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appointed according to Article 29 of Construction Products Regulation 2011 as amended by the Construction Products (Amendment etc.) (EU Exit) Regulations 2019 and the Construction Products (Amendment etc.) (EU Exit) Regulations 2020

# UK Technical Assessment

# 0843-UKTA-22/0041 of 31/03/2023

| | |
|---|---|
| **Technical Assessment Body Issuing the UKTA:** | UL International (UK) Ltd |
| **Trade name of the construction product** | Hilti Firestop Foam CFS-F FX |
| **Product family to which the construction product belongs** | Fire Stopping and Fire Sealing Products - Penetration Seals |
| **Manufacturer** | Hilti Corporation<br>Feldkircherstrasse 100<br>9494 Schaan<br>LIECHTENSTEIN |
| **Manufacturing plant(s)** | HILTI production plant 4a |
| **This UK Technical Assessment contains** | 93 pages including 5 Annexes which form an integral part of this assessment |
| **This UK Technical Assessment* is issued, on the basis of** | EAD 350454-00-1104, September 2017 |



*** in accordance with Construction Products Regulation 2011 as amended by the Construction Products (Amendment etc.) (EU Exit) Regulations 2019 and the Construction Products (Amendment etc.) (EU Exit) Regulations 2020**

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**SPECIFIC PARTS OF THE UK TECHNICAL ASSESSMENT**

## 1 Technical description of the product

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

## 2 Specification of the intended use(s) in accordance with the applicable UK Assessment Document (Pre-Exit European Assessment Document): EAD 350454-00-1104

### 2.1 General description of the use of Hilti Firestop CFS-F FX

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

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

- flexible walls, rigid walls, cross-laminated timber (CLT) walls
- rigid floors, cross-laminated timber (CLT) floors

The seal is formed by applying Hilti Firestop Foam CFS-F FX into 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 | 8.3, 8.4, 8.5, 8.6, 8.7 |
| Cables / cable trays | 8.3, 8.4, 8.5, 8.6, 8.7 |
| Conduits | 8.3, 8.4, 8.5, 8.6, 8.7 |
| Metal pipes | 8.3, 8.4, 8.5, 8.6, 8.7 |
| Plastic pipes | 8.3, 8.4, 8.5, 8.6, 8.7 |
| Mixed | 8.3, 8.4, 8.5, 8.6 |

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

Hilti Firestop Foam CFS-F FX is intended for environmental conditions as defined by use category $Y_2$ (intended for use at temperatures between -20 °C and + 70°C, but with no exposure to rain nor to UV) according to EOTA TR 024.

The provisions made in this UK Technical Assessment are based on an assumed working life of this "Fire Stopping and Sealing Product" of 25 years, provided that the conditions relating to manufacturing, installation, use and repair, are met. In normal use conditions the real working life might be considerably longer.

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

### 2.2 Additional components for pipe penetrations

In some cases (see Annex C) of plastic pipes and metal pipes with combustible insulations (reaction to fire class B to E according to EN 13501-1) a Hilti Firestop Bandage CFS-B (see UKTA-22/0038) is wrapped around the pipe.

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

| Basic requirements for construction works | Essential characteristic | Method of verification | Performance |
|---|---|---|---|
| **BWR 2** | Reaction to fire | EN 13501-1 | Clause 3.1.1 of this UKTA |
| | Resistance to fire | EN 13501-2 | Clauses 3.1.2 and Annex C of this UKTA |
| **BWR 3** | Air permeability | EN 1026 | Clause 3.2.1 of this UKTA |
| | Water permeability | No performance assessed | |
| | Content and/or release of dangerous substances | Declaration of conformity by the manufacturer | |
| **BWR 4** | Mechanical resistance and stability | EOTA TR 001 | Clause 3.3.1 of this UKTA |
| | Resistance to impact/movement | EOTA TR 001 | Clause 3.3.1 of this UKTA |
| | Adhesion | Clause 3.3.3 of this UKTA | |
| | Durability | Clause 3.3.4 of this UKTA | |
| **BWR 5** | Airborne sound insulation | Clause 3.4.1 of this UKTA | |
| **BWR 6** | Thermal properties | No performance assessed | |
| | Water vapour permeability | No performance assessed | |

## 3.1 Safety in case of fire (BWR 2)

3.1.1 Reaction to fire

"Hilti Firestop Foam CFS-F FX" is classified 'E' in accordance with EN 13501-1.

3.1.2 Resistance to fire

The resistance to fire performance according to EN 13501-2 of penetration incorporating Hilti Firestop Foam CFS-F FX is given in Annex C.
Information on ancillary products which were tested within the framework of this UK Technical Assessment for evaluating resistance to fire is given in Annex B.
Other parts or supporting constructions other than those given in Annex 2 must not penetrate the seal.
Provisions shall be taken such that floor penetration seals cannot be stepped on or are not subjected to forces higher than the limit taken from the impact tests, e.g. by covering with a wire mesh.

## 3.2 Hygiene, health and environment (BWR 3)

3.2.1 Air permeability

The air permeability of "Hilti Firestop Foam CFS-F FX" was tested according to EN 1026:2016 and EN 12211:2016 in an aerated concrete wall. The overall dimensions of the test specimen were 250 mm high x 250 mm wide x 150 mm thick.

Up to a pressure difference of 9750 Pa no air permeability was measured.

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

3.2.2 Water permeability

No performance assessed.

3.2.3 Content, emission and/or release of dangerous substances.

The manufacturer has provided a declaration on the content, emission and/or release of dangerous substances in relation to their products with the title "Statement on Product Regulatory Compliance: Version 1.1 October 2022).

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

**3.3 Safety and accessibility in use (BWR 4)**

3.3.1 Mechanical resistance and stability

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

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

3.3.2 Resistance to impact / movement

See above, clause 3.3.1.

3.3.3 Adhesion

It is assumed that verification of adequate adhesion is covered by the impact tests detailed in clause 3.3.1.

3.3.4 Durability

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

Products intended for use at temperatures between -20 °C and + 70°C, but with no exposure to rain nor UV in accordance with EAD 350454-00-1104, Section 1.2.

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

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

## 3.4 Protection against noise (BWR 5)

### 3.4.1 Airborne sound insulation

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

According to these tests reports the single number ratings are:

Weighted sound reduction index: $R_w(C;C_{tr})$ = 61(-1;-6) dB

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

*Regarding the value $D_{n,e,w}(C;C_{tr})$: $A_o$ = 10 $m^2$ reference area*

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

The total thickness of the wall element described in the table below: $t_{wall}$ = 155 mm. The outer dimensions of the same wall: W x H = 1200 mm x 1480 mm. This wall element was penetrated by a square opening of w x h = 200 mm x 200 mm which was filled with Hilti Firestop Foam CFS-F FX. The total thickness of the penetration seal was 200 mm, i.e., 45 mm thicker than the wall element. This was made possible by 3 layers of plasterboard strips mounted around the opening on each side.

| **Description of the wall element, in layers** |
|---|
| 2 x 12.5 mm plasterboard |
| 50 mm steel frame with 40 mm mineral wool |
| 5 mm air gap, i.e. distance |
| 50 mm steel frame with mineral wool |
| 2 x 12.5 mm plasterboard |

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

## 3.5 Energy economy and heat retention (BWR 6)

### 3.5.1 Thermal properties

No performance assessed.

### 3.5.2 Water vapour permeability

No performance assessed.

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

According to the Statutory Instrument 2019 No. 465 – made 5th March 2019 and cited as the Construction Products (Amendment etc.) (EU Exit) Regulations 2019 and coming into force on exit day and Statutory Instrument 2020 No. 1359 – made 26th November 2020 and cited as the Construction Products (Amendment etc.) (EU Exit) Regulations 2020 and coming into force immediately before the 2019 Regulations come into force, on the procedure for attesting the conformity of construction products as regards fire stopping, fire sealing and fire protective products, published as 'Pre-Exit' European Assessment Documents, (see https://www.gov.uk/guidance/pre-exit-european-assessment-documents-construction-products), the system of assessment and verification of constancy of performance (see Annex V to Construction Products Regulation 2011 as amended by the Construction Products (Amendment etc.) (EU Exit) Regulations 2019 and the Construction Products (Amendment etc.) (EU Exit) Regulations 2020) given in the following table(s) apply.

| Product(s) | Intended use(s) | Level(s) or class(es) | System |
|---|---|---|---|
| Fire Stopping and Fire Sealing Products | For fire compartmentation and/or fire protection or fire performance | any | 1 |

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

Tasks of the manufacturer:
Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this UK Technical Assessment.

The manufacturer may only use initial / raw / constituent materials stated in the technical documentation of this UK Technical Assessment.

The factory production control shall be in accordance with the Control Plan of 14/01/2022 relating to the UK Technical Assessment 0843-UKTA-22/0041 issued on 31/03/2023 which is part of the technical documentation of this UK technical Assessment. The "Control Plan" is laid down in the context of the factory production control system operated by the manufacturer and deposited at UL International (UK) Ltd.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the Control Plan.

Other tasks of the manufacturer
Additional information

The manufacturer shall provide a technical data sheet and an installation instruction with the following minimum information:

(a) Technical data sheet:

- Field of application:
- Building elements for which the penetration seal is suitable, type and properties of the building elements like minimum thickness, density, and - in case of lightweight constructions – the construction requirements.
- Limits in size, minimum thickness etc. of the penetration seal
- Construction of the penetration seal including the necessary components and additional products (e.g. backfilling material) with clear indication whether they are generic or specific.
- Services which the penetration seal is suitable, type and properties of the services like material, diameter, thickness etc. in case of pipes including insulation materials; necessary/allowed supports/fixings (e.g. pipe trays)

(b) Installation instruction:

- Steps to be followed
- Procedure in case of retrofitting
- Stipulations on maintenance, repair and replacement

**Issued on: 31st March 2023**

Report by:

C. Sweeney
Project Engineer Associate
Built Environment
**For and on behalf of UL International (UK) Ltd**.

Reviewed by:

D. Yates
Senior Project Engineer
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## 6 ANNEX A: REFERENCE DOCUMENTS

### 6.1 References to standards mentioned in the UKTA

| | |
|---|---|
| EN 1026 | Windows and doors – Air permeability – Test method |
| EN 1366-3 | Fire resistance tests for service installations - Part 3: Penetration seals |
| EN 1519 | Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Polyethylene (PE) |
| EN 13238 | Reaction to fire tests for building products: Conditioning procedures and general rules for selection of substrates |
| EN 13501-1 | Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests |
| EN 13501-2 | Fire classification of construction products and building elements – Part 2: Classification using test data from fire resistance tests |
| EN 13823 | Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item |
| EN ISO 140-3 | Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurements of airborne sound insulation of building elements |
| EN ISO 140-10 | Acoustics – Measurements of sound insulation in buildings and of building elements – Part 10: Laboratory measurement of airborne sound insulation of small building elements |
| EN ISO 717-1 | Acoustics – Rating of sound insulation of buildings and of building elements – Part 1: Airborne sound insulation |
| EN ISO 1452-2 | Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - Unplasticized poly(vinyl chloride) (PVC-U) - Part 2: Pipes |
| EN ISO 11925-2 | Reaction to fire tests – Ignitability of building products subjected to direct impingement of flame – Part 2: Single-flame source test |
| EN ISO 15493 | Plastics piping systems for industrial applications - Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) - Specifications for components and the system; Metric series |
| EN ISO 15494 | Plastics piping systems for industrial applications - Polybutene (PB), polyethylene (PE) and polypropylene (PP) - Specifications for components and the system; Metric series |
| HD 22.4 | Cables of rated voltages up to and including 450/750 V and having crosslinked insulation – Part 4: Cords and flexible cables |
| HD 640.5 | 0.6/1kV Power cables with special fire performance for use in power stations – Part 5: single core and multicore halogen-free cables |

### 6.2 Other reference documents

| | |
|---|---|
| EOTA TR 001 | Determination of impact resistance of panels and panel assemblies |
| EOTA TR 024 | Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products |

Safety Data Sheet according to 1907/2006/EC, Article 31, for Hilti Firestop Foam CFS-F FX

## 7 ANNEX B: DESCRIPTION OF THE PRODUCT AND ANCILIARY PRODUCT(S)

### 7.1 Hilti Firestop Foam CFS-F FX

The Control Plan is defined in document "Control Plan" relating to the UK Technical Assessment UKTA-22/0041 - Hilti Firestop Foam CFS-F FX" which is a non-public part of this UKTA.

Foil pack 325ml

Mixing nozzle

### 7.2 Use of small, cured oddments /cured pieces of CFS-F FX

Small scale cured pieces of CFS-F FX may be used as a floating barrier or to fill bigger gaps in other seals. There is an excellent adhesion of the fresh, liquid foam and cured CFS-F FX-foam pieces. Used oddments should be covered completely with freshly applied foam.

### 7.3 Dispenser

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

MD 2000


ED 3500

HDM 330


HDE 500-A22

**7.4 Technical product literature**

- Technical Datasheet Hilti Firestop Foam CFS-F FX including instructions for the use of Hilti Firestop Foam CFS-F FX
- Instruction for Use (see Annex D)
- Material Safety Data Sheet (MSDS)

**7.5 Ancillary components**

**7.6 Hilti Firestop Bandage CFS-B**

For specification and further details see UKTA-22/0038.


The bandage is positioned with half of its width (62.5 mm) within the seal (central marking line at the surface of the seal), secured by means of adhesive tape and fixed with metallic wire. For necessary number of layers of the bandage see the relevant chapter in Annex C

Supporting documents:

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

## 8 ANNEX C - RESISTANCE TO FIRE CLASSIFICATION OF HILTI FIRESTOP FOAM CFS-F FX

### 8.1 Intended Use of Penetrants and Reference to Relevant Sections

| Intended use of penetrations and reference to relevant section (list not exhaustive, other uses of pipes may be possible) | | | | | |
|---|---|---|---|---|---|
| Application | Penetration material | Flexible & rigid wall ≥ 100 mm | Rigid floor ≥ 150 mm | Cross-laminated timber wall ≥ 80 mm | Cross-laminated timber floor ≥ 80 mm |
| Cables | Sheathed, Wire tied bundles | 8.3.1.3 | 8.5.4 | 8.4.5 | 8.6.5 |
| Electrical conduits | PVC, PO | 8.3.1.5 | 8.5.5 | 8.4.6 | 8.6.6 |
| Heating pipes Potable water pipes | Copper | 8.3.1.7 and 8.3.2.4 | 8.5.6.1 and 0 | 8.4.7 | 8.6.7 |
| | Steel, stainless | 8.3.1.6 and 8.3.2.3 | 8.5.7 and 8.5.6 and 8.5.8 | 8.4.7 | 8.6.7 |
| | Al-composite | 8.3.1.14 | 8.5.9 | 8.4.9 | n.a. |
| Chilled water pipes | Steel, stainless | 8.3.2.3 and 8.3.2.3 | 8.5.8 and 8.5.7 | n.a. | n.a. |
| | PE PVC | 8.3.1.15 | 8.5.10 | 8.4.8 | 8.6.8 |
| Air condition | Clima Split pipe bundles | 8.3.1.19 | 8.5.12 | 0 | 8.6.9 |

### 8.2 General Information Hilti Firestop Foam CFS-F FX

#### 8.2.1 Penetration seal and penetrant orientation

Single penetration seal if not other indicated. The foam should be applied over the entire wall/floor thickness. The penetrants should penetrate the wall/floor seal in a perpendicular situation only, if not other indicated.

#### 8.2.2 Suitable building structures, where CFS-F FX may be used

Hilti Firestop Foam may be used to seal penetration in flexible and rigid walls, in rigid floors, in cross-laminated timber walls and floors. For details refer to section 8.3, 8.4, 8.5, 8.6.

#### 8.2.3 Seal Thickness increase / Aperture framing and beading

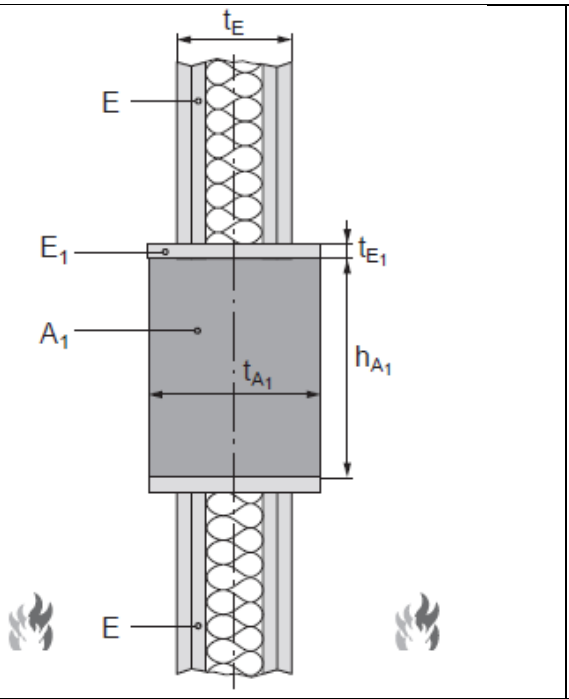
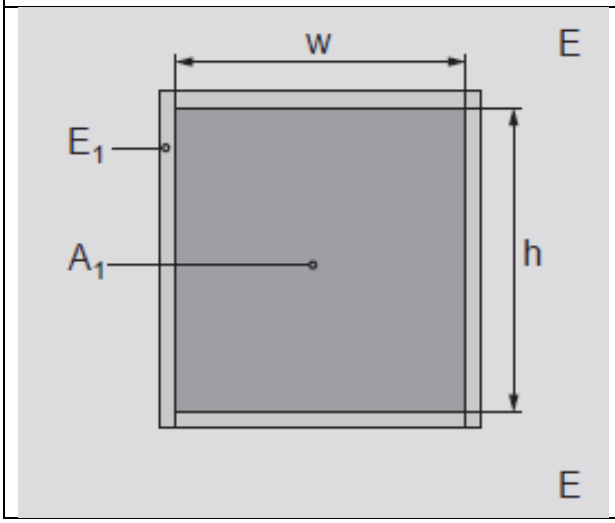
Where the required seal thickness $t_A$ given in *8. ANNEX C - RESISTANCE TO FIRE CLASSIFICATION OF HILTI FIRESTOP FOAM CFS-F FX* is higher than the wall or floor thickness $t_E$, a support frame ($E_1$) – aperture framing or beading - shall be installed to support the Hilti Firestop Foam CFS-F FX as illustrated in Fig. 8.2.3. A -G.

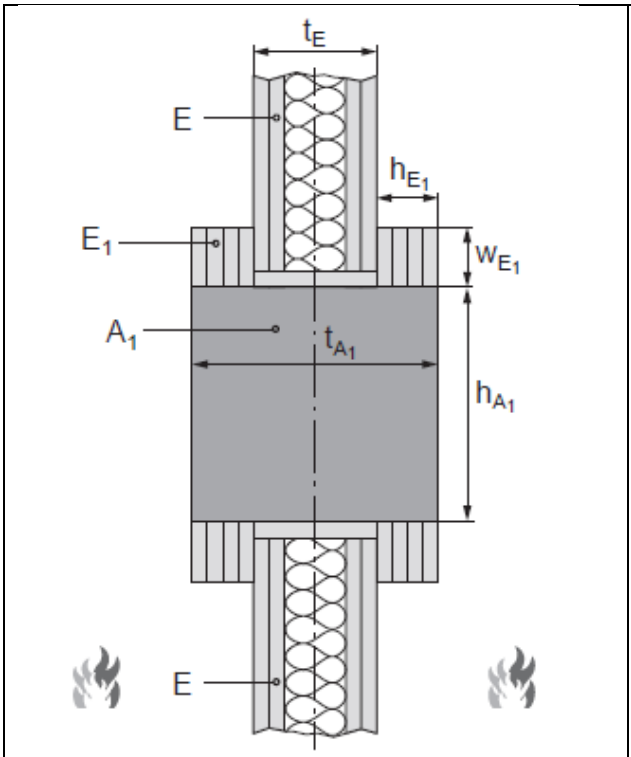
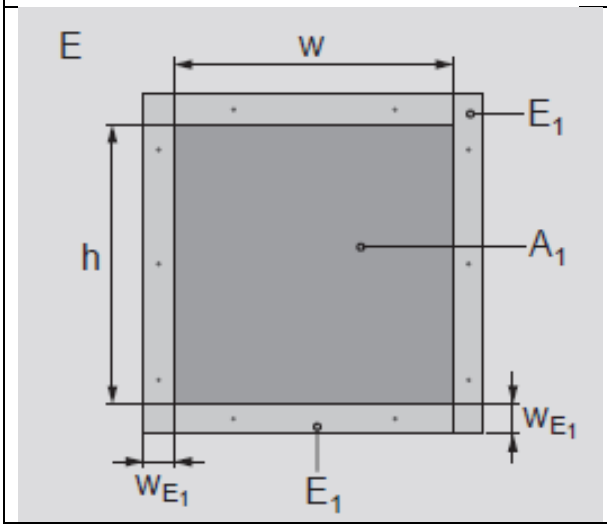
For flexible/rigid walls with aperture framing (refer to fig.8.2.3. A, B):

- Centred position related to wall
- Framing depth related to requested seal thickness $t_{A1}$
- Possible (not mandatory) seal between framing and wall with Hilti Firestop Acrylic Sealant CFS-S ACR
- Material for aperture framing: material of class A1 or A2 according to EN 13501-1 (e.g. gypsum board acc. EN 520)

For flexible/rigid/cross-laminated timber walls with outside framing (beading) (refer to fig.8.2.3. C, D):

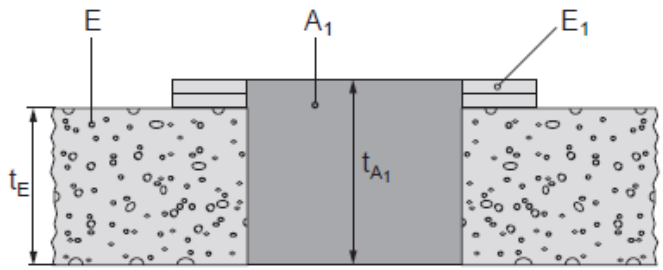
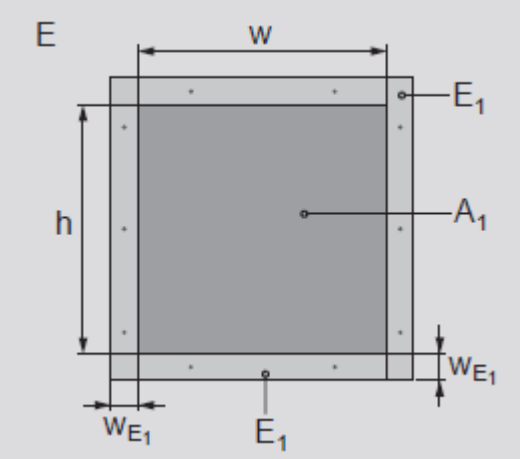
- Identical framing set-up on both sides of the wall
- Framing depth related to requested seal thickness $t_{A1}$
- Framing width $w_{E1} \geq 50$ mm for wall applications
- Fixing of framing parts with at least 2 metal screws
- Max. distance between fixing screws: 150mm
- Possible (not mandatory) seal between framing and wall with Hilti Firestop Acrylic Sealant CFS-S ACR
- Framing in cross-laminated timber walls to be made from timber boards/strips

| | |
|---|---|
|  | 8.2.3. A:<br>Wall penetration (empty seal) with installed aperture framing $E_1$.<br>(Applicable for rigid or flexible walls) |
|  | 8.2.3. B:<br>Wall penetration (empty seal) with installed aperture framing $E_1$.<br>(Applicable for rigid or cross-laminated timber walls too) |

| | |
|---|---|
|  | 8.2.3.C:<br>Wall penetration (empty seal) with installed outside framing (beading)<br>(Applicable for rigid or cross-laminated timber walls too)<br>The shown aperture framing within the wall is not mandatory, but helpful in cases, where no mineral wool is inside the wall) |
|  | 8.2.3.D:<br>Wall penetration (empty seal) with installed outside framing (beading)<br>(Applicable for rigid or cross-laminated timber walls too) |

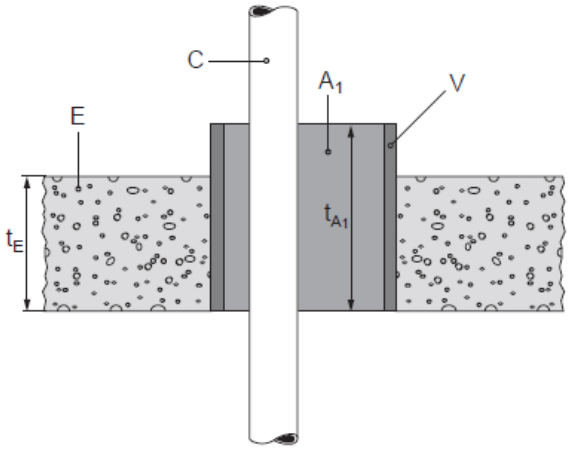
For rigid/cross-laminated timber floors with outside framing (beading) (refer to fig.8.2.3. E, F):

- Framing set-up on top side of floor only
- Framing depth related to requested seal thickness $t_{A1}$
- Framing width $w_{E1} \geq 50$ mm for rigid/cross-laminated timber floor applications
- Fixing of each framing parts with at least 2 metal screws
- Max. distance between fixing screws: 150mm
- Possible (not mandatory) seal between framing and wall with Hilti Firestop Acrylic Sealant CFS-S ACR
- Framing material in rigid floor: material of class A1 or A2 according to EN 13501-1 (e.g. gypsum board acc. EN 520)
- Framing material in cross-laminated timber floor: to be made from timber boards/strips

| | |
|---|---|
|  | 8.2.3. E:<br>Floor penetration with installed outside framing<br>(Applicable for cross-laminated timber floors too) |
|  | 8.2.3. F:<br>Floor penetration with installed outside framing on top side only<br>(Applicable for cross-laminated timber floors too)<br>(View from top side) |

In some cases of floor penetration in rigid floors a sleeve V could be used as framing, refer to fig. 8.2.3. G:

- PVC-sleeve casted into the rigid floor, flush with bottom side of floor
- Sleeve length = seal thickness $t_{A1}$




8.2.3. G:
Floor penetration with sleeve V

### 8.2.4 Seal Size

For the approved seal size and E/I-classification in wall and floor (empty and penetrated seal) refer to section 8.3, 8.4, 8.5 and 8.6.

### 8.2.5 First support for pipe penetrants

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

| | **Flexible and Rigid Wall** (identical on both sides of the wall): | **Rigid Floor** (topside only) |
|---|---|---|
| **Pipes** | 300 mm | 250 mm |
| **Cables** | 500 mm | 415 mm |
| | **Cross-laminated timber Wall** (identical on both sides of the wall): | **Cross-laminated timber Floor** (topside only) |
| **Pipes** | 350mm | 350mm |
| **Cables** | 350mm | 350mm |

### 8.2.6 Foamed elastomeric insulation products for pipe insulation

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

| Manufacturer | Product designation |
|---|---|
| Armacell International GmbH | Armaflex AF, 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 ECO, K-Flex ST Frigo, |
| 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.

### 8.2.7 Sound decoupling insulation

No sound decoupling insulation has been tested and has been approved on plastic pipes. Based on the soft and flexible mechanical structure of CFS-F FX normally there is no need for additional decoupling.

### 8.2.8 Mineral wool pipe insulation

Mineral wool pipe insulation, installed in CS (continued sustained) – if not other indicated in specific section 8.3, 8.4, 8.5, 8.6. Type: Rockwool RS800 or equal.
Reaction to Fire class: $A2_{L\text{-}s1}$, d0 acc. EN 13501-1 or better
Melting Point: > 1000°C acc. DIN 4102-17

### 8.2.9 Metal pipes

The field of application given in 8. Annex C (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.

### 8.2.10 Polyethylene-based insulation

The following foamed polyethylene based thermal insulation material can be considered to be identical according to their behaviour in fire acc. EN 1366-3:

- 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

### 8.2.11 General rules for penetrating items

The seals may only be penetrated by the services described in 8. Annex C (Resistance to fire). 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 assessment does not address any risks associated with leakage of dangerous liquids or gases caused by failure of the pipe(s) in case of fire.
- The durability assessment does not take account of the possible effect of substances permeating through the pipe on the penetration seal.
- The classifications for metal and plastic pipes relate to C/U (capped inside the furnace/uncapped outside), U/C (uncapped inside the furnace/capped outside) and U/U (uncapped inside the furnace/uncapped outside). For further information refer to national regulations.

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

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

The classification of the resistance to fire performance has been carried out in accordance with clause 7.5.8 in EN 13501-2:2007.
The classifications require that the rules for installation shown in sec.9 are followed.
The separating elements must be classified in accordance with EN 13501-2 for the required fire resistance period or fulfil the requirements of the relevant Eurocode.
The classifications are not valid for sandwich panel constructions.
Single Penetration seals require a minimum distance of 100mm.
For minimum distance of cable and pipe first support constructions with wall and floor seals see 8.2.5.

### 8.3 Flexible and rigid walls with seals made of Hilti CFS-F FX

All test results from flexible wall testing ($t_e \geq 100$mm) are applicable for rigid walls ($t_e \geq 100$mm) too.

#### 8.3.1 Specific characteristics for flexible and rigid walls with $t_E \geq 100$mm

For flexible walls:

The wall must have a minimum thickness of 100 mm and 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 of the seal to any stud and the cavity between stud and seal must be closed. A minimum 100 mm insulation of Class A1 or A2 (in accordance with EN 13501-1) has to remain in the cavity between stud and seal. In steel stud construction the space between linings has not to be completely filled with insulation material, especially in the neighbourhood to the seal. Nevertheless, the wall construction has to be set up according to requirements given in EN 1366-3:2009 or the construction itself has been classified according EN 13501-2.

The wall comprises timber or steel studs lined on both faces with minimum 2 layers of minimum 12,5 mm thick boards. A higher number of board layers is accepted if the overall board layer thickness is equal or bigger than tested. A higher overall board layer thickness is accepted, if the number of board layers is equal or bigger than tested.

The boards are according EN 520 type F or according to the specification of the tested and approved flexible wall construction system according EN 13501-2.

For Rigid walls, the wall must comprise concrete, aerated concrete or masonry, with a minimum density of 650 kg/m$^3$.

##### 8.3.1.1 Maximum seal size / Blank seals in rigid/flex. Wall

Construction details:

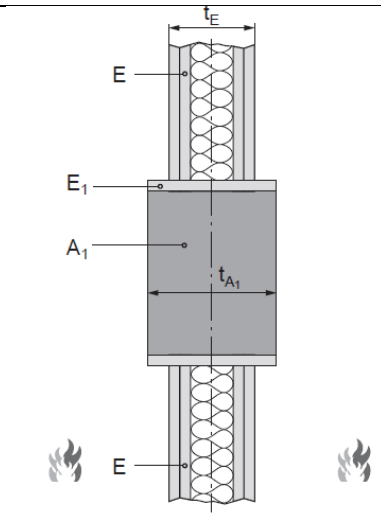
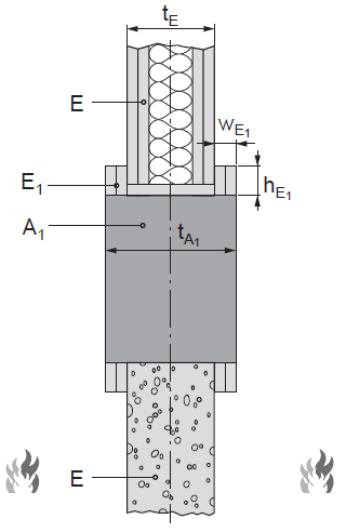
- Hilti Firestop Foam CFS-F FX (A) of thickness $t_A$ centred regarding the thickness of the building element (E).
- In case of seal thickness $t_A$ > building element thickness $t_E$, Fig. 8.3.2.A and Fig. 8.3.2.B

For symbols and abbreviations see sec.10, Annex E.

Maximum seal size (with and without penetrants):

| | Classification blank seal: | seal size: w x h | seal size: Ø | seal thickness: $t_{A1}$ |
|---|---|---|---|---|
| Wall penetrations | EI 90 | ≤ 600 x 600 mm | ≤ 600 mm | ≥ 100 mm |
| | EI 120 | ≤400 x 400 mm | ≤400 mm | ≥ 150 mm |

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

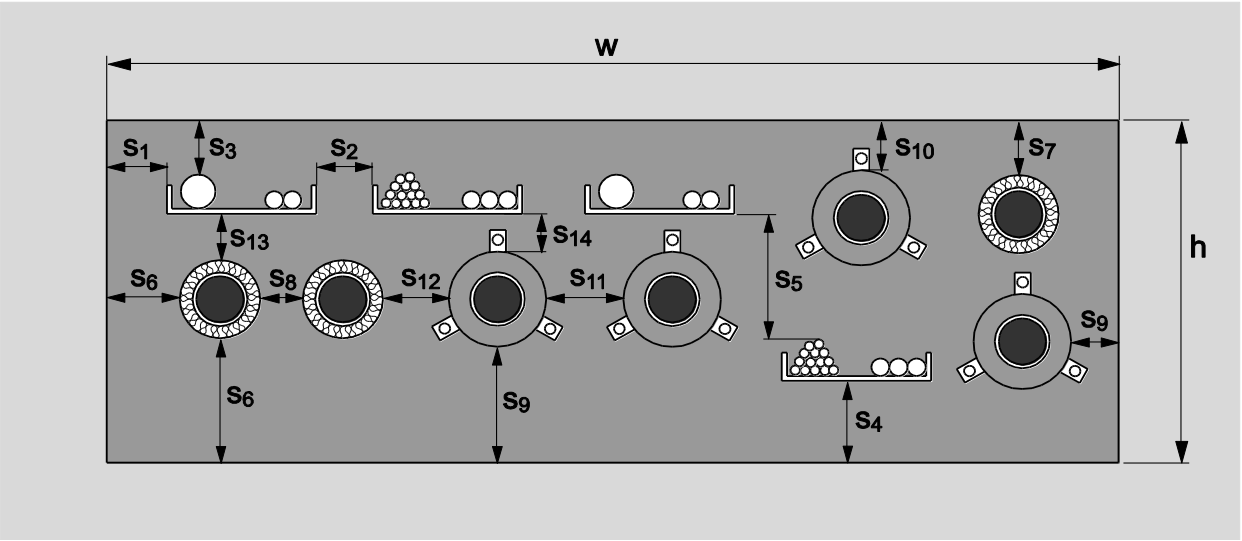
| | |
|---|---|
|  | 8.3.2 A:<br>Blank Seal in flexible wall using aperture framing, where $t_{A1}$ exceed $t_E$<br><br>For details refer to sec. 8.2.3 |
|  | 8.3.2 B:<br>Blank Seal in flexible or rigid wall using additional framing, where $t_{A1}$ exceed $t_E$ |

For first support refer to 8.2.5

#### 8.3.1.2 Minimum distances for penetrations ≥≥

The distances are valid for single, multiple and mixed penetrations in flexible/rigid walls only.

| | Valid for flexible/rigid walls only. | Minimum distance (mm) |
|---|---|---|
| $s_1$ | (distance between cables/cable supports and seal edge) | 0 |
| $s_2$ | (distance between cable supports) | 0 |
| $s_3$ | (distance between cables and upper seal edge) | 25 |
| $s_4$ | (distance between cable supports and bottom seal edge) | 0 |
| $s_5$ | (distance between cables and cable support above) | 50 |
| $s_6$ | (distance between metal pipes and seal edge) | 0 |
| $s_7$ | (distance between metal pipes and upper seal edge) | 20 |
| $s_8$ | (distance between metal pipes) linear arrangement | 0 |
| $s_8$ | (distance between metal pipes) grouped arrangement | 40 |
| $s_9$ | (distance between plastic pipes/pipe closure devices and seal edge) | 0 |
| $s_{10}$ | (distance between plastic pipes/pipe closure devices and upper seal edge) | 20 |
| $s_{11}$ | (distance between plastic pipes/pipe closure devices) | 35 |
| $s_{12}$ | (distance between metal pipes and plastic pipes/pipe closure devices) | 35 |
| $s_{13}$ | (distance between cables/cable supports and metal pipes) | 50 |
| $s_{14}$ | (distance between cables/cable supports and plastic pipes/pipe closure devices) | 50 |

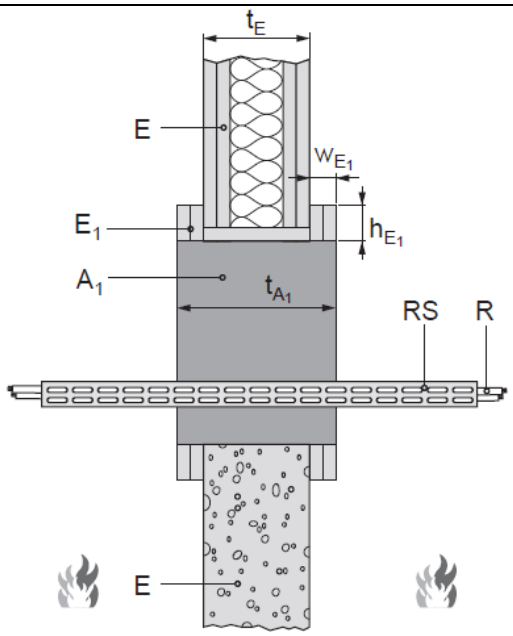
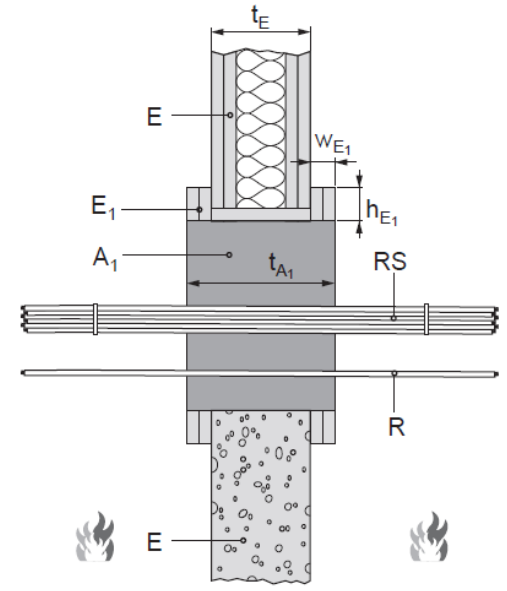


#### 8.3.1.3 Cable seal in flexible or rigid wall

Construction details:

- Hilti Firestop Foam CFS-F FX (A) of thickness $t_A$ centred regarding the thickness of the building element $t_E$.
- In case of seal thickness $t_A$ > building element thickness $t_E$, see sec.8.2.3.

For symbols and abbreviations see 10.

| | |
|---|---|
|  | 8.3.4.1.A:<br>CFS-F FX seal, penetrated with a cable tray RS in flexible or rigid wall<br><br>Cable support construction: Perforated metal cable trays with a melting point higher than 1100°C (e.g. galvanised steel, stainless steel). Trays with organic coatings are covered if their overall classification is minimum A2 according to EN 13501-1. |
|  | 8.3.4.1.B:<br>CFS-F FX seal, penetrated with a single (R) or bunched cables (RB) in flexible or rigid wall |

#### 8.3.1.4 Cable penetrants in flexible and rigid wall constructions

Cables within flexible and rigid wall constructions according to sec.8.3.1:

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

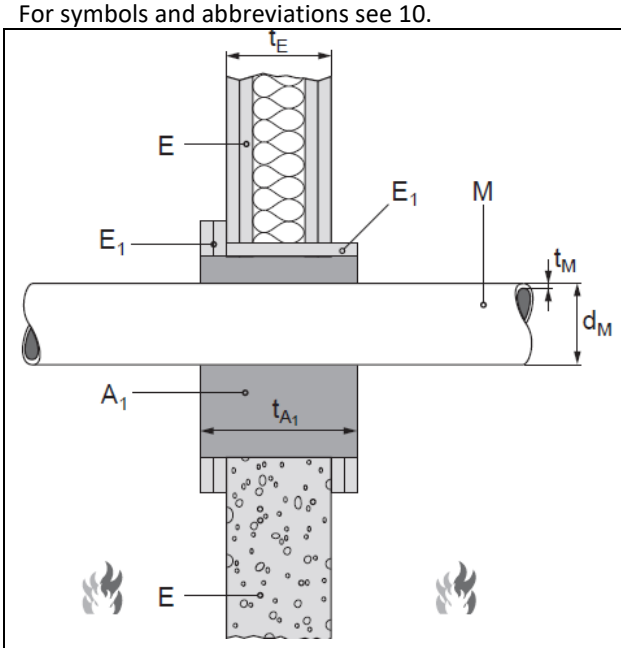
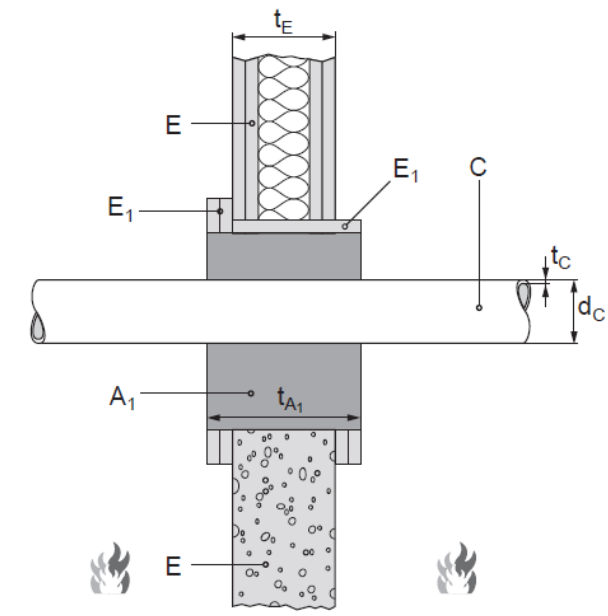
#### 8.3.1.5 Conduits and tubes with flexible and rigid wall constructions

Construction details:

- For construction details and drawings refer to fig.8.3.1.5. A and B.
- Steel conduits: for material refer to 8.2.9, copper excluded
- Plastic conduits material: all types of plastic approved
- For conduit bundle: max. Ø of single conduit in bundle: 32mm

| **Penetration seal / Services** | **Classification** (with and without cables) | |
|---|---|---|
| | (multiple) | (mixed) |
| seal thickness | $t_A \geq 100$ | $t_A \geq 200$ |
| Steel conduits and tubes,<br>Ø ≤16 mm | EI 90 C/U | EI 120 C/U |
| For field of application: refer to sec.8.2.11 | | |
| Plastic conduits and tubes,<br>Ø ≤16 mm | EI 120 U/U | EI 120 U/U |
| Flexible plastic conduits,<br>16mm ≤ Ø ≤ 32 mm | - | EI 120 U/U |
| Rigid plastic conduits,<br>16mm ≤ Ø ≤ 32 mm | - | EI 120 U/U |
| Bundle of plastic conduits, conduits flexible or rigid,16mm ≤ Ø ≤ 32 mm<br>Bundle diameter: Ø ≤ 100 mm | - | EI 120 U/U |

For symbols and abbreviations see 10.

| | |
|---|---|
|  | 8.3.1.5.A:<br>Metal conduit in flexible/rigid wall, sealed with CFS-F FX |
|  | 8.3.1.5.B:<br>Plastic conduit in flexible/rigid wall, sealed with CFS-F FX |

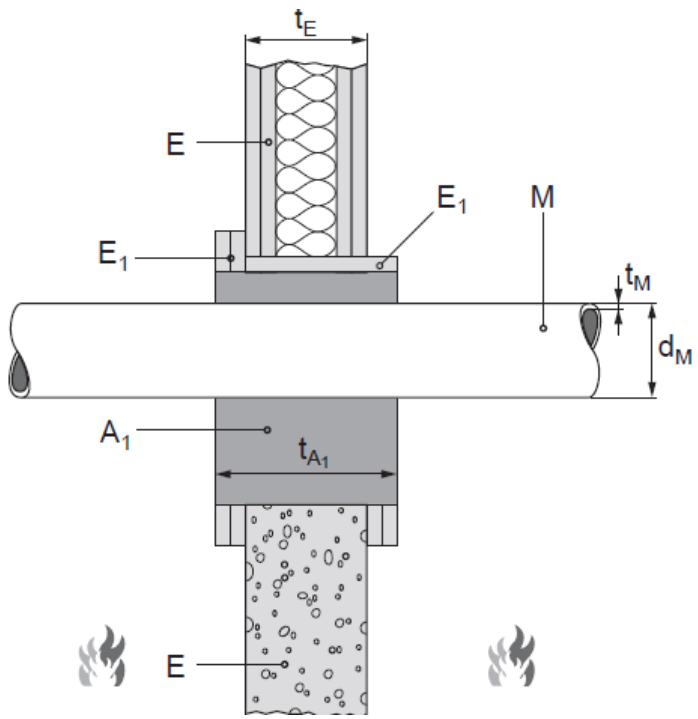
### 8.3.1.6 Metal pipes without insulation in flexible and rigid wall construction

Construction details :

- Hilti Firestop Foam CFS-F FX ($A_1$) of thickness $t_{A1}$ centred regarding the thickness of the building element ($t_E$).
- In case of seal thickness $t_{A1}$ > building element thickness $t_E$, see sec.8.2.3.
- For distances to other penetrants: min. 100 mm
- For copper and others, for pipe material, refer to 8.2.9

| seal thickness $t_{A1}$: $t_{A1} \geq 200$ mm | | **Classification** (mixed seal) |
|---|---|---|
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | |
| ≦ 28 | 1,0 – 14,2 | EI 90-C/U |

For symbols and abbreviations see 10.



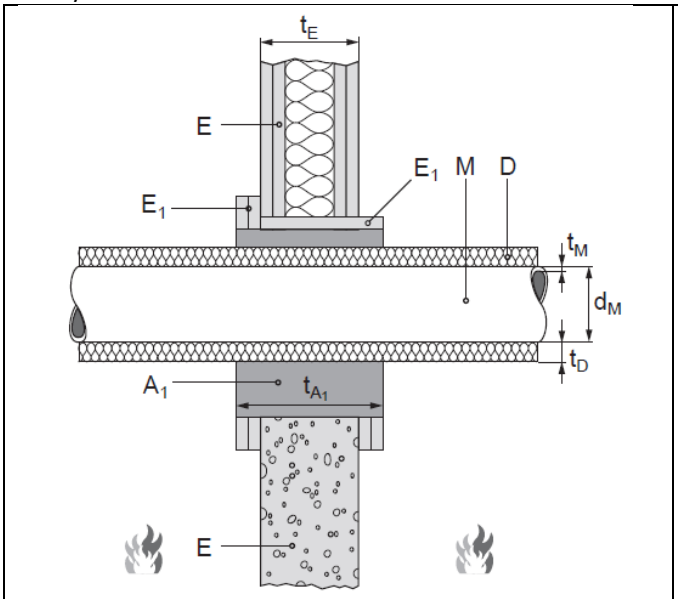
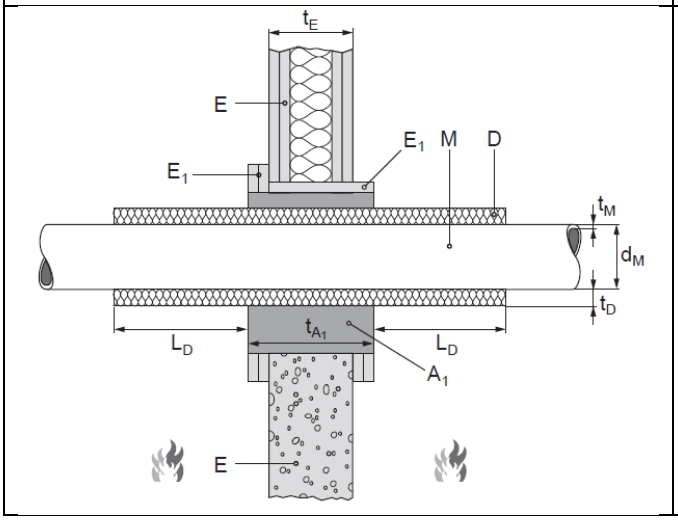

8.3.6.1:
Uninsulated metal pipes in flexible/rigid wall, sealed with CFS-F FX

### 8.3.1.7 Metal pipes with insulation in flexible and rigid wall construction

Construction details :

- Hilti Firestop Foam CFS-F FX ($A_1$) of thickness $t_{A1}$ centred regarding the thickness of the building element (E).
- In case of seal thickness $t_A$ > building element thickness $t_E$, see sec.8.2.3
- For distances refer to sec.8.3.1.2
- For pipe-material field of application: refer to sec. 8.2.9. For symbols and abbreviations see Annex 5.

For symbols and abbreviations see 10.

| | |
|---|---|
|  | 8.3.1.7.A:<br>Insulated metal pipes in flexible/rigid wall, sealed with CFS-F FX, insulation in CS-situation |
|  | 8.3.1.7.B:<br>Insulated metal pipes in flexible/rigid wall, sealed with CFS-F FX, insulation in LS-situation |

#### 8.3.1.8 Steel pipes with mineral wool insulation

Approved field of application for EI 120-C/U in seal thickness $t_{A1} \geq 150$mm with identical setup on both sides of the wall:

- For type of mineral wool insulation – refer to sec. 8.2.8.
- For thickness of mineral wool insulation: $t_D \geq 40$mm
- insulation situation: CS (Continues Sustained) or LS (Local Sustained) with ($l_D > 500$mm)
- For metal pipe material: steel and others – refer to sec. 8.2.9, copper excluded
- For metal pipe dimension: refer to fig. 8.3.8.1. below

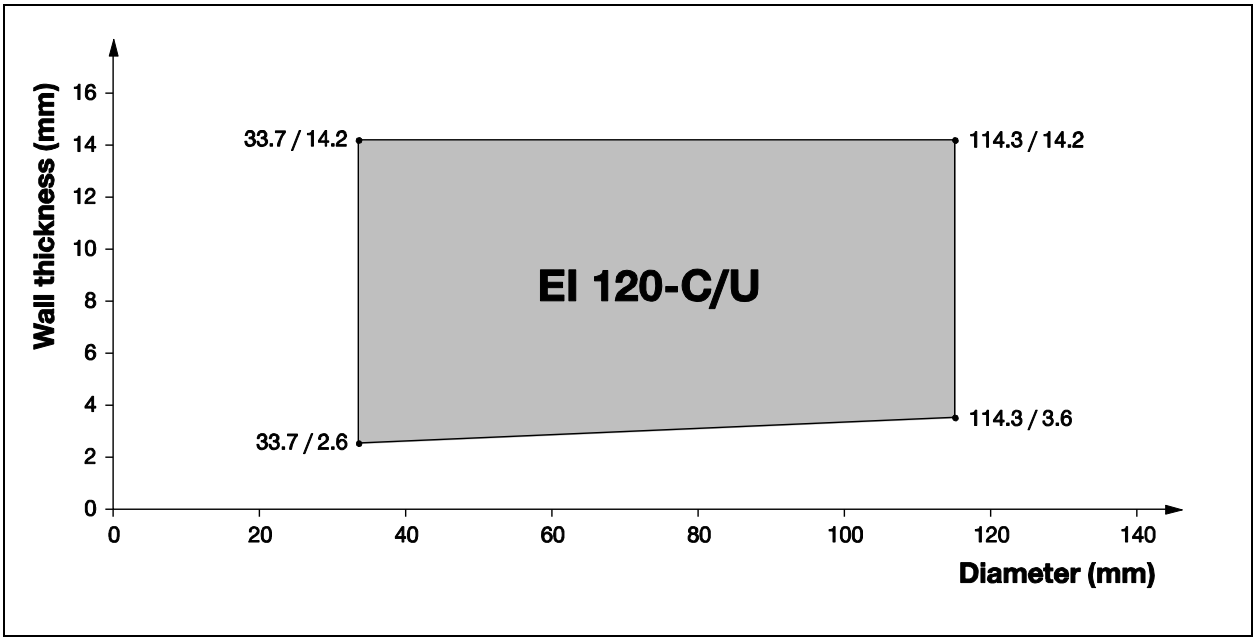



Fig. 8.3.8.1

Additional approved field of application for EI 120-C/U in seal thickness $t_{A1} \geq 150$mm:

- For type of mineral wool insulation – refer to sec. 8.2.8
- For thickness of mineral wool insulation: $t_D \geq 30$mm
- insulation situation: LS (Local Sustained) with ($l_D > 500$mm)
- For metal pipe material: steel and others – refer to sec.8.2.9, copper excluded
- For metal pipe dimension: diameter $d_M \leq 33{,}7$mm, wall thickness: $(2{,}6 \leq t_m \leq 14{,}2)$ mm

#### 8.3.1.9 Copper pipes with mineral wool insulation

Construction details:

- Arranged linear or in a cluster with sustained insulation made from Rockwool RS800 or equal (refer to sec.8.2.8)
- For type of mineral wool insulation – refer to sec. 8.2.8.
- For thickness of mineral wool insulation: refer to table below
- insulation situation: CS (Continues Sustained) or LS (Local Sustained) with ($l_D$ > 500mm)
- For metal pipe material: steel and others – refer to sec.8.2.9,
- For metal pipe dimension and classifications: refer to table below

For symbols and abbreviations see 10.

| seal thickness | | | $t_{A1}$ ≥150 mm | $t_{A1}$ ≥200 mm |
|---|---|---|---|---|
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_C$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (multiple) | (mixed) |
| 28 – 88,9 | 1,0/2,0 – 14,2 [1] | 20 | EI 60 C/U | - |
| 88,9 | 2,0 – 14,2 | 20 | EI 90 C/U | - |
| 12 – 48 | 1,0/1,5 – 14,2 [2] | 20 | - | EI 120-C/U |
| 48 – 88,9 | 1,5/2,0 – 14,2 [3] | 40 | - | EI 120-C/U |

[1] Interpolation of minimum wall thickness between 1,0 for diameter 28 and 2,0 for diameter 88,9 for pipe diameters in between

[2] Interpolation of minimum wall thickness between 1,0 for diameter 12 and 1,5 for diameter 48 for pipe diameters in between.

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

#### 8.3.1.10 Copper pipes with foamed elastomeric insulation

Construction details:

- Arranged linear or in a cluster with insulation (D) made from foamed elastomeric insulation according to sec.8.2.6.
- For type of elastomeric insulation – refer to sec.8.2.6.
- For thickness of elastomeric insulation: refer to table below
- insulation situation: CS (Continues Sustained) or LS (Local Sustained) with ($l_D$ > 500mm)
- For metal pipe material: steel and others – refer to sec.8.2.9,
- For metal pipe dimension and classifications: refer to table below

For symbols and abbreviations see 10.

| seal thickness: $t_{A1}$ ≥200 mm | | | |
|---|---|---|---|
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_M$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (mixed) |
| 6 – 42 | 1,0/1,2 – 14,2 | 7,0/9,0 | EI 90-C/U |
| 6 – 18 | 1,0– 14,2 | 7,0/8,0 | EI 120-C/U |

#### 8.3.1.11 Zero distance between metal pipes insulated with mineral wool

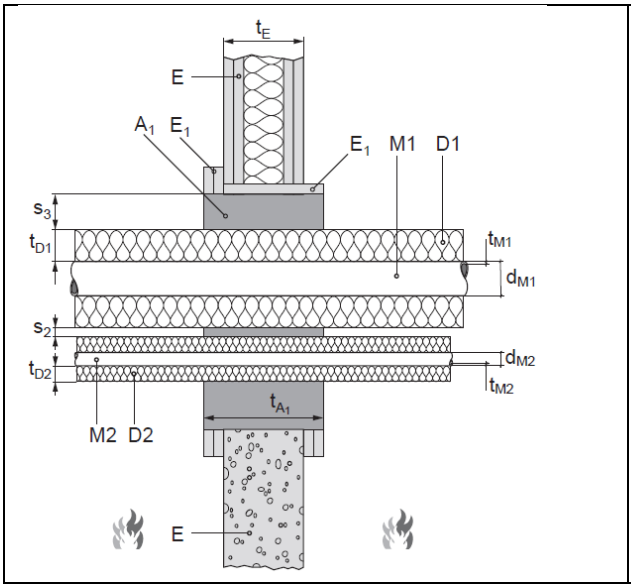
Construction details:

- Seal thickness $t_{A1} \geqq 150$mm
- Max. Seal size inside the wall: 400 x 200mm
- Number of pipes: unlimited
- Only linear arrangement, no cluster arrangements
- Zero distance between insulated pipes ($s_2 \geqq 0$mm)

Specific conditions:

- Applicable to metal pipes as indicated below
- For pipe material interpretation: refer to sec. 8.2.9
- Pipe insulation: mineral wool, for material refer to sec. 8.2.8
- Pipe insulation in LI and CI
- Minimum insulation length $L_D$ on both sides of the wall: 500mm

| Penetrating service | | | | |
|---|---|---|---|---|
| Pipe Material | Max. Pipe diameter (mm) | Max. Pipe wall thickness (mm) | Insulation thickness (mm) | **Classification** |
| Steel | ≦ 114,3 | 3,6 – 14,2 | ≧ 40 | EI 120-C/U |
| Copper | ≦ 42 | 1,5 – 14,2 | ≧ 20 | |
| Copper | ≦ 88,9 | 2,0 – 14,2 | ≧ 40 | |



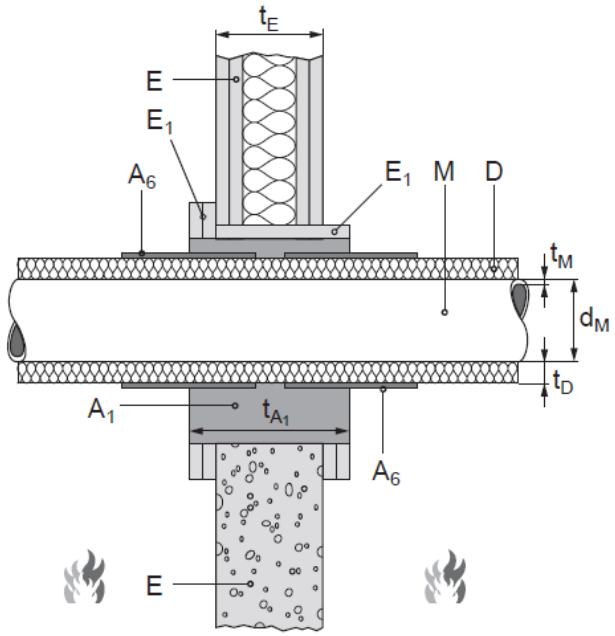
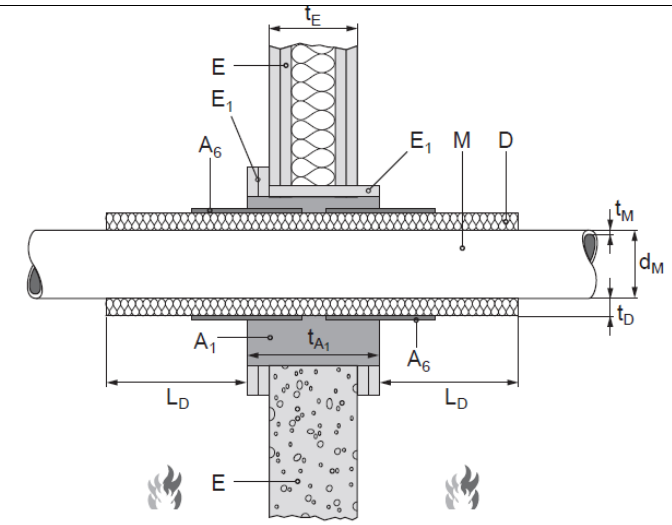

8.3.1.11
Mineral wool (D1, D2) insulated metal pipes (M1, M2) side by side ($s_2 \geqq 0$mm) penetrate a flexible/rigid wall with aperture/additional framing $E_1$, sealed with CFS-F FX ($A_1$)

### 8.3.1.12 Metal pipes with foamed elastomeric insulation and Firestop Bandage CFS-B

Construction details

- Identical CFS-B seal installation on both sides of the wall
- Always two layers of Hilti Firestop Bandage CFS-B for one seal
- CFS-B positioned with its centre- line flush to the seal surface, installed half in wall.
- Every bandage to be secured twice by metallic wire.

For symbols and abbreviations see sec.10

| | |
|---|---|
|  | 8.3.1.12. A:<br>Metal pipe (M) with insulation (D) in CS-situation, penetrating a flexible/rigid wall, sealed by means of CFS-B ($A_6$) and CFS-F FX ($A_1$).<br>For the flexible wall both types of increasing the seal thickness $t_{A1}$ have been shown. |
|  | 8.3.1.12 B:<br>Metal pipe (M) with insulation (D) in LS-situation for insulation length $L_D$, penetrating a flexible/rigid wall, sealed by means of CFS-B ($A_6$) and CFS-F FX ($A_1$).<br>For the flexible wall both types of increasing the seal thickness $t_{A1}$ have been shown. |

#### 8.3.1.13 Copper pipes with foamed elastomeric insulation

Construction details:

- Arranged linear or in a cluster
- For insulation material refer to sec.8.2.6.
- Insulation in CS or LS situation ($L_D$ > 500mm)
- For metal pipe material refer to sec.8.2.9, copper excluded

| | | | seal thickness $t_{A1}$ ≥200 mm |
|---|---|---|---|
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_M$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (mixed) |
| 28 – 54 | 1.0/1.5 – 14.2 [4] | 8.5/9.0 – 35.0/38.0 [6] | EI 90-C/U |
| 28 – 54 | 1.0/1.5 – 14.2 [5] | 8.5 – 35.0/38.0 [6] | EI 120-C/U |

[4] Interpolation of minimum wall thickness between 1,0 mm for diameter 28 mm and 1,5 mm for diameter 54 mm for pipe diameters in between

[5]Interpolation of minimum wall thickness between 1,0 for diameter 28 and 1,5 for diameter 54 for pipe diameters in between.

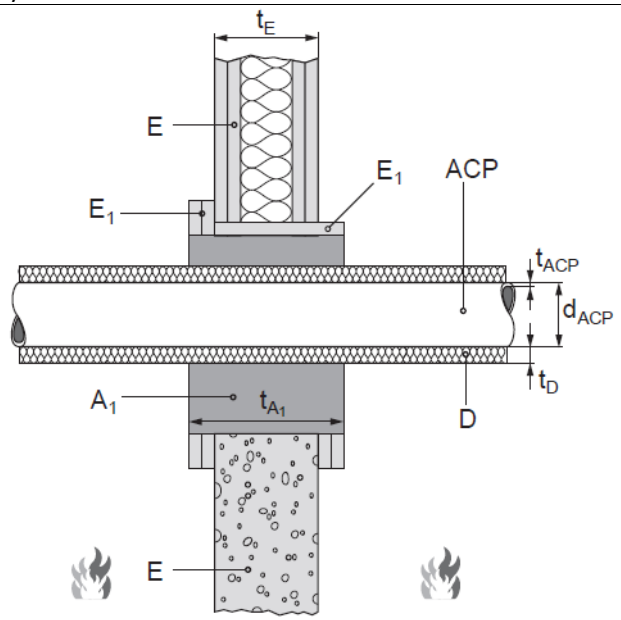
[6]The slash indicates minimum insulation thickness for 28 mm pipe and 54 mm pipe, followed by maximum insulation thickness for 28 mm pipe and 54 mm pipe.

### 8.3.1.14 Aluminium-composite pipes with foamed elastomeric insulation flexible and rigid wall

Construction details:

- Hilti Firestop Foam CFS-F FX ($A_1$) of thickness $t_{A1}$ centred regarding the thickness of the building element (tE).
- In case of requested seal thickness $t_{A1}$ > building element thickness $t_E$, see sec.8.2.3.
- For distances refer to sec.8.3.1.2

For symbols and abbreviations see sec.10




8.3.1.14:
Aluminium-composite pipe (ACP) with insulation (D) in CS-situation, penetrating a flexible/rigid wall, sealed by means of CFS-F FX ($A_1$).
For the flexible wall both possibilities of increasing the seal thickness $t_{A1}$ have been shown in parallel.

8.3.1.14.1 Aluminium- composite pipes «Geberit *Mepla*» with foamed elastomeric insulation

- For insulation material – refer to sec.8.2.6.
- Insulation situation: CS

| Al composite pipes *Geberit Mepla* with foamed elastomeric insulation | | | |
|---|---|---|---|
| seal thickness: $t_{A1} \geq 200$ mm | | | |
| Pipe diameter (d) [mm] | Pipe wall thickness ($t_A$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (mixed) |
| 16 – 32 | 2.0 – 3.0 | 8.0 – 9.0 | EI 120-U/C |

8.3.1.14.2 Aluminium- composite pipes «Alpex duo» with foamed elastomeric insulation

- For insulation material – refer to sec.8.2.6.
- Insulation situation: CS

| Al composite pipes «*Alpex duo*» from *Fränkische Röhrenwerke* (ACP) with foamed elastomeric insulation | | | |
|---|---|---|---|
| seal thickness: $t_{A1} \geq 200$ mm | | | |
| Pipe diameter (d) [mm] | Pipe wall thickness (t) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (mixed) |
| 16 – 32 | 2.0 – 3.0 | 8.0 – 9.0 | EI 120-U/C |

8.3.1.14.3 Aluminium- composite pipes «*Viega Raxofix and Sanfix Fosta*» with foamed elastomeric insulation

Construction details:

- If seal thickness $t_{A1} \geqq t_E$ consider additional framing, refer to sec.8.2.3
- With insulation and without insulation, in CS, for material: refer to sec.8.2.6
- Insulation thickness: see approved thickness below in table
- Gap width between penetrating isolated/non insulated pipe and seal edge/framing: ($0 \leqq s_3 \leqq 55$) mm, to be sealed with CFS-F FX over the entire thickness $t_{A1}$

| Al composite pipes *Viega Sanfix Fosta* from *Viega* (ACP) with foamed elastomeric insulation - seal thickness: $t_{A1}$ ≥ 200 mm | | | |
|---|---|---|---|
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | Insulation thickness ($t_D$) [mm] | Classification |
| 16 | 2,2 | 8,0 – 17,5 | EI 120-U/C |
| 20 | 2,8 | 8,5 – 18,0 | EI 120-U/C |
| 25 | 2,7 | 8,5 – 18,5 | EI 120-U/C |
| 32 | 3,2 | 9,0 – 19,5 | EI 120-U/C |
| 16 | 2,2 | No insulation | EI 120-U/C |
| 20 | 2,8 | No insulation | EI 120-U/C |
| 25 | 2,7 | No insulation | EI 120-U/C |
| 32 | 3,2 | No insulation | EI 120-U/C |

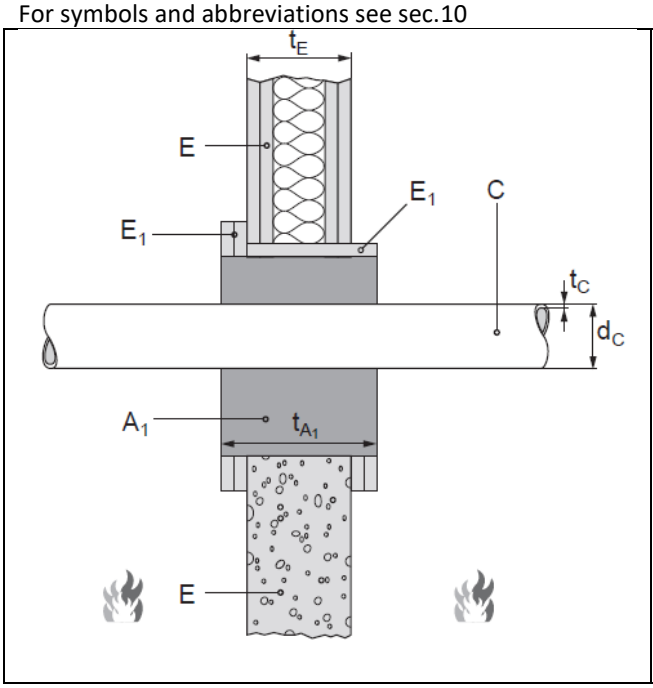
| Al composite pipes *Viega Raxofix* from *Viega* (ACP) with foamed elastomeric insulation (D) — continuous sustained (CS) –U/C pipe end configuration - seal thickness: $t_{A1} \geq 200$ mm | | | |
|---|---|---|---|
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | Insulation thickness ($t_D$) [mm] | Classification (mixed) |
| 16 | 2,2 | 8,0 – 17,5 | EI 120-U/C |
| 20 | 2,8 | 8,5 – 18,0 | EI 120-U/C |
| 25 | 2,7 | 8,5 – 18,5 | EI 120-U/C |
| 32 | 3,2 | 9,0 – 19,5 | EI 120-U/C |
| 16 | 2,2 | No insulation | EI 120-U/C |
| 20 | 2,8 | No insulation | EI 120-U/C |
| 25 | 2,7 | No insulation | EI 120-U/C |
| 32 | 3,2 | No insulation | EI 120-U/C |

### 8.3.1.15 Plastic pipes penetrating flexible and rigid wall, sealed with CFS-F FX

Construction details

- Hilti Firestop Foam CFS-F FX (A) of thickness $t_A$, centred regarding $t_E$,
- If seal thickness $t_{A1} \geq t_E$ consider additional framing, refer to sec.8.2.3

For symbols and abbreviations see sec.10




8.3.1.15:
Plastic pipe penetrating a flexible/rigid wall, sealed by means of CFS-F FX ($A_1$).
For the flexible wall both possibilities of increasing the seal thickness $t_{A1}$ have been shown in parallel.

#### 8.3.1.16 PE pipes flexible and rigid wall constructions

8.3.1.16.1 PE pipes (C) according to EN ISO 15494 and DIN 8074/8075 – U/U

| PE pipes (C) according to EN ISO 15494 and DIN 8074/8075 – U/U | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| ≤ 40 | 2.3 – 3.7 | EI 120-U/U |

8.3.1.16.2 PE pipes (C) according to EN 1519-1 and DIN 8074/8075 – U/C

| PE pipes (C) according to EN 1519-1 and DIN 8074/8075 – U/C arranged linear | | | |
|---|---|---|---|
| seal thickness: | | $t_A$ ≥150 mm | $t_{A1}$ ≥150 mm |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** | |
| | | (multiple) | (mixed) |
| 50 | 2.9 – 4.6 | EI 120-U/C | EI 60-U/C |

#### 8.3.1.17 PVC-U pipes in flexible and rigid wall constructions

8.3.1.17.1 PVC-U pipes (C) according to EN ISO 1452-2, EN ISO 15493 and DIN 8061/8062 – U/U

| PVC-U pipes (C) according to EN ISO 1452-2, EN ISO 15493 and DIN 8061/8062 – U/U | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| ≤ 40 | 1.9 – 3.0 | EI 120-U/U |

8.3.1.17.2 PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 – U/U

| PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 – U/U arranged linear | | | |
|---|---|---|---|
| seal thickness | | $t_{A1}$ ≥150 mm | $t_{A1}$ ≥150 mm |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** | |
| | | (multiple) | (mixed) |
| 50 | 3.7 | EI 120-U/U | - |

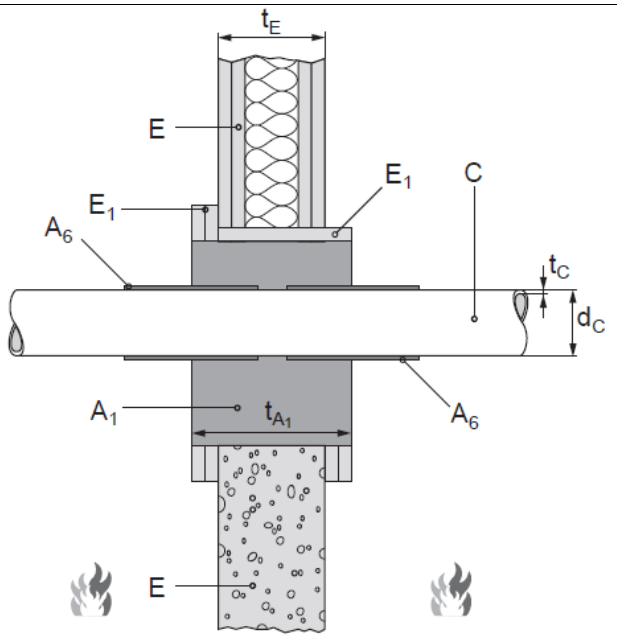
8.3.1.17.3 PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 – U/U

| PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 – U/C arranged linear | | | |
|---|---|---|---|
| seal thickness[Error! Bookmark not defined.] | | $t_{A1}$ ≥150 mm | $t_{A1}$ ≥150 mm |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** | |
| | | (multiple) | (mixed) |
| 50 | 3.7 – 5.6 | EI 120-U/C | EI 60-U/C |

#### 8.3.1.18 Plastic pipes penetrating flexible and rigid wall, sealed with CFS-F FX and CFS-B

Construction details

- Framing (beading) or aperture framing to be finished bevor installing the firestop
- CFS-B Firestop bandage has to be wrapped around the pipe two times (two layers),
- CFS-B secured by means of adhesive tape and fixed (two times) by using metal wire
- CFS-B ($A_6$) to be installed half of its length into the seal, identical on both sides of the wall
- Formwork/sheeting to be installed for CFS-F FX foam application, refer to sec.8.2.3
- Fill opening around the bandage/around pipe with foam $A_1$ over entire thickness $t_{A1}$.




8.3.18:
Plastic pipe (C), penetrating a flexible/rigid wall, sealed by means of CFS-F FX ($A_1$), sealed additionally with CFS-B ($A_6$).
For the flexible wall both possibilities of increasing the seal thickness $t_{A1}$ have been shown in parallel.

8.3.1.18.1 PE pipes (C) with Hilti Firestop Bandage CFS-B

| PE pipes (C) according to EN ISO 15494 and DIN 8074/8075 – U/U with Hilti Firestop Bandage CFS-B | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| 50 - 110 | 2.9/2.7 – 10.0 | EI 120-U/U |

See Fig. 8.3.1.18A

8.3.1.18.2 PVC-U pipes (C) with Hilti Firestop Bandage CFS-B

| PVC-U pipes (C) according to EN 14493 and DIN 8061/8062 with Hilti Firestop Bandage CFS-B | | |
|---|---|---|
| seal thickness: $t_A$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| 50 - 110 | 1.8/2.2 – 12.3 | EI 120-U/U |

See Fig. 8.3.1.18A

8.3.1.18.3 PVC-U pipes in CFS-F FX

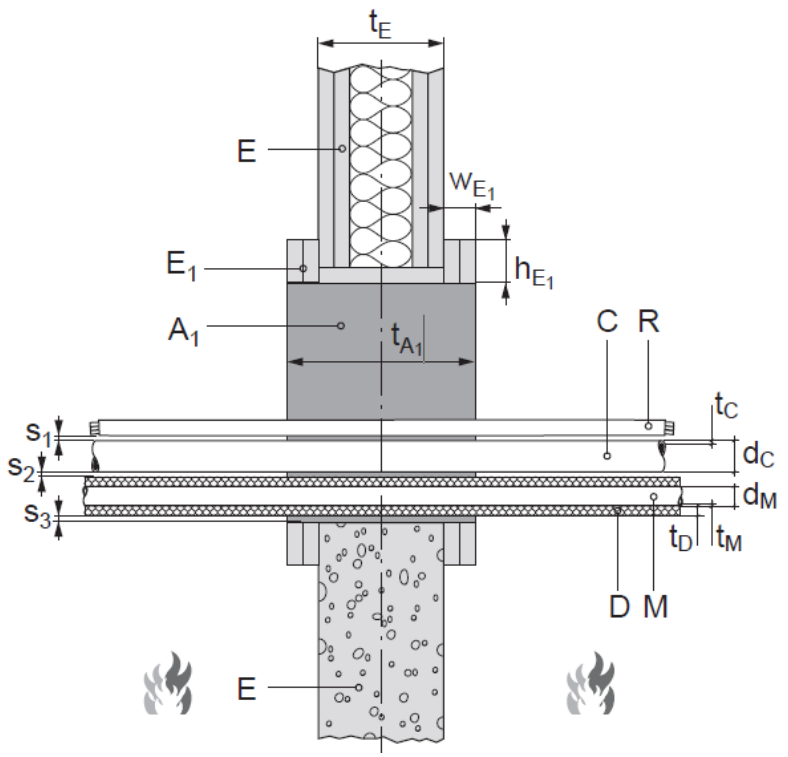
| PVC-U pipes (C) | | |
|---|---|---|
| seal thickness: $t_A$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| 16 | 3,7 | EI 90-U/U |
| 25 | 4,3 | EI 90-U/U |
| 40 | 2,4 | EI 90-U/U |

See Fig. 8.3.1.18B

### 8.3.1.19 Mixed pipe and cable penetration in flexible and rigid walls, sealed with CFS-F FX

Construction details for “Clima split” – application with elastomeric insulation:

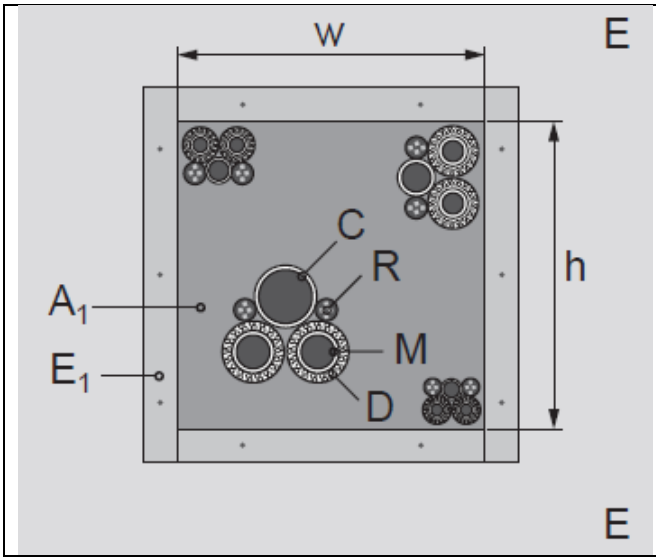
- Penetrating service is a tight bundle of isolated metal pipes, plastic pipes and cables
- Distances : see below
- Metal pipes: max. 2 parallel copper pipes, isolated
- Type of metal: copper and others (refer to 8.2.9)
- Dimension of metal pipes - refer to 8.3.14.2
- Type of insulation (CS-situation): foamed elastomeric – refer to 8.2.6
- Insulation thickness: 9mm
- One penetrating non-insulated plastic pipe
- Max. two parallel cables
- Seal thickness with CFS-F FX: over entire thickness $t_{A1}$,
- In case of seal thickness $t_A$ > building element thickness $t_E$, refer to sec.8.2.3




8.3.1.19 A:
Clima split – Application with foamed elastomeric thermal insulation on metal pipes penetrating a flexible/rigid floor.

For symbols and abbreviations see Annex 5 in sec.10.

| Distance position | Minimum distances (mm): |
|---|---|
| between services and seal edge ($s_3$): | 0 |
| between all services inside Clima split bundle ($s_2$): | 0 |
| between services and upper seal edge | 20 |




8.3.1.19 B:
Clima split – Application with foamed polyethylene thermal insulation on metal pipes penetrating a flexible/rigid wall
Seal done with CFS-F FX ($A_1$)
and CFS-B ($A_6$)

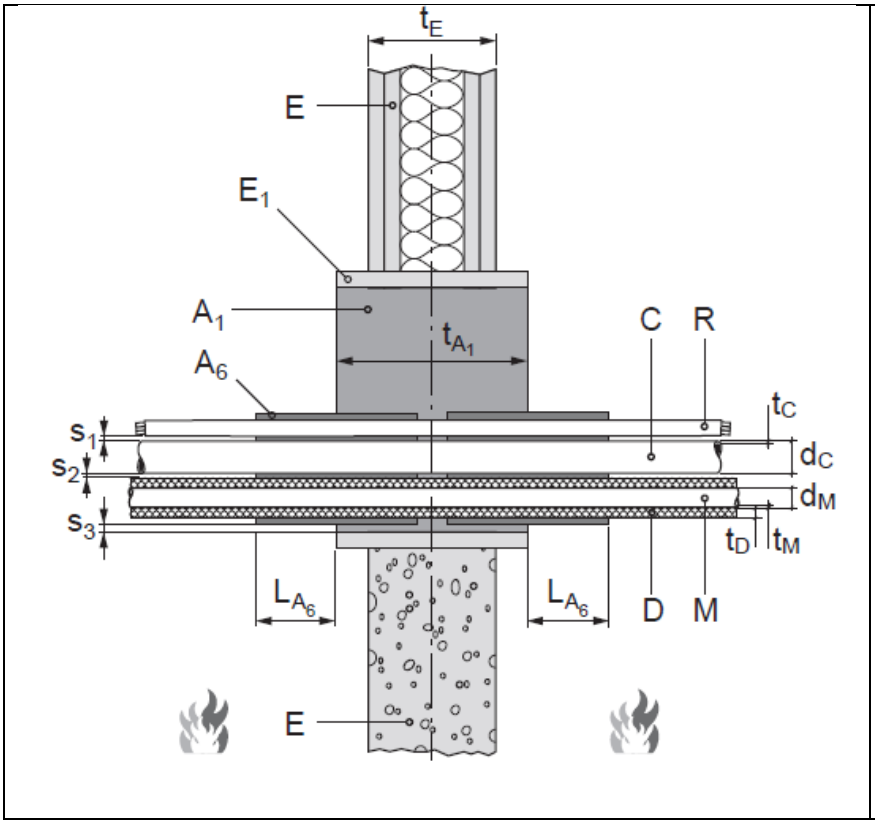
| Distance position | Minimum distances (mm): |
|---|---|
| between services and side seal edge ($s_3$): | 0 |
| between all services inside Clima split bundle ($s_2$): | 0 |
| between services and upper seal edge | 0 |
| between Clima split application in one seal | 100 |

| seal thickness: $t_{A1}$ ≥200 mm | | | | |
|---|---|---|---|---|
| **Pentrant** | **Type / diameter** (d) [mm] | **wall thickness** (t) [mm] | **pipe end** | **Classification** (mixed) |
| copper pipes (M) | 6 - 42 | 1.0 | C/U | EI 90 |
| cables (R) | 5 x 1.5mm²<br>5 x 6mm² | | n.a. | |
| PVC pipes (C) | 16 | 3.7 | U/U | |
| | 25 | 4.3 | | |
| | 40 | 2.4 | | |
| copper pipes (M) | 6 – 18 | 1.0 | C/U | EI 120 |
| cables (R) | 5 x 1.5mm²<br>5 x 6mm² | | n.a. | |
| PVC pipes (C) | 16 | 3.7 | U/U | |
| | 25 | 4.3 | | |
| | 40 | 2,4 | | |

### 8.3.1.20 Mixed pipe and cable penetration in flexible and rigid walls, sealed with CFS-F FX and Hilti Firestop Bandage CFS-B

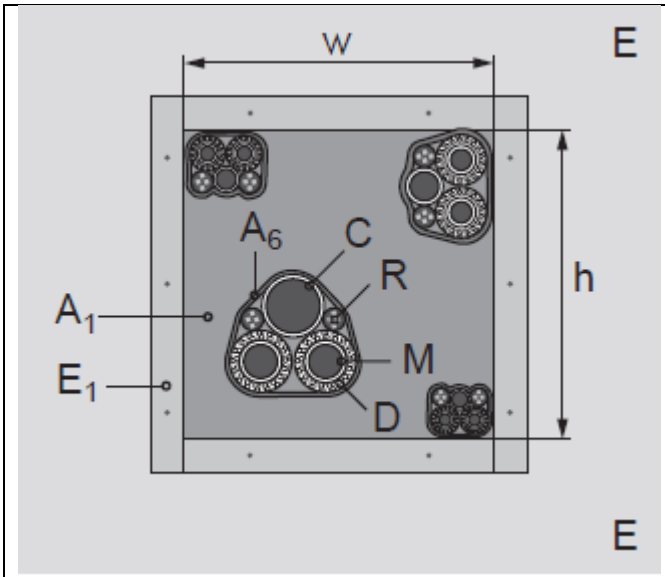
Construction details:

- Penetrating service is a tight bundle of isolated metal pipes, plastic pipes and cables
- Distances: see below
- Metal pipes: max. 2 parallel copper pipes, isolated
- Type of metal: copper and others - refer to 8.2.9
- Type of insulation (CS-situation): foamed PE (polyethylene)
- One penetrating non-insulated plastic pipe
- Max. two parallel cables, for details refer to 8.3.15.2
- Seal thickness with CFS-F FX: over entire thickness tA1
- In case of seal thickness tA > building element thickness tE, refer to sec.8.2.3
- Number of devices CFS-B: two, each from each side
- Number of windings of CFS-B (A6): one
- Installation depth CFS-B: half into the wall opening




8.3.1.20 A:
Clima split – Application with foamed polyethylene thermal insulation on metal pipes penetrating a flexible/rigid wall.

For symbols and abbreviations see Annex 5 in sec.10.




8.3.1.20 B:
Clima split – Application with foamed polyethylene thermal insulation on metal pipes penetrating a flexible/rigid wall
Seal done with CFS-F FX ($A_1$)
and CFS-B ($A_6$)

| Distance position | Minimum distances (mm): |
|---|---|
| between services and side seal edge ($s_3$): | 0 |
| between all services inside Clima split bundle ($s_2$): | 0 |
| between services and upper seal edge | 0 |
| between Clima split application in one seal | 100 |

| seal thickness | | | | $t_{A1}$ ≥150 mm |
|---|---|---|---|---|
| **Pentrant** | **Type / diameter** ($d_M$) [mm] | **wall thickness (minimum)** ($t_M$) [mm] | **pipe end** | **Classification (mixed)** |
| copper pipes (M) [13] | 6,4 – 15,9 | 0,8 | C/U | EI 120 |
| cables (R) | 5 x 1.5mm² | | n.a. | |
| PVC pipes (C), flexible | 13 - 24 | 1,5 – 2,0 | U/U | |

[13] Copper pipes have to be insulated with polyethylene-insulation (CS) thickness 9mm

### 8.3.2 Specific characteristics for flexible and rigid walls with $t_E \geq 112mm$

For flexible walls:

The wall must have a minimum thickness of 112 mm and 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 of the seal to any stud and the cavity between stud and seal must be closed. A minimum 100 mm insulation of Class A1 or A2 (in accordance with EN 13501-1) has to remain in the cavity between stud and seal. In steel stud construction the space between linings has not to be completely filled with insulation material, especially in the neighbourhood to the seal. Nevertheless, the wall construction has to be set up according to requirements given in EN 1366-3:2009 or the construction itself has been classified according EN 13501-2.

The wall comprises timber or steel studs lined on both faces with minimum 2 layers of minimum 12,5 mm thick boards. A higher number of board layers is accepted if the overall board layer thickness is equal or bigger than tested. A higher overall board layer thickness is accepted, if the number of board layers is equal or bigger than tested.

The boards are according EN 520 type F or according to the specification of the tested and approved flexible wall construction system according EN 13501-2.

For Rigid walls, the wall must comprise concrete, aerated concrete or masonry, with a minimum density of 650 kg/m$^3$.

All test results from flexible wall testing ($t_e \geq 112mm$) are applicable for rigid walls ($t_e \geq 112mm$) too.

#### 8.3.2.1 Maximum seal size / Blank seals in rigid/flexible wall

For maximum seal size / blank seal size refer to sec. 8.3.1.1.

#### 8.3.2.2 Minimum distances for penetrations

For minimum distances between penetrations refer to sec.8.3.1.2.

#### 8.3.2.3 Steel pipes with foamed elastomeric insulation and Hilti Firestop Bandage CFS-B in flexible and rigid wall construction, $t_E \geq 112$ mm

- Arranged linear or in a cluster
- For insulation material refer to sec.8.2.68.2.6.
- Insulation in CS or LS situation ($L_D > 500$mm)
- For metal pipe material refer to sec.8.2.9 copper excluded

| seal thickness: $t_{A1} \geq 150$ mm | | | | |
|---|---|---|---|---|
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_M$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (multiple) | **Classification** (mixed) |
| 33.7 – 114.3 | 2.6/3.6 – 14.2 [7] | 19 | EI 60-C/U | EI 60-C/U |
| 33.7 – 114.3 | 2.6/3.6 – 12.5 [8] | 19 | EI 90-C/U | n.a. |

[7] Interpolation of minimum wall thickness between 2,6mm for diameter 33,7mm and 3,6 mm for diameter 114,3mm for pipe diameters in between

[8] Interpolation of minimum wall thickness between 2,6 for diameter 33,7mm and 3,6 for diameter 114,2for pipe diameters in between.

#### 8.3.2.4 Copper pipes with foamed elastomeric insulation in flexible/rigid wall $t_E \geq 112$mm

- Arranged linear or in a cluster
- For insulation material refer to sec.8.2.6.
- Insulation in CS or LS situation ($L_D > 500$mm)
- For metal pipe material refer to sec.8.2.9
- Foamed elastomeric insulation – for material refer to sec.8.2.6.

| seal thickness: $t_{A1} \geq 150$ mm | | | | |
|---|---|---|---|---|
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_M$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (multiple) | **Classification** (mixed) |
| 28 – 88,9 | 1,0/2,0 – 14,2 [9] | 19 | EI 60-C/U | EI 60-C/U |
| 28 | 1,0 – 14,2 | 19 | EI 120-C/U | - |

[9] Interpolation of minimum wall thickness between 1,0 mm for diameter 28 mm and 2,0 mm for diameter 88,9 mm for pipe diameters in between

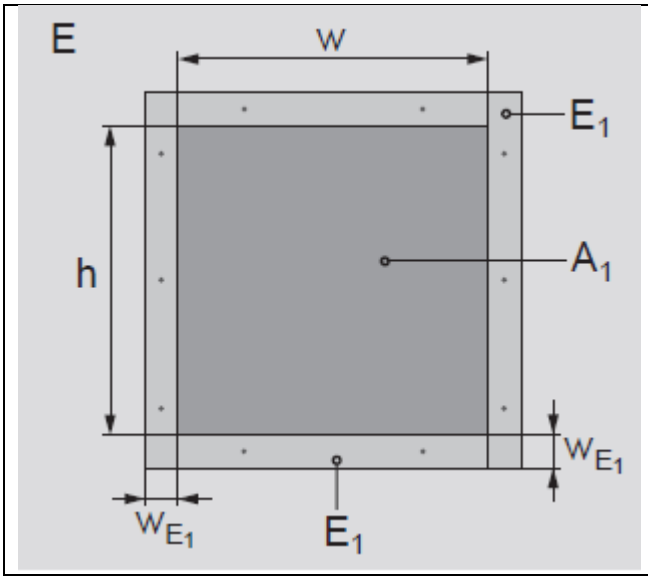
### 8.4 Cross-laminated timber walls - Construction details

Characterization for the cross-laminated timber walls:

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

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.

#### 8.4.1 Blank seals of CFS-F FX in cross-laminated timber walls




8.4.1:
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) | **Classification** |
|---|---|---|---|---|
| 400 | 400 | ≧ 80 | ≧ 150 | EI 60 |
| 400 | 400 | ≧ 100 | ≧ 150 | EI 90 |

#### 8.4.2 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. For details refer to sec.8.2.3

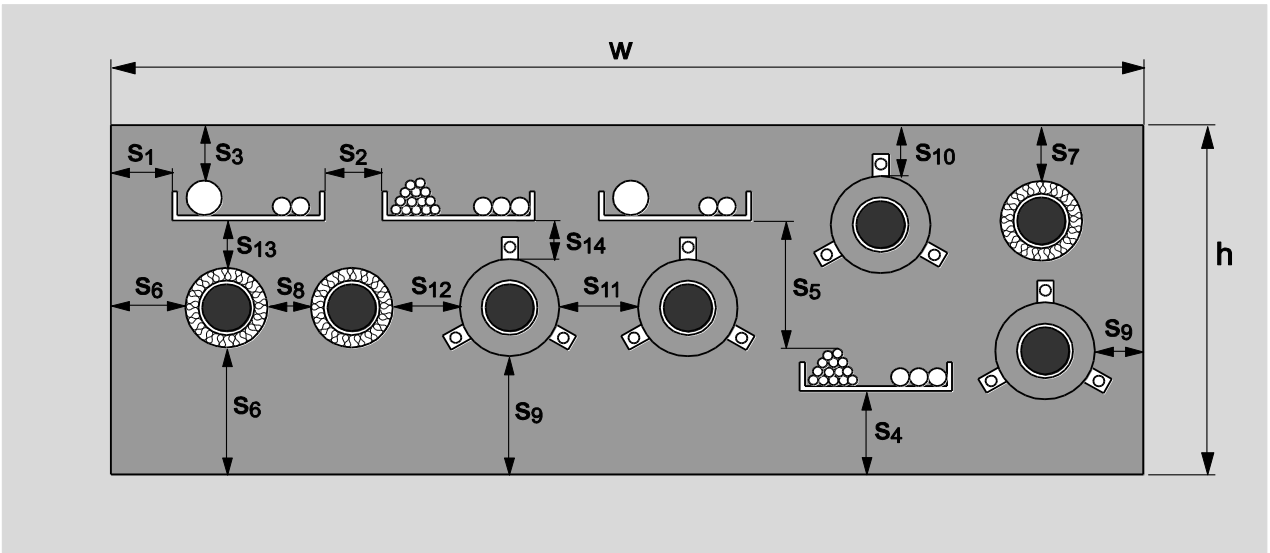
#### 8.4.3 First support in cross-laminated timber wall

First support for any kind of penetrants in cross-laminated timber wall is 350mm.

### 8.4.4 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 |



### 8.4.5 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 in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables
- Cable size: see table below
- First support: refer to 8.6.3

| Size of cables Max. Cable Diameter | Cross-laminated timber wall thickness $t_E$ | Requested Seal thickness $t_{A1}$ | Cable Carrier system | **Classification** |
|---|---|---|---|---|
| Up to 21mm | ≧ 80 mm | ≧ 150 mm | With and without | EI 60 |
| Up to 50 mm | ≧ 80 mm | ≧ 150 mm | With and without | EI 60 |
| Up to 21mm | ≧ 100 mm | ≧ 150 mm | With and without | EI 60 and E90 |
| Up to 50 mm | ≧ 100 mm | ≧ 150 mm | With and without | EI 60 and E90 |

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: 200mm
- Max. carrier high: 60mm
- Carrier material thickness: ≧ 1,5mm
- For distances refer to 8.4.4
- Other carries to be stopped 150mm before the seal

### 8.4.6 Conduits and tubes in cross-laminated timber wall construction

General conditions:

- First support: refer to 8.5.4
- Conduit end configuration: U/C,
- Conduit end seal: sealed with CFS-S ACR, sealing depth: ≥ 15mm
- Projecting length (identical on both sides of the wall): ≧ 500mm
- 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 $t_{A1}$ | **Classification** |
|---|---|---|---|
| Single conduits, rigid plastic conduits Ø ≤ 32 mm | ≧ 80 mm | ≧ 150 mm | EI 60-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 90-U/C |
| Single conduits, flexible, pliable, and plastic conduits Ø ≤ 32 mm | ≧ 80 mm | ≧ 150 mm | EI 60-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 60-U/C |
| Bundle of rigid plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm | ≧ 80 mm | ≧ 150 mm | EI 60-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 90-U/C |
| Bundle of flexible/pliable plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm | ≧ 80 mm | ≧ 150 mm | EI 60-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 60-U/C |
| 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 | EI 60-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 60-U/C |

### 8.4.7 Metal pipes with PE-insulation in cross-laminated timber wall construction

General conditions:

- First support: refer to 8.4.3
- Minimum wall thickness: $t_E \geq 100$mm
- Minimum seal thickness: $t_{A1} \geq 200$mm
- For distances refer to 8.4.4

#### 8.4.7.1 Copper pipes with PE-insulation sealed with CFS-F FX in cross-laminated timber wall construction

Construction details:

- Insulated copper pipes,
- Insulation: 9mm PE in CS-position
- For insulation material refer to sec.8.2.10.
- Distances between both insulated pipes ≥ 0mm

| | cross-laminated timber wall thickness | seal thickness $t_{A1}$ | **Classification** |
|---|---|---|---|
| insulated copper pipe, max. ∅ = 18mm, wall thickness ≥ 1mm | $t_E \geq 80$ mm | $t_{A1} \geq 150$ mm | EI 60-C/U |
| insulated copper pipe, max. ∅ = 18mm, wall thickness ≥ 1mm | $t_E \geq 100$ mm | $t_{A1} \geq 150$ mm | EI 60-C/U |

### 8.4.8 Plastic pipes in cross-laminated timber wall construction

Construction details:

- First support: refer to 8.4.3
- For distances refer to 8.4.4.
- Single penetration seal

#### 8.4.8.1 PP- pipes without insulation sealed with CFS-F FX in cross-laminated timber wall construction

| PP pipes (C) according to EN 1451-1, 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] | **Classification** |
| 50 | 1.8 | EI 90-U/U |

#### 8.4.8.2 PVC- pipes without insulation sealed with CFS-F FX in cross-laminated timber wall construction

| PVC pipes according to EN 1452-2, EN 1451-1, EN 1329-1 and EN1566-1<br>In CLT wall construction, $t_E$ ≥100 mm | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥ 200 mm | | |
| Pipe diameter (dC) [mm] | Pipe wall thickness (tC) [mm] | **Classification** |
| 50 | 1,8 – 5,6 | EI 90-U/U |

| PVC pipes flexible, pliable, rigid<br>In CLT wall construction, $t_E$ ≥ (80 – 100) mm | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥ 200 mm | | |
| Pipe diameter (dC) [mm] | Pipe wall thickness (tC) [mm] | **Classification** |
| 25 | 4,3 | EI 60-U/U |

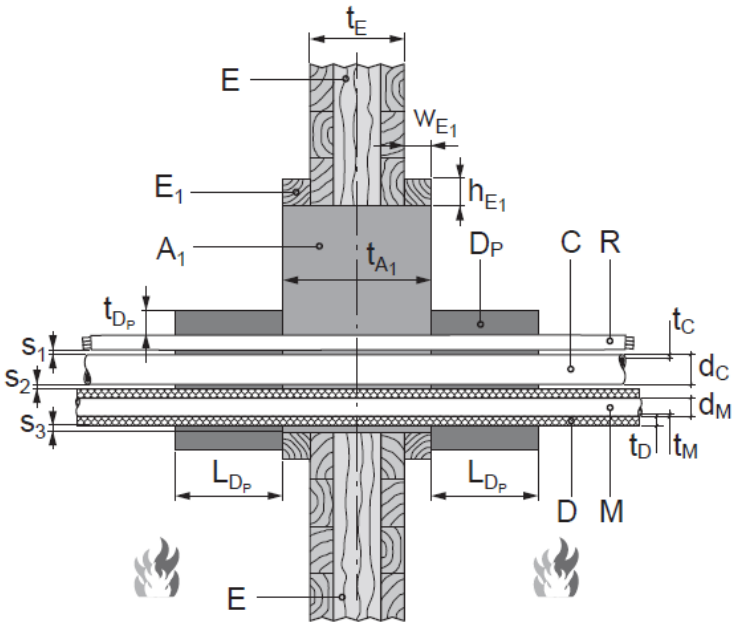
### 8.4.9 Aluminium-composite pipes without insulation sealed with CFS-F FX in cross-laminated timber wall construction

| 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] | **Classification** |
| 32 | 3,0 | EI 90-U/C |

### 8.4.10 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, in C/U pipe-end configuration
- Type of metal: copper and others (refer to 8.2.9)
- Type of insulation (CS-situation): foamed PE (polyethylene), refer to 8.2.10
- Max. two cables
- Max.one plastic pipe, non-insulated, in U/U pipe-end configuration
- In case of seal thickness tA1 > building element thickness tE, refer to sec.8.2.3
- An additional protect insulation made from elastomeric foam (refer to 8.2.6), thickness tDP = 9mm, length LDP = 250mm has to be installed don both sides of the wall in LI or CI situation.




8.4.10
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: 18mm<br>• Wall thickness = (1,0-14,2) mm<br>• PE-insulation thickness: 9 mm<br>• Type: Tubolit, Frigoline |
| Plastic pipe: | • PVC pipe, flexible, pliable or rigid<br>• Plastic pipe diameter: max.25mm<br>• Plastic pipe wall thickness: max. 4,3mm |
| Cables: | • Max. size: 5x1,5mm²<br>• Cable diameter: maximum 14mm |

| "Clima split" bundles acc. Fig.8.4.10 | seal thickness $t_{A1}$ | Classification |
|---|---|---|
| In wall thickness $t_E$ ≥80 mm | $t_{A1}$ ≥150 mm | EI 60 |
| In wall thickness $t_E$ ≥100 mm | $t_{A1}$ ≥150 mm | EI 60 |

## 8.5 Rigid floors

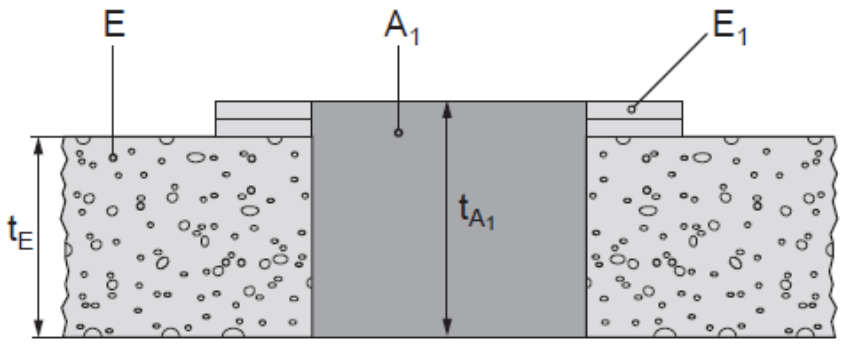
### 8.5.1 Specifics for Rigid Floors

The floor must have a minimum thickness of 150 mm and comprise aerated concrete or concrete with a minimum density of at least 2200 kg/m³. This UKTA does not cover use of this product as a penetration seal in sandwich panel constructions.

### 8.5.2 Maximum seal size / Blank seals in rigid floors

Construction details:

Hilti Firestop Foam CFS-F FX ($A_1$) of thickness $t_{A1}$ flush with soffit of the building element (E).
In case of seal thickness $t_A$ > building element thickness $t_E$, see sec.8.2.3 with. Fig. 8.2.3.E, F for additional framing.
For symbols and abbreviations see Annex 4 in sec.10.




8.5.2A:
Blank Seal in rigid wall using aperture framing, where $t_{A1}$ exceed $t_E$

For details refer to sec. 8.2.3

For first support refer to sec. 8.2.5

Maximum opening size for blank or penetrated seal:

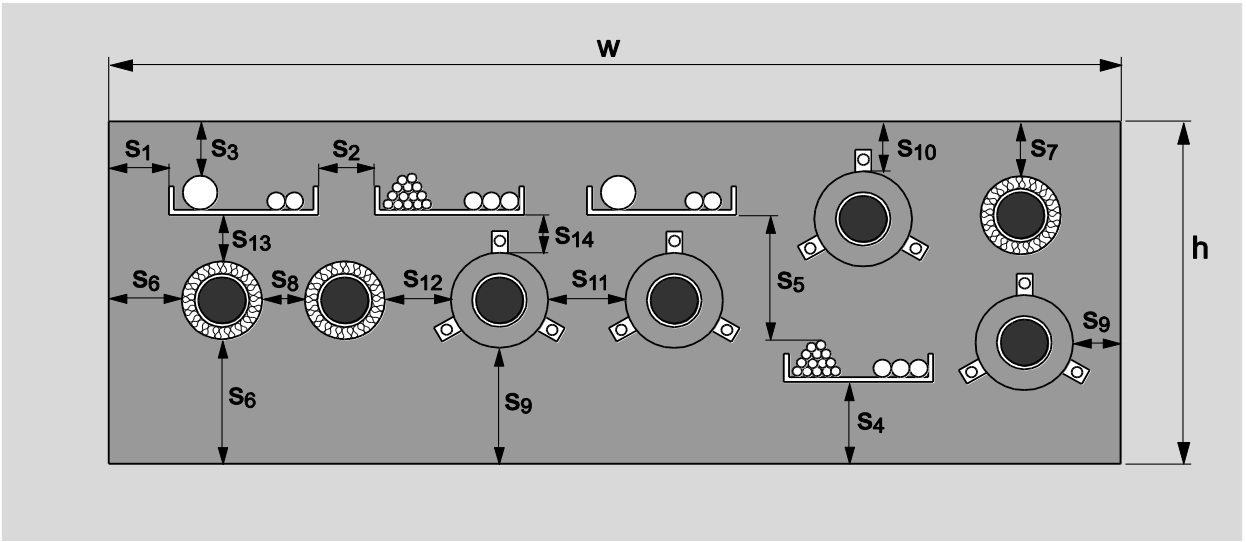
| | **Classification** | seal size: | | seal thickness: |
|---|---|---|---|---|
| | | w x h | ø | $t_{A1}$ |
| Rigid floor penetrations | EI 120 | ≤400 x 400 mm" | ≤400 mm | ≥ 150 mm |

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

### 8.5.3 Minimum distances for penetrations

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

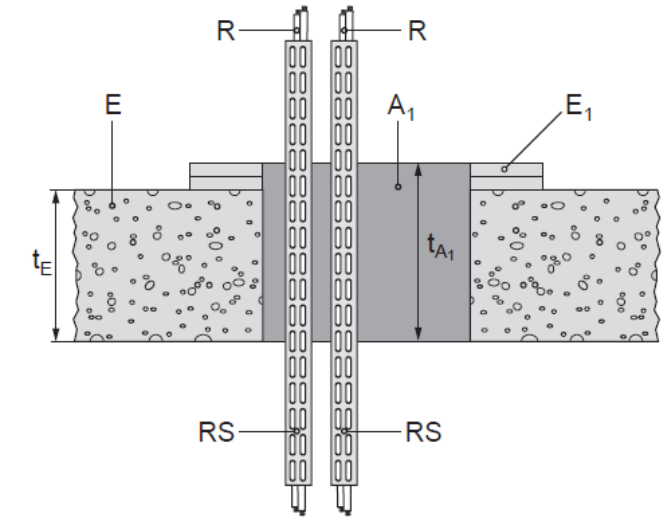
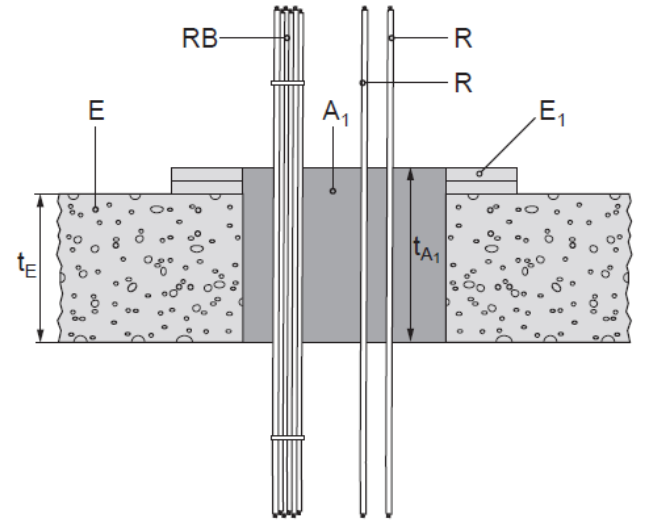
| | Valid for rigid floors only. | **minimum distance (mm)** |
|---|---|---|
| $s_1$ | (distance between cables/cable supports and seal edge | 0 |
| $s_2$ | (distance between cable supports) | 0 |
| $s_3$ | (distance between cables and upper seal edge) | n.a. |
| $s_4$ | (distance between cable supports and bottom seal edge) | n.a. |
| $s_5$ | (distance between cables and cable support above) | 50 |
| $s_6$ | (distance between metal pipes and seal edge) | 20 |
| $s_7$ | (distance between metal pipes and upper seal edge) | n.a. |
| $s_8$ | (distance between metal pipes) linear arrangement | 15 |
| $s_8$ | (distance between metal pipes) grouped arrangement | 20 |
| $s_9$ | (distance between plastic pipes/pipe closure devices and seal edge) | 20 |
| $s_{10}$ | (distance between plastic pipes/pipe closure devices and upper seal edge) | n.a. |
| $s_{11}$ | (distance between plastic pipes/pipe closure devices) | 20 |
| $s_{12}$ | (distance between metal pipes and plastic pipes/pipe closure devices) | 20 |
| $s_{13}$ | (distance between cables/cable supports and metal pipes) | 80 |
| $s_{14}$ | (distance between cables/cable supports and plastic pipes/pipe closure devices) | 80 |



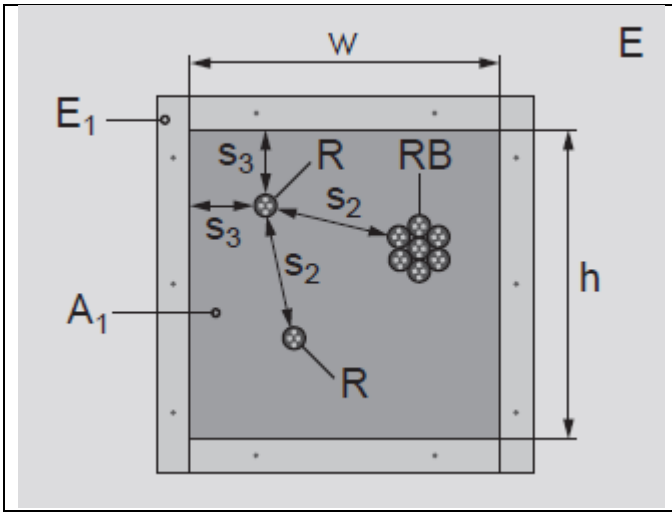
### 8.5.4 Cable seals in rigid floor

Construction details:

For symbols and abbreviations see Annex 5.

| | |
|---|---|
|  | 8.5.4A:<br>CFS-F FX seal, penetrated with a cable tray RS in rigid floor<br><br>Cable support construction: Perforated metal cable trays with a melting point higher than 1100°C (e.g. galvanised steel, stainless steel). Trays with organic coatings are covered if their overall classification is minimum A2 according to EN 13501-1. |
|  | 8.5.4.B:<br>CFS-F FX seal, penetrated with single (R) or bunched cables (RB) in rigid floor |

#### 8.5.4.1 Minimum distance in floor penetration:




8.4.3.2.A:
Distances in cable/bunched cable seals

Cable to seal edge ($s_3$): ≧ 0 mm
Cable to cable ($s_2$): ≧ 0 mm
Cable to cable bundle ($s_2$): ≧ 33 mm
For minimum distances to other penetrants, support systems or insulation refer to sec.8.2.5.

#### 8.5.4.2 Cable penetrants in rigid floor constructions

Cables within rigid floor constructions according to sec.8.5.1.

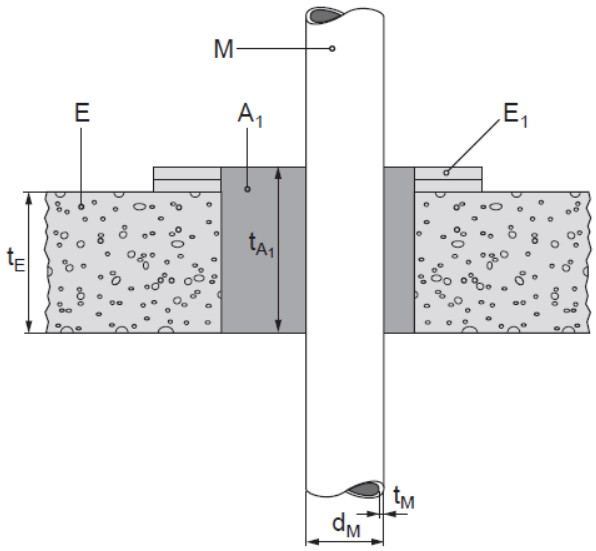
| Penetration seal / Services | **Classification** (multiple)[10] | | (mixed)[11] |
|---|---|---|---|
| Seal thickness | $150 \leq t_A \leq 250$ | $t_A \geq 250$ | $t_A \geq 200$ |
| All sheathed cable types currently and commonly used in building practice in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables, with a diameter of: | | | |
| Ø ≤ 21 mm | EI 60 | EI 120 | EI 120 |
| 21 ≤ Ø ≤ 50 mm | EI 60 | EI 90 | EI 90 |
| 50 ≤ Ø ≤ 80 mm | EI 60 | EI 90 | EI 90 |
| Tied cable bundle, maximum diameter of single cable 21 mm | | | |
| Ø ≤ 100 mm, | EI 60 | EI 120 | EI 120 |
| Non sheated cables | | | |
| Ø ≤ 24 mm, | - | - | EI 90 |

[10] multiple seals: combination of single cables, bunched cables or cable support constructions within one seal

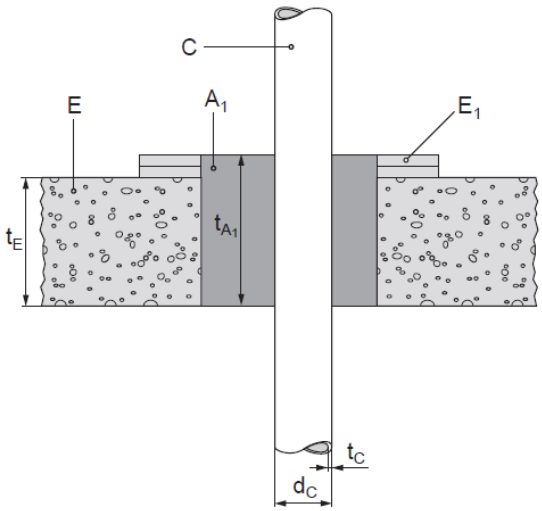
[11] mixed seals: combination of single cables, bunched cables or cable support constructions with metal or plastic pipes, conduits within one seal.

### 8.5.5 Conduits and tubes in rigid floor constructions

Construction details:




8.5.5 A:
Metal conduit in rigid floor, sealed with CFS-F FX




8.5.5..B:
Plastic conduit in rigid floor, sealed with CFS-F FX

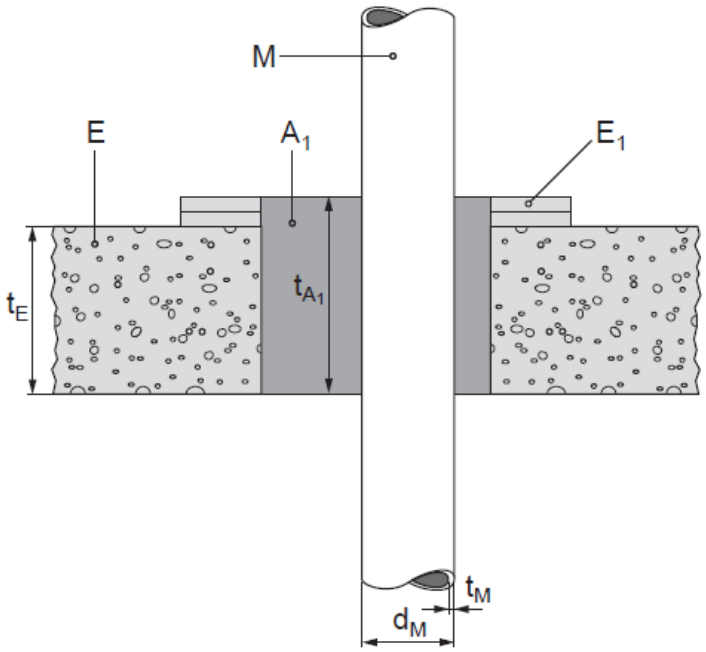
| **Penetration seal / Services** | **Classification** (with and without cables) | |
|---|---|---|
| | multiple | mixed |
| seal thickness (mm) | $t_{A1} \geq 150$ | $t_{A1} \geq 200$ |
| Steel conduits and tubes, Ø ≤16 mm | EI 120 U/U | EI 120 C/U |
| For field of application: refer to sec.8.2.11 | | |
| Plastic conduits and tubes, Ø ≤16 mm | EI 120 U/U | EI 120 U/U |
| Flexible plastic conduits (Polyolefin, PVC), 16mm ≤ Ø ≤ 32 mm | - | EI 120 U/U |
| Rigid plastic conduits (Polyolefin, PVC), 16mm ≤ Ø ≤ 32 mm | - | EI 120 U/U |
| Bundle of plastic conduits (Polyolefin, PVC), conduits flexible or rigid,16mm ≤ Ø ≤ 32 mm Ø ≤ 100 mm | - | EI 120 U/U |

For construction details and drawings refer to fig.8.5.5. A and B.

### 8.5.6 Metal pipes without insulation in rigid floor construction

Construction details :

Hilti Firestop Foam CFS-F FX ($A_1$) of thickness $t_{A1}$ flush with soffit of building element (E).
In case of seal thickness $t_{A1}$ > building element thickness $t_E$, see sec.8.2.3.
For distances refer to sec.8.2.5
For symbols and abbreviations see Annex 5 in sec.10.




8.5.6 A:
Uninsulated metal pipes in rigid floor, sealed with CFS-F FX

#### 8.5.6.1 Copper pipes without insulation in rigid-floor

| seal thickness: $t_{A1}$ ≥200 mm | | In flexible walls and solid walls |
|---|---|---|
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| ≤ 28 | 1,0 – 14,2 | EI 90-C/U |

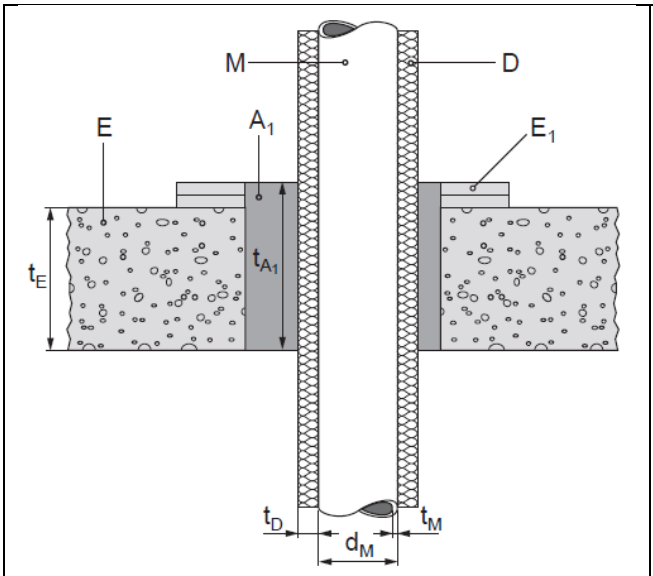
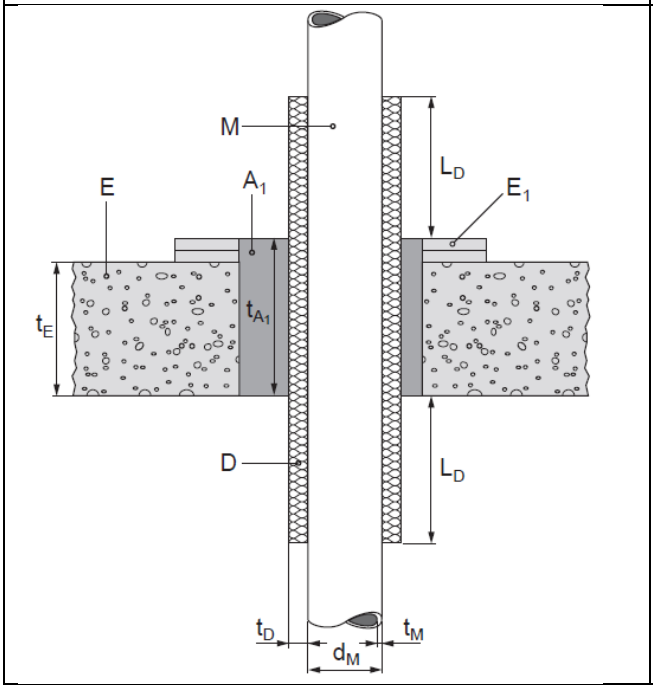
For pipe-material field of application: refer to sec.8.2.9

### 8.5.7 Metal pipes with insulation in rigid floor construction

Construction details:

- Hilti Firestop Foam CFS-F FX ($A_1$) of thickness $t_{A1}$ flush with soffit of the building element (E).
- In case of seal thickness $t_A$ > building element thickness $t_E$, see sec.8.2.3
- For distances refer to sec.8.5.3

For symbols and abbreviations see Annex 4 in sec.10.

| | |
|---|---|
|  | 8.5.7 A:<br>Insulated metal pipes in rigid floor, sealed with CFS-F FX, insulation in CS-situation |
|  | 8.5.7.B:<br>Insulated metal pipes in rigid floor, sealed with CFS-F FX, insulation in LS-situation |

#### 8.5.7.1 Steel pipes with mineral wool insulation in rigid floor

8.5.7.1.1 Steel pipes with mineral wool insulation in CS-situation

Approved field of application for EI 120-C/U in seal thickness $t_{A1} \geq 150$mm with identical setup on both sides of the floor:

- For type of mineral wool insulation – refer to sec. 8.2.8
- For thickness of mineral wool insulation: $t_D \geq 40$mm
- insulation situation: CS (continues sustained) or LI (Local Interrupted) with ($l_D > 500$mm)
- For metal pipe material: steel and others – refer to sec.8.2.11, copper excluded
- For metal pipe dimension: refer to fig.8.5.7.1.1.A below

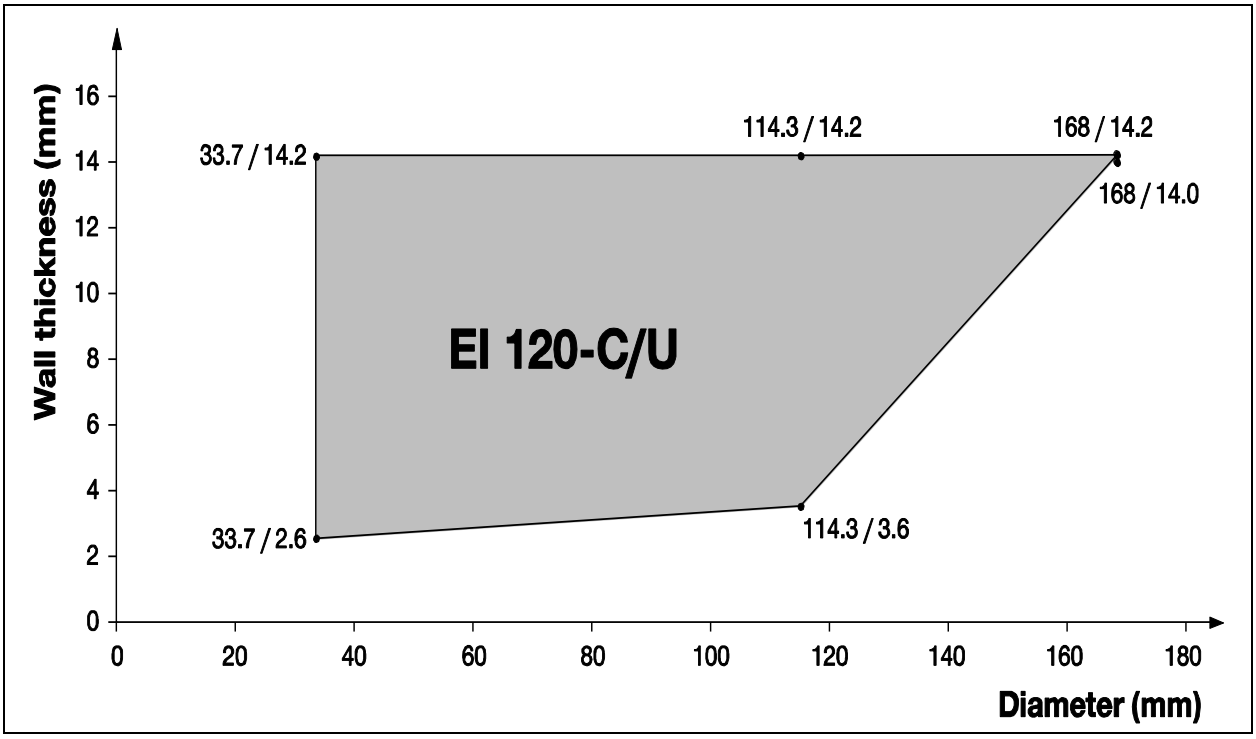



Fig.8.5.7.1.1.A

Additional approved field of application for EI 120-C/U in seal thickness $t_{A1} \geq 150$mm with identical setup on both sides of the floor:

- For type of mineral wool insulation – refer to sec. 8.2.8
- For thickness of mineral wool insulation: $t_D \geq 30$mm
- insulation situation: CS (continues sustained)
- For metal pipe material: steel and others – refer to sec.8.2.9, copper excluded
- For metal pipe dimension: diameter $d_M \leq 33{,}7$mm, wall thickness: $(2{,}6 \leq t_m \leq 14{,}2)$ mm

8.5.7.1.2 Steel pipes with mineral wool insulation in LS-situation

Approved field of application for EI 120-C/U in seal thickness $t_{A1} \geq 150$mm with identical setup on both sides of the floor:

- For type of mineral wool insulation – refer to sec.8.2.8
- For thickness of mineral wool insulation: $t_D \geq 40$mm
- insulation situation: LS (Local Sustained) with ($l_D > 500$mm)
- For metal pipe material: steel and others – refer to sec.8.2.9, copper excluded
- For metal pipe dimension: refer to fig. 8.5.7.1.2. below

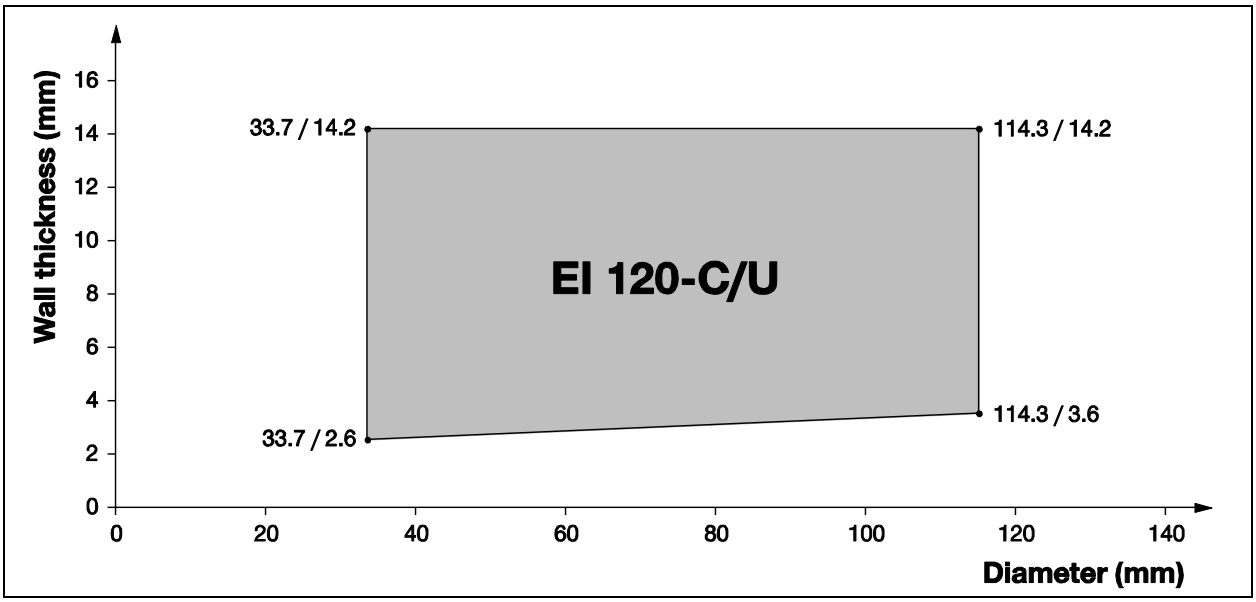



Fig.8.5.7.1.2.

Additional approved field of application for EI 120-C/U in seal thickness $t_{A1} \geq 150$mm with identical setup on both sides of the floor:

- For type of mineral wool insulation – refer to sec. 8.2.8
- For thickness of mineral wool insulation: $t_D \geq 30$mm
- insulation situation: LS (Local Sustained) with ($l_D \geq 500$mm)
- For metal pipe material: steel and others – refer to sec.8.2.9, copper excluded
- For metal pipe dimension: diameter $d_M \leq 33{,}7$mm, wall thickness: ($2{,}6 \leq t_m \leq 14{,}2$) mm

#### 8.5.7.2 Copper pipes with mineral wool insulation in rigid floor

- Arranged linear or in a cluster
- Insulation made from Rockwool RS800 or equal - refer to sec.8.2.8
- For metal pipe material: copper and others – refer to sec.8.2.9

| Copper pipes (M) with continued insulation (D) – sustained (CS) | | | | | |
|---|---|---|---|---|---|
| seal thickness | | | | $t_{A1}$ ≥150 mm | $t_{A1}$ ≥200 mm |
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_C$) [mm] | Insulation thickness ($t_D$) [mm] | | **Classification** (multiple) | **Classification** (mixed) |
| 28 – 88,9 | 1,0/2,0 – 14,2 [12] | 20 | | EI 120 C/U | - |
| 12 – 48 | 1,0/1,5 – 14,2 [13] | 20 | | - | EI 90-C/U |
| 48 – 88,9 | 1,5/2,0 – 14,2 [14] | 40 | | - | EI 120-C/U |
| Copper pipes (C) with local insulation (D) – sustained (LS) | | | | | |
| seal thickness | | | | $t_{A1}$ ≥150 mm | $t_{A1}$ ≥200 mm |
| Pipe | | Insulation | | **Classification** (multiple) | **Classification** (mixed) |
| diameter ($d_M$) [mm] | wall thickness ($t_C$) [mm] | thickness ($t_D$) [mm] | length ($L_D$) [mm] | | |
| 28 – 88,9 | 1,0/2,0 – 14,2 [12] | 20 | ≥ 500 | EI 120 C/U | - |
| 12 – 48 | 1,0/1,5 – 14,2 [13] | 20 | ≥ 500 | - | EI 90-C/U |
| 48 – 88,9 | 1,5/2,0 – 14,2 [14] | 40 | ≥ 500 | - | EI 120-C/U |

[12]Interpolation of minimum wall thickness between 1,0 for diameter 28 and 2,0 for diameter 88,9 for pipe diameters in between

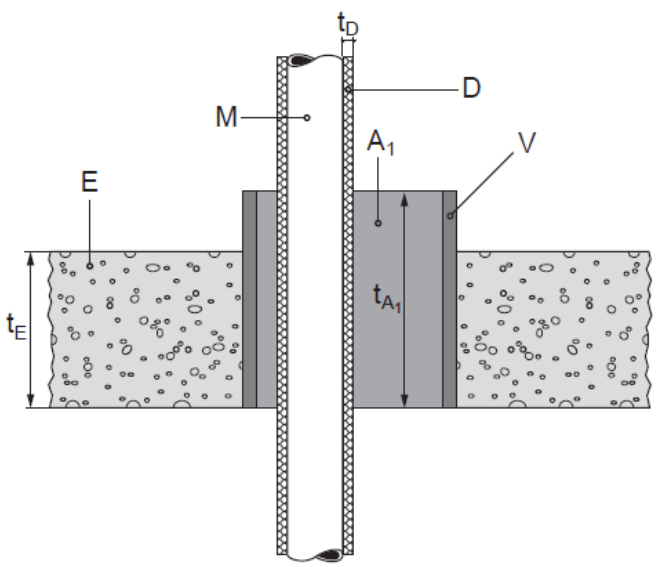
[13] Interpolation of minimum wall thickness between 1,0 for diameter 12 and 1,5 for diameter 48 for pipe diameters in between.

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

### 8.5.7.3 Copper/steel pipes with insulation in sleeves in rigid floor constructions

Construction details:

- Hilti Firestop Foam CFS-F FX (A) in PVC sleeves,
- Sleeve diameter 75 mm – 110 mm, sleeve length of sleeve 200 mm,
- build in flush to bottom side of the building element (E). Refer to sec.8.2.3.




8.5.7.3
Isolated Metal Pipe M penetrating a rigid floor through a plastic sleeve V, sealed with CFS-F FX ($A_1$)

| Metal pipes (M) with local mineral wool insulation (D) – local sustained (LS) + continuous sustained (CS) | | | | |
|---|---|---|---|---|
| seal thickness | | | | $t_{A1}$ ≥200 mm |
| Pipe | | Insulation | | **Classification** |
| diameter ($d_C$) [mm] | wall thickness ($t_C$) [mm] | thickness ($t_D$) [mm] | length ($L_D$) [mm] | (multiple) |
| 28 | 1,0 – 14,2 | 20 | ≥ 500 | EI 120-C/U |

For field of application: copper and other metal, refer to 8.2.9

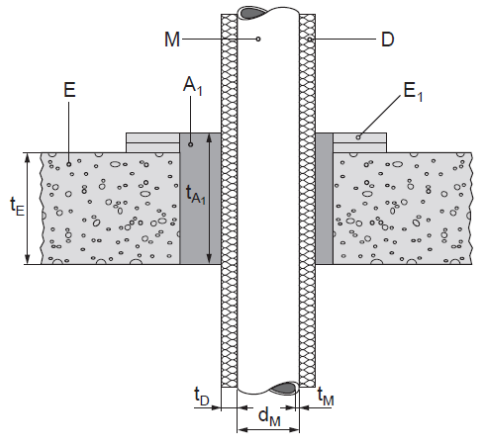
| Metal pipes (M) with local mineral wool insulation (D) – local sustained (LS) + continuous sustained (CS) | | | | |
|---|---|---|---|---|
| seal thickness: | | | | $t_{A1}$ ≥200 mm |
| Pipe | | Insulation | | **Classification** |
| diameter ($d_C$) [mm] | wall thickness ($t_C$) [mm] | thickness ($t_D$) [mm] | length ($L_D$) [mm] | (multiple) |
| 33,7 | 2,6 – 14,2 | 10 | ≥ 500 | EI 120-C/U |

For field of application: steel and other metal, copper excluded, refer to 8.2.9

#### 8.5.7.4 Copper pipes with foamed elastomeric insulation in rigid floor construction

Construction details:

- Pipes arranged as single pipe or in linear or in a cluster arrangement
- with insulation (D) made from foamed elastomeric insulation according to sec.8.2.6.

| | |
|---|---|
|  | 8.5.7.4<br>Isolated metal pipe (M) penetrating a foam seal made of CFS-F FX (A1) in a rigid floor construction |

| Copper pipes (C) with continued foamed elastomeric insulation (D) – sustained (CS) – in C/U pipe end configuration | | | |
|---|---|---|---|
| seal thickness: $t_{A1}$ ≥200 mm | | | |
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_M$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification**<br>(mixed) |
| 6 – 42 | 1,0/1,2 – 14,2 | 7,0/9,0 | EI 120-C/U |

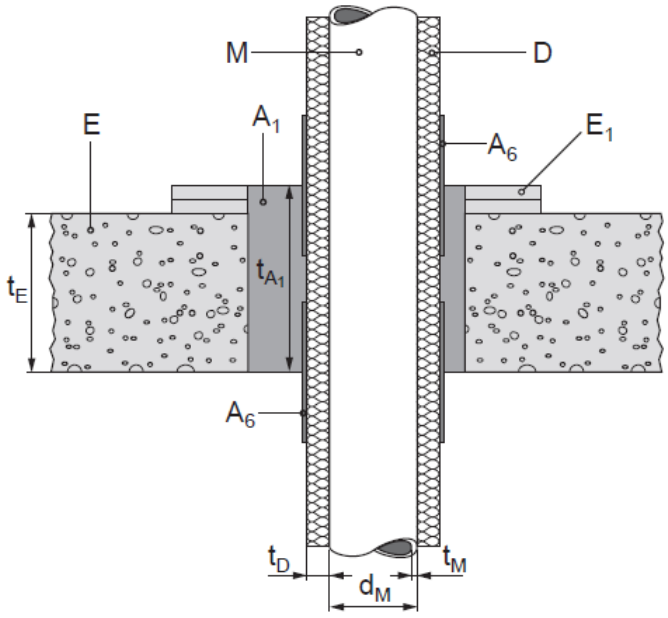
For metal pipe material: copper and others – refer to sec.8.2.9.

### 8.5.8 Metal pipes with foamed elastomeric insulation and Firestop Bandage CFS-B in rigid floor construction

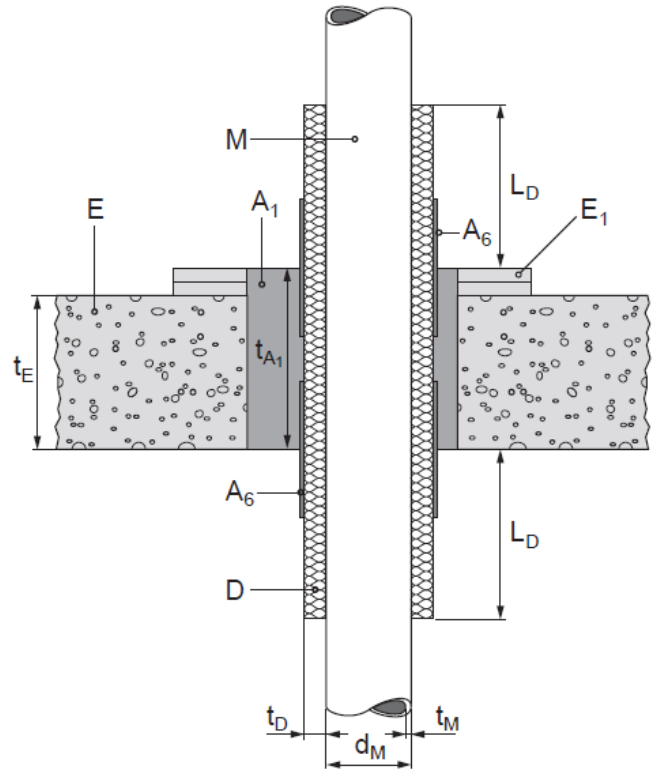
Construction details:

- Services covered by two layers of Hilti Firestop Bandage CFS-B identical on both sides of the floor
- bandage CFS-B is positioned with its centre- line flush to the seal surface
- bandage CFS-B to be secured twice by metallic wire.

For symbols and abbreviations see Annex 4 in sec.10.




8.5.8 A:
Metal pipe (M) with insulation (D) in CS-situation, penetrating a flexible/rigid wall, sealed by means of CFS-B ($A_6$) and CFS-F FX ($A_1$).




8.5.8 B:
Metal pipe (M) with insulation (D) in LS-situation for insulation length $L_D$, penetrating a flexible/rigid wall, sealed by means of CFS-B ($A_6$) and CFS-F FX ($A_1$).

#### 8.5.8.1 Steel pipes with foamed elastomeric insulation and CFS-B in rigid floor

- Arranged linear or in a cluster
- with elastomeric insulation (D) – for material refer to sec.8.2.6.
- Insulation in LS and CS case
- For metal pipe material: steel and others – refer to sec.8.2.9, copper excluded.

| **Steel pipes (C) with continued sustained (CS) foamed elastomeric insulation (D)** | | | | |
|---|---|---|---|---|
| seal thickness: $t_{A1}$ ≥150 mm | | | | |
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ™ [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (multiple) | **Classification** (mixed) |
| 33.7 – 114.3 | 2.6/3.6 – 14.2 [15] | 19 | EI 90-C/U | EI 60-C/U |
| 33.7 – 114.3 | 2.6/3.6 – 12.5 [16] | 19 | EI 120-C/U | n.a. |

| **Steel pipes (C) with local sustained (LS) foamed elastomeric insulation (D)** | | | | | |
|---|---|---|---|---|---|
| seal thickness: $t_{A1}$ ≥150 mm | | | | $t_{A1}$ ≥150 mm | |
| Pipe | | Insulation | | **Classification** (multiple) | **Classification** (mixed) |
| diameter ($d_C$) [mm] | wall thickness ($t_C$) [mm] | thickness ($t_D$) [mm] | length ($L_D$) [mm] | | |
| 33.7 – 114.3 | 2.6/3.6 – 14.2 [15] | 19 | ≥ 500 | EI 90-C/U | EI 60-C/U |
| 33.7 – 114.3 | 2.6/3.6 – 12.5 [16] | 19 | ≥ 500 | EI 120-C/U | n.a. |

[15] Interpolation of minimum wall thickness between 2,6mm for diameter 33,7mm and 3,6 mm for diameter 114,3mm for pipe diameters in between

[16]Interpolation of minimum wall thickness between 1,0 for diameter 12 and 1,5 for diameter 48 for pipe diameters in between.

#### 8.5.8.2 Copper pipes with foamed elastomeric insulation and CFS-B in rigid floor

- Arranged linear or in a cluster
- With foamed elastomeric insulation – for material refer to sec.8.2.6.
- Insulation in LS (Length $L_D \geq$ 500mm), and CS case
- For metal pipe material: copper and others – refer to sec.8.2.9

| **Copper pipes (C) with continued sustained (CS) foamed elastomeric insulation (D)** | | | | | |
|---|---|---|---|---|---|
| | | | seal thickness | | |
| | | | $t_{A1}$ ≥150 mm | | $t_{A1}$ ≥200 mm |
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_M$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** | | |
| | | | multiple | mixed | |
| 28 – 88,9 | 1,0/2,0 – 14,2 [17] | 19 | EI 90-C/U | EI 60- C/U | n.a. |
| 28 | 1,0 – 14.2 | 19 | EI 120- C/U | n.a. | n.a. |
| 28 – 54 | 1,0/1,5 – 14,2[18] | 8,5/9,0-35,0/38,0[19] | n.a. | n.a. | EI 90- C/U |
| 28 – 54 | 1,0/1,5 – 14,2[18] | 8,5 - 35,0/38,0[19] | n.a. | n.a. | EI 120- C/U |
| **Copper pipes (C) with local sustained (LS) foamed elastomeric insulation (D)** | | | | | |
| | | | seal thickness | | |
| | | | $t_{A1}$ ≥150 mm | | $t_{A1}$ ≥200 mm |
| Pipe diameter ($d_M$) [mm] | Pipe wall thickness ($t_M$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** | | |
| | | | multiple | mixed | |
| 28 – 88,9 | 1,0/2,0 – 14,2 [17] | 19 | EI 90- C/U | EI 60- C/U | n.a. |
| 28 | 1,0 – 14.2 | 19 | EI 120- C/U | n.a. | n.a. |
| 28 – 54 | 1,0/1,5 – 14,2[18] | 8,5/9,0-35,0/38,0[19] | n.a. | n.a. | EI 90- C/U |
| 28 – 54 | 1,0/1,5 – 14,2[18] | 8,5 - 35,0/38,0[19] | n.a. | n.a. | EI 120- C/U |

[17] Interpolation of minimum wall thickness between 1,0 mm for diameter 28 mm and 2,0 mm for diameter 89 mm for pipe diameters in between

[18] Interpolation of minimum wall thickness between 1,0 for diameter 28mm and 1,5 for diameter 54mm for pipe diameters in between.

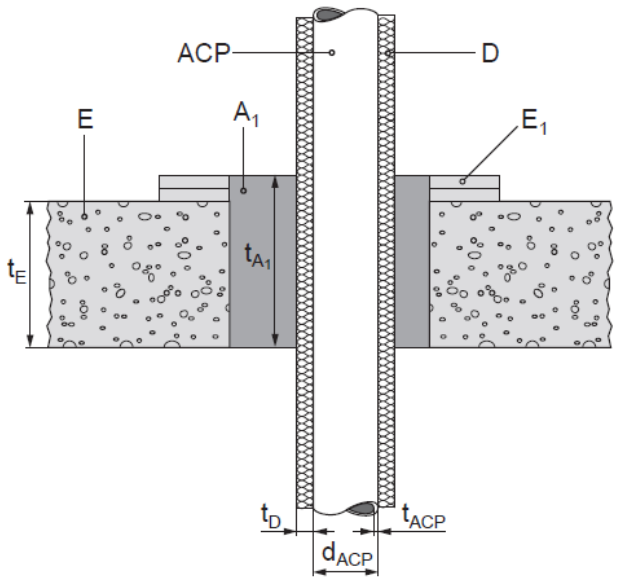
[19] The slash indicates minimum insulation thickness for 28 mm pipe and 54 mm pipe, followed by maximum insulation thickness for 28 mm pipe and 54 mm pipe.

### 8.5.9 Aluminium-composite pipes with foamed elastomeric insulation in rigid floor construction

Construction details:

- Hilti Firestop Foam CFS-F FX ($A_1$) of thickness $t_{A1}$ flush with the soffit of the building element (E).
- In case of seal thickness $t_{A1}$ > building element thickness $t_E$, see sec.8.2.3.
- For distances refer to sec.8.5.3.
- Foamed elastomeric insulation – for material refer to sec.8.2.6
- Insulation case: CS

For symbols and abbreviations see Annex E in sec.10.




8.5.9.:
Aluminium-composite pipe (ACP) with insulation (D) in CS-situation, penetrating a rigid floor, sealed by means of CFS-F FX ($A_1$).

#### 8.5.9.1 Aluminium-composite pipes «*Mepla*» with continued foamed elastomeric insulation

| Al composite pipes *Geberit Mepla* (ACP) with foamed elastomeric insulation | | | |
|---|---|---|---|
| seal thickness: $t_{A1} \geq 200$ mm | | | |
| Pipe diameter ($d_{ACP}$) [mm] | Pipe wall thickness ($t_{ACP}$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (mixed) |
| 16 – 32 | 2.0 – 3.0 | 8.0 – 9.0 | EI 120-U/C |

#### 8.5.9.2 Aluminium-composite pipes «Alpex duo» with continued foamed elastomeric insulation

| Al composite pipes «*Alpex duo*» from *Fränkische Röhrenwerke* (ACP) with foamed elastomeric insulation | | | |
|---|---|---|---|
| seal thickness: $t_{A1} \geq 200$ mm | | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** (mixed) |
| 16 – 32 | 2.0 – 3.0 | 8.0 – 9.0 | EI 120-U/C |

#### 8.5.9.3 Aluminium-composite pipes «*Sanfix Fosta and Viega Raxofix*» with and without continued foamed elastomeric insulation

| Al composite pipes *Viega Sanfix Fosta* from *Viega* (ACP) with foamed elastomeric insulation | | | |
|---|---|---|---|
| seal thickness: $t_{A1} \geq 200$ mm | | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** |
| 16 | 2,2 | 8,0 – 17,5 | EI 120-U/C |
| 20 | 2,8 | 8,5 – 18,0 | EI 120-U/C |
| 25 | 2,7 | 8,5 – 18,5 | EI 120-U/C |
| 32 | 3,2 | 9,0 – 19,5 | EI 120-U/C |
| 16 | 2,2 | No insulation (naked pipe) | EI 120-U/C |
| 20 | 2,8 | No insulation (naked pipe) | EI 120-U/C |
| 25 | 2,7 | No insulation (naked pipe) | EI 120-U/C |
| 32 | 3,2 | No insulation (naked pipe) | EI 120-U/C |

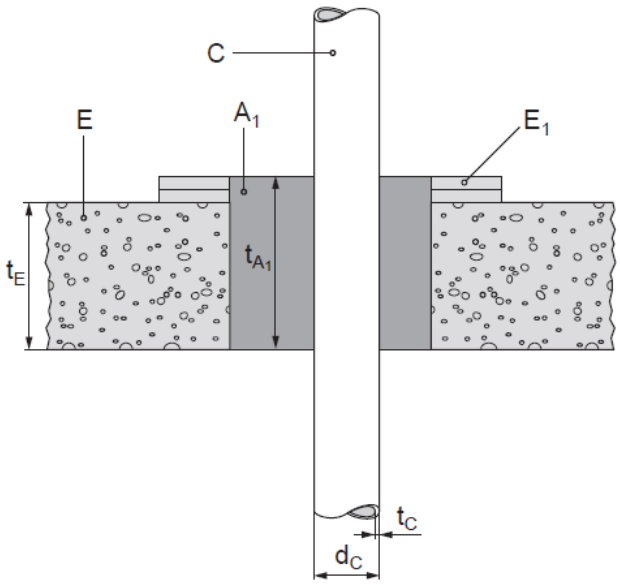
| Al composite pipes *Viega Raxofix* from *Viega* (ACP) with foamed elastomeric insulation | | | |
|---|---|---|---|
| seal thickness: $t_{A1} \geq 200$ mm | | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | Insulation thickness ($t_D$) [mm] | **Classification** |
| 16 | 2,2 | 8,0 – 17,5 | EI 120-U/C |
| 20 | 2,8 | 8,5 – 18,0 | EI 120-U/C |
| 25 | 2,7 | 8,5 – 18,5 | EI 120-U/C |
| 32 | 3,2 | 9,0 – 19,5 | EI 120-U/C |
| 16 | 2,2 | No insulation (naked pipe) | EI 120-U/C |
| 20 | 2,8 | No insulation (naked pipe) | EI 120-U/C |
| 25 | 2,7 | No insulation (naked pipe) | EI 120-U/C |
| 32 | 3,2 | No insulation (naked pipe) | EI 120-U/C |

### 8.5.10 Plastic pipes penetrating a rigid floor, sealed with CFS-F FX

Construction details

- Hilti Firestop Foam CFS-F FX of thickness $t_A$ flush with the soffit of the building element
- If seal thickness $t_A$ > building element thickness $t_E$, refer to sec.8.2.3.

For symbols and abbreviations see Annex E in sec.10.




8.5.10
Plastic pipe (C), penetrating a rigid floor, sealed by means of CFS-F FX ($A_1$).

#### 8.5.10.1 PE pipes in rigid floor constructions

| PE pipes (C) according to EN ISO 15494 and DIN 8074/8075 | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| ≤ 40 | 2.3 – 3.7 | EI 120-U/U |

| PE pipes (C) according to EN 1519-1 and DIN 8074/8075 – arranged linear | | | |
|---|---|---|---|
| seal thickness: $t_A$ ≥150 mm | | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** | |
| | | (multiple) | (mixed) |
| ≤ 50 | 2.9 – 4.6 | EI 120-U/C | EI 60-U/C |

#### 8.5.10.2 PVC-U pipes in rigid floor constructions

| PVC-U pipes (C) according to EN ISO 1452-2, EN ISO 15493 and DIN 8061/8062 | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| ≤ 40 | 1.9 – 3.0 | EI 120-U/U |

| PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 - arranged linear | | | |
|---|---|---|---|
| seal thickness: $t_{A1}$ ≥150 mm | | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** | |
| | | (multiple) | (mixed) |
| ≤ 50 | 3.7 | EI 120-U/U | n.a. |

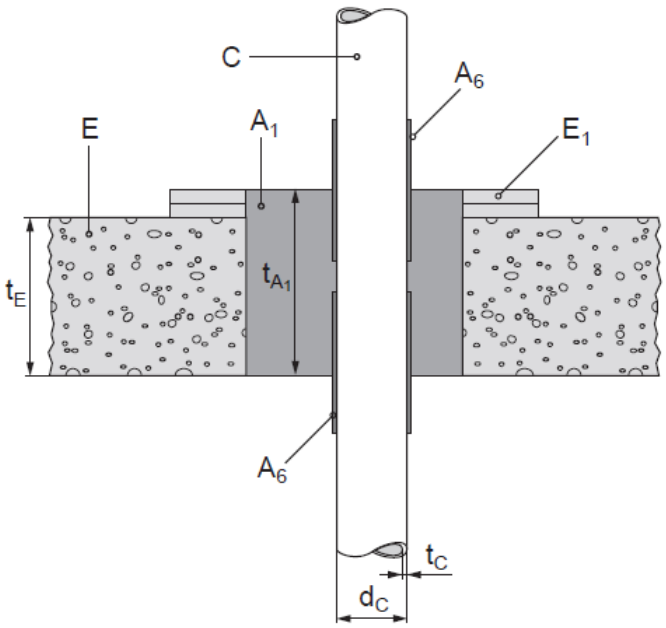
| PVC-U pipes (C) according to EN 1452-2 and DIN 8061/8062 – arranged linear | | | |
|---|---|---|---|
| seal thickness: $t_{A1}$ ≥150 mm | | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** | |
| | | (multiple) | (mixed) |
| ≤ 50 | 3.7 – 5.6 | EI 120-U/C | EI 60-U/C |

### 8.5.11 Plastic pipes penetrating a rigid floor, sealed with CFS-F FX and CFS-B

Construction details:

- Hilti Firestop Foam CFS-F FX of thickness $t_{A1}$ flush with the soffit of the building element
- In case of seal thickness $t_A$ > building element thickness $t_E$, refer to sec.8.2.3.

For symbols and abbreviations see Annex E in sec.10.

| | |
|---|---|
|  | 8.5.11<br>Plastic pipe (C), penetrating a rigid floor, sealed by means of CFS-F FX ($A_1$), sealed additionally with CFS-B ($A_6$). |

Further details to be considered:

- Framing (beading) on topside of floor to be finished before installing the firestop
- CFS-B Firestop bandage has to be wrapped around the pipe two times (two layers), secured by means of adhesive tape and fixed (two times) by using metal wire
- CFS-B to be installed half of its length into the seal, half of seal stays outside above and below the seal
- Formwork/sheeting to be installed below the floor-seal
- Fill opening around the bandage/around pipe with foam $A_1$

#### 8.5.11.1 PE pipes in rigid floor, sealed with CFS-F FX and Bandage CFS-B

| PE pipes (C) according to EN ISO 15494 and DIN 8074/8075 | | |
|---|---|---|
| seal thickness: $t_{A1}$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| 50 - 110 | 2.9/2.7 – 10.0 | EI 120-U/U |

#### 8.5.11.2 PVC-U pipes in rigid floor, sealed with CFS-F FX and Bandage CFS-B

| PVC-U pipes (C) according to EN 14493 and DIN 8061/8062 – U/U | | |
|---|---|---|
| seal thickness: $t_A$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| 50 - 110 | 1.8 – 12.3 | EI 120-U/U |

| PVC-U pipes (C) according to EN 1452-2, EN ISO 15493 and DIN 8061/8062 | | |
|---|---|---|
| seal thickness: $t_A$ ≥200 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (mixed) |
| ≦ 40 | 1.9 – 3,0 | EI 120-U/U |

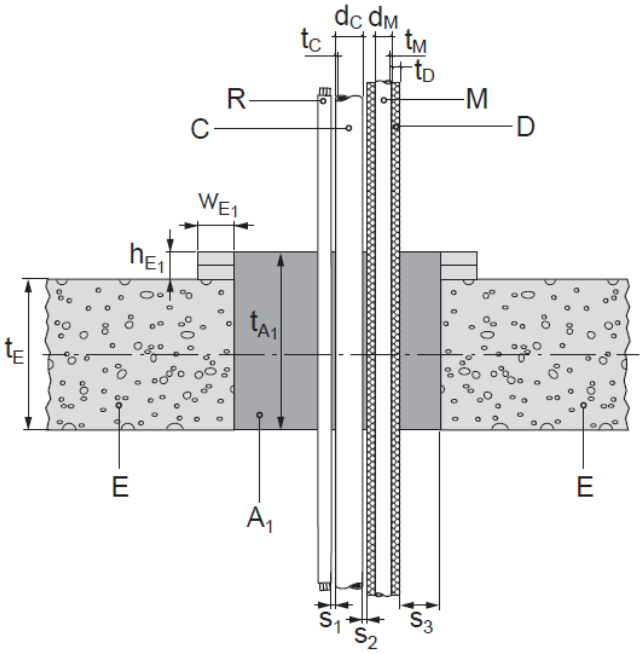
| PVC-U pipes (C) according to EN 1452-2, EN ISO 15493 and DIN 8061/8062 | | |
|---|---|---|
| seal thickness: $t_A$ ≥150 mm | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (multiple) |
| ≤ 50 | 3,7 | EI 120-U/U |

| PVC-U pipes (C) according to EN 1452-2, EN ISO 15493 and DIN 8061/8062 | | | |
|---|---|---|---|
| seal thickness: $t_A$ ≥150 mm | | | |
| Pipe diameter ($d_C$) [mm] | Pipe wall thickness ($t_C$) [mm] | **Classification** (multiple) | (mixed) |
| ≤ 50 | 3,7 – 5,6 | EI 120-U/C | EI 60-U/C |

### 8.5.12 Mixed pipe and cable penetration in rigid floors, sealed with CFS-F FX

Construction details:

- Penetrating service is a tight bundle of insulated metal pipes, plastic pipe and cables
- Distances : see below
- Metal pipes: max. 2 parallel copper pipes, insulated
- Type of metal: copper and others (refer to 8.2.9 )
- Type of insulation foamed elastomeric – for material refer to 8.2.6
- Insulation thickness: 9mm, type: CS-situation
- One penetrating non-insulated plastic pipe
- Max. two parallel cables
- Seal thickness with CFS-F FX: over entire thickness $t_{A1}$
- In case of seal thickness $t_A$ > building element thickness $t_E$, refer to sec.8.2.3




8.5.12:
Clima split – Application with foamed elastomeric thermal insulation on metal pipes penetrating a flexible/rigid floor.

For symbols and abbreviations see Annex E in Sec.10.

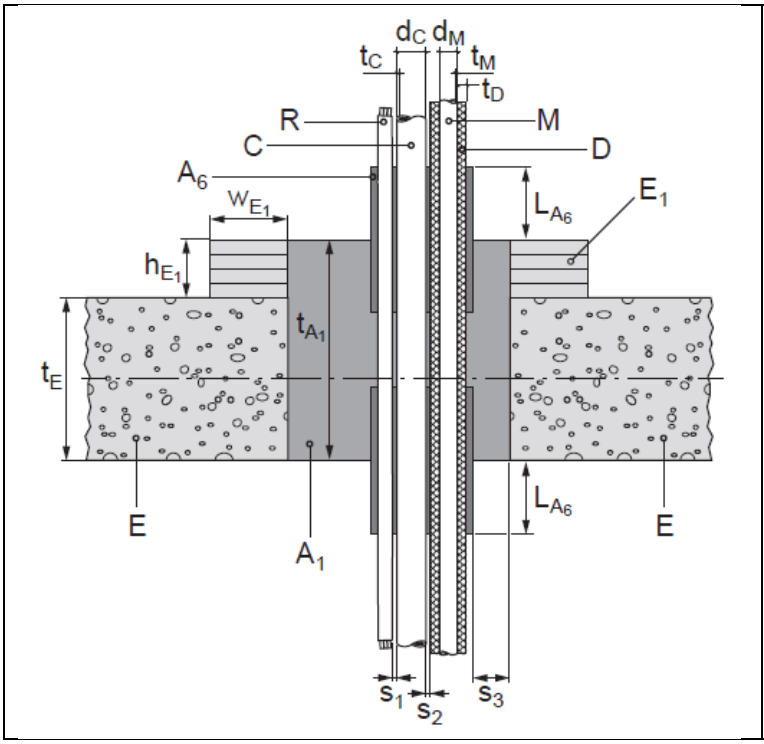
| Distance position | Minimum distances (mm): |
|---|---|
| between services and seal edge ($s_3$): | 20 |
| between all services inside Clima split bundle ($s_1$, $s_2$): | 0 |
| between services and upper seal edge | n.a. |

| seal thickness: $t_{A1}$ ≥200 mm | | | | |
|---|---|---|---|---|
| **Penetrant** | **Type / diameter** (d) [mm] | **floor thickness** (t) [mm] | **pipe end** | **Classification** (mixed) |
| copper pipes (M), insulated | 6 - 42 | 1.0 | C/U | EI 90 |
| cables (R) | 5 x 1.5mm²<br>5 x 6mm² | | n.a. | |
| PVC pipes (C) | 16 | 3.7 | U/U | |
| | 25 | 4.3 | | |
| | 40 | 2.4 | | |

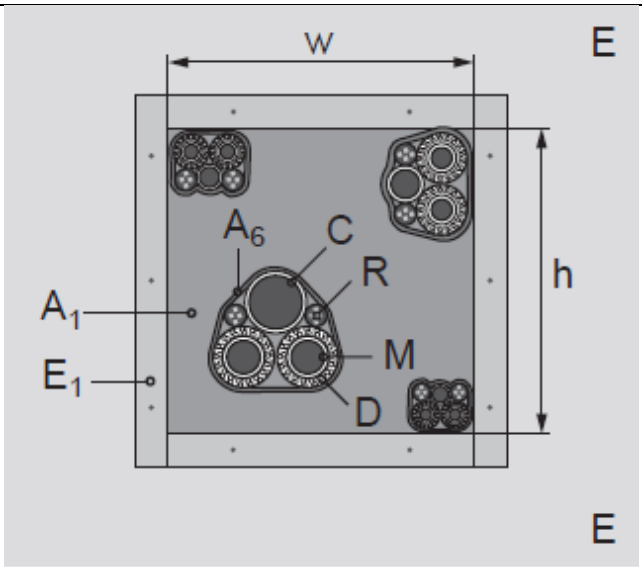
### 8.5.13 Mixed pipe and cable penetration in rigid floors with PE-insulation and CFS-B Firestop Bandage

Construction details:

- Penetrating service is a tight bundle of insulated metal pipes, plastic pipe and cables
- Distances: see below
- Metal pipes: max. 2 parallel copper pipes, insulated
- Type of metal: copper and others - refer to 8.2.9
- Type of insulation foamed PE – for material refer to 8.2.10, Type: CS-situation
- One penetrating non-insulated plastic pipe
- Max. two parallel cables
- Seal thickness with CFS-F FX: over entire thickness tA1, see fig.8.5.13A
- In case of seal thickness tA > building element thickness tE, refer to sec.8.2.3
- CFS-B to be installed on both sides of the seal, half inside the seal, see fig.8.5.13A
- Number of windings of CFS-B Firestop Bandage (A6): one




8.5.13 A
Clima split – Application with foamed thermal insulation made of PE on metal pipes penetrating a rigid floor.




8.5.13. B:
Clima split – Application with foamed thermal insulation on metal pipes penetrating a rigid floor, sealed with CFS-F FX ($A_1$) and CFS-B ($A_6$).
Mixed penetration may be positioned directly into the corner.

For symbols and abbreviations see Annex 5.

| Distance position | Minimum distances (mm): |
|---|---|
| between services and seal edge ($s_3$): | 0 |
| between all services inside clima split bundle ($s_2$): | 0 |
| between services and upper seal edge | n.a. |

| Seal thickness $t_{A1}$ ≥150 mm | | | | |
|---|---|---|---|---|
| **Pentrant** | **Type / diameter** ($d_M$) [mm] | **wall thickness (minimum)** ($t_M$) [mm] | **pipe end** | **Classification** (mixed) |
| copper pipes (M) [13] | 6,4 – 15,9 | 0,8 | C/U | EI 120 |
| cables (R) | 5 x 1.5mm$^2$ | | n.a. | |
| PVC pipes (C), flexible | 13 - 24 | 1,5 – 2,0 | U/U | |

### 8.6 Cross-laminated timber floors – System Binderholz - Construction details

Characterization for the cross-laminated timber floors:

- Binderholz BBS XL (CLT)
- Number of cross-laminated timber layers: ≧ 3 (for floor thickness $t_E$ ≧ 80mm)
- Number of cross-laminated timber layers: ≧ 5 (for floor thickness $t_E$ ≧ 100mm)
- PU / MUF adhesives permitted
- Edge glue not required
- Minimum thickness of outer cross-laminated timber layers $t_l$ ≧ 20mm,

#### 8.6.1 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.8.2.3.

#### 8.6.2 Blank seals of CFS-F FX in cross-laminated timber floors

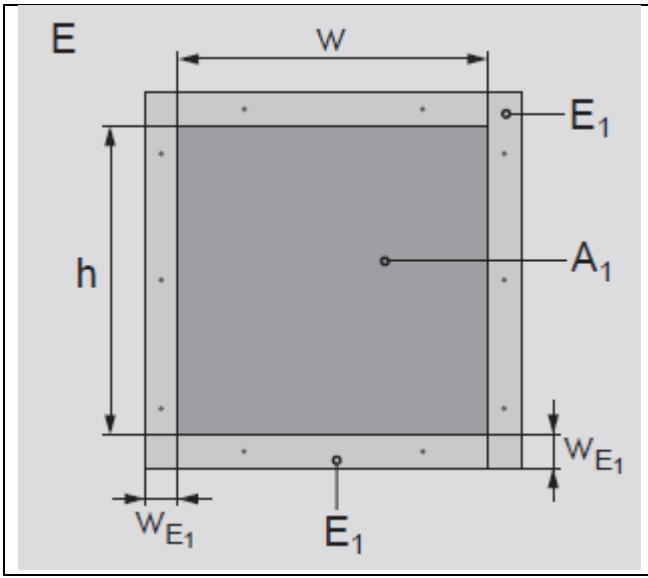



Fig. 8.6.2:

Blank seal of CFS-F FX ($A_1$) in a cross-laminated timber wall 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) | **Classification** |
|---|---|---|---|---|
| 400 | 400 | 80 | 80 | EI 30 |
| 400 | 400 | 100 | 150 | EI 90 |
| 400 | 400 | 140 | 200 | EI 90 |

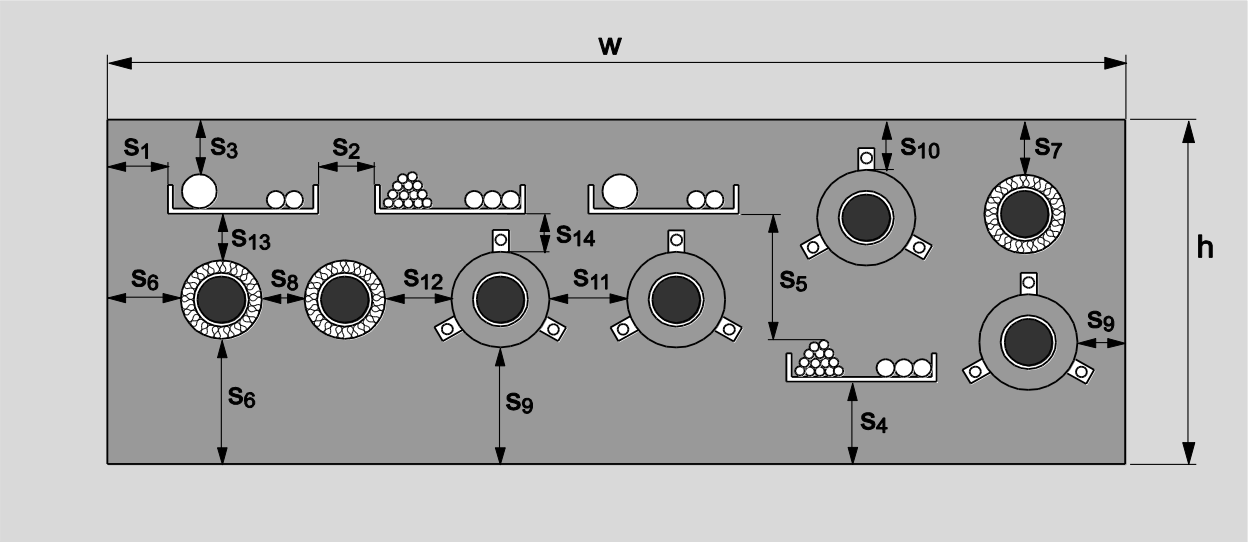
#### 8.6.3 First support in cross-laminated timber floor

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

### 8.6.4 Minimum distances for penetrations in cross-laminated timber floor construction– System Binderholz

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 |



### 8.6.5 Cables in cross-laminated timber floor constructions– System Binderholz

For penetrating cables:

- Type of cable: All sheathed cable types currently and commonly used in building practice in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables
- Cable size: see table below
- First support: refer to 8.5.15

| Size of cables Max. Cable Diameter | Cross-laminated timber floor thickness $t_E$ | Requested Seal thickness $t_{A1}$ | Cable Carrier system | **Classification** |
|---|---|---|---|---|
| ≤ 21mm | ≧ 80 mm | ≧ 80 mm | With and without | EI 30 |
| ≤ 50 mm | ≧ 80 mm | ≧ 80 mm | With and without | EI 30 |
| ≤ 21mm | ≧ 100 mm | ≧ 150 mm | With and without | EI 60 and E90 |
| ≤ 50 mm | ≧ 100 mm | ≧ 150 mm | With and without | EI 45 and E90 |
| ≤ 21mm | ≧ 140 mm | ≧ 200 mm | With and without | EI 90 |
| ≤ 50 mm | ≧ 140 mm | ≧ 200 mm | With and without | EI 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: 200mm
- Max. carrier high: 60mm
- For distances refer to 8.6.4
- Carrier material thickness: ≥ 1,5mm

### 8.6.6 Conduits and tubes in cross-laminated timber floor construction– System Binderholz

General conditions:

- First support: refer to 8.6.3
- Conduit end configuration: U/C,
- Conduit end seal: sealed with CFS-S ACR, sealing depth: ≥ 15mm
- Projecting length (identical on both sides of the wall): ≧ 500mm
- 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 $t_{A1}$ | **Classification** |
|---|---|---|---|
| Single conduits, rigid plastic conduits Ø ≤ 32 mm | ≧ 80 mm | ≧ 80 mm | EI 30-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 90-U/C |
| Single conduits, flexible, pliable and plastic conduits Ø ≤ 32 mm | ≧ 80 mm | ≧ 80 mm | EI 30-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 90-U/C |
| Bundle of rigid plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm | ≧ 80 mm | ≧ 80 mm | EI 30-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 90-U/C |
| Bundle of flexible/pliable plastic conduits, bundle diameter Ø ≤ 100mm, max. single conduit within this bundle is Ø ≤ 32 mm | ≧ 80 mm | ≧ 80 mm | EI 30-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 90-U/C |
| 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 | EI 30-U/C |
| | ≧ 100 mm | ≧ 150 mm | EI 90-U/C |

### 8.6.7 Metal pipes in cross-laminated timber floor– System Binderholz

Construction details:

- 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.8.2.9
- Metal pipes diameter: d ≧ 18mm
- Metal pipe wall thickness = (1,0-14,2) mm
- Pipe insulation, for material refer to 8.2.10
- Pipe insulation thickness: 9mm

| | seal thickness $t_{A1}$ | Classification |
|---|---|---|
| In floor thickness $t_E$ ≥ 80 mm | ≥80 mm | EI 30-C/U |
| In floor thickness $t_E$ ≥ 100 mm | ≥150 mm | EI 90-C/U |
| In floor thickness $t_E$ ≥ 140 mm | ≥200 mm | EI 90-C/U |

### 8.6.8 Plastic pipes in cross-laminated timber floor– System Binderholz

Construction details:

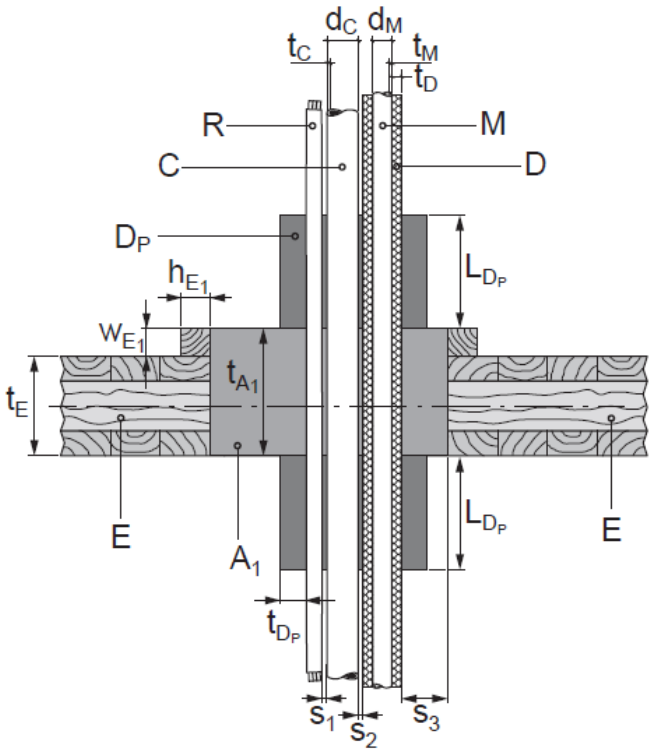
- One non isolated plastic pipe
- Pipe in U/U pipe-end configuration
- Pipe made of PVC
- For flexible, pliable and rigid pipes
- Plastic pipe diameter: max.25mm
- Plastic pipe wall thickness: max. 4,3mm

| Clima split bundles acc. Fig.8.5.7.1.A | seal thickness $t_{A1}$ | Classification |
|---|---|---|
| In floor thickness $t_E$ ≥80 mm | ≥80 mm | EI 30-U/U |
| In floor thickness $t_E$ ≥100 mm | ≥150 mm | EI 90-U/U |
| In floor thickness $t_E$ ≥140 mm | ≥200 mm | EI 90-U/U |

### 8.6.9 Mixed pipe and cable penetration in cross-laminated timber floors with PE-insulation and CFS-B Firestop Bandage– System Binderholz

Clima split - construction details:

- Penetrating service is a tight bundle of insulated metal pipes, plastic pipes and cable
- Distances: see below Fig.8.5.16:
- Metal pipes: max. 2 parallel copper pipes, insulated,
- Type of metal: copper and others - refer to 8.2.9
- Type of insulation (CS-situation): foamed PE (polyethylene), refer to 8.2.10
- One penetrating non-insulated plastic pipe
- Max. two cables max. diameter = 14mm
- Seal thickness with CFS-F FX: over entire thickness tA1, see Fig.8.6.9
- In case of seal thickness tA1 > building element thickness tE, refer to sec.8.2.3
- Above and below the floor there should be an LDP = min. 250mm long additional protect insulation DP made of foamed elastomer (refer to 8.2.6), thickness tDP = 9mm, in LI or CI situation




8.6.9
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: ($s_1 = s_2 = s_3$) $\geq$ 0mm

| | |
|---|---|
| Metal pipes: | • Metal pipes maximum diameter: 18mm<br>• Wall thickness = (1,0-14,2) mm<br>• PE-insulation thickness: 9 mm |
| Plastic pipe: | • PVC pipe, flexible, pliable or rigid<br>• Plastic pipe diameter: max.25mm<br>• Plastic pipe wall thickness: max. 4,3mm |
| Cables: | • Max. size: 5x1,5mm²<br>• Cable diameter: maximum 14mm |

| | seal thickness $t_{A1}$ | Classification: |
|---|---|---|
| In floor thickness $t_E \geq$80 mm | ≥ 80 mm | EI 30 |
| In floor thickness $t_E \geq$100 mm | ≥ 150 mm | EI 90 |
| In floor thickness $t_E \geq$140 mm | ≥ 200 mm | EI 90 |

### 8.7 Cross-laminated timber floors – System Lignotrend - Construction details

Characterization for the cross-laminated timber rib element floors:

- LIGNO Rib Q2 Acoustic Z2 196 – EI90, floor thickness $t_E$ = 196mm
- LIGNO Rib Q2 Acoustic Z2 169 – EI60, floor thickness $t_E$ = 169mm

#### 8.7.1 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.8.2.3.

#### 8.7.2 Blank seals of CFS-F FX in cross-laminated timber floors – System Lignotrend

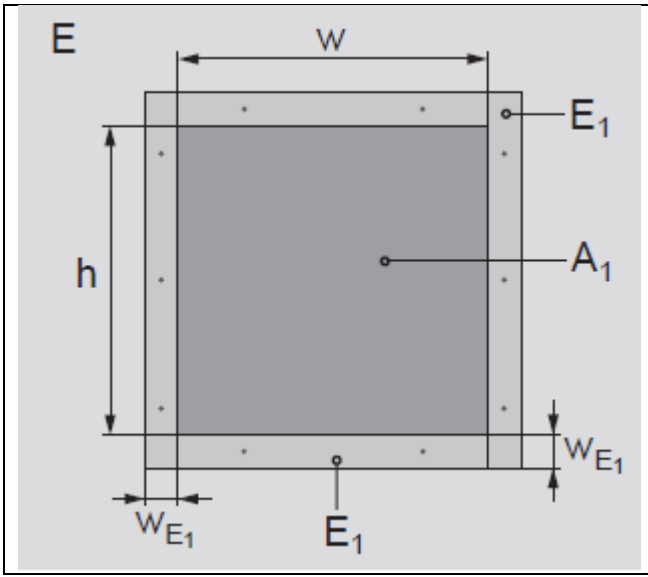



Fig. 8.6.2:

Blank seal of CFS-F FX ($A_1$) in a cross-laminated timber wall – 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) | **Classification** |
|---|---|---|---|---|
| 400 | 400 | 169 | 150 | EI 90 |
| 400 | 400 | 196 | 200 | EI 90 |

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

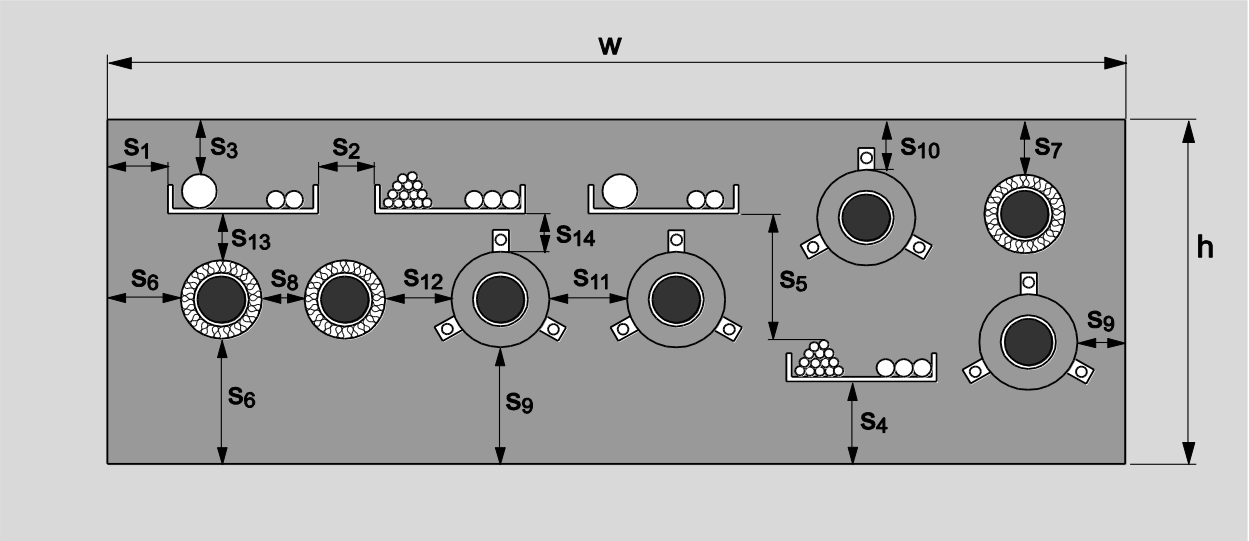
- Max.400mm by 400mm (or diameter 400mm)
- Min.seal depth $t_{A1}$ = 169mm /196mm (over entire floor thickness $t_E$)

#### 8.7.4 First support in cross-laminated timber floor – System Lignotrend

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

### 8.7.5 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 |



### 8.7.6 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 in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables
- Cable size: see table below
- First support: refer to 8.6.3

| Size of cables<br>Max. Cable Diameter | Cross-laminated timber floor thickness $t_E$ | Requested Seal thickness $t_{A1}$ | **Classification** |
|---|---|---|---|
| ≤ 21mm single cables | ≧ 169 mm | ≧ 169 mm | EI 60 |
| bunched cables ≤ 21 mm, max. ∅ bundle = 100mm, | ≧ 169 mm | ≧ 169 mm | EI 60 |
| ≤ 21mm single cables | ≧ 196 mm | ≧ 196 mm | EI 90 |
| bunched cables ≤ 21 mm, max. ∅ bundle = 100mm, | ≧ 196 mm | ≧ 196 mm | EI 90 |

For cable carrier systems:

- Not allowed

### 8.7.7 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.8.2.9
- Metal pipes diameter: d ≦ 160mm
- Metal pipe wall thickness = (0,5-14,2) mm
- With product TS18 Wildeboer installed on underside of ceiling
- For first support: refer to 8.6.3

| | seal thickness $t_{A1}$ | **Classification** |
|---|---|---|
| In floor thickness $t_E$ ≥ 169 mm | ≥ 169 mm | EI 60-U/U |
| In floor thickness $t_E$ ≥ 196 mm | ≥ 196 mm | EI 90-U/U |

### 8.7.8 Plastic pipes in cross-laminated timber floor – System Lignotrend

Construction details:

- Single insulated or non-insulated plastic pipe
- Pipe in U/C pipe-end configuration
- Pipe type Aquatherm PP-R pipes “Blue Pipe” and “Green Pipe”
- Plastic pipe diameter: 20 – 40mm
- Plastic pipe wall thickness: max. 2,8 – 3,7mm
- Insulation (if applicable): Armaflex AF3, CS (14mm / 16,5mm)
- For first support: refer to 8.6.3
- 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 $t_{A1}$ | Classification |
|---|---|---|
| In floor thickness $t_E$ ≥ 169 mm | ≥ 169 mm | EI 60-U/C |
| In floor thickness $t_E$ ≥ 196 mm | ≥ 196 mm | EI 90-U/C |

## 9 ANNEX D – INSTALLATION OF THE PRODUCT (INSTRUCTION FOR USE)

The application (appropriate installation) of Hilti Firestop Foam CFS-F FX is described and illustrated in chapter 8 – Annex C.

The folder *Instruction for use* is available at Hilti's website. www.hilti.com

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**

| Abbreviation | Description |
|---|---|
| $A_1$ | Hilti Firestop Foam CFS-F FX |
| $A_10$ | Hilti Firestop Collar Endless CFS-C EL with oddment |
| $A_2$ | Annular gap seal with Hilti Firestop Acrylic Sealant CFS-S ACR |
| $A_3$ | Annular gap seal with Hilti CFS-FIL |
| $A_4$ | Annular gap seal with gypsum plaster |
| $A_5$ | Annular gap seal with cementitious mortar acc. EN 998-2, group M10 |
| $A_6$ | Hilti Firestop Bandage CFS-B |
| ACP | Aluminium Composite Pipe |
| B | Backfilling material (mineral wool) |
| C | Plastic Pipe |
| $C_1$ | Sound decoupling insulation |
| CLT | Cross Laminated Timber – specific cross-laminated timber floor and wall set-up |
| D | Pipe insulation |
| $D_W$ | Pipe insulation, incombustible, based on mineral wool |
| $D_E$ | Pipe insulation, combustible, based on elastomeric foamed material |
| $D_P$ | Pipe insulation - Protect insulation |
| $D_{PE}$ | Pipe insulation, combustible, based on polyethylene foam |
| $d_A$ | Aperture diameter in supporting construction E |
| $d_C$ | Pipe diameter (nominal outside diameter) for plastic pipes |
| $d_M$ | Pipe diameter (nominal outside diameter) for metal pipes |
| $d_{ACP}$ | Pipe diameter (nominal outside diameter) for Aluminum composite pipes |
| $d_{RC}$ | Pipe diameter (nominal outside diameter) for Cable conduits |
| E | Building element (wall, floor) |
| $E_1$ | Aperture framing / beading / additional framing |
| F | Hooks (long or short) for fixing of the collar |
| H | High |
| $h_{E1}$ | High of aperture framing / beading / additional framing |
| L | Length |
| $L_D$ | Length of Insulation |
| $L_{A6}$ | Length of CFS-B Firestop bandage outside the seal = 125mm minus installation depth of $AR_6$ |
| $L_{DP}$ | Length of Protect Insulation |
| $L_{RC}$ | Projecting Length for electric conduits, filled or unfilled |
| n | amount, number of pieces |
| n.a. | Not applicable |
| n.r. | Not relevant |

| Abbreviation | Description |
|---|---|
| M, M1, M2, … | Metal pipe |
| PG | Pipe group |
| R | Electric Cables, optical cables |
| RC | Conduit for electric/optical cables |
| RB | Bundle of electric/optical cables |
| RS | Cable support system |
| $s_1$ | Minimum distance between single penetration seals |
| $s_2$ | Minimum distance between clustered pipes or other penetrants within one penetration |
| $s_3$ | Minimum distance between penetrating pipe and building element |
| $t_A$ | Total seal thickness |
| $t_{A2}$ | Thickness of Hilti Firestop Acrylic Sealant CFS-S ACR |
| $t_{A3}$ | Thickness of Hilti CFS-FIL |
| $t_{ACP}$ | Aluminium composite pipe wall thickness |
| $t_C$ | Plastic Pipe wall thickness |
| $t_{C1}$ | Thickness of acoustic sound decoupling insulation |
| $t_D$ | Insulation thickness |
| $t_E$ | Thickness of the building element |
| $t_I$ | Thickness of individual layer thickness within cross-laminated timber constructions |
| $t_{DP}$ | Thickness of Additional Protect Insulation |
| $t_M$ | Metal Pipe wall thickness |
| $t_{RC}$ | Wall thickness / Wave high for electric conduits |
| V | Sleeve |
| w | Width |
| $w_{E1}$ | Width of aperture framing / beading / additional framing |
| $\rho_E$ | Density of the building element |