI 120	EN 1366-3, EN 13501-2
Use category	Type Z <sub>1</sub> – intended for use in internal conditions with humidity ≥ 85 %, excluding temperatures below 0°C, without exposure to rain or UV	EOTA TR 024
Density	1825 kg/m <sup>3</sup> ± 75 kg/m <sup>3</sup>	
Colour	grey	
Load-bearing capacity	2.5 N/m <sup>2</sup> (fully cured)	EN 6399
Acoustic performance	R <sub>w</sub> (C;Ctr) = 52 (-4;-8)	EN ISO 10140
Storage and shelf-life	6 months, store in dry conditions off the floor between +5°C and +25°C. Protect against humidity. For further details please see Safety Data Sheet	EC 1907/2006 (REACH) EC 1272/2008 (CLP)

### Ready to use in 20 kg bags

Code	Packaging units	Pieces/carton
PRO-1000HS-20	20 kg	1

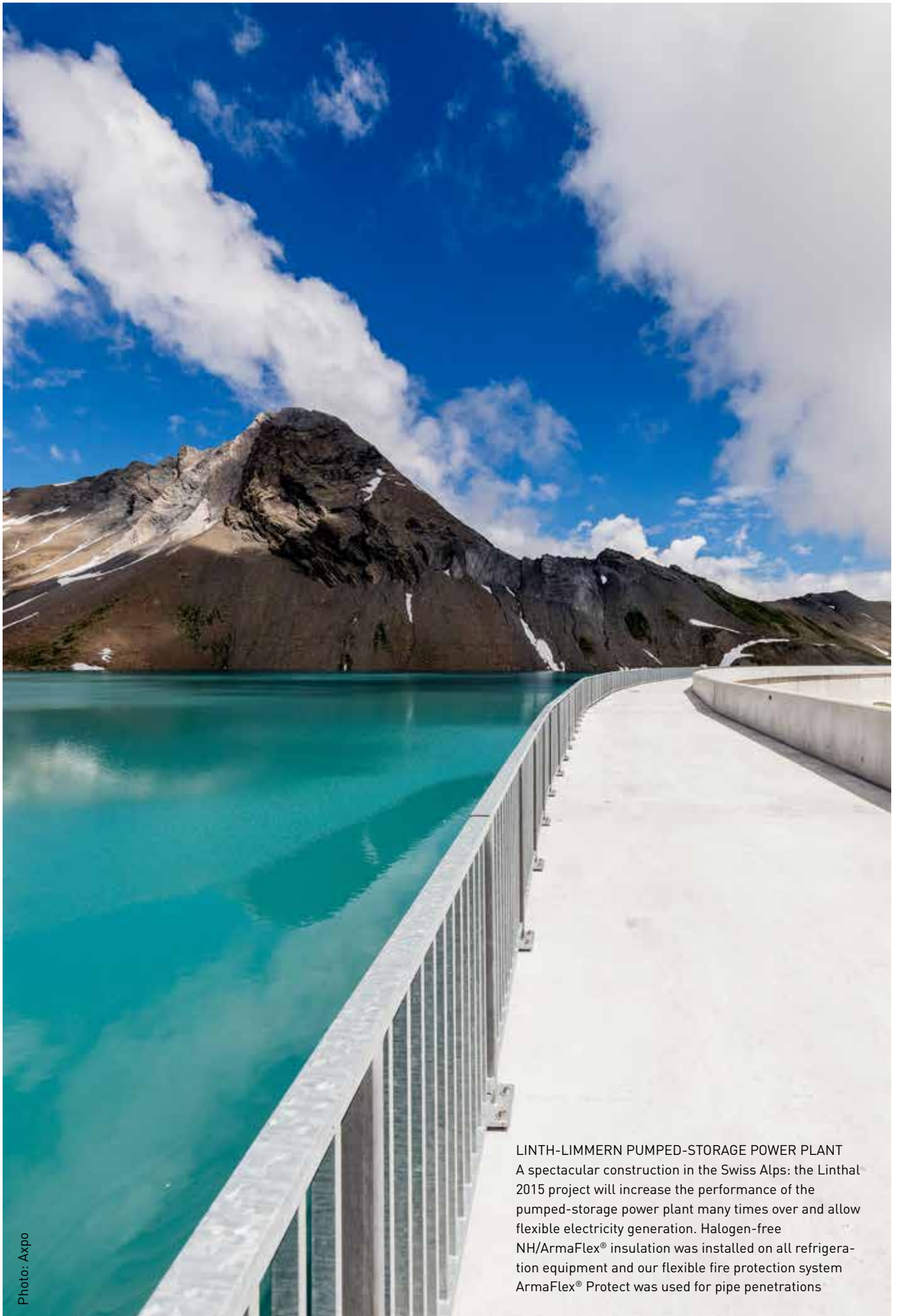


Photo: Axpo

#### LINTH-LIMMERN PUMPED-STORAGE POWER PLANT

A spectacular construction in the Swiss Alps: the Linthal 2015 project will increase the performance of the pumped-storage power plant many times over and allow flexible electricity generation. Halogen-free NH/ArmaFlex® insulation was installed on all refrigeration equipment and our flexible fire protection system ArmaFlex® Protect was used for pipe penetrations



## 1. NON-INSULATED PLASTIC PIPES

### A) Rigid floor

#### Substrates

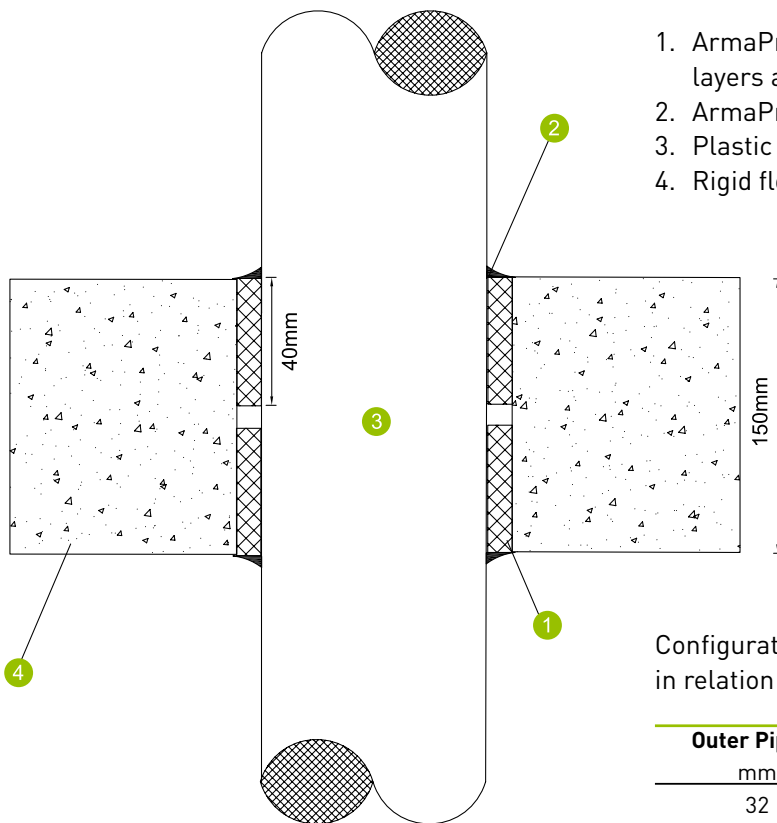
The floors must be a minimum of 150 mm thick and consist of concrete, aerated concrete or masonry, with a minimum density of 650 kg/m<sup>3</sup>. All floors must have at least the same fire rating as that required for the sealing system.

#### Service support requirements

Services must be supported at maximum 400 mm above the surface of the floor. The supporting construction must be classified in accordance to EN 13501-2 for the required fire resistance period.

### ARMAPROTECT WRAP

Designed according to ETA 19/0714



1. ArmaProtect Wrap, number of layers as indicated in table below
2. ArmaProtect Seal
3. Plastic pipe
4. Rigid floor

Configuration of ArmaProtect Wrap layers in relation to outer pipe diameter

Outer Pipe Ø mm	Layers	Thickness (mm)
32	1	1x2
40	1	1x2
50	1	1x2
55	2	2x2
63	2	2x2
75	2	2x2
82	2	2x2
90	3	3x2
110	3	3x2
125	4	4x2
160	4	4x2
200	5	5x2

## ArmaProtect Wrap, friction fitted flush to both sides (top and bottom) of rigid floor with a minimum thickness of 150 mm

### PP PIPES

Penetration specification		ArmaProtect Wrap width: 40 mm	Annulus space mm	Classification
Pipe diameter mm	Wall thickness mm			EN 13501-2
32, 40 and 50	2.9	2 x 1 layer of 2 mm (T)	4	EI 120 U/C
200	4.9	2 x 5 layers of 2 mm (T)	12	E 20 U/C EI 15 U/C
200	18.2			E 120 U/C EI 90 U/C

For PP pipes interpolation is possible between pipes of  $\emptyset$  50 mm: 2.9 mm wall thickness to  $\emptyset$  200 mm: 18.2 mm wall thickness for an EI 90 U/C classification

### PE PIPES

Penetration specification		ArmaProtect Wrap width: 40 mm	Annulus space mm	Classification
Pipe diameter mm	Wall thickness mm			EN 13501-2
32, 40 and 50	2.9	2 x 1 layer of 2 mm (T)	4	EI 120 U/C
200	4.9	2 x 5 layers of 2 mm (T)	12	
200	11.4			

For PE pipes interpolation is possible between pipes of  $\emptyset$  50 mm: 2.9 mm wall thickness to  $\emptyset$  200 mm: 11.4 mm to 4.9 mm wall thicknesses for an EI 120 U/C classification

### PVC PIPES

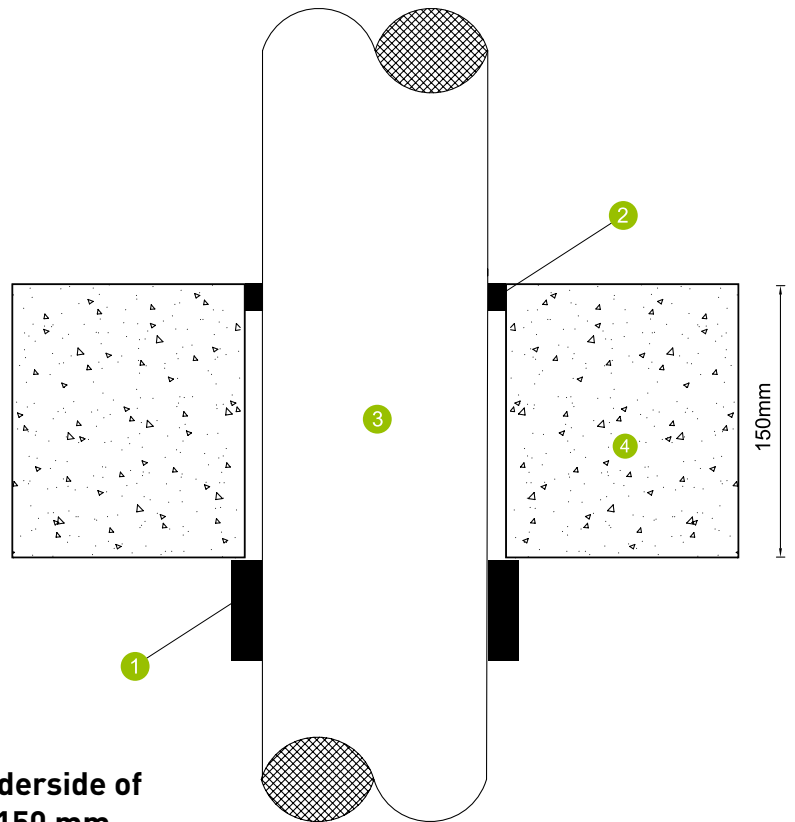
Penetration specification		ArmaProtect Wrap width: 40 mm	Annulus space mm	Classification
Pipe diameter mm	Wall thickness mm			EN 13501-2
32, 40 and 50	1.8	2 x 1 layer of 2 mm (T)	4	EI 120 U/C
200	7.7	2 x 5 layers of 2 mm (T)	12	E 120 U/C EI 90 U/C
200	9.6			EI 60 U/C

For PVC pipes interpolation is possible between pipes of  $\emptyset$  50 mm: 1.8 mm wall thickness to  $\emptyset$  200 mm: 7.7 mm wall thickness for an EI 90 U/C classification

**ARMAPROTECT COLLAR****Designed according to ETA 19/0713**

1. ArmaProtect Collar
2. ArmaProtect Seal
3. Plastic pipe
4. Rigid floor

Face fixed on the underside of rigid floor with 3 x Fischer FSA Ø 8 x 60 mm long, with M6 hexagon bolts or equivalent



**ArmaProtect Collar, face fixed on the underside of rigid floor with a minimum thickness of 150 mm**

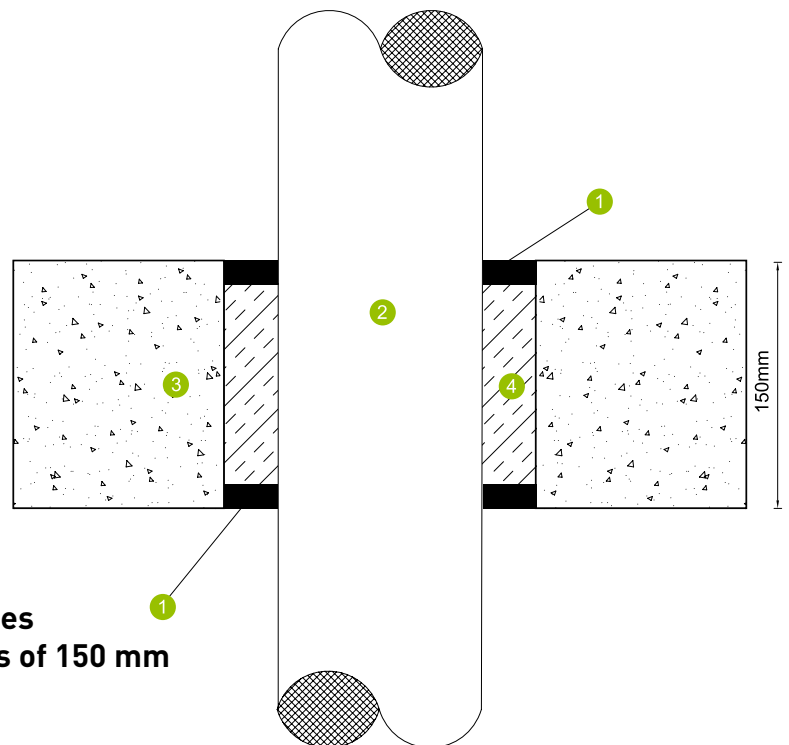
**PVC / PP / PE PIPES**

ArmaProtect Collar	Penetration specification			Annulus space	Classification
Size	Pipe type and thickness			mm	EN 13501-2
	PVC	PP	PE		
32	1.8	2.9	2.9	10	EI 240 U/C
40	1.8	2.9	2.9		
50	1.8	2.9	2.9		
55	2.3 – 3.0	2.9 – 4.4	2.9 – 4.4		
63	2.3 – 3.0	2.9 – 4.4	2.9 – 4.4		
75	3.1 – 4.8	2.8 – 6.7	2.8 – 6.7		
82	3.1 – 4.8	2.8 – 6.7	2.8 – 6.7		
90	4.2 – 7.4	2.7 – 10	2.7 – 10		
100	4.2 – 7.4	2.7 – 10	2.7 – 10		
110	4.2 – 7.4	2.7 – 10	2.7 – 10		
125	6	3.1	3.1		
140	6.1 – 7.5	3.5 – 8.0	3.9 – 5.8		
160	6.2 – 9.5	4.0 – 14.6	4.9 – 9.5		

**ARMAPROTECT SEAL X**

Designed according to ETA 19/0715

1. ArmaProtect Seal X
2. Plastic pipe
3. Rigid floor
4. Stone wool backing



**ArmaProtect Seal X applied to both sides of rigid floor with a minimum thickness of 150 mm**

**PVC / PP / PE PIPES**

Position of first support from the upper face of the substrate	Pipe type mm	Pipe diameter mm	Wall thickness mm	Annulus mm	Depth mm	Backing material	Classification (EN 13501-2)
250 mm	PVC	40	2.0	20	25	100 mm Deep stone wool 45 kg/m <sup>3</sup>	EI 240 U/C
	PVC	114	3.6				EI 45 U/C
	PVC	114	8.1				EI 120 U/C
	PP	50	2.1				EI 240 U/C
	PP	110	3.7				EI 30 U/C
	PP	110	10.7				EI 120 C/U
	PE	40	4.1				EI 240 U/C
	PE	125	7.6				EI 60 U/C
	PE	125	11.4				EI 90 U/C

For PE pipes interpolation is possible between pipes of; Ø40 mm: 4.1 mm - 11.4 mm wall thicknesses and Ø125 mm: 7.6 mm - 11.4 mm wall thicknesses for an EI 60 U/C classification

For rigid floors with a minimum thickness of 150 mm, **ArmaProtect Seal X (20 mm annulus x 25 mm depth, applied on both sides)** can also be used within **ArmaProtect Board (2x50 mm)** for an opening of maximum **750 mm (W) x 1100 mm (H)** for non-insulated **PVC pipes**.

In this case, to achieve a classification of **EI 60 U/C**, interpolation is possible between pipes of Ø50 mm: 2.4-7.4 mm wall thickness to Ø125 mm: 4.8-7.4 mm wall thickness. For more information please refer to ETA 19/0712, B4.1.3 or consult your Armacell contact.

## 1. NON-INSULATED PLASTIC PIPES

### B) Flexible and rigid wall

#### Substrates

**Flexible walls:** The walls must have a minimum thickness of 100 mm and consist of timber or steel studs lined on both faces with minimum 2 layers of 12.5 mm thick "Type F" gypsum boards according to EN 520. In timber stud walls, no part of the penetration seal shall be closer than 100 mm to a stud, and minimum 100 mm of insulation of class A1 or A2 according to EN 13501-1 is provided within the cavity between the penetration seal and the stud.

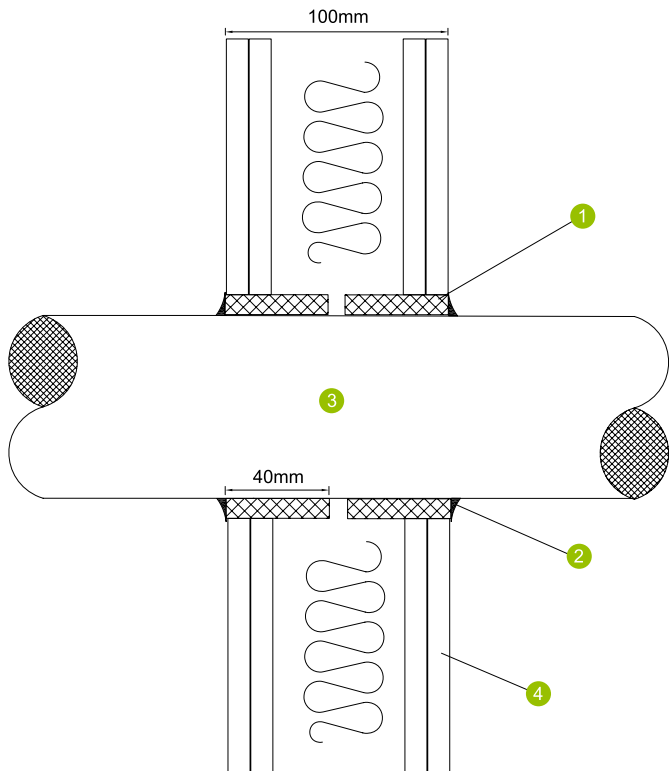
**Rigid walls:** The wall must have a minimum thickness of 100 mm and consist of concrete, aerated concrete or masonry, with a minimum density of 650 kg/m<sup>3</sup>.

#### Service Support Requirements

Services must be supported at maximum 400 mm on both sides from the face of the separating element for walls. The supporting construction must be classified in accordance with EN 13501-2 for the required fire resistance period.

### ARMAPROTECT WRAP

Designed according to ETA 19/0714



Configuration of ArmaProtect Wrap layers in relation to outer pipe diameter

Outer pipe Ø mm	Layers	Thickness (mm)
32	1	1x2
40	1	1x2
50	1	1x2
55	2	2x2
63	2	2x2
75	2	2x2
82	2	2x2
90	3	3x2
110	3	3x2
125	4	4x2
160	4	4x2
200	5	5x2
250	6	6x2

1. ArmaProtect Wrap, number of layers as indicated in the table
2. ArmaProtect Seal
3. Plastic pipe
4. Flexible or rigid wall

## ArmaProtect Wrap friction fitted flush to both sides of flexible or rigid walls with a minimum thickness of 100 mm

### PVC PIPES

Penetration specification		ArmaProtect Wrap width: 40 mm	Annulus space mm	Classification
Pipe diameter mm	Wall thickness mm			EN 13501-2
32, 40 and 50	1.8	2 x 1 layer of 2 mm (T)	4	EI 120 U/C
160	6.2	2 x 4 layers of 2 mm (T)	10	EI 90 U/C
160	9.5			EI 120 U/C
200	7.7	2 x 5 layers of 2 mm (T)	12	EI 120 U/C
200	9.6			EI 120 U/C

For PVC pipes, interpolation is possible between pipes of Ø50 mm: 1.8 mm wall thickness and Ø160 mm: 6.2 mm – 9.5 mm wall thickness and Ø200 mm: 7.7 mm – 9.6 mm wall thickness for an EI 120 U/C classification.

### PP PIPES

Penetration specification		ArmaProtect Wrap width: 40 mm	Annulus space mm	Classification
Pipe diameter mm	Wall thickness mm			EN 13501-2
32, 40 and 50	2.9	2 x 1 layer of 2 mm (T)	4	EI 120 U/C
160	4	2 x 4 layers of 2 mm (T)	10	EI 90 U/C
160	14.6			EI 120 U/C
200	4.9	2 x 5 layers of 2 mm (T)	12	E 120 U/C and EI 90 U/C
200	18.2			EI 120 U/C
250	10.1	2 x 6 layers of 2 mm (T)	14	E 120 U/C and EI 20 U/C

For PP pipes interpolation is possible between pipes of Ø50 mm: 2.9 mm wall thickness to Ø160 mm: 4.0 mm to 14.6 mm wall thicknesses and Ø200 mm: 4.9 mm and 18.2 mm wall thickness for an EI 90 U/C classification.

### PE PIPES

Penetration specification		ArmaProtect Wrap width: 40 mm	Annulus space mm	Classification
Pipe diameter mm	Wall thickness mm			EN 13501-2
32, 40 and 50	2.9	2 x 1 layer of 2 mm (T)	4	EI 120 U/C
160	4.9	2 x 4 layers of 2 mm (T)	10	EI 15 U/C
160	9.5			EI 90 U/C
200	4.9	2 x 5 layers of 2 mm (T)	12	EI 15 U/C
200	18.4			EI 120 U/C

For PE pipes interpolation is possible between pipes of Ø50 mm: 2.9 mm wall thickness and Ø160 mm: 9.5 mm wall thickness and Ø200 mm: 18.4 mm wall thickness for an EI 90 U/C classification.

For flexible or rigid walls with a minimum thickness of 75 mm, **ArmaProtect Wrap (applied on both sides of the wall)** can also be used within **ArmaProtect Board (2x50mm)** in a patress assembly for an opening of maximum **730 mm (W) x 1200 mm (H)** for non-insulated **PVC, PP and PE pipes to achieve a classification of EI 60 U/C. (Patress installation: ArmaProtect Boards (2x50mm) are installed in horizontal rows and fixed on at least two vertical edges. Overlap of ArmaProtect Board to substrate should be min. 100 mm. ArmaProtect Board must be mechanically fixed onto substrate with min. 6 mm x 80 mm steel screws and steel retaining washers.) Fixings should be installed at max. 300 mm centres. Please note that in this case the number of layers of ArmaProtect Wrap to be used in the assembly can be taken from above table (please see p.20).** (First support positioned 400 mm from both faces of the wall). PVC pipes: Interpolation between pipes of Ø50 mm: 1.8-3.7 mm wall thickness to Ø200 mm: 7.7-9.6 mm wall thickness. PP pipes: Interpolation between pipes of Ø50 mm: 2.9-6.9 mm wall thickness to Ø200 mm: 4.9-18.2 mm wall thickness. PE pipes: Interpolation between pipes of Ø50 mm: 2.9-4.6 mm wall thickness to Ø200 mm: 11.9-18.4 mm wall thickness. For more information please refer to ETA 19/0712, B2.2.2 or consult your Armacell contact.

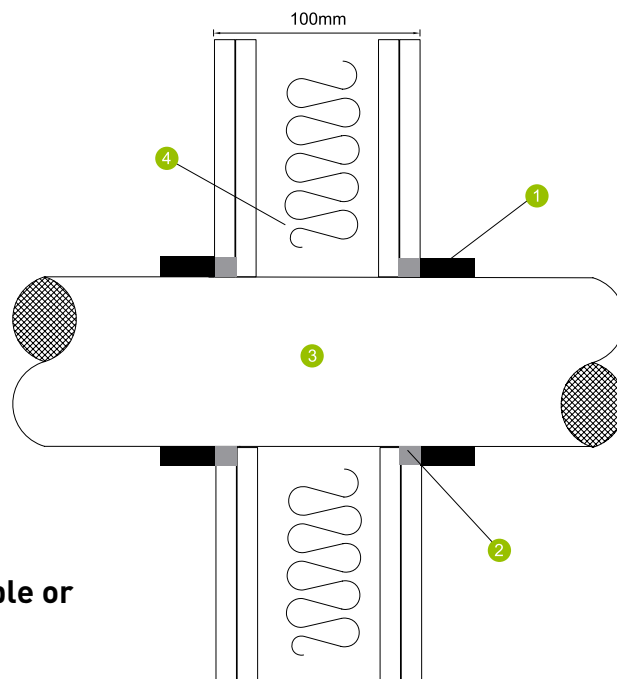
## ARMAPROTECT COLLAR

Designed according to ETA 19/0713

1. ArmaProtect Collar
2. ArmaProtect Seal
3. Plastic pipe penetration
4. Flexible or rigid wall

Fixed on both sides of the wall with a 6 mm x 65 mm long Fischer HM S steel toggle anchor or equivalent

**ArmaProtect Collar installed on both sides of flexible or rigid wall with a minimum thickness of 100 mm**



## PVC / PP / PE PIPES

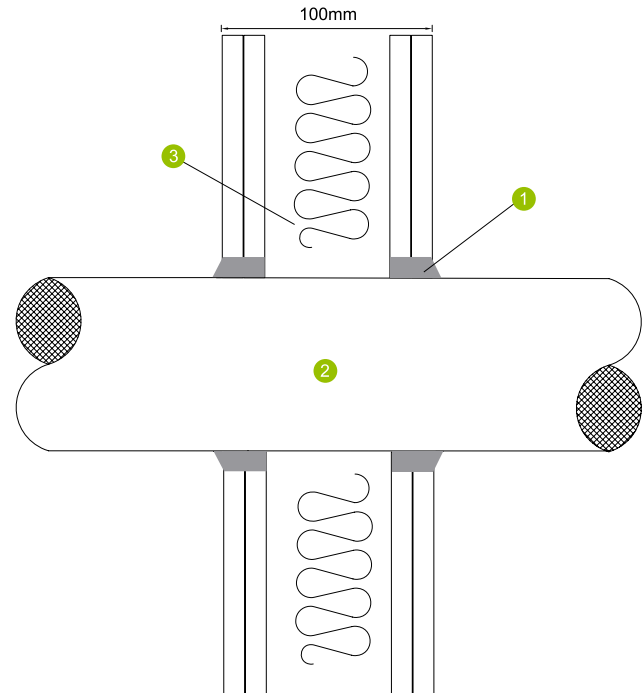
ArmaProtect Collar	Penetration specification			Annulus space	Classification
Size	Pipe type and thickness			mm	EN 13501-2
	PVC	PP	PE		
32	1.8	2.9	2.9		
40	1.8	2.9	2.9		
50	1.8	2.9	2.9		
55	2.3 – 3.0	2.9 – 4.4	2.9 – 4.4		
63	2.3 – 3.0	2.9 – 4.4	2.9 – 4.4		
75	3.1 – 4.8	2.8 – 6.7	2.8 – 6.7	10	EI 120 U/C
82	3.1 – 4.8	2.8 – 6.7	2.8 – 6.7		
90	4.2 – 7.4	2.7 – 10	2.7 – 10		
100	4.2 – 7.4	2.7 – 10	2.7 – 10		
110	4.2 – 7.4	2.7 – 10	2.7 – 10		
125	6	3.1	3.1		
140	6.1 – 7.5	3.5 – 8.0	3.9 – 5.8		
160	6.2 – 9.5	4.0 – 14.6	4.9 – 9.5		
250	6.2 (only for PP pipes)				

For flexible or rigid walls with a minimum thickness of 100 mm, **ArmaProtect Collar (applied on both sides of the wall)** can also be used within **ArmaProtect Board (2x50mm)** for an opening of maximum **730 mm (W) x 1200 mm (H)** for non-insulated **PVC, PP and PE pipes to achieve a classification of EI 120 U/C**. Please note that in this case data provided in the table above also applies, with the exception of data for  $\varnothing$  160 and  $\varnothing$  250, for PP pipes (First support positioned 400 mm from both faces of the wall). For more information please refer to ETA 19/0712, B2.1.3 or consult your Armacell contact.



**ARMAPROTECT SEAL X****Designed according to ETA 19/0715**

1. ArmaProtect Seal X
2. Plastic pipe
3. Flexible or rigid wall



**ArmaProtect Seal X applied to both sides of flexible or rigid walls**

**PVC / PP / PE / ABS PIPES**

Min. wall thickness mm	Position of first support from the upper face of the substrate mm	Pipe type mm	Pipe diameter mm	Wall thickness mm	Annulus mm	Depth mm	Backing material	Classification (EN 13501-2)
120	150	PVC	40	1.9 – 3.0	10	25	N/A	EI 120 U/C
120	150	PVC	125	4.8 – 7.4	16	25	30mm deep, stone wool (80kg/m <sup>3</sup> )	EI 120 U/C
100	270	PVC	125	9.2	20	25	N/A	EI 60 C/U
120	150	PE	90	9.2	12.5	25	N/A	EI 120 U/C
100	270	ABS	40	1.9	20	25	N/A	EI 120 C/U
120	150	ABS	90	6.0	12.5	25	N/A	EI 120 U/C
100	270	PP	40	2.0	20	25	N/A	EI 120 C/U

For rigid walls with a minimum thickness of 150 mm, **ArmaProtect Seal X (20 mm annulus x 25 mm depth, applied on both sides of the wall)** can also be used within ArmaProtect Board (2x50mm) for an opening of maximum **750 mm (W) x 1100 mm (H)** for non-insulated **PVC pipes**. In this case, to achieve a classification of **EI 120 U/C**, interpolation is possible between pipes of Ø50mm: 2.4-7.4 mm wall thickness to Ø125mm: 7.4 mm wall thickness. To achieve a classification of **EI 90 U/C**, interpolation is possible between pipes of Ø50 mm: 2.4-7.4 mm wall thickness to Ø125mm: 4.8-7.4 mm wall thickness. (First support positioned 400mm from both faces of the wall). For more information please refer to ETA 19/0712, B3.2.3 or consult your Armacell contact.

## 2. INSULATED PLASTIC PIPES

### A) Flexible and rigid wall

#### Substrates

**Flexible walls:** The walls must have a minimum thickness of 100 mm and consist of timber or steel studs lined on both faces with minimum 2 layers of 12.5 mm thick "Type F" gypsum boards according to EN 520. In timber stud walls, no part of the penetration seal shall be closer than 100 mm to a stud, and minimum 100 mm of insulation of class A1 or A2 according to EN 13501-1 is provided within the cavity between the penetration seal and the stud.

**Rigid walls:** The wall must have a minimum thickness of 100 mm and consist of concrete, aerated concrete or masonry, with a minimum density of 650 kg/m<sup>3</sup>.

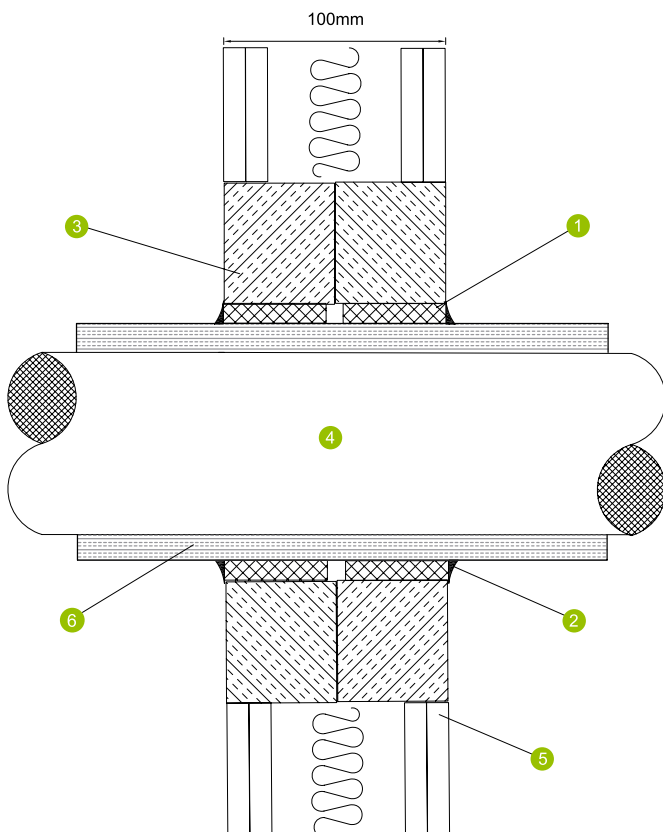
#### Service support requirements

Services must be supported at maximum 400 mm on both sides from the face of the separating element for walls. The supporting construction must be classified in accordance with EN 13501-2 for the required fire resistance period.

### ARMAPROTECT WRAP USED WITH ARMAPROTECT BOARD

#### Designed according to ETA 19/0712

The total amount of cross sections (including insulation) should not exceed 60 % of the penetration area.



1. ArmaProtect Wrap, number of layers as indicated in the table below
2. ArmaProtect Seal
3. ArmaProtect Board
4. Plastic pipe
5. Flexible or rigid wall
6. Elastomeric foam or phenolic foam

Configuration of ArmaProtect Wrap layers in relation to type of thermal insulation used on the pipe.

Insulation type	Layers	Thickness (mm)	Pipe Ø mm
Elastomeric <sup>1</sup> or phenolic foam <sup>2</sup>	3	3x2	40
	5	5x2	110

<sup>1</sup> Minimum reaction to fire B/B<sub>L</sub>-s3, d0  
(Classified acc. to EN 13501-1  
Tested acc. to EN 13823; EN ISO 11925-2)

<sup>2</sup> Minimum reaction to fire B<sub>L</sub>-s1, d0  
(Classified acc. to EN 13501-1  
Tested acc. to EN 13823; EN ISO 11925-2)

## ArmaProtect Wrap in ArmaProtect Board fitted flush to both sides of flexible or rigid walls with a minimum thickness of 100 mm

### PVC PIPES

Max. opening mm	Penetration specification		System				Classification
	Pipe diameter mm	Wall thickness mm	Insulation type Continued Sustained	Insulation thickness mm	ArmaProtect Board thickness: 50 mm	ArmaProtect Wrap width: 40 mm	
730 mm (W) x 1200 mm (H)	40	1.9	Elastomeric foam	32	2 x 50 mm	2 x 3 layers of 2 mm (T)	E 120 C/U EI 90 C/U
	40	3.0		9			
	110	4.2		32		2 x 5 layers of 2 mm (T)	EI 120 C/U
	110	6.6		13			
	40	1.9	Phenolic foam	25		2 x 3 layers of 2 mm (T)	E 120 C/U EI 90 C/U
	40	3.0		15			
	110	4.2		25		2 x 5 layers of 2 mm (T)	EI 120 C/U E 120 C/U EI 90 C/U
	110	6.6		20			

## 1. NON-INSULATED METAL PIPES

### A) Rigid Floor

#### Substrates

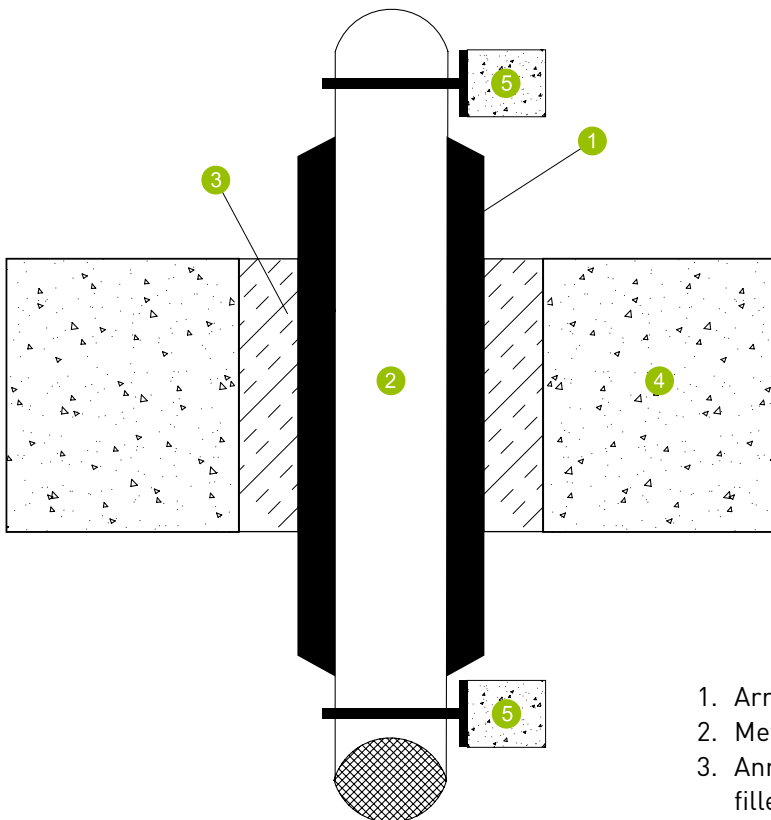
The rigid floor (aerated concrete, concrete) must be a minimum of 150 mm thick and have a minimum density of 550 kg/m<sup>3</sup>. The rigid floor must be classified in accordance with EN 13501-2 for the required fire resistance period.

#### Service support requirements

The pipes must be supported at least on the top of the separating element. The supporting construction must be classified in accordance with EN 13501-2 for the required fire resistance period.

### ARMAFLEX PROTECT (for non-insulated and insulated metal pipes)

Designed according to ETA 11/0454



1. ArmaFlex Protect
2. Metal pipe
3. Annular gap (maximum width 50 mm) – to be filled completely with gypsum joint filler, cement or mortar (“gap filler”)
4. Rigid floor
5. Service support construction (at least on the top of the separating element)

## ArmaFlex Protect fitted into a rigid floor with a minimum thickness of 150 mm

### METAL PIPES

Pipe diameter mm	Wall thickness of the pipe mm	ArmaFlex Protect		Adjoining insulation		Fire resistance classification
		Insulation thickness mm	Insulation length [L] mm	Insulation thickness mm	Insulation length mm	
≤ 8	1.0 – 14.2	16		-	-	EI 120 C/U
> 8 – ≤ 15	1.0 – 14.2	19	≥ 500	-	-	EI 120 C/U
> 15 – ≤ 25	1.0 – 14.2	20		-	-	EI 120 C/U
> 25 – ≤ 35	1.0 – 14.2	25		-	-	EI 120 C/U
> 35 – ≤ 42	1.5 – 14.2	25		-	-	EI 120 C/U
> 42 – ≤ 89	2.0 – 14.2	25	≥ 1000	-	-	EI 120 C/U
> 89 – ≤ 108	2.5 – 14.2	25		25	≥ 150	EI 90 C/U
> 108 – ≤ 168.3 <sup>1,2</sup>	2.9 – 14.2	26	≥ 500	25	≥ 450	EI 90 C/U
> 168.3 – ≤ 326 <sup>1,2</sup>	5.6 – 14.2	26		25	≥ 750	EI 60 C/U

<sup>1</sup> only valid for steel pipes; <sup>2</sup> Adjoining insulation must be AF/ArmaFlex

## 1. NON-INSULATED METAL PIPES

### B) Flexible and rigid wall

#### Substrates

**Rigid wall:** The wall (aerated concrete, concrete, masonry) must be a minimum of 100 mm thick. The rigid wall must be classified in accordance with EN 13501-2 for the required fire resistance period.

**Flexible wall:** The wall must be a minimum of 94 mm thick. Steel studs or timber studs lined on both faces with minimum 2 layers of boards (minimum thickness 12.5 mm) with classification A2-s1,d0 or A1 according to EN 13501-1. For timber stud walls there must be a minimum distance of 100 mm between the penetration seal and any timber stud.

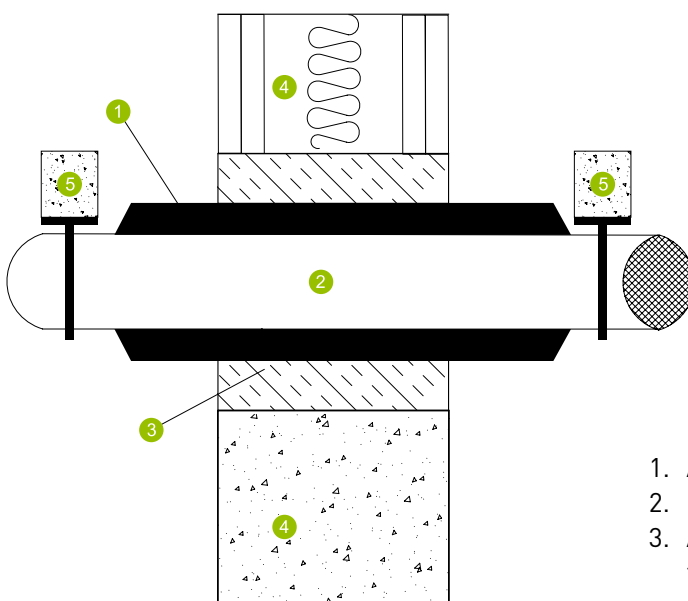
The cavity between the penetration seal and the timber stud has to be closed with at least 100 mm of insulation classified A1 or A2 according to EN 13501-1. Classification according to EN 13501-2:  $\geq$  EI 90.

#### Service support requirements

The pipes must be supported on both sides of the separating element. The first support (service support construction) for multi-layer composite pipes, metal pipes and additional auxiliary cables and auxiliary heaters in flexible and rigid walls has to be at maximum 650 mm (measured from the surface of the separating element).

### ARMAFLEX PROTECT (for non-insulated and insulated metal pipes)

Designed according to ETA 11/0454



1. ArmaFlex Protect
2. Metal pipe
3. Annular gap (maximum width 50 mm) – to be filled completely with gypsum joint filler, cement or mortar (“gap filler”)
4. Flexible or rigid wall
5. Service support construction on both sides of the wall

## ArmaFlex Protect fitted into a flexible or rigid wall with a minimum thickness of 100 mm

### METAL PIPES

Pipe diameter mm	Wall thickness of the pipe mm	ArmaFlex Protect		Adjoining insulation		Fire resistance classification
		Insulation thickness mm	Insulation length [L] mm	Insulation thickness mm	Insulation length mm	
≤ 8	1.0 – 14.2	16		-	-	EI 120 C/U
> 8 – ≤ 15	1.0 – 14.2	19	≥ 500	-	-	EI 90 C/U
> 15 – ≤ 28	1.0 – 14.2	20		-	-	EI 90 C/U
≤ 35	1.0 – 14.2	25		-	-	EI 120 C/U
> 35 – ≤ 42	1.5 – 14.2	25		-	-	EI 120 C/U
> 42 – ≤ 89	2.0 – 14.2	25	≥ 1000	-	-	EI 120 C/U
> 89 – ≤ 108	2.5 – 14.2	25		-	-	EI 90 C/U
> 108 – ≤ 168.3 <sup>1, 2</sup>	3.0 – 14.2	26	≥ 500	25	≥ 450	EI 45 C/U

<sup>1</sup> Only valid for steel pipes; <sup>2</sup> Adjoining insulation must be AF/ArmaFlex



## 2. INSULATED METAL PIPES

### A) Rigid Floor

#### Substrates

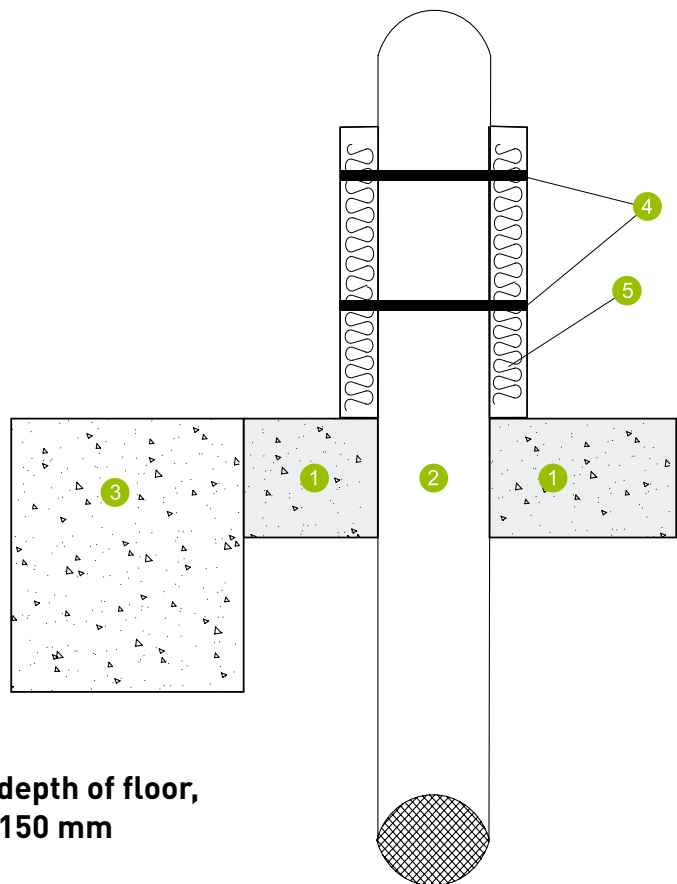
The rigid floor (aerated concrete, concrete) must be a minimum of 150 mm thick and have a minimum density of 650 kg/m<sup>3</sup>. The rigid floor must be classified in accordance with EN 13501-2 for the required fire resistance period.

#### ARMAPROTECT 1000-HS

##### Designed according to ETA 19/0716

The total amount of cross sections of services (including insulation) should not exceed 60% of the penetration area.

1. ArmaProtect 1000-HS
2. Metal pipe
3. Rigid floor, minimum density 650 kg/m<sup>3</sup>
4. Service support construction (at least on the top of the separating element)
5. Stone wool pipe section



**ArmaProtect 1000-HS installed 100 mm depth of floor, rigid walls with a minimum thickness of 150 mm**

### METAL PIPES

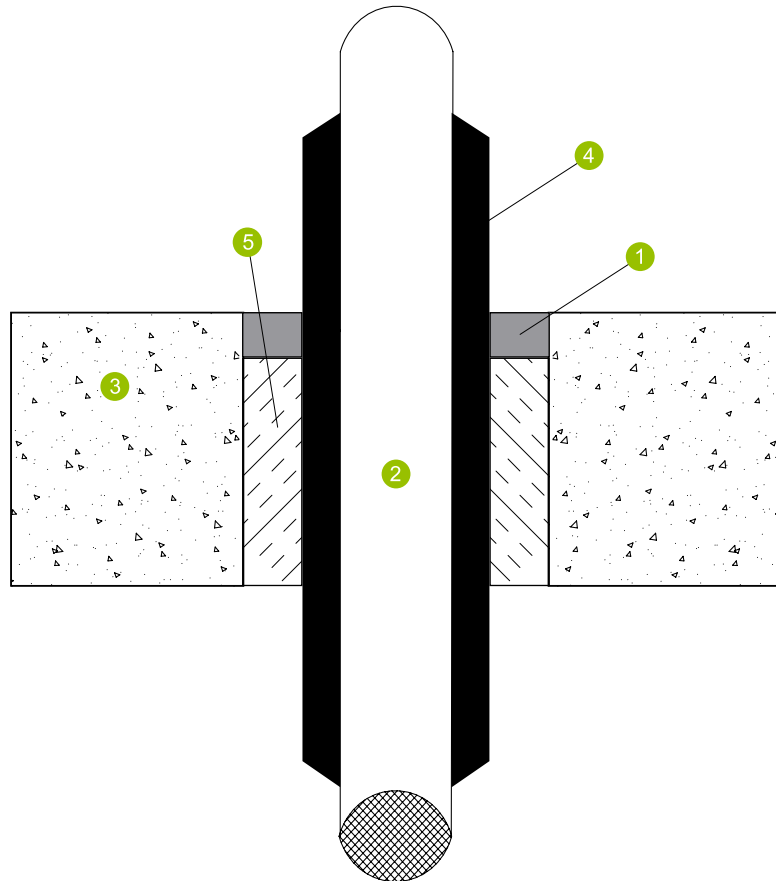
Max. opening		Penetration specification				Classification
mm	Pipe material	Pipe diameter mm	Wall thickness mm	Insulation type Local Interrupted 500mm	Insulation thickness mm	EN 13501-2
1800 mm (W) x 1800 mm (L)	Copper	40-107	1.5 – 14.2	Foil-faced stone wool min. 120 kg/m <sup>3</sup>	50	EI 15 C/U
	Steel	40-115	3.5 – 14.2	Foil-faced stone wool min. 120 kg/m <sup>3</sup>		EI 120 C/U
		160	5.0 – 14.2	Foil-faced stone wool min. 120 kg/m <sup>3</sup>		EI 90 C/U

\*The minimum permitted separation between adjacent seals/apertures is 200 mm.  
Services within the system ArmaProtect 1000-HS do not require a minimum separation.

**ARMAPROTECT SEAL X****Designed according to ETA 19/0715**

1. ArmaProtect Seal X
2. Metal pipe
3. Rigid floor
4. Elastomeric Foam \*
5. 100 mm deep stone wool backing (45 kg/m<sup>3</sup>)

\* AF/ArmaFlex, AF/ArmaFlex N, AF/ArmaFlex Class O, ArmaFlex XG and ArmaFlex ACE Plus.



Position of first support from the upper face of the substrate mm	Pipe diameter mm	Wall thickness mm	Insulation type Continued Sustained	Thickness mm	Annulus mm	Depth mm	Classification (EN 13501-2)
250	41 – 159	2.5 – 14.2	Elastomeric Foam	16 – 32	20	25	EI 20 U/C
	41	1.4 – 14.2	Elastomeric Foam	16	20	25	EI 60 U/C

## 2. INSULATED METAL PIPES

### B) Flexible and rigid wall

#### Substrates

**Flexible walls:** The walls must have a minimum thickness of 100 mm and consist of timber or steel studs lined on both faces with minimum 2 layers of 12.5mm thick "Type F" gypsum boards according to EN 520. In timber stud walls, no part of the penetration seal shall be closer than 100 mm to a stud, and minimum 100 mm of insulation of class A1 or A2 according to EN 13501-1 is provided within the cavity between the penetration seal and the stud.

**Rigid walls:** The wall must have a minimum thickness of 100 mm and consist of concrete, aerated concrete or masonry, with a minimum density of 650 kg/m<sup>3</sup>.

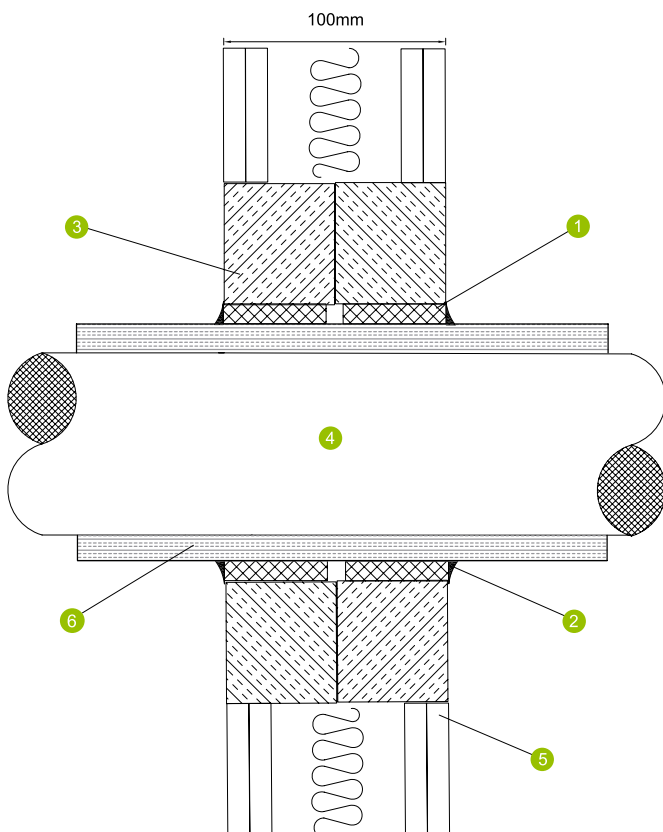
#### Service support requirements

Services must be supported at maximum 400 mm on both sides from the face of the separating element for walls. The supporting construction must be classified in accordance to EN 13501-2 for the required fire resistance period.

### ARMAPROTECT WRAP USED WITH ARMAPROTECT BOARD

#### Designed according to ETA 19/0712

The total amount of cross sections (including insulation) should not exceed 60% of the penetration area.



1. ArmaProtect Wrap, number of layers as indicated in the table below
2. ArmaProtect Seal
3. ArmaProtect Board
4. Metal pipe
5. Flexible or rigid wall
6. Various types of insulation

Configuration of ArmaProtect Wrap layers in relation to type of thermal insulation used on the pipe.

Insulation Type	Layers	Thickness (mm)
Phenolic foam <sup>1</sup>	2	2x2
Elastomeric Foam <sup>2</sup>	2	2x2
Glass wool	2	2x2

First service support 400 mm from both faces of the substrate.

<sup>1</sup> Minimum reaction to fire B<sub>L</sub>-s1, d0  
(Classified acc. to EN 13501-1  
Tested acc. to EN 13823; EN ISO 11925-2)

<sup>2</sup> Minimum reaction to fire B/B<sub>L</sub>-s3, d0  
(Classified acc. to EN 13501-1  
Tested acc. to EN 13823; EN ISO 11925-2)

## ArmaProtect Wrap in ArmaProtect Board fitted flush to both sides of flexible or rigid walls with a minimum thickness of 100 mm

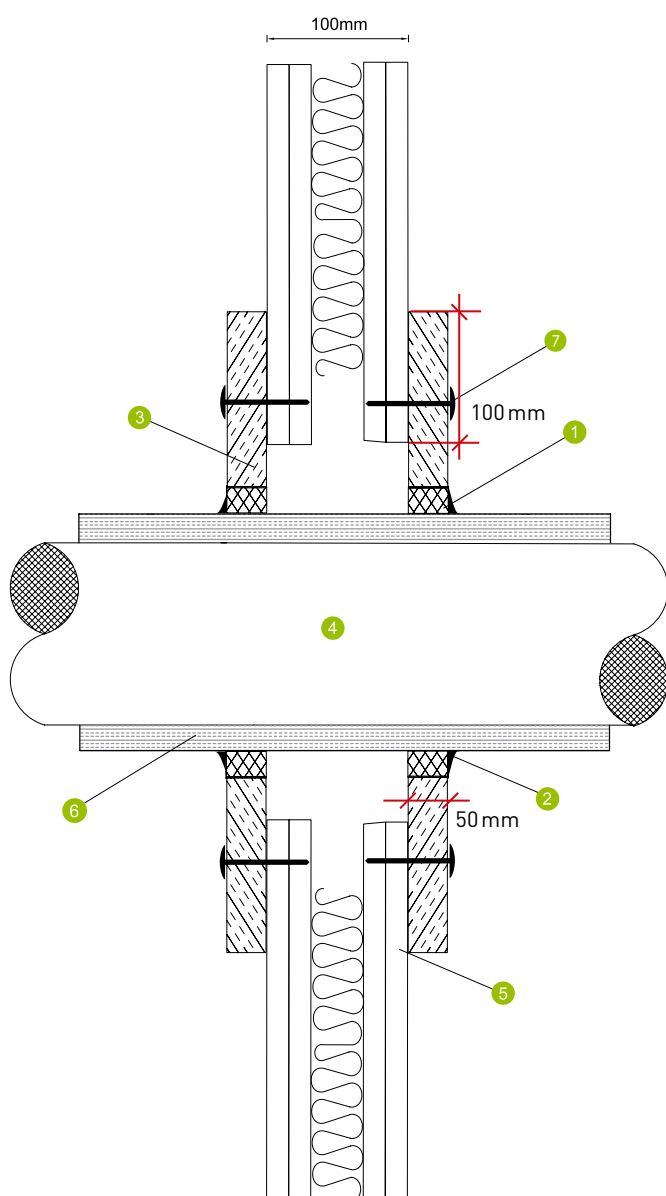
### METAL PIPES

Max. opening mm	Penetration specification		System				Classification EN 13501-2
	Pipe diameter mm	Wall thickness mm	Insulation type Continued Sustained	Insulation thickness mm	ArmaProtect Board thickness: 50 mm	ArmaProtect Wrap width: 40 mm	
750 mm (W) x 1200 mm (H)	42 – 159	1.2 – 14.2	Elastomeric foam	13 – 25	2 x 50 mm	2 x 2 layers of 2 mm (T)	E 120 C/U EI 60 C/U
	42	1.0 – 14.2					E 120 C/U EI 90 C/U
	42 – 108	1.2 – 14.2	Phenolic foam	25 – 40			E 120 C/U EI 60 C/U
	42	1.0 – 14.2					E 120 C/U EI 90 C/U
42	1.2 – 14.2	Glass wool	50	E 120 C/U EI 90 C/U			

## ARMAPROTECT WRAP USED WITH ARMAPROTECT BOARD (Patress installation)

### Designed according to ETA 19/0712

The total amount of cross sections (including insulation) should not exceed 60% of the penetration area.



1. ArmaProtect Wrap, number of layers as indicated in the table below
2. ArmaProtect Seal
3. ArmaProtect Board
4. Metal pipe
5. Flexible or rigid wall
6. Various types of insulation
7. 6 mm x 80 mm steel screws

Configuration of ArmaProtect Wrap layers in relation to type of thermal insulation applied on the pipe.

Insulation Type	Layers	Thickness (mm)
Phenolic foam <sup>1</sup>	2	2x2
Elastomeric Foam <sup>2</sup>	2	2x2
Glass wool	2	2x2

Patress installation of ArmaProtect Board installed on horizontal rows. Overlap of ArmaProtect Board onto the substrate; minimum 100 mm. ArmaProtect Board mechanically fixed to substrate with minimum 6 mm x 80 mm steel screws and steel retaining washers. Fixings installed at maximum 300 mm centres. First service support 400 mm from both faces of substrate.

<sup>1</sup> Minimum reaction to fire B<sub>L</sub>-s1, d0  
(Classified acc. to EN 13501-1  
Tested acc. to EN 13823; EN ISO 11925-2)

<sup>2</sup> Minimum reaction to fire B/B<sub>L</sub>-s3, d0  
(Classified acc. to EN 13501-1  
Tested acc. to EN 13823; EN ISO 11925-2)

## ArmaProtect Wrap in ArmaProtect Board in patress installation on both sides of flexible or rigid walls with a minimum thickness of 100 mm

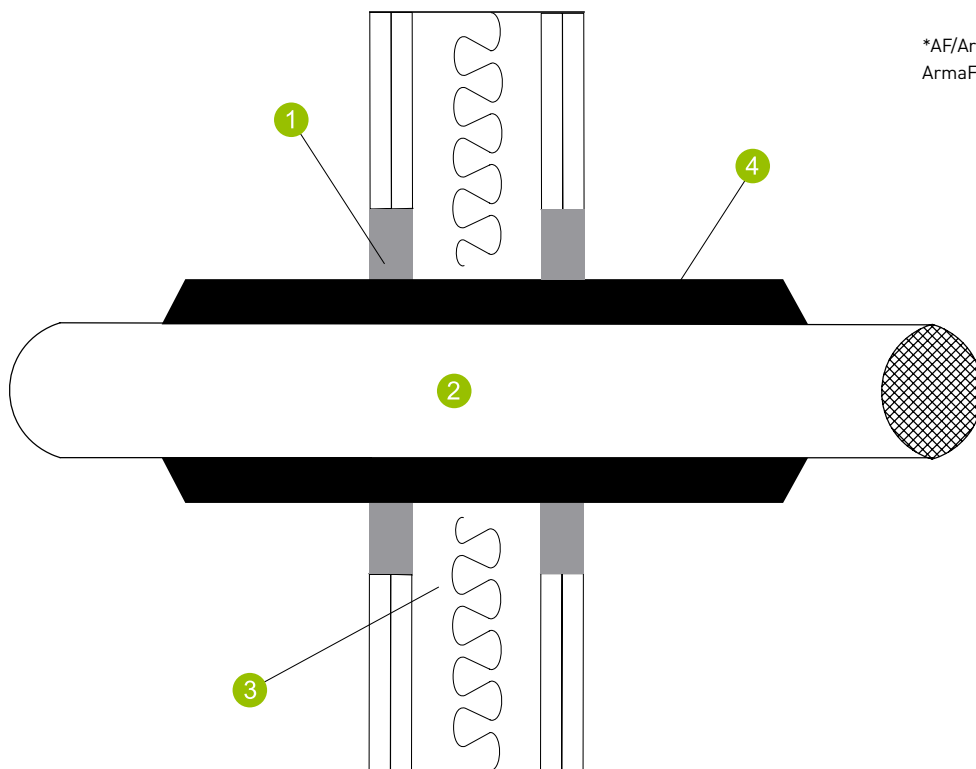
### METAL PIPES

Max. opening mm	Penetration specification		System				Classification EN 13501-2
	Pipe diameter mm	Wall thickness mm	Insulation type Continued Sustained	Insulation thickness mm	ArmaProtect Board thickness: 50 mm	ArmaProtect Wrap width: 40 mm	
750 mm (W) x 1200 mm (H)	42 – 159	1.2 – 14.2	Elastomeric foam	13 – 25	2 x 50 mm	2 x 2 layers of 2 mm (T)	E 120 C/U EI 60 C/U
	42 – 159	1.2 – 14.2		25			E 120 C/U EI 90 C/U
	42	1.0 – 14.2	Phenolic foam	13 – 25			EI 120 C/U
	42 – 108	1.2 – 14.2		25 – 40			E 120 C/U EI 90 C/U
	42	1.0 – 14.2		EI 120 C/U			
	42	1.2 – 14.2		Glass wool min. 30 kg/m <sup>3</sup>			50

**ARMAPROTECT SEAL X****Designed according to ETA 19/0715**

1. ArmaProtect Seal X
2. Metal pipe
3. Flexible or rigid wall
4. Elastomeric foam \*

\*AF/ArmaFlex, AF/ArmaFlex N, AF/ArmaFlex Class 0, ArmaFlex XG and ArmaFlex ACE Plus.

**METAL PIPES**

Min. wall thickness mm	Position of first support from the upper face of the substrate mm	Pipe diameter mm	Wall thickness mm	Insulation Type	Definition of pipe insulation	Thickness mm	An-nulus mm	Depth mm	Backing material	"Classification (EN 13501-2)"
120	150	15	0.8 – 7.0	Elastomeric Foam*	Continued Sustained	13	15	25	N/A	EI 120 U/C
120	150	60	0.8 – 14.2	Elastomeric Foam*	Continued Sustained	32	20	25	N/A	EI 90 U/C
100	400	40	1.5 – 14.2	Elastomeric Foam*	Local Sustained 650 mm	32	20	25	N/A	EI 30 C/U
100	400	40 – 159	2.0 – 14.2	Elastomeric Foam*	Local Sustained 650 mm	32	20	25	N/A	EI 30 C/U

\* Includes brand names: AF/ArmaFlex, AF/ArmaFlex N, AF/ArmaFlex Class 0, ArmaFlex XG and ArmaFlex ACE Plus



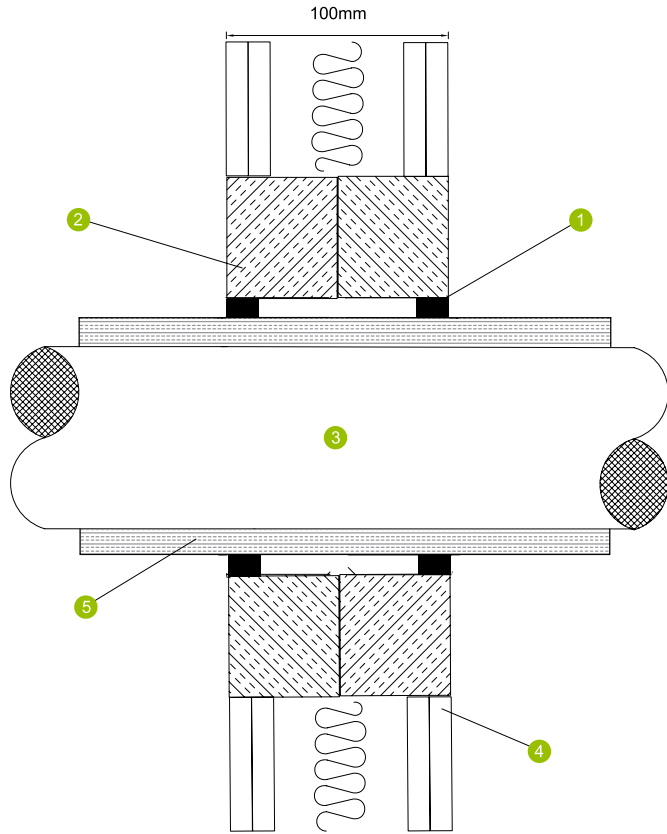


## ARMAPROTECT SEAL X USED WITH ARMAPROTECT BOARD

Designed according to ETA 19/0712

The total amount of cross sections (including insulation) should not exceed 60% of the penetration area.

1. ArmaProtect Seal X
2. ArmaProtect Board
3. Metal pipe
4. Flexible or rigid wall
5. Glass wool insulation



**ArmaProtect Seal X (applied on both sides) within ArmaProtect Board (2x50 mm), rigid or flexible wall with minimum thickness of 100 mm**

### METAL PIPES

Max. opening mm	Position of first support from both faces of the substrate mm	Penetration specification		Insulation type		ArmaProtect Seal X		Backing material	Classification EN 13501-2	
		Pipe diameter mm	Wall thickness mm	Definition of pipe insulation	Thickness mm	Annulus mm	Depth mm			
730 mm (W) x 1200 mm (H)	250	40	1.5 - 14.2	foil-faced glass wool (80 kg/m³)	Continued Sustained	20	15	15	N/A	EI 60 C/U
		40 - 159	2.3 - 14.2		Continued Sustained	30				

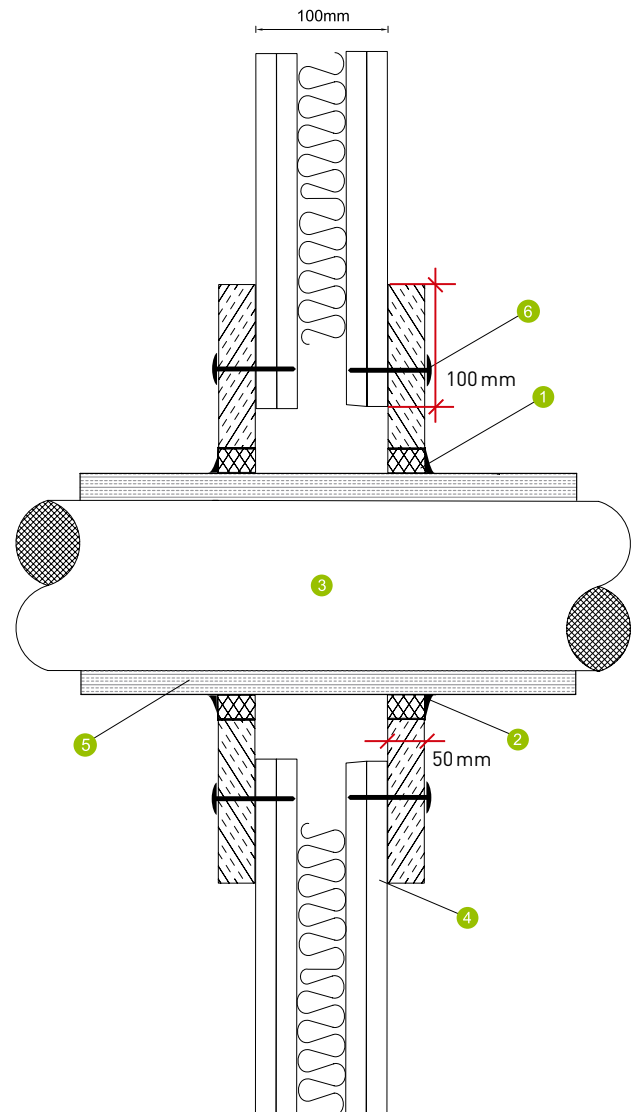
## ARMAPROTECT BOARD (Patress installation)

### Designed according to ETA 19/0712

The total amount of cross sections (including insulation) should not exceed 60 % of the penetration area.

Patress installation of ArmaProtect Board: The boards are installed in horizontal rows and fixed on at least two vertical edges. Overlap of ArmaProtect Board onto the substrate minimum 100 mm. ArmaProtect Board mechanically fixed onto substrate with minimum 6 mm x 80 mm steel screws and steel retaining washers. Fixings installed at maximum 300 mm centres.

1. ArmaProtect Seal X
2. ArmaProtect Board
3. Metal pipe
4. Flexible or rigid wall
5. Glass wool insulation
6. 6 mm x 80 mm steel screws



**ArmaProtect Board in patress installation on both sides of flexible or rigid walls with a minimum thickness of 100 mm**

## METAL PIPES

Max. opening mm	Position of first support from both faces of the substrate mm	Penetration specification		Insulation type		Classification EN 13501-2
		Pipe diameter mm	Wall thickness mm	Definition of pipe insulation	Thickness mm	
600 mm (W) x 600 mm (H)	400	42	1.0 – 14.2	foil-faced glass wool (30 kg/m <sup>3</sup> )	Continued Sustained	EI 120 C/U
		42 – 159	1.2 – 14.2		Continued Sustained	EI 90 C/U

## 1. NON-INSULATED COMPOSITE PIPES

### A) Rigid Floor

#### Substrates

The rigid floor (aerated concrete, concrete) must be minimum of 150 mm thick. The rigid floor must be classified in accordance with EN 13501-2 for the required fire resistance period.

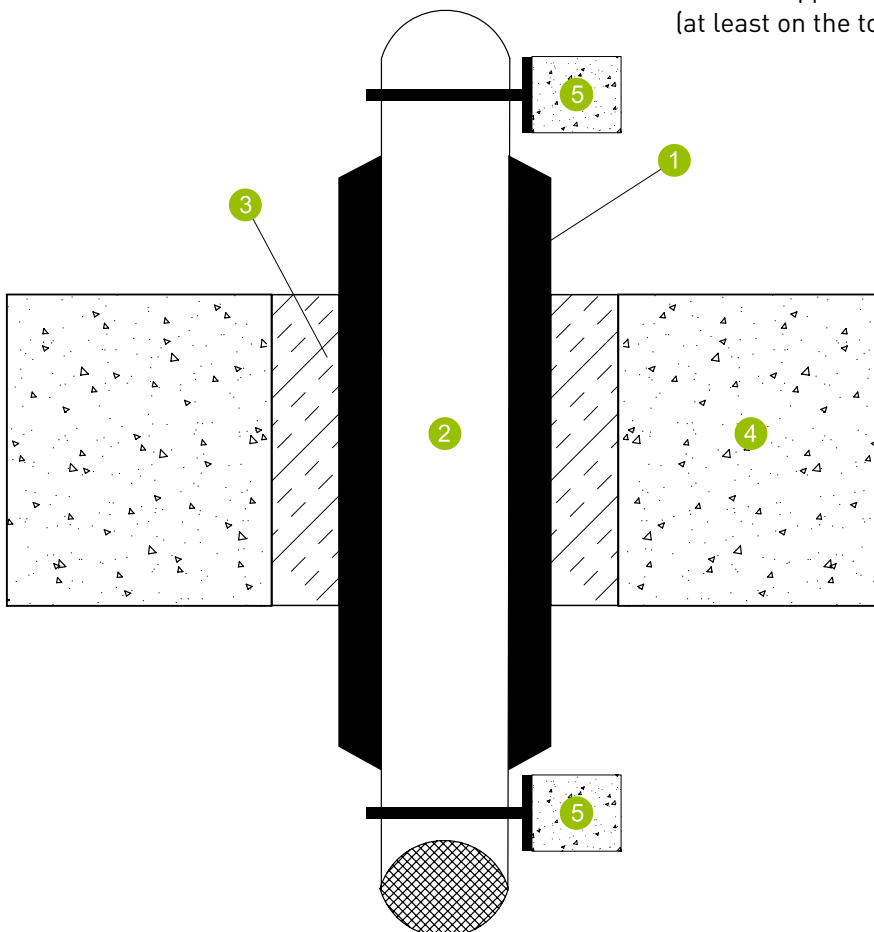
#### Service support requirements

The pipes must be supported at least on the top of the separating element. The supporting construction must be classified in accordance with EN 13501-2 for the required fire resistance period.

### ARMAFLEX PROTECT (for non-insulated and insulated composite pipes)

Designed according to ETA 11/0454

1. ArmaFlex Protect
2. Alpex F50 Profi and Alpex L pipe
3. Annular gap (maximum width 50 mm) – to be filled completely with gypsum joint filler, cement or mortar (“gap filler”)
4. Rigid floor, min. density 550 kg/m<sup>3</sup>
5. Service support construction (at least on the top of the separating element)



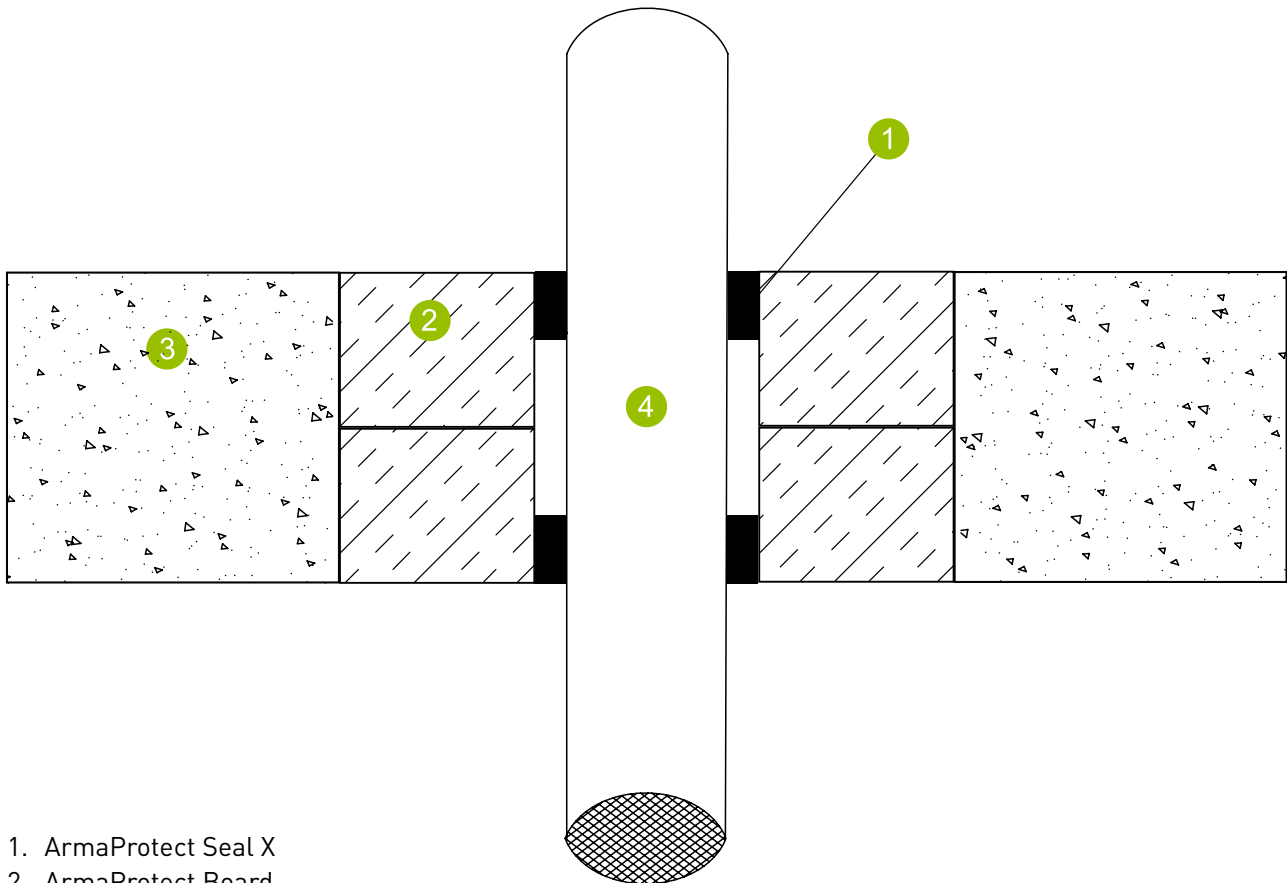
**ArmaFlex Protect fitted into a rigid floor with a minimum thickness of 150 mm****ALPEX F50 PROFI (16 – 32 mm) and ALPEX L (40 – 75 mm) PIPES**

Pipe diameter mm	Wall thickness of the pipe mm	ArmaFlex Protect		Fire resistance classification
		Insulation thickness mm	Insulation length [L] mm	
16	2.0	20	≥ 500	EI 120 U/C
20	2.0	20		EI 120 U/C
26	3.0	20		EI 120 U/C
32	3.0	25		EI 90 U/C
40	3.5	25		EI 120 U/C
50	4.0	25		EI 90 U/C
63	4.5	25		EI 120 U/C
75	5.0	25		EI 120 U/C

**ARMAPROTECT SEAL X USED WITH ARMAPROTECT BOARD****Designed according to ETA 19/0712**

The total amount of cross sections (including insulation) should not exceed 60% of the penetration area.

Services must be supported at maximum 400 mm above the surface of the floor. The supporting construction must be classified in accordance with EN 13501-2 for the required fire resistance period.



1. ArmaProtect Seal X
2. ArmaProtect Board
3. Rigid floor, min. density 650 kg/m<sup>3</sup>
4. Uponor MLC pipe

**ArmaProtect Seal X (applied on both sides) within ArmaProtect Board (2x50mm), rigid floor with minimum thickness of 150 mm**

### UPONOR MLC PIPES

Max. opening mm	Penetration specification		ArmaProtect Seal X		ArmaProtect Board	Classification
	Pipe diameter mm	Wall thick- ness mm	Annulus mm	Depth mm	Thickness: 50 mm	
750 mm (W) x 1100 mm (L)	40	4.0	20	25	2 x 50 mm	EN 13501-2  EI 60 U/C
	50	4.5				
	63	6.0				
	75	7.5				
	90	8.5				
	110	10				

## 1. NON-INSULATED COMPOSITE PIPES

### B) Flexible and rigid wall

#### Substrates

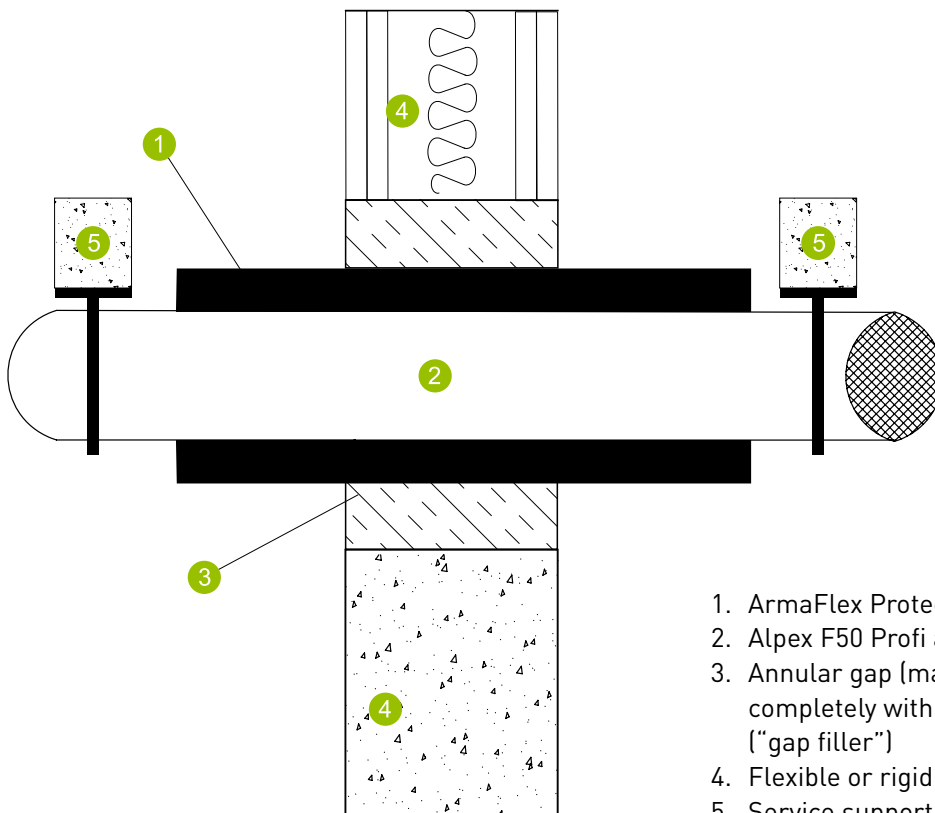
**Rigid wall:** The wall (aerated concrete, concrete, masonry) must be a minimum of 100 mm thick. The rigid wall must be classified in accordance with EN 13501-2 for the required fire resistance period.

**Flexible wall:** The wall must be at least 94 mm thick. Steel studs or timber studs lined on both faces with minimum 2 layers of boards (minimum thickness 12.5 mm)

with classification A2-s1,d0 or A1 according to EN 13501-1. For timber stud walls there must be a minimum distance of 100 mm between the penetration seal and any timber stud. The cavity between the penetration seal and the timber stud has to be closed with at least 100 mm of insulation classified A1 or A2 according to EN 13501-1. Classification according to EN 13501-2:  $\geq$  EI 90.

### ARMAFLEX PROTECT (for non-insulated and insulated composite pipes)

Designed according to ETA 11/0454



1. ArmaFlex Protect
2. Alpex F50 Profi and Alpex L pipe
3. Annular gap (maximum width 50 mm) – to be filled completely with gypsum joint filler, cement or mortar (“gap filler”)
4. Flexible or rigid wall
5. Service support construction on both sides of the wall

## ArmaFlex Protect fitted into a flexible or rigid wall with a minimum thickness of 100 mm

### ALPEX F50 PROFI (16 – 32 mm) and ALPEX L (40 – 75 mm) PIPES

Pipe diameter mm	Wall thickness of the pipe mm	ArmaFlex Protect		
		Insulation thickness mm	Insulation length [L] mm	Fire resistance classification
16	2.0	20	≥ 500	EI 120 U/C
20	2.0	20		EI 120 U/C
26	3.0	20		EI 120 U/C
32	3.0	25		EI 120 U/C
40	3.5	25		EI 120 U/C
50	4.0	25		EI 120 U/C
63	4.5	25		EI 120 U/C
75	5.0	25		EI 120 U/C



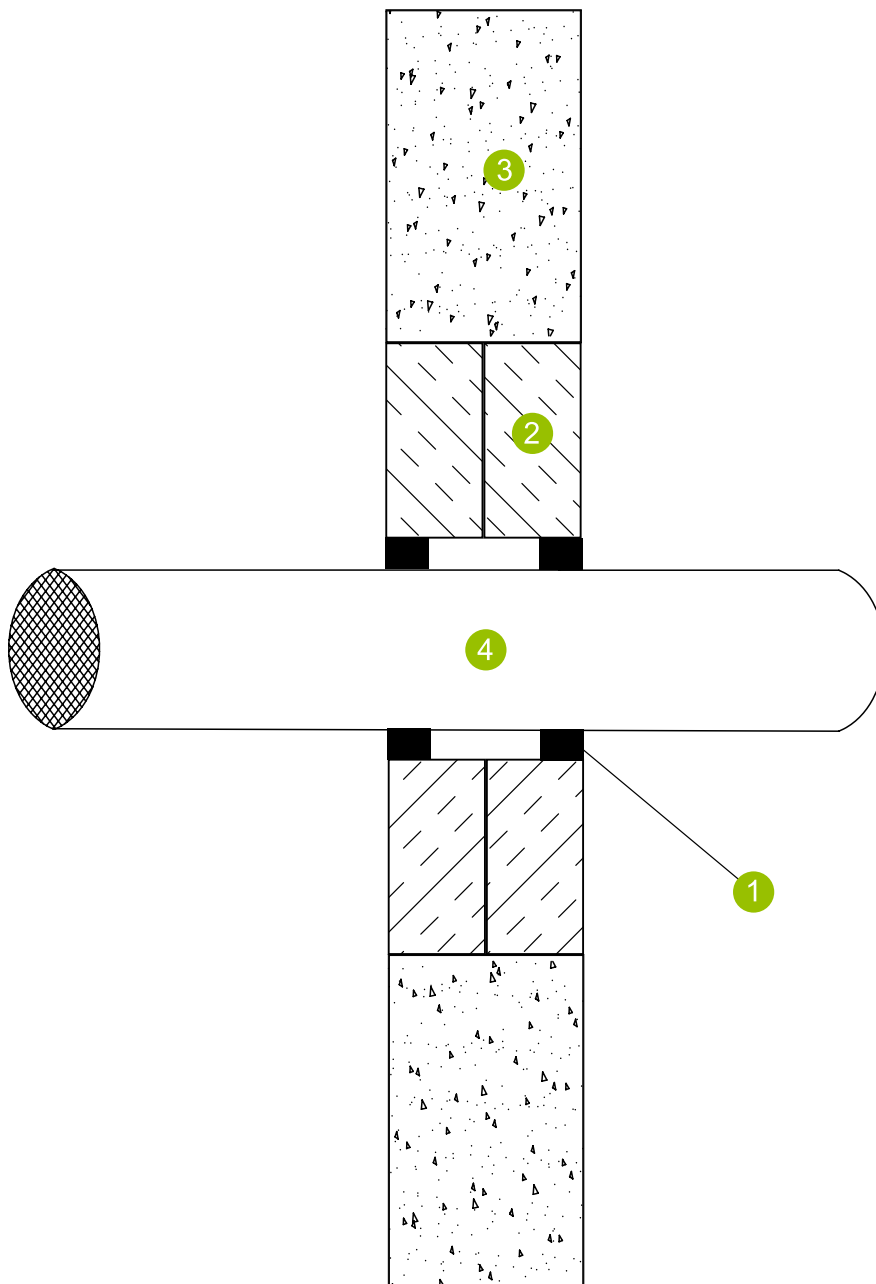


## ARMAPROTECT SEAL X USED WITH ARMAPROTECT BOARD

Designed according to ETA 19/0712

Services must be supported at maximum 400 mm on both sides from the face of the separating element for walls.

1. ArmaProtect Seal X
2. ArmaProtect Board
3. Rigid wall, min. density 650 kg/m<sup>3</sup>
4. Uponor MLC pipe



**ArmaProtect Seal X used with armaprotect board to both sides of rigid walls with a minimum thickness of 150 mm**

### UPONOR MLC PIPES

Max. opening	Penetration specification		ArmaProtect Seal X		ArmaProtect Board	Classification
	mm	Pipe diameter mm	Wall thickness mm	Annulus mm	Depth mm	
750 mm (W) x 1100 mm (L)	40	4.0	20	25	2 x 50 mm	EN 13501-2
	50	4.5				
	63	6.0				
	75	7.5				
	90	8.5				
	110	10				

## Installation of ArmaFlex Protect

The European Technical Assessment ETA-11/0454 of the Austrian Institute for Construction Engineering (OIB) is decisive when carrying out the pipe penetration seal. Only single pipe penetration seals are allowed and therefore each pipe to be sealed off must be equipped with ArmaFlex Protect.

ArmaFlex Protect seal is installed as tube or sheet material on the pipe which is centred in the opening in the separating element. Branches or elbows also have to be equipped with ArmaFlex Protect or in some cases with AF/ArmaFlex along the required minimum insulation length on both sides of the separating element.

For pipes with a diameter  $\leq 88.9$  mm ArmaFlex Protect tubes must be used. The tube can be either sleeved over the pipe or slit and glued with ArmaFlex 520 on the longitudinal seam. For pipes with outer diameter  $> 88.9$  mm ArmaFlex Protect sheet material has to be used. The sheet must be wrapped around the pipe, the longitudinal seam bonded and additionally fixed in place with a winding wire (steel wire with diameter  $\geq 0.5$  mm; minimum 6 windings per metre).

Secure the glued seam outside the building element with ArmaFlex self-adhesive tape. The ArmaFlex Protect tube or sheet has to be continuous along the required minimum insulation length ( $\geq 500$  mm for multi-layer composite pipes and metal pipes  $\geq 1000$  mm for metal pipes with a diameter  $> 35$  mm. For metal pipe penetrations with pipe diameters above  $\varnothing 88.9$  mm for floors and above  $\varnothing 108$  mm for walls, adjoining AF/ArmaFlex insulation (tubes or sheets) must be glued on both sides of ArmaFlex Protect. Butt joints must be glued with ArmaFlex 520.

The residual gap (maximum width 50 mm, measured from the surface of ArmaFlex Protect) between ArmaFlex Protect and the rigid wall or floor must be completely filled (over the entire thickness of the separating element) with gypsum joint filler, cement or mortar on both sides of the separating element.

The annular gap (maximum 50 mm width) between ArmaFlex Protect and a flexible wall must be filled with gypsum joint filler in at least the thickness of the lining after first filling the gap with shredded mineral wool (stone wool with classification A1 according to EN 13501-1, a min. compacted apparent density of  $100 \text{ kg/m}^3$  and a melting point  $\geq 1000^\circ\text{C}$  according to DIN 4102-17) or completely filled (over the entire thickness of the separating element) with gypsum joint filler on both sides of the separating element. For this, the surfaces must be clean, dry and free from all traces of oil, grease and dust.

## Installation of ArmaProtect WRAP

Please note, that the wrap is installed around the pipe at both faces of the wall and at the soffit and upper face of floors, depending on the application, by applying a number of layers to reach the required thickness. The number of layers is indicated in the detailed tables provided in the relevant sections.

Ensure that the services in question are tested with ArmaProtect Wrap, and the site conditions are within the application specifications. Sufficient annular space needs to be present around the service (pipe penetration) to allow adequate installation depth. All services need to be clean and free of all dust and loose particles. The aperture temperature needs to be +5 °C or above at the time of installation.

1. Ensure that the "non-mesh" side is facing towards the application surface (i.e. the mesh side is facing away from the application surface).
2. Make sure that ArmaProtect Wrap is applied around the pipe in the correct number of layers as per the tables provided in the related literature or on the product packaging.
3. It is recommended that the wrap is applied relatively loosely. Leave approximately 5 mm between the wrap and the surface of the pipe or insulation, to allow movement.

4. Slide the applied wrap into the annular space between the pipe and the separating element (wall/floor), leaving 5 mm from the surface (i.e. the distance between the surface of the wall/floor and the closest side of the wrap should be 5 mm).

5. Fill the annular space thoroughly and uniformly with ArmaProtect Seal flush with the surface of the separating element so that after the sealant is applied the installed wrap material is no longer visible.

6. Smooth off the ArmaProtect Seal surface for a more professional-looking finish.

## Installation of ArmaProtect BOARD

Ensure that the aperture and services in question have been tested with ArmaProtect Board and the site conditions are within the application specification. All services and apertures need to be clean and free of all dust and loose particles. The aperture temperature needs to be +5 °C or above at the time of installation. Upon installation, make sure that ArmaProtect Board is installed with at least 10 % friction fit. Measure the size of the opening, the position and size of the services. Mask all surfaces where necessary to ensure an aesthetic appearance of ArmaProtect sealant. Draw these details onto the ArmaProtect Board and cut out using a suitable saw. Coat all joints and interfaces (also along the edges of the newly formed ArmaProtect Board sections if cutting was required) of ArmaProtect Board thoroughly and uniformly with ArmaProtect Seal. Once compacted within the frame, finish off all exposed edges with ArmaProtect Seal to ensure a complete seal is achieved. Smooth off excess ArmaProtect Seal with a pallet knife to ensure a professional-looking finish. For patress installaton, upon application make sure that ArmaProtect Board is installed with 100 mm overlap onto the substrate. Fix the board to the substrate with at least 80 mm steel wood screws and penny washers and maximum 300 mm centres overcoated with 2 mm ArmaProtect Seal bead. Coat all joints using ArmaProtect Seal and ensure all leading edges of the ArmaProtect Board are coated with ArmaProtect Seal.

## Application of ArmaProtect SEAL

For good adhesion ensure the application surfaces are firm, clean, dry, uniform and free from any contaminants such as oil, grease or dust. Ensure that the aperture and services in question have been tested with ArmaProtect Seal and the site conditions are within the application specification. An annular space needs to be present around the service to apply sufficient installation depth. The aperture temperature needs to be at least +5 °C at the time of installation. Upon installation, make sure that you apply the ArmaProtect Seal around all services needed. Once compacted, smooth off the ArmaProtect Seal to produce a professional finish.

## Application of ArmaProtect SEAL X

Ensure that the aperture and services in question have been tested with ArmaProtect Seal X and the site conditions are within the application specification. An annular space needs to be present around the service to allow sufficient installation depth. All services and apertures need to be clean and free of all dust and loose particles. The aperture temperature needs to be at least +5 °C at the time of installation. When required use backing material as indicated in ETA 19/0715. The backing material should be non-combustible stone wool. Upon installation ensure that enough application area is left around the penetration. Apply ArmaProtect Seal X thoroughly and uniformly in the provided depth and annulus around all penetrations. Once compacted, smooth off the ArmaProtect Seal X surface to produce a professional finish. For applications where ArmaProtect Seal X is used with ArmaProtect Board, please also refer to ArmaProtect Board literature and ETA 19/0712 in addition to those for ArmaProtect Seal X.

## Installation of ArmaProtect COLLAR

Ensure that the aperture and services in question have been tested with ArmaProtect Collar and the site conditions are within the application specification. An annular space needs to be present around the service to allow a sufficient installation depth of ArmaProtect Seal.

All services and apertures need to be clean and free of all dust and loose particles. The aperture temperature needs to be at least +5 °C at the time of installation. Before installing ArmaProtect Collar make sure that you fill in the annular gap around the pipe and the substrate (maximum 10 mm annulus) with ArmaProtect Seal, place the ArmaProtect Collar around the pipe and fix the collar to the wall (on each side) or floor (underside) with the recommended fixings.

## Application of ArmaProtect 1000-HS

### ArmaProtect 1000-HS / water ratio:

Pourable mix ratio: 3 – 3 ½ : 1 ;

Trowelable mix ratio: 4:1

Mix sufficient material to be used within the recommended pot life (20-30 minutes). Time required for setting can change depending on conditions. Installation should not be carried in conditions where temperatures exceed +35 °C. Nominal setting times range between 30 and 90 minutes. Design strength is achieved when fully hardened and dry.

### Mixing:

ArmaProtect 1000-HS should preferably be mixed using a mechanical paddle type mixer, though it can also be mixed manually if necessary. Use clean water and a clean container for the mixing process. Slowly add ArmaProtect 1000-HS powder into the

correct amount of clean water and stir continually to ensure a smooth, homogeneous consistency is achieved in the correct ratio for the desired application method.

### Application:

All services and apertures need to be clean and free of all dust and loose particles. The aperture temperature needs to be at least +5 °C at the time of installation. Fill the full depth in a single pour to create a solid structure. Provide minimum 100 mm depth in a single pour to achieve load-bearing capabilities. Once filled smooth off the ArmaProtect 1000-HS to produce a professional finish.

When sealing holes in floor slabs, appropriate shuttering must be installed, cut to fit tightly around any services within the opening to support the wet mix until it sets. Non-combustible shuttering materials, such as mineral fibre slabs, can be left in place, but combustible materials must be removed after the mix has set. For complex penetrations it may be preferable to initially form a thin seal around all services with a 5 mm layer of ArmaProtect 1000-HS mix. Once this has set the remaining depth of seal should be poured in one operation.

**Please ensure that for specific cases permanent steel shuttering can be required in order to achieve long-term service conditions.**





<b>Ablative material</b>	The term describes a material which does not expand significantly when exposed to heat but may consume energy through chemical or physical processes and only degrade slowly in a fire, remaining sufficiently stable to delay the passage of heat, smoke, flames or any combination of these.
<b>Building element</b>	Integral part of a built environment. Note: This includes floors, walls, beams, columns, doors and penetrations, but does not include furnishings.
<b>Burning behaviour</b>	<fire tests> Response of a test specimen when it burns under specified conditions, to examination of reaction to fire or fire resistance
<b>Composite material</b>	Structured combination of two or more discrete materials.
<b>Fire barrier</b>	Separating element that exhibits fire integrity or fire stability or thermal insulation or a combination thereof, for a period of time under specified conditions.
<b>Fire classification</b>	Standardised system of classifying fires in terms of the nature of the fuel. Note: In Europe there are six classes: <ul style="list-style-type: none"> <li>- Class A: fire involving solid materials, usually of an organic nature, in which combustion normally takes place with the formation of glowing embers</li> <li>- Class B: fire involving liquids or liquefiable solids</li> <li>- Class C: fire involving gases</li> <li>- Class D: fire involving metals</li> <li>- Class E: fire involving electrical hazards</li> <li>- Class F: fires involving cooking oil or fat.</li> </ul>
<b>Fire compartment</b>	Enclosed space, which may be subdivided, separated from adjoining spaces by fire barriers.
<b>Fire integrity</b>	Ability of a separating element, when exposed to fire on one side, to prevent the passage of flames and hot gases or the occurrence of flames on the unexposed side for a stated period of time in a standard fire resistance test. Note: Compare with the term integrity criterion “E”.
<b>Fire resistance</b>	Ability of a test specimen to withstand fire or give protection from it for a period. Note: Typical criteria used to assess fire resistance in a standard fire test are fire integrity, fire stability and thermal insulation.
<b>Fire safety objective</b>	Desired outcome with respect to the probability of an unwanted fire, relative to essential aspect of the built environment. Note: The essential aspects typically relate to the issues of life safety, conservation of property, continuity of operations, protection of the environment and preservation of heritage.
<b>Fire stability</b>	<fire resistance> Ability of a building element to resist collapse for a stated period of time in a standard fire resistance test. Note: The building element may or may not be load-bearing.
<b>Floor</b>	Horizontal, load-bearing, separating element of building construction.

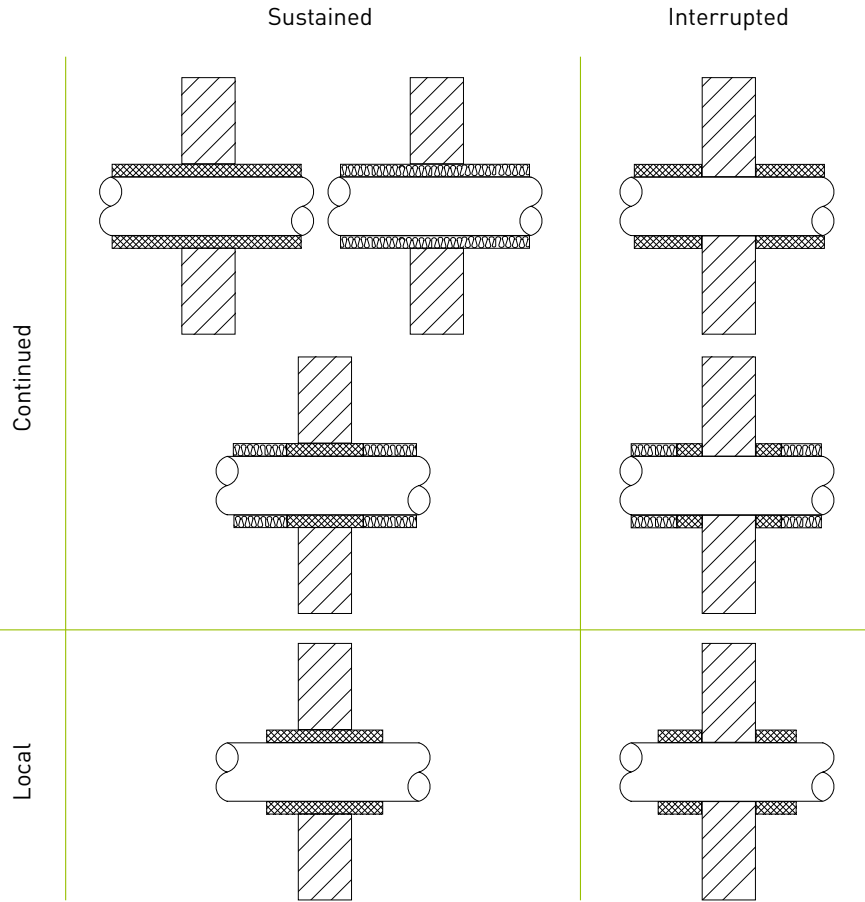
<b>Intumescent material</b>	The term describes a material which expands, creating a foam or char, when exposed to heat in a fire to restrict the passage of heat, smoke, flames or any combination of these.
<b>Insulation criteria "I"</b>	<p>Criterion by which the thermal insulation is assessed.</p> <p>Note: The "I" criterion is based on the measurement of temperature rise on the surface away from fire. The insulation criterion can vary and will depend on the fire safety objective(s).</p>
<b>Insulation criteria "E"</b>	<p>Criterion by which the ability of a separating element to prevent the passage of flames and hot gases is assessed.</p> <p>Note: Compare with the terms "fire integrity" and "fire resistance".</p>
<b>Load-bearing criterion "R"</b>	<p>Criterion by which the ability of a building element or structure to sustain an imposed load when exposed to fire is assessed.</p> <p>Note: This term is preferred to "load-bearing capacity" within the European Community. It is used by the European fire testing and construction industry and by those who use European standards both inside and outside the EC.</p>
<b>Load-bearing elements</b>	<p><b>For load-bearing elements:</b></p> <p>REI tt: tt being the classification period in minutes during which all criteria, load-bearing capacity, integrity and thermal insulation, are satisfied</p> <p>RE tt: tt being the classification period in minutes during which the criteria load-bearing capacity and integrity are satisfied</p> <p>R tt: tt being the classification period in minutes during which the criteria load-bearing capacity is satisfied</p> <p><b>For non-load-bearing elements:</b></p> <p>EI tt: tt being the classification period in minutes during which the criteria integrity and thermal insulation are satisfied</p> <p>E tt: tt being the classification period in minutes during which the criteria integrity is satisfied</p> <p>Note: tt can be one of below; 10, 15, 20, 30, 45, 60, 90, 120, 180, 240, 360</p> <p>Thus the following example classes may be defined: REI 20, REI 30 ..... EI 45, EI 60 .....</p>
<b>Non-combustible</b>	<p>Not capable of undergoing combustion under specified conditions.</p> <p>Note. In some regulations, a material is classified as being "non-combustible" even if it is capable of combustion, provided that its heat of combustion is less than a defined amount.</p>
<b>Non-flammable</b>	Not capable of burning with a flame under specified conditions
<b>The use categories for penetration seals</b>	<p>Type X: intended for use in conditions exposed to weathering.</p> <p>Type Y<sub>1</sub>: intended for use at temperatures below 0°C with exposure to UV but no exposure to rain</p> <p>Type Y<sub>2</sub>: intended for use at temperatures below 0°C, but with no exposure to rain or UV.</p> <p>Type Z<sub>1</sub>: intended for use in internal conditions with humidity equal to or higher than 85% RH excluding temperatures below 0°C, without exposure to rain or UV.</p> <p>Type Z<sub>2</sub>: intended for uses in internal conditions with humidity lower than 85 % RH excluding temperatures below 0°C, without exposure to rain or UV.</p> <p>Products that meet requirements for type X meet the requirements for all other types.</p> <p>Products that meet requirements for type Y<sub>1</sub> also meet the requirements for type Y<sub>2</sub>, Z<sub>1</sub> and Z<sub>2</sub>.</p> <p>Products that meet the requirements for type Y<sub>2</sub> also meet the requirements for type Z<sub>1</sub> and Z<sub>2</sub>.</p> <p>Products that meet the requirements for type Z<sub>1</sub> also meet the requirements for type Z<sub>2</sub>.</p>



**Definition of pipe insulation**

NOTE:  
Depending on the reaction to fire classification of the insulation, it may be the penetration seal / part of the penetration seal or additional sealing means (which are not shown in the figures) may be necessary.

-  Building element
-  Pipe
-  Thermal / acoustic or other pipe insulation
-  Insulation acting as penetration seal or forming part of the penetration seal



Pipe end configuration <sup>1)</sup>	Pipe-end condition		Additional specification for classification
	Inside the furnace	Outside the furnace	
uncapped	uncapped	uncapped	U/U
capped	uncapped	uncapped	C/U
uncapped	capped	capped	U/C
capped	capped	capped	C/C

<sup>1)</sup>The class obtained for the penetration seal is specified by the letter indicating the test condition as given above, e.g. EI 30 C/U.

**Field of application rules for pipe end configuration**

		Tested			
		U/U	C/U	U/C	C/C
<b>Covered</b>	<b>U/U</b>	Y	N	N	N
	<b>C/U</b>	Y	Y	N	N
	<b>U/C</b>	Y	Y	Y	N
	<b>C/C</b>	Y	Y	Y	Y

**Y = acceptable**  
**N = not acceptable**

**Real-scale fire test** Fire test that simulates a given application, taking into account the real scale, the real way the item is installed and used, and the environment.

**Separating element** Physical barrier intended to resist the passage of fire from one side of the barrier to the other side.

<b>Separating wall</b>	Wall with or without glazing provided within a building or between adjoining buildings to prevent the transfer of fire from one side to the other.
<b>Specimen</b>	Representative piece of the material, product or assembly which is to be tested together with any substrate or treatment. Note. Often the term specimen is replaced by test specimen.
<b>Temperature-time-curve</b>	<standardized> Time-related variation of temperature prescribed in a specified way during a standard fire resistance test defined in ISO R 834.
<b>Thermal insulation material</b>	Material used for the confinement of heat to a particular location.

### <sup>1)</sup> Pipe end configuration of plastic pipes versus intended use (EN 1366-3, Table H.1)

Intended use of pipe	Pipe-end condition	
	Inside the furnace	Outside the furnace
Rainwater pipe	uncapped	uncapped
Sewage pipe	ventilated	uncapped
	unventilated	capped
Gas, drinking-water, heating-water pipe	uncapped	capped

### Pipe end configuration of metal pipes versus intended use (EN 1366-3, Table H.2)

Use of pipe	Pipe-end condition	
	Inside the furnace	Outside the furnace
Supported by fire-rated “suspension” system <sup>a</sup>	capped	uncapped
Supported by non-fire-rated “suspension” system	uncapped	capped
Waste disposal shafts made from pipes	uncapped	capped

<sup>a</sup> Shown by test or calculation (e.g. Eurocodes).

The information may constitute a guide only, since individual operating conditions affect the usability in addition. In cases where there is no operational experience, we recommend a preliminary test to avoid risks. The applications described above do not necessarily represent an exhaustive list of applications for the Armacell products shown. Armacell does not accept responsibility for the consequences of using Armacell products in applications different from those described within this compendium or related product / technical literature for the products shown. **Please check and study ArmaProtect System Compendium and related product literature before commencing with application.** Please also seek expert technical advice directly from Armacell if you have any questions or if you are considering applications with electrical apertures or other applications not described here.

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