The Catalonia Institute of Construction Technology

Wellington 19
ES-08018 Barcelona
Tel. +34 93 309 34 04
qualprod@itec.cat
itec.cat

Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
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European Technical Assessment

ETA 26/0349 of 12.05.2026

General part

Technical Assessment Body issuing the ETA: ITeC ITeC has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment).	
Trade name of the construction product	**GRAPHIT FOAM**
Product family to which the construction product belongs	Fire stopping and fire sealing products. Penetration seals.
Manufacturer	**ROTHO BLAAS SRL** Via dell'Adige 2/1 IT-39040 Cortaccia (BZ) Italy Tel. + 39 0471 818400 www.rothoblaas.com
Manufacturing plant(s)	According to Annex N kept by ITeC.
This European Technical Assessment contains	61 pages including 2 annexes which form an integral part of this assessment and Annex N, which contains confidential information and is not included in the European Technical Assessment when that assessment is publicly available.
This European Technical Assessment is issued in accordance with Article 95(4) of Regulation (EU) 2024/3110, on the basis of	European Assessment Document EAD 350454-00-1104.

General comments

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es)).

Specific parts of the European Technical Assessment

1 Technical description of the product

GRAPHIT FOAM is a two-component polyurethane foam with graphite used as fire penetration seal. GRAPHIT FOAM is supplied in cartridges with the application parameters and end-use hardened density as given in Table 1. GRAPHIT FOAM is a reactive material with intumescent properties when exposed to fire (as given in Table 1).

Table 1: Characteristics of GRAPHIT FOAM.

Application parameters	**Nominal value**
Reaction time (s)	10
Tack-free time (s)	100
Increase in volume at 20 °C (free expansion) (times)	3 – 5
Hardened density (kg/m^3)	310 ± 10 %
Intumescent properties	**Nominal value**
Expansion ratio at 500 ºC (times)	3,57
Expansion pressure at 500 ºC (MPa)	0,166

Figure 1: GRAPHIT FOAM (cartridge at the left, applied foam seal at the right).

Detailed description of GRAPHIT FOAM installation procedure is given in Annex B. Assembled penetration seals may require additional components as described in the annexes of this ETA. These components cannot be CE marked based on this ETA.

2 Specification of the intended use(s) in accordance with the applicable EAD

GRAPHIT FOAM is used to reinstate the resistance to fire performance of a constructive element where it is penetrated by the following services (detailed specification in Annex A):

- Insulated and non-insulated plastic pipes.
- Insulated and non-insulated metal pipes.
- Insulated multilayer composite pipes.
- Cables, cable bundles and cable trays.

The constructive elements where GRAPHIT FOAM may be installed to provide a penetration seal are as follows (detailed specification in Annex B):

- Flexible walls (B.2.2.1).
- Sandwich panels walls (B.2.2.2).
- Timber (CLT) walls (B.2.2.3).
- Rigid walls (B.2.2.4).
- Rigid floors (B.2.3.1).
- Timber (CLT) floors (B.2.3.2).

The constructive element where the penetration seal is installed must be classified in accordance with EN 13501-2 [1] for the required fire resistance period.

GRAPHIT FOAM is also intended for use as an ancillary component in the fire penetration seals as given in ETA 24/1205 for MASS.

GRAPHIT FOAM is intended for environmental conditions as defined for use category Type Y_1 according to EAD 350454-00-1104: intended for semi-exposed use at temperatures below 0°C, with exposure to UV but not to rain. Type Y_1 includes lower use categories (i.e., Type Y_2, Type Z_1 and Type Z_2).

The provisions made in this ETA are based on a working life of GRAPHIT FOAM of at least 25 years, provided that the conditions laid down in the manufacturer's instructions for the installation, use and maintenance are met. These provisions are based upon the current state of the art and the available knowledge and experience.

The indications given as to the working life of the product cannot be interpreted as a guarantee but are regarded only as a means for choosing the appropriate products in relation to the expected economically reasonable working life of the works.

[1] EN 13501-2 Fire classification of construction products and building elements. Part 2: Classification using data from fire resistance tests, excluding ventilation services.

3 Performance of the product and reference to the methods used for its assessment

3.1 Performance of the product

The assessment of GRAPHIT FOAM has been performed in accordance with EAD 350454-00-1104 for *Penetration Seals (September 2017)*.

Table 3: Performance of the product.

Product: GRAPHIT FOAM		**Intended use:** Fire penetration seal
Basic requirement	**Essential characteristic**	**Performance**
BWR 2 Safety in case of fire	Reaction to fire	NPA [2]
	Resistance to fire	See Annex A
BWR 3 Hygiene, health and the environment	Content, emission and/or release of dangerous substances	$TVOC_{3d}$ = 5600 µg/m^3 $TVOC_{28d}$ = 2800 mg/m^3
BWR 4 Safety and accessibility in use	Durability	Type Y_1

The rest of characteristics included in EAD 350454-00-1104 have not been assessed in this ETA.

[2] NPA: No Performance Assessed.

3.2 Methods used for the assessment

3.2.1 Resistance to fire

Tested and assessed according to EN 1366-3 [3], the fire resistance classification has been determined according to EN 13501-2 and is given in Annex A.

3.2.2 Content, emission and/or release of dangerous substances

For the release scenarios IA1 and IA2, the total volatile organic compounds (TVOC) have been determined in accordance with EN 16516 [4] after 3 days and after 28 days, considering the following test conditions:

- Preconditioning period: 34 days.
- Chamber test period: 28 days.
- Chamber size (volume): 119 l.
- Temperature (air supply): (23 ± 1) ºC.
- Relative humidity (air supply): (50 ± 3) %.
- Air change rate: 0,5 h^{-1}.
- Air velocity: 0,1 m/s.
- Area specific ventilation rate: 0,5 m/h.
- Exposed sample area: 0,120 m^2.
- Loading factor: 1,0 m^2/m^3.

3.2.3 Durability

GRAPHIT FOAM has been tested and assessed for a 25-year working life for the environmental use category Type Y_1 in accordance with section 2.2.9 of EAD 350454-00-1104 and the EOTA Technical Report 024 [5], section 2.2.4, considering low temperature conditions (table 2A in TR 024).

[3] EN 1366-3 Fire resistance tests for service installations. Part 3: Penetration seals.

[4] EN 16516+A1 Construction products. Assessment of release of dangerous substances. Determination of emissions into indoor air.

[5] EOTA TR 024 Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products, Edition August 2019.

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

According to the Decision 1999/454/EC of the Europ0ean Commission, the system of AVCP (see EC delegated Regulation (EU) No 568/2014 amending Annex V to Regulation (EU) 305/2011) given in the following table applies.

Table 4: AVCP System.

Product(s)	Intended use(s)	Level(s) or class(es)	System(s)
Fire stopping and fire sealing products	For fire compartmentation and/or fire protection or fire performance	Any	1

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

All the necessary technical details for the implementation of the AVCP system are laid down in the *Control Plan* deposited with the ITeC and agreed in accordance with EAD 350454-00-1104, section 3.

The *Control Plan* is a confidential part of the ETA and only handed over to the notified product certification body involved in the assessment and verification of constancy of performance.

The factory production control operated by the manufacturer shall be in accordance with the above mentioned *Control Plan*.

Issued in Barcelona on 12 May 2026
by the Catalonia Institute of Construction Technology.

Institut de Tecnologia de la Construcció de Catalunya

Ferran Bermejo Nualart
Technical Director, ITeC

ANNEX A. Resistance to fire performance

In this Annex, the resistance to fire performance of GRAPHIT FOAM is given (see the following Index). The classification is expressed in terms of classification of the supporting construction with fire-separating function being penetrated.

The supporting constructive elements and GRAPHIT FOAM installation criteria shall meet the specification given in Annex B.

The rules for the field of direct application of the test results given in EN 1366-3 can be applied as appropriate.

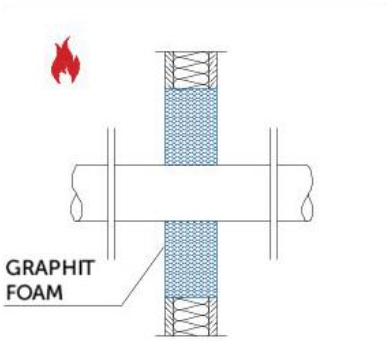
INDEX

A.1 Plastic pipes

A.1.1 Non-insulated plastic pipes

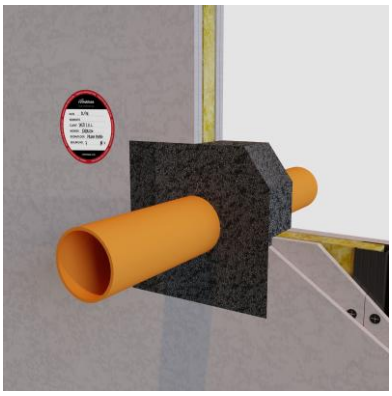
A.1.1.1 Flexible wall

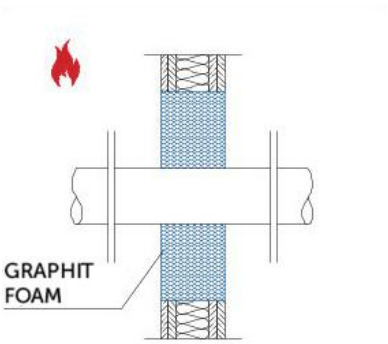
A.1.1.1.1 80 mm thick flexible wall



Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
PVC	≤ 50	3,0	EI 60 C/C
PP-R	≤ 50	8,3	EI 60 C/C

A.1.1.1.2 100 mm thick flexible wall



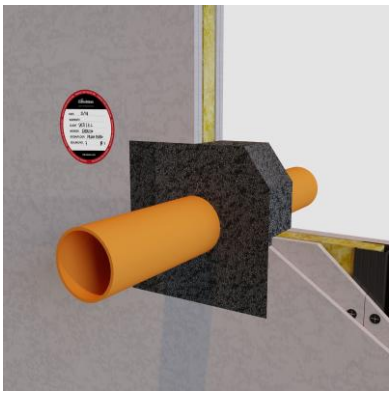


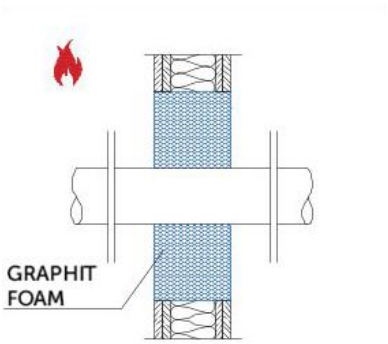
Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
PVC	≤ 50	3,0	EI 120 C/C
		3,0 – 6,2	EI 120 C/C (*)
		6,2	EI 120 U/C (*)
	≤ 110	1,8 – 8,1	EI 120 U/C (*)
		8,1	EI 120 U/C
		3,2 – 8,1	EI 90 U/C
PP-R[6]	≤ 50	1,8 – 8,3	EI 90 U/C
		1,8 – 8,3	EI 120 U/C (*)

(*) A frame is installed around the opening (of maximum size 250 mm x 250 mm) in accordance with the specification given in section B.2.2.1. The whole opening thickness of 125 mm (wall + frame) shall be entirely filled with GRAPHIT FOAM.

[6] Polypropylene reinforced with mineral fibres.

A.1.1.1.3 120 mm thick flexible wall

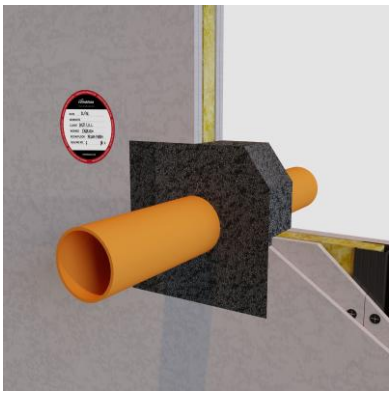


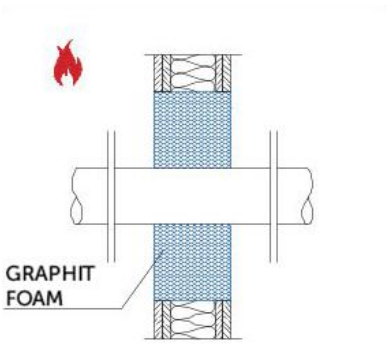


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
PVC	≤ 50	3,0	EI 120 C/C
		3,0 – 6,2	EI 120 C/C (*)
		6,2	EI 120 U/C (*)
	≤ 110	1,8 – 8,1	EI 120 U/C (*)
		8,1	EI 120 U/C
		3,2 – 8,1	EI 90 U/C
HDPE, PE, ABS, SAN+PVC	≤ 56	3,2	EI 120 U/C
PP	≤ 50	3,7	EI 120 U/C
PP-R	≤ 50	1,8 – 8,3	EI 90 U/C
		8,3	EI 120 U/C
		1,8 – 8,3	EI 120 U/C (*)

(*) A frame is installed around the opening (of maximum size 250 mm x 250 mm) in accordance with the specification given in section B.2.2.1. The whole opening thickness of 145 mm (wall + frame) shall be entirely filled with GRAPHIT FOAM.

A.1.1.1.4 125 mm thick flexible wall



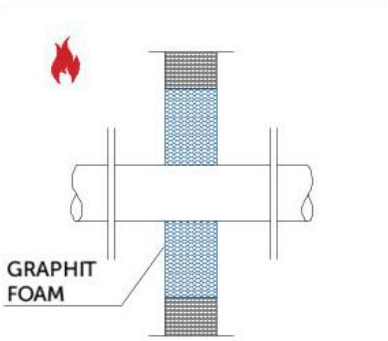


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
PVC	≤ 50	3,0	EI 120 U/C
		3,0 – 6,2	EI 120 C/C (*)
		6,2	EI 120 U/C (*)
	≤ 110	1,8 – 8,1	EI 120 U/C (*)
		8,1	EI 120 U/C
		3,2 – 8,1	EI 90 U/C
HDPE, PE, ABS, SAN+PVC	≤ 56	3,2	EI 120 U/C
PP	≤ 50	3,7	EI 120 U/C
PP-R	≤ 50	1,8 – 8,3	EI 90 U/C
		8,3	EI 120 U/C
		1,8 – 8,3	EI 120 U/C (*)

(*) A frame is installed around the opening (of maximum size 250 mm x 250 mm) in accordance with the specification given in section B.2.2.1. The whole opening thickness of 150 mm (wall + frame) shall be entirely filled with GRAPHIT FOAM.

A.1.1.2 Sandwich wall

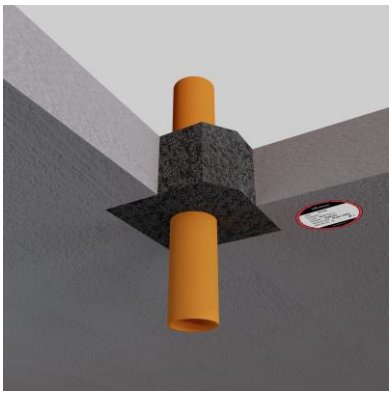
A.1.1.2.1 80 mm thick sandwich wall

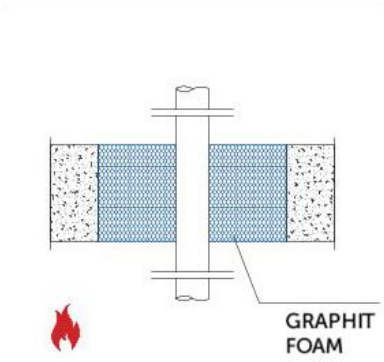


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
PVC	≤ 50	3,0	EI 60 U/C

A.1.1.3 Rigid floor

A.1.1.3.1 150 mm thick rigid floor



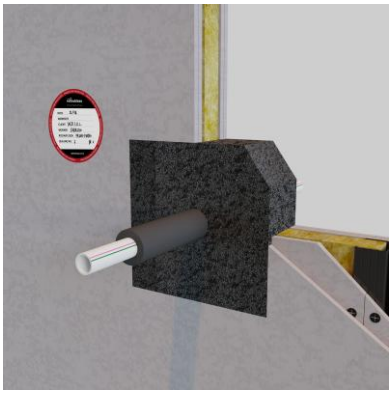


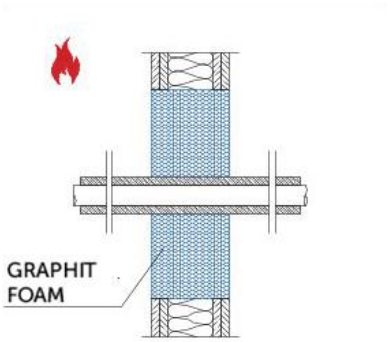
Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
PVC	≤ 50	3,0	EI 180 C/C
	≤ 110	6,3	EI 120 U/C
HDPE, PE, ABS, SAN+PVC	≤ 50	4,6	EI 180 U/C
	≤ 110	10,0	EI 120 U/C
PP	≤ 50	2,7	EI 180 U/C
	≤ 110	6,3	EI 120 U/C
PP-R	≤ 50	1,8	EI 180 U/C

A.1.2 Insulated plastic pipes

A.1.2.1 Flexible wall

A.1.2.1.1 120 mm thick flexible wall

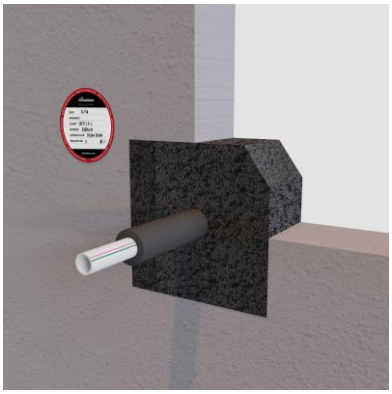


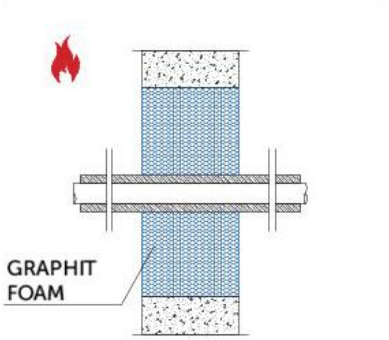


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PP-R	≤ 32	2,9	13,0	EI 120 U/C

A.1.2.2 Rigid wall

A.1.2.2.1 150 mm thick rigid wall

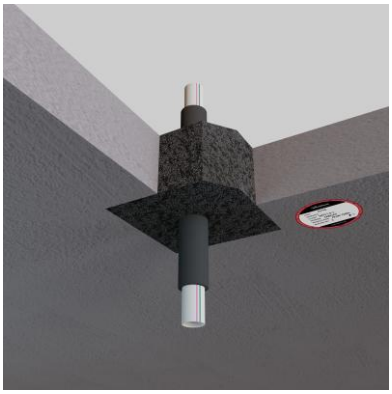


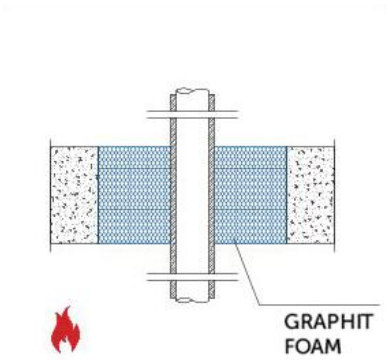


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PVC	≤ 25	2,0	19,0	EI 180 C/C
PP-R	≤ 32	2,9	13,0	EI 120 U/C

A.1.2.3 Rigid floor

A.1.2.3.1 150 mm thick rigid floor





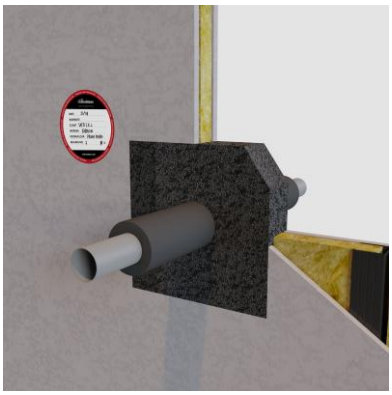
Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PP-R	≤ 50	1,8	9,0	EI 180 U/C

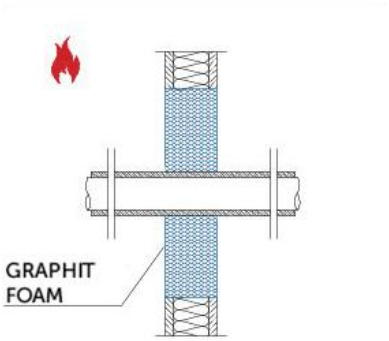
A.2 Metal pipes

A.2.1 Insulated steel pipes

A.2.1.1 Flexible wall

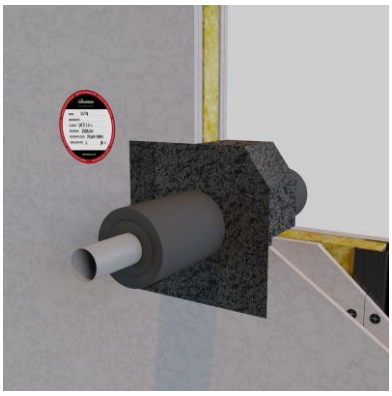
A.2.1.1.1 80 mm thick flexible wall

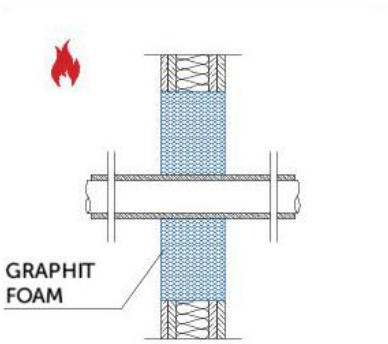




Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 50	≥ 1,0	19,0	EI 60 C/C

A.2.1.1.2 100 mm thick flexible wall

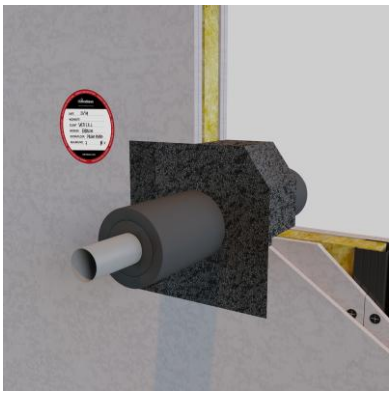


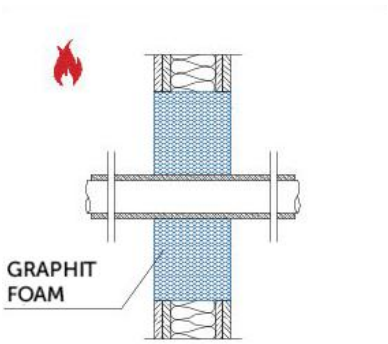


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 50	≥ 1,0	19,0	EI 120 C/C
		40,0	EI 120 C/U (*)
			EI 90 C/U
≤ 108	≥ 1,0	19,0	EI 90 C/U (*)
			EI 60 C/U

(*) A frame is installed around the opening (of maximum size 250 mm x 250 mm) in accordance with the specification given in section B.2.2.1. The whole opening thickness of 125 mm (wall + frame) shall be entirely filled with GRAPHIT FOAM.

A.2.1.1.3 135 mm thick flexible wall



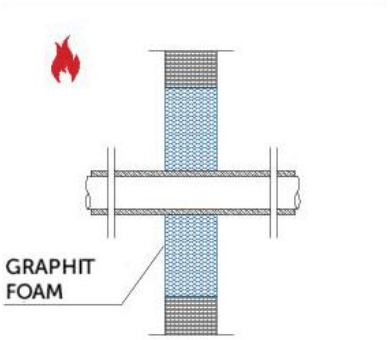


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 50	≥ 3,0	19,0	EI 120 U/C
	≥ 1,0	40,0	EI 120 C/U (*)
			EI 90 C/U
≤ 108	≥ 1,0	19,0	EI 90 C/U (*)
			EI 60 C/U

(*) A frame is installed around the opening (of maximum size 250 mm x 250 mm) in accordance with the specification given in section B.2.2.1. The whole opening thickness of 160 mm (wall + frame) shall be entirely filled with GRAPHIT FOAM.

A.2.1.2 Sandwich wall

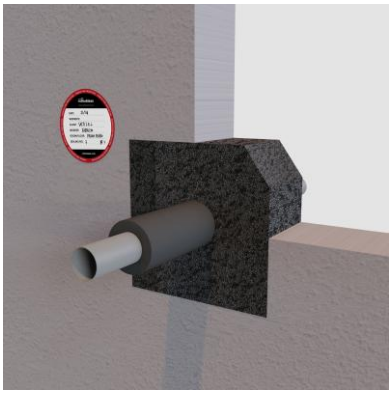
A.2.1.2.1 80 mm thick sandwich wall

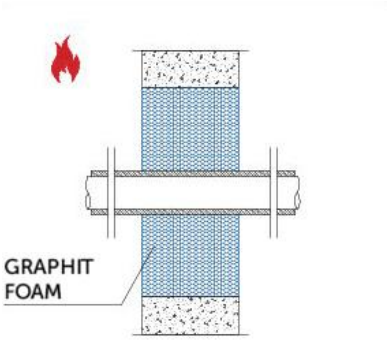


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 50	≥ 1,0	40,0	EI 60 C/U

A.2.1.3 Rigid wall

A.2.1.3.1 150 mm thick rigid wall

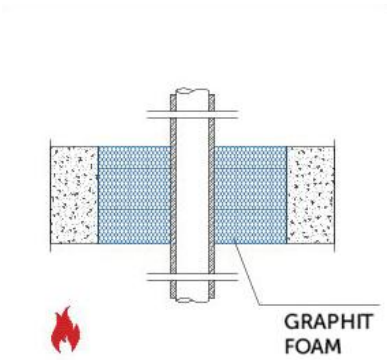




Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 50	≥ 1,0	19,0	EI 180 C/C

A.2.1.4 Rigid floor

A.2.1.4.1 150 mm thick rigid floor

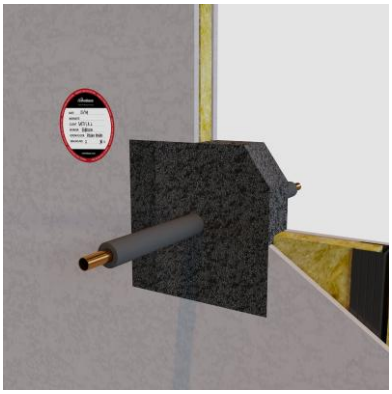


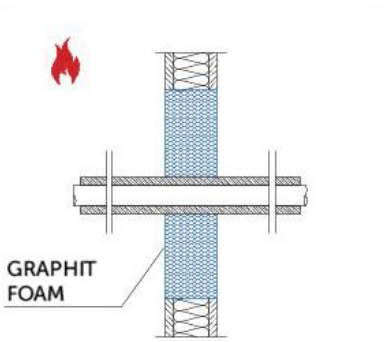
Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 50	≥ 1,0	19,0	EI 180 U/C

A.2.2 Insulated copper pipes

A.2.2.1 Flexible wall

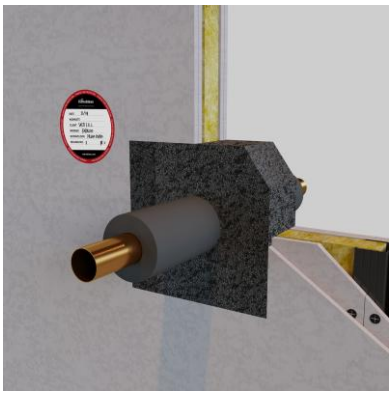
A.2.2.1.1 80 mm thick flexible wall

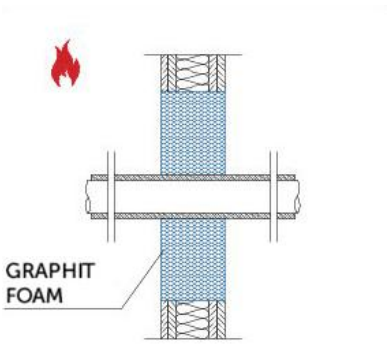




Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 20	≥ 1,5	9,0	EI 60 C/C

A.2.2.1.2 100 mm thick flexible wall

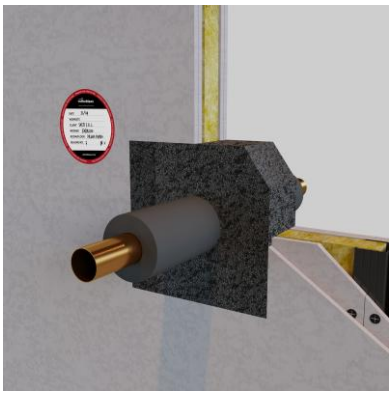


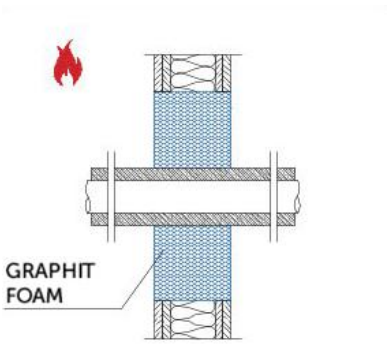


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 50	≥ 1,5	13,0	EI 90 C/U
		40,0	EI 120 C/U (*)

(*) The insulated pipe is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.2.2.1.3 120 mm thick flexible wall



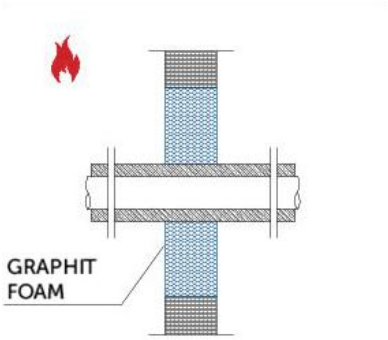


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 6	≥ 1,0	9,0	EI 120 C/C
≤ 20	≥ 1,5	9,0	EI 60 C/C
≤ 50	≥ 1,5	13,0	EI 90 C/U
		40,0	EI 120 C/U (*)
	≥ 4,0	30,0	EI 120 C/C

(*) The insulated pipe is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.2.2.2 Sandwich wall

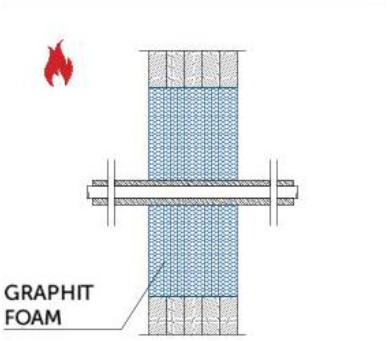
A.2.2.2.1 80 mm thick sandwich wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 21	≥ 1,5	19,0	EI 60 C/U
≤ 50	≥ 2,0	40,0	EI 60 C/U

A.2.2.3 CLT wall

A.2.2.3.1 137 mm thick CLT wall

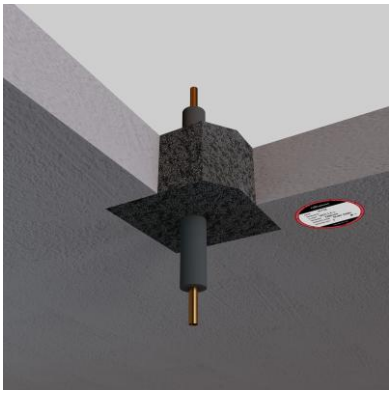


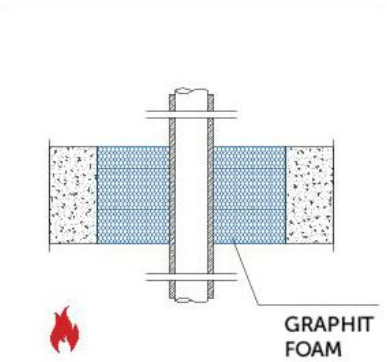
Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 22	≥ 1,0	8,5 (*)	EI 120 C/U

(*) Foamed elastomeric insulation material with reaction to fire class B_L-s3,d0 (for other parameters of the insulation specification, see table B.3.1).

A.2.2.4 Rigid floor

A.2.2.4.1 150 mm thick rigid floor



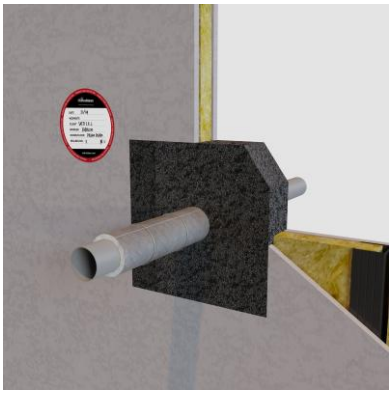


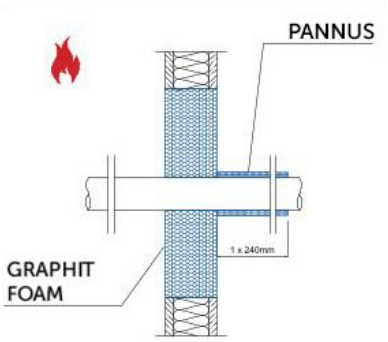
Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
≤ 20	≥ 1,0	20,0	EI 180 C/C

A.2.3 Steel pipes

A.2.3.1 Flexible wall

A.2.3.1.1 80 mm thick flexible wall

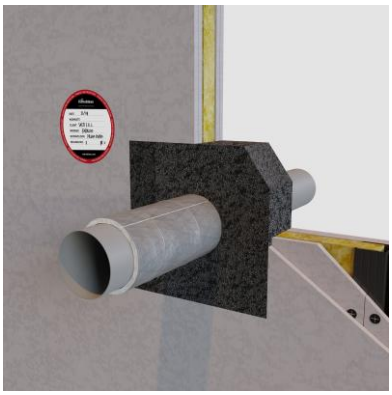


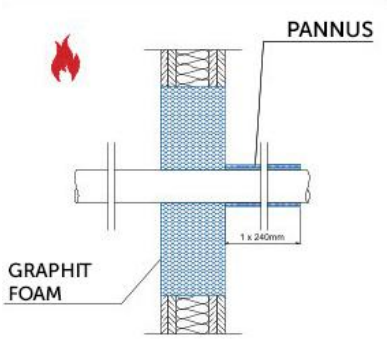


Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 50	≥ 1,0	EI 60 C/C (*)

(*) The pipe is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.2.3.1.2 100 mm thick flexible wall

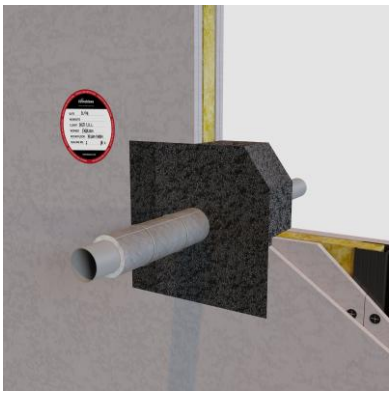


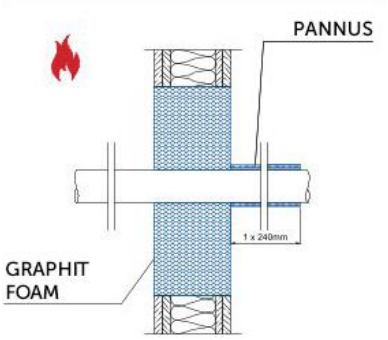


Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 108	≥ 1,0	EI 60 C/U (*)

(*) The pipe is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.2.3.1.3 120 mm thick flexible wall



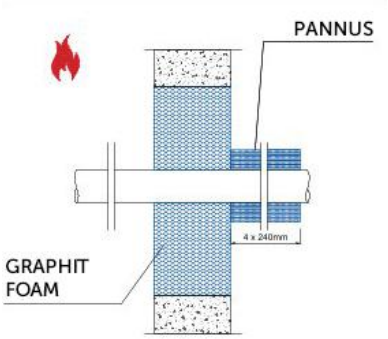


Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 50	≥ 1,0	EI 120 U/C (*)

(*) The pipe is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.2.3.2 Rigid wall

A.2.3.2.1 150 mm thick rigid wall

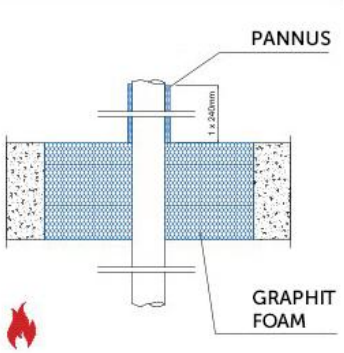


Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 50	≥ 1,0	EI 180 C/C (*)

(*) The pipe is protected at the fire non-exposed side of the wall with PANNUS: 28 mm thickness (four layers) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.2.3.3 Rigid floor

A.2.3.3.1 150 mm thick rigid floor



Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 50	≥ 1,0	EI 180 U/C (*)
≤ 108	≥ 1,0	EI 120 C/C (**) [7]

(*) The pipe is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

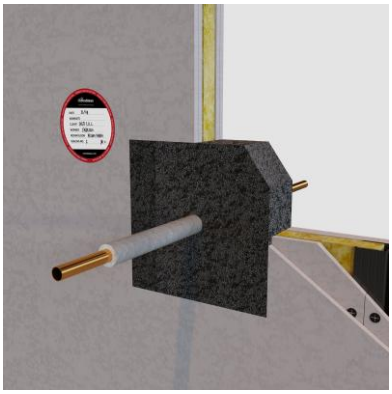
(**) The pipe is protected at the fire non-exposed side of the wall with PANNUS: 14 mm thickness (two layers) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

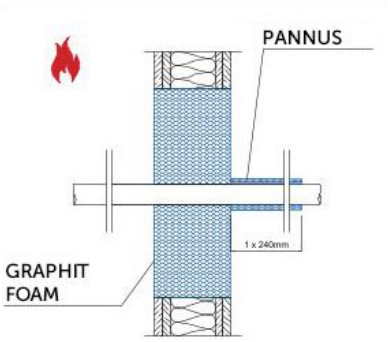
[7] Test result valid on rigid concrete floors with minimum density of 1600 kg/m^3.

A.2.4 Copper pipes

A.2.4.1 Flexible wall

A.2.4.1.1 120 mm thick flexible wall





Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 20	≥ 1,0	EI 120 C/C (*)

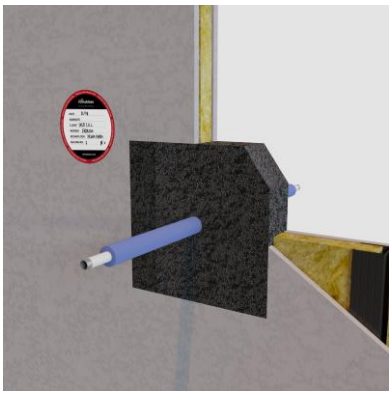
(*) The pipe is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

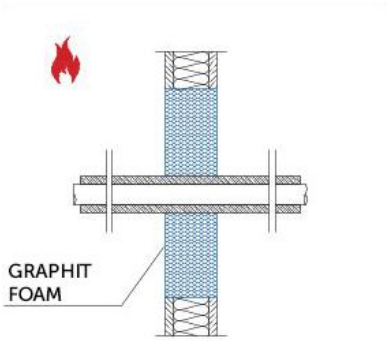
A.3 Multilayer composites pipes

A.3.1 Insulated multilayer composite pipes

A.3.1.1 Flexible wall

A.3.1.1.1 80 mm thick flexible wall

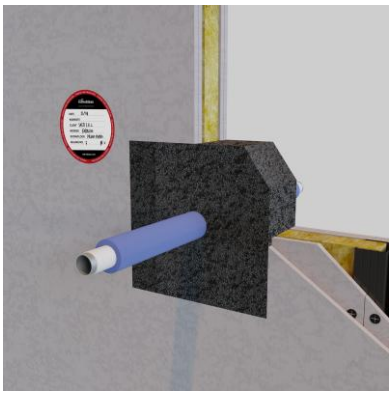


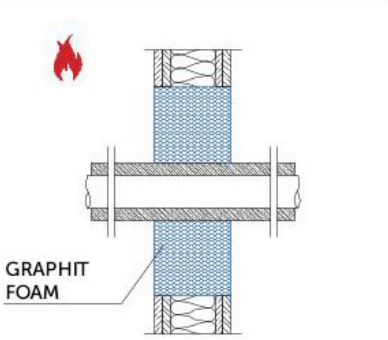


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PE-X/Al/HDPE [8]	≤ 16	2,0 – 3,0	9,0	EI 60 C/C
	≤ 26	3,0		EI 60 C/C

[8] PE-X refers to PE-Xa, PE-Xb or PE-Xc throughout section A.3.

A.3.1.1.2 125 mm thick flexible wall

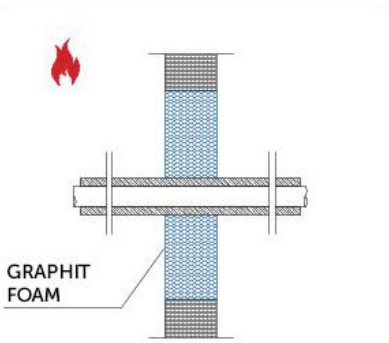




Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PE-X/Al/HDPE	≤ 32	3,0	10,0	EI 120 C/C

A.3.1.2 Sandwich wall

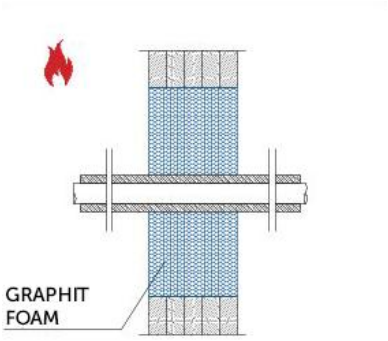
A.3.1.2.1 80 mm thick sandwich wall



Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PE-X/Al/HDPE	≤ 16	2,0	19,0	EI 60 U/U

A.3.1.3 Cross laminated timber (CLT) wall

A.3.1.3.1 137 mm thick CLT wall

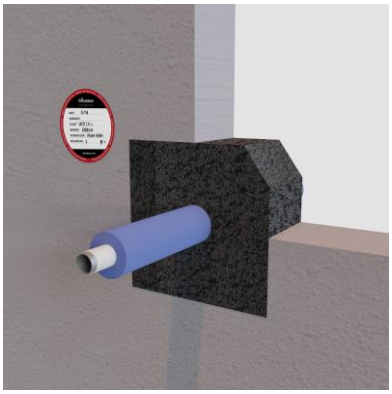


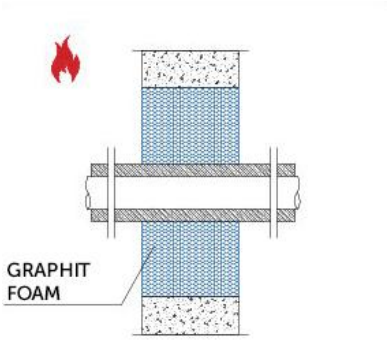
Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PE-X/Al/PE-RT	≤ 16	2,0	8,0 (*)	EI 120 U/C

(*) Foamed elastomeric insulation material with reaction to fire class B_L-s3,d0 (for other parameters of the insulation specification, see table B.3.1).

A.3.1.4 Rigid wall

A.3.1.4.1 150 mm thick rigid wall

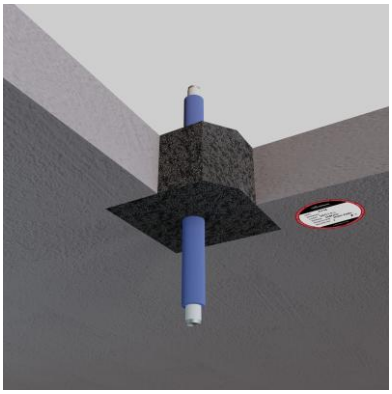


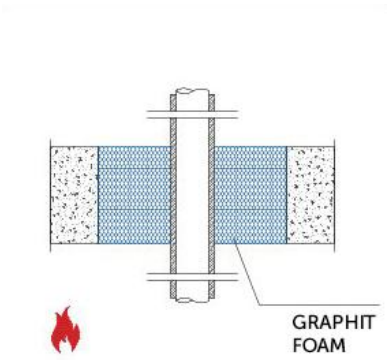


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PE-X/Al/HDPE	≤ 32	3,0	19,0	EI 180 C/C

A.3.1.5 Rigid floor

A.3.1.5.1 150 mm thick rigid floor

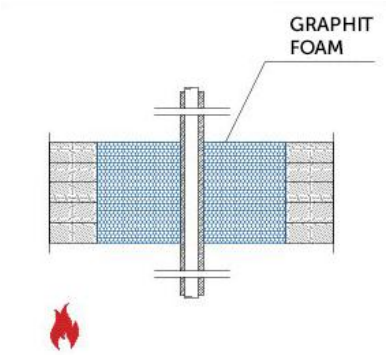




Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PE-X/Al/HDPE	≤ 32	3,0	10,0 – 15,0	EI 180 C/C

A.3.1.6 Cross laminated timber (CLT) floor

A.3.1.6.1 158 mm thick CLT floor



Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Classification
PE-X/Al/HDPE	≤ 16	2,00 – 2,25	8,0 (*)	EI 120 U/C
	≤ 20	2,25		

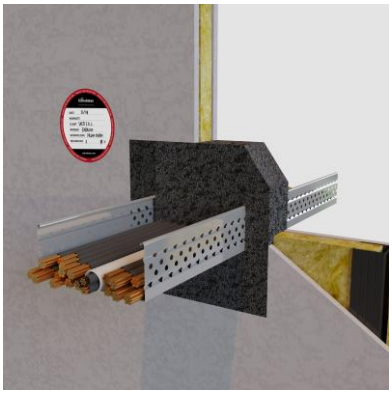
(*) Foamed elastomeric insulation material with reaction to fire class B_L-s3,d0 (for other parameters of the insulation specification, see table B.3.1).

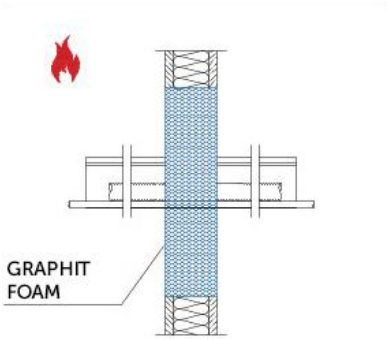
A.4 Cables

A.4.1 Cable trays

A.4.1.1 Flexible wall

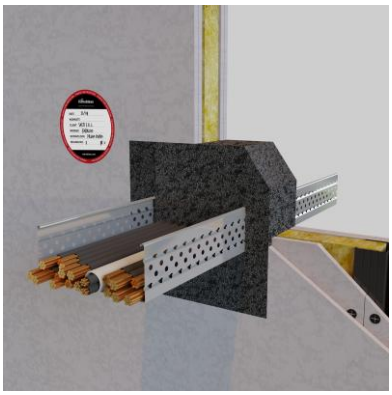
A.4.1.1.1 80 mm thick flexible wall

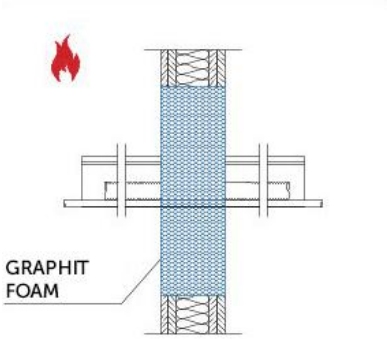




Service description	Classification
Perforated steel tray of maximum width 200 mm with: • Small sheathed cables (Ø ≤ 21 mm) • 1 corrugated PVC pipe (Ø ≤ 32 mm, t = 1,2 mm) with one cable type A1	EI 60 C/C

A.4.1.1.2 100 mm thick flexible wall





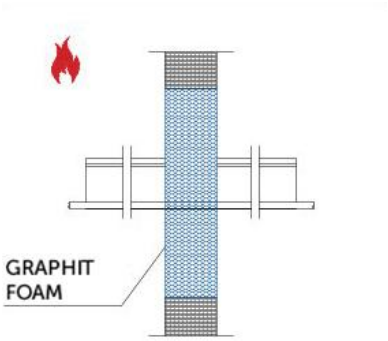
Service description	Classification
Perforated steel tray of maximum width 300 mm with: • Small sheathed cables (Ø ≤ 21 mm) • One corrugated PVC pipe (Ø ≤ 32 mm, t = 2 mm) with one cable type A1	EI 120 C/C
Steel cable carrier with: • Small and medium sheathed cables (Ø ≤ 50 mm)	EI 90 (*) (**)
Steel cable carrier with: • Small and medium sheathed cables (Ø ≤ 50 mm)	EI 60 (**)

(*) A frame is installed around the opening (of maximum size 525 mm x 250 mm) in accordance with the specification given in section B.2.2.1. The whole opening thickness of 125 mm (wall + frame) shall be entirely filled with GRAPHIT FOAM.

(**) The cables tray is protected at the fire non-exposed side of the wall with PANNUS: 14 mm thickness (two layers) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.4.1.2 Sandwich wall

A.4.1.2.1 80 mm thick sandwich wall

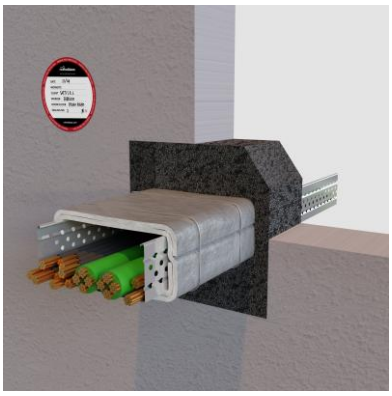


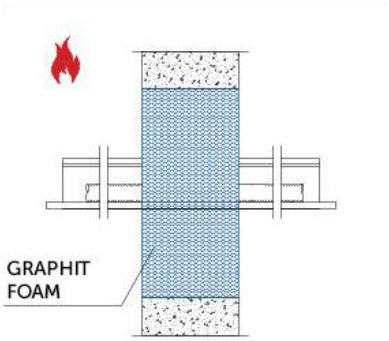
Service description	Classification
Perforated steel tray of maximum width 300 mm with: • Small sheathed cables (Ø ≤ 21 mm)	EI 60 (*)

(*) The cables tray is protected at the fire non-exposed side of the wall with PANNUS: 7 mm thickness (one layer) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.4.1.3 Rigid wall

A.4.1.3.1 150 mm thick rigid wall



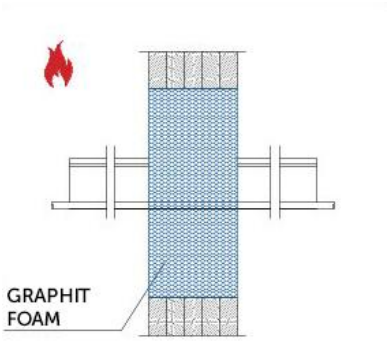


Service description	Classification
Steel cable carrier with: • Small and medium sheathed cables (Ø ≤ 50 mm) • One corrugated PVC pipe (Ø ≤ 20 mm, t = 1,2 mm) with one cable type A1	EI 180 C/C (*)

(*) The cables tray is protected at the fire non-exposed side of the wall with PANNUS: 14 mm thickness (two layers) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.4.1.4 Cross laminated timber (CLT) wall

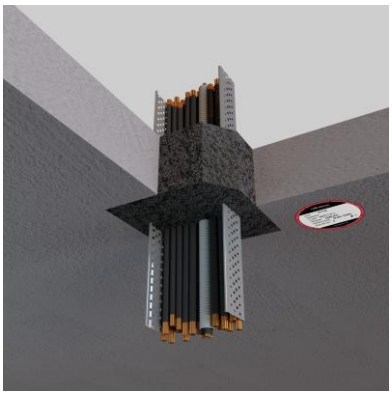
A.4.1.4.1 137 mm thick CLT wall

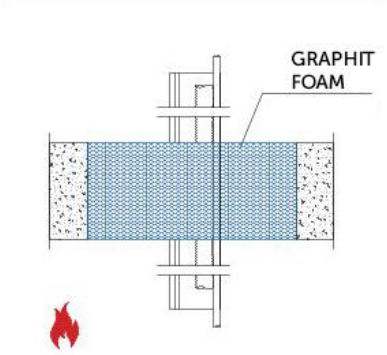


Service description	Classification
Perforated steel tray of maximum width 150 mm with: • Small sheathed cables (Ø ≤ 21 mm)	EI 60

A.4.1.5 Rigid floor

A.4.1.5.1 150 mm thick rigid floor



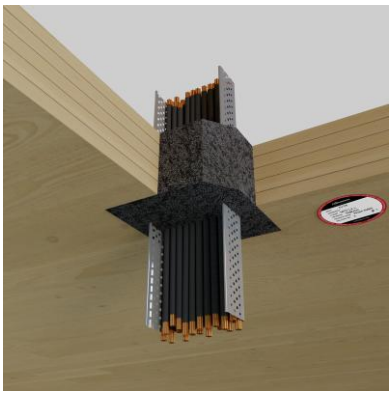


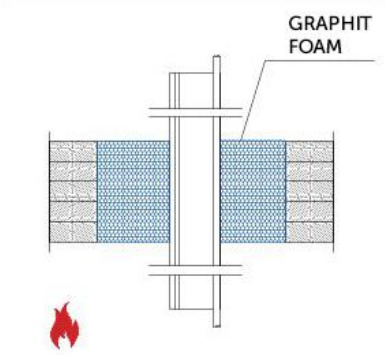
Service description	Classification
Perforated steel tray of maximum width 300 mm with: • Small sheathed cables (Ø ≤ 21 mm) • Two corrugated PVC pipes (Ø ≤ 32 mm, t = 1,2 mm) with one cable type A1 each	EI 180 C/C
PVC tray maximum dimensions (200 × 80 x 2,8) mm with: • Small sheathed cables (Ø ≤ 21 mm)	EI 180
Steel cable carrier with: • Small and medium sheathed cables (Ø ≤ 50 mm)	EI 120 (*)

(*) The cables tray is protected at the fire non-exposed side of the wall with PANNUS: 14 mm thickness (two layers) and 240 mm length, fixed with two steel wires of diameter 1 mm. See table B.3.1 on the specification of PANNUS.

A.4.1.6 Cross laminated timber (CLT) floor

A.4.1.6.1 158 mm thick CLT floor



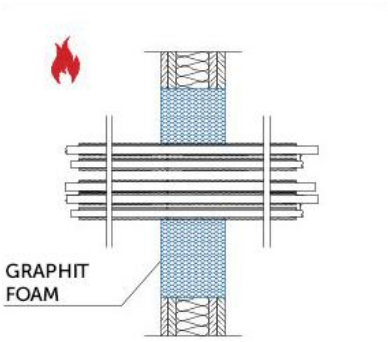


Service description	Classification
Perforated steel tray of maximum width 155 mm with: • Small sheathed cables (Ø ≤ 21 mm)	EI 120

A.4.2 Cables and cables bundles

A.4.2.1 Flexible wall

A.4.2.1.1 100 mm thick flexible wall

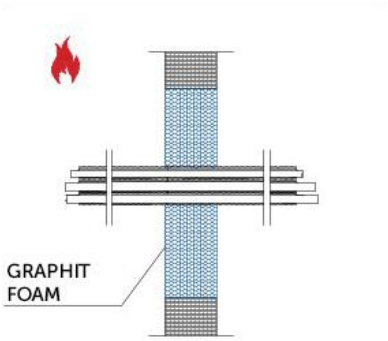


Approx. bundle diameter (mm)	Service description	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 100 (*)	12 corrugated PVC pipes with 1 cable type A1 each	≤ 22	1,2	EI 120 C/C
	2 corrugated PVC pipes with 3 cables type A1 each	≤ 30	1,2	
	1 corrugated PVC pipe with 5 cables type A1	≤ 40	1,2	
	1 PVC pipe with 5 cables type A1	≤ 40	1,5	

(*) The number of pipes and/or cables can be reduced provided that the GRAPHIT FOAM seal fits around the bundle.

A.4.2.2 Sandwich wall

A.4.2.2.1 80 mm thick sandwich wall

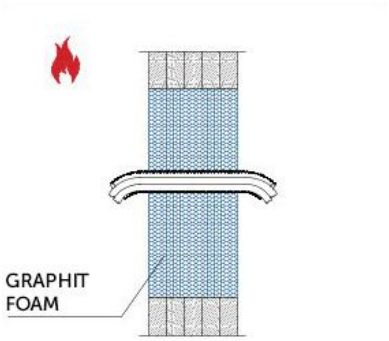


Approx. bundle diameter (mm)	Service description	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
≤ 30 mm (*)	Three corrugated PVC pipes with 1 cable type A1 each	≤ 16	1,2	EI 60 U/U

(*) The number of pipes and/or cables can be reduced provided that the GRAPHIT FOAM seal fits around the bundle.

A.4.2.3 Cross laminated timber (CLT) wall

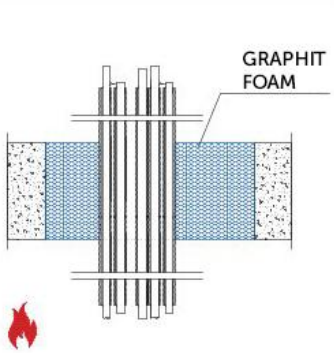
A.4.2.3.1 137 mm thick CLT wall



Service description	Pipe diameter (mm)	Pipe wall thickness (mm)	Classification
One corrugated PVC pipe with 1 cable type A2	≤ 24	0,6	EI 120 U/C

A.4.2.4 Rigid floor

A.4.2.4.1 150 mm thick rigid floor



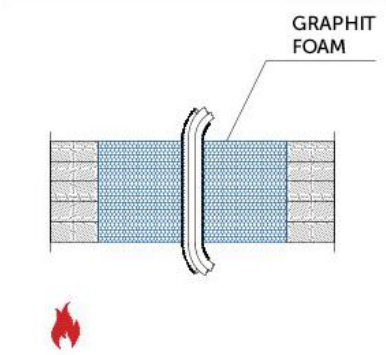
Service Description	Pipe Diameter (mm)	Pipe wall thickness (mm)	Classification
Small and medium sheathed cables (Ø ≤ 50 mm)	--	--	EI 120 (*)
One corrugated PE pipe with small sheathed cables (Ø ≤ 21 mm)	≤110	1,2	EI 120 C/C
Bundle (approx. overall Ø ≤ 60 mm) of 7 corrugated PVC pipes with 1 cable type A1/A3 each (**)	≤ 22	0,6	EI 180 U/C

(*) The cable is protected at the fire non-exposed side of the wall with PANNUS: 14 mm thickness (two layers) and 240 mm length, fixed with two steel wires of diameter 1 mm.

(**) The number of pipes and/or cables can be reduced provided that the GRAPHIT FOAM seal fits around the bundle.

A.4.2.5 Cross laminated timber (CLT) floor

A.4.2.5.1 158 mm thick CLT floor



Service Description	Pipe Diameter (mm)	Pipe wall thickness (mm)	Classification
One corrugated PVC pipe with one cable type A1/A3	≤ 20	0,6	EI 120 C/C

ANNEX B. Installation procedure of GRAPHIT FOAM and specification of the supporting constructive elements

B.1. Installation of GRAPHIT FOAM

B.1.1. Installation procedure

GRAPHIT FOAM shall be installed in accordance with the manufacturer instructions and the provisions in this annex.

GRAPHIT FOAM is supplied in a 330 ml special cartridge equipped with a mixer which, with the help of a spray gun, allows the simultaneous extrusion of the two components and their mixing inside the application nozzle. The foam expands 3 – 5 times during application (see table 1 of the ETA for information on properties related to the foam application).

GRAPHIT FOAM application method shall be as follows:

a. The mixer is screwed onto the cartridge and the cartridge inserted into the spray gun. An appropriate spray gun shall be used according to the manufacturer's recommendations.
b. GRAPHIT FOAM is applied starting from the furthest point, without immersing the mixing nozzle in the extruded product.
c. The opening shall be completely filled with a thickness equal to the total thickness of the supporting constructive element as specified in Annex A.
d. Interruption of the extrusion shall be avoided for more than five seconds to prevent sudden hardening of the material in the mixer.
e. When hardened, the overflowing edges of GRAPHIT FOAM shall be removed with a cutter.

For installation of a service in an existing GRAPHIT FOAM seal, to replace an existing service or to insert a new one, the necessary part of the foam will be removed from the GRAPHIT FOAM seal. The new service will be installed through the gap made in the seal and GRAPHIT FOAM reapplied until the gap between the new service and the rest of the seal is completely filled.

The additional components that make up the penetration seal, generically referred to in Annex A, shall meet the specification given in table B.3.1, except if otherwise specified in Annex A.

B.1.2. Installation conditions

The maximum rectangular shape seal size shall be:

- For walls: a maximum area 0,165 m^2, with maximum height of 0,3 m.
- For floors: a maximum area 0,100 m^2, with a maximum largest side of 0,4 m.

The maximum circular shape seal size shall be, both for walls and floors: 0,09 m^2 (maximum diameter of 0,338 m).

The maximum size of the seal when a frame is installed around the opening in flexible walls (see section B.2.2.1) is given in the relevant sections of Annex A.

The minimum distance between openings in the supporting constructive elements sealed with GRAPHIT FOAM shall be 200 mm.

In mixed penetration seals:

- The maximum cross-section area of the passing services in relation to the seal area shall not exceed 60 %.
- The minimum recommended distance between passing services shall be 50 mm, except if otherwise specified in Annex A (e.g., bundle of pipes) or in the manufacturer's instructions based on specific test results.
- The minimum recommended distance from the services to the seal edge shall be 50 mm, except if otherwise specified in the manufacturer's instructions based on specific test results.

The maximum distance from the constructive element to the adequate service support is 500 mm both for walls (cold side) and floors (upper side).

The following installation provisions will be noted:

- The installation of the penetration seal will not have an effect on the stability of the adjacent building element, even in the event of fire.
- The structural elements related to the wall/floor in which the penetration seal is incorporated will be designed and fire protected in such a way that no additional mechanical load is imposed on the penetration seal.
- The thermal movements of the pipework will be accommodated in such a way that no resulting load is imposed on the penetration seal.
- The services are fixed to the building element in such a way that no additional mechanical load is imposed on the penetration seal in the event of fire.
- The support of the services is maintained during the required period of resistance to fire.
- Pneumatic dispatch systems, compressed air systems, etc. are switched off in the event of fire.

B.2. Supporting constructive elements

B.2.1. General

The constructive elements where GRAPHIT FOAM may be installed are specified in this annex, together with the relevant installation conditions, to reach the resistance to fire performance given in Annex A:

- Flexible walls (B.2.2.1).
- Sandwich panels walls (B.2.2.2).
- Timber (CLT) walls (B.2.2.3).
- Rigid walls (B.2.2.4).
- Rigid floors (B.2.3.1).
- Timber (CLT) floors (B.2.3.2).

The constructive element where the penetration seal is installed must be classified in accordance with EN 13501-2 for the required fire resistance period as given in Annex A. The rules given in section 13.3 of EN 1366-3 for supporting constructions can be applied regarding the field of direct application of test results.

B.2.2. Specification of the supporting walls

B.2.2.1. Flexible walls

The flexible walls comprise timber or steel studs lined on both faces with minimum two layers [9] of 12,5 mm thick 'Type F' or 'Type DF' gypsum plasterboards according to EN 520 (or minimum one layer of 15 mm in the case of the 80 mm thick flexible wall). In timber stud walls, no part of the penetration shall be closer than 100 mm to a stud, the cavity must be closed between the penetration seal and the stud and minimum 100 mm of insulation of reaction to fire class A1 or A2 according to EN 13501-1, is provided within the cavity between the penetration seal and the stud.

The following flexible walls are considered in this ETA, as specified in Annex A:

- Walls with a minimum thickness of 80 mm and resistance to fire EI 60.
- Walls with a minimum thickness of between 100 mm and 135 mm, and resistance to fire EI 120.

The opening sealed with GRAPHIT FOAM shall not be placed in any joint between boards.

The resistance to fire performance given in Annex A for flexible walls may be applied to rigid constructions of an overall thickness equal to or greater and a minimum density of 350 kg/m^3.

When a frame is installed around an opening in the flexible wall, the following procedure shall be followed. At the cold side of the wall, strips (50 mm width and 12,5 mm thick, two layers for a total frame thickness of 25 mm) of 'Type F' gypsum plasterboards according to EN 520 are fixed to the wall with self-tapping steel screws Ø3,9 mm x 45 mm.

[9] The number of board layers can be reduced, provided that the same or higher overall lining thickness is kept, if an aperture framing is installed in accordance with section 13.3.2 of EN 1366-3.

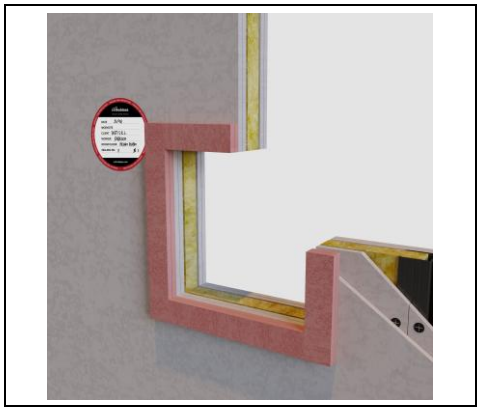


Figure B.1: Opening frame in flexible walls.

B.2.2.2. Self-supporting sandwich panels walls

Walls with a minimum thickness of 80 mm and resistance to fire EI 90, made of self-supporting sandwich panels with rock wool insulation core of density 100 kg/m^3 faced at both sides with two corrugated galvanised steel sheets of thickness 0,5 mm. The sandwich panels have tongue and groove joint and are fixed to each other with steel self-tapping screws every 150 mm, and to horizontal steel L-profiles with steel self-tapping screws every 400 mm. The L-profiles are fixed to the rigid floors with steel anchors every 300 mm.

The opening sealed with GRAPHIT FOAM shall not be placed in any joint between panels.

B.2.2.3. Timber walls

Walls with a minimum thickness of 137 mm and resistance to fire EI 120, made of cross laminated timber boards (X-LAM panels according to ETA 12/0347 or equivalent in accordance with EN 1366-3).

The opening sealed with GRAPHIT FOAM shall not be placed in any joint between boards.

B.2.2.4. Rigid walls

Concrete or masonry walls with a minimum thickness of 150 mm, minimum density of 600 kg/m^3 and resistance to fire EI 180.

B.2.3. Specification of the supporting floors

B.2.3.1. Rigid floors

Concrete or other type of rigid floors with a minimum thickness of 150 mm and minimum density of 600 kg/m^3 (for a required fire resistance period EI 120 as given in Annex A) or minimum density of 1600 kg/m^3 (for a required fire resistance period EI 180 as given in Annex A), except if otherwise specified in Annex A.

B.2.3.2. Timber floors

Floors with a minimum thickness of 158 mm and resistance to fire EI 120, made of cross laminated timber boards (X-LAM panels according to ETA 12/0347 or equivalent in accordance with EN 1366-3).

The opening sealed with GRAPHIT FOAM shall not be placed in any joint between boards.

B.3. Additional components of the fire penetration seal

The additional components, generically referred to in Annex A, shall meet the following specification.

Table B.3.1: Specification of the fire penetration seal additional components.

Component	Specification
Metal pipes	The steel pipes will be made of steel with a minimum melting point of 1450 ºC and a maximum thermal conductivity of 52 W/(m·K). The copper pipes will be made of copper with a minimum melting point of 1085 ºC and a maximum thermal conductivity of 390 W/(m·K).
Insulation material for pipes (unless otherwise specified in Annex A)	Foamed elastomeric insulation material: • Continuous insulation. • Reaction to fire: from D_L-s1,d0 to D_L-s3,d0. • Maximum thermal conductivity (23 ºC): $\lambda \leq 0{,}043$ W/(m·K). • Fixed around the pipe with a steel wire of diameter 1 mm.
Small cables	Small sheathed cables, according to section A.4.2.1 of EN 1366-3, of maximum diameter 21 mm. Tied bundles, waveguides, optical fibre and coaxial cables are included.
Medium cables	Medium sheathed cables, according to section A.4.2.1 of EN 1366-3, of maximum diameter 50 mm. Tied bundles, waveguides, optical fibre and coaxial cables are included.
Cable carriers	• Type: ladders, perforated trays or non-perforated trays of maximum width 500 mm (except if otherwise specified in Annex A). • Material: galvanised steel, stainless steel or coated steel with a minimum reaction to fire class A2.
PANNUS	PANNUS is a fire protective cushion made of a glass wool mat with an ablative layer applied to the side in contact with the passing service, installed at the fire non-exposed side of the constructive element and fixed with Ø1 mm steel wires. PANNUS has the following dimensions: • Length: 5000 mm. • Width: 240 mm. • Thickness: 7 mm ± 10%.