

European Technical Assessment

ETA 18/1024

of 15/07/2025

General Part

Technical Assessment Body issuing the ETA:	RISE Research Institutes of Sweden AB
Trade name of the construction product	Hilti Firestop Flexible Seal CFS-FS Hilti Firestop Block CFS-BL P
Product family to which the construction product belongs	Fire resistant penetrations when incorporated in floors and Walls
Manufacturer	Hilti AG, Feldkircherstrasse 100, LI-9494 Schaan, Liechtenstein, www.hilti.se
Manufacturing plant	Hilti Production Plant 4a
This European Technical Assessment contains	67 pages including 5 Annexes which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	European Assessment Document 350454-00-1104, edition September 2017.
This version replaces	ETA 18/1024, issued on 2024-05-16

Translations

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Technical description of the product

1.1 Definition of the Construction Product

The Hilti Firestop Flexible Seal CFS-FS and the Hilti Firestop Block CFS-BL P are penetration seals.

The mat-shaped Hilti Firestop Flexible Seal CFS-FS is based on a fully cured, pre-formed PU-based firestop material with intumescent components.

The Hilti Firestop Block CFS-BL P is a brick-shaped block based on a fully cured, pre-formed PU-based firestop material with intumescent components.

For further information see section 7, Annex B.

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

2.1 Intended use

The Hilti Firestop Flexible Seal CFS-FS and the Hilti Firestop Block CFS-BL P are intended to form a penetration seal, which is used to maintain the fire resistance of a separating element (Wall or floor) at the position where services pass through as further detailed in section 7 and 8 (Annex B and C).

2.2 Use category / Durability

According to European Assessment Document 350454-00-1104, edition September 2017, penetration seals may be used in various environmental conditions, which are described by the following use conditions listed in the table below.

The table below includes the information which requirements regarding use category and durability (BWR 4) are fulfilled by the listed products.

Use condition	Requirements	Hilti Firestop Flexible Seal CFS-FS	Hilti Firestop Block CFS-BL P
		fulfils requirements of	
Type X	intended for use in conditions exposed to weathering	-	-
Type Y ₁	intended for use at temperatures below 0 °C with exposure to UV but no exposure to rain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Type Y ₂	intended for use at temperatures below 0 °C, but with no exposure to rain no UV	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Type Z ₁	intended for use in internal conditions with humidity equal to or higher than 85% RH excluding temperatures below 0 °C, without exposure to rain or UV	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Type Z ₂	intended for use in internal conditions with humidity lower than 85% RH excluding temperatures below 0 °C, without exposure to rain or UV	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Products that meet the requirements for type X meet the requirements for all other types. Products that meet the requirements for type Y ₁ also meet the requirements for type Y ₂ , Z ₁ and Z ₂ . Products that meet the requirements for type Y ₂ also meet the requirements for type Z ₁ and Z ₂ . Products that meet the requirements for type Z ₁ also meet the requirements for type Z ₂ .			

2.3 Working life

The assessment methods included or referred to in the EAD 0350454-00-1104 have been written based on the manufacturer's request to take into account a working life of the products Hilti Firestop Flexible Seal and CFS-FS Hilti Firestop Block CFS-BL P for the intended use of 25 years when installed in the works, provided that the products are subject to appropriate installation, use and maintenance according to the manufacturers specifications. These provisions are based upon the current state of the art and the available knowledge and experience.

The indication given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting the EAD 0350454-00-1104 nor by the Technical Assessment Body (RISE Research Institutes of Sweden AB) issuing this ETA based on the EAD 0350454-00-1104, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

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

3.1 Essential characteristics and their performance

Basic works requirement	Essential characteristic	Performance
BWR 2 – Safety in case of fire	Reaction to fire	See 3.2 of this ETA
	Resistance to fire	See 3.3 of this ETA
BWR 3 – Hygiene, health and the environment	Air permeability	See 3.4 of this ETA
	Water permeability	No performance assessed
	Content, emission and/or release of dangerous substances	See 3.5 of this ETA
BWR 4 – Safety and accessibility in use	Mechanical resistance and stability	No performance assessed
	Resistance to impact/movement	No performance assessed
	Adhesion	No performance assessed
	Durability	See 3.6 of this ETA
BWR 5 – Protection against noise	Airborne sound Insulation	See 3.7 of this ETA
BWR 6 – Energy economy and heat retention	Thermal properties	See 3.8 of this ETA
	Water vapour permeability	No performance assessed

3.2 Reaction to fire

The Hilti Firestop Flexible Seal CFS-FS and the Hilti Firestop Block CFS-BL P have been classified according to EN 13501-1, class E.

3.3 Resistance to fire

The resistance to fire performance according to EN 13501-2 for penetration seals incorporating Hilti Firestop Flexible Seal and CFS-FS Hilti Firestop Block CFS-BL P is given in section 8 (Annex C) of the ETA.

3.4 Air permeability

The air permeability was tested according to EN 1026:2016 and EN 12211:2016 in an aerated concrete Wall.

valid for Hilti Firestop Block CFS-FS version 200 mm					tested opening size 500 mm x 280 mm			
Average values of positive and negative wind pressures								
Pressure differential in Pa	50	100	150	200	250	300	450	600
Flow rate (volume) in m³/h	0,10	0,22	0,32	0,50	0,55	0,66	1,02	1,31
Overall are-related in m³/ (h m²)	0,64	1,42	2,09	3,26	3,57	4,33	6,70	8,57

No failure until pressure differential of (static pressure differential)	2000	Pa
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valid for Hilti Firestop Block CFS-FS version 130 mm					tested opening size 545 mm x 280 mm			
Average values of positive and negative wind pressures								
Pressure differential in Pa	50	100	150	200	250	300	450	600
Flow rate (volume) in m³/h	0,24	0,48	0,75	0,97	1,13	1,44	2,06	2,66
Overall are-related in m³/(h m²)	1,59	3,17	4,89	6,38	7,39	9,45	13,51	17,43

No failure until pressure differential of (static pressure differential)	1000	Pa
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valid for Hilti Firestop Block CFS-BL P version 200 mm				tested opening size 500 mm x 280 mm				
Average values of positive and negative wind pressures								
Pressure differential in Pa	50	100	150	200	250	300	450	600
Flow rate (volume) in m³/h	0,08	0,15	0,23	0,27	0,35	0,41	0,59	0,77
Overall are-related in m³/ (h m²)	0,51	1,00	1,50	1,78	2,27	2,63	3,80	5,01

No failure until pressure differential of (static pressure differential)	6200	Pa
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valid for Hilti Firestop Block CFS-BL P version 130 mm				tested opening size 545 mm x 280 mm				
Average values of positive and negative wind pressures								
Pressure differential in Pa	50	100	150	200	250	300	450	600
Flow rate (volume) in m³/h	0,13	0,28	0,40	0,59	0,64	0,78	1,17	1,50
Overall are-related in m³/ (h m²)	0,87	1,85	2,60	3,85	4,19	5,09	7,66	9,83

No failure until pressure differential of (static pressure differential)	4000	Pa
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3.5 Content, emission and/or release of dangerous substances

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 it does not contain such substances above the acceptable limits.

The release of semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) has been determined according to EAD 350454-00-1104 clause 2.2.5.1 and 16516:2018-01 (CFS-BL P) and DIN EN 16516:2020-10 (CFS-FS). The loading factor used for emission testing for CFS-FS was 0,007m²/m³ and 0,05m²/m³ for CFS-BL P

	Hiti Firestop Flexible Seal CFS-FS	Hilti Firestop Block CFS-BL P
Total emission of SVOC of product after 3 days [mg/m ³]:	< 0.005	< 0.005
Total emission of SVOC of product after 28 days [mg/m ³]:	< 0.005	< 0.005
Total emission of VOC of product after 3 days [mg/m ³]:	0.047	0.650
Total emission of VOC of product after 28 days [mg/m ³]:	0.012	0.068

3.6 Durability

The durability tests have been carried out according to EOTA TR 024. The results for durability are listed in chapter 2.2 of this ETA.

3.7 Airborne sound Insulation

Test reports from noise reduction according to EN ISO 10140-2 and EN ISO 717-1 have been provided. The tests were performed in flexible Wall backfilled with compressed mineral wool.

The reached values for the airborne sound Insulation are given in the following table. The opening size of each is 600 x 500 [mm].

Product version	R _w (C; C _{tr}) in dB
CFS-FS 200 mm	53 (-3; -8)
CFS-FS 130 mm	51 (-3; -7)
CFS-BL P 200 mm	53 (-2; -9)
CFS-BL P 130 mm	50 (-2; -7)

3.8 Thermal properties

The thermal conductivity shown in the table below was assessed according to EN 12667:

Product version	Thermal conductivity λ [W/mK]
Hilti Firestop Flexible Seal CFS-FS	0.0614
Hilti Firestop Block CFS-BL P	0.089

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

According to the decision 1999/454/EC - Commission decision of date 22 June 1999, published in the Official Journal of the European Union (OJEU) L178 of 14/07/1999, amended by decision 2001/596/EC – Commission decision of date 8 January 2001, published in the Official Journal of the European Union (OJEU) L209 of 02/08/2001, of the European Commission the systems of assessment and verification of constancy of performance (see Annex V to the regulation (EU) No 305/2011) given in the following table apply:

Product(s)	Intended use(s)	Level(s) or class(es)	System(s)
Fire Stopping and Fire Sealing Products	For fire compartmentation and/or fire protection or fire performance	any	1
	For uses subject to regulations on reaction to fire	A1*, A2*, B*, C*	1
		A1**, A2**, B**, C**, D, E	3
		(A1 to E)***, F	4
*Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire Classification (e.g. an addition of fire retardants or a limiting of organic material)			
**Products/materials not covered by footnote (*)			
***Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of class A1 according to Commission Decision 96/603/EC, as amended)			

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the Technical Assessment Body RISE Research Institutes of Sweden AB.

The notified product certification body shall visit the factory at least twice a year for surveillance of the manufacturer.

Issued in Borås on 2025-07-15
By RISE Research Institutes of Sweden AB



Martin Tillander
Director, Product certification

6. ANNEX A REFERENCE DOCUMENTS

6.1 References to standards mentioned in the ETA

EN 1026	Windows and doors – Air permeability – Test method
EN 1366-3	Fire resistance tests for service installations – Part 3: Penetration seals
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 16516	Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air
EN ISO 717-1	Acoustics – Rating of sound Insulation of buildings and of building elements – Part 1: Airborne sound Insulation
EN ISO 10140-1 EN ISO 10140-2	Acoustics – Laboratory measurement of sound Insulation of building elements Part 2: Measurement of airborne sound Insulation Part 3: Measurement of impact sound Insulation
EN 12667	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance
EN ISO 12572	Hygrothermal performance of building materials and products - Determination of water vapour transmission properties - Cup method (ISO 12572:2016, IDT)
EN 300	Oriented Strand Boards (OSB) - Definitions, Classification and specifications
EN 338	Structural timber - Strength classes
EN 520	Gypsum plasterboards - Definitions, requirements and test methods
EN 16351	Timber structures - Cross laminated timber - Requirements
EN 13986	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking
EN 14081-1	Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements

6.2 Other reference documents

EOTA TR 024	Characterization, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products
EOTA TR 001	Determination of impact resistance of panels and panel assemblies
ETA-10/0241 / Z-9.1-501	Leno Brettsperrholz (cross laminated timber - Züblin Timber GmbH)
ETA-06/0009	Binderholz Brettsperrholz BBS (cross laminated timber Binderholz Bau-Systeme GmbH))
ETA-11/0137	LIGNATUR-box element (LKE), -surface element (LFE) and -shell element (LSE) (prefabricated wood-based loadbearing stressed skin panels - Lignatur AG)
ETA-21/0360	Lignotrend ETA- (cross laminated timber - LIGNOTREND GmbH & Co. KG)

7. ANNEX B - The product CFS-FS-and CFS-BL P

7.1 Description of the products and ancillary product(s)

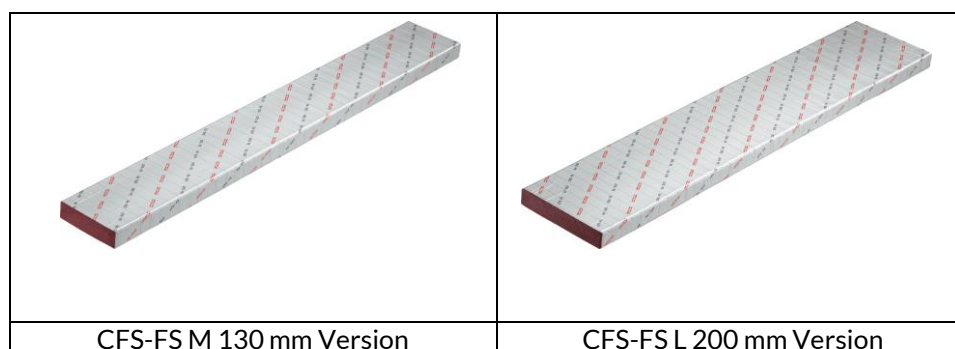
7.2 Hilti Firestop Flexible Seal CFS-FS

The Hilti Firestop Flexible Seal CFS-FS is a mat-shaped block, which is based on a fully cured, pre-formed PU-based firestop material with intumescent components. The Hilti Firestop Flexible Seal CFS-FS exists in two sizes as shown in the table below.

Product name	Hilti Firestop Flexible Seal CFS-FS	
Short name	CFS-FS M	CFS-FS L
Length [mm]	1000	1000
Width [mm]	130	200
Height [mm]	35	35

A detailed specification of the product is contained in the document “Identification / Product Specification” relating to this European Technical Assessment 18/1024 – “Hilti CFS-FS Firestop Flexible Seal / Hilti Firestop Block CFS-BL P”, which is a non-public part of this ETA.

The control plan is defined in the document “Control Plan” relating to this European Technical Assessment 18/1024, which is a non-public part of this ETA.



7.3 Hilti Firestop Block CFS-BL P

The Hilti Firestop Block CFS-BL P is a brick-shaped block based on a fully cured, pre-formed PU-based firestop material with intumescent components. The Hilti Firestop Block CFS-BL P has dimensions of 200 mm x 130 mm x 50 mm.

A detailed specification of the product is contained in the document “Identification / Product Specification” relating to this European Technical Assessment 18/1024 – “Hilti CFS-FS Firestop Flexible Seal / Hilti Firestop Block CFS-BL P”, which is a non-public part of this ETA.

The control plan is defined in the document “Control Plan” relating to this European Technical Assessment 18/1024, which is a non-public part of this ETA.



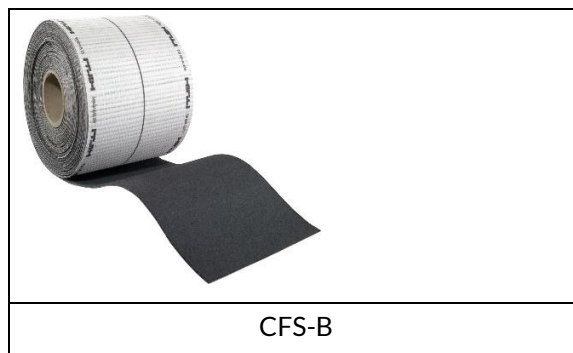
7.4 Hilti Firestop Filler CFS-FIL

- One-component, water based intumescent acrylic sealant
- Available in cartridges and foils
- CFS-FIL is fully described in **ETA-21/0256**



7.5 Hilti Firestop Bandage CFS-B

- One component intumescent bandage
- Delivered as a coil
- CFS-B is fully described in **ETA-20/0993**



7.6 Hilti Firestop Foam CFS-F FX

- Two component polyurethane soft foam
- Available in foil cartridges
- CFS-F FX is fully described in **ETA-10/0109**



7.7 Technical product literature

- Technical data sheets for the individual solutions (including all ancillary products) and Material safety Data Sheet (MSDS) see www.hilti.group
- Instruction for Use (see sec. 9)

8. ANNEX C - Resistance to fire Classification of “Hilti Firestop Block CFS-BL P and Hilti Firestop Flexible Seal CFS-FS

Chapters 8.1 and 8.2 and the applications listed therein must be applied separately. Relevant information regarding the respective applications can also be found in the respective sections (8.1 or 8.2).

8.1 Hilti Firestop Flexible Seal CFS-FS M (130 mm)

8.1.1 Intended use of penetrants and reference to relevant section

Application	Penetration material	Flexible & rigid wall $t_E \geq 100 \text{ mm}$
Cables	Sheathed cables, glass fiber, Tied cable bundles Cable support systems	8.1.3.5.1
Electrical conduits	All types of plastic	8.1.3.5.2
Heating pipes Potable water pipes	Copper Steel, stainless steel	8.1.3.5.10 8.1.3.5.11 8.1.3.5.111
	Al-composite	8.1.3.5.8 8.1.3.5.9
Cold water pipes Waste water pipes	PE, PVC, PP, ABS, SAN-PVC	8.1.3.5.3 8.1.3.5.4 8.1.3.5.5
Sprinkler pipes	CPVC	8.1.3.5.6
Rectangular pipes	PVC	8.1.3.5.67
Flexible gas piping	Corrugated stainless steel with PE jacket	8.1.3.5.12
Air condition	Klima split pipe bundles (HVAC supply bundle)	8.1.3.5.13 8.1.3.5.133

Table 1: Overview of penetrants and relevant sections

8.1.2 General information

8.1.2.1 Penetration seal, service orientation and CFS-FS orientation

- Single, multiple, and mixed penetration seal
- All services are passing through the penetration seal, perpendicular to the supporting construction, if not separately stated otherwise
- CFS-FS must be installed horizontally stacked in the wall aperture
- A tight installation of CFS-FS to all aperture edges is required

8.1.2.2 Suitable building structures, where CFS-FS can be used

- Flexible and rigid walls
- CLT wall and floor
- Lignatur and Lignotrend floor
- CFS-FS penetration seal can be installed in a top of wall aperture abutting an overlying rigid floor slab (low- or high-density concrete with min. density of 350 kg/m³)
- For details refer to section 8.1.3.1

8.1.2.3 Seal thickness increase / Aperture framing and beading

- Beading around the apertures is not required for FS 130mm
- CFS-FS seal thickness must not be increased for walls up to 500 mm (see section 8.1.3.2 for details)
- A higher wall thickness of $t_E > 500$ mm is allowed if the thickness of the CFS-FS seal of 130 mm increases with the same amount in order to remain the covered position of CFS-FS in relation to both wall surfaces; see section 8.1.3.2 for details
- The apertures in flexible walls must be provided with an aperture framing over the entire thickness of the wall.
- Aperture framing must be composed of a metal stud frame, finished with a minimum one gypsum board layer with thickness $\geq 12,5$ mm

8.1.2.4 Seal size

- Maximum dimensions for rectangular penetration seals portrait or landscape orientation can be found in the respective sections

8.1.2.5 Gap seal

- Tight installation of CFS-FS to all aperture edges required
- Gap filler is only required if gaps completely through the seal > 0 mm existing
- Gap filler CFS-FIL or CFS-F FX fills through gaps between
- Individual CFS-FS strips
- CFS-FS strips and wall aperture edges
- CFS-FS strips and penetrating services
- Gap size (width): ≤ 15 mm
- Gap filler depth: ≥ 25 mm
- Gap filler to be applied flush with both sides of CFS-FS

8.1.2.6 First support for penetrants

- ≤ 500 mm for Flexible seal 130mm
- For wood application can be found in the respective sections

8.1.2.7 Foamed elastomeric insulation products for pipe insulation (FEF)

The types of foamed elastomeric insulation products listed in the table below may be used as pipe insulation:

Manufacturer	Product designation
Armacell International GmbH	Armaflex AF, SH, Ultima, XG, NH, HT
nmc INSUL-TUBE	H-Plus
Kaimann GmbH	Kaiflex KK plus, Kaiflex KK, EPDM Plus, HF Plus
L'Isolante	K-Flex ECO, K-Flex ST Frigo
Aeroflex	HF
Conel	Flex HT
Eurobatex Union Foam	HF
ISIDEM	Coolflex AF
3i	Isopipe HT
ODE Insulation	R-Flex RPM
Würth	Flexen Kältekautschuk

Table 2: Overview of approved FEF-products and manufacturers

If a protect insulation (D_P) based on flexible elastomeric foams (FEF) is requested in combination with an additional insulation (D), it should be made from the same elastomeric material as the thermal pipe insulation itself.

8.1.2.8 Metal pipes

- Ratings for copper pipes are also valid for pipes made of steel, stainless steel, iron and cast iron
- Ratings for steel pipes are also valid for pipes made of stainless steel, iron and cast iron

8.1.2.9 Non-regulated PP-pipes

The pipe brands listed in the table below are covered as non-regulated PP pipes.

Manufacturer / Supplier	Pipe brand
Aliaxis Poland	dBlue
Coes	Blue Power
Coes	PhoNoFire
Conel	Drain Hausabflussleitungen
Geberit	Silten PP
Geberit	Silent Pro
KeKelit	PhonEx AS
Marley	Silent
Ostendorf	Skolan dB
Ostendorf	Skolan Safe
Pipelife	Master 3
Pipelife	Master 3 Plus
Poloplast	PoloKal NG
Poloplast	PoloKal XS

Poloplast	PoloKal 3S
Rehau	Raupiano Plus
Silenta	Premium
Uponor	S&W Decibel
Valsir	TriPlus
Valsir	Silere
Wavin	Sitech
Wavin	Sitech +
Wavin	AS
Wavin	AS +

Table 3: List of approved non-regulated PP pipes

8.1.2.10 General rules for penetrating items

The following requirements should be met:

- Seals may only be penetrated by the services described in section 8 (Annex C)
- 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
- For tied cable bundles the space between cables does not need to be sealed.
- 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 installation of the penetration seal does not affect the stability of the adjacent building elements – even in case of fire
- The support of the installations is maintained for the classification period required

8.1.2.11 CPVC / C-PVC pipes not to be sealed with CFS-FS or other HILTI Firestop Systems

If HILTI CFS-FS is intended to be used in combination with CPVC / C-PVC pipes, please check before installation – beside the “Resistance to Fire” annex within this ETA – also the system compatibility via Lubrizol FBC™ system compatible program.

Consider testing not only the HILTI components in direct contact to those pipes, but all involved components of the proposed HILTI fire sealing system.

Only listed and Lubrizol FBC™ -labelled construction products must be used together.

See: <https://www.lubrizol.com/CPVC/FBC-System-Compatible-Program/System-Compatible-Product-Finder>

8.1.2.12 Additionally covered pipe dimensions

The classified pipe dimensions listed in section 8.1.3.2 can be extended additionally to 0,2 mm or 0,25 mm smaller pipe wall thicknesses as shown in Figure 1 below.

This rule applies to classified metal pipes (hmp), single layer plastic pipes, multilayer plastic pipes (e.g. non-regulated PP pipes), MLC pipes, CPVC pipes and rectangular pipes. The classified maximum pipe wall thickness and remains unaffected by this rule.

The classified pipe diameter range listed in the corresponding chapter for each material group remains unchanged.

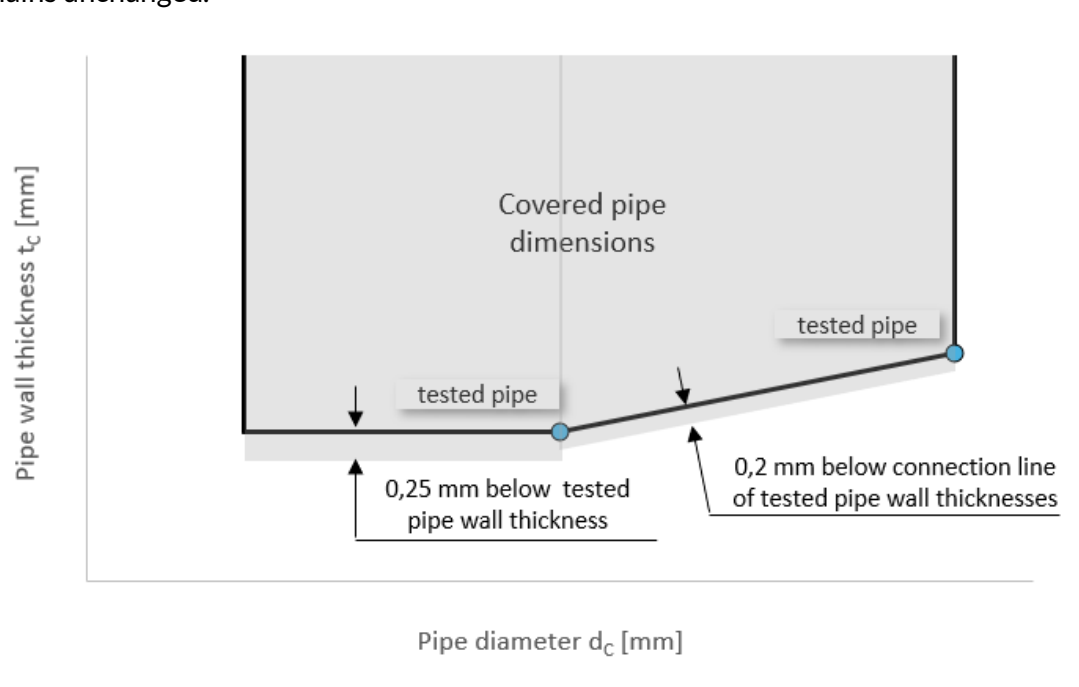


Figure 1: Rule for additionally covered pipe dimensions

8.1.2.13 Downwards movement of penetrating services

All services listed in section 8.1.3.5, penetrating the CFS-FS seal and installed in wall constructions, can be subjected to a mechanically induced downward movement (e.g. caused by deflection of overlaying floor or deflection of service supporting construction) up to 25 mm, if the following setup requirements are met:

- Above the top row services, a CFS-FS seal with a minimum height (X) of 70 mm with a compression (Y) equal or larger than the movement (Y') need to be present. The area must remain unpenetrated.
- Below the lower row services, a CFS-FS seal with a minimum height (Z) of 35 mm without compression needs to be present. The area must remain unpenetrated.
- The minimum distances for penetrating services according to section 8.1.3.4 must be within their limits according to Figure 5.

Figure 1 below shows the requirements for setting up a penetration seal, where the penetrating services are subject to movement.

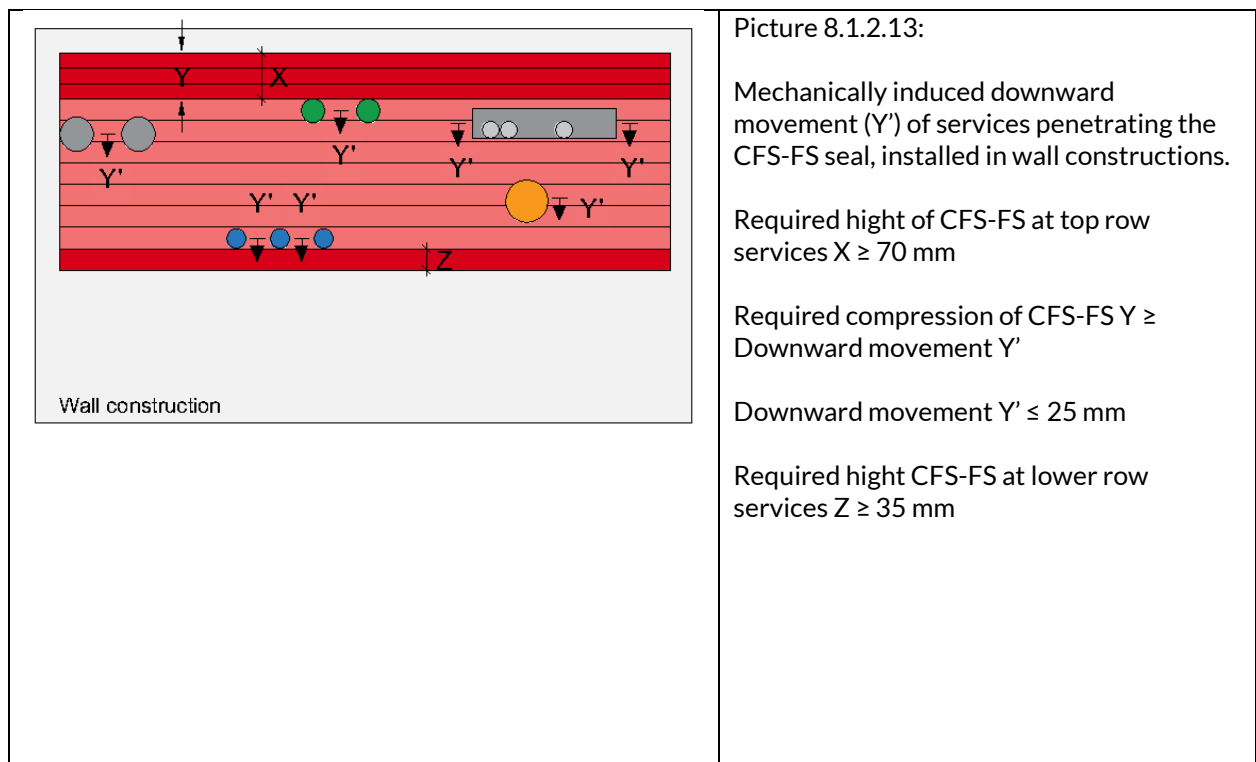


Figure 2: CFS-FS installation requirements if seal is subject to downwards movement

8.1.3 Flexible and rigid wall constructions with seals made of CFS-FS (130 mm)

8.1.3.1 Specific characteristics for flexible and rigid walls with $t_E \geq 100$ mm to $t_E \leq 500$ mm

8.1.3.1.1 Flexible wall constructions

- Minimum wall thickness of $t_E \geq 100$ mm
- Maximum wall thickness of $t_E \leq 500$ mm
- See section 8.1.3.2 for wall thicknesses $t_E > 500$ mm
- Comprise timber or steel studs
- Lined on both sides with minimum of 2 layers of $\geq 12,5$ mm thick boards made of gypsum boards in accordance with EN 520 or Calcium Silicate boards which are CE marked based on an ETA for the application as lining of flexible walls
- A reduced number of board layers (< 2 layers on each side) is acceptable, if the overall lining thickness is same as higher than tested (≥ 25 mm on each side) with insulation of any type
- Wall construction must be set up according to the requirements given in EN 1366-3:2021
- Wall construction needs to be classified according to EN 13501-2
- Aperture framing is required; refer to section 8.1.2.3

Additionally for flexible wall constructions with timber studs:

- Minimum distance of 100 mm between seal to any stud/nogging piece
- There must be a cavity between the studs
- Minimum 100 mm of insulation of class A1 or A2 (in accordance with EN 13501-1) must remain in the cavity between seal and stud/nogging piece

8.1.3.1.2 Rigid wall constructions

- Wall construction must comprise concrete, aerated concrete, brickwork or masonry
- Minimum density ρ_E of 350 kg/m³
- Minimum wall thickness of $t_E \geq 100$ mm
- Maximum wall thickness of $t_E \leq 500$ mm
- See section 8.1.3.2 for wall thicknesses $t_E > 500$ mm

8.1.3.2 Position of CFS-FS in wall openings

- CFS-FS can be installed centrally inside the wall or eccentrically as long as the positions in relation to both wall surfaces a and s are respected. See Figure 3 below for details
- A flush installation of CFS-FS to the wall surface is possible for wall thicknesses $t_E \geq 115$ mm to ≤ 315 mm
- CFS-FS seal thickness needs to be increased for wall thickness $t_E > 500$ mm to keep the values a and s within their respective limits ($a \leq 15$ mm / $s \leq 185$ mm)

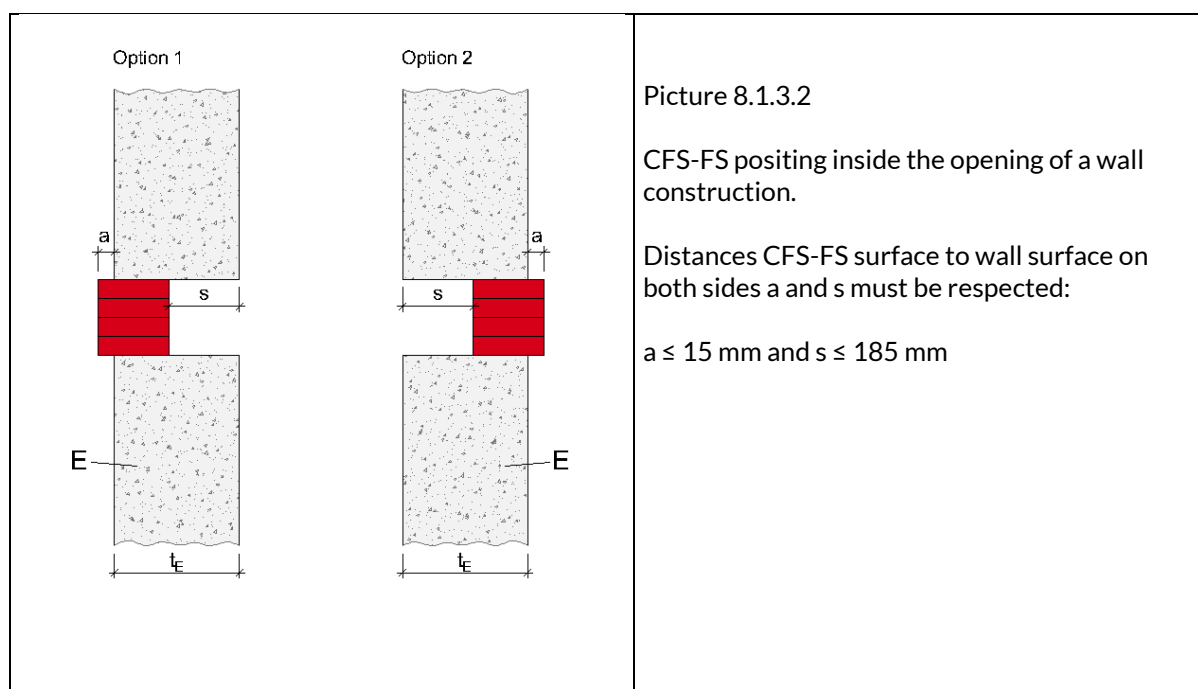
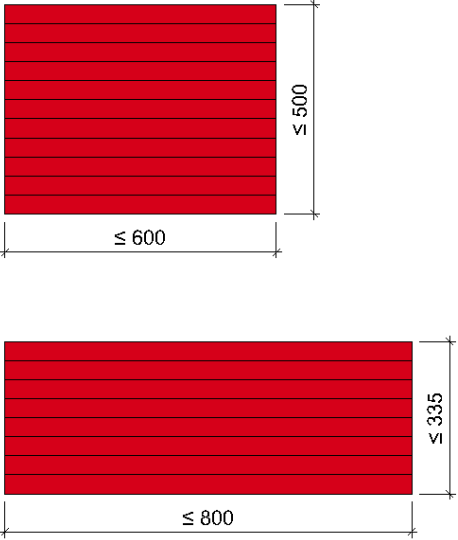
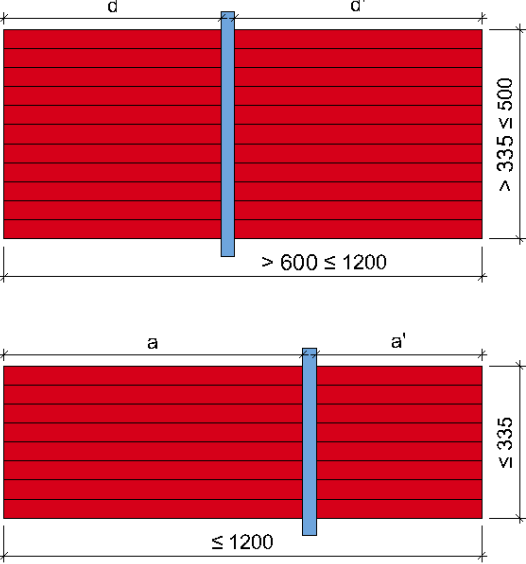
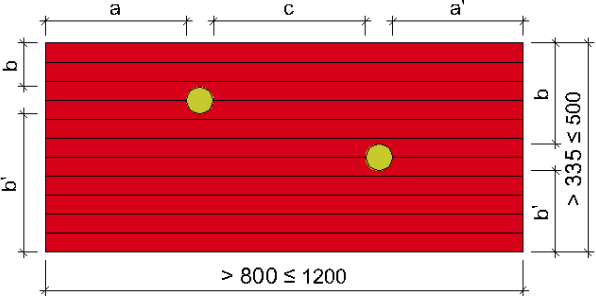


Figure 3: CFS-FS positioning inside the opening

8.1.3.3 Maximum seal size w and w/o penetrating and/ or supporting

- See section 8.1.2.4 for maximum seal size and seal orientation
- Depending on seal size, a CFS-FS seal can be 1) unsupported, 2) supported with metal strip/profile or 3) supported with penetrating services
- Large unsupported areas of CFS-FS seal need additional support to obtain the required stability.
- An unsupported area is defined as an area without penetrating services with a diameter $d \geq 40$ mm or other penetrating services with minimum the same contact surface to the CFS-FS seal.
- The minimum required seal support can be:
 - a metal profile or strip (melting point $\geq 1000^\circ\text{C}$) on both sides of the wall with minimum section dimensions of 40 mm x 2 mm or
 - a penetrating service (in the required number) (e.g. pipe, cable) with a minimum outer diameter of 40 mm (or other with minimal the same contact surface to CFS-FS).
- The rules listed for positioning the seal holder must be observed.
- Below shows the dimensions of the blank seals and the installation requirements if the seal size requires additional support. The options available for the seal support depend on the size of the seal.

	<p>Picture 8.1.3.3</p> <p>Blank seals Largest unsupported areas of CFS-FS penetration seal. No seal support needed until the seal dimensions:</p> <p>$\leq 600 \text{ mm} \times \leq 500 \text{ mm}$ or $\leq 800 \text{ mm} \times \leq 335 \text{ mm}$</p>
	<p>Option 1: CFS-FS blank seal and CFS-FS penetration seal supported with metal strip</p> <p>Distances d and $d' \leq 600 \text{ mm}$ for seal sizes: $> 600 \text{ mm} \leq 1200 \text{ mm} \times > 335 \text{ mm} \leq 500 \text{ mm}$</p> <p>Distances a and $a' \leq 800 \text{ mm}$ for seal sizes: $\leq 1200 \text{ mm} \times \leq 335 \text{ mm}$</p>
	<p>Option 2: CFS-FS penetration seal supported with two penetrating services ($d \geq 40 \text{ mm}$)</p> <p>Distances a and $a' \leq 400 \text{ mm}$, distances b and $b' \leq 335 \text{ mm}$ and distance $c \leq 400 \text{ mm}$ or Distances a and $a' \leq 300 \text{ mm}$, distances b and $b' \leq 250 \text{ mm}$ and distance $c \leq 600 \text{ mm}$ for seal sizes: $> 800 \text{ mm} \times > 335 \text{ mm} \leq 500 \text{ mm}$</p>

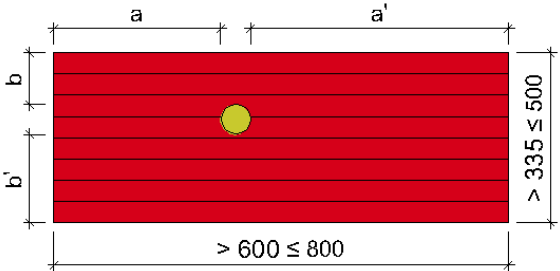
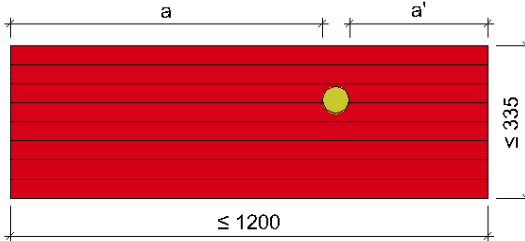
	<p>Option 3: CFS-FS penetration seal supported with one penetrating service ($d \geq 40$ mm)</p> <p>Distances a and $a' \leq 400$ mm and distances b and $b' \leq 335$ mm or Distances a and $a' \leq 600$ mm and distances b and $b' \leq 250$ mm for seal sizes: $> 600 \text{ mm} \leq 800 \text{ mm} \times > 335 \text{ mm} \leq 500 \text{ mm}$</p>
	<p>Option 4: CFS-FS penetration seal supported with one penetrating service ($d \geq 40$ mm)</p> <p>Distances a and $a' \leq 800$ mm for seal sizes: $\leq 1200 \text{ mm} \times \leq 335 \text{ mm}$</p>
<p>Note for options 1 -4: Additional penetration services are not subjected to prescribed positions or minimum diameter (contact surface).</p>	

Figure 4: Blank seal sizes and installation requirements for supported penetrated seals

8.1.3.4 Minimum distances for penetrating services and seals in wall constructions

- Minimum distance between CFS-FS seals to other penetration seals: ≥ 100 mm
- Minimum distance between and other fire rated seals (e.g. fire doors, dampers etc.) ≥ 200 mm
- For distances of penetrating services within one CFS-FS seal refer to Figure 5
- The distances listed in Figure 5 are valid for single, multiple and mixed penetration seals in Flexible and rigid wall constructions
- The penetrating services can be set up in any arrangement (linear, cluster) if the distances listed in Figure 5 stay within their limits

[illegible]

Figure 5: Minimum required distances of penetrating services within one CFS-FS seal

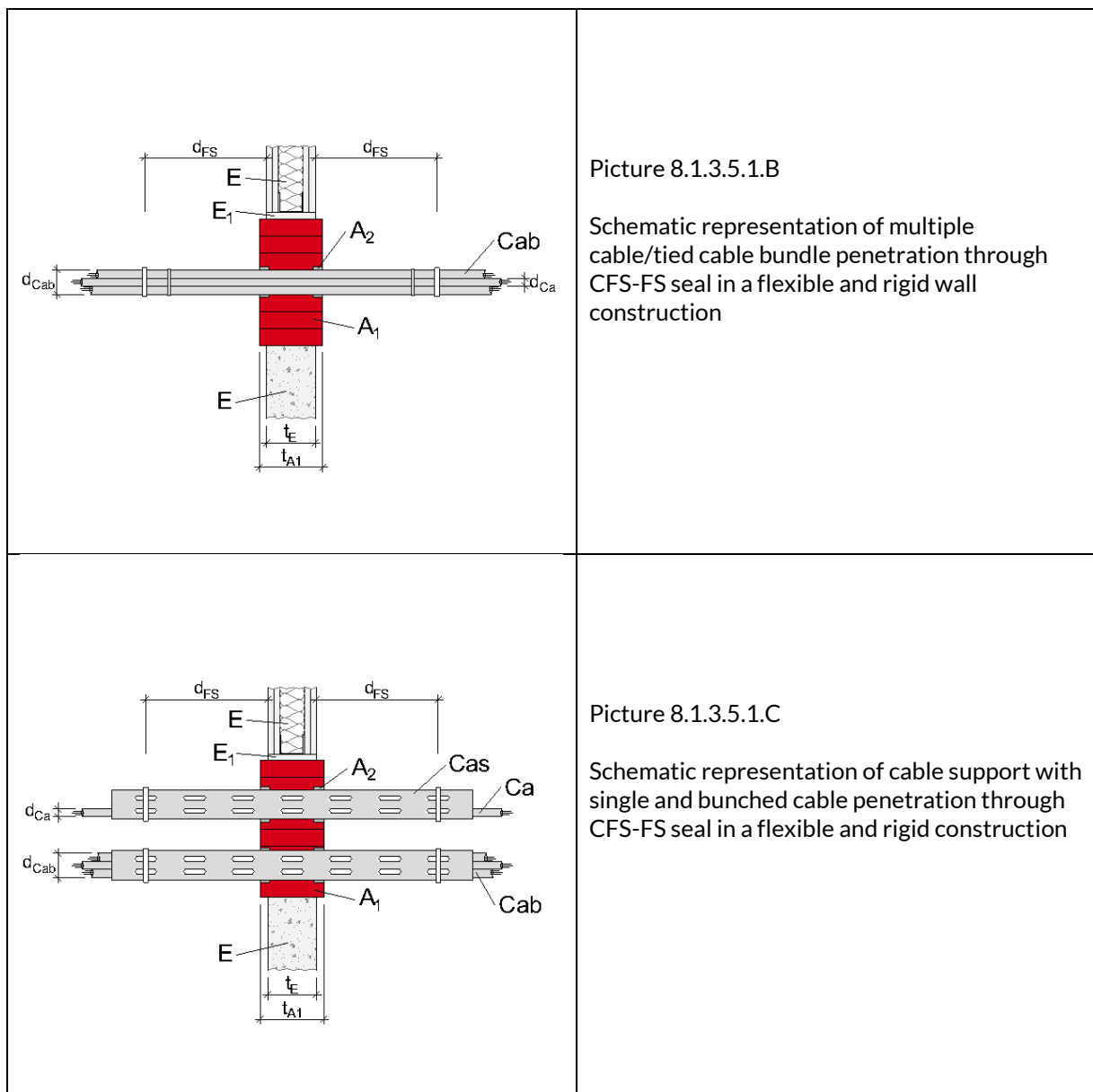


Figure 6: Different cable penetration applications through CFS-FS seal

The classifications listed in Figure 7: Classifications for cable penetration through CFS-FS seal in flexible and rigid wall constructions apply for the different cable applications in CFS-FS seal in flexible and rigid wall constructions.

Type of penetrating service	Classification
Single cables	EI 60
Single coaxial cables	EI 60
Tied cable bundles	EI 60
Cable support	EI 60

Figure 7: Classifications for cable penetration through CFS-FS seal in flexible and rigid wall constructions

8.1.3.5.2 Conduits with and without cables through CFS-FS seal

8.1.3.5.2.1 Single flexible/pliable and rigid conduits

Conduits:

- Single and multiple penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Flexibility type: flexible/pliable or rigid or mixtures of them
- Material: All types of plastic
- Projecting length (LPRC) on both sides from CFS-FS seal $A1 \geq 300$ mm
- Intended use: continued with both ends open or closed
- Maximum diameter of single conduit $d_{RC} \leq 32$ mm
- Maximum wave height (flexible/pliable conduits) $t_{RC} \leq 4,25$ mm
- Maximum wall thickness (rigid conduits) $t_{RC} \leq 2,0$ mm
- With and without cable infill
- Cable support is not covered

Cables:

- All sizes of cables currently and commonly used in building practice in Europe fitting into the conduit, including optical fibre cables
- Maximum outer diameter coaxial cable $d_R \leq 28$ mm
- Non-sheathed cables (wires) are not covered

Gap closure:

- See section 8.1.2.5 for details

The Figure 8 below shows a single conduit application in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

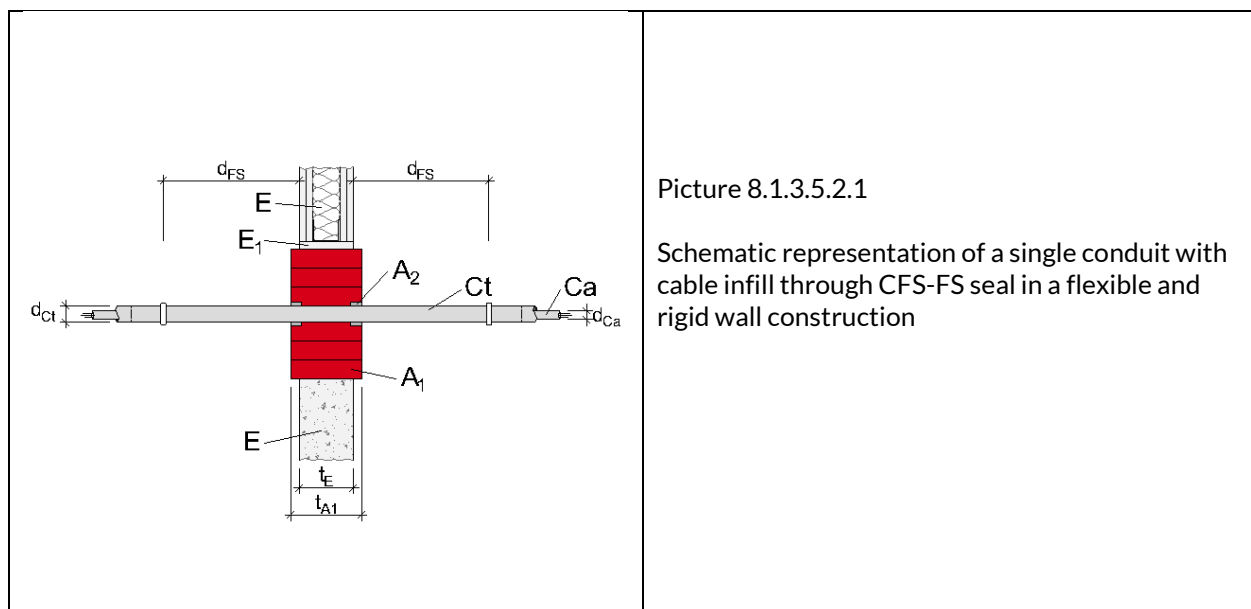


Figure 8: Single conduit penetration through CFS-FS seal

The classification listed in Figure 9 applies for single conduit applications in CFS-FS seal in flexible and rigid wall constructions.

Type of penetrating service	Classification
Single conduits	EI 60-U/U

Figure 9: Classification for single conduit penetr. through CFS-FS seal in flexible & rigid wall constructions

8.1.3.5.2.2 Flexible/pliable and rigid conduits, additionally sealed with CFS-B

Conduits:

- Single, multiple and tied bundle penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Flexibility type: flexible/pliable or rigid or mixtures of them (except for bundles)
- Material: All types of plastic
- Projecting length (LPRC) on both sides from CFS-FS seal $A1 \geq 300$ mm
- Intended use: continued with both ends open or closed
- Maximum diameter of single conduit/single conduit in bundle $d_{RC} \leq 50$ mm
- Maximum wave high (flexible/pliable conduits) $t_{RC} \leq 7,1$ mm
- Maximum wall thickness (rigid conduits) $t_{RC} \leq 4,0$ mm
- Maximum diameter of conduit bundle (flexible/pliable or rigid) $d_{RCB} \leq 100$ mm
- With and without cable infill
- Cable support is not covered

Cables:

- All sizes of cables currently and commonly used in building practice in Europe fitting into the conduit, including optical fibre cables
- Maximum outer diameter coaxial cable $d_R \leq 28$ mm
- Non-sheathed cables (wires) are not covered

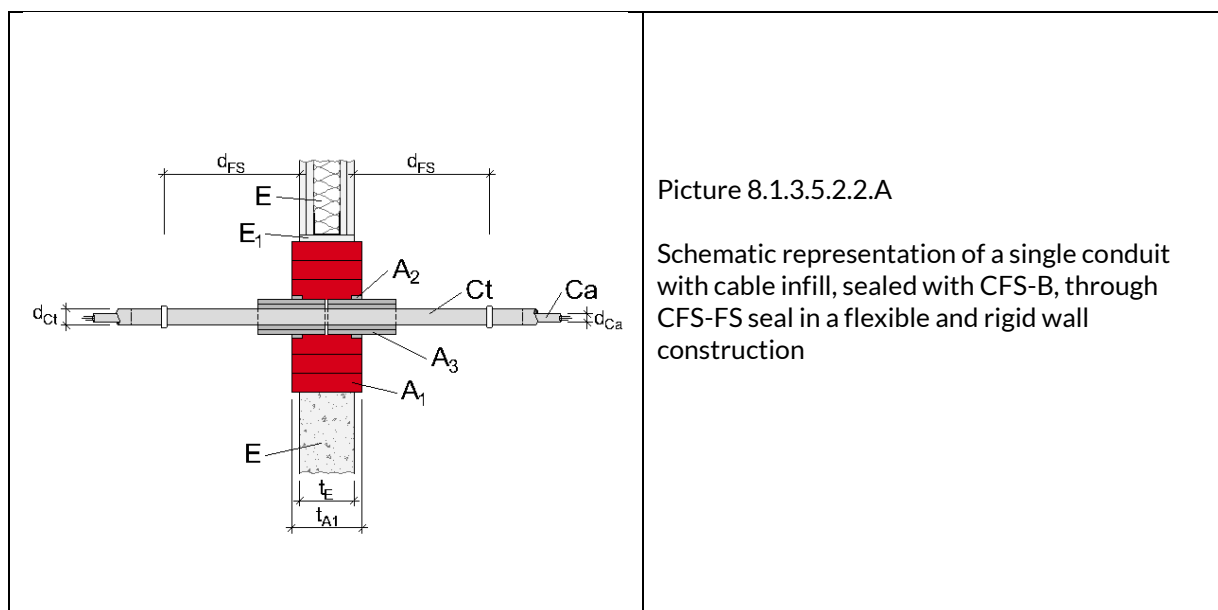
Penetrating service closure:

- Two devices CFS-B per service, one at each side
- CFS-B wrapped around the service
- Two layers of CFS-B on each side
- Projecting length of CFS-B outside of the CFS-FS seal $62,5$ mm
- Fixing the CFS-B around the service by means of two metal wires per bandage, one inside the CFS-FS seal and one outside the CFS-FS seal

Gap closure:

- See section 8.1.2.5 for details

The Figure 10 below show a single conduit and a conduit bundle application, additionally sealed with CFS-B, in CFS-FS seal in a wall construction. For symbols and Abbreviation refer to section



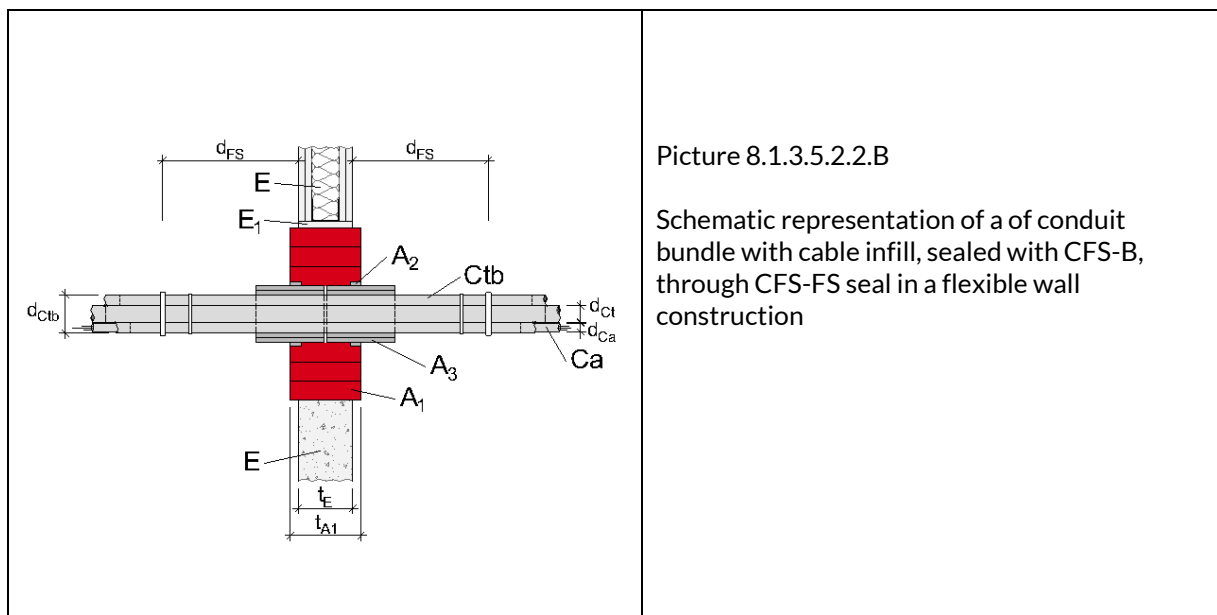


Figure 10: Single conduit and conduit bundle penetration, sealed with CFS-B, through CFS-FS seal

The classification listed in Figure 11 applies for single conduit and conduit bundle applications, additionally sealed with CFS-B, in CFS-FS seal in flexible and rigid wall constructions.

Type of penetrating service	Classification
Single conduits	EI 60-U/U
Conduit bundle	EI 60-U/U

Figure 11: Classifications for single conduits & conduit bundle, sealed with CFS-B, through CFS-FS seal in flexible and rigid wall construction

8.1.3.5.2.3 Metal trunking through CFS-FS seal

Trunking:

- Multiple seal penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Material: steel or others; refer to section 8.1.2.8 (copper excluded)
- Dimension: height $h_T \leq 150$ mm; width $w_T \leq 150$ mm; wall thickness $t_T \geq 1,1$ mm
- End configuration of trunking: U/U
- Projecting length ≥ 500 mm on both sides
- Insulated
- Filled with CFS-FS

Cables:

- All sizes of cables currently and commonly used in building practice in Europe
- Maximum outer diameter cable $d_R \leq 80$ mm
- Maximum outer diameter coaxial cable $d_R \leq 28$ mm
- Maximum outer diameter non-sheathed cables (wires) $d_R \leq 24$ mm
- Distances between cables ≥ 0 mm
- Distances between cables and trunking ≥ 0 mm

Insulation:

- Trunking insulated on both sides of the CFS-FS seal in configuration LI or CI
- Material: Mineral wool, Duct wrap by Rockwool
- Length $L_D \geq 420$ mm
- Thickness $t_D \geq 25$ mm

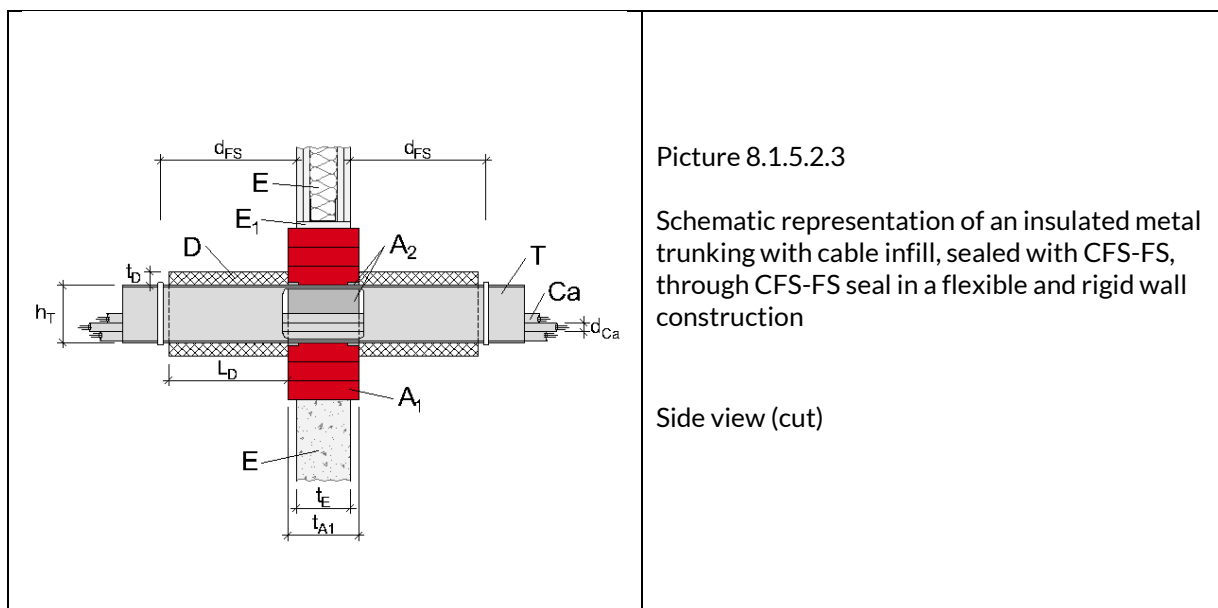
Trunking closure:

- Trunking filled with CFS-FS over the width of 130 mm (corresponds to CFS-FS seal thickness) (required for filled and unfilled trunking)
- Positioned at the intersection area of the CFS-FS seal
- Tight installation of CFS-FS filling required

Gap closure:

- See section 8.1.2.5 for details

The Figure 12 is showing a trunking application in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section



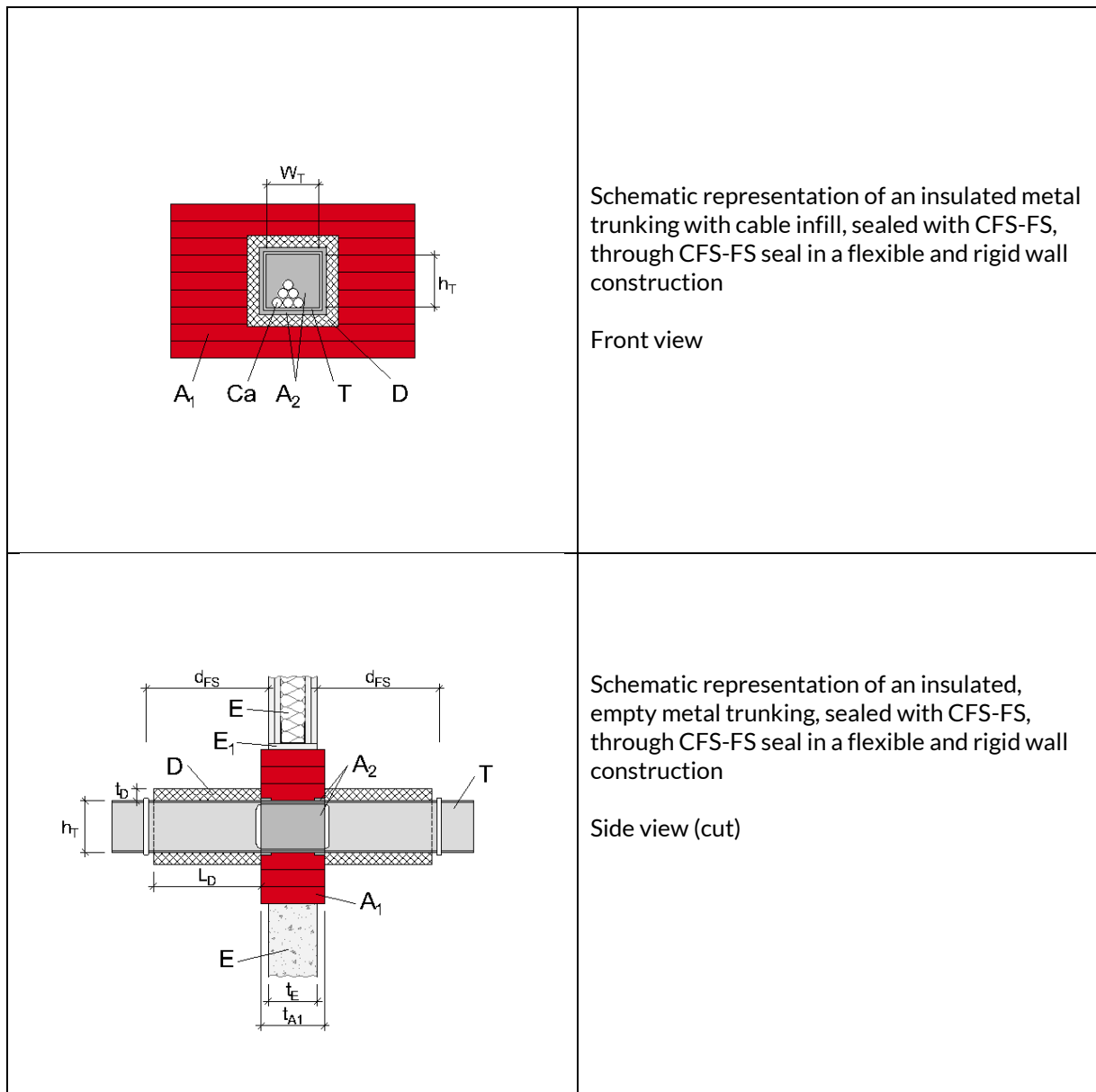


Figure 12: Metal trunking penetration through CFS-FS

The classification listed in Figure 13 applies for insulated metal trunking applications in a CFS-FS seal in flexible and rigid wall constructions.

Type of penetrating service	Classification
Metal trunking filled with cables	EI 60
Metal trunking without cables (empty)	EI 60

Figure 13: Classification for metal trunking sealed with CFS-FS through CFS-FS seal in flexible & rigid wall constructions

8.1.3.5.3 Single layer plastic pipes through CFS-FS seal

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Pipe material:
 - PVC-U in accordance with EN 1329-1, EN 1453-1, EN ISO 15493, EN ISO 1452-2
 - PVC-C in accordance with EN 1566-1, EN ISO 15493, EN ISO 15877-2
 - PE in accordance with EN 12201-2, EN 1519-1, EN ISO 15494, EN 12666-1
 - ABS in accordance with EN 1455-1, EN ISO 15493
 - SAN+PVC in accordance with ISO 19220
 - PP in accordance with EN 1451-1 (solid wall pipes), EN ISO 15874, EN ISO 15494
- (not for multilayer plastic pipes made of PP)

Insulation:

- No thermal insulation
- No acoustic pipe decoupling on pipe

Gap closure:

- See section 8.1.2.5 for details

The Figure 14 is showing a plastic pipe application through CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

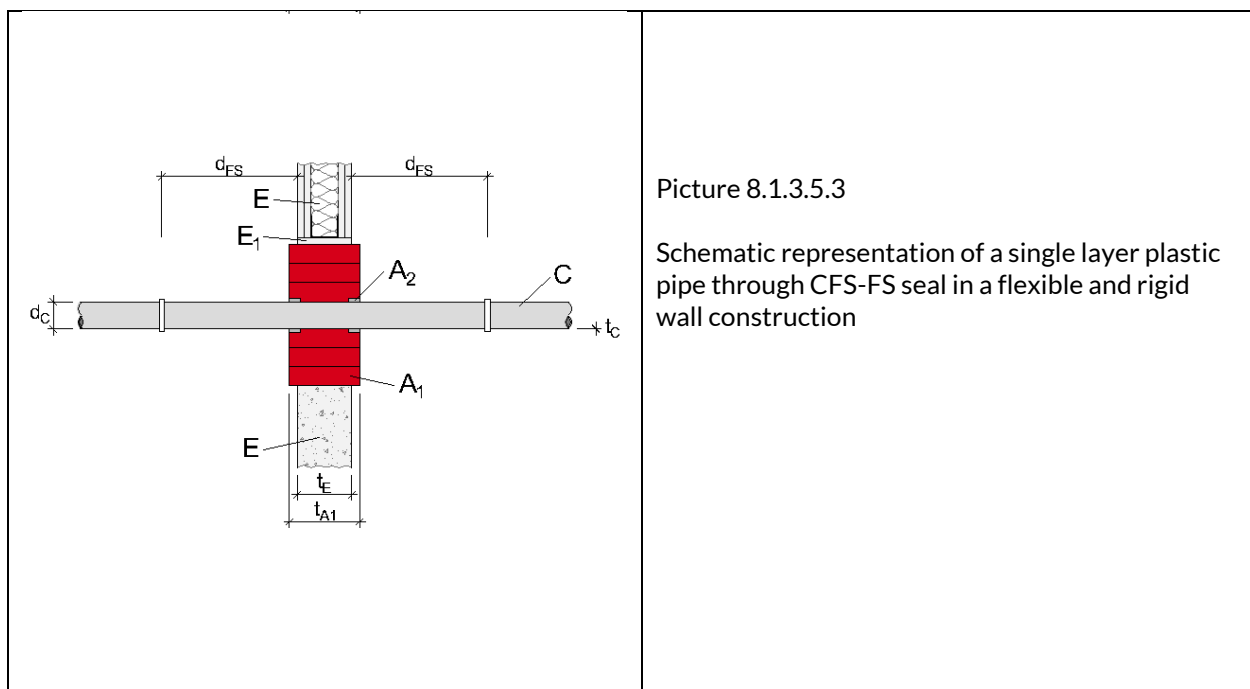


Figure 14: Plastic pipe through CFS-FS

The classifications shown in Figure 15 and Figure 16 applying for single layer plastic pipe applications in a CFS-FS seal in flexible and rigid wall constructions.

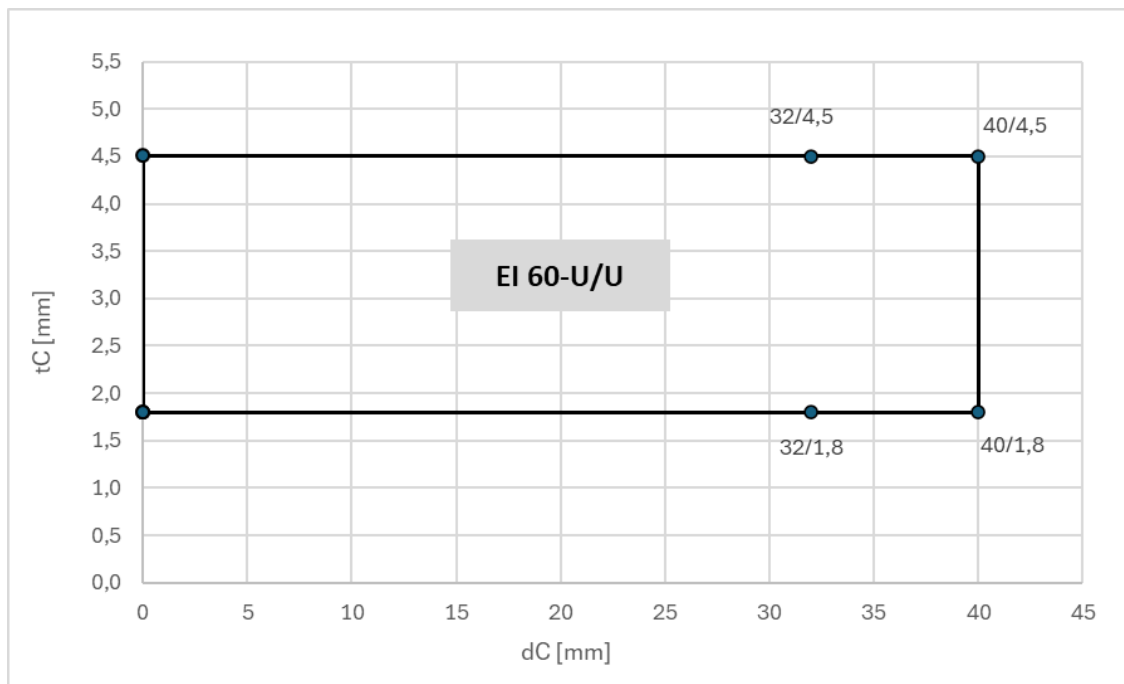


Figure 15: Classified pipe range for single layer plastic pipes

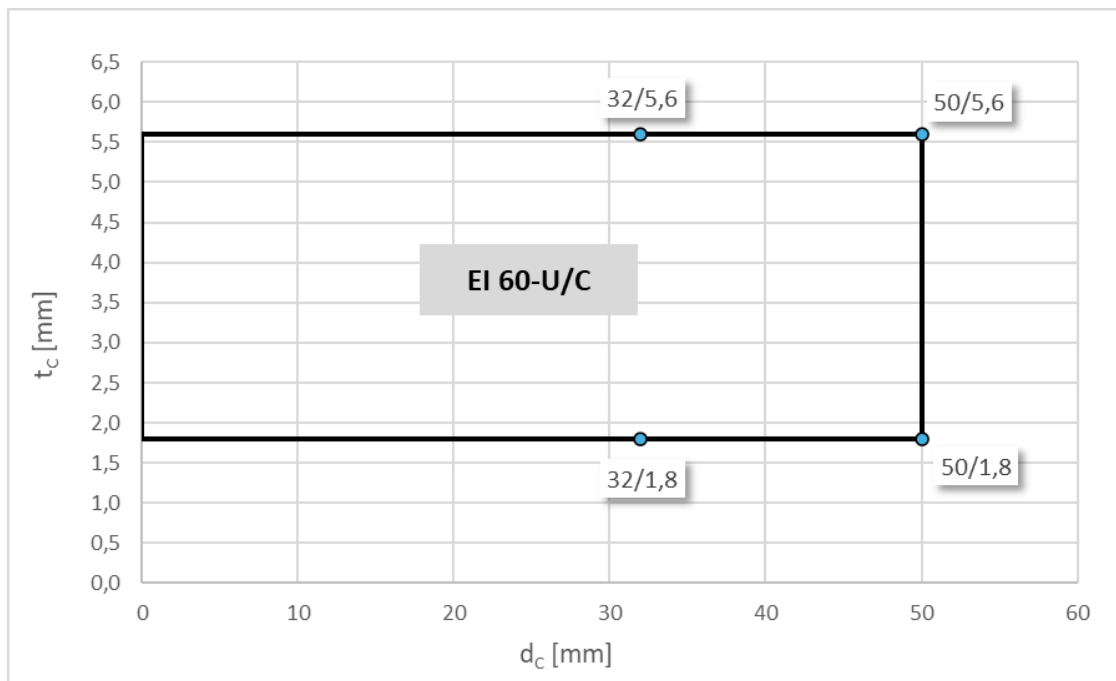


Figure 16: Classified pipe range for single layer plastic pipes

8.1.3.5.4 Single layer plastic pipes through CFS-FS seal, additionally sealed with CFS-B

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Pipe material:
 - PVC-U in accordance with EN 1329-1, EN 1453-1, EN ISO 15493, EN ISO 1452-2
 - PVC-C in accordance with EN 1566-1, EN ISO 15493, EN ISO 15877-2
 - PE in accordance with EN 12201-2, EN 1519-1, EN ISO 15494, EN 12666-1
 - ABS in accordance with EN 1455-1, EN ISO 15493
 - SAN+PVC in accordance with ISO 19220
 - PP in accordance with EN 1451-1 (solid wall pipes), EN ISO 15874, EN ISO 15494
- (not for multilayer plastic pipes made of PP)

Insulation:

- No thermal insulation
- No acoustic pipe decoupling on pipe

Penetrating service closure:

- Two devices CFS-B per service, one at each side
- CFS-B wrapped around the service
- Two layers of CFS-B on each side
- Projecting length of CFS-B outside of the CFS-FS seal 62,5 mm
- Fixing the CFS-B around the service by means of two metal wires per bandage, one inside the CFS-FS seal and one outside the CFS-FS seal

Gap closure:

- See section 8.1.2.5 for details

The Figure 17 below shows a single layer plastic pipe application, additionally sealed with CFS-B, through CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

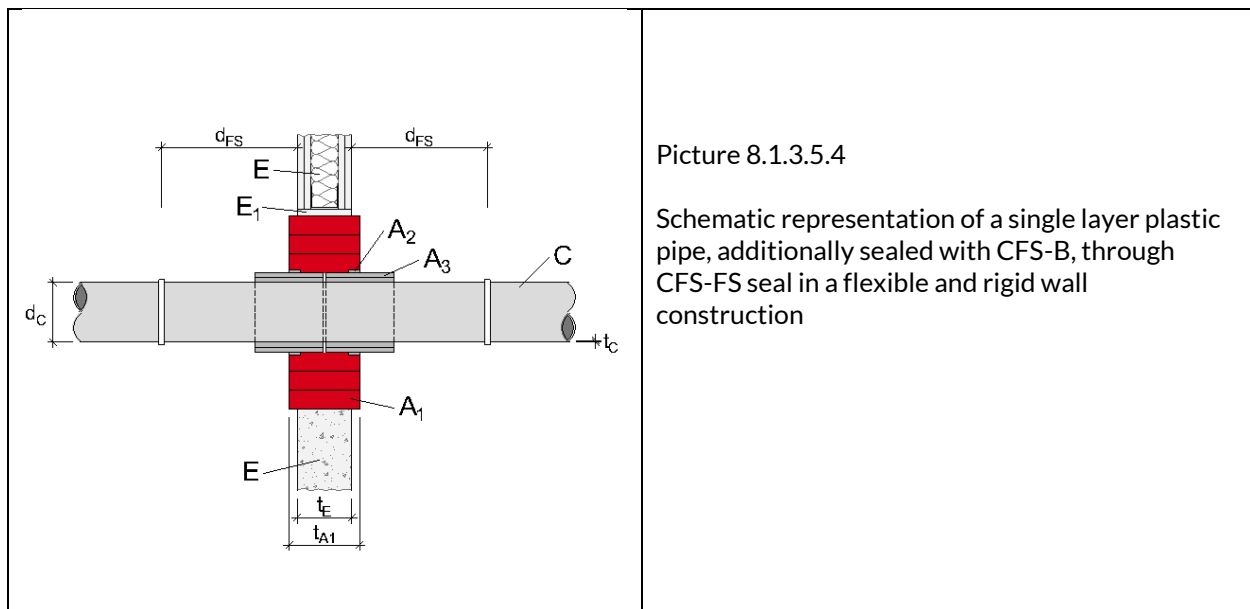


Figure 17: Plastic pipe penetration, sealed with CFS-B, through CFS-FS seal

The classification shown in Figure 18 applies for single layer plastic pipe applications, additionally sealed with CFS-B, in a CFS-FS seal in flexible and rigid wall constructions.

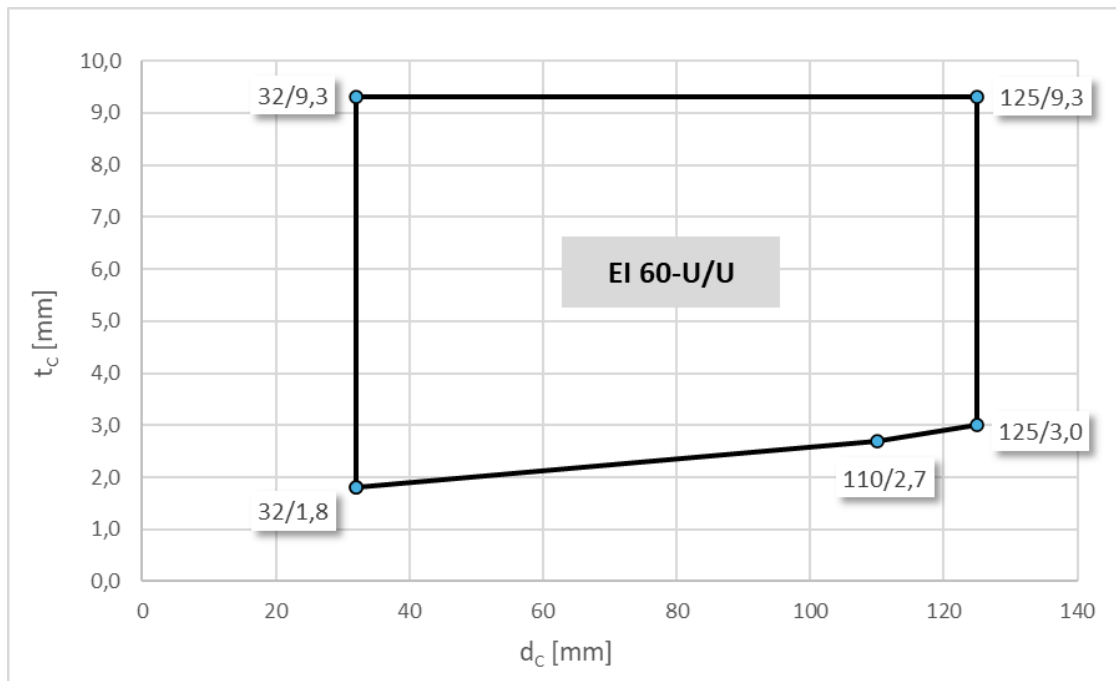


Figure 18: Classified pipe range for single layer plastic pipes, add. sealed with CFS-B

8.1.3.5.5 Non-regulated PP-pipes through CFS-FS seal, additionally sealed with CFS-B

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Pipe material:
- PP (see section 8.1.2.9 for details)

Insulation:

- No thermal insulation
- No acoustic pipe decoupling on pipe

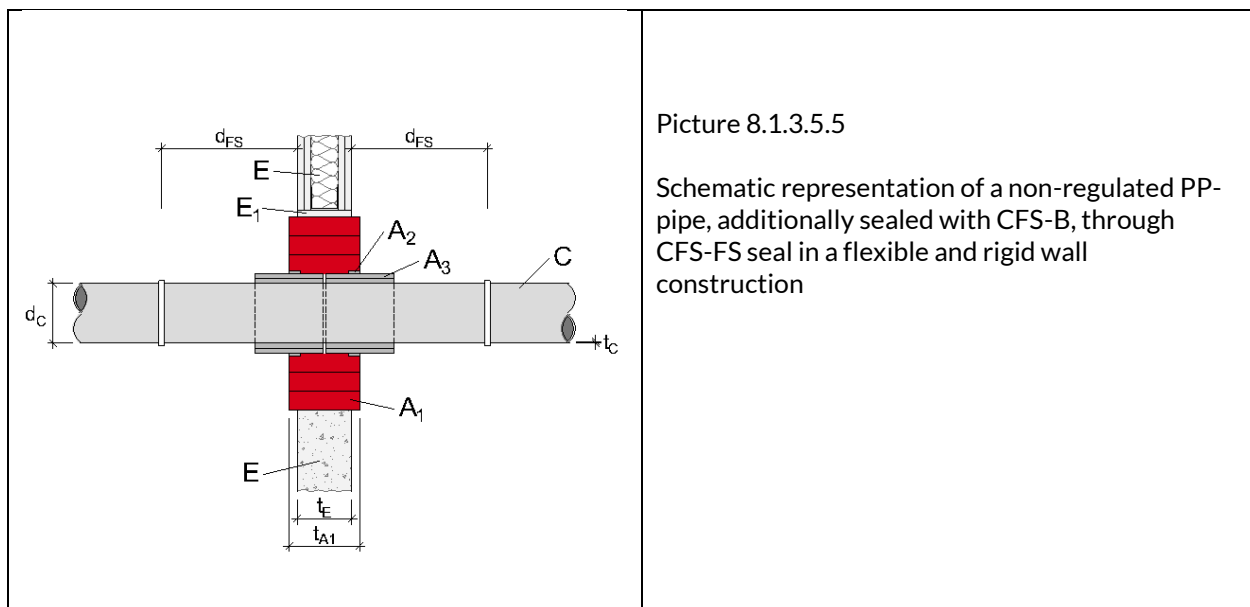
Penetrating service closure:

- Two devices CFS-B per service, one at each side
- CFS-B wrapped around the service
- Two layers of CFS-B on each side
- Projecting length of CFS-B outside of the CFS-FS seal 62,5 mm
- Fixing the CFS-B around the service by means of two metal wires per bandage, one inside the CFS-FS seal and one outside the CFS-FS seal

Gap closure:

- See section 8.1.2.5 for details

The Figure 19 below shows a non-regulated PP-pipe application, additionally sealed with CFS-B, in CFS-FS



Picture 8.1.3.5.5

Schematic representation of a non-regulated PP-pipe, additionally sealed with CFS-B, through CFS-FS seal in a flexible and rigid wall construction

Figure 19: Non-regulated PP-pipe penetration, sealed with CFS-B, through CFS-FS seal

The classification shown in Figure 20 applies non-regulated PP-pipe applications, additionally sealed with CFS-B, in a CFS-FS seal in flexible and rigid wall constructions.

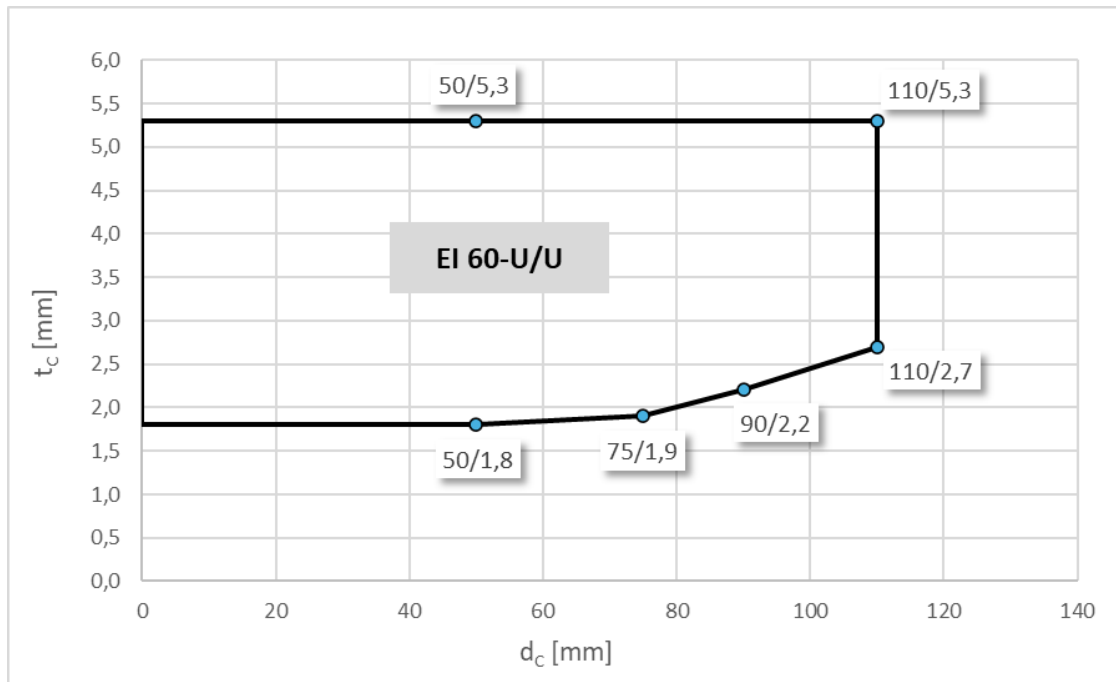


Figure 20: Classified pipe range for non-regulated PP-pipes, add. sealed with CFS-B

8.1.3.5.6 CPVC pipes through CFS-FS seal

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Pipe material:
 - CPVC/C-PVC pipe types from manufacturer
 - Blazemaster - Viking Plastics
 - FlameGuard - Spears

Insulation:

- No thermal insulation
- No acoustic pipe decoupling on pipe

Gap closure:

- See section 8.1.2.5 for details

The Figure 21 below shows a CPVC-pipe application in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

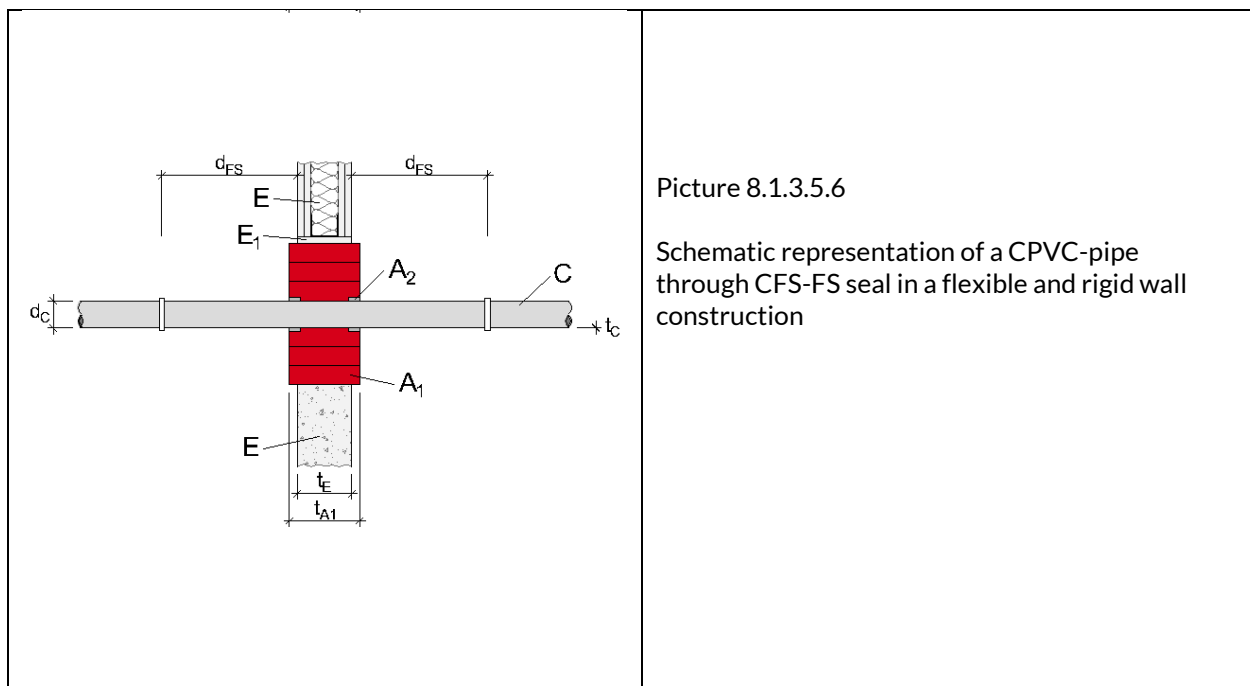


Figure 21: CPVC pipe penetration through CFS-FS seal

The classifications shown in Figure 22 and Figure 23 applies for CPVC-pipes in a CFS-FS seal in flexible and rigid wall constructions. Figure 22 covers Blazemaster pipes from Viking Plastics and Figure 23 FlameGuard pipes from Spears.

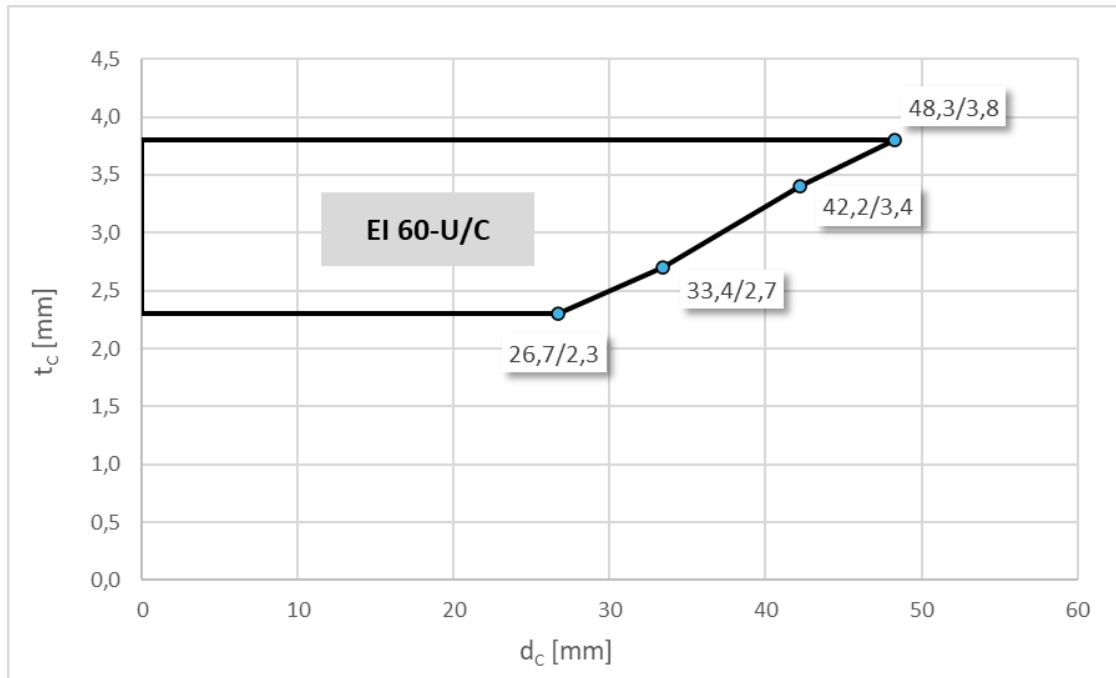


Figure 22: Classified pipe range for Blazemaster-CPVC-pipes from Viking Plastics

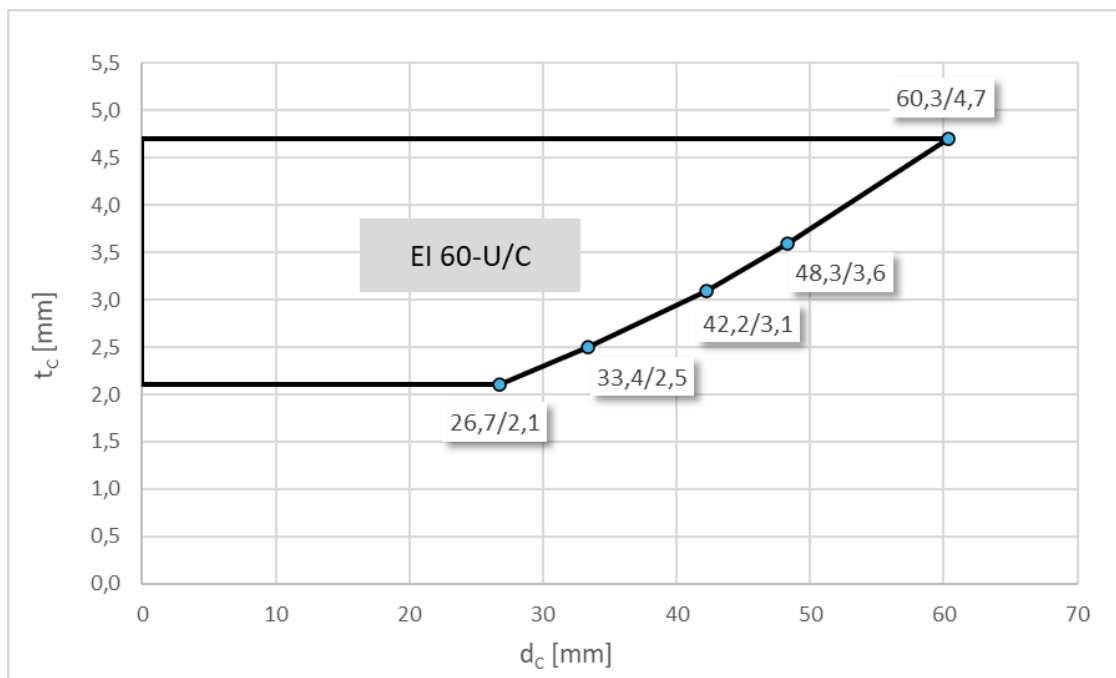


Figure 23: Classified pipe range for FlameGuard-CPVC-pipes from Spears

8.1.3.5.7 Rectangular PVC pipe through CFS-FS seal, additionally sealed with CFS-B

Rectangular pipe:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Pipe material: PVC
- Rectangular form
- Width $w_G \leq 220$ mm
- Height $h_G \leq 90$ mm
- Wall thickness $t_G = 2,0$ mm
- Non-insulated

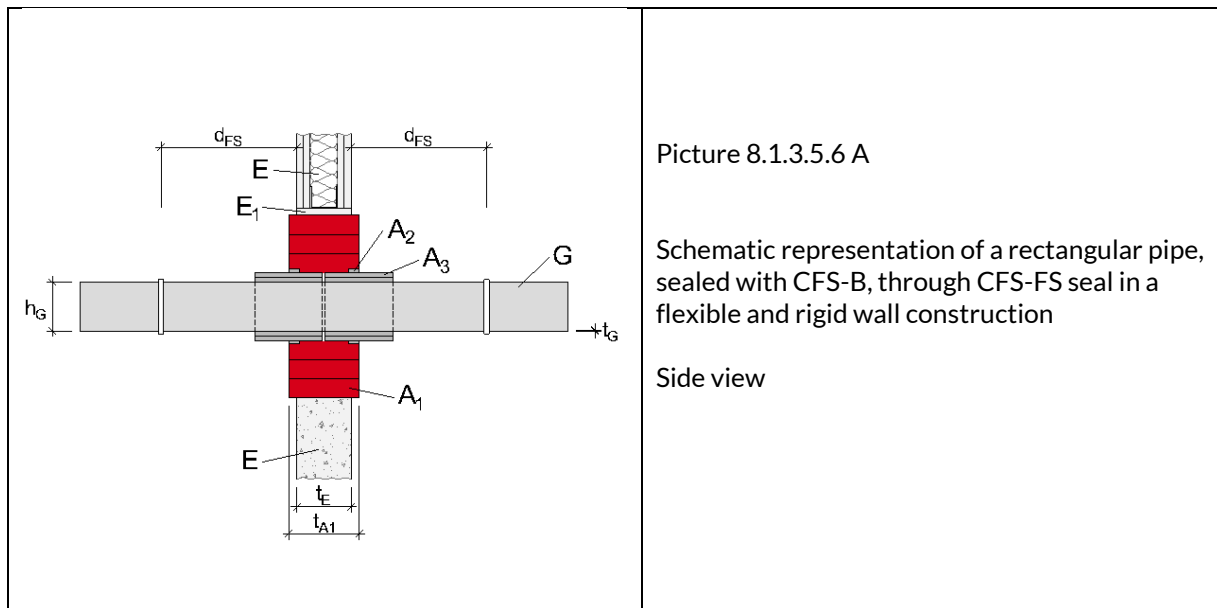
Penetrating service closure:

- Two devices CFS-B per service, one at each side
- CFS-B wrapped around the service
- Two layers of CFS-B on each side
- Projecting length of CFS-B outside of the CFS-FS seal 62,5 mm
- Fixing the CFS-B around the service by means of two metal wires per bandage, one inside the CFS-FS seal and one outside the CFS-FS seal

Gap closure:

- See section 8.1.2.5 for details

The Figure 24 below shows a rectangular pipe application, additionally sealed with CFS-B, in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section



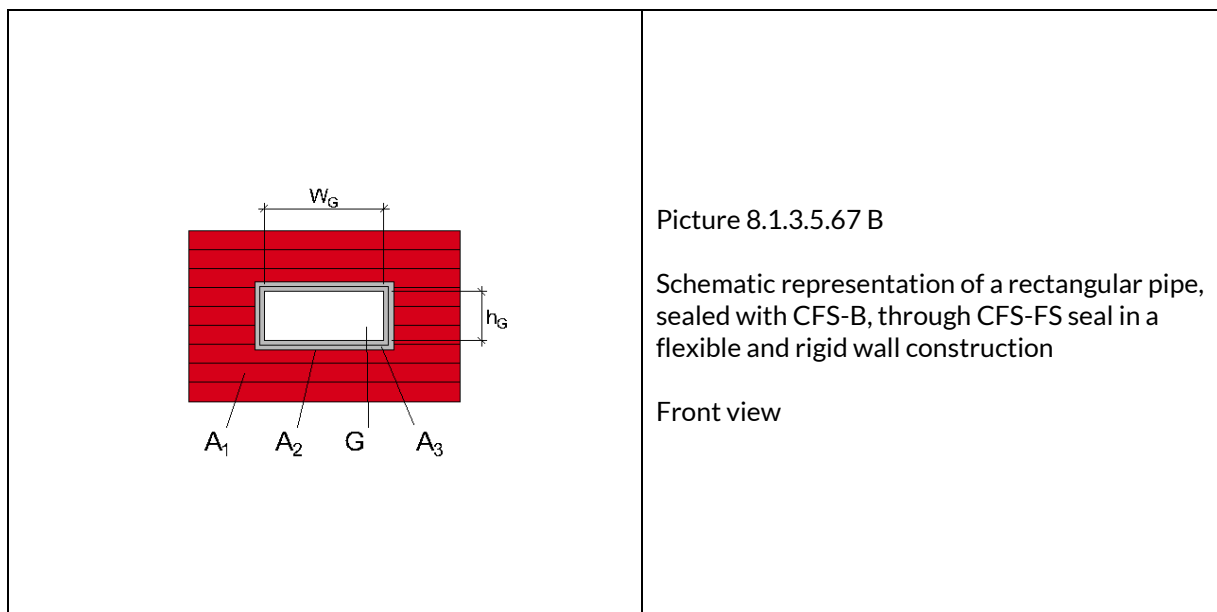


Figure 24: Rectangular pipe penetration, sealed with CFS-B, through CFS-FS seal

The classification listed in Figure 25 applies for rectangular PVC-pipe applications, additionally sealed with CFS-B, in a CFS-FS seal in flexible and rigid wall constructions.

Type of penetrating service	Classification
Rectangular pipe	EI 60-U/U

Figure 25: Classification for rectangular PVC-pipes, sealed with CFS-B, through CFS-FS seal in flexible and rigid wall constructions

8.1.3.5.8 Alu composite pipes (MLC pipes) through CFS-FS seal

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Pipe material: PE-RT (II) / AI / PE-RT (II)
- Type and brand:
- Mepla - Geberit
- Uponor Uni Pipe Plus
- Uponor MLC

Insulation:

- No thermal insulation
- No acoustic pipe decoupling on pipe

Gap closure:

- See section 8.1.2.5 for details

The Figure 26 below shows an alu-composite pipe application in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

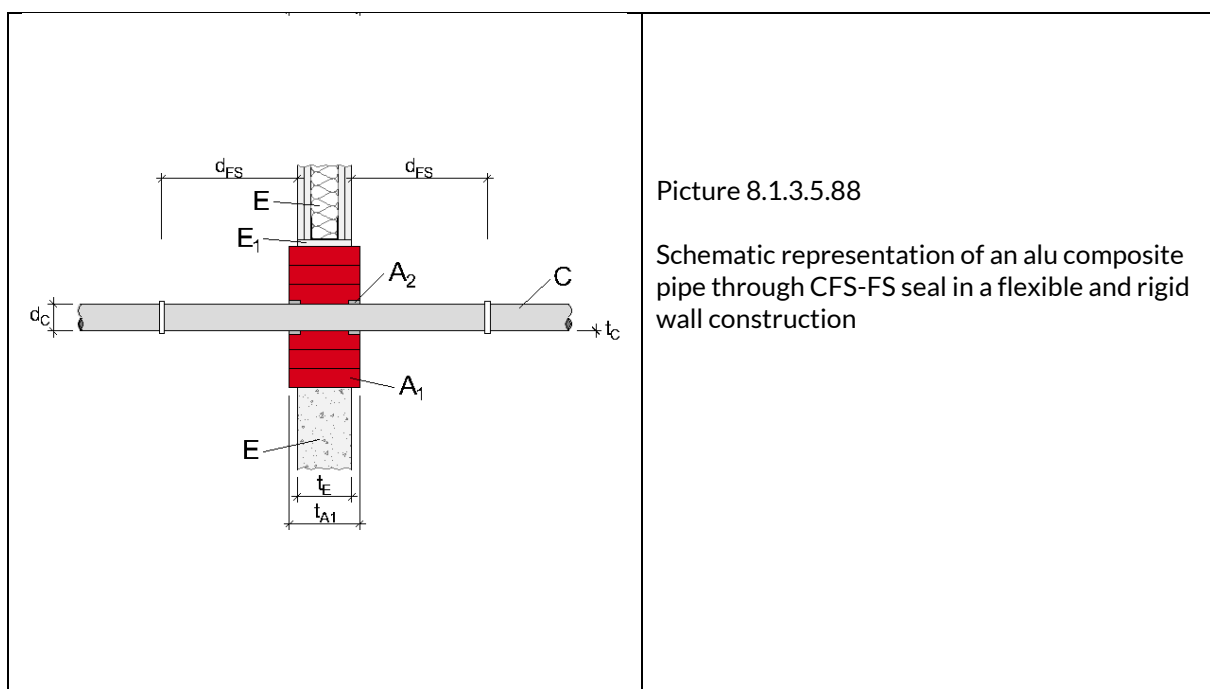


Figure 26: MLC pipe penetration through CFS-FS seal

The classifications shown in Figure 27, Figure 28 and Figure 29 applying for non-insulated MLC pipes in a CFS-FS seal in flexible and rigid wall constructions. Figure 27 covers Mepla pipes from Geberit, Figure 28 covers Uni Pipe Plus pipes from Uponor and Figure 29 covers Uponor MLC.

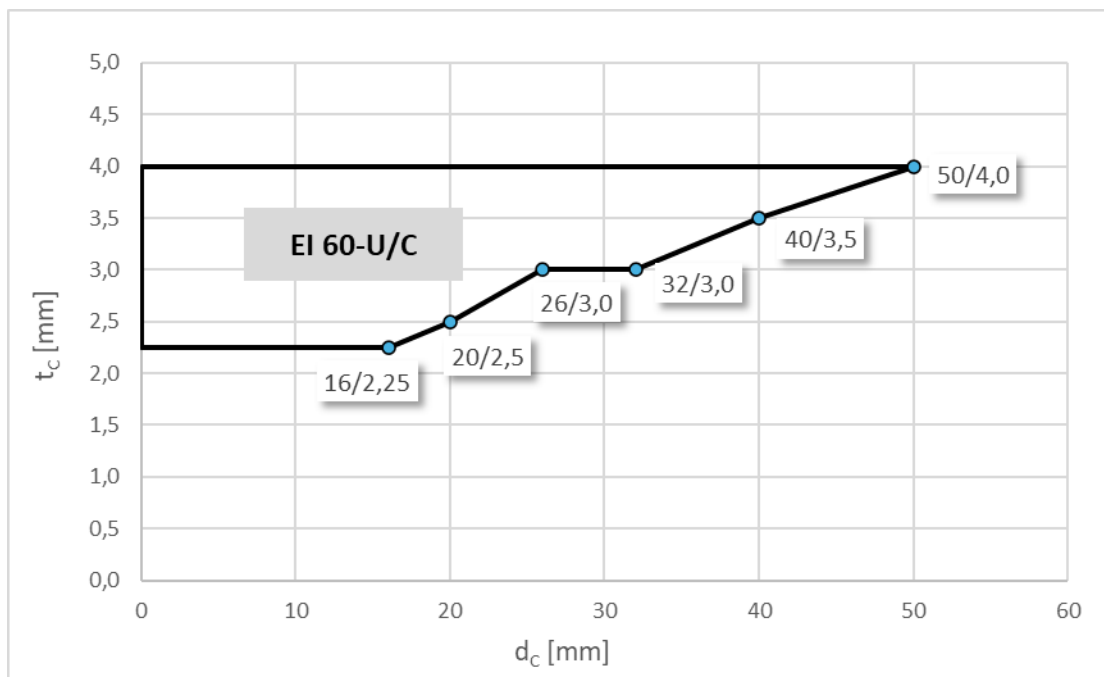


Figure 27: Classified pipe range for Geberit Mepla MLC pipes

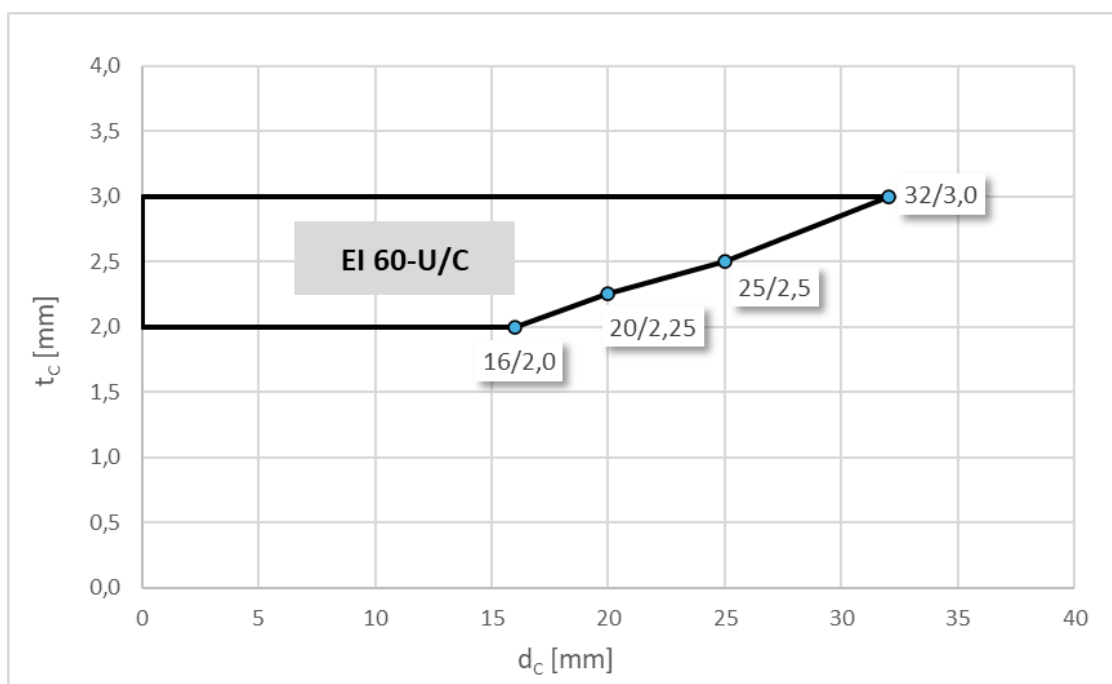


Figure 28: Classified pipe range for Uponor Uni Pipe Plus pipes

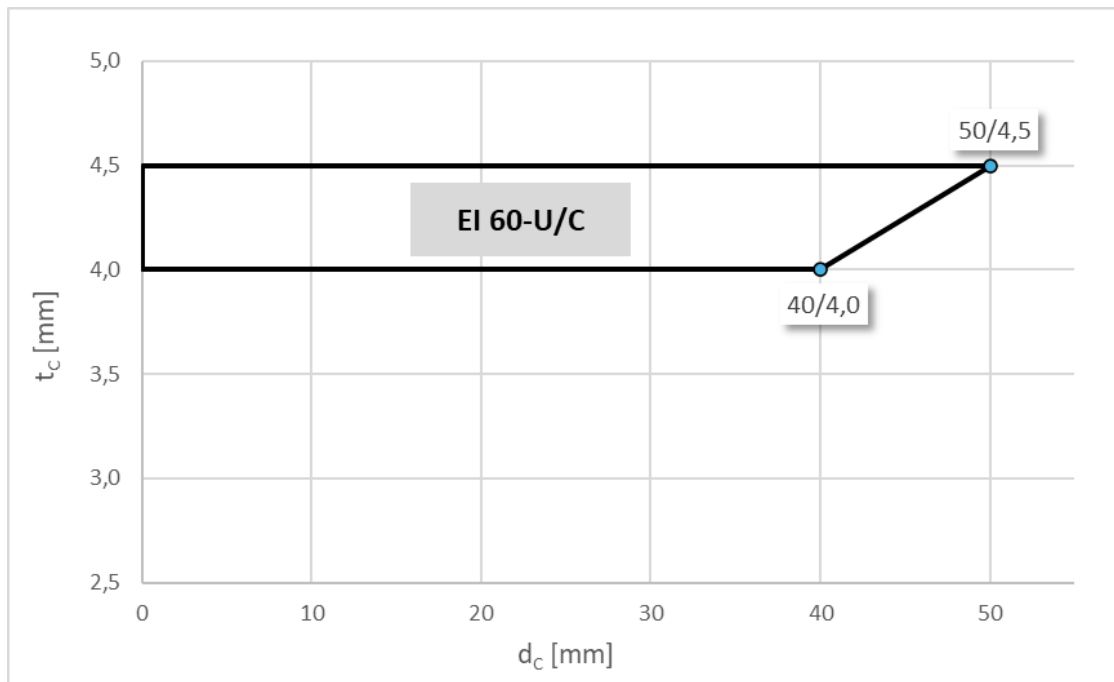


Figure 29: Classified pipe range for Uponor MLC pipes

8.1.3.5.9 Alu composite pipes (MLC pipes) with combustible insulation through CFS-FS seal

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Insulated with insulation of type 1 or type 2
- Pipe material: PE-RT (II) / Al / PE-RT (II)
- Type and brand:
- Uponor Uni Pipe Plus
- Uponor MLC

Insulation type 1:

- Material: Only FEF-insulation as approved
- Brand and Type: refer to section 8.1.2.7
- Fixing: according to the manufacturer's instructions
- Insulation thickness: AF1 – AF6 (8,0 mm – 37,5 mm)
- Insulation configuration: CS (continuous sustained)

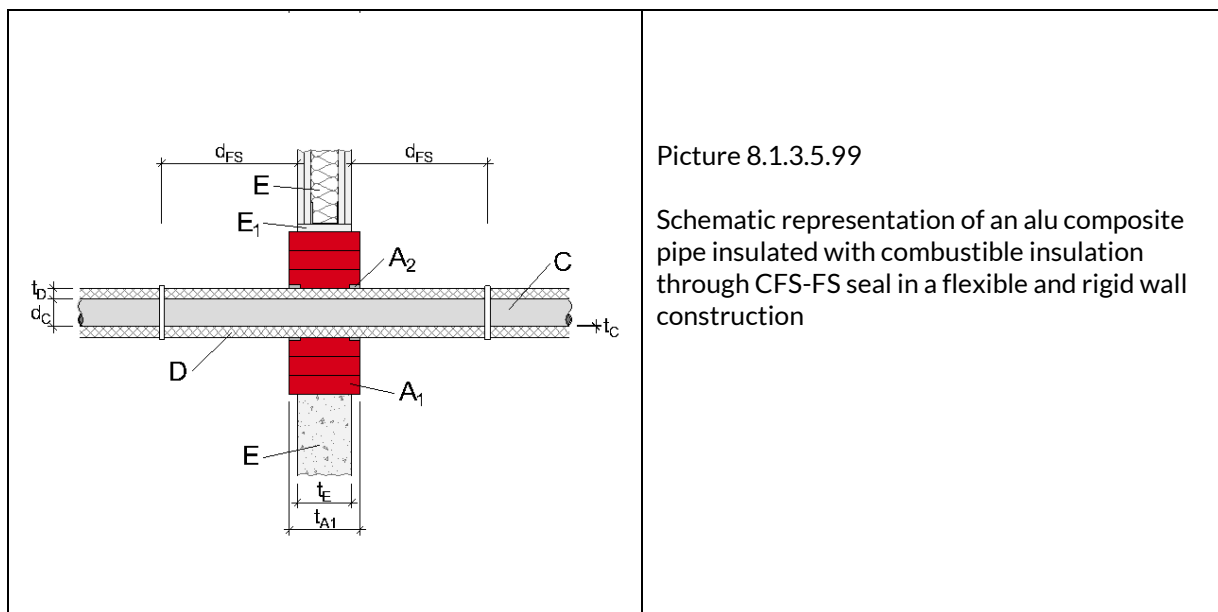
Insulation type 2:

- Material: Closed cell phenolic foam (C.C.P.F.) insulation
- Brand and Type: Kingspan Kooltherm
- Fixing: according to the manufacturer's instructions
- Insulation thickness: 15 mm – 40 mm
- Insulation configuration: CS (continuous sustained)

Gap closure:

- See section 8.1.2.5 for details

The Figure 30 below shows an FEF- or C.C.P.F.-insulated alu composite pipe application in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section



Picture 8.1.3.5.99

Schematic representation of an alu composite pipe insulated with combustible insulation through CFS-FS seal in a flexible and rigid wall construction

Figure 30: FEF- or C.C.P.F.-insulated MLC pipe through CFS-FS seal

The classifications shown in Figure 31 and Figure 32 applying for FEF- and C.C.P.F.-insulated MLC pipes in a CFS-FS seal in flexible and rigid wall constructions. Figure 31 covers Uni Pipe Plus pipes from Uponor and Figure 32 covers Uponor MLC pipes.

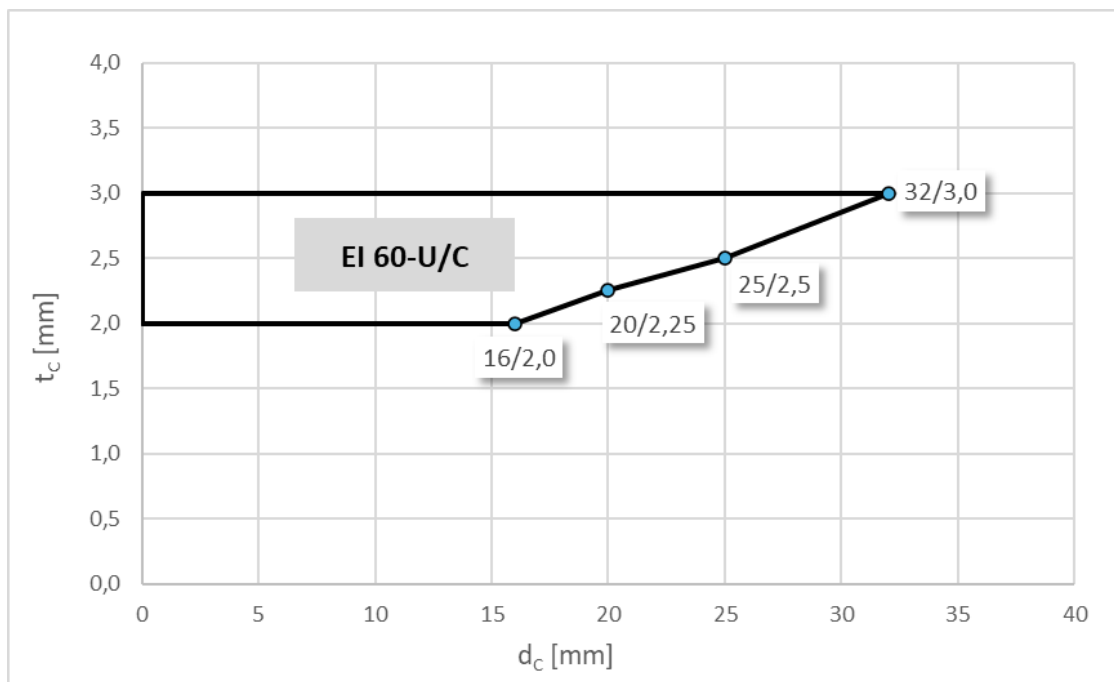


Figure 31: Classified pipe range for Uponor Uni Pipe Plus pipes, FEF- or C.C.P.F - insulated

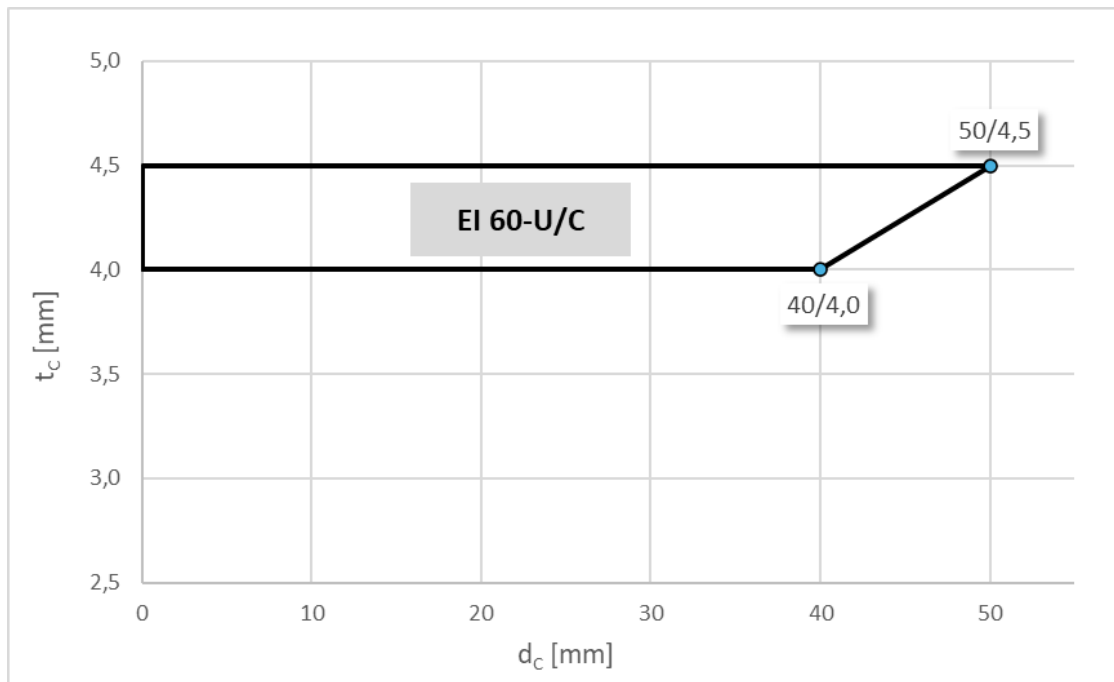


Figure 32: Classified pipe range for Uponor MLC pipes, FEF- or C.C.P.F - insulated

8.1.3.5.10 Metal pipes (HMP) with non-combustible insulation through CFS-FS seal

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Insulated with insulation of type 1 or type 2
- Pipe material:
- For pipe diameters $d_C \leq 108$ mm: Copper pipes and other metal pipes
- For pipe diameters $d_C \leq 114,3$ mm: Steel pipes and other metal pipes
- Refer to section 8.1.2.8 for material

Insulation type 1:

- Material: Mineral wool sheet with a reinforced aluminum backing
- Brand and Type: Rockwool duct-wrap
- Fixing: according to the manufacturer's instructions
- Insulation thickness:
- For pipe diameters $d_C \leq 12$ mm to ≤ 54 mm: ≥ 25 mm
- For pipe diameters $d_C \geq 54$ mm to $\leq 114,3$ mm: ≥ 40 mm
- Insulation configuration: CS (continuous sustained)

Insulation type 2:

- Material: Mineral wool sheet with a reinforced aluminum backing
- Brand and Type: Rockwool Rocklap
- Fixing: according to the manufacturer's instructions
- Insulation thickness:
- For pipe diameters $d_C \leq 12$ mm to ≤ 54 mm: 25 mm
- For pipe diameters $d_C \geq 54$ mm to $\leq 114,3$ mm: 40 mm
- Insulation configuration: LS (local sustained), CS (continuous sustained)
- Insulated length LD on both sides of CFS-FS seal: ≥ 450 mm

Gap closure:

- See section 8.1.2.5 for details

The Figure 33 is showing metal pipe applications with non-combustible insulation in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

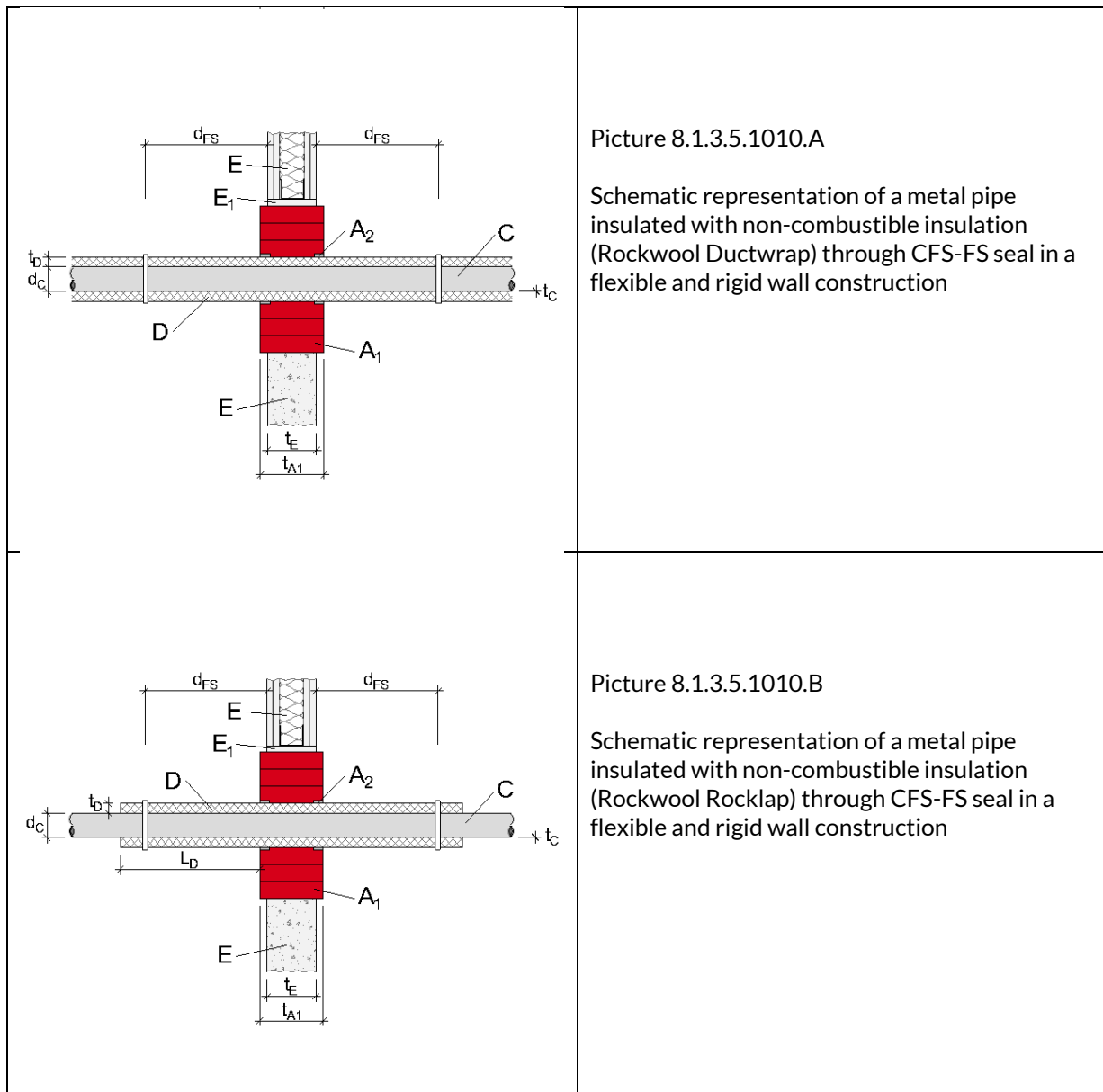
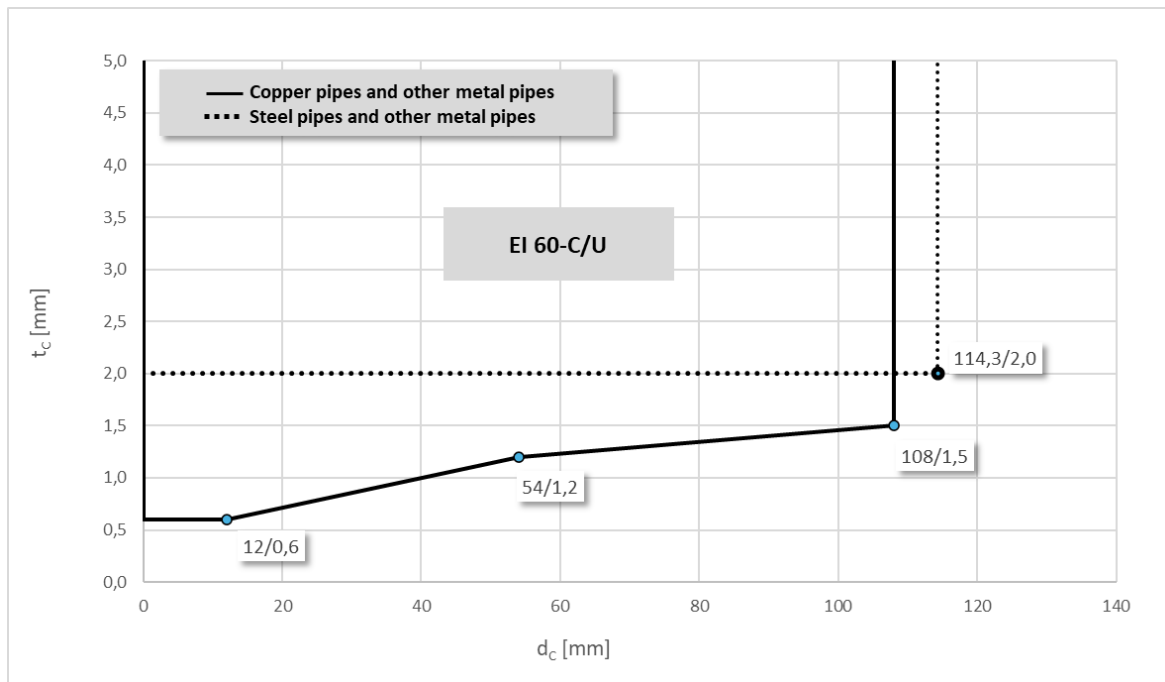


Figure 33: Metal pipes with non-combustible insulation through CFS-FS seal

The classifications shown in

Figure 34 applying for pipes with non-combustible insulation in a CFS-FS seal in flexible and rigid wall constructions.



Test results for tubes made of copper are also valid for tubes made of steel, cast iron but not vice versa.

Figure 34: Classified pipe range for metal pipes with non-combustible insulation

8.1.3.5.11 Metal pipes (HMP) with combustible insulation through CFS-FS seal

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Insulated with insulation of type 1 or type 2
- Pipe material:
- For pipe diameters $d_c \leq 108$ mm: Copper pipes and other metal pipes
- For pipe diameters $d_c \leq 114,3$ mm: Steel pipes and other metal pipes
- Refer to section 8.1.2.8 for material

Insulation type 1:

- Material: Only FEF-insulation as approved
- Brand and Type: refer to section 8.1.2.7
- Fixing: according to the manufacturer's instructions
- Insulation thickness:
- For pipe diameters $d_c \leq 12$ mm to ≤ 54 mm: AF - 7,5 mm – 38 mm
- For pipe diameters $d_c \geq 54$ mm to $\leq 114,3$ mm: AF - 17,0 mm – 42,5 mm
- Insulation configuration: CS (continuous sustained)

Insulation type 2:

- Material: Closed cell phenolic foam (C.C.P.F.) insulation
- Brand and Type: Kingspan Kooltherm
- Fixing: according to the manufacturer's instructions
- Insulation thickness:
- For pipe diameters $d_c \leq 12$ mm to ≤ 54 mm: 15 mm – 40 mm
- For pipe diameters $d_c \geq 54$ mm to $\leq 114,3$ mm: 20 mm – 40 mm
- Insulation configuration: CS (continuous sustained)

Gap closure:

- See section 8.1.2.5 for details

The Figure 35 is showing metal pipe applications with combustible insulation in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

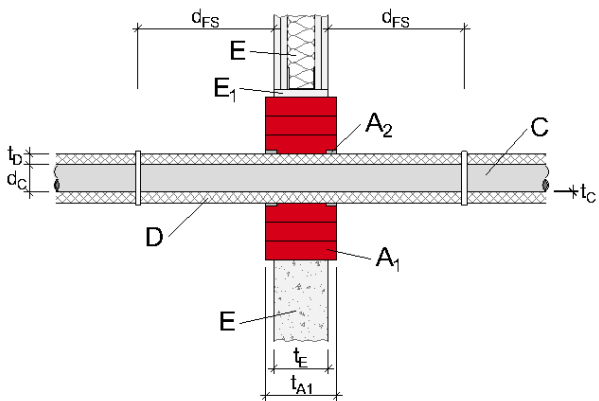
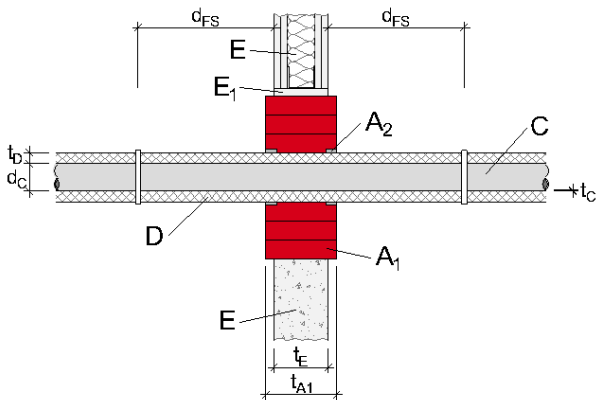
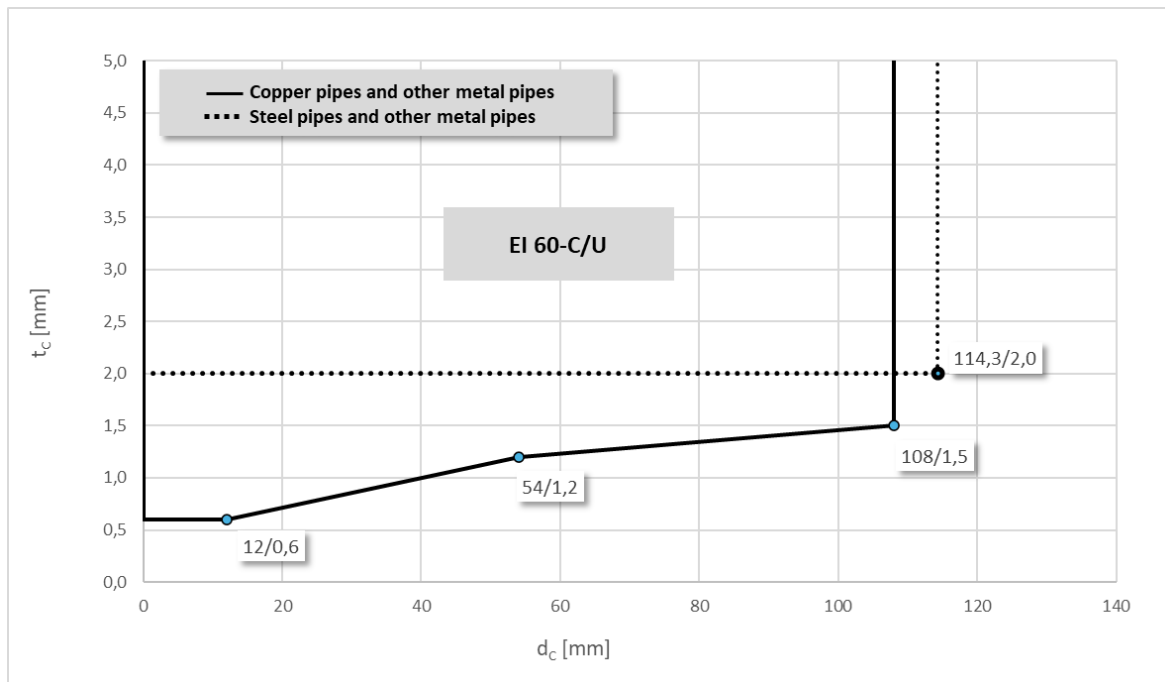
	<p>Picture 8.1.3.5.111.A</p> <p>Schematic representation of a metal pipe insulated with FEF-insulation through CFS-FS seal in a flexible and rigid wall construction</p>
	<p>Picture 8.1.3.5.111.B</p> <p>Schematic representation of a metal pipe insulated with C.C.P.F.-insulation (Kingspan Kooltherm) through CFS-FS seal in a flexible wall construction</p>

Figure 35: Metal pipes with combustible insulation through CFS-FS seal in flexible wall construction

The classifications shown in Figure 36 applying for pipes with combustible insulation in a CFS-FS seal in flexible and rigid wall constructions.



Test results for tubes made of copper are also valid for tubes made of steel and cast iron but not vice versa.

Figure 36: Classified pipe range for metal pipes with combustible insulation

8.1.3.5.12 Flexible gas piping through CFS-FS seal

Pipes:

- Single and multiple pipe penetration
- Linear arrangement (horizontal or vertical) or cluster arrangement
- Pipe material: Corrugated stainless steel with PE jacket
- MLC pipe types from manufacturer
- TracPipe - Omegaflex
- TracePipe CC – Omegaflex
- No insulation
- No acoustic pipe decoupling on pipe
- Flexible gas pipe must be covered by an additional PE sleeve

Additional protection

- Material: PE
- Sleeve V must be placed centered within the CFS-FS seal
- Length of sleeve: 132 mm
- Wall thickness of sleeve: 3 mm
- See Figure 38 for outer diameter of sleeve

Gap closure:

- See section 8.1.2.5 for details
- Gap between PE sleeve and flexible gas pipe must be filled with CFS-FIL
- Gap filler must be applied on both sides of CFS-FS
- Depth of gap filler: ≥ 25 mm

The Figure 37 below shows a flexible gas piping application in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

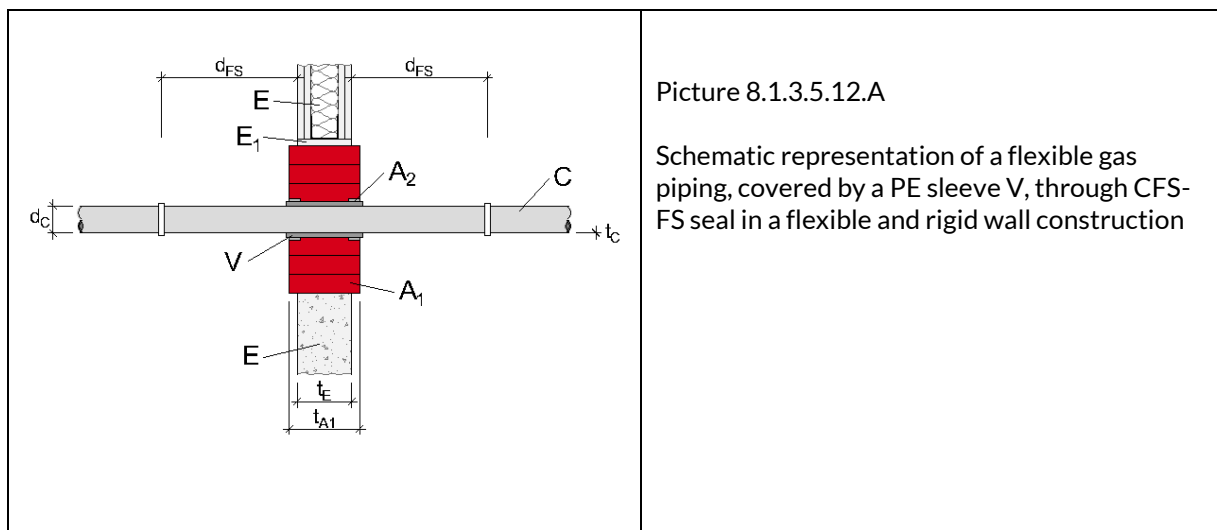


Figure 37: Flexible gas piping through CFS-FS

The classifications shown in Figure 38 applying for flexible gas piping's (TracPipe and TracePipe CC) in a CFS-FS seal in flexible and rigid wall constructions.

Type and brand of pipe	Outer diameter [mm]	Wave height [mm]	Wall thickness [mm]	Outer diameter PE sleeve [mm]	Classification
TracPipe – 22 Omegaflex	28	3,5	$\geq 0,25$	40	EI 60-C/U
TracPipe – 28 Omegaflex	35	4,0	$\geq 0,25$	40	EI 60-C/U
TracPipe – 32 Omegaflex	42	4,5	$\geq 0,30$	50	EI 60-C/U
TracPipe – 40 Omegaflex	49	4,5	$\geq 0,30$	56	EI 60-C/U
TracPipe CC – 22 Omegaflex	31	5,0	$\geq 0,25$	40	EI 60-C/U
TracPipe CC – 28 Omegaflex	38	5,5	$\geq 0,25$	50	EI 60-C/U
TracPipe CC – 32 Omegaflex	45	6,0	$\geq 0,25$	50	EI 60-C/U
TracPipe CC – 40 Omegaflex	52	6,0	$\geq 0,25$	56	EI 60-C/U

Figure 38: Classified pipe range for flexible gas pipes

8.1.3.5.13 HVAC-supply bundle (Klimasplit) through CFS-FS

Construction details:

- Mixed seal penetration
- Setup bundle:
- one non-insulated plastic pipe combined with
- two FEF-insulated copper pipes and
- two small scale cables
- Distances between penetrants within bundle: ≥ 0 mm
- Single and multiple penetration (related to bundle)
- Linear arrangement (horizontal or vertical) or cluster arrangement (related to bundle)

Cables:

- Sheathed cables only (non-sheathed cables and coaxial cables excluded)
- Maximum cable size $dR \leq 14$ mm
- Cable support excluded

Plastic pipe:

- Pipe material: PVC-U (flexible and transparent / non-regulated)
- Diameter $dC = 32$ mm
- Wall thickness $tC = 4$ mm
- End configuration: U/U or U/C

Metal pipes:

- Pipe material: Copper pipes and other metal pipes
- Refer to section 8.1.2.8 for material
- Dimension range: diameter dC (wall thickness tC):
- ≤ 12 mm ($tC \geq 0,6$ mm) up to ≤ 28 mm ($\geq 0,9$ mm)
- Insulated
- End configuration: C/U

Insulation metal pipe:

- Material: Only FEF-insultation as approved
- Brand and Type: refer to section 8.1.2.7
- Fixing: sealed with an adhesive Armaflex glueing strip
- Insulation thickness: AF1 – AF4 (7,5 mm – 15,5 mm)
- Insulation configuration: CS (continuous sustained)

Gap closure:

- See section 8.1.2.5 for details

The Figure 39 below shows a Klimasplit application in CFS-FS seal in a wall construction. For symbols and abbreviations refer to section

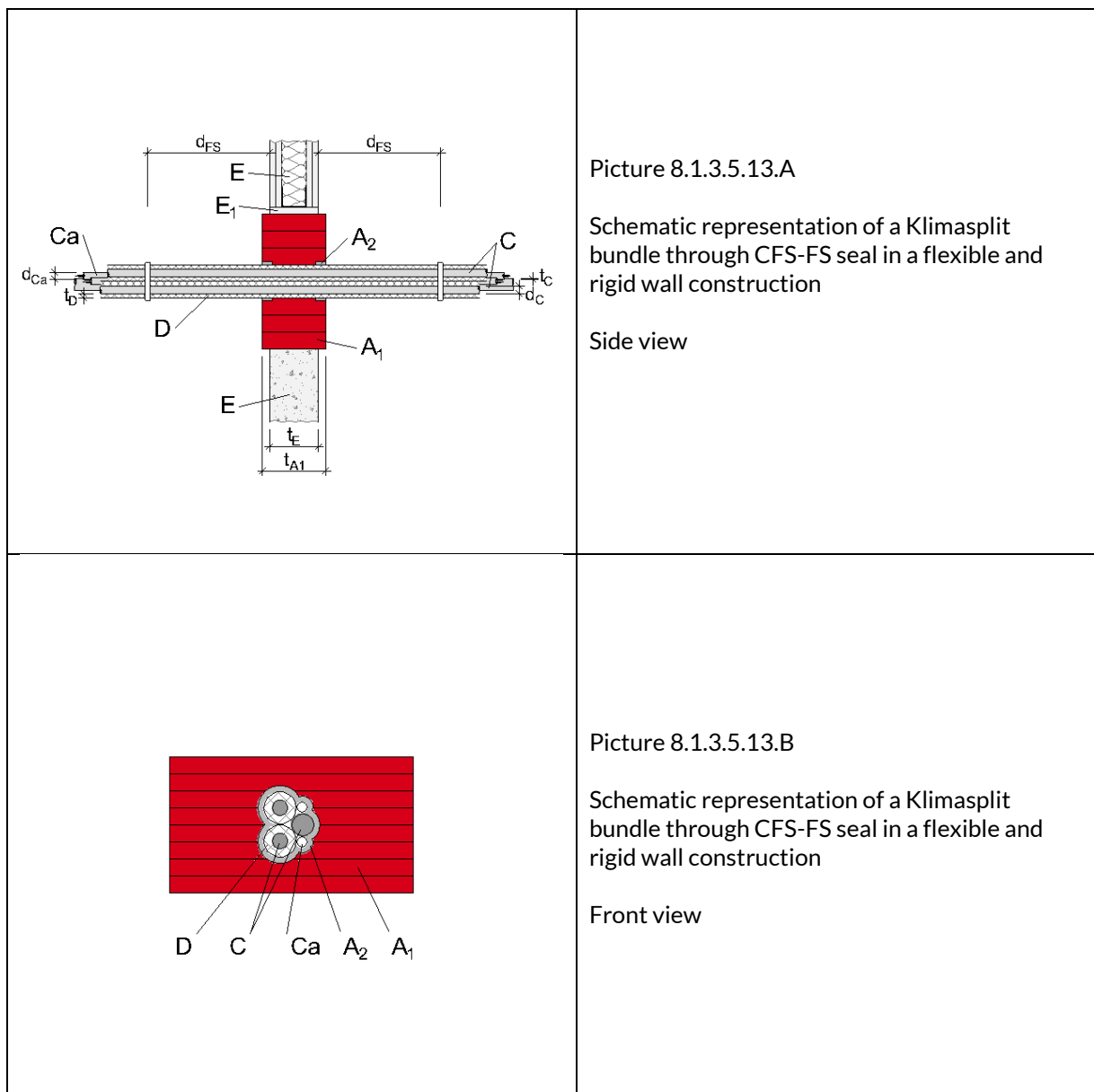


Figure 39: Klimasplit bundle through CFS-FS seal

The classifications shown in Figure 40 applying for Klimasplit bundles in a CFS-FS seal in flexible and rigid wall constructions.

Type of penetrating service	Classification
HVAC-supply bundles / Klimasplit bundles	EI 60

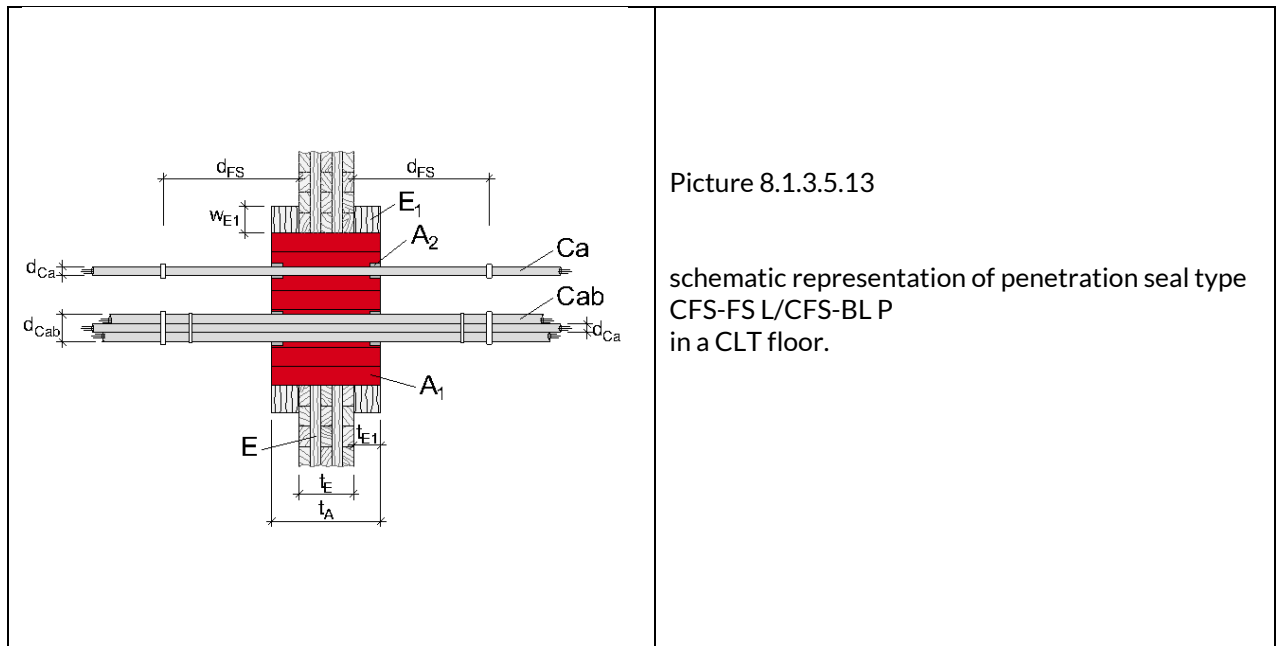
Figure 40: Classifications for HVAC-supply bundles

8.2 Cross laminated timber wall and floor

8.2.1 Penetration seal type CFS-FS L or CFS-BL P (200)

After fixing the penetrants through the (rectangular) opening the remaining opening is filled with Hilti Firestop Flexible seal CFS-FS L or Hilti Firestop CFS-BL P blocks. The thickness of the penetration seal is 200 mm the blocks are used lengthwise. Any remaining openings or gaps (up to maximum 10 mm width) must be filled with Hilti Firestop Filler CFS-FIL, minimum 25 mm depth.

The distance between this penetration and other penetrations needs to be 100 mm or more.



Picture 8.1.3.5.13

schematic representation of penetration seal type CFS-FS L/CFS-BL P in a CLT floor.

Figure 41: cable penetration applications through CFS-FS L or CFS-BL P seal in a timber wall

8.2.2 Cross laminated timber floor - type Leno Brettsperrholz - construction type A

- Leno Brettsperrholz cross laminated timber acc. ETA-10/0241
- or CLT types classified according to EN 16351
- number of cross-laminated timber layers: ≥ 7 (for wall thickness $t_E \geq 220$ mm)
- PU / MUF adhesives permitted
- edge glue not required
- two outer layers and middle one ≥ 34 mm
- the other layers ≥ 24 mm
- valid only for softwood CLT types such as: spruce/fir, pine, larch, stone pine

8.2.2.1 Minimum distances for penetrants in Leno Brettsperrholz floor

Minimum distances [mm] in between	Cables	Side seal edge
Cables	0	0

8.2.2.2 Cable seal – single and multiple

- Sheathed cables only
- With and without cable supports penetrating the seal

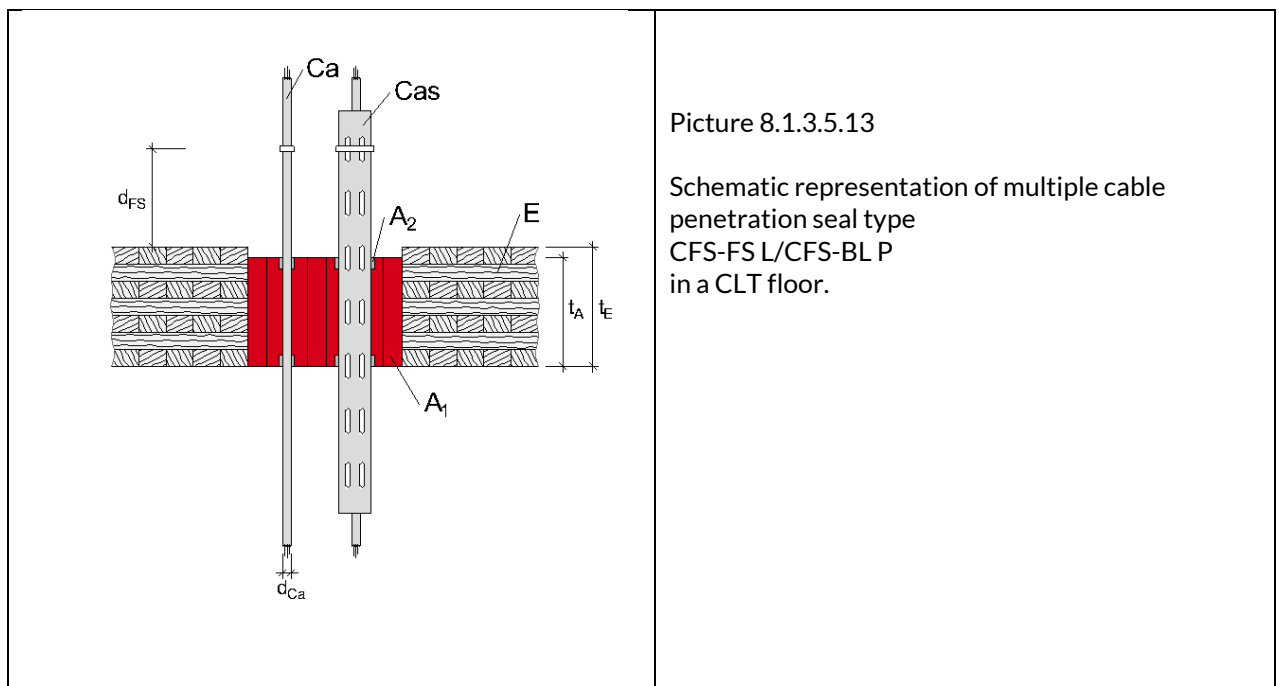


Figure 42: cable penetration applications through CFS-FS L or CFS-BL P seal in a timber floor

Single and multiple cable penetration (C)	Diameter (d_c) [mm]	Classification CFS-FS L / CFS-BL P
All sheathed cable types* with and without cable tray	≤ 50 mm	EI 90

Figure 43: Classifications for cable penetrations in timber wall and floor

currently and commonly used in building practice in Europe; Non-sheathed cables and waveguides not covered

8.2.3 Closed timber beam floor construction - prefabricated timber element – construction type B

- prefabricated timber element
- minimum total thickness ≥ 236 mm
- wood frame strength class C24 acc. EN 338 / ≥ 100 mm in width and ≥ 160 mm in height
- span ≥ 400 mm
- cavity filled with stone wool density $\rho \geq 44$ kg/m³ / two layer of 80 mm / 160 mm thick
- bottom side covered with 2x18 mm EN 520 board
- topside covered with inner layer 22 mm OSB / outer layer 1x18 mm EN 520 board
- OSB: type e.g.: “Agepan/Greenline OSB 3 PUR” acc. EN 300 or DIN EN 13986

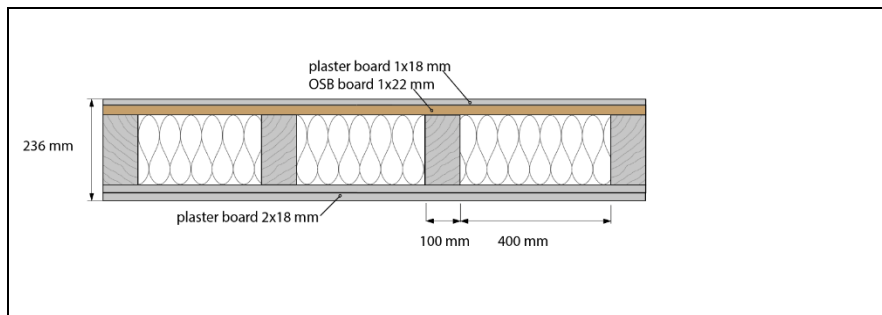


Figure 44: Closed timber beam floor construction

In the timber beam floor, the opening was framed with an 18 mm thick gypsum plasterboard

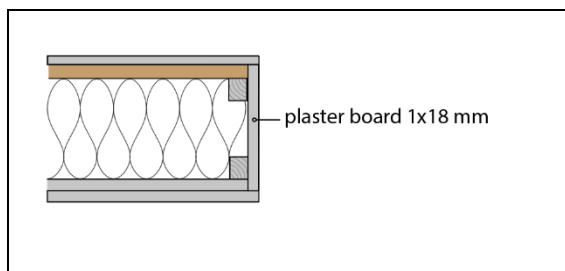


Figure 45: Frame at an opening in a floor

8.2.3.1 Minimum distances for penetrants on closed timber beam floor

Minimum distances [mm] in between	Cables	Side seal edge
Cables	0	0

8.2.3.2 Cable seal – single and multiple

- Sheathed cables only
- With and without cable support penetrating the seal

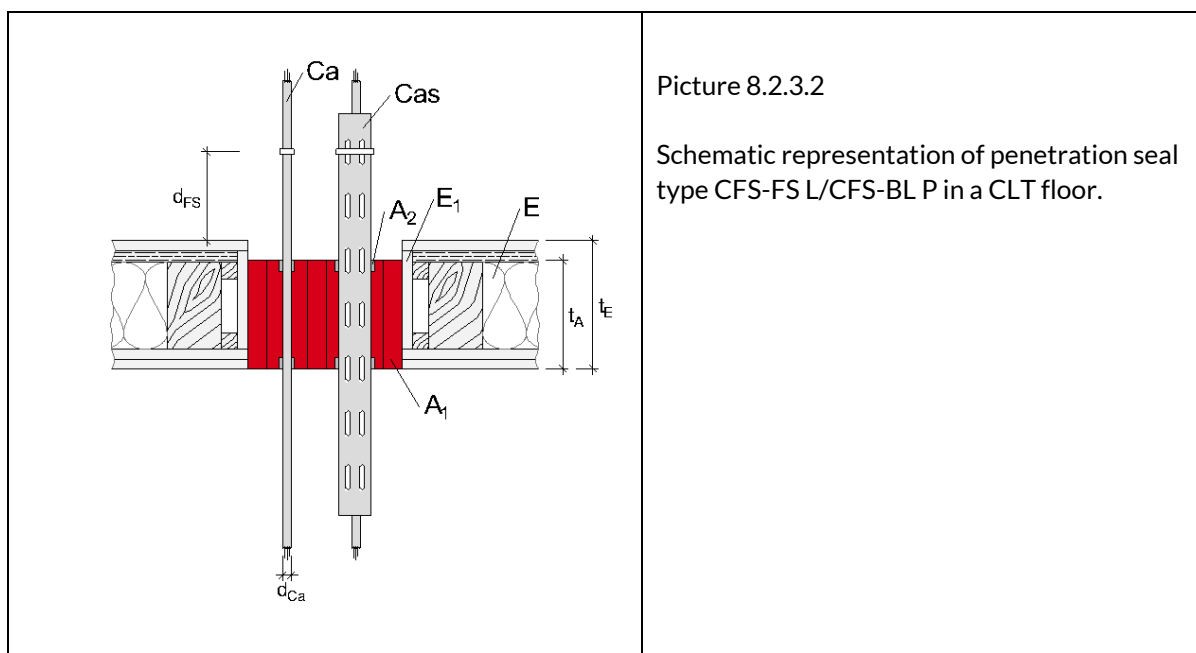


Figure 46: cable penetration applications through CFS-FS L or CFS-BL P seal in a 8.2.3 Closed timber beam floor construction

Single and multiple cable penetration (C)	Diameter (d_c) [mm]	Classification CFS-FS L / CFS-BL P
All sheathed cable types* with and without cable tray	≤ 50 mm	EI 90

Figure 47: Classifications for cable penetrations in Closed timber beam floor construction

* currently and commonly used in building practice in Europe; Non-sheathed cables and waveguides not covered

8.2.4 Cross laminated timber wall - type Leno Brettsperrholz – construction type C

- “Leno Brettsperrholz” cross laminated timber acc. ETA-10/0241
- or CLT types classified according to EN 16351
- minimum total thickness ≥ 148 mm
- number of cross-laminated timber layers: ≥ 6
- PU / MUF adhesives permitted.
- edge glue not required
- one of the second outer layers 34 mm
- the other layers ≥ 24 mm
- valid only for softwood CLT types such as: spruce/fir, pine, larch, stone pine

8.2.4.1 Minimum distances for penetrants in Leno Brettsperrholz wall

Minimum distances [mm] in between	Cables up to 21	Cables up to 50	Side seal edge	Upper seal edge	Bottom seal edge
Cables up to 21	0	0	0	0	0
Cables up to 50	0	0	0	70	0

8.2.4.2 Cable seal – single and multiple

- Sheathed cables only
- With and without cable supports penetrating the seal

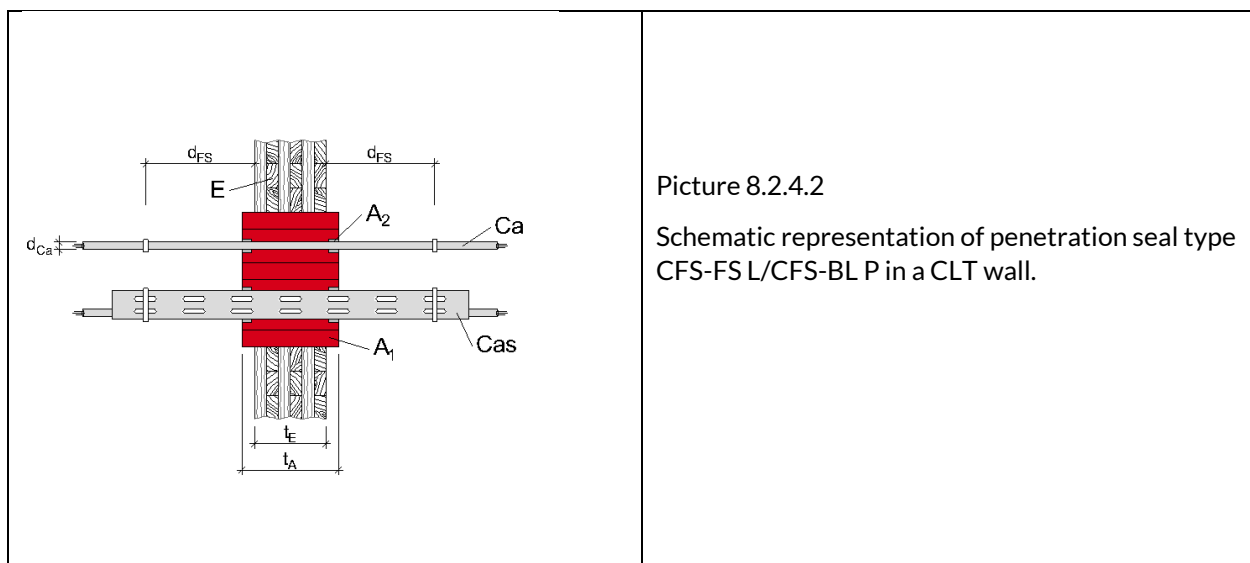


Figure 48: cable penetration applications through CFS-FS L or CFS-BL P seal trough a timber wall construction

Single and multiple cable penetration (C)	Diameter (d _c) [mm]	Classification CFS-FS L / CFS-BL P
All sheathed cable types without cable tray	≤ 21 mm	EI 90
All sheathed cable types with and without cable tray	≤ 50 mm	EI 60, E 90

Figure 49: Classifications for cable penetrations in timber beam wall construction

8.2.5 Timber stud partition wall – construction type D

- minimum total thickness ≥ 152 mm
- center to center distance stud ≤ 595 mm
- wood frame strength class C24 acc. EN 338 / min. 60 mm x 80 mm
- symmetric line double layer gypsum plasterboard/ class F acc. EN 520 / each 18 mm thick
- cavity filled with stone wool density $\rho \geq 44 \text{ kg/m}^3$

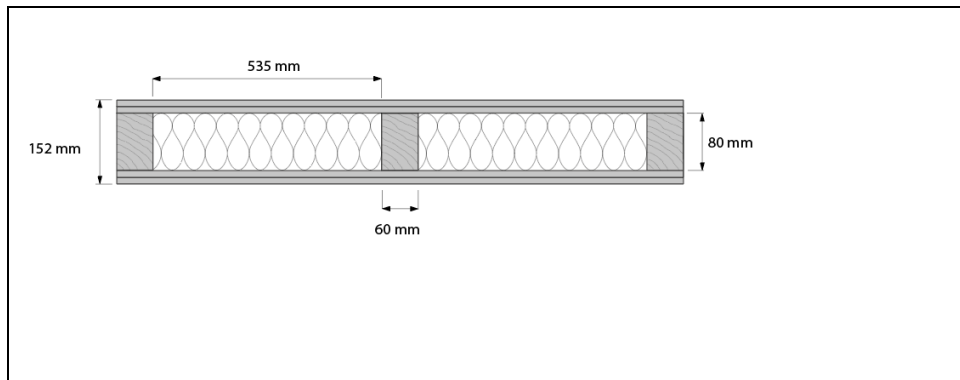


Figure 50: Timber stud partition wall – top view

In the timber stud wall, the opening was framed with a 18 mm thick gypsum plasterboard.

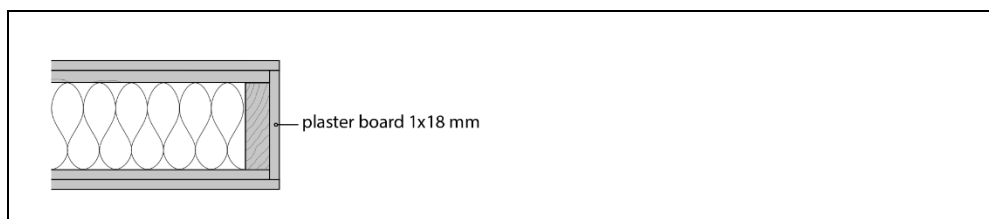


Figure 51: Frame at opening in a wall

8.2.5.1 Minimum distances for penetrants in timber stud partition wall

Minimum distances [mm] in between	Cables up to 21	Cables up to 50	Side seal edge	Upper seal edge	Bottom seal edge
Cables up to 21	0	0	0	0	0
Cables up to 50	0	0	0	70	0

8.2.5.2 Cable seal – single and multiple

- Sheathed cables only
- With and without cable supports penetrating the seal

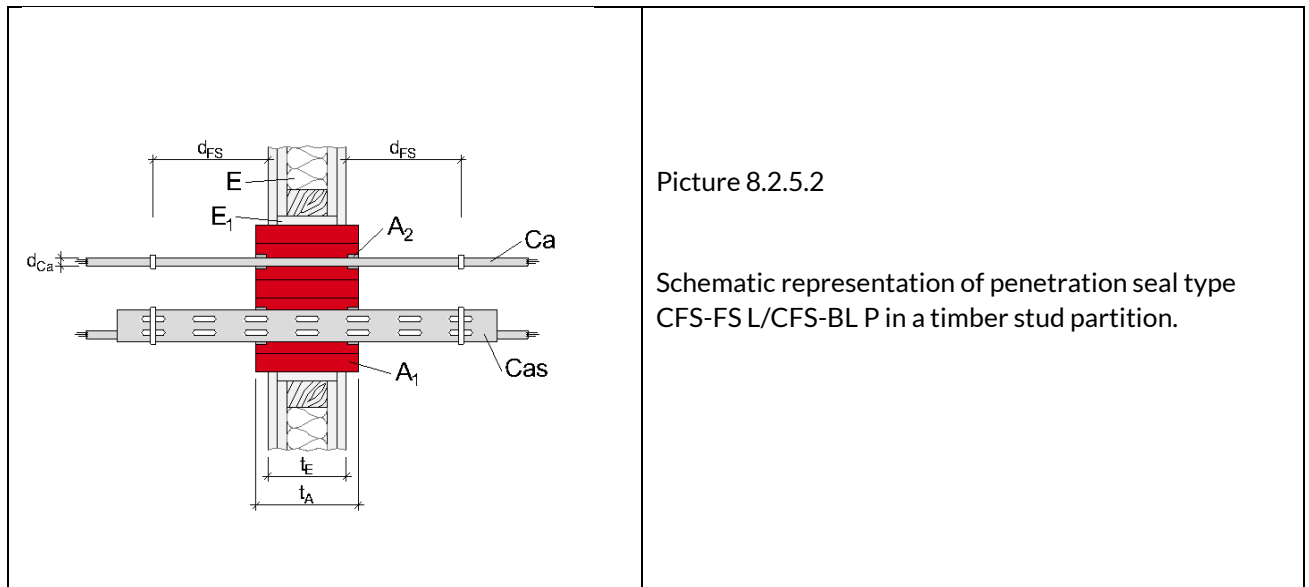


Figure 52: cable penetration applications through CFS-FS L or CFS-BL P seal trough a timber stud partition wall construction

Single and multiple cable penetration (C)	Diameter (d _c) [mm]	Classification CFS-FS L / CFS-BL P
All sheathed cable types* without cable tray	≤ 21 mm	EI 60, E 90
All sheathed cable types* with and without cable tray	≤ 50 mm	EI 60, E 90

Figure 53: Classifications for cable penetrations in timber stud partition wall construction

8.2.6 Acceptable variations of construction type A to D

The following variations are acceptable for the elements without a negative effect on the fire resistance performance:

For the cross laminated timber elements (floor type A and wall type C): the cross laminated timber must be manufactured in accordance with the applicable ETA; the CLT elements (walls / floors) must be classified in accordance with EN 13501-2 for the required fire resistance period or fulfil the requirements of the relevant Eurocode:

- increase in element thickness;
- increase in the thickness of the layers;

For the timber beam floor construction (floor type B); the floor must be classified in accordance with EN 13501-2 for the required fire resistance period or fulfil the requirements of the relevant Eurocode;

- increase in the cross section of the timber beams (to EN 14081-1);
- increase in the thickness of the floor;
- decrease of the span;
- increase in the thickness of the applied boards (gypsum plasterboards (to EN 570) and/or OSB (OSB 3 to EN 13986).

For the timber stud partition (wall type D); the wall must be classified in accordance with EN 13501-2 for the required fire resistance period or fulfil the requirements of the relevant Eurocode;

- increase in the cross section of the timber studs;
- use of suitable metal studs
- increase in the thickness of the wall;
- increase in the thickness of the applied boards.
- the test results will also apply to concrete or masonry wall elements of an overall thickness of 152 mm or more.

9. ANNEX D – Installation of the product (instruction for use)

The application (appropriate installation) of Hilti Firestop Flexible seal CFS-FS / Hilti Firestop Block CFS-BL P is described and illustrated in chapter 8 – Annex C.

The folder Instruction for use is available at Hilti website: www.hilti.group

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

10. ANNEX E – Abbreviations

Abbreviations used in drawings

A ₁	Hilti Firestop Flexible Seal CFS-FS
A ₂	Annular gap seal (gap filler) Hilti Firestop Filler CFS-FS or Hilti Firestop Foam CFS-F FX
A ₃	Hilti Firestop Bandage CFS-B
a / a'	Distances (various)
b / b'	Distances (various)
C	Plastic pipe
c / c'	Distances (various)
D	Pipe insulation
d / d'	Distances (various)
d _C	Pipe diameter (nominal outside diameter)
d _{FS}	Distance First Support
d _{Cab}	Diameter (nominal outside diameter) for cables and conduits
d _{Ctb}	Diameter conduit bundle for electric cables, optical cables
E	Building element (wall, floor)
E ₁	Aperture framing / beading / additional framing
G	Rectangular pipe (channel)
h _T	Hight of trunking
L	Length
L _D	Length of insulation
L _{DP}	Length of protection insulation
LP	Projecting length
Ca	Electric cables, optical cables
Cas	Conduit for electric cables, optical cables
Ctb	Bundle of electric cables, optical cables
Cas	Cables support system
s	Distances (various)
s ₁	Minimum distance between single penetration seals
s ₂	Minimum distance between clustered pipes or other penetrating services within one penetration seal
s ₃	Minimum distance between penetrating service and building element
T	Trunking for cables
t _A	Total seal thickness
t _{A1}	Thickness of Hilti Firestop Flexible Seal CFS-FS
t _{A2}	Thickness of annular gap seal (gap filler)
t _C	pipe wall thickness
t _D	Insulation thickness
t _E	Thickness of building element
t _{E1}	Thickness of aperture framing of the building element
t _G	Wall thickness of rectangular pipe (channel)
t _{DA}	Thickness of additional protection insulation

V	Sleeve
w	Width
w _{E1}	Width of aperture framing / beading / additional framing
w _G	Width of channel
w _T	Width of trunking
X	Required hight of CFS-FS at top row services
Y	Required compression of CFS-FS at top row services
Y'	Mechanically induced downward movement
Z	Required hight at lower row services
ρ _E	Density of building element

Standard abbreviations as used in EN 1366-3:2021 (e.g. U/U, CS) are considered as common knowledge.