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European Technical Assessment

ETA 10/0109
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Section I: General Part

Technical Assessment Body issuing the European Technical Assessment:	SINTEF Building and infrastructure
Trade name of the construction product	Hilti Firestop Foam CFS-F FX
Product family to which the construction product belongs	Fire Stopping and Sealing Product. Penetration Seals.
Manufacturer	HILTI Corporation Feldkircherstrasse 100 9494 Schaan Liechtenstein
Manufacturing plant	HILTI Werk 4a
This European Technical Assessment contains	49 pages including 4 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	ETAG 026-1(09-2012), ETAG 026-2 (08-2011), both used as EAD
This version replaces	ETA 10/0109 issued on April 11, 2014

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Section II: Specific parts

1. Technical description of the product and intended use

Hilti Firestop Foam CFS-F FX is a two-component foam, composed essentially of expanding substances and binder. For further information, see Annex 1.

2. Specification of the intended use

2.0 General description of the use of Hilti Firestop Foam CFS-F FX

Hilti Firestop Foam CFS-F FX is intended to form a penetration seal, which is used to maintain the fire resistance of a separating element (wall or floor) when and where services pass through.

The specific structures where Hilti Firestop Foam CFS-F FX may be used to provide a penetration seal are

- flexible walls
- rigid walls
- rigid floors

The seal is formed by applying Hilti Firestop Foam CFS-F FX in the opening around the penetrating services.

Hilti Firestop Foam CFS-F FX may be used to provide a penetration seal with the following specific services in single or multiple applications as well as in mixed application of these service types (mixed):

Blank seal	No services as given in Annex 2
Cables / cable trays	Services as given in Annex 2
Conduits	Services as given in Annex 2
Metal pipes	Services as given in Annex 2
Plastic pipes	Services as given in Annex 2
Mixed	Services as given in Annex 2

Further details on the type of services covered by the declared classifications and other parameters to be considered are given in Annex 2.

Hilti Firestop Foam CFS-F FX is intended for environmental conditions as defined by use category Y₂ (intended for use at temperatures between -20 °C and + 70°C, but with no exposure to rain nor to UV) according to EOTA TR 024.

The provisions made in this European Technical Assessment are based on an assumed working life of this "Fire Stopping and Sealing Product" of 10 years, provided that the conditions relating

to manufacturing, installation, use and repair, are met. In normal use conditions the real working life might be considerably longer.

The indications given on the intended working life cannot be interpreted as a guarantee given by the producer or the approval body, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

2.1 Additional components for pipe penetrations

In some cases (see Annex 2) of plastic pipes and metal pipes with combustible insulations (reaction to fire class B to E according to EN 13501-1) a Hilti Firestop Bandage CFS-B (see ETA-10/0212) is wrapped around the pipe.

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

3.0 Summary of the performance of the product

The assessment of fitness for use has been made in accordance with ETAG No 026 - Part 2 (08-2011), summarized as follows:

ETAG Clause No.	Characteristic	Assessment of characteristic
	Mechanical resistance and stability	Not relevant
	Safety in case of fire	
2.4.1	Reaction to fire	Class E (cured state), according to EN 13501-1
2.4.2	Resistance to fire	According to EN 13501-2, see clause 3.1 and Annex 2
	Hygiene, Health and the Environment	
2.4.3	Air permeability	According to EN 1026, see clause 3.2
2.4.4	Water permeability	No performance determined
2.4.5	Dangerous substances	No indication, see clause 3.3
	Safety in use	
2.4.6	Mechanical resistance and stability	Zone type I to IV according to EOTA TR 001, see clause 3.4
2.4.7	Resistance to impact/movement	See clause 3.4
2.4.8	Adhesion	See clause 3.5
	Protection against noise	
2.4.9	Airborne sound insulation	See clause 3.6

Energy, Economy and Heat Retention

2.4.11 Thermal properties	No performance determined
2.4.12 Water vapour permeability	No performance determined

General aspects relating to fitness for use

2.4.13 Durability and serviceability	Y _{2, (-20/+70)°C} according to ETAG 026-2, Compatibility with coatings, see clause 3.7
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3.1 Resistance to fire

The resistance to fire performance according to EN 13501-2 of penetration seals incorporating Hilti Firestop Foam CFS-F FX is given in Annex 2.

Information on ancillary products which were tested within the framework of this European Technical Approval for evaluating resistance to fire is given in Annex 1.

Other parts or support constructions than given in Annex 2 must not penetrate the seal. Provisions shall be taken such that floor penetration seals cannot be stepped on or are not subjected to forces higher than the limit taken from the impact tests, e.g. by covering with a wire mesh.

3.2 Air permeability, and permeability regarding some other gases

The permeability has been tested according to EN 1026.

The following two flow rates (**q**) per area (**A**) for air permeability were achieved for the given air pressure differences (**Δp**):

Δp [Pa]	q / A [m³/(h· m²)]	Layer thickness [mm]
50	0,0007	174
250	0,0033	174

The permeability regarding the gases N₂, CO₂ and CH₄ (methane) has been determined as follows for foam layer with thickness 174 mm, and where the flow rate index q indicates the type of gas:

Δp [Pa]	q_{N₂} / A [m³/(h·m²)]	q_{CO₂} / A [m³/(h·m²)]	q_{CH₄} / A [m³/(h·m²)]
50	0,0006	0,0004	0,0007
250	0,0031	0,0021	0,0035

The declared values refer to a penetration seal made from Hilti Firestop Foam CFS-F FX without any penetrating installation.

3.3 Emission of dangerous substances or radiation

According to the manufacturer's declaration, the product specification has been compared with the list of dangerous substances of the European Commission to verify that that it does not contain such substances above the acceptable limits.

A written declaration in this respect was submitted by the ETA-holder.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3.4 Mechanical resistance and stability

In impact tests according to EOTA TR001 the requirements for the highest risk zone type (Type IV) have been fulfilled as defined for internal walls in EOTA TR 001 A.1 for safety in use (500 Nm soft body impact, 10 Nm hard body impact) as well as serviceability (120 Nm soft body impact, 6 Nm hard body impact).

The results are valid for a maximum dimension of the penetration seal equal or lower to 0.4 m x 0.4 m.

3.5 Adhesion

It is assumed that verification of adequate adhesion is covered by the impact tests shown in clause 3.4.

3.6 Airborne sound insulation

Test reports concerning noise reduction measurements according to EN ISO 10140-1:2010+A1:2012, EN ISO 10140-2:2010 and EN ISO 717-1: 2013 have been provided.

According to these tests reports the single number ratings are:

Weighted sound reduction index: $R_w(C;C_{tr}) = 61(-2;-6)$ dB

Weighted element-normalized level difference: $D_{n,e,w}(C;C_{tr}) = 69(-2;-7)$ dB

Regarding the value $D_{n,e,w}(C;C_{tr})$: $A_o = 10$ m² reference area

The acoustic measurement test results apply to the test specimen as described in the following.

The total thickness of the wall element described in the table below: $t_{wall} = 155$ mm. The outer dimensions of the same wall: $W \times H = 1200$ mm x 1480 mm. This wall element was penetrated by a square opening of $w \times h = 200^2$ mm² which was filled with Hilti Firestop

Foam CFS-F FX. The total thickness of the penetration seal was 200 mm, i.e. 45 mm thicker than the wall element. This was made possible by 3 layers of plasterboard strips mounted around the opening on each side.

Description of the wall element, in layers
2 x 12,5 mm plasterboard
50 mm steel frame with 40 mineral wool
5 mm air gap, i.e. distance
50 mm steel frame with mineral wool
2 x 12,5 mm plasterboard

The given results apply to the measurement where the seal was not penetrated by any cables ("blank seal"). Based on the relevant measurements the penetration seal do not have any acoustic influence on wall elements with R_w -values up to about 61 dB; assuming same dimensions on "the penetration seal cube" through a wall with a thickness close to 155 mm. Other results must be expected for installations where cable trays, pipes, tubes, etc. are passing through the penetration seal.

3.7 Durability and serviceability

3.7.1 Durability

Hilti Firestop Foam CFS-F FX fulfils the requirements of use category Y_2 :

Products intended for use at temperatures between -20 °C and $+70\text{ °C}$, but with no exposure to rain nor UV in accordance with ETAG 026-2, Section 1.2.

Since the requirements for type Y_2 are met, also the requirements for type Z_1 and Z_2 are fulfilled.

3.7.2 Serviceability

Hilti Firestop Foam CFS-F FX has been tested in combination with coatings based on an acrylic dispersion, alkyd resin, polyurethane/acrylic and epoxy resin. The results of the test have demonstrated suitability of penetration seals made from Hilti Firestop Foam CFS-F FX for being painted over by those types of coatings.

4. Assessment and verification of constancy of performance system (AVCP)

4.1 AVCP system

According to the decision 1999/455/EC¹ of the European Commission, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V of Regulation (EU) No 305/2011) is given in the following table:

Product	Intended use	Resistance to fire Level(s) or class(es)	AVCP system
Fire Stopping and Fire Sealing Products <i>See section I: General Part</i>	For fire compartmentation and/or fire protection or fire performance, as given in <i>section II, clause 2</i>	<i>See clause 3.1, and Annex 1 and 2</i>	1

Note! References given in the table are made to this ETA document only.

The AVCP system referred to in the table above is described as follows:

Tasks for the manufacturer:

- (1) factory production control (FPC),
- (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

Tasks for the Notified Product Certification Body:

- (3) determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product
- (4) initial inspection of factory and of factory production control (FPC),
- (5) continuous surveillance, assessment and evaluation of FPC

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable ETAG used as EAD

According to Decision 98/143/EC by the European Commission, the system 2+ of assessment and verification of constancy of performance applies. See Annex V to Regulation (EU) No. 305/2011.

Issued in Trondheim on 17.04.2014

By

SINTEF Building and Infrastructure



Hans Boye Skogstad

¹ Official Journal of the European Communities L178/52 of 14/7/1999

DESCRIPTION OF THE PRODUCT AND ANCILLARY PRODUCT(S)

1.1 Product

1.1.1 Hilti Firestop Foam CFS-F FX

A detailed specification of the product is contained in document "Identification / Product Specification relating to the European Technical Assessment ETA-10/0109 - Hilti Firestop Foam CFS-F FX" which is a non-public part of this ETA.

The Control Plan is defined in document "Control Plan" relating to the European Technical Approval ETA-10/0109 - Hilti Firestop Foam CFS-F FX" which is a non-public part of this ETA.

Foil pack 325ml



Mixing nozzle



1.1.2 Dispenser

Hilti Firestop Foam CFS-F FX may be applied with a Hilti MD 2000 / HDM 330 (manual) or Hilti ED 3500 / HDE 500-A22 dispenser (battery). See also the installation instruction in Annex 3.

MD 2000



ED 3500



HDM 330



HDE 500-A22



1.1.3 Technical product literature

Technical Datasheet Hilti Firestop Foam CFS-F FX including instructions for the use of Hilti Firestop Foam CFS-F FX (including all components as shown in 1.1 and 1.2)

1.2 Ancillary component

1.2.1 Hilti Firestop Bandage CFS-B

For specification and further details see ETA-10/0212.



Technical Datasheet Hilti Firestop Bandage CFS-B including instructions for use Hilti Firestop Bandage CFS-B.

ANNEX 2

RESISTANCE TO FIRE CLASSIFICATION OF HILTI FIRESTOP FOAM CFS-F FX

2.1 General

The specific structures where Hilti Firestop Foam CFS-F FX may be used to provide a penetration seal are as follows:

- Flexible walls:** The wall must comprise timber or steel studs lined on both faces with minimum 2 layers of 12.5 mm thick boards. For timber stud walls there must be a minimum distance of 100 mm between the seal and any stud. The cavity must be filled with minimum 100 mm insulation of Class A1 or A2 in accordance with EN 13501-1). Minimum wall thickness as defined in Annex 2
- Rigid walls:** The wall must comprise concrete, aerated concrete or masonry, with a minimum density of 650 kg/m³. Minimum wall thickness as defined in Annex 2
- Rigid floors:** The floor must have a minimum thickness of 150 mm and comprise aerated concrete or concrete with a minimum density of 2200 kg/m³. This ETA does not cover use of this product as a penetration seal in sandwich panel constructions.

The seals may only be penetrated by the services described in Annex 2. Other parts or support constructions must not penetrate the seal.

The service support construction must be fixed to the building element containing the penetration seal or a suitable adjacent building element, on both sides of the penetration in such a manner that in the case of fire, no additional load is imposed on the seal. Furthermore it is assumed that this support is maintained on the unexposed side, for the required period of fire resistance.

Specific considerations:

- For tied cable bundles the space between the cables needs not be sealed.
- The total cross section of the cables (including cable supporting systems like cable trays etc.) must not be more than 60% of the total seal (opening) size.
- Pipes must be perpendicular to the seal surface.
- The function of the pipe seal in case of pneumatic dispatch systems, pressurized air systems etc. is guaranteed only when the systems are shut off in case of fire.
- The approval does not address any risks associated with leakage of dangerous liquids or gases caused by failure of the pipe(s) in case of fire.
- The durability assessment does not take account of the possible effect of substances permeating through the pipe on the penetration seal.
- The classifications for metal and plastic pipes relate to C/U (capped inside the furnace/uncapped outside), U/C (uncapped inside the furnace/capped outside) and U/U (uncapped inside the furnace/uncapped outside). For further information refer to national regulations.

For evaluating resistance to fire of the penetration seal using "Hilti Firestop Foam CFS-F FX" as specified in Annex 2 it is assumed that

- the installation of the penetration seal does not affect the stability of the adjacent building elements – even in case of fire,
- the installations are fixed to the adjacent building elements (not to the seal) in accordance with the relevant regulations in such a way that, in case of fire, no additional mechanical load is imposed on the seal,
- the support of the installations is maintained for the classification period required and
- pneumatic dispatch systems, compressed air systems, etc. are switched off by additional means in case of fire.

The classification of the resistance to fire performance has been carried out in accordance with clause 7.5.8 in EN 13501-2:2007.

The classifications require that the rules for installation shown in Annex 3 are followed.

The separating elements must be classified in accordance with EN 13501-2 for the required fire resistance period or fulfil the requirements of the relevant Eurocode.

The classifications are not valid for sandwich panel constructions.

Penetration seals require a minimum distance of 200mm. For minimum distances between services within a penetration seal (multiple or mixed penetration seal) see Annex 2.1.3.

For minimum distance of cable and pipe support constructions with wall and floor seals see Annex 2.1.4.

Intended use of penetrations and reference to relevant section (list not exhaustive, other uses of pipes may be possible)				see Annex 2	
Application	Penetration material	Manufacturer, product (samples)	Insul.	Flexible & rigid wall ≥ 100 mm	Rigid floor ≥ 150 mm
Cables	Sheeted Wires tied bundles			2.3.1	2.3.2
Electrical conduits	PVC, PO			2.4.1	2.4.2
Heating pipes	Copper		CS LS	2.5.2.2.1 2.5.3.1.1 2.5.4.2.1 2.5.4.2.2	2.5.2.2.2 2.5.2.2.3 2.5.3.1.2 2.5.4.2.3
	Steel, stainless		CS LS	2.5.2.1.1 2.5.4.1.1	2.5.2.1.2 2.5.3.1.3 2.5.4.1.2
	Al-composite	Geberit: Mepla Fränkische RW: Alpex duo	CS	2.6.1.1 2.6.1.2	2.6.1.1 2.6.1.2
Potable water pipes	Copper		- CS LS	2.5.1.1 2.5.2.2.1 2.5.3.1.1 2.5.4.2.1 2.5.4.2.2	2.5.1.1 2.5.2.2.2 2.5.3.1.2 2.5.4.2.3
	Stainless		CS LS	2.5.2.1.1 2.5.4.1.1	2.5.2.1.2 2.5.3.1.3 2.5.4.1.2
	Al-composite	Geberit: Mepla Fränkische RW: Alpex duo	CS	2.6.1.1 2.6.1.2	2.6.1.1 2.6.1.2
Chilled water pipes	Copper		CS LS	2.5.2.2.1 2.5.3.1.1 2.5.4.2.1 2.5.4.2.2	2.5.2.2.2 2.5.2.2.3 2.5.3.1.2 2.5.4.2.3
	Steel, stainless		CS LS	2.5.2.1.1 2.5.4.1.1	2.5.2.1.2 2.5.3.1.3 2.5.4.1.2
	PE	EN ISO 15494, DIN 8074/8075	-	2.7.1.1 2.7.1.3	2.7.1.1 2.7.1.3
Waste water pipes	PE	EN 1519	-	2.7.1.2	2.7.1.2
	PVC-U	EN ISO 1452	-	2.7.2.2 2.7.2.3	2.7.2.2 2.7.2.3 2.7.3
Pneumatic pipes	PVC-U	EN ISO 1452	-	2.7.2.2 2.7.2.3	2.7.2.2 2.7.2.3
Industry pipes	Copper		- CS LS	2.5.1.1 2.5.2.2.1 2.5.3.1.1 2.5.4.2.1 2.5.4.2.2	2.5.1.1 2.5.2.2.2 2.5.2.2.3 2.5.3.1.2 2.5.4.2.3
	Steel, stainless		CS LS	2.5.2.1.1 2.5.4.1.1	2.5.2.1.2 2.5.3.1.3 2.5.4.1.2
	Al-composite	Geberit: Mepla Fränkische RW: Alpex duo	CS	2.6.1.1 2.6.1.2	2.6.1.1 2.6.1.2
	PE	EN ISO 15494, DIN 8074/8075	-	2.7.1.1 2.7.1.3	2.7.1.1 2.7.1.3
	PVC-U	EN ISO 14493	-	2.7.2.1 2.7.2.4	2.7.2.1 2.7.2.4
Air condition	Clima Split pipe bundles		CS	2.8.1	2.8.2

2.1.1 Seal Thickness

Where the required seal thickness t_A given in Annex 2 is higher than the wall or floor thickness t_E , a support frame (E_1) made from material of class A1 or A2 according to EN 13501-1 (e.g. gypsum board) shall be installed to support the Hilti Firestop Foam CFS-F FX as illustrated in Fig. 1.

The frame may be installed inside the opening, its depth being minimum the seal thickness t_A , in case of a penetration seal in a wall centred in relation to the wall. Alternatively a frame made from gypsum board may be fixed to the wall or floor around the opening (width $w_A \geq 50$ mm for wall applications, $w_A \geq 75$ mm for floor applications, total thickness wall plus frame \geq seal thickness t_A). The frame must be fixed by minimum 2 metal screws per side of the frame with a maximum distance of 150 mm between the screws. In case of a penetration seal in a wall the frame shall be installed on both sides so that the penetration seal is centred in relation to the wall.

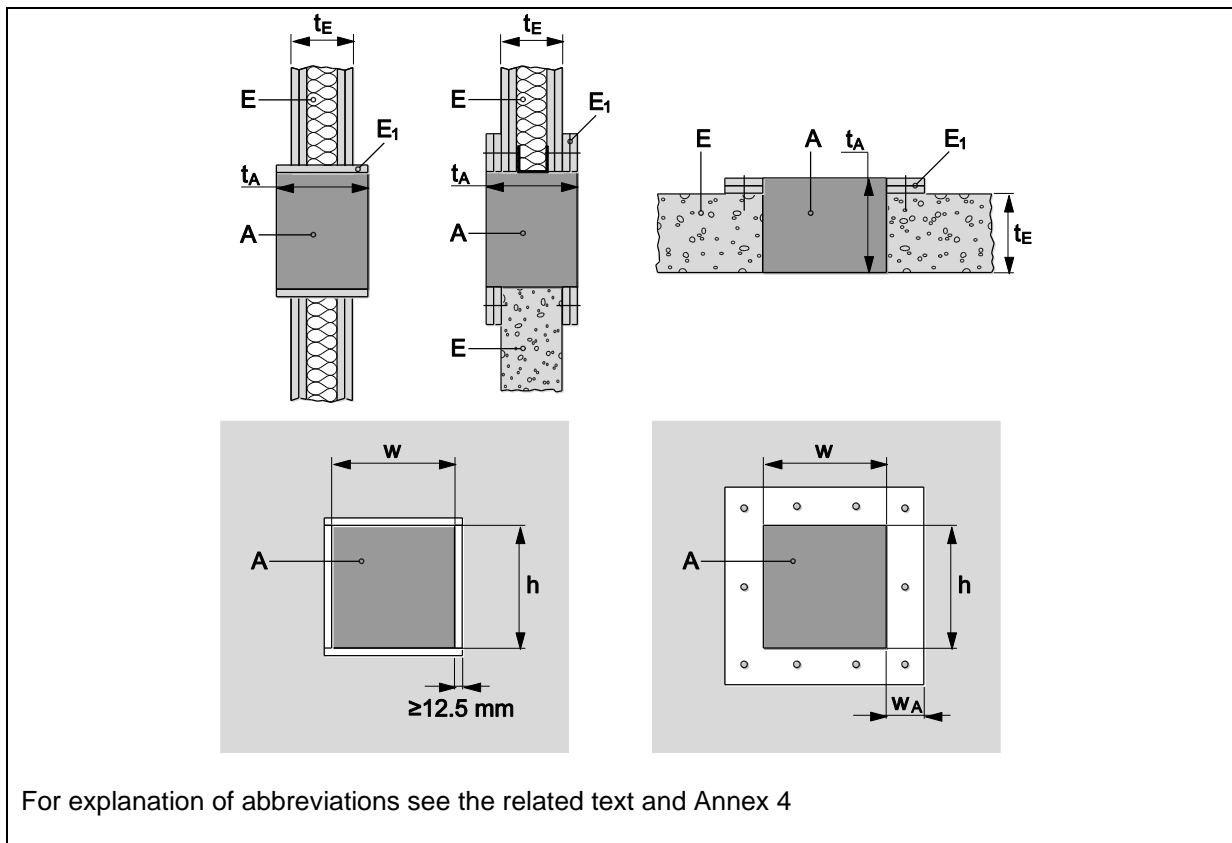


Fig. 1: Options for support frames (seal thickness higher than wall/floor thickness)

For some floor applications a pipe sleeve (F) can be casted into concrete floor made from PVC-pipes, diameter 75 mm – 110 mm, with 200 mm length mounted flush to the bottom side of the floor as illustrated in Fig. 2.

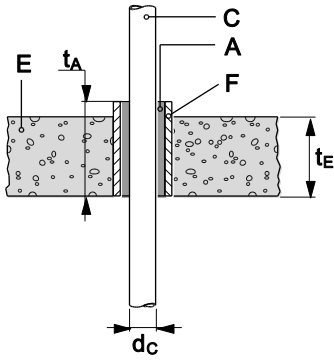


Fig. 2: Sleeves for floor applications

Aperture Framing

In case of a flexible wall with no insulation between the panels, an insulation that does not fill the space between the linings completely, an insulation of a density of less than 100 kg/m³ or an insulation made from glass wool, an aperture framing has to be installed. It has to be made from material used to construct the wall, i.e. studs and boards with a minimum board thickness of 12.5 mm, as illustrated in Figure 3.

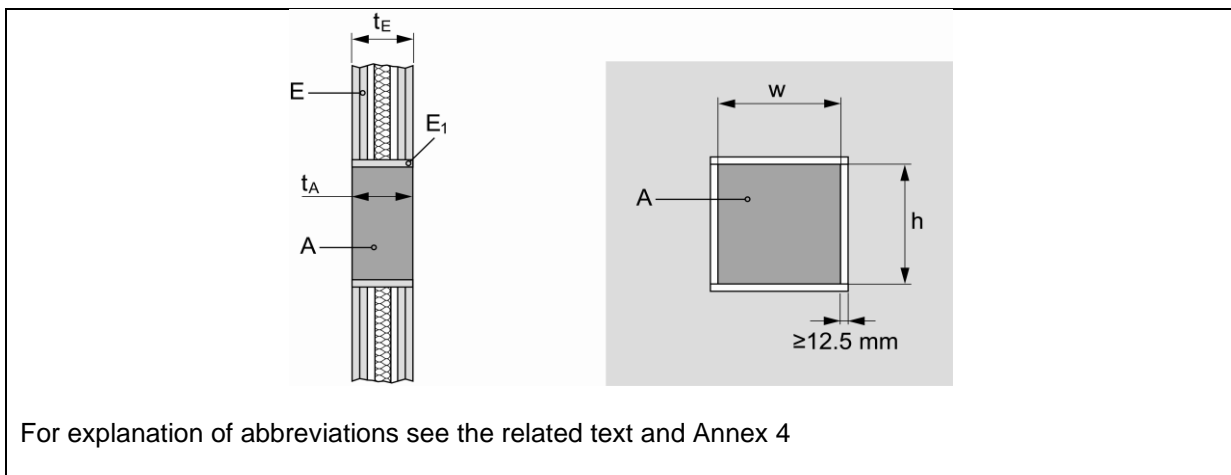


Fig. 3 Aperture framing

2.1.2 Seal size

The results are valid for any penetration seal size equal or lower to:

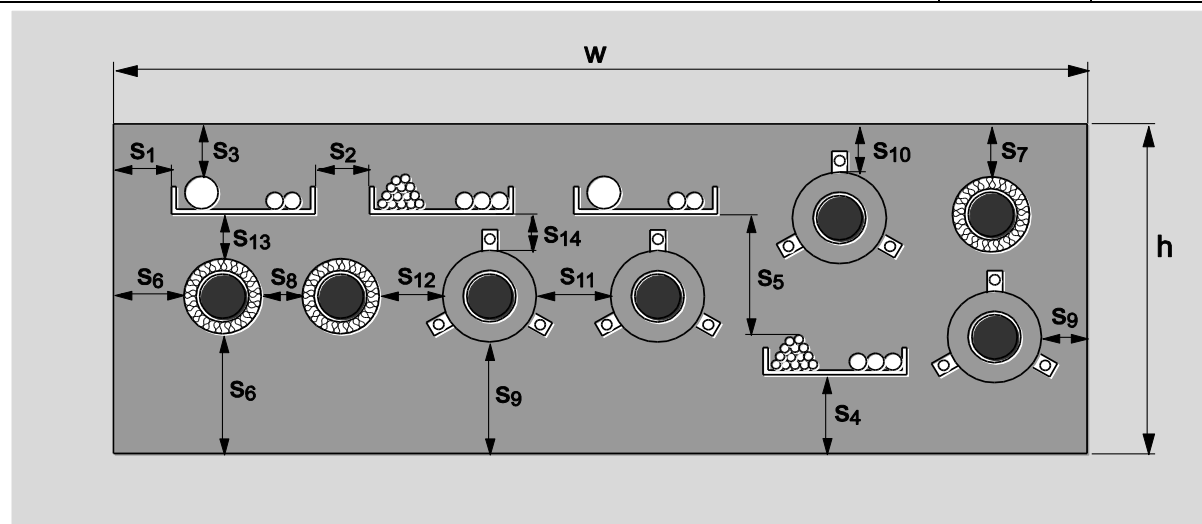
	Classification	seal size:		seal thickness: t_A
		w x h	Ø	
Wall penetrations	EI 90	≤ 600 x 600 mm	≤ 600 mm	≥ 100 mm
	EI 120	≤ 400 x 400 mm	≤ 400 mm	≥ 150 mm
Floor penetrations	EI 120	≤ 400 x 400 mm	≤ 400 mm	≥ 150 mm

Provided that the total amount of services (including insulation) is equal or lower than 60% of the penetration surface.

2.1.3 Minimum distances for penetrations

The distances are valid for single, multiple and mixed penetrations.

	[mm]	Wall	Floor
S₁ (distance between cables/cable supports and seal edge)		00	00
S₂ (distance between cable supports)		25	0
S₃ (distance between cables and upper seal edge)		0	0
S₄ (distance between cable supports and bottom seal edge)		50	50
S₅ (distance between cables and cable support above)		0	20
S₆ (distance between metal pipes and seal edge)		20	-
S₇ (distance between metal pipes and upper seal edge)		0	15
S₈ (distance between metal pipes) linear arrangement		40	20
(distance between metal pipes) grouped arrangement		0	20
S₉ (distance between plastic pipes/pipe closure devices and seal edge)		20	-
S₁₀ (distance between plastic pipes/pipe closure devices and upper seal edge)		35	20
S₁₁ (distance between plastic pipes/pipe closure devices)		35	20
S₁₂ (distance between metal pipes and plastic pipes/pipe closure devices)		50	80
S₁₃ (distance between cables/cable supports and metal pipes)		50	80
S₁₄ (distance between cables/cable supports and plastic pipes/pipe closure devices)			



2.1.4 Distances for pipe and cable support constructions

The distances for support constructions away from the construction elements are:

	Wall (distance from the face of the wall on both sides):	Floor (distance from upper side of floor)
Pipes	300 mm	250 mm
Cables	500 mm	415 mm

2.1.5 Additional components for pipe penetrations

In some cases of plastic pipes and metal pipes with combustible insulations (reaction to fire class B to E according to EN 13501-1) a **Hilti Firestop Bandage CFS-B** (see ETA-10/0212) is wrapped around the pipe.

The bandage is positioned with half of its width (62.5 mm) within the seal (central marking line at the surface of the seal) and fixed with wire. For necessary number of layers of the bandage see the relevant chapter in Annex 2 (special care has to be taken to use the correct position when the required Hilti Firestop Foam CFS-F FX seal thickness is higher than the wall or floor thickness).

2.1.6 Foamed elastomeric insulation products for pipe insulation

The following types of foamed elastomeric insulation products may be used as pipe insulation:

Manufacturer	Product designation
Armacell International GmbH	Armaflex AF (CE marked according to EN 14304), Armaflex SH, Armaflex Ultima, Armaflex HAT
NMC Group	Insul-Tube (nmc), Insul-Tube H-Plus (nmc),
Kaimann GmbH	Kaiflex KK plus, Kaiflex KK
L'Isolante K-Flex	l'Isolante K-Flex HT, l'Isolante K-Flex ECO, l'Isolante K-Flex ST, l'Isolante K-Flex H, l'Isolante K-Flex ST Plus

Named material may be used in make of an insulation hose, bandage/wrap or plates. If a protect insulation D_p is used, it should be made from the same elastomeric material as the thermal pipe insulation itself.

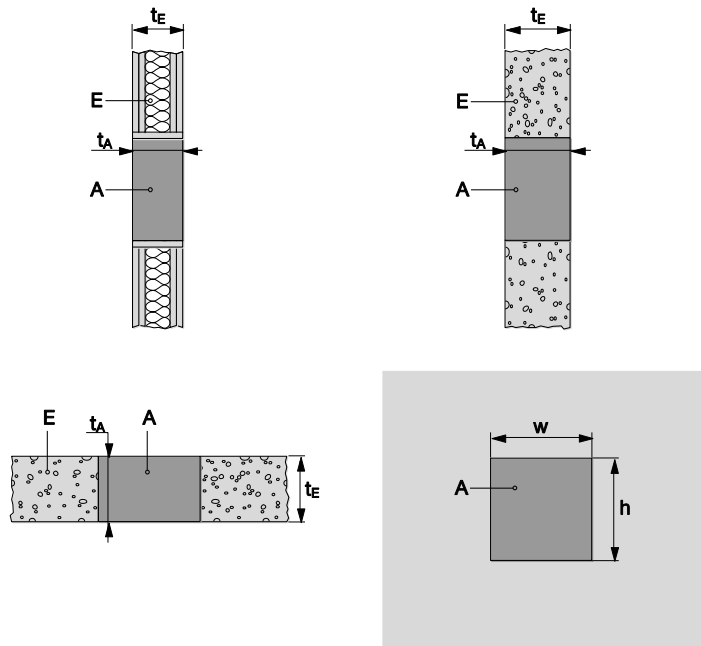
2.2 Blank seals

Construction details :

Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E).

In case of seal thickness $t_A >$ building element thickness t_E , see Annex 2.1.2

For symbols and abbreviations see Annex 4.



* If services are added later on in a blank seal only the services listed in the tables below may be added that fulfil the required classification

2.2.1 Blank seal in flexible and rigid walls according Annex 2.1		Classification
seal size:	$w \times h \leq 600 \times 600 \text{ mm}$	EI 90
seal thickness:	$t_A \geq 100 \text{ mm}$	
seal size:	$w \times h \leq 400 \times 400 \text{ mm}$	EI 120
seal thickness:	$t_A \geq 150 \text{ mm}$	
2.2.2 Blank seal in rigid floors according Annex 2.1,		Classification
seal size:	$w \times h \leq 400 \times 400 \text{ mm}$	EI 120
seal thickness:	$t_A \geq 150 \text{ mm}$	

2.3 Cables

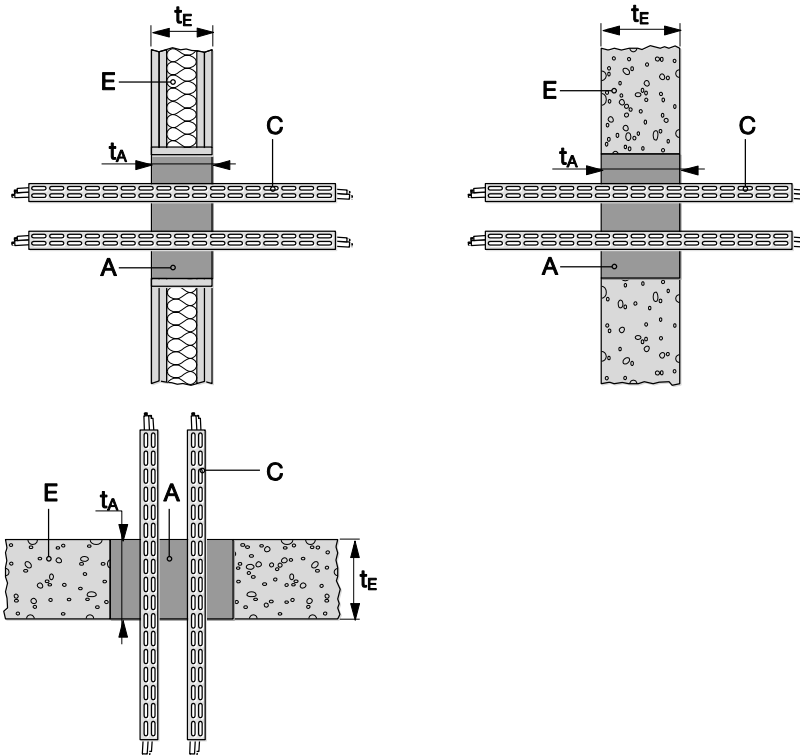
Construction details :

Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E).

In case of seal thickness $t_A >$ building element thickness t_E , see Annex 2.1.2

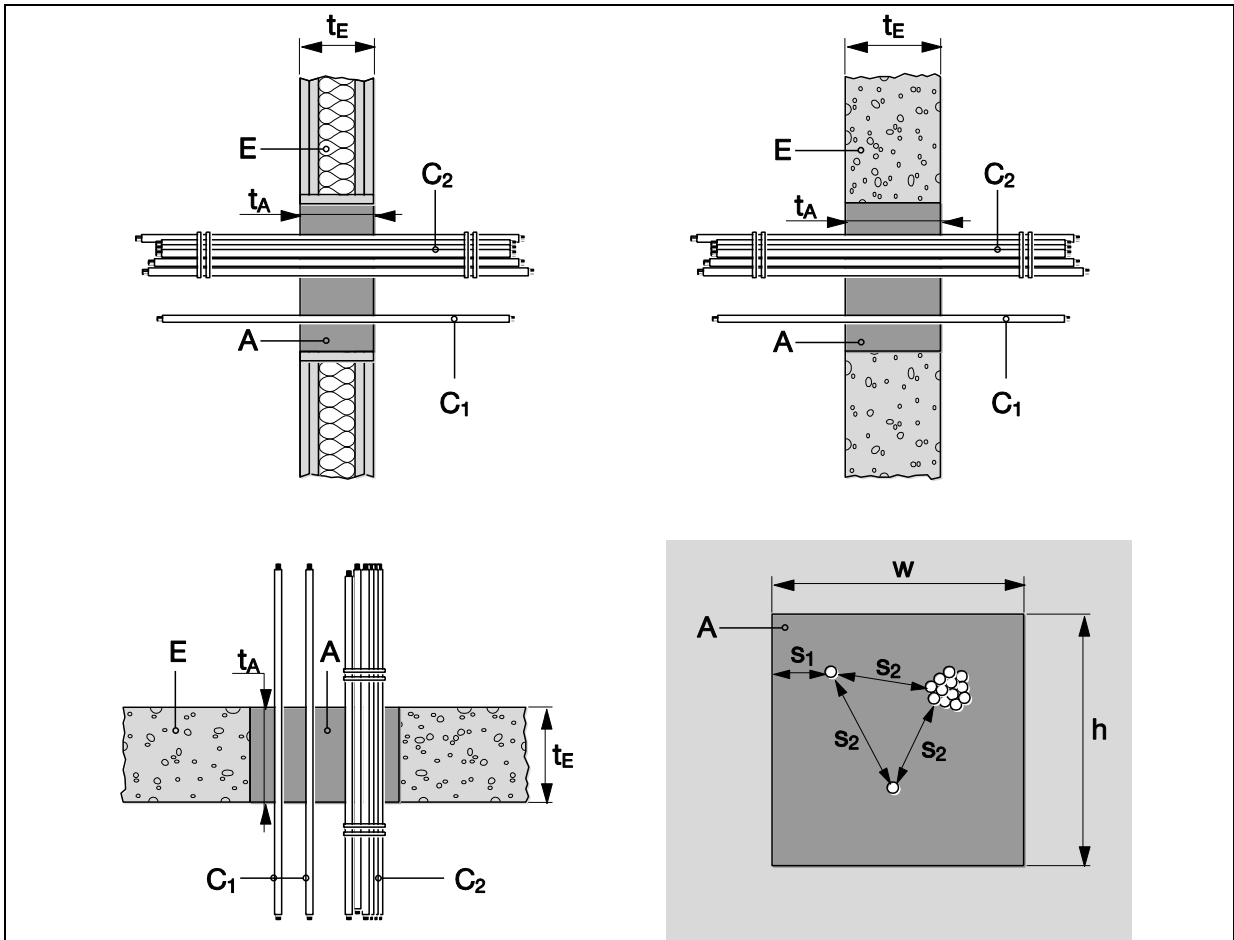
For symbols and abbreviations see Annex 4.

A) Cables on cable trays (distances acc. Annex 2.1.3):



Cable support construction: Perforated metal cable trays with a melting point higher than 1100°C (e.g. galvanised steel, stainless steel). Trays with organic coatings are covered if their overall classification is minimum A2 according to EN 13501-1.

B) Cables without cable tray:



Minimum distance w/o cable trays (mm):

Cable to seal edge (s_1):	0
Cable to cable (s_2):	0
Cable to cable bundle (s_2):	33

2.3.1 Cables with flexible and rigid wall constructions according to Annex 2.1.

Penetration seal / Services	Classification	
	(multiple) ²	(mixed)
Seal thickness ³	$150 \leq t_A \leq 200$	$t_A \geq 200$
All sheathed cable types currently and commonly used in building practice in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables, with a diameter of:		
$\varnothing \leq 21$ mm	EI 60	EI 120
$21 \leq \varnothing \leq 50$ mm	EI 60	EI 90
$50 \leq \varnothing \leq 80$ mm	EI 60	EI 90
All sheathed single core cables		
$\varnothing \leq 21$ mm	EI 120	EI 120
Sheathed multi-core halogen free cables according to HD 604.5		
$\varnothing \leq 50$ mm	EI 90	
Single sheathed multi-core rubber cables according to HD 22.4		
$\varnothing \leq 80$ mm	EI 120	
Tied cable bundle ⁶ , maximum diameter of single cable 21 mm		
$\varnothing \leq 100$ mm,	EI 60	EI 120
Non sheathed cables		
$\varnothing \leq 24$ mm,	-	EI 90

2.3.2 Cables with rigid floor constructions according to Annex 2.1.

Penetration seal / Services	Classification		
	(multiple) ²		(mixed)
Seal thickness ³	$150 \leq t_A \leq 250$	$t_A \geq 250$	$t_A \geq 200$
All sheathed cable types currently and commonly used in building practice in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables, with a diameter of:			
$\varnothing \leq 21$ mm	EI 60	EI 120	EI 120
$21 \leq \varnothing \leq 50$ mm	EI 60	EI 90	EI 90
$50 \leq \varnothing \leq 80$ mm	EI 60	EI 90	EI 90
Tied cable bundle ⁶ , maximum diameter of single cable 21 mm			
$\varnothing \leq 100$ mm,	EI 60	EI 120	EI 120
Non sheathed cables			
$\varnothing \leq 24$ mm,	-	-	EI 90

² For definition see chapter 2.0

³ For max. seal size see annex 2.1.2

2.4 Conduits and tubes

Construction details and drawing see Annex 2.3

2.4.1 Conduits and tubes with flexible and rigid wall constructions according to Annex 2.1.

Penetration seal / Services	Classification (with and without cables)	
	(multiple) ²	(mixed)
seal thickness ³	$t_A \geq 100$	$t_A \geq 200$
Steel conduits and tubes, $\varnothing \leq 16$ mm	EI 90 U/U	EI 120 C/U
The field of application given above is also valid for other metal conduits or tubes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050°C, e.g. low alloyed steels, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys).		
Plastic conduits and tubes, $\varnothing \leq 16$ mm	EI 120 U/U	EI 120 U/U
Flexible plastic conduits (Polyolefin, PVC), $16\text{mm} \leq \varnothing \leq 32$ mm	-	EI 120 U/U
Rigid plastic conduits (Polyolefin, PVC), $16\text{mm} \leq \varnothing \leq 32$ mm	-	EI 120 U/U
Bundle of plastic conduits (Polyolefin, PVC), conduits flexible or rigid, $16\text{mm} \leq \varnothing \leq 32$ mm $\varnothing \leq 100$ mm	-	EI 120 U/U

2.4.2 Conduits and tubes with rigid floor constructions according to Annex 2.1.

Penetration seal / Services	Classification (with and without cables)	
	(multiple) ²	(mixed)
seal thickness ³	$t_A \geq 150$ mm	$t_A \geq 200$ mm
Steel conduits and tubes, $\varnothing \leq 16$ mm	EI 120 U/U	EI 120 C/U
The field of application given above is also valid for other metal conduits or tubes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050°C, e.g. low alloyed steels, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys).		
Plastic conduits and tubes, $\varnothing \leq 16$ mm	EI 120 U/U	EI 120 U/U
Flexible plastic conduits (Polyolefin, PVC), $16\text{mm} \leq \varnothing \leq 32$ mm	-	EI 120 U/U
Rigid plastic conduits (Polyolefin, PVC), $16\text{mm} \leq \varnothing \leq 32$ mm	-	EI 120 U/U
Bundle of plastic conduits (Polyolefin, PVC), conduits flexible or rigid, $16\text{mm} \leq \varnothing \leq 32$ mm $\varnothing \leq 100$ mm	-	EI 120 U/U

2.5 Metal pipes

Construction details :

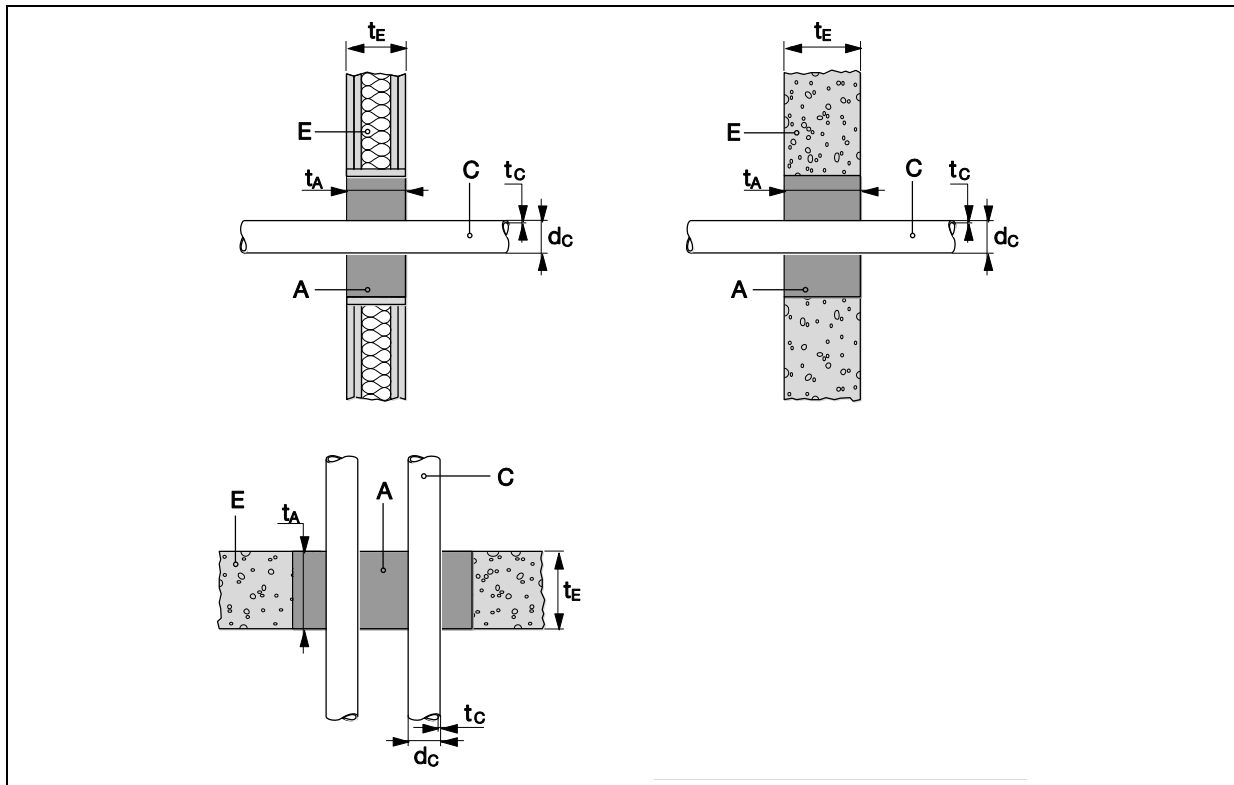
Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E).

In case of seal thickness $t_A >$ building element thickness t_E , see Annex 2.1.2

Distances acc. Annex 2.1.3

For symbols and abbreviations see Annex 4.

2.5.1 Metal pipes without insulation flexible and rigid wall constructions + floor constructions according Annex 2.1



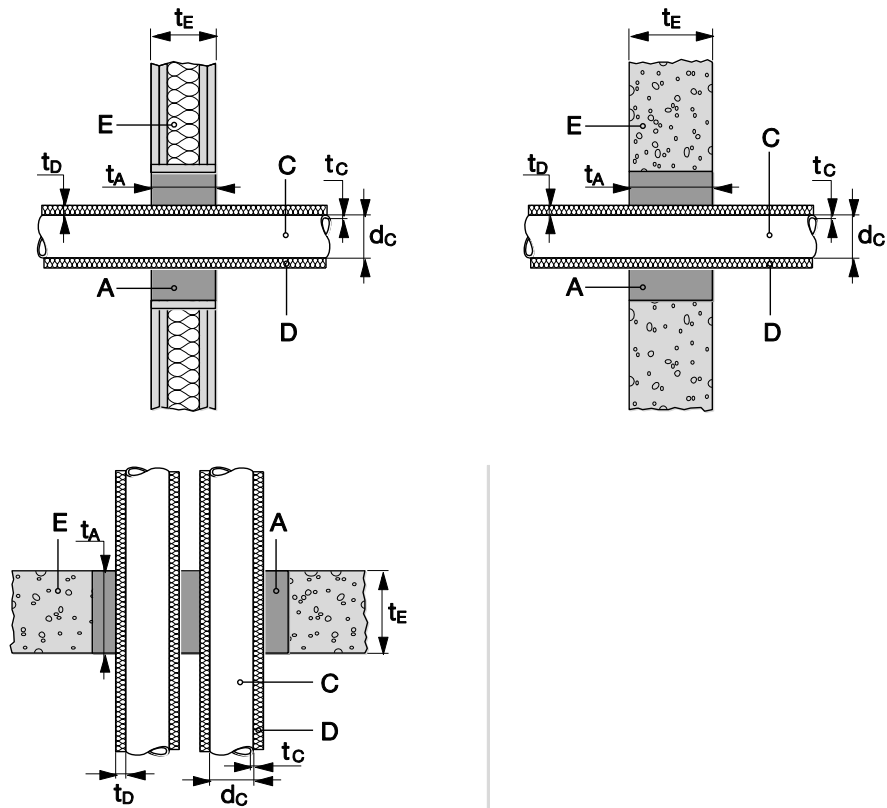
2.5.1.1 Copper pipes without insulation

	seal thickness ³	$t_A \geq 200$ mm
Pipe diameter (d_c) [mm]	Pipe wall thickness (t_c) [mm]	Classification (mixed)
28	1.0 – 14.2 ⁴	EI 90-C/U

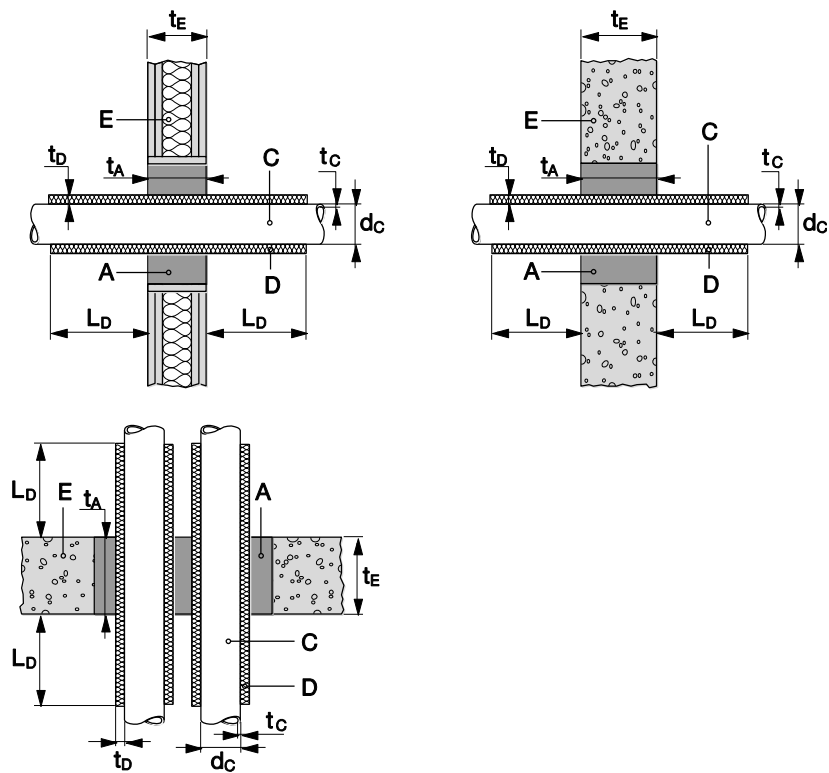
⁴ 14.2 mm is the maximum value covered by the rules in EN 1366-3. This value may be limited by the particular pipe dimensions available in practice

2.5.2 Metal pipes with mineral wool insulation

A) Continued insulation



B) Local insulation:



2.5.2.1 Steel pipes with mineral wool insulation

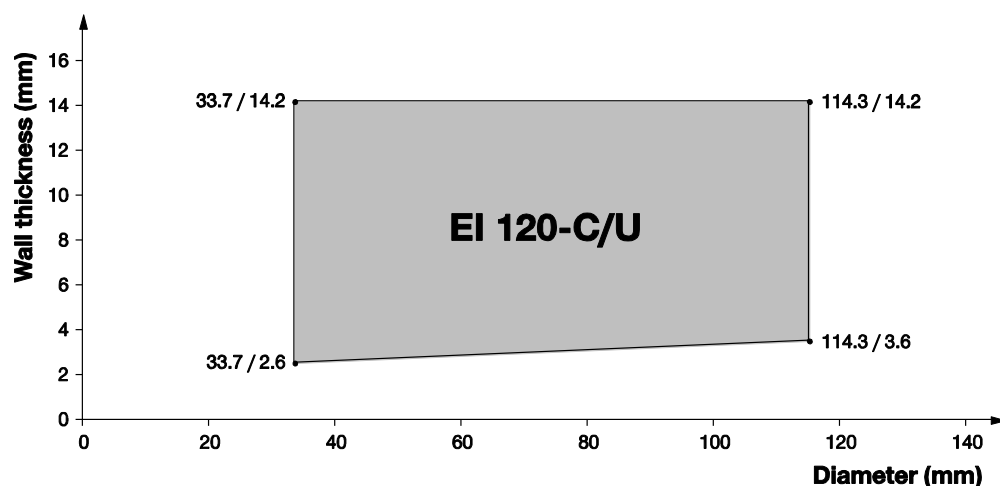
Arranged linear or in a cluster with sustained insulation (D) made from **Rockwool RS800** or equal.

2.5.2.1.1 Steel pipes with mineral wool insulation flexible or rigid wall construction according to Annex 2.1

Steel pipes (C) with continued insulation (D) – sustained – C/U				
seal thickness ³				$t_A \geq 150$ mm
Pipe diameter (d_c) [mm]	Pipe wall thickness (t_c) [mm]	Insulation thickness (t_b) [mm]		Classification (multiple)
33.7	2.6 – 14.2 ⁴	30		EI 120 C/U
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	40		EI 120 C/U
Steel pipes (C) with local insulation (D) – sustained – C/U				
seal thickness ³				$t_A \geq 150$ mm
Pipe		Insulation		Classification (multiple)
diameter (d_c) [mm]	wall thickness (t_c) [mm]	thickness (t_b) [mm]	length (L_b) [mm]	
33.7	2.6 – 14.2 ⁴	30	≥ 500	EI 120 C/U
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	40	≥ 500	EI 120 C/U

The field of application given above is also valid for other metal pipes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050°C, e.g. low alloyed steels, cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys).

Wall:



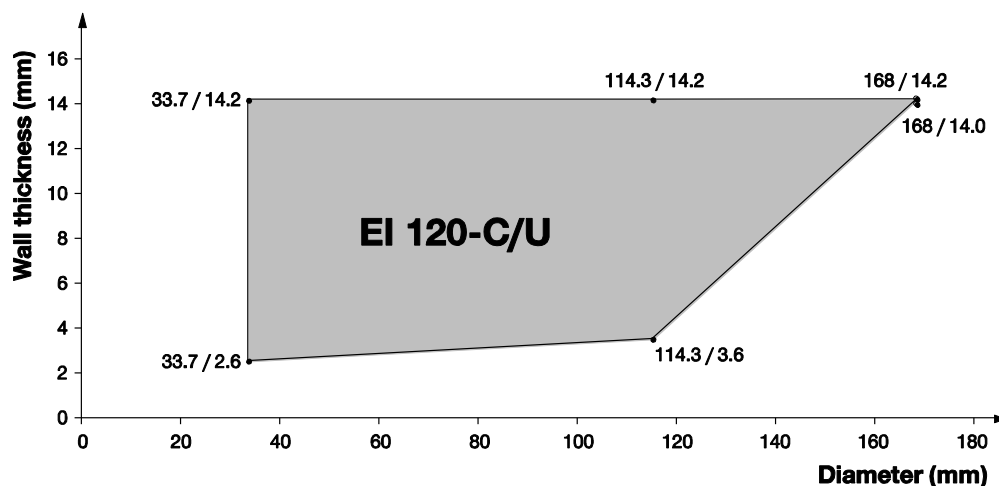
⁵ Interpolation of minimum wall thickness between 2.6 for diameter 33.7 and 3.6 for diameter 114.3 for pipe diameters in between.

2.5.2.1.2 Steel pipe with mineral wool insulation floor constructions according to Annex 2.1

Steel pipes (C) with continued insulation (D) – sustained – C/U				
seal thickness ³				$t_A \geq 150$ mm
Pipe diameter (d_c) [mm]	Pipe wall thickness (t_c) [mm]	Insulation thickness (t_D) [mm]		Classification (multiple)
33.7	2.6 – 14.2 ⁴	30		EI 120 C/U
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	40		EI 120 C/U
114.3 – 168	3.6/14 – 14.2 ^{4,6}	40		EI 120 C/U
Steel pipes (C) with local insulation (D) – sustained – C/U				
seal thickness ³				$t_A \geq 150$ mm
Pipe		Insulation		Classification (multiple)
diameter (d_c) [mm]	wall thickness (t_c) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	
33.7	2.6 – 14.2 ⁴	30	≥ 500	EI 120 C/U
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	40	≥ 500	EI 120 C/U

The field of application given above is also valid for other metal pipes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050°C, e.g. low alloyed steels, cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys).

Floor:



⁶ Interpolation of minimum wall thickness between 3.6 for diameter 114.3 and 14 for diameter 168

2.5.2.2 Copper pipes with mineral wool insulation

Arranged linear or in a cluster with sustained insulation made from **Rockwool RS800** or equal.

2.5.2.2.1 Copper pipes with mineral wool insulation flexible or rigid wall constructions according to Annex 2.1

Copper pipes (C) with continued insulation (D) – sustained – C/U					
			seal thickness ³	$t_A \geq 150$ mm	$t_A \geq 200$ mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification		
			(multiple)	(mixed)	
28 – 88.9	1.0/2.0 – 14.2 ^{4,7}	20	EI 60 C/U	-	
88.9	2.0 – 14.2 ⁴	20	EI 90 C/U	-	
12 – 48	1.0/1.5 – 14.2 ^{4,8}	20	-	EI 120-C/U	
48 – 88.9	1.5/2.0 – 14.2 ^{4,9}	40	-	EI 120-C/U	
Copper pipes (C) with local insulation (D) – sustained – C/U					
			seal thickness ³	$t_A \geq 150$ mm	$t_A \geq 200$ mm
Pipe		Insulation		Classification	
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(multiple)	(mixed)
28 – 88.9	1.0/2.0 – 14.2 ^{4,7}	20	≥ 500	EI 60 C/U	-
88.9	2.0 – 14.2 ⁴	20	≥ 500	EI 90 C/U	-
12 – 48	1.0/1.5 – 14.2 ^{4,8}	20	≥ 500		EI 120-C/U
48 – 88.9	1.5/2.0 – 14.2 ^{4,9}	40	≥ 500		EI 120-C/U
The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).					

⁷ Interpolation of minimum wall thickness between 1.0 for diameter 28 and 2.0 for diameter 88.9 for pipe diameters in between

⁸ Interpolation of minimum wall thickness between 1.0 for diameter 12 and 1.5 for diameter 48 for pipe diameters in between.

⁹ Interpolation of minimum wall thickness between 1.5 for diameter 48 and 2.0 for diameter 88.9 for pipe diameters in between

2.5.2.2.2 Copper pipes with mineral wool insulation floor constructions according to Annex 2.1

Copper pipes (C) with continued insulation (D) – sustained – C/U					
			seal thickness ³	t _A ≥150 mm	t _A ≥200 mm
Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Insulation thickness (t _D) [mm]	Classification		
			(multiple)	(mixed)	
28 – 88.9	1.0/2.0 – 14.2 ^{4,7}	20	EI 120 C/U	-	
12 – 48	1.0/1.5 – 14.2 ^{4,8}	20	-	EI 90 C/U	
48 – 88.9	1.5/2.0 – 14.2 ^{4,9}	40	-	EI 120-C/U	
Copper pipes (C) with local insulation (D) – sustained – C/U					
			seal thickness ³	t _A ≥150 mm	t _A ≥200 mm
Pipe		Insulation		Classification	
diameter (d _C) [mm]	wall thickness (t _C) [mm]	thickness (t _D) [mm]	length (L _D) [mm]	(multiple)	(mixed)
			seal thickness t _A (mm)	t _A ≥150 mm	t _A ≥200 mm
28 – 88.9	1.0/2.0 – 14.2 ⁴	20	≥ 500	EI 120 C/U	-
12 – 48	1.0/1.5 – 14.2 ^{4,8}	20	≥ 500		EI 90-C/U
48 – 88.9	1.5/2.0 – 14.2 ^{4,9}	40	≥ 500		EI 120-C/U
The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).					

2.5.2.2.3 Copper pipes with mineral wool insulation in floor constructions according Annex 2.1 with cast-in sleeves

Hilti Firestop Foam CFS-F FX (A) in PVC sleeves, diameter 75 mm – 110 mm, length of sleeve 200 mm, build in flush to bottom side of the building element (E).

Copper pipes (C) with local mineral wool insulation (D)– sustained – C/U					
			seal thickness ³	t _A ≥200 mm	
Pipe		Insulation		Classification	
diameter (d _C) [mm]	wall thickness (t _C) [mm]	thickness (t _D) [mm]	length (L _D) [mm]	(multiple)	
28	1.0 – 14.2 ⁴	20	≥ 500	EI 120-C/U	
The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).					

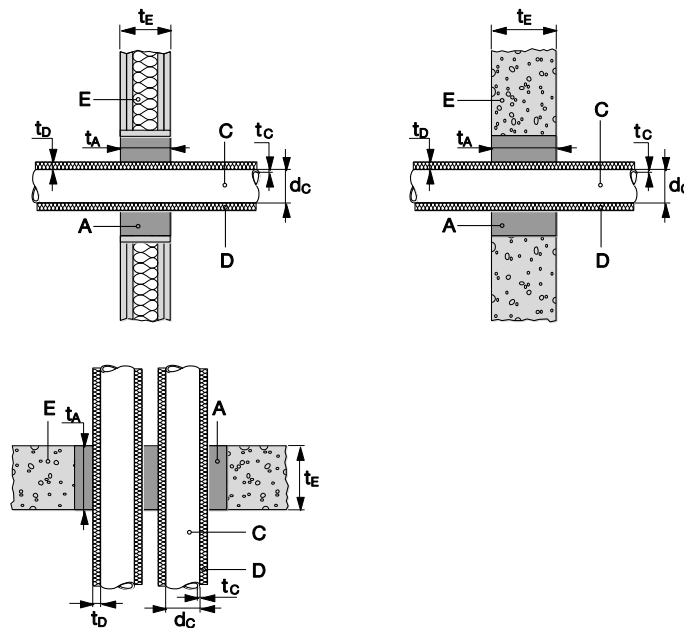
2.5.3 Metal pipes with foamed elastomeric insulation

Construction details :

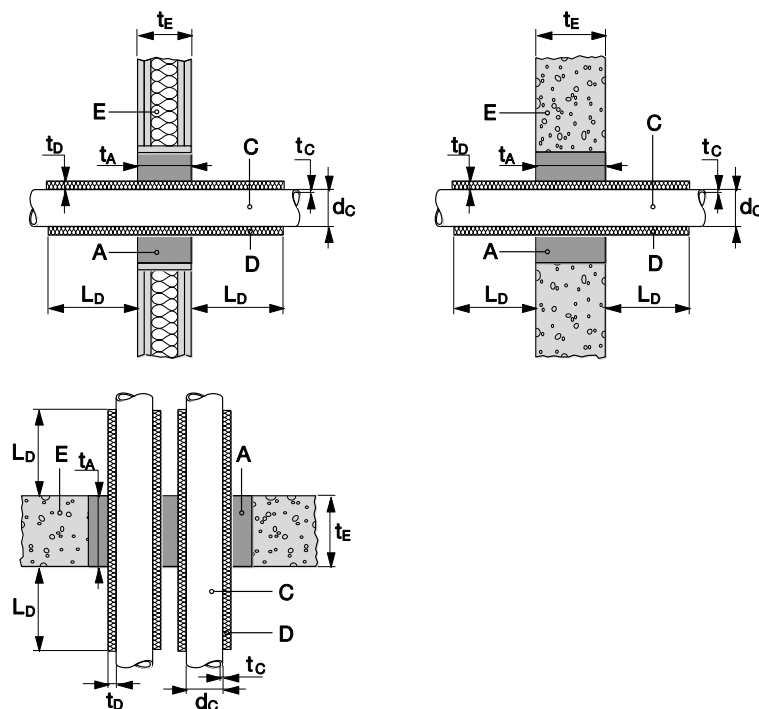
Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E).
 In case of seal thickness $t_A >$ building element thickness t_E , see Annex 2.1.2

For symbols and abbreviations see Annex 4.

A) Continued insulation



B) Local insulation:



In some cases of floor applications a PVC sleeve (F), diameter 75 mm – 110 mm, length 200 mm, is build in flush to bottom side of the building element (E). Hilti Firestop Foam CFS-F FX is then applied inside of that sleeve, resulting in seal thickness $t_A = 200$ mm

Minimum distance with sleeve in floor applications (mm):

between pipe and edge of PVC sleeve	-	10
between two PVC-sleeves:	-	200

2.5.3.1.1 Copper pipes with foamed elastomeric insulation flexible and rigid wall constructions according Annex 2.1

arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained – C/U			
seal thickness ³			$t_A \geq 200$ mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification (mixed)
6 – 42	1.0/1.2 – 14.2 ⁴	7.0/9.0	EI 90-C/U
6 – 18	1.0– 14.2 ⁴	7.0/8.0	EI 120-C/U

The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).

2.5.3.1.2 Copper pipes with foamed elastomeric insulation floor constructions according Annex 2.1

arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained – C/U			
seal thickness ³			$t_A \geq 200$ mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification (mixed)
6 – 42	1.0/1,2 – 14.2 ⁴	7,0/9,0.	EI 120-C/U

The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).

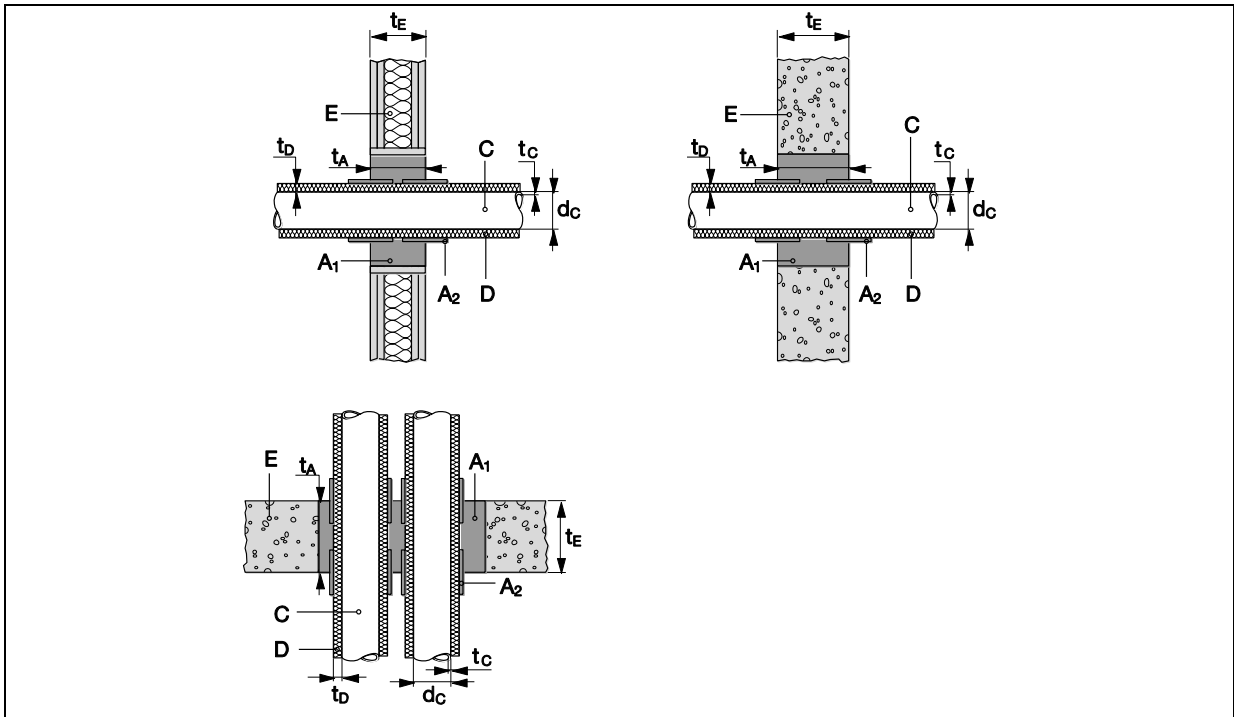
2.5.3.1.3 Steel pipes with foamed elastomeric insulation, floor constructions according Annex 2.1 with cast-in sleeves

Hilti Firestop Foam CFS-F FX (A) in PVC sleeves (F) , diameter 75mm – 110mm, length of sleeve 200mm., build in flush to bottom side of the building element (E).

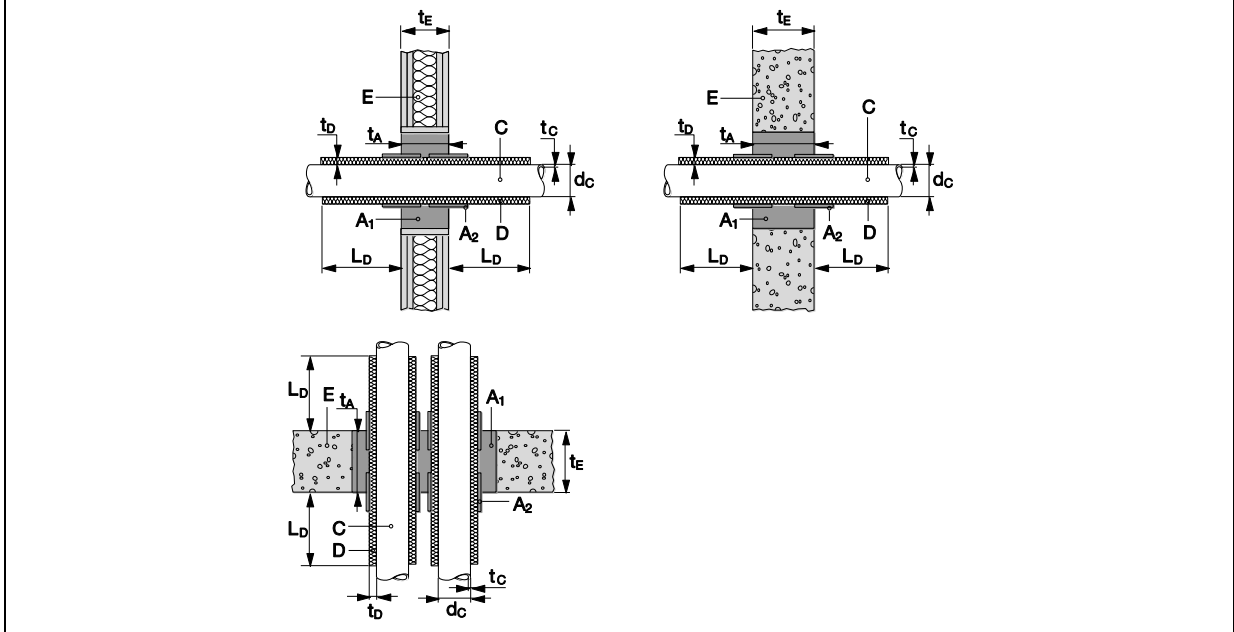
Steel pipes (C) with local insulation (D) – sustained – C/U				
seal thickness ³				$t_A \geq 200$ mm
Pipe		Insulation		Classification (multiple)
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	
33.7	2.6 – 14.2 ⁴	10	≥ 500	EI 120-C/U
The field of application given above is also valid for other metal pipes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050°C, e.g. low alloyed steels, cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys).				

2.5.4 Metal pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B

<p>Construction details :</p> <p>Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E). In case of seal thickness $t_A >$ building element thickness t_E, see Annex 2.1.2</p> <p>Services covered by two layers of Hilti Firestop Bandage CFS-B on both sides. The bandage is positioned with its center line flush to the seal surface.</p> <p>For symbols and abbreviations see Annex 4.</p>
A) Continued insulation



B) Local insulation:



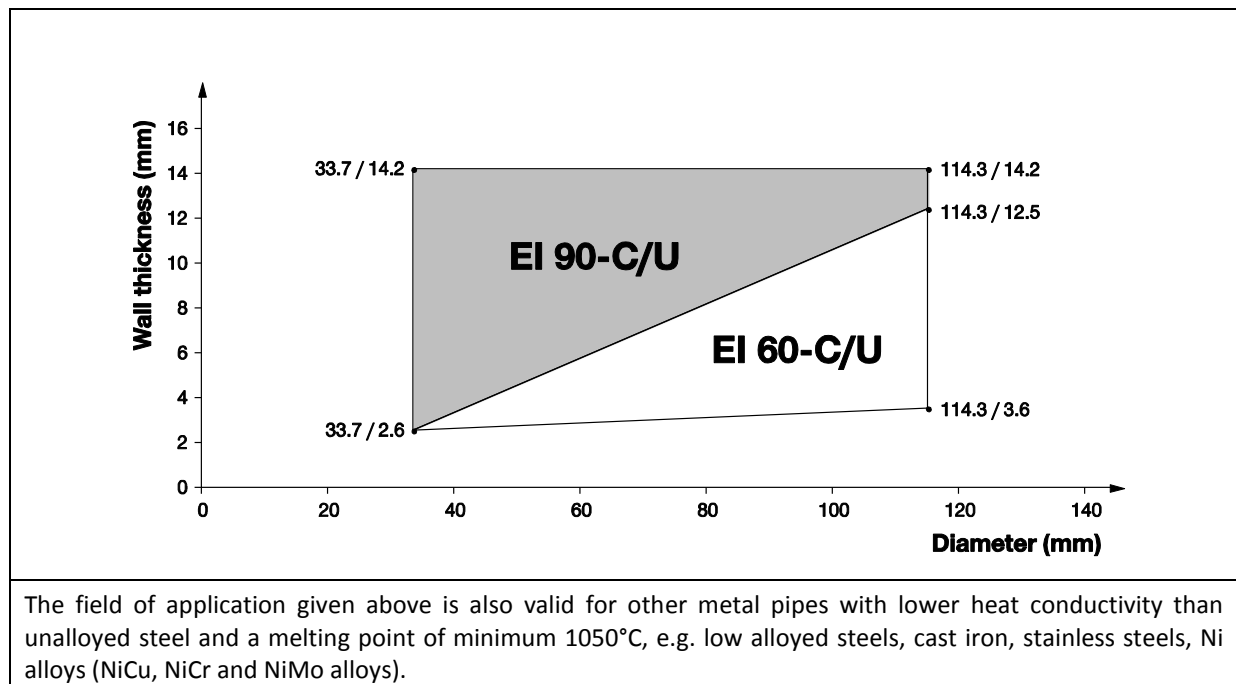
2.5.4.1 Steel pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B

2.5.4.1.1 Steel pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B flexible and rigid wall construction according Annex 2.1, $t_E \geq 112$ mm

arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Steel pipes (C) with continued foamed elastomeric insulation (D) – sustained – C/U					
seal thickness ³				$t_A \geq 150$ mm	
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification		
			(multiple)	(mixed)	
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	19	EI 60-C/U	EI 60-C/U	
33.7 – 114.3	2.6/3.6 – 12.5 ⁵	19	EI 90-C/U	-	

Steel pipes (C) with local foamed elastomeric insulation (D) – sustained – C/U					
seal thickness ³				$t_A \geq 150$ mm	
Pipe		Insulation		Classification	
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(multiple)	(mixed)
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	19	≥ 500	EI 60-C/U	EI 60-C/U
33.7 – 114.3	2.6/3.6 – 12.5 ⁵	19	≥ 500	EI 90-C/U	-



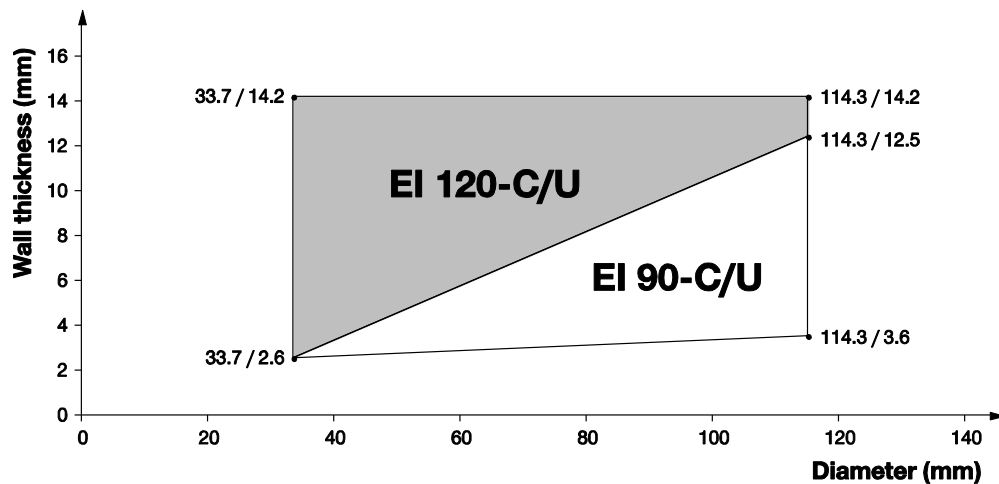
2.5.4.1.2 Steel pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B floor construction according Annex 2.1

arranged linear or in a cluster with Insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Steel pipes (C) with continued foamed elastomeric insulation (D) – sustained – C/U					
			seal thickness ³	$t_A \geq 150 \text{ mm}$	
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification		
			(multiple)	(mixed)	
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	19	EI 90-C/U	EI 60-C/U	
33.7 – 114.3	2.6/3.6 – 12.5 ⁵	19	EI 120-C/U	-	

Steel pipes (C) with local foamed elastomeric insulation (D) – sustained – C/U					
			seal thickness ³	$t_A \geq 150 \text{ mm}$	
Pipe		Insulation		Classification	
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(multiple)	(mixed)
33.7 – 114.3	2.6/3.6 – 14.2 ^{4,5}	19	≥ 500	EI 90-C/U	EI 60-C/U
33.7 – 114.3	2.6/3.6 – 12.5 ⁵	19	≥ 500	EI 120-C/U	-

Floor (multiple):



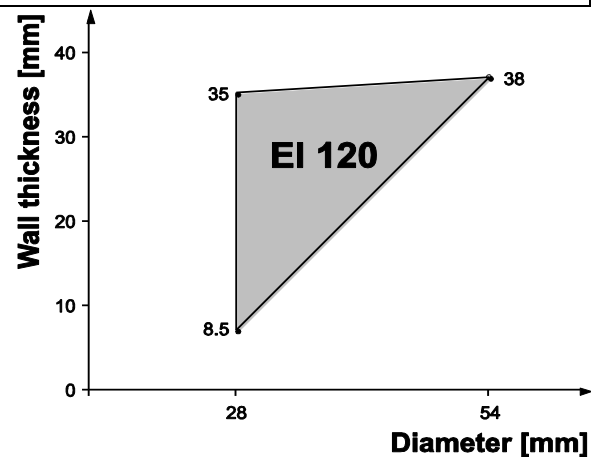
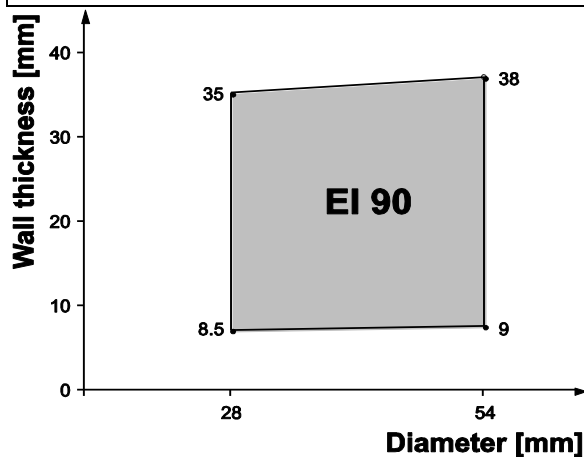
The field of application given above is also valid for other metal pipes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050°C, e.g. low alloyed steels, cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys).

2.5.4.2 Copper pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B

2.5.4.2.1 Copper pipes with foamed elastomeric insulation, flexible and rigid wall constructions according Annex 2.1

arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained – C/U				
seal thickness ³				$t_A \geq 200$ mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]		Classification (mixed)
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5/9.0 – 35.0/38.0		EI 90-C/U
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5 – 35.0/38.0		EI 120-C/U
Copper pipes (C) with local foamed elastomeric insulation (D) – sustained – C/U				
seal thickness ³				$t_A \geq 200$ mm
Pipe		Insulation		Classification (mixed)
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5/9.0 – 35.0/38.0	≥ 500	EI 90-C/U
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5 – 35.0/38.0	≥ 500	EI 120-C/U
The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).				

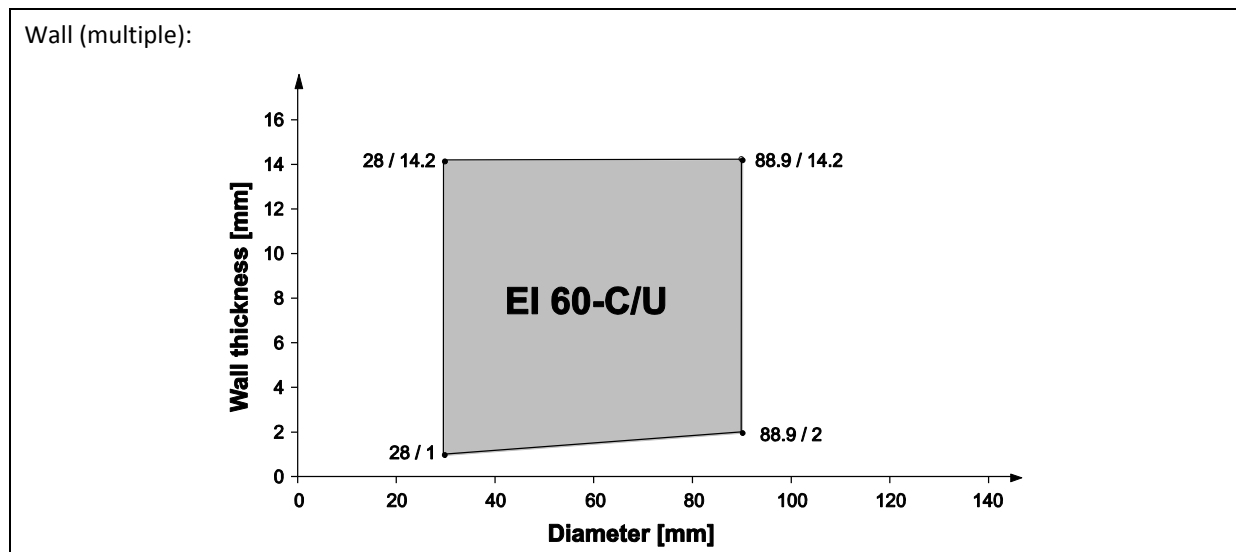


¹⁰ Interpolation of minimum wall thickness between 1.0 for diameter 28 and 1.5 for diameter 54 for pipe diameters in between

2.5.4.2.2 Copper pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B flexible and rigid wall construction according Annex 2.1, $t_E \geq 112$ mm

arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained – C/U					
seal thickness ³					$t_A \geq 150$ mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification		
			(multiple)	(mixed)	
28 – 88.9	1.0/2.0 – 14.2 ^{4,7}	19	EI 60-C/U	EI 60-C/U	
28	1.0 – 14.2 ⁴	19	EI 120-C/U	-	
Copper pipes (C) with local foamed elastomeric insulation (D) – sustained – C/U					
seal thickness ³					$t_A \geq 150$ mm
Pipe		Insulation		Classification	
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(multiple)	(mixed)
28 – 88.9	1.0/2.0 – 14.2 ^{4,7}	19	≥ 500	EI 60-C/U	EI 60-C/U
28	1.0 – 14.2 ⁴	19	≥ 500	EI 90-C/U	-
The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).					

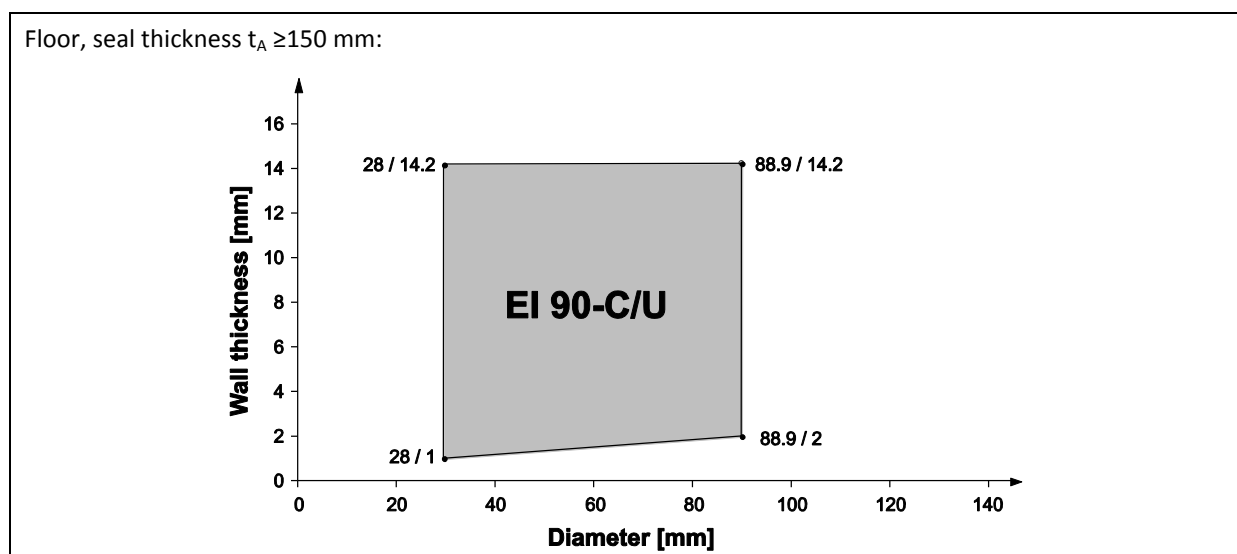


2.5.4.2.3 Copper pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B, floor construction according Annex 2.1

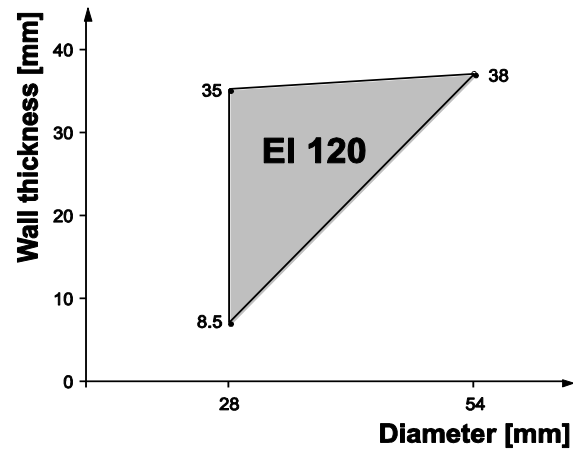
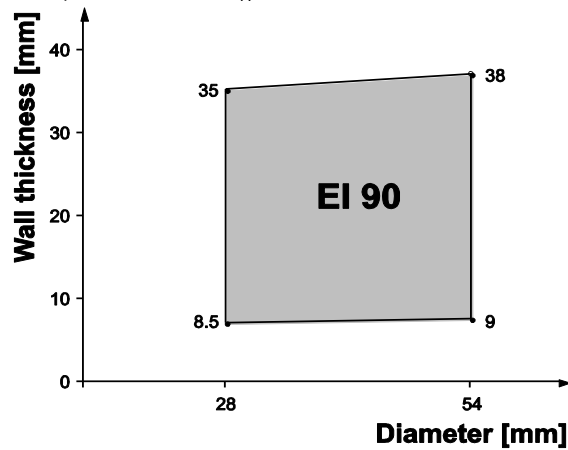
arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained – C/U					
seal thickness ³			$t_A \geq 150$ mm	$t_A \geq 200$ mm	
Pipe diameter (d_c) [mm]	Pipe wall thickness (t_c) [mm]	Insulation thickness (t_D) [mm]	Classification		
			(multiple)	(mixed)	
28 – 88.9	1.0/2.0 – 14.2 ^{4,7}	19	EI 90-C/U	EI 60-C/U	-
28	1.0 – 14.2 ⁴	19	EI 120-C/U	-	-
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5/9.0 – 35.0/38.0			EI 90-C/U
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5 – 35.0/38.0			EI 120-C/U

Copper pipes (C) with local foamed elastomeric insulation (D) – sustained – C/U						
seal thickness ³				$t_A \geq 150$ mm	$t_A \geq 200$ mm	
Pipe		Insulation		Classification		
diameter (d_c) [mm]	wall thickness (t_c) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(multiple)	(mixed)	
28 – 88.9	1.0/2.0 – 14.2 ^{4,7}	19	≥ 500	EI 90-C/U	EI 60-C/U	
28	1.0 – 14.2 ⁴	19	≥ 500	EI 120-C/U	-	
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5/9.0 – 35.0/38.0	≥ 500			EI 90-C/U
28 – 54	1.0/1.5 – 14.2 ^{4,10}	8.5 – 35.0/38.0	≥ 500			EI 120-C/U



Floor, seal thickness $t_A \geq 200$ mm:



The field of application given above is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, cast iron, stainless steels, Ni and Ni alloys (NiCu, NiCr and NiMo alloys).

2.6 Al composite pipes

2.6.1 Al composite pipes with foamed elastomeric insulation flexible and rigid wall constructions + floor constructions according Annex 2.1

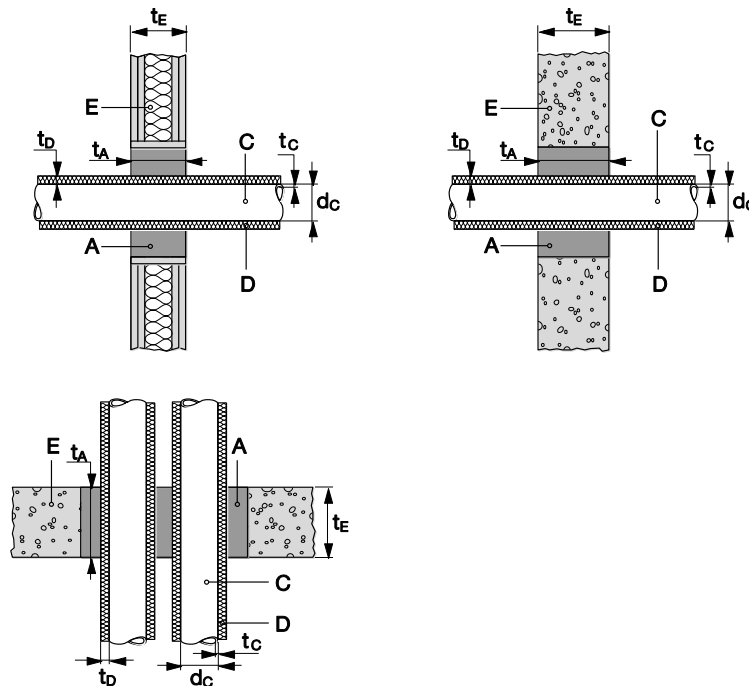
arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according Annex 2.6.1

Construction details :

Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E).

In case of seal thickness $t_A >$ building element thickness t_E , see Annex 2.1.2

For symbols and abbreviations see Annex 4.



2.6.1.1 Al composite pipes «Mepla» (C) with continued foamed elastomeric insulation (D) – sustained – C/U

Manufacturer: Geberit

			seal thickness ³	$t_A \geq 200$ mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification (mixed)	
16 – 32	2.0 – 3.0	8.0 – 9.0	EI 120-C/U	

2.6.1.2 Al composite pipes «Alpex duo» (C) with continued foamed elastomeric insulation (D) – sustained – C/U

Manufacturer: Fränkische Rohrwerke

			seal thickness ³	$t_A \geq 200$ mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	Classification (mixed)	
16 – 32	2.0 – 3.0	8.0 – 9.0	EI 120-C/U	

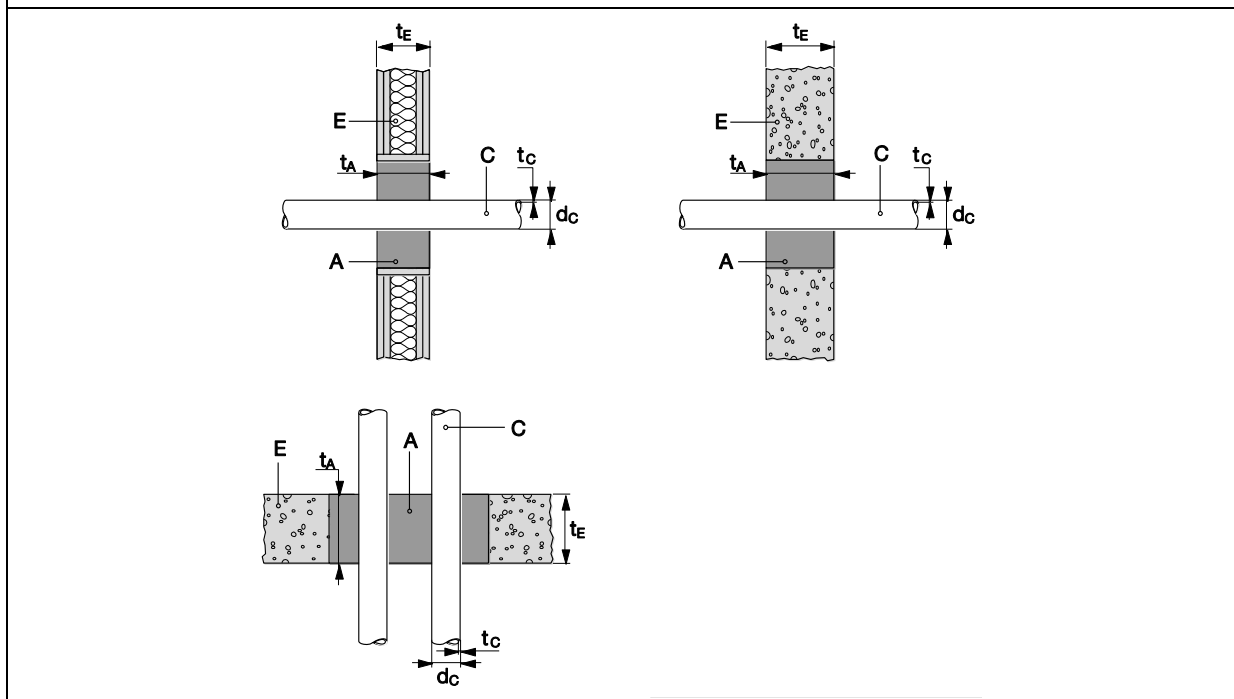
2.7 Plastic pipes

Construction details :

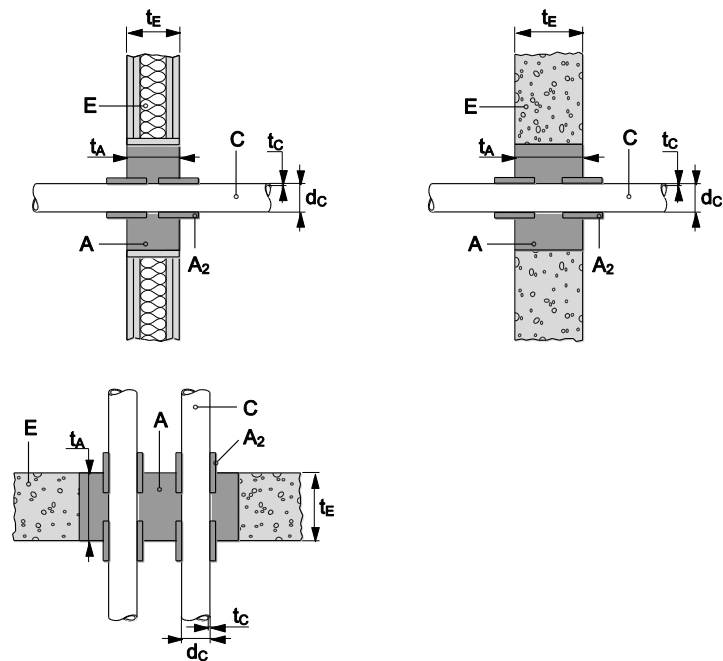
Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E).

In case of seal thickness $t_A >$ building element thickness t_E , see Annex 2.1.2

For symbols and abbreviations see Annex 4.



In some cases the services are covered by two layers of **Hilti Firestop Bandage CFS-B** on both sides. The bandage is positioned with its centre line flush to the seal surface.



In some cases of floor applications a PVC sleeves, diameter 75mm – 110mm, length 200mm., is built in flush to bottom side of the building element (E). Hilti Firestop Foam CFS-F FX is then applied inside of that sleeve, resulting in seal thickness $t_A = 200\text{mm}$

Minimum distance with sleeve in floor applications (mm):

between pipe and edge of PVC sleeve	-	10
between two PVC-sleeves:	-	200

2.7.1 PE pipes
flexible and rigid wall constructions + floor constructions according Annex 2.1

2.7.1.1 PE pipes (C) according to EN ISO 15494 and DIN 8074/8075 – U/U			
seal thickness ³		$t_A \geq 200$ mm	
Pipe diameter (d_c) [mm]	Pipe wall thickness (t_c) [mm]	Classification (mixed)	
≤ 40	2.3 – 3.7	EI 120-U/U	
2.7.1.2 PE pipes (C) according to EN 1519-1 and DIN 8074/8075 – U/C arranged linear			
seal thickness ³		$t_A \geq 150$ mm	$t_A \geq 150$ mm
Pipe diameter (d_c) [mm]	Pipe wall thickness (t_c) [mm]	Classification	
		(multiple)	(mixed)
50	2.9 – 4.6	EI 120-U/C	EI 60-U/C

2.7.1.3 PE pipes (C) according to EN ISO 15494 and DIN 8074/8075 – U/U with Hilti Firestop Bandage CFS-B			
seal thickness ³		$t_A \geq 200$ mm	
Pipe diameter (d_c) [mm]	Pipe wall thickness (t_c) [mm]	Classification (mixed)	
50 - 110	2.9/2.7 – 10.0	EI 120-U/U	

**2.7.2 PVC-U pipes
flexible and rigid wall constructions + floor constructions according Annex 2.1**

2.7.2.1 PVC-U pipes (C) according to EN ISO 1452-2, EN ISO 15493 and DIN 8061/8062 – U/U			
seal thickness ³		t _A ≥ 200 mm	
Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Classification (mixed)	
≤ 40	1.9 – 3.0	EI 120-U/U	
2.7.2.2 PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 – U/U arranged linear			
seal thickness ³		t _A ≥ 150 mm	t _A ≥ 150 mm
Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Classification	
		(multiple)	(mixed)
50	3.7	EI 120-U/U	-
2.7.2.3 PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 – U/C arranged linear			
seal thickness ³		t _A ≥ 150 mm	t _A ≥ 150 mm
Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Classification	
		(multiple)	(mixed)
50	3.7 – 5.6	EI 120-U/C	EI 60-U/C

2.7.2.4 PVC-U pipes (C) according to EN 14493 and DIN 8061/8062 – U/U with Hilti Firestop Bandage CFS-B			
seal thickness ³		t _A ≥ 200 mm	
Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Classification (mixed)	
for wall applications			
50 - 110	1.8/2.2 – 12.3	EI 120-U/U	
for floor applications			
50 - 110	1.8 – 12.3	EI 120-U/U	

2.7.3 PVC pipes floor constructions according Annex 2.1 with cast-in sleeves

Hilti Firestop Foam CFS-F FX (A) in PVC sleeves (F), diameter 75mm – 110mm, length of sleeve 200mm., build in flush to bottom side of the building element (E).

PVC pipes (C) – U/U				
seal thickness ³				$t_A \geq 200 \text{ mm}$
Pipe		Insulation		Classification
diameter (d_c) [mm]	wall thickness (t_c) [mm]	thickness (t_b) [mm]	length (L_b) [mm]	
32	1.9	-	-	EI 120-U/U

2.8 Special penetrations

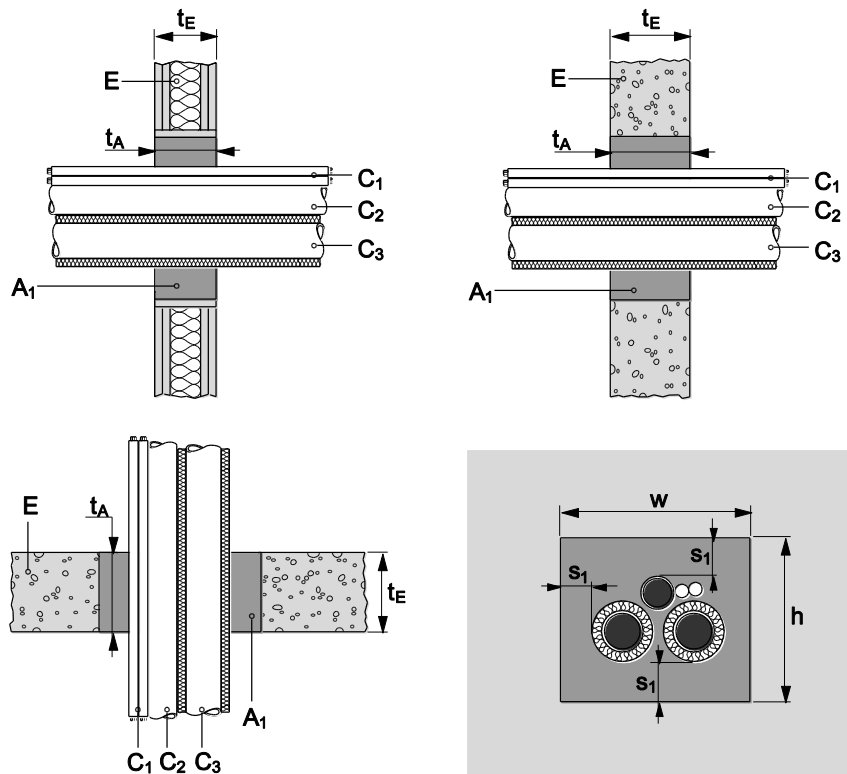
Construction details :

Penetrating service is a bundle consisting of 2 copper pipes with foamed elastomeric insulation, 2 cables and 1 plastic pipe.

Hilti Firestop Foam CFS-F FX (A) of thickness t_A centered regarding the thickness of the building element (E).

In case of seal thickness $t_A >$ building element thickness t_E , see Annex 2.1.2

For symbols and abbreviations see Annex 4.



Minimum distances (mm):

between services and seal edge (s_1):
between all services inside clima split bundle (s_2):
between services and upper seal edge

wall floor

0 20
0 0
20 -

2.8.1 “Clima split” bundles of pipes & cables flexible and rigid wall constructions according Annex 2.1

Clima split bundles (C)					seal thickness ³	t _A ≥200 mm
Pentrant		Type / diameter (dC) [mm]	wall thickness (tC) [mm]	pipe end		
Bundle (C) consisting of: 2 copper pipes (C ₁) with continued sustained foamed elastomeric insulation 2 cables (C ₂) 1 PVC pipe (C ₃)	<u>copper pipes</u> (C ₁)	6 - 42	1.0	C/U	EI 90	
	<u>cables</u> (C ₂)	5 x 1.5mm ² 5 x 6mm ²		-		
	<u>PVC pipes</u> (C ₃)	16	3.7 flex	U/U		
		25	4.3 flex			
40	2.4					
Bundle (C) consisting of: 2 copper pipes (C ₁) with continued sustained foamed elastomeric insulation 2 cables (C ₂) 1 PVC pipe (C ₃)	<u>copper pipes</u> (C ₁)	6 – 18	1.0	C/U	EI 120	
	<u>cables</u> (C ₂)	5 x 1.5mm ² 5 x 6mm ²		-		
	<u>PVC pipes</u> (C ₃)	16	3.7 flex	U/U		
		25	4.3 flex			
40	2.4					

2.8.2 “Clima split” bundles of pipes & cables PVC-U pipes floor constructions according Annex 2.1

Clima split bundles (C)					seal thickness ³	t _A ≥200 mm
Pentrant		Type / diameter (dC) [mm]	wall thickness (tC) [mm]	pipe end		
Bundle (C) consisting of: 2 copper pipes (C ₁) with continued sustained foamed elastomeric insulation 2 cables (C ₂) 1 PVC pipe (C ₃)	<u>copper pipes</u> (C ₁)	6 - 42	1.0	C/U	EI 120	
	<u>cables</u> (C ₂)	5 x 1.5mm ² 5 x 6mm ²		-		
	<u>PVC pipes</u> (C ₃)	16	3.7 flex	U/U		
		25	4.3 flex			
40	2.4					

ANNEX 3

INSTALLATION OF THE PRODUCT

Instructions for use

Hilti Firestop Foam CFS-F FX is approved **as a permanent firestop seal for indoor applications.**

The foam can be used to form a firestop seal around cables, cable trays, combustible / non-combustible pipes passing through medium-sized openings in fire compartment walls and ceilings.

National approval and fire prevention regulations take priority and must be observed.

Read these instructions and safety precautions before using the product.

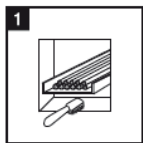
Expiry date: See date printed on the manifold (month/year). Use of the foil pack after this date is not permissible!

Transport and storage: Store in a cool, dry, dark place at a temperature of **+5°C to +25°C / +41°F to +77°F.**

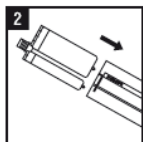
Foil pack temperature: Must be between **+10°C and +35°C / +50°F and +97°F** during application.

Base material temperature: Must be between **0°C and +40°C / 32°F and +104°F** during application.

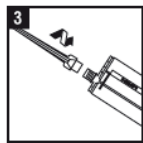
Installation instructions: The operations to be carried out are illustrated in pictograms 1- 9.



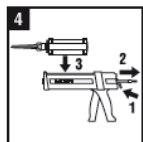
Clean the opening to be sealed. The material around the opening must be dry, in sound condition and free from dust or grease.




Check the foil pack holder for damage and ensure that it functions correctly. **Slide the foil pack into the holder. Caution:** Never use damaged foil packs and/or damaged or badly soiled foil pack holders.

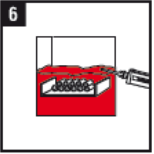



Remove the cap. **Screw the mixing nozzle all the way onto the foil pack and tighten it securely.** Check that the black mixing element is in place inside the nozzle! Do not use damaged mixing nozzles. Do not, under any circumstances, modify or tamper with the mixing nozzle. The foil pack should only be used together with the mixing nozzle supplied. A new mixing nozzle must be used with each new foil pack.





Insert the holder containing the foil pack into the dispenser: Press the release button on the dispenser, pull the piston rod back as far as it will go and then insert the holder containing the foil pack into the dispenser.

5  The foil pack opens automatically when dispensing begins. Never pierce a hole in the foil pack! This will cause the system to malfunction.
Discard the unevenly mixed initial quantity: The foam dispensed by the first stroke of the dispenser must be discarded, e.g. in the empty outer packaging material.

6  **Apply the firestop foam in the opening to be sealed.** The mixed components of the foam react and begin to expand approx. 30 seconds after application (at 23°C). Fill the opening completely with firestop foam, including gaps between individual cables, etc.
- NOTE -
It is generally best to begin in the middle of the opening, building up the foam by working from bottom to top. In openings with access from only one side, begin at the rear and work toward the front.
The foam will harden in the mixing nozzle during pauses (i.e. > 1 minute at 23°C; > 20 seconds at 35°C). **The mixing nozzle must then be changed.** Release the pressure from the piston rod before changing the mixing nozzle.
Use formwork made from an air-permeable material (e.g. perforated cardboard) when filling openings in ceilings.

7  The foam can be shaped or smoothed by hand (if necessary) after approx. 5 minutes (at 23°C).
Wear protective gloves! After approx. 10 minutes (at 23°C) the foam becomes hard and it can then be cut.
- NOTE -
After hardening, any projecting foam can be trimmed off to the specified minimum depth. Trimmed-off scraps of hardened foam can be placed in the next opening and fresh foam applied around these.

8  **Mount the installation identification plate beside the correctly sealed opening.**

9  **Subsequent installation of cables or pipes**
Additional cables or pipes can be installed in the opening without difficulty.
Do not exceed the approved maximum number and size of cables or pipes.
1. The cable or pipe may be pushed directly through the foam. Where necessary, use a suitable tool (screwdriver or drill bit, etc.) to make a hole in the foam before pushing the cable or pipe through. Do not damage existing cables.
2. Seal any remaining caps carefully with Hilti Firestop Foam CFS-F FX

For safe handling the provisions of the Material Safety Data Sheet for the product shall be followed.

ANNEX 4

ABBREVIATIONS AND REFERENCE DOCUMENTS

Abbreviations used in drawings

Abbreviation	Description	Abbreviation	Description
A, A ₁ , A ₂ ,...	Firestop product	h	Height/length of penetration seal
C, C ₁ , C ₂ ,...	Penetrating services	S ₁ , S ₂	Distances
D	Pipe insulation	t _A	Thickness of penetration seal
E,	Building element (wall, floor)	t _c	Pipe wall thickness
E ₁ , E ₂ ,...	Apperture or support framing	t _D	Thickness of insulation
F	casted in pipe sleeve	t _E	Thickness of the building element
L _D	Length of insulation	w	Width of penetration seal
d _c	Pipe diameter	w _A	Width of framing

References to standards mentioned in the ETA:

DIN 8061	Unplasticized polyvinyl chloride (PVC-U) pipes - General quality requirements and testing
DIN 8062	Unplasticized polyvinyl chloride (PVC-U) pipes - Dimensions
DIN 8074	Polyethylene (PE) - Pipes PE 63, PE 80, PE 100, PE-HD - Dimensions
DIN 8075	Polyethylene (PE) pipes - PE 63, PE 80, PE 100, PE-HD - General quality requirements, testing
EN 1026	Windows and doors – Air permeability – Test method
EN 1366-3:2009	Fire resistance tests for service installations - Part 3: Penetration seals
EN 1519	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Polyethylene (PE)
EN 13238	Reaction to fire tests for building products: Conditioning procedures and general rules for selection of substrates
EN 13501-1	Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests
EN 13501-2	Fire classification of construction products and building elements – Part 2: Classification using test data from fire resistance tests
EN 13823:2002	Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item
EN ISO 140-3	Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurements of airborne sound insulation of building elements
EN ISO 140-10	Acoustics – Measurements of sound insulation in buildings and of building elements – Part 10: Laboratory measurement of airborne sound insulation of small building elements
EN ISO 717-1	Acoustics – Rating of sound insulation of buildings and of building elements – Part 1: Airborne sound insulation

EN ISO 1452-2	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - Unplasticized poly(vinyl chloride) (PVC-U) - Part 2: Pipes
EN ISO 11925-2	Reaction to fire tests – Ignitability of building products subjected to direct impingement of flame – Part 2: Single-flame source test
EN ISO 15493	Plastics piping systems for industrial applications - Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) - Specifications for components and the system; Metric series
EN ISO 15494	Plastics piping systems for industrial applications - Polybutene (PB), polyethylene (PE) and polypropylene (PP) - Specifications for components and the system; Metric series
HD 22.4	Cables of rated voltages up to and including 450/750 V and having crosslinked insulation – Part 4: Cords and flexible cables
HD 640.5	0.6/1kV Power cables with special fire performance for use in power stations – Part 5: single core and multicore halogen-free cables

Other reference documents:

EOTA TR 001	Determination of impact resistance of panels and panel assemblies
EOTA TR 024	Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products
Safety Data Sheet according to 1907/2006/EC, Article 31, for Hilti Firestop Foam CFS-F FX	