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Authorised and notified according to Article 10 of the Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products.

MEMBER OF EOTA

European Technical Approval ETA-10/0212

Trade name:	**Hilti Firestop Bandage CFS-B**
Holder of the approval:	HILTI Corporation Feldkircherstrasse 100 9494 Schaan Liechtenstein
Generic type and use of construction product:	Fire Stopping and Sealing Product. Penetration Seals
Valid from:	2010-08-24
to:	2015-08-24
Manufacturing plant:	C/006
This European Technical Approval contains:	12 pages and 3 Annexes, 24 pages in total

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Issued by:

For and on behalf of Warrington Certification Limited

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 Warrington Certification Limited in accordance with:

The Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1] modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];

UK implementation of CPD Statutory Instruments 1991, No 1620 Building and Buildings The Construction Products Regulations 1991- made 15 July 1991, laid before Parliament 22 July 1991, coming into force 27 December 1991, and amended by The Construction Products (Amendment) Regulations 1994 (Statutory Instruments 1994, No 3051);

Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC[4];

Guideline for European Technical Approval of Fire Stopping and Fire Sealing Products: ETAG 026 Part 1: "General" and Part 2: "Penetration Seals".

2 Warrington Certification Limited is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant(s). Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for their 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 manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1.

4 This European Technical Approval may be withdrawn by Warrington Certification Limited, 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 Warrington Certification Limited. 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 should correspond fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

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[1] Official Journal of the European Communities N° L40, 11.2.1989, p. 12
[2] Official Journal of the European Communities N° L 220, 30.08.1993, p. 1
[3] Official Journal of the European Union N° L 284, 31.10.2003, p. 1
[4] Official Journal of the European Communities N° L17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

1) Hilti Firestop Bandage CFS-B is a 'wrap/bandage' used to wrap around pipes and pipe insulation to form a penetration seal to reinstate the fire resistance performance of wall and floor constructions, where they have been provided with apertures for the penetration of metal pipes services with insulation of class B to E according to EN 13501-1 (hereafter referred to as "combustible insulation").

2) Hilti Firestop Bandage CFS-B includes an intumescent component to close any gaps or joints when heated and prevent the passage of fire.

3) The Hilti Firestop Bandage CFS-B is supplied in roll form, with binding wire. The bandage is cut to a length to suit the overall diameter of pipe or pipe and insulation and then wrapped around the pipe within the separating element.

4) Installation of the system Hilti Firestop Bandage CFS-B – See 4.2

1.2 Intended Use and Use Category

1.2.1 Intended Use

The intended use of system Firestop Bandage CFS-B is to reinstate the fire resistance performance of flexible wall constructions, rigid wall constructions and rigid floor constructions where they are penetrated by various metal pipe services with combustible insulation.

1) The specific elements of construction that the system Firestop Bandage CFS-B may be used to provide a penetration seal in, are as follows:

   Flexible walls: The wall must have a minimum thickness of 125 mm and comprise timber or steel studs lined on both faces with minimum 2 layers of 12.5 mm thick boards. The aperture around the pipe/bandage shall be infilled with gypsum plaster minimum 25 mm thick. 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 and minimum 100 mm insulation of Class A1 or A2 (in accordance with EN 13501-1) in the cavity between stud and seal.

   Rigid walls: The wall must have a minimum thickness of 120 mm and comprise concrete, aerated concrete or masonry, with a minimum density of 650 kg/m^3.

   Rigid floors: The floor must have a minimum thickness of 150 mm and comprise aerated concrete or concrete with a minimum density of 650 kg/m^3.

The supporting construction must be classified in accordance with EN 13501-2 for the required fire resistance period.

2) The system Hilti Firestop Bandage CFS-B may be used to provide a penetration seal with specific insulated metal pipes, single only (for details see Annex C).

3) Apertures in the separating element shall be maximum 50 mm diameter oversize with respect to the pipe diameter, plus pipe insulation (if applied) and Hilti Firestop Bandage CFS-

B. The remaining annular space/gap shall be infilled with gypsum plaster or cementitious mortar. Apertures for the penetration of pipes do not require separation i.e. may be directly adjoining with annular interaction.

4) Pipes shall be supported at maximum 500 mm and 700 mm away from both faces of the wall constructions and from the upper face of floor constructions.

The provisions made in this European Technical Approval are based on an assumed working life of the Hilti Firestop Bandage CFS-B 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

Type Z_2: Intended for use at internal conditions with humidity classes other than Z_1[5], excluding temperatures below 0°C.

2 Characteristics of the product and methods of verification

The assessment of fitness for use has been made in accordance with EOTA ETAG 026 Part 2: 2008-01-01

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 E 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	No performance determined
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	No performance determined
2.4.7	2.7	Resistance to impact/movement	No performance determined
2.4.8	2.8	Adhesion	No performance determined
		Protection against noise	
2.4.9	2.9	Airborne sound insulation	No performance determined
		Energy, Economy and Heat Retention	

[5] i.e. humidity class other than class 5 in accordance with EN ISO 13788

2.4.10	2.10	Thermal properties	No performance determined
2.4.11	2.11	Water vapour permeability	No performance determined
		General aspects relating to fitness for use	
2.4.12	2.12	Durability and serviceability	Z_2, see clause 2.12

2.1 Reaction to fire

Hilti Firestop Bandage CFS-B is classified '**E'** in accordance with EN 13501-1.

2.2 Resistance to fire

System Hilti Firestop Bandage CFS-B has been tested in accordance with prEN 1366-3: 2006 & 2007 and based upon the test results and the field of direct application specified within EN 1366-3: 2009, the system Hilti Firestop Bandage CFS-B has been classified in accordance with EN 13501-2, as given in Annex C:

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

In case of flexible wall constructions mineral wool must be used to provide support for the gypsum or mortar gap filling at the position of the aperture edge (for construction details see Annex C). 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.

Pipes must be perpendicular to the seal surface.

It is assumed that compressed air systems are switched off by other means in the case of fire.

The function of the pipe seal in case of pneumatic dispatch systems, pressurised air systems etc. is guaranteed only when the systems are shut off in case of fire.

The assessment does not cover the avoidance of destruction of the seal or of the abutting building element(s) by forces caused by temperature changes in case of fire. This has to be considered when designing the piping system.

NOTE For example, for non-insulated metal pipes the elongation to be considered can be calculated using the relevant temperature from the standard time temperature curve at the fire resistance period required.

The approval does not address any risks associated with leakage of dangerous liquids or gases caused by failure of the pipe(s) in case of fire.

The durability assessment does not take account of the possible effect of substances permeating through the pipe on the penetration seal.

The classifications relate to C/U (capped inside the furnace/uncapped outside). For further information refer to national regulations.

2.3 Air permeability

No performance determined

2.4 Water permeability

No performance determined

2.5 Dangerous substances

Hilti Corporation has presented a declaration that Hilti Firestop Bandage CFS-B is in compliance with Council Directive 76/769/EEC of 27th July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (incl. all amendments and adaptations).

Confirmation has further been declared that all dangerous chemical substances ≥ 1.0 % w/w as well as all toxic, carcinogenic, toxic for reproduction and mutagenic chemical substances ≥ 0.1 % w/w (Status: 29. adaption – 2004/73/EG – of the EU directive 67/548/EEC – classification, packaging and labelling of dangerous substances) are stated in Hilti safety data sheets (according to 91/155/EEC including amendments) and have been considered for the classification of the products according to the directive 1999/45/EG (classification of preparations, including amendments).

All dangerous chemical substances are below the classification limits of 67/548/EEC.

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

2.6 Mechanical resistance and stability

No performance determined.

2.7 Resistance to impact/movement

No performance determined.

2.8 Adhesion

Not relevant.

2.9 Airborne sound insulation

No performance determined.

2.10 Thermal properties

No performance determined.

2.11 Water vapour permeability

No performance determined.

2.12 Durability and serviceability

Hilti Firestop Bandage CFS-B has been tested in accordance with EOTA Technical Report - TR024 – Edition November 2006, for the type Z_2 use category specified in EOTA 026-2, and the results of the tests have demonstrated suitability for penetration seals intended for use at internal conditions with humidity classes other than Z_1, excluding temperatures below 0°C ("internal dry conditions").

3 Evaluation of Conformity and CE marking

3.1 Attestation of Conformity system

According to the decision 1999/454/EC of the European Commission 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

(1) initial type-testing of the product;

(2) initial inspection of factory and of factory production control;

(3) continued surveillance, assessment and approval of factory production control.

3.2 Responsibilities

3.2.1 Tasks for 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 ensure that the product is in conformity with this European technical approval.

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

The factory production control shall be in accordance with the Control Plan of 17th March 2010 relating to the European technical approval ETA -…(number) issued on …(date)" 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 Warrington Certification Limited.

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

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.
  - 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.

(b) Installation instruction:

- Steps to be followed
- Procedure in case of retrofitting.

The manufacturer shall, on the basis of a contract, involve a body which is 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 the European technical approval ETA-10/0212 issued on 2010.08.24.

3.2.2 Tasks of approved bodies

The approved body shall perform the

- initial type-testing of the product,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the "Control Plan of 17th March 2010 relating to the European technical approval ETA-10/0212 issued on 2010.08.24.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification 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 Warrington Certification Limited without delay.

3.3 CE-Marking

The CE marking shall be affixed on the Hilti Firestop Bandage CFS-B. The marking “CE” shall be followed by the identification number of the approved certification body and be accompanied by the following additional information:

- identification number of the notified body (as mentioned above)
- the name 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 Guideline for European Technical Approval
- the use category Z_2
- see ETA-10/0212 issued on 2010.08.24 for other relevant characteristics

Example of CE marking and accompanying information:

CE	**‘CE’-Marking**
1121	Identification number of approved certification body
Hilti AG Feldkircherstrasse 100 FL-9494 Schaan Liechtenstein	Name and address of the producer (legal entity responsible for the manufacturer)
09	Two last digits of year of affixing the CE marking
XXXX-CPD-XXXX	Number of EC certificate of conformity
ETA-10/0212	Number of European technical approval
ETAG N° 026 part 2	Number of guideline for European technical approval
Penetration Seal ‘Hilti Firestop Bandage CFS-B‘	Designation of the product (trade name)
Use category Z_2	Use category in accordance with the ETA section 1 and 2
see ETA 10/0212 for other relevant characteristics	Other relevant characteristics see ETA ETA-10/0212 issued on 2010.08.24

4 Assumptions under which the fitness of the product for the intended use was favorably assessed

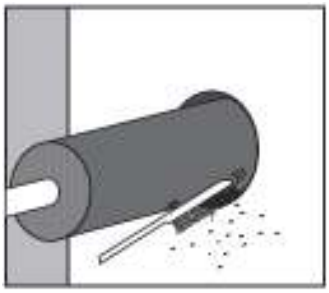
4.1 Manufacturing

The European technical approval is issued for Hilti Firestop Bandage CFS-B on the basis of agreed data/information, deposited with Warrington Certification Limited, 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 Warrington Certification Limited before the changes are introduced. Warrington Certification Limited 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

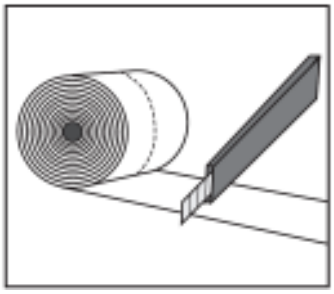
Installation of system Firestop Bandage CFS-B shall be conducted as follows:

1



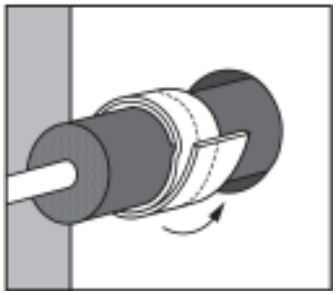
Clean opening.

2



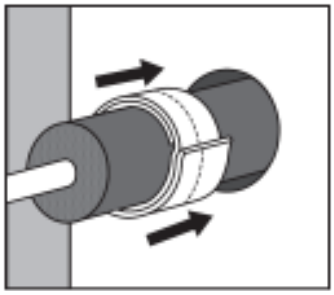
Cut Hilti Firestop Bandage CFS-B to fit the outside diameter of the insulation. Consider the number of 2 layers.

3



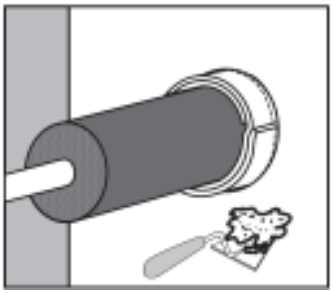
Wrap Hilti Firestop Bandage CFS-B around the insulation. Secure the bandage with steel bands or wire (≥ 0.7mm)

4



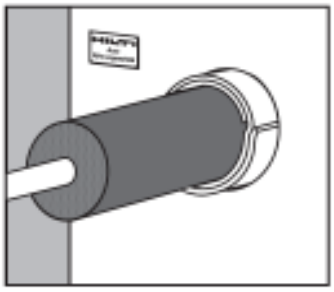
Install Hilti Firestop Bandage CFS-B on both sides within the opening in a depth of 62.5 mm.

5



Close the remaining gap with mortar or gypsum.

6



If it is necessary, an additional insulation over the bandage has to be installed.

Two layers of bandage are required around the pipe/insulation.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

The following measures should be adopted with regard to handling and storage of the Hilti Firestop Bandage CFS-B:

- Handling
  - Information for safe handling: No special measures required.
  - Information about protection against explosions and fires: No special measures required.
- Storage
  - Don't store the product under 0 °C and not over +60 °C

5.2 Use, maintenance, repair

The system Hilti Firestop Bandage CFS-B should be installed and used as described earlier in this document.

System Hilti Firestop Bandages CFS-B seals which are damaged should not be used or if damaged after installation, should be removed and replaced with undamaged bandages.

In the area covered by the ETA when the set up recommendation have been followed there is no maintenance protocol to be followed. The product does not need any maintenance in the life time indicated in the ETA.

Annex A

Reference Documents and LIST OF ABBREVIATIONS

References to standards mentioned in the ETA:

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

Other reference documents:

EOTA TR 024	Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products

Abbreviations used in drawings

Abbreviation	Description
A, A_1, A_2,..	Firestop product
B	Backfilling material
C	Pipe
D_1	Pipe insulation
D_2	Additional insulation
E	Building element (wall, floor)
E_B	Aperture framing made from mineral wool (flexible wall constructions)
d_C	Pipe diameter
t_C	Pipe wall thickness
t_D, t_{D1}	Thickness of pipe insulation D, D_1
t_{D2}	Thickness of additional insulation D_2
t_E	Thickness of building element (wall, floor)
L_{D2}	Minimum length of additional insulation D_2

Annex B

Description of Product and Product Literature

Hilti Firestop Bandage CFS-B

A detailed specification of the product is contained in document “Identification / Product Specification and Control Plan of 17.03.2010 relating to the European Technical Approval ETA –10/XXX issued on ...(date) Hilti Firestop Bandage CFS-B” which is a non-public part of this ETA.

Technical product literature:

- Technical data sheet and instructions for use Hilti Firestop Bandage CFS-B

Annex C

Resistance to Fire Classification of Hilti Firestop Bandage CSF-B

C.1 Flexible wall constructions and rigid wall constructions according to 1.2.1 with wall thickness t_E of minimum 125 mm

C.1.1 Penetration seal with 2 layers of Hilti Firestop Bandage CFS-B and additional insulation

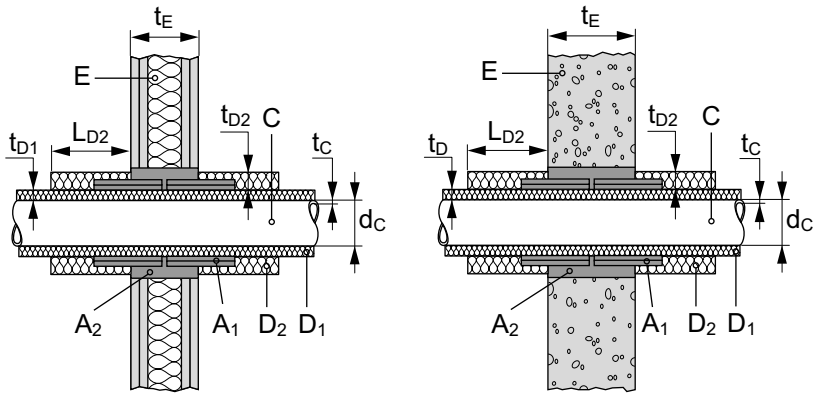
Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by two layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the wall (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2). Additional insulation (D_2) of minimum 300 mm length (L_{D2}) from the surface of the wall (E) on both sides in a thickness of 19 mm (t_{D2}) made from the same material as the pipe insulation.

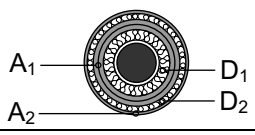
In case the flexible wall construction is not filled completely with insulation material the aperture must be framed by installing mineral wool (E_B) with a minimum thickness of 50 mm into the gap between the linings of the wall.

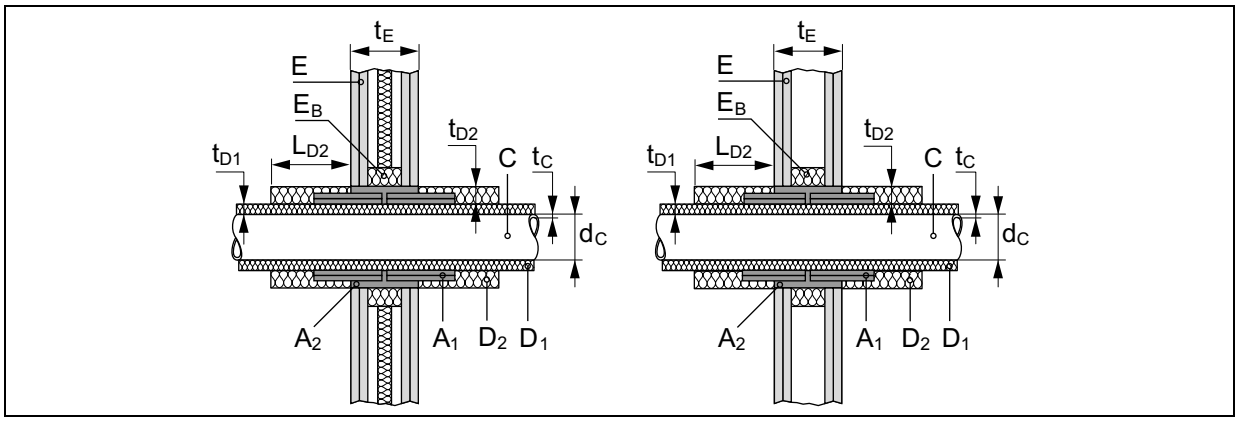
*Pipe insulation may comprise the following materials:

- Armacell International GmbH – Armaflex AF (Production status 2008 or CE marked according to EN 14304)
- Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (Production status 2010 or CE marked according to EN 14304)
- Saint Gobain Isover G+H AG – Isover ML-3 (Production status 2009 or CE marked according to EN 14303)

Construction details:







C.1.1.1 Separation of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 28 mm, wall thickness (t_C) between 1 mm and 10 mm; thickness of insulation (t_{D1}) 10 mm	EI 120 - C/U
Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm, thickness of insulation (t_{D1}) 30 - 100 mm	EI 90 - C/U E 120 - C/U
Steel pipes [7] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) between Ø 88.9 mm and Ø 159 mm, with minimum wall thickness (t_C) 2 mm and 4 mm respectively, interpolation of minimum thickness between these diameters; maximum wall thickness (t_C) 14,2 mm; thickness of insulation (t_{D1}) 30-80 mm	EI 90 - C/U E 120 - C/U

C.1.1.2 Zero separation of services

Services	Classification
Copper pipes [6] arranged linear with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 0 mm.	
Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm, thickness of insulation (t_{D1}) 30 mm	EI 120 - C/U

[6] The field of application given above is also valid for other metal pipes with lower heat conductivity than copper (ca. 350 W/m.K at 20°C) and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, stainless steel, cast iron, Ni and its alloys (NiCu, NrCr and NiMo alloys), CuNi alloys.

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

C.1.2 Penetration seal with 2 layers of Hilti Firestop Bandage CFS-B

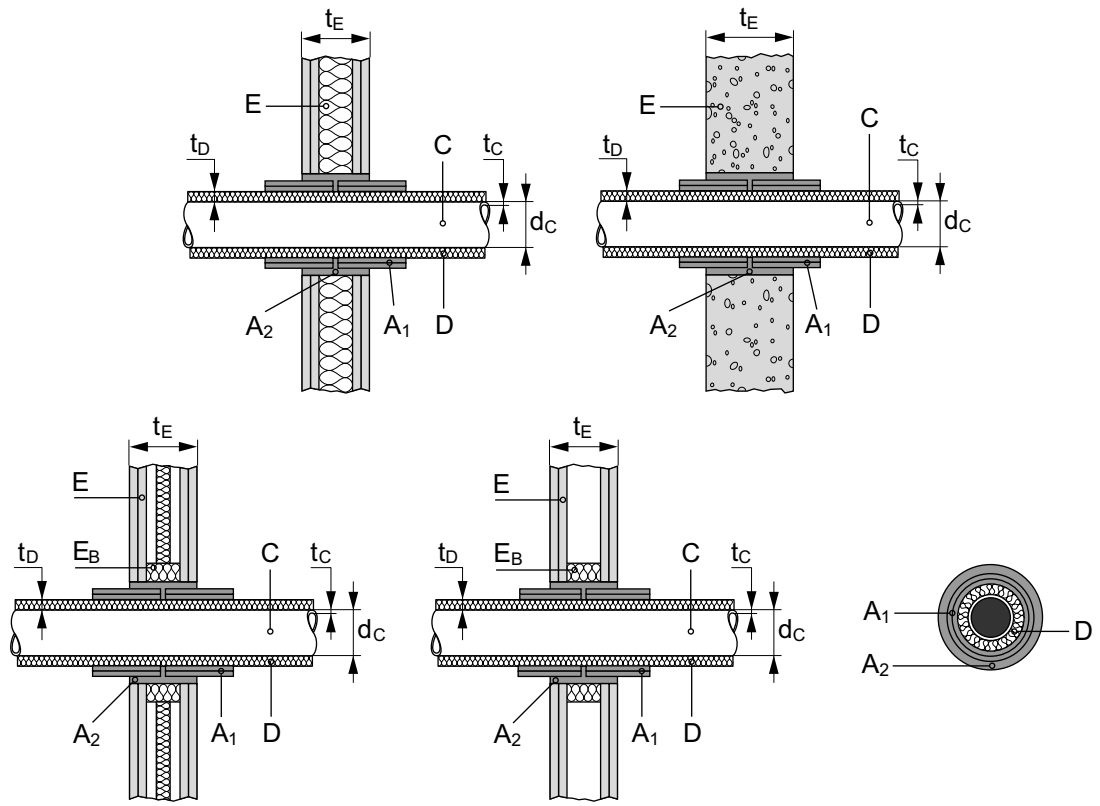
Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by two layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the wall (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2).

In case the flexible wall construction is not filled completely with insulation material the aperture must be framed by installing mineral wool (E_B) with a minimum thickness of 50 mm into the gap between the linings of the wall.

*Pipe insulation may comprise the following materials:

- Armacell International GmbH – Armaflex AF (Production status 2008 or CE marked according to EN 14304)
- Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (Production status 2010 or CE marked according to EN 14304)
- Saint Gobain Isover G+H AG – Isover ML-3 (Production status 2009 or CE marked according to EN 14303)

Construction details:



C.1.2.1 Separation of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) between Ø 42 mm and Ø 54 mm, with minimum wall thickness (t_C) 1,5 mm and 2 mm respectively, interpolation of minimum thickness between these diameters; maximum wall thickness (t_C) 14,2 mm; thickness of insulation (t_{D1}) 30 mm	EI 90 - C/U E 120 - C/U

C.2 Flexible wall constructions and rigid wall constructions according to 1.2.1 with wall thickness t_E of minimum 100 mm

C.2.1 Penetration seal with 2 layers of Hilti Firestop Bandage CFS-B and additional insulation

Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by two layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the wall (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2). Additional insulation (D_2) of minimum 300 mm length (L_{D2}) from the surface of the wall (E) on both sides in a thickness of 19 mm (t_{D2}) made from the same material as the pipe insulation. In case the flexible wall construction is not filled completely with insulation material the aperture must be framed by installing mineral wool (E_B) with a minimum thickness of 50 mm into the gap between the linings of the wall. *Pipe insulation may comprise the following materials: • Armacell International GmbH – Armaflex AF (2008 or CE marked according to EN 14304) • Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (2010 or CE marked according to EN 14304) • Saint Gobain Isover G+H AG – Isover ML-3 (2009 or CE marked according to EN 14303)
Construction details: see C.1.1

C.2.1.1 Separation of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 28 mm, wall thickness (t_C) between 1 mm and 10 mm; thickness of insulation (t_{D1}) 10 mm	EI 120 - C/U
Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm, thickness of insulation (t_{D1}) 100 mm	EI 120 - C/U
Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm, thickness of insulation (t_{D1}) 30-100 mm	EI 90 - C/U E 120 - C/U
The field of application given above is also valid for other metal pipes with lower heat conductivity than copper (ca. 350 W/m.K at 20°C) and a melting point of minimum 1050°C, e.g. unalloyed steels, low alloyed steels, stainless steel, cast iron, Ni and its alloys (NiCu, NrCr and NiMo alloys), CuNi alloys.	
Steel pipes [7] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) between Ø 88.9 mm and Ø 114,3 mm, with minimum wall thickness (t_C) 2 mm, interpolation of minimum thickness between these diameters; maximum wall thickness (t_C) 14,2 mm; thickness of insulation (t_{D1}) 40 mm	EI 90 - C/U E 120 - C/U

C.2.1.2 Zero separation of services

Services	Classification
Copper pipes [6] arranged linear with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 0 mm.	

Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 30 mm	EI 90 - C/U E 120 - C/U

C.2.2 Penetration seal with 2 layers of Hilti Firestop Bandage CFS-B

Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by two layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the wall (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2).

In case the flexible wall construction is not filled completely with insulation material the aperture must be framed by installing mineral wool (E_B) with a minimum thickness of 50 mm into the gap between the linings of the wall.

*Pipe insulation may comprise the following materials:

- Armacell International GmbH – Armaflex AF (Production status 2008 or CE marked according to EN 14304)
- Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (Production status 2010 or CE marked according to EN 14304)
- Saint Gobain Isover G+H AG – Isover ML-3 (Production status 2009 or CE marked according to EN 14303)

Construction details see C.1.2

C.2.2.1 Separation of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 54 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 30 mm	EI 90 - C/U E 120 - C/U

C.3 Rigid wall constructions according to 1.2.1 with wall thickness t_E of minimum 150 mm

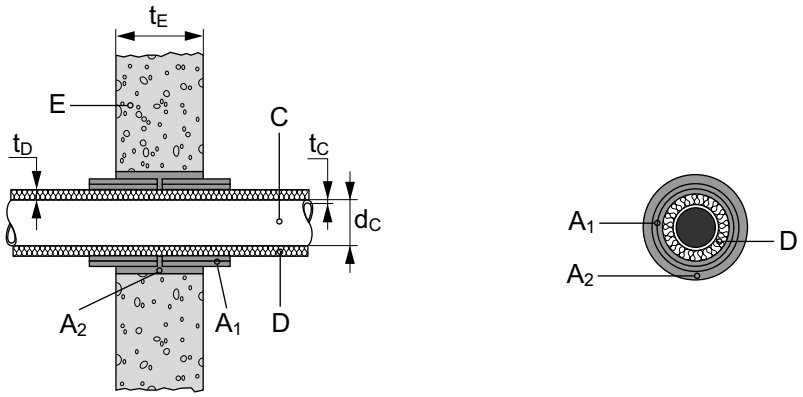
C.3.1 Penetration seal with 2 layers of Hilti Firestop Bandage CFS-B

Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by two layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the wall (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2).

*Pipe insulation may comprise the following materials:

- Armacell International GmbH – Armaflex AF (Production status 2008 or CE marked according to EN 14304)
- Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (Production status 2010 or CE marked according to EN 14304)
- Saint Gobain Isover G+H AG – Isover ML-3 (Production status 2009 or CE marked according to EN 14303)

Construction details:



C.3.1.1 Separation of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 28 mm, wall thickness (t_C) between 1 mm and 10 mm; thickness of insulation (t_{D1}) 10 mm	EI 120 - C/U
Diameter (d_C) Ø 54 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 13 mm	EI 90 - C/U E 120 - C/U
Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 19 - 100 mm	EI 90 - C/U
Steel pipes [7] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	

Diameter (d_C) between Ø 88.9 mm and Ø 159 mm, with minimum wall thickness (t_C) 2 mm and 4 mm respectively, interpolation of minimum thickness between these diameters; maximum wall thickness (t_C) 14,2 mm; thickness of insulation (t_{D1}) 40-80 mm	EI 90 - C/U

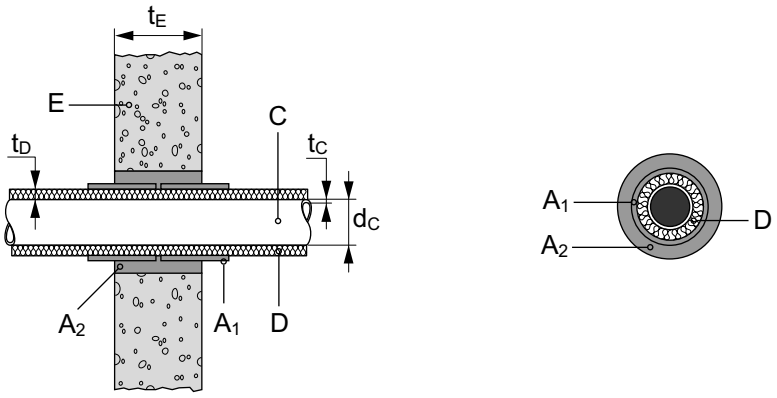
C.3.2 Penetration seal with 1 layer of Hilti Firestop Bandage CFS-B

Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by one layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the wall (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2).

*Pipe insulation may comprise the following materials:

- Armacell International GmbH – Armaflex AF (Production status 2008 or CE marked according to EN 14304)
- Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (Production status 2010 or CE marked according to EN 14304)
- Saint Gobain Isover G+H AG – Isover ML-3 (Production status 2009 or CE marked according to EN 14303)

Construction details:



C.3.2.1 Separation of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 54 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 13 mm	EI 60 - C/U E 90 - C/U
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 19 mm	EI 60 - C/U E 90 - C/U

C.4 Rigid floor constructions according to 1.2.1 with wall thickness t_E of minimum 150 mm

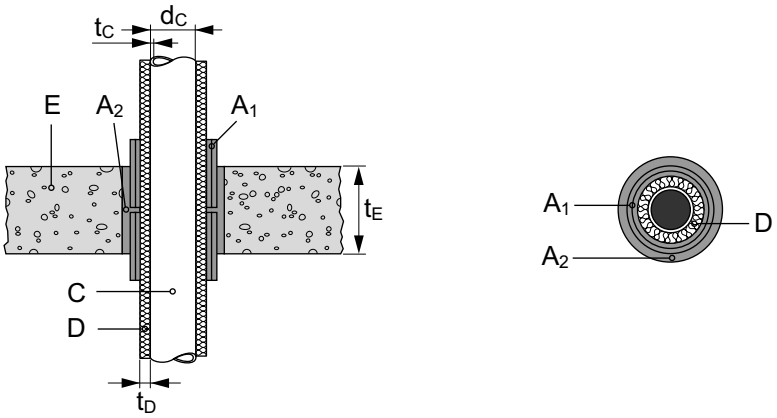
C.4.1 Penetration seal with 2 layers of Hilti Firestop Bandage CFS-B

Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by two layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the floor (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2).

*Pipe insulation may comprise the following materials:

- Armacell International GmbH – Armaflex AF (Production status 2008 or CE marked according to EN 14304)
- Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (Production status 2010 or CE marked according to EN 14304)
- Saint Gobain Isover G+H AG – Isover ML-3 (Production status 2009 or CE marked according to EN 14303)

Construction details:



C.4.1.1 Separation distance of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 28 mm, wall thickness (t_C) between 1 mm and 10 mm; thickness of insulation (t_{D1}) 10 mm	EI 120 - C/U
Diameter (d_C) Ø 54 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 13 - 40 mm	EI 90 - C/U E 120 - C/U
Diameter (d_C) Ø 54 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 40 mm	EI 120 - C/U
Diameter (d_C) Ø 88,9 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 19 - 100 mm	EI 90 - C/U E 120 - C/U
Steel pipes [7] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 100 mm.	
Diameter (d_C) Ø 114,3 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 40 mm	EI 120 - C/U

Diameter (d_C) between Ø 88.9 mm and Ø 159 mm, with minimum wall thickness (t_C) 2 mm and 4 mm respectively, interpolation of minimum thickness between these diameters; maximum wall thickness (t_C) 14,2 mm; thickness of insulation (t_{D1}) 25 - 80 mm	EI 90 - C/U E 120 - C/U
Diameter (d_C) between Ø 54 mm and Ø 159 mm, with minimum wall thickness (t_C) 2 mm and 4 mm respectively, interpolation of minimum thickness between these diameters; maximum wall thickness (t_C) 14,2 mm; thickness of insulation (t_{D1}) 19 mm	EI 60 - C/U E 120 - C/U

C.4.1.2 Zero separation of services

Services	Classification
Copper pipes [6] arranged linear with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 0 mm.	
Diameter (d_C) Ø 28 mm, wall thickness (t_C) between 1 mm and 10 mm; thickness of insulation (t_{D1}) 10 mm	EI 90 - C/U E 120 - C/U

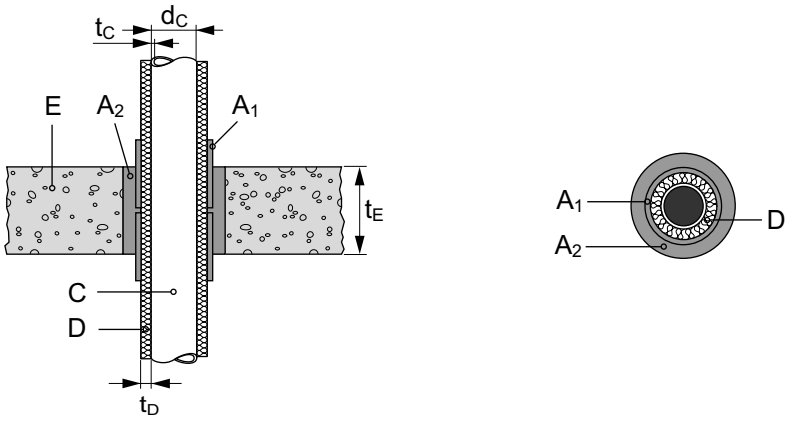
C.4.2 Penetration seal with 1 layer of Hilti Firestop Bandage CFS-B

Penetration Seal: Services (pipe (C), including pipe insulation* (D_1)) covered by one layers of Hilti Firestop Bandage CFS-B (A_1) on both sides. The bandage is positioned with its centre line flush to the wall (E) surface. Annular space filled with gypsum plaster or cementitious mortar (A_2).

*Pipe insulation may comprise the following materials:

- Armacell International GmbH – Armaflex AF (Production status 2008 or CE marked according to EN 14304)
- Kaimann GmbH – Kaiflex KK (2006) or Kaiflex KK Plus (Production status 2010 or CE marked according to EN 14304)
- Saint Gobain Isover G+H AG – Isover ML-3 (Production status 2009 or CE marked according to EN 14303)

Construction details:



C.4.2.1 Separation of services minimum 100 mm

Services	Classification
Copper pipes [6] arranged linear or in a non-linear grouping with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or**	

Isover ML-3; minimum distance 100 mm.	
Diameter (d_C) Ø 28 mm, wall thickness (t_C) between 1 mm and 10 mm; thickness of insulation (t_{D1}) 10 mm	EI 120 - C/U
Diameter (d_C) Ø 42 mm, wall thickness (t_C) between 1 mm and 14,2 mm; thickness of insulation (t_{D1}) 13 mm	EI 120 - C/U
Diameter (d_C) Ø 54 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 13 – 40 mm	EI 90 - C/U E 120 - C/U
Diameter (d_C) Ø 54 mm, wall thickness (t_C) between 2 mm and 14,2 mm; thickness of insulation (t_{D1}) 40 mm	EI 120 - C/U

C.4.2.2 Zero separation of services

Services	Classification
Copper pipes [6] arranged linear with sustained, continued insulation made from **Armaflex AF, Kaiflex KK, Kaiflex KK Plus or Isover ML-3;** minimum distance 0 mm.	
Diameter (d_C) Ø 28 mm, wall thickness (t_C) between 1 mm and 10 mm; thickness of insulation (t_{D1}) 10 mm	EI 90 - C/U E 120 - C/U