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Certificate No.	UL-AU-230003
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Date of Issue	2023-11-01
Certificate Holder	Hilti (Aust.) Pty. Ltd 1G Homebush Bay Drive PO Box 3217 Rhodes NSW 2138, Australia
Manufacturer	Hilti AG, Feldkircherstrasse 100 FL-9494 Schaan Liechtenstein Internet: www.hilti.com
Production Sites (Factory)	Hilti Production Plant 4a
Certified Product Description	Firestopping Foam
Model(s)	Hilti Firestop Foam CFS-F FX
Trade Name or Trademark	Hilti Firestop Foam CFS-F FX
Rating Information	Refer to Appendix A
Standard tested to	AS 1530.4:2014 and AS 4072.1:2005
Test Report References	See page 71 and 72
Listing Category and File Ref	AUED.RS5418
Additional Information and Conditions	See page 2
Expiry date	2033-11-01

Stuart Foster
Certification Officer

JAS-ANZ

www.jas-anz.org/register

Certification Body

This is to certify that representative samples of the Product described herein ("Certified Product") have been investigated and found in compliance with the Standard(s) indicated on this Certificate, in accordance with the UL-AU Mark Scheme requirements and JAS-ANZ accreditation requirements. The designated Certificate Holder is entitled to use the UL-AU Mark for the Certified Product manufactured at the production site(s) identified above, in accordance with the UL-AU Mark Scheme Service Agreement.
Only those Products bearing the UL-AU Mark for Australia should be considered as being covered by UL's UL-AU Mark Service. This certificate shall remain valid through to the expiration date, unless terminated earlier in accordance with the Service Agreement including without limitation if the Standard identified on this Certificate is amended or withdrawn prior to the expiration date.

This Certificate remains the property of UL International New Zealand Ltd.

If the client provides copies of the certification documents to others, the documents shall be reproduced in their entirety.

All dates are in Year-Month-Day format (YYYY-MM-DD).

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Additional Information:

This certificate is evidence that prototypes of the nominated products and their configurations as detailed in Appendix A conform to the following parameters:

1. Have been tested to AS 1530.4:2014 and AS 4072.1:2005 or an equivalent or more severe test and the Fire Resistance Level (FRL) nominated in Appendix A was achieved by the prototype for each nominated assembly of service penetration, building element and protection method configuration, without the assistance of an active fire suppression system.

2. Test results are detailed in a confidential test report that may be available from the certificate holder upon request. The information regarding the test parameters is included in the confidential technical file.

   (i) the method and conditions of the test;

   (ii) form of construction of the tested prototype; and

   (iii) that restraint complied with AS 1530.4.

3. Testing was conducted at multiple locations by suitably accredited laboratories that are accredited by a signatory to the International Accreditation Cooperation Mutual Recognition Arrangement (ILAC-MRA) as recognised by NATA who is also a signatory body to this Agreement. The data has been reviewed by UL against the relevant to accreditation schedules.

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The UL Enhanced Mark shall appear on certified products only and shall be used only in accordance with the UL-AU Mark Scheme Service Terms Minimum size is not specified, as long as the Mark is legible. The following are **examples** of the format.

The file number that replaces E123456 and NC12345 in the above examples is; **RS5418**

The following Supplementary Information shall be placed adjacent to the Certification Mark;
Firestopping - Intumescent Seals and Fire Pillows
AS 1530.4

The UL Enhanced Mark may appear on a label, nameplate, or may be cast, stamped or molded into the product. When appearing on a label or nameplate, the Manufacturer's name or trademark along with a model number are also required on that same label or nameplate. If cast, stamped or molded, the Manufacturer's name or trademark and model number shall also appear elsewhere on the product.
All content shall be in accordance with the details provided on this Certificate.

PROCUREMENT

The Production site may reproduce the Mark or obtain it from a UL authorized supplier. The list of UL authorized suppliers can be found on UL's online directory at www.ul.com.

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Appendix A

Conforming product configurations to achieve nominated FRL's

A.1 Specific Parts and Supporting Constructions for Hilti Firestop Plug CFS PL:

Technical description of product:

Hilti Firestop Foam CFS-F FX is a two-component foam, composed essentially of expanding substances and binder.

Intended use:

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
- cross-laminated timber (CLT) floors and walls

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 FRL (Fire Resistance Level) and other parameters to be considered are given in Annex 2.

Additional components for pipe penetrations

In some cases (see Annex 2) of plastic pipes and metal pipes with combustible insulations a Hilti Firestop Bandage CFS-B is wrapped around the pipe.

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DESCRIPTION OF THE PRODUCT AND ANCILLARY PRODUCT(S)

A.1.1 Product

A.1.1.1 Hilti Firestop Foam CFS-F FX

Foil pack 325ml	
Mixing nozzle	

A.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).

MD 2000 	ED 3500 
HDM 330 	HDE 500-A22 

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A.1.2 Ancillary component

A.1.2.1 Hilti Firestop Bandage CFS-B

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A.2 RESISTANCE TO FIRE CLASSIFICATION OF HILTI FIRESTOP FOAM CFS-F FX

A.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. 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/m^3. Minimum wall thickness as defined in Annex 2
Floors:	The floor must have a minimum thickness of 150 mm and comprise aerated concrete or concrete with a minimum density of 2200 kg/m^3.This certificate does not cover use of this product as a penetration seal in sandwich panel constructions.
CLT Floors and walls	Any cross laminated timber floor and walls (minimum FRL -/90/90). Minimum thickness of 80 mm.

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.

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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 FRL (Fire Resistance Level)period required and
- pneumatic dispatch systems, compressed air systems, etc. are switched off by additional means in case of fire.

Penetration seals require a minimum distance of 200 mm. 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.

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A.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 (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 centered 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 ≥ 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 centered in relation to the wall.

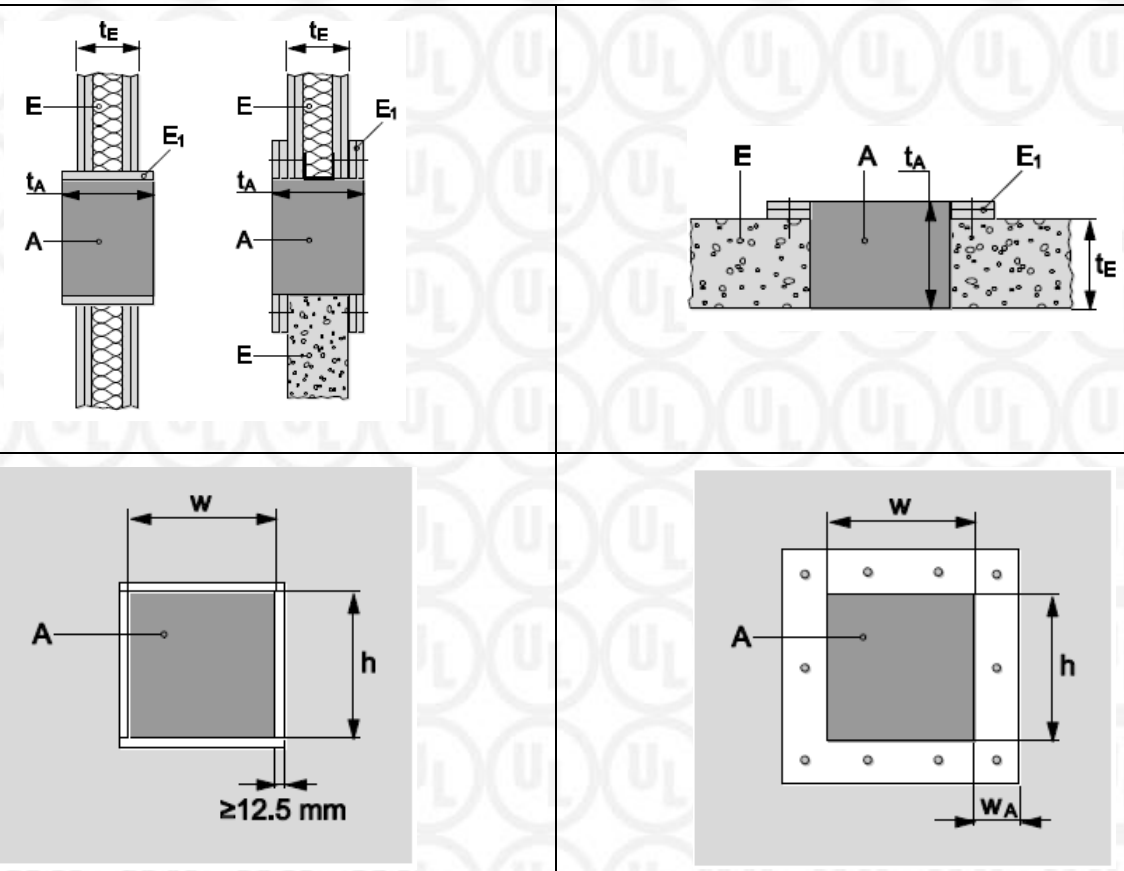

Fig. 1: Options for support frames (seal thickness higher than wall/floor thickness)

For explanation of abbreviations see the related text and Annex A.2.1.1.1

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A.2.1.1.1 Abbreviations used in drawings

Abbreviation	Description	Abbreviation	Description
A, A_1, A_2,…	Firestop products	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,…	Aperture 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

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.

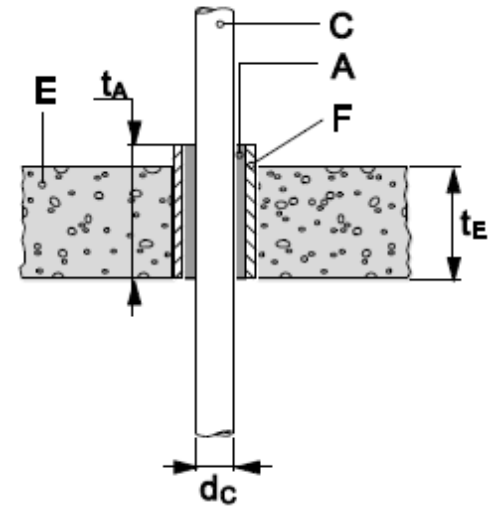

Figure 2 Sleeves for floor applications

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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/m^3 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.

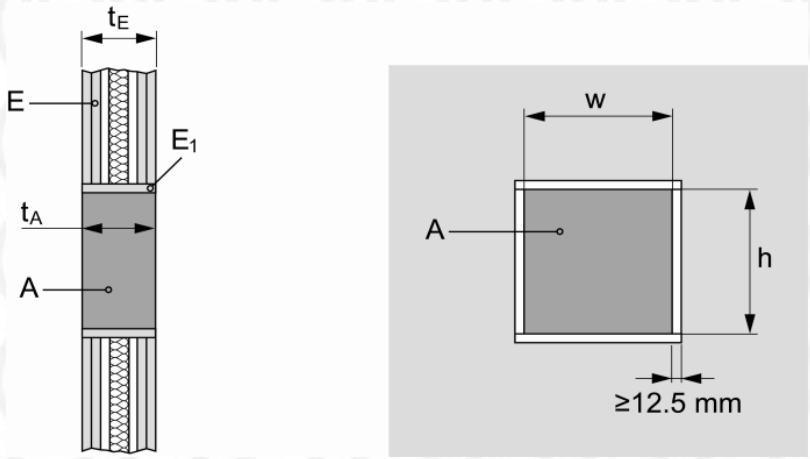

Figure 3 Aperture framing

For explanation of abbreviations see the related text and Annex A.2.1.1.1

A.2.1.2 Seal size

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

	FRL (Fire Resistance Level)	seal size:		seal thickness: t_A
		w x h	Ø	
Wall penetrations	–/90/90	≤ 600 x 600 mm	≤ 600 mm	≥ 100 mm
	–/120/120	≤400 x 400 mm	≤400 mm	≥ 150 mm
Floor penetrations	–/120/120	≤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.

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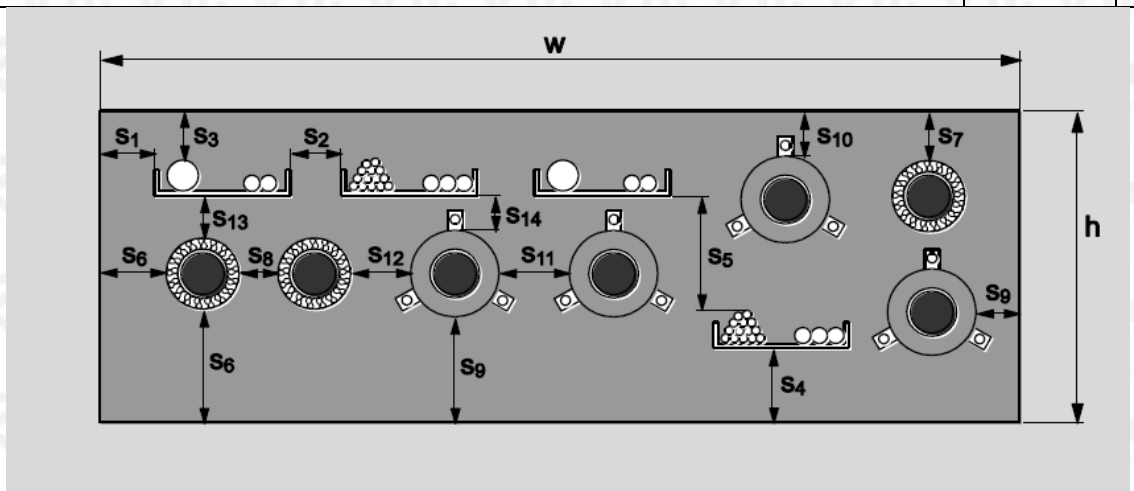
A.2.1.3 Minimum distances for penetrations

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

	(mm)	Wall	Floor
s_1	(distance between cables/cable supports and seal edge	00	00
s_2	(distance between cable supports)	25	0
s_3	(distance between cables and upper seal edge)	0	0
s_4	(distance between cable supports and bottom seal edge)	50	50
s_5	(distance between cables and cable support above)	0	20
s_6	(distance between metal pipes and seal edge)	20	-
s_7	(distance between metal pipes and upper seal edge)	0	15
s_8	(distance between metal pipes) linear arrangement	40	20
	(distance between metal pipes) grouped arrangement		
s_9	(distance between plastic pipes/pipe closure devices and seal edge)	0	20
s_{10}	(distance between plastic pipes/pipe closure devices and upper seal edge)	20	-
s_{11}	(distance between plastic pipes/pipe closure devices)	35	20
s_{12}	(distance between metal pipes and plastic pipes/pipe closure devices)	35	20
s_{13}	(distance between cables/cable supports and metal pipes)	50	80
s_{14}	(distance between cables/cable supports and plastic pipes/pipe closure devices)	50	80



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A.2.1.5 Additional components for pipe penetrations

In some cases of plastic pipes and metal pipes with combustible insulations a Hilti Firestop Bandage CFS-B 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).

Manufacturer	**Product designation**
Armacell International GmbH	Armaflex AF, SH, Ultima, XG, NH, HT Armaflex AF, SH, Ultima, XG, NH, HT
NMC Group	Insul-Tube (nmc), Insul-Tube H-Plus (nmc),
Kaimann GmbH	Kaiflex KK plus, Kaiflex KK, EPDM Plus, HF plus
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
Aeroflex	Aeroflex HF
Conel	Conel Flex HAT
Eurobatex	HF
ISIDEM	Coolflex AF
3i	Isopipe HAT
ODE Insulation	ODE R-Flex RPM
Würth	Flexen Kälteschlauch

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

A.2.1.6 Metal pipes

The field of application given in Annex A2 (Resistance to fire) for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of at least equal to the material tested, so copper – pipe testing includes steel pipes, cast iron, stainless steel, Ni-alloys and Ni too.

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A.2.1.7 Polyethylene-based insulation

The following foamed polyethylene based thermal insulation material can be considered to be identical according to their behaviour in fire

- Flex PE Conel
- Thermocompact TF
- Climaflex stabil Abfluß nmC
- Kaiflex PE-DWS Abwasserschlauch
- Tubolit Fonowave
- Kaifoam PE-RO
- Wicuflex PE
- Misselsystem Abwasser MSA
- Nmc Klimaflex PE -Schaum
- Nmc Klimaflex stabil PE-Schaum
- Frigoline MKM PE Dämmung
- Frigoline Thermocompact

A.2.1.8 Seal configurations

multiple seals:	combination of single cables, bunched cables or cable support constructions within one seal.
mixed seals:	combination of single cables, bunched cables or cable support constructions with metal or plastic pipes, conduits within one seal.

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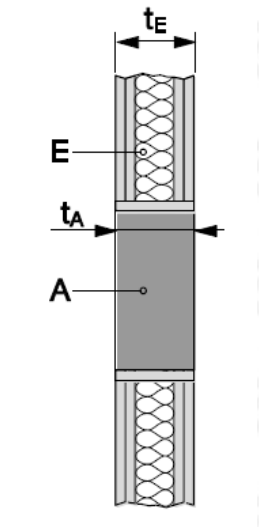
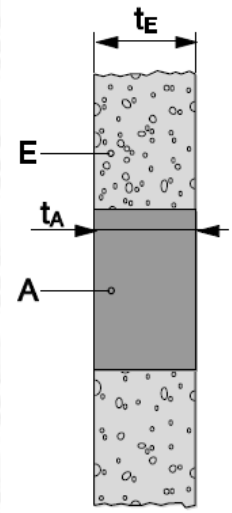
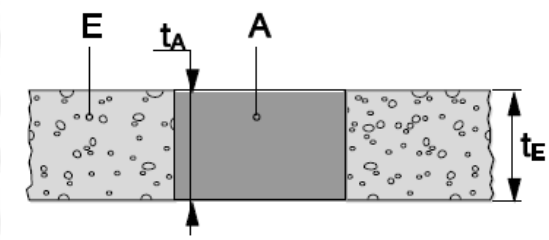
A.2.2 Blank Seals

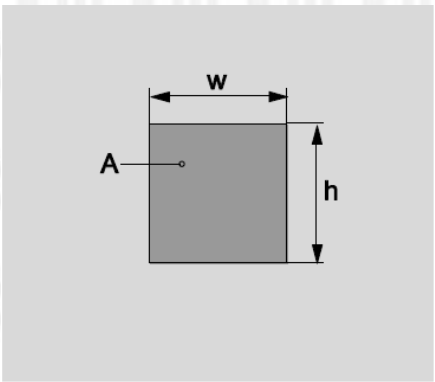
Construction details:

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 A.2.1.1.1.









* 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 FRL (Fire Resistance Level)

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2.2.1 Blank seal in flexible and rigid walls according to Annex 2.1		**FRL (Fire Resistance Level)**
seal size: seal thickness:	w x h ≤ 600 x 600 mm tA ≥ 100 mm	–/90/90
seal size: seal thickness:	w x h ≤ 400 x 400 mm tA ≥ 150 mm	–/120/120
2.2.2 Blank seal in rigid floors according Annex 2.1		**FRL (Fire Resistance Level)**
seal size: seal thickness:	w x h ≤ 400 x 400 mm tA ≥ 150 mm	–/120/120

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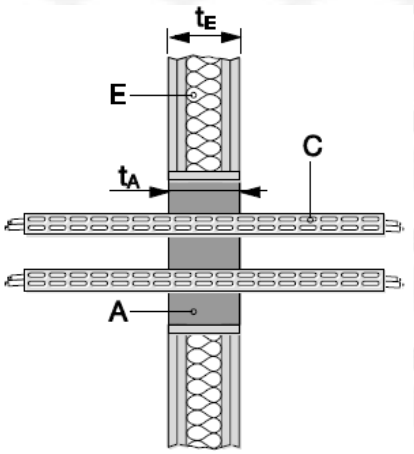
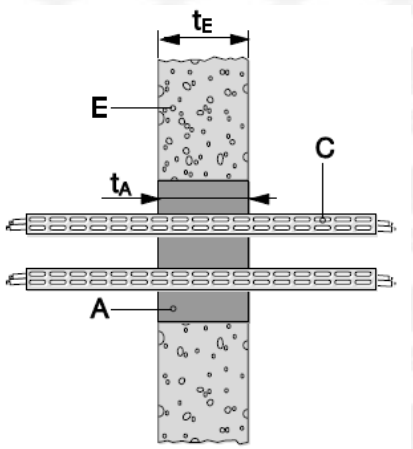
2.3 Cables

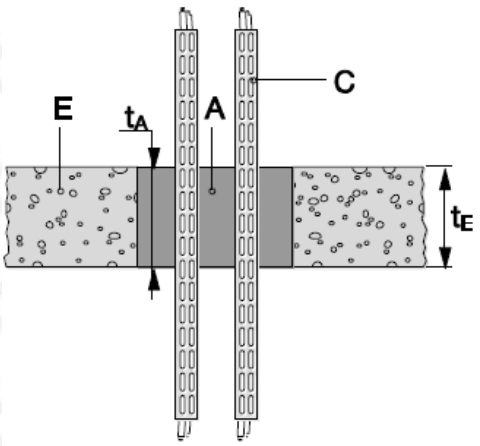
Construction details:

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 A.2.1.1.1.

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).

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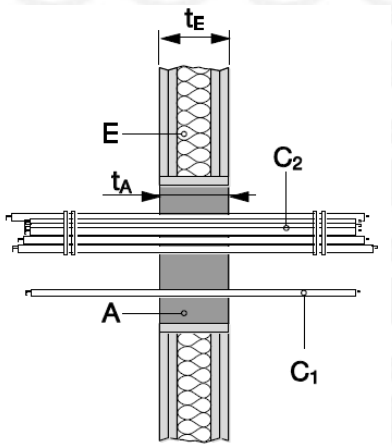
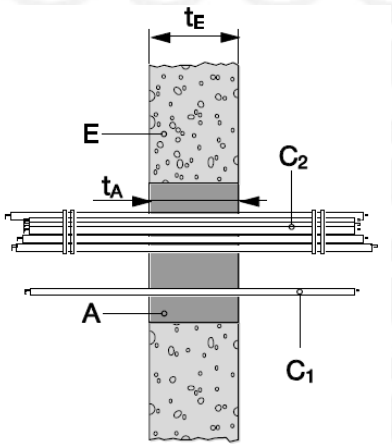
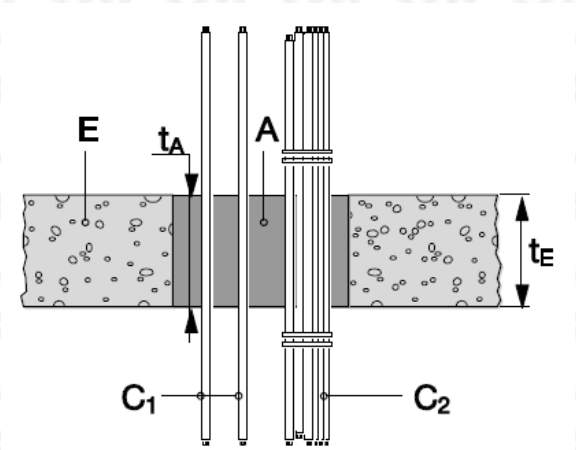
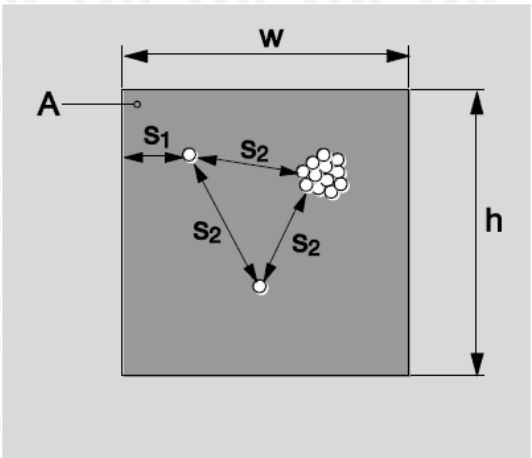
A) Cables without cable trays:









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

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

Penetration seal / Services	**FRL (Fire Resistance Level)**	
	(multiple)[2]	(mixed)
Seal thickness[3]	150 ≤ t_A ≤ 200	t_A ≥ 200
All sheathed cable types currently and commonly used in building practice (e.g. power, control, signal, telecommunication, data, optical fibre cables, with a diameter of:		
Ø ≤ 21 mm	–/60/60	–/120/120
21 ≤ Ø ≤ 50 mm	–/60/60	–/90/90
50 ≤ Ø ≤ 80 mm	–/60/60	–/90/90
All sheathed single core cables		
Ø ≤ 21 mm	–/120/120	–/120/120
Sheathed multi-core halogen free cables according to HD 604.5		
Ø ≤ 50 mm	–/90/90	
Single sheathed multi-core rubber cables according to HD 22.4		
Ø ≤ 80 mm	–/120/120	
Tied cable bundle[6], maximum diameter of single cable 21 mm		
Ø ≤ 100 mm	–/60/60	–/120/120
Non sheathed cables		
Ø ≤ 24 mm	-	–/90/90

Penetration seal / Services	**FRL (Fire Resistance Level)**	
	(multiple)[2]	(mixed)
Seal thickness[3]	t_A ≥ 150	t_A ≥ 150
PVC insulated Power Cables with or without cable tray (Standard D1 cable set, in accordance with AS 1530.4: 2014 Appendix D	-/120/60 (Foam only)	-/120/120 (with CFS P BA putty bandage)
PVC insulated Communication Cables with or without cable tray (Standard D2 cable set, in accordance with AS 1530.4: 2014 Appendix D	-/120/60 (Foam only)	-/120/120 (with CFS P BA putty bandage)

[2] For definition see Annex A.1
[3] For max. seal size see Annex 2.1.2

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A.2.3.2 Cables with rigid floor constructions according to Annex 2.1.

Penetration seal / Services	**FRL (Fire Resistance Level)**		
	(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 (e.g. power, control, signal, telecommunication, data, optical fibre cables, with a diameter of:			
Ø ≤ 21 mm	–/60/60	–/120/120	–/120/120
21 ≤ Ø ≤ 50 mm	–/60/60	–/90/90	–/90/90
50 ≤ Ø ≤ 80 mm	–/60/60	–/90/90	–/90/90
Tied cable bundle[6], maximum diameter of single cable 21 mm			
Ø ≤ 100 mm	–/60/60	–/120/120	–/120/120
Non sheathed cables			
Ø ≤ 24 mm	-	-	–/90/90

Penetration seal / Services	**FRL (Fire Resistance Level)**	
	(multiple)[2]	(mixed)
Seal thickness[3]	$t_A \geq 150$	$t_A \geq 150$
PVC insulated Power Cables with or without cable tray (Standard D1 cable set, in accordance with AS 1530.4: 2014 Appendix D	-/120/60 (Foam only)	-/120/120 (with CFS P BA putty bandage)
PVC insulated Communication Cables with or without cable tray (Standard D2 cable set, in accordance with AS 1530.4: 2014 Appendix D	-/120/60 (Foam only)	-/120/120 (with CFS P BA putty bandage)

[2] For definition see Annex A.1
[3] For max. seal size see Annex 2.1.2

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A.2.4 Conduits and tubes

Construction details and drawing see Annex 2.3

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

Penetration seal / Services	**FRL (Fire Resistance Level)** (with and without cables)	
	(multiple)[2]	(mixed)
Seal thickness[3]	$t_A \geq 100$	$t_A \geq 200$
Steel conduits and tubes, Ø ≤16 mm	–/90/90	–/120/120
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, Ø ≤16 mm	–/120/120	–/120/120
Flexible plastic conduits (Polyolefin, PVC), filled with cables, optic fibers or empty, 16mm ≤ Ø ≤ 32 mm	-	–/120/120
Rigid plastic conduits (Polyolefin, PVC) filled with cables, optic fibers or empty, 16mm ≤ Ø ≤ 32 mm	-	–/120/120
Bundle of plastic conduits (Polyolefin, PVC), conduits flexible or rigid,16mm ≤ Ø ≤ 32 mm Bundle diameter Ø ≤ 100 mm	-	–/120/120

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A.2.4.2 Conduits and tubes with rigid floor constructions according to Annex 2.1.		
Penetration seal / Services	**FRL (Fire Resistance Level)** (with and without cables)	
	(multiple)[2]	(mixed)
Seal thickness[3]	$t_A \geq 150$	$t_A \geq 200$
Steel conduits and tubes, Ø ≤16 mm	–/120/120	–/120/120
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, Ø ≤16 mm	–/120/120	–/120/120
Flexible plastic conduits (Polyolefin, PVC filled with cables, optic fibers or empty),), 16mm ≤ Ø ≤ 32 mm	-	–/120/120
Rigid plastic conduits (Polyolefin, PVC), 16mm ≤ Ø ≤ 32 mm	-	–/120/120
Rigid plastic conduits (Polyolefin, PVC) filled with cables, optic fibers or empty, 16mm ≤ Ø ≤ 32 mm	-	–/120/120
Bundle of plastic conduits (Polyolefin, PVC), conduits flexible or rigid, 16mm ≤ Ø ≤ 32 mm Bundle diameter Ø ≤ 100 mm	-	–/120/120

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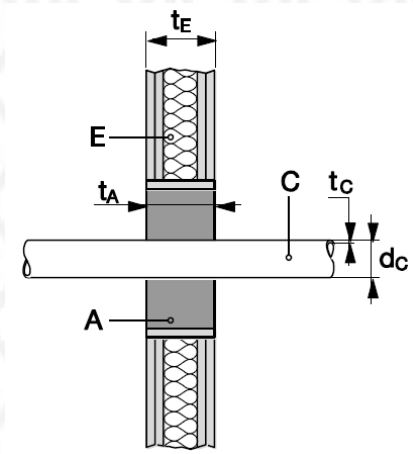
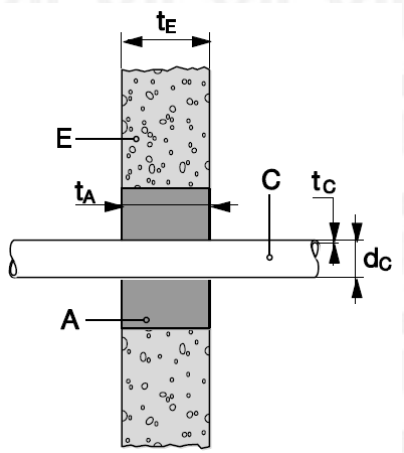
A.2.5 Metal pipes

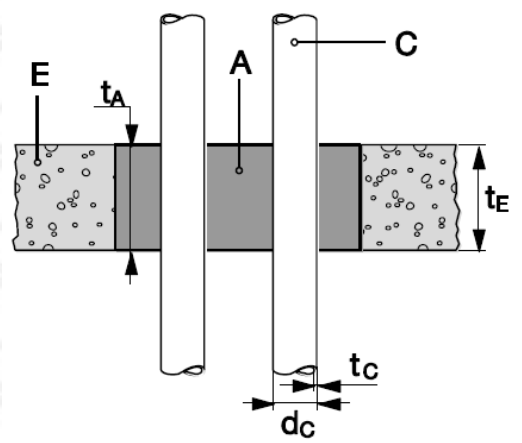
Construction details:

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 A.2.1.1.1.

A.2.5.1 Metal pipes without insulation, flexible and rigid wall constructions, and floor constructions according to Annex 2.1







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A.2.5.1.1 Copper pipes without insulation

Seal thickness[3]	$t_A \geq 200$	
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	**FRL (Fire Resistance Level)** (mixed)
28	1.0 – 14.2[4]	–/90/90

[4] 14.2 mm is the maximum value covered. This value may be limited by the particular pipe dimensions available in practice

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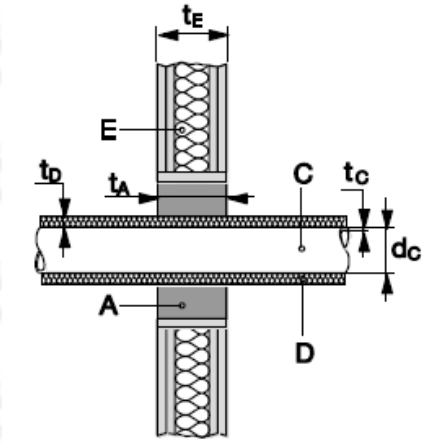
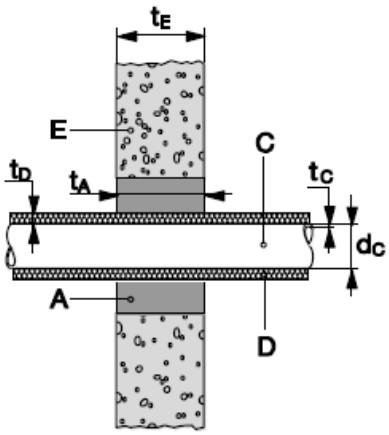
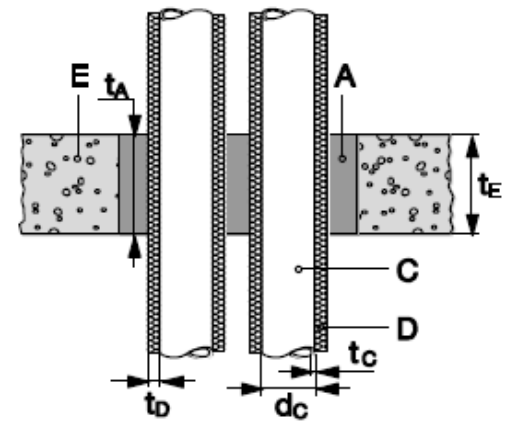
A.2.5.2 Metal pipes with mineral wool insulation.

A) Continued insulation







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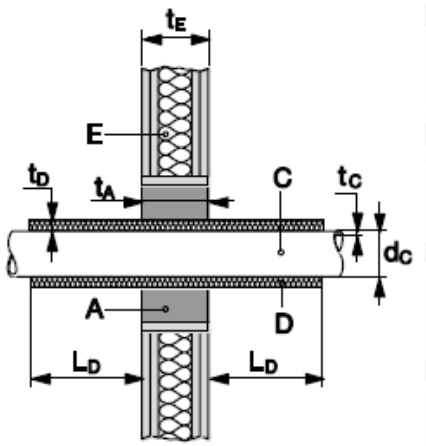
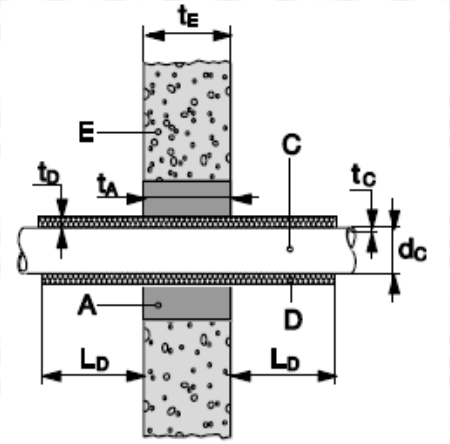
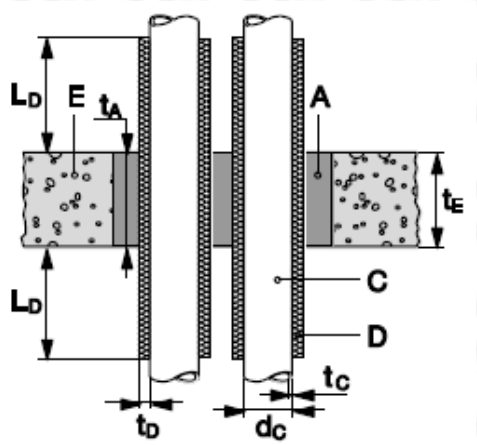
B) Local insulation







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A.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.

A.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

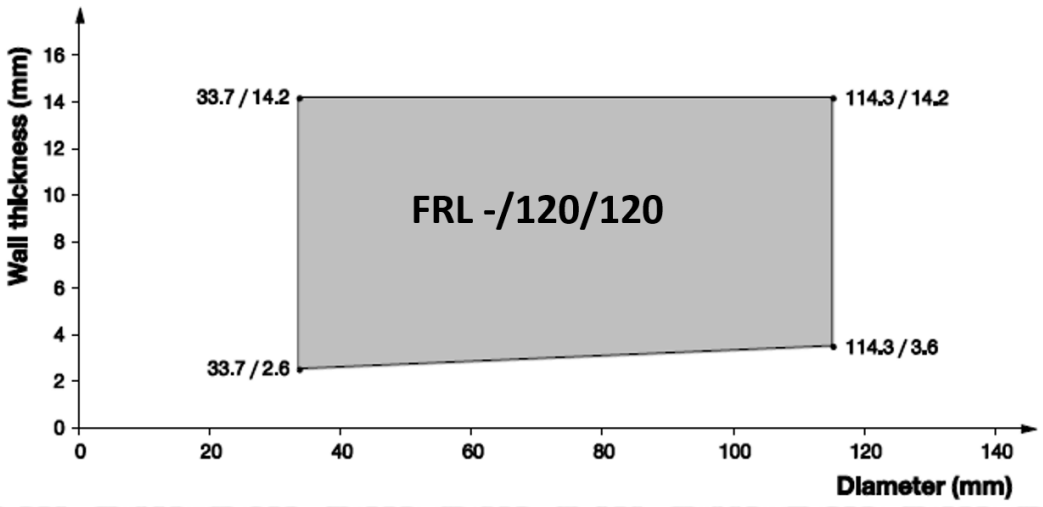
Seal thickness[3]			t_A ≥150 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level) (multiple)
33.7	2.6 – 14.2[4]	30	–/120/120
33.7 – 114.3	2.6/3.6 – 14.2[4,5]	40	–/120/120

Steel pipes (C) with local insulation (D) – sustained – C/U

Seal thickness[3]				t_A ≥150 mm
Pipe		Insulation		FRL (Fire Resistance Level) (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	–/120/120
33.7 – 114.3	2.6/3.6 – 14.2[4,5]	40	≥ 500	–/120/120

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.

Certification Body **UL International New Zealand Ltd,**
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http://newzealand.ul.com

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A.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

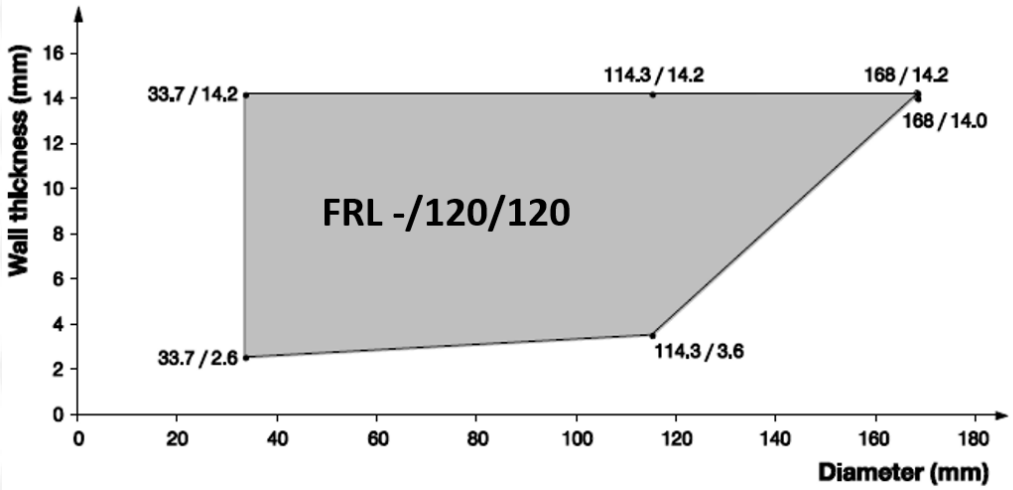
Seal thickness[3]			t_A ≥150 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level) (multiple)
33.7	2.6 – 14.2[4]	30	–/120/120
33.7 – 114.3	2.6/3.6 – 14.2[4,5]	40	–/120/120
	3.6/14 – 14.2[4,6]	40	–/120/120

Steel pipes (C) with local insulation (D) – sustained

Seal thickness[3]				t_A ≥150 mm
Pipe		Insulation		FRL (Fire Resistance Level) (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	–/120/120
33.7 – 114.3	2.6/3.6 – 14.2[4,5]	40	≥ 500	–/120/120

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.

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A.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.

A.2.5.2.2.1 Copper pipes with mineral wool insulation flexible or rigid wall construction according to Annex 2.1

Copper pipes (C) with continued insulation (D) – sustained

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]	FRL (Fire Resistance Level)	
			(multiple)	(mixed)
28 – 88.9	1.0/2.0 – 14.2[4,7]	20	–/60/60	-
88.9	2.0 – 14.2[4]	20	–/90/90	-
12 – 48	1.0/1.5 – 14.2[4,8]	20	-	–/120/120
48 – 88.9	1.5/2.0 – 14.2[4,9]	40	-	–/120/120

Copper pipes (C) with local insulation (D) – sustained

Seal thickness[3]				t_A ≥150 mm	t_A ≥200 mm
Pipe		Insulation		FRL (Fire Resistance Level)	
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	–/60/60	-
88.9	2.0 – 14.2[4]	20	≥ 500	–/90/90	-
12 – 48	1.0/1.5 – 14.2[4,8]	20	≥ 500	-	–/120/120
48 – 88.9	1.5/2.0 – 14.2[4,9]	40	≥ 500	-	–/120/120

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).

[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

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A.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

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]	FRL (Fire Resistance Level)	
			(multiple)	(mixed)
28 – 88.9	1.0/2.0 – 14.2[4,7]	20	–/120/120	-
12 – 48	1.0/1.5 – 14.2[4,8]	20	-	–/90/90
48 – 88.9	1.5/2.0 – 14.2[4,9]	40	-	–/120/120

Copper pipes (C) with local insulation (D) – sustained – C/U

Seal thickness[3]				t_A ≥150 mm	t_A ≥200 mm
Pipe		Insulation		FRL (Fire Resistance Level)	
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]	20	≥ 500	–/120/120	-
12 – 48	1.0/1.5 – 14.2[4,8]	20	≥ 500	-	–/90/90
48 – 88.9	1.5/2.0 – 14.2[4,9]	40	≥ 500	-	–/120/120

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).

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A.2.5.2.2.3 Copper pipes with mineral wool insulation in floor constructions according to 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

Seal thickness[3]				t_A ≥200 mm
Pipe		Insulation		FRL (Fire Resistance Level)
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	–/120/120

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).

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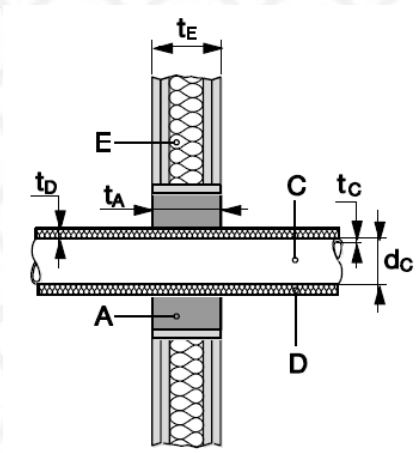
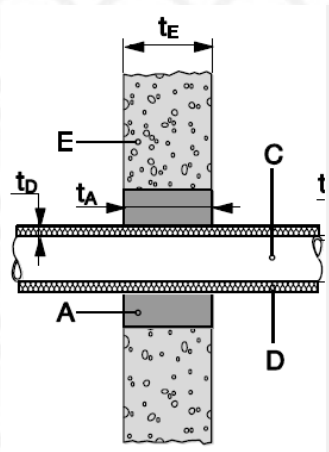
A.2.5.3 Metal pipes with foamed elastomeric insulation

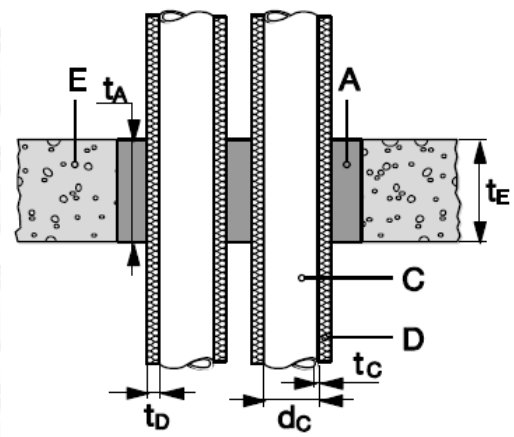
Construction details:

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 A.2.1.1.1.

A) Continued insulation







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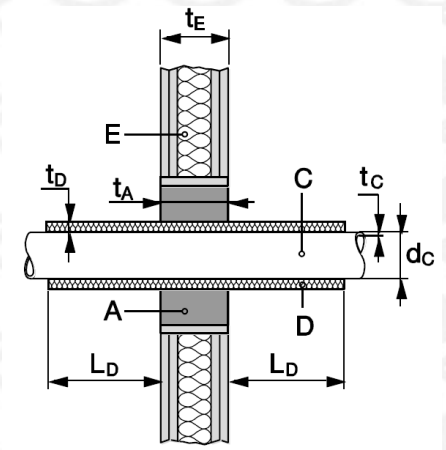
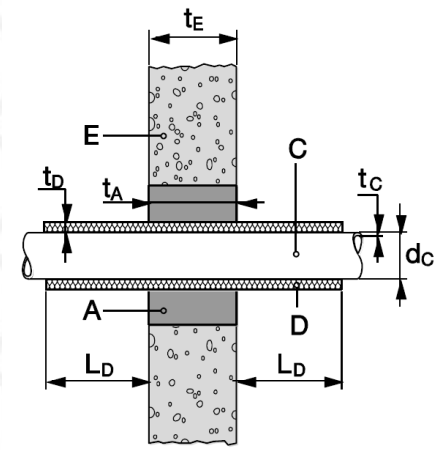
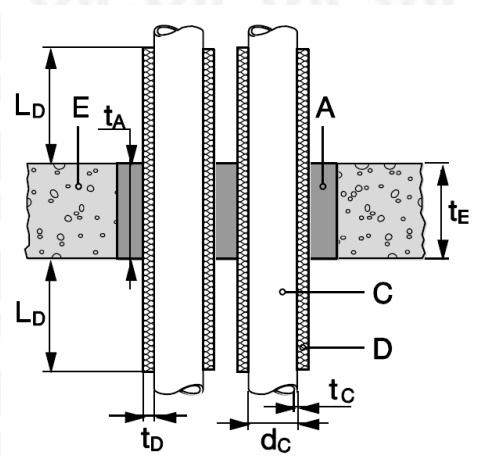
B) Local insulation







In some cases of floor applications, a PVC sleeve (F), diameter 75 mm – 110 mm, length 200 mm, 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 mm

Minimum distance with sleeve in floor applications (mm):

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

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

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

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained

Seal thickness[3]			t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level) (mixed)
6 – 42	1.0/1.2 – 14.2[4]	7.0/9.0	–/90/90
6 – 18	1.0– 14.2[4]	7.0/8.0	–/120/120

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).

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

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

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained

Seal thickness[3]			t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level) (mixed)
6 – 42	1.0/1.2 – 14.2[4]	7.0/9.0	–/120/120

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).

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

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

Steel pipes (C) with local insulation (D) – sustained

Seal thickness[3]				t_A ≥200 mm
Pipe		Insulation		FRL (Fire Resistance Level)
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(multiple)
33.7	2.6 – 14.2[4]	10	≥ 500	–/120/120

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).

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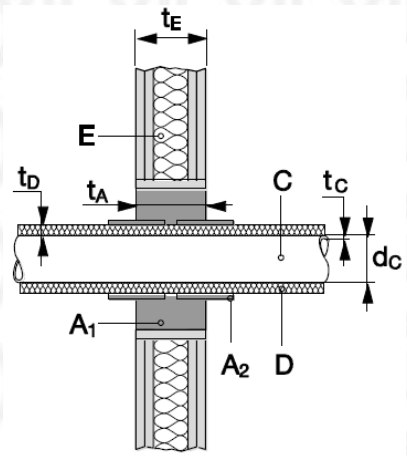
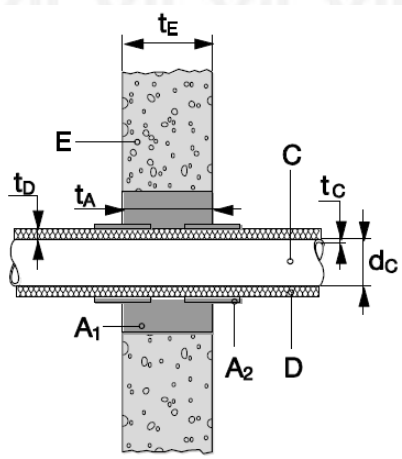
A.2.5.4 Metal pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B

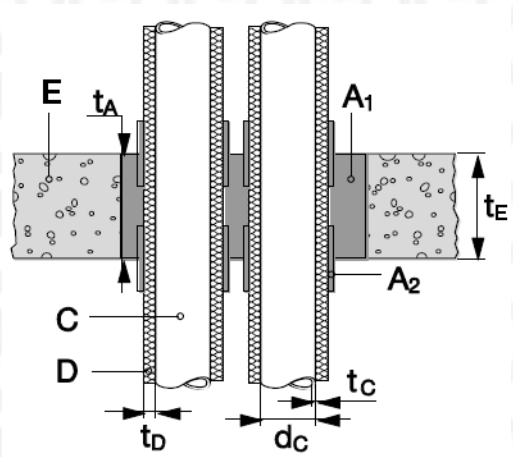
Construction details:

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
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.
For symbols and abbreviations see Annex A.2.1.1.1.

A) Continued insulation







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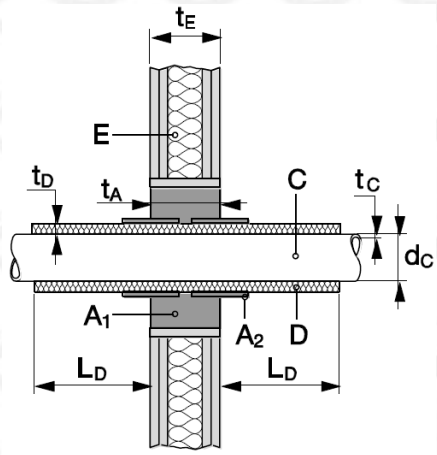
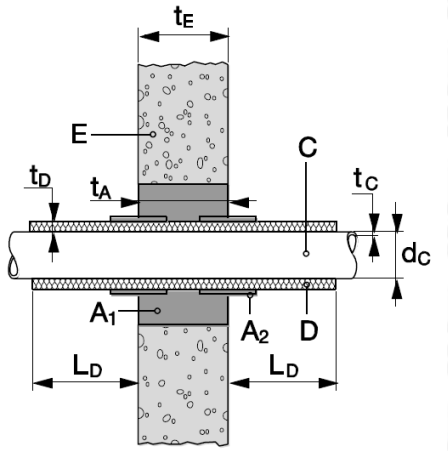
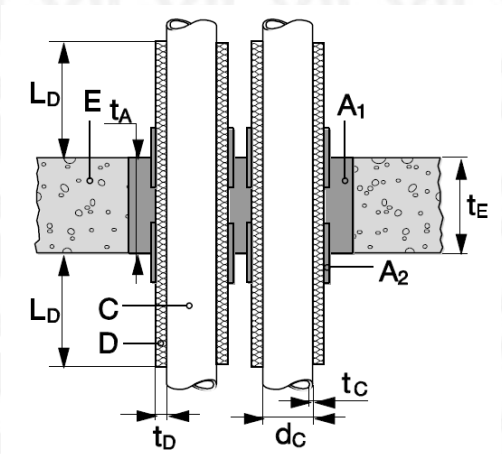
B) Local insulation







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A.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 to Annex 2.1, $t_E \geq 112$ mm

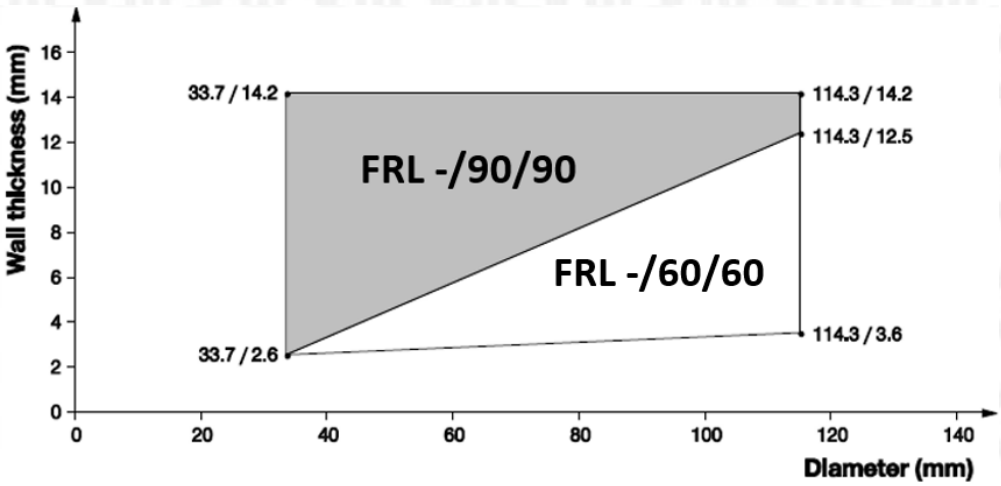
Arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according to Annex 2.6.1

Steel pipes (C) with continued foamed elastomeric insulation (D) – sustained

Seal thickness[3]			$t_A \geq 150$ mm	
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level)	
			(multiple)	(mixed)
33.7 – 114.3	2.6/3.6 – 14.2[4,5]	19	–/60/60	–/60/60
33.7 – 114.3	2.6/3.6 – 12.5[5]	19	–/90/90	-

Steel pipes (C) with local foamed elastomeric insulation (D) – sustained

Seal thickness[3]				$t_A \geq 150$ mm	
Pipe		Insulation		FRL (Fire Resistance Level)	
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	–/60/60	–/60/60
33.7 – 114.3	2.6/3.6 – 12.5[5]	19	≥ 500	–/90/90	-



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).

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

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

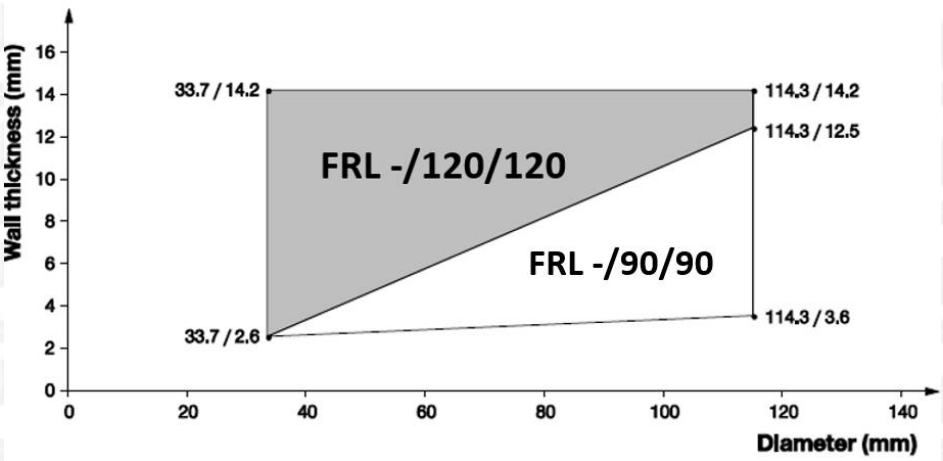
Steel pipes (C) with continued foamed elastomeric insulation (D) – sustained

Seal thickness[3]			t_A ≥150 mm	
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level)	
			(multiple)	(mixed)
33.7 – 114.3	2.6/3.6 – 14.2[4,5]	19	–/90/90	–/60/60
33.7 – 114.3	2.6/3.6 – 12.5[5]	19	–/120/120	-

Steel pipes (C) with local foamed elastomeric insulation (D) – sustained – C/U

Seal thickness[3]				t_A ≥150 mm	
Pipe		Insulation		FRL (Fire Resistance Level)	
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	–/90/90	–/60/60
33.7 – 114.3	2.6/3.6 – 12.5[5]	19	≥ 500	–/120/120	-

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).

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

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

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

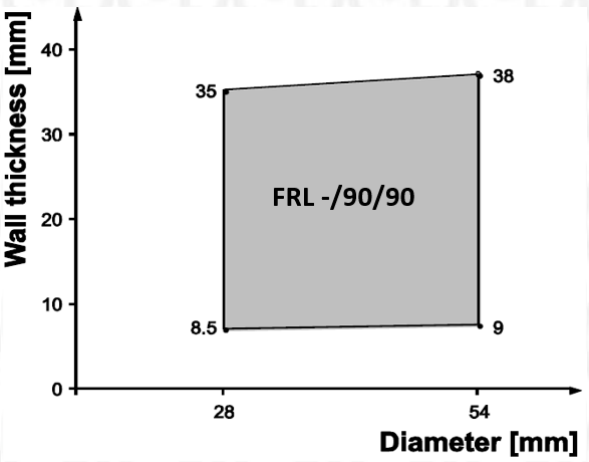
Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained

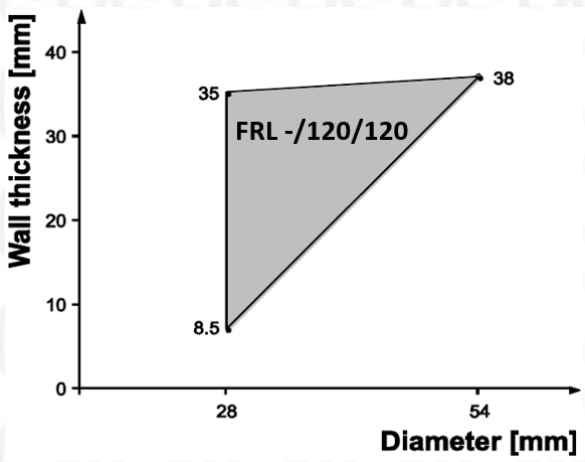
Seal thickness[3]			t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level) (mixed)
28 – 54	1.0/1.5 – 14.2[4,10]	8.5/9.0 – 35.0/38.0	–/90/90
28 – 54	1.0/1.5 – 14.2[4,10]	8.5 – 35.0/38.0	–/120/120

Copper pipes (C) with local foamed elastomeric insulation (D) – sustained

Seal thickness[3]				t_A ≥200 mm
Pipe		Insulation		FRL (Fire Resistance Level)
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(mixed)
28 – 54	1.0/1.5 – 14.2[4,10]	8.5/9.0 – 35.0/38.0	≥ 500	–/90/90
28 – 54	1.0/1.5 – 14.2[4,10]	8.5 – 35.0/38.0	≥ 500	–/120/120

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

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

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

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained

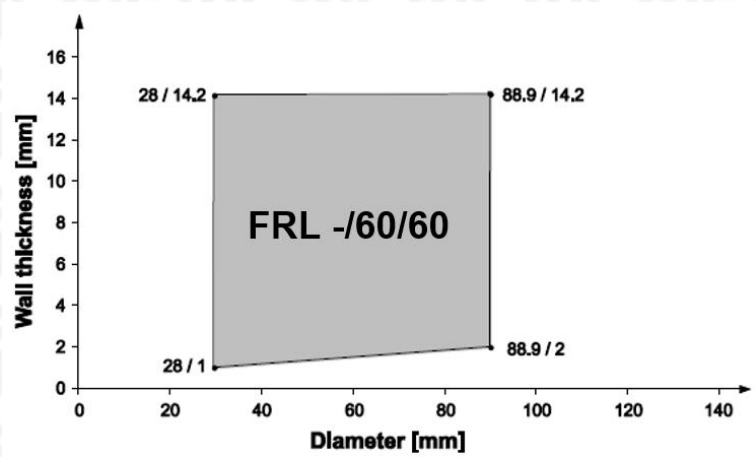
Seal thickness[3]			$t_A \geq 150$ mm	
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level)	
			(multiple)	(mixed)
28 – 88.9	1.0/2.0 – 14.2[4,7]	19	–/60/60	–/60/60
28	1.0 – 14.2[4]	19	–/120/120	-

Copper pipes (C) with local foamed elastomeric insulation (D) – sustained

Seal thickness[3]				$t_A \geq 150$ mm	
Pipe		Insulation		FRL (Fire Resistance Level)	
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	–/60/60	–/60/60
28	1.0 – 14.2[4]	19	≥ 500	–/90/90	-

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).

Wall (multiple):



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

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

Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained

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]	FRL (Fire Resistance Level)		
			(multiple)	(mixed)	
28 – 88.9	1.0/2.0 – 14.2[4,7]	19	–/90/90	–/60/60	-
28	1.0 – 14.2[4]	19	–/120/120	-	-
28 – 54	1.0/1.5 – 14.2[4,10]	8.5/9.0 – 35.0/38.0	-	-	–/90/90
28 – 54	1.0/1.5 – 14.2[4,10]	8.5 – 35.0/38.0	-	-	–/120/120

Copper pipes (C) with local foamed elastomeric insulation (D) – sustained

Seal thickness[3]					t_A ≥150 mm	
Pipe		Insulation			FRL (Fire Resistance Level)	
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	–/90/90	–/60/60	-
28	1.0 – 14.2[4]	19	≥ 500	–/120/120	-	-
28 – 54	1.0/1.5 – 14.2[4,10]	8.5/9.0 – 35.0/38.0	≥ 500	-	-	–/90/90
28 – 54	1.0/1.5 – 14.2[4,10]	8.5 – 35.0/38.0	≥ 500	-	-	–/120/120

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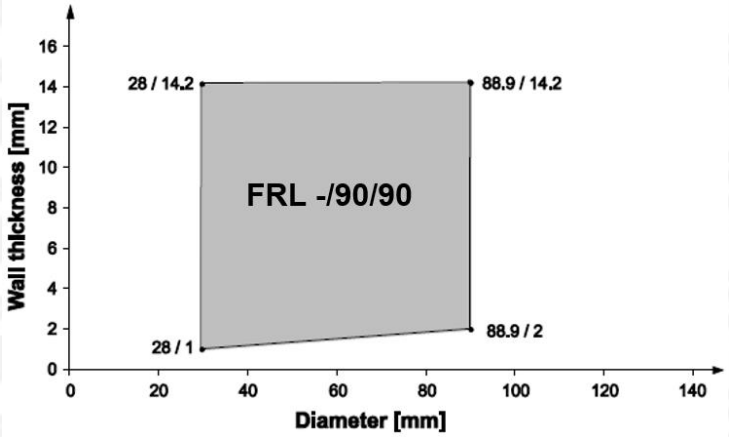
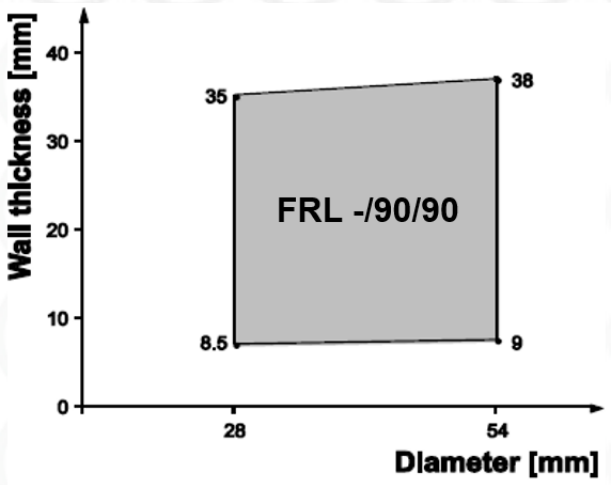
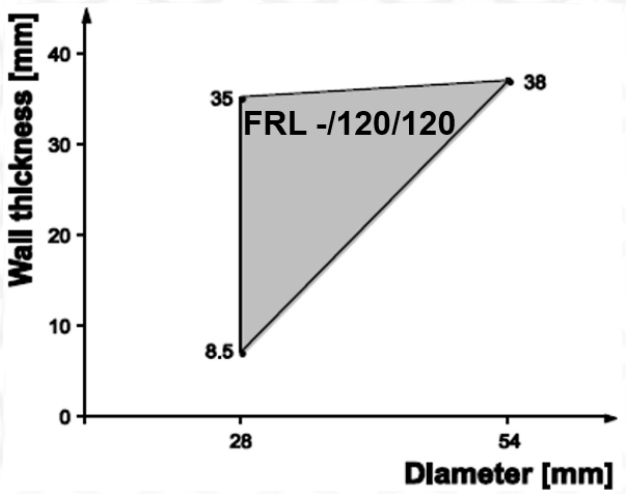
Floor, seal thickness t_A ≥150 mm:



Floor, seal thickness t_A ≥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).

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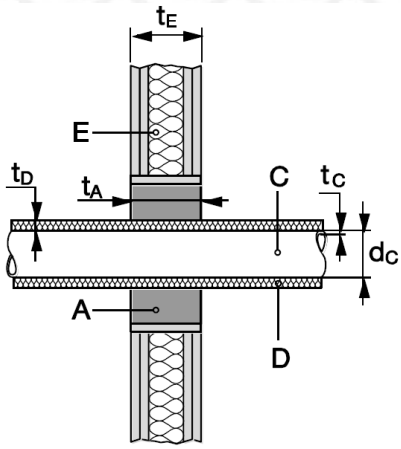
A.2.6 Al composite pipes

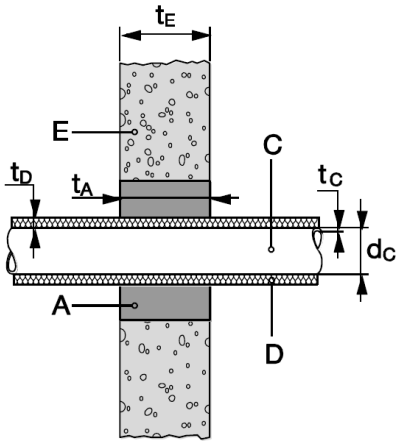
A.2.6.1 Al composite pipes with foamed elastomeric insulation, flexible and rigid wall constructions, and floor constructions according to Annex 2.1

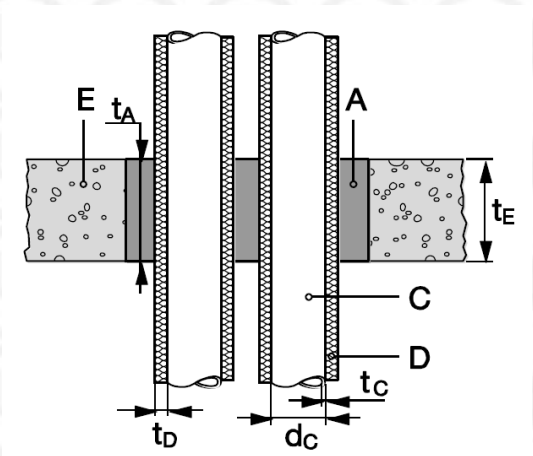
Arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according to Annex 2.6.1

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 A.2.1.1.1.







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Date of Issue 2023-11-01

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

Manufacturer: Geberit

Seal thickness[3]			t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level) (mixed)
16 – 32	2.0 – 3.0	8.0 – 9.0	–/120/120

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

Manufacturer: Fränkische Rohrwerke

Seal thickness[3]			t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Insulation thickness (t_D) [mm]	FRL (Fire Resistance Level) (mixed)
16 – 32	2.0 – 3.0	8.0 – 9.0	–/120/120

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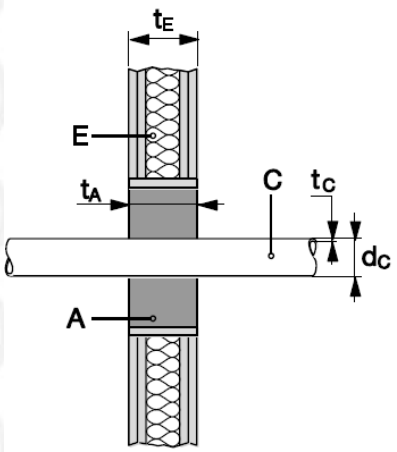
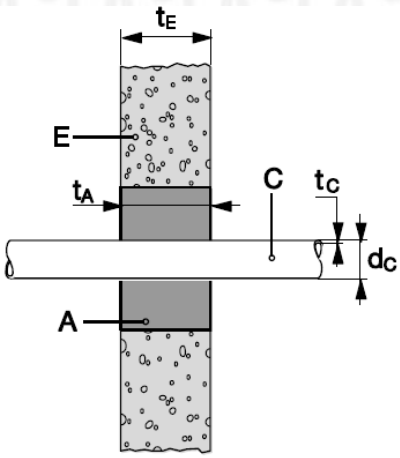
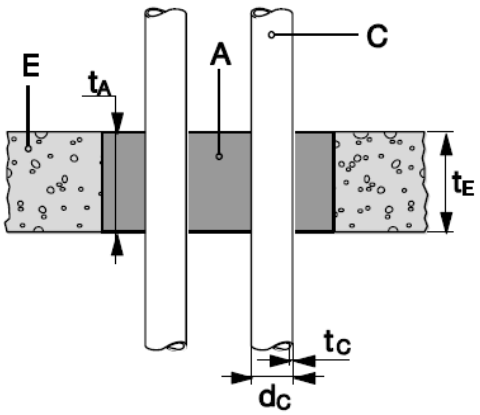
A.2.7 Plastic pipes

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 A.2.1.1.1.







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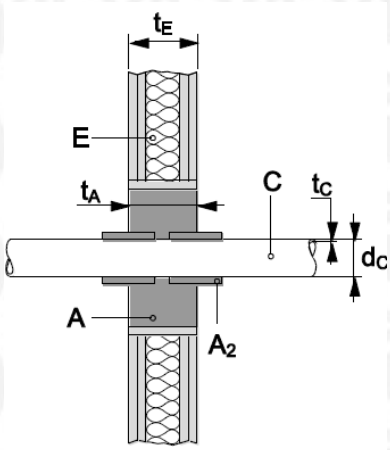
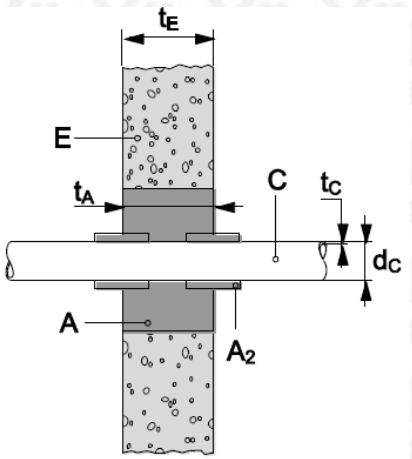
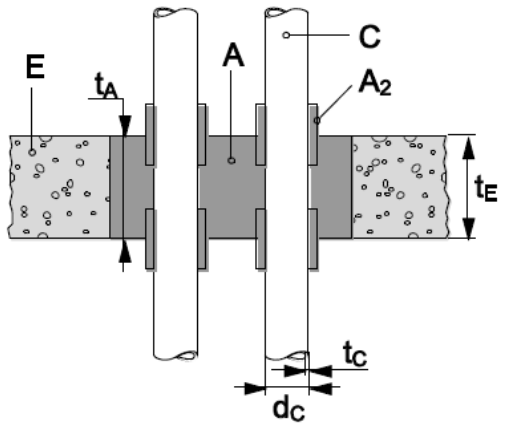
In some cases, the services are covered by two layers of Hilti Firestop Bandage CFS-B on both sides. The bandage is positioned with its centre line flush to the seal surface.







In some cases of floor applications, a PVC sleeve, diameter 75 mm – 110 mm, length 200 mm, 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 mm

Minimum distance with sleeve in floor applications (mm):

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

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A.2.7.1 PE pipes flexible and rigid wall constructions, and floor constructions according to Annex 2.1

A.2.7.1.1 PE pipes without insulation (C)

Seal thickness[3]		t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	FRL (Fire Resistance Level) (mixed)
≤ 40	2.3 – 3.7	–/120/120

A.2.7.1.2 PE pipes (including HDPE, MDPE and PE 100) (C)

Seal thickness[3]		t_A ≥150 mm	t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	FRL (Fire Resistance Level) (multiple)	FRL (Fire Resistance Level) (mixed)
50	2.9 – 4.6	–/120/120	–/60/60

A.2.7.1.3 PE pipes (including HDPE, MDPE and PE 100) (C) with Hilti Firestop Bandage CFS-B

Seal thickness[3]		t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	FRL (Fire Resistance Level) (mixed)
50 - 110	2.9/2.7 – 10.0	–/120/120

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A.2.7.2 PVC-U pipes flexible and rigid wall constructions, and floor constructions according to Annex 2.1

Seal thickness[3]		t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	FRL (Fire Resistance Level) (mixed)
≤ 40	1.9 – 3.0	–/120/120

Seal thickness[3]		t_A ≥150 mm	t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	FRL (Fire Resistance Level) (multiple)	FRL (Fire Resistance Level) (mixed)
50	3.7	–/120/120	-

Seal thickness[3]		t_A ≥150 mm	t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	FRL (Fire Resistance Level) (multiple)	FRL (Fire Resistance Level) (mixed)
50	3.7 – 5.6	–/120/120	–/60/60

A.2.7.2.1 PVC-U pipes (C) with Hilti Firestop Bandage CFS-B

Seal thickness[3]		t_A ≥200 mm
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	FRL (Fire Resistance Level) (mixed)
For wall applications		
50 - 110	1.8/2.2 – 12.3	–/120/120
For floor applications		
50 - 110	1.8 – 12.3	–/120/120

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A.2.7.3 PVC pipes, floor constructions according to 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, built in flush to bottom side of the building element (E).

PVC pipes

Seal thickness[3]				t_A ≥200 mm
Pipe		Insulation		FRL (Fire Resistance Level)
diameter (d_C) [mm]	wall thickness (t_C) [mm]	thickness (t_D) [mm]	length (L_D) [mm]	(multiple)
32	1.9	-	-	–/120/120

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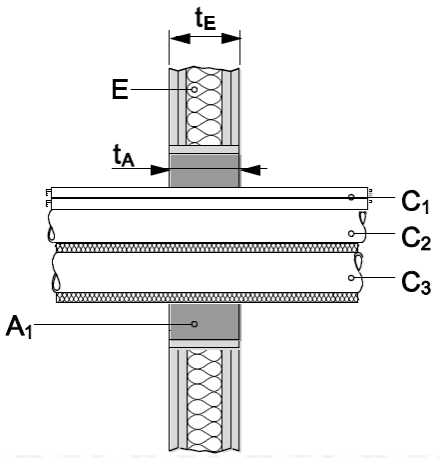
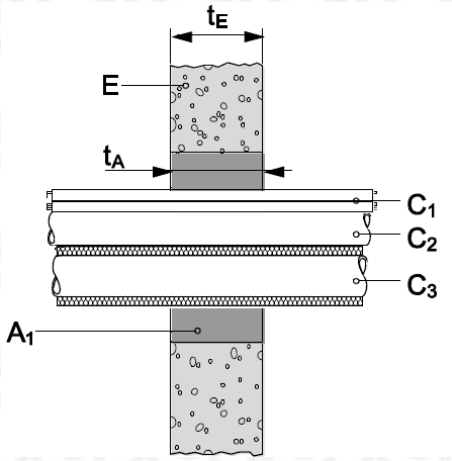
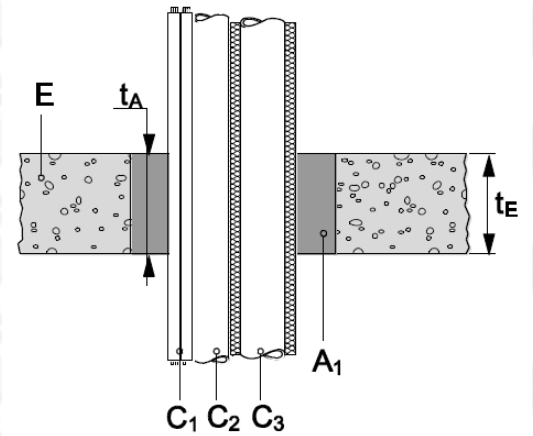
A.2.8 Special penetrations

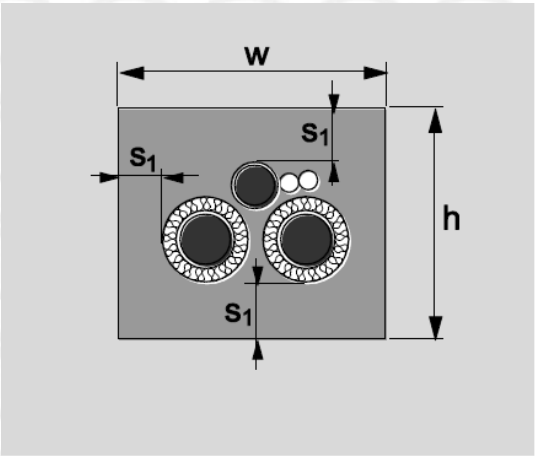
Construction details:

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 A.2.1.1.1.









Minimum distance (mm):	Wall	Floor
between service and seal edge (s_1):	0	20
between all services inside clima split bundle (s_2):	20	0
between services and upper seal edge:	20	-

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A.2.8.1 "Clima split" bundles of pipes & cables flexible and rigid wall constructions according to Annex 2.1

Clima split bundles (C)

seal thickness[3]				t_A ≥200 mm
Penetrant		**Type / diameter** (dC) [mm]	**wall thickness** (tC) [mm]	**FRL (Fire Resistance Level) (mixed)**
Bundle (C) consisting of: 2 copper pipes (C_1) with 9 mm thick continued sustained foamed elastomeric insulation 2 cables (C_2) 1 PVC pipe (C_3)	copper pipes (C_1)	6 - 42	1.0	–/90/90
	cables (C_2)	5 x 1.5mm2 5 x 6mm²		
	PVC pipes (C_3)	16	3.7 flex	
		25	4.3 flex	
		40	2.4	
Bundle (C) consisting of: 2 copper pipes (C_1) with 9 mm thick continued sustained foamed elastomeric insulation 2 cables (C_2) 1 PVC pipe (C_3)	copper pipes (C_1)	6 – 18	1.0	–/120/120
	cables (C_2)	5 x 1.5mm2 5 x 6mm²		
	PVC pipes (C_3)	16	3.7 flex	
		25	4.3 flex	
		40	2.4	

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A.2.8.2 "Clima split" bundles of pipes & cables PVC-U pipes, floor constructions according to Annex 2.1				
Clima split bundles (C)				
seal thickness[3]				t_A ≥200 mm
Penetrant		**Type / diameter** (dC) [mm]	**wall thickness** (tC) [mm]	**FRL (Fire Resistance Level) (mixed)**
Bundle (C) consisting of: 2 copper pipes (C_1) with 9 mm thick continued sustained foamed elastomeric insulation	copper pipes (C_1)	6 – 42	1.0	-/90/90
	cables (C_2)	5 x 1.5mm² 5 x 6 mm²		
	PVC pipes (C_3)	16	3.7 flex	
2 cables (C_2)		25	4.3 flex	
1 PVC pipe (C_3)		40	2.4	

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A.2.9 Cross-laminated timber walls - Construction details

Construction details:

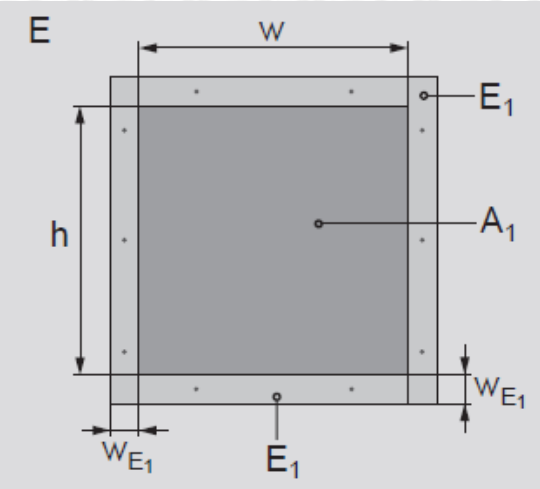
Characterization for the cross-laminated timber walls:

- Cross-laminated timber
- Number of cross-laminated timber layers: ≥ 3 (for wall thickness t_E ≥ 80 mm)
- Number of cross-laminated timber layers: ≥ 5 (for wall thickness t_E ≥ 100 mm)
- PU / MUF adhesives permitted
- Edge glue not required
- Minimum thickness of outer cross-laminated timber layers t_l ≥ 20 mm,
- Symmetrical wall-layer set-up,

Or CLT walls at minimum 180 mm thickness and must have achieved an FRL of not less than -/90/90 under Full scale test established by an Accredited Testing Lab

Cross-laminated timber walls do have a symmetrical construction set-up related to a vertical running axis of symmetry. Individual thickness of layers may vary or be identical.

A.2.9.1 Blank seals of CFS-F FX in cross-laminated timber walls



A.2.9.1:
Blank seal of CFS-F FX (A_1) in a cross-laminated timber wall made of X-lam. Cross-laminated timber framing E_1 installed.

Max. height h (mm)	Max. width w (mm)	Wall thickness t_E (mm)	Seal depth t_{A1} (mm)	**FRL (Fire Resistance Level)**
400	400	≥ 80	≥ 150	-/60/60
400	400	≥ 100	≥ 150	-/90/90

A.2.9.2 Additional Framing in cross-laminated timber walls

If requested seal thickness t_{A1} is bigger than available wall thickness t_E an additional framing E_1 is requested.

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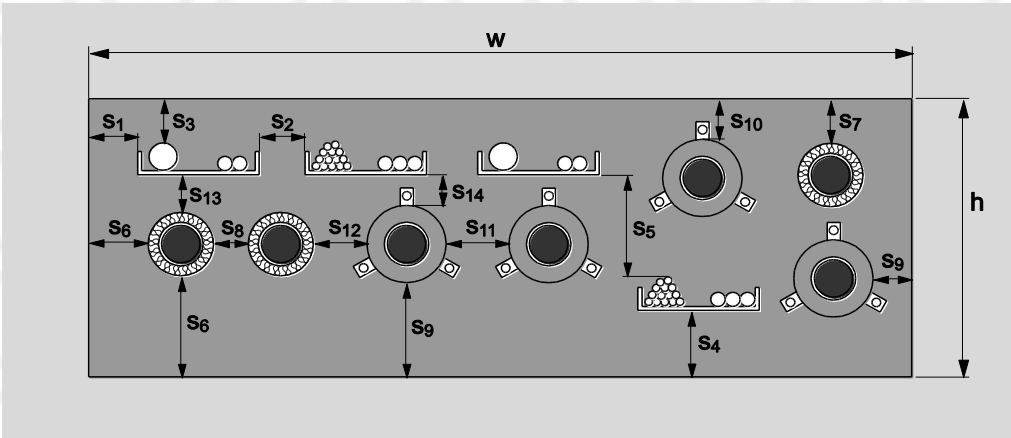
A.2.9.3 First support in cross-laminated timber wall
First support for any kind of penetrants in cross-laminated timber wall is 350 mm.
A.2.9.4 Minimum distances for penetrations in cross-laminated timber wall construction
The distances are valid for single, multiple and mixed penetrations in cross-laminated timber wall construction made of cross-laminated timber walls

Valid for cross-laminated timber walls only		**Minimum distance (mm)**
s_1	distance between single cables and side seal edge	20
	distance between cables support and side seal edge	20
	distance between cable bundle or conduit bundle /single conduit and side seal edge	50
	distance between Clima split and side seal edge	50
s_2	distance between cable supports	0
	distance between single cables	0
	distance between single conduits/conduit bundle and edge of the seal on side	50
	distance between Clima split and single cable /cable bundle	100
s_3	distance between single cables or conduits and upper seal edge	20
	distance between bunched cables or conduits and upper seal edge	
s_4	distance between cable supports and bottom seal edge	100
s_5	distance between cables and cable support above	50
s_6	distance between metal pipes and side seal edge	100
	distance between Clima split and downside seal edge	50
	distance between single or bunched conduits and downside seal edge	50
s_7	distance between metal pipes and upper seal edge	100
s_8	distance between metal pipes in linear arrangement	0
s_9	distance between plastic pipes/pipe closure devices and side seal edge	100
s_{10}	distance between plastic pipes/pipe closure devices and upper seal edge	100
s_{11}	distance between plastic pipes/pipe closure devices	100
s_{12}	distance between metal pipes and plastic pipes/pipe closure devices	100
s_{13}	distance between cables/cable supports and metal pipes	100
s_{14}	distance between cables/cable supports and plastic pipes/pipe closure devices	100



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A.2.9.5 Cables in cross-laminated timber wall construction

General conditions:
For penetrating cables:

- Type of cable: All sheathed cable types currently and commonly used in building practice (e.g. power, control, signal, telecommunication, data, optical fibre cables
- Cable size: see table below
- First support: refer to A.2.9.3

Size of cables Max. Cable Diameter	Cross-laminated timber wall thickness t_E	Requested Seal thickness t_{A1}	Cable Carrier system	**FRL (Fire Resistance Level)**
Up to 21mm single cables	≧ 80 mm	≧ 150 mm	With and without	-/60/60
Up to 50 mm single cables	≧ 80 mm	≧ 150 mm	With and without	-/60/60
Up to 21mm single cables	≧ 100 mm	≧ 150 mm	With and without	-/60/60
Up to 50 mm single cables	≧ 100 mm	≧ 150 mm	With and without	-/60/60

For cable carrier systems:

- Cable carrier penetrating the wall
- Only open cable carrier systems approved, non-perforated steel cable trays
- For carrier material: steel
- Max. carrier width: 200 mm
- Max. carrier high: 60 mm
- Carrier material thickness: ≥ 1,5 mm
- For distances refer to A.2.9.4
- Other carries to be stopped 150 mm before the seal

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A.2.9.6 Conduits and tubes in cross-laminated timber wall construction

General conditions:

- First support: refer to A.2.9.3
- Conduit end seal: sealed with CFS-S ACR, sealing depth: ≥ 15 mm
- Projecting length (identical on both sides of the wall): ≥ 500 mm
- Single conduits and bunched conduits
- With or without cables in
- All plastic material for flexible and rigid conduits approved

Size and type of conduits	Cross-laminated timber wall thickness t_E	Requested Seal thickness t_{A1}	**FRL (Fire Resistance Level)**
Single conduits, rigid plastic conduits Ø ≤ 32 mm	≧ 80 mm	≧ 150 mm	-/60/60
	≧ 100 mm	≧ 150 mm	-/90/90
Single conduits, flexible, pliable, and plastic conduits Ø ≤ 32 mm	≧ 80 mm	≧ 150 mm	-/60/60
	≧ 100 mm	≧ 150 mm	-/60/60
Bundle of rigid plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm	≧ 80 mm	≧ 150 mm	-/60/60
	≧ 100 mm	≧ 150 mm	-/90/90
Bundle of flexible/pliable plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm	≧ 80 mm	≧ 150 mm	-/60/60
	≧ 100 mm	≧ 150 mm	-/60/60
Bundle of mixed plastic conduits, (flexible/pliable/rigid), bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm	≧ 80 mm	≧ 150 mm	-/60/60
	≧ 100 mm	≧ 150 mm	-/60/60

A.2.9.7 Metal pipes with PE-insulation in cross-laminated timber wall construction

General conditions:

- First support: refer to A.2.9.3
- Minimum wall thickness: t_E ≥ 100 mm
- Minimum seal thickness: t_{A1} ≥ 200 mm
- For distances refer to A.2.9.4

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A.2.9.7.1 Copper pipes with PE-insulation sealed with CFS-F FX in cross-laminated timber wall construction

General conditions:

- Insulated copper pipes,
- Insulation: 9 mm PE in CS-position
- For insulation material refer to sec. A.2.1.6.
- Distances between both insulated pipes ≥ 0 mm

	Cross-laminated timber wall thickness t_E	Seal thickness t_{A1}	**FRL (Fire Resistance Level)**
insulated copper pipe, max. Ø = 18 mm, wall thickness ≥ 1 mm	≧ 80 mm	≧ 150 mm	-/60/60
Single conduits, flexible, pliable, and plastic conduits Ø ≤ 32 mm	≧ 80 mm	≧ 150 mm	-/60/60

A.2.9.8 Plastic pipes in cross-laminated timber wall construction

Construction details:

- First support: refer to A.2.9.3
- For distances refer to A.2.9.4
- Single penetration seal

A.2.9.8.1 PP- pipes without insulation sealed with CFS-F FX in cross-laminated timber wall construction

PP pipes (C), in CLT wall construction, t_E ≥100 mm

seal thickness: t_{A1} ≥ 200 mm		
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	**FRL (Fire Resistance Level)**
50	1.8	-/90/90

A.2.9.8.2 PVC- pipes without insulation sealed with CFS-F FX in cross-laminated timber wall construction

PVC pipes
In CLT wall construction, t_E ≥100 mm

seal thickness: t_{A1} ≥ 200 mm		
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	**FRL (Fire Resistance Level)**
50	1.8 – 5.6	-/90/90

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PVC pipes flexible, pliable, rigid In CLT wall construction, t_E ≥ (80 – 100) mm		
seal thickness: t_{A1} ≥ 200 mm		
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	**FRL (Fire Resistance Level)**
25	4.3	-/60/60

A.2.9.9 Aluminium-composite pipes without insulation sealed with CFS-F FX in cross-laminated timber wall construction		
Geberit Mepla pipe (ACC), non-regulated, in CLT wall construction, t_E ≥100 mm		
seal thickness: t_{A1} ≥ 200 mm		
Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	**FRL (Fire Resistance Level)**
32	3.0	-/90/90

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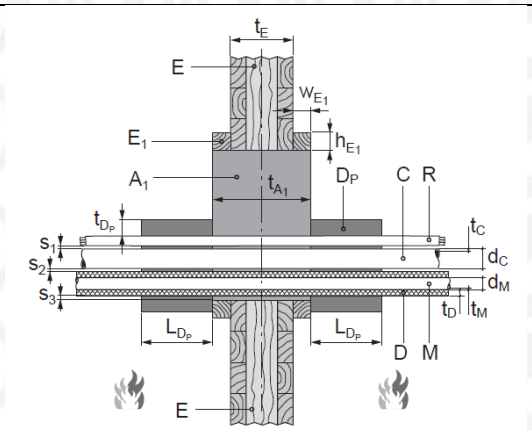
A.2.9.10 Mixed pipe and cable penetration in cross-laminated timber wall with elastomeric insulation

Clima split application - Construction details:

- Penetrating service is a tight bundle of isolated metal pipes, plastic pipe and cables
- Metal pipes: max. 2 parallel copper pipes, isolated
- Type of metal: copper and others (refer to A.2.1.6)
- Type of insulation (CS-situation): foamed PE (polyethylene), refer to A.2.1.7
- Max. two cables
- Max.one plastic pipe, non-insulated
- In case of seal thickness t_{A1} > building element thickness t_E, refer to sec. A.2.1.1
- An additional protect insulation made from elastomeric foam (refer to A.2.1.5), thickness t_{DP} = 9mm, length L_{DP} = 250mm has to be installed on both sides of the wall in Local Interrupted (LI) or Continuous Interrupted (CI) situation.



A.2.9.10
Clima split application (penetrant C, R, M) penetrating a cross-laminated timber wall, sealed with CFS-F FX (A_1) over seal thickness t_{A1}.

An addition framing made of wood (E_1) has been installed due to the fact, that wall thickness t_E was smaller than requested seal thickness t_{A1}.

For distances: ($s_1 = s_2 = s_3$) ≥ 0mm

Metal pipes:	• Metal pipes maximum diameter: 18 mm • Wall thickness = (1.0-14.2) mm • PE-insulation thickness: 9 mm • Type: Tubolit, Frigoline
Plastic pipe:	• PVC pipe, flexible, pliable or rigid • Plastic pipe diameter: max.25 mm • Plastic pipe wall thickness: max. 4.3 mm
Cables:	• Max. size: 5x1.5 mm² • Cable diameter: maximum 14 mm

"Clima split" bundles acc. Fig. A.2.9.10	seal thickness t_{A1}	**FRL (Fire Resistance Level)**
In wall thickness t_E ≥80 mm	t_{A1} ≥150 mm	-/60/60
In wall thickness t_E ≥100 mm	t_{A1} ≥150 mm	FRL -/60/60

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A.2.10 Cross-laminated timber floors - Construction details

Characterization for the cross-laminated timber floors:

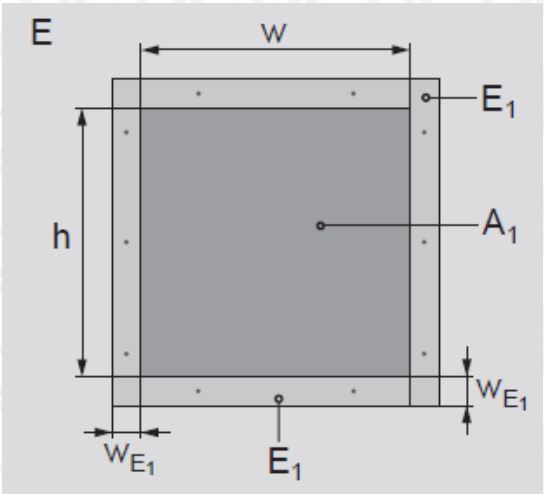
- Cross-Laminated Timber
- Number of cross-laminated timber layers: ≥ 3 (for floor thickness t_E ≥ 80 mm)
- Number of cross-laminated timber layers: ≥ 5 (for floor thickness t_E ≥ 100 mm)
- PU / MUF adhesives permitted
- Edge glue not required
- Minimum thickness of outer cross-laminated timber layers t_l ≥ 20 mm,

Or, CLT floors at minimum 180 mm thickness and must have achieved an FRL of not less than -/90/90 under Full scale test established by an Accredited Testing Lab

A.2.10.1 Additional Framing in cross-laminated timber floors

If required seal thickness t_{A1} is bigger than available floor thickness t_E an additional framing E_1 is required. For details refer to sec. A.2.1.1.

A.2.10.2 Blank seals of CFS-F FX in cross-laminated timber floors



A.2.10.2:
Blank seal of CFS-F FX (A_1) in a cross-laminated timber floor made of CLT. Cross-laminated timber framing E_1 installed around the opening.

View from topside.

Max. height h (mm)	Max. width w (mm)	Min. floor thickness t_E (mm)	Min. seal depth t_{A1} (mm)	**FRL (Fire Resistance Level)**
400	400	80	80	-/30/30
400	400	100	150	-/90/90
400	400	140	200	-/90/90

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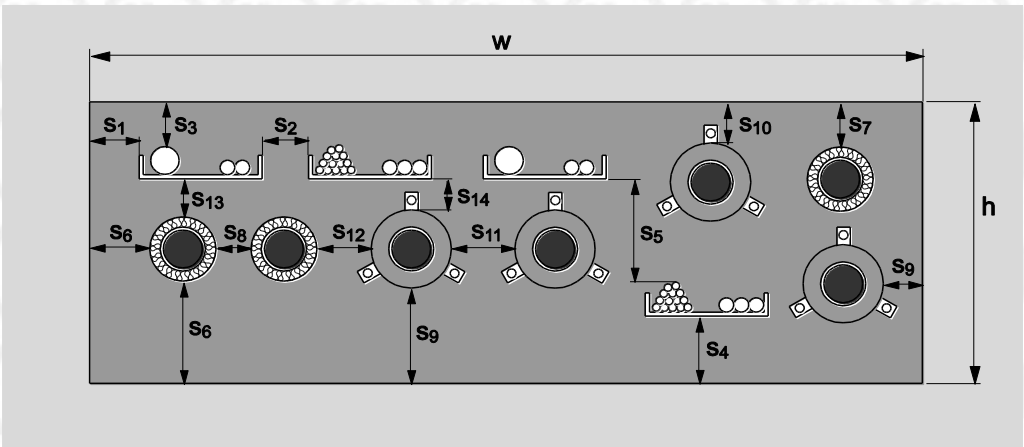
A.2.10.3 First support in cross-laminated timber floor
First support for any kind of penetrants in cross-laminated timber floor should be ≤ 350 mm, independent from cross-laminated timber floor thickness.
A.2.10.4 Minimum distances for penetrations in cross-laminated timber floor construction
The distances are valid for single, multiple and mixed penetrations in cross-laminated timber floor construction.

Valid for cross-laminated timber floors only		**Minimum distance (mm)**
s_1, s_3, s_4	distance between cable supports and seal edge	20
	distance between cables or conduits to seal edge	20
	distance between Clima split or conduit bundle to seal edge	50
	distance between cable and conduit, and between conduit to conduit, between conduit and conduit bundle	50
	distance between cable to Clima split	100
	distance between conduit to Clima split	50
	distance between cables to cable (with or without cable support)	100
s_2, s_5	distance between cable supports or bunched cables and another cable support	100
s_6	distance between metal pipes and seal edge	100
s_7	distance between metal pipes and seal edge	100
s_8	distance between metal pipes linear arrangement	0
s_9, s_{10}	distance between plastic pipes/pipe closure devices and seal edge	100
s_{11}	distance between plastic pipes/pipe closure devices	100
s_{12}	distance between metal pipes and plastic pipes/pipe closure devices	100
s_{13}	distance between cables/cable supports and metal pipes	100
s_{14}	distance between cables/cable supports and plastic pipes/pipe closure devices	100



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A.2.10.5 Cables in cross-laminated timber floor constructions

For penetrating cables:

- Type of cable: All sheathed cable types currently and commonly used in building practice (e.g. power, control, signal, telecommunication, data, optical fibre cables
- Cable size: see table below
- First support: refer to A.2.10.3

Size of cables Max. Cable Diameter	Cross-laminated timber floor thickness t_E	Requested Seal thickness t_{A1}	Cable Carrier system	**FRL (Fire Resistance Level)**
≤ 21mm single cables	≥ 80 mm	≥ 80 mm	With and without	-/30/30
≤ 50 mm single cables	≥ 80 mm	≥ 80 mm	With and without	-/30/30
≤ 21mm single cables	≥ 100 mm	≥ 150 mm	With and without	-/60/60
≤ 50 mm single cables	≥ 100 mm	≥ 150 mm	With and without	-/45/45
≤ 21mm single cables	≥ 140 mm	≥ 200 mm	With and without	-/90/90
≤ 50 mm single cables	≥ 140 mm	≥ 200 mm	With and without	-/90/90

For cable carrier systems:

- Cable carrier penetrating the floor
- Only open cable carrier systems approved,
- For carrier material: non – perforated steel
- Max. carrier width: 200 mm
- Max. carrier high: 60 mm
- For distances refer to A.2.10.4
- Carrier material thickness: ≥ 1.5 mm

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A.2.10.6 Conduits and tubes in cross-laminated timber floor construction

General conditions:

- First support: refer to A.2.10.3
- Conduit end seal: sealed with CFS-S ACR, sealing depth: ≥ 15 mm
- Projecting length (identical on both sides of the wall): ≥ 500 mm
- Single conduits and bunched conduits
- With or without cables in
- All plastic material for flexible and rigid conduits approved

Size and type of conduits	Cross-laminated timber wall thickness t_E	Requested Seal thickness t_{A1}	**FRL (Fire Resistance Level)**
Single conduits, rigid plastic conduits Ø ≤ 32 mm	≧ 80 mm	≧ 80 mm	-/30/30
	≧ 100 mm	≧ 150 mm	-/90/90
Single conduits, flexible, pliable and plastic conduits Ø ≤ 32 mm	≧ 80 mm	≧ 80 mm	-/30/30
	≧ 100 mm	≧ 150 mm	-/90/90
Bundle of rigid plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm	≧ 80 mm	≧ 80 mm	-/30/30
	≧ 100 mm	≧ 150 mm	-/90/90
Bundle of flexible/pliable plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm	≧ 80 mm	≧ 80 mm	-/30/30
	≧ 100 mm	≧ 150 mm	-/90/90
Bundle of mixed plastic conduits, (flexible/pliable/rigid), bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm	≧ 80 mm	≧ 80 mm	-/30/30
	≧ 100 mm	≧ 150 mm	-/ 90/90

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A.2.10.7 Metal pipes in cross-laminated timber floor

General conditions:

- One or two isolated metal pipes
- Insulation in CS position
- Distance in between both isolated pipes s ≧ 0 mm
- Pipe material: copper and others, refer to sec. A.2.1.6
- Metal pipes diameter: d ≧ 18 mm
- Metal pipe wall thickness = (1.0-14.2) mm
- Pipe insulation, for material refer to A.2.1.7
- Pipe insulation thickness: 9 mm

	seal thickness t_{A1}	**FRL (Fire Resistance Level)**
In floor thickness t_E ≥ 80 mm	≥80 mm	-/30/30
In floor thickness t_E ≥ 100 mm	≥150 mm	-/90/90
In floor thickness t_E ≥ 140 mm	≥200 mm	-/90/90

A.2.10.8 Plastic pipes in cross-laminated timber floor

General conditions:

- One non isolated plastic pipe
- Pipe made of PVC
- For flexible, pliable and rigid pipes
- Plastic pipe diameter: max.25mm
- Plastic pipe wall thickness: max. 4,3mm

Clima split bundles	seal thickness t_{A1}	**FRL (Fire Resistance Level)**
In floor thickness t_E ≥ 80 mm	≥80 mm	-/30/30
In floor thickness t_E ≥ 100 mm	≥150 mm	-/90/90
In floor thickness t_E ≥ 140 mm	≥200 mm	-/90/90

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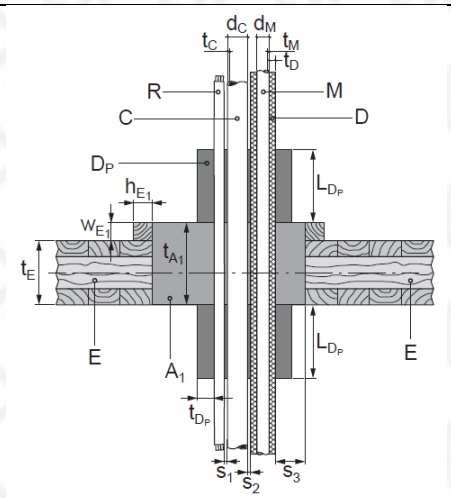
A.2.10.9 Mixed pipe and cable penetration in cross-laminated timber floors with PE-insulation and CFS-B Firestop Bandage

Clima split - Construction details:

- Penetrating service is a tight bundle of insulated metal pipes, plastic pipes and cable
- Distances: see below:
- Metal pipes: max. 2 parallel copper pipes, insulated,
- Type of metal: copper and others - refer to A.2.1.6
- Type of insulation (CS-situation): foamed PE (polyethylene), refer to A.2.1.7
- One penetrating non-insulated plastic pipe
- Max. two cables max. diameter = 14 mm
- Seal thickness with CFS-F FX: over entire thickness t_{A1}, see Fig.A.2.10.9
- In case of seal thickness t_{A1} > building element thickness t_E, refer to sec. A.2.1.1
- Above and below the floor there should be an LDP = min. 250 mm long additional protect insulation D_P made of foamed elastomer (refer to A.2.1.5), thickness t_{DP} = 9 mm, in Local Interrupted (LI) or Continuous Interrupted (CI) situation



A.2.10.9
Clima split
application (penetrant C, R, M) penetrating a cross-laminated timber floor, sealed with CFS-F FX (A_1) over seal thickness t_{A1}.

An addition framing made of wood (E_1) has been installed due to the fact, that floor thickness t_E was smaller than requested seal thickness t_{A1}.

For distances: ($s_1 = s_2 = s_3$) ≥ 0mm

Metal pipes:	• Metal pipes maximum diameter: 18 mm • Wall thickness = (1.0-14.2) mm • PE-insulation thickness: 9 mm
Plastic pipe:	• PVC pipe, flexible, pliable or rigid • Plastic pipe diameter: max. 25 mm • Plastic pipe wall thickness: max. 4.3 mm
Cables:	• Max. size: 5x1.5 mm² • Cable diameter: maximum 14 mm

	seal thickness t_{A1}	**FRL (Fire Resistance Level)**
In floor thickness t_E ≥80 mm	≥80 mm	-/30/30
In floor thickness t_E ≥100 mm	≥150 mm	-/90/90
In floor thickness t_E ≥140 mm	≥200 mm	-/90/90

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A.2.11 Cross-laminated timber floors – System Lignotrend - Construction details

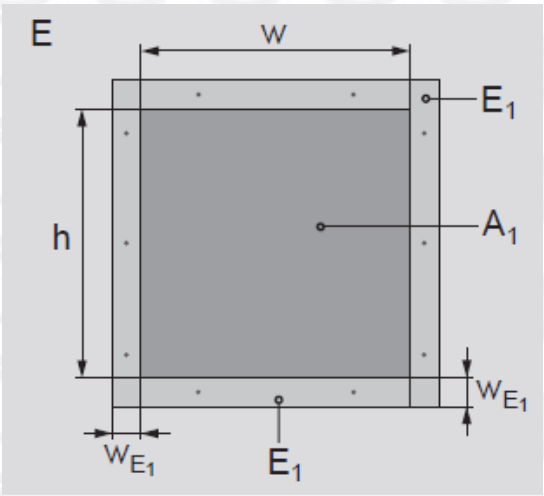
Characterization for the cross-laminated timber rib element floors:

- LIGNO Rib Q2 Acoustic Z2 196 – FRL -/90/90, floor thickness t_E = 196 mm
- LIGNO Rib Q2 Acoustic Z2 169 – FRL -/60/60, floor thickness t_E = 169mm

A.2.11.1 Additional Framing in cross-laminated timber floors – System Lignotrend

If required seal thickness t_{A1} is bigger than available floor thickness t_E an additional framing E_1 is required. For details refer to sec. A.2.1.1.

A.2.11.2 Blank seals of CFS-F FX in cross-laminated timber floors – System Lignotrend



A.2.11.2:
Blank seal of CFS-F FX (A_1) in a cross-laminated timber floor – System Lignotrend. Cross-laminated timber framing E_1 installed around the opening.

View from topside.

Max. height h (mm)	Max. width w (mm)	Min. floor thickness t_E (mm)	Min. seal depth t_{A1} (mm)	**FRL (Fire Resistance Level)**
400	400	169	150	-/90/90
400	400	196	200	-/90/90

A.2.11.3 Max. seal size of CFS-F FX in cross-laminated timber floors – System Lignotrend

- Max.400 mm by 400 mm (or diameter 400 mm)
- Min. seal depth t_{A1} = 169 mm /196 mm (over entire floor thickness t_E)

A.2.11.4 First support in cross-laminated timber floor – System Lignotrend

First support for any kind of penetrants in cross-laminated timber floor should be ≤ 350 mm, independent from cross-laminated timber floor thickness.

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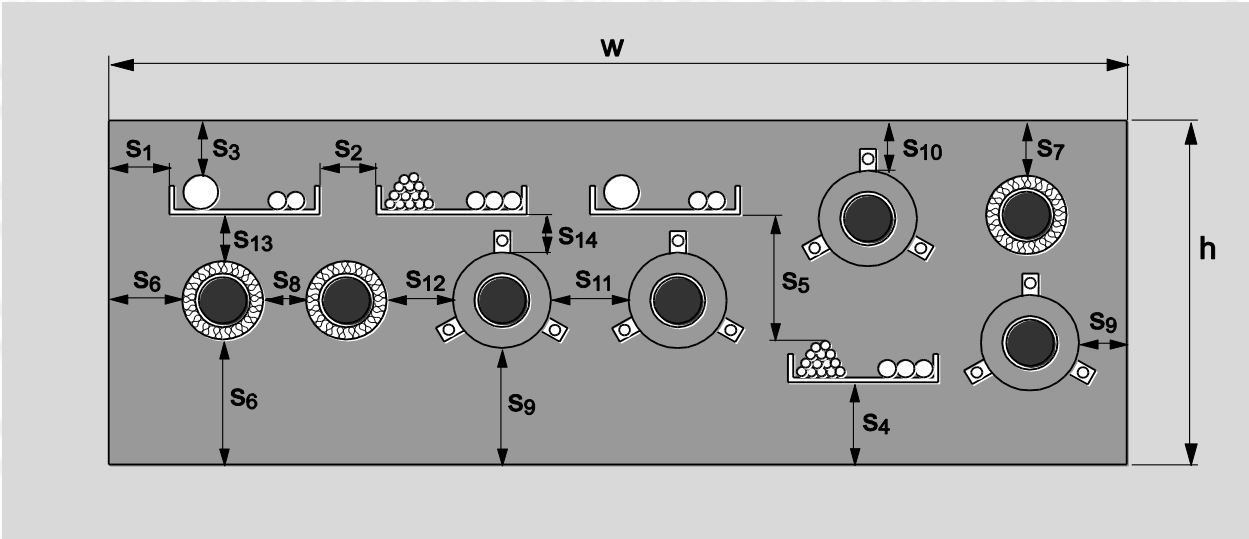
A.2.11.5 Minimum distances for penetrations in cross-laminated timber floor construction– System Lignotrend

		Minimum distance (mm)
s_3	distance between cables to seal edge	20
	distance between cables, optical fibre cables, telecommunication cables without cable support structures	0
s_2, s_5	distance between cable, optical fibre cables, telecommunication cables to cable bundle	50
s_6, s_7	distance between metal pipes and seal edge	20
s_{13}, s_{14}, s_5	distance between plastic pipe closure devices/metal pipes/cable bundles to cable	50
s_8	distance between metal pipes in linear arrangement	20
s_9, s_{10}	distance between plastic pipes/pipe closure devices and seal edge	20
s_{11}	distance between plastic pipes/pipe closure devices	50
s_{12}	distance between metal pipes and plastic pipes/pipe closure devices	50
s_{13}	distance between cables and metal pipes	50
s_{14}	distance between cables and plastic pipes/pipe closure devices	50



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A.2.11.6 Cables in cross-laminated timber floor constructions– System Lignotrend

For penetrating cables:

- Type of cable: All sheathed cable types currently and commonly used in building practice (e.g. power, control, signal, telecommunication, data, optical fibre cables
- Cable size: see table below
- First support: refer to 2.10.3

Size of cables Max. Cable Diameter	Cross-laminated timber floor thickness t_E	Requested Seal thickness t_{A1}	**FRL (Fire Resistance Level)**
≤ 21mm single cables	≧ 169 mm	≧ 169 mm	-/60/60
bunched cables ≤ 21 mm, max. ∅ bundle = 100mm,	≧ 169 mm	≧ 169 mm	-/60/60
≤ 21mm single cables	≧ 196 mm	≧ 196 mm	-/90/90
bunched cables ≤ 21 mm, max. ∅ bundle = 100mm,	≧ 196 mm	≧ 196 mm	-/90/90

For cable carrier systems:

- Not allowed

A.2.11.7 Metal pipes in cross-laminated timber floor – System Lignotrend

Construction details:

- One non-insulated metal pipe
- Pipe material: steel (galvanized) and others, refer to sec. A.2.1.6
- Metal pipes diameter: d ≤ 160 mm
- Metal pipe wall thickness = (0.5-14.2) mm
- With product TS18 Wildeboer installed on underside of ceiling
- For first support: refer to 2.10.3

	seal thickness t_{A1}	**FRL (Fire Resistance Level)**
In floor thickness t_E ≥ 169 mm	≥ 169 mm	-/60/60
In floor thickness t_E ≥ 196 mm	≥ 196 mm	-/90/90

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A.2.11.8 Plastic pipes in cross-laminated timber floor – System Lignotrend

Construction details:

- Single insulated or non-insulated plastic pipe
- Pipe type Aquatherm PP-R pipes “Blue Pipe” and “Green Pipe”
- Plastic pipe diameter: 20 – 40 mm
- Plastic pipe wall thickness: max. 2.8 – 3.7 mm
- Insulation (if applicable): Armaflex AF3, CS (14 mm / 16.5 mm)
- For first support: refer to 2.10.3
- One layer Hilti Firestop Bandage CFS-B to be wrapped around the insulated pipe only, half inside the floor, below and above the ceiling

	seal thickness t_{A1}	**FRL (Fire Resistance Level)**
In floor thickness t_E ≥ 169 mm	≥ 169 mm	-/60/60
In floor thickness t_E ≥ 196 mm	≥ 196 mm	-/90/90

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Appendix B

Test report details – report reference.

Name of Test Institute	Owner	Number of Report	Date of Test	Test standard
AFITI LICOF Centre for Fire Testing and Research	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	Nr 8828/13 date 25.03.2013	13/02/2013	EN 1366-3: 2009
AFITI LICOF Centre for Fire Testing and Research	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	Nr 8829/13 date 26.03.2013	15/02/2013	EN 1366-3: 2009
Bodycote Warringtonfire	**Hilti Entwicklungsgesellschaft GmbH** 86916 Kaufering, Germany	WF No. 179848 Date 01/05/2009	06.02.2009	EN 1366-3: 2004 and prEN 1366-3: October 2008
SINTEF NBL	**Hilti AG** Hiltistrasse 6 86916 Kaufering, Germany	103080.23 date 18.12.2007	19/11/2007	prEN 1366-3: 2006
SINTEF NBL	**Hilti AG** Hiltistrasse 6 86916 Kaufering, Germany	103080.25 date 05.05.2008	10/04/2008	prEN 1366-3: 2006
EFECTIS France	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	08-E-079-F date 11.08.2008	13/03/2008	prEN 1366-3: 2006
Warringtonfire Australia Pty Ltd	**HILTI (Aust.) Pty Ltd** P.O. Box 3217 Rhodes NSW 2138 Australia	FRT190130 R2.0 date 31.07.2019	11/07/2019	AS1530.4-2014
EFECTIS France	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	08-E-079-A date 07.07.2008	13/03/2008	prEN 1366-3: 2006
WFRGENT nv	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	18269A, date 14.07.2017	28/03/2017	EN 1366-3: 2009
WFRGENT nv	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	18270A, date 26.07.2017	29/03/2017	EN 1366-3: 2009
WFRGENT nv	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	18271A, date 26.07.2017	29/03/2017	EN 1366-3: 2009
WFRGENT nv	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	18272A, date 14.07.2017	30/03/2017	EN 1366-3: 2009

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Name of Test Institute	Owner	Number of Report	Date of Test	Test standard
WFRGENT nv	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	18655A, date 06.03.2018	05/12/2017	EN 1366-3: 2009
WFRGENT nv	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	18666A, date 06.03.2018	04/12/2017	EN 1366-3: 2009
WFRGENT nv	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	18667A, date 06.03.2018	04/12/2017	EN 1366-3: 2009
EFECTIS France	**HILTI AG** Feldkircher Str. 100 LI-9494 Schaan	07-E-317 date 10.04.2008	11/10/2007	prEN 1366-3: 2006