APPLICATION MANUAL

ArmaFlex[®] Protect

With ArmaFlex Protect, cold service pipe penetrations can be sealed off more simply than ever before. By combining the proven properties of ArmaFlex Protect with an intumescent component, fire spread is mostly ruled out. At the same time, this product ensures effective thermal insulation and reliable condensation control for **shipbuilding and offshore applications**.

www.armacell.com



PREFORMED FIRESTOP SOLUTION WITH THERMAL INSULATION PROPERTIES



KEY BENEFITS

- // Firestop, thermal insulation and condensation control in one step
- // Fire resistance for A-60

 (bulkhead and deck) and B-15
 (bulkhead) application (certified by DNV and Bureau Veritas)
- // Large approval range for pipes with diameter up to 89 mm and fire resistance up to A-60
- // For application with cold service pipes (from -50°C up to +85°C)
- // Energy-efficient insulation: λ ≤ 0.056 W/(m·K) at 0°C
- // Closed-cell structure for longterm condensation control (with µ ≥ 7000)
- // No mineral wool fibres dust
 and fibre-free application
- // Can be combined with IMO certified ArmaFlex products as continued insulation

- // Available as tubes (insulation thickness from 16 to 25 mm) and sheets (13 mm insulation thickness)
- // With intumescent components
- // Specifiable solution firestop penetrations can be planned from early beginning
- // Ensuring compliance firestop material is already installed in the early stage
- // No risk of delays within the project – no need to apply further firestop material
- // Easy, clean and compliant installation
- // Cost-efficient firestop solution
- // Easy inspection
- // Low effort for maintenance within the lifetime of a ship or offshore platform

This product guarantees reliable fire safety in all A-class divisions (A-60 class decks and bulkheads) without the need for any complicated additional measures.



Conventional design for A-60 (metal sleeve)



Non-conventional design for A-60 (without metal sleeve)



APPLICATION

- // Tested in steel, copper and multilayer composite pipes in steel bulkhead and decks
- // Approved as pipe penetrations by DNV (Module B) and Bureau Veritas (Module D) - "A" class divisions (bulkhead and deck penetrations) and B-15 bulkhead pipe penetration
- // Pipe penetration system for single fitted with a layer of continuous IMO approved pipe insulation type "ArmaFlex".
 "ArmaFlex" insulation (like AF/ArmaFlex, AF/ArmaFlex Evo, ArmaFlex Ultima etc.) must have a minimum thickness of 13 mm.
- // In the area of the division penetration the continuous pipe insulation is replaced by local insulation of type "ArmaFlex Protect" with a length of at least 1000 mm (for A-60 applications) and 200 mm (for B-15 applications), equally distributed on each side of the bulkhead.
- // Branches, elbows, couplings or pipe supports shall also be insulated with "ArmaFlex Protect" along with required minimum insulation length as for straight pipes.



INSTALLATION INSTRUCTIONS FOR A-60

APPROVED FOR USE AS A PIPE PENETRATION SYSTEM THROUGH "A" CLASS DIVISIONS: PIPE, DUCT, TRUNK, ETC. PENETRATION

Pipe penetration system for single fitted with a layer of continuous IMO approved pipe insulation type "ArmaFlex". Minimum thickness of "ArmaFlex" insulation see below tables. In the area of the division penetration the continuous pipe insulation is replaced by local insulation of type "ArmaFlex Protect" with a length of 1000 mm, preferable 500 mm on each side of the bulkhead or deck. Branches, elbows, couplings or pipe supports like "ArmaFix®" shall also be insulated with "ArmaFlex Protect" along with required minimum insulation length as for straight pipes without any restrictions of the distance to the division.

TYPE OF PIPE PENETRATIONS

- // Conventional design with steel sleeve
- // Non-conventional design without steel sleeve

CONVENTIONAL DESIGN

Circular steel sleeve, minimum length 100 mm, welded to the deck or bulkhead opening. The steel sleeve insulation positioned on the upper (non-insulated) side of the deck. The insulation material shall be of approved type with a density with at least 66 kgm³ and thickness of 30 mm or equivalent.

APPLICATION / LIMITATION

For A-60 steel bulkhead and decks, general application, i.e. no limitation on the positioning of penetration sleeves in decks or bulkheads.

For application on A-0, A-15 and A-30 divisions, the penetration system shall be insulated as approved for class A-60. The penetrated division is to be insulated with A-60 at least 200 mm around the penetration. Other applications are subject to case-by-case-approval.

For application on offshore structures the requirements specified in the applicable DNV Offshore Rules may have to be observed.

APPROVED PIPING SYSTEMS AND INSTALLATION AREAS

The penetration system is only approved for pipes and pipe insulation as shown in the table on next page for use in cold service' pipework on refrigeration systems everywhere onboard, and other piping systems, limited to cargo areas, mail rooms, baggage rooms and refrigerated compartments of service spaces, and exterior locations (SOLAS II-2/5.3.1.1).

' Piping for hot or cold sanitary water is not considered as "cold service system".

APPROVED PIPE SIZE RANGE AND PIPE MATERIAL

A) CONVENTIONAL DESIGN

A-60 CLASS STEEL DECK PENETRATION WITH "SYSTEM ARMAFLEX PROTECT" THROUGH STEEL SLEEVES

Pipe material	Pipe outer diameter	ArmaFlex Protect		ArmaFlex	Sika Firesil Marine N	Steel sleeve
	(mm)	Average insulation thickness (mm)	Length (mm)	Minimum insulation thickness (mm)	Average thickness (mm)	Wall thickness (mm)
Steel	≥15 – ≤89	19 – 25	≥ 1000	13 ± 1.5 mm	≤ 11	2.9 - 4.0
Copper	≥15 – ≤54	19 – 25	≥ 1000	13 ± 1.5 mm	≤ 11	2.9 - 3.6
Aluminum reinforced polyethylene (PE-Xc/Al/PE-Xc)	≥16 - ≤20	20	≥ 1000	13 ± 1.5 mm	≤ 10	3.6



A-60 CLASS STEEL BULKHEAD PENETRATION WITH "SYSTEM ARMAFLEX PROTECT" THROUGH STEEL SLEEVES

Pipe material	Pipe outer diameter	ArmaFlex Protect		ArmaFlex	Sika Firesil Marine N	Steel sleeve
	(mm)	Average insulation thickness (mm)	Length (mm)	Minimum insulation thickness (mm)	Average thickness (mm)	Wall thickness (mm)
Steel	≥15 – ≤89	19 – 25	≥ 1000	13 ± 1.5 mm	≤ 9.5	2.9 - 4.0
Aluminum reinforced polyethylene pipes (PE-Xc/Al/PE-Xc)	≥16 - ≤32	9.7	≥ 1000	13 ± 1.5 mm	≤9.7	3.6



A-60 CLASS STEEL BULKHEAD PENETRATION WITH "SYSTEM ARMAFLEX PROTECT" THROUGH STEEL SLEEVES

Pipe material	Pipe outer diameter	ArmaFlex Protect ¹⁾		ArmaFlex	Sika Firesil Marine N	Steel sleeve
	(mm)	Average insulation thickness (mm)	Length (mm)	Minimum Insulation thickness (mm)	Average thickness (mm)	Wall thickness (mm)
Copper pipes	≥12 – ≤54	19 – 25	≥ 1000	13 ± 1.5 mm	≤ 10.9	2.9 – 4.0

¹⁾ A second layer of 13 mm ArmaFlex Protect sheet starting from the sleeve has to be applied.



B) NON-CONVENTIONAL DESIGN

A-60 CLASS STEEL DECK AND BULKHEAD PENETRATION WITH "SYSTEM ARMAFLEX PROTECT"

Pipe material	Pipe outer	ArmaFlex Protect		ArmaFlex	Sika Firesil Marine N
	diameter (mm)	Average insulation thickness (mm)	Length (mm)	Minimum insulation thickness (mm)	Average thickness (mm)
Steel	≥15 – ≤89	19 – 25	≥ 1000	13 ± 1.5 mm	8
Copper	≥15 – ≤54	19 – 25	≥ 1000	13 ± 1.5 mm	8
Aluminum reinforced polyethylene (PE-Xc/Al/PE-Xc)	≥16 - ≤20	20	≥ 1000	13 ± 1.5 mm	8





APPLICATION

A tube of "ArmaFlex Protect" can be either pushed onto the pipe or slotted and glued at the longitudinal joint. Using a sharp knife, slit the tube along its entire length. Place the slit tube onto the clean pipe, apply ArmaFlex adhesive based on polychloroprene (e.g. ArmaFlex 520, ArmaFlex HT625, ArmaFlex RS850,

CONVENTIONAL DESIGN

The residual gap between the ArmaFlex Protect surface and the steel sleeve has to be sealed completely with SIKA Firesil Marine N. For this the surfaces must be clean, dry and free from all traces of oil, grease and dust.

Cut the nipple from the thread of the cartridge. Trim the nozzle to the required size. Use a cartridge hand-, air- or battery-driven gun. Tooling and finishing of the sealant surface

NON-CONVENTIONAL DESIGN

The remaining gap (8 mm) between deck resp. bulkhead and the ArmaFlex Protect surface has to be sealed with SIKA Firesil Marine N. ArmaFlex 525) to the two cut edges applying a thin even film of adhesive using a short bristle brush. Apply the adhesive at 200 mm intervals, along the tube. Allow the adhesive to become touch dry (test with the fingernail). Free the seams from the pipe where applicable, then line up the edges together and press the

must be carried out within the tackfree time (appr. 120 minutes at 23°C / 50%) of the sealant. We recommend the use of Sika tooling Agent N. Other finishing agents or lubricants must be tested for suitability and compatibility. The application temperature of the sealant is 5°C – 40°C.

Further information on SIKA Firesil Marine N is available at: www.sika.com or www.sika.ch.

For this the surfaces must be clean, dry and free from all traces of oil, grease and dust. seam together with firm even pressure to finish. Push ArmaFlex Protect tube into the centre of the bulkhead resp. deck penetration. The ArmaFlex installation manual is part of these installation instructions and can be found in the download area at www.armacell.com.

For copper pipes in a bulkheads

(conventional design), apply a second layer of 13 mm ArmaFlex Protect sheet starting from the sleeve. The length of ArmaFlex Protect is min. 200 mm. Determine the circumference of the first layer of ArmaFlex Protect. Use a strip of ArmaFlex Protect sheet material to do this. Do not stretch the strip. Transfer circumference length determined to the sheet and cut out the piece. Apply a thin coat of ArmaFlex adhesive to the cut edges and allow tacking dry. Press together at the two ends first, then in the middle. From here, close the seam completely working from the inside to the outside.

INSULATION OF ARMAFIX PIPE SUPPORT

"ArmaFix" pipe supports represent the best solution to create a fully water-vapour-tight system and prevent condensation on cold applications. If the ArmaFix pipe support is located inside the ArmaFlex Protect partition, the following must be observed:



Schematic cross-section of a connection of ArmaFlex Protect tubes or sheets with ArmaFix pipe support.

- 1. ArmaFix pipe support
- 2. ArmaFlex Protect tube or sheet
- 3. ArmaFlex Protect double layer
- 4. ArmaFlex Protect overlap (thickness min. 13 mm)
- 5. Connection thread
- 6. Threaded bar

The ArmaFlex installation manual is part of the installation instructions and can be found in the download area at www.armacell.com.



 Install ArmaFlex Protect on either side of the ArmaFix pipe support. Wet seal the butt joints of the ArmaFix pipe support using ArmaFlex adhesive.

Note: Ensure that the pipe insulation is installed under slight compression.

- 2. Clean the surface of the ArmaFix pipe support using ArmaFlex cleaner.
- Apply ArmaFlex adhesive on the surfaces which are to be glued.
 Allow this first layer of ArmaFlex adhesive to dry.

- 4. Apply a second thin coat of adhesive evenly on both the surface of the clamp and the ArmaFlex adhesive joints. After the adhesive has cured, the joints should be pressed together briefly, but firmly.
- 5. If necessary, double the ArmaFlex thickness to the diameter of the pipe support.
- To secure the butt joints, apply an overlapping strip of ArmaFlex using all-over adhesive coverage.

INSTALLATION INSTRUCTIONS FOR B-15

APPROVED FOR USE AS A PIPE PENETRATION SYSTEM IN CLASS B-15 BULKHEADS

Approved for use in class B-0 and B-15 when the penetration system is insulated to B-15 bulkhead from SAINT GOBAIN ISOVER G+H AG, "ULTIMATE U SeaProtect Slab 66 A-A". The penetration system is only approved for the pipes and pipe insulation as in the table below for use as cold service pipework on refrigeration systems everywhere onboard, and for pipework in cargo areas, mail rooms, baggage rooms and refrigerated compartments of service spaces, and exterior locations (SOLAS II-2/5.3.1.1).

B-15 BULKHEAD PENETRATION WITH "SYSTEM ARMAFLEX PROTECT"

Pipe material	Pipe outer	ArmaFlex Protect			
	diameter (mm)	Average insulation thickness (mm)	Length (mm)		
Steel	≥15 – ≤89	19 – 25	≥ 200		
Copper	≥15 – ≤54	19 – 25	≥ 200		
Multi-layer plastic pipes	≥15 – ≤63	19 – 25	≥ 200		





APPLICATION

A tube of "ArmaFlex Protect" can be either pushed onto the pipe or slotted and glued at the longitudinal joint.

Using a sharp knife, slit the tube along its entire length. Place the slit tube onto the clean pipe, apply ArmaFlex adhesive based on polychloroprene (e.g. ArmaFlex 520, ArmaFlex HT625, ArmaFlex RS850) to the two cut edges applying a thin even film of adhesive using a short bristle brush. If the ArmaFlex Protect tube is longer than 200 mm, apply the adhesive at 200 mm intervals along the tube. Allow the adhesive to become touch dry (test with the fingernail). Free the seams from the pipe where applicable, then line up the edges together and press the seam together with firm even pressure to finish.

Push the ArmaFlex Protect tube into the penetration until the tube length is at least 75 mm on each side of the B-15 bulkhead (total length at least 200 mm). Cover the area between the pipe penetration and the B-15 wall with self-adhesive aluminium tape. To do this, apply the aluminium tape to the B-15 bulkhead over the ArmaFlex tube so that any openings in the penetration are sealed.

The continuous ArmaFlex insulation must be installed according to the ArmaFlex manual and can be found in the download area at www.armacell.com.

Brief description	Flexible fire seal and insulation for metal and composite pipes through fire-resistant walls and floors (up to El 120).				
Material type	Elastomeric foam based on synthetic rubber.				
Product colour range	Black				
Installation	For industrial applications it is recommended to con reliable and seamless installation.	sult the relevant Armacell application manual(s). Use Arm	aFlex 520 adhesive for a		
Approvals and compliance	_				
Specification compliance	Meets IMO FTP Code 2010, part 3				
Property	Value / Assessment		Standard / Test method		
Temperature range					
Service temperature	Min. °C	Max. °C	EN 14706, EN 14707, EN		
	-50	85	14304		
Thermal conductivity					
Declared thermal conductivity	θm	0°0	EN 12667, EN ISO 8497		
	λd ≤ [W/(m·K)]	0.056			
	Formula	λd = 0.056 + 0,0001 · ϑm			
Fire Performance and Approval	3				
Fire resistance of bulkhead and decks	B-15 bulkheads up to 89 mm A-60 bulkheads and decks up to 89 mm		IMO 2010 FTP code, Part 3 (IMO A.754(18))		
Passive fire protection					
Fire resistance of elements of construction	up to El 120		EN 13501-2, EN 1366-3		
Fire performance					
Practical fire behaviour	Self-extinguishing, does not drip, does not spread flar	nes			
Resistance to water vapour					
Water vapour diffusion resistance factor	µ ≥ 7,000		EN 12086, EN 13469		
Health and environment					
Volatile organic compounds VOC) content	Fulfills all VOC requirements (French, Italian, Belgian monfort GOLD).	, German AgBB, Blauer Engel and Eurofins Indoor Air	ISO 16000 Parts 3, 6 & 9		
Health aspects	Please refer to latest product Safety Datasheet (SDS).				
Emission of dangerous substances	No dangerous substances.				
Additional features	SCCP, MCCP-free				
Other technical features					
Shelf life	No shelf life.				
Property	Value / Assessment		Standard / Test method		
Storage	Cartons shall be stored horizontally. Can be stored in dry, clean rooms at normal relative h °C). Minimum temperature for transport -50 °C under con	numidity (50 % - 70 %) and ambient temperature (0 °C - 35 dition of frost-free storage before installation.			

Tube – standard. Black

Pipe Ø [mm]	ltem	Description	Insulation thickness [mm]	Primary content [metric]
6	PRO-AX-16X006	ArmaFlex Protect tube (1 m, outer-Ø 6 mm, 16 mm insulation thickness)	16	34 m
8	PRO-AX-16X008	ArmaFlex Protect tube (1 m, outer-Ø 8 mm, 16 mm insulation thickness)	16	30 m
10	PRO-AX-19X010	ArmaFlex Protect tube (1 m, outer-Ø 10 mm, 19 mm insulation thickness)	19	
12	PRO-AX-19X012	ArmaFlex Protect tube (1 m, outer-Ø 12 mm, 19 mm insulation thickness)	19	
15	PRO-AX-19X015	ArmaFlex Protect tube (1 m, outer-Ø 15 mm, 19 mm insulation thickness)	19	
16	PRO-AX-20X016	ArmaFlex Protect tube (1 m, outer-Ø 16 mm, 20 mm insulation thickness)	20	
18	PRO-AX-20X018	ArmaFlex Protect tube (1 m, outer-Ø 18 mm, 20 mm insulation thickness)	20	13 m
20	PRO-AX-20X020	ArmaFlex Protect tube (1 m, outer-Ø 20 mm, 20 mm insulation thickness)	20	12 m
22	PR0-AX-20X022	ArmaFlex Protect tube (1 m, outer-Ø 22 mm, 20 mm insulation thickness)	20	12 m
25	PR0-AX-20X025	ArmaFlex Protect tube (1 m, outer-Ø 25 mm, 20 mm insulation thickness)	20	11 m
28	PR0-AX-25X028	ArmaFlex Protect tube (1 m, outer-Ø 28 mm, 25 mm insulation thickness)	25	9 m
32	PR0-AX-25X032	ArmaFlex Protect tube (1 m, outer-Ø 32 mm, 25 mm insulation thickness)	25	8 m
35	PRO-AX-25X035	ArmaFlex Protect tube (1 m, outer-Ø 35 mm, 25 mm insulation thickness)	25	8 m
40	PRO-AX-25X040	ArmaFlex Protect tube (1 m, outer-Ø 40 mm, 25 mm insulation thickness)	25	6 m
42	PR0-AX-25X042	ArmaFlex Protect tube (1 m, outer-Ø 42 mm, 25 mm insulation thickness)	25	6 m
48	PRO-AX-25X048	ArmaFlex Protect tube (1 m, outer-Ø 48 mm, 25 mm insulation thickness)	25	5 m
50	PRO-AX-25X050	ArmaFlex Protect tube (1 m, outer-Ø 50 mm, 25 mm insulation thickness)	25	5 m
54	PRO-AX-25X054	ArmaFlex Protect tube (1 m, outer-Ø 54 mm, 25 mm insulation thickness)	25	5 m
60	PR0-AX-25X060	ArmaFlex Protect tube (1 m, outer-Ø 60 mm, 25 mm insulation thickness)	25	4 m
63	PR0-AX-25X063	ArmaFlex Protect tube (1 m, outer-Ø 63 mm, 25 mm insulation thickness)	25	4 m

Tube – standard. Black

Pipe Ø [mm]	ltem	Description	Insulation thickness [mm]	Primary content [metric]
76	PRO-AX-25X076	ArmaFlex Protect tube (1 m, outer-Ø 76 mm, 25 mm insulation thickness)	25	4 m
89	PR0-AX-25X089	ArmaFlex Protect tube (1 m, outer-Ø 89 mm, 25 mm insulation thickness)	25	4 m

Roll - standard. Black

ltem	Insulation thickness [mm]	Description	Width (m)	Length [m]	Primary content [metric]
PRO-AX-13MM/E	13	ArmaFlex Protect sheet (6 m x 0,5 m, 13 mm insulation thickness)	0.5	6	6 m²

ADHESIVES

Item	Description	Content
ADH520/0,25E	0.25 litre tins of ArmaFlex 520 adhesive with built-in brush, packed in a carton.	24 tins
ADH520/0,25N	0.25 litre tins of ArmaFlex 520 adhesive packed in a carton.	24 tins
ADH520/0,5E	0.5 litre tins of ArmaFlex 520 adhesive packed in a carton.	12 tins
ADH520/1,0E	1.0 litre tins of ArmaFlex 520 adhesive packed in a carton.	12 tins
ADH520/2,5E	2.5 litre tins of ArmaFlex 520 adhesive packed in a carton.	8 tins
ADH-RS850/0,5	ArmaFlex RS850 adhesive. Available in 0.5 litre cans.	6 cans
ADH-RS850/0,5-12	ArmaFlex RS850 adhesive. Available in 0.5 litre cans.	12 cans

ArmaFlex Protect ideal for condensation control on refrigeration and coolant piping

diameter	Line temperature / Ambient temperature					
	+6 °C / 23 °C	0 °C / 23 °C	-5°C / 23 °C	-10°C / 23 °C		
≥ 10 mm ≤ 323,9 mm	Relative humidity ≼ 80 %	Relative humidity ≰ 75 %	Relative humidity ≰ 70 %	Relative humidity ≤ 65 %		

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ABOUT ARMACELL

As the inventor of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal and mechanical solutions that create sustainable value for its customers. Armacell's products significantly contribute to global energy efficiency making a difference around the world every day. With more than 3,300 employees and 27 production plants in 19 countries, the company operates two main businesses, Advanced Insulation and Engineered Foams. Armacell focuses on insulation materials for technical equipment, high-performance foams for acoustic and lightweight applications, recycled PET products, next-generation aerogel technology and passive fire protection systems.

