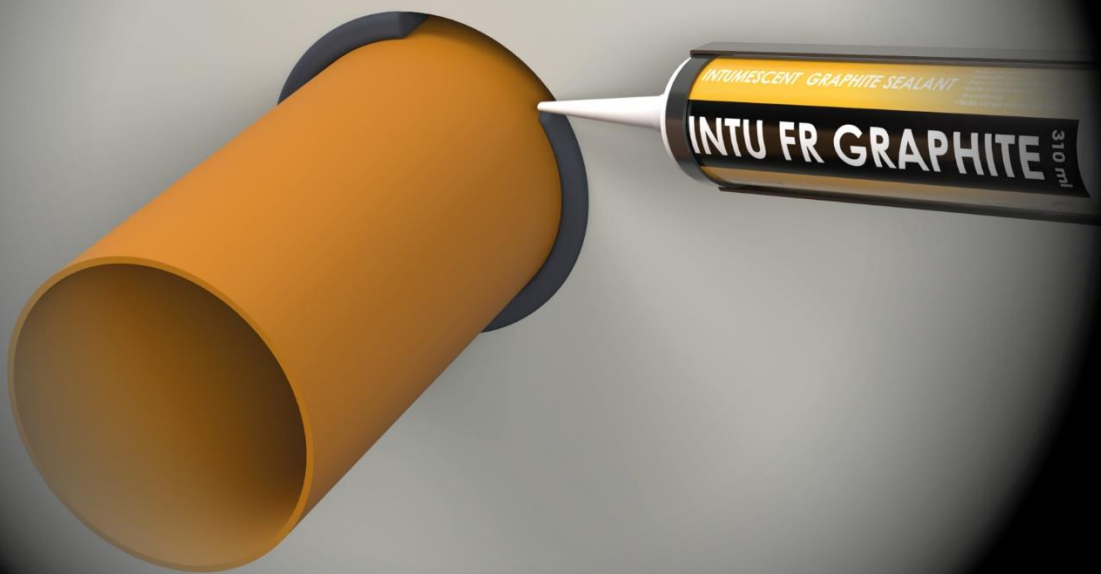


# INTU FR GRAPHITE

*Intumescent graphite sealant*

TDS Technical Data Sheet



# INTU FR GRAPHITE

Intumescent graphite sealant

Technical Data Sheet

**INTUSEAL®**  
passive fire protection manufacturer

## → PRODUCT DESCRIPTION

The **INTU FR GRAPHITE** is an insulating and intumescent mass based on graphite, designed for fire resistant sealing of combustible pipes as well as small and medium-sized openings. The types of service penetrations that can be sealed with **INTU FR GRAPHITE** are: electrical cables, coaxial cables, fibre-optic cables, bundles of copper pipes for air conditioning. The mass effectively fills the gaps around the service penetration, ensuring that the partition maintains the integrity and insulation with a fire resistance class up to EI120 (details according to the referential documents). Under a high temperature (about 140°C), the mass swells and closes the opening, preventing the spread of fire.

## → APPLICATION

**INTU FR GRAPHITE** - an intumescent sealing mass is used for fire protection of penetrations of plastic pipes, electrical cables, coaxial cables, opt fibre cables that are led in casing pipes or without them. Fire protection of:

- combustible pipes diameter of  $\varnothing \leq 110\text{mm}$
- steel pipes diameter  $\varnothing \leq 16\text{mm}$
- single cables diameter  $\varnothing \leq 21\text{mm}$ , cable bundles, fibre optics in casing pipes diameter  $\varnothing \leq 37\text{mm}$
- cables in AROT type pipes up to  $\varnothing 110\text{ mm}$  diameter
- bundles of copper pipes for air conditioning
- perfect for installation in hard -to-reach places
- sealing of irregularly shaped penetrations
- sealing of penetrations without service installations

### Flexible walls:

The wall must be minimum 100 mm thickness with a frame structure of steel or wooden sections covered on both sides with a minimum of 2 layers of panels with a thickness of min 12,5 mm.

### Rigid walls:

The wall must be minimum 100 mm thickness, made of concrete, reinforced concrete, concrete blocks, cellular concrete, ceramic brick (solid, hollow or lattice) or silicate brick (solid or hollow) with a density of min. 450 kg/m<sup>3</sup>.

### Rigid floors:

The floor must be at least 150 mm thick made of concrete, reinforced concrete or cellular concrete with a minimum density of 550 kg/m<sup>3</sup>.

## → AVAILABILITY

Contents	Mass colour	Box	Pallet	Article number
310 ml	Black	15	1260	INFRG310

## → APPLICATION CONDITIONS

- Application temperature range: od +5 °C do +40 °C
- Do not use INTU FR GRAPHITE mass if the ambient temperature is below 5°C
- Curing time: ≈ 1mm / 24h

## → TRANSPORT AND STORAGE

Store in dry and cool conditions, at a temperature between +5°C to +25°C.

Usefulness 12 months from the date of production placed on the package.



## → COMPLIANCE

- Reference standard: EN 1366-3 / EAD 350454-00-1104
- ETA-24/0152
- DoP 3/2024
- TDS

# INTU FR GRAPHITE

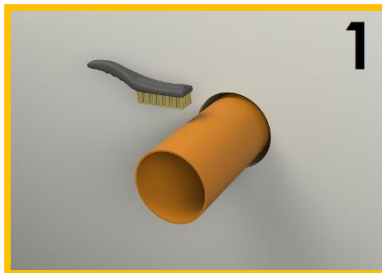
Intumescent graphite sealant

Technical Data Sheet

## ➔ INSTALLATION METHOD

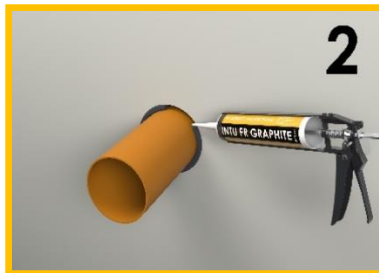
### 1. PREPARATION

Before applying the mass, clean the surfaces of grease and other contaminants. The mass should not be used on substrates that produce oils, softeners or solvents.



### 2. APPLICATION

Fill the gap with **INTU FR GRAPHITE** mass on 25 mm depth (according to the technical tables and solution details below).



### 3. FINISH

At the end line up the surface of the mass.



## ➔ CONSUMPTION

Approximate consumption of INTU FR GRAPHITE for CABLE PENETRATIONS				
Hole diameter/ hole dimension W x H (mm)	Percentage part of hole area which cables inside			
	0%	20%	40%	60%
	Mass consumption*			
80	0,80	0,64	0,48	0,32
100	1,30	1,04	0,78	0,52
120	1,80	1,44	1,08	0,72
140	2,50	2,00	1,50	1,00
160	3,20	2,56	1,92	1,28
150 x 150	3,60	2,88	2,16	1,44

Approximate consumption of INTU FR GRAPHITE for PIPE PENETRATIONS		
Ø pipe (mm)	Ø hole (mm)	Mass consumption*
20	40	0,15
32	52	0,21
50	70	0,30
63	83	0,37
75	95	0,43
90	110	0,51
110	130	0,61

\* quantity of packages of mass (310 ml) when filled to a depth of 25 mm (on both sides)

## ➔ FIRE RESISTANCE CLASSIFICATION for combustible pipe in walls

Combustible pipes penetration seals in flexible or rigid wall with thickness  $A \geq 100$  mm

Fig.1 Page 7

### BlazeMaster CPVC pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width graphite mass [mm]	Fire resistance class
$\varnothing \leq 19.0$	2.24 – 3.38	2 x 25.0 x 10.0-20.0	EI 120-U/C
	3.39 – 3.84		EI 90-U/C
19.0 < $\varnothing \leq 25.4$	2.71 – 3.38		EI 120-U/C
	3.39 – 3.84		EI 90-U/C
25.4 < $\varnothing \leq 31.8$	3.38		EI 120-U/C
	3.39 – 3.84		EI 90-U/C
31.8 < $\varnothing \leq 38.1$	3.84	EI 90-U/C	

### PE-HD pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width graphite mass [mm]	Fire resistance class
$\varnothing \leq 32$	1.8 – 6.8	2 x 25.0 x 10.0-20.0	EI 120-U/C
	6.9 – 10.0		EI 90-U/C
32 < $\varnothing \leq 50$	2.3 – 6.8		EI 120-U/C
	6.9 – 10.0		EI 90-U/C
50 < $\varnothing \leq 75$	3.0 – 6.8		EI 120-U/C
	6.9 – 10.0		EI 90-U/C
75 < $\varnothing \leq 110$	4.2 – 9.9	EI 60-U/C	
	10.0	EI 90-U/C	

#### PE-RT/AL/PE-RT pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width graphite mass [mm]	Fire resistance class
Ø ≤ 20	2.0 – 6.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
	6.1 – 7.5		EI 60-U/C E 120-U/C
20 < Ø ≤ 32	3.1		EI 120-U/C
32 < Ø ≤ 40	3.9		EI 120-U/C
40 < Ø ≤ 50	4.8		EI 120-U/C
50 < Ø ≤ 63	6.0		EI 120-U/C
63 < Ø ≤ 75	7.5		EI 60-U/C E 120-U/C

#### PE-X/AL/PE-X pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width graphite mass [mm]	Fire resistance class
Ø ≤ 20	2.0 – 6.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
20 < Ø ≤ 32	3.1		
32 < Ø ≤ 40	3.9		
40 < Ø ≤ 50	4.8		
50 < Ø ≤ 63	6.0		

#### PE-Xa pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width graphite mass [mm]	Fire resistance class
Ø ≤ 20	2.0 – 5.8	2 x 25.0 x 10.0-20.0	EI 120 U/C
20 < Ø ≤ 32	3.0		
32 < Ø ≤ 40	3.8		
40 < Ø ≤ 50	4.6		
50 < Ø ≤ 63	5.8		

#### PP-R pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width mass [mm]	Fire resistance class
Ø ≤ 20	2.3 – 10.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
20 < Ø ≤ 32	3.3 – 12.5		EI 120-U/C
	12.6 – 16.0		EI 90-U/C
32 < Ø ≤ 50	4.8 – 12.5		EI 120-U/C
	12.6 – 18.3		EI 90-U/C
50 < Ø ≤ 63	5.8 – 12.5		EI 120-U/C
	12.6 – 18.3		EI 90-U/C
50 < Ø ≤ 75	6.8 – 12.5		EI 120-U/C
	12.6 – 18.3		EI 90-U/C
75 < Ø ≤ 90	8.2 – 10.0		EI 120-U/C
	10.1 – 18.3		EI 90-U/C
75 < Ø ≤ 110	10.0		EI 120-U/C
	10.1 – 18.3	EI 90-U/C	

#### PP pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width graphite mass [mm]	Fire resistance class
Ø ≤ 50	1.8 – 18.3	2 x 25.0 x 10.0-20.0	EI 120 U/C
50 < Ø ≤ 75	1.9 – 18.3		
75 < Ø ≤ 90	2.3 – 18.3		
90 < Ø ≤ 110	2.7 – 18.3		

#### PP-R/AL/PP-R pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width mass [mm]	Fire resistance class	
Ø ≤ 20	2.8 – 10.0	2 x 25.0 x 10.0-20.0	EI 120-U/C	
20 < Ø ≤ 32	4.4 – 16.0			
32 < Ø ≤ 50	6.9 – 18.3			
50 < Ø ≤ 63	8.6 – 18.3			
63 < Ø ≤ 75	10.3 – 18.3			
75 < Ø ≤ 90	12.3 – 14.9			EI 90-U/C
	15.0 – 18.3			EI 120-U/C
90 < Ø ≤ 110	15.1 – 18.2			EI 90-U/C
	18.3			EI 120-U/C

#### PP-R/PP-R-GF/PP-R pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width graphite mass [mm]	Fire resistance class
Ø ≤ 20	2.8 – 10.0	2 x 25.0 x 10.0-20.0	EI 120 U/C
20 < Ø ≤ 32	4.4 – 16.0		
32 < Ø ≤ 50	6.9 – 18.3		
50 < Ø ≤ 63	8.6 – 18.3		
63 < Ø ≤ 75	10.3 – 18.3		
75 < Ø ≤ 90	12.3 – 18.3		
90 < Ø ≤ 110	15.1 – 18.3		

#### PVC-U pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth x width mass [mm]	Fire resistance class
Ø ≤ 32	1.5 – 8.1	2 x 25.0 x 10.0-20.0	EI 120-U/C
32 < Ø ≤ 50	1.6 – 8.1		
50 < Ø ≤ 75	1.8 – 8.1		
75 < Ø ≤ 110	2.0 – 8.0		
	8.1	EI 120-U/C	

Electrical and mixed penetration seals in flexible or rigid wall with thickness  $A \geq 100$  mm

Fig.2-5 Page 7-8

Installation penetration type	Diameter $\varnothing$ [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
			Flexible / Rigid wall
Small cable	$\varnothing \leq 21$	2 x 25.0	EI 120
Bundle of cables	$\varnothing_{\text{CABLE}} \leq 21$ $\varnothing_{\text{BUNDLE}} \leq 100$		
Single type F cable	-		
Single coaxial wireless cable type	$\varnothing \leq 22,23$		
Steel conduits without cables	$\varnothing_{\text{CONDUIT}} \leq 16$		

#### PVC (plastic) conduits with or without small cables

Conduit diameter [mm]	Conduit wall thickness [mm]	Service inside	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 16$	0.85 – 1.50	Empty	2 x 25.0	EI 120-U/U
		Small cable: $\varnothing_{\text{CABLE}} \leq \varnothing_{\text{CONDUIT}}^{1)}$		
		Cable bundle: $\varnothing_{\text{BUNDLE}} \leq \varnothing_{\text{CONDUIT}}^{1)}$ $\varnothing_{\text{CABLE}} \leq \varnothing_{\text{CONDUIT}}^{1)}$		
16 < $\varnothing \leq 25$	1.05 – 1.50	Empty		
		Small cable: $\varnothing_{\text{CABLE}} \leq 21$ mm		
		Cable bundle: $\varnothing_{\text{BUNDLE}} \leq \varnothing_{\text{CONDUIT}}^{1)}$ $\varnothing_{\text{CABLE}} \leq 21$ mm		
25 < $\varnothing \leq 37$	1.50	Empty		
		Small cable: $\varnothing_{\text{CABLE}} \leq 21$ mm		
		Cable bundle: $\varnothing_{\text{BUNDLE}} \leq \varnothing_{\text{CONDUIT}}^{1)}$ $\varnothing_{\text{CABLE}} \leq 21$ mm		

1) conduit inner diameter

#### Plastic conduits (AROT DVK) with or without small cables

Conduit diameter [mm]	Conduit wave height [mm]	Services inside	1(one side) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 100$	3.0	Empty	1 x 25.0	EI 90 / E 120-U/C
		$\varnothing_{\text{CABLE}} \leq 21$ mm		
		$\varnothing_{\text{BUNDLE}} \leq \varnothing_{\text{CONDUIT}}^{1)}$ $\varnothing_{\text{CABLE}} \leq 21$ mm		

1) conduit inner diameter



Mixed bundle penetration seals in flexible or rigid wall with thickness  $A \geq 100$  mm

Fig.6 Page 8

Mixed bundle consisting of:	Pipe configuration	Pipe diameter [mm] / Cable size	Pipe wall thickness [mm]	Insulation type	Insulation thickness [mm]	2(on both sides) x depth of mass [mm]	Fire resistance class
• max. 2 x COPPER pipe	C/U	$\varnothing \leq 12.7$	$\geq 0.8$	FEF	13	2 x 25.0	EI 120
• max. 1 x COPPER pipe	C/U	$\varnothing \leq 28.6$	$\geq 1.0$		13		
• max. 1 x PVC-U pipe	U/U	$\varnothing \leq 25.0$	1.0	-	-		
• max. 1 x CABLE	-	4 x 1.5mm <sup>2</sup>	-	-	-		

Mixed bundle consisting of:	Pipe configuration	Pipe diameter [mm] / Cable size	Pipe wall thickness [mm]	Insulation type	Insulation thickness [mm]	2(on both sides) x depth of mass [mm]	Fire resistance class
• max. 4 x COPPER pipe	C/U	$\varnothing \leq 12.7$	$\geq 0.8$	PE	9	2 x 25.0	EI 60
• max. 2 x COPPER pipe	C/U	$\varnothing \leq 22.3$	$\geq 1.0$		9		
• max. 2 x COPPER pipe	C/U	$\varnothing \leq 28.6$	$\geq 1.0$		13		
• max. 2 x PVC-U pipe	U/U	$\varnothing \leq 25.0$	1.0	-	-		
• max. 2 x CABLE	-	4 x 1.5mm <sup>2</sup>	-	-	-		

Combustible pipes penetration seals in rigid floor with thickness  $A \geq 150$  mm and density  $\rho \geq 550$  kg/m<sup>3</sup>

Fig.7 Page 8

#### PE-HD pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 32$	1.8 – 10.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
$32 < \varnothing \leq 50$	2.3 – 10.0		
$50 < \varnothing \leq 75$	3.0 – 10.0		
$75 < \varnothing \leq 90$	3.5 – 10.0		
$75 < \varnothing \leq 110$	4.2 – 10.0		

#### PE-RT/AL/PE-RT pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 20$	2.0 – 7.5	2 x 25.0 x 10.0-20.0	EI 120-U/C
$20 < \varnothing \leq 32$	3.1		
$32 < \varnothing \leq 40$	3.9		
$40 < \varnothing \leq 50$	4.8		
$50 < \varnothing \leq 63$	6.0		
$63 < \varnothing \leq 75$	7.5		

#### PE-X/AL/PE-X pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 20$	2.0 – 6.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
$20 < \varnothing \leq 32$	3.1		
$32 < \varnothing \leq 40$	3.9		
$40 < \varnothing \leq 50$	4.8		
$50 < \varnothing \leq 63$	6.0		

#### PE-Xa pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 20$	2.0 – 5.8	2 x 25.0 x 10.0-20.0	EI 120-U/C
$20 < \varnothing \leq 32$	3.0		
$32 < \varnothing \leq 40$	3.8		
$40 < \varnothing \leq 50$	4.6		
$50 < \varnothing \leq 63$	5.8		

#### PP pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 50$	1.8 – 18.3	2 x 25.0 x 10.0-20.0	EI 120-U/C
$50 < \varnothing \leq 75$	1.9 – 18.3		
$75 < \varnothing \leq 110$	2.7 – 18.3		

#### PP-R pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 20$	2.3 – 10.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
$20 < \varnothing \leq 32$	3.3 – 16.0		
$32 < \varnothing \leq 50$	4.8 – 18.3		
$50 < \varnothing \leq 63$	5.8 – 18.3		
$63 < \varnothing \leq 75$	6.8 – 18.3		
$75 < \varnothing \leq 90$	8.3 – 18.3		
$90 < \varnothing \leq 110$	10.0 – 18.3		

#### PP-R/AL/PP-R pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 20$	2.3 – 10.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
$20 < \varnothing \leq 32$	4.0 – 16.0		
$32 < \varnothing \leq 50$	6.7 – 18.3		
$50 < \varnothing \leq 63$	8.6 – 18.3		
$63 < \varnothing \leq 75$	10.3 – 18.3		
$75 < \varnothing \leq 90$	12.3 – 18.3		
$90 < \varnothing \leq 110$	15.1 – 18.3		

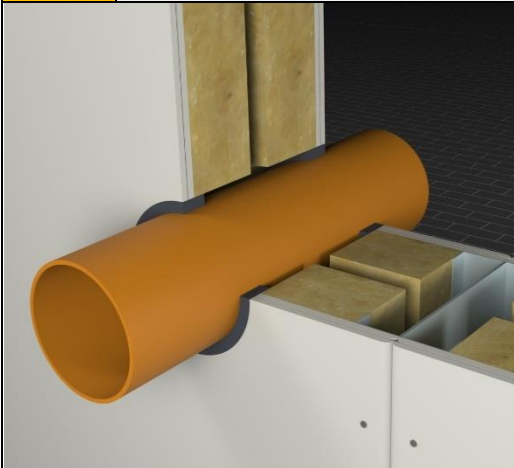
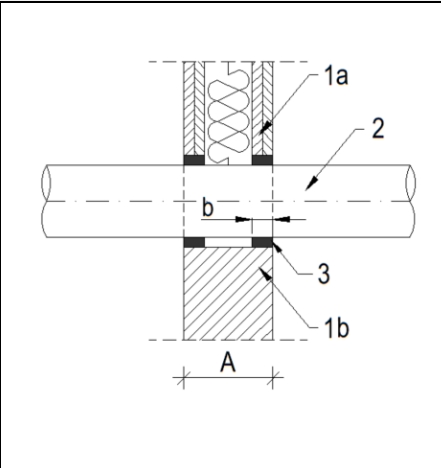

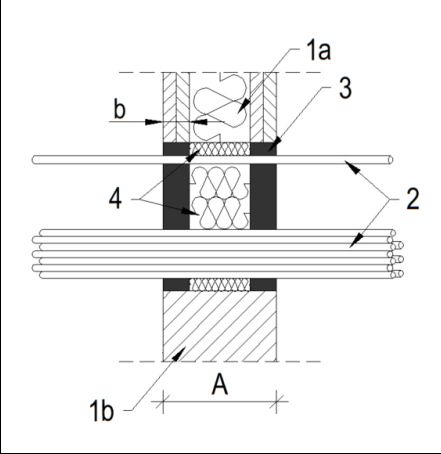
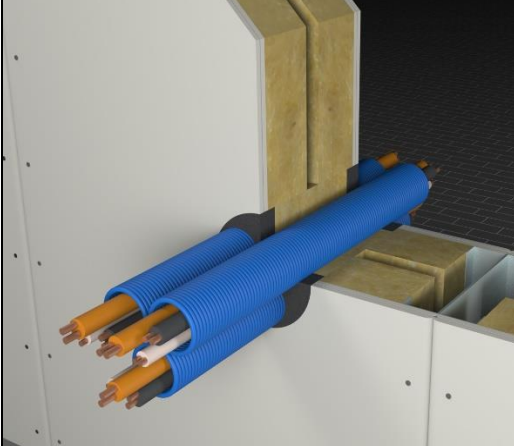
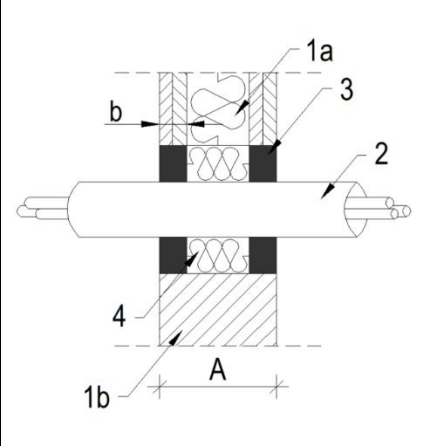
#### PP-R/PP-R-GF/PP-R pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 20$	2.8 – 10.0	2 x 25.0 x 10.0-20.0	EI 120-U/C
$20 < \varnothing \leq 32$	4.4 – 16.0		
$32 < \varnothing \leq 50$	6.9 – 18.3		
$50 < \varnothing \leq 63$	8.6 – 18.3		
$63 < \varnothing \leq 75$	10.3 – 18.3		
$75 < \varnothing \leq 90$	12.3 – 18.3		
$90 < \varnothing \leq 110$	15.1 – 18.3		

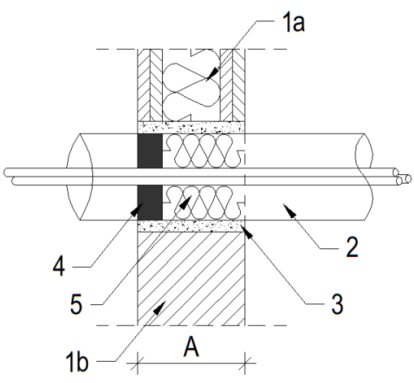

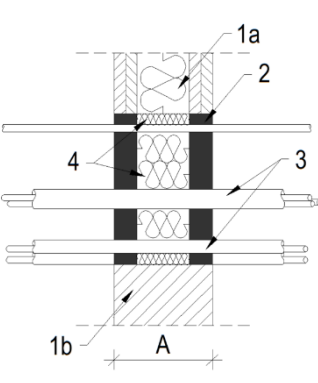
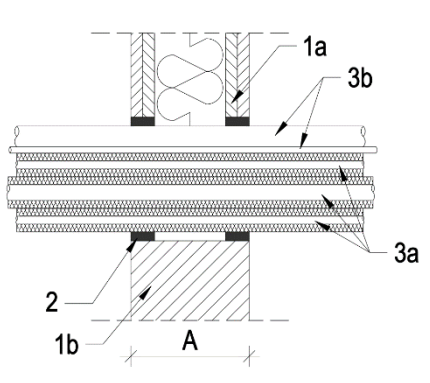
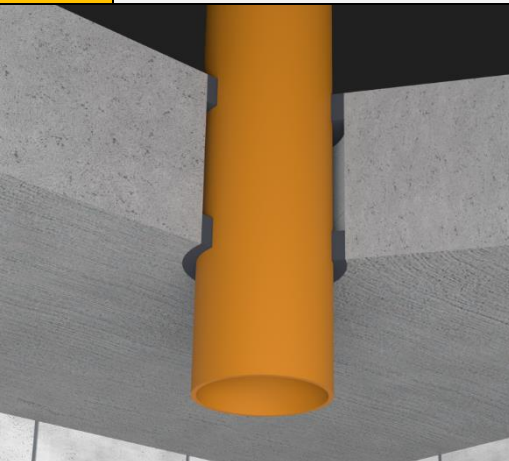
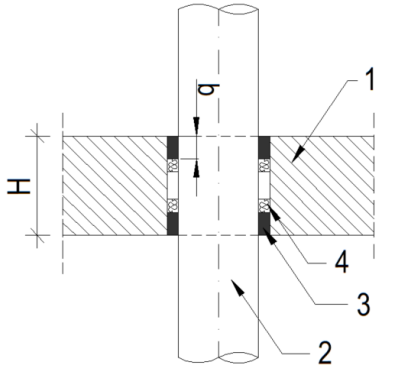
#### PVC-U pipes penetration

Pipe diameter [mm]	Pipe wall thickness [mm]	2(on both sides) x depth of the graphite mass [mm]	Fire resistance class
$\varnothing \leq 32$	1.5 – 8.1	2 x 25.0 x 10.0-20.0	EI 120-U/C
$32 < \varnothing \leq 50$	1.6 – 8.1		
$50 < \varnothing \leq 75$	1.8 – 8.1		
$75 < \varnothing \leq 110$	2.0 – 8.1		

## ➔ SOLUTION DETAILS

<p><b>Fig.1</b></p>	<p>Combustible pipes penetration seals with single row of band in flexible or rigid wall with thickness <math>A \geq 100</math> mm</p>	
		<p><b>1a</b> - flexible wall, thic kn. <math>A \geq 100</math> mm  <b>1b</b> - rigid wall, thickness <math>A \geq 100</math> mm  <b>2</b> - INTU FR GRAPHITE sealant with minimum depth <math>b \geq 25</math> mm  <b>3</b> - combustible pipe <math>\varnothing \leq 110</math> mm</p>
<p><b>Fig.2</b></p>	<p>Electrical and mixed penetration seals in flexible or rigid wall with thickness <math>A \geq 100</math> mm</p>	
		<p><b>1a</b> - flexible wall, thic kn. <math>A \geq 100</math> mm  <b>1b</b> - rigid wall, thickness <math>A \geq 100</math> mm  <b>2</b> - single cable <math>\varnothing_{\text{CABLE}} \leq 21</math> mm or cables bundle <math>\varnothing_{\text{BUNDLE}} \leq 100</math> mm, single type F cable, single coaxial wireless cable type <math>\varnothing \leq 22,23</math> mm  <b>3</b> - INTU FR GRAPHITE sealant with minimum depth <math>b \geq 25</math> mm  <b>4</b> - empty space filling with mineral wool with density <math>\geq 35</math> kg/m<sup>3</sup></p>
<p><b>Fig.3</b></p>	<p>PVC (plastic) conduits with or without small cables in flexible or rigid wall with thickness <math>A \geq 100</math> mm</p>	
		<p><b>1a</b> - flexible wall, thic kn. <math>A \geq 100</math> mm  <b>1b</b> - rigid wall, thickness <math>A \geq 100</math> mm  <b>2</b> - plastic protective pipe PVC <math>\varnothing_{\text{CONDUIT}} \leq 37</math> mm empty or with small cable <math>\varnothing_{\text{CABLE}} \leq 21</math> mm / bundle of cables <math>\varnothing_{\text{BUNDLE}} \leq \varnothing_{\text{CONDUIT}}</math>  <b>3</b> - INTU FR GRAPHITE sealant with minimum depth <math>b \geq 25</math> mm  <b>4</b> - empty space filling with mineral wool with density <math>\geq 35</math> kg/m<sup>3</sup></p>



<p><b>Fig.4</b></p>	<p>Plastic conduits (AROT DVK) with or without small cables in flexible or rigid wall with thickness <math>A \geq 100</math> mm</p> 	<p>1a - rigid wall, thickness <math>A \geq 100</math> mm          1b - flexible wall, thickness <math>A \geq 100</math> mm          2 - single cable <math>\varnothing_{\text{CABLE}} \leq 21</math> mm / bundle of cables in a protective pipe <math>\varnothing_{\text{BUNDLE}} \leq \varnothing_{\text{CONDUIT}}</math> / empty plastic conduit <math>\varnothing_{\text{CONDUIT}} \leq 100</math> mm          3 - cement mortar          4 - INTU FR GRAPHITE sealant minimum depth <math>\geq 25</math>mm, applied on one any side          5 - mineral wool with density <math>\geq 35</math> kg/m<sup>3</sup></p>
<p><b>Fig.5</b></p> 	<p>PVC (plastic) conduits with or without small cables</p> 	<p><b>Fig.6</b> Mixed bundle penetration seals</p>  <p>1a - flexible wall, <math>A \geq 100</math> mm          1b - rigid wall, <math>A \geq 100</math> mm          2 - INTU FR GRAPHITE sealant min. depth <math>\geq 25</math>mm, applied on both sides of the partition          3 - cable or bundle of cables in a protective pipe          4 - filling empty space with mineral wool with density <math>\geq 35</math> kg/m<sup>3</sup></p> <p>Air conditioning installation bundle:          3a - in FEF insulation: max. 3 x copper pipe, in PE insulation: max. 8 x copper pipe,          3b - with copper in FEF: 1 x PVC pipe and 1 x cable with copper in PE: 2 x PVC pipe and 2 x cable</p>
<p><b>Fig.7</b></p> 	<p>Combustible pipes penetration seals in rigid floor with thickness <math>A \geq 150</math> mm and density <math>\rho \geq 550</math> kg/m<sup>3</sup></p> 	<p>1 - rigid floor <math>H \geq 150</math> mm          2 - combustible pipe          3 - INTU FR GRAPHITE sealant with minimum depth <math>b \geq 25</math> mm, applied on both sides of the floor          4 - mineral wool (density <math>\geq 35</math> kg/m<sup>3</sup>), material depth <math>\geq 15</math> mm.</p>