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Designated according to Article 29 of Regulation (EU) No 305/2011

Member of www.eota.eu

European Technical Assessment

ETA 10/0212
of 06/05/14

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011:	
Trade name of the construction product	**Hilti Firestop Bandage CFS-B**
Product family to which the construction product belongs	Fire Stopping and Sealing Product Penetration Seals
Manufacturer	**Hilt Corporation** Feldkircherstrasse 100 9494 Schaan Liechtenstein
Manufacturing plant(s)	Werk 5a
This European Technical Assessment contains	44 pages including 4 Annex(es) which form an integral part of this assessment.
	Annex(es) A - D Contain(s) confidential information and is/are not included in the European Technical Assessment when that assessment is publicly available.
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	ETAG 026, edition 2011, used as European Assessment Document (EAD)

General Comments

1. This European Technical Assessment is issued by Warrington Certification Limited on the basis of ETAG 026 Fire Protective Products Part 1: General June 2013, and Part 2: Fire Stopping and Fire Sealing Products Aug 2011, Used as European Assessment Document.

2. This European Technical Assessment 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.

1 SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical Description of the Product

(Detailed information and data are given in Annexes)

1) Hilti Firestop Bandage CFS-B is a graphite based pipe wrap used to reinstate the fire resistance performance of wall or floor constructions where they have been provided with apertures for the penetration of single or multiple services.

2) The Hilti Firestop Bandage CFS-B is supplied in roll form, with binding wire used to wrap around pipes and pipe insulation to form a penetration seal. The bandage is cut to a length which suits the overall diameter of pipe or pipe and insulation and wrapped around the penetration twice.

3) Hilti Firestop Bandage CFS-B is supplied in 125 mm width, 2 mm thick and 10 m length.

4) Hilti Firestop Bandage CFS-B is used in conjunction with Hilti Firestop Acrylic CFS-S ACR to seal annular spaces up to 15 mm. Hilti Firestop Acrylic CFS-S ACR is subject to a separate ETA referenced 10/0292 & 10/0389.

5) Hilti Firestop Bandage CFS-B is used in conjunction with mortar and gypsum to seal annular spaces up to 50 mm. The mortar should be EN998-2 – class M10.

Internal use- ETAG 026-2 (used as European Assessment Document EAD) Type Z_2.

2 Specification Of The Intended Use In Accordance With The Relevant EAD

2.1 Intended Use

The intended use of Hilti Firestop Bandage CFS-B is to reinstate the fire resistance performance of rigid and flexible wall constructions where they are penetrated by various insulated plastic, aluminium composite and metallic pipes.

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

Rigid walls:	The wall must have a minimum thickness 100 mm and comprise concrete, aerated concrete or masonry, with a minimum density of 550 kg/m^3.
Rigid Floors	The floors must have a minimum thickness of 150 mm and comprise concrete, aerated concrete or masonry, with a minimum density of 550 kg/m^3.
Flexible walls	The wall must have a minimum thickness of 100 mm and comprise timber or steel studs lined on both faces with minimum 2 layers of 12.5 mm thick, 'Type F' Gypsum boards according to EN 520. In timber stud walls, no part of the penetration shall be closer than 100 mm to a stud, the cavity must be closed between the penetration seal and the stud and minimum 100 mm of insulation of class A1 or A2 according to EN 13501-1, is provided within the cavity between the penetration seal and the stud.

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 insulated plastic, aluminium composite and metallic pipes

3) There is no minimum separation between adjacent seals

4) Services in walls shall be supported at maximum 450mm from the face of the separating element for walls, and 330mm above the surface of the floor.

5) The provisions made in this European technical approval are based on an assumed working life of the firestop product of 10 years, provided the conditions laid down in clauses 4 and 5 relating to manufacturing, installation, use and repair, are met.
The indications given on the intended working life cannot be interpreted as a guarantee given by the producer or the approval body, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works. The real working life might be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

2.2 Use Category

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

3 Performance Of The Product And References To The Methods Used For Its Assessment

The assessment of fitness for use has been made in accordance with EOTA ETAG 026 Part 2: 2011-08-08 (used as European Assessment Document, EAD)

ETAG Clause No.	**ETA Clause No.**	**Characteristic**	**Assessment of characteristic**
		Mechanical resistance and stability	Not relevant
		Safety in case of fire	**See Clause 2.1**
2.4.1	3.1	Reaction to fire	**Class E according to EN 13501-1**
2.4.2	3.2	Resistance to fire	**See clause 2.2 & Annex C**
		Hygiene, Health and the Environment	
2.4.3	3.3	Air permeability	No performance determined
2.4.4	3.4	Water permeability	No performance determined
2.4.5	3.5	Dangerous substances	**See clause 2.5**
		Safety in use	
2.4.6	3.6	Mechanical resistance and stability	No performance determined
2.4.7	3.7	Resistance to impact/movement	No performance determined
2.4.8	3.8	Adhesion	No performance determined
		Protection against noise	No performance determined
2.4.9	3.9	Airborne sound insulation	No performance determined
		Energy, Economy and Heat Retention	
2.4.10	3.10	Thermal properties	No performance determined
2.4.11	3.11	Water vapour permeability	No performance determined
		General aspects relating to fitness for use	
2.4.12	3.12	Durability and serviceability	**Z_2**

3.1 Reaction to fire

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

3.2 Resistance to fire

System Hilti Firestop Bandage CFS-B has been tested in accordance with EN 1366-3: 2009 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.

The service support construction must be fixed to the building element containing the penetration seal or a suitable adjacent building element, in such a manner that in the case of fire, no additional load is imposed on the seal. Furthermore it is assumed that the unexposed face support is maintained 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.

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 classifications relate to C/U (capped inside the furnace/uncapped outside) for metal pipes and U/C (capped outside/uncapped inside the furnace) for plastic and composite pipes. For further information refer to national regulations.

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

3.3 Air permeability

No performance determined

3.4 Water permeability

No performance determined

3.5 Dangerous substances

The applicant is required to submit a written declaration stating whether or not the fire stopping and fire sealing product contains dangerous substances according to European and national regulations, when and where relevant in the Member States of destination, and shall list these substances.

Hilti Corporation declare that product 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 the Hilti Firestop Bandage CFS-B material safety data sheets (according to 91/155/EEC including amendments) and have been considered for the classification of the products according to the directive1999/45/EG (classification of preparations, including amendments).

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

3.6 Mechanical resistance and stability

No performance determined.

3.7 Resistance to impact/movement

No performance determined.

3.8 Adhesion

Not relevant.

3.9 Airborne sound insulation

No performance determined

3.10 Thermal Properties

No performance determined.

3.11 Water vapour permeability

No performance determined.

3.12 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 ETAG 026-2 (used as European Assessment Document, EAD), and the results of the tests have demonstrated suitability for penetration seals intended for use in internal conditions with humidity lower than 85% RH excluding temperatures below 0^{o}C, without exposure to rain or UV.

4 Assessment And Verification Of Constancy Of Performance (Hereinafter AVCP) System Applied, With References To Its Legal base

According to the decision 1999/454/EC of the European Commission the system of assessment and verification of constancy of performance (see Annex V to the Regulation (EU) No 305/2011) given in the following table apply:

Products	Intended uses	Level or Class	System
Fire stopping and fire sealing products	For fire compartmentation and / or fire protection or fire performance	Any	System 1

5. Technical Details Necessary For The Implementation Of The AVCP System, As Provided For In The Applicable EAD.

Tasks for the Manufacturer

Factory production control

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

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

The factory production control shall be in accordance with the Control Plan of 17/3/10 relating to the European technical assessment ETA 10/0212 which is part of the technical documentation of this European technical assessment. 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.

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.

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 17/3/10 relating to the European Technical Assessment 10/0212.

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 assessment.

In cases where the provisions of the European technical assessment 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.

Signatories

Responsible Officer

C. Abbott* - Principal Certification Engineer

Approved

A. Kearns* - Technical Manager

* For and on behalf of Warrington Certification Limited.

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
EN 1366-3	Fire resistance tests for service installations - Part 3: Penetration seals

Other reference documents:

EOTA TR 024	Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products
ETAG No. 026: Part 2	Guideline For European Technical Approval of Fire Stopping and Fire Sealing Products, Part 3: Penetration Seals(used as European Assessment Document, EAD)

Annex B

Description of Product and Product Literature

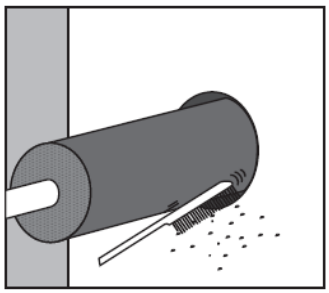
Hilti Firestop Bandage CFS-B

A detailed specification of the product is contained in document "Evaluation Report" relating to the European Technical Approval ETA – 10/0212 issued on 07/04/14, of Hilti Firestop Bandage CFS-B which is a non-public part of this ETA.

1 Installation

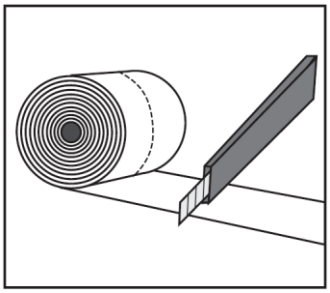
Installation of system Firestop Bandage CFS-B shall be conducted as follows:

1



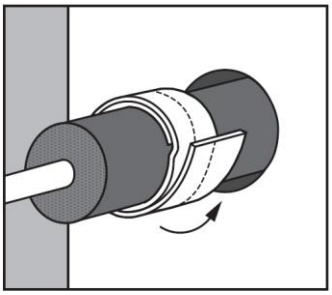
Clean opening.

2



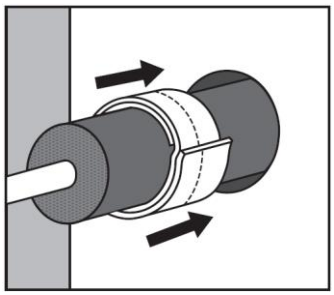
Cut Hilti Firestop Bandage CFS-B to fit the outside diameter of the insulation. Consider the number of 2 layers.

3



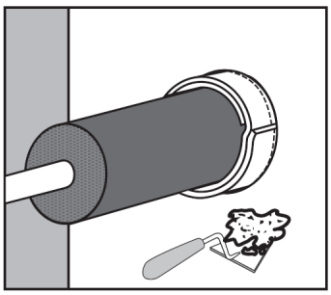
Wrap Hilti Firestop Bandage CFS-B around the insulation. Secure the bandage with steel bands or wire (≥ 0.7mm)

4



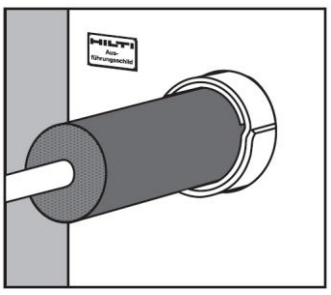
Install Hilti Firestop Bandage CFS-B on both sides within the opening in a depth of 62.5 mm.

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.

2 Indications to the manufacturer

2.1 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

2.2 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 C

RESISTANCE TO FIRE CLASSIFICATION OF PENETRATION SEALS MADE OF HILTI FIRESTOP BANDAGE CFS-B

Intended use of pipes and reference to relevant section.

Typical Application	Pipe Material	Pipe standard	Flexible and rigid wall ≥ 100 mm	Rigid wall ≥ 200 mm	Floor ≥ 150mm
Heating	Copper		see 2.1.2	see 2.2.2	see 2.3.2
	Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4
	PE-Xa	EN ISO 15875	see 2.1.5	-	see 2.3.5
Potable Water	Stainless Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4
	PE-Xa	EN ISO 15875	see 2.1.5	-	see 2.3.5
Cooling	Copper		see 2.1.2	see 2.2.2	see 2.3.2
	Steel / Stainless Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4
	PE-HD	EN 12201-2	see 2.1.5		see 2.3.5
Various	Copper		see 2.1.2	see 2.2.2	see 2.3.2
	Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4

1 General Information Hilti Firestop Bandage CFS-B

1.1 Penetration seal and bandage installation

Pipes insulated with elastomeric combustible insulation (see Annex D) fire-stopped by wrapping the Hilti Firestop Bandage CFS-B twice around the insulation material.

Steel wire is utilised to hold the Hilti Firestop Bandage CFS-B together, positioned approximately in the first quarter measured from the flank.

The Hilti Firestop Bandage CFS-B is mounted on both side of the penetration.

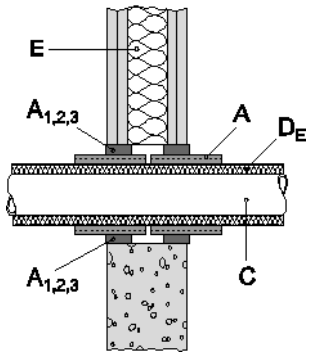
The Hilti Firestop Bandage CFS-B is then pushed into the penetration in line with the designated marking shown on midsize of the Hilti Firestop Bandage CFS-B or at 100 mm thick walls the Hilti Firestop Bandage CFS-B was placed with a distance of approximately 5 mm from each other.

1.1.1 Single penetration seal

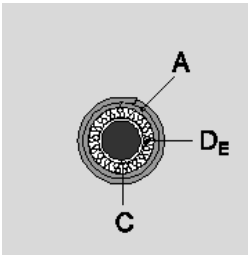
Single insulated pipes running through the penetration are sealed utilising two layers of Hilti Firestop Bandage CFS-B.

Installation scheme of bandage
a) side view b) front view

a)



b)



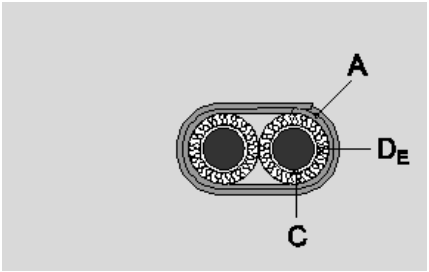
1.1.2 Bundled penetration

Small aluminium composite pipes (≤Ø 16mm) can be wrapped together in a double penetration with the Hilti Firestop Bandage CFS-B.

Hilti Firestop Bandage CFS-B is wrapped over both insulated pipes. Fixing and positioning of the bandage is installed as described above.

Installation and Hilti Firestop Bandage CFS-B is as described above

Installation sceme of bandage
Front view of two pipes wrapped together with bandage



1.2 Pipe insulation with combustible and mineral wool insulation

Specific insulation thickness with corresponding classification class is shown at each section below.

1.2.1 Elastomeric combustible insulation

Pipes are insulated with elastomeric combustible insulation material of varying thickness'.

Elastomeric material ranges from 7,7 mm up to 45 mm in configuration (CS) Continued Sustained.

Results were displayed considering E.2.7.5.2 and E.2.7.8.2 allowing interpolation of wall thickness and diameter between tested specimens and insulation thickness, respectively.

Metallic pipes from diameter 323.9mm on were insulated by a fixed thickness of 25mm elastomeric combustible insulation.

Metallic pipes were tested in C/U configuration, plastic and aluminum composite pipes in U/C configuration

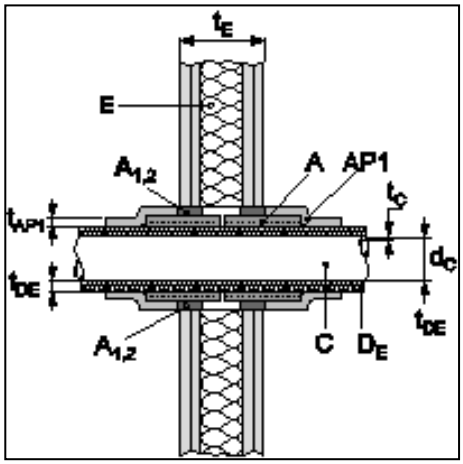
1.2.2 Mineral wool insulation

For mineral wool insulation Rockwool conlit shells /Rockwool 800 or Rockwool KlimaRock / Rockwool RS 800 (40mm, approx. 40kg/m³; (LI) Local Interrupted was utilised.

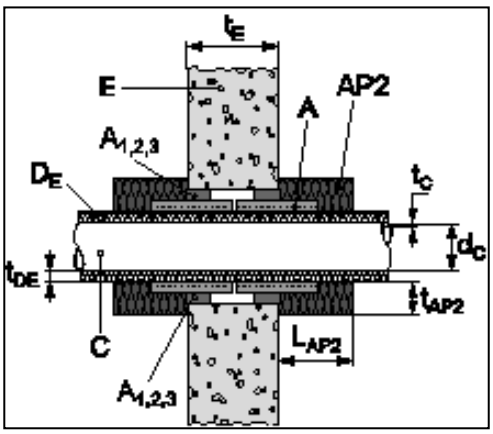
1.3 Additional Protection

Additional insulation material (AP) is utilised for some applications and comprises of the following:

AP1: Armaflex AF elastomeric material for thermal insulation, 19 mm thick and 250 mm in length (LI) Local Interrupted

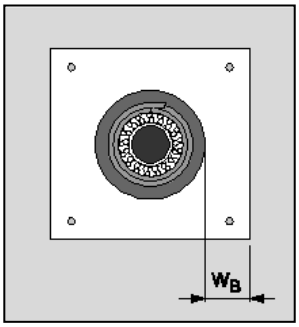


AP2: Mineral wool, Rockwool Klimarock, 40mm thick, 250 mm in length; density approximately40kg/m³ (LI) Local Interrupted



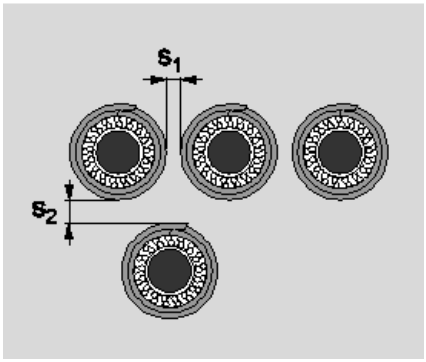
AP3: Beading / Outside Framing

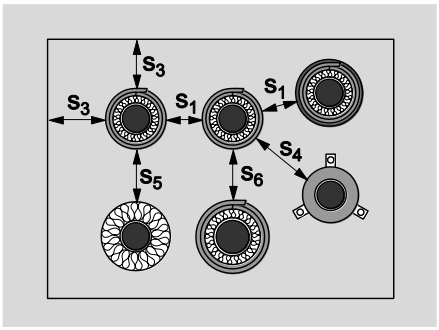
Beading for flexible wall (100 mm) is applied by adding boards on both sides in two layers (2x12,5 mm Type F board) fixed with drywall screws. The resulting strips around the pipe whole are at least 50 mm in width. Final penetration seal thickness is 150 mm.



1.4 Clearance to insulated pipes and other fire-stopped services

Clearance of services to each other – references see below 1.4.1 to 1.4.5
These clearance are valid for flexible, rigid wall and floor.





1.4.1 Clearance to pipes firestopped by bandage in linear configuraton - S_1

Clearance is ≥ 0 mm to each other for insulated pipes wrapped by bandage CFS-B and in some cases to additional protection according classification.

1.4.2 Clearance to pipes firestopped by bandage in cluster configuraton – S_2

Clearance is ≥ 0 mm to each other for insulated pipes wrapped by bandage CFS-B and in some cases to additional protection according classification.

1.4.3 Distances to seal edge - S_3

In round openings distance to seal edge are up to 50mm. In case where no gap is left between construction and bandage, smoke tightness has been secured.

1.4.4 Clearance to Hilti Firestop Collar CFS-C EL - S_4

Clearance to Hilti Firestop Collar is shown to be zero. Please refer for detailed results the corresponding ETA 14/0085.

1.4.5 Clearance to Conlit shell and Klimarock - S_5

Insulated pipes fire-stopped with Hilti Firestop Bandage CFS-B are tested to have a clearance to bandage or respectively to additional protection of zero.

1.4.6 Distance to PE-HD / PE-Xa pipes- S_6

Minimum distance to plastic pipes (PE-HD / PE-Xa) is in Wall ≥65 mm, in floor ≥0 mm.

1.5 Annular Gap

In flexible and rigid wall Hilti Acrylic Firestop CFS-S ACR and gypsum is used to fill annular space. Mortar and gypsum is used in rigid walls and floors.
Hilti Acrylic Firestop CFS-S ACR is used for gaps of 0 mm -15 mm

Mortar and gypsum is used in rigid walls and floors, annular space is allowed from approximately 3 up to 50 mm.

1.6 Pipe Support

Pipes are supported in wall application at a distance of 450 mm.
In floors first support was in 330 mm distance installed from surface.

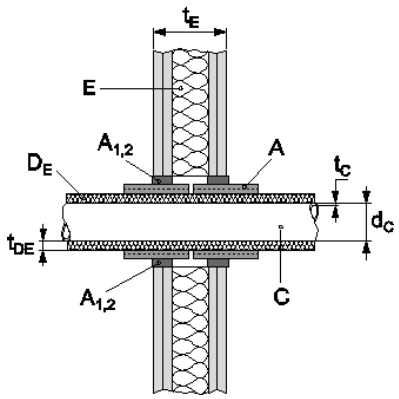
2 Testing of fire resistance in different constructions

2.1 Flexible wall (≥100 mm)

2.1.1 Installation variations of insulated pipes protected by Hilti Firestop Bandage CFS-B

Installation examples:
a) Standard installation
b) Installation with additional protection AP1
c) Installation with additional protection beading/outside framing (AP3)

a)



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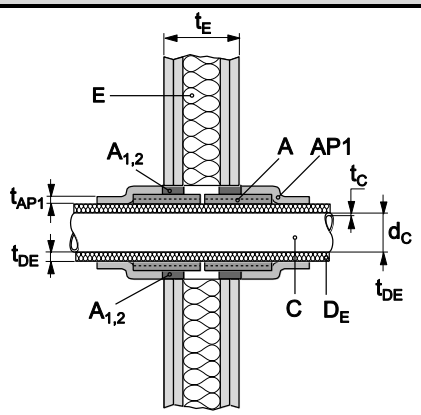
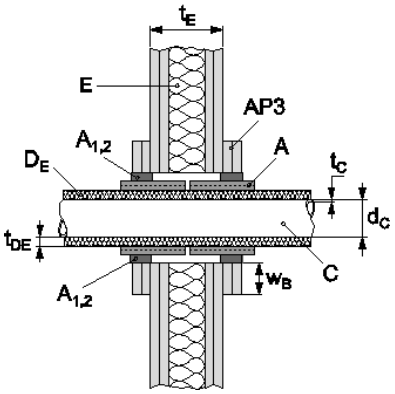


c)

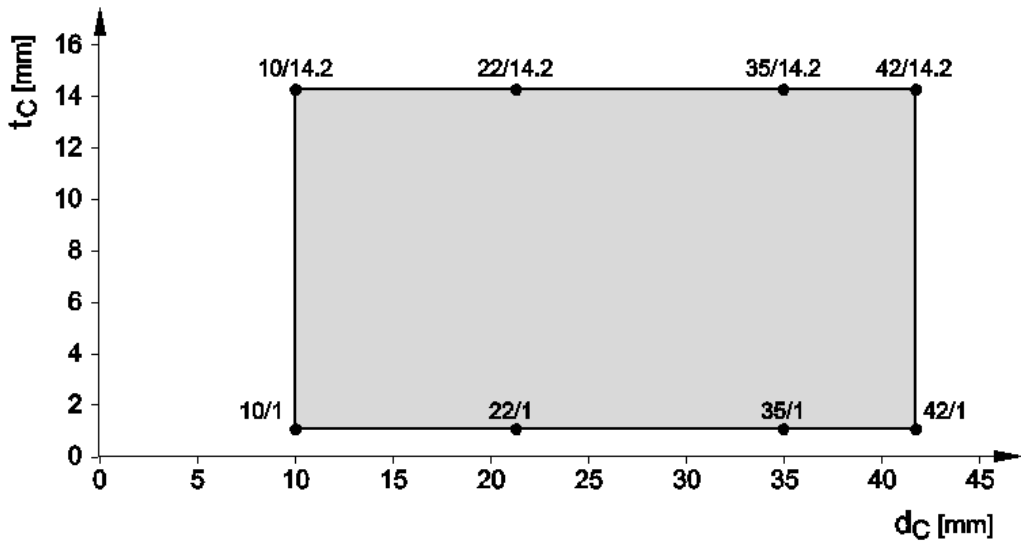


2.1.2 Copper pipes

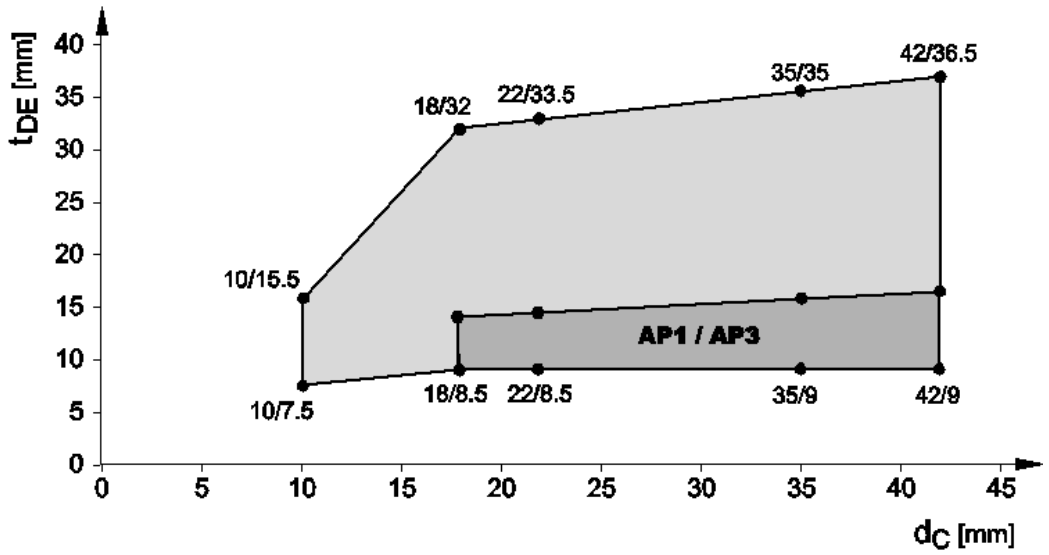
Copper pipes are insulated with elastomeric combustible insulation ranging in thickness [mm] from 7,5mm till up to 36,5mm.

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification		
			from		to			addition. protection	
			Ø small	Ø big	Ø small	Ø big	-	AP 1	AP 3
Copper	10 to 18	1 - 14,2	7,5	8,0	15,4	32,0	EI 90	-	-
Copper	18 to 42	1 - 14,2	8,0	9,0	33,5	36,5	EI 60	EI 90	-
Copper	18 to 42	1 - 14,2	14,5	16,5	33,5	36,5	EI 90		-
Copper	18 to 42	1 - 14,2	8,0	9,0	33,5	36,5			EI 90
Copper	10 to 35	1 - 14,2	7,5	9,0	15,4	35,0			EI 120

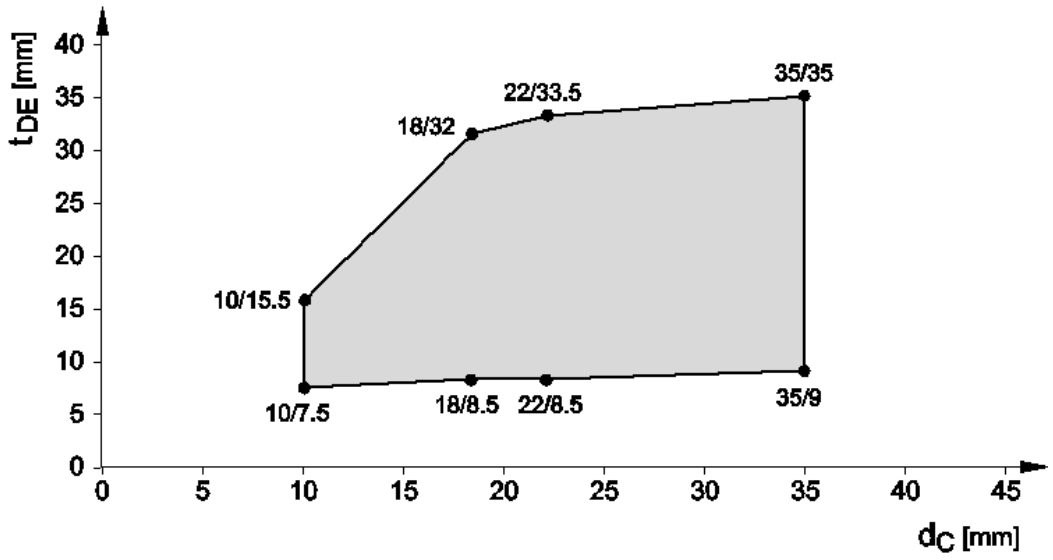
Copper pipe – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (II) towards pipe diameter (Ø dC)



Copper pipes, C/U, flexible wall ≥100 mm – EI 90
Thin insulation thickness aquires at higher pipe diameter additional protection (AP1 or AP3; dark area)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø dC)



Copper pipes, C/U, flexible wall ≥100 mm – EI 120
Additional protection AP3 – penetration seal thickness 150 mm
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø dC)

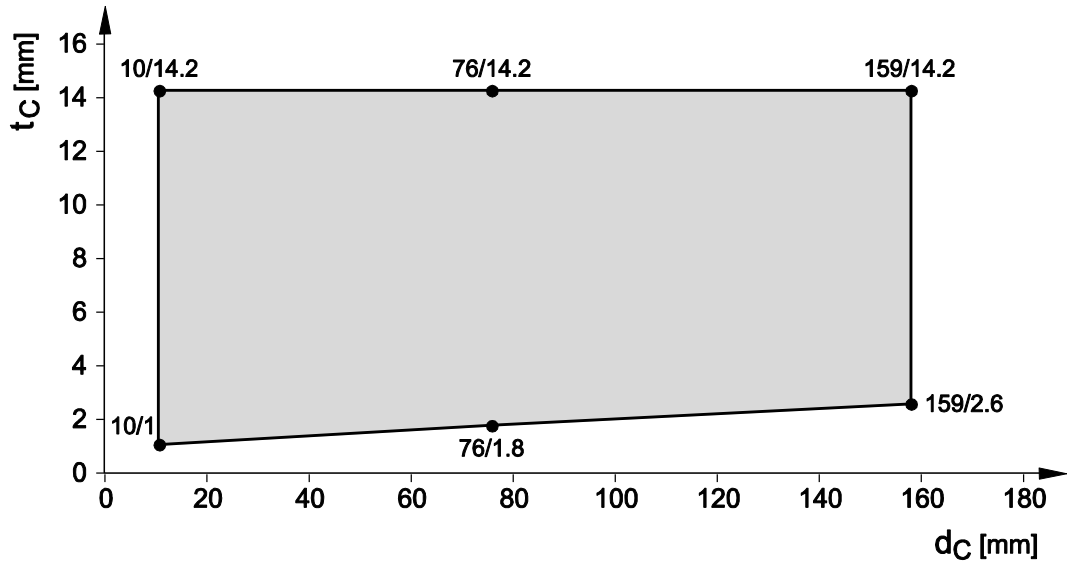


2.1.3 Steel Pipes

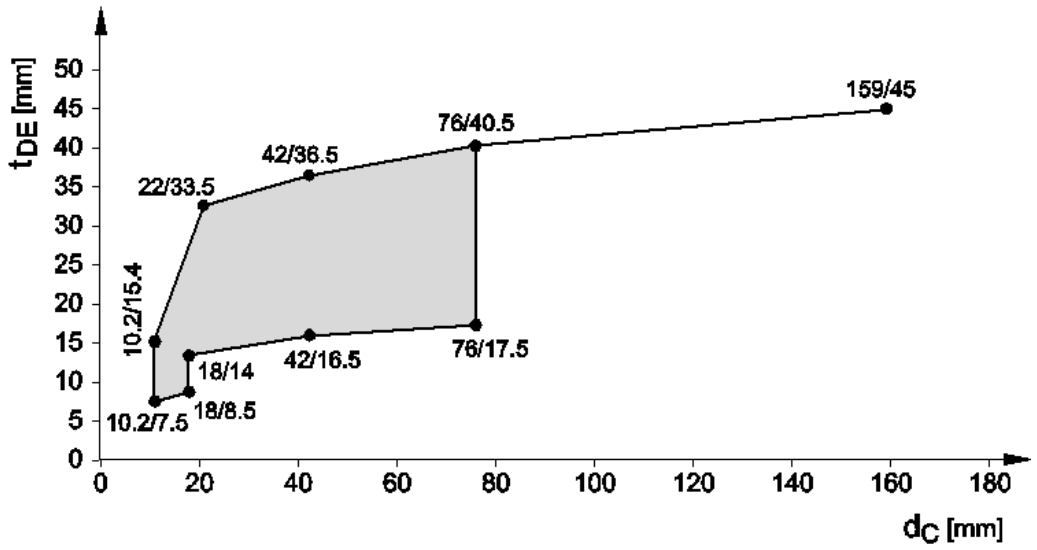
Applying Annex E1.3.2 of DIN EN 1366-3:2009 the field of application given above for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steel, low alloyed steel, cast iron, stainless steel, Ni alloys (NiCu, NiCr, NiMo alloys) and Ni.

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification		
			from		to			addition. protection	
			Ø small	Ø big	Ø small	Ø big	-	AP 1	AP 3
Steel	10,2 to 18	1 - 14,2	7,5	8,5	15,4	33,5	EI 90		
Steel	18 to 42	1 - 14,2	8,5	9,0	32,0	36,5	EI 60	EI 90	
Steel	18 to 42	1 - 14,2	14,0	16,5	32,0	36,5	EI 90		
Steel	42,4 to 76	1,4 - 14,2	16,5	17,5	36,5	40,5	EI 90		
Steel	10,2 to 76	1 - 14,2	7,5	9,5	15,4	40,5		EI 90	
Steel	76 to 159	1,8 - 14,2	40,5	45	40,5	45	EI 90		
Steel	10,2 - 60	1 - 14,2	7,5	9,0	15,4	39			EI 120

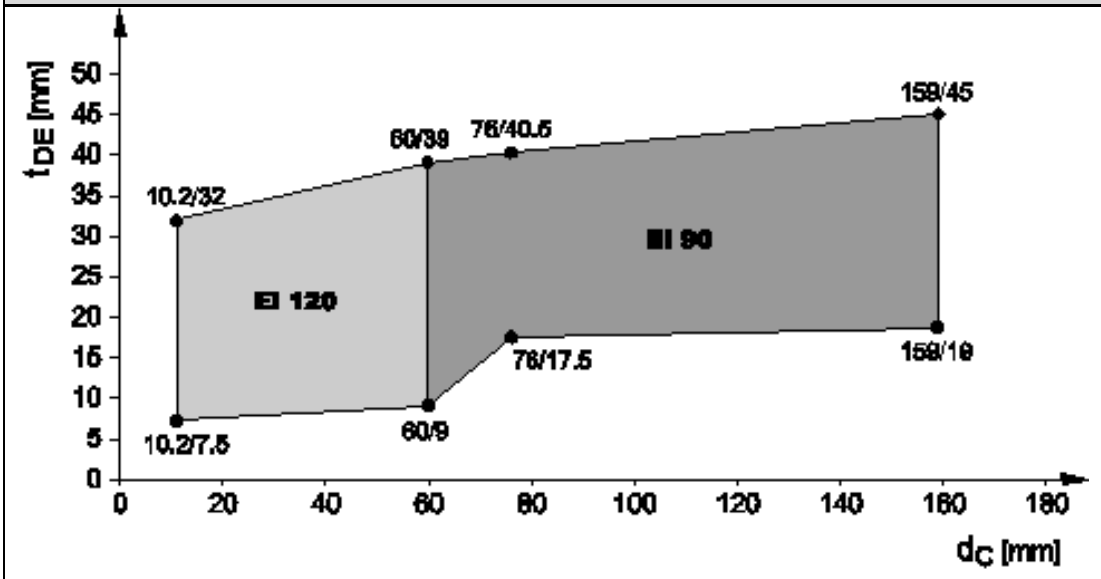
Steel pipe, flexible wall ≥100 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø dC)



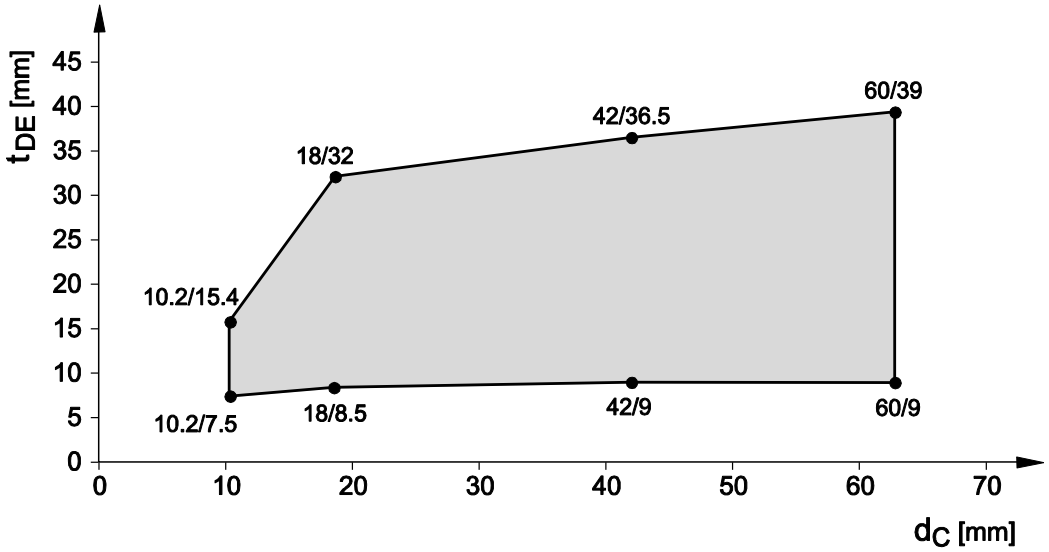
Steel pipes, C/U, flexible wall ≥100 mm – EI 90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø dC)



Steel pipes, C/U, flexible wall ≥100 mm – EI 60 or EI 90 + AP1
Additional protection AP1 is required to reach EI 90
From pipe Ø 76 to Ø 159 mm classification is EI 120 at high insulation thickness (40.5/45 mm; see dotted line in graph below)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



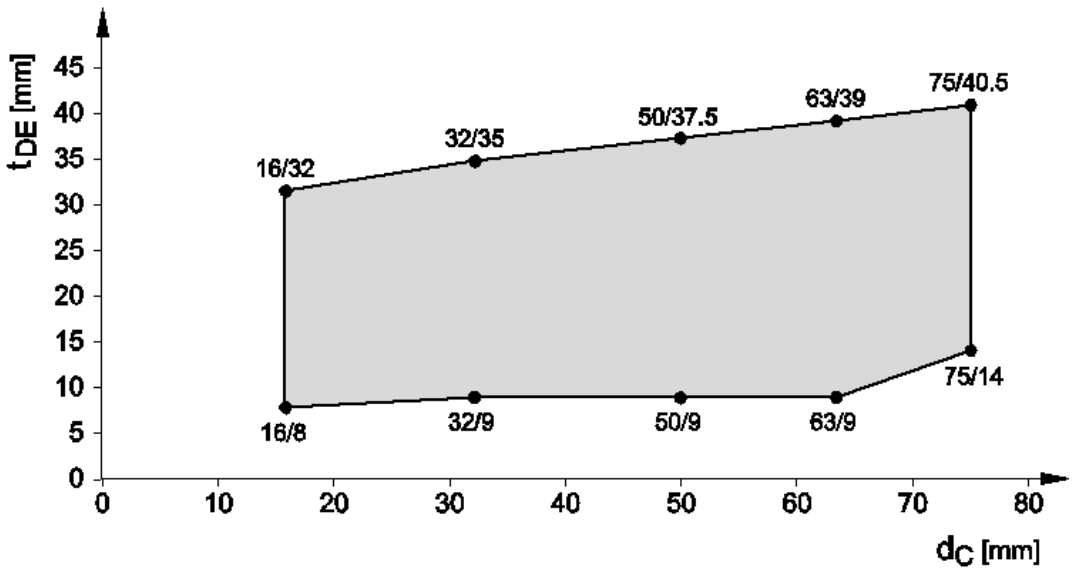
Steel pipes, C/U, flexible wall ≥100 mm – EI 120 with beading (AP3)
Additional protection AP3, thickness of penetration seal 150 mm
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



2.1.4 Aluminium Composite Pipes

Manu-facturer	Product name	Pipe diameter dc (mm)	Insulation thickness (mm)				Classification	
			from		to			Additional Protection
			Ø small	Ø big	Ø small	Ø big		AP3
Fränkische Rohrwerke	Alpex F50 Profi	16 to 32	8,0	9,0	32,0	35,0	EI 90	
		32 to 40	9,0	9,0	35,0	36,5	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		50 to 75	9,0	9,0	37,5	40,5	EI 60	
		50 to 75	37,5	40,5	37,5	40,5	EI 120	
Geberit	Mepla	16 to 32	8,0	9,0	32,0	35,0	EI 90	
		32 to 40	9,0	9,0	35,0	36,5	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		50 to 75	9,0	9,0	37,5	40,5	EI 60	
		50 to 75	37,5	40,5	37,5	40,5	EI 120	
Georg Fischer	Sanipex	16 to 32	8,0	9,0	32,0	35,0	EI 90	
		32 to 40	9,0	9,0	35,0	36,5	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		50 to 63	9,0	9,0	37,5	39	EI 60	
		40 to 63	9,0	9,0	36,5	39	EI 120	
IVT	PRINETO Stabilrohr	17 to 52	8,0	9,0	32,0	37,5	EI 90	
		52 to 63	9,0	9,0	37,5	39	EI 60	
		17 to 63	32	39	32	39	EI 120	
KeKelit	KELOX KM 110	16 to 75	8,0	14,0	32,0	40,5	EI 90	
		16 to 73	32	40,5	32	40,5	EI 120	
Rehau	Rautitan stabil	16 to 40	8,0	9,0	32,0	38,5	EI 90	
		16 to 40	32,0	38,5	32,0	38,5	EI 120	
TECE	TECEflex Verbundrohr	16 to 50	8,0	9,0	32,0	37,5	EI 90	
		63	9,0	9,0	29	29	EI 60	
		16 to 63	32	40,5	32	40,5	EI 120	
Uponor	Unipipe MLC	16 to 32	8,0	9,0	32,0	35,0	EI 120	
Viega	SANIFIX Fosta-Rohr	16 to 32	8,0	9,0	32,0	35,0	EI 120	
		32 to 63	9,0	9,0	36,5	39	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		16 to 63	32	39	32	39	EI 120	

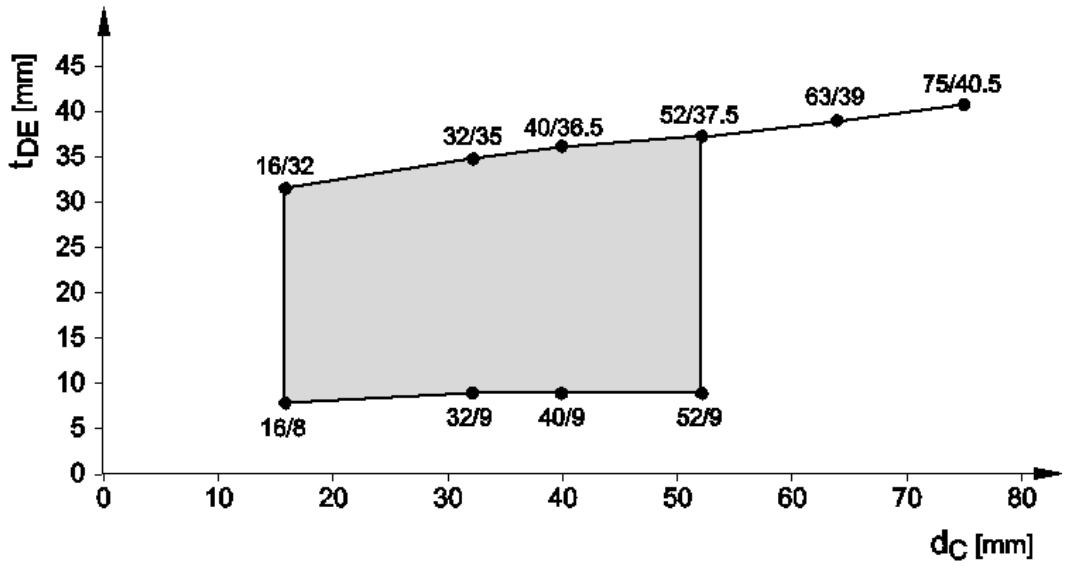
Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 60
All specimens listed
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



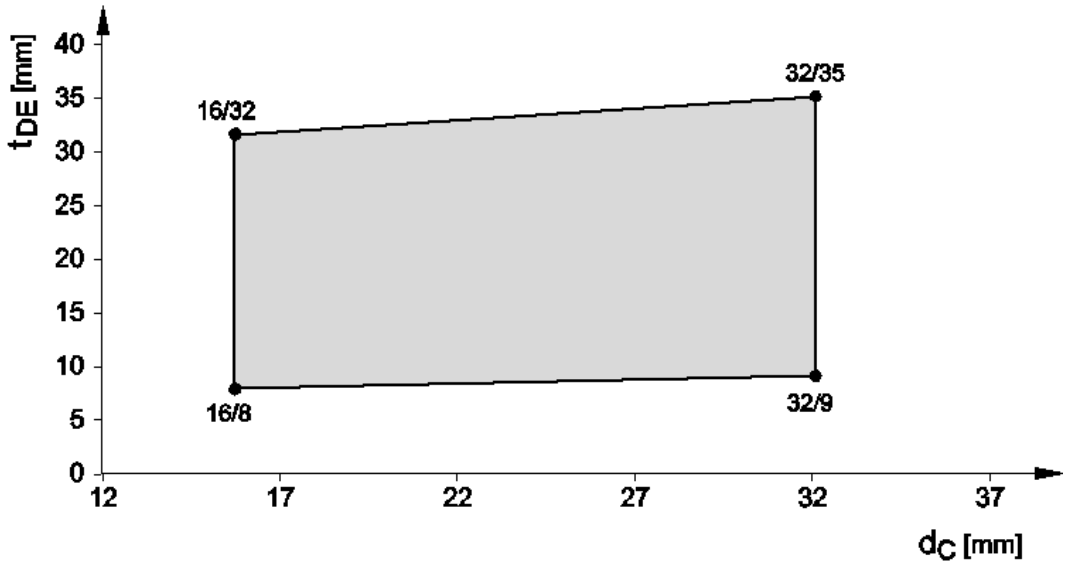
list_1 of composite pipes – Brand (Type):
Kekelit (Kelox), IVT (Prineto Stabil Rohr), Rehau (Rautitan stabil), TECEflex (Verbundrohr)

list_2 of composite pipes - Brand (Type):
Fränkische Rohrwerke (Alpex System), Geberit (Mepla), Georg Fischer (Sanipex) Viega (Sanifix Fosta), Uponor (Unipipe MLC – pipe Ø range from 16 to 32 mm, only)

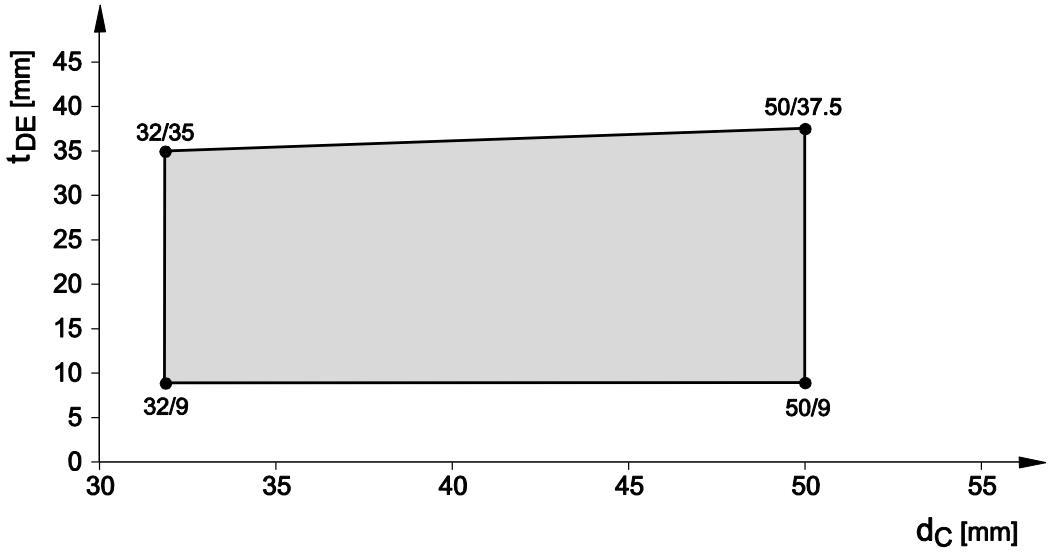
Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 90
All specimens list_1
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 90
All specimens list_2
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



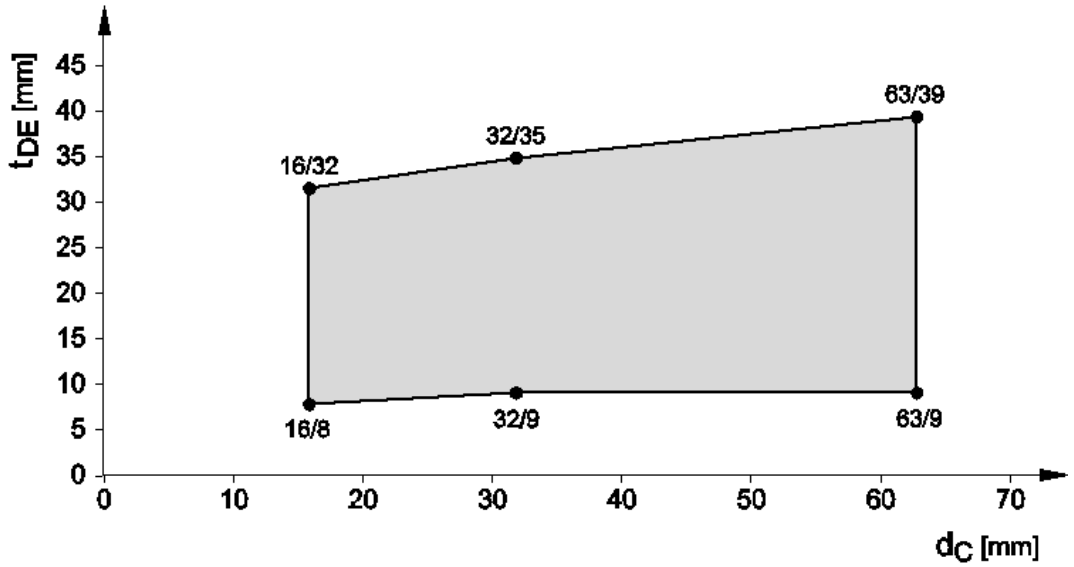
Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 120 with beading
All specimens list_2 but without Uponor
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



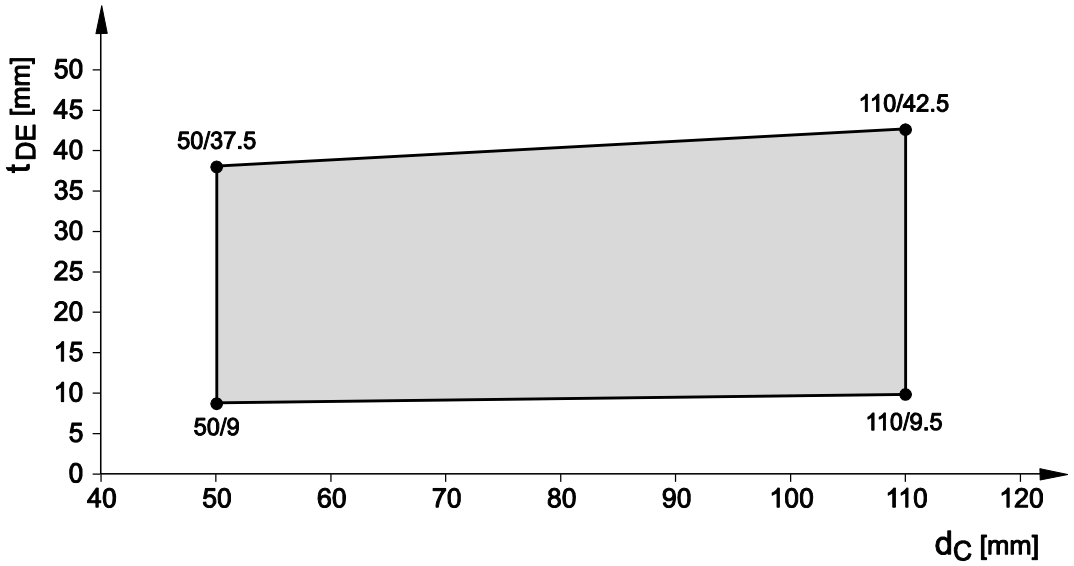
2.1.5 Plastic pipes made of PE-Xa (EN ISO 15875) and PE HD (EN 12201-2)

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	-
PE-Xa	16 to 63	2,2 to 8,6	8	9,0	32	39	EI 120
PE HD 100	50 to 110	4,6 to 10	9	9,5	37,5	42,5	EI 120

Plastic pipes PE-X according EN ISO 15875, U/C, flexible wall ≥ 100 mm - EI 120
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Plastic pipes PE-HD according EN 12201-2, U/C, flexible wall ≥ 100 mm - EI 120
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



120

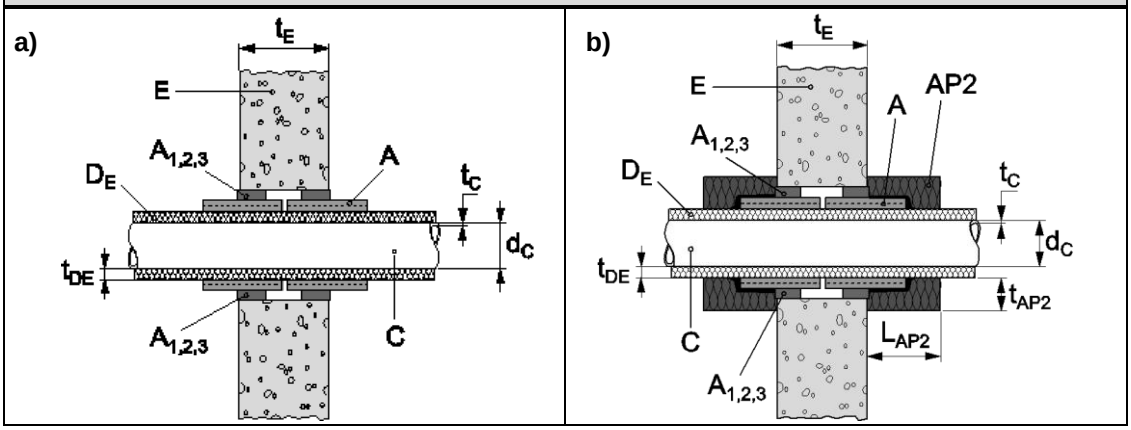
2.2 Rigid Wall

2.2.1 Set-up of rigid wall (200 mm)

The wall must have a minimum thickness of 200 mm and comprise of concrete, aerated concrete or masonry, with a minimum density of 550 kg/m^3

Installation variants of insulated pipes protected by Hilti Firestop Bandage CFS-B

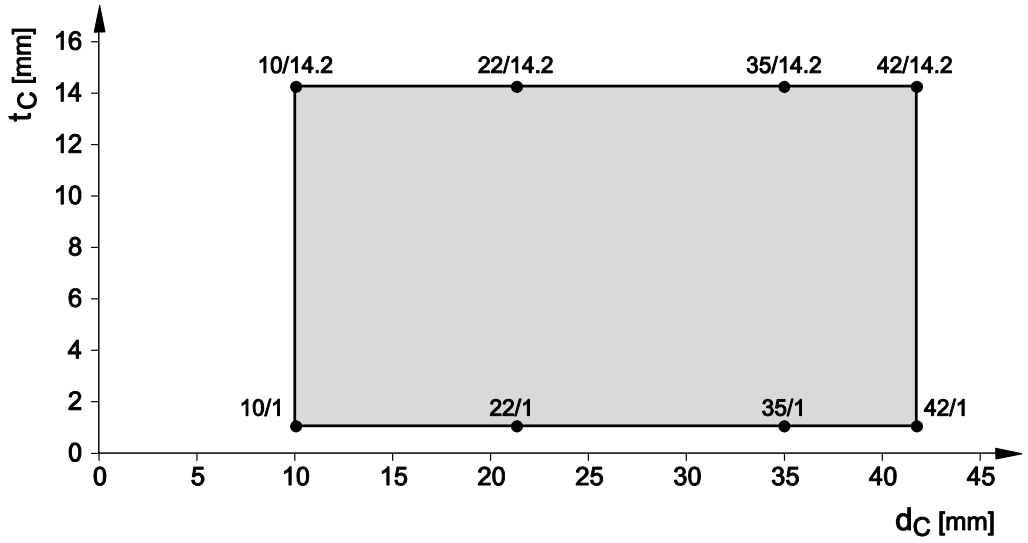
Installation examples:
a) Standard installation
b) Installation with additional protection AP2



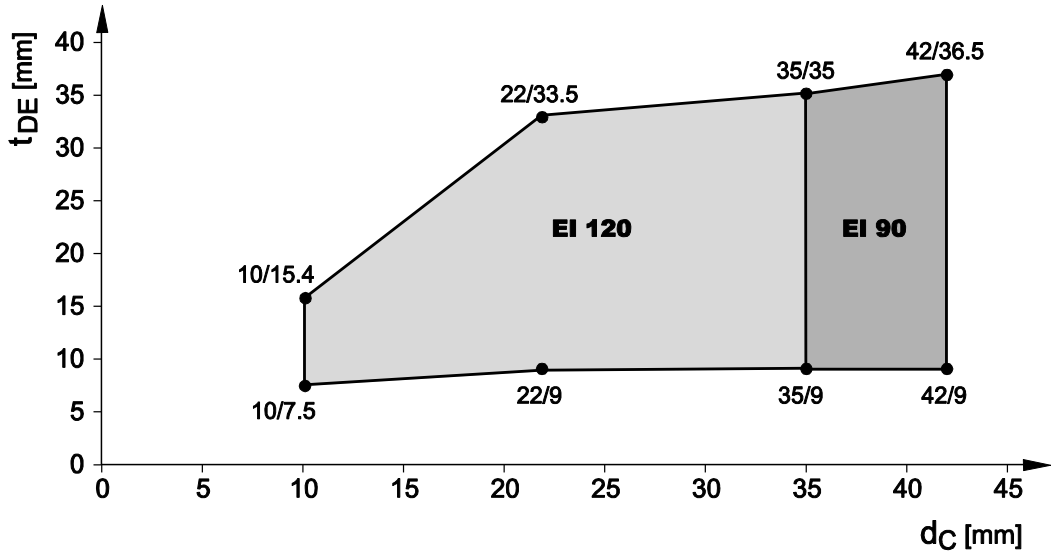
2.2.2 Copper Pipes

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	-
Copper	10 to 42	1 - 14,2	7,5	9,0	15,4	36,5	EI 90
Copper	10 to 35	1 - 14,2	7,5	9,0	15,4	35,0	EI 120

Copper pipe, rigid wall ≥200 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_C)



Copper pipes, C/U, rigid wall ≥200 mm – EI 120 / EI 90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



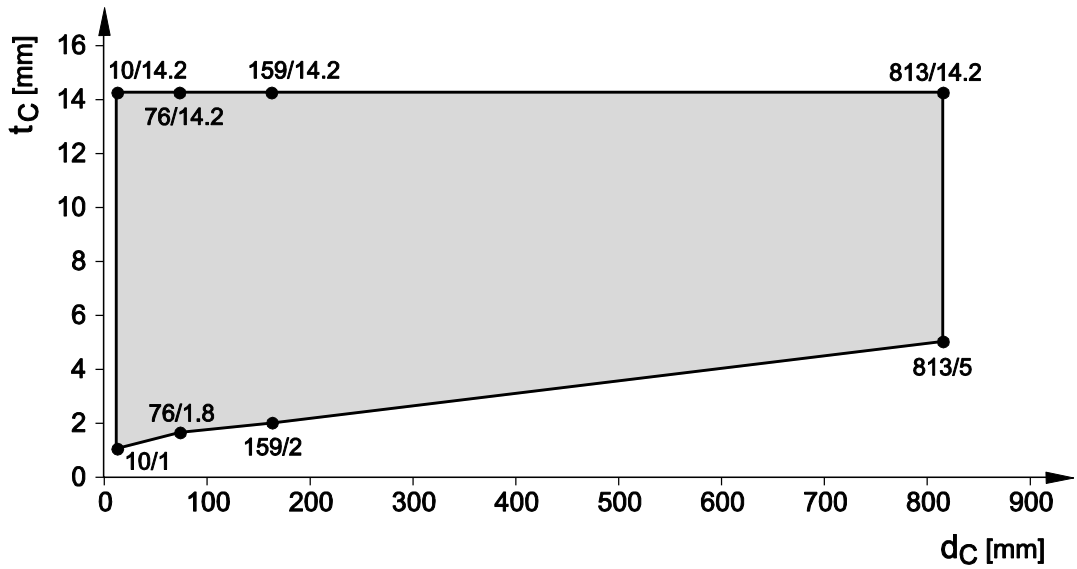
2.2.3 Steel Pipes

Applying Annex E1.3.2 of DIN EN 1366-3:2009 the field of application given in 2.2.2 for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steel, low alloyed steel, cast iron, stainless steel, Ni alloys (NiCu, NiCr, NiMo alloys) and Ni.

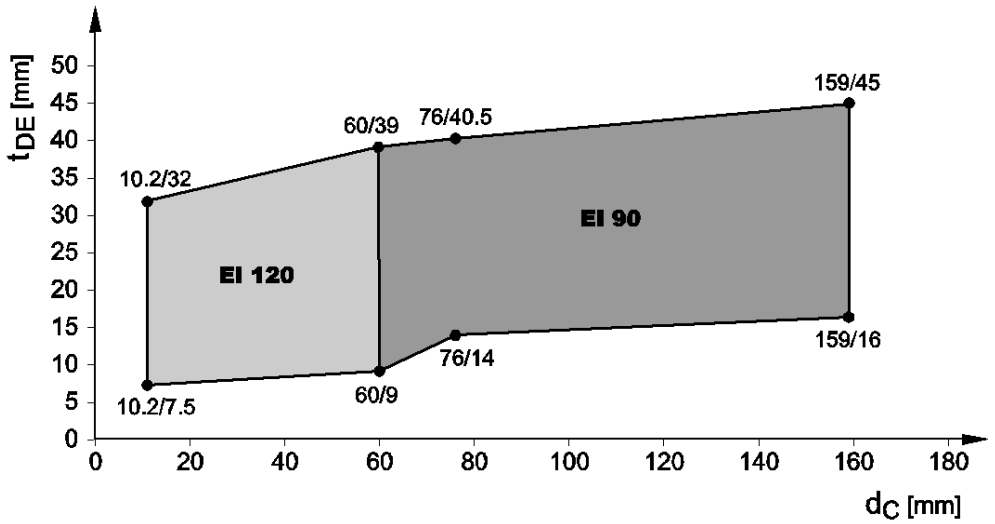
Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification	
			from		to			
			Ø small	Ø big	Ø small	Ø big	-	AP 2
Steel	10,2 to 60	1 to 14,2	7,5	9	32,0	39	EI120	
Steel	76 to 159	1,8 to 14,2	17,5	19	40,5	45	EI 90	
Steel	159	2 to 14,2	45	45	45	45	EI 120	
Steel	159 to 813	2 to 14,2	16	25	45	25		EI 120

AP 2 insulation was applied in a length of 500 mm for pipe Ø813. Therefore this is valid for pipe range from Ø159 to Ø813 mm.

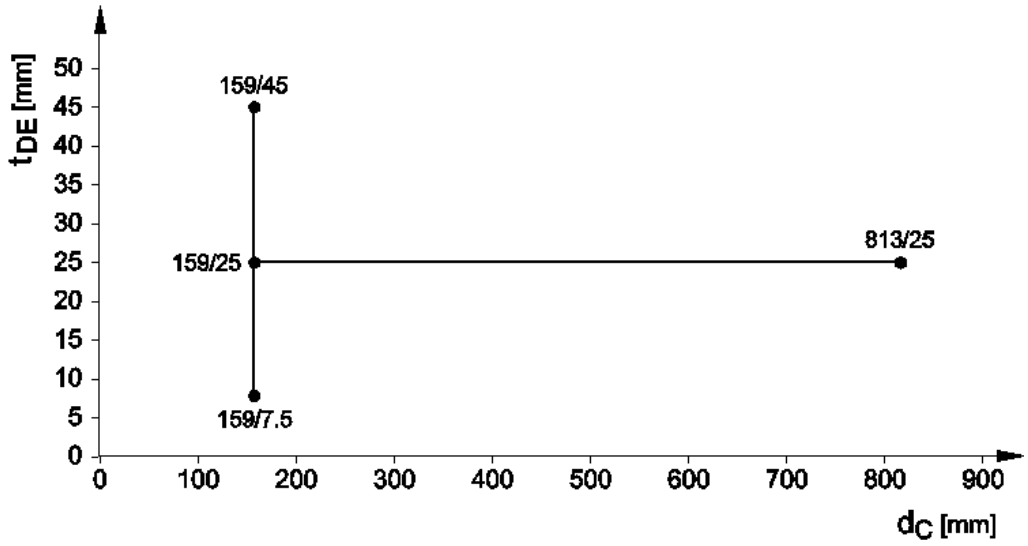
Steel pipe, rigid wall ≥200 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_C)



Steel pipes, C/U, rigid wall ≥200 mm – EI 120 /90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Steel pipes, C/U, rigid wall ≥200 mm – EI 120
Insulated large pipes from Ø 159 up to 813 mm
Elastomeric insulation plus additional protection mineralwool (AP2, Klimarock 40mm)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)

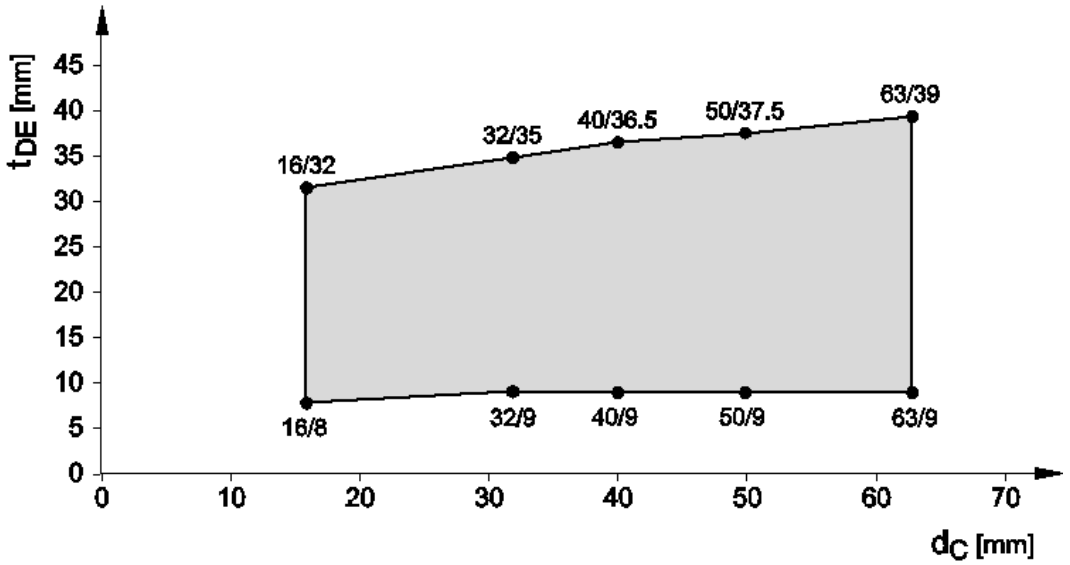


2.2.4 Aluminium Composite Pipes

Manu-facturer	Product name	Pipe diameter dc (mm)	Insulation thickness (mm)				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	
Fränkische Rohrwerke	Alpex F50 Profi	16 to 63	8,0	9,0	32,0	39,0	EI 120
Geberit	Mepla	16 to 63	8,0	9,0	32,0	39,0	EI 120
Georg Fischer	Sanipex	16 to 63	8,0	9,0	32,0	39,0	EI 120
IVT	PRINETO Stabilrohr	16 to 63	8,0	9,0	32,0	39,0	EI 120
KeKelit	KELOX KM 110	16 to 63	8,0	9,0	32,0	39,0	EI 120
Rehau	Rautitan stabil	16 to 63	8,0	9,0	32,0	39,0	EI 120
TECE	TECEflex Verbundrohr	16 to 63	8,0	9,0	32,0	39,0	EI 120
Viega	SANIFIX Fosta-Rohr	16 to 63	8,0	9,0	32,0	39,0	EI 120

Result is valid for composite pipes list_1 and List_2 with exception Uponor (see 2.4; note[2,3])

Aluminium Composite Pipes, U/C, rigid wall ≥ 200 mm - EI 90
All specimens list_1 and list_2 (not proven for Uponor)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



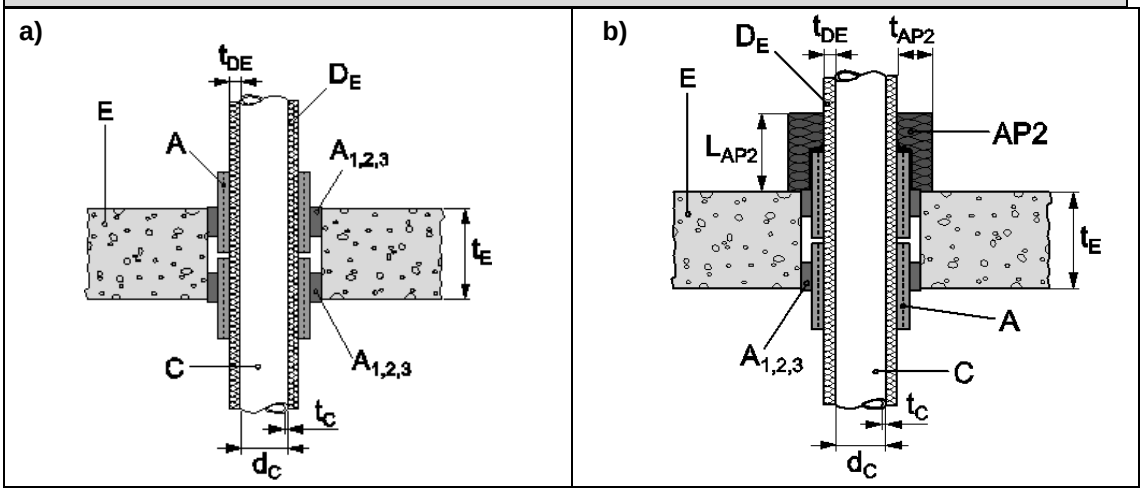
2.3 Floor

2.3.1 Set-up of floor

The supporting construction is build according EN 1355-3:2009 of at least lightweight concrete slabs of a thickness of 150 mm and a density of 550 kg/m³.

Installation variants of insulated pipes protected by Hilti Firestop Bandage CFS-B

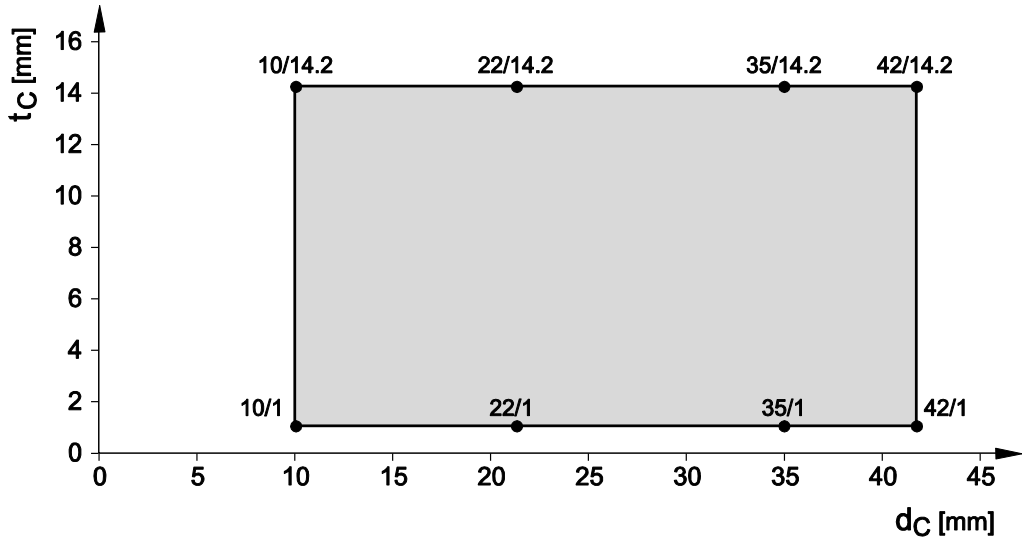
Installation examples:
a) Standard installation
b) Installation with additional protection AP2



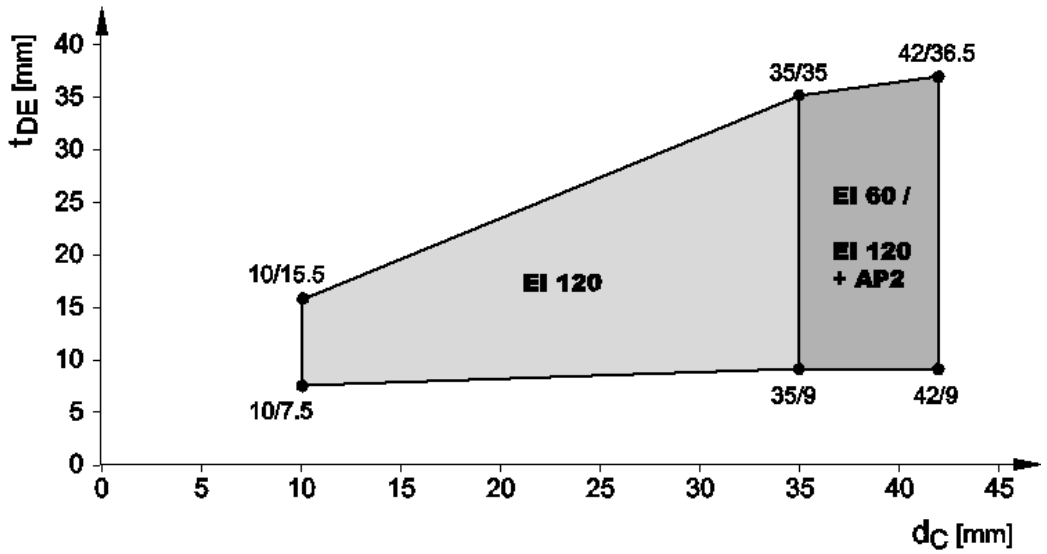
2.3.2 Copper Pipes

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification		
			from		to				
			Ø small	Ø big	Ø small	Ø big	-	AP 1	AP 2
Copper	10 to 35	1 - 14,2	7,5	9,0	15,5	35,0	EI 120	-	-
Copper	35 to 42	1 - 14,2	9,0	9,0	35,0	36,5	EI 60		EI 120

Copper pipe, rigid wall ≥200 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_C)



Copper pipes, C/U, floor ≥150 mm – EI 120 / EI 60 / EI 120 plus AP2
Additional protection AP2 (mineral wool) is required from Ø 35 to 42 mm to reach
EI 120
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)

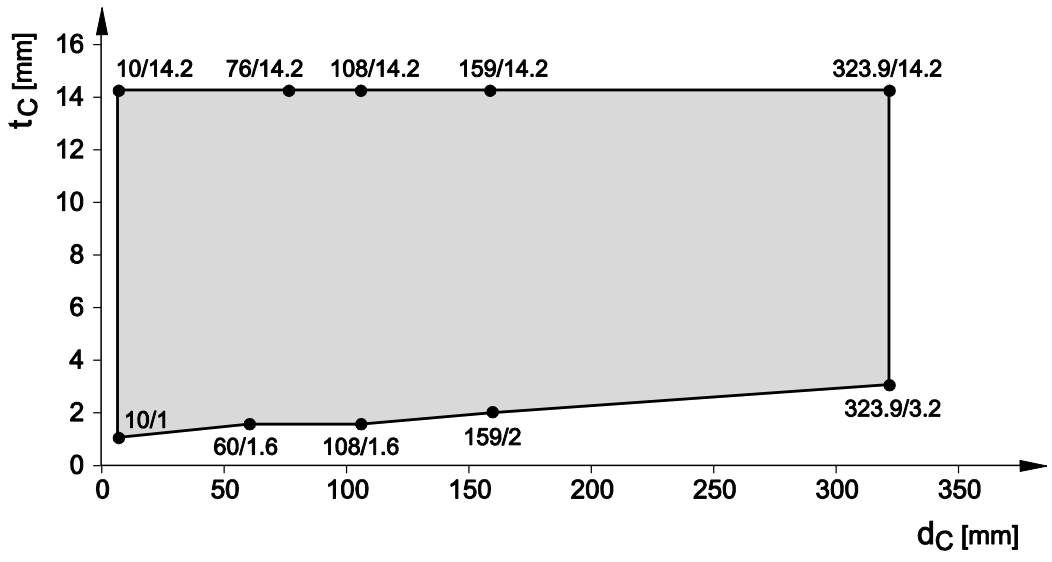


2.3.3 Steel Pipes

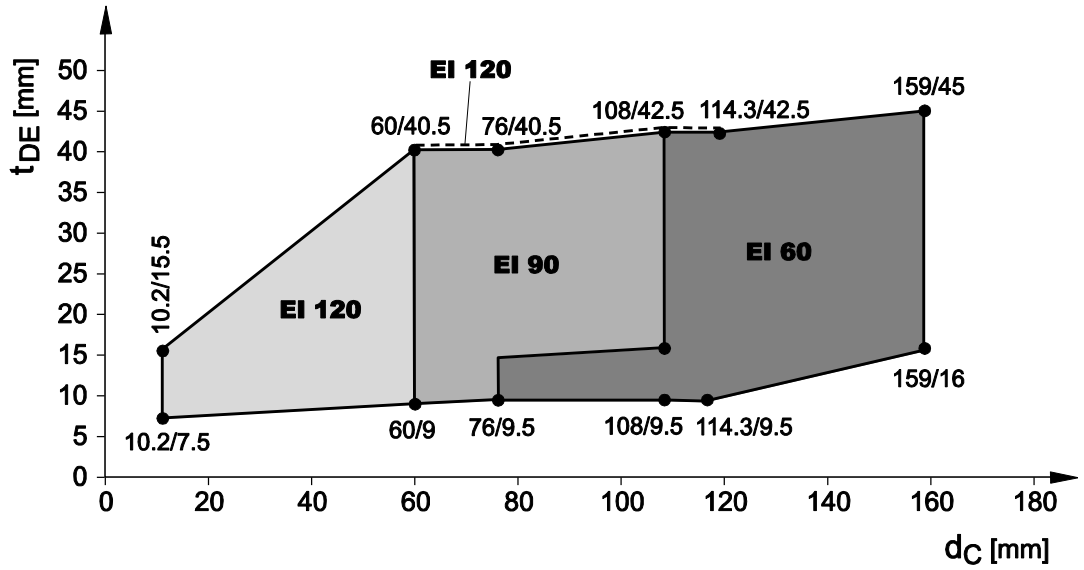
Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification	
			from		to			
			Ø small	Ø big	Ø small	Ø big	-	AP 2
Steel	10,2 to 60	1 to 14,2	7,5	9,0	15,5	39,0	EI120	
Steel	60 to 76	1 to 14,2	9,0	9,5	39,0	40,5	EI 90	EI 120
Steel	76 to 108	1,8 to 14,2	14,0	14,5	39,0	42,5	EI 90	
Steel	10,2 to 114,3	1 to 14,2	15,5	42,5	15,5	42,5	EI 120	
Steel	76 to 323,9	1,8 to 14,2	9,5	25	39,0	25		EI 120
Steel	76 to 159	1,6 to 14,2	9,0	16,0[2]	39,0	45	EI 60	

[1] till Ø159 mm insulation thickness is up to 45mm; pipe diameters above insulation is 25 mm. AP 2 – Klima Rock Insulation 40mm - was applied on pipe Ø 323,9 at a length of 500 mm.
[2] minimal insulation thickness above Ø114,3 mm is increased to 16 mm

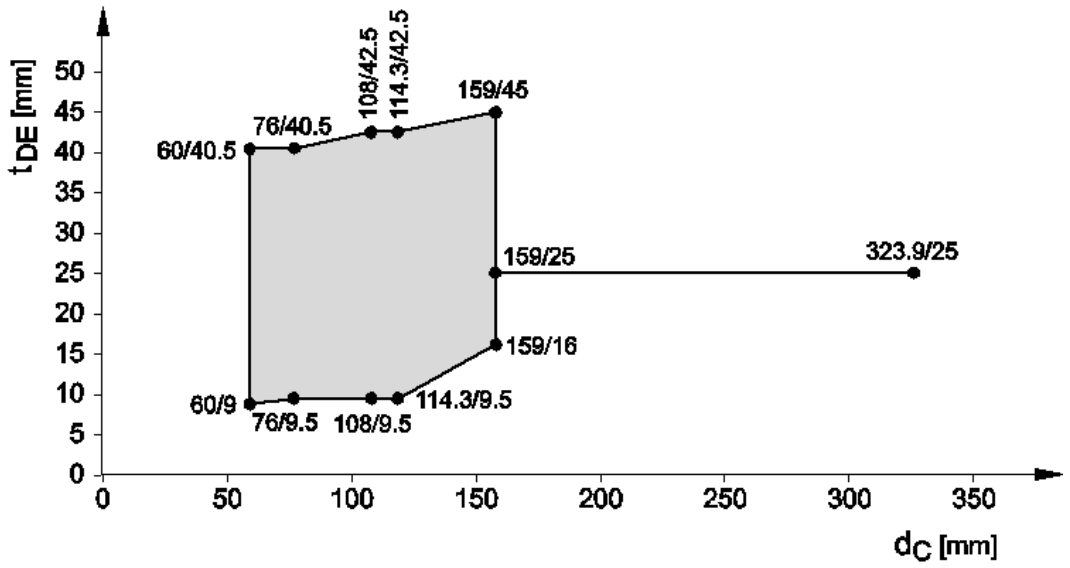
Steel pipe, floor ≥150 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_C)



Steel pipes, C/U, floor ≥150 mm – EI 120 / EI 90 / EI 60
Different insulation thickness results in distinct classifications
EI 120 classification is valid for highest insulation thickness up to Ø 114 mm (dotted line)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



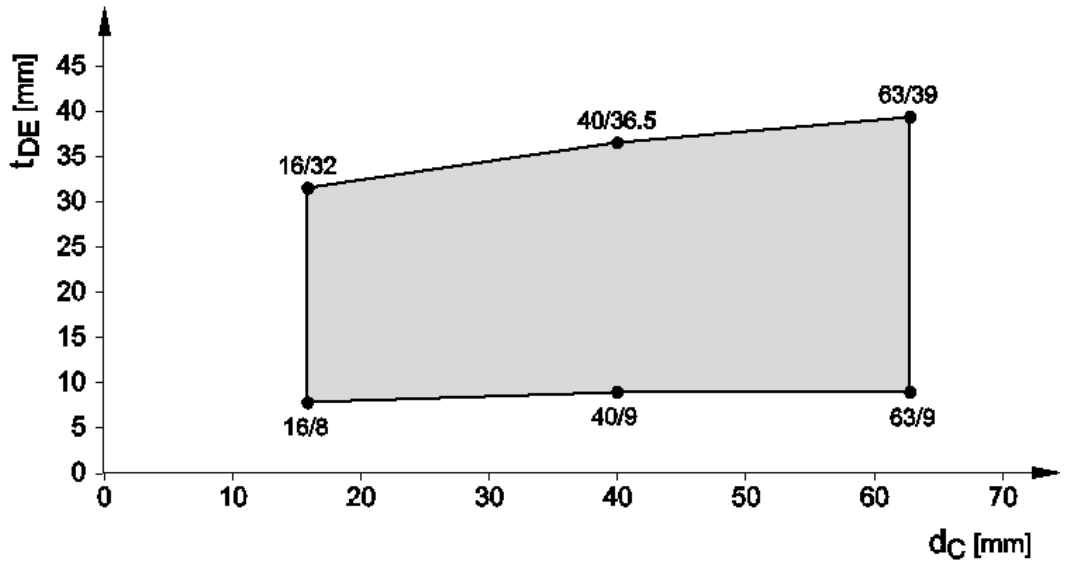
Steel pipes, C/U, floor ≥150 mm – EI 180 plus AP2
Pipes insulated with elastic combustible insulation are additional protected by AP2 (Klimarock 40 mm)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



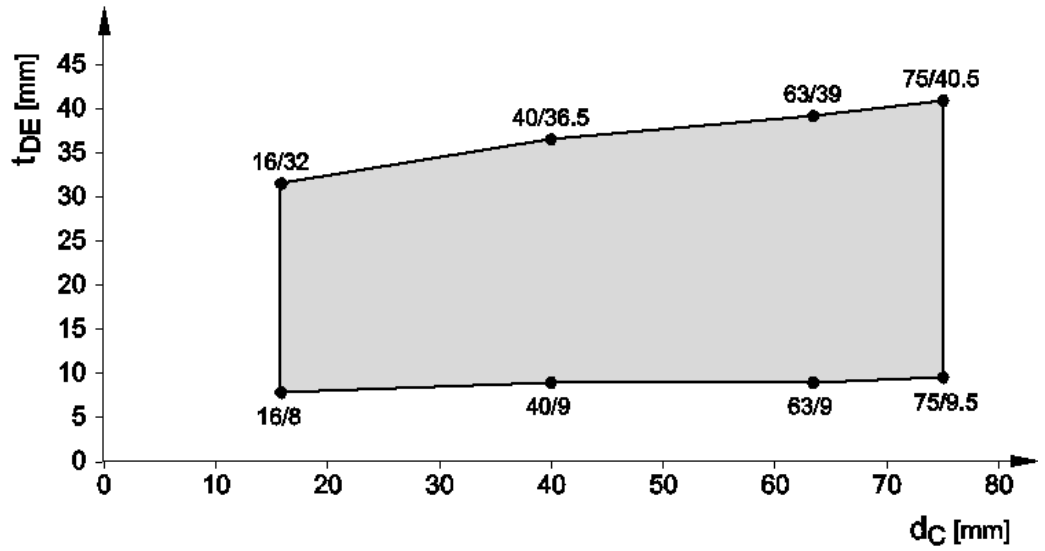
2.3.4 Aluminium Composite Pipes

Manu-facturer	Product name	Pipe diameter dc (mm)	Insulation thickness (mm)				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	
Fränkische Rohrwerke	Alpex F50 Profi	16 to 40	8,0	9,0	32,0	36,5	EI 120
		40 to 75	9,0	9,0	36,5	40,5	EI 90
		75	40,5		40,5		EI 180
Geberit	Mepla	16 to 75	8,0	9,0	32,0	39,0	EI 120
		75	40,5		40,5		EI 180
Georg Fischer	Sanipex	16 to 63	8,0	9,0	32,0	39,0	EI 120
IVT	PRINETO Stabilrohr	17 to 63	8,0	9,0	32,0	39,0	EI 120
KeKelit	KELOX KM 110	16 to 63	8,0	9,0	32,0	39,0	EI 120
		75	9,5		40,5		EI 180
Rehau	Rautitan stabil	16 to 63	8,0	9,0	32,0	39,0	EI 120
TECE	TECEflex Verbundrohr	16 to 63	8,0	9,0	32,0	39,0	EI 120
Uponor	Unipipe MLC	16 to 32	8,0	9,0	32,0	35,0	EI 180
Viega	SANIFIX Fosta-Rohr	16 to 63	8,0	9,0	32,0	39,0	EI 120

Aluminium Composite Pipes, U/C, floor ≥ 150 mm - EI 120
All specimens listed
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



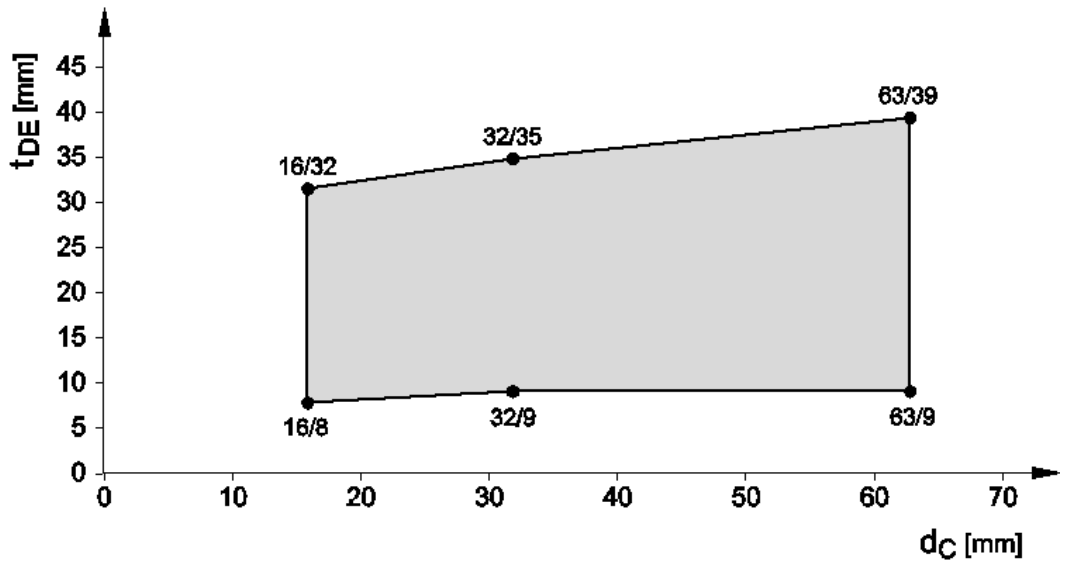
Aluminium Composite Pipes, "Fränkische Rohrwerke", U/C, floor ≥ 150 mm- EI 90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



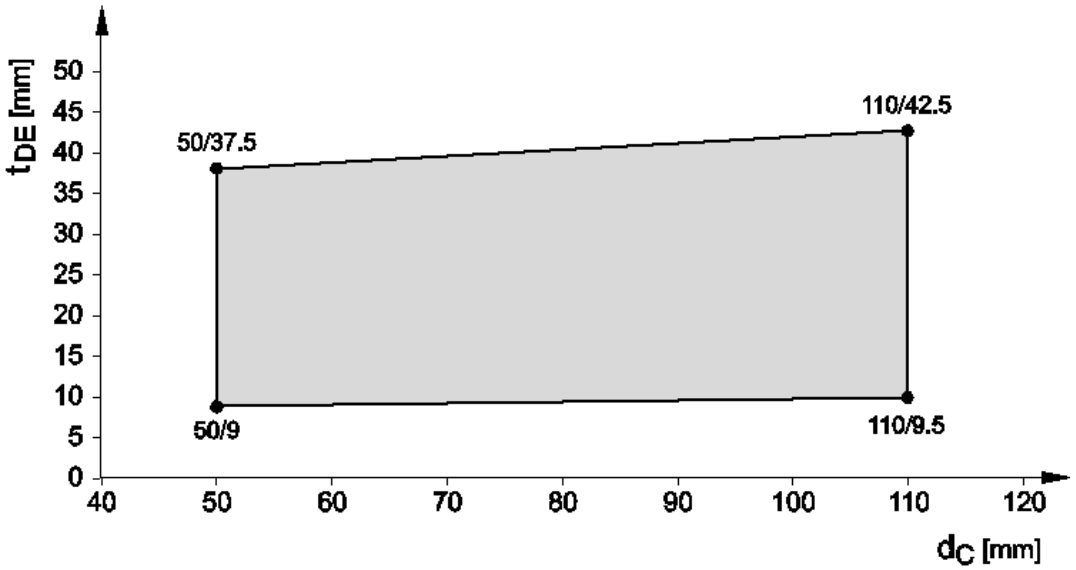
2.3.5 Plastic pipes made of PE-Xa (EN ISO 15875) and PE HD (EN 12201-2)

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	-
PE-Xa	16 to 63	2,2 to 8,6	8	9,0	32	39	EI 180
PE HD 100	50 to 110	4,6 to 10	9	9,5	37,5	42,5	EI 180

Plastic pipes PE-X according EN ISO 15875, U/C, floor ≥ 150 mm - EI 180
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Plastic pipes PE-HD according EN 12201-2, U/C, floor ≥ 150 mm - EI 180
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Annex D

Abbreviations used in drawings

Abbreviation	Description
A	Hilti Firestop Bandage CFS-B
A_1	Annular gap seal with Hilti Firestop Acrylic Sealant CFS-S ACR
A_2	Annular gap seal with gypsum plaster
A_3	Annular gap seal with cementious mortar acc. EN 998-2, group M10
C	Service (metal, composite, plastic pipes)
D_E	Pipe insulation, combustible, butyl based elastomeric foamed material
d_C	Pipe diameter (nominal outside diameter)
E	Building element (wall, floor)
s_1	Minimum distance between single insulated pipes
s_2	Minimum distance between clustered pipes
s_3	Minimum distance between penetrating pipe and building element
S_4	Minimum distance between single insulated pipes and Collar CFS-C SL
S_5	Minimum distance between single insulated pipes and Conlit shell or Klimarock
t_C	Pipe wall thickness
t_{DE}	Insulation thickness
t_E	Thickness of the building element
L_D	Length of Insulation
AP1	Additional protection by elastomeric, combastible insulation
AP2	Additional protection by mineralwool (Klimarock)
AP3	Additional protection by beading / outside framing

List of approved elastomeric combustible Insulations:

Producer	Approved Type of foamed elastomeric thermal isolation
Armacell GmbH	• Armaflex AF, Armaflex SH, Armaflex Ultima, Armaflex HT
NMC Group	• Insul-Tube (nmc), Insul-Tube H-Plus (nmc),
Kaimann GmbH	• Kaiflex KK plus, Kaiflex KK,
L'Isolante K-Flex	• l'Isolante K-Flex HT, l'Isolante K-Flex ECO, l'Isolante K-Flex ST, l'Isolante K-Flex H, l'Isolante K-Flex ST Plus