



## European Technical Assessment

**ETA 26/0348**  
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**

**FIRE STRIPE GRAPHITE PRO**

**Product family to which the construction product belongs**

Fire stopping and fire sealing products.  
Penetration seals.

**Manufacturer**

**ROTHO BLAAS SRL**  
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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 Regulation (EU) 305/2011, 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

FIRE STRIPE GRAPHITE PRO is a service closure device used as fire penetration seal consisting of an intumescent strip. FIRE STRIPE GRAPHITE PRO with the dimensions shown in Table 1 is supplied in rolls (as shown in Figure 1) and cut to suit the external diameter of the service to be protected.

**Table 1:** Dimensions of FIRE STRIPE GRAPHITE PRO.

Dimension	Nominal value	Tolerances
Thickness	4 mm	- 0 mm / + 0,8 mm
Width	50 mm	- 1 mm / + 2,5 mm

FIRE STRIPE GRAPHITE PRO can also be supplied as a preformed collar, with the intumescent strip contained in a plastic (polyethylene) envelope, at the standard diameters as shown in Table 2.

**Table 2:** Size of preformed FIRE STRIPE GRAPHITE PRO.

Internal collar diameter (mm) <sup>(1)</sup>	Number of windings <sup>(2)</sup>
30 / 40 / 50 / 63 / 75 / 80 / 90 / 100 / 110	2
125 / 140 / 160	3
200	4

<sup>(1)</sup> The internal diameter of FIRE STRIPE GRAPHITE PRO shall tightly fit around the protected service external diameter.

<sup>(2)</sup> The number of windings refers to the layers of intumescent strip: 2 windings accounts for a total thickness of the intumescent part of 8 mm, 3 windings for a total thickness of the intumescent part of 12 mm and 4 windings for a total thickness of the intumescent part of 16 mm.



**Figure 1:** FIRE STRIPE GRAPHITE PRO

The detailed description of FIRE STRIPE GRAPHITE PRO installation procedure is given in Annex B.

Assembled penetration seals 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

FIRE STRIPE GRAPHITE PRO 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):

- Plastic pipes.
- Insulated steel and copper pipes,
- Multilayer composite pipes,
- Cable bundles.

The constructive elements where FIRE STRIPE GRAPHITE PRO may be installed to provide a penetration seal are as follows (detailed specification in Annex B):

- Flexible walls (B.2.1).
- Lining walls (B.2.2).
- Sandwich panels walls (B.2.3).
- Timber (CLT) walls (B.2.4).
- Rigid walls (B.2.5).
- Rigid floors (B.3.1).
- Timber (CLT) floors (B.3.2).
- False ceilings (B.3.3).

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

FIRE STRIPE GRAPHITE PRO is intended for environmental conditions as defined for use category Type Y<sub>1</sub> 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<sub>1</sub> includes lower use categories (i.e., Type Y<sub>2</sub>, Type Z<sub>1</sub> and Type Z<sub>2</sub>).

The provisions made in this ETA are based on a working life of FIRE STRIPE GRAPHITE PRO 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.

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<sup>1</sup> 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 FIRE STRIPE GRAPHITE PRO has been performed in accordance with EAD 350454-00-1104 for *Penetration Seals (September 2017)*.

**Table 3:** Performance of the product.

<b>Product:</b> FIRE STRIPE GRAPHITE PRO		<b>Intended use:</b> Fire penetration seal	
<b>Basic requirement</b>	<b>Essential characteristic</b>		<b>Performance</b>
BWR 2 Safety in case of fire	Reaction to fire	Intumescent strip	E
		Plastic envelope	NPA <sup>2</sup>
	Resistance to fire	See Annex A	
BWR 3 Hygiene, health and the environment	Content, emission and/or release of dangerous substances		VOC <sub>3d</sub> = 0,760 mg/m <sup>3</sup> VOC <sub>28d</sub> = 0,420 mg/m <sup>3</sup>
BWR 4 Safety and accessibility in use	Durability		Type Y <sub>1</sub>

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

<sup>2</sup> NPA: No Performance Assessed.

## 3.2 Methods used for the assessment

### 3.2.1 Reaction to fire

The performance of the intumescent material of FIRE STRIPE GRAPHITE PRO has been tested according to EN ISO 11925-2<sup>3</sup> and classified according to EN 13501-1<sup>4</sup> and Regulation (EU) 2016/364.

The plastic (polyethylene) envelope of the preformed FIRE STRIPE GRAPHITE PRO has not been assessed.

### 3.2.2 Resistance to fire

Tested and assessed according to EN 1366-3<sup>5</sup>, the fire resistance classification has been determined according to EN 13501-2 and is given in Annex A.

### 3.2.3 Content, emission and/or release of dangerous substances

For the release scenarios IA1 and IA2, the volatile organic compounds (VOC) have been determined in accordance with EN 16516<sup>6</sup> after 3 days and after 28 days, using a loading factor of 1,0 m<sup>2</sup>/m<sup>3</sup>.

### 3.2.4 Durability

FIRE STRIPE GRAPHITE PRO has been tested and assessed for the environmental use category Type Y<sub>1</sub> in accordance with section 2.2.9 of EAD 350454-00-1104 and the EOTA Technical Report 024<sup>7</sup>, section 4.2.4 (for a 25-year working life).

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<sup>3</sup> EN ISO 11925-2 Reaction to fire tests. Ignitability of products subjected to direct impingement of flame. Part 2: Single-flame source test.

<sup>4</sup> EN 13501-1 Fire classification of construction products and building elements. Part 1: Classification using data from reaction to fire tests.

<sup>5</sup> EN 1366-3 Fire resistance tests for service installations. Part 3: Penetration seals.

<sup>6</sup> EN 16516+A1 Construction products. Assessment of release of dangerous substances. Determination of emissions into indoor air.

<sup>7</sup> EOTA TR 024 Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products, Edition July 2009.

#### 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 European 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.



Ferran Bermejo Nualart  
Technical Director, ITeC

## ANNEX A. Resistance to fire performance

In this Annex, the resistance to fire performance of FIRE STRIPE GRAPHITE PRO 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 FIRE STRIPE GRAPHITE PRO 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.

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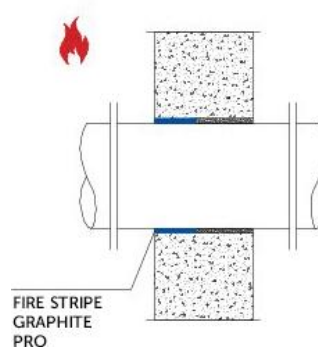
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## A.1 Plastic pipes

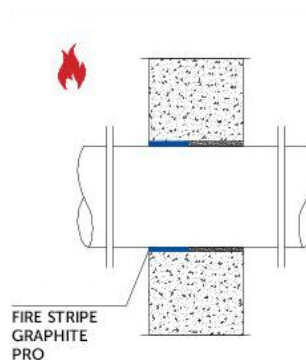
### A.1.1 Plastic pipes through the constructive element

#### A.1.1.1 Rigid wall

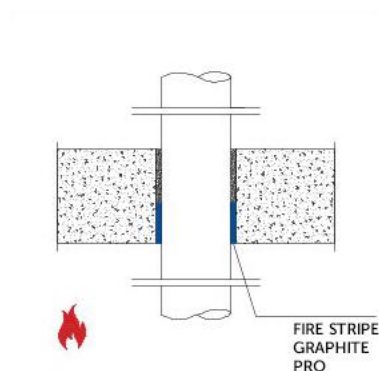
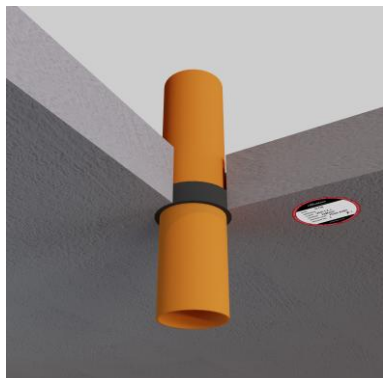
##### A.1.1.1.1 150 mm thick rigid wall



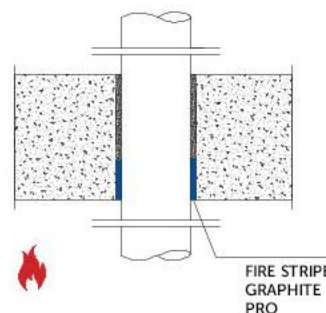
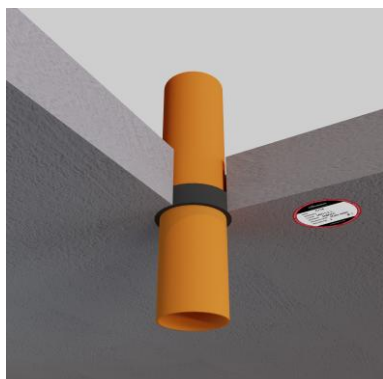
Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
PVC	≤ 110	3,2 – 8,1	2	EI 180 U/C
	≤ 160	3,2 – 11,0	3	EI 180 U/C
PP	≤ 110	2,7 – 16,1	2	EI 180 U/C
	≤ 160	3,9 – 14,6	3	EI 180 U/C
HDPE, PE, ABS, SAN+PVC	≤ 110	4,2 – 12,3	2	EI 180 U/C
	≤ 160	6,2 – 16,0	3	EI 180 U/C

**A.1.1.1.2 200 mm thick rigid wall**

Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
PVC	≤ 110	3,2 – 8,1	2	EI 180 U/C
		8,1	2	EI 240 U/C
	≤ 160	3,2 – 11,0	3	EI 180 U/C
		11,8	3	EI 240 U/C
PP	≤ 110	2,7 – 16,1	2	EI 180 U/C
	≤ 160	3,9 – 14,6	3	EI 180 U/C
HDPE, PE, ABS, SAN+PVC	≤ 110	4,2 – 12,3	2	EI 180 U/C
	≤ 160	6,2 – 16,0	3	EI 180 U/C

**A.1.1.2 Rigid floor****A.1.1.2.1 150 mm thick rigid floor**

Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
PVC	≤ 110	3,2 – 8,1	2	EI 180 U/C
	≤ 160	3,2 – 11,0	3	EI 180 U/C
PP	≤ 110	3,2 – 8,1	2	EI 180 U/C
	≤ 160	3,2 – 11,0	3	EI 180 U/C
HDPE, PE, ABS, SAN+PVC	≤ 110	3,2 – 8,1	2	EI 180 U/C
	≤ 160	3,2 – 15,0	3	EI 180 U/C
PPR	≤ 110	4,0	2	EI 180 U/C

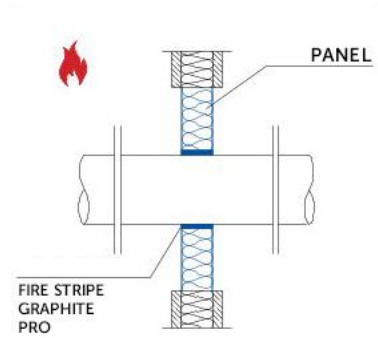
**A.1.1.2.2 200 mm thick rigid floor**

Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
PVC	≤ 110	3,2 – 8,1	2	EI 180 U/C
	≤ 160	3,2 – 11,0	3	EI 180 U/C
	≤ 200	4,0	4	EI 60 U/C
PP	≤ 110	3,2 – 8,1	2	EI 180 U/C
	≤ 160	3,2 – 11,0	3	EI 180 U/C
HDPE, PE, ABS, SAN+PVC	≤ 110	3,2 – 8,1	2	EI 180 U/C
	≤ 160	3,2 – 15,0	3	EI 180 U/C
PPR	≤ 110	5,3	2	EI 240 U/C

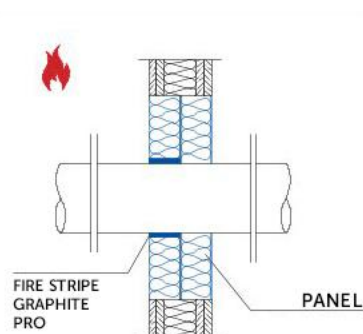
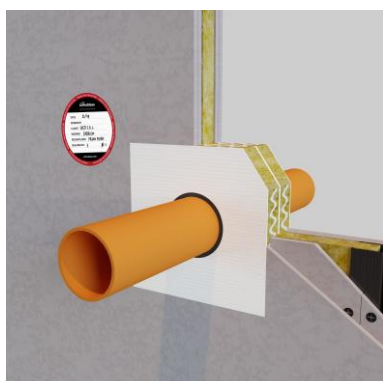
## A.1.2 Plastic pipes through PANEL

### A.1.2.1 Flexible wall

#### A.1.2.1.1 80 mm thick flexible wall



Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
PVC	≤ 110	8,1	2	EI 60 U/C
PP	≤ 110	7,5	2	EI 60 U/C
HDPE, PE, ABS, SAN+PVC	≤ 110	10,5	2	EI 60 U/C
PPR	≤ 110	15,1	2	EI 60 U/C

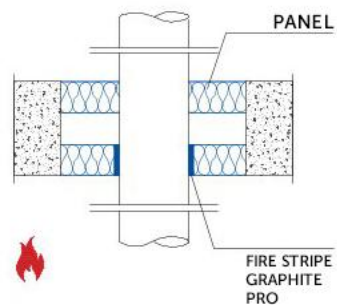
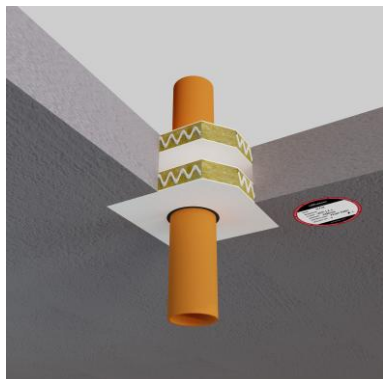
**A.1.2.1.2 100 mm thick flexible wall**

Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
PVC	≤ 110	8,1	2	EI 120 U/C <sup>(i)</sup>
PP	≤ 110	7,5	2	EI 60 U/C <sup>(i)</sup>
HDPE, PE, ABS, SAN+PVC	≤ 110	4,2	2	EI 60 U/U <sup>(i)</sup>
	≤ 110	10,5	2	EI 60 U/C <sup>(i)</sup>
PPR	≤ 110	12,3	2	EI 90 U/U <sup>(i)</sup>

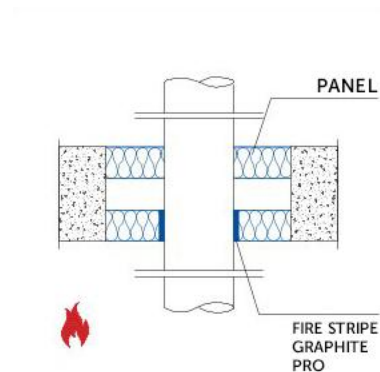
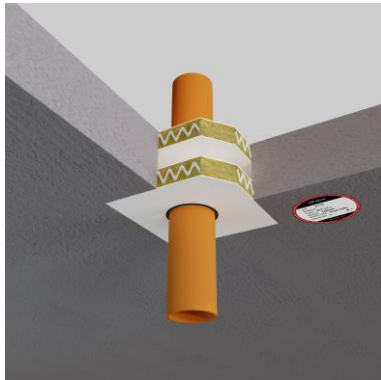
<sup>(i)</sup> Double FIRE STRIPE GRAPHITE PRO.

**A.1.2.2 Rigid floor**

**A.1.2.2.1 150 mm thick rigid floor**



Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
Reinforced PP-R type SILERE of VALSIR	≤ 110	5,4	2	EI 120 U/C

**A.1.2.2.2 200 mm thick rigid floor**

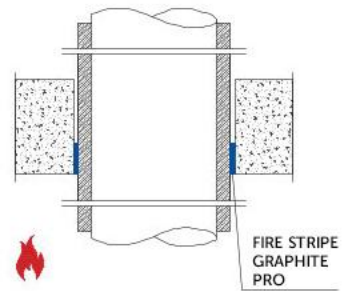
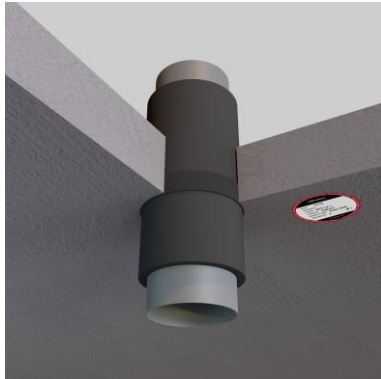
Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
PVC-U	≤ 200	4,9 – 11,9	2	EI 120 U/C
PP	≤ 40	3,7 – 5,4	1	EI 120 U/C
	≤ 50	3,7	1	EI 120 U/C
	≤ 110	4,2 – 6,6	2	EI 120 U/C
Reinforced PP-R type SILERE of VALSIR	≤ 110	5,4	2	EI 120 U/C

## A.2 Insulated metal pipes

### A.2.1 Insulated steel pipes through the constructive element

#### A.2.1.1 Rigid floor

##### A.2.1.1.1 150 mm thick rigid floor

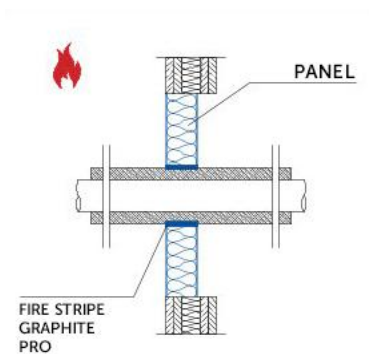
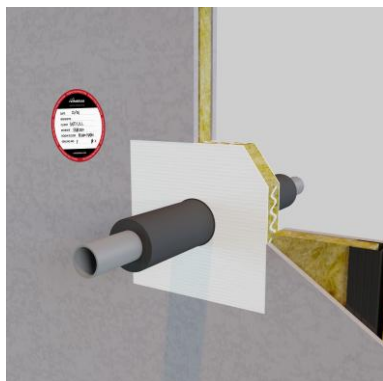


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 200	≥ 1,0	19,0	1	EI 180 U/C

## A.2.2 Insulated steel pipes through PANEL

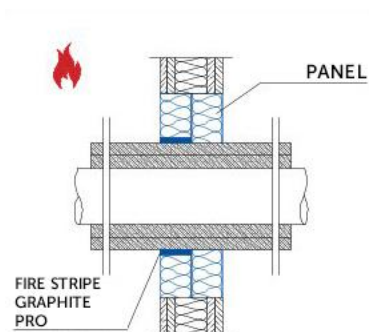
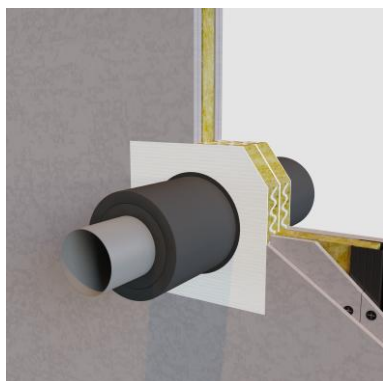
### A.2.2.1 Flexible wall

#### A.2.2.1.1 80 mm thick flexible wall

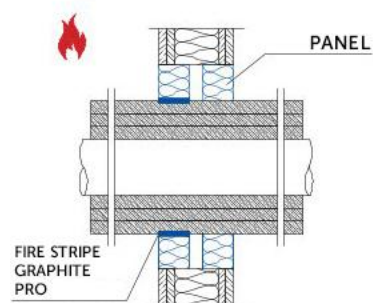
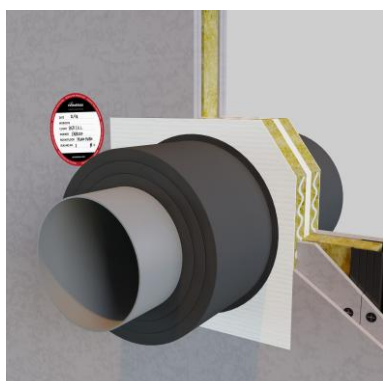


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 1,0	19,0	1	EI 60 C/C

**A.2.2.1.2 100 mm thick flexible wall**



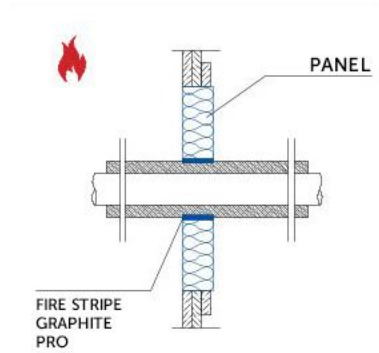
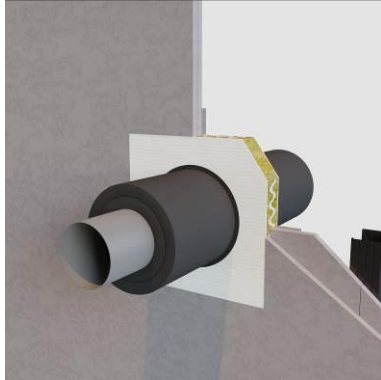
Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 108	≥ 1,0	20,0	1	EI 120 C/C
		20,0 – 40,0	2	EI 120 C/C

**A.2.2.1.3 120 mm thick flexible wall**

Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 20	≥ 1,5	9,0	1	EI 120 C/C
≤ 108	≥ 1,0	20,0	1	EI 120 C/C
		20,0 – 40,0	2	EI 120 C/C
≤ 200	≥ 1,0	19,0	1	EI 120 C/C
		19,0 – 40,0	2	EI 120 C/C
		40,0 – 60,0	3	EI 120 C/C

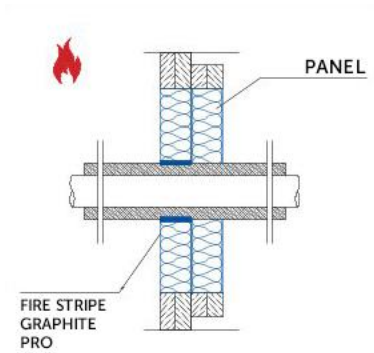
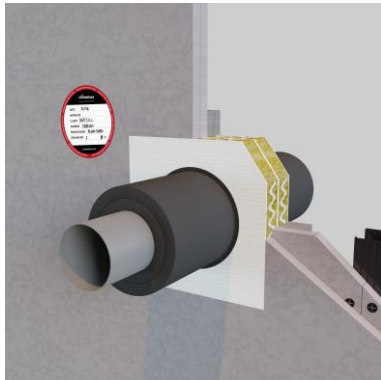
### A.2.2.2 Lining wall

#### A.2.2.2.1 30 mm thick lining wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 108	≥ 1,0	20,0	1	EI 60 U/C
		20,0 - 40,0	2	EI 60 U/C

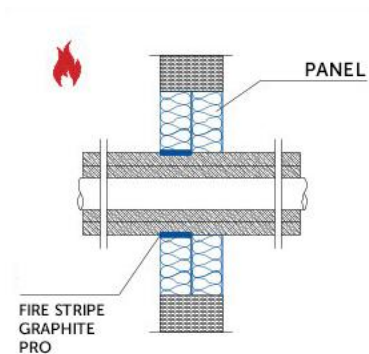
**A.2.2.2.2 50 mm thick lining wall**



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 2,0	20,0	1	EI 120 C/C

### A.2.2.3 Sandwich wall

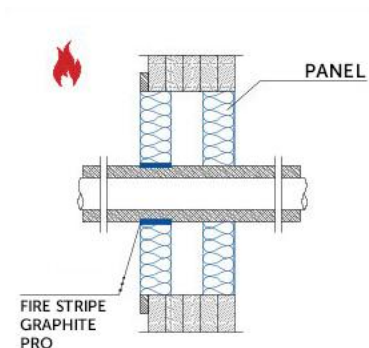
#### A.2.2.3.1 100 mm thick sandwich wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 100	≥ 4,0	20,0	1	EI 120 C/C
		20,0 - 40,0	2	EI 120 C/C

### A.2.2.4 Cross laminated timber (CLT) wall

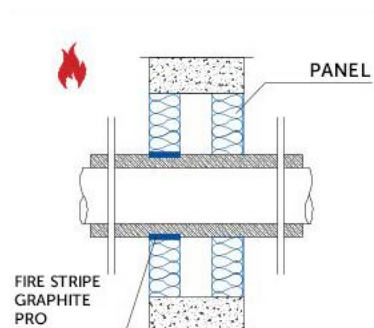
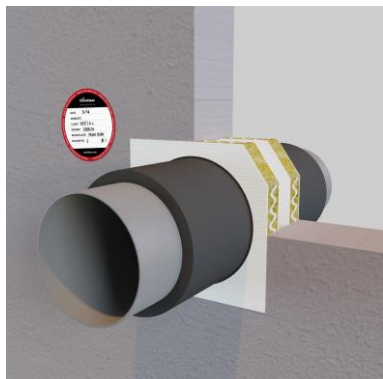
#### A.2.2.4.1 137 mm CLT wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 1,5	21,0	1	EI 120 C/U

## A.2.2.5 Rigid wall

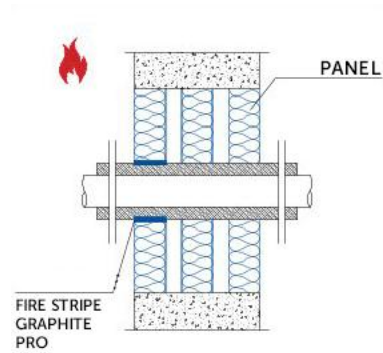
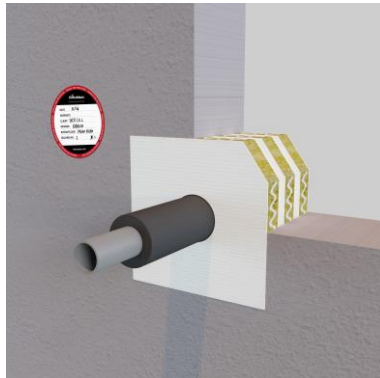
### A.2.2.5.1 150 mm rigid wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 2,5	20,0	1	EI 180 C/U
		40,0 <sup>(i)</sup>	2	EI 180 C/U
≤ 200	≥ 4,5	20,0	1	EI 180 C/U

<sup>(i)</sup> The insulation can be covered with an aluminium foil 0,6 mm thick.

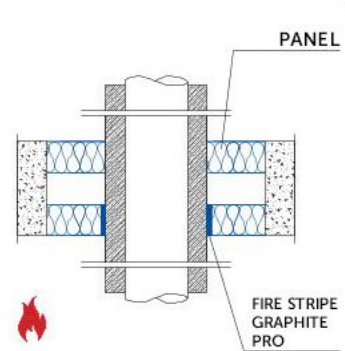
**A.2.2.5.2 200 mm rigid wall**



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 1,0	19,0	1	EI 240 U/C

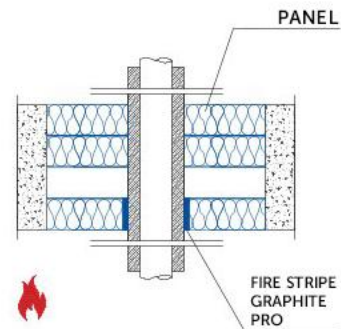
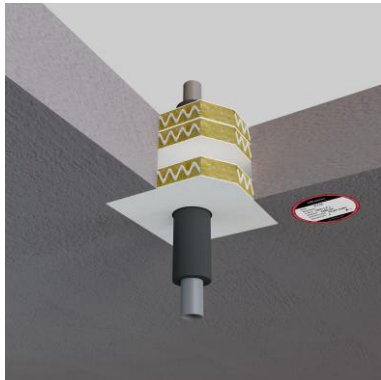
**A.2.2.6 Rigid floor**

**A.2.2.6.1 150 mm rigid floor**



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 100	≥ 4,0	30,0 <sup>(i)</sup>	1	EI 180 C/C
≤ 200	≥ 1,0	19,0	1	EI 60 U/U
		19,0	1	EI 180 U/C
		19,0 – 40,0	2	EI 60 U/U
		40,0 – 60,0	3	EI 60 U/U
≤ 206	≥ 3,0	20,0 – 40,0	2	EI 180 C/U
		40,0 - 60,0	3	

(i) 1 layer of 30 mm thick rock wool insulation (LS) of density 80 kg/m<sup>3</sup>.

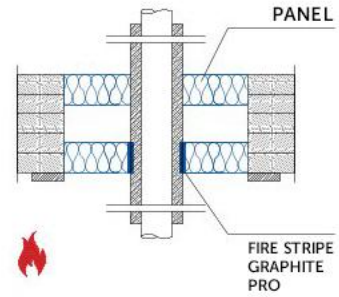
**A.2.2.6.2 200 mm rigid floor**

Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 1,0	19,0	1	EI 240 U/C
≤ 100	≥ 4,0	30,0 <sup>(i)</sup>	1	EI 180 C/C
≤ 200	≥ 1,0	19,0	1	EI 60 U/U
		19,0	1	EI 180 U/C
		19,0 – 40,0	2	EI 60 U/U
		40,0 – 60,0	3	EI 60 U/U
≤ 206	≥ 3,0	20,0 – 40,0	2	EI 180 C/U
		40,0 - 60,0	3	

(i) 1 layer of 30 mm thick rock wool insulation (LS) of density 80 kg/m<sup>3</sup>.

### A.2.2.7 Cross laminated timber (CLT) floor

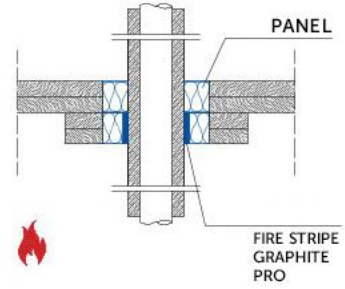
#### A.2.2.7.1 158 mm CLT floor



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 1,25	16,5	1	EI 120 U/C

### A.2.2.8 False ceiling

#### A.2.2.8.1 50 mm false ceiling

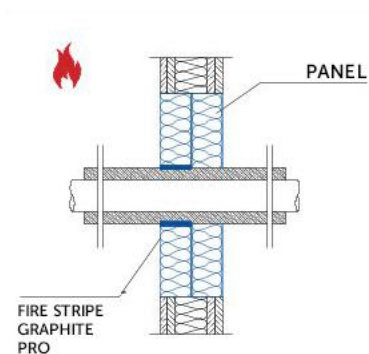
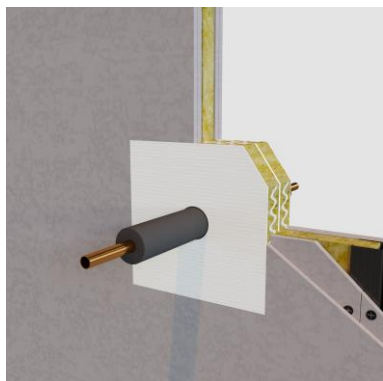


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 2,0	20,0	1	EI 120 C/C

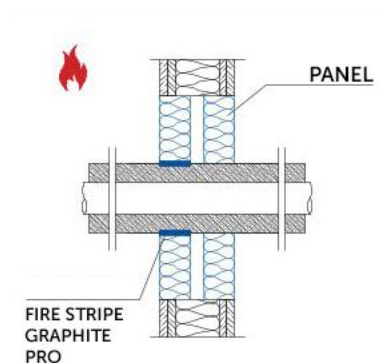
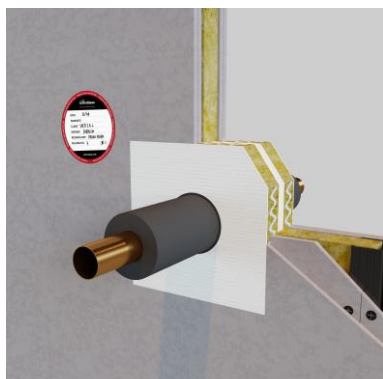
### A.2.3 Insulated copper pipes through PANEL

#### A.2.3.1 Flexible wall

##### A.2.3.1.1 100 mm thick flexible wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 22	≥ 1,0	19,0	1	EI 60 C/C

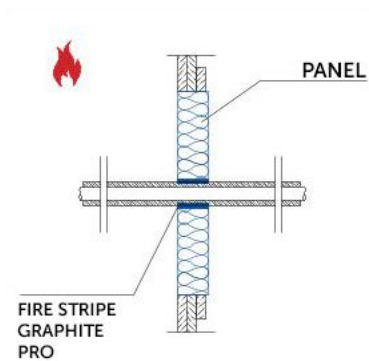
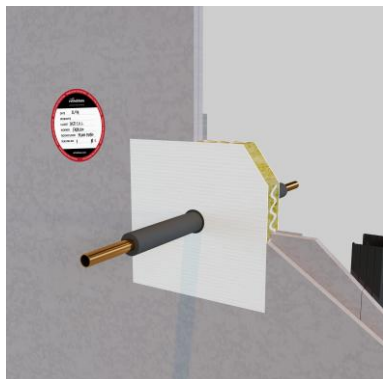
**A.2.3.1.2 120 mm thick flexible wall**

Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 22	≥ 1,0	20,0	1	EI 120 C/C
≤ 50	≥ 4,0	30,0 <sup>(i)</sup>	1	EI 120 C/C
		30,0	2	EI 120 C/C

<sup>(i)</sup> Insulation material according to table B.1 and reaction to fire class D-s3,d0.

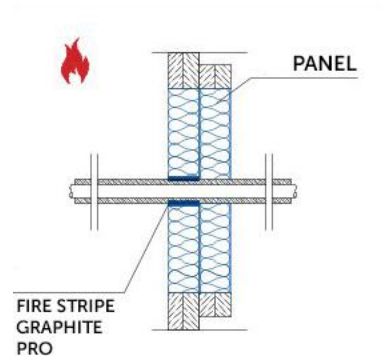
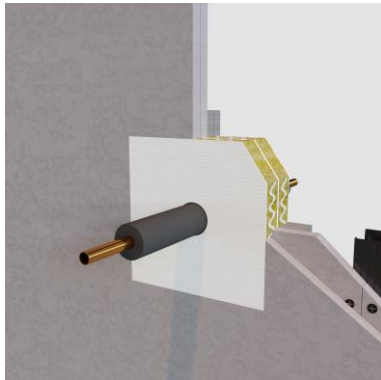
### A.2.3.2 Lining wall

#### A.2.3.2.1 30 mm thick lining wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 21	≥ 1,0	9,0	1	EI 60 U/C

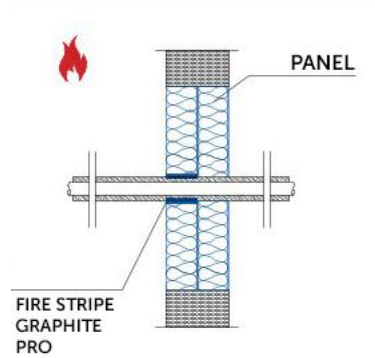
**A.2.3.2.2 50 mm thick lining wall**



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 20	≥ 2,0	6,0 – 20,0	1	EI 120 C/C

### A.2.3.3 Sandwich wall

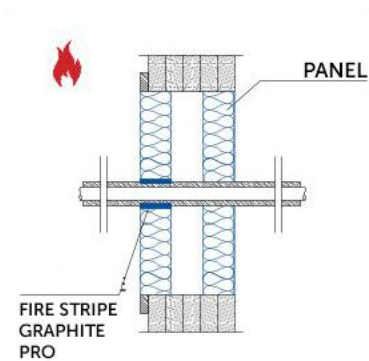
#### A.2.3.3.1 100 mm thick sandwich wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 20	≥ 2,0	6,0 – 20,0	1	EI 120 C/C

### A.2.3.4 Cross laminated timber (CLT) wall

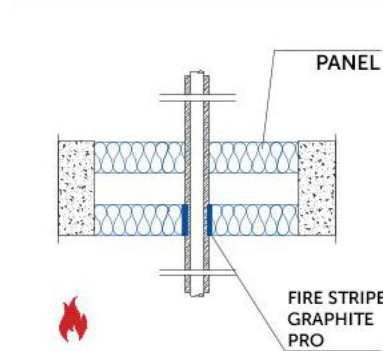
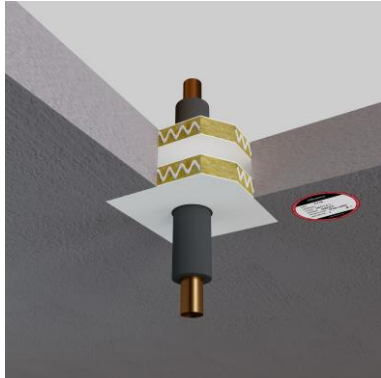
#### A.2.3.4.1 137 mm thick CLT wall



Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 22	≥ 1,0	8,5	1	EI 45 C/U

### A.2.3.5 Rigid floor

#### A.2.3.5.1 150 mm rigid floor

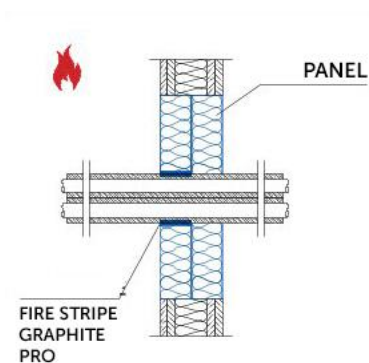
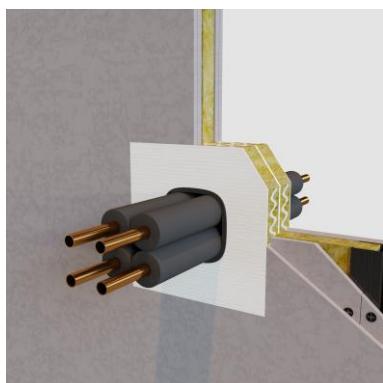


Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
≤ 50	≥ 1,5	9,0 – 20,0	1	EI 90 C/U

## A.2.4 Insulated copper pipes in bundles through PANEL

### A.2.4.1 Flexible wall

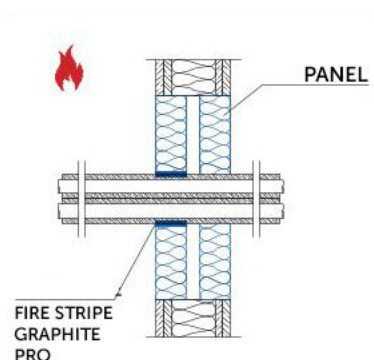
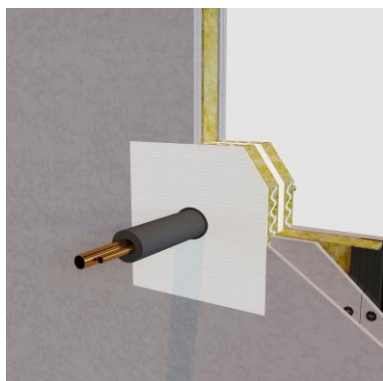
#### A.2.4.1.1 100 mm thick flexible wall



Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
4 <sup>(i)</sup>	≤ 22	≥ 1,0	19,0	2	EI 60 C/C <sup>(ii)</sup>

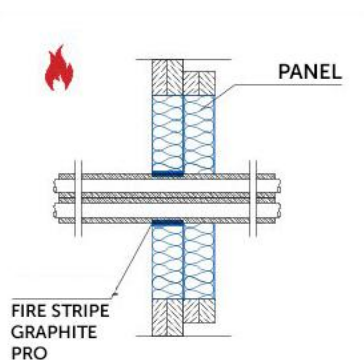
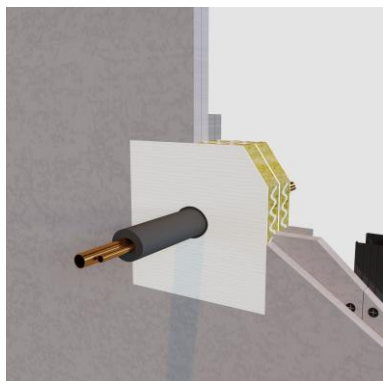
<sup>(i)</sup> Cluster arrangement of maximum four pipes, individually insulated and wrapped together with FIRE STRIPE GRAPHITE PRO (no distance between services).

<sup>(ii)</sup> Double FIRE STRIPE GRAPHITE PRO.

**A.2.4.1.2 120 mm thick flexible wall**

Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
1 (i)	$\leq 22$	$\geq 1,0$	20,0	1	EI 120 C/C
1 (i)	$\leq 12$				

- (i) Linear arrangement of two pipes insulated together (no distance between pipes). FIRE STRIPE GRAPHITE PRO wrapping both insulated pipes together.

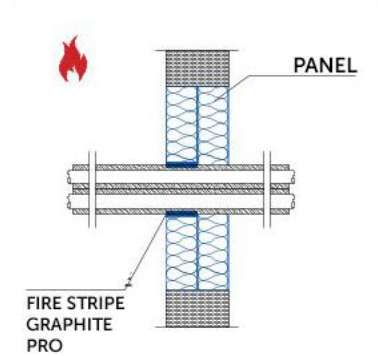
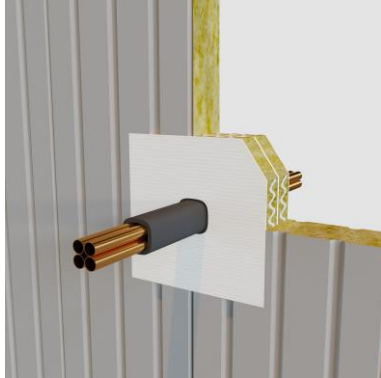
**A.2.4.2 Lining wall****A.2.4.2.1 50 mm thick lining wall**

Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
1 <sup>(i)</sup>	≤ 20	≥ 2,0	20,0	1	EI 120 C/C
1 <sup>(i)</sup>	≤ 5	≥ 1,0			

- <sup>(i)</sup> Linear arrangement of two pipes insulated together (no distance between pipes). FIRE STRIPE GRAPHITE PRO wrapping both insulated pipes together.

### A.2.4.3 Sandwich wall

#### A.2.4.3.1 100 mm thick sandwich wall

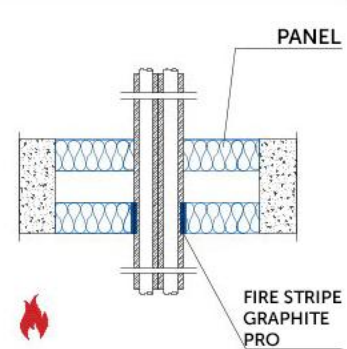
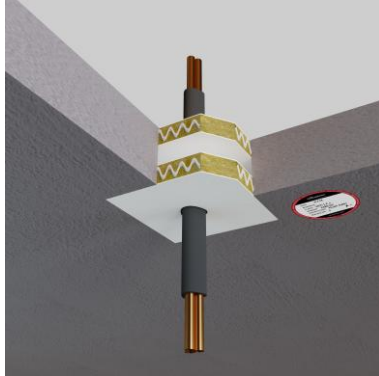


Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
4 <sup>(i)</sup>	≤ 20	≥ 2,0	6,0	1	EI 120 C/C

- (i) Cluster arrangement of maximum four pipes insulated together (no distance between pipes). FIRE STRIPE GRAPHITE PRO wrapping all insulated pipes together.

### A.2.4.4 Rigid floor

#### A.2.4.4.1 150 mm thick rigid floor



Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
3 <sup>(i)</sup>	21	≥ 1,0	9,0	2	EI 90 C/U

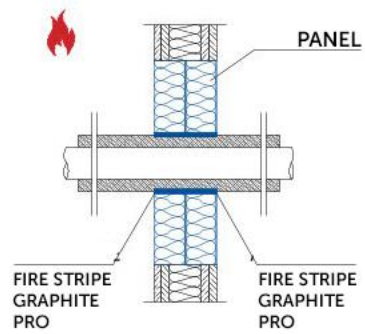
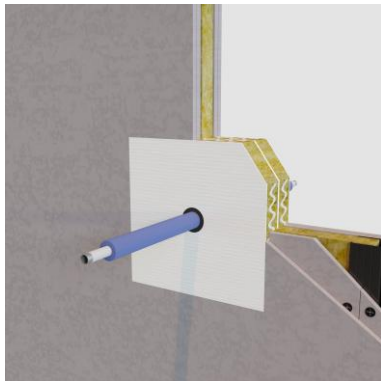
- (i) Cluster arrangement of maximum three pipes insulated together (no distance between pipes). FIRE STRIPE GRAPHITE PRO wrapping all insulated pipes together.

### A.3 Multilayer composite pipes

#### A.3.1 Multilayer composite pipes through PANEL

##### A.3.1.1 Flexible wall

##### A.3.1.1.1 100 mm thick flexible wall



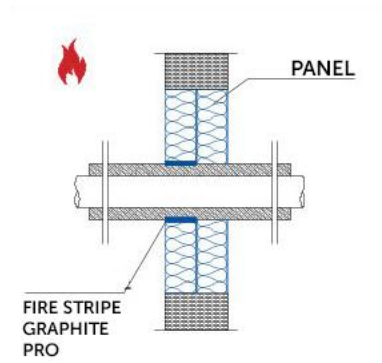
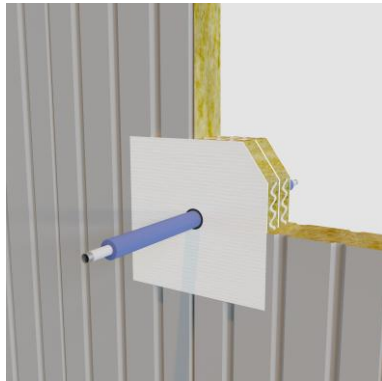
Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
PE-X/Al/HDPE <sup>8</sup>	≤ 16	2,0	6,0	2	EI 120 C/C <sup>(i)</sup>

(i) Double FIRE STRIPE GRAPHITE PRO.

<sup>8</sup> PE-X refers to PE-Xa, PE-Xb or PE-Xc throughout section A.3.

**A.3.1.2 Sandwich wall**

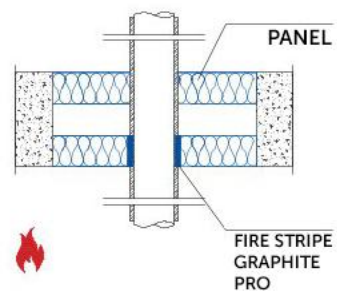
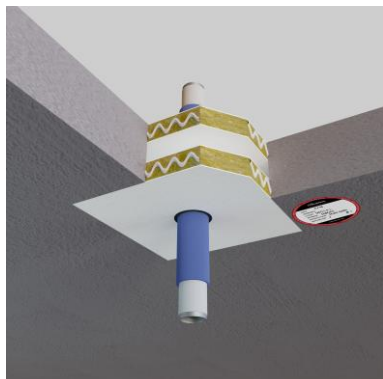
**A.3.1.2.1 100 mm thick sandwich wall**



Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
PE-X/Al/HDPE	≤ 20	3,0	6,0	1	EI 120 C/C

### A.3.1.3 Rigid floor

#### A.3.1.3.1 150 mm thick rigid floor

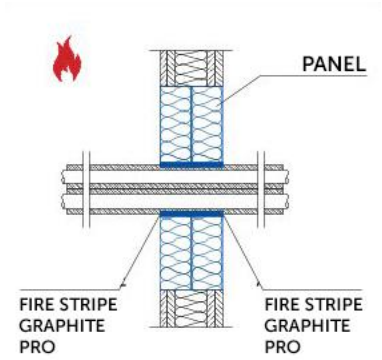
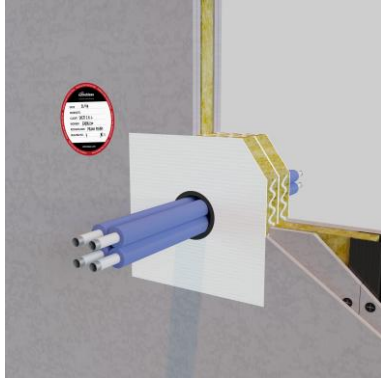


Pipe material	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
PE-X/Al/HDPE	≤ 16	2,0	9,0	2	EI 90 U/U
PE-X/Al/HDPE	≤ 63	4,0 – 6,0	19,0	2	EI 180 U/C

### A.3.2 Multilayer composite pipes in bundles through PANEL

#### A.3.2.1 Flexible wall

##### A.3.2.1.1 100 m thick flexible wall

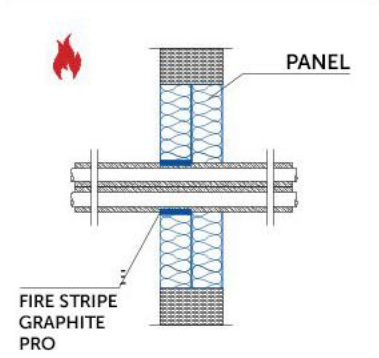
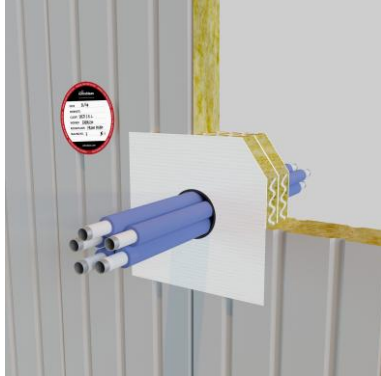


Pipe material	Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
PE-X/Al/HDPE	4 <sup>(i)</sup>	≤ 16	2,0	6,0	2	EI 120 C/C <sup>(ii)</sup>

- (i) Cluster arrangement of maximum four pipes, individually insulated and wrapped together with FIRE STRIPE GRAPHITE PRO (no distance between services).
- (ii) Double FIRE STRIPE GRAPHITE PRO.

**A.3.2.2 Sandwich wall**

**A.3.2.2.1 100 mm thick sandwich wall**

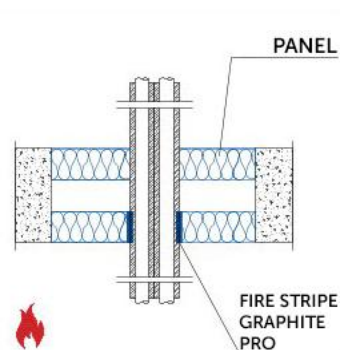
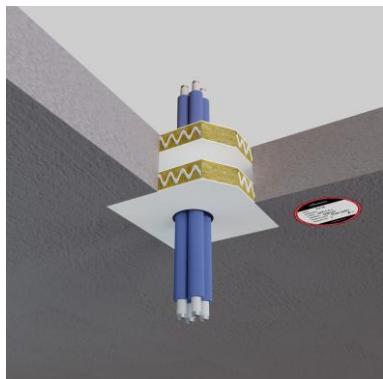


Pipe material	Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
PE-X/Al/HDPE	5 <sup>(i)</sup>	≤ 20	3,0	6,0	1	EI 120 C/C

<sup>(i)</sup> Cluster arrangement of maximum five pipes, individually insulated and wrapped together with FIRE STRIPE GRAPHITE PRO (no distance between services).

### A.3.2.3 Rigid floor

#### A.3.2.3.1 150 mm thick rigid floor



Pipe material	Pipe number	Pipe diameter (mm)	Pipe wall thickness (mm)	Insulation thickness (mm)	Windings	Classification
PE-X/Al/HDPE	4 <sup>(i)</sup>	≤ 16	2,0	9,0	2	EI 90 U/U

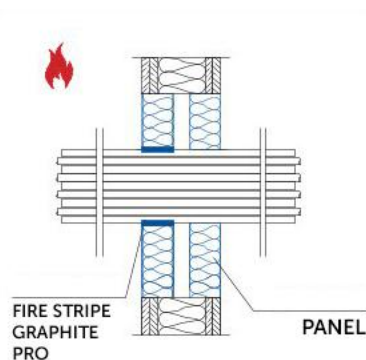
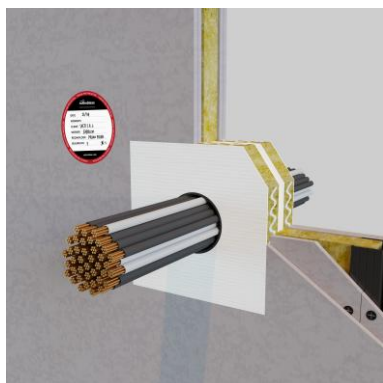
- <sup>(i)</sup> Cluster arrangement of maximum four pipes, individually insulated and wrapped together with FIRE STRIPE GRAPHITE PRO (no distance between services).

## A.4 Cables

### A.4.1 Cable bundles through PANEL

#### A.4.1.1 Flexible wall

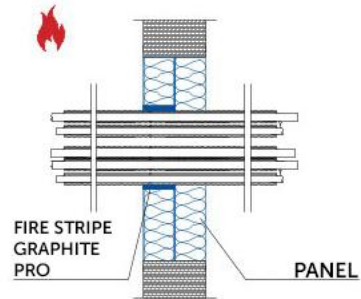
##### A.4.1.1.1 125 mm thick flexible wall



Overall diameter (mm)	Service description	Windings	Classification
≤ 80	Bundle of maximum 50 cables type A1	1	EI 120

### A.4.1.2 Sandwich wall

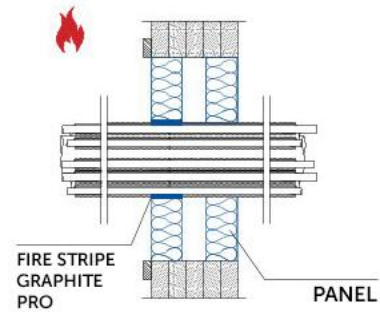
#### A.4.1.2.1 100 mm thick sandwich wall



Overall diameter (mm)	Service description	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
≤ 60	Bundle of maximum 5 corrugated PVC pipes with a cable type A1	≤ 20	2,0	1	EI 120 C/C

### A.4.1.3 Cross laminated timber (CLT) wall

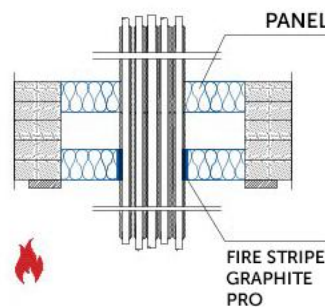
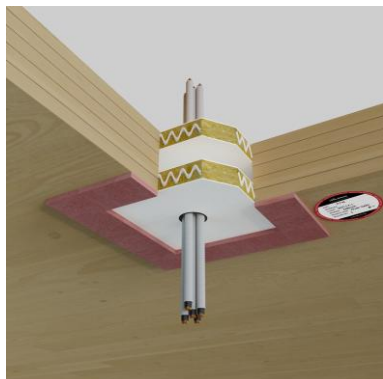
#### A.4.1.3.1 137 mm thick CLT wall



Overall diameter (mm)	Service description	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
≤ 80	Bundle of maximum 7 corrugated PVC pipes with a cable type A2	≤ 24	0,6	1	EI 120 U/C

### A.4.1.4 Cross laminated timber (CLT) floor

#### A.4.1.4.1 158 mm thick CLT floor



Overall diameter (mm)	Service description	Pipe diameter (mm)	Pipe wall thickness (mm)	Windings	Classification
≤ 60	Bundle of maximum 5 corrugated PVC pipes with a cable type A1	≤ 20	2,0	1	EI 120

## **ANNEX B. Supporting constructive elements and installation criteria**

### **B.1. General**

The constructive elements where FIRE STRIPE GRAPHITE PRO 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: section B.2.1.
- Lining walls: section B.2.2.
- Sandwich panels walls: section B.2.3.
- Timber walls: section B.2.4.
- Rigid walls: section B.2.5.
- Rigid floors: section B.3.1.
- Timber floors: section B.3.2.
- False ceilings: section B.3.3.

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

The installation of FIRE STRIPE GRAPHITE PRO shall follow the procedure described in section B.4. The additional components that make up the penetration seal, generically referred to in Annex A, shall meet the specification given in table B.1, except if otherwise specified in Annex A.

### **B.2. Specification of the supporting walls**

#### **B.2.1. Flexible walls**

The flexible walls comprise timber or steel studs lined on both faces with minimum two layers<sup>9</sup> 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 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<sup>3</sup>.

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<sup>9</sup> 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 in those cases where an opening in the wall is closed with PANEL.

#### B.2.1.1 Flexible wall of thickness 80 mm

Walls with a minimum thickness of 80 mm and resistance to fire EI 60.

When an opening in the wall is closed with PANEL, one layer is installed, at centre position of the wall thickness in the case of plastic pipe penetration through PANEL or levelled to the surface at the fire exposed side of the wall for other type of penetration through PANEL. The maximum size of the opening is 550 mm x 600 mm.

#### B.2.1.2 Flexible wall of thickness 100 mm

Walls with a minimum thickness of 100 mm and resistance to fire EI 120.

When an opening in the wall is closed with PANEL, two layers are installed levelled to the surface at both sides of the wall. The maximum size of the opening is 750 mm x 500 mm.

#### B.2.1.3 Flexible wall of thickness 120 mm

Walls with a minimum thickness of 120 mm and resistance to fire EI 120.

When an opening in the wall is closed with PANEL, two layers are installed levelled to the surface at both sides of the wall. The maximum size of the opening is 500 mm x 900 mm.

#### B.2.1.4 Flexible wall of thickness 125 mm

Walls with a minimum thickness of 125 mm and resistance to fire EI 120.

When an opening in the wall is closed with PANEL, two layers are installed levelled to the surface at both sides of the wall. The maximum size of the opening is 500 mm x 900 mm.

### **B.2.2. Lining walls**

#### B.2.2.1 Lining wall of thickness 30 mm

One-sided flexible walls with a minimum thickness of 30 mm (boards only) and resistance to fire EI 60, which comprise a steel frame of a minimum thickness 50 mm (studs of 50 mm x 49 mm x 0,6 mm), lined at one side only with minimum two layers of 15 mm thick 'Type F' gypsum plasterboards according to EN 520. The lining boards are placed at the fire exposed side of the steel frame.

When an opening in the wall is closed with PANEL, one layer is installed. A frame is installed around the opening, fixed to the wall plasterboards with self-tapping steel screws Ø 3,5 mm every 200 mm, made of strips (50 mm width and 15 mm thick) of 'Type F' gypsum plasterboards according to EN 520. The maximum size of the opening is 500 mm x 1000 mm.

#### B.2.2.2 Lining wall of thickness 50 mm

One-sided flexible walls with a minimum thickness of 50 mm (boards only) and resistance to fire EI 120, which comprise a steel frame of a minimum thickness 75 mm (studs of 75 mm x 50 mm x 0,6 mm), lined at one side only with minimum two layers of 25 mm thick 'Type GM-F' gypsum and vermiculite plasterboards, coated with fiberglass, according to EN 520. The lining boards are placed at the fire exposed side of the steel frame.

When an opening in the wall is closed with PANEL, two layers are installed. A frame is installed around the opening, fixed to the wall plasterboards with self-tapping steel screws Ø 4 mm every

200 mm, made of strips (50 mm width and 25 mm thick, two layers for a total thickness of 50 mm) of 'Type GM-F' gypsum and vermiculite plasterboards, coated with fiberglass, according to EN 520. The maximum size of the opening is 500 mm x 1000 mm.

### **B.2.3. Self-supporting sandwich panels wall**

Walls with a minimum thickness of 100 mm and resistance to fire EI 120, made of self-supporting sandwich panels with rock wool insulation core of density 100 kg/m<sup>3</sup> 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 rivets Ø3,5 mm x 14 mm, and to the rigid floors with steel L-profiles and steel anchors.

When an opening in the wall is closed with PANEL, two layers are installed levelled to the surface at both sides of the wall. The maximum size of the opening is 500 mm x 1000 mm.

### **B.2.4. Timber wall**

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).

When an opening in the wall is closed with PANEL, two layers are installed levelled to the surface at both sides of the wall. A frame is installed around the opening, fixed to the wall timber boards with self-tapping steel screws Ø6 mm every 200 mm, made of strips (110 mm width and 12,5 mm thick) of 'Type F' gypsum plasterboards according to EN 520. The maximum size of the opening is 600 mm x 600 mm.

### **B.2.5. Rigid walls**

#### **B.2.5.1 Rigid wall of thickness 150 mm**

Concrete or masonry walls with a minimum thickness of 150 mm, minimum density of 550 kg/m<sup>3</sup> and resistance to fire EI 180.

When an opening in the wall is closed with PANEL, two layers are installed levelled to the surface at both sides of the wall. The maximum size of the opening is 1800 mm x 650 mm.

#### **B.2.5.2 Rigid wall of thickness 200 mm**

Concrete or masonry walls with a minimum thickness of 200 mm, minimum density of 550 kg/m<sup>3</sup> and resistance to fire EI 240.

When an opening in the wall is closed with PANEL, three layers are installed with the external panels levelled to the surface at both sides of the wall. The maximum size of the opening is 600 mm x 250 mm.

## **B.3. Specification of the supporting floors**

### **B.3.1. Rigid floors**

#### **B.3.1.1 Rigid floor of thickness 150 mm**

Concrete or other type of rigid floors with a minimum thickness of 150 mm, minimum density of 650 kg/m<sup>3</sup> and resistance to fire EI 180.

When an opening in the floor is closed with PANEL, two layers are installed levelled to the surface at both sides of the floor. The maximum size of the opening is 900 mm x 450 mm. The maximum size can be enlarged up to 2000 mm x 1000 mm when supporting profiles are installed beneath the panels. Steel slotted profiles (30 mm width and 1 mm thick) placed under the panel's splices at maximum 500 mm, fixed to the floor at both profile's ends with expansion anchors Ø60 mm x 8 mm.

#### **B.3.1.2 Rigid floor of thickness 200 mm**

Concrete or other type of rigid floors (such as reinforced aerated concrete) with a minimum thickness of 200 mm, minimum density of 650 kg/m<sup>3</sup> and resistance to fire EI 240.

When an opening in the floor is closed with PANEL, three layers are installed with the external panels levelled to the surface at both sides of the floor. The maximum size of the opening is 1360 mm x 200 mm.

### **B.3.2. Timber floor**

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).

When an opening in the floor is closed with PANEL, two layers of PANEL are installed levelled to the surface at both sides of the floor. A frame is installed around the opening, fixed to the floor timber boards with self-tapping steel screws Ø 5 mm approximately every 175 mm, made of strips (110 mm width and 12,5 mm thick) of 'Type F' gypsum plasterboards according to EN 520. The maximum size of the opening is 700 mm x 500 mm.

### **B.3.3. False ceiling**

False ceiling with a minimum thickness of 50 mm (boards only) and resistance to fire EI 120 (a ← b), which comprise a steel frame lined at the bottom side with minimum two layers of 25 mm thick 'Type F' gypsum plasterboards according to EN 520.

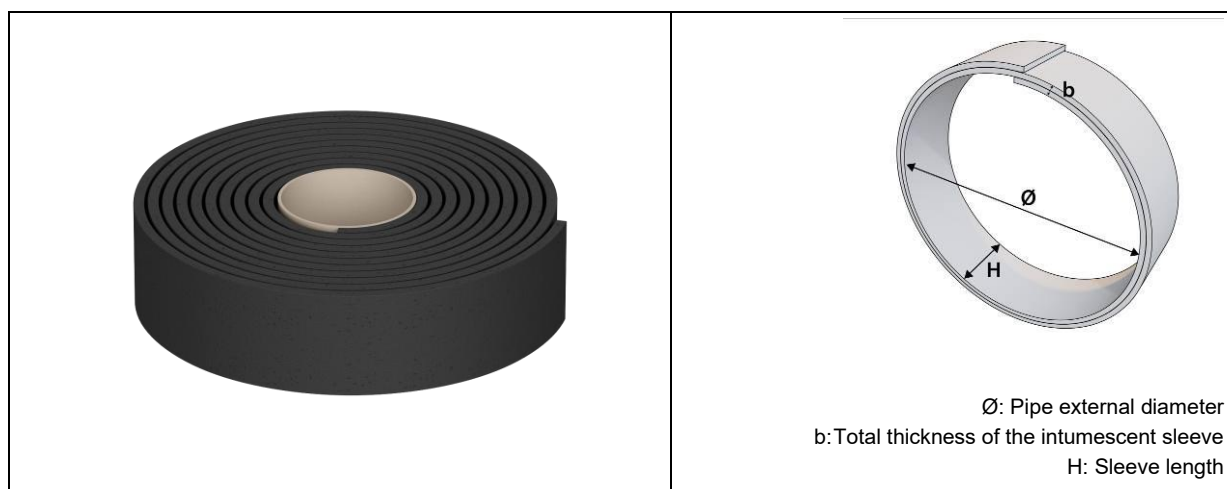
When an opening in the false ceiling is closed with PANEL, a frame made of strips (50 mm width and 25 mm thick, two layers for a total thickness of 50 mm) of 'Type GM-F' gypsum plasterboards coated with fiberglass, according to EN 15283-1, is installed around the opening in the false ceiling, fixed to the gypsum plasterboards with self-tapping steel screws approximately every 100 mm. The opening is closed with two layers of PANEL. The maximum size of the opening is 500 mm x 300 mm.

## B.4. Installation FIRE STRIPE GRAPHITE PRO

### B.4.1. General

FIRE STRIPE GRAPHITE PRO will be installed in accordance with the manufacturer instructions and the provisions established in this annex.

The intumescent strip is cut to the prescribed length to suit the external diameter of the protected service in accordance with the dimensions assessed in Annex A. The strip is manufactured at a nominal thickness of 4 mm and the total intumescent thickness of every installed sleeve ( $b$  in figure B.1) is achieved by adding the required number of intumescent strip layers (windings), depending on the external diameter of the protected service, as given in Annex A.



**Figure B.1:** General view of FIRE STRIPE GRAPHITE PRO (roll and preformed) and dimensions of the installed sleeve.

FIRE STRIPE GRAPHITE PRO is installed integrated into the constructive element (wall or floor) or into PANEL (see section B.4.2), wrapped around the service and tightly fitted by pressure against the constructive element, without mechanical fixing. FIRE STRIPE GRAPHITE PRO is installed at the fire exposed side (except if otherwise specified in Annex A), levelled to the constructive element surface.

In the case of the preformed FIRE STRIPE GRAPHITE PRO, it can be installed when the standard sleeve sizes (internal collar diameter) and the number of windings, given in table 2 of this ETA, match the penetration seal characteristics (external service diameter and windings) assessed in Annex A.

When FIRE STRIPE GRAPHITE PRO is used to seal insulated metal pipes, the sleeve shall fit the total service diameter (pipe plus insulation thickness), ensuring that the intumescent strip thickness ( $b$  in figure B.1) is at least 4 mm (1 layer) for insulation thicknesses  $\leq 20$  mm, 8 mm (2 layers) for insulation thicknesses between 20 mm and 40 mm, and 12 mm (3 layers) for insulation thicknesses between 40 mm and 60 mm.

All small gaps between penetrations and constructive elements shall be filled in with mortar (floors and rigid walls) or gypsum paste (flexible walls), also at the non-exposed side where all joints shall be sealed and mortar/gypsum spread around the penetration over the constructive element surface.

When the overall thickness of the constructive element is greater than the minimum specified in Annex A, the length of the seal will be increased accordingly and kept levelled at the element surface, in accordance with EN 1366-3.

The minimum distance between services is generally 100 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 maximum distance from the constructive element to the adequate service support is 500 mm in case of 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.4.2. FIRE STRIPE GRAPHITE PRO installation on PANEL**

PANEL closing solution will be installed in the constructive element in accordance with the provisions given in ETA 24/1206, section A.2, and the manufacturer's instructions.

The maximum size of the opening shut with PANEL is given in sections B.2 and B.3 of this ETA in relation to the supporting construction. In the case of walls, the given maximum size can be increased up to either 25 % in height or 25 % in width or 25 % in area according to table A.3 in EN 15882-3<sup>10</sup>. If a blank seal (opening shut with PANEL without passing services) is installed, splices within the seal area have not been assessed.

When FIRE STRIPE GRAPHITE PRO is installed within PANEL closing solution, levelled to the constructive element surface at the fire exposed side, it is wrapped around the service and tightly fitted by pressure against PANEL, without mechanical fixing.

The minimum distance from services to the edge of PANEL closure area, as well as the minimum distance between passing services, is generally 100 mm, except if otherwise specified in the manufacturer's instructions based on specific test results.

SEAL W acrylic sealant is applied at an approximate dry thickness of 2 mm over the fire exposed surface of PANEL, sealing all the joints with the service and the constructive element, and spreading

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<sup>10</sup> EN 15882-3 Extended applications of results from fire resistance tests for service installations. Part 3: Penetration seals.

over the constructive element surface around the seal. In the case of cross laminated timber (CLT) walls/floor, SEAL W acrylic sealant is also applied over the PANEL area at the fire non-exposed side of the constructive element.

### B.5. Additional components of the fire penetration seal

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

**Table B.1:** Specification of the fire penetration seal additional components.

Component	Specification
Metal pipes	<p>The steel pipes will be made of steel with a minimum melting point of 1450 °C and a maximum thermal conductivity of 52 W/(m·K).</p> <p>The copper pipes will be made of copper with a minimum melting point of 1085 °C and a maximum thermal conductivity of 390 W/(m·K).</p>
Insulation material for pipes (unless otherwise specified in Annex A)	<p>Foamed elastomeric insulation material:</p> <ul style="list-style-type: none"> <li>• Continuous insulation.</li> <li>• Reaction to fire: from B<sub>L</sub>-s1,d0 to D<sub>L</sub>-s3,d0.</li> <li>• Maximum thermal conductivity (23 °C): <math>\lambda \leq 0,043</math> W/(m·K).</li> <li>• Fixed around the pipe with a steel wire of diameter 1 mm.</li> </ul>
Small-sheathed cables	<p>Cables type group 1 according to Annex A of EN 1366-3:</p> <ul style="list-style-type: none"> <li>• Cables type A1 model "5×1,5 mm<sup>2</sup> CI 1 PVC/PVC 600/1000V NYYJ".</li> <li>• Cables type A2 model "5×1,5 mm<sup>2</sup> CI 5 Cu EP/PCP 450/750V H07RN-F".</li> <li>• Cables type A3 model "5×1,5 mm<sup>2</sup> CI 1 Cu XLPE/LSZH 600/1000V N2XH-J".</li> <li>• Cables type B model "1×95 mm<sup>2</sup> CI 2 PVC/PVC 600/1000V NYY0".</li> </ul>
PANEL	PANEL is CE marked based on ETA 24/1206, with which product and installation conditions of PANEL shall conform.
SEAL W	SEAL W is CE marked based on ETA 24/1207, with which product and installation conditions of SEAL W shall conform.