



INSTYTUT TECHNIKI BUDOWLANEJ



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European Technical Assessment

**ETA-18/0593
of 30/09/2025**



General Part

Technical Assessment Body issuing the European Technical Assessment

Instytut Techniki Budowlanej

Trade name of the construction product

INTU FR WRAP
INTU FR WRAP L

Product family to which the construction product belongs

Fire Stopping and Fire Sealing Products.
Penetration Seals

Manufacturer

ALFASEAL GROUP Sp. z o.o.
ul. Kineskopowa 1
PL 05-500 Piaseczno, Poland

Manufacturing plant

Plant MPA 1

This European Technical Assessment contains

123 pages including 2 Annexes which form an integral part of this Assessment

This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of

European Assessment Document (EAD)
350454-00-1104 "Fire Stopping and Fire Sealing Products. Penetration Seals"

This version replaces

ETA-18/0593 issued on 31/12/2018

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Specific Part

1 Technical description of the product

INTU FR WRAP and INTU FR WRAP L are intumescent, graphite based, wrap pipe closure devices. They are used to form penetration seals where combustible pipes (with insulation or not) or insulated metal pipes (single or in bundles) penetrate walls and floors.

INTU FR WRAP is supplied in assembled form. It includes from 1 to 8 layers of an intumescent liner, with thickness of 2,0 mm, inserted into an outer layer made of PE foil. Width of the wrap (liner) is 60 or 100 mm.

INTU FR WRAP L is supplied in roll form tape in width of 60 or 100 mm and thickness of 2,0 mm. Length of rolls is up to 50 m. It can be supplied with self-adhesive layer.

INTU FR WRAP and INTU FR WRAP L shall be wrapped around the pipe and may be cut to a required length (equal or greater than external circumference of the pipe), if necessary. They shall be pushed into the aperture in the separating element.

Auxiliary products used with INTU FR WRAP and INTU FR WRAP L are:

- flexible elastomeric foam (FEF) Armaflex insulation, produced by Armacell Poland according to EN 14304, with reaction to fire class D_L-s3,d0 according to EN 13501-1,
- flexible elastomeric foam (FEF) Kaiflex ST insulation, produced by Kaimann, in accordance with EN 14304, with reaction to fire class B_L-s2,d0 according to EN 13501-1,
- polyethylene foam PE Tubolit insulation, produced by Armacell, according to EN 14313, with reaction to fire class E according to EN 13501-1,
- polyethylene foam PE Tubolit DG insulation, produced by Armacell, according to EN 14313, with reaction to fire class E_L according to EN 13501-1,
- polyethylene foam PE Tubolit DG PLUS insulation, produced by Armacell, according to EN 14313, with reaction to fire class B_L-s1,d0 according to EN 13501-1,
- mineral wool Paroc Hvac Lamella Mat AluCoat produced by Paroc Group, according to EN 14303, with nominal density of 35 kg/m³ and reaction to fire class A1 according to EN 13501-1,
- INTU FR MASTIC according to ETA-19/0038,
- INTU FR BOARD A according to ETA-19/0037,
- loose mineral wool produced by Paroc Group, compressed to the density of $\rho = 100 \text{ kg/m}^3$ and reaction to fire class A1 according to EN 13501-1,
- INTU FR COAT A according to ETA-19/0037.

2 Specification of the intended use in accordance with the applicable European Assessment Document (EAD)

2.1 Intended use

The intended use of INTU FR WRAP and INTU FR WRAP L is to reinstate the fire resistance performance of flexible wall, rigid wall or rigid floor constructions, where they are penetrated by combustible pipes (with insulation or not), insulated metal pipes, single or in bundles, with heating cable or without, cables or cables in conduits.

The specific elements of construction that INTU FR WRAP and INTU FR WRAP L may be used to provide a penetration seal in, are as follows:

- Rigid walls:** The wall must have a minimum thickness of 100, 125 or 150 mm (for details see Annex B) and comprise concrete, reinforced concrete, aerated concrete, ceramic brick, cavity brick or checker brick, with a minimum density of 450 kg/m³ in case of penetration seals given in Tables B1.1 – B1.7, B2.1, B6.1 – B6.3, B12.1 – B12.4, B13.1, B14.1 – B14.4, B15.1 – B15.2, B16.1 – B16.2, B17.1, B18.1, B19.1 – B19.2 and B20.1 – B20.2 or 600 kg/m³ in case of penetration seals given in Tables B3.1, B4.1 – B4.3, B5.1 – B5.5, B7.1 – B7.3, B8.1, B9.1, B10.1 – B10.2, B11.1 – B11.4, B21.1 and B22.1 in Annex B.
- Flexible walls:** The wall must have a minimum thickness of 100 mm and comprise timber or steel studs lined on both faces with minimum two layers (with overall board layer thickness on one side equal to or greater than 25 mm) of 'Type F' or 'Type DF' gypsum plasterboards according to EN 520 or calcium silicate boards which are CE marked based on an ETA for the application as lining of flexible walls. 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.
- Rigid floors:** The floor must have a minimum thickness of 150 mm and comprise concrete, reinforced concrete, aerated concrete, with a minimum density of 550 kg/m³ in case of penetration seals given in Tables B23.1, B24.1 and B28.2 or 1700 kg/m³ in case of penetration seals given in Tables B23.2 – B23.5, B25.1 – B25.3, B26.1 – B26.3, B27.1, B28.1, B28.3 – B28.4, B29.1 – B29.3, B30.1, B31.1 – B31.2 and B32.1 – B32.6.

The supporting construction shall be classified in accordance with EN 13501-2 for the required fire resistance period (equal to or greater than specified in Annex B).

INTU FR WRAP and INTU FR WRAP L may be used to provide a penetration seal with specific combustible and metal pipes (according to Annex B).

Details of penetration seals are provided in Annexes B. Additional provisions are provided in Annex A.

The provisions made in this European Technical Assessment are based on an assumed working life of the products of 25 years, when installed in the works, provided that the penetration seal is subject to appropriate installation, in accordance with the manufacturer's recommendations. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

2.2 Use category

Type Z₂: intended for use in internal conditions with humidity lower than 85% RH, excluding temperatures below 0°C, without exposure to rain or UV.

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

3.1 Performance of the product

3.1.1 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	E

Essential characteristic	Performance
Resistance to fire	Annex B

3.1.2 Hygiene, health and the environment (BWR 3)

No performance assessed.

3.1.3 Safety and accessibility in use (BWR 4)

Essential characteristic	Performance
Mechanical resistance and stability	No performance assessed
Resistance to impact / movement	No performance assessed
Adhesion	No performance assessed
Durability	Use category: Type Z ₂

3.1.4 Protection against noise (BWR 5)

No performance assessed.

3.1.5 Energy economy and heat retention (BWR 6)

No performance assessed.

3.2 Methods used for the assessment

The assessment has been made in accordance with EAD 350454-00-1104.

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

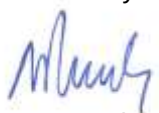
According to the Decision 1999/454/EC of the European Commission, as amended by Decision 2001/596/EC of the European Commission, the system 1 of assessment and verification of constancy of performance applies (see Annex V to regulation (EU) No 305/2011).

5 Technical details necessary for the implementation of the AVCP system, as provided in the applicable European Assessment Document (EAD)

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited in Instytut Techniki Budowlanej.

For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 30/09/2025 by Instytut Techniki Budowlanej


 Anna Panek, MSc
 Deputy Director of ITB

Additional provisions

- INTU FR WRAP and INTU FR WRAP L are placed, depending on the intended use, either on the both sides of the wall (two rows of wrap), in the centre of the wall thickness (single row of wrap), in the distance of max. 10 mm from the bottom of the floor (single row of wrap) or on the bottom side of the floor in case of use INTU FR BOARD A, in accordance with Annex B. In penetration seals in walls with two rows of wrap, wrap shall be lined up with the surface of the wall.
- The gap between INTU FR WRAP or INTU FR WRAP L and the opening in separating element shall be filled with (according to Annex B):
 - cement mortar,
 - INTU FR MASTIC,
 - INTU FR MASTIC and mineral wool (MW),
 - INTU FR BOARD A.
- The mortar shall be put:
 - to the depth of at least 25 mm from the surface of the wall, on both sides of the wall – in case of flexible walls,
 - in the entire depth of the wall or floor – in case of rigid walls and rigid floors.
- INTU FR MASTIC shall be put:
 - to the depth of at least 25 mm from the surface of the wall, on both sides of the wall – in case of flexible walls,
 - to the depth of at least 15 mm from the surface of the wall, on both sides of the wall – in case of rigid walls,
 - to the depth of 10 mm from the surface of the floor – in case of rigid floor with use of INTU FR BOARD A mineral wool plates.
- The minimum distance between the penetration seals (between adjacent wraps) in supporting construction are presented in Fig. A1 and shall be:
 - $a_1=0$ mm:
 - for plastic pipe diameter of: $D \leq 110$ mm penetration seals in rigid walls thickness of min. 150 mm in case of penetration seals given in Fig. B1,
 - for metal pipe diameter of $D \leq 219.1$ mm, with flexible elastomeric foam (FEF) insulation, in accordance with PN-EN 14304, with reaction to fire class B_L-s2, d0 and additional Paroc Hvac Lamella Mat AluCoat insulation, in rigid wall thickness of min. 150 mm in case of penetration seals given in Fig. B6d,
 - for metal pipe diameter of $D \leq 22.23$ mm, with flexible elastomeric foam (FEF) insulation, in accordance with PN-EN 14304, with reaction to fire class B_L-s2, d0 with or without additional Paroc Hvac Lamella Mat AluCoat insulation, in case of penetration seals given in Fig. B16,
 - for metal pipe diameter of $D \leq 22.23$ mm, with polyethylene foam (PE) insulation, in accordance with PN-EN 14313, with reaction to fire class B_L-s1, d0, in case of penetration seals given in Fig. B29,
 - for metal pipe in case of penetration seals given in Fig. B17,
 - for mixed bundles in case of penetration seals given in Fig. B10b, B11b, B19c, B19d, B20c, B20d, B31b and B32b.
 - $a_1=100$ mm in case of the other penetration seals.

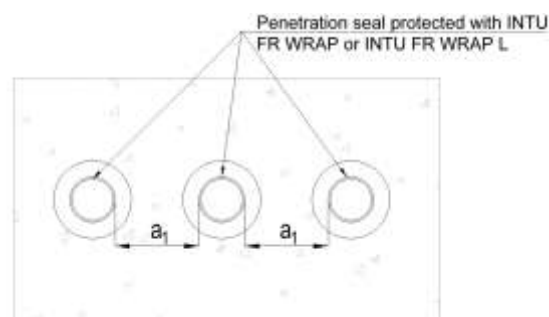


Fig. A1. Distance between penetration seals

INTU FR WRAP and INTU FR WRAP L	Annex A of European Technical Assessment ETA-18/0593
Additional provisions	

- In rigid walls thickness of min. 150 mm plastic pipes diameter of: $D \leq 110$ mm, can be placed in one penetration (in 0 mm or greater distance) together with metal pipe with flexible elastomeric foam (FEF) insulation, in accordance with PN-EN 14304, with reaction to fire class B_s-s2, d0, diameter of $D \leq 168.3$ mm in accordance with Fig. B6c.
- In rigid walls thickness of min. 150 mm metal pipe with flexible elastomeric foam (FEF) insulation, in accordance with PN-EN 14304, with reaction to fire class B_s-s2, d0, diameter of $D \leq 168.3$ mm can be placed in one penetration (in 0 mm or greater distance) together with plastic pipe diameter of: $D \leq 110$ mm, in accordance with Fig. B6c.
- Services in metal pipes are placed in angle between 45° and 90° to the supporting construction. The other services are placed in angle 90° to the supporting construction.
- Classifications given in Annex B are valid for plastic pipes:
 - PVC-U according to EN 1329-1, EN 1453-1, EN ISO 1452-2 or EN ISO 15493,
 - PVC-C according to EN 1566-1, EN ISO 15493 or EN ISO 15877-2,
 - PE-HD according to EN 1519-1 or EN 12666-1,
 - ABS according to EN 1455-1 or EN ISO 15493,
 - SAN + PVC according to ISO 19220,
 - PE according to EN 12201-2, EN 1519-1, EN 12666-1 or EN ISO 15494,
 - PE-RT according to EN ISO 21003-1,
 - PE-X according to EN ISO 21003-1 or 15875-2,
 - PE-Xa according to EN ISO 21003-1,
 - PP according to EN 1451-1, DIN 8077, DIN 8078, DIN 16962, EN 15874-2 or EN ISO 15494,
 - PP-HT according to EN 1451-1 or EN 14758-1,
 - PP-M (Magnaplast Ultra dB) according to EN 1451-1 or EN 14758-1,
 - PP-R according to EN ISO 15874-2, DIN 8077 or DIN 8078, according to tables in Annex B.
- Classifications given in Annex B are valid for MLC pipes:
 - PE-X/AL/PE-X according to EN ISO 21003-2,
 - PE-RT/AL/PE-RT according to EN ISO 21003-2,
 - PP-R/AL/PP-R according to EN ISO 15874-1, EN ISO 15874-2 or EN ISO 23391-2, according to tables in Annex B.
- Classifications given in Annex B are valid for composite pipes:
 - PP-R/PP-R-GF/PP-R according to EN ISO 15874-1 or EN ISO 15874-2, according to tables in Annex B.
- Classifications given in Annex B for steel and copper pipes are also valid for other metal pipes with:
 - thermal conductivity lower than respectively steel or copper, and
 - melting point at least equal to respectively steel or copper, and greater than:
 - 739°C for the fire resistance class EI 15 and E 15,
 - 78 °C for the fire resistance class EI 20 and E 20,
 - 84 °C for the fire resistance class EI 30 and E 30,
 - 902°C for the fire resistance class EI 45 and E 45,
 - 945°C for the fire resistance class EI 60 and E 60,
 - 1006°C for the fire resistance class EI 90 and E 90,
 - 1049°C for the fire resistance class EI 120 and E 120,
 - 1110°C for the fire resistance class EI 180 and E 180,
 - 1153°C for the fire resistance class EI 240 and E 240.

INTU FR WRAP and INTU FR WRAP L

Additional provisions

Annex A
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- Classifications given in Annex B for cables are valid for:
 - small cables that are currently and commonly used in building practice in Europe, with maximum diameter of 21 mm, including optical fibre cables, except tied bundles, waveguides and non-sheathed cables (wires),
 - YDY 4 x 1,5 mm² according to EN 50525-1,
 - cable A1: E-YY-J 5x1,5 RE according to HD 603.3A,
 - cable A1: NYY-J 5x1,5 RE according to HD 603.3M,
 - cable A1: VV 5x1,5 according to HD 603.3G,
 - cable F: A-2Y(L)2Y 20X2X0,6 according to DIN VDE 0816,
 - tied cable bundles with diameter of less than or equal to $\varnothing_{\text{bundle}}$ given in the appropriate annex, made of cables commonly used in building practice in Europe to a maximum diameter of 21 mm, including optical fibre cables, except waveguides and non-sheathed cables (wires),
 - heating cable type DEVIPIEGUARD of DEVI with diameter equal or less than DEVIPIEGUARD / 230V 25W cable, in accordance with tables in Annex B.
- Classifications given in Annex B are valid for specific conduits:
 - AROT DVK produced by Wavin, according to tables in Annex B.
- Classifications given in Annex B for mixed bundles consisting of are valid for:
 - copper pipes or metal pipes in FEF (Kaiflex ST) or PE (Tubolit, Tubolit DG PLUS) insulation with dimensions in accordance with Annex B,
 - plastic PVC-U pipes (or pipes in accordance with Table B68) with dimensions in accordance with Annex B,
 - cables 4 x 1,5 mm²,
 - cables A1.
- Pipes shall be supported at maximum 400 mm away from both faces of the wall constructions and from the upper face of floor constructions.
- Classifications given in Annex B for insulated pipes are valid for pipes with continued insulation made of Kaiflex ST or Armaflex flexible elastomeric foam (FEF) or Tubolit, Tubolit DG or Tubolit DG Plus (PE) insulation and for plastic / composite / MLC pipes with continued insulation made of Paroc Hvac Lamella Mat AluCoat mineral wool (for details see clause 1 of ETA) and does not cover locally insulated or non-insulated pipes. The thickness of insulation shall remain in accordance with ETA provisions.
- Classifications given in Annex B are valid for pipes with local sustained Tubolit DG Plus (PE) insulation concerns locally insulated pipes in case LS (local sustained) and does not cover locally insulated pipes in case LI (local interrupted) or non-insulated pipes. The length of insulation can be increased but may not be reduced. The thickness of insulation shall remain in accordance with ETA provisions.
- Classifications given in Annex B are valid for metal pipes with local sustained mineral wool Paroc Hvac Lamella Mat AluCoat insulation concerns locally insulated pipes in case LS (local sustained) and does not cover locally insulated pipes in case LI (local interrupted) or non-insulated pipes. The length of insulation can be increased but may not be reduced. The thickness of insulation shall remain in accordance with ETA provisions.
- Classifications given in Annex B are valid for metal pipes with local interrupted mineral wool Paroc Hvac Lamella Mat AluCoat insulation concerns locally insulated pipes in case LI (local interrupted) and does not cover locally insulated pipes in case LS (local sustained) or non-insulated pipes. The length of insulation can be increased but may not be reduced. The thickness of insulation shall remain in accordance with ETA provisions.
- Classification given in Annex B are valid for mixed bundles with continued insulation made of Kaiflex ST or Armaflex flexible elastomeric foam (FEF) or Tubolit or Tubolit DG Plus (PE) insulation concerns continuously insulated pipes and does not cover local insulated nor non-insulated pipes. The thickness of insulation shall remain in accordance with ETA provisions.

INTU FR WRAP and INTU FR WRAP L

Additional provisions

Annex A
of European
Technical Assessment
ETA-18/0593

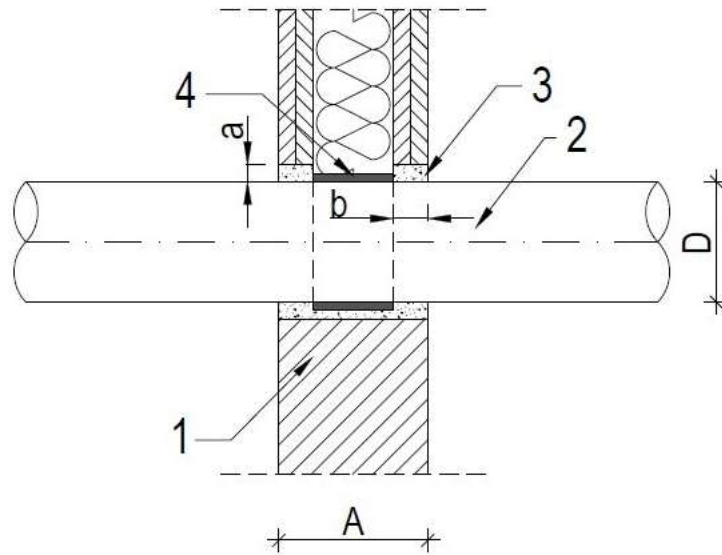
- In case of penetration seals made of single row of INTU FR WRAP or INTU FR WRAP L in walls the supporting construction thickness may only be increased in practice above the value given as minimum in Annex B if the seal length (width of the wrap) is increased so that the distance from the surface of the wall remain maximum the same on both sides as it is in case of minimum wall supporting construction thickness.

INTU FR WRAP and INTU FR WRAP L

Additional provisions

Annex A
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Fig. B1. Plastic pipe, MLC pipe and composite pipe (without insulation) penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.



1. Flexible or rigid wall supporting construction thickness of: $A \geq 100$ mm.
2. Plastic pipe, composite pipe and MLC pipe, diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 110$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic / MLC / Composite pipes (without insulation) penetration seals in flexible or rigid wall

Annex B1
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Table B1.1. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 32$	2.0 – 6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$32 < D \leq 50$	2.6 – 6.7	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$50 < D \leq 63$	2.9 – 6.7	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$63 < D \leq 75$	3.3 – 6.7	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$75 < D \leq 90$	3.5 – 4.1	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
		4.2 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$90 < D \leq 110$	4.2	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
		4.2 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$110 < D \leq 125$	4.8 – 9.5	-	1 x 100.0 x 6.0	EI 120-U/C EI 120-C/C
		9.5	-	1 x 100.0 x 10.0	EI 180-U/C EI 180-C/C
		9.6 – 10.0	-	1 x 100.0 x 6.0	EI 120-U/C EI 120-C/C
	$125 < D \leq 160$	6.2 – 9.4	-	1 x 100.0 x 10.0	EI 120-U/C EI 120-C/C
		9.5	-	1 x 100.0 x 10.0	EI 180-U/C EI 180-C/C
		9.6 – 10.0	-	1 x 100.0 x 10.0	EI 120-U/C EI 120-C/C
	$160 < D \leq 200$	7.7	-	1 x 100.0 x 16.0	EI 90-U/C EI 90-C/C
		7.8 – 11.9	-	1 x 100.0 x 16.0	EI 60-U/C EI 60-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in rigid wall

Annex B2
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Table B1.1, cont. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT	$D \leq 20$	2.0 – 7.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 25$	2.5	-	1 x 60.0 x 2.0	
	$25 < D \leq 40$	4.0	-	1 x 60.0 x 2.0	
	$40 < D \leq 63$	6.3	-	1 x 60.0 x 2.0	
	$63 < D \leq 75$	7.5	-	1 x 60.0 x 2.0	
PE-X	$D \leq 20$	2.0	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		2.1 – 7.5	-	1 x 60.0 x 2.0	EI 180 / E 240-U/C EI 180 / E 240-C/C
	$20 < D \leq 25$	2.5	-	1 x 60.0 x 2.0	EI 180 / E 240-U/C EI 180 / E 240-C/C
	$25 < D \leq 40$	4.0	-	1 x 60.0 x 2.0	
	$40 < D \leq 63$	6.3	-	1 x 60.0 x 2.0	
	$63 < D \leq 75$	7.5	-	1 x 60.0 x 2.0	
PE-Xa	$D \leq 20$	2.0 – 5.8	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 32$	3.0	-	1 x 60.0 x 2.0	
	$32 < D \leq 40$	3.7	-	1 x 60.0 x 2.0	
	$40 < D \leq 50$	4.6	-	1 x 60.0 x 2.0	
	$50 < D \leq 63$	5.8	-	1 x 60.0 x 2.0	
PP-R	$D \leq 20$	2.3 – 3.3	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		3.4	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 25$	3.2 – 4.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$25 < D \leq 32$	3.8 – 5.3	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		5.4	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$32 < D \leq 40$	4.4 – 6.6	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.7	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in rigid wall

Annex B3
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Table B1.1, cont. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R	40 < D ≤ 50	5.2 – 8.2	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		8.3	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	50 < D ≤ 63	6.1 – 10.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		10.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	63 < D ≤ 75	6.8 – 12.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	63 < D ≤ 75	12.6 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	75 < D ≤ 90	8.2 – 18.3	-	1 x 60.0 x 4.0	
	90 < D ≤ 110	10.0 – 18.3	-	1 x 60.0 x 4.0	
	90 < D ≤ 110	10.0 – 18.3	-	1 x 60.0 x 4.0	
PP	D ≤ 50	1.8 – 12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	50 < D ≤ 75	1.9 – 12.4	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		12.6 – 18.4	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
	75 < D ≤ 90	2.3 – 18.3	-	1 x 60.0 x 2.0	EI 120 / E 180-U/C EI 120 / E 180-C/C
		2.3 – 18.3	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
		18.4	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
	90 < D ≤ 110	2.7 – 18.3	-	1 x 60.0 x 2.0	EI 120 / E 180-U/C EI 120 / E 180-C/C
		2.7 – 18.3	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
		18.4	-	1 x 60.0 x 2.0	
	110 < D ≤ 125	3.8 – 16.7	-	1 x 100.0 x 6.0	EI 60-U/C EI 60-C/C
	125 < D ≤ 160	5.5 – 12.5	-	1 x 100.0 x 10.0	
	160 < D ≤ 170	6.1 – 11.3	-	1 x 100.0 x 12.0	
	170 < D ≤ 185	6.9 – 9.5	-	1 x 100.0 x 14.0	
	160 < D ≤ 200	7.7	-	1 x 100.0 x 16.0	
	160 < D ≤ 200	7.7	-	1 x 100.0 x 16.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in rigid wall

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Table B1.1, cont. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PVC-U/ PVC-C	$D \leq 25$	1.5 – 1.7	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		1.8 – 3.6	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$D \leq 25$	3.7 – 4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
	$25 < D \leq 50$	1.8 – 3.6	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		3.7 – 4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 8.1	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$50 < D \leq 75$	1.9 – 3.5	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		3.6	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		3.7 – 4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 8.1	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$75 < D \leq 110$	2.2 – 3.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		3.6	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
			-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
		3.7 – 4.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
			-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
		4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 8.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
			-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (without insulation) penetration seals in rigid wall

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Table B1.1, cont. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PVC-U/ PVC-C	$110 < D \leq 125$	3.4 – 6.1	-	1 x 100.0 x 8.0	EI 120-U/C EI 120-C/C
		6.2	-	1 x 100.0 x 8.0	EI 120-U/C EI 120-C/C
			-	1 x 100.0 x 10.0	EI 240-U/C EI 240-C/C
		6.3 – 9.5	-	1 x 100.0 x 6.0	EI 180-U/C EI 180-C/C
	$125 < D \leq 160$	6.2	-	1 x 100.0 x 10.0	EI 240-U/C EI 240-C/C
		6.3 – 9.5	-	1 x 100.0 x 10.0	EI 180-U/C EI 180-C/C
	$160 < D \leq 200$	5.9	-	1 x 100.0 x 16.0	EI 180-U/C EI 180-C/C
		6.0 – 7.7	-	1 x 100.0 x 16.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (without insulation) penetration seals in rigid wall

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Table B1.2. Resistance to fire classification of MLC pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/AL/ PE-RT	$D \leq 20$	2.0	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 25$	2.5	-	1 x 60.0 x 2.0	
	$25 < D \leq 40$	4.0	-	1 x 60.0 x 2.0	
	$40 < D \leq 63$	6.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.3	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 75$	7.5	-	1 x 60.0 x 2.0	
PE-X/AL/ PE-X	$D \leq 20$	2.0 – 7.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 25$	2.5	-	1 x 60.0 x 2.0	
	$25 < D \leq 32$	3.0	-	1 x 60.0 x 2.0	
	$32 < D \leq 40$	4.0	-	1 x 60.0 x 2.0	
	$40 < D \leq 50$	5.5	-	1 x 60.0 x 2.0	
	$50 < D \leq 63$	6.0	-	1 x 60.0 x 2.0	
PP-R/AL/ PP-R	$D \leq 20$	3.2 – 3.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 32$	4.7 – 5.4	-	1 x 60.0 x 2.0	
	$32 < D \leq 40$	5.7 – 6.7	-	1 x 60.0 x 2.0	
	$40 < D \leq 50$	6.9 – 8.3	-	1 x 60.0 x 2.0	
	$50 < D \leq 63$	8.5 – 10.5	-	1 x 60.0 x 2.0	
	$63 < D \leq 75$	10.0 – 12.5	-	1 x 60.0 x 2.0	
	$75 < D \leq 90$	12.3 – 15.0	-	1 x 60.0 x 4.0	
	$90 < D \leq 110$	15.1 – 18.2	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
		18.3	-	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
MLC pipes (without insulation) penetration seals in rigid wall

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Table B1.3. Resistance to fire classification of composite pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/ PP-R-GF/ PP-R	$D \leq 20$	2.8 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 32$	3.7 – 4.3	-	1 x 60.0 x 4.0	
		4.4 – 5.4	-	1 x 60.0 x 2.0	
	$32 < D \leq 40$	4.4 – 5.4	-	1 x 60.0 x 4.0	
		5.5 – 6.7	-	1 x 60.0 x 2.0	
	$20 < D \leq 50$	5.2 – 6.8	-	1 x 60.0 x 4.0	
		6.9 – 12.5	-	1 x 60.0 x 2.0	
		12.6 – 18.2	-	1 x 60.0 x 4.0	
		18.3	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
	$50 < D \leq 63$	6.3 – 8.6	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		8.7 – 12.5	-	1 x 60.0 x 2.0	
		12.6 – 18.2	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
		18.3	-	1 x 60.0 x 4.0	
	$63 < D \leq 75$	7.2 – 10.2	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		10.3 – 12.5	-	1 x 60.0 x 2.0	
		12.6 – 18.2	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
		18.3	-	1 x 60.0 x 4.0	
	$75 < D \leq 90$	8.4 – 18.2	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.3	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C
	$90 < D \leq 110$	10.0 – 18.2	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.3	-	1 x 60.0 x 4.0	EI 180-U/C EI 180-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Composite pipes (without insulation) penetration seals in rigid wall

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Table B1.4. Resistance to fire classification of bundle of max. 3 plastic pipes (max. 2 x PE-HD, $D \leq 32$ mm x $t = 2.0$ mm + max. 1 x PVC-U, $D \leq 50$ mm x $t = 1.8$ mm) penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, length of 60.0 mm and thickness of 2.0 mm (separate tape/wrap for each pipe or one tape/wrap for whole bundle) in accordance with Annex A and Fig. B1:

Fire resistance class:

EI 240-U/C

EI 240-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes bundle (without insulation) penetration seals in rigid wall

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Table B1.5. Resistance to fire classification of MLC pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 100$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/AL/PE-RT	$D \leq 20$	2.0	-	$1 \times 60.0 \times 2.0$	EI 120-U/C EI 120-C/C
		2.1 – 7.5	-	$1 \times 60.0 \times 2.0$	EI 45 / E 90-U/C EI 45 / E 90-C/C
	$20 < D \leq 25$	2.5	-	$1 \times 60.0 \times 2.0$	
	$25 < D \leq 40$	4.0	-	$1 \times 60.0 \times 2.0$	
	$40 < D \leq 63$	6.3	-	$1 \times 60.0 \times 2.0$	
	$63 < D \leq 75$	7.5	-	$1 \times 60.0 \times 2.0$	
PE-X/AL/PE-X	$D \leq 20$	2.0	-	$1 \times 60.0 \times 2.0$	EI 120-U/C EI 120-C/C
		2.1 – 7.5	-	$1 \times 60.0 \times 2.0$	EI 45 / E 120-U/C EI 45 / E 120-C/C
	$20 < D \leq 25$	2.5	-	$1 \times 60.0 \times 2.0$	
	$25 < D \leq 40$	4.0	-	$1 \times 60.0 \times 2.0$	
	$40 < D \leq 63$	6.3	-	$1 \times 60.0 \times 2.0$	
	$63 < D \leq 75$	7.5	-	$1 \times 60.0 \times 2.0$	
PP-R/AL/PP-R	$D \leq 20$	3.4	-	$1 \times 60.0 \times 2.0$	EI 120-U/C EI 120-C/C
		3.5 – 10.0	-	$1 \times 60.0 \times 4.0$	
	$20 < D \leq 50$	8.3	-	$1 \times 60.0 \times 4.0$	
	$50 < D \leq 63$	10.5	-	$1 \times 60.0 \times 4.0$	
	$63 < D \leq 75$	12.5	-	$1 \times 60.0 \times 4.0$	
	$75 < D \leq 90$	15.0	-	$1 \times 60.0 \times 4.0$	
	$90 < D \leq 110$	18.3	-	$1 \times 60.0 \times 4.0$	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
MLC pipes (without insulation) penetration seals in flexible or rigid wall

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Table B1.6. Resistance to fire classification of plastic pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 100$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-M (Magnaplast Ultra dB)	$D \leq 110$	3.4	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in flexible or rigid wall

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Table B1.7. Resistance to fire classification of composite pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 100$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B1:

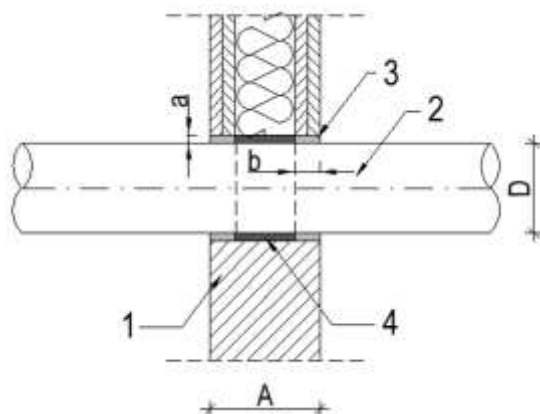
Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/PP-R-GF/PP-R	$D \leq 20$	2.8 – 3.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 32$	4.1 – 4.8	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		4.9 – 5.4	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$32 < D \leq 40$	5.0 – 6.1	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		6.2 – 6.7	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$40 < D \leq 50$	6.0 – 7.9	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		8.0 – 8.4	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$50 < D \leq 75$	8.7 – 12.2	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		12.3 – 12.5	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$75 < D \leq 90$	10.3 – 14.8	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		14.9 – 15.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$90 < D \leq 110$	12.5 – 18.2	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Composite pipes (without insulation) penetration seals in flexible or rigid wall

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Fig. B2. Plastic pipe (without insulation) penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.



1. Flexible or rigid wall supporting construction thickness of: $A \geq 100 \text{ mm}$.
2. Plastic pipe, diameter of "D" and pipe wall thickness "t".
3. Gap filler (area between the wrap / tape and supporting construction, ring with max. width: $a = 25 \text{ mm}$ width, sealant minimum depth: $b = 25 \text{ mm}$, on both sides of the wall) – INTU FR MASTIC.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic pipes (without insulation) penetration seals in flexible or rigid wall

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Table B2.1. Resistance to fire classification of plastic pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 100$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B2:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 32$	2.0	-	1 x 60.0 x 2.0	EI 60-U/C
		2.1 – 9.9	-	1 x 60.0 x 4.0	EI 60-C/C
		10.0	-	1 x 60.0 x 4.0	EI 90-U/C EI 90-C/C
	$32 < D \leq 50$	2.5 – 9.9	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		10.0	-	1 x 60.0 x 4.0	EI 90-U/C EI 90-C/C
	$50 < D \leq 75$	3.2 – 9.9	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		10.0	-	1 x 60.0 x 4.0	EI 90-U/C EI 90-C/C
	$75 < D \leq 110$	4.2 – 9.9	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		10.0	-	1 x 60.0 x 4.0	EI 90-U/C EI 90-C/C
PP	$D \leq 32$	1.8	-	1 x 60.0 x 2.0	EI 90 / E 120-U/C EI 90 / E 120-C/C
		1.9 – 2.7	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		2.8 – 16.0	-	1 x 60.0 x 4.0	EI 45-U/C EI 45-C/C
	$32 < D \leq 50$	2.0 – 2.7	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		2.8 – 18.3	-	1 x 60.0 x 4.0	EI 45-U/C EI 45-C/C
	$50 < D \leq 75$	2.3 – 2.7	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		2.8 – 18.3	-	1 x 60.0 x 4.0	EI 45-U/C EI 45-C/C
	$75 < D \leq 110$	2.7	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		2.8 – 18.3	-	1 x 60.0 x 4.0	EI 45-U/C EI 45-C/C
PVC-U/ PVC-C	$D \leq 32$	1.8	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-U/C
		1.9 – 4.2	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
	$32 < D \leq 50$	1.9 – 4.1	-	1 x 60.0 x 4.0	EI 45-U/C EI 45-C/C
		4.2	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
	$50 < D \leq 75$	2.0 – 4.1	-	1 x 60.0 x 4.0	EI 45-U/C EI 45-C/C
		4.2	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
	$75 < D \leq 110$	2.2 – 4.1	-	1 x 60.0 x 4.0	EI 45-U/C EI 45-C/C
		4.2	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C

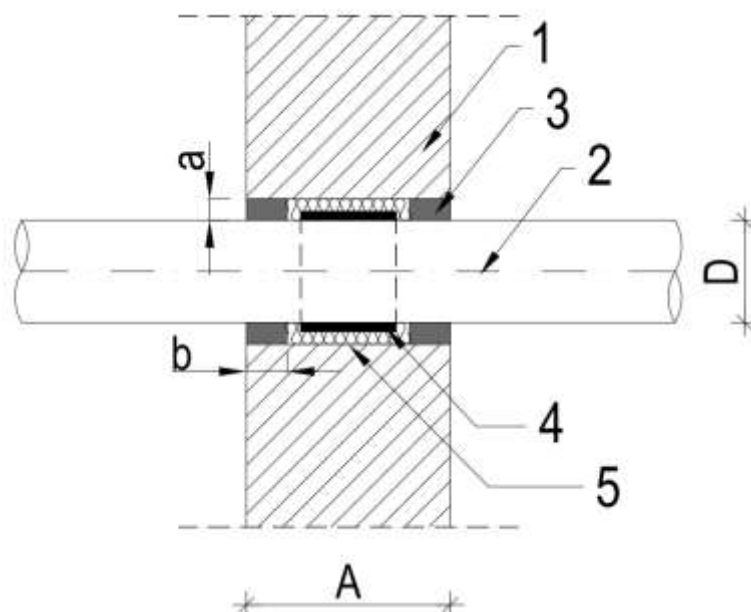
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in flexible or rigid wall

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Fig. B3. Plastic pipe (without insulation) penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Plastic pipe, diameter of "D" and pipe wall thickness "t".
3. Gap filler (area between the wrap / tape and supporting construction, ring with max. width: $a = 50$ mm, sealant minimum depth: $b = 15$ mm, on both sides of the wall) – INTU FR MASTIC.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).
5. Loose mineral wool, compressed to the density of: $\rho = 100$ kg/m³.

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic pipes (without insulation) penetration seals in rigid wall

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Table B3.1. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B3:

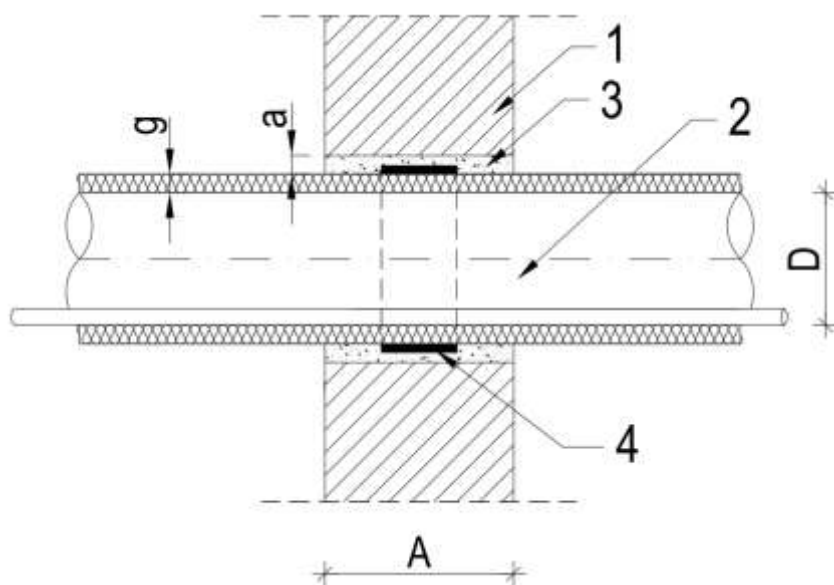
Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 110$	4.2	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
PP	$D \leq 110$	2.7	-	1 x 60.0 x 4.0	EI 90-U/C EI 90-C/C
PP-R	$D \leq 110$	18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
PVC-U/ PVC-C	$D \leq 110$	4.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (without insulation) penetration seals in rigid wall

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Fig. B4. Plastic pipe and composite pipe with or without heating cable, with flexible elastomeric foam (FEF) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Plastic pipe with / without heating cable in continuous insulation - flexible elastomeric foam (FEF); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar, ring with max. width: $a = 100$ mm, on the whole depth of the partition.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic / composite pipes (with insulation) penetration seals in rigid wall

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of European
Technical Assessment
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Table B4.1. Resistance to fire classification of plastic pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B4:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 110$	10.0	9	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
PP	$D \leq 110$	2.7	9	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
PP-R	$D \leq 110$	18.3	9	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

Table B4.2. Resistance to fire classification of plastic pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B4:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	D ≤ 110	4.2 – 10.0	13	1 x 60.0 x 6.0	EI 120-U/C EI 120-C/C
	110 < D ≤ 125	4.8 – 14.5	13	1 x 100.0 x 8.0	EI 60-U/C EI 60-C/C
		14.6	13	1 x 100.0 x 8.0	EI 90-U/C EI 90-C/C
	125 < D ≤ 160	6.2 – 14.5	13	1 x 100.0 x 12.0	EI 60-U/C EI 60-C/C
		14.6	13	1 x 100.0 x 12.0	EI 90-U/C EI 90-C/C
PP	D ≤ 110	2.7 – 18.3	13	1 x 60.0 x 6.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

Construction details
Plastic pipes (with insulation) penetration seals in rigid wall

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Table B4.3. Resistance to fire classification of composite pipes with flexible elastomeric foam (FEF) , with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B4:

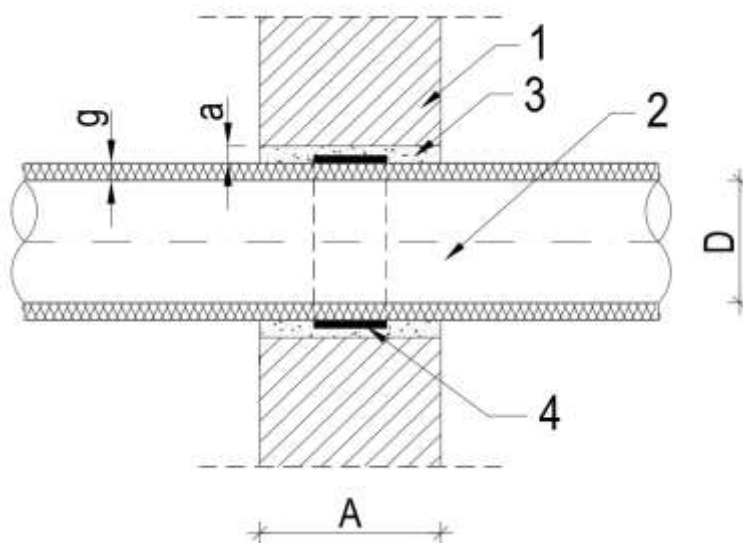
Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/ PP-R-GF/ PP-R	$D \leq 110$	18.3	9	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Composite pipes (with insulation) penetration seals in rigid wall

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Fig. B5. Plastic pipe, MLC pipe and composite pipe with polyethylene foam (PE) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Plastic pipe, composite pipe and MLC pipe in continuous insulation - polyethylene foam (PE); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar, ring with max. width: $a = 50$ mm, on the whole depth of the partition
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic / MLC / Composite pipes (with insulation) penetration seals
in rigid wall

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Table B5.1. Resistance to fire classification of plastic pipes with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B5:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP	$D \leq 75$	2.7	9	1 x 60.0 x 2.0	EI 60-U/C EI 60-C/C
		12.5	13	1 x 60.0 x 4.0	
	$75 < D \leq 110$	12.5	13	1 x 60.0 x 4.0	
PVC-U/ PVC-C	$D \leq 32$	2.0	9	1 x 60.0 x 4.0	EI 120 / E 180-U/C EI 120 / E 180-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (with insulation) penetration seals in rigid wall

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of European
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Table B5.2. Resistance to fire classification of MLC pipes with polyethylene foam (PE), with reaction to fire class E_L, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B5:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-X/AL/ PE-X	$D \leq 32$	3.0	9	1 x 60.0 x 2.0	EI 120-U/C

Table B5.3. Resistance to fire classification of MLC pipes with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B5:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/AL/ PE-RT	$D \leq 20$	2.0 – 3.0	9	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 25$	2.5	9	1 x 60.0 x 2.0	
	$25 < D \leq 32$	3.0	9	1 x 60.0 x 2.0	
PE-X/AL/ PE-X	$D \leq 20$	2.0	9	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
MLC pipes (with insulation) penetration seals in rigid wall

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Table B5.4. Resistance to fire classification of composite pipes with polyethylene foam (PE), with reaction to fire class E_L, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B5:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/PP-R-GF/PP-R	$D \leq 50$	6.9 – 8.3	9	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C

Table B5.5. Resistance to fire classification of composite pipes with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B5:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/PP-R-GF/PP-R	$D \leq 20$	2.8 – 3.4	9	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C

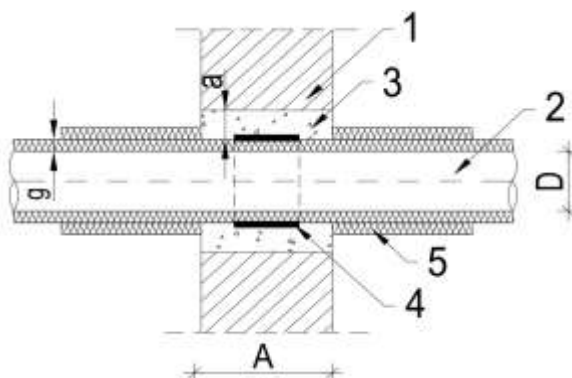
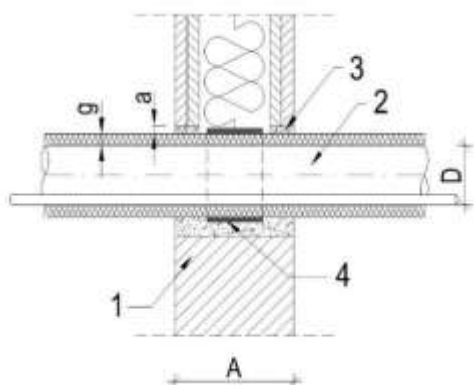
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Composite pipes (with insulation) penetration seals in rigid wall

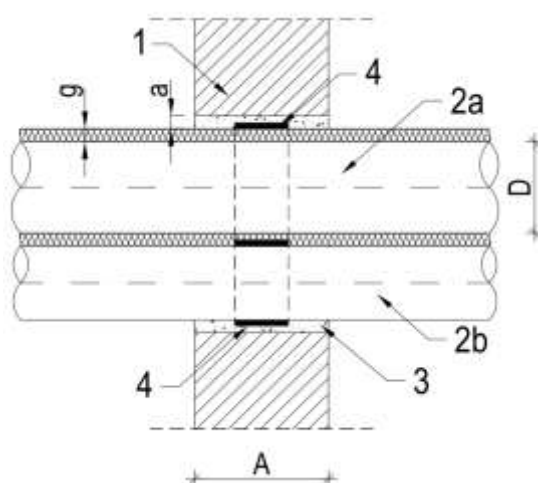
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Fig. B6. Metal pipe with or without heating cable, with flexible elastomeric foam (FEF) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.

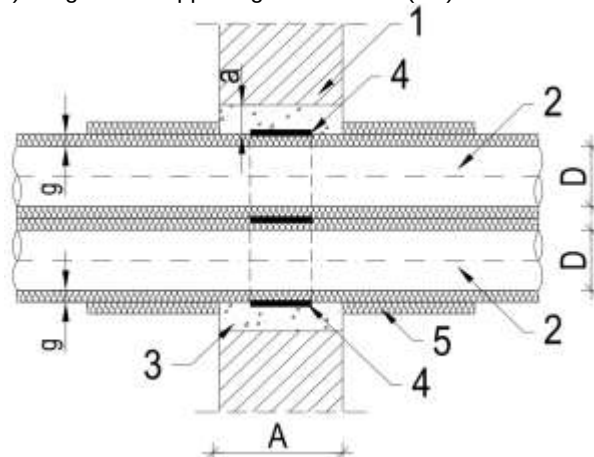
- a) Flexible or rigid wall supporting construction (v.1) b) Rigid wall supporting construction (v.2)



- c) Rigid wall supporting construction (v.3)



- d) Rigid wall supporting construction (v.4)



1. Flexible or rigid wall supporting construction thickness of: $A \geq 100$ mm.
2. Metal pipe with / without heating cable in continuous insulation - flexible elastomeric foam (FEF); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".

For variant 3:

- 2a. Metal pipe without heating cable in continuous insulation - flexible elastomeric foam (FEF); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
- 2b. Plastic pipe diameter of max. 110 mm.
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall
 - for rigid walls cement mortar ring with max. width: $a = 100$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (single row on each pipe – placed in the wall thickness center).
5. Mineral wool density of 35 kg/m^3 , thickness of lamella insulation 40 mm or 50 mm and length of 500 mm.

INTU FR WRAP and INTU FR WRAP L

Construction details

Metal pipes (with insulation) penetration seals in rigid or flexible wall

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of European
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Table B6.1. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) type penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 15.0$	1.0 – 1.4	9	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 180-C/U EI 180-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 1.5	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 180-C/U EI 180-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$15.0 < D \leq 22.0$	1.1 – 1.4	9	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 1.5	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$22.0 < D \leq 28.0$	1.2 – 1.4	9	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 1.5	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$28.0 < D \leq 42.0$	1.3 – 1.4	9	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Metal pipes (with insulation) penetration seals in rigid wall

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Technical Assessment
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Table B6.1, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$28.0 < D \leq 42.0$	≥ 1.5	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$42.0 < D \leq 54.0$	≥ 1.5	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$54.0 < D \leq 64.0$	≥ 1.6	9	1 x 60.0 x 2.0	EI 30 / E 240-C/U EI 30 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 30 / E 60-C/U EI 30 / E 60-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 60-C/U EI 60-C/C
	$64.0 < D \leq 76.1$	≥ 1.7	9	1 x 60.0 x 2.0	EI 30 / E 240-C/U EI 30 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 30 / E 60-C/U EI 30 / E 60-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 60-C/U EI 60-C/C
	$76.1 < D \leq 88.9$	≥ 1.8	9	1 x 60.0 x 2.0	EI 30 / E 240-C/U EI 30 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 30 / E 60-C/U EI 30 / E 60-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 60-C/U EI 60-C/C
	$88.9 < D \leq 108.0$	≥ 2.0	9	1 x 60.0 x 2.0	EI 30 / E 240-C/U EI 30 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 30 / E 60-C/U EI 30 / E 60-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 60-C/U EI 60-C/C

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Metal pipes (with insulation) penetration seals in rigid wall

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Table B6.1, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$D \leq 42.4$	2.0 – 2.5	9	1 x 60.0 x 2.0	EI 180-C/U EI 180-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 2.6	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$42.4 < D \leq 48.3$	2.1 – 2.5	9	1 x 60.0 x 2.0	EI 180-C/U EI 180-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 2.6	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$48.3 < D \leq 60.3$	2.2 – 2.5	9	1 x 60.0 x 2.0	EI 180-C/U EI 180-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 2.6	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid wall

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Table B6.1, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	60.3 < D ≤ 76.1	2.4 – 2.5	9	1 x 60.0 x 2.0	EI 180-C/U EI 180-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 2.6	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	76.1 < D ≤ 88.9	≥ 2.6	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C EI 180 / E 240-C/U EI 180 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	88.9 < D ≤ 114.3	≥ 3.1	9	1 x 60.0 x 2.0	EI 90 / E 240-C/U EI 90 / E 240-C/C
			10 – 23	1 x 60.0 x 4.0	
			24 – 36	1 x 60.0 x 6.0	EI 90 / E 180-C/U EI 90 / E 180-C/C
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 180-C/U EI 180-C/C
	114.3 < D ≤ 139.7	≥ 3.6	9	1 x 60.0 x 2.0	EI 90 / E 240-C/U EI 90 / E 240-C/C
			10 – 23	1 x 60.0 x 4.0	
			24 – 36	1 x 60.0 x 6.0	EI 90 / E 180-C/U EI 90 / E 180-C/C
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 180-C/U EI 180-C/C
	139.7 < D ≤ 159.0	≥ 4.0	9	1 x 60.0 x 2.0	EI 90 / E 240-C/U EI 90 / E 240-C/C
			10 – 23	1 x 60.0 x 4.0	
			24 – 36	1 x 60.0 x 6.0	EI 90 / E 180-C/U EI 90 / E 180-C/C
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 180-C/U EI 180-C/C
	159.0 < D ≤ 168.3	≥ 4.0	50	1 x 60.0 x 2.0	EI 90-C/U EI 90-C/C
	168.3 < D ≤ 219.0	≥ 4.0	50	1 x 60.0 x 2.0	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Metal pipes (with insulation) penetration seals in rigid wall

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Table B6.2. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
	$12.7 < D \leq 15.0$	≥ 0.9	9	1 x 60.0 x 4.0	
	$15.0 < D \leq 22.23$	≥ 1.0	9	1 x 60.0 x 4.0	
steel	$D \leq 18.0$	1.2 – 1.4	9	1 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
			10 – 25	1 x 60.0 x 4.0	
		≥ 1.5	9	1 x 60.0 x 2.0	
			10 – 25	1 x 60.0 x 4.0	
			26 – 37	1 x 60.0 x 6.0	
			38 – 50	1 x 60.0 x 8.0	
	$18.0 < D \leq 28.0$	1.3 – 1.4	9	1 x 60.0 x 2.0	
			10 – 25	1 x 60.0 x 4.0	
		≥ 1.5	9	1 x 60.0 x 2.0	
			10 – 25	1 x 60.0 x 4.0	
			26 – 37	1 x 60.0 x 6.0	
			38 – 50	1 x 60.0 x 8.0	
	$28.0 < D \leq 48.3$	1.4	9	1 x 60.0 x 2.0	
			10 – 25	1 x 60.0 x 4.0	
		≥ 1.5	9	1 x 60.0 x 2.0	
			10 – 25	1 x 60.0 x 4.0	
			26 – 37	1 x 60.0 x 6.0	
			38 – 50	1 x 60.0 x 8.0	
	$48.3 < D \leq 66.7$	≥ 1.5	9	1 x 60.0 x 2.0	
			10 – 25	1 x 60.0 x 4.0	
			26 – 37	1 x 60.0 x 6.0	
			38 – 50	1 x 60.0 x 8.0	
	$66.7 < D \leq 76.1$	≥ 1.6	25	1 x 60.0 x 4.0	
			26 – 37	1 x 60.0 x 6.0	
			38 – 50	1 x 60.0 x 8.0	
	$76.1 < D \leq 88.9$	≥ 1.8	25	1 x 60.0 x 4.0	
			26 – 37	1 x 60.0 x 6.0	
			38 – 50	1 x 60.0 x 8.0	

INTU FR WRAP and INTU FR WRAP L					Annex B29 of European Technical Assessment ETA-18/0593
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L					
Metal pipes (with insulation) penetration seals in rigid wall					

Table B6.2, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$88.9 < D \leq 108.0$	≥ 2.0	25	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			26 – 37	1 x 60.0 x 6.0	
			38 – 50	1 x 60.0 x 8.0	
	$108.0 < D \leq 114.3$	≥ 2.2	50	1 x 60.0 x 8.0	
	$114.3 < D \leq 139.7$	≥ 3.1	50	1 x 60.0 x 8.0	
	$139.7 < D \leq 168.3$	≥ 4.0	50	1 x 60.0 x 8.0	
	$168.3 < D \leq 219.1$	≥ 4.0	50 ¹⁾	1 x 60.0 x 8.0	
	$219.1 < D \leq 273.0$	≥ 4.6	50 ²⁾	1 x 60.0 x 8.0	
	$273.0 < D \leq 323.9$	≥ 5.2	50 ²⁾	1 x 60.0 x 8.0	
	$323.9 < D \leq 355.6$	≥ 5.6	50 ²⁾	1 x 60.0 x 8.0	

¹⁾ Pipe additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 40 x 500 mm (thickness x length)

²⁾ Pipe additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 50 x 500 mm (thickness x length)

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid wall

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Table B6.3. Resistance to fire classification of steel pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 100$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$D \leq 42.4$	2.0 – 2.8	9	1 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
			10 - 22	1 x 60.0 x 4.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 2.9	9	1 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
			10 - 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$42.4 < D \leq 48.3$	≥ 2.1	9	1 x 60.0 x 2.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
			10 - 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 120-C/U EI 120-C/C
	$48.3 < D \leq 60.3$	≥ 2.3	9	1 x 60.0 x 2.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
			10 - 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 120-C/U EI 120-C/C
	$60.3 < D \leq 76.1$	≥ 2.7	9	1 x 60.0 x 2.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
			10 - 22	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Table B6.3, cont. Resistance to fire classification of steel pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 100$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B6a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$60.3 < D \leq 76.1$	≥ 2.7	23 – 36	1 x 60.0 x 6.0	EI 60 / E 120-C/U
			37 – 49	1 x 60.0 x 8.0	EI 60 / E 120-C/C
			50	1 x 60.0 x 8.0	EI 120-C/U EI 120-C/C
	$76.1 < D \leq 88.9$	≥ 2.9	9	1 x 60.0 x 2.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 120-C/U EI 120-C/C
	$88.9 < D \leq 114.3$	≥ 3.3	9	1 x 60.0 x 2.0	EI 45 / E 120-C/U EI 45 / E 120-C/C
			10 – 22	1 x 60.0 x 4.0	EI 45 / E 90-C/U EI 45 / E 90-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 90-C/U EI 90-C/C
	$114.3 < D \leq 139.7$	≥ 3.6	9	1 x 60.0 x 2.0	EI 45 / E 120-C/U EI 45 / E 120-C/C
			10 – 22	1 x 60.0 x 4.0	EI 45 / E 90-C/U EI 45 / E 90-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 90-C/U EI 90-C/C
	$139.7 < D \leq 168.3$	≥ 4.0	9	1 x 60.0 x 2.0	EI 45 / E 120-C/U EI 45 / E 120-C/C
			10 – 22	1 x 60.0 x 4.0	EI 45 / E 90-C/U EI 45 / E 90-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 90-C/U EI 90-C/C

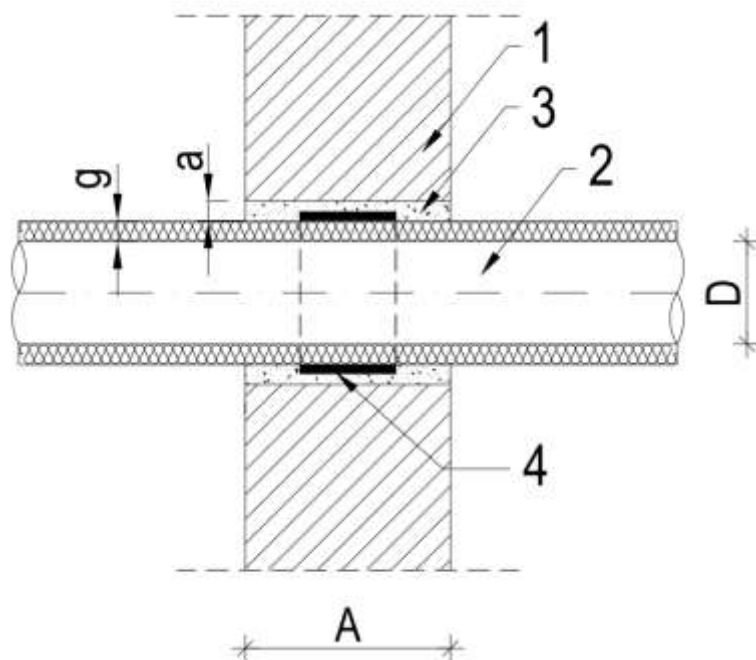
INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Fig. B7. Metal pipe with polyethylene foam (PE) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Metal pipe in continuous insulation – polyethylene foam (PE), thickness of PE insulation “g”, pipe diameter of “D” and pipe wall thickness “t”.
3. Gap filled with cement mortar, ring with max. width: $a = 100$ mm, on the whole depth of the partition.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details

Metal pipes (with insulation) penetration seals in rigid wall

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Table B7.1. Resistance to fire classification of copper pipes with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS) penetration seal in rigid wall thickness of: $t \geq 150$ mm made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B7:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 6.35$	≥ 0.8	9	1 x 60.0 x 4.0	EI 240-C/U EI 240-C/C
	$6.35 < D \leq 15.88$	≥ 1.0	9	1 x 60.0 x 4.0	EI 180 / E 240-C/U EI 180 / E 240-C/C

Table B7.2. Resistance to fire classification of copper pipes with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS) penetration seal in rigid wall thickness of: $t \geq 150$ mm made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B7:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
	$12.7 < D \leq 22.23$	≥ 1.0	9	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Metal pipes (with insulation) penetration seals in rigid wall

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Table B7.3. Resistance to fire classification of bundle of max. 3 copper pipes (max. $2 \times D \leq 6.35 \text{ mm} \times t = 0.8 \text{ mm}$ + max. $1 \times D \leq 15.88 \text{ mm} \times t = 1.0 \text{ mm}$) with continuous PE foam insulation, with reaction to fire class E, (thickness of 9 mm) penetration seal in rigid wall thickness of: $t \geq 150 \text{ mm}$ made with use of single row of INTU FR WRAP or INTU FR WRAP L, length of 60 mm and thickness of 4.0 mm (separate tape / wrap for each pipe or one wrap for whole bundle) in accordance with Annex A and Fig. B7:

Fire resistance class:
EI 180-C/U
EI 180-C/C

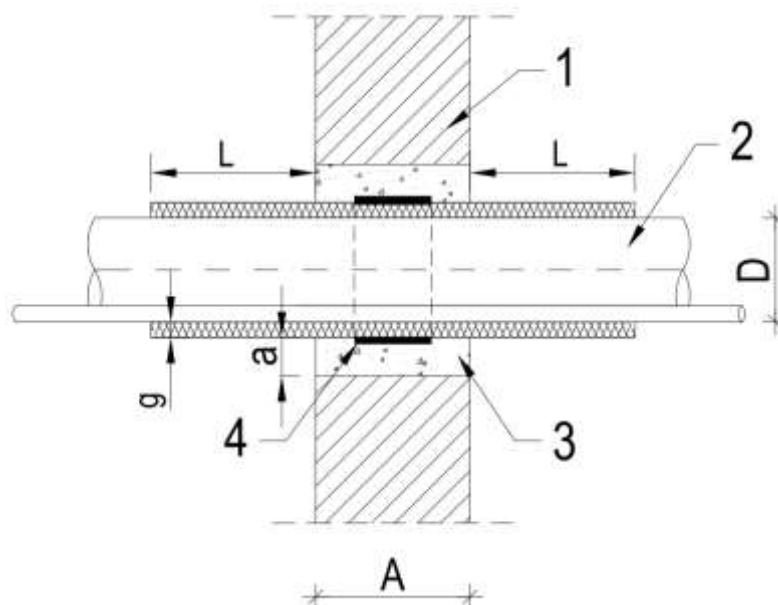
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Metal pipe bundle (with insulation) penetration seals in rigid wall

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Fig. B8. Metal pipe with or without heating cable, with mineral wool insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Metal pipe in local sustained insulation – mineral wool density of 35 kg/m^3 , mineral wool insulation thickness “g” and length “L”, pipe diameter of “D” and pipe wall thickness “t”.
3. Gap filled with cement mortar, ring with max. width: $a = 100$ mm, on the whole depth of the partition.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details

Metal pipes (with insulation) penetration seals in rigid wall

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Table B8.1. Resistance to fire classification of steel pipes with mineral wool mat local sustained insulation (case LS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B8:

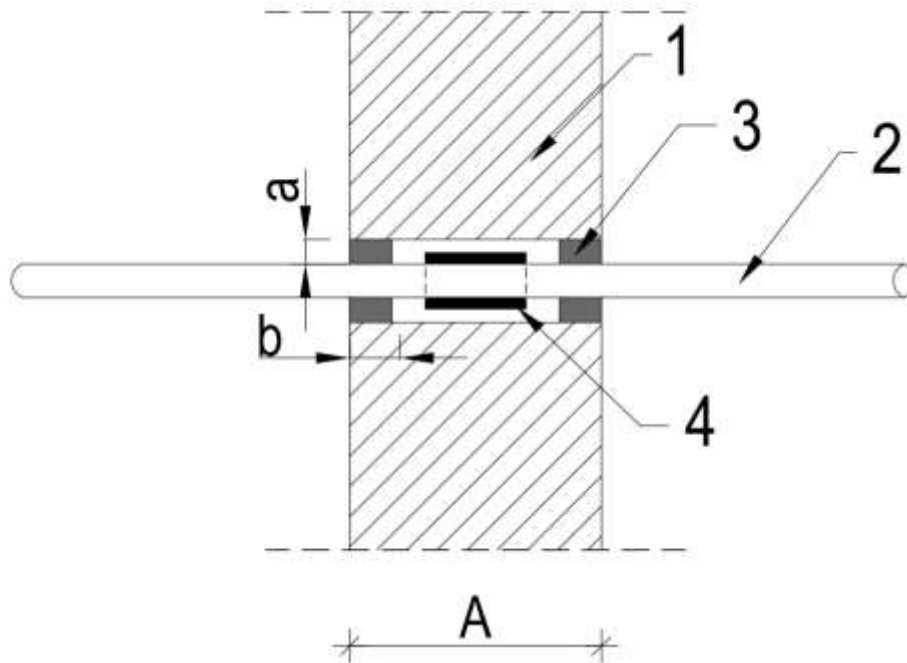
Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$D \leq 42.4$	≥ 1.5	20 x 300	1 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
			(21 – 30) x 500	1 x 60.0 x 2.0	
		≥ 2.0	(21 – 40) x 600	1 x 60.0 x 2.0	
	$42.4 < D \leq 66.7$	≥ 1.5	30 x 500	1 x 60.0 x 2.0	
		≥ 2.0	(31 – 40) x 600	1 x 60.0 x 2.0	
	$66.7 < D \leq 108.0$	≥ 2.0	40 x 600	1 x 60.0 x 2.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid wall

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Fig. B9. Cable penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Single cable.
3. Gap filled with INTU FR MASTIC sealant, ring with max width: $a = 20$ mm, minimum depth: $b = 15$ mm, on both sides of the wall.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details
Cable penetration seals in rigid wall

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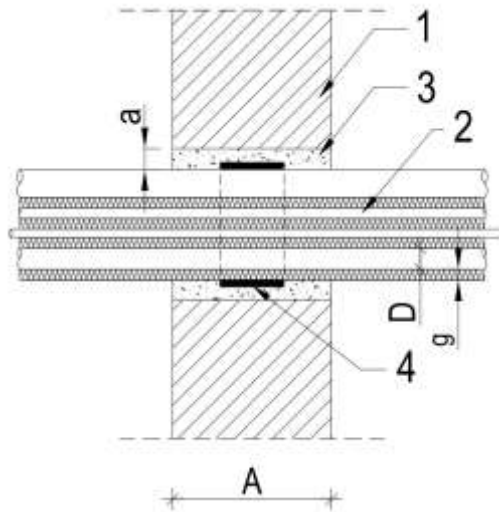
Table B9.1. Resistance to fire classification of single F cable (A-2Y(L)2Y 20X2X0,6) penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, length of 60.0 mm and thickness of 2.0 mm and INTU FR MASTIC gap filling in accordance with Annex A and Fig. B9:

**Fire resistance class:
EI 120**

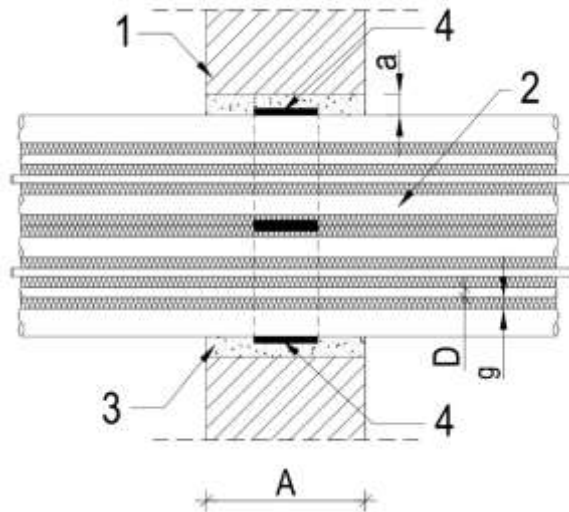
INTU FR WRAP and INTU FR WRAP L	Annex B39 of European Technical Assessment ETA-18/0593
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L Cable pipes penetration seals in rigid wall	

Fig. B10. Mixed bundle with flexible elastomeric foam (FEF) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.

a) Rigid wall supporting construction (v.1)



b) Rigid wall supporting construction (v.2)



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Bundle or two bundles of pipes and cable: 2 x copper pipe with continuous flexible elastomeric foam (FEF) insulation (thickness of FEF insulation "g"), 1 x PVC-U pipe and 1 x Cable 4 x 1.5 mm². Pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar, ring with max. width: $a = 50$ mm, on the whole depth of the partition.
4. INTU FR WRAP or INTU FR WRAP L (single row on each bundle – placed in the wall thickness center).

INTU FR WRAP and INTU FR WRAP L

Construction details

Mixed pipe bundle (with insulation) penetration seals in rigid wall

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Table B10.1. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, in accordance with Annex A and Fig. B10:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
single copper pipe	$D \leq 12.7$	≥ 0.8	9	1 x 60.0 x 4.0	EI 120
	$12.7 < D \leq 22.23$	≥ 1.0	9	1 x 60.0 x 4.0	

Table B10.2. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, in accordance with Annex A and Fig. B10:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
double copper pipe	12.7 x 0.8	12.7 x 0.8	9	1 x 60.0 x 4.0	EI 120
	12.7 x 0.8	22.23 x 1.0	9	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

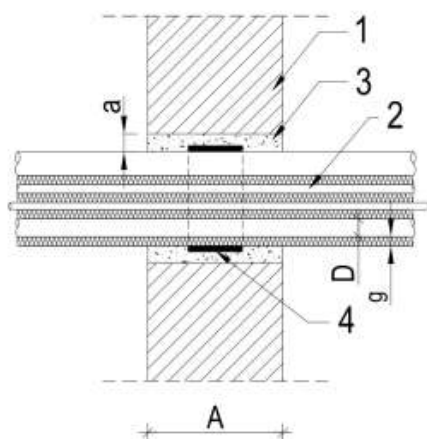
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

Metal pipe bundle (with insulation) penetration seals in rigid wall

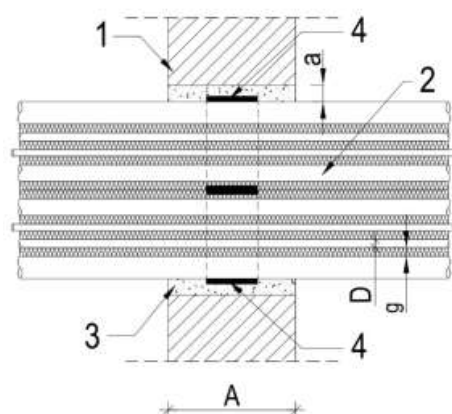
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Fig. B11. Mixed bundle with polyethylene foam (PE) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid wall.

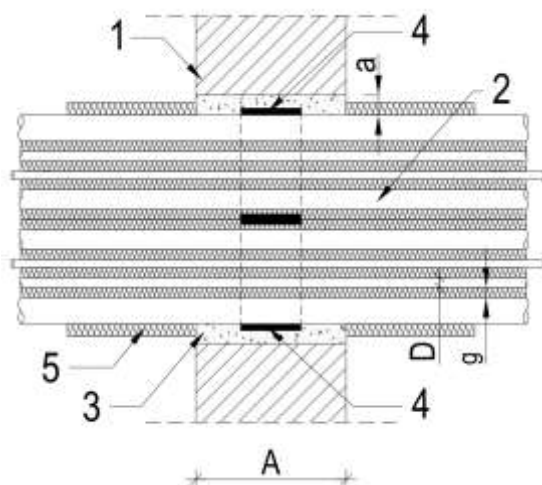
a) Rigid wall supporting construction (v.1)



b) Rigid wall supporting construction (v.2)



c) Rigid wall supporting construction (v.3)



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Bundle or two bundles of pipes and cable: 2 x Copper pipe with continuous polyethylene foam (PE) insulation (thickness of PE insulation "g"), 1 x PVC-U pipe and 1 x Cable 4 x1.5 mm² (in case of PE insulation with reaction to fire class B_L-s1,d0, according to clause 1 of ETA) or 1 x Cable A1 (in case of PE insulation with reaction to fire class E, according to clause 1 of ETA). Pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar, ring with max. width: a = 50 mm, on the whole depth of the partition.
4. INTU FR WRAP or INTU FR WRAP L (single on each bundle – placed in the wall thickness center).
5. Mineral wool density of: 35 kg/m³, lamella insulation thickness of 20 mm and length of 200 mm.

INTU FR WRAP and INTU FR WRAP L

Construction details

Mixed pipe bundle (with insulation) penetration seals in rigid wall

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Table B11.1. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS), with additional single A1 cable (E-YY-J 5x1,5; RE NYY-J 5x1,5 RE; VV 5x1,5) and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 32$ mm and pipe wall thickness of: $t_p = 2.0$ mm penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, in accordance with Annex A and Fig. B11:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
single copper pipe	$D \leq 6.35$	≥ 0.8	9	1 x 60.0 x 4.0	EI 240
	$6.35 < D \leq 15.88$	≥ 1.0	9	1 x 60.0 x 4.0	EI 180 / E 240

Table B11.2. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS), with additional single A1 cable (E-YY-J 5x1,5; RE NYY-J 5x1,5 RE; VV 5x1,5) and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 32$ mm and pipe wall thickness of: $t_p = 2.0$ mm penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, in accordance with Annex A and Fig. B11:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
double copper pipe	6.0 x 0.8	6.0 x 0.8	9	1 x 60.0 x 4.0	EI 120 / E 180
	6.0 x 0.8	15.0 x 1.0	9	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Mixed pipe bundle (with insulation) penetration seals in rigid wall

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Table B11.3. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with polyethylene foam (PE) with reaction to fire class B_L-s1,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, in accordance with Annex A and Fig. B11:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
single copper pipe	$D \leq 12.7$	≥ 0.8	9	1 x 60.0 x 4.0	EI 120
	$12.7 < D \leq 22.23$	≥ 1.0	9	1 x 60.0 x 4.0	

Table B11.4. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid wall thickness of: $t \geq 150$ mm, made with use of single row of INTU FR WRAP or INTU FR WRAP L, in accordance with Annex A and Fig. B11:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
double copper pipe	12.7 x 0.8	12.7 x 0.8	9	1 x 60.0 x 4.0	EI 120
	12.7 x 0.8	22.23 x 1.0	9	1 x 60.0 x 4.0	

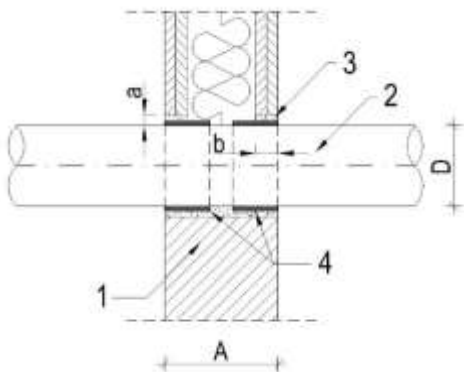
INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

Mixed pipes bundle (with insulation) penetration seals in rigid wall

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Fig. B12. Plastic pipe, MLC pipe and composite pipe (without insulation) penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Plastic pipe, composite pipe and MLC pipe, diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 100$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic / MLC / composite pipe (without insulation) penetration seals
in flexible or rigid wall

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Table B12.1. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B12:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP	$D \leq 50$	1.8	-	$2 \times 60.0 \times 2.0$	EI 120-U/C EI 120-C/C
		1.9	-	$2 \times 60.0 \times 2.0$	EI 120 / E 180-U/C EI 120 / E 180-C/C
		2.0 – 12.5	-	$2 \times 60.0 \times 2.0$	EI 120-U/C EI 120-C/C
		12.6 – 18.4	-	$2 \times 60.0 \times 4.0$	
	$50 < D \leq 75$	1.9	-	$2 \times 60.0 \times 2.0$	EI 120 / E 180-U/C EI 120 / E 180-C/C
		2.0 – 12.5	-	$2 \times 60.0 \times 2.0$	EI 120-U/C EI 120-C/C
		12.6 – 18.4	-	$2 \times 60.0 \times 4.0$	
	$75 < D \leq 90$	2.2 – 18.4	-	$2 \times 60.0 \times 4.0$	
	$90 < D \leq 110$	2.7 – 18.4	-	$2 \times 60.0 \times 4.0$	EI 60-U/C EI 60-C/C
	$110 < D \leq 125$	3.4 – 14.5	-	$2 \times 60.0 \times 6.0$	
		14.6	-	$2 \times 60.0 \times 6.0$	EI 120-U/C EI 120-C/C
	$125 < D \leq 160$	4.9 – 14.5	-	$2 \times 60.0 \times 10.0$	EI 60-U/C EI 60-C/C
		14.6	-	$2 \times 60.0 \times 10.0$	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (without insulation) penetration seals in rigid wall

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Table B12.2. Resistance to fire classification of plastic pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B12:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 32$	2.0 – 6.8	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.9 – 10.0	-	2 x 60.0 x 4.0	
	$32 < D \leq 50$	2.4 – 6.8	-	2 x 60.0 x 2.0	
		6.9 – 10.0	-	2 x 60.0 x 4.0	
	$50 < D \leq 75$	3.0 – 6.8	-	2 x 60.0 x 2.0	
		6.9 – 10.0	-	2 x 60.0 x 4.0	
PE-Xa	$75 < D \leq 90$	3.5 – 10.0	-	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$90 < D \leq 110$	4.2 – 10.0	-	2 x 60.0 x 4.0	
	$D \leq 20$	2.0 – 5.8	-	2 x 60.0 x 2.0	
	$20 < D \leq 32$	3.0	-	2 x 60.0 x 2.0	
	$32 < D \leq 40$	3.7	-	2 x 60.0 x 2.0	
PP-R	$40 < D \leq 50$	4.6	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$50 < D \leq 63$	5.8	-	2 x 60.0 x 2.0	
	$D \leq 20$	2.3 – 10.0	-	2 x 60.0 x 2.0	
		3.3 – 12.5	-	2 x 60.0 x 2.0	
	$20 < D \leq 32$	12.6 – 16.0	-	2 x 60.0 x 4.0	
		4.8 – 12.5	-	2 x 60.0 x 2.0	
	$32 < D \leq 50$	12.6 – 18.3	-	2 x 60.0 x 4.0	
		5.8 – 12.5	-	2 x 60.0 x 2.0	
	$50 < D \leq 63$	12.6 – 18.3	-	2 x 60.0 x 4.0	
		6.8 – 12.5	-	2 x 60.0 x 2.0	
PVC-U/ PVC-C	$63 < D \leq 75$	12.6 – 18.3	-	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		8.2 – 18.3	-	2 x 60.0 x 4.0	
	$75 < D \leq 90$	10.0 – 18.3	-	2 x 60.0 x 4.0	
	$D \leq 50$	1.8 – 3.6	-	2 x 60.0 x 2.0	
		3.7 – 4.2	-	2 x 60.0 x 4.0	
	$50 < D \leq 75$	1.9 – 3.6	-	2 x 60.0 x 2.0	
		3.7 – 4.2	-	2 x 60.0 x 4.0	
	$75 < D \leq 90$	2.0 – 4.2	-	2 x 60.0 x 4.0	
	$90 < D \leq 110$	2.2 – 4.2	-	2 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in flexible or rigid wall

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Table B12.2, cont. Resistance to fire classification of plastic pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B12:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP	D ≤ 50	1.8	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		1.9	-	2 x 60.0 x 2.0	EI 120 / E 180-U/C EI 120 / E 180-C/C
		2.0 – 12.5	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.6 – 18.4	-	2 x 60.0 x 4.0	
	50 < D ≤ 75	1.9	-	2 x 60.0 x 2.0	EI 120 / E 180-U/C EI 120 / E 180-C/C
		2.0 – 12.5	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.6 – 18.4	-	2 x 60.0 x 4.0	
	75 < D ≤ 90	2.2 – 18.4	-	2 x 60.0 x 4.0	
	90 < D ≤ 110	2.7 – 18.4	-	2 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in flexible or rigid wall

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Table B12.3. Resistance to fire classification of MLC pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B12:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/ AL/PE-RT	$D \leq 20$	2.0 – 3.0	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 25$	2.5	-	2 x 60.0 x 2.0	
	$25 < D \leq 32$	3.0	-	2 x 60.0 x 2.0	EI 90 / E 120-U/C EI 90 / E 120-C/C
	$32 < D \leq 40$	4.0	-	2 x 60.0 x 2.0	
	$40 < D \leq 63$	6.0	-	2 x 60.0 x 2.0	
PE-X/AL/ PE-X	$D \leq 32$	3.0 – 6.0	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$32 < D \leq 40$	3.8	-	2 x 60.0 x 2.0	
	$40 < D \leq 63$	6.0	-	2 x 60.0 x 2.0	
PP-R/AL/ PP-R	$D \leq 20$	2.8 – 10.0	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 32$	4.4 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 16.0	-	2 x 60.0 x 4.0	
	$32 < D \leq 50$	6.9 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 18.3	-	2 x 60.0 x 4.0	
	$50 < D \leq 63$	8.7 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 18.3	-	2 x 60.0 x 4.0	
	$63 < D \leq 75$	10.3 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 18.3	-	2 x 60.0 x 4.0	
	$75 < D \leq 90$	12.4 – 18.3	-	2 x 60.0 x 4.0	
	$90 < D \leq 110$	15.1 – 18.3	-	2 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
MLC pipes (without insulation) penetration seals in flexible or rigid wall

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Table B12.4. Resistance to fire classification of composite pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B12:

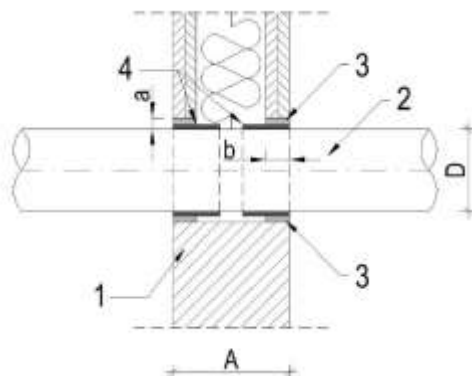
Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/ PP-R- GF/PP-R	$D \leq 20$	2.8 – 10.0	-	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	$20 < D \leq 32$	4.4 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 15.1	-	2 x 60.0 x 4.0	
	$32 < D \leq 50$	6.7 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 15.1	-	2 x 60.0 x 4.0	
	$50 < D \leq 63$	8.4 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 15.1	-	2 x 60.0 x 4.0	
	$63 < D \leq 75$	10.0 – 12.5	-	2 x 60.0 x 2.0	
		12.6 – 15.1	-	2 x 60.0 x 4.0	
	$75 < D \leq 110$	15.1	-	2 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Composite pipes (without insulation) penetration seals
in flexible or rigid wall

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Fig. B13. Plastic pipe (without insulation) penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Plastic pipe, diameter of "D" and pipe wall thickness "t".
3. Gap filler (area between the wrap / tape and supporting construction, ring with max. width: $a = 25$ mm width, sealant minimum depth: $b = 25$ mm, on both sides of the wall) – INTU FR MASTIC.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic pipes (without insulation) penetration seals in flexible or rigid wall

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Table B13.1. Resistance to fire classification of plastic pipes (without insulation) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B13:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 110$	4.2	-	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
PP	$D \leq 110$	2.7	-	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
PP-R	$D \leq 110$	18.3	-	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
PVC-U/ PVC-C	$D \leq 110$	3.2	-	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

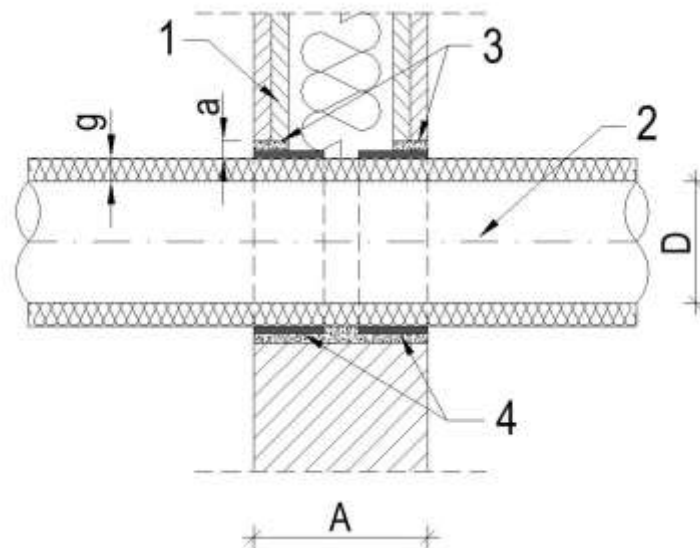
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in flexible or rigid wall

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Fig. B14. MLC pipe and composite pipe with polyethylene foam (PE) insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Composite pipe and MLC pipe in continuous insulation - polyethylene foam (PE); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 50$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).

INTU FR WRAP and INTU FR WRAP L

Construction details
MLC / composite pipes (with insulation) penetration seals
in flexible or rigid wall

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Table B14.1. Resistance to fire classification of MLC pipes with polyethylene foam (PE), with reaction to fire class E_L, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B14:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/AL/ PE-RT	$D \leq 32$	3.0	9	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
PE-X/AL/ PE-X	$D \leq 32$	3.0	9	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C

Table B14.2. Resistance to fire classification of MLC pipes with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B14:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/AL/ PE-RT	$D \leq 20$	2.0	9	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
PE-X/AL/ PE-X	$D \leq 20$	2.0	9	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

MLC pipes (with insulation) penetration seals in flexible or rigid wall

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Table B14.3. Resistance to fire classification of composite pipes with polyethylene foam (PE), with reaction to fire class E_L, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B14:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/PP-R-GF/PP-R	$D \leq 50$	5.9 – 8.9	9	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C

Table B14.4. Resistance to fire classification of composite pipes with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B14:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/PP-R-GF/PP-R	$D \leq 20$	2.8 – 3.4	9	2 x 60.0 x 2.0	EI 120-U/C EI 120-C/C

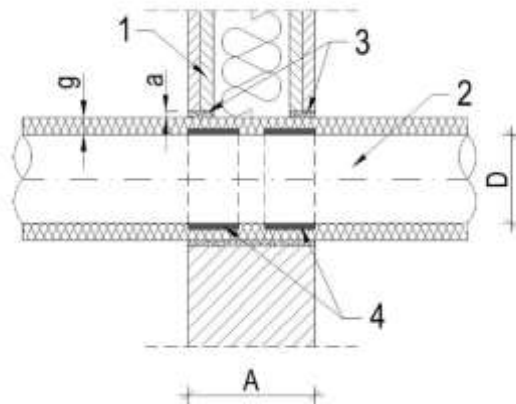
INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Composite pipes (with insulation) penetration seals in flexible or rigid wall

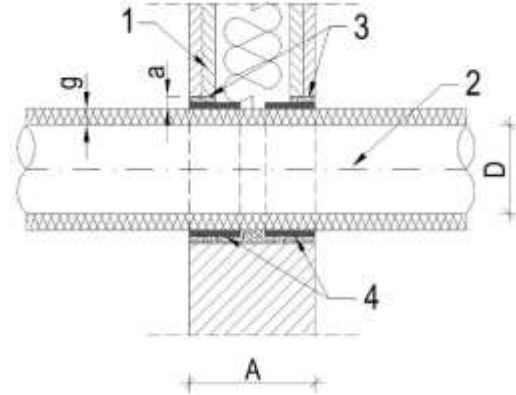
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Fig. B15. Plastic pipe with mineral wool insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.

a) Flexible or rigid wall supporting construction (v.1)



b) Flexible or rigid wall supporting construction (v.2)



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Plastic pipe in continuous insulation – mineral wool density of 35 kg/m^3 , thickness of mineral wool insulation "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 50$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic pipes (with insulation) penetration seals in flexible or rigid wall

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Table B15.1. Resistance to fire classification of plastic pipes with mineral wool mat continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L placed on the pipe, under the insulation in accordance with Annex A and Fig. B15a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R	$D \leq 20$	2.3	20	$2 \times 60.0 \times 2.0$	EI 120-U/C EI 120-C/C
		6.8 – 12.5	30	$2 \times 60.0 \times 2.0$	
	$20 < D \leq 75$	6.8 – 12.5	30	$2 \times 60.0 \times 2.0$	

Table B15.2. Resistance to fire classification of plastic pipes with mineral wool mat continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L placed on the insulation in accordance with Annex A and Fig. B15b:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R	$D \leq 20$	2.3	20	$2 \times 60.0 \times 2.0$	EI 120-U/C EI 120-U/C
		6.8 – 12.5	30	$2 \times 60.0 \times 6.0$	
	$20 < D \leq 75$	6.8 – 12.5	30	$2 \times 60.0 \times 6.0$	

INTU FR WRAP and INTU FR WRAP L

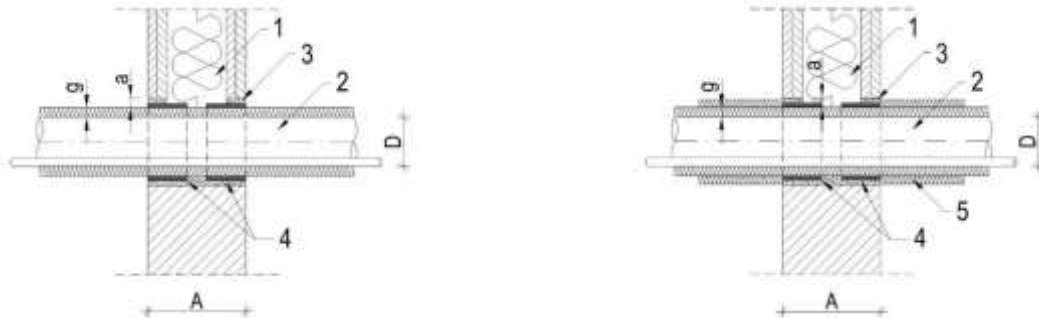
**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (with insulation) penetration seals in flexible or rigid wall

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Fig. B16. Metal pipe with or without heating cable, with flexible elastomeric foam (FEF) insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.

- a) Flexible or rigid wall supporting construction (v.1) b) Flexible or rigid wall supporting construction (v.2)



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Metal pipe with/without heating cable in continuous insulation - flexible elastomeric foam (FEF); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 50$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).
5. Mineral wool density of 35 kg/m^3 , thickness of lamella insulation 20 mm and length of 200 mm.

INTU FR WRAP and INTU FR WRAP L

Construction details

Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Table B16.1. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B16:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 15.0$	≥ 1.0	9	$2 \times 60.0 \times 2.0$	EI 120-C/U EI 120-C/C
			10 – 22	$2 \times 60.0 \times 4.0$	
			23 – 36	$2 \times 60.0 \times 6.0$	
			37 – 50	$2 \times 60.0 \times 8.0$	
	$15.0 < D \leq 22.0$	≥ 1.1	9	$2 \times 60.0 \times 2.0$	EI 30-C/U EI 30-C/C
			10 – 22	$2 \times 60.0 \times 4.0$	
			23 – 36	$2 \times 60.0 \times 6.0$	
			37 – 49	$2 \times 60.0 \times 8.0$	
			50	$2 \times 60.0 \times 8.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
	$22.0 < D \leq 28.0$	≥ 1.2	9	$2 \times 60.0 \times 2.0$	EI 30-C/U EI 30-C/C
			10 – 22	$2 \times 60.0 \times 4.0$	
			23 – 36	$2 \times 60.0 \times 6.0$	
			37 – 49	$2 \times 60.0 \times 8.0$	
			50	$2 \times 60.0 \times 8.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
	$28.0 < D \leq 42.0$	≥ 1.3	9	$2 \times 60.0 \times 2.0$	EI 30-C/U EI 30-C/C
			10 – 22	$2 \times 60.0 \times 4.0$	
			23 – 36	$2 \times 60.0 \times 6.0$	
			37 – 49	$2 \times 60.0 \times 8.0$	
			50	$2 \times 60.0 \times 8.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
	$42.0 < D \leq 54.0$	≥ 1.5	9	$2 \times 60.0 \times 2.0$	EI 30-C/U EI 30-C/C
			10 – 22	$2 \times 60.0 \times 4.0$	
			23 – 36	$2 \times 60.0 \times 6.0$	
			37 – 49	$2 \times 60.0 \times 8.0$	
			50	$2 \times 60.0 \times 8.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
steel	$D \leq 42.4$	≥ 2.0	9	$2 \times 60.0 \times 2.0$	EI 120-C/U EI 120-C/C
			10 – 22	$2 \times 60.0 \times 4.0$	
			23 – 36	$2 \times 60.0 \times 6.0$	
			37 – 50	$2 \times 60.0 \times 8.0$	
	$42.4 < D \leq 48.3$	≥ 2.1	9	$2 \times 60.0 \times 2.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
			10 – 22	$2 \times 60.0 \times 4.0$	
			23 – 36	$2 \times 60.0 \times 6.0$	
			37 – 49	$2 \times 60.0 \times 8.0$	
			50	$2 \times 60.0 \times 8.0$	EI 120-C/U EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Table B16.1, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B16:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$48.3 < D \leq 60.3$	≥ 2.2	9	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			10 – 22	2 x 60.0 x 4.0	
			23 – 36	2 x 60.0 x 6.0	
			37 – 49	2 x 60.0 x 8.0	
			50	2 x 60.0 x 8.0	EI 120-C/U EI 120-C/C
	$60.3 < D \leq 76.1$	≥ 2.4	9	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			10 – 22	2 x 60.0 x 4.0	
			23 – 36	2 x 60.0 x 6.0	
			37 – 49	2 x 60.0 x 8.0	
			50	2 x 60.0 x 8.0	EI 120-C/U EI 120-C/C
	$76.1 < D \leq 88.9$	≥ 2.6	9	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			10 – 22	2 x 60.0 x 4.0	
			23 – 36	2 x 60.0 x 6.0	
			37 – 49	2 x 60.0 x 8.0	
			50	2 x 60.0 x 8.0	EI 120-C/U EI 120-C/C
	$88.9 < D \leq 114.3$	≥ 3.1	9	2 x 60.0 x 2.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
			10 – 22	2 x 60.0 x 4.0	
			23 – 36	2 x 60.0 x 6.0	
			37 – 50	2 x 60.0 x 8.0	
			50	2 x 60.0 x 8.0	EI 30-C/U EI 30-C/C
	$114.3 < D \leq 139.7$	≥ 3.6	9	2 x 60.0 x 2.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
			10 – 22	2 x 60.0 x 4.0	
			23 – 36	2 x 60.0 x 6.0	
			37 – 50	2 x 60.0 x 8.0	
			50	2 x 60.0 x 8.0	EI 30-C/U EI 30-C/C
	$139.7 < D \leq 159.0$	≥ 4.0	9	2 x 60.0 x 2.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
			10 – 22	2 x 60.0 x 4.0	
			23 – 36	2 x 60.0 x 6.0	
			37 – 50	2 x 60.0 x 8.0	
			50	2 x 60.0 x 8.0	EI 30-C/U EI 30-C/C

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Table B16.2. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B16:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9	$2 \times 60.0 \times 4.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
			g ¹⁾	$2 \times 60.0 \times 4.0$	EI 120-C/U EI 120-C/C
	$12.7 < D \leq 15.0$	≥ 0.9	9	$2 \times 60.0 \times 4.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
			g ¹⁾	$2 \times 60.0 \times 4.0$	EI 120-C/U EI 120-C/C
	$15.0 < D \leq 22.23$	≥ 1.0	9	$2 \times 60.0 \times 4.0$	EI 90 / E 120-C/U EI 90 / E 120-C/C
			g ¹⁾	$2 \times 60.0 \times 4.0$	EI 120-C/U EI 120-C/C
steel	$D \leq 18.0$	$1.2 - 1.4$	9	$2 \times 60.0 \times 2.0$	EI 120-C/U EI 120-C/C
			10 – 25	$2 \times 60.0 \times 4.0$	
		≥ 1.5	9	$2 \times 60.0 \times 2.0$	
			10 – 25	$2 \times 60.0 \times 4.0$	
			26 – 37	$2 \times 60.0 \times 6.0$	EI 90 / E 120-C/U
			38 – 50	$2 \times 60.0 \times 8.0$	EI 90 / E 120-C/C
	$18.0 < D \leq 28.0$	$1.3 - 1.4$	13	$2 \times 60.0 \times 2.0$	EI 60 / E 120-C/U
			14 – 24	$2 \times 60.0 \times 4.0$	EI 60 / E 120-C/C
			25	$2 \times 60.0 \times 4.0$	EI 120-C/U EI 120-C/C
			26 – 37	$2 \times 60.0 \times 6.0$	EI 90 / E 120-C/U
			38 – 50	$2 \times 60.0 \times 8.0$	EI 90 / E 120-C/C
		≥ 1.5	9	$2 \times 60.0 \times 2.0$	EI 120-C/U
			10 – 25	$2 \times 60.0 \times 4.0$	EI 120-C/C
			26 – 37	$2 \times 60.0 \times 6.0$	EI 90 / E 120-C/U
			38 – 50	$2 \times 60.0 \times 8.0$	EI 90 / E 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Table B16.2, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B16:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$28.0 < D \leq 48.3$	≥ 1.4	13	2 x 60.0 x 2.0	EI 60 / E 120-C/U
			14 – 24	2 x 60.0 x 4.0	EI 60 / E 120-C/C
			25	2 x 60.0 x 4.0	EI 120-C/U
			26 – 37	2 x 60.0 x 6.0	EI 120-C/C
			38 – 50	2 x 60.0 x 8.0	EI 90 / E 120-C/U
	$48.3 < D \leq 66.7$	≥ 1.5	13	2 x 60.0 x 2.0	EI 90 / E 120-C/C
			14 – 24	2 x 60.0 x 4.0	EI 90 / E 120-C/C
			25	2 x 60.0 x 4.0	EI 120-C/U
			26 – 37	2 x 60.0 x 6.0	EI 120-C/C
			38 – 50	2 x 60.0 x 8.0	EI 90 / E 120-C/U
	$66.7 < D \leq 76.1$	≥ 1.6	13	2 x 60.0 x 2.0	EI 90 / E 120-C/C
			14 – 24	2 x 60.0 x 4.0	EI 45 / E 120-C/U
			25	2 x 60.0 x 4.0	EI 45 / E 120-C/C
			26 – 37	2 x 60.0 x 6.0	EI 60 / E 120-C/U
			38 – 49	2 x 60.0 x 8.0	EI 60 / E 120-C/C
steel	$76.1 < D \leq 88.9$	≥ 1.8	50	2 x 60.0 x 8.0	EI 90 / E 120-C/U
			13	2 x 60.0 x 2.0	EI 90 / E 120-C/C
			14 – 24	2 x 60.0 x 4.0	EI 45 / E 120-C/U
			25	2 x 60.0 x 4.0	EI 45 / E 120-C/C
			26 – 37	2 x 60.0 x 6.0	EI 60 / E 120-C/U
	$88.9 < D \leq 108.0$	≥ 2.0	38 – 49	2 x 60.0 x 8.0	EI 60 / E 120-C/C
			13	2 x 60.0 x 2.0	EI 90 / E 120-C/U
			14 – 24	2 x 60.0 x 4.0	EI 90 / E 120-C/C
			25	2 x 60.0 x 4.0	EI 45 / E 120-C/U
			26 – 37	2 x 60.0 x 6.0	EI 45 / E 120-C/C
			38 – 49	2 x 60.0 x 8.0	EI 60 / E 120-C/U
			50	2 x 60.0 x 8.0	EI 60 / E 120-C/C

¹⁾ Pipe additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 20 x 200 mm (thickness x length)

INTU FR WRAP and INTU FR WRAP L

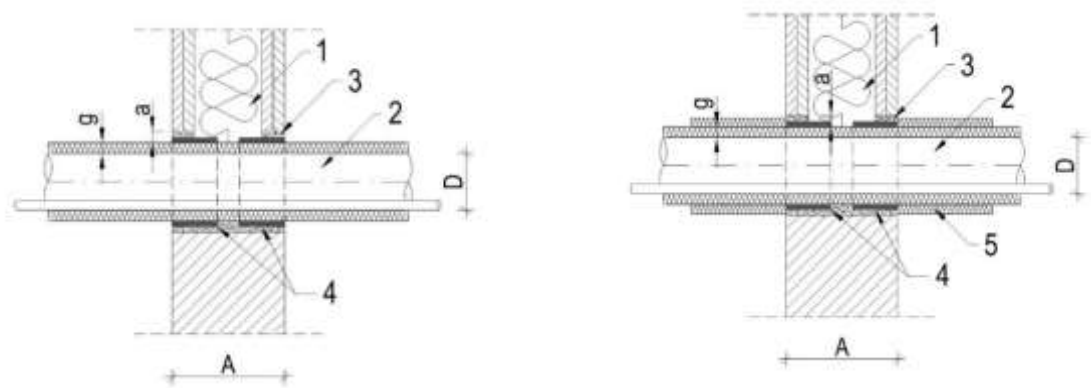
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Fig. B17. Metal pipe with polyethylene foam (PE) insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.

a) Flexible or rigid wall supporting construction (v.1) b) Flexible or rigid wall supporting construction (v.2)



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Metal pipe with/without heating cable in continuous insulation - polyethylene foam (PE); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 50$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).
5. Mineral wool density of 35 kg/m^3 , thickness of lamella insulation 20 mm and length of 200 mm.

INTU FR WRAP and INTU FR WRAP L		Annex B63 of European Technical Assessment ETA-18/0593
Construction details Metal pipes (with insulation) penetration seals in flexible or rigid wall		

Table B17.1. Resistance to fire classification of copper pipes with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B17:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9	2 x 60.0 x 4.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			9 ¹⁾	2 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
	$12.7 < D \leq 15.0$	≥ 0.9	9	2 x 60.0 x 4.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			9 ¹⁾	2 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
	$15.0 < D \leq 22.23$	≥ 1.0	9	2 x 60.0 x 4.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			9 ¹⁾	2 x 60.0 x 4.0	EI 120-C/U EI 120-C/C

¹⁾ Pipe additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 20 x 200 mm (thickness x length)

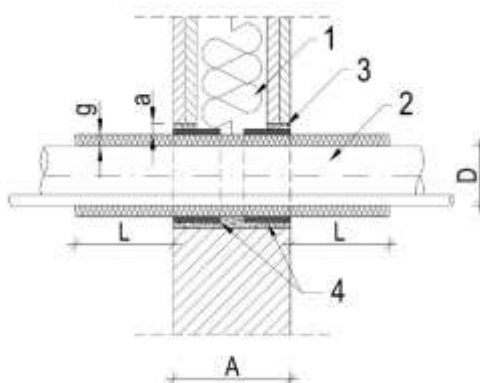
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Fig. B18. Metal pipe with or without heating cable, with mineral wool insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Metal pipe in local sustained insulation – mineral wool density of 35 kg/m^3 , mineral wool insulation thickness “g” and length “L”, pipe diameter of “D” and pipe wall thickness “t”.
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 25$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 100$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Metal pipes (with insulation) penetration seals in flexible or rigid wall

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Table B18.1. Resistance to fire classification of steel pipes with mineral wool mat local sustained insulation (case LS) penetration seals in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B18:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$D \leq 42.4$	≥ 1.5	20 x 300	2 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
			(21 – 30) x 500	2 x 60.0 x 2.0	
		≥ 2.0	(21 – 40) x 600	2 x 60.0 x 2.0	
		≥ 4.0	(41 – 50) x 600	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
		≥ 5.6	(41 – 50) x 750	2 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
	$42.4 < D \leq 66.7$	≥ 1.5	30 x 500	2 x 60.0 x 2.0	
		≥ 2.0	(31 – 40) x 600	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
		≥ 4.0	(41 – 50) x 600	2 x 60.0 x 2.0	
		≥ 5.6	(41 – 50) x 750	2 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
	$66.7 < D \leq 108.0$	≥ 2.0	40 x 600	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
		≥ 4.0	(41 – 50) x 600	2 x 60.0 x 2.0	
		≥ 5.6	(41 – 50) x 750	2 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
	$108.0 < D \leq 114.3$	≥ 3.6	40 x 600	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
			(41 – 50) x 600	2 x 60.0 x 2.0	
			(41 – 50) x 750	2 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
	$114.3 < D \leq 168.3$	≥ 4.0	50 x 600	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
		≥ 5.6	50 x 750	2 x 60.0 x 2.0	
	$168.3 < D \leq 219.1$	≥ 4.0	50 x 600	2 x 60.0 x 2.0	EI 90 / E 120-C/U EI 90 / E 120-C/C
		≥ 5.6	50 x 750	2 x 60.0 x 2.0	
	$219.1 < D \leq 273.0$	≥ 5.6	50 x 750	2 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
	$273.0 < D \leq 323.9$	≥ 5.6	50 x 750	2 x 60.0 x 2.0	
	$323.9 < D \leq 355.6$	≥ 5.6	50 x 750	2 x 60.0 x 2.0	

INTU FR WRAP and INTU FR WRAP L

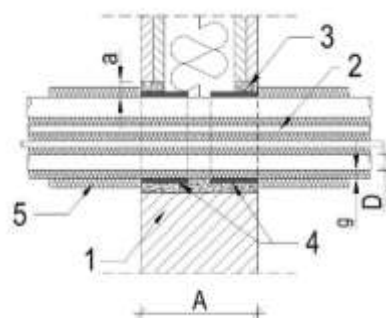
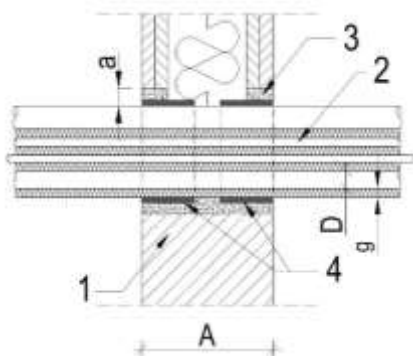
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

Metal pipes (with insulation) penetration seals in flexible or rigid wall

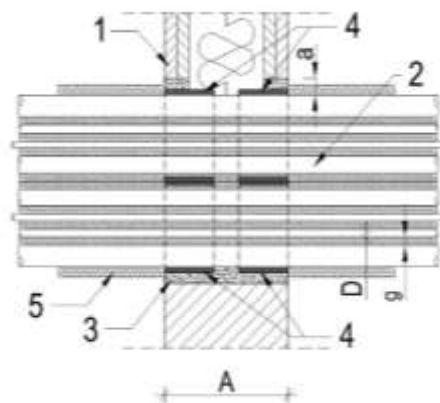
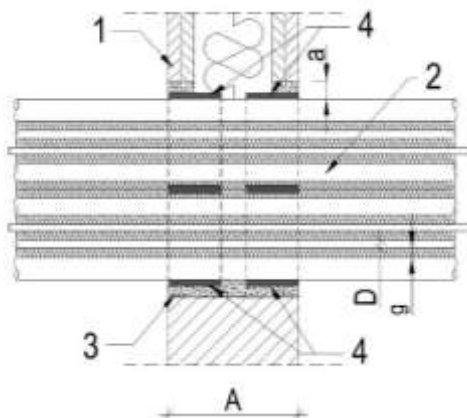
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Fig. B19. Mixed bundle with flexible elastomeric foam (FEF) insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.

- a) Flexible or rigid wall supporting construction (v.1) b) Flexible or rigid wall supporting construction (v.2)



- c) Flexible or rigid wall supporting construction (v.3) d) Flexible or rigid wall supporting construction (v.4)



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Bundle or two bundles of pipes and cable: 2 x Copper pipe with continuous flexible elastomeric foam (FEF) insulation (thickness of FEF insulation "g"), 1 x PVC-U pipe and 1 x Cable 4 x1.5 mm². Pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 50$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 50$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).
5. Mineral wool density of: 35 kg/m³, lamella insulation thickness of 20 mm and length of 200 mm.

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Mixed pipes bundle (with insulation) penetration seals in flexible or rigid wall

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Table B19.1. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B19:

Pipe material	Copper pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class	Figure in Annex B
single copper pipe	$D \leq 12.7$	≥ 0.8	9	2 x 60.0 x 4.0	EI 60 / E 120 ¹⁾	B19b
			9	2 x 60.0 x 4.0	EI 90 / E 120	B19a,b, c,d
			g ²⁾	2 x 60.0 x 4.0	EI 120	
	$12.7 < D \leq 22.23$	≥ 1.0	9	2 x 60.0 x 4.0	EI 60 / E 120 ¹⁾	B19b
			9	2 x 60.0 x 4.0	EI 90 / E 120	B19a,b, c,d
			g ²⁾	2 x 60.0 x 4.0	EI 120	

¹⁾ Fire resistance class in case of penetration seals placed in 0 mm distance between the adjacent wraps.

²⁾ Mixed bundle additionally insulated with wool density of 35 kg/m³, local insulation (case LI) dimensions of: 20 x 200 mm (thickness x length).

Table B19.2. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B19:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class	Figure in Annex B
double copper pipe	12.7×0.8	12.7×0.8	9	2 x 60.0 x 4.0	EI 60 / E 120 ¹⁾	B19b
			9	2 x 60.0 x 4.0	EI 90 / E 120	B19a,b, c,d
			g ²⁾	2 x 60.0 x 4.0	EI 120	
	12.7×0.8	22.23×1.0	9	2 x 60.0 x 4.0	EI 60 / E 120 ¹⁾	B19b
			9	2 x 60.0 x 4.0	EI 90 / E 120	B19a,b, c,d
			g ²⁾	2 x 60.0 x 4.0	EI 120	

¹⁾ Fire resistance class in case of penetration seals placed in 0 mm distance between the adjacent wraps.

²⁾ Mixed bundle additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 20 x 200 mm (thickness x length).

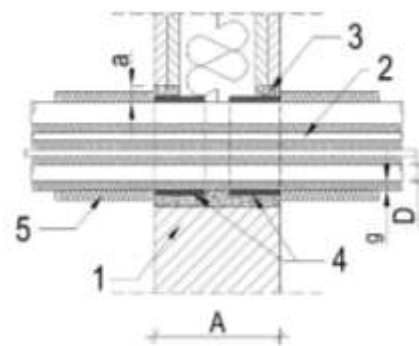
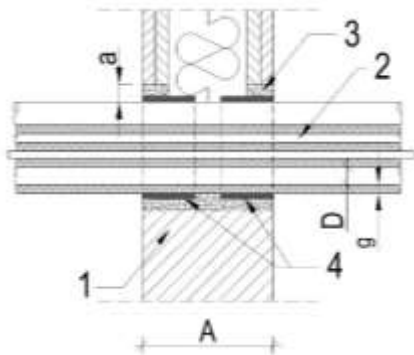
INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Mixed pipes bundle (with insulation) penetration seals in flexible or rigid wall

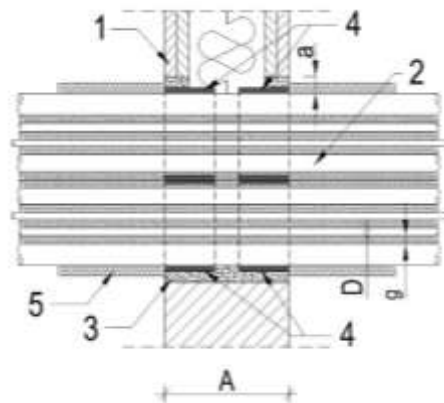
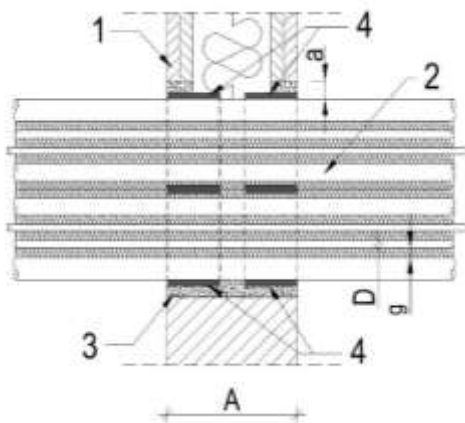
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Fig. B20. Mixed bundle with polyethylene foam (PE) insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in flexible or rigid wall.

- a) Flexible or rigid wall supporting construction (v.1) b) Flexible or rigid wall supporting construction (v.2)



- c) Flexible or rigid wall supporting construction (v.3) d) Flexible or rigid wall supporting construction (v.4)



1. Flexible or rigid wall supporting construction thickness of: $A \geq 125$ mm.
2. Bundle or two bundles of pipes and cable: 2 x Copper pipe with continuous polyethylene foam (PE) insulation (thickness of PE insulation "g"), 1 x PVC-U pipe and 1 x Cable 4x1.5mm². Pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction:
 - for flexible walls cement mortar ring with max. width: $a = 50$ mm, on the minimum depth: 25 mm on both sides of the wall,
 - for rigid walls cement mortar ring with max. width: $a = 50$ mm, on the whole depth of the wall.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).
5. Mineral wool density of: 35 kg/m³, lamella insulation thickness of 20 mm and length of 200 mm.

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Mixed pipes bundle (with insulation) penetration seals in flexible or rigid wall

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Table B20.1. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B20:

Pipe material	Copper pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
single copper pipe	$D \leq 12.7$	≥ 0.8	9	2 x 60.0 x 4.0	EI 90 / E 120
			g ¹⁾	2 x 60.0 x 4.0	EI 120
	$12.7 < D \leq 22.23$	≥ 1.0	9	2 x 60.0 x 4.0	EI 90 / E 120
			g ¹⁾	2 x 60.0 x 4.0	EI 120

¹⁾ Mixed bundle additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 20 x 200 mm (thickness x length).

Table B20.2. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in flexible or rigid wall thickness of: $t \geq 125$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B20:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
double copper pipe	12.7×0.8	12.7×0.8	9	2 x 60.0 x 4.0	EI 90 / E 120
			g ¹⁾	2 x 60.0 x 4.0	EI 120
	12.7×0.8	22.23×1.0	9	2 x 60.0 x 4.0	EI 90 / E 120
			g ¹⁾	2 x 60.0 x 4.0	EI 120

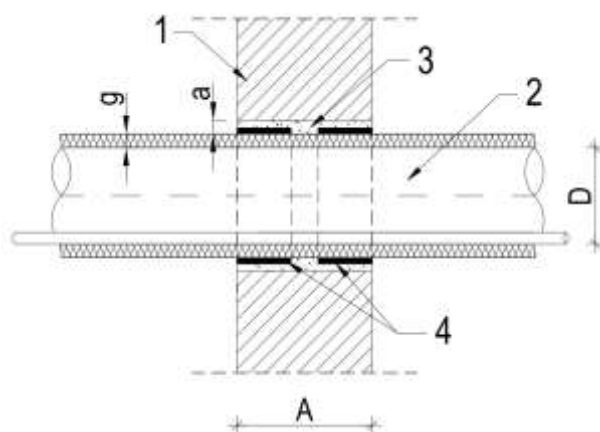
¹⁾ Mixed bundle additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 20 x 200 mm (thickness x length).

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Mixed pipes bundle (with insulation) penetration seals in flexible or rigid wall

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Fig. B21. Plastic pipe with or without heating cable, with flexible elastomeric foam (FEF) insulation penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in rigid wall.



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Plastic pipe with/without heating cable in continuous insulation - flexible elastomeric foam (FEF); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar, ring with max. width: $a = 100$ mm, on the whole depth of the partition.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic pipe (with insulation) penetration seals in rigid wall

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Table B21.1. Resistance to fire classification of plastic pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B21:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP	$D \leq 160$	4.9 – 14.5	13	2 x 60.0 x 12.0	EI 30-U/C EI 30-C/C
		14.6	13	2 x 60.0 x 12.0	EI 120-U/C EI 120-C/C

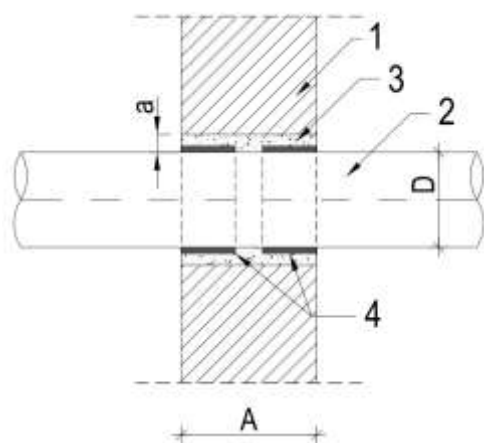
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (with insulation) penetration seals in rigid wall

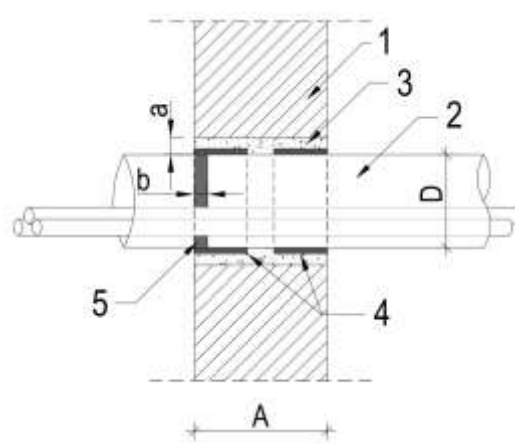
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Fig. B22. Plastic conduit penetration seals made with use of double row of INTU FR WRAP or INTU FR WRAP L in rigid wall.

a) Rigid wall supporting construction (v.1)



b) Rigid wall supporting construction (v.2)



1. Rigid wall supporting construction thickness of: $A \geq 150$ mm.
2. Conduit AROT DVK of WAVIN, empty or with single cable / bundle of cables; conduit diameter of "D" and wave height "t".
3. Gap filled with cement mortar, ring with max. width: $a = 50$ mm, on the whole depth of the partition.
4. INTU FR WRAP or INTU FR WRAP L (double row – placed on both sides, flush with the wall surface).
5. INTU FR MASTIC sealant on one side of the wall, depth of: $b \geq 15$ mm.

INTU FR WRAP and INTU FR WRAP L

Construction details
Plastic conduit penetration seals in rigid wall

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Table B22.1. Resistance to fire classification of AROT DVK conduit penetration seals in rigid wall thickness of: $t \geq 150$ mm, made with use of double row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B22:

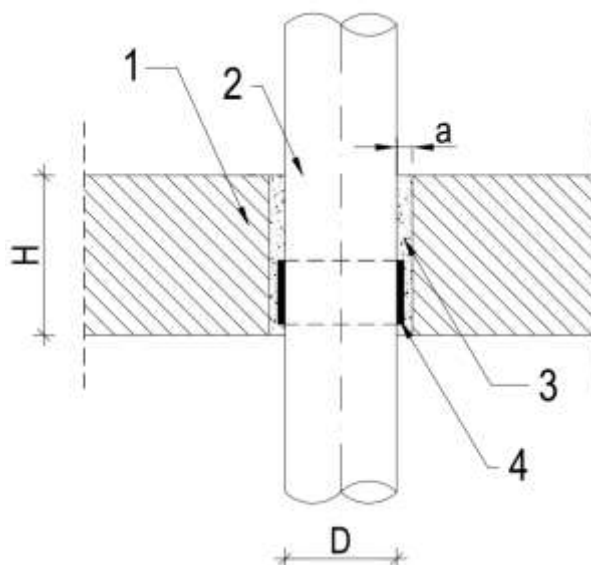
Conduit material	Conduit diameter [mm]	Conduit wave height [mm]	Services inside]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
AROT DVK	$D \leq 110$	3.0	empty	2 x 60.0 x 4.0	EI 120-U/U EI 120-U/C EI 120-C/U EI 120-C/C
			Small cable: $\varnothing_{\text{cable}} \leq 21$ mm	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
			Cable bundle: $\varnothing_{\text{bundle}} \leq 100$ mm $\varnothing_{\text{cable}} \leq 21$ mm	2 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic conduit penetration seals in rigid wall

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Fig. B23. Plastic pipe, MLC pipe and composite pipe (without insulation) penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Plastic pipe, composite pipe and MLC pipe, diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 110$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic / MLC / Composite pipes (without insulation) penetration seals in rigid floor

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Table B23.1. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 550$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B23:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-HT	$D \leq 50$	1.8 – 1.9	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		2.0 – 2.7	-	1 x 60.0 x 4.0	
		2.8 – 3.9	-	1 x 100.0 x 10.0	
	$50 < D \leq 75$	1.9	-	1 x 60.0 x 2.0	
		2.0 – 2.7	-	1 x 60.0 x 4.0	
		2.8 – 3.9	-	1 x 100.0 x 10.0	
	$75 < D \leq 110$	2.7	-	1 x 60.0 x 4.0	
		2.8 – 3.9	-	1 x 100.0 x 10.0	
	$110 < D \leq 125$	3.9	-	1 x 100.0 x 10.0	
	$125 < D \leq 160$	3.9	-	1 x 100.0 x 10.0	
PP-M Magnaplast Ultra dB	$D \leq 50$	2.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		2.1 – 3.4	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		3.5 – 4.9	-	1 x 100.0 x 10.0	EI 120-U/C EI 120-C/C
	$50 < D \leq 75$	2.6	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		2.7 – 4.9	-	1 x 100.0 x 10.0	EI 120-U/C EI 120-C/C
	$75 < D \leq 110$	3.4	-	1 x 60.0 x 4.0	EI 60-U/C EI 60-C/C
		3.5 – 4.9	-	1 x 100.0 x 10.0	EI 120-U/C EI 120-C/C
	$110 < D \leq 160$	4.9	-	1 x 100.0 x 10.0	EI 60-U/C EI 60-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (without insulation) penetration seals in rigid floor

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Table B23.2. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B23:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 32$	2.0 – 6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$32 < D \leq 50$	2.5 – 6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$50 < D \leq 63$	2.8 – 6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$63 < D \leq 75$	3.0 – 6.8	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		6.9 – 10.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$75 < D \leq 90$	3.5 – 4.1	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
		4.3 – 9.5	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		4.3 – 9.5	-	1 x 100.0 x 10.0	EI 240-U/C EI 240-C/C
		9.6 – 10.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		9.6 – 10.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$90 < D \leq 110$	4.2	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
		4.3 – 9.5	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		4.3 – 9.5	-	1 x 100.0 x 10.0	EI 240-U/C EI 240-C/C
		9.6 – 10.0	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	$110 < D \leq 125$	4.8 – 5.8	-	1 x 100.0 x 6.0	EI 240-U/C EI 240-C/C
		5.9 – 6.2	-	1 x 100.0 x 6.0	EI 120-U/C EI 120-C/C
		5.9 – 6.2	-	1 x 100.0 x 10.0	EI 240-U/C EI 240-C/C
		6.3 – 9.5	-	1 x 100.0 x 6.0	EI 120-U/C EI 120-C/C
		6.3 – 9.5	-	1 x 100.0 x 10.0	EI 240-U/C EI 240-C/C
		9.6 – 9.9	-	1 x 100.0 x 6.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Plastic pipes (without insulation) penetration seals in rigid floor

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Table B23.2, cont. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B23:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	125 < D ≤ 160	6.2 – 9.5	-	1 x 100.0 x 10.0	EI 240-U/C EI 240-C/C
	160 < D ≤ 200	6.3 – 11.9	-	1 x 100.0 x 16.0	EI 120-U/C EI 120-C/C
PE-Xa	D ≤ 20	2.0 – 5.8	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	20 < D ≤ 32	3.0	-	1 x 60.0 x 2.0	
	32 < D ≤ 40	3.7	-	1 x 60.0 x 2.0	
	40 < D ≤ 50	4.6	-	1 x 60.0 x 2.0	
	50 < D ≤ 63	5.8	-	1 x 60.0 x 2.0	
PP	D ≤ 50	1.5 – 12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		12.6 – 18.4	-	1 x 60.0 x 4.0	
	50 < D ≤ 75	1.9 – 12.5	-	1 x 60.0 x 2.0	
		12.6 – 18.4	-	1 x 60.0 x 4.0	
	75 < D ≤ 90	2.3 – 18.4	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
	90 < D ≤ 110	2.7 – 18.4	-	1 x 60.0 x 4.0	
	110 < D ≤ 125	3.1 – 15.2	-	1 x 100.0 x 6.0	EI 120-U/C EI 120-C/C
	125 < D ≤ 160	4.0 – 7.7	-	1 x 100.0 x 10.0	
	160 < D ≤ 200	7.7	-	1 x 100.0 x 16.0	EI 45-U/C EI 45-C/C
PP-R	D ≤ 20	2.3 – 4.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 10.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	20 < D ≤ 32	2.7 – 4.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 12.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	32 < D ≤ 40	3.0 – 4.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 12.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	40 < D ≤ 50	3.3 – 4.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 12.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
	50 < D ≤ 63	3.8 – 4.1	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		4.2	-	1 x 60.0 x 2.0	EI 180-U/C EI 180-C/C
		4.3 – 12.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.4 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
INTU FR WRAP and INTU FR WRAP L					Annex B78 of European Technical Assessment ETA-18/0593
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L Plastic pipes (without insulation) penetration seals in rigid floor					

Table B23.2, cont. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B23:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R	63 < D ≤ 75	4.2	-	1 × 60.0 × 2.0	EI 180-U/C EI 180-C/C
		4.3 – 12.5	-	1 × 60.0 × 2.0	EI 120-U/C
	75 < D ≤ 90	6,7 – 7,6	-	1 × 60.0 × 4.0	EI 120-C/C
		7.7 – 12.2	-	1 × 60.0 × 4.0	EI 180-U/C EI 180-C/C
		12.3	-	1 × 60.0 × 4.0	EI 240-U/C EI 240-C/C
		12.4 – 18.3	-	1 × 60.0 × 4.0	EI 120-U/C
	90 < D ≤ 110	10.0 – 12.2	-	1 × 60.0 × 4.0	EI 120-C/C
		12.3	-	1 × 60.0 × 4.0	EI 240-U/C EI 240-C/C
		12.4 – 18.3	-	1 × 60.0 × 4.0	EI 120-U/C EI 120-C/C
PCV-U/ PVC-C	D ≤ 25	1.5	-	1 × 60.0 × 4.0	EI 120-U/U EI 120-U/C EI 120-C/U EI 120-C/C
		1.5 – 4.2	-	1 × 60.0 × 2.0	EI 240-U/C EI 240-C/C
	25 < D ≤ 32	1.5 – 4.2	-	1 × 60.0 × 2.0	
	32 < D ≤ 50	1.8 – 4.2	-	1 × 60.0 × 2.0	
	50 < D ≤ 75	1.9 – 4.2	-	1 × 60.0 × 2.0	
	75 < D ≤ 90	2.1 – 3.4	-	1 × 60.0 × 4.0	EI 180-U/C EI 180-C/C
		3.5 – 4.2	-	1 × 60.0 × 4.0	
	90 < D ≤ 110	2.2	-	1 × 60.0 × 4.0	EI 240-U/C EI 240-C/C
		2.3 – 4.2	-	1 × 60.0 × 4.0	EI 180-U/C EI 180-C/C
	110 < D ≤ 125	2.5 – 3.9	-	1 × 100.0 × 6.0	EI 120-U/C EI 120-C/C
		4.0 – 5.3	-	1 × 100.0 × 6.0	EI 240-U/C
		5.4 – 7.7	-	1 × 100.0 × 10.0	EI 240-C/C
	125 < D ≤ 160	3.2 – 7.6	-	1 × 100.0 × 10.0	EI 120-U/C EI 120-C/C
		7.7	-	1 × 100.0 × 10.0	EI 240-U/C EI 240-C/C
	160 < D ≤ 170	4.4 – 7.6	-	1 × 100.0 × 12.0	EI 120-U/C EI 120-C/C
		7.7	-	1 × 100.0 × 12.0	EI 240-U/C EI 240-C/C
	170 < D ≤ 185	6.1 – 7.6	-	1 × 100.0 × 14.0	EI 120-U/C EI 120-C/C
		7.7	-	1 × 100.0 × 14.0	EI 240-U/C
	185 < D ≤ 200	7.7	-	1 × 100.0 × 16.0	EI 240-C/C
	INTU FR WRAP and INTU FR WRAP L				
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L					
Plastic pipes (without insulation) penetration seals in rigid floor					

Table B23.3. Resistance to fire classification of MLC pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B23:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/AL/ PE-RT	$D \leq 20$	2.0	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		2.1 – 7.5	-	1 x 60.0 x 2.0	EI 180 / E 240-U/C EI 180 / E 240-C/C
	$20 < D \leq 25$	2.5	-	1 x 60.0 x 2.0	
	$25 < D \leq 32$	3.2	-	1 x 60.0 x 2.0	
	$32 < D \leq 40$	4.0	-	1 x 60.0 x 2.0	
	$40 < D \leq 63$	6.0	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.3	-	1 x 60.0 x 2.0	EI 180 / E 240-U/C EI 180 / E 240-C/C
	$63 < D \leq 75$	7.5	-	1 x 60.0 x 2.0	
PE-X/AL/ PE-X	$D \leq 20$	2.0 – 7.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 32$	3.0 – 7.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		7.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$32 < D \leq 40$	4.0	-	1 x 60.0 x 2.0	EI 120-U/C
	$40 < D \leq 63$	6.0 – 7.4	-	1 x 60.0 x 2.0	EI 120-C/C
		7.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$63 < D \leq 75$	7.5	-	1 x 60.0 x 2.0	
		7.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
MLC pipes (without insulation) penetration seals in rigid floor

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Table B23.3, cont. Resistance to fire classification of MLC pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B23:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/AL/ PP-R	$D \leq 20$	2.8 – 3.3	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		3.4 – 10.0	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 32$	4.4 – 12.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C
		12.6 – 18.4	-	1 x 60.0 x 4.0	EI 240-C/C
	$32 < D \leq 50$	6.9 – 12.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C
		12.6 – 18.4	-	1 x 60.0 x 4.0	EI 240-C/C
	$50 < D \leq 63$	8.7 – 12.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C
		12.6 – 18.4	-	1 x 60.0 x 4.0	EI 240-C/C
	$63 < D \leq 75$	10.3 – 12.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C
		12.6 – 18.4	-	1 x 60.0 x 4.0	EI 240-C/C
	$75 < D \leq 90$	12.4 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
	$90 < D \leq 110$	15.1 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
MLC pipes (without insulation) penetration seals in rigid floor

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Table B23.4. Resistance to fire classification of composite pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B23:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/ PP-R-GF/ PP-R	$D \leq 20$	2.8 – 10.0	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 32$	4.4 – 12.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
	$20 < D \leq 32$	12.6 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
	$32 < D \leq 50$	6.9 – 12.4	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		12.6 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
	$50 < D \leq 63$	8.7 – 12.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		12.6 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
	$63 < D \leq 75$	10.3 – 12.5	-	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		12.5	-	1 x 60.0 x 2.0	EI 240-U/C EI 240-C/C
		12.6 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
	$75 < D \leq 90$	11.2 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
	$90 < D \leq 110$	12.3 – 18.3	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C
		18.4	-	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Composite pipes (without insulation) penetration seals in rigid floor

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Table B23.5. Resistance to fire classification of bundle of max. 3 plastic pipes (max. 3 x PE-HD. $D \leq 32$ mm x $t = 2.0$ mm) penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L, length of 60.0 mm and thickness of 4.0 mm in accordance with Annex A and Fig. B23:

Fire resistance class:
EI 240-U/C
EI 240-C/C

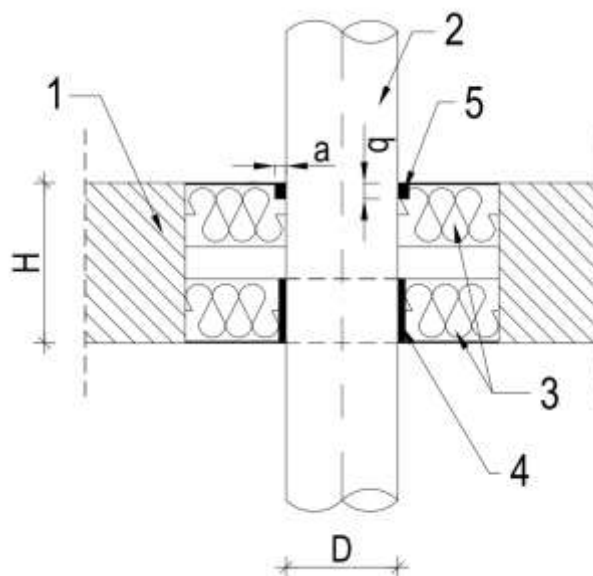
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipe bundle penetration seals in rigid floor

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Fig. B24. Plastic pipe (without insulation) penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Plastic pipe diameter of "D" and pipe wall thickness "t".
3. Mineral wool plate type INTU FR BOARD A according to ETA-19/0037, thickness of 60 mm, installed from both sides of the floor. Mineral wool painted with INTU FR COAT A on the outer side, dry layer thickness of 1 mm.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed on pipe inside the bottom mineral wool).
5. INTU FR MASTIC sealant (area between the pipe and the top mineral wool plate, ring with width of: $a = 10$ mm, sealant depth of: $b = 10$ mm).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic pipes (without insulation) penetration seals in rigid floor

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Table B24.1. Resistance to fire classification of plastic pipes (without insulation) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 550$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B24:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PVC-U PVC-C	$D \leq 110$	4.2	-	1 x 60.0 x 4.0	EI 120-U/C EI 120-C/C

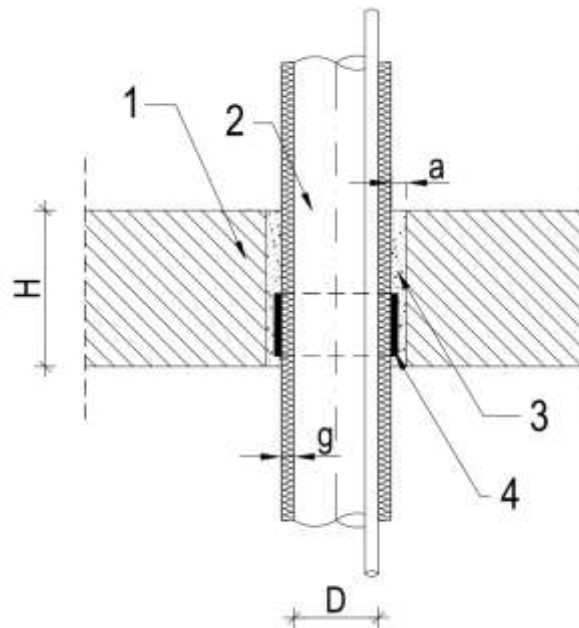
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (without insulation) penetration seals in rigid floor

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Fig. B25. Plastic pipe and composite pipe with or without heating cable, with flexible elastomeric foam (FEF) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Plastic pipe and composite pipe with/without heating cable in continuous insulation - flexible elastomeric foam (FEF); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 110$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic / composite pipes (with insulation) penetration seals in rigid floor

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Table B25.1. Resistance to fire classification of plastic pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B25:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 110$	6.2	23	1 x 60.0 x 16.0	EI 120-U/C EI 120-C/C
		10.0	9 – 13	1 x 60.0 x 8.0	
	$110 < D \leq 160$	6.2	23	1 x 60.0 x 16.0	
PP	$D \leq 110$	2.7	9	1 x 60.0 x 8.0	EI 120-U/C EI 120-C/C
PP-R	$D \leq 110$	18.3	9	1 x 60.0 x 8.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (with insulation) penetration seals in rigid floor

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Table B25.2. Resistance to fire classification of composite pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B25:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/ PP-R-GF/ PP-R	$D \leq 110$	15.1	9	1 x 60.0 x 8.0	EI 120-U/C EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Composite pipes (with insulation) penetration seals in rigid floor

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Table B25.3. Resistance to fire classification of plastic pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B25:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-HD/ PE/PE-X/ ABS/ SAN+PVC	$D \leq 110$	4.2	13	1 x 60.0 x 6.0	EI 120-U/C EI 120-C/C
		4.3 – 10.0	13	1 x 60.0 x 6.0	EI 90-U/C EI 90-C/C
	$110 < D \leq 125$	4.8 – 14.5	13	1 x 100.0 x 8.0	EI 45-U/C EI 45-C/C
		14.6	13	1 x 100.0 x 8.0	EI 90-U/C EI 90-C/C
	$125 < D \leq 160$	6.2 – 14.5	13	1 x 100.0 x 12.0	EI 45-U/C EI 45-C/C
		14.6	13	1 x 100.0 x 12.0	EI 90-U/C EI 90-C/C
PP	$D \leq 160$	4.0 – 14.5	13	1 x 100.0 x 12.0	EI 30-U/C EI 30-C/C
		14.6	13	1 x 100.0 x 12.0	EI 60-U/C EI 60-C/C

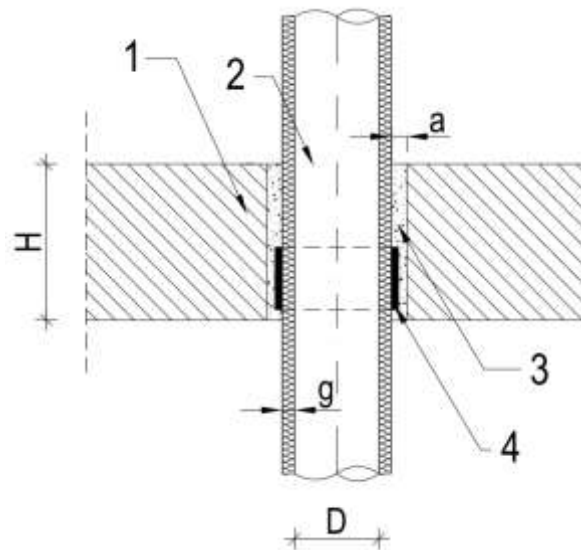
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (with insulation) penetration seals in rigid floor

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Fig. B26. Plastic pipe, MLC pipe and composite pipe with polyethylene foam (PE) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Plastic pipe, MLC pipe and composite pipe in continuous insulation - polyethylene foam (PE); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 110$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic / MLC / composite pipes (with insulation) penetration seals
in rigid floor

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Table B26.1. Resistance to fire classification of plastic pipes with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS) type penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B26:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP	$D \leq 75$	12.5	9	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C
PVC-U/ PVC-C	$D \leq 32$	2.0	9	1 x 60.0 x 4.0	EI 240-U/C EI 240-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Plastic pipes (with insulation) penetration seals in rigid floor

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Table B26.2. Resistance to fire classification of MLC pipes with polyethylene foam (PE), with reaction to fire class E_L, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B26:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PE-RT/AL/ PE-RT	$D \leq 20$	2.0 – 3.0	9	1 x 60.0 x 2.0	EI 120-U/C
	$20 < D \leq 32$	3.0	9	1 x 60.0 x 2.0	EI 120-C/C
PE-X/AL/ PE-X	$D \leq 20$	2.0 – 3.0	9	1 x 60.0 x 2.0	EI 120-U/C
	$20 < D \leq 32$	3.0	9	1 x 60.0 x 2.0	EI 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
MLC pipes (with insulation) penetration seals in rigid floor

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Table B26.3. Resistance to fire classification of composite pipes with polyethylene foam (PE), with reaction to fire class E_L, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B26:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R/ PP-R-GF/ PP-R	$D \leq 20$	2.8	9	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.9 – 8.3	13	1 x 60.0 x 2.0	
	$20 < D \leq 50$	6.9 – 8.3	13	1 x 60.0 x 2.0	

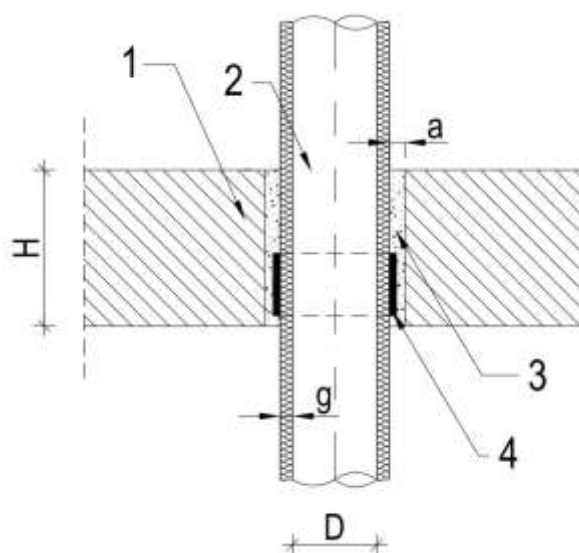
INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

Composite pipes (with insulation) penetration seals in rigid floor

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Fig. B27. Plastic pipe with mineral wool insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Plastic pipe in continuous insulation – mineral wool density of 35 kg/m^3 , thickness of mineral wool insulation “g”, pipe diameter of “D” and pipe wall thickness “t”.
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 50$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Plastic pipes (with insulation) penetration seals in rigid floor

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Table B27.1. Resistance to fire classification of plastic pipes with mineral wool mat continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L placed on the insulation in accordance with Annex A and Fig. B27:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
PP-R	$D \leq 20$	2.3 – 3.4	20	1 x 60.0 x 2.0	EI 120-U/C EI 120-C/C
		6.8 – 12.5	30	1 x 60.0 x 6.0	
	$20 < D \leq 75$	6.8 – 12.5	30	1 x 60.0 x 6.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**

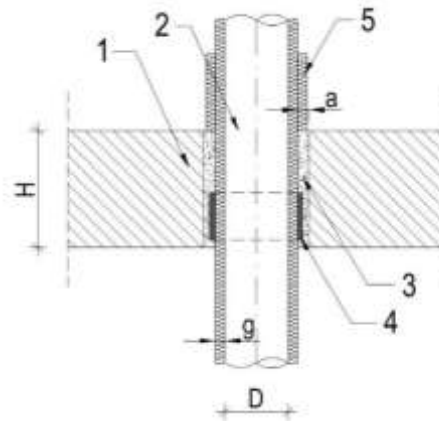
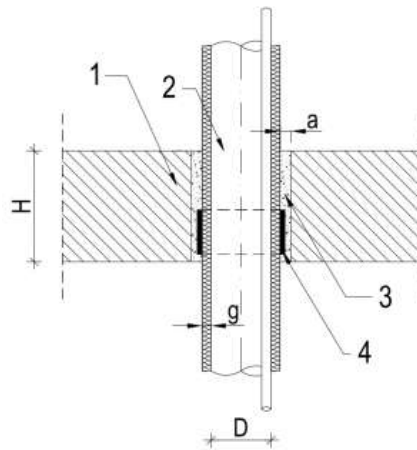
Plastic pipes (with insulation) penetration seals in rigid floor

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Fig. B28. Metal pipe with or without heating cable, with flexible elastomeric foam (FEF) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.

a) Rigid floor supporting construction (v.1)

b) Rigid floor supporting construction (v.2)



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Metal pipe with / without heating cable in continuous insulation - flexible elastomeric foam (FEF); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 110$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).
5. Mineral wool density of: 35 kg/m^3 , lamella insulation thickness of: 50 mm and length of: 700 mm.

INTU FR WRAP and INTU FR WRAP L

Construction details

Metal pipes (with insulation) penetration seals in rigid floor

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Table B28.1. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B28a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 15.0$	≥ 1.0	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	$15.0 < D \leq 22.0$	≥ 1.1	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120 / E 180-C/U EI 120 / E 180-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 180-C/U EI 180-C/C
	$22.0 < D \leq 28.0$	≥ 1.2	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120 / E 180-C/U EI 120 / E 180-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 180-C/U EI 180-C/C
	$28.0 < D \leq 42.0$	≥ 1.3	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120 / E 180-C/U EI 120 / E 180-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 180-C/U EI 180-C/C
	$42.0 < D \leq 54.0$	≥ 1.5	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U
			10 – 22	1 x 60.0 x 4.0	EI 120 / E 180-C/U EI 120 / E 180-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 180-C/U EI 180-C/C
steel	$D \leq 42.4$	≥ 2.0	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
			10 – 22	1 x 60.0 x 4.0	
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid floor

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Table B28.1, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B28a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	42.4 < D ≤ 48.3	2.1 – 2.5	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
		≥ 2.6	9 – 12	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			13	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			14 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			24 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	48.3 < D ≤ 60.3	2.3 – 2.5	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	48.3 < D ≤ 60.3	≥ 2.6	9 – 12	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			13	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			14 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			24 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	60.3 < D ≤ 76.1	≥ 2.6	9 – 12	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			13	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			14 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			24 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Metal pipes (with insulation) penetration seals in rigid floor

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Table B28.1, cont. Resistance to fire classification of metal pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B28a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	76.1 < D ≤ 88.9	2.6 – 2.7	13	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
		≥ 2.8	9 – 12	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			13	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
			14 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			24 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	88.9 < D ≤ 114.3	≥ 3.2	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	114.3 < D ≤ 139.7	≥ 3.7	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	139.7 < D ≤ 159.0	≥ 4.0	9	1 x 60.0 x 2.0	EI 120 / E 240-C/U EI 120 / E 240-C/C
			10 – 22	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 50	1 x 60.0 x 8.0	
	159.0 < D ≤ 168.3	≥ 4.1	9	1 x 60.0 x 2.0	EI 90-C/U EI 90-C/C
			10 – 22	1 x 60.0 x 4.0	EI 60 / E 90-C/U EI 60 / E 90-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 60 / E 120-C/U EI 60 / E 120-C/C
	168.3 < D ≤ 219.0	≥ 4.5	9	1 x 60.0 x 2.0	EI 90-C/U EI 90-C/C
			10 – 22	1 x 60.0 x 4.0	EI 60 / E 90-C/U EI 60 / E 90-C/C
			23 – 36	1 x 60.0 x 6.0	
			37 – 49	1 x 60.0 x 8.0	
			50	1 x 60.0 x 8.0	EI 60 / E 120-C/U EI 60 / E 120-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid floor

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Table B28.2. Resistance to fire classification of steel pipes with flexible elastomeric foam (FEF), with reaction to fire class D_L-s3,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 550$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B28a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$D \leq 168.3$	≥ 4.0	23	1 x 60.0 x 4.0	EI 60-C/U EI 60-C/C

Table B28.3. Resistance to fire classification of copper pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B28a:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
	$12.7 < D \leq 15.0$	≥ 0.9	9	1 x 60.0 x 4.0	
	$15.0 < D \leq 22.23$	≥ 1.0	9	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

Metal pipes (with insulation) penetration seals in rigid floor

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Table B28.4. Resistance to fire classification of steel pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B28:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class	Figure in Annex B
steel	D ≤ 18.0	1.2 – 1.4	9	1 x 60.0 x 2.0	EI 120-C/U EI 120-C/C	B28a
			10 - 25	1 x 60.0 x 4.0		
	D ≤ 18.0	≥ 1.5	9	1 x 60.0 x 2.0		
			10 - 25	1 x 60.0 x 4.0		
			26 – 37	1 x 60.0 x 6.0		
			38 - 50	1 x 60.0 x 8.0		
	18.0 < D ≤ 28.0	1.3 – 1.4	9	1 x 60.0 x 2.0		
			10 - 25	1 x 60.0 x 4.0		
		≥ 1.5	9	1 x 60.0 x 2.0		
			10 - 25	1 x 60.0 x 4.0		
			26 – 37	1 x 60.0 x 6.0		
			38 - 50	1 x 60.0 x 8.0		
	28.0 < D ≤ 48.3	1.4	9	1 x 60.0 x 2.0		
			10 - 25	1 x 60.0 x 4.0		
		≥ 1.5	9	1 x 60.0 x 2.0		
			10 - 25	1 x 60.0 x 4.0		
			26 – 37	1 x 60.0 x 6.0		
			38 - 50	1 x 60.0 x 8.0		
	48.3 < D ≤ 66.7	≥ 1.5	9	1 x 60.0 x 2.0		
			10 - 25	1 x 60.0 x 4.0		
			26 – 37	1 x 60.0 x 6.0		
			38 - 50	1 x 60.0 x 8.0		
	66.7 < D ≤ 76.1	≥ 1.6	25	1 x 60.0 x 4.0		
			26 – 37	1 x 60.0 x 6.0		
			38 - 50	1 x 60.0 x 8.0		
	76.1 < D ≤ 88.9	≥ 1.8	25	1 x 60.0 x 4.0		
			26 – 37	1 x 60.0 x 6.0		
			38 - 50	1 x 60.0 x 8.0		
	88.9 < D ≤ 108.0	≥ 2.0	25	1 x 60.0 x 4.0		
			26 – 37	1 x 60.0 x 6.0		
			38 – 50	1 x 60.0 x 8.0		

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid floor

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Table B28.4, cont. Resistance to fire classification of steel pipes with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B28:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class	Figure in Annex B
steel	$108.0 < D \leq 114.3$	≥ 2.2	50	1 x 60.0 x 8.0	EI 120-C/U EI 120-C/C	B28a
	$114.3 < D \leq 139.7$	≥ 3.1	50	1 x 60.0 x 8.0		
	$139.7 < D \leq 168.3$	≥ 4.0	50	1 x 60.0 x 8.0		
	$168.3 < D \leq 219.1$	≥ 4.4	50 ¹⁾	1 x 60.0 x 8.0	EI 90 / E 120-C/U EI 90 / E 120-C/C	B28b
	$219.1 < D \leq 273.0$	≥ 4.9	50 ¹⁾	1 x 60.0 x 8.0		
	$273.0 < D \leq 323.9$	≥ 5.3	50 ¹⁾	1 x 60.0 x 8.0		
	$323.9 < D \leq 355.6$	≥ 5.6	50 ¹⁾	1 x 60.0 x 8.0		

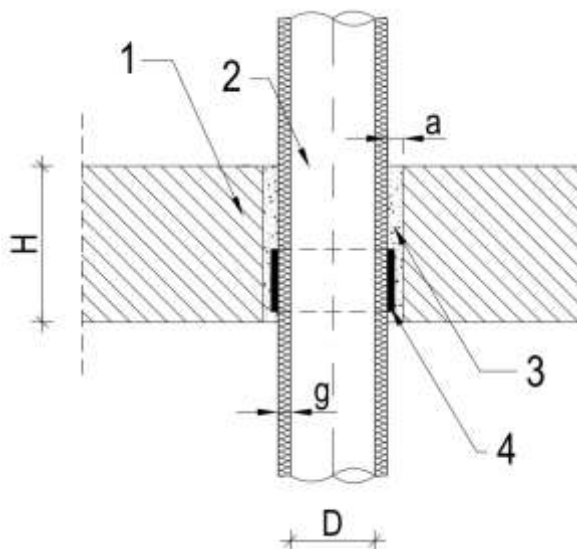
¹⁾ Pipe additionally insulated with mineral wool density of 35 kg/m³, local insulation (case LI) dimensions of: 50 x 700 mm (thickness x length)

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid floor

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Fig. B29. Metal pipe with polyethylene foam (PE) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Metal pipe in continuous or local insulation - polyethylene foam (PE); insulation thickness of "g", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 110$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Metal pipes (with insulation) penetration seals in rigid floor

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Table B29.1. Resistance to fire classification of metal pipes with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS) penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B29:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 6.0$	≥ 0.8	9	1 x 60.0 x 2.0	EI 240-C/U EI 240-C/C
	$6.0 < D \leq 15.88$	≥ 1.0	9	1 x 60.0 x 2.0	
steel	$D \leq 42.4$	2.1 – 2.8	20	1 x 60.0 x 2.0	EI 180 / E 240-C/U EI 180 / E 240-C/C
		≥ 2.9	20	1 x 60.0 x 2.0	
			21 – 25	1 x 60.0 x 4.0	
	$42.4 < D \leq 48.3$	≥ 2.1	25	1 x 60.0 x 4.0	
	$48.3 < D \leq 60.3$	≥ 2.3	25	1 x 60.0 x 4.0	
	$60.3 < D \leq 76.1$	≥ 2.7	25	1 x 60.0 x 4.0	
	$76.1 < D \leq 88.9$	≥ 2.9	25	1 x 60.0 x 4.0	
	$88.9 < D \leq 108.0$	≥ 4.0	25	1 x 60.0 x 4.0	EI 60-C/U EI 60-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid floor

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Table B29.2. Resistance to fire classification of bundle of max. 3 copper pipes (max. 2 x $D \leq 6.35 \text{ mm}$ x $t = 0.8 \text{ mm}$ + max. 1 x $D \leq 15.88 \text{ mm}$ x $t = 1.0 \text{ mm}$) with continuous PE foam insulation, with reaction to fire class E, (thickness of 9 mm) penetration seal in rigid floor thickness of: $t \geq 150 \text{ mm}$ and density of: $\rho \geq 1700 \text{ kg/m}^3$, made with use of single row of INTU FR WRAP or INTU FR WRAP L length of 60.0 mm and thickness of 4.0 mm in accordance with Annex A and Fig. B29:

Fire resistance class:

EI 180 / E 240-C/U

EI 180 / E 240-C/C

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes bundle (with insulation) penetration seals in rigid floor

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Table B29.3. Resistance to fire classification of copper pipes with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, local sustained insulation (case LS) penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B29:

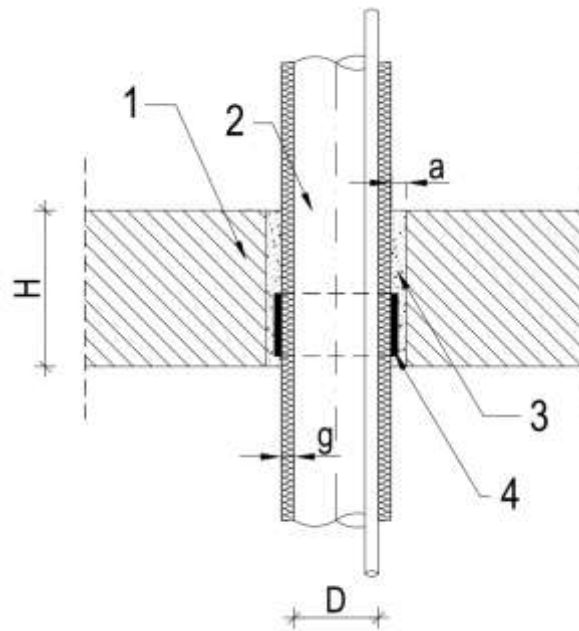
Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9 x 400	1 x 60.0 x 4.0	EI 120-C/U EI 120-C/C
	$12.7 < D \leq 22.23$	≥ 1.0	9 x 400	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

**Penetration seals made with use of INTU FR WRAP
or INTU FR WRAP L**
Metal pipes (with insulation) penetration seals in rigid floor

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Fig. B30. Metal pipe with or without heating cable, with mineral wool insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.



1. Rigid floor supporting construction thickness of: $H \geq 150 \text{ mm}$.
2. Metal pipe with / without heating cable in local sustained insulation – mineral wool density of 35 kg/m^3 , mineral wool insulation thickness "g" and length "L", pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 110 \text{ mm}$, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details
Metal pipes (with insulation) penetration seals in rigid floor

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Table B30.1. Resistance to fire classification of steel pipes with mineral wool mat local sustained insulation (case LS) penetration seals in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B30:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
steel	$D \leq 42.4$	≥ 1.5	20 x 300	1 x 60.0 x 2.0	EI 120-C/U EI 120-C/C
			(21 – 30) x 400	1 x 60.0 x 2.0	
		≥ 2.0	(21 – 40) x 600	1 x 60.0 x 2.0	
		≥ 4.0	(21 – 50) x 600	1 x 60.0 x 2.0	
	$42.4 < D \leq 66.7$	≥ 1.5	30 x 500	1 x 60.0 x 2.0	
		≥ 2.0	(31 – 40) x 600	1 x 60.0 x 2.0	
		≥ 4.0	(31 – 50) x 600	1 x 60.0 x 2.0	
	$66.7 < D \leq 108.0$	≥ 2.0	40 x 600	1 x 60.0 x 2.0	
		≥ 4.0	(41 – 50) x 600	1 x 60.0 x 2.0	
	$108.0 < D \leq 114.3$	≥ 4.0	50 x 600	1 x 60.0 x 2.0	
	$114.3 < D \leq 139.7$	≥ 4.0	50 x 600	1 x 60.0 x 2.0	
	$139.7 < D \leq 168.3$	≥ 4.0	50 x 600	1 x 60.0 x 2.0	

INTU FR WRAP and INTU FR WRAP L

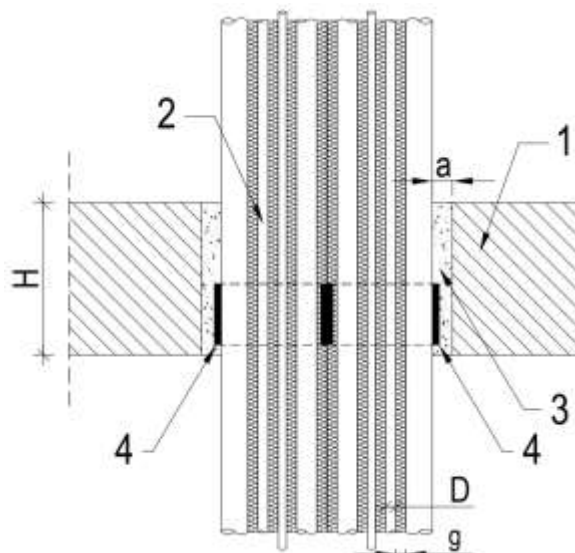
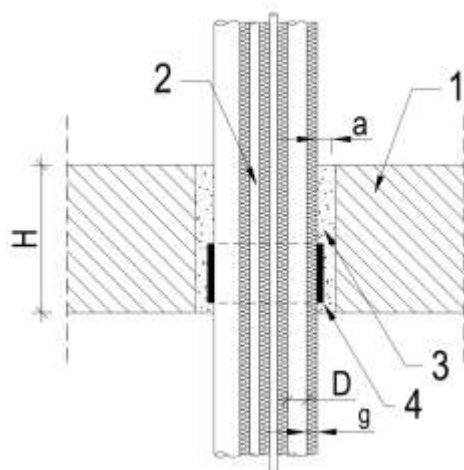
Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L
Metal pipes (with insulation) penetration seals in rigid floor

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Fig. B31. Mixed bundle with flexible elastomeric foam (FEF) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.

a) Rigid floor supporting construction (v.1)

b) Rigid floor supporting construction (v.2)



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Bundle or two bundles of pipes and cable: 2 x Copper pipe with continuous flexible elastomeric foam (FEF) insulation (thickness of FEF insulation "g"), 1 x PVC-U pipe and 1 x Cable 4 x 1.5 mm². Pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar - area between the wrap / tape and supporting construction ring with max. width: $a = 110$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row on each bundle – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

Mixed pipes bundle (with insulation) penetration seals in rigid floor

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Table B31.1. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B31:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9	1 x 60.0 x 4.0	EI 120
	$12.7 < D \leq 22.23$	≥ 1.0	9	1 x 60.0 x 4.0	

Table B31.2. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with flexible elastomeric foam (FEF), with reaction to fire class B_L-s2,d0, continuous insulation (case CS), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B31:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	12.7 x 0.8	12.7 x 0.8	9	1 x 60.0 x 4.0	EI 120
	12.7 x 0.8	22.23 x 1.0	9	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

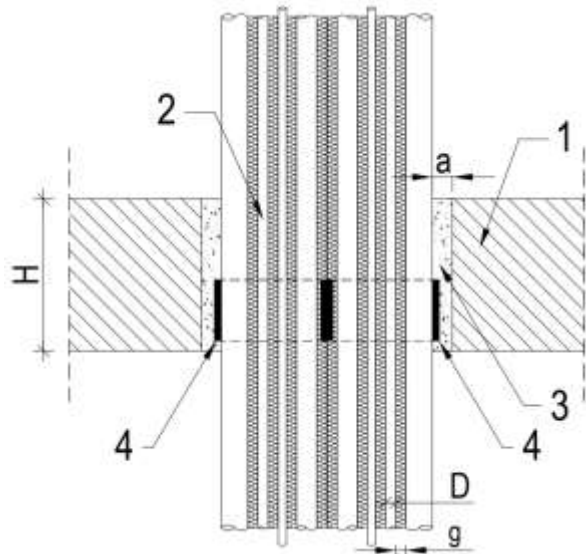
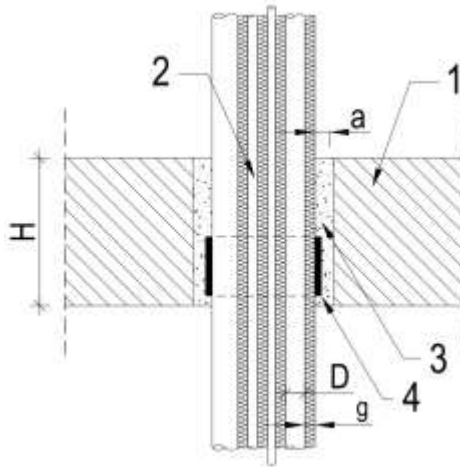
Mixed pipes bundle (with insulation) penetration seals in rigid floor

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Fig. B32. Mixed bundle with polyethylene foam (PE) insulation penetration seals made with use of single row of INTU FR WRAP or INTU FR WRAP L in rigid floor.

a) Rigid floor supporting construction (v.1)

b) Rigid floor supporting construction (v.2)



1. Rigid floor supporting construction thickness of: $H \geq 150$ mm.
2. Bundle or two bundles of pipes and cable: 2 x Copper pipe with continuous polyethylene foam (PE) insulation (thickness of PE insulation "g"), 1 x PVC-U pipe and 1 x Cable $4 \times 1.5 \text{ mm}^2$ (in case of PE insulation with reaction to fire class $B_L-s1,d0$, according to clause 1 of ETA) or 1 x Cable A1 (in case of PE insulation with reaction to fire class E, according to clause 1 of ETA). Pipe diameter of "D" and pipe wall thickness "t".
3. Gap filled with cement mortar, ring with max. width: $a = 110$ mm, on the whole depth of the floor.
4. INTU FR WRAP or INTU FR WRAP L (single row on each bundle – placed inside the floor on the bottom side, max. 10 mm from the floor bottom surface).

INTU FR WRAP and INTU FR WRAP L

Construction details

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Table B32.1. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS), with additional single A1 cable (E-YY-J 5x1,5; RE NYY-J 5x1,5 RE; VV 5x1,5) penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B32:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 6.0$	≥ 0.8	9	1 x 60.0 x 2.0	EI 240
	$6.4 < D \leq 15.6$	≥ 1.0	9	1 x 60.0 x 2.0	

Table B32.2. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS), with additional single A1 cable (E-YY-J 5x1,5; RE NYY-J 5x1,5 RE; VV 5x1,5) penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B32:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	6.0 x 0.8	6.0 x 0.8	9	1 x 60.0 x 2.0	EI 240
	6.0 x 0.8	15.6 x 1.0	9	1 x 60.0 x 2.0	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

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Table B32.3. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS), with additional single A1 cable (E-YY-J 5x1,5; RE NYY-J 5x1,5 RE; VV 5x1,5) and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 32$ mm and pipe wall thickness of: $t_p = 2.0$ mm penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B32:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 6.0$	≥ 0.8	9	1 x 60.0 x 4.0	EI 240
	$6.0 < D \leq 15.9$	≥ 1.0	9	1 x 60.0 x 4.0	

Table B32.4. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class E, continuous insulation (case CS) type, with additional single cable type A1 (E-YY-J 5x1,5; RE NYY-J 5x1,5 RE; VV 5x1,5) and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 32$ mm and pipe wall thickness of: $t_p = 2.0$ mm penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B32:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	6.0 x 0.8	6.0 x 0.8	9	1 x 60.0 x 4.0	EI 240
	6.0 x 0.8	15.9 x 1.0	9	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

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Table B32.5. Resistance to fire classification of mixed bundle of single copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, local insulation (case LS, insulation length of 400 mm) type, with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B32:

Pipe material	Pipe diameter [mm]	Pipe wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	$D \leq 12.7$	≥ 0.8	9 x 400	1 x 60.0 x 4.0	EI 120
	$12.7 < D \leq 22.23$	≥ 1.0	9 x 400	1 x 60.0 x 4.0	

Table B32.6. Resistance to fire classification of mixed bundle of double copper pipe (C/U end configuration) with polyethylene foam (PE), with reaction to fire class B_L-s1,d0, local insulation (case LS, insulation length of 400 mm), with additional single cable 4 x 1.5 mm² and single PVC-U pipe (U/C end configuration) diameter of: $D \leq 25$ mm and pipe wall thickness of: $t_p = 1.5$ mm penetration seal in rigid floor thickness of: $t \geq 150$ mm and density of: $\rho \geq 1700$ kg/m³, made with use of single row of INTU FR WRAP or INTU FR WRAP L in accordance with Annex A and Fig. B32:

Pipe material	Copper pipe No. 1 max. diameter x min. wall thickness [mm]	Copper pipe No. 2 max. diameter x min. wall thickness [mm]	Insulation thickness [mm]	Rows [pcs] x intumescent material length x thickness [mm]	Fire resistance class
copper	12.7 x 0.8	12.7 x 0.8	9 x 400	1 x 60.0 x 4.0	EI 120
	12.7 x 0.8	22.23 x 1.0	9 x 400	1 x 60.0 x 4.0	

INTU FR WRAP and INTU FR WRAP L

Penetration seals made with use of INTU FR WRAP or INTU FR WRAP L

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