

Translation

Classification report on fire resistance

in accordance with EN 13501-2:2016

Classification report no.:

K-3579/821/14-MPA BS

Client:

Armacell GmbH
Robert-Bosch-Str. 10
48153 Münster, Germany

Product to be classified:

Pipe penetration seals "AF/ArmaFlex®...",
"SH/ArmaFlex®" or "ArmaFlex® Ultima" for metal pipes
(steel, stainless steel, cast iron and copper pipes)
installed in a solid wall or solid ceiling structure

Notified testing laboratory no.: 0761-CPR

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This classification report replaces Classification Report No. K-3579/821/14-MPA BS dated 08/08/2018.

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1 Introduction

This fire resistance classification report defines the classification of the component pipe penetration seals "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima" for metal pipe penetrations (steel, stain-less steel, cast iron and copper pipes) and installed in a solid wall structure ($t \geq 150$ mm, $t \geq 175$ mm, $t \geq 200$ mm or $t \geq 240$ mm) or in a solid ceiling structure ($t \geq 150$ mm or $t \geq 175$ mm) in compliance with the procedures specified in EN 13501-2:2016.

When the component pipe penetration seals "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima" – which are made for metal pipes (steel, stainless steel, cast iron and copper pipes) – are installed in a solid wall or a solid ceiling structure, the seal components consist mainly of an insulating jacket, encasing the metal pipe penetrations and pipe ducts, and a joint seal of the remaining component opening. The thickness of these jackets varies and it is made of flexible elastomeric foam (FEF) insulation in accordance with DIN EN 14304 called "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima."

Depending on the field of application of the pipe penetration seals, the flexible elastomeric foam insulation hoses or panels are installed around the metal pipe during the assembly of the pipe penetration seals. The edge of the longitudinal splice of the insulation hoses or panels is always butt-jointed together. A system-related adhesive based on polychloroprene by Armacell GmbH, Münster, Germany, is applied to the edge to ensure the elastomeric foam insulation remains tight to the pipe. Outside the component feed-through, the edge of the longitudinal splice of the elastomeric foam insulating hoses or panels is to be covered with a 3 mm thick and 50 mm wide system-related and self-adhesive tape "AF/ArmaFlex®", "SH/ArmaFlex®" or "ArmaFlex® Ultima" made by Armacell GmbH, Münster, Germany.

2 Details of the classified product

2.1 Function information

The component pipe penetration seals "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima" for metal pipes (steel, stainless steel, cast iron and copper pipes) is defined as a pipe penetration seal. The pipe penetration seal is designed to resist the product's characteristic behaviour specified in Section 5 of EN 13501-2:2016.

2.2 Description

The component pipe penetration seal "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima" for metal pipes (steel, stainless steel, cast iron and copper pipes) is described in full in the test reports listed in Section 3.1

3 Test reports and test results used to substantiate the classification

3.1 Test reports

Name of testing laboratory	Name of client	Number of test report	Test procedures
MPA Braunschweig	Armacell GmbH Robert-Bosch-Str. 10 48153 Münster, Germany	(3499/278/08)–CR dated 20/03/2009	prEN 1366-3.2: N185, 07/2007 in conjunction with DIN EN 1363-1:1999-10
MPA Braunschweig	Armacell GmbH Robert-Bosch-Str. 10 48153 Münster, Germany	(3730/016/12)–Wsp dated 30/01/2014	DIN EN 1366-3:2009-07 in conjunction with DIN EN 1363-1:1999-10
MPA Braunschweig	Armacell GmbH Robert-Bosch-Str. 10 48153 Münster, Germany	(3638/914/13)–Wsp of 06/01/2014	DIN EN 1366-3:2009-07 in conjunction with DIN EN 1363-1:1999-10
MPA Braunschweig	Armacell GmbH Robert-Bosch-Str. 10 48153 Münster, Germany	(3729/015/12)–Wsp dated 06/01/2014	DIN EN 1366-3:2009-07 in conjunction with DIN EN 1363-1:1999-10
MPA Braunschweig	Armacell GmbH Robert-Bosch-Str. 10 48153 Münster, Germany	(3637/913/13)–Wsp dated 06/01/2014	DIN EN 1366-3:2009-07 in conjunction with DIN EN 1363-1:1999-10

3.2 Results of the pipe penetration seals “AF/ArmaFlex®...”

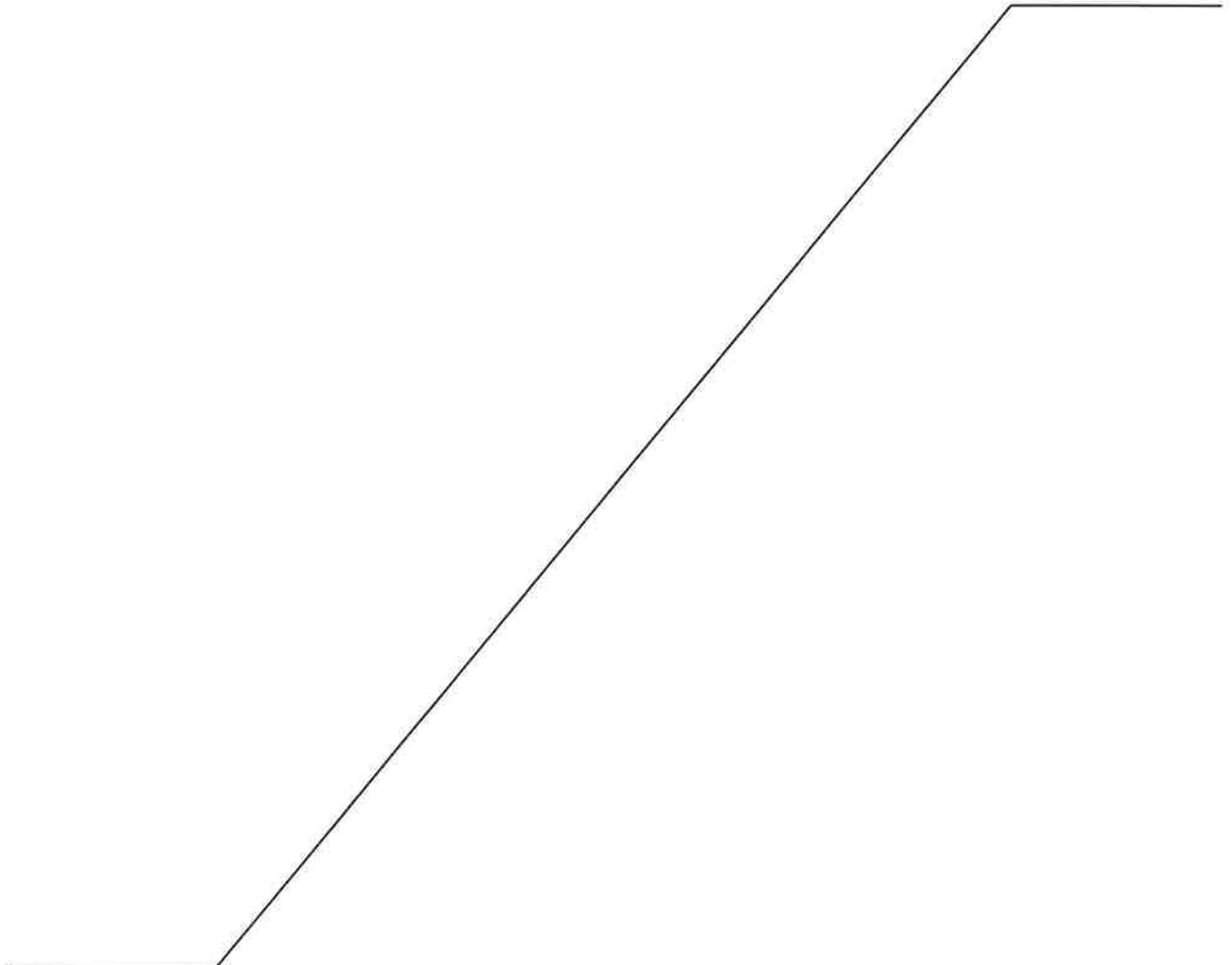
3.2.1 Installing the pipe penetration seals into a solid wall structure

Component	Pipe penetration seal “AF/ArmaFlex®...” for metal pipes (steel and copper pipes)			
	Installation in a 150 mm, 200 mm or 240 mm thick solid wall structure made of aerated concrete			
Test method(s) and test report	Parameter(s)		Results	
DIN EN 1366-3:2009-07, Test report: – No. (3499/278/08)-CR dated 20/03/2009	Fire load		Standard temperature-time curve in accordance with DIN EN 1363-1:1999-10	
	Direction of fire load:		fire load on one side	
	Load applied:		None (see prEN 1366-3.2: N185, 07/2007)	
	Integrity (enclosure)	E	Cotton pad	see Annex 1
			Gap gauge	see Annex 1
			Sustained flaming	see Annex 1
Thermal insulation	I	maximum temperature increase of no more than 180 °C above the mean starting temperature	see Annex 1	

Component	Pipe penetration seal “AF/ArmaFlex®...” for metal pipes (steel and copper pipes)			
	Installation in a 150 mm or 175 mm thick solid wall structure made of aerated concrete			
Test method(s) and test report	Parameter(s)		Results	
DIN EN 1366-3:2009-07, Test report: – No. (3730/016/12)–Wsp dated 30/01/2014 and – No. (3638/914/13)–Wsp dated 06/01/2014	Fire load		Standard temperature-time curve in accordance with DIN EN 1363-1:1999-10	
	Direction of fire load:		fire load on one side	
	Load applied:		None (see DIN EN 1366-3:2009-07)	
	Integrity (enclosure)	E	Cotton pad	see Annex 2
			Gap gauge	see Annex 2
			Sustained flaming	see Annex 2
Thermal insulation	I	maximum temperature increase of no more than 180 °C above the mean starting temperature	see Annex 2	

3.2.2 Installing the pipe penetration seals into a solid ceiling structure

Component	Pipe penetration seal "AF/ArmaFlex®..." for metal pipes (steel and copper pipes)			
	Installation in a 150 mm or 175 mm thick solid ceiling structure made of aerated concrete			
Test method(s) and test report	Parameter(s)	Results		
DIN EN 1366-3:2009-07, Test report: – No. (3729/015/12)–Wsp dated 06/01/2014 and – No. (3637/913/13)–Wsp dated 06/01/2014	Fire load	Standard temperature-time curve in accordance with DIN EN 1363-1:1999-10		
	Direction of fire load:	fire load on one side		
	Load applied:	None (see DIN EN 1366-3:2009-07)		
	Integrity (enclosure)	E	Cotton pad	see Annex 3
			Gap gauge	see Annex 3
			Sustained flaming	see Annex 3
Thermal insulation	I	maximum temperature increase of no more than 180 °C above the mean starting temperature	see Annex 3	



3.3 Results of the pipe penetration seals “SH/ArmaFlex®”

3.3.1 Installing the pipe penetration seals into a solid wall structure

Component	Pipe penetration seal “SH/ArmaFlex®” for metal pipes (steel and copper pipes)			
	Installation in a 150 mm thick solid wall structure made of aerated concrete			
Test method(s) and test report	Parameter(s)		Results	
DIN EN 1366-3:2009-07, Test report: – No. (3730/016/12)–Wsp dated 30/01/2014 and – No. (3638/914/13)–Wsp dated 06/01/2014	Fire load		Standard temperature-time curve in accordance with DIN EN 1363-1:1999-10	
	Direction of fire load:		fire load on one side	
	Load applied:		None (see DIN EN 1366-3:2009-07)	
	Integrity (enclosure)	E	Cotton pad	see Annex 4
			Gap gauge	see Annex 4
			Sustained flaming	see Annex 4
	Thermal insulation	I	maximum temperature increase of no more than 180 °C above the mean starting temperature	see Annex 4

3.3.2 Installing the pipe penetration seals into a solid ceiling structure

Component	Pipe penetration seal “SH/ArmaFlex®” for metal pipes (steel and copper pipes)			
	Installation in a 150 mm thick solid ceiling structure made of aerated concrete			
Test method(s) and test report	Parameter(s)		Results	
DIN EN 1366-3:2009-07, Test report: – No. (3729/015/12)–Wsp dated 06/01/2014 and – No. (3637/913/13)–Wsp dated 06/01/2014	Fire load		Standard temperature-time curve in accordance with DIN EN 1363-1:1999-10	
	Direction of fire load:		fire load on one side	
	Load applied:		None (see DIN EN 1366-3:2009-07)	
	Integrity (enclosure)	E	Cotton pad	see Annex 5
			Gap gauge	see Annex 5
			Sustained flaming	see Annex 5
	Thermal insulation	I	maximum temperature increase of no more than 180 °C above the mean starting temperature	see Annex 5

3.4 Results of the pipe penetration seals “ArmaFlex® Ultima”

3.4.1 Installing the pipe penetration seals into a solid wall structure

Component	Pipe penetration seal “ArmaFlex® Ultima” for metal pipes (steel and copper pipes)			
	Installation in a 150 mm thick solid wall structure made of aerated concrete			
Test method(s) and test report	Parameter(s)		Results	
DIN EN 1366-3:2009-07, Test report: – No. (3730/016/12)–Wsp dated 30/01/2014 and – No. (3638/914/13)–Wsp dated 06/01/2014	Fire load		Standard temperature-time curve in accordance with DIN EN 1363-1:1999-10	
	Direction of fire load:		fire load on one side	
	Load applied:		None (see DIN EN 1366-3:2009-07)	
	Integrity (enclosure)	E	Cotton pad	see Annex 6
			Gap gauge	see Annex 6
			Sustained flaming	see Annex 6
Thermal insulation	I	maximum temperature increase of no more than 180 °C above the mean starting temperature	see Annex 6	

3.4.2 Installing the pipe penetration seals into a solid ceiling structure

Component	Pipe penetration seal “ArmaFlex® Ultima” for metal pipes (steel and copper pipes)			
	Installation in a 150 mm thick solid ceiling structure made of aerated concrete			
Test method(s) and test report	Parameter(s)		Results	
DIN EN 1366-3:2009-07, Test report: – No. (3729/015/12)–Wsp dated 06/01/2014 and – No. (3637/913/13)–Wsp dated 06/01/2014	Fire load		Standard temperature-time curve in accordance with DIN EN 1363-1:1999-10	
	Direction of fire load:		fire load on one side	
	Load applied:		None (see DIN EN 1366-3:2009-07)	
	Integrity (enclosure)	E	Cotton pad	see Annex 7
			Gap gauge	see Annex 7
			Sustained flaming	see Annex 7
Thermal insulation	I	maximum temperature increase of no more than 180 °C above the mean starting temperature	see Annex 7	

4 Classification and scope of application

4.1 Basis for the classification

This classification was performed in accordance with EN 13501-2:2016, Section 7.5.8.

4.2 Classification

The component pipe penetration seals "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima" for metal pipes (steel, stainless steel, cast iron and copper pipes) is classified according to the following combinations of performance parameters and classes.

R	E	I	W		tt	-	M	S	C	IncSlow	sn	ef	r
-	x	x	-		x	-	-	-	-	-	-	-	-

The classification for the pipe penetration seals "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima" for metal pipes (steel, stainless steel, cast iron and copper pipes) dependent on the structural constraints, i.e.

- the component (solid wall or solid ceiling structure) into which the pipe penetration seal is installed, and the required component thickness in the area of the pipe penetration,
- the dimensions of the metal pipes (steel, stainless steel, cast iron and copper pipes), and
- the type (hoses or panels) as well as the thickness of the elastomeric foam insulations

can be found in Annexes 11 to 16 in conjunction with Sections 4.2.1 to 4.2.6 of this classification report.

4.2.1 Pipe penetration seal "AF/ArmaFlex®..." for metal pipe penetrations when installed in a solid wall structure

The pipe penetration seal "AF/ArmaFlex®...", in conjunction with metal pipes (steel, stainless steel, cast iron and copper pipes) according to Annex 11 of this Classification Report when installed in an at least 150 mm, 175 mm, 200 mm or 240 mm thick solid wall structure, is classified as described below:

Fire resistance classification: E 15-C/U to E 90-C/U

Fire resistance classification: EI 15-C/U to EI 90-C/U

4.2.2 Pipe penetration seal “AF/ArmaFlex®...” for metal pipe penetrations when installed in a solid ceiling structure

The pipe penetration seal “AF/ArmaFlex®”, in conjunction with metal pipes (steel, stainless steel, cast iron and copper pipes) according to Annex 12 of this classification report when installed in an at least 150 mm or 175 mm thick solid ceiling structure, is classified as described below:

Fire resistance classification: E 15-C/U to E 90-C/U

Fire resistance classification: EI 15-C/U to EI 90-C/U

4.2.3 Pipe penetration seal “SH/ArmaFlex®” for metal pipe penetrations when installed in a solid wall structure

The pipe penetration seal “SH/ArmaFlex®”, in conjunction with metal pipes (steel, stainless steel, cast iron and copper pipes) according to Annex 13 of this classification report when installed in an at least 150 mm thick solid wall structure, is classified as described below:

Fire resistance classification: E 15-C/U to E 90-C/U

Fire resistance classification: EI 15-C/U to EI 90-C/U

4.2.4 Pipe penetration seal “SH/ArmaFlex®” for metal pipe penetrations when installed in a solid ceiling structure

The pipe penetration seal “SH/ArmaFlex®”, in conjunction with metal pipes (steel, stainless steel, cast iron and copper pipes) according to Annex 14 of this classification report when installed in an at least 150 mm thick solid ceiling structure, is classified as described below:

Fire resistance classification: E 15-C/U to E 90-C/U

Fire resistance classification: EI 15-C/U to EI 90-C/U

4.2.5 Pipe penetration seal “ArmaFlex® Ultima” for metal pipe penetrations when installed in a solid wall structure

The pipe penetration seal “ArmaFlex® Ultima”, in conjunction with metal pipes (steel, stainless steel, cast iron and copper pipes) according to Annex 15 of this classification report when installed in an at least 150 mm thick solid wall structure, is classified as described below:

Fire resistance classification: E 15-C/U to E 120-C/U

Fire resistance classification: EI 15-C/U to EI 120-C/U

4.2.6 Pipe penetration seal “ArmaFlex® Ultima” for metal pipe penetrations when installed in a solid ceiling structure

The pipe penetration seal “ArmaFlex® Ultima”, in conjunction with metal pipes (steel, stainless steel, cast iron and copper pipes) according to Annex 16 of this classification report when installed in an at least 150 mm thick solid ceiling structure, is classified as described below:

Fire resistance classification: E 15-C/U to E 120-C/U

Fire resistance classification: EI 15-C/U to EI 120-C/U

4.3 Scope of application

Based on Annexes 11 to 16, the component pipe penetration seal “AF/ArmaFlex®...”, “SH/ArmaFlex®” or “ArmaFlex® Ultima” – in connection with metal pipes (steel, stainless steel, cast iron and copper pipes) – has the field of application listed in Sections 4.4 to 4.5 in accordance with EN 13501-2:2016 in conjunction with EN 1366-3:2009-07 when installed in a solid wall structure ($t \geq 150$ mm, $t \geq 175$ mm, $t \geq 200$ mm or $t \geq 240$ mm) or in a solid ceiling structure ($t \geq 150$ mm or $t \geq 175$ mm).

The test results are directly applicable to designs that deviate from the tested design in one or more of the aspects listed in Sections 4.4 to 4.5:

4.4 Alignment

4.4.1 The test results are only applicable to the alignment in which the pipe penetration seals “AF/ArmaFlex®...”, “SH/ArmaFlex®” or “ArmaFlex® Ultima” have been tested.

4.5 Supporting construction

4.5.1 Solid wall structure

4.5.1.1 The test results obtained with the 150 mm, 175 mm, 200 mm or 240 mm thick solid wall structure apply to separating components made of masonry (aerated concrete, etc.), concrete or reinforced concrete of equal or greater thickness than the tested component (i.e., $t \geq 150$ mm, $t \geq 175$ mm, $t \geq 200$ mm or $t \geq 240$ mm) and a density of $\rho \geq 650$ kg/m³.

4.5.2 Solid ceiling structure

4.5.2.1 The test results obtained with the 150 mm or 175 mm thick solid ceiling structure apply to separating components made of aerated concrete, concrete or reinforced concrete of equal or greater thickness than the tested component ($t \geq 150$ mm or $t \geq 175$ mm) and a density of $\rho \geq 650$ kg/m³.

4.5.3 Duct support fixture

4.5.3.1 The distance between the component surface (wall or ceiling) to the nearest support point for the pipes (metal pipes) must be less than or equal to the tested distance – measured from the surface of the component – i.e., it must not exceed $a = 650$ mm.

4.5.4 Spacing

4.5.4.1 The test results of the pipe penetration seals apply only if the distance between the pipe penetration seals – measured between the pipe insulations “AF/ArmaFlex®...”, “SH/ArmaFlex®” or “ArmaFlex® Ultima” – is $s \geq 0$ mm or $s \geq 100$ mm as specified in Annexes 11 to 16 and depending on the structural constraints of the relevant pipe penetration seals.

4.5.4.2 The test results of the “AF/ArmaFlex®...”, “SH/ArmaFlex®” “ArmaFlex® Ultima” pipe penetration seals apply to multiple penetration seals in accordance with DIN EN 1366-3:2009-07, Image E.1, Option 1 (“linear arrangement” of pipe penetration seals).

4.5.4.3 If the metal pipes are arranged as a group, the fire resistance times achieved also apply if neighbouring insulated metal pipes are touching each other, however the metal pipes must only be arranged linearly (see DIN EN 1366-3:2009-07, Image E.1 – Option 1). The distance between the linearly arranged rows of pipes must be at least $s = 100$ mm, measured between the pipe insulations. If the pipes are arranged as a so-called cluster (see DIN EN 1366-3:2009-07, Image E.1 – Option 2), the fire resistance times achieved only apply if the distance between the pipe insulations is at least $s = 100$ mm.

4.5.5 Fields of application for metal pipes (steel, stainless steel, cast iron and copper pipes) with elastomeric foam insulation “AF/ArmaFlex®...”, “SH/ArmaFlex®” or “ArmaFlex® Ultima” – Annexes 11 to 16

4.5.5.1.1 The results on the tested metal pipes (copper pipes) in combination with thermal insulation made of flexible elastomer foam apply to pipe penetrations made of copper, steel, stainless steel and cast iron with a lower heat conductivity than in the test, provided, however, the above-mentioned metal pipes have a melting point which is at least equal to or higher than the temperature in the test furnace at the time which

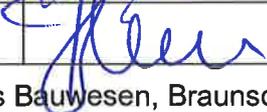
determines the required classification; i.e., the melting point must not be less than 842 °C (EI 30), 902 °C (EI 45), 945 °C (EI 60), 1,006 °C (EI 90) or 1,049 °C (EI 120).

- 4.5.5.1.2 The results on the tested metal pipes (steel pipes) in combination with thermal insulation made of flexible elastomer foam apply to pipe penetrations made of steel, stainless steel and cast iron with a lower heat conductivity than in the test, provided, however, the above-mentioned metal pipes have a melting point which is at least equal to or higher than the temperature in the test furnace at the time which determines the required classification; i.e., the melting point must not be less than 842 °C (EI 30), 902 °C (EI 45), 945 °C (EI 60), 1,006 °C (EI 90) or 1,049 °C (EI 120).
- 4.5.5.1.3 The results of the insulated metal pipes tested apply to steel, stainless steel, cast iron and copper pipes which lie within the field of application set out in Annexes 11 to 16 of this classification report.
- 4.5.5.1.4 The fire resistance times reached do not apply to non-insulated metal pipes.
- 4.5.5.1.5 The test results of the pipe penetration seals "AF/ArmaFlex®...", "SH/ArmaFlex®" or "ArmaFlex® Ultima" apply to "continuous" insulation of metal pipe penetrations and ducts of type "CS" in accordance with DIN EN 1366-32009-07, Table 1.
- 4.5.5.1.6 The apparent density of the elastomeric foam insulation "AF/ArmaFlex®", "AF/ArmaFlex® Evo", "AF/ArmaFlex® N" or "AF/ArmaFlex® Class 0" must be at least $\rho = 52 \text{ kg/m}^3$.
- 4.5.5.1.7 The apparent density of the elastomeric foam insulation "SH/ArmaFlex®" must be at least $\rho = 49 \text{ kg/m}^3$.
- 4.5.5.1.8 The apparent density of the elastomeric foam insulation "ArmaFlex® Ultima" must be at least $\rho = 68 \text{ kg/m}^3$.
- 4.5.5.1.9 The achieved fire resistance times of the pipe penetration seals "AF/ArmaFlex®..." only apply to thermal insulation made of flexible elastomeric foam in accordance with DIN EN 14304 of type "AF/ArmaFlex®" (Certificate of Conformity No. 0543-CPR-2016-001), "AF/ArmaFlex® Evo" (Certificate of Conformity No. 0543-CPR-2020-101), "AF/ArmaFlex® N" (Certificate of Conformity No. 0550-CPR-2013-008, 0551-CPR-2013-008) or "AF/ArmaFlex® Class 0" (Certificate of Conformity No. 0550-CPR-2013-009, No. 0551-CPR-2013-009) or for "ArmaFix AF" pipe supports according to Certificate of Conformity No. 122701.1d.

- 4.5.5.1.10 The achieved fire resistance times of the pipe penetration seals "SH/ArmaFlex®" only apply to thermal insulation made of flexible elastomeric foam in accordance with DIN EN 14304 of type "SH/ArmaFlex®" according to Certificate of Conformity No. 0543-CPR-2013-01.
- 4.5.5.1.11 The achieved fire resistance times of the pipe penetration seals "ArmaFlex® Ultima" only apply to thermal insulation made of flexible elastomeric foam in accordance with DIN EN 14304 of type "ArmaFlex® Ultima" according to Certificate of Conformity No. 0543-CPR-2016-017.
- 4.5.5.1.12 The achieved fire resistance times of the pipe penetration seals "AF/ArmaFlex®..." in connection with an "ArmaFix AF" pipe support according to Annex No. 9 apply to pipe penetration seals "AF/ArmaFlex®..." for metal pipes (steel, stainless steel, cast iron and copper pipes) with an outside pipe diameter of $\varnothing \leq 42.0$ mm (see Annex 11) and for installation in solid walls ($t \geq 150$ mm or $t \geq 175$ mm). In this case, the thickness of the "AF/ArmaFlex®..." insulation in the range of the component feed-through must be less than or equal to the tested thickness and the distance between the component surface to the nearest supporting or suspension point for the pipes must be a maximum of $s = 650$ mm.
- 4.5.5.1.13 The achieved fire resistance times apply only to pipes that are installed at an angle of $\varphi = 90^\circ$ to the component's surface.
- 4.5.5.1.14 The fire resistance times achieved in conjunction with the "C/U" pipe end configuration apply to the "C/U" and "C/C" test conditions in accordance with DIN EN 1366-3:2009-07, Table 2 (see also DIN EN 1366-3:2009-07, Section H.4.2.2 in connection with Table H.1).
- 4.5.5.1.15 The test results are only valid if – after installation of the pipe penetration seals into solid construction components – the width of the remaining ring-shaped gap is $w \leq 25$ mm between the wall or ceiling intrados and the insulated pipe in the entire component thickness is completely sealed tightly with cement mortar or concrete.

5 Restrictions

The classification document cannot be construed as type approval or certification for the product.

Classification report	Name	Signature ^{a)}	Date
Prepared by	F. Wierspecker		18/12/2020
Checked by	G. Blume		18/12/2020

^{a)} For and on behalf of: Materialprüfanstalt für das Bauwesen, Braunschweig

This document is the translated version of Classification Report no. K-3579/821/14-MPA BS – dated 18/12/2020. The legally binding text is the aforementioned German Classification Report.



Results of the pipe penetration seals "AF/ArmaFlex®..."
– installation in a 150 mm, 200 mm or 240 mm thick aerated concrete wall (continued from Section 3.2.1) –

Test and Test Report No.	Pipe penetration seals				Integrity E			Thermal insulation I	Max. fire resistance class in accordance with EN 13501-2
	Test specimen	Medium pipe	Ø _{pipe} x s _{pipe}	Wall thickness	Ignition of cotton pad	Gaps or openings	Sustained flaming		
[-]	[-]	[-]	[mm]	[mm]	[min]	[min]	[min]	[min]	[-]
	1a/1b ¹⁾	Fe pipe	88.9 x 2.9	150	> 125	> 125	110	110	EI 90-C/U
	2a/2b ¹⁾	Cu pipe	28.0 x 1.0	150	> 125	> 125	> 125	> 125	EI 90-C/U
	3 ¹⁾	Fe pipe	114.3 x 3.2	150	> 125	> 125	110	69	EI 60-C/U
	4 ¹⁾	Fe pipe	114.3 x 3.2	150	> 125	> 125	> 125	> 125	EI 120-C/U
	5	Cu pipe	35.0 x 1.5	150	> 125	> 125	> 125	> 125	EI 120-C/U
	6	Cu pipe	35.0 x 1.5	150	> 125	> 125	> 125	> 125	EI 120-C/U
	7	Fe pipe	133.0 x 3.2	150	> 125	> 125	110	66	EI 60-C/U
	8a/8b ¹⁾	Cu pipe	28.0 x 1.0	200	> 125	> 125	> 125	> 125	EI 120-C/U
	9a/9b ¹⁾	Fe pipe	88.9 x 2.9	200	> 125	> 125	> 125	91	EI 90-C/U
	10	Fe pipe	114.3 x 3.2	200	> 125	> 125	> 125	> 125	EI 120-C/U
	11	Fe pipe	133.0 x 3.2	200	> 125	> 125	89	89	EI 60-C/U
	12	Fe pipe	114.3 x 3.2	240	> 125	> 125	> 125	> 125	EI 120-C/U
	13	Fe pipe	133.0 x 3.2	240	> 125	> 125	> 125	> 125	EI 120-C/U

¹⁾ Distance between the pipe penetration seals s = 0 mm

Structural design of the test specimens

Pipe penetration seals "AF/ArmaFlex®..." for metal pipes
 – Results for wall installation –

Materialprüfanstalt für das Bauwesen
 Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 1 to
 Classification Report

No. K-3579/821/14-MPA BS

Results of the pipe penetration seals "AF/ArmaFlex®..."
– installation in a 150 mm or 175 mm thick aerated concrete wall (continued from Section 3.2.1) –

Test and Test Report No.		Pipe penetration seals				Integrity E			Thermal insulation I	Max. fire resistance class in accordance with EN 13501-2
		Test specimen	Medium pipe	Ø _{Pipe} x s _{Pipe}	Wall thickness	Ignition of cotton pad	Gaps or openings	Sustained flaming		
[-]	[-]	[-]	[-]	[mm]	[mm]	[min]	[min]	[min]	[min]	[-]
Test 2 on 22/11/2012 Test Report No. (3730/016/12)-Wsp dated 30/01/2014	AF1	Fe pipe	88.9 x 2.9	150	> 125	> 125	85	EI 60-C/U		
	AF2	Fe pipe	48.3 x 2.3		> 125	> 125	92	EI 60-C/U		
	AF3 ¹⁾	Fe pipe	88.9 x 2.9		> 125	> 125	67	EI 60-C/U		
	AF4 ¹⁾	Cu pipe	42.0 x 1.5		> 125	> 125	67	EI 60-C/U		
	AF5	Cu pipe	42.0 x 1.5		> 125	> 125	93	EI 90-C/U		
	AF6	Cu pipe	28.0 x 1.0		> 125	> 125	90	EI 90-C/U		
	AF7	Cu pipe	28.0 x 1.0		> 125	> 125	> 125	EI 120-C/U		
	AF8	Fe pipe	76.1 x 2.6		> 125	> 125	94	EI 60-C/U		
	AF9	Fe pipe	76.1 x 2.6		> 125	> 125	80	EI 60-C/U		
	AF10	Fe pipe	48.3 x 2.3		> 125	> 125	> 125	EI 120-C/U		
Test 3 of 17/05/2013 Test Report No. (3638/914/13)-Wsp dated 06/01/2014	AF1 ¹⁾	Fe pipe	88.9 x 2.9	175	> 125	> 125	109	EI 60-C/U		
	AF2 ¹⁾	Cu pipe	42.0 x 1.5	175	> 125	> 125	109	EI 90-C/U		
	AF3	Fe pipe	76.1 x 2.6	175	> 125	> 125	113	EI 90-C/U		
	AF1a	Fe pipe	88.9 x 2.9	150	> 125	> 125	92	EI 60-C/U		

¹⁾ Distance between the pipe penetration seals s = 0 mm

Structural design of the test specimens

Pipe penetration seals "AF/ArmaFlex®..." for metal pipes
 – Results of wall installation (continued) –

Materialprüfanstalt für das Bauwesen

Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 2 to
 Classification Report

No. K-3579/821/14-MPA BS

Results of the pipe penetration seals "AF/ArmaFlex®..."
– installation in a 150 mm or 175 mm thick aerated concrete ceiling (continued from Section 3.2.2) –

Test and Test Report No.		Pipe penetration seals				Integrity E			Thermal insulation I	Max. fire resistance class in accordance with EN 13501-2
		Test specimen	Medium pipe	Ø _{Pipe} x s _{Pipe}	Ceiling thickness	Ignition of cotton pad	Gaps or openings	Sustained flaming		
[-]	[-]	[-]	[-]	[mm]	[mm]	[min]	[min]	[min]	[min]	[-]
Test 1 on 08/11/2012 Test Report No. (3729/015/12)-Wsp dated 06/01/2014	AF1	Fe pipe	48.3 x 2.3	150	> 125	> 125	> 125	121	109	EI 90-C/U
	AF2 ¹⁾	Fe pipe	88.9 x 2.9		> 125	> 125	> 125	54	48	EI 45-C/U
	AF3 ¹⁾	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	54	45	EI 30-C/U
	AF4	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	118	116	EI 90-C/U
	AF5	Cu pipe	28.0 x 1.0		> 125	> 125	> 125	123	95	EI 90-C/U
	AF6	Cu pipe	28.0 x 1.0		> 125	> 125	> 125	110	108	EI 90-C/U
	AF7	Fe pipe	76.1 x 2.6		> 125	> 125	> 125	65	58	EI 45-C/U
	AF8	Fe pipe	76.1 x 2.6		> 125	> 125	> 125	77	95	EI 60-C/U
	AF9	Fe pipe	48.3 x 2.3		> 125	> 125	> 125	> 125	> 125	EI 120-C/U
	AF10	Fe pipe	88.9 x 2.9		> 125	> 125	> 125	123	122	EI 120-C/U
Test 2 on 12/04/2013 Test Report No. (3637/913/13)-Wsp dated 06/01/2014	AF1 ¹⁾	Fe pipe	88.9 x 2.9	175	> 95	> 95	> 95	89	87	EI 60-C/U
	AF2 ¹⁾	Cu pipe	42.0 x 1.5		> 95	> 95	> 95	89	84	EI 60-C/U
	AF3	Fe pipe	76.1 x 2.6		> 95	> 95	> 95	80	80	EI 60-C/U

¹⁾ Distance between the pipe penetration seals s = 0 mm

Structural design of the test specimens

Pipe penetration seals "AF/ArmaFlex®..." for metal pipes
 – Results of ceiling installation –

Materialprüfanstalt für das Bauwesen
 Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 3 to
 Classification Report

No. K-3579/821/14-MPA BS

Results of the pipe penetration seals "SH/ArmaFlex®"
– installation in a 150 mm thick aerated concrete wall (continued from Section 3.3.1) –

Test and Test Report No.		Pipe penetration seals					Integrity E			Thermal insulation I	Max. fire resistance class in accordance with EN 13501-2
		Test specimen	Medium pipe	Ø _{Pipe} x s _{Pipe}	Wall thickness	Ignition of cotton pad	Gaps or openings	Sustained flaming			
[-]	Test 1 on 22/12/2012 – Test Report No. (3730/016/12)–Wsp dated 30/01/2014	[-]	[-]	[mm]	[mm]	[min]	[min]	[min]	[min]	[-]	
		SH1	Fe pipe	48.3 x 2.3	150	> 125	> 125	83	77	EI 60-C/U	
		SH2	Cu pipe	28.0 x 1.0		> 125	> 125	92	92	EI 90-C/U	
		SH3	Cu pipe	28.0 x 1.0		> 125	> 125	92	94	EI 90-C/U	
		SH4	Cu pipe	35.0 x 1.5		> 125	> 125	74	74	EI 60-C/U	
		SH5 ¹⁾	Cu pipe	35.0 x 1.5		> 125	> 125	86	80	EI 60-C/U	
SH6 ¹⁾	Fe pipe	48.3 x 2.3	> 125	> 125		86	79	EI 60-C/U			
Test 2 on 17/05/2013 – Test Report No. (3638/914/13)–Wsp dated 06/01/2014	SH1	Fe pipe	48.3 x 2.3	150	> 125	> 125	78	78	EI 60-C/U		
	SH2 ¹⁾	Cu pipe	35.0 x 1.5		> 125	> 125	69	44	EI 30-C/U		
	SH3 ¹⁾	Fe pipe	48.3 x 2.3		> 125	> 125	69	59	EI 45-C/U		
	SH2a	Cu pipe	35.0 x 1.5		> 125	> 125	> 125	75	EI 60-C/U		
	SH3a	Fe pipe	48.3 x 2.3		> 125	> 125	> 125	> 125	EI 120-C/U		

¹⁾ Distance between the pipe penetration seals s = 0 mm

Structural design of the test specimens
 Pipe penetration seals "SH/ArmaFlex®" for metal pipes
 – Results of wall installation –

Materialprüfanstalt für das Bauwesen
 Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 4 to
 Classification Report

No. K-3579/821/14-MPA BS

Results of the pipe penetration seals "SH/ArmaFlex®"
-- installation in a 150 mm thick aerated concrete ceiling (continued from Section 3.3.2) --

Test and Test Report No.		Pipe penetration seals					Integrity E			Thermal insulation I	Max. fire resistance class in accordance with EN 13501-2
		Test specimen	Medium pipe	Ø _{Pipe} x s _{Pipe}	Ceiling thickness	Ignition of cotton pad	Gaps or openings	Sustained flaming			
Test 1 on 08/11/2012 — Test Report No. (3729/015/12)–Wsp dated 06/01/2014	[–]	[–]	[–]	[mm]	[mm]	[min]	[min]	[min]	[min]	[–]	
	SH1	Fe pipe	48.3 x 2.3	150	> 125	> 125	83	83	EI 60-C/U		
	SH2	Cu pipe	28.0 x 1.0		> 125	> 125	122	121	EI 120-C/U		
	SH3	Cu pipe	28.0 x 1.0		> 125	> 125	> 125	> 125	EI 120-C/U		
	SH4	Cu pipe	35.0 x 1.5		> 125	> 125	> 125	> 125	EI 120-C/U		
	SH5 ¹⁾	Cu pipe	35.0 x 1.5		> 125	> 125	100	72	EI 60-C/U		
SH6 ¹⁾	Fe pipe	48.3 x 2.3	> 125		> 125	100	84	EI 60-C/U			
Test 2 on 17/05/2013 — Test Report No. (3637/913/13)–Wsp dated 06/01/2014	SH1	Fe pipe	48.3 x 2.3	150	> 95	> 95	53	53	EI 45-C/U		
	SH2 ¹⁾	Cu pipe	35.0 x 1.5		> 95	> 95	69	65	EI 60-C/U		
	SH3 ¹⁾	Fe pipe	48.3 x 2.3		> 95	> 95	69	76	EI 60-C/U		

¹⁾ Distance between the pipe penetration seals s = 0 mm

Structural design of the test specimens
 Pipe penetration seals "SH/ArmaFlex®" for metal pipes
 – Results of ceiling installation –

Materialprüfanstalt für das Bauwesen
 Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 5 to
 Classification Report

No. K-3579/821/14-MPA BS

**Results of the pipe penetration seals "ArmaFlex® Ultima"
– installation in a 150 mm thick aerated concrete wall (continued from Section 3.4.1) –**

Test and Test Report No.		Pipe penetration seals				Integrity E			Thermal insulation I	Max. fire resistance class in accordance with EN 13501-2
		Test specimen	Medium pipe	Ø _{Pipe} x S _{Pipe}	Wall thickness	Ignition of cotton pad	Gaps or openings	Sustained flaming		
[-]	[-]	[-]	[-]	[mm]	[mm]	[min]	[min]	[min]	[min]	[-]
Test 1 on 22/11/2012 – (3730/016/12)–Wsp dated 30/01/2014	UL2 ¹⁾	Fe pipe	88.9 x 2.9	150	> 125	> 125	> 125	> 125	75	EI 60-C/U
	UL3 ¹⁾	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	> 125	80	EI 60-C/U
	UL4	Fe pipe	88.9 x 2.9		> 125	> 125	> 125	> 125	80	EI 60-C/U
	UL5	Fe pipe	76.1 x 2.6		> 125	> 125	> 125	> 125	> 125	EI 120-C/U
	UL6	Fe pipe	76.1 x 2.6		> 125	> 125	> 125	> 125	63	EI 60-C/U
	UL7	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	> 125	122	EI 120-C/U
	UL8	Cu pipe	28.0 x 1.0		> 125	> 125	> 125	> 125	100	EI 90-C/U
	UL9	Cu pipe	28.0 x 1.0		> 125	> 125	> 125	> 125	> 125	EI 120-C/U
	UL10	Fe pipe	48.3 x 2.3		> 125	> 125	> 125	> 125	83	EI 60-C/U
	UL1	Fe pipe	48.3 x 2.3		> 125	> 125	> 125	> 125	> 125	EI 120-C/U
Test 2 on 17/05/2013 – Test Report No. (3638/914/13)–Wsp dated 06/01/2014	UL2 ¹⁾	Fe pipe	88.9 x 2.9	150	> 125	> 125	> 125	> 125	61	EI 60-C/U
	UL3 ¹⁾	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	> 125	112	EI 90-C/U
	UL4	Fe pipe	88.9 x 2.9		> 125	> 125	> 125	> 125	122	EI 120-C/U
	UL2a	Fe pipe	88.9 x 2.9		> 125	> 125	> 125	> 125	78	EI 60-C/U
	UL3a	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	> 125	73	EI 60-C/U

¹⁾ Distance between the pipe penetration seals s = 0 mm

<p>Structural design of the test specimens Pipe penetration seals "ArmaFlex® Ultima" for metal pipes – Results of wall installation –</p>	<p>Annex 6 to Classification Report No. K-3579/821/14-MPA BS</p>
<p>Materialprüfanstalt für das Bauwesen Institut für Baustoffe, Massivbau und Brandschutz der Technischen Universität Braunschweig</p>	

Results of the pipe penetration seals "ArmaFlex® Ultima"

-- installation in a 150 mm thick aerated concrete ceiling (continued from Section 3.4.2) --

Test and Test Report No.	Pipe penetration seals Test report				Integrity E			Thermal insulation I	Max. fire resistance class in accordance with EN 13501-2
	Test specimen	Medium pipe	Ø _{Pipe} x s _{Pipe}	Ceiling thickness	Ignition of cotton pad	Gaps or openings	Sustained flaming		
[-]	[-]	[-]	[mm]	[mm]	[min]	[min]	[min]	[min]	[-]
Test 1 on 08/11/2012 -- Test Report No. (3729/015/12)-Wsp dated 06/01/2014	UL1	Cu pipe	28.0 x 1.0	150	> 125	> 125	> 125	> 125	EI 120-C/U
	UL2	Fe pipe	48.3 x 2.3		> 125	> 125	> 125	> 125	EI 60-C/U
	UL3	Fe pipe	48.3 x 2.3		> 125	> 125	> 125	> 125	EI 120-C/U
	UL4 ¹⁾	Fe pipe	88.9 x 2.9		> 125	> 125	> 125	> 125	EI 60-C/U
	UL5 ¹⁾	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	> 125	EI 60-C/U
	UL6	Fe pipe	88.9 x 2.9		> 125	> 125	> 125	> 125	EI 120-C/U
	UL7	Fe pipe	76.1 x 2.6		> 125	> 125	> 125	> 125	EI 120-C/U
	UL8	Fe pipe	76.1 x 2.6		> 125	> 125	> 125	> 125	EI 120-C/U
	UL9	Cu pipe	42.0 x 1.5		> 125	> 125	> 125	> 125	EI 120-C/U
	UL10	Cu pipe	28.0 x 1.0		> 125	> 125	> 125	> 125	EI 120-C/U
Test 2 on 12/04/2013 -- Test Report No. (3637/913/13)-Wsp dated 06/01/2014	UL1	Fe pipe	48.3 x 2.3	150	> 95	> 95	> 95	> 95	EI 90-C/U
	UL2 ¹⁾	Fe pipe	88.9 x 2.9		> 95	> 95	> 95	> 95	EI 60-C/U
	UL3 ¹⁾	Cu pipe	42.0 x 1.5		> 95	> 95	> 95	> 95	EI 60-C/U
	UL4	Fe pipe	76.1 x 2.6		> 95	> 95	> 95	> 95	EI 60-C/U

¹⁾ Distance between the pipe penetration seals s = 0 mm

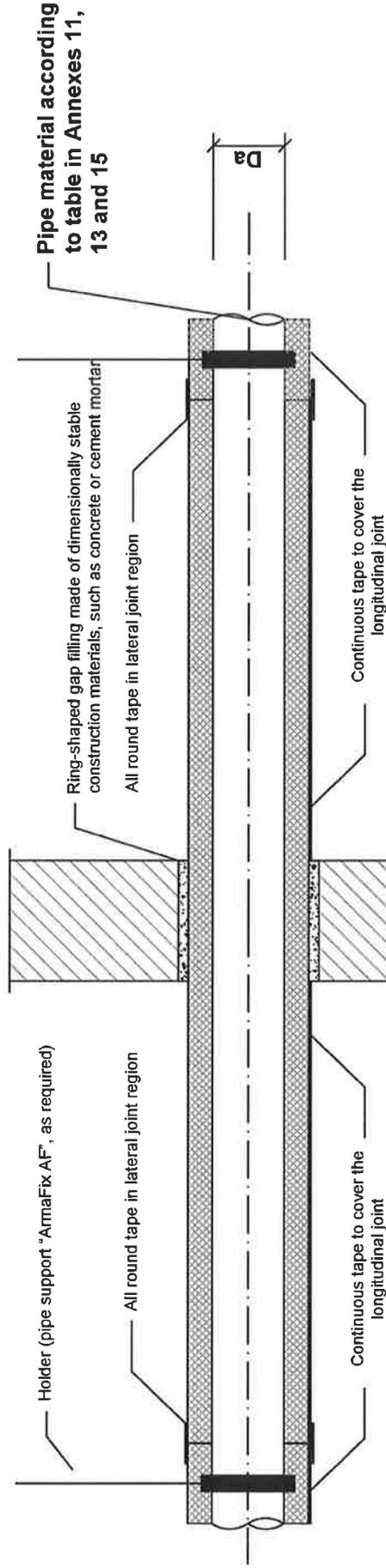
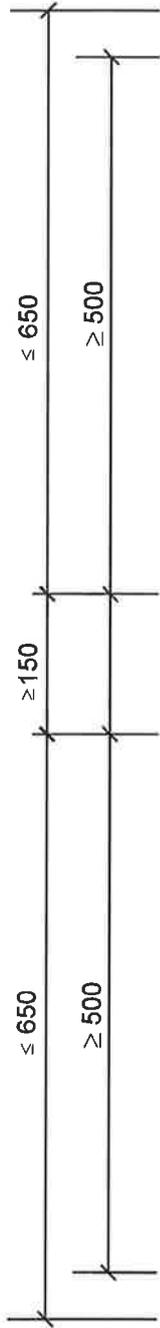
Structural design of the test specimens

Pipe penetration seals "ArmaFlex® Ultima" for metal pipes
 -- Results of ceiling installation --

Materialprüfanstalt für das Bauwesen
 Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 7 to
 Classification Report

No. K-3579/821/14-MPA BS



Solid wall – wall thickness in accordance with Annexes 11, 13 and 15

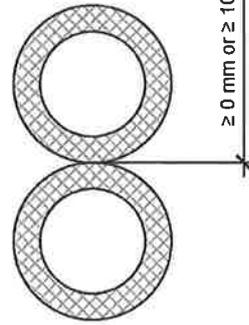
Pipe insulation “AF/ArmaFlex...”, “SH/ArmaFlex” or “ArmaFlex Ultima, etc.” according to Annexes 11, 13 and 15

- Thickness of insulation according to table

Insulation hoses:

- Hoses pushed on or slotted and glued
- All joints must be covered with a system-related tape

Multiple pipe penetrations (distance of insulations according to Annexes 11, 13 and 15)



Space filling and ring-shaped gap filling with dimensionally stable construction materials (e.g., concrete, cement mortar) at the same thickness as the component, so that the cavities are tightly filled

The longitudinal joints are covered outside of the component feed-through; no tape is placed in the area of the component feed-through. There must not be any transverse joints in the area of component feed-through (i.e., continuous insulation).

Structural design of the pipe penetration seals

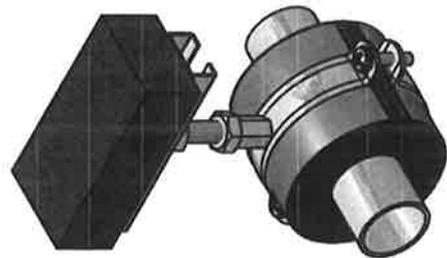
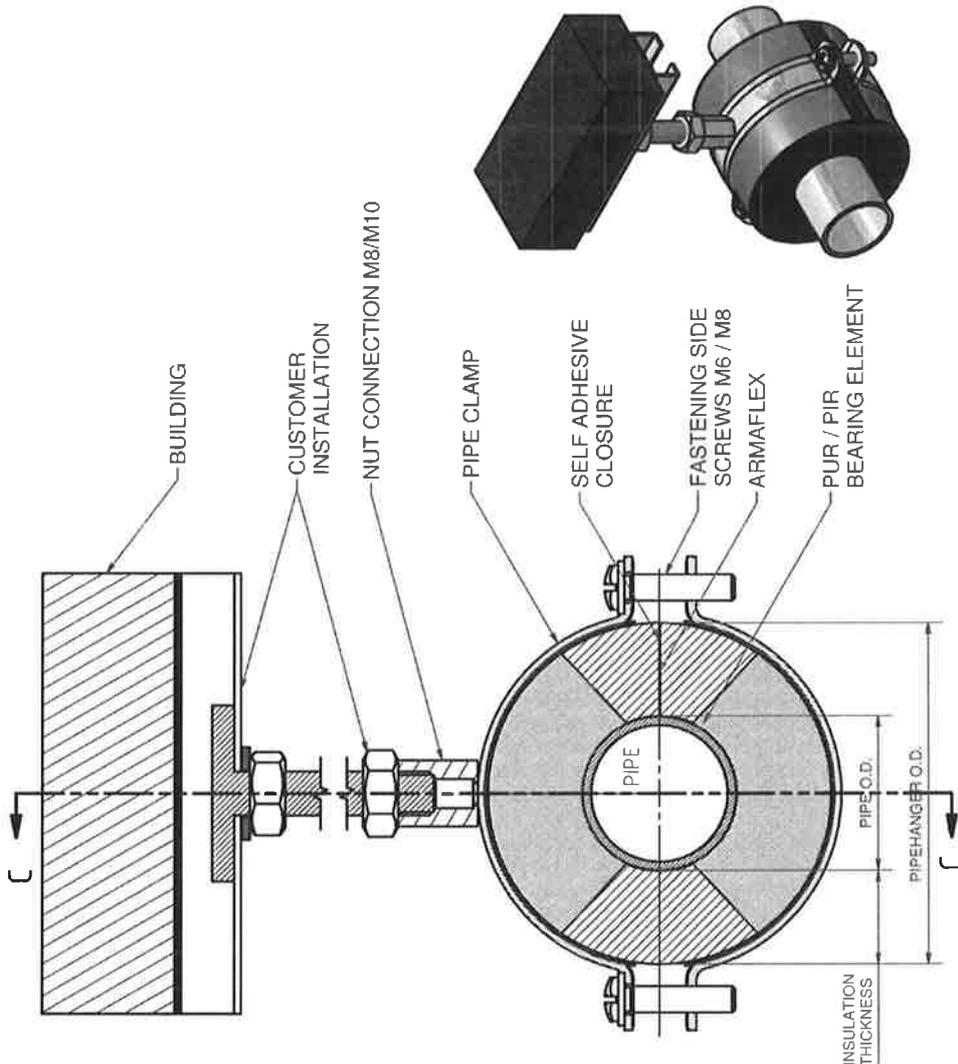
Pipe penetration seals for metal pipes
– Wall installation –

Annex 8 to

Classification Report

Materialprüfanstalt für das Bauwesen
Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig

No. K-3579/821/14-MPA BS



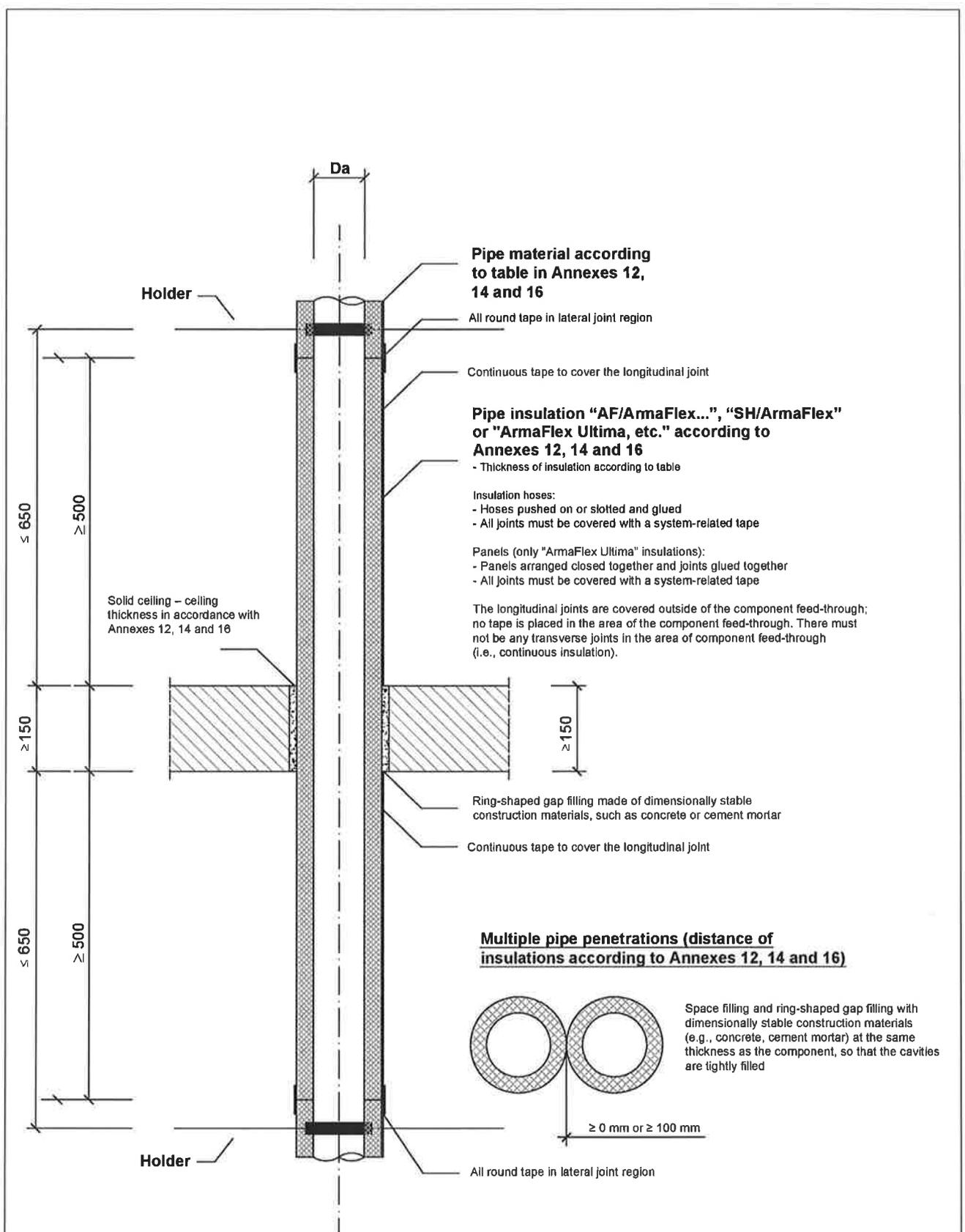
Structural design of the pipe penetration seals

Pipe penetration seals for metal pipes – Pipe support “ArmaFix AF”
 – Wall installation –

Materialprüfanstalt für das Bauwesen

Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 9 to
 Classification Report
 No. K-3579/821/14-MPA BS



Structural design of the pipe penetration seals

Pipe penetration seals for metal pipes – Pipe support "ArmaFix AF"
 – Ceiling installation –

Materialprüfanstalt für das Bauwesen

Institut für Baustoffe, Massivbau und Brandschutz
 der Technischen Universität Braunschweig

Annex 10 to

Classification Report

No. K-3579/821/14-MPA BS

**Classification of the pipe penetration seals "AF/ArmaFlex®..."
in a fire resistance class
"E 15-C/U" to "E 90-C/U" or "EI 15-C/U" to "EI 90-C/U" in accordance with DIN EN 13501-2
(installed in $t \geq 150$ mm, $t \geq 175$ mm, $t \geq 200$ mm or
 $t \geq 240$ mm thick solid walls in accordance with Annexes 8 and 9)**

Pipe material	Outside diameter	Pipe wall thickness	Installation situation in accordance with Annexes 8 and 9	Insulation	Insulation thickness	Insulation in accordance with DIN EN 1366-3, Table 1	Component thickness	max. fire resistance class in accordance with EN 13501-2
	d [mm]	t [mm]	s [mm]	[mm]	t [mm]	[-]	d [mm]	[-]
Copper, steel, stainless steel and cast iron	$\leq 28.0^{3)}$	≥ 1.0 ≤ 14.2	Distance $s \geq 100$ mm	AF/ArmaFlex® or AF/ArmaFlex® N or AF/ArmaFlex® Class 0 or AF/ArmaFlex® Evo (hoses)	≥ 8.5 ≤ 35.0	Type "CS"	≥ 150	E 90-C/U or EI 90-C/U ¹⁾
	$\leq 35.0^{3)}$	≥ 1.5 ≤ 14.2			≥ 13.0 ≤ 32.0		≥ 150	E 90-C/U or EI 90-C/U ¹⁾
	$\leq 42.0^{3)}$	≥ 1.5 ≤ 14.2			≥ 20.5 ≤ 36.5		≥ 175	E 90-C/U or EI 90-C/U ¹⁾
Steel, stainless steel and cast iron	≤ 48.3	≥ 2.3 ≤ 14.2	Distance $s \geq 100$ mm		≥ 21.0 ≤ 37.5		≥ 150	E 60-C/U or EI 60-C/U ²⁾
	≥ 76.1	≥ 2.6 ≤ 14.2			≥ 22.0 ≤ 40.5		≥ 175	E 60-C/U or EI 60-C/U ³⁾
	≥ 88.9	≥ 2.9 ≤ 14.2			19.0		≥ 200	E 90-C/U or EI 90-C/U
	≤ 114.3	≥ 3.2 ≤ 14.2		19.0	≥ 200	E 90-C/U or EI 90-C/U		
	≤ 133.0	≥ 3.2 ≤ 14.2		19.0	≥ 240	E 90-C/U or EI 90-C/U		

- 1) when installed in solid walls ($t \geq 150$ mm) and in connection with a distance of $s \geq 0$ mm the max. fire resistance class "E 60-C/U" or "EI 60-C/U" applies
- 2) when installed in solid walls ($t \geq 150$ mm) and in connection with an insulation thickness of $t = 37.5$ mm (AF-6) the max. fire resistance class "E 90-C/U" or "EI 90-C/U" applies
- 3) when installed in solid walls ($t \geq 175$ mm) and in connection with an insulation thickness of $t = 40.5$ mm (AF-6) the max. fire resistance class "E 90-C/U" or "EI 90-C/U" applies
- 4) Suspension of pipes $\varnothing \leq 42$ mm optionally with a pipe support "ARMAFIX AF" (see Section 4.5.5.1.12)

Field of application
Pipe penetration seals "AF/ArmaFlex®..."
– Wall installation –

Materialprüfanstalt für das Bauwesen
Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig

Annex 11 to
Classification Report
No. K-3579/821/14-MPA BS

**Classification of the pipe penetration seals "AF/ArmaFlex®..."
in a fire resistance class
"E 15-C/U" to "E 90-C/U" or "EI 15-C/U" to "EI 90-C/U" in accordance with DIN EN 13501-2
(installed in $t \geq 150$ mm or $t \geq 175$ mm thick solid ceilings in accordance with Annex 10)**

Pipe material	Outside diameter	Pipe wall thickness	Installation situation in accordance with Annex 10	Insulation	Insulation thickness	Insulation in accordance with DIN EN 1366-3, Table 1	Component thickness	Fire resistance class in accordance with EN 13501-2
	d [mm]	t [mm]	a [mm]	[mm]	t [mm]	[-]	d [mm]	[-]
Copper, steel, stainless steel and cast iron	≥ 28.0	≥ 1.0 ≤ 14.2	Distance $s \geq 100$ mm	AF/ArmaFlex® or AF/ArmaFlex® N or AF/ArmaFlex® Class 0 or AF/ArmaFlex® Evo (hoses)	≥ 8.5 ≤ 35.0	Type "CS"	≥ 150	E 90-C/U or EI 90-C/U ³⁾
	≥ 42.0	≥ 1.5 ≤ 14.2			≥ 19.0 ≤ 36.5		≥ 175	E 60-C/U or EI 60-C/U ^{1), 3)}
Steel, stainless steel and cast iron	≤ 48.3	≥ 2.3 ≤ 14.2	Distance $s \geq 100$ mm		≥ 21.0 ≤ 37.5		≥ 150	E 90-C/U or EI 90-C/U ³⁾
	≥ 76.1	≥ 2.6 ≤ 14.2			≥ 21.0 ≤ 40.5		≥ 150	E 60-C/U or EI 45-C/U
					40.5		≥ 175	E 60-C/U or EI 60-C/U ³⁾
	≥ 88.9	≥ 2.9 ≤ 14.2			≥ 22.5 ≤ 41.5		≥ 175	E 60-C/U or EI 60-C/U ^{2), 3)}

- 1) when installed in solid ceilings ($t \geq 150$ mm) and in connection with an insulation thickness of $t = 36.5$ mm (AF-6) the max. fire resistance class "E 90-C/U" or "EI 90-C/U" applies
- 2) when installed in solid ceilings ($t \geq 150$ mm) and in connection with an insulation thickness of $t = 41.5$ mm (AF-6) the max. fire resistance class "E 90-C/U" or "EI 90-C/U" applies
- 3) when installed in solid ceilings ($t \geq 175$ mm) and in connection with a distance of $s \geq 0$ mm the max. fire resistance class "E 60-C/U" or "EI 60-C/U" applies

Scope of application
Pipe penetration seals "AF/ArmaFlex®..."
– Ceiling installation –

Materialprüfanstalt für das Bauwesen
Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig

Annex 12 to
Classification Report
No. K-3579/821/14-MPA BS

**Classification of the pipe penetration seals "SH/ArmaFlex®"
in a fire resistance class
"E 15-C/U" to "E 90-C/U" or "EI 15-C/U" to "EI 90-C/U" in accordance with DIN EN 13501-2
(installed in $t \geq 150$ mm thick solid walls in accordance with Annex 8)**

Pipe material	Outside diameter d [mm]	Pipe wall thickness t [mm]	Installation situation in accordance with Annex 8 a [mm]	Insulation [mm]	Insulation thickness t [mm]	Insulation in accordance with DIN EN 1366-3, Table 1 [-]	Component thickness d [mm]	Fire resistance class in accordance with EN 13501-2 [-]
Copper, steel, stainless steel and cast iron	≥ 28.0	≥ 1.0 ≤ 14.2	Distance $s \geq 100$ mm	SH/ArmaFlex® (hoses)	≥ 11.0 ≤ 25.0	Type "CS"	≥ 150	E 90-C/U ¹⁾ or EI 90-C/U ¹⁾
	≥ 35.0	≥ 1.5 ≤ 14.2			≥ 10.0 ≤ 38.0			E 60-C/U ¹⁾ or EI 60-C/U ¹⁾
Steel, stainless steel and cast iron	≤ 48.3	≥ 2.3 ≤ 14.2			≥ 10.0 ≤ 53.0			E 60-C/U ¹⁾ or EI 60-C/U ¹⁾

¹⁾ when installed in solid walls ($t \geq 150$ mm) and in connection with a distance of $s \geq 0$ mm the max. fire resistance class "E 60-C/U" or "EI 30-C/U" in accordance with DIN EN 13501-2 applies

Scope of application
Pipe penetration seals "SH/ArmaFlex®"
- Wall installation -

Materialprüfanstalt für das Bauwesen
Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig

Annex 13 to
Classification Report
No. K-3579/821/14-MPA BS

**Classification of the pipe penetration seals "SH/ArmaFlex®"
in a fire resistance class
"E 15-C/U" to "E 90-C/U" or "EI 15-C/U" to "EI 90-C/U" in accordance with DIN EN 13501-2
(installed in $t \geq 150$ mm thick solid ceilings in accordance with Annex 10)**

Pipe material	Outside diameter	Pipe wall thickness	Installation situation in accordance with Annex 10	Insulation	Insulation thickness	Insulation in accordance with DIN EN 1366-3, Table 1	Component thickness	Fire resistance class in accordance with EN 13501-2
	d [mm]	t [mm]	a [mm]	[mm]	t [mm]	[-]	d [mm]	[-]
Copper, steel, stainless steel and cast iron	≥ 28.0	≥ 1.0 ≤ 14.2	Distance $s \geq 100$ mm	SH/ArmaFlex® (hoses)	≥ 11.0 ≤ 25.0	Type "CS"	≥ 150	E 90-C/U ¹⁾ or EI 90-C/U ¹⁾
	≥ 35.0	≥ 1.5 ≤ 14.2			≥ 10.0 ≤ 38.0			E 60-C/U ¹⁾ or EI 60-C/U ^{1), 2)}
Steel, stainless steel and cast iron	≤ 48.3	≥ 2.3 ≤ 14.2			10.0			E 60-C/U ¹⁾ or EI 60-C/U ¹⁾
					≥ 10.0 ≤ 53.0			E 45-C/U ¹⁾ or EI 45-C/U ¹⁾

- ¹⁾ when installed in solid ceilings ($t \geq 150$ mm) and in connection with a distance of $s \geq 0$ mm the max. fire resistance class "E 45-C/U" or "EI 30-C/U" in accordance with DIN EN 13501-2 applies
- ²⁾ in connection with an insulation thickness of $t = 38$ mm the max. fire resistance class "E 90-C/U" or "EI 90-C/U" in accordance with DIN EN 13501-2 applies

Scope of application
Pipe penetration seals "SH/ArmaFlex®"
– Ceiling installation –

Materialprüfanstalt für das Bauwesen
Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig

Annex 14 to
Classification Report
No. K-3579/821/14-MPA BS

**Classification of the pipe penetration seals "ArmaFlex® Ultima"
in a fire resistance class
"E 15-C/U" to "E 120-C/U" or "EI 15-C/U" to "EI 120-C/U" in accordance with DIN EN 13501-2
(installed in $t \geq 150$ mm thick solid walls in accordance with Annex 8)**

Pipe material	Outside diameter	Pipe wall thickness	Installation situation in accordance with Annex 8	Insulation	Insulation thickness	Insulation in accordance with DIN EN 1366-3, Table 1	Component thickness	Fire resistance class in accordance with EN 13501-2
	d [mm]	t [mm]	a [mm]	[mm]	t [mm]	[-]	d [mm]	[-]
Copper, steel, stainless steel and cast iron	≥ 28.0	≥ 1.0 ≤ 14.2	Distance $s \geq 0$ mm	ArmaFlex® Ultima (hoses or panels)	≥ 9.0 ≤ 25.0	Type "CS"	≥ 150	E 120-C/U ¹⁾ or EI 90-C/U ¹⁾
	≥ 42.0	≥ 1.5 ≤ 14.2			≥ 9.0 ≤ 25.0			E 120-C/U ¹⁾ or EI 60-C/U ¹⁾
Steel, stainless steel and cast iron	≤ 48.3	≥ 2.3 ≤ 14.2	Distance $s \geq 0$ mm		≥ 9.0 ≤ 25.0			E 120-C/U or EI 60-C/U
	≥ 76.1	≥ 2.6 ≤ 14.2			≥ 9.0 ≤ 25.0			E 120-C/U or EI 60-C/U
	≥ 88.9	≥ 2.9 ≤ 14.2			≥ 9.0 ≤ 25.0			E 120-C/U or EI 60-C/U

¹⁾ in connection with an insulation thickness of $d = 25$ mm (insulation hoses) and a distance of $s \geq 100$ mm the fire resistance class "E 120-C/U" or "EI 120-C/U" in accordance with DIN EN 13501-2 applies

Scope of application
Pipe penetration seals "ArmaFlex® Ultima"
– Wall installation –

Materialprüfanstalt für das Bauwesen
Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig

Annex 15 to
Classification Report
No. K-3579/821/14-MPA BS

**Classification of the pipe penetration seals "ArmaFlex® Ultima"
in a fire resistance class
"E 15-C/U" to "E 120-C/U" or "EI 15-C/U" to "EI 120-C/U" in accordance with DIN EN 13501-2
(installed in $t \geq 150$ mm thick solid ceilings in accordance with Annex 10)**

Pipe material	Outside diameter	Pipe wall thickness	Installation situation in accordance with Annex 10	Insulation	Insulation thickness	Insulation in accordance with DIN EN 1366-3, Table 1	Component thickness	Fire resistance class in accordance with EN 13501-2
	d [mm]	t [mm]	a [mm]	[mm]	t [mm]	[-]	d [mm]	[-]
Copper, steel, stainless steel and cast iron	≥ 28.0	≥ 1.0 ≤ 14.2	Distance $s \geq 0$ mm	ArmaFlex® Ultima (hoses or panels)	≥ 9.0 ≤ 25.0	Type "CS"	≥ 150	E 120-C/U or EI 120-C/U
	≥ 42.0	≥ 1.5 ≤ 14.2			≥ 9.0 ≤ 25.0			E 120-C/U or EI 60-C/U ¹⁾
Steel, stainless steel and cast iron	≤ 48.3	≥ 2.3 ≤ 14.2	Distance $s \geq 0$ mm		≥ 9.0 ≤ 25.0			E 120-C/U or EI 60-C/U
	≥ 76.1	≥ 2.6 ≤ 14.2			≥ 9.0 ≤ 25.0			E 120-C/U or EI 60-C/U ²⁾
	≥ 88.9	≥ 2.9 ≤ 14.2			≥ 9.0 ≤ 25.0			E 120-C/U or EI 60-C/U ²⁾

- ¹⁾ in connection with an insulation thickness of $d = 25$ mm (insulation hoses) and a distance of $s \geq 100$ mm the fire resistance class "E 120-C/U" or "EI 120-C/U" in accordance with DIN EN 13501-2 applies
- ²⁾ in connection with an insulation thickness of $d = 25$ mm (insulation hoses) and a distance of $s > 100$ mm, the fire resistance class "E 120-C/U" or "EI 90-C/U" in accordance with DIN EN 13501-2 applies

Scope of application
Pipe penetration seals "ArmaFlex® Ultima"
– Ceiling installation –

Materialprüfanstalt für das Bauwesen
Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig

Annex 16 to
Classification Report
No. K-3579/821/14-MPA BS