



Österreichisches Institut für Bautechnik
Schenkenstrasse 4 | 1010 Vienna | Austria
T +43 1 533 65 50 | F +43 1 533 64 23
mail@oib.or.at | www.oib.or.at



European technical approval

ETA-12/0101

(English language translation, the original version is in German language)

Handelsbezeichnung:
Trade name:

Hilti Firestop Mortar CFS-M RG

Zulassungsinhaber:
Holder of approval:

**Hilti AG
Feldkircherstrasse 100
9494 Schaan
Liechtenstein**

Zulassungsgegenstand
und Verwendungszweck:

Brandschutzmörtel für Abschottungen

Generic type and use of construction product:

Firestop mortar for penetration seals

Geltungsdauer vom:
Validity from:
bis:
to:

30.04.2012

29.04.2017

Herstellwerk:
Manufacturing plant:

Hilti Werk 7a

Diese Europäische
technische Zulassung umfasst:
This European technical approval contains:

37 Seiten inklusive 25 Anhänge

37 pages including 25 Annexes



European Organisation for Technical Approvals
Europäische Organisation für Technische Zulassungen
Organisation Européenne pour l'Agrément Technique

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by the Österreichisches Institut für Bautechnik in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by the Council Directive 93/68/EEC² and Regulation (EC) no. 1882/2003 of the European Parliament and of the Council³;
 - Wiener Bauprodukte- und Akkreditierungsgesetz – WBAG. LGBl. Nr. 30/1996, zuletzt geändert durch das Gesetz LGBl. für Wien Nr. 24/2008;
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁴;
 - Guideline for European technical approval for “Fire Stopping and Fire Sealing Products” ETAG no. 026, edition January 2008;
 - EOTA technical Report “Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products” TR no. 024, edition November 2006, amended July 2009.
- 2 The Österreichisches Institut für Bautechnik is authorised to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturer other than those indicated on page 1; or manufacturing plants other than those laid down in the context of this European technical approval.
- 4 This European technical approval may be withdrawn by the Österreichisches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of the Österreichisches Institut für Bautechnik. In this case, partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

¹ Official Journal of the European Communities no. L 40, 11.2.1989, p. 12

² Official Journal of the European Communities no. L 220, 30.8.1993, p. 1

³ Official Journal of the European Union no. L 284, 31.10.2003, p. 1

⁴ Official Journal of the European Communities no. L 17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product(s) and intended use

1.1 Definition of the construction product

1.1.1 Hilti Firestop Mortar CFS-M RG:

Hilti Firestop Mortar CFS-M RG is a product to form a penetration seal used to reinstate the fire resistance performance of wall and floor constructions, where they have been provided with apertures for the penetration of services.

Hilti Firestop Mortar CFS-M RG is cement based and is composed essentially of cement and aggregates. Colour: grey.

Hilti Firestop Mortar CFS-M RG is supplied in paper bags. The mortar is installed in the opening in the building element around the penetrating services.

1.1.2 Additional components for cable/small conduit penetrations:

Depending on the required fire resistance additional protection (AP) may be required (for details see Annex C):

AP: Mineral wool mat according to Table C.1, wrapped around cables /cable support (trays, ladders), Al-faced side outside, fastened with wire, width (length along the cables/small conduits) 200 mm, thickness 30 mm.

1.1.3 Additional components for metal pipe penetrations:

In case of metal pipes pipes insulated with combustible insulation (reaction to fire class B to E according EN 13501-1) a Hilti Firestop Bandage CFS-B is wrapped around the pipe insulation on each side of the seal. The bandage is positioned with half of its width (62,5 mm) within the seal (central marking line at the surface of the seal) and fastened with wire. For necessary number of layers of the bandage see Annex C.

1.1.4 Additional components for plastic pipe penetrations:

Hilti Firestop Collar CFS-C P: for details see Annex C.1.4 and C.3.4

Hilti Firestop Collar CFS-C: for details see Annex C.1.5 and C.4.3

Fixing components for Hilti Firestop Collars CFS-C and CFS-C P:
for specification see Annex B.4

Hilti Firestop Wrap CFS-W: for details see Annex C.2 and C.5

1.1.5 Additional component for metal pipe penetrations with Armaflex insulation:

Hilti Firestop Bandage CFS-B: for details see Annex C.1.3.2 and C.3.3.2

1.2 Intended Use and Use Category

1.2.1 Intended Use

Hilti Firestop Mortar CFS-M RG may be used to provide a penetration seal around services running through square or rectangular openings of maximum dimensions $w \times h = 1200 \text{ mm} \times 2000 \text{ mm}$ in walls. For the maximum seal size in floor applications see Annex C. Further details on the type of services covered by the declared classifications and other parameters to be considered are given in Annex C.

- (1) The specific structures where Hilti Firestop Mortar CFS-M RG may be used to provide a penetration seal are as follows:

Rigid walls type A:	The wall must have a minimum thickness of 150 mm and comprise concrete, aerated concrete or masonry, with a minimum density of 550 kg/m ³ .
Rigid walls type B:	The wall must have a minimum thickness of 175 mm and comprise concrete or masonry (e.g. hollow brick), with a minimum density of 1100 kg/m ³ .
Rigid floors type A:	The floor must have a minimum thickness of 150 mm and comprise aerated concrete or concrete with a minimum density of 550 kg/m ³ .
Rigid floors type B:	The floor must have a minimum thickness of 150 mm and comprise concrete with a minimum density of 2400 kg/m ³ .
Rigid floors type C:	The floor must have a minimum thickness of 175 mm and comprise concrete with a minimum density of 2400 kg/m ³ .

This ETA does not cover use of this product as a penetration seal in sandwich panel constructions.

- (2) Hilti Firestop Mortar CFS-M RG may be used to provide a penetration seal with the following specific services, single, multiple or mixed:

Cables	Services as given in Annex C
Metal pipes	Services as given in Annex C
Plastic pipes	Services as given in Annex C
Mixed (combination)	Services as given in Annex C

- (3) The first support of the cables, conduits and pipes shall be located at maximum 260 mm away from both faces of wall constructions and maximum 300 mm from the upper face of floor constructions, except stated otherwise in Annex C.

The provisions made in this European technical approval are based on an assumed working life of Hilti Firestop Mortar CFS-M RG of 10 years, provided that the conditions laid down in sections 4.2/5.1/5.2 for the packaging / transport / storage / installation / use / repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

1.2.2 Use Category

The use category of Hilti Firestop Mortar CFS-M RG is Type Y₁. Since the requirements for type Y₁ are met, also the requirements for type Y₂, Z₁ and Z₂ are fulfilled.

Type Y ₁ :	Products for penetration seals intended for use at temperatures between -5 °C and + 70°C, but with no exposure to rain.
Type Y ₂ :	Products for penetration seals intended for use at temperatures between -5 °C and + 70°C, but with no exposure to rain nor UV.
Type Z ₁ :	Products for penetration seals intended for use at internal conditions with high humidity, excluding temperatures below 0°C. ⁵
Type Z ₂ :	Products for penetration seals intended for uses at internal conditions with humidity classes other than Z ₁ , excluding temperatures below 0°C.

⁵ These uses apply for internal humidity class 5 in accordance with EN ISO 13788

2 Characteristics of the product and methods of verification

The identification tests and the assessment of the fitness for use according to the Essential Requirements were carried out in compliance with the “ETA Guidance no. 026-Part 2” concerning Penetration Seals – edition January 2008 (called ETAG 026-2 in this ETA).

ETAG Clause No.	ETA Clause No.	Characteristic	Assessment of characteristic
		Mechanical resistance and stability	Not relevant
		Safety in case of fire	
2.4.1	2.1	Reaction to fire	Class A1 according to EN 13501-1
2.4.2	2.2	Resistance to fire	See clause 2.2
		Hygiene, Health and the Environment	
2.4.3	2.3	Air permeability	See clause 2.3
2.4.4	2.4	Water permeability	No performance determined
2.4.5	2.5	Dangerous substances	See clause 2.5
		Safety in use	
2.4.6	2.6	Mechanical resistance and stability	See clause 2.6
2.4.7	2.7	Resistance to impact/movement	See clause 2.6
2.4.8	2.8	Adhesion	See clause 2.6
		Protection against noise	
2.4.9	2.9	Airborne sound insulation	See clause 2.9
		Energy, Economy and Heat Retention	
2.4.10		Thermal properties	See clause 2.10
2.4.11		Water vapour permeability	No performance determined
		General aspects relating to fitness for use	
2.4.12		Durability and serviceability	Y ₁

2.1 Reaction to fire

The classification of the resistance to fire performance has been carried out in accordance with EN 13501-1. The resulting classification is A1.

2.2 Resistance to 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. Penetration seals made from Hilti Firestop Mortar CFS-M RG are classified according to combinations of performance parameters and classes as shown in Annex C. The classifications are valid for services running through square or rectangular openings of maximum dimensions as given in Annex C. The classifications require that the rules for installation shown in cl. 4.2 and Annex C are followed.

The classifications are not valid for sandwich panel constructions.

No performance claim against the slow heating curve (classification with suffix “IncSlow”) is made.

2.3 Air permeability

The gas permeability regarding the gases nitrogen (N₂), carbon dioxide (CO₂) and CH₄ (methane) has been tested according to the principles of EN 1026 for a mortar thickness of 52 mm. The following flow rates per area (q/A) have been achieved for the given air pressure differences (Δp). The flow rate index indicates the type of gas. The declared values refer to a body of pure Hilti Firestop Mortar CFS-M RG without any penetrating installation.

Gas permeability of Hilti Firestop Mortar CFS-M RG

Δp [Pa]	q/A N ₂ [m ³ /(h·m ²)]	q/A CO ₂ [m ³ /(h·m ²)]	q/A CH ₄ [m ³ /(h·m ²)]
50	≤ 0,0066	≤ 0,0053	≤ 0,0079
250	≤ 0,0332	≤ 0,0265	≤ 0,0393

Air permeability has been tested for a mortar thickness of 150 mm in two pressure areas.

Air permeability of Hilti Firestop Mortar CFS-M RG

Pressure [Pa]	150 to 900	1050	2100
q/A air [m ³ /(h·m ²)]	<0,0009	0,0012	0,0014

Pressure [Pa]	3750 to 4350	4500	4650	4800	4950
q/A air [m ³ /(h·m ²)]	<0,0009	0,0012	0,0011	0,0018	0,0022

2.4 Water permeability

No performance determined.

2.5 Dangerous substances

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

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

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

2.6 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 and for floors in EOTA TR 001 A.4 for safety in use (600 Nm soft body impact, 10 Nm hard body impact) as well as serviceability (120 Nm soft body impact, 6 Nm hard body impact).

2.7 Resistance to impact/movement

See 2.6

2.8 Adhesion

See 2.6

2.9 Airborne sound insulation

Test reports from noise reduction according to EN ISO 20140-10 and EN ISO 717-1 have been provided.

The acoustic tests were performed in a rigid wall. Hilti Firestop Mortar CFS-M RG was tested as a blank mortar seal without services. The seal was 500 mm wide and 600 mm high with a thickness of 175 mm. The area of Hilti Firestop Mortar CFS-M RG was 0,3 m². The acoustic characteristics of the walls itself have not been measured. According to these tests reports the single number ratings are:

Weighted element-normalized level difference: $D_{n,w} = 59$ dB

From this $D_{n,w}$ the weighted sound reduction index calculates to: $R_w = 52$ dB

Structure of the rigid wall: 175 mm thick wall made of blockwork of density class 2,0 which was plastered on both sides.

It should be noticed that both above mentioned results apply to the total wall construction of the size $S = 1,25 \text{ m} \times 1,50 \text{ m}$ ($= 1,88 \text{ m}^2$), i.e. the given wall with 0,3 m² Hilti Firestop Mortar CFS-M RG.

2.10 Thermal properties

The heat conductivity has been determined according to EN 12667 using the single plate apparatus for a mortar thickness of 52 mm.

Heat conductivity (λ_{10} , calculated): 0,232 W/mK (for a dry density of 939 kg/m³)

2.11 Water vapour permeability

No performance determined.

2.12 Durability and serviceability

2.12.1 Durability

Hilti Firestop Mortar CFS-M RG has been tested in accordance with EOTA technical Report - TR024, Table 4.2, for the type Y₁ use category specified in EOTA 026-2. The results of the tests have demonstrated suitability for penetration seals intended for use at temperatures between -5 °C and +70 °C, but with no exposure to rain (Y₁).

2.12.2 Serviceability

Electrical properties:

- Volume resistivity (according to DIN IEC 93 (VDE 0303 Part 30):1993-12):
133 E+10 ± 50 E+10 Ω.cm
- Surface resistivity (according to DIN IEC 93 (VDE 0303 Part 30):1993-12):
233 E+08 ± 80 E+08 Ω

3 Evaluation of Conformity and CE marking

3.1 Attestation of Conformity system

According to the decision 1999/454/EC of the European Commission⁶ the system 1 of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by a notified certification body on the basis of:

- (a) Tasks for the manufacturer:
 - (1) factory production control
 - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan
- (b) Tasks for the notified body
 - (3) initial type-testing of the product
 - (4) initial inspection of factory and of factory production control
 - (5) continuous surveillance, assessment and approval of factory production control

3.2 Responsibilities

3.2.1 Tasks of the Manufacturer

3.2.1.1 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 insure that the product is in conformity with this European technical approval.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control that applies. The documentation to be carried out by the manufacturer and the applicable procedures shall be appropriate to the product and manufacturing process. The factory production control shall ensure the conformity of the product to an appropriate level. This involves:

- a) the preparation of documented procedures and instructions relating to factory production control operations.
- b) the effective implementation of these procedures and instructions.
- c) the recording of these procedures and their results.
- d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the factory production control to rectify the cause of non-conformity.
- e) a procedure to ensure that both the approval Body and the Notified (Certification) Bodies are advised before any significant change to the product, its components or manufacturing process, is made.
- f) a procedure to ensure that personnel involved in the production processes and the quality control procedures are qualified and adequately trained to carry out their required tasks.
- g) that all testing and measuring equipment is maintained and up to date calibration records are documented.
- h) maintenance of records to ensure every batch produced is clearly labelled with the batch number, which allows traceability to its production to be identified.

⁶ Official Journal of the European Communities N° L 178, 14.7.1999, p. 52

The manufacturer may only use components stated in the technical documentation of this European technical approval.

For the components which the ETA-holder does not manufacture by himself, he shall make sure that factory production control carried out by the other manufacturers gives the guaranty of the components compliance with the European technical approval.

The factory production control of the ETA holder and the provisions taken by the ETA-holder for components not produced by himself shall be in accordance with the control plan⁷ relating to this European technical approval which is part of the technical documentation of this European technical approval. The "Control Plan" is laid down in the context of the factory production control system operated by the manufacturer and deposited at the Österreichisches Institut für Bautechnik.

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

3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body (bodies) which is (are) approved for the tasks referred to in section 3.1 in the field of penetration seals in order to undertake the actions laid down in section 3.3. For this purpose, the "control plan" referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body or bodies involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

Additional information

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

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.
 - Services for 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. cable trays)
 - 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.

Installation instruction:

- Steps to be followed
- Procedure in case of retrofitting

⁷ The control plan is a confidential part of the European technical approval and only handed over to the Notified Body or Bodies involved in the procedure of conformity.

3.2.2 Tasks of Notified Bodies

The Notified Body (Bodies) shall perform the

- initial type-testing of the product (for system 1)
The results of the tests performed as part of the assessment for the European technical approval may be used unless there are changes in the production line or plant. In such cases, the necessary initial type testing has to be agreed between the Österreichisches Institut für Bautechnik and the Notified Bodies involved.
- initial inspection of factory and of factory production control
The Notified Body (Bodies) shall ascertain that, in accordance with the control plan, the factory (in particular the employees and the equipment) and the factory production control are suitable to ensure continuous and orderly manufacturing of the components according to the specifications mentioned in clause 2 of this ETA.
- continuous surveillance, assessment and approval of factory production control
The Notified Body (Bodies) shall visit the factory at least twice a year or once a year for surveillance of this manufacturer having a FPC system complying with a quality management system covering the manufacturing of the approval product components. It has to be verified that the system of factory production control and the specified automated manufacturing process are maintained taking into account the control plan.

These tasks shall be performed in accordance with the provisions laid down in the control plan of this European technical approval.

The Notified Body (Bodies) shall retain the essential points of its (their) actions referred to above and state the results obtained and conclusions drawn in a written report.

The Notified Body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform the Österreichisches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on the product itself, on a label attached to it, on its packaging or on the commercial documents accompanying the components of the product. The letters „CE“ shall be followed by the identification number of the Notified Body involved and be accompanied by the following additional information:

- the name or identifying mark and address of the ETA holder
- the last two digits of the year in which the CE marking was affixed
- the number of the EC certificate of conformity for the product
- the number of the European technical approval
- the number of the ETAG (ETAG N° 026 part 2)
- the designation of the product (trade name)
- the use category in accordance with the ETA section 1 and 2
- “see ETA-12/0101 for other characteristics”

4 Assumptions under which the fitness of the product(s) for the intended use was favourably assessed

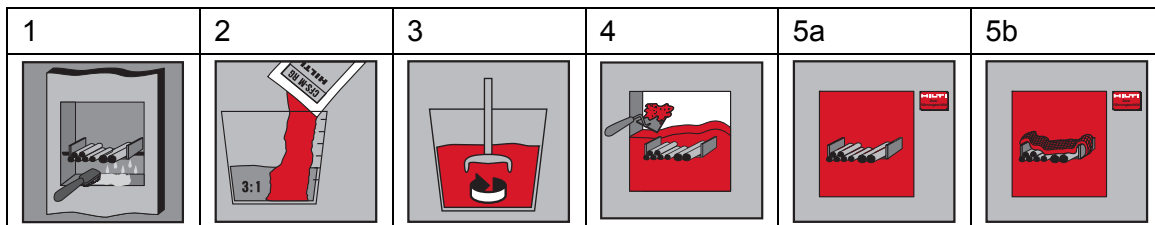
4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Österreichisches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Österreichisches Institut für Bautechnik before the changes are introduced. Österreichisches Institut für Bautechnik will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA, shall be necessary.

4.2 Installation

The ETA is issued under the assumption that the installation of the approval product shall be in accordance with the manufacturer's technical literature.

Installation of the Hilti Firestop Mortar CFS-M RG must be conducted as follows:



For installation of additional components, e.g. Hilti Firestop Collar CFS-C P and Hilti Firestop Wrap CFS-W see Annex C.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

In the accompanying document and/or on the packaging the manufacturer shall give information as to transport and storage.

At least the following shall be indicated: storing temperature, type of storage, maximum duration of storage and required data related to minimum temperature for transport and storage.

5.2 Use, maintenance, repair

The Hilti Firestop Mortar CFS-M RG should be installed and used as described earlier in this document.

The assessment of the fitness for use is based on the assumption that damage, for example caused by accidental impact, is repaired. The relevant manufacturer instructions shall be followed.

Storage/transport:

Transport and storage temperature: -20 °C to +40 °C.

CFS-M RG has to be stored dry in its original packaging.

On behalf of Österreichisches Institut für Bautechnik

Rainer Mikulits
Managing Director

ANNEX A REFERENCE DOCUMENTS and LIST OF ABBREVIATIONS

A.1 References to standards mentioned in the ETA

DIN IEC 60093 (VDE 0303 Part 30)	Methods of test for insulating materials for electrical purposes: Volume resistivity and surface resistivity of solid electrical insulating materials
EN 1026	Windows and doors – Air permeability – Test method
EN 12667	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance
EN 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 ISO 20140-10	Acoustics; measurement of sound insulation in buildings and of building elements; part 10: laboratory measurement of airborne sound insulation of small building elements (ISO 140-10:1991)
EN ISO 717-1	Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

A.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 Mortar CFS-M RG

A.3 Abbreviations used in drawings

Abbreviation	Description
A ₁	Hilti Firestop Mortar CFS-M RG according to Annex B.1
A ₂	Hilti Firestop Bandage CFS-B according to Annex B.6
A ₃	Hilti Firestop Collar CFS-C P or CFS-C according to Annex B.2 and B.3
A ₄	Hilti Firestop Wrap CFS-W according to Annex B.5
AP	Additional protection according to 1.1.2
C, C ₁ , C ₂ , C ₃	Services
D	Pipe insulation
d _A	Overlap of mortar (seal type 2)
d _c	Pipe diameter
E	Building element (wall, floor)
h	Height of penetration seal
l	Length of the penetration seal
L _D	Length of local pipe insulation
L _{AP}	Length of the additional protection AP
s ₁ to s ₁₄	Distances
t _{A1}	Thickness of the mortar seal
t _{AP}	Thickness of the additional protection AP
t _c	Wall thickness of the pipe
t _D	Thickness of the pipe insulation
t _E	Thickness of the building element (wall, floor)
w	Width of penetration seal

ANNEX B

DESCRIPTION OF PRODUCT(S) & PRODUCT LITERATURE

B.1 Hilti Firestop Mortar CFS-M RG

A detailed specification of the product is contained in document "Identification / Product Specification relating to the European technical approval ETA-12/0101 - Hilti Firestop Mortar CFS-M RG" which is a non-public part of this ETA.

The Control Plan is defined in document "Control Plan relating to the European technical approval ETA-12/0101 - Hilti Firestop Mortar CFS-M RG" which is a non-public part of this ETA.

B.2 Hilti Firestop Collar CFS-C

See ETA-10/0403

B.3 Hilti Firestop Collar CFS-C P

See ETA-10/0404

B.4 Fixing for Hilti Firestop Collars CFS-C and CFS-C P

Threaded rods M8, galvanised, minimum strength category 4.6, washers A 8.4-28 s=2mm, galvanised (e.g. according to DIN EN ISO 7089), nuts M8, galvanised (e.g. according to DIN EN ISO 4032)

B.5 Hilti Firestop Wrap CFS-W

See ETA-10/0405

B.6 Hilti Firestop Bandage CFS-B

See ETA-10/0212

B.7 Hilti Firestop Acrylic Sealant CFS-S ACR

See ETA-10/0292

B.8 technical product literature

technical data sheet Hilti Firestop Mortar CFS-M RG (including the additional components Hilti Firestop Collars CFS-C and CFS-C P, Hilti Firestop Wrap CFS-W and Hilti Firestop Bandage CFS-B).

ANNEX C

RESISTANCE TO FIRE CLASSIFICATION OF PENETRATION SEALS MADE OF HILTI FIRESTOP MORTAR CFS-M RG

C.1 Rigid wall type A according to 1.2.1 (density $\geq 550 \text{ kg/m}^3$), minimum thickness 150 mm

Penetration seal

Hilti Firestop Mortar CFS-M RG (A_1), thickness (t_{A1}) $\geq 150 \text{ mm}$ (opening depth t_E filled completely).

Maximum distance for 1st service support: 260 mm subject to deviating values given in the tables below.

Maximum seal size: $w \times h = 1200 \times 2000 \text{ mm}$

Minimum distances in mm (see illustration below):

$s_1 = 0$ (distance between cables/cable supports and seal edge)

$s_2 = 0$ (distance between cable supports)

$s_3 = 0$ (distance between cables and upper seal edge)

$s_4 = 0$ (distance between cable supports and bottom seal edge)

$s_6 = 0$ (distance between metal pipes and seal edge)

$s_8 = 0$ (distance between metal pipes) in case of mineral wool insulation and linear arrangement; in case of cluster arrangement $s_8 = 100 \text{ mm}$

$s_8 = 10$ (distance between metal pipes) in case of Armaflex insulation and linear arrangement; in case of cluster arrangement $s_8 = 100 \text{ mm}$

$s_9 = 117$ (distance between plastic pipes/pipe closure devices and seal edge)

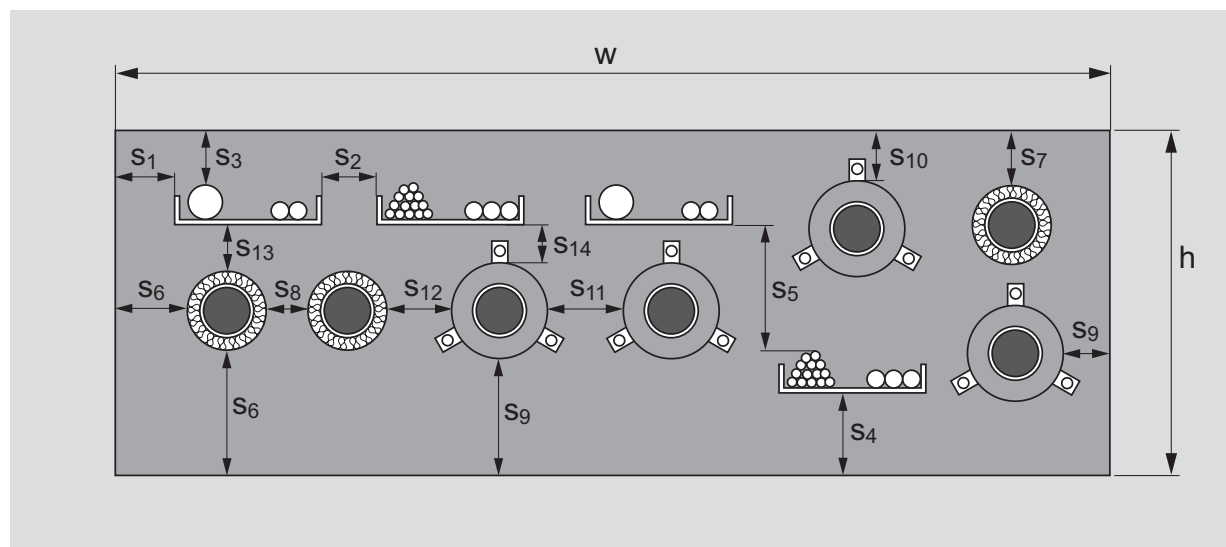
$s_{11} = 0$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collar CFS-C P and linear arrangement; in case of cluster arrangement $s_{11} = 100 \text{ mm}$

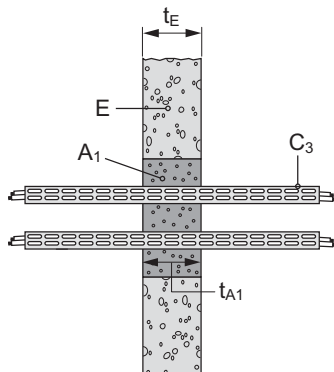
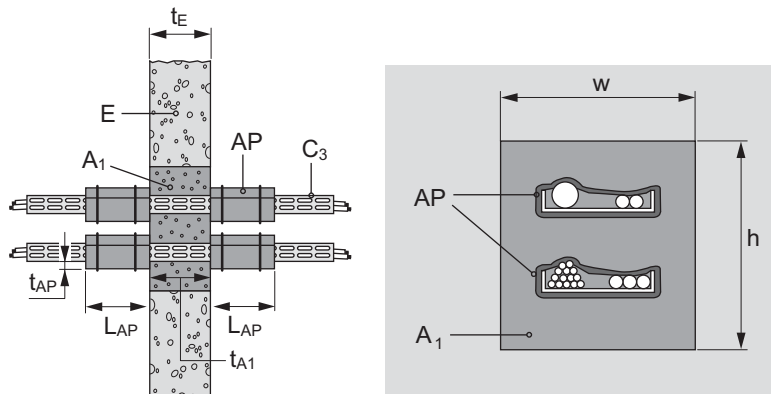
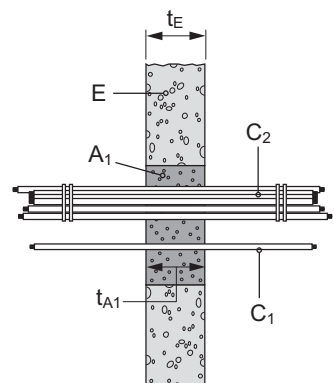
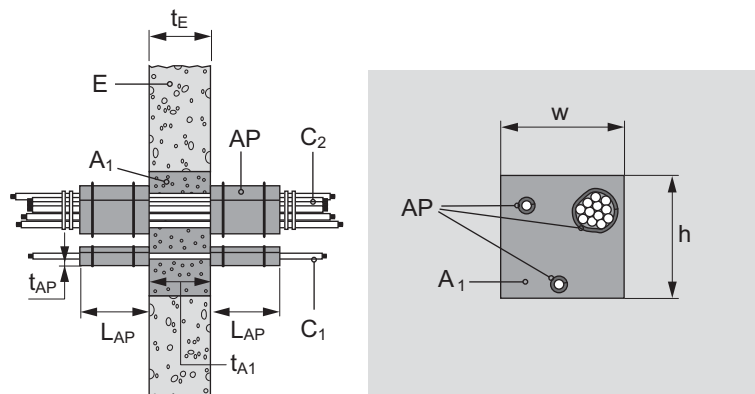
$s_{11} = 50$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collar CFS-C and linear arrangement; in case of cluster arrangement $s_{11} = 100 \text{ mm}$

$s_{12} = 0$ (distance between metal pipes and plastic pipes/pipe closure devices)

$s_{13} = 0$ (distance between cables/cable supports and metal pipes)

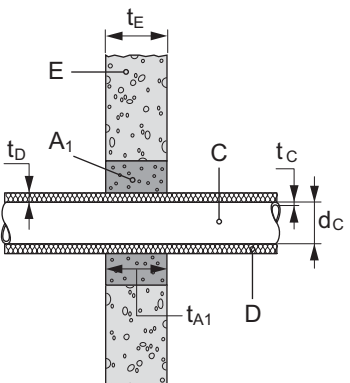
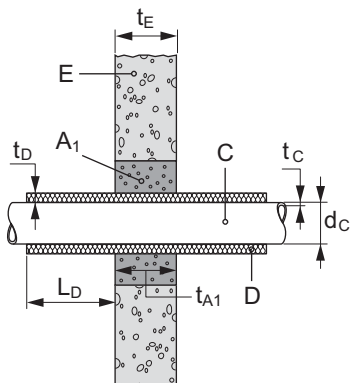
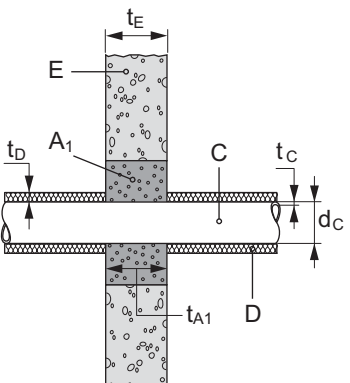
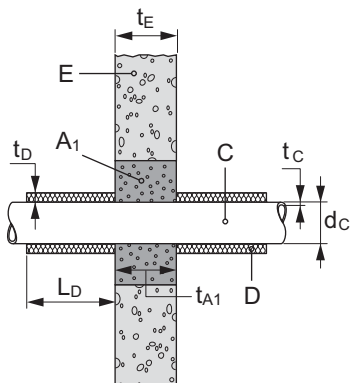
$s_{14} = 0$ (distance between cables/cable supports and plastic pipes/pipe closure devices)



Penetrating services (single, multiple or mixed):		
C.1.1 Cables		
Construction details (for symbols and abbreviations see Annex A.3): Additional protection AP according to 1.1.2 may be used as illustrated below.		
<p>Cables on trays without additional protection</p> 	<p>Cables on trays with additional protection AP</p> 	
<p>Single cables / cable bundles without additional protection</p> 	<p>Single cables / cable bundles with additional protection AP</p> 	
		Classification
Additional protection according to 1.1.2:		without with
All sheathed cable types currently and commonly used in building practice in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables, with or without cable supports, with a diameter of:		
Maximum Ø 21 mm	EI 120	EI 120
$21 \leq \varnothing \leq 50$ mm	EI 90	EI 120
$50 \leq \varnothing \leq 80$ mm	EI 90	EI 120
Non-sheathed cables (wires) currently and commonly used in building practice in Europe, with or without cable supports, with a diameter of:		
Maximum Ø 17 mm	EI 30	EI 120
Maximum Ø 24 mm	EI 30	EI 120
Tied cable bundle ⁸ , maximum diameter of single cable 21 mm, with or without cable support. For tied cable bundles the space between the cables needs not be sealed.		
Maximum Ø 100 mm	EI 120	EI 120

⁸ Several cables running in the same direction and bound closely together by mechanical means

C.1.2 Small conduits and tubes	
Construction details: see C.1.1	
In case a conduit is installed with open ends on both sides of the wall (case U/U) both ends of the conduit must be closed using an acrylic sealant, e.g. Hilti Firestop Sealant CFS-S ACR.	
	Classification
$\varnothing \leq 16$ mm, arranged linear, with or without cables, with or without cable supports	
Plastic conduits and tubes	EI 180-U/C
Steel conduits and tubes	EI 180-C/U

C.1.3 Metal pipes	
C.1.3.1 Metal pipes with mineral wool insulation according to Table C.2	
Pipes arranged linear Construction details (for symbols and abbreviations see Annex A.3):	
<p>Continued insulation, sustained (CS)</p> 	<p>Local insulation, sustained (LS)</p> 
<p>Continued insulation, interrupted (CI)</p> 	<p>Local insulation, interrupted (LI)</p> 

Steel pipes (C) with continued insulation (D) – sustained			
Insulation thickness (t_D) [mm]	Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
≥ 20	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 120-C/U
≥ 40	76,0 – 168,3	2,9 / 3,6 ¹¹ – 14,2 ¹⁰	EI 120-C/U

⁹ Interpolation of minimum pipe wall thickness between 2,2 mm for diameter 26,7 mm and 2,9 mm for diameter 76 mm for pipe diameters in between.

¹⁰ 14,2 mm is the maximum value covered by the rules in EN 1366-3. This value may be limited by the particular pipe dimensions available in practice.

¹¹ Interpolation of minimum pipe wall thickness between 2,9 mm for diameter 76 mm and 3,6 mm for diameter 168,3 mm for pipe diameters in between.

Steel pipes (C) with local insulation (D) – sustained				
Insulation		Pipe		Classification
thickness (t _D) [mm]	length (L _D) [mm]	diameter (d _C) [mm]	wall thickness (t _C) [mm]	
20	≥ 500	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 120-C/U
40	≥ 500	76,0	2,9 – 14,2 ¹⁰	EI 120-C/U
40	≥ 500	76,0 – 168,3	2,9 / 3,6 ¹¹ – 14,2 ¹⁰	EI 90-C/U
Steel pipes (C) with continued insulation (D) – interrupted				
Maximum distance of 1st support from mortar seal: 200 mm				
Insulation thickness (t _D) [mm]	Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Classification	
≥ 40	114,3	3,7 – 14,2 ¹⁰	EI 120-C/U	
Steel pipes (C) with local insulation (D) – interrupted				
Maximum distance of 1st support from mortar seal: 200 mm				
Insulation		Pipe		Classification
thickness (t _D) [mm]	length (L _D) [mm]	diameter (d _C) [mm]	wall thickness (t _C) [mm]	
40	≥ 800	114,3	3,7 – 14,2 ¹⁰	EI 120-C/U
The field of application given above for steel pipes is also valid for other metal pipes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050 °C, e.g. cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys)				
Copper pipes (C) with continued insulation (D) – sustained				
Insulation thickness (t _D) [mm]	Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Classification	
≥ 20	28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 120-C/U	
≥ 40	54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U	
Copper pipes (C) with local insulation (D) – sustained				
Insulation		Pipe		Classification
thickness (t _D) [mm]	length (L _D) [mm]	diameter (d _C) [mm]	wall thickness (t _C) [mm]	
20	≥ 500	28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 120-C/U
40	≥ 500	54	1,5 – 14,2 ¹⁰	EI 120-C/U
40	≥ 800	54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U
The field of application given above for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1100 °C, e.g. cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys) and Ni.				

¹² Interpolation of minimum pipe wall thickness between 1,0 mm for diameter 28 mm and 1,5 mm for diameter 54 mm for pipe diameters in between.

¹³ Interpolation of minimum pipe wall thickness between 1,5 mm for diameter 54 mm and 2,0 mm for diameter 89 mm for pipe diameters in between.

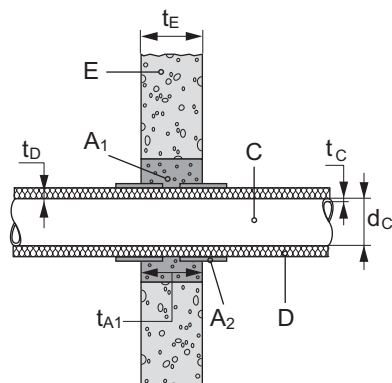
C.1.3.2 Metal pipes with Armaflex AF insulation and Hilti Firestop Bandage CFS-B

Construction details (for symbols and abbreviations see Annex A.3):

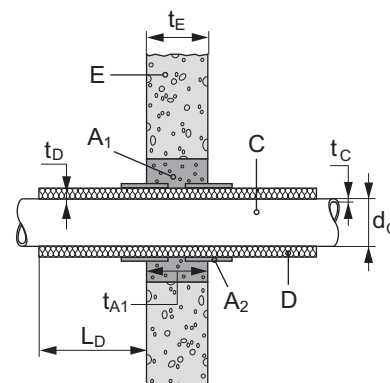
For specification of Armaflex AF see Annex D Table D.3.

Two layers of Firestop Bandage CFS-B (A_2) wrapped around the pipe insulation, on each side of the seal. The bandage is positioned with half of its width (62.5 mm) within the seal (central marking line at the surface of the seal) and outside the seal fastened with wire.

Continued insulation, sustained (CS)



Local insulation, sustained (LS)



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

Insulation thickness (t_D) [mm]	Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
19	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 120-C/U
19 - 41	76,0	2,9 – 14,2 ¹⁰	EI 120-C/U
41	76,0 – 168,3	2,9 / 3,6 ¹¹ – 14,2 ¹⁰	EI 120-C/U

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

Insulation		Pipe		Classification
thickness (t_D) [mm]	length (L_D) [mm]	diameter (d_C) [mm]	wall thickness (t_C) [mm]	
19	≥ 500	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 120-C/U
19 - 41	≥ 500	76,0	2,9 – 14,2 ¹⁰	EI 120-C/U
41	≥ 500	76,0 – 168,3	2,9 / 3,6 ¹¹ – 14,2 ¹⁰	EI 60-C/U

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

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

Insulation thickness (t_D) [mm]	Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
19	28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 120-C/U
19 - 41	54	1,5 – 14,2 ¹⁰	EI 120-C/U
41	54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U

Copper pipes (C) with local insulation (D) – sustained				
Insulation		Pipe		Classification
thickness (t_D) [mm]	length (L_D) [mm]	diameter (d_C) [mm]	wall thickness (t_C) [mm]	
19	≥ 500	28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 120-C/U
19 - 41	≥ 500	54	1,5 – 14,2 ¹⁰	EI 120-C/U
41	≥ 800	54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U

The field of application given above for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1100°C, e.g. cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys) and Ni.

C.1.3.3 Metal pipes with Armaflex AF insulation	
<p>Construction details (for symbols and abbreviations see Annex A.3):</p> <p>Additional protection with Armaflex AF, thickness 25 mm over a length of 200 mm from the seal on both sides. For specification of Armaflex AF see Annex D Table D.3.</p> <p>Maximum distance of 1st support from mortar seal: 200 mm</p>	
<p>Continued insulation, interrupted (CI)</p>	<p>Local insulation, interrupted (LI)</p>

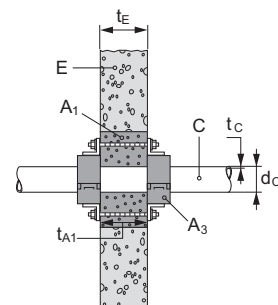
Steel pipes (C) with continued insulation (D) – interrupted			
Insulation thickness (t_D) [mm]	Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
≥ 25	114,3	7,1 – 14,2 ¹⁰	EI 120-C/U

Steel pipes (C) with local insulation (D) – interrupted				
Insulation		Pipe		Classification
thickness (t_D) [mm]	length (L_D) [mm]	diameter (d_C) [mm]	wall thickness (t_C) [mm]	
25	≥ 780	114,3	7,1 – 14,2 ¹⁰	EI 120-C/U

C.1.4 Plastic pipes with Hilti Firestop Collar CFS-C P

Construction details (for symbols and abbreviations see Annex A.3):

Hilti Firestop Collars CFS-C P (A_3) are installed on both sides of the mortar seal, fastened together by threaded rods, washers and nuts as specified in Annex B.4.



C.1.4.1 PVC-U pipes according to EN ISO 15493, EN ISO 1452 and DIN 8061/8062

Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Collar size (A_1)	No. of hooks	Classification
50	2,4 – 5,6	CFS-C P 50/1.5"	2	EI 120-U/U
63	3,0 – 4,7	CFS-C P 63/2"	2	EI 120-U/U
75	2,2 – 3,6	CFS-C P 75/2.5"	3	EI 180-U/U
90	2,7 – 4,3	CFS-C P 90/3"	3	EI 120-U/U
110	2,2 – 8,1	CFS-C P 110/4"	4	EI 120-U/U
110	8,1	CFS-C P 110/4"	4	EI 180-U/U
125	3,7 – 6,0	CFS-C P 125/5"	4	EI 120-U/U
160	2,5 – 11,8	CFS-C P 160/6"	6	EI 120-U/U
160	11,8	CFS-C P 160/6"	6	EI 180-U/U

C.1.4.2 PE pipes according to EN ISO 15494 and DIN 8074/8075

Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Collar size (A_1)	No. of hooks	Classification
50	2,9	CFS-C P 50/1.5"	2	EI 180-U/U
50	2,9 – 4,6	CFS-C P 50/1.5"	2	EI 120-U/U
63	1,8 – 5,8	CFS-C P 63/2"	2	EI 90-U/U
63	3,6 – 5,8	CFS-C P 63/2"	2	EI 120-U/U
75	1,9 – 6,8	CFS-C P 75/2.5"	3	EI 120-U/U
90	2,2 – 8,2	CFS-C P 90/3"	3	EI 120-U/U
110	2,7 – 10,0	CFS-C P 110/4"	4	EI 120-U/U
125	3,1 – 7,1	CFS-C P 125/5"	4	EI 120-U/U
160	4,0 – 9,1	CFS-C P 160/6"	6	EI 120-U/U
160	9,1	CFS-C P 160/6"	6	EI 180-U/U

C.1.4.3 PE pipes according to EN 1519-1¹⁴

Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Collar size (A_1)	No. of hooks	Classification
50	3,0	CFS-C P 50/1.5"	2	EI 120-U/U
63	3,0	CFS-C P 63/2"	2	EI 180-U/U
75	3,0	CFS-C P 75/2.5"	3	EI 120-U/U
90	3,5	CFS-C P 90/3"	3	EI 180-U/U
110	4,2	CFS-C P 110/4"	4	EI 120-U/U
125	4,8	CFS-C P 125/5"	4	EI 120-U/U
160	6,2	CFS-C P 160/6"	6	EI 120-U/U

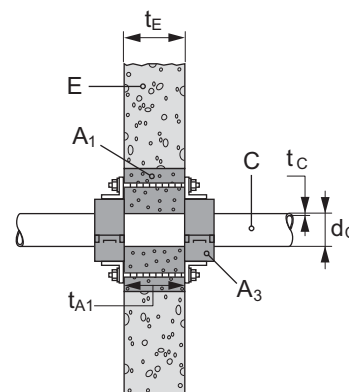
C.1.5 Plastic pipes with Hilti Firestop Collar CFS-C

Construction details (for symbols and abbreviations see Annex A.3):

Hilti Firestop Collars CFS-C (A_3) are installed on both sides of the mortar seal, fastened together by threaded rods, washers and nuts as specified in Annex B.8.

Maximum distance of 1st support from mortar seal: 200 mm

Restrictions by national building regulations to use seals with classification extension U/C have to be considered.



C.1.5.1 PVC-U pipes according to EN ISO 15493, EN ISO 1452 and DIN 8061/8062

Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Collar size (A_1)	No. of hooks	Classification
50	2,2	CFS-C 50/1.5"	2	EI 180-U/C
110	3,7 – 12,8	CFS-C 110/4"	3	EI 180-U/C

¹⁴ In Germany high-density polyethylene (PE-HD) pipes for hot-water resistant waste and soil discharge systems (HT) inside buildings have additionally to comply with DIN 19535-10.

C.2 Rigid wall type B according to 1.2.1 (density $\geq 1100 \text{ kg/m}^3$), minimum thickness 175 mm

Penetration seal

Hilti Firestop Mortar CFS-M RG (A_1), thickness (t_{A1}) $\geq 150 \text{ mm}$ (opening depth t_E filled completely).

Maximum distance for 1st service support: 230 mm.

Maximum seal size: $w \times h = 1000 \times 1500 \text{ mm}$

Minimum distances in mm (for illustration see C.1):

$s_9 = 210$ (distance between plastic pipes/pipe closure devices and seal edge)

$s_{11} = 100$ (distance between plastic pipes/pipe closure devices

$s_1 = 0$ (distance between cables/cable supports and seal edge)

$s_2 = 0$ (distance between cable supports)

$s_3 = 0$ (distance between cables and upper seal edge)

$s_4 = 0$ (distance between cable supports and bottom seal edge)

$s_6 = 0$ (distance between metal pipes and seal edge)

$s_8 = 0$ (distance between metal pipes) in case of mineral wool insulation and linear arrangement; in case of cluster arrangement $s_8 = 100 \text{ mm}$

$s_8 = 10$ (distance between metal pipes) in case of Armaflex insulation and linear arrangement; in case of cluster arrangement $s_8 = 100 \text{ mm}$

$s_9 = 117$ (distance between plastic pipes/pipe closure devices and seal edge)

$s_{11} = 0$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collar CFS-C P and linear arrangement; in case of cluster arrangement $s_{11} = 100 \text{ mm}$

$s_{11} = 50$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collar CFS-C and linear arrangement; in case of cluster arrangement $s_{11} = 100 \text{ mm}$

$s_{11} = 100$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Wrap CFS-W

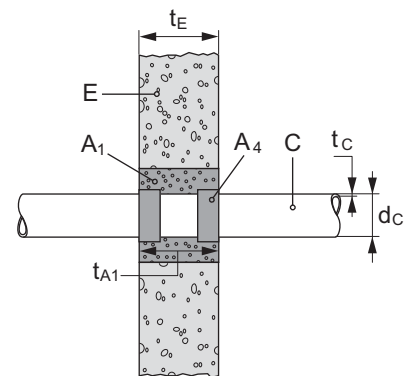
$s_{12} = 0$ (distance between metal pipes and plastic pipes/pipe closure devices)

$s_{13} = 0$ (distance between cables/cable supports and metal pipes)

$s_{14} = 0$ (distance between cables/cable supports and plastic pipes/pipe closure devices)

Construction details (for symbols and abbreviations see Annex A.3):

Hilti Firestop Wrap CFS-W (A_4) on both sides of the mortar seal, flush with the surface of the seal



Penetrating services: in addition to the services as in C.1 (single, multiple or mixed):				
C.2.1 Plastic pipes with Hilti Firestop Wrap CFS-W				
C.2.1.1 PVC pipes according to EN ISO 15493, EN ISO 1452 and DIN 8061/8062				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Type of CFS-W (A ₁)	Size (CFS-W SG) / No. of layers (CFS-W EL)	Classification
≤ 32	1,8	CFS-W EL	1	EI 240-U/C
90	3,2	CFS- W SG	90/3"	EI 240-U/C
110	3,2	CFS- W SG	110/4"	EI 240-U/C
> 75 ≤ 110	3,2	CFS-W EL	2	EI 240-U/C
160	3,2 – 13,0	CFS- W SG	160/6"	EI 240-U/C
> 125 ≤ 160	3,2 – 13,0	CFS-W EL	3	EI 240-U/C
C.2.1.2 PE pipes according to EN ISO 15494 and DIN 8074/8075				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Type of CFS-W (A ₁)	Size (CFS-W SG) / No. of layers (CFS-W EL)	Classification
≤ 32	1,8	CFS-W EL	1	EI 240-U/C
90	2,7	CFS- W SG	90/3"	EI 240-U/C
110	2,7	CFS- W SG	110/4"	EI 240-U/C
> 75 ≤ 110	2,7	CFS-W EL	2	EI 240-U/C
160	4,0 – 14,6	CFS- W SG	160/6"	EI 240-U/C
> 125 ≤ 160	4,0 – 14,6	CFS-W EL	3	EI 240-U/C
C.2.1.3 PE pipes according to EN 1519-1¹⁴				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Type of CFS-W (A ₁)	Size (CFS-W SG) / No. of layers (CFS-W EL)	Classification
160	6.2	CFS-W SG	160/6"	EI 180-U/C
> 125 ≤ 160	6.2	CFS-W EL	3	EI 180-U/C

C.3 Rigid floor type A according to 1.2.1 (density $\geq 550 \text{ kg/m}^3$), minimum thickness 150 mm

Penetration seal

Type 1: Hilti Firestop Mortar CFS-M RG (A_1), thickness (t_{A1}) $\geq 150 \text{ mm}$ (opening depth t_E filled completely).

Type 2: Hilti Firestop Mortar CFS-M RG (A_1), thickness (t_{A1}) $\geq 200 \text{ mm}$ (opening depth t_E filled completely), with an overlap of the mortar seal of 50 mm over the top side of the floor on all sides of the opening.

Maximum distance for 1st service support: 300 mm.

Maximum seal size: see figure below

Minimum distances in mm (for illustration see below):

$s_1 = 0$ (distance between cables/cable supports and seal edge)

$s_2 = 0$ (distance between cable supports)

$s_3 = 0$ (distance between cables and upper seal edge)

$s_4 = 0$ (distance between cable supports and bottom seal edge)

$s_6 = 0$ (distance between metal pipes and seal edge)

$s_8 = 0$ (distance between metal pipes) in case of mineral wool insulation and linear arrangement; in case of cluster arrangement $s_8 = 100 \text{ mm}$

$s_8 = 12$ (distance between metal pipes) in case of Armaflex insulation and linear arrangement; in case of cluster arrangement $s_8 = 100 \text{ mm}$

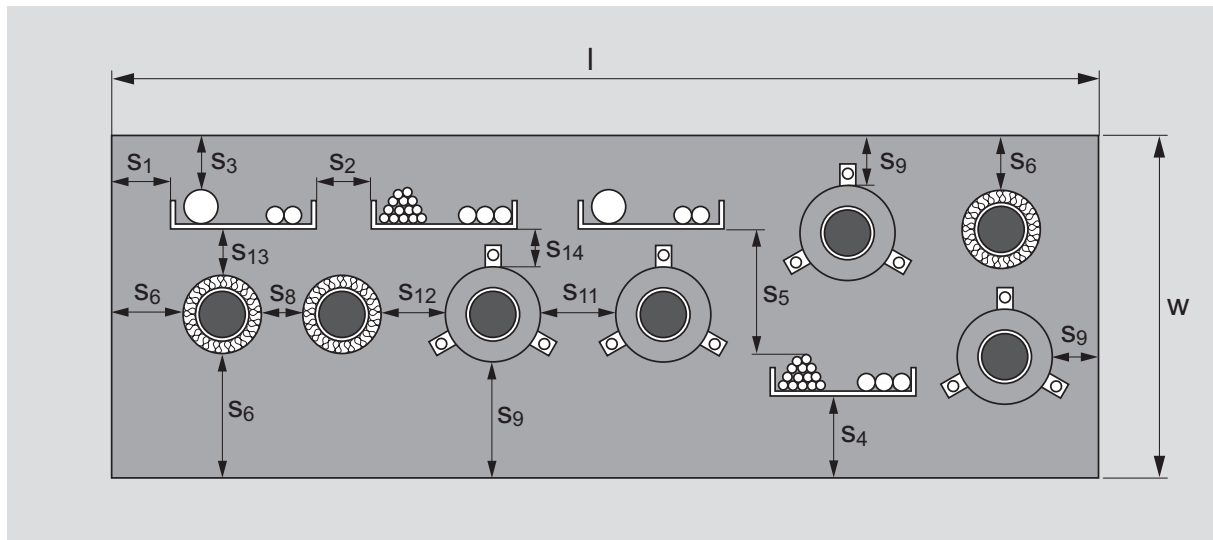
$s_9 = 0$ (distance between plastic pipes/pipe closure devices and seal edge)

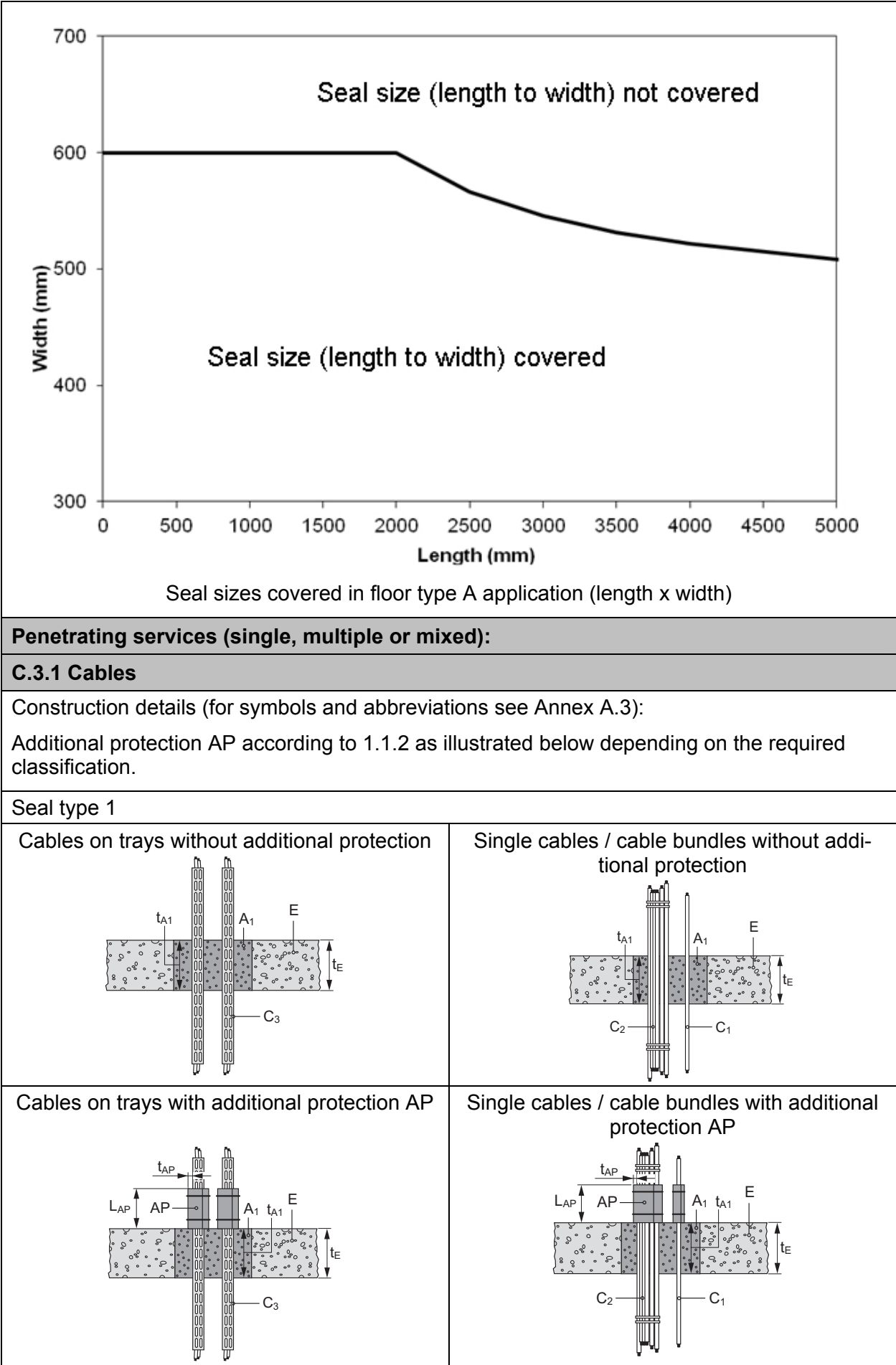
$s_{11} = 0$ (distance between plastic pipes/pipe closure devices) and linear arrangement; in case of cluster arrangement $s_{11} = 100 \text{ mm}$

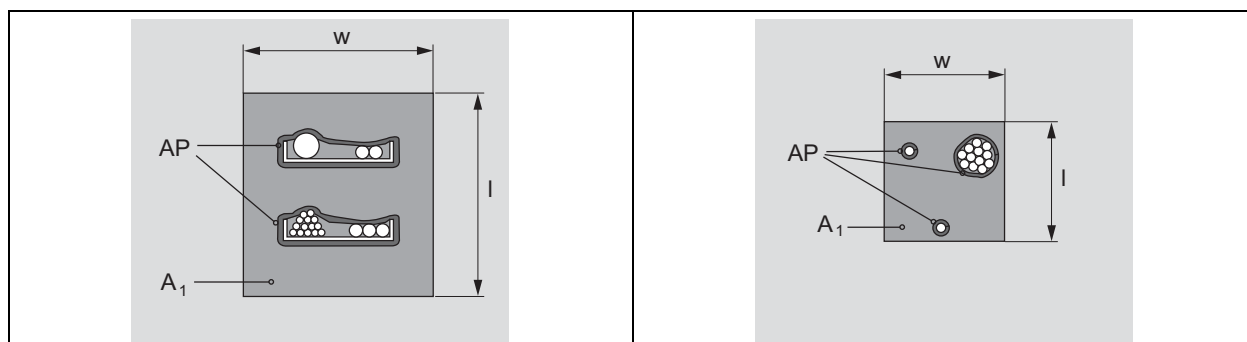
$s_{12} = 30$ (distance between metal pipes and plastic pipes/pipe closure devices)

$s_{13} = 30$ (distance between cables/cable supports and metal pipes)

$s_{14} = 18$ (distance between cables/cable supports and plastic pipes/pipe closure devices)

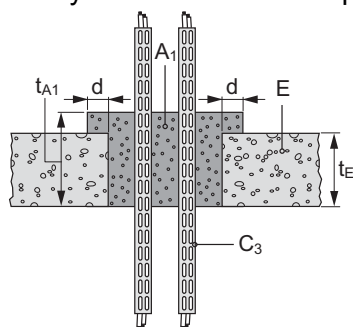




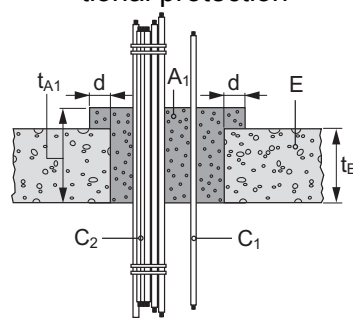


Seal type 2

Cables on trays without additional protection



Single cables / cable bundles without additional protection



		Classification	
Seal thickness (mm)	200 (Type 2)	150 (Type 1)	150 (Type 1)
Additional protection according to 1.1.2:	without	without	with
All sheathed cable types currently and commonly used in building practice in Europe (e.g. power, control, signal, telecommunication, data, optical fibre cables, with cable supports, with a diameter of:			
Maximum Ø 21 mm	EI 90	EI 90	EI 90
$21 \leq \text{Ø} \leq 50 \text{ mm}$	EI 90	EI 60	EI 90
$50 \leq \text{Ø} \leq 80 \text{ mm}$	EI 90	EI 60	EI 90
Non-sheathed cables (wires) currently and commonly used in building practice in Europe, with or without cable supports, with a diameter of:			
Maximum Ø 17 mm	EI 90	EI 45	EI 90
Maximum Ø 24 mm	EI 45	EI 45	EI 60
Tied cable bundle ¹⁵ , maximum diameter of single cable 21 mm, with or without cable supports. For tied cable bundles the space between the cables needs not be sealed.			
Maximum Ø 100 mm	EI 90	EI 90	EI 90

¹⁵ Several cables running in the same direction and bound closely together by mechanical means

In case a conduit is installed with open ends on both sides of the floor (case U/U) the ends of the conduit must be closed using an acrylic sealant, e.g. Hilti Firestop Sealant CFS-S ACR: for metal conduits the end below the floor, for plastic conduits both ends.

		Classification	
Seal thickness (mm)	200 (Type 2)	150 (Type 1)	150 (Type 1)
Ø ≤ 16 mm, arranged linear, with or without cables, with or without cable supports			
Additional protection according to 1.1.2:	without	without	with
Plastic conduits and tubes	EI 120-U/C	EI 90-U/C	EI 90-U/C
Steel conduits and tubes	EI 120-C/U	EI 90-C/U	EI 90-C/U

C.3.3.1 Metal pipes with mineral wool insulation according to Table C.2

(CS)

[illegible]

Insulation thickness (t_D) [mm]	Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
≥ 20	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 120-C/U
≥ 40	76,0 – 168,3	2,9 / 3, ⁶¹¹ – 14,2 ¹⁰	EI 120-C/U

Insulation		Pipe		Classification
thickness (t_D) [mm]	length (L_D) [mm]	diameter (d_C) [mm]	wall thickness (t_C) [mm]	
20	≥ 500	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 120-C/U
40	≥ 500	76,0	2,9 – 14,2 ¹⁰	EI 120-C/U
40	≥ 700	76,0 – 168,3	2,9 / 3,6 ¹¹ – 14,2 ¹⁰	EI 120-C/U

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

Copper pipes (C) with continued insulation (D) – sustained				
Insulation thickness (t_D) [mm]		Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
≥ 20		28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 120-C/U
≥ 40		54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U
Copper pipes (C) with local insulation (D) – sustained				
Insulation		Pipe		Classification
thickness (t_D) [mm]	length (L_D) [mm]	diameter (d_C) [mm]	wall thickness (t_C) [mm]	
20	≥ 500	28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 120-C/U
40	≥ 500	54	1,5 – 14,2 ¹⁰	EI 120-C/U
40	≥ 800	54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U
The field of application given above for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1100 °C, e.g. cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys) and Ni.				

C.3.3.2 Metal pipes with Armaflex AF insulation and Hilti Firestop Bandage CFS-B	
Construction details (for symbols and abbreviations see Annex A.3): Seal type 1 (see C.2) For specification of Armaflex AF see Annex D Table D.3. Two layers of of Firestop Bandage CFS-B (A_2) wrapped around the pipe insulation, on each side of the seal. The bandage is positioned with half of its width (62.5 mm) within the seal (central marking line at the surface of the seal) and outside the seal fastened with wire.	
<p>Continued insulation, sustained (CS)</p>	<p>Local insulation, sustained (LS)</p>

Steel pipes (C) with continued insulation (D) – sustained			
Insulation thickness (t_D) [mm]	Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
19	26,7	2,2 – 14,2 ¹⁰	EI 120-C/U
19	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 90-C/U
19 – 41	76,0	2,9 – 14,2 ¹⁰	EI 90-C/U
41	76,0	2,9 – 14,2 ¹⁰	EI 120-C/U
41	76,0 – 168,3	2,9 / 3,6 ¹¹ – 14,2 ¹⁰	EI 90-C/U

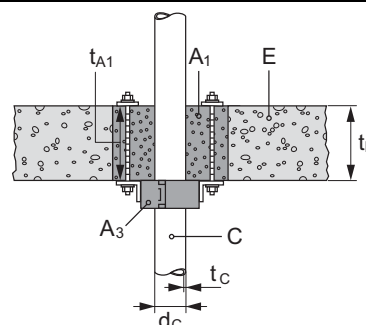
Steel pipes (C) with local insulation (D) – sustained				
Insulation		Pipe		Classification
thickness (t _D) [mm]	length (L _D) [mm]	diameter (d _C) [mm]	wall thickness (t _C) [mm]	
19	≥ 500	26,7	2,2 – 14,2 ¹⁰	EI 120-C/U
19	≥ 500	26,7 – 76,0	2,2 / 2,9 ⁹ – 14,2 ¹⁰	EI 90-C/U
19 - 41	≥ 500	76,0	2,9 – 14,2 ¹⁰	EI 90-C/U
41	≥ 500	76,0	2,9 – 14,2 ¹⁰	EI 120-C/U
41	≥ 700	76,0 – 168,3	2,9 / 3,6 ¹¹ – 14,2 ¹⁰	EI 90-C/U
The field of application given above for steel pipes is also valid for other metal pipes with lower heat conductivity than unalloyed steel and a melting point of minimum 1050 °C, e.g. cast iron, stainless steels, Ni alloys (NiCu, NrCr and NiMo alloys)				
Copper pipes (C) with continued insulation (D) – sustained				
Insulation thickness (t _D) [mm]	Pipe diameter (d _C) [mm]	Pipe wall thickness (t _C) [mm]	Classification	
19	28	1,0 – 14,2 ¹⁰	EI 120-C/U	
19	28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 90-C/U	
19 - 41	54	1,5 – 14,2 ¹⁰	EI 90-C/U	
41	54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U	
Copper pipes (C) with local insulation (D) – sustained				
Insulation		Pipe		Classification
thickness (t _D) [mm]	length (L _D) [mm]	diameter (d _C) [mm]	wall thickness (t _C) [mm]	
19	≥ 500	28	1,0 – 14,2 ¹⁰	EI 120-C/U
19	≥ 500	28 - 54	1,0 / 1,5 ¹² – 14,2 ¹⁰	EI 90-C/U
19 - 41	≥ 500	54	1,5 – 14,2 ¹⁰	EI 90-C/U
41	≥ 500	54	1,5 – 14,2 ¹⁰	EI 120-C/U
41	≥ 800	54 - 89	1,5 / 2,0 ¹³ – 14,2 ¹⁰	EI 120-C/U
The field of application given above for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1100 °C, e.g. cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys) and Ni.				

C.3.4 Plastic pipes with Hilti Firestop Collar CFS-C P

Construction details (for symbols and abbreviations see Annex A.3):

Seal type 1 (see C.2)

Hilti Firestop Collars CFS-C P (A_3) are installed on the bottom side of the mortar seal, fastened by threaded rods through the mortar seal, washers and nuts as specified in Annex B.8.



C.3.4.1 PVC-U pipes according to EN ISO 15493, EN ISO 1452 and DIN 8061/8062				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Collar size (A_1)	No. of hooks	Classification
50	2,4 – 5,6	CFS-C P 50/1.5"	2	EI 120-U/U
63	3,0 – 4,7	CFS-C P 63/2"	2	EI 120-U/U
75	2,2 – 3,6	CFS-C P 75/2.5"	3	EI 120-U/U
90	2,7 – 4,3	CFS-C P 90/3"	3	EI 120-U/U
110	1,8 – 8,1	CFS-C P 110/4"	4	EI 120-U/U
125	3,7 – 6,0	CFS-C P 125/5"	4	EI 120-U/U
160	2,5 – 11,8	CFS-C P 160/6"	6	EI 120-U/U
C.3.4.2 PE pipes according to EN ISO 15494 and DIN 8074/8075				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Collar size (A_1)	No. of hooks	Classification
50	2,9 – 4,6	CFS-C P 50/1.5"	2	EI 120-U/U
63	1,8 – 5,8	CFS-C P 63/2"	2	EI 120-U/U
75	1,9 – 6,8	CFS-C P 75/2.5"	3	EI 120-U/U
90	2,2 – 8,2	CFS-C P 90/3"	3	EI 120-U/U
110	2,7 – 10,0	CFS-C P 110/4"	4	EI 120-U/U
125	3,1 – 7,1	CFS-C P 125/5"	4	EI 120-U/U
160	4,0 – 9,1	CFS-C P 160/6"	6	EI 120-U/U
C.3.4.3 PE pipes according to EN 1519-1¹⁴				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Collar size (A_1)	No. of hooks	Classification
50	3,0	CFS-C P 50/1.5"	2	EI 120-U/U
63	3,0	CFS-C P 63/2"	2	EI 120-U/U
75	3,0	CFS-C P 75/2.5"	3	EI 120-U/U
90	3,5	CFS-C P 90/3"	3	EI 120-U/U
110	4,2	CFS-C P 110/4"	4	EI 120-U/U
125	4,8	CFS-C P 125/5"	4	EI 120-U/U
160	6,2	CFS-C P 160/6"	6	EI 120-U/U

C.4 Rigid floor type B according to 1.2.1 (density $\geq 2400 \text{ kg/m}^3$), minimum thickness 150 mm

Penetration seal

Hilti Firestop Mortar CFS-M RG (A₁), thickness (t_{A1}) $\geq 150 \text{ mm}$ (opening depth t_E filled completely).

Maximum distance for 1st service support: 200 mm.

Maximum seal size: 1200 x 700 mm (l x w); for higher lengths see figure below

Minimum distances in mm (for illustration see C.3):

$s_1 = 20$ (distance between cables/cable supports and seal edge)

$s_2 = 0$ (distance between cable supports)

$s_3 = 8$ (distance between cables and upper seal edge)

$s_4 = 0$ (distance between cable supports and bottom seal edge)

$s_5 = 50$ (distance between cables and cables support above)

$s_6 = 30$ (distance between metal pipes and seal edge)

$s_8 = 100$ (distance between metal pipes)

$s_9 = 40$ (distance between plastic pipes/pipe closure devices and seal edge)

$s_{11} = 0$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collars CFS-C P and linear arrangement

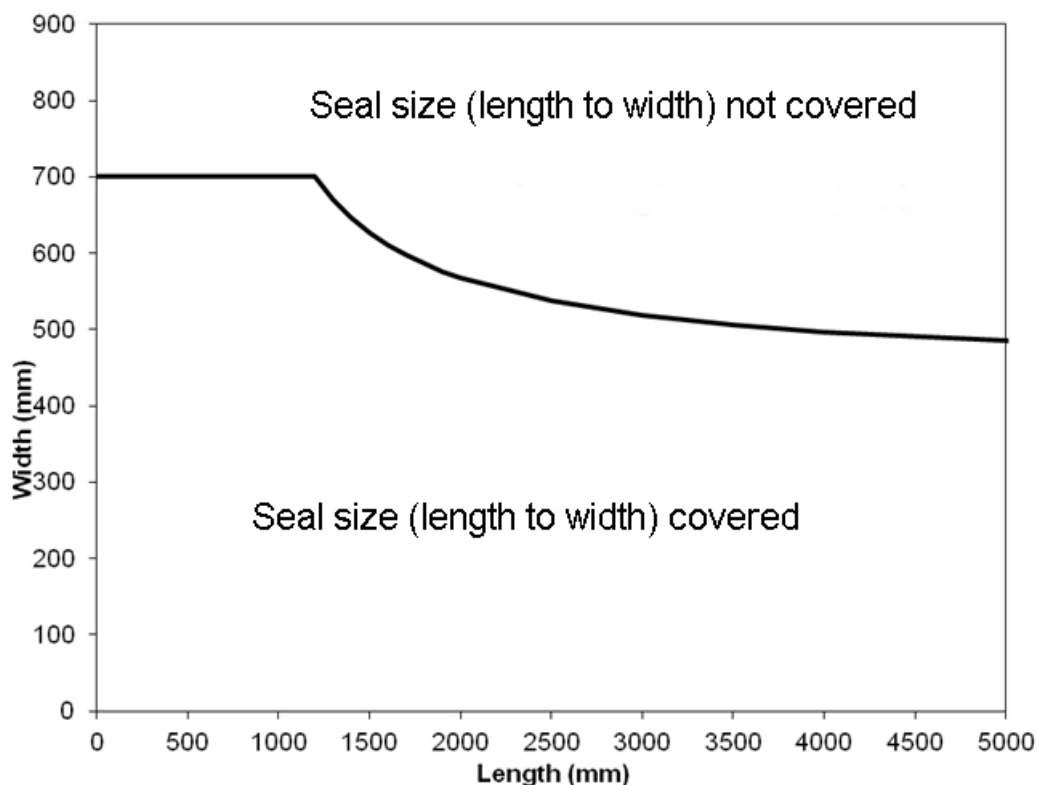
$s_{11} = 50$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collars CFS-C and linear arrangement

$s_{11} = 100$ (distance between plastic pipes/pipe closure devices) in all cases of cluster arrangement

$s_{12} = 40$ (distance between metal pipes and plastic pipes/pipe closure devices)

$s_{13} = 20$ (distance between cables/cable supports and metal pipes)

$s_{14} = 40$ (distance between cables/cable supports and plastic pipes/pipe closure devices)



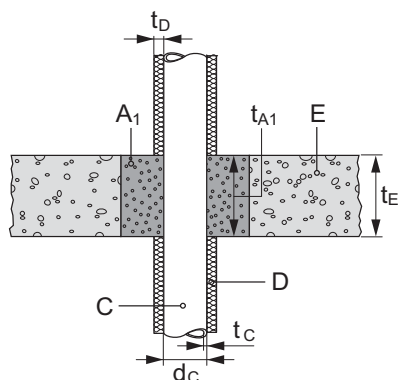
Seal sizes covered in floor type B application (length x width)

Penetrating services: in addition to the services as in C.3 (single, multiple or mixed):

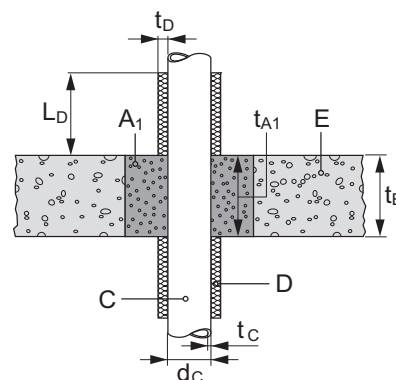
C.4.1 Metal pipes with mineral wool insulation according to Table C.2

Construction details (for symbols and abbreviations see Annex A.3):

Continued insulation, interrupted (CI)



Local insulation, interrupted (LI)



Steel pipes (C) with continued insulation (D) – interrupted

Maximum distance of 1st support from mortar seal: 200 mm

Insulation thickness (t_D) [mm]	Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
≥ 40	114,3	3,7 – 14,2 ¹⁰	EI 120-C/U

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

Maximum distance of 1st support from mortar seal: 200 mm

Insulation		Pipe		Classification
thickness (t_D) [mm]	length (L_D) [mm]	diameter (d_C) [mm]	wall thickness (t_C) [mm]	
40	≥ 800	114,3	3,7 – 14,2 ¹⁰	EI 120-C/U

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

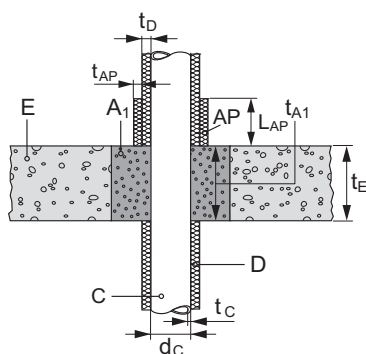
C.4.2 Metal pipes with Armaflex AF insulation

Construction details (for symbols and abbreviations see Annex A.3):

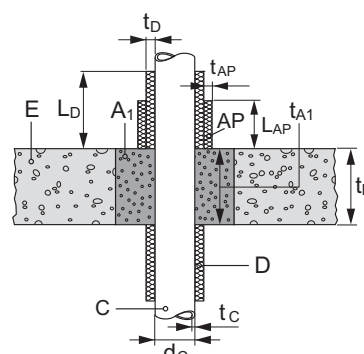
For specification of Armaflex AF see Annex D Table D.3.

Additional protection with Armaflex AF, thickness 25 mm over a length of $L_{AP} = 200$ mm from the seal on the top side of the floor.

Continued insulation, interrupted (CI)



Local insulation, interrupted (LI)



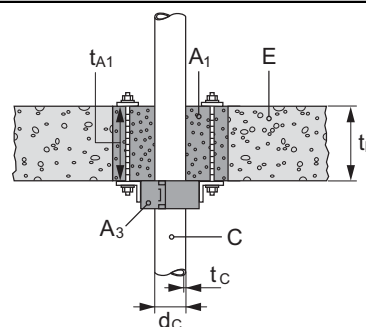
Steel pipes (C) with continued insulation (D) – interrupted				
Insulation thickness (t_D) [mm]		Pipe diameter (d_C) [mm]	Pipe wall thickness (t_C) [mm]	Classification
≥ 25		114,3	7,1 – 14,2 ¹⁰	EI 180-C/U
Steel pipes (C) with local insulation (D) – interrupted				
Insulation		Pipe		Classification
thickness (t_D) [mm]	length (L_D) [mm]	diameter (d_C) [mm]	wall thickness (t_C) [mm]	
25	≥ 800	114,3	7,1 – 14,2 ¹⁰	EI 180-C/U

C.4.3 Plastic pipes with Hilti Firestop Collar CFS-C

Construction details (for symbols and abbreviations see Annex A.3):

Hilti Firestop Collars CFS-C (A_3) are installed on the bottom side of the mortar seal, fastened by threaded rods through the mortar seal, washers and nuts as specified in Annex B.8.

Restrictions by national building regulations to use seals with classification extension U/C have to be considered.



C.4.3.1 PVC-U pipes according to EN ISO 15493, EN ISO 1452 and DIN 8061/8062

Pipe diameter d_C (mm)	Pipe wall thickness t_C (mm)	Collar size (A_1)	No. of hooks	Classification
50	2,0	CFS-C 50/1.5"	2	EI 180-U/C
110	2,7 – 12,3	CFS-C 110/4"	3	EI 180-U/C

The results are also valid for PVC-C pipes according to EN 1566-1 and PVC-U pipes according to EN 1329-1 and EN 1453-1.

C.5 Rigid floor type C according to 1.2.1 (density $\geq 2400 \text{ kg/m}^3$), minimum floor thickness 175 mm

Penetration seal

Hilti Firestop Mortar CFS-M RG (A_1), thickness (t_{A1}) $\geq 175 \text{ mm}$ (opening depth t_E filled completely).

Maximum distance for 1st service support: 200 mm.

Maximum seal size: 1500 x 1000 mm (l x w); for higher lengths see figure below

Minimum distances in mm (for illustration see C.3):

$s_9 = 52$ (distance between plastic pipes/pipe closure devices and seal edge)

$s_{11} = 100$ (distance between plastic pipes/pipe closure devices)

$s_1 = 20$ (distance between cables/cable supports and seal edge)

$s_2 = 0$ (distance between cable supports)

$s_3 = 8$ (distance between cables and upper seal edge)

$s_4 = 0$ (distance between cable supports and bottom seal edge)

$s_5 = 50$ (distance between cables and cables support above)

$s_6 = 30$ (distance between metal pipes and seal edge)

$s_8 = 100$ (distance between metal pipes)

$s_9 = 52$ (distance between plastic pipes/pipe closure devices and seal edge)

$s_{11} = 0$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collars CFS-C P and linear arrangement

$s_{11} = 50$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Collars CFS-C and linear arrangement

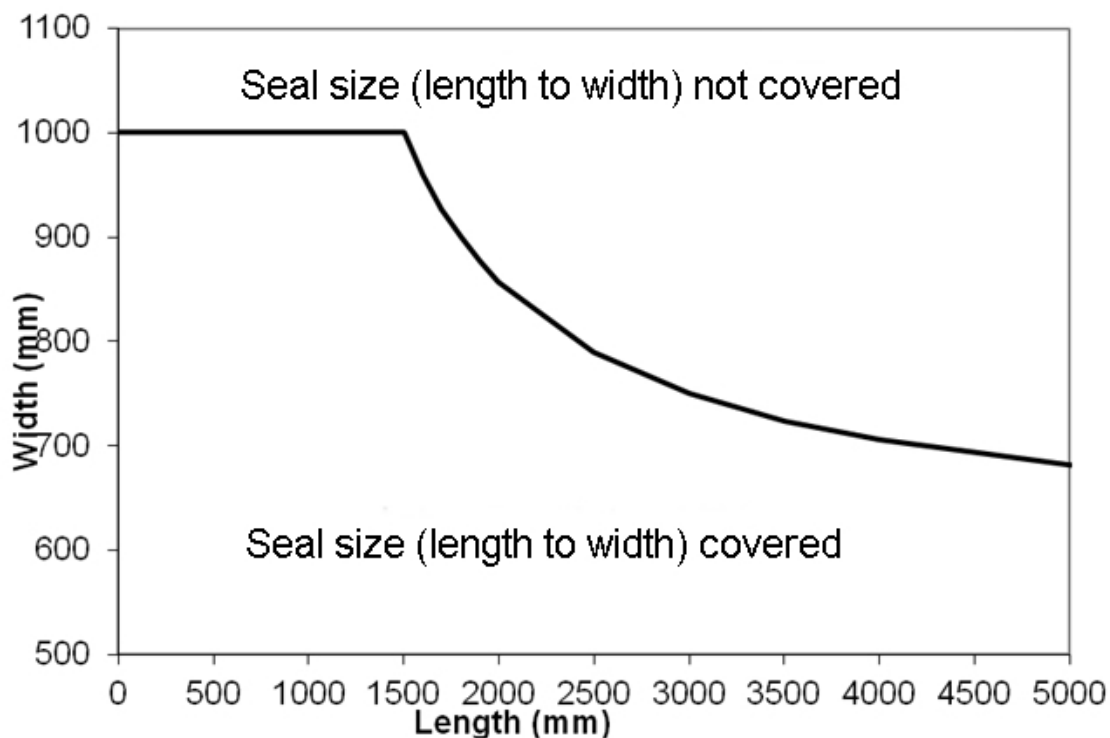
$s_{11} = 100$ (distance between plastic pipes/pipe closure devices) in case of Hilti Firestop Wraps CFS-W and linear arrangement

$s_{11} = 100$ (distance between plastic pipes/pipe closure devices) in all cases of cluster arrangement

$s_{12} = 40$ (distance between metal pipes and plastic pipes/pipe closure devices)

$s_{13} = 20$ (distance between cables/cable supports and metal pipes)

$s_{14} = 40$ (distance between cables/cable supports and plastic pipes/pipe closure devices)



Seal sizes covered in floor application (length x width)				
Penetrating services: in addition to the services as in C.3 and C.4 (single, multiple or mixed):				
C.5.1 Plastic pipes with Hilti Firestop Wrap CFS-W				
Construction details (for symbols and abbreviations see Annex A.3):				
<p>Hilti Firestop Wrap CFS-W (A_4) on the underside of the mortar seal flush with the lower surface of the mortar seal.</p>				
C.5.1.1 PVC-U pipes according to EN ISO 15493, EN ISO 1452 and DIN 8061/8062				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Type of CFS-W (A_1)	Size (CFS-W SG) / No. of layers (CFS-W EL)	Classification
≤ 32	1,8	CFS-W EL	1	EI 120-U/C
50	2,2 – 3,6	CFS-W SG	50/1.5"	EI 120-U/C
63	2,2 – 3,6	CFS- W SG	63/2"	EI 120-U/C
75	2,2 – 3,6	CFS- W SG	75/2.5"	EI 120-U/C
$> 32 \leq 75$	2,2 – 3,6	CFS-W EL	1	EI 120-U/C
90	3,2 – 6,0	CFS- W SG	90/3"	EI 120-U/C
110	3,2 – 6,0	CFS- W SG	110/4"	EI 120-U/C
$> 75 \leq 110$	3,2 – 6,0	CFS-W EL	2	EI 120-U/C
125	3,7 – 6,0	CFS- W SG	125/5"	EI 120-U/C
$> 110 \leq 125$	3,7 – 6,0	CFS-W EL	2	EI 120-U/C
160	2,5 – 3,2	CFS- W SG	160/6"	EI 60-U/C
$> 125 \leq 160$	2,5 – 3,2	CFS-W EL	3	EI 60-U/C
160	3,2 – 13,0	CFS- W SG	160/6"	EI 120-U/C
$> 125 \leq 160$	3,2 – 13,0	CFS-W EL	3	EI 120-U/C

C.5.1.2 PE pipes according to EN ISO 15494 and DIN 8074/8075				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Type of CFS-W (A_1)	Size (CFS-W SG) / No. of layers (CFS-W EL)	Classification
≤ 32	1,8	CFS-W EL	1	EI 120-U/C
50	1,9 – 6,8	CFS-W SG	50/1.5"	EI 120-U/C
63	1,9 – 6,8	CFS- W SG	63/2"	EI 120-U/C
75	1,9 – 6,8	CFS- W SG	75/2.5"	EI 120-U/C
$> 32 \leq 75$	1,9 – 6,8	CFS-W EL	1	EI 120-U/C
90	2,7 – 7,1	CFS- W SG	90/3"	EI 120-U/C
110	2,7 – 7,1	CFS- W SG	110/4"	EI 120-U/C
$> 75 \leq 110$	2,7 – 7,1	CFS-W EL	2	EI 120-U/C
125	3,2 – 7,1	CFS- W SG	125/5"	EI 120-U/C
$> 110 \leq 125$	3,2 – 7,1	CFS-W EL	2	EI 120-U/C
160	4,0 – 14,6	CFS- W SG	160/6"	EI 120-U/C
$> 125 \leq 160$	4,0 – 14,6	CFS-W EL	3	EI 120-U/C
C.5.1.3 PE pipes according to EN 1519-1¹⁴				
Pipe diameter d_c (mm)	Pipe wall thickness t_c (mm)	Type of CFS-W (A_1)	Size (CFS-W SG) / No. of layers (CFS-W EL)	Classification
50	3,0	CFS-W SG	50/1.5"	EI 120-U/C
63	3,0	CFS- W SG	63/2"	EI 120-U/C
75	3,0	CFS- W SG	75/2.5"	EI 120-U/C
≤ 75	3,0	CFS-W EL	1	EI 120-U/C
90	4,8	CFS- W SG	90/3"	EI 120-U/C
110	4,8	CFS- W SG	110/4"	EI 120-U/C
125	4,8	CFS- W SG	125/5"	EI 120-U/C
$> 75 \leq 125$	4,8	CFS-W EL	2	EI 120-U/C
160	6,2	CFS- W SG	160/6"	EI 120-U/C
$> 125 \leq 160$	6,2	CFS-W EL	3	EI 120-U/C

ANNEX D

SPECIFICATION OF MINERAL WOOL PRODUCTS AND PIPE INSULATION PRODUCTS

Table D.1: Specification for mineral wool products suitable for being used as additional protection for cables/cable supports

Characteristic	Specification	Unit
Stone wool according to EN 14303		
Reaction to fire class according to EN 13501-1	A1 or A2	-
Thermal conductivity at 20 °C	≤ 0.040	W/(mK)
Density	35 - 45	kg/m ³
Surface	Al-foil faced on one side	-

The following list contains suitable products but may not be exhaustive:

Manufacturer	Product designation
Isover	Ultimate U TFA 34
Knauf	Lamella Forte LLMF AluR
Paroc	Lamella Mat 35 Alu Coat
Rockwool	Klimafix
Rockwool	Klimarock
Rockwool	Rockwool 133 (Lamella mat)

Table D.2: Specification for mineral wool products suitable for being used as pipe insulation

Interrupted insulation	
Stone wool according to EN 14303, class A2 or A1 according to EN 13501-1, Al-faced	
Sustained insulation	
Manufacturer	Product designation
Isover	Coquilla AT-LR
Isover	Protect 1000 S alu
Isover	Protect BSR 90 alu
Paroc	Section AluCoat T
Rockwool	Conlit Pipe sections
Rockwool	Klimarock
Rockwool	RS 800 pipe sections

Table D.3: Specification for flexible elastomeric foam (FEF) products suitable for being used as pipe insulation

Manufacturer	Product designation
Armacell International GmbH	Armaflex AF (CE marked according to EN 14304)

blank page

blank page

blank page