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

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European Technical Assessment

ETA-14/0085 of 09.04.2025

General part

Technical Assessment Body issuing the European Technical Assessment	Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering
Trade name of the construction product	Hilti Firestop Collar Endless CFS-C EL
Product family to which the construction product belongs	Fire Stopping and Fire Sealing Products: Penetration Seals
Manufacturer	Hilti AG Feldkircherstrasse 100 9494 Schaan LIECHTENSTEIN
Manufacturing plant	HILTI production plant 4A HILTI production plant 5B
This European Technical Assessment contains	292 pages including Annexes 1 to 5 which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	European Assessment Document EAD 350454-00-1104 “Fire stopping and fire sealing products – Penetration seals”
This European Technical Assessment replaces	European Technical Assessment ETA-14/0085 of 29.12.2020

Member of EOTA

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Content

Specific parts

1 Technical description of the product

"Hilti Firestop Collar Endless CFS-C EL" is a pipe collar to be used as pipe penetration seal.

Type of penetration seal system: Pipe closure device – collar (see EAD 350454-00-1104, clause 1.1). "Hilti Firestop Collar Endless CFS-C EL" consists of an intumescent strip with a soft PUR foam strip, metallic closure plates and fastening hooks (long and short version), made of stainless steel.

"Hilti Firestop Collar Endless CFS-C EL" is supplied in one size only. The collar is cut to a length to suit the overall circumference of pipe or pipe and insulation and equipped with closing plates, then installed underneath floors or on both sides of a wall and fixed by hooks and metal anchors/screws or threaded rods with washers and nuts.

Ancillary products referred to in this European Technical Assessment within the framework of evaluating resistance to fire (see Annex 2 and 3 of the ETA) are not covered by this European Technical Assessment and cannot be CE-marked based on it.

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

2.1 Intended use

"Hilti Firestop Collar Endless CFS-C EL" is intended to form a penetration seal or to form parts of a penetration seal, which is used to maintain the fire resistance of a separating element (flexible wall, shaft wall, rigid wall, rigid floor, timber wall or timber floor) when and where services pass through.

The pipe penetration seal is intended for plastic pipes in piping systems for waste water, non-combustible liquids and fluids, for pneumatic dispatch systems and for pipes in centralized vacuum-cleaning systems.

"Hilti Firestop Collar Endless CFS-C EL" may be used to provide a penetration seal with plastic pipes as mainly single penetrations. For details on diameters, wall thicknesses, pipe materials and pipe standards see Annex 3 of the ETA, which gives details of penetration seals for which fire resistance was assessed. Pipes have to be installed mainly perpendicular to the seal surface. Deviant situations are described in detail in Annex 3 of the ETA. This European Technical Assessment covers only assemblies installed in accordance with the provisions given in Annex 2 and 3 of the ETA.

For the purpose of smoke and draft stop, air or water tightness and airborne sound insulation, the gap between opening edge and pipe/pipe insulation has to be sealed off by gypsum plaster, cementious mortar or a construction sealant, the latter optionally in combination with mineral wool as backfilling material, considering the detailed prescriptions given in Annex 2 and 3 of the ETA.

Sound decoupling can be provided either by using "Hilti Firestop Acrylic Sealant CFS-S ACR" (ETA-10/0292) as annular gap seal or by using gypsum plaster or cementious mortar along with PE foam or a polyester based sound decoupling material. For details see Annex 2 and 3 of the ETA.

2.2 Use condition

"Hilti Firestop Collar Endless CFS-C EL" is intended for use at temperatures below 0 °C, but with no exposure to rain nor UV, and can therefore – according to EAD 350454-00-1104, clause 2.2.9.3.1 – be categorized as Type Y_2. Since the requirements for Type Y_2 are met, also the requirements for Type Z_1 and Z_2 are fulfilled.

Although a penetration seal is intended for indoor applications only, the construction process may result in it being subjected to more exposed conditions for a period before the building envelope is closed. For this case provisions shall be made to protect temporarily exposed penetration seals according to the ETA-holder's installation instructions.

2.3 Working life

The provisions made in this European Technical Assessment are based on an assumed working life of "Hilti Firestop Collar Endless CFS-C EL" of 10 years, provided the conditions laid down in the technical literature of the manufacturer relating to packaging, transport, storage, 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 Technical Assessment Body, but are to be regarded only 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 basic requirements for construction works.

2.4 General assumptions

It is assumed that

- damages to the penetration seal are repaired accordingly,
- the installation of the penetration seal does not effect the stability of the adjacent building element – even in case of fire,
- the lintel or floor above the penetration seal is designed structurally and in terms of fire protection such that no additional mechanical load (other than its own weight) is imposed on the penetration seal,
- the thermal movement in the pipe work will be accommodated in such way that it does not impose a load on the penetration seal,
- the installations are fixed to the adjacent building element in accordance with the relevant regulations in such a way that, in case of fire, no additional mechanical load is imposed to the penetration seal,
- the support of the installations is maintained for the required period of fire resistance and
- pneumatic dispatch systems, compressed air systems, etc. are switched off by additional means in case of fire.

This European Technical Assessment does not address any risks associated with the emission of dangerous liquids or gases caused by failure of the pipe(s) in case of fire nor does it prove the prevention of the transmission of fire through heat transfer via the medium in the pipes.

This European Technical Assessment does not verify the prevention of destruction of adjacent building elements with fire separating function or of the pipes themselves due to distortion forces caused by extreme temperatures. These risks shall be accounted for by taking appropriate measures when designing or installing the pipe work.
The mounting or hanging of the pipes or the layout of the pipe work shall be implemented in such a way that the pipes and the fire resistant building elements shall remain functional within a period of time which corresponds to the fire resistance period required.

The risk of downward spread of fire caused by burning material which drips through a pipe to floors below, is not considered in this European Technical Assessment.

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

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

2.5 Manufacturing

The European Technical Assessment is issued for the product on the basis of agreed data/information, deposited with the Österreichisches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Österreichisches Institut für Bautechnik before the changes are introduced.

The Österreichisches Institut für Bautechnik will decide whether or not such changes affect the European Technical Assessment and consequently the validity of the CE marking on the basis of the European Technical Assessment and if so whether further Assessment or alterations to the European Technical Assessment, shall be necessary.

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

3.1 Essential characteristics of the product

Table 1: Performance of the product in relation to the essential characteristics

Essential characteristic	Method of assessment	Performance
Basic requirement for construction works 2: Safety in case of fire		
Reaction to fire	EN 13501-1	Clause 3.1.1
Resistance to fire	EN 13501-2	Clause 3.1.2
Basic requirement for construction works 3: Hygiene, health and environment		
Air permeability	EN 1026:2016	Clause 3.1.3
Water vapour permeability	EN 12086:2013	Clause 3.1.4
Content, emission and/or release of dangerous substances	EN 16516	Clause 3.1.5
Basic requirement for construction works 4: Safety and accessibility in use		
Mechanical resistance and stability	No performance assessed	
Resistance to impact / movement	No performance assessed	
Adhesion	No performance assessed	
Durability	EAD 350454-00-1104	Clause 3.1.9
Basic requirement for construction works 5: Protection against noise		
Airborne sound insulation	EN ISO 140-10, EN ISO 10140-1, EN ISO 10140-2 and EN ISO 717-1	Clause 3.1.10
Basic requirement for construction works 6: Energy economy and heat retention		
Thermal properties	No performance assessed	
Water vapour permeability	No performance assessed	
Basic requirement for construction works 7: Sustainable use of natural resources		
No characteristics assessed.		

3.1.1 Reaction to fire

The components of “Hilti Firestop Collar Endless CFS-C EL” were assessed according to EAD 350454-00-1104, clause 2.2.1 and classified according to EN 13501-1.

The reaction to fire classification for the inlay of “Hilti Firestop Collar Endless CFS-C EL” is class “E” according to EN 13501-1. (Other components are made of stainless steel with reaction to fire class “A1” according to Commission Decision 96/603/EC[1]).

The reaction to fire classification for “Hilti Firestop Acrylic Sealant CFS-S ACR” is class “D-s1 d0” according to EN 13501-1.

[1] Official Journal of the European Communities no. L 267, 19.10.1996, p. 23

The reaction to fire classification for “Hilti Firestop Mastic Filler CFS-FIL” is class “E” according to EN 13501-1.

The reaction to fire classification for “Hilti Fire Stop Coating CFS-CT” is class “E” according to EN 13501-1.

3.1.2 Resistance to fire

The resistance to fire classification according to EN 13501-2 of penetration seals made of “Hilti Firestop Collar Endless CFS-C EL” is given in Annex 3 of the ETA.

Information on ancillary products, which were tested within the framework of this European Technical Assessment for assessing resistance to fire is given in Annex 2 of the ETA.

3.1.3 Air permeability

Air tightness for a single penetration of a plastic pipe, equipped with “Hilti Firestop Collar Endless CFS-C EL” can only be achieved when the annular gap is sealed with a sealant, e.g. “Hilti Firestop Acrylic Sealant CFS-S ACR” or “Hilti Firestop Mastic Filler CFS-FIL”.

For “Hilti Firestop Acrylic Sealant CFS-S ACR” and “Hilti Firestop Mastic Filler CFS-FIL” the gas permeability regarding the gases air, nitrogen (N_2), carbon dioxide (CO_2) and CH_4 (methane) has been tested according to the principles of EN 1026. The “Hilti Firestop Acrylic Sealant CFS-S ACR” was installed in a thickness of 10 mm. The “Hilti Firestop Mastic Filler CFS-FIL” was installed in a thickness of 50 mm.

The “Hilti Firestop Coating CFS-CT” was tested on a precoated board “Hilti Firestop Board CFS-CT B 1S”. Two precoated board samples (each of 50 mm mineral wool coated with a dry film thickness of 1 to 2 mm) were put together and gas flow was determined.

The non-tested air flow rate for “Hilti Firestop Mastic Filler CFS-FIL” and “Hilti Firestop Coating CFS-CT” will be similar to the nitrogen flow rate, as air consists of nearly 80 % of tested nitrogen.

For annular gaps sealed with cementious mortar or gypsum plaster no performance has been assessed.

The following flow rates per area (q/A) have been achieved for the given air pressure differences (Δp). The flow rate index indicates the type of gas:

Product	**Δp [Pa]**	**q/A air [$m^3/(h*m^2)$]**	**q/A N_2 [$m^3/(h*m^2)$]**	**q/A CO_2 [$m^3/(h*m^2)$]**	**q/A CH_4 [$m^3/(h*m^2)$]**
CFS-S ACR	50	≤ 1,9E-06	≤ 1,1E-06	≤ 6,4E-05	≤ 4,3E-05
	250	≤ 9,7E-06	≤ 5,5E-06	≤ 3,2E-04	≤ 2,1E-04
CFS-FIL	50	Not tested	< 1 E-06	< 1 E-06	< 1 E-06
	250	Not tested	< 1 E-06	< 1 E-06	< 1 E-06
CFS-CT / CFS-CT B 1S/2S	50	Not tested	≤ 3,2 E-02	≤ 6,0 E-02	≤ 6,5 E-02
	250	Not tested	≤ 1,6 E-01	≤ 3,0 E-01	≤ 3,3 E-01

The values refer to a body of pure “Hilti Firestop Acrylic Sealant CFS-S ACR”, “Hilti Firestop Mastic Filler CFS-FIL”, “Hilti Firestop Coating CFS-CT” / “Hilti Firestop Board CFS-CT B 1S” / “Hilti Firestop Board CFS-CT B 2S” without any penetrating installation.

3.1.4 Water permeability

Water tightness for a single penetration of a plastic pipe, equipped with “Hilti Firestop Collar Endless CFS-C EL” can only be achieved when the annular gap is sealed with a sealant, e.g.

"Hilti Firestop Acrylic Sealant CFS-S ACR", "Hilti Firestop Mastic CFS-FIL" or ", "Hilti Firestop Coating CFS-CT" / "Hilti Firestop Board CFS-CT B 1S" / "Hilti Firestop Board CFS-CT B 2S".

The water permeability of "Hilti Firestop Acrylic Sealant CFS-S ACR", "Hilti Firestop Mastic Filler CFS-FIL", "Hilti Firestop Coating CFS-CT" / "Hilti Firestop Board CFS-CT B 1S" / "Hilti Firestop Board CFS-CT B 2S" has been tested according to the principles given in Annex C of EAD 350454-00-1104. The specimen consisted of 2 mm "Hilti Firestop Acrylic Sealant CFS-S ACR" and "Hilti Firestop Mastic Filler CFS-FIL" (dry film thickness) on mineral wool. "Hilti Firestop Coating CFS-CT" was tested as a 0,7mm thick coating dry film on mineral wool board.

Test result: water tight to 1000 mm head of water or 9806 Pa.

For annular gaps sealed with cementious mortar or gypsum plaster no performance has been assessed.

3.1.5 Content, emission and/or release of dangerous substances

"Hilti Firestop Collar Endless CFS-C EL" was tested for SVOC and VOC according EAD 350454-00-1104, clause 2.2.5.1, in accordance with EN 16516 with a loading factor of 0,007 m²/m³. Release scenario IA1 and IA2 have been tested.

The concentration of SVOC after 3 days and after 28 days was < 0,005 mg/m³. The concentration of the total emission of VOC after 3 days and after 28 days was, as well, < 0,005 mg/m³.

3.1.6 Mechanical resistance and stability

No performance assessed

3.1.7 Resistance to impact / movement

No performance assessed

3.1.8 Adhesion

No performance assessed

3.1.9 Durability

"Hilti Firestop Collar Endless CFS-C EL" is intended for use at temperatures below 0 °C, but with no exposure to rain nor UV, and can therefore – according to EAD 350454-00-1104, clause 2.2.9.3.1 – be categorized as Type Y_2.

3.1.10 Airborne sound insulation

Airborne sound insulation for a single penetration of a plastic pipe, equipped with "Hilti Firestop Collar Endless CFS-C EL" can only be achieved when the annular gap is sealed "Hilti Firestop Acrylic Sealant CFS-S ACR". It has to be noted that the values given in in this clause are only valid if the annular gap is sealed using stone wool as backfilling material (which is not necessary in all cases for fire resistance – see Annex 3 of the ETA).

The acoustic characteristics of the walls itself have not been measured. According to the test results the single number ratings are:

Flexible wall:
Weighted element-normalized level difference:
$D_{n,e,w}$ (C,C_{tr}) = 68 (-2;-6) dB (scenario 1)
$D_{n,e,w}$ (C,C_{tr}) = 64 (-3;-) dB (scenario 2)

From this $D_{n,e,w}$ the weighted sound reduction index calculates to:
R_w (C; C_{tr}) = 61 (-3;-6) dB (scenario 1)
R_w R(C; C_{tr}) = 56 (-2;-2) dB (scenario 2)

It should be noticed that both above mentioned results apply to the total wall construction of the size S = 1,25 m x 1,50 m (= 1,88 m²)

$D_{n,e,w}$ = weighted element-normalized level difference of small building elements (given with spectrum adaptation terms C and C_{tr})
R_w = weighted sound reduction index (given with spectrum adaptation terms C and C_{tr})

3.1.11 Thermal properties

No performance assessed

3.1.12 Water vapour permeability

No performance assessed

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

4.1 AVCP system

According to the Decision 1999/454/EC[2], amended by Decision 2001/596/EC[3] of the European Commission the system(s) of assessment and verification of constancy of performance (see Annex V of Regulation (EU) No 305/2011) is given in the following table.

Product(s)	**Intended use(s)**	**Level(s) or class(es)** (resistance to fire)	**System** of assessment and verification of constancy of performance
Fire Stopping and Fire Sealing Products	for fire compartmentation and/or fire protection or fire performance	any	1

In addition, according to the Decision 1999/454/EC, amended by Decision 2001/596/EC of the European Commission the system(s) of assessment and verification of constancy of performance, with regard to reaction to fire, is given in the following table.

Product(s)	**Intended use(s)**	**Level(s) or class(es)** (reaction to fire)	**System** of assessment and verification of constancy of performance
Fire Stopping and Fire Sealing Products	For uses subject to regulations on reaction to fire	A1*, A2*, B*, C*	1
		A1**, A2**, B**, C**, D, E	3
		(A1 to E)***, F	4

* Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material)

** Products/materials not covered by footnote (*)

*** Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of class A1 according to Commission Decision 96/603/EC, as amended)

[2] Official Journal of the European Communities no. L 178, 14.7.1999, p. 52
[3] Official Journal of the European Communities no. L 209, 2.8.2001, p. 33

5 Technical details necessary for the implementation of the AVCP system, as provided for the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik.

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

Issued in Vienna on 09.04.2025
by Österreichisches Institut für Bautechnik

The original document is signed by:

Thomas Rockenschaub
Deputy Managing Director

6 ANNEX 1: REFERENCE DOCUMENTS

6.1 Standards mentioned in this ETA

EN 1026	Windows and doors – Air permeability – Test method
EN 1329-1	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Unplasticized poly(vinyl chloride) (PVC-U)
EN 1366-3	Fire resistance tests for service installations - Part 3: Penetration seals
EN 1451-1	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Polypropylene (PP) – Part 1: Specifications for pipes, fittings and the system
EN 1453-1	Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings - Unplasticized poly(vinyl chloride) (PVC-U)
EN 1519-1	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Polyethylene (PE) - Part 1: Specifications for pipes, fittings and the system
EN 1566-1	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly(vinyl chloride) (PVC-C) - Part 1: Specifications for pipes, fittings and the system
EN 12201-2	Plastics piping systems for water supply, and for drainage and sewerage under pressure - Polyethylene (PE) - Part 2: Pipes
EN 12666-1	Plastics piping systems for non-pressure underground drainage and sewerage – Polyethylene (PE) – Part 1: Specifications for pipes, fittings and the system
EN 13501	Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests Part 2: Classification using test data from fire resistance tests, excluding ventilation services
EN ISO 140-3	Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurements of airborne sound insulation of building elements[4]
EN ISO 717-1	Acoustics – Rating of sound insulation of buildings and of building elements – Part 1: Airborne sound insulation
EN ISO 1519	Paints and varnishes – Bend test (cylindrical mandrel)
EN ISO 1452	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - Unplasticized poly(vinyl chloride) (PVC-U)[5]
EN ISO 15493	Plastics piping systems for industrial applications - Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) - Specifications for components and the system; Metric series
EN ISO 15494	Plastics piping systems for industrial applications - Polybutene (PB), polyethylene (PE) and polypropylene (PP) - Specifications for components and the system; Metric series
EN ISO 15874	Plastics piping systems for hot and cold water installations - Polypropylene (PP)
EN ISO 20140-10	Acoustics – Measurements of sound insulation in buildings and of building elements – Part 10: Laboratory measurement of airborne sound insulation of small building elements
EN 998-2:2003	Specification for mortar used for masonry – Part 2
DIN 8061	Unplasticized polyvinyl chloride (PVC-U) pipes - General quality requirements and testing
DIN 8062	Unplasticized polyvinyl chloride (PVC-U) pipes - Dimensions

[4] In September 2010 substituted by the EN ISO 10140 series
[5] Successor of EN 1452 since December 2009

DIN 8074	Polyethylene (PE) - Pipes PE 80, PE 100 - Dimensions
DIN 8075	Polyethylene (PE) pipes - PE 80, PE 100 - General quality requirements, testing
DIN 8077	Polypropylene (PP) pipes - PP-H, PP-B, PP-R, PP-RCT – Dimensions
DIN 8078	Polypropylene (PP) pipes - PP-H, PP-B, PP-R, PP-RCT - General quality requirements and testing
DIN 19531-10	Pipes and fittings made of unplasticized polyvinyl chloride (PVC-U) socket for waste and soil discharge systems inside buildings – Part 10: Fire behaviour, quality control and installation recommendations
DIN 19535-10	High-density polyethylene (PE-HD) pipes and fittings for hot-water resistant waste and soil discharge systems (HT) inside buildings – Part 10: Fire behaviour, quality control and installation recommendations

6.2 Other reference documents

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

7 ANNEX 2: DESCRIPTION OF PRODUCT(S) & PRODUCT LITERATURE

7.1 Hilti Firestop Collar Endless CFS-C EL

The inlay of the collar consists of one intumescent strip with a soft polyurethane foam layer as a noise decoupling element. A detailed specification of the product is contained in document “Identification / Product Specification” relating to this European Technical Assessment, which is a non-public part of this ETA.

The Control Plan is defined in document "Control Plan” relating to this European Technical Assessment, which is a non-public part of this ETA.

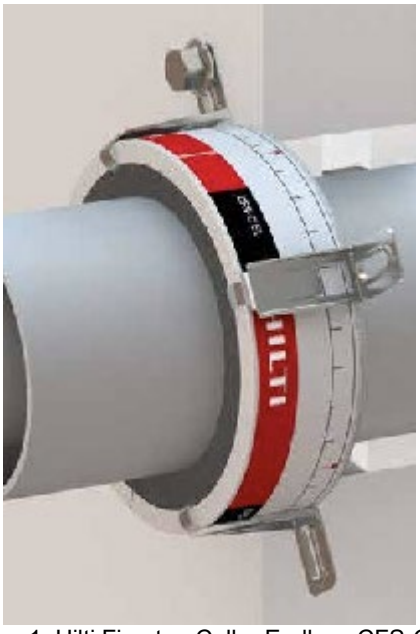


Figure 1: Hilti Firestop Collar Endless CFS-C EL

Technical product literature

- Technical Data Sheet Hilti Firestop Collar Endless CFS-C EL (including the use of ancillary products according to Annex 2 of the ETA).

7.2 Ancillary products

7.2.1 Hilti Firestop Acrylic Sealant CFS-S ACR

- One-component, water based acrylic sealant
- Available in cartridges, foil bags and pails
- CFS-S ACR is fully described in ETA-10/0292 and ETA-10/0389

Figure 2: Hilti Firestop Acrylic Sealant CFS-S ACR cartridge

7.2.2 Gypsum plaster

- Any gypsum plaster suitable for use with flexible wall constructions or the intended type of rigid walls or floors may be used.

7.2.3 Cementious mortar

- Any cementious mortar according EN 998-2 - class M10 is suitable for use with the intended type of rigid walls or floors.

7.2.4 Mineral wool

- Loose mineral wool products for use as backfilling material
- To be used with Hilti Firestop Acrylic Sealant CFS-S ACR
- Reaction to fire class: A1 or A2 in accordance with EN 13501-1

Product	Manufacturer	Specification
Heralan LS	Knauf Insulation GmbH	Product data sheet of Knauf
Isover loose wool SL	Saint-Gobain ISOVER	Product data sheet of Isover
Isover Universal-Stopfwolle	Saint-Gobain ISOVER	Product data sheet of Isover
Rockwool RL	Rockwool	Product data sheet of Rockwool
Paroc Pro Loose Wool	Paroc OY AB	Product data sheet of Paroc

Table **1**: Loose mineral wool products to be used as backfiller

7.2.5 Hilti Firestop Mastic Filler CFS-FIL

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

Figure 3: Hilti Firestop Mastic Filler CFS-FIL cartridge

7.2.6 Hilti Fire Stop Coating CFS-CT and coated boards

- One-component, water-based coating, to be applied on mineral wool boards
- Available as liquid coating (in pails) or cured on pre-coated boards CFS-CT B 1S, CFS-CT B 2S and CFS-CT HDB
- CFS-CT is fully described in ETA-11/0429
- CFS-CT B 1S is described in ETA-11/0429
- CFS-CT B 2S is described in ETA-11/0428
- CFS-CT HDB is described in ETA-23/0267

Figure 4: Hilti Firestop Board CFS-CT B 1S

7.2.7 Hilti Firestop Bandage CFS-B

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

Figure 5: Hilti Firestop Bandage CFS-B

7.2.8 Hilti Firestop Board High Density CFS-CT HDB

- Double side coated mineral wool board
- Thickness 60mm
- Density (NV) = 160 kg/m³
- To be combined with several firestop products, as well as CFS-C EL
- CFS-CT HDB is fully described in ETA-23/0267

Figure 6: Hilti Firestop Board High Density CFS-CT HDB

7.2.9 Technical product literature

The technical product literature is a separated part of this European Technical Assessment.

8 ANNEX 3: OVERVIEW RESISTANCE TO FIRE CLASSIFICATION OF PENETRATION SEALS MADE OF HILTI FIRESTOP COLLAR ENDLESS CFS-C EL

8.1 Intended use of pipes and reference to relevant section

Separating construction element		**Shaft-wall**	**Flexible + rigid wall**	**Rigid wall**	**Timber wall**	**Rigid floor**	**Timber floor**
Thickness		$t_E \geq 45$ mm	$t_E \geq 100$ mm	$t_E \geq 150$ mm	$t_E \geq 80$ mm	$t_E \geq 150$ mm	$t_E \geq 80$ mm
Waste water / sewage	Straight pipes in DG1	See 8.6	See 8.3	See 8.3, 8.4, 8.4.6	See 8.5	See 8.7	See 8.8, 8.9
	Straight pipes in DG2	Not relevant	Not relevant	See 8.3, 8.4, 8.4.6	See 8.5	See 8.7	See 8.8, 8.9
	Inclined pipes	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	Not relevant
	Couplings and elbows	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	See 8.5	See 8.7	Not relevant
	Zero distance pipe to wall/floor	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	See 8.5	See 8.7	Not relevant
	Zero distance pipe in the corner	Not relevant	Not relevant	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	Not relevant
	Zero distance collar to collar CFS-C EL	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	Not relevant
	Zero distance CFS-C EL to CFS-B	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	Not relevant
	Zero distance CFS-C EL to mineral wool	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	Not relevant
	Zero distance CFS-C EL to coated board CFS-CT B 1S	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	Not relevant
Specials	Roof drainage	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	See 8.8, 8.9
	Pneumatic dispatch systems	Not relevant	See 8.3	See 8.3, 8.4, 8.4.6	Not relevant	See 8.7	Not relevant
	Heating, Sprinkler, fresh water	See 8.6	See 8.3	See 8.3, 8.4, 8.4.6	See 8.5	See 8.7	See 8.8, 8.9

Table 2: Intended use of pipes and reference to relevant section

(list not exhaustive, other use of pipes possible)

8.2 General Information Hilti Firestop Collar Endless CFS-C EL

8.2.1 Penetration seal

- Single penetration seal if not other indicated
- Hilti Firestop Collar Endless CFS-C EL (A_1) to be mounted on both sides of the wall
- Hilti Firestop Collar Endless CFS-C EL (A_1) to be mounted on the underside of floor (soffit) only

8.2.2 Design Groups

The Design Group (DG) defines the application, see Figure 7.

Design Groups of Hilti Firestop Collar Endless CFS-C EL in wall/floor application:
- Design Group 1 means one jacket on one side of the seal,
- Design Group 2 means two jackets on one side of the seal.

Design Group (DG) is mainly defined by pipe outside diameter and isolation thickness

- Design Group 1 - pipes outside nominal diameter d_C = (32,0 mm ≤ d_C ≤ 110,0 mm).
- Design Group 2 - pipes outside nominal diameter d_C = (110,1 mm ≤ d_C ≤ 160,0 mm).

- Specific situation for some pipes with outside nominal diameter d_C = 125 mm, where pipes are assessed within Design Group 1.

- Design Group is independent from material of supporting construction.

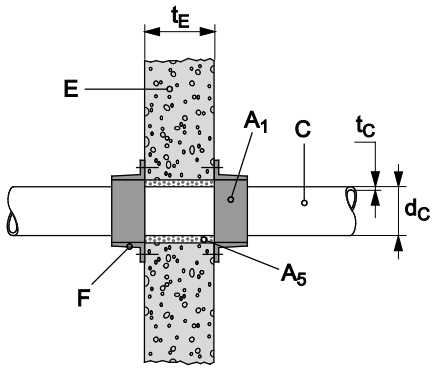
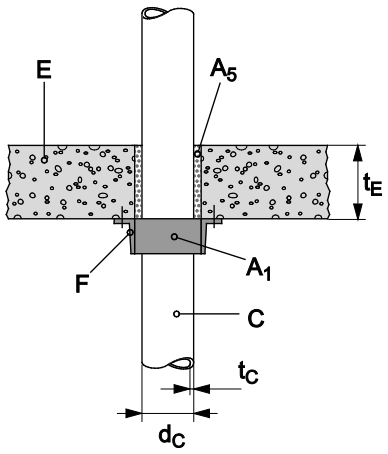
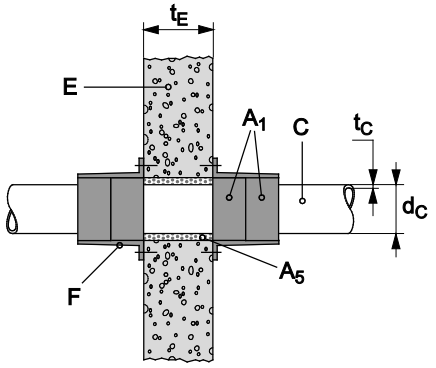
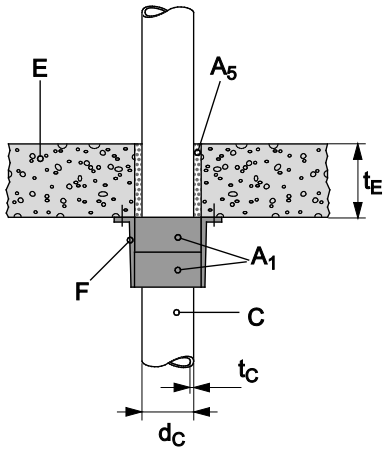
	For any type of wall	For any type of floor
Pictures 8.2.2 A: Design Group 1 (DG 1)		
Pictures 8.2.2 B: Design Group 2 (DG 2)		

Figure 7: Design Groups of CFS-C EL in wall/floor application

8.2.3 Installation of Collar

- CFS-C EL has to be installed in close contact with pipe or pipe insulation
- No annular space between Collar and pipe/isolated pipe is permitted
- Using closure plates and relevant number of hooks is mandatory (see Table 3)

8.2.4 Collar fixing

Hilti Firestop Collar Endless CFS-C EL (A_1) to be installed on the wall or floor using the specified number and type of fixing hooks, see Table 3.

Hooks have to be fixed in the supporting construction by fixing elements.

The maximum distance between two hooks is 150 mm. If the distance increases, an additional hook (short or long) must be used.

One hook (short or long) should be fixed always with one fixing element.
Exception: shaft wall application. In this case two hooks might be fixed with one fixing element of collars nearby. See Figure 8: Collar fixing situation.

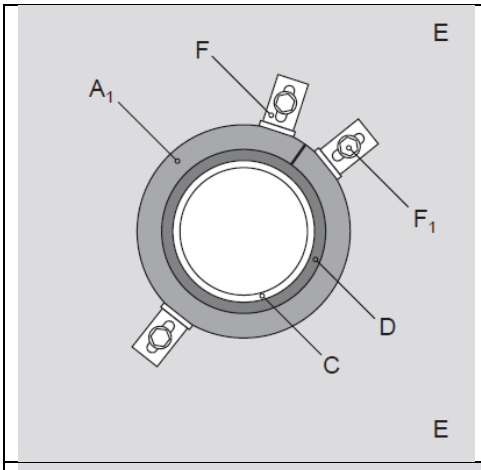
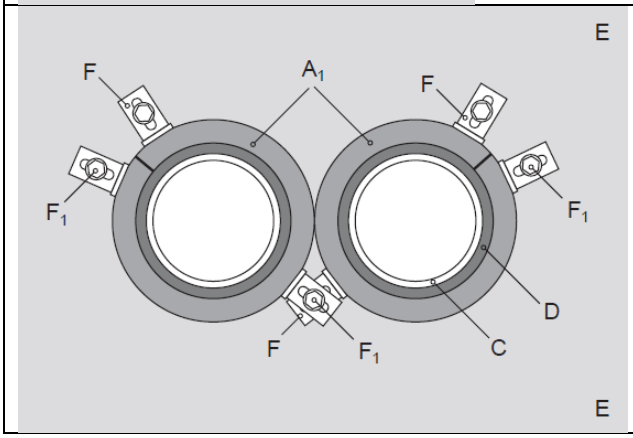
	Picture 8.2.4 A: Collar fixing with one fixing element (F_1) for one hook (F) – standard way of hook fixing
	Picture 8.2.4 B: Collar fixing with two hooks (F), using one fixing element (F_1) – to be used in shaft walls system B only.

Figure 8: Collar fixing situation

8.2.4.1 Fixing elements for hooks in flexible walls:

- Screw Anchor Hilti HUS H6 or P6, HUS3-P, HUS3-H
- Hollow Wall Metallic Anchor Hilti HTB-S or HTB-2
- Cavity Anchor Hilti HHD-S or
- threaded rod minimum M6 with flat washer and nut on both sides of the wall.

8.2.4.2 **Fixing elements for hooks in rigid walls and floors:**

- Screw Anchor Hilti HUS H6 or P6, HUS3-P, HUS3-H
- threaded rod minimum M6 with flat washer and nut.

8.2.4.3 **Fixing elements for hooks in shaft wall systems:**

- Screw Anchor Hilti HUS H6 and P6 or
- Hollow Wall Metallic Anchor Hilti HTB-S or HTB-2, HUS3-P, HUS3-H

8.2.4.4 **Fixing elements for collars, installed on mineral wool board**

- Hook fixing with threaded rods minimum M6 with flat washer and nut on both sides of supporting construction
- Threaded rod penetrates the boards

8.2.4.5 **Fixing elements for collars in wooden supporting construction**

- Hilti HUS 3 H6 (60mm)
- Hilti S-WS 11Y (75mm)
- Hilti S-WS 11Z x (75mm)
- Hilti Wood-screws hexagonal head, S-WDF-Z, 6x 60mm

8.2.4.6 **Fixing elements for collars installed on mineral wool backfillers**

- Flat washer must not have direct contact to mineral wool backfilling
- A metal plate/strip of at least 1mm thickness must be placed over the wall/floor opening on both sides of support construction
- Metal plate/strip is supported on supporting construction itself (see Figure 9)
- Metal plate/strip to be penetrated by threaded rod
- Metal plate/strip to be made of steel or iron

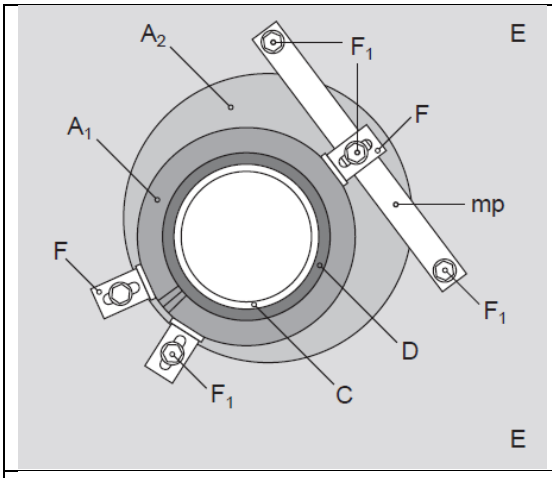
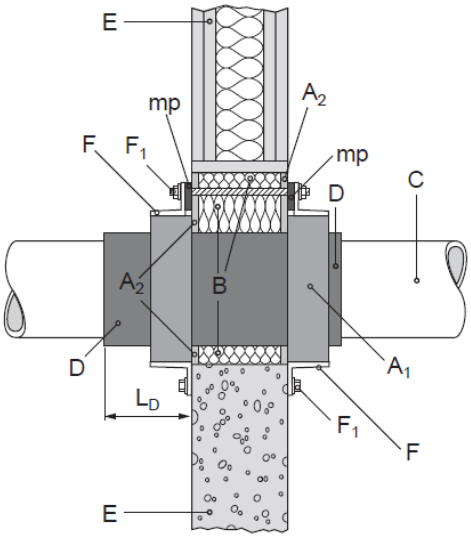
	Picture 8.2.4.6 A: CFS-C EL (A_1) fixing by using a metal plate/strip (mp), penetrated by threaded rod over a mineral wool backfilling in rigid/flexible wall
	Picture 8.2.4.6 B: CFS-C EL (A_1) fixing by using a metal plate/strip (mp), penetrated by threaded rod over a mineral wool backfilling in rigid/flexible wall

Figure 9: Collar fixing on mineral wool back filler

8.2.4.7 **Bended hooks in wet mortar**

- Hooks to be bended from 90° into a flat form (180°)
- Bended hooks to be fixed to the collar CFS-C EL
- pressed into the wet annular gap seal, made of cementious mortar
- applicable in rigid walls ($t_E \geq 100$ mm) and rigid floors ($t_E \geq 150$ mm)
- applicable for CFS-C EL in Design group 1 and 2
- usage of bended hooks will not impact given classification

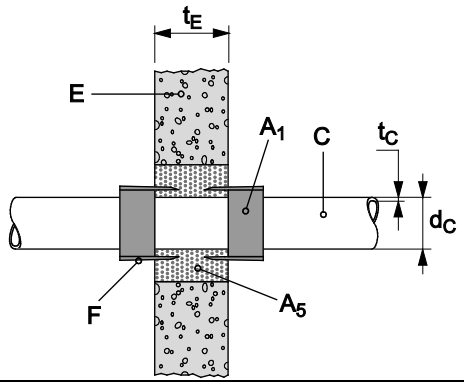
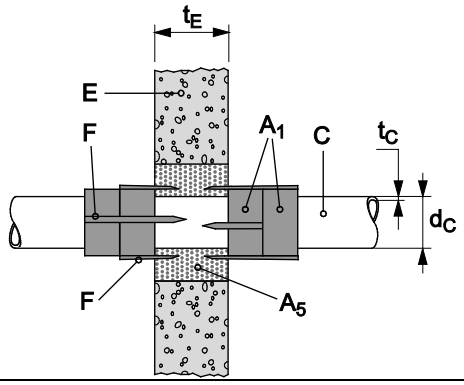
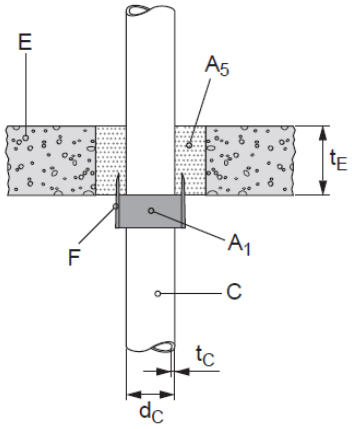
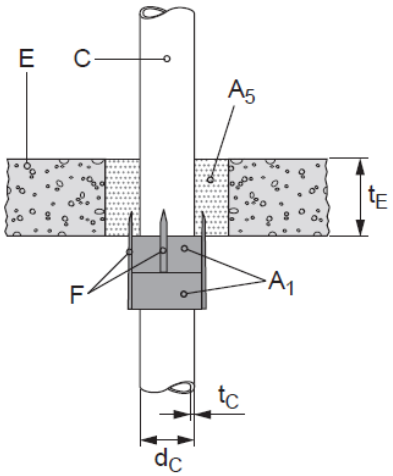
	Picture 8.2.4.7 A: CFS-C EL in rigid wall application with bended hooks in mortar annular gap seal (A_6) in Design Group 1
	Picture 8.2.4.7 B: CFS-C EL in rigid wall application with bended hooks in mortar annular gap seal (A_6) in Design Group 2
	Picture 8.2.4.7 C: CFS-C EL in rigid floor application with bended hooks in mortar annular gap seal (A_6) in Design Group 1
	Picture 8.2.4.7 D: CFS-C EL in rigid floor application with bended hooks in mortar annular gap seal (A_6) in Design Group 2

Figure 10: Collar fixing in mortar in rigid walls and floors with bended hooks

8.2.5 Required number of fixing hooks

Required number of hooks to fix Hilti Firestop Collar Endless CFS-C EL (A_1) to separating construction element. (For perpendicular penetration only)

Design Group	Type of hooks	Pipe outside diameter d_C (mm)	**Numbers of hooks in flexible walls, rigid walls and rigid floors**					
			Max. insulation thickness Acoustic or thermal insulation					
			0 (mm)	**4 mm**	**9 mm**	**13mm**	**19mm**	**25mm**
DG 1	**short**	16	n.a.	n.a.	2	2	n.a.	3
		32	2	2	2	2	n.a.	3
		40	2	2	2	3	n.a.	3
		50	2	2	2	n.a.	n.a.	n.a.
		56	3	3	3	n.a.	n.a.	n.a.
		63	3	3	3	n.a.	n.a.	n.a.
		75	3	3	3	n.a.	n.a.	n.a.
		90	3	3	3	n.a.	n.a.	n.a.
		110	3	3	3	n.a.	5	n.a.
		125	4	4	n.a.	n.a.	n.a.	n.a.
DG 2	**short + long**	125	2 + 4	2 + 4	2 + 4	n.a.	2 + 4	n.a.
		135	2 + 4	2 + 4	2 + 4	n.a.	2 + 4	n.a.
		140	2 + 4	2 + 4	2 + 4	n.a.	2 + 5	n.a.
		160	2 + 4	2 + 4	2 + 4	n.a.	2 + 5	n.a.

Table **3**: Number and type of hooks to be used for flexible walls, rigid walls and rigid floors

Design Group	Type of hooks	Pipe outside diameter d_C (mm)	**Number of hooks in timber walls and floor**	**Numbers of hooks in shaft walls**
			No acoustic / thermal pipe insulation	No acoustic / thermal pipe insulation
DG 1	**short**	16	n.a.	n.a.
		32	n.a.	2
		40	n.a.	2
		50	2	2
		56	**3**	**3**
		63	**3**	**3**
		75	**3**	**3**
		90	**3**	**3**
		110	**3**	**3**
DG 2	**short + long**	125	2 + 4	n.a.
		135	2 + 4	n.a.
		140	2 + 4	n.a.
		160	2 + 4	n.a.

Table **4**: Number and type of hooks for timber walls and floors, shaft walls

The number of hooks for special application may be increased, but not decreased.

Special installation situation (inclined pipes, pipe coupling, elbow pipes, etc.) require additional hooks to fix the collar. Refer to specific clauses.

8.2.6 Pipe support construction – first support

First pipe support:
- On both sides on the wall
- On upper side of floor only
- For minimum first pipe support distance see Table 5

Pipe Material + Standard	Pipe Design Group	Flexible wall / Rigid wall	Shaft wall	Wooden Wall (BBS)*	Rigid Floor	Wooden Floor (BBS)*
PE EN 1519-1	DG 1	400mm	250mm	450mm	400mm	450mm
	DG 2	400mm	n.a.	450mm	400mm	450mm
PE EN ISO 15494	DG 1	400mm	250mm	n.a.	400mm	n.a.
	DG 2	400mm	n.a.	n.a.	400mm	n.a.
PE Geberit Silent dB20	DG 1	400mm	250mm	450mm	400mm	450mm
	DG 2	400mm	n.a.	450mm	400mm	450mm
ABS, SAN-PVC EN 1455	DG 1	400mm	250mm	450mm	400mm	450mm
	DG 2	250mm	n.a.	450mm	400mm	450mm
PVC EN 1452-2	DG 1	400mm	250mm	450mm	400mm	450mm
	DG 2	400mm	n.a.	450mm	250mm	450mm
PVC Friatec Friaphon	DG 1	400mm	n.a.	n.a.	400mm	n.a.
	DG 2	400mm	n.a.	n.a.	400mm	n.a.
PP EN 1451-1	DG 1	400mm	250mm	450mm	400mm	450mm
	DG 2	400mm	n.a.	450mm	400mm	450mm
PP Non-regulated	DG 1	400mm	250mm	450mm	400mm	450mm
	DG 2	400mm	n.a.	450mm	400mm	450mm

Table 5: First support depending from support construction

*valid for BBS wood support construction. For other brands see 8.9.1.5 and 8.9.2.5

8.2.7 Sound decoupling insulation

Plastic pipes can be with or without sound decoupling insulation.
Assessed material:
- Foamed polyethylene based sound decoupling insulation, thickness (4 mm - 9 mm)
- Thermaflex, ThermoVließ B2 (Polyesther), thickness 4 mm

Acoustic Pipe Insulation penetrates the wall/floor element and the Hilti Firestop Collar Endless CFS-C EL.
Sound decoupling insulation can be used in LS and CS situation.

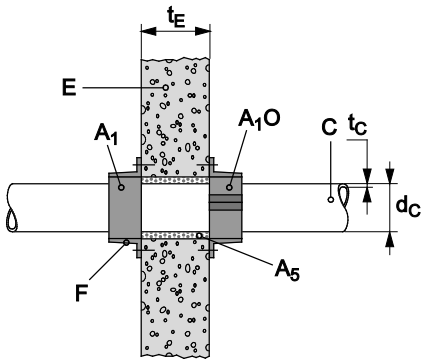
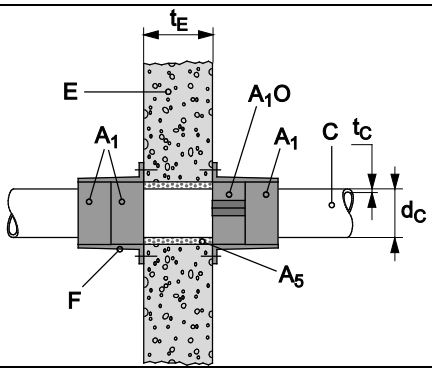
8.2.8 Utilization of small intumescent sections (oddments)

8.2.8.1 Preconditions for use of oddments

- To be used only in designated support construction only (see Table 6)
- Collars with oddments to be used in single pipe penetration only
- Collars with oddments to be used in perpendicular pipe penetration only
- Minimum length of oddments to be used: 120 mm
- Maximum one oddment per collar to be used
- Maximum one oddment per pipe seal to be used
- Consider of position of modified CFS-C EL-collar - CFS-C EL with oddment (A_1O) always in direct wall or floor contact (see Figure 11)
- Consider adjusted number of hooks for modified collars with oddment - Table 7
- Oddments will not impact the classification given for non-modified collars

	Flexible wall + rigid wall ($t_E \geq 100$mm)	Shaft wall + timber wall	Rigid floor ($t_E \geq 150$mm)	Timber floor
Oddments allowed	Yes	No	Yes	No

Table **6**: Possible use of oddments depending on support construction

	Picture 8.2.8 A: Collar CFS-C EL with oddment (A_1O) installed as pipe seal in rigid wall in Design Group 1
	Picture 8.2.8 B: Collar CFS-C EL with oddment (A_1O) installed as pipe seal in rigid wall in Design Group 2.

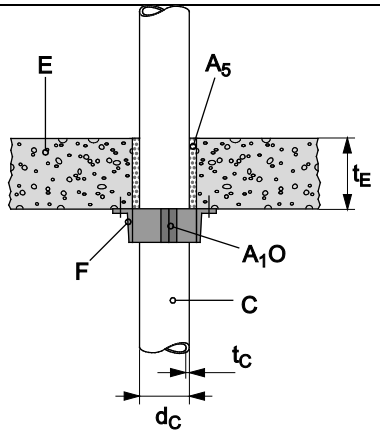
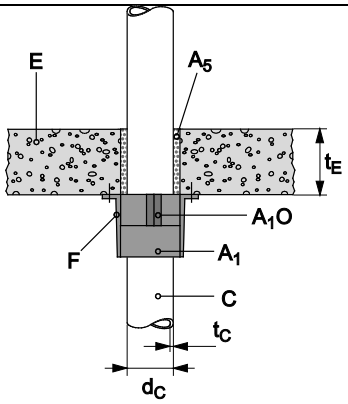
	Picture 8.2.8 C: Collar CFS-C EL with oddment (A_1O) installed as pipe seal in rigid floor in Design Group 1
	Picture 8.2.8 D: Collar CFS-C EL with oddment (A_1O) installed as pipe seal in rigid floor in Design Group 2

Figure 11: Position of CFS-C EL with oddment (A_1O) in wall and floor application

8.2.8.2 **Oddment preparation and usage**

- Oddment together with an additional collar-strip section must fulfil recommended bandage length, see ANNEX 5: INSTRUCTION FOR USE.
- Oddment and the additional section must be equipped identically with the closure plates.
- Oddment and additional section to be sticked together, than wrapped around the pipe, closed, equipped with necessary hooks (see Table 7) and fixed to support construction.

Minimal number of hooks used to fix a modified collar in Design group 1 to flexible/rigid walls:	4
Minimal number of hooks used to fix a modified collar in Design group 2 to flexible/rigid walls:	6
Minimal number of hooks used to fix a modified collar in Design group 1 to rigid floors:	4
Minimal number of hooks used to fix a modified collar in Design group 2 to rigid floors:	6

Table **7**: Number of hooks required for fixing modified collars (A_1O)

8.2.9 Pipe orientation

For all assessed supporting constructions and all assessed applications:

- Perpendicular pipe installation

For pipes in Design group 1 in rigid wall / flexible wall ($t_E \geq 100$mm) and rigid floor ($t_E \geq 150$mm) only:

- Perpendicular pipe installation and
- Inclined installation between 45 ° and 90°, see Figure 11

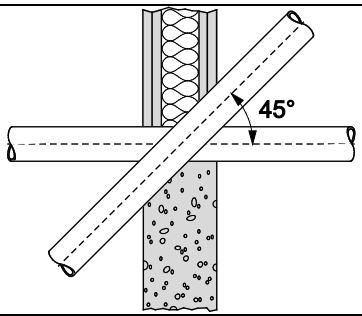
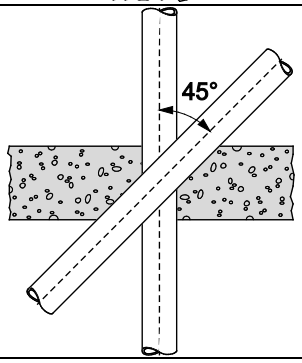
	Pict. 8.2.9 A: Inclined pipe, penetrating a rigid or flexible wall ($t_E \geq 100$mm)
	Pict. 8.2.9 B: Inclined pipe, penetrating a rigid floor ($t_E \geq 100$mm)

Figure 12: Inclined pipes in Design group 1, penetrating rigid walls / flexible walls and rigid floors

8.2.10 Distance between penetrations

8.2.10.1 Distance collar to collar

For flexible walls / rigid walls, rigid floors and shaft walls (always linear arrangement of single penetration):

	Flexible and Rigid wall	Rigid wall	Rigid floor	Shaft Wall
Thickness of support construction	$t_E \geq 100$ mm	$t_E \geq 150$ mm	$t_E \geq 150$ mm	All thicknesses
Design Group 1	($s_1 \geq 0$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 0$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 0$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.
Design Group 2	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 0$ mm) Max. number of pipes in line: 2 Distance between two pipe clusters: ($s_2 \geq 60$ mm)	($s_1 \geq 0$ mm) Max. number of pipes in line: unlimited.	Not relevant, application not covered

Table **8**: Distance collar to collar in flexible / rigid walls, rigid floors and shaft walls

For timber walls and floors:

	Timber walls			Timber floors	
Thickness of support construction	$t_E \geq 80$ mm	$t_E \geq 100$ mm	$t_E \geq 80$ mm	$t_E \geq 100$ mm	$t_E \geq 140$ mm
Design Group 1	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 50$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 50$ mm) Max. number of pipes in line: unlimited.
Design Group 2	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 50$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 100$ mm) Max. number of pipes in line: unlimited.	($s_1 \geq 50$ mm) Max. number of pipes in line: unlimited.

Table **9**: Distance collar to collar in timber walls and floors

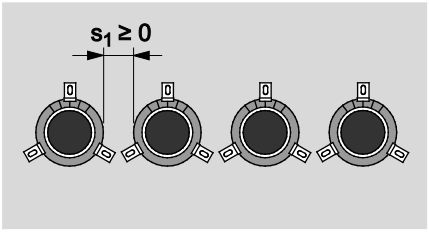
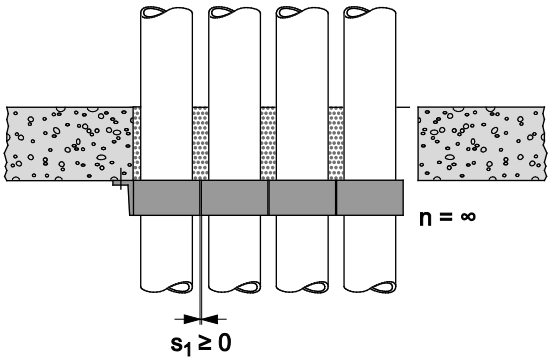
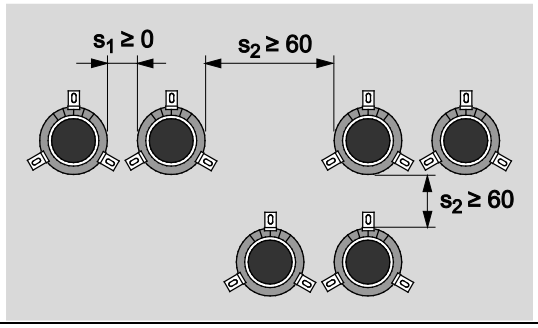
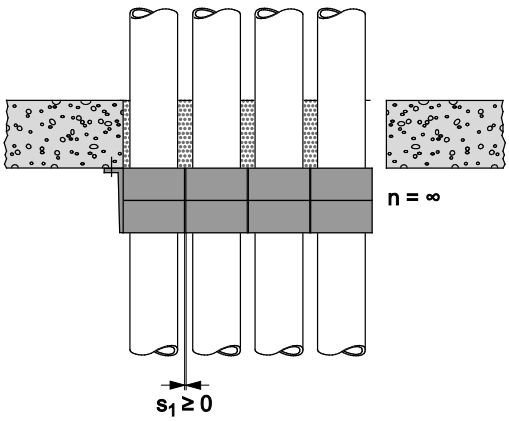
	Pict. 8.2.10.1 A: Distance collar to collar Collar CFS-C EL in Design Group 1 in rigid/flexible wall $t_E \geq 100$ mm
	Pict. 8.2.10.1 B: Distance collar to collar Collar CFS-C EL in Design Group 1 in rigid floor $t_E \geq 150$ mm
	Pict. 8.2.10.1 C: Distance collar to collar Collar CFS-C EL in Design Group 2 in rigid wall $t_E \geq 150$ mm
	Pict. 8.2.10.1 D: Distance collar to collar Collar CFS-C EL in Design Group 2 in rigid floor $t_E \geq 150$ mm

Figure 13: Distance collar to collar, depending from basement and Desing Group

8.2.10.2 Distance Hilti Firestop Collar Endless CFS-C EL to mineral wool-insulated metal pipes

CFS-C EL collar on any pipe in Design group 1 may be in direct contact to Conlit 150 and Rockwool 800 as a thermal insulation on metallic pipes. ($s_1 \geq 0$ mm).

Metal pipes:

- Material: refer to 8.2.11
- outside diameter ($d_M \leq 114{,}3$ mm)
- wall thickness of ($1{,}2$ mm $\leq t_M \leq 14{,}2$ mm).

Thermal insulation D_w:

- Conlit 150 inside the wall/floor only
- Rockwool 800, covering the metal pipe outside the wall/floor
- Both of reaction to fire class A1 or A2 in accordance with EN 13501-1.

For details see the specific classification clauses.

8.2.10.3 Distance Hilti Firestop Collar Endless CFS-C EL to mineral wool-insulated MLC-pipes

CFS-C EL collar on any pipe in Design group 1 may be used in direct contact to Mineral wool pipe insulation used as thermal insulation D_w on metallic pipes and aluminium composite pipes. ($s_1 \geq 0$ mm).

Thermal insulation D_w:

- Form: prefabricated pipe shells, coated with Al-foil
- Reaction to fire classification A1 or A2 in accordance with EN 13501-1
- Melting point: ≥ 1000°C
- Minimum density: ≥ 70kg/m³
- Insulation thickness t_D of $D_w \geq 20$ mm
- LS situation

For details see the specific classification clauses.

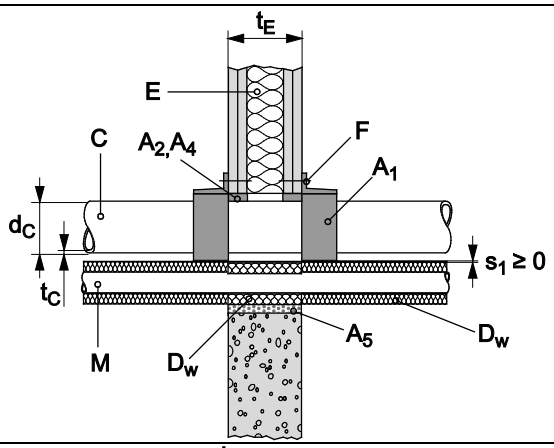
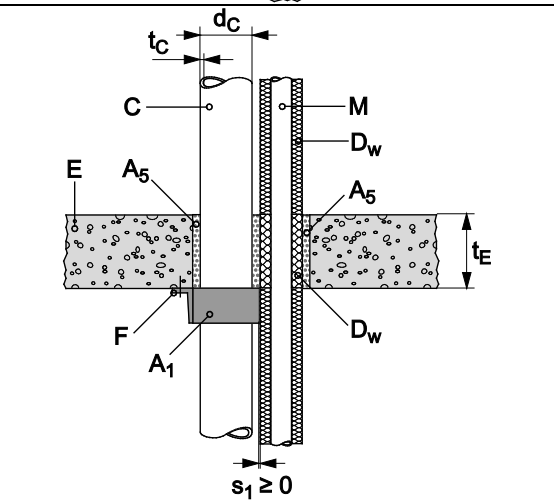
	Pict. 8.2.10.2 A: Collar CFS-C EL (A_1) in direct contact to mineral wool insulated (D_w) metal or MLC-pipes in flexible/rigid wall ($t_E \geq 100$mm)
	Pict. 8.2.10.2 B: Collar CFS-C EL (A_1) in direct contact to mineral wool insulated (D_w) metal or MLC-pipes in rigid floor ($t_E \geq 150$mm)

Figure 14: Distance Collar CFS-C EL to mineral wool-insulated metal pipes / MLC-pipes

8.2.10.4 Distance Hilti Firestop Collar Endless CFS-C EL to FEF-insulated metal pipes, MLC-pipes and PP-R pipes, sealed with CFS-B

Hilti Firestop Collar Endless CFS-C EL collar on any pipe in Design group 1 may be in direct contact ($s_1 \geq 0$ mm) to metal pipes, insulated with flexible elastomeric foam (FEF) and sealed with Hilti Firestop Bandage CFS-B.

Situation:

- Single plastic pipe penetration directly beside a penetrating insulated pipe (metal, MLB or PP-R pipe)

Metal pipes, MLC-pipes, PP-R pipes:

- For material and dimensions: see specific classification clauses

Elastomeric foamed thermal insulation D_E:

- Made of a material described in 8.2.12
- D_E thickness and length: see specific classification clauses

In wall application with FEF-insulated metal pipes (flexible wall and rigid wall $t_E \geq 100$ mm) an additional protection insulation D_P might be necessary on top of installed FEF insulation hose and bandage CFS-B.
In floor application ($t_E \geq 150$ mm) there is no need for an additional protection insulation D_P.

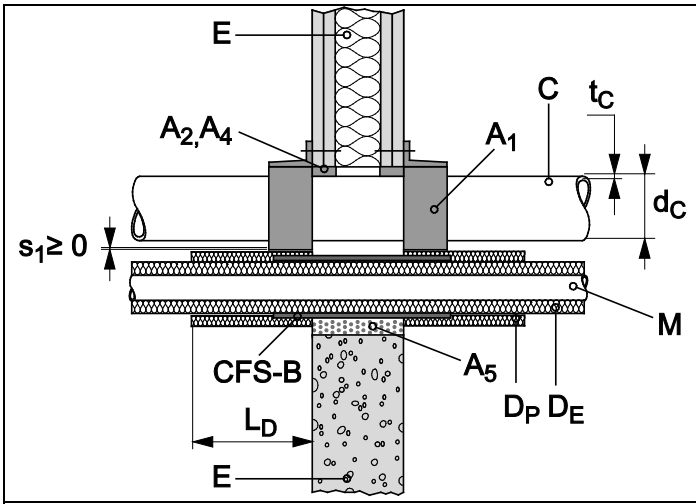
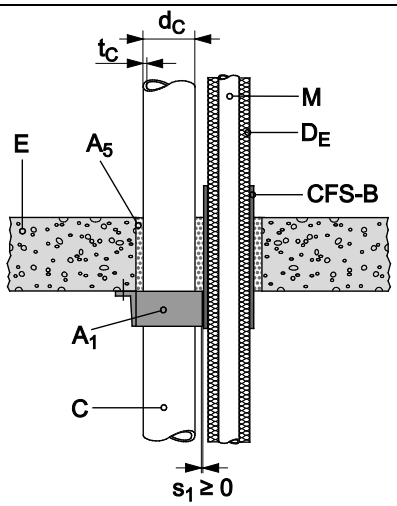
	Pict. 8.2.10.4 A: Distance s_1 between collar CFS-C EL (A_1) and FEF-insulated pipe (M), sealed with Bandage CFS-B and protection insulation D_P in wall application.
	Pict. 8.2.10.4 B: Distance s_1 between collar CFS-C EL (A_1) and FEF-insulated pipe (M), sealed with Bandage CFS-B in floor application.

Figure 15: Zero distance CFS-C EL to CFS-B

8.2.11 Metal pipes

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.

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

8.2.12 Elastomeric combustible insulation

The following types of foamed elastomeric insulation (FEF) material may be used in direct contact ($s_1 \geq 0$ mm) to Hilti Firestop Collar Endless CFS-C EL:

Producer / Seller	Assessed type of foamed elastomeric thermal isolation
Armacell GmbH	Armaflex - Type: AF, SH, Ultima, HT, XG, NH, EVO
NMC Group	Insul-Tube H-Plus (nmc)
Kaimann GmbH	Kaiflex KK plus, Kaiflex KK, HF plus, EPDM plus
L'Isolante K-Flex	l'Isolante K-Flex - Type: ECO, ST Frigo
CONEL GmbH	Conel Flex HT
Union Foam AG	Eurobatex
A.Würth GmbH & Co.KG	Flexen Kälteschlauch
3i Intern. Innovative Industries S.A.	Isopipe HAT
Aeroflex	HF
Isidem / Yalitim	Coolflex AF
ODE	R-flex RPM

Table **10**: Possible foamed elastomeric insulation to be used in direct contact to CFS-C EL

Named material may be used in form of an insulation hose, bandage/wrap or plates. If a protect insulation D_P is used, it should be made of the same elastomeric material as the thermal pipe isolation itself.

8.2.13 PE based foamed thermal pipe insulation

The following types of foamed polyethylene insulation material may be used in direct contact ($s_1 > 0$ mm) to Hilti Firestop Collar Endless CFS-C EL as thermal insulation:

Producer / Seller	Assessed types
Conel	Flex PE
Thermaflex	Thermocompact TF
nmc	Climaflex stabil Abfluss, Klimaflex PE-Schaum, Klimaflex stabil PE-Schaum,
Kaimann	Kaiflex PE-DWS Abwasserschlauch, Kaifoam PE-RO
Armacell GmbH	Tubolit Fonowave
Wieland	Wicuflex PE
Missel	Misselsystem Abwasser MSA
Frigotechnik	Frigoline MKM PE Dämmung, Frigoline Thermocompact

Table **11**: Possible foamed polyethylene insulation to be used in contact with CFS-C EL

8.2.14 Hilti Firestop Double Board Seal

Hilti Firestop Collar Endless CFS-C EL may be used to seal plastic pipes penetrating flexible boards installed in flexible wall and rigid wall ($t_E \geq 100$ mm) and floor ($t_E \geq 150$ mm). The flexible boards are covered within the ETA-11/0429 - Hilti Firestop Double Board Seal.

The following types of boards are allowed:

- Hilti Firestop Board CFS-CT B 1S (see 7.2.6)
- Hilti Firestop Board CFS-CT B 2S (see 7.2.6)
- Hilti Firestop Board High Density CFS-CT HDB (see 7.2.6)
- Hilti Firestop Coating CFS-CT applied on uncoated mineral wool boards (see 7.2.6)

Only pipes of Design group 1 (see 8.2.2) may be used in combination with Hilti Firestop Double Board Seal.

Gap seal:
- Between pipe and board with Hilti Firestop Acrylic Sealant CFS-S ACR
- Between pipe and basement with Hilti Firestop Acrylic Sealant CFS-S ACR
- Distance pipe to seal edge / aperture framing (s_3 ≥ 0 mm)

Board seal to be installed:
- in flexible walls / rigid walls (t_E ≥ 100 mm)
- in rigid floors (t_E ≥ 150 mm)
- no installation in shaft walls or in timber constructions assessed

Double board seal to be installed:
- flush to both surfaces of supporting construction in walls and floors
- if the floor is thicker than 100 mm the space between both boards has to be filled with mineral wool according detailed description in ETA-11/0429 “Hilti Firestop Double Board Seal”

Distance between installed pipes (s_1):
- in rigid walls and flexible walls (s_1 ≥ 80 mm)
- in rigid floors (s_1 ≥ 100 mm)
- for details see specific classification clauses

For collar fixing refer to 8.2.4

Pipe grouping in rigid walls and flexible walls (t_E ≥ 100 mm):
- Pipes must be group in line, not in clusters
- An unlimited number of pipes group in line is assessed

Pipe grouping in rigid floors (t_E ≥ 150 mm):
- Pipes must be group in line, not in clusters
- An unlimited number of pipes group in line is assessed.

8.2.15 Non-regulated acoustic PP-pipes

The following types of mineral reinforced non-regulated PP-pipes are allowed in different configurations:

- Aliaxis Poland dBlue
- Coes Blue Power
- Coes PhoNo Fire
- Conel Drain Hausabflußrohr
- Geberit Silent PP
- Geberit Silent Pro
- GF Silenta Premium
- KE KELIT PhonEx AS
- Marley Silent
- Ostendorf Skolan db
- Ostendorf Skolan Safe
- Pipelife Master 3
- Pipelife Master 3 Plus
- Poloplast Polokal NG
- Poloplast Polokal 3S
- Poloplast Polokal XS
- Rehau Raupiano Plus
- Uponor S&W Decibel
- Valsir Silere
- Valsir Triplus
- Wavin AS
- Wavin AS +
- Wavin SiTech
- Wavin SiTech +

8.2.16 CPVC or C-PVC-pipes, not to be sealed with CFS-C EL

If Hilti CFS-C EL is intended to be used in combination with CPVC or C-PVC pipes please check before installation - besides the Resistance to Fire annex in this ETA - also the system compatibility via the Lubrizol FBC™ System Compatible Program.
Consider for testing not only the Hilti components in direct contact to those pipes, but all involved components of the proposed Hilti fire sealing system.
Only listed and Lubrizol FBC™-labelled construction products must be used together.
See: https://www.lubrizol.com/CPVC/FBC-System-Compatible-Program/System-Compatible-Product-Finder

8.3 Flexible walls

8.3.1 Specific characteritics for Flexible walls ($t_E \geq 100$ mm)

8.3.1.1 Flexible walls – wall construction

Requirements for wall constructions:
- minimum thickness t_E = 100 mm
- comprise timber or steel studs lined identically on both faces
- Lining to be done with minimum 2 layers of minimum 12,5 mm thick boards
- Higher number of board layers is accepted if the overall board layer thickness is equal or bigger than tested
- Higher board layer thickness is accepted, if the number of board layers is equal or bigger than tested
- Boards are according EN 520 type F or according to the specification of the tested and assessed flexible wall construction system according EN 13501-2
- With and without insulation class A1 or A2 (in accordance with EN 13501-1) in the cavity between stud and seal

For timber stud walls only:
- Minimum distance of 100 mm of the seal to any stud
- Minimum 100 mm insulation of class A1 or A2 (in accordance with EN 13501-1) has to remain in the cavity between stud and seal.

Nevertheless, the wall construction has to be set up according to requirements given in EN 1366-3:2009 or the construction itself has been classified according EN 13501-2.

An aperture framing inside the wall is not required.

8.3.1.2 Annular gap

Annular gaps around pipes in flexible walls should be filled with either
- Gypsum based mortar or Hilti Firestop Acrylic sealant CFS-S ACR
- Joint filler has to be installed from both sides of the flexible wall
- Minimum installation depth of ($t_{A2} \geq 25$ mm)
- Gap width: 0 – 15 mm
- Backfilling is not requested

8.3.1.3 Collar fixing

Hilti Firestop Collar Endless CFS-C EL (A_1) has to be fixed with hooks (F) on the wall. The requested number and type of hooks is shown in 8.2.4.

Hooks fixing in flexible walls is described in 8.2.4.1.

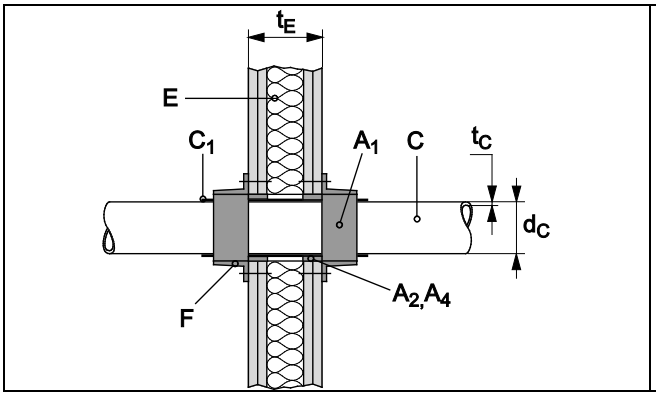
8.3.2 Penetrating services in 100 mm flexible wall

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

Construction details:
- Single pipe penetration

Insulation:
- No thermal insulation
- With and without acoustic pipe decoupling (refer to 8.2.7)

Pipe closure:
- Pipe seal with CFS-C EL in Design group 1 (refer to 8.2.2)
- Pipe fixing - refer to 8.2.4 and 8.2.5
- For first pipe support refer to 8.2.6



Pict. 8.3.2:

Plastic Pipe penetrating a flexible wall construction

Figure 16: Plastic pipe with annular gap seal, penetrating a flexible wall

8.3.2.1 PE pipes according to EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1

Classification shown in Figure 17 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer

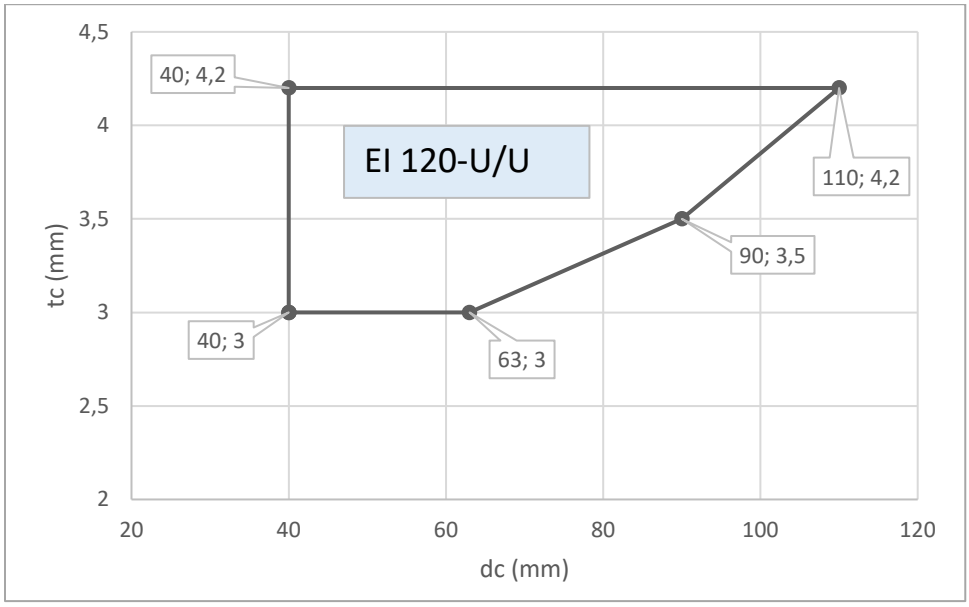


Figure 17: Classified pipe range for pipes made of PE, PE-X, ABS, SAN+PVC in DG 1 for EI120-U/U

8.3.2.2 ABS- pipes according to EN 1455-1 in DG 1

Classification shown in Figure 18 and Figure 19 is valid for pipes made from:

- ABS according EN 1455-1 and EN ISO 15493
- No limitation for brands/producer

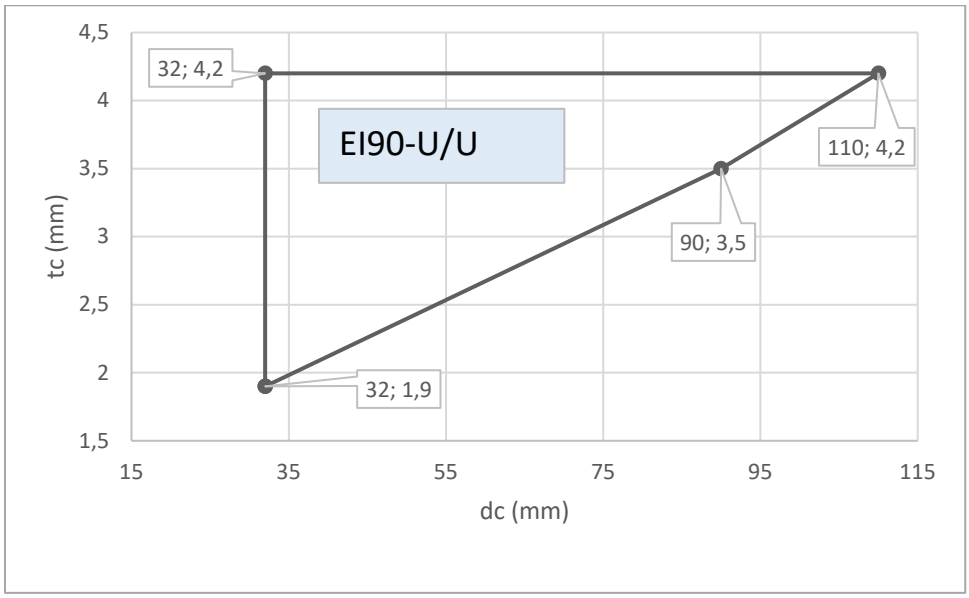


Figure 18: Classified pipe range for pipes made of ABS in DG 1 for EI 90-U/U

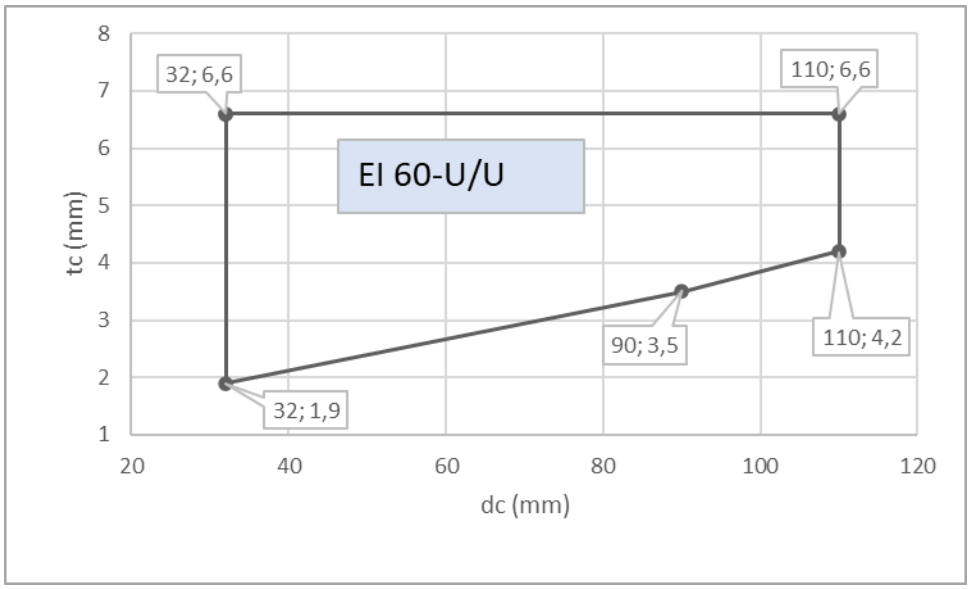


Figure 19: Classified pipe range for pipes made of ABS in DG 1 for EI60-U/U

8.3.2.3 PE-pipes according to EN ISO 15494 in DG 1

Classification shown in Figure 20, Figure 21, Figure 22 and Figure 23 is valid for pipes made from:

- PE according EN ISO 15494, EN 12201-2 and DIN 8074/75
- No limitation for brands/producer

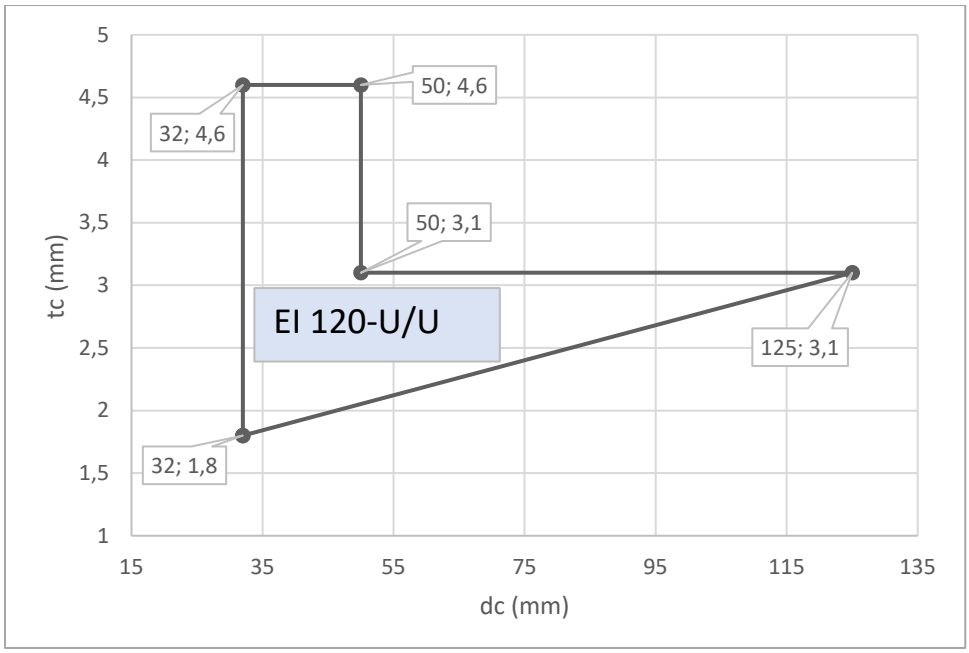


Figure 20: Classified pipe range for pipes made of PE in DG 1 for EI120-U/U

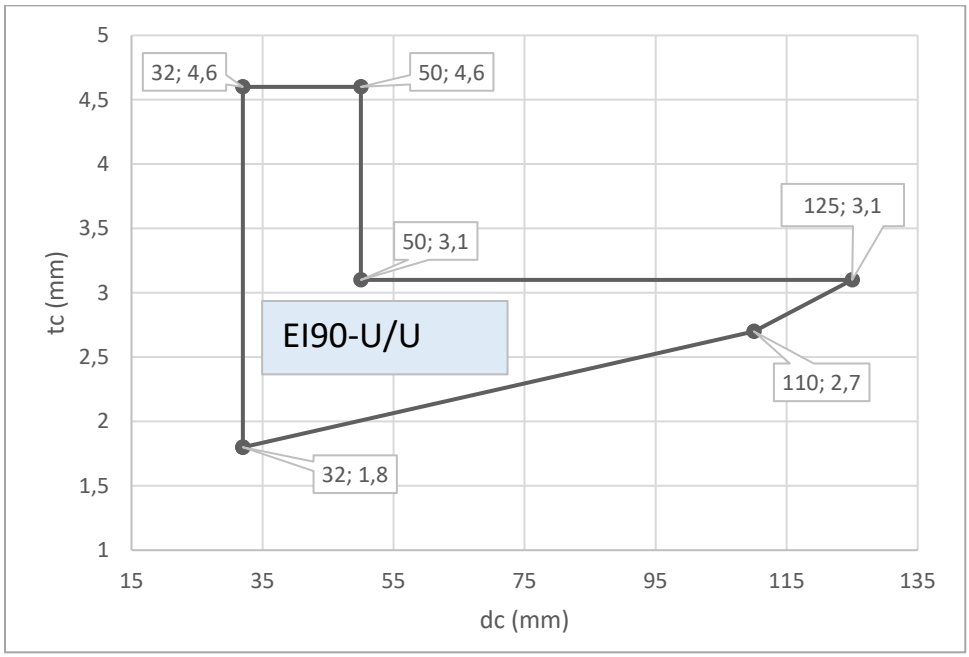


Figure 21: Classified pipe range for pipes made of PE in DG 1 for EI 90-U/U

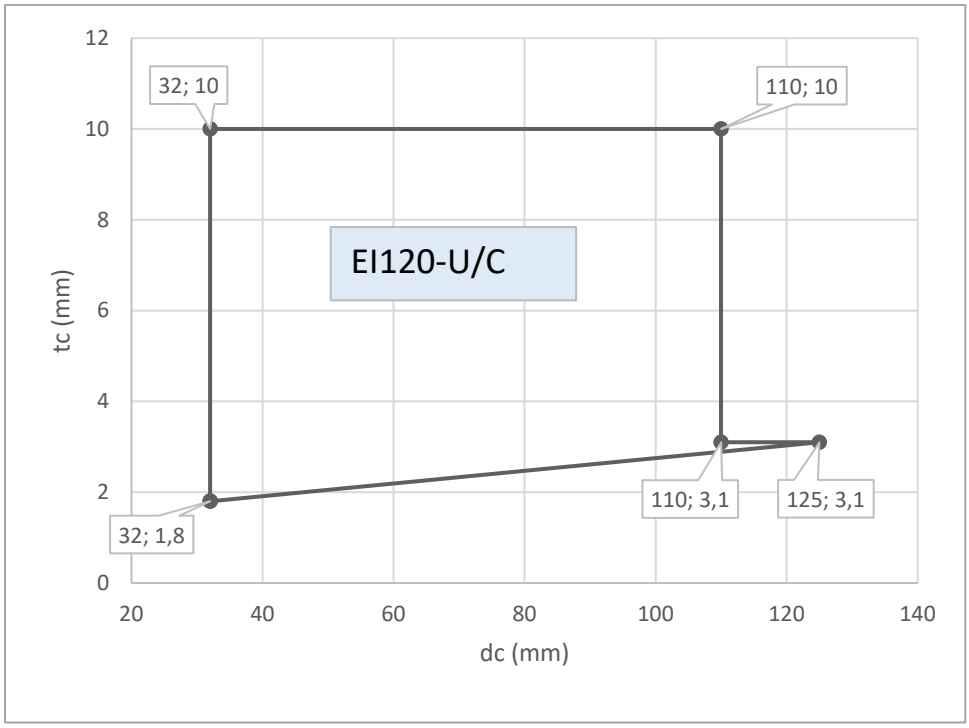


Figure 22: Classified pipe range for pipes made of PE in DG 1 for EI120-U/C

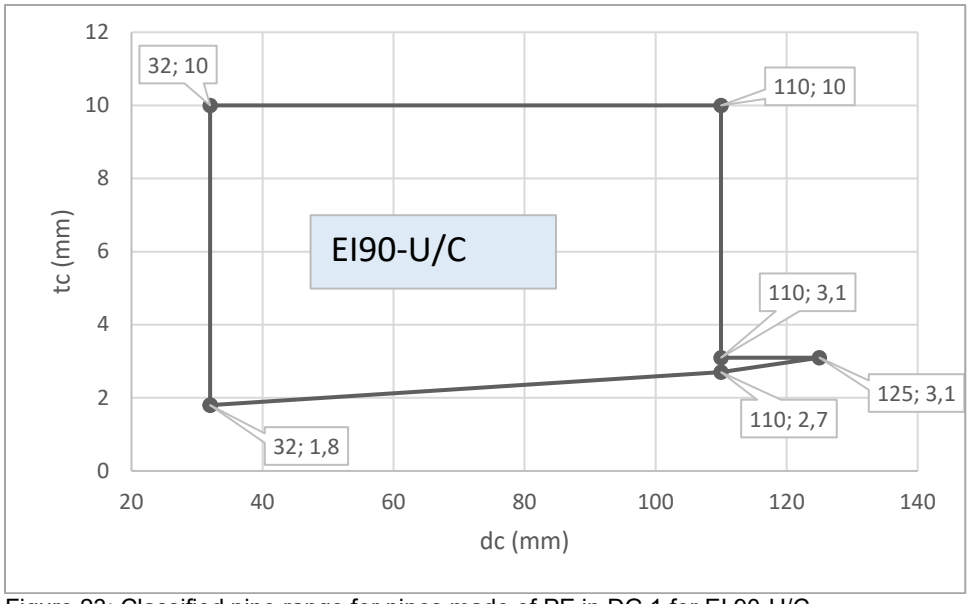


Figure 23: Classified pipe range for pipes made of PE in DG 1 for EI 90-U/C

8.3.2.4 PVC - pipes acc EN 1452-2 in DG 1

Classification shown in Figure 24 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Carefully consider disclaimer in 8.2.16

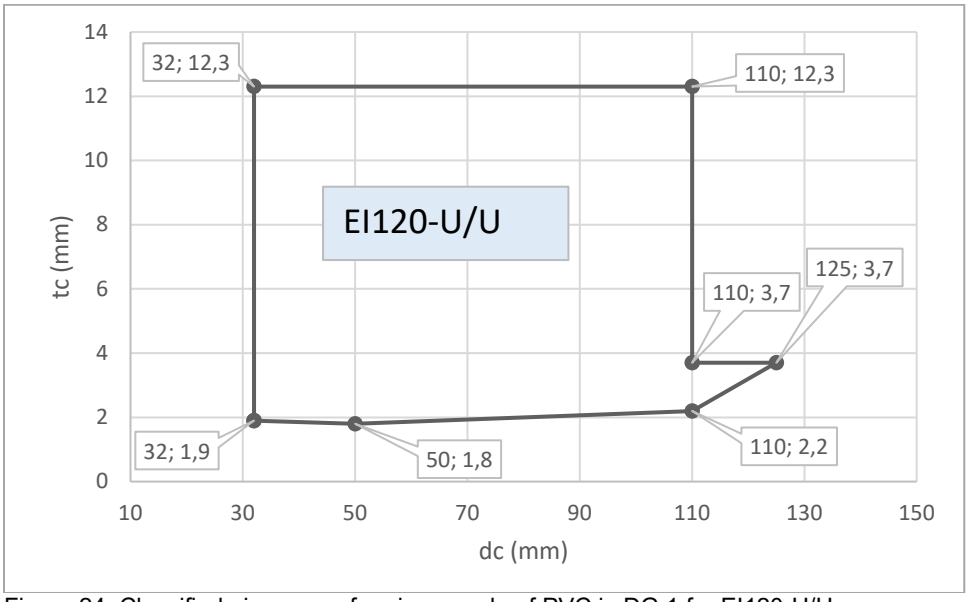


Figure 24: Classified pipe range for pipes made of PVC in DG 1 for EI120-U/U

8.3.2.5 PP-pipes, non-regulated in DG 1

Classification shown in Figure 25 is valid for pipes made from:

- For assessed brands/producers refer to 8.2.15.

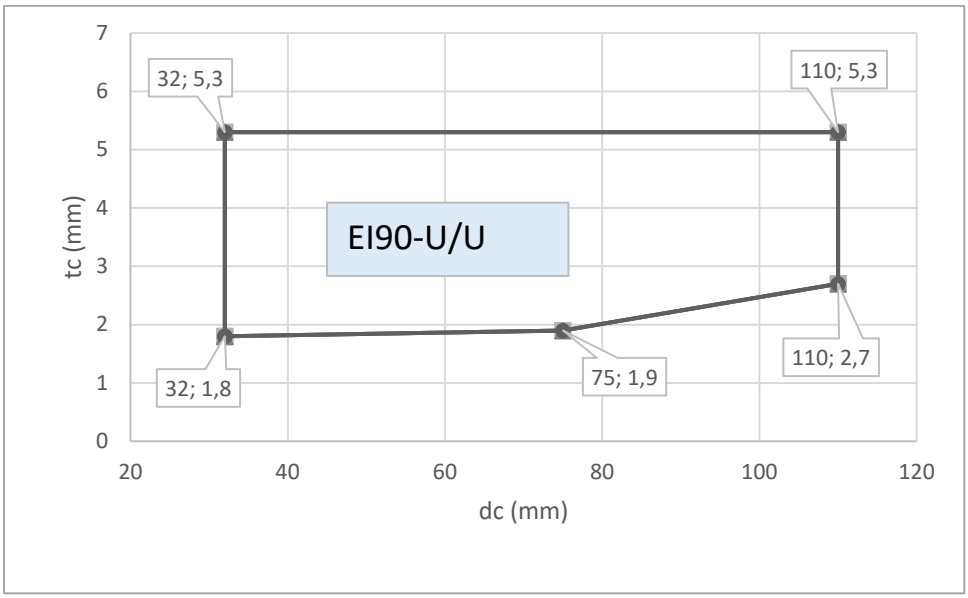


Figure 25: Classified pipe range for pipes made of PP f in DG 1 or EI 90-U/U

8.3.2.6 PP-pipes according to EN 1451-1 in DG 1

Classification shown in Figure 26 and Figure 27 is valid for pipes made from:

- PP according to EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer

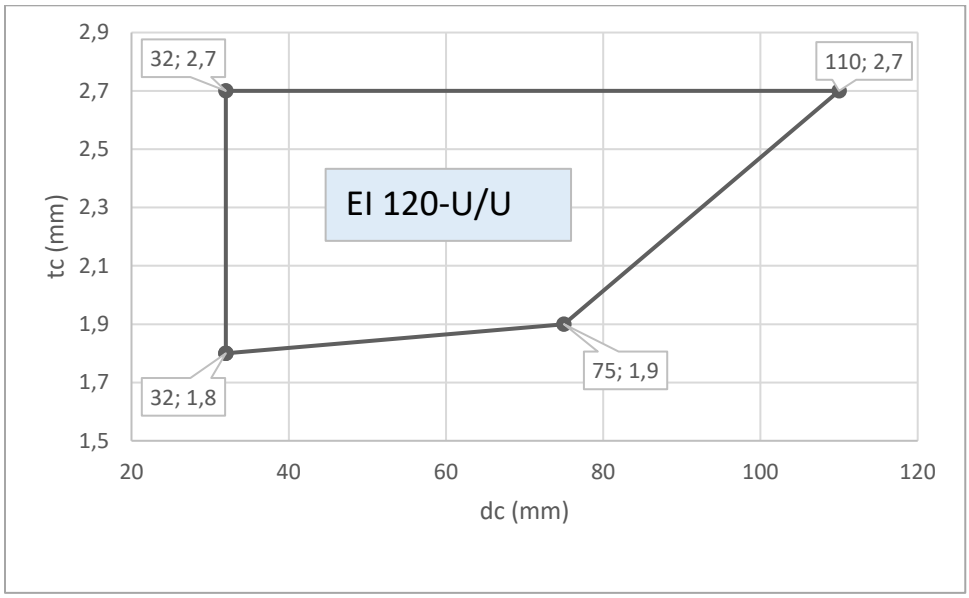


Figure 26: Classified pipe range for pipes made of PP in DG 1 for EI120-U/U

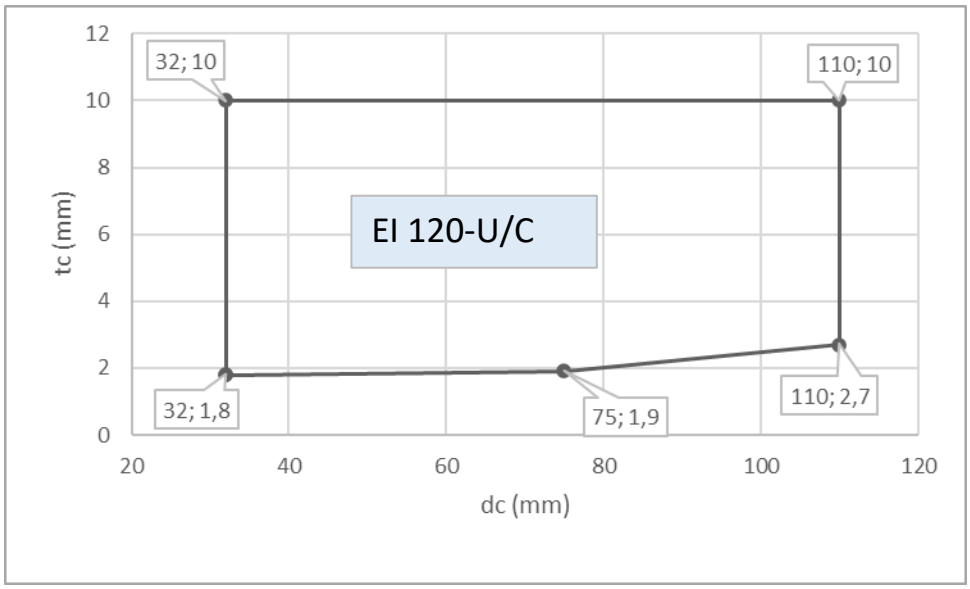


Figure 27: Classified pipe range for pipes made of PP in DG 1 for EI120-U/C

8.3.2.7 PE-pipes, non-regulated (Geberit Silent dB20) in DG 1

Classification shown in Figure 28 is valid for pipes made from:

- For Geberit Silent dB20 only

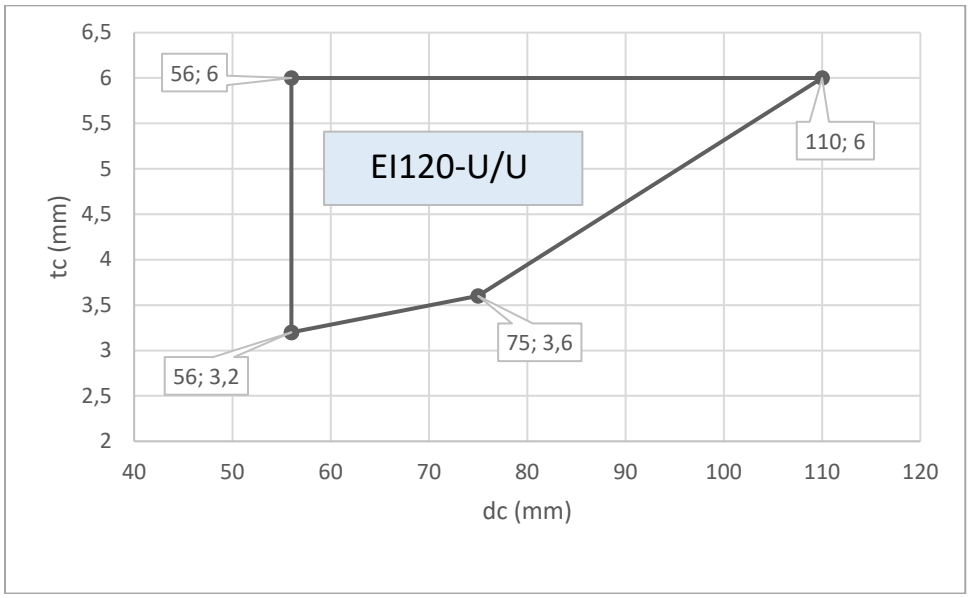


Figure 28: Classified pipe range for Geberit Silent dB20 pipes in DG 1 for EI120-U/U

8.3.2.8 PVC–pipes, non-regulated (Friatec Friaphon) in DG 1

Classification shown in Figure 29 is valid for pipes made from:

- For Friatec Friaphon only

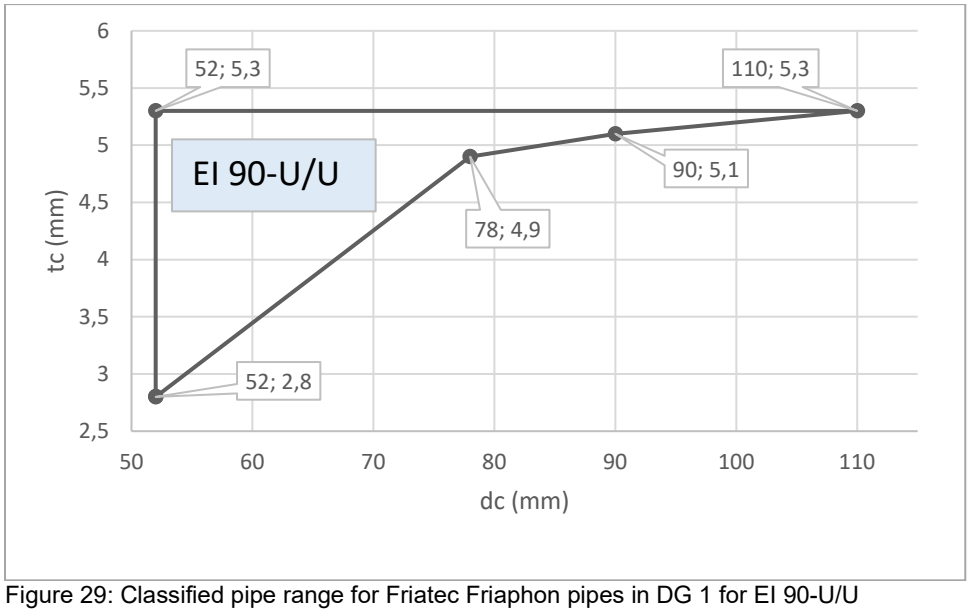


Figure 29: Classified pipe range for Friatec Friaphon pipes in DG 1 for EI 90-U/U

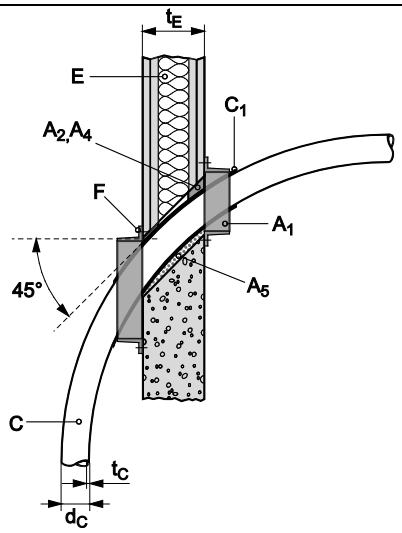
8.3.2.9 **Pneumatic dispatch system in DG 1**

Situation:
- Mixed seal
- One pipe together with max. three cables penetrating the floor
- Pipe inclination: (45° ≤ pipe inclination ≤ 90°)
- Direct contact pipe and cable
- Cable might be single or bunched

Pipes:
- PVC pipe according to DIN 6660
- Pipe diameter (d_c = 110 mm)
- Pipe wall thickness (t_C = 2,3 mm)
- Pipe inclination: (45° ≤ inclination ≤ 90°)

Cables:
- Max. 2 cables
- NYM-J 3x2,5 mm²
- J-Y (St) Y 6 x 2 x 0,6 mm²
-

Gap seal:
- For flexible wall (t_E ≥ 100 mm) see 8.3.1.2
- For rigid wall (t_E ≥ 100 mm) see 8.4.3.2



Pict. 8.3.2.9:

Pneumatic dispatch system, penetrating a flexible or rigid wall, sealed by CFS-C EL (A_1)

Figure 30: Pneumatic dispatch system, penetrating a flexible wall / rigid wall

Type of Penetrant	Classification
Pneumatic dispatch system, mixed seal, sealed with CFS-C EL in DG 1	EI 90 – U/U

Table **12**: Classification for pneumatic dispatch systems in wall

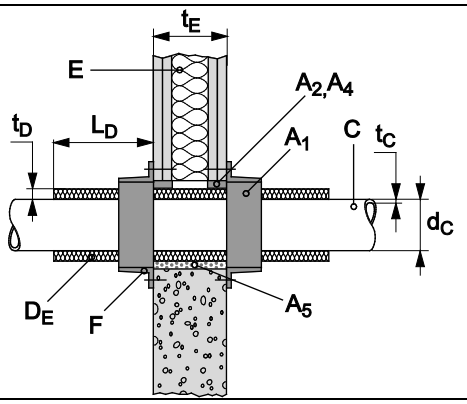
8.3.2.10 **PE-X pipes Rehau Rautitan flex**

Situation:
- Single pipe seal
- Perpendicular to wall

Pipes:
- PE-X acc. EN 15875
- Brand/Producer: Rehau Rautitan flex
- Pipe diameter (16 mm ≤ d_c ≤ 32 mm)
- Pipe wall thickness (2,2 mm ≤ t_C ≤ 4,4 mm)
- Pipe inclination: 90°

Insulation:
- FEF (flexible elastomeric insulation)
- For brand and producer refer to 8.2.12
- Thickness of D_E: (9 mm ≤ t_D ≤ 25 mm)
- LS and CS situation
- For LS situation: insulation length: (L_D ≥ 250 mm) on pipes on both sides of the wall

Gap seal:
- For flexible wall (t_E ≥ 100 mm) refer to 8.3.1.2
- For rigid wall (t_E ≥ 100 mm) refer to 8.4.3.2



Pict. 8.3.2.10:

Insulated PE-X pipes penetrating a wall

Figure 31: Insulated PE-X pipes penetrating a wall

Type of Penetrant	Classification
PE-X – pipes, insulated with FEF-insulation	EI 120 – U/C

Table **13**: Classification of insulated PE-X pipes in DG 1 in wall

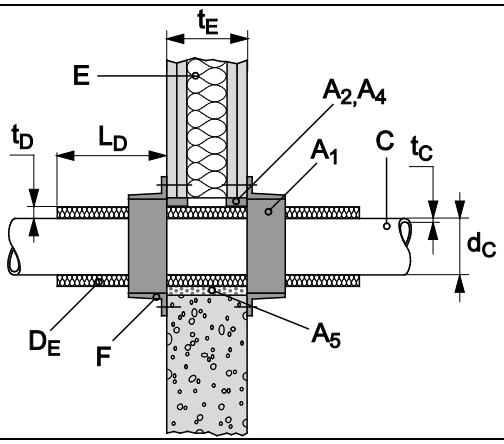
8.3.2.11 **PP-R pipe aquatherm green pipe**

Situation:
- Single pipe seal
- Perpendicular to wall

Pipes:
- PP-R acc. EN 15874
- Brand/Producer: Aquatherm fusiolen = aquatherm green pipe S
- Pipe diameter (16 mm ≤ d_c ≤ 32 mm)
- Pipe wall thickness (2,2 mm ≤ t_C ≤ 4,4 mm)
- Pipe inclination: 90°

Insulation:
- FEF (flexible elastomeric insulation)
- For brand and producer refer to 8.2.12
- Thickness of D_E: (9 mm ≤ t_D ≤ 25 mm)
- LS and CS situation
- For LS situation: insulation length: (L_D ≥ 250 mm) on pipes on both sides of the wall

Gap seal:
- For flexible wall (t_E ≥ 100 mm) refer to 8.3.1.2
- For rigid wall (t_E ≥ 100 mm) refer to 8.4.3.2



Pict. 8.3.2.11:

Insulated PP-R pipes penetrating a wall

Figure 32: Insulated PP-R pipes penetrating a wall

Type of Penetrant	Classification
PE-X – pipes, insulated with FEF-insulation	EI 120 – U/C

Table **14**: Classification of insulated PP-R pipes in DG 1 in walls

8.3.2.12 **PP pipes, non-regulated, Pipe coupling, EI 120-U/U**

Situation:
- Single penetration seal
- Perpendicular to wall
- Pipe coupling is within the wall or half in the wall
- Pipe coupling or pipe to be sealed with CFS-C EL from both sides of the wall
- On one side of the wall pipe runs nearly parallel to wall with zero distance ($s_3 \geq 0$mm)

Pipes:
- PP–pipes, non-regulated
- Brand/Producer: refer to section 8.2.15
- Pipe diameter and wall thickness refer to section 8.3.2.5

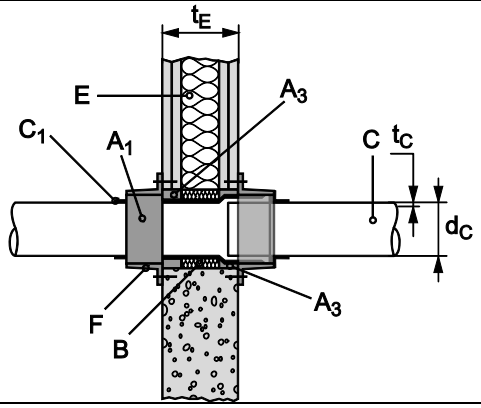
Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Gap filler: Hilti CFS-FIL
- Annular Gap width: 5 – 40 mm, depth ($t_{A3} \geq 25$ mm)
- In drywall no backfilling required
- In rigid wall backfilling with mineral wool, refer to section 7.2.4

Number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (incoming pipe / outgoing pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table **15**: Number of hooks to be used for coupling-sealing of non-regulated PP-pipes



Pict. 8.3.2.12:

Non-regulated PP-pipes with pipe coupling, Penetrating a wall

Figure 33: Non-regulated PP-pipes with pipe coupling, penetrating a wall

Type of Penetrant	Classification
Non-regulated PP-pipes with pipe coupling	EI 120 – U/U

Table **16**: Classification of pipe seal: coupling of non-regulated PP pipes in DG 1 in wall

8.3.2.13 **PP pipes, non-regulated, Elbow Pipes 87°**

Situation:
- Single penetration seal
- Perpendicular to wall
- Pipe elbow-connector 87° is within the wall or half inside the wall
- Elbow-connector or pipe to be sealed with CFS-C EL from both sides of the wall
- On one side of the wall pipe runs nearly parallel to wall with zero distance ($s_3 \geq 0$mm)

Pipes:
- PP–pipes, non-regulated
- Brand/Producer: refer to section 8.2.15
- Pipe diameter and wall thickness refer to section 8.3.2.5

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

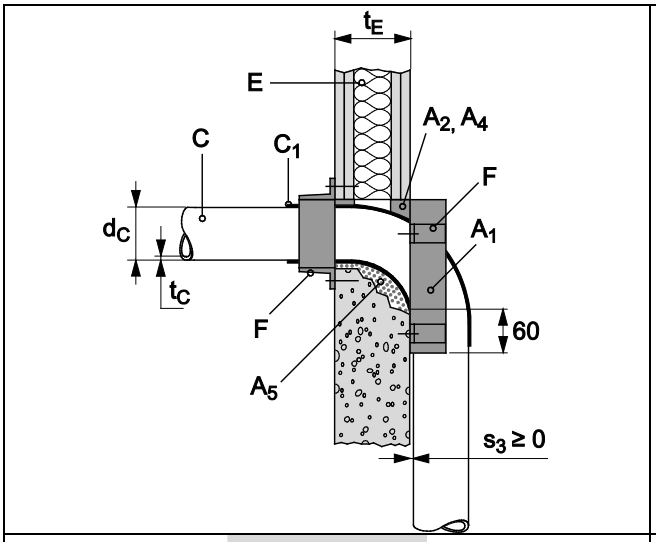
Gap closure in flexible wall:
- Gap filler: Hilti CFS-S ACR or gypsum
- Annular Gap width: 0 – 15 mm
- Depth: ($t_{A2} \geq 25$ mm)
- No backfilling required

Gap closure in rigid wall:
- Gap filler: cementious Mortar M10 acc. EN 998-2
- Annular gap width: 0 – 40mm
- Annular gap depth: entire wall thickness t_E

Number of hooks to be used:

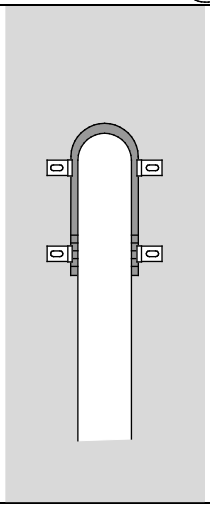
Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (incoming pipe / outgoing pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table **17**: Number of hooks to be used for 87° elbow-sealing of non-regulated PP-pipes



Pict. 8.3.2.13 A:

87° elbow-sealing of non-regulated PP-pipes in wall penetration (side view)



Pict. 8.3.2.13 B:

87° elbow-sealing of non-regulated PP-pipes in wall penetration (front view)

Figure 34: 87° elbow-sealing of non-regulated PP-pipes

Type of Penetrant	Classification
Non-regulated PP-pipes with 87° - elbow	EI 90 – U/U

Table **18**: Classification of pipe seal: 87° elbow for non-regulated PP pipes in DG 1 in wall

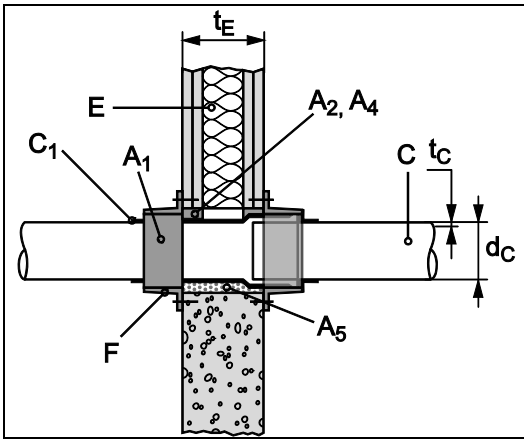
8.3.2.14 **PP pipes, non-regulated, Pipe coupling, EI 60-U/U**

Situation:
- Single penetration seal
- Perpendicular to wall
- Pipe coupling is within the wall or half in the wall
- Pipe coupling or pipe to be sealed with CFS-C EL from both sides of the wall
- On one side of the wall pipe runs nearly parallel to wall with zero distance ($s_3 \geq 0$mm)

Pipes:
- PP – pipes, non-regulated
- Brand/Producer: refer to section 8.2.15
- Pipe diameter and wall thickness refer to section 8.3.2.5

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict.8.3.2.14:

Pipe coupling in flexible or rigid wall, sealed with CFS-C EL (A_1)

Figure 35: Pipe coupling in flexible or rigid wall

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (incoming pipe / outgoing pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table **19**: Number of hooks to be used for coupling-sealing of non-regulated PP-pipes

Type of Penetrant	Classification
Non-regulated PP-pipes with coupling, sealed with CFS-S ACR and CFS-C EL	EI 60 – U/U

Table **20**: Classification for non-regulated PP – pipes in DG 1 with coupling

8.3.2.15 **PP-pipes, non-regulated, with elbow 2x45°**

Situation:
- Pipe elbow-connector 2x45° is below the floor or half in the floor
- Pipe elbow inside the wall, half in the wall or outside the wall, covered by CFS-C EL
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)

Pipes:
- PP – pipes, non-regulated
- Brand/Producer: refer to section 8.2.15
- Pipe diameter and wall thickness refer to section 8.3.2.5

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap seal:
- For flexible wall (tE ≥ 100 mm) refer to 8.3.1.2
- For rigid wall (tE ≥ 100 mm) refer to 8.4.3.2

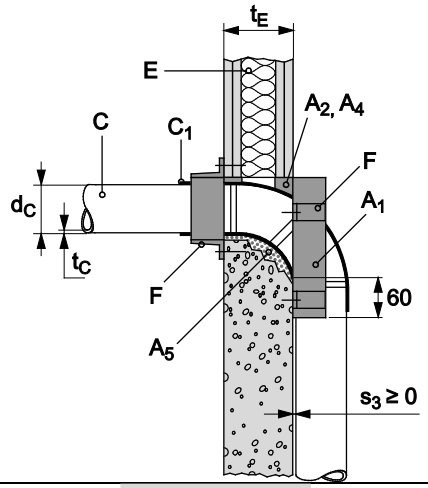
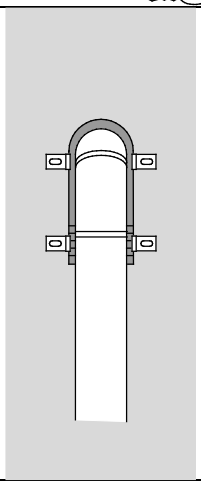
	Pict. 8.3.2.15 A: Non-regulated PP – pipes with 2x45° elbow, Sealed with CFS-C EL (A_1) Side view/sectional view
	Pict. 8.3.2.15 B: Non-regulated PP – pipes with 2x45° elbow, Sealed with CFS-C EL (A_1) Frontal view

Figure 36: Non-regulated PP-pipes with 2x45° elbow

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (incoming pipe / outgoing pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table **21**: Number of hooks to be used for 2x45° elbow-sealing of non-regulated PP-pipes

Type of Penetrant	Classification
Non-regulated PP-pipes with coupling, sealed with CFS-S ACR and CFS-C EL	EI 60 – U/U

Table **22**: Classification for non-regulated PP – pipes with 2x45° elbow in DG 1 in wall

8.3.2.16 **Inclined pipes in DG 1**

Situation:
- Single pipe seal
- Pipe inclination (45° – 90°)

Pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, .8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Excluded are pipes with outside nominal diameter d_C > 110 mm

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap seal:
- For flexible wall (t_E ≥ 100 mm) refer to 8.3.1.2
- For rigid wall (t_E ≥ 100 mm) refer to 8.4.3.2

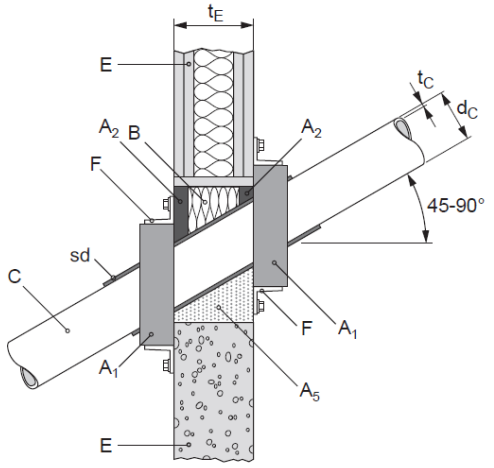
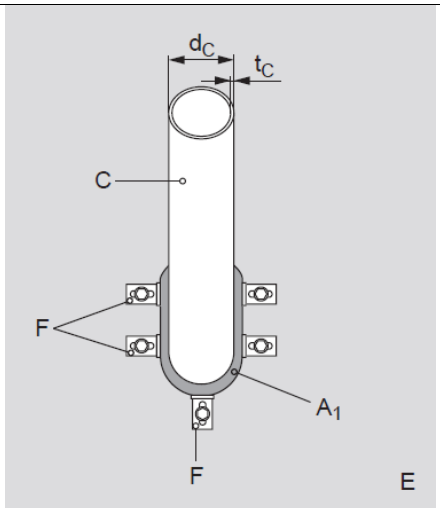
	Pict. 8.3.2.16.A: Inclined pipe Sectional view
	Pict. 8.3.2.16.B: Inclined pipe Front view

Figure 37: Inclined pipes, sealed with CFS-C EL

Number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (identical number of hooks on both sides of the wall)		
(mm)	0	4	9
32	3	3	3
50	3	3	3
75	3	4	4
90	4	4	5
110	5	6	5

Table **23**: Number of hooks to be used for inclined pipe sealing in DG 1

Type of Penetrant	Classification
Inclined plastic pipes in DG 1, sealed with CFS-C EL	EI 90 – U/U

Table **24**: Classification for non-regulated PP-pipes with 2x45° elbow in DG 1 in wall

8.3.2.17 **Zero distance CFS-C EL to mineral wool insulated pipes**

8.3.2.17.1 Zero distance CFS-C EL to mineral wool insulation on small to medium-size metal pipes

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to mineral wool insulation on metal pipes

Plastic pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter $d_C > 110$ mm

Metal pipes:
- Pipe diameter ($d_M \leq$ of 89 mm),
- Pipe wall thickness of (1,2 mm $\leq t_M \leq$ 14,2 mm)
- C/U pipe end configuration
- Covered material types: copper and others – refer to 8.2.11

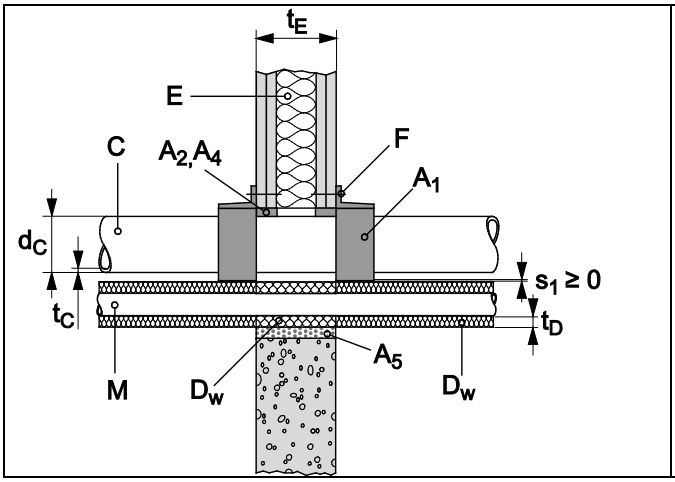
Insulation:
- Used type of insulation: refer to 8.2.10.2

For Pipes diameter ($d_M \leq 42$ mm):
- Insulation thickness ($t_D \geq 19$ mm) within the flexible wall ($t_E = L_D$)
- Insulation thickness ($t_D \geq 20$ mm) on metal pipes on both sides of the wall
- Insulation length $L_D \geq$ 1000mm on both sides of the wall
- LS or CS situation

Or

For Pipes diameter (42 mm $\leq d_M \leq$ 89 mm):
- Insulation thickness ($t_D \geq 19$ mm) within the flexible wall ($t_E = L_D$)
- Insulation thickness ($t_D \geq 30$ mm) on metal pipes on both sides of the wall
- Insulation length $L_D \geq$1000mm on both sides of the wall
- LS or CS situation

Gap seal:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict. 8.3.2.17 A:

Plastic pipe C, sealed with CFS-C EL (A_1) in direct contact ($s_1 \geq 0$ mm) to insulated metal pipe M

Figure 38: Plastic pipe, sealed with CFS-C EL in direct contact to insulated metal pipe

Type of Penetrant	Classification
plastic pipes in DG 1, in direct contact to insulated metal pipe	EI 90 – U/U

Table **25**: Classificationfor plastic pipes, sealed with CFS-C EL in DG 1 in direct contact to insulated metal pipe

8.3.2.17.2 Zero distance CFS-C EL to mineral wool insulation on small to big metal pipes

Situation:
- Collar CFS-C EL on plastic pipe in direct contact (s_1 ≥ 0 mm) to mineral wool insulation on metal pipes

Plastic pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter d_C > 110 mm

Metal pipes:
- Pipe diameter (d_M ≤ of 114,3 mm),
- Pipe wall thickness of (1,2 mm ≤ t_M ≤ 14,2 mm)
- C/U pipe end configuration
- Covered material types: Fe / steel and others – refer to 8.2.11

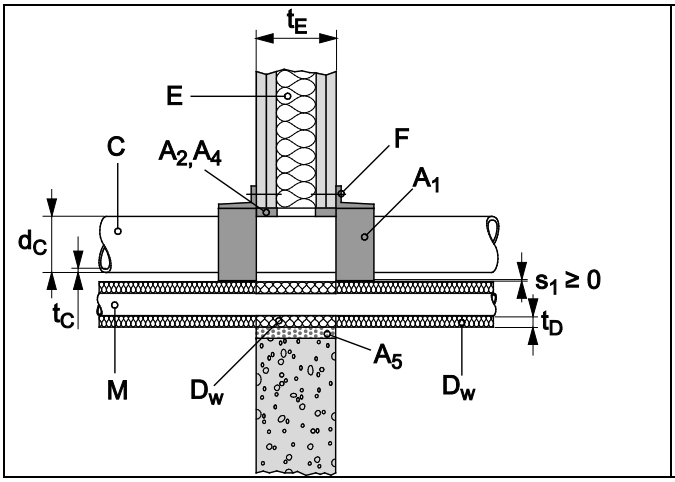
Insulation:
- Used type of insulation: refer to 8.2.10.2

For Pipes diameter (d_M ≤ 42 mm):
- Insulation thickness (t_D ≥ 19 mm) within the flexible wall (t_E = L_D)
- Insulation thickness (t_D ≥ 20 mm) on metal pipes on both sides of the wall
- Insulation length L_D ≥1000mm on both sides of the wall
- LS or CS situation

Or

Pipes diameter (42 mm ≤ d_M ≤ 114,3 mm):
- Insulation thickness (t_D ≥ 30 mm) within the flexible wall (t_E = L_D)
- Insulation thickness (t_D ≥ 30 mm) on metal pipes on both sides of the wall
- Insulation length L_D ≥1000mm on both sides of the wall
- LS or CS situation

Gap seal:
- For flexible wall (t_E ≥ 100 mm) refer to 8.3.1.2
- For rigid wall (t_E ≥ 100 mm) refer to 8.4.3.2



Pict. 8.3.2.17 B:

Plastic pipe C, sealed with CFS-C EL (A_1) in direct contact ($s_1 \geq 0$ mm) to insulated metal pipe M

Figure 39: Plastic pipe, sealed with CFS-C EL in direct contact to insulated metal pipe

Type of Penetrant	Classification
plastic pipes in DG 1, in direct contact to insulated metal pipe	EI 90 – U/U

Table **26**: Classification for plastic pipes, sealed with CFS-C EL in DG 1 in direct contact to insulated metal pipe

8.3.2.17.3 Zero distance CFS-C EL to mineral wool insulation on Aluminum composite pipe

Classification is valid for:

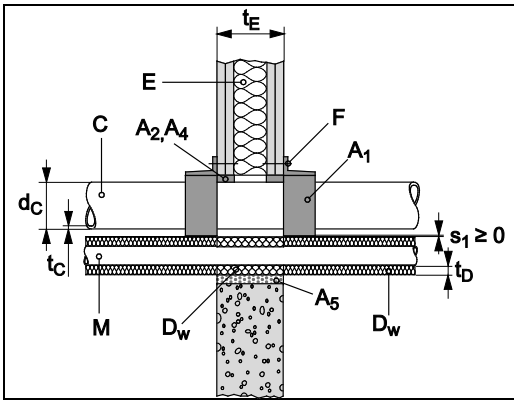
Situation:
- Collar CFS-C EL on plastic pipe in direct contact (s_1 ≥ 0 mm) to mineral wool insulation on aluminum composite pipes (MLC-pipes)

Plastic pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter d_C > 110 mm

Aluminum composite pipes:
- For Pipe diameter and wall thickness: refer to Table 27
- U/C pipe end configuration

Insulation:
- Used type of insulation: refer to 8.2.10.2
- For insulation thickness: refer to Table 27
- Insulation length L_D ≥1000mm identical on both sides of the wall
- LS or CS situation

Gap seal:
- For flexible wall (t_E ≥ 100 mm) refer to 8.3.1.2
- For rigid wall (t_E ≥ 100 mm) refer to 8.4.3.2



Pict. 8.3.2.17 C:

Plastic pipe C, sealed with CFS-.C EL (A_1) in zero distance (s_1 ≥ 0mm) to insulated MLC-pipe (M)

Figure 40: Plastic pipe, sealed with CFS-.C EL in zero distance to insulated MLC-pipes

Pipe producer / pipe brand / material	Pipe diameter (mm)	Wall thickness (mm)	Mineral wool Insulation Thickness (mm)
Geberit Mepla material: PE-Xb/Al/PE-Xb	16 - 63	2,25 - 4,5	20 - 60
Kekelit Kelox material: PE-RT/Al/PE-RT	16 - 63	2,0 - 6,0	20 - 60
Rehau Rautitan Flex material: PE-Xa – standard: EN 151875	16 - 63	2,2 – 8,6	20 - 60
TECEflex Verbundrohr material: PE-Xc/Al/PE	16 - 63	2,75 – 6,0	20 - 60
Uponor Unipipe MLC material: PE-RT/Al/PE-RT	16 - 63	2,0 - 6,0	20 - 60
Uponor Unipipe Plus material: PE-RT/Al/PE-RT	16 - 32	2,0 – 3,0	20 - 60
Viega Raxofix material: PE-Xc/Al/PE-Xc	16 - 63	2,2 – 4,5	20 - 60
Wavin Tigris material: PE-Xc/Al/PE	16 - 63	2,0 – 6,0	

Table **27**: Aluminum composite pipes (MLC), suitable for direct contact to CFS-C EL

Type of Penetrant	Classification
plastic pipes in DG 1, in direct contact to mineral wool insulated MLC pipes	EI 90 – U/U

Table **28**: Classification for plastic pipes in DG 1 in direct contact to mineral wool insulated MLC pipes

8.3.2.18 **Zero distance CFS-C EL to combustible insulated pipes covered with CFS-B**

8.3.2.18.1 Zero distance between CFS-C EL and CFS-B on FEF insulation on metal pipes

Classification is valid for:

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to FEF- insulation on metal pipes
- Additional protect insulation (D_P) necessary

Plastic pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter $d_C > 110$ mm

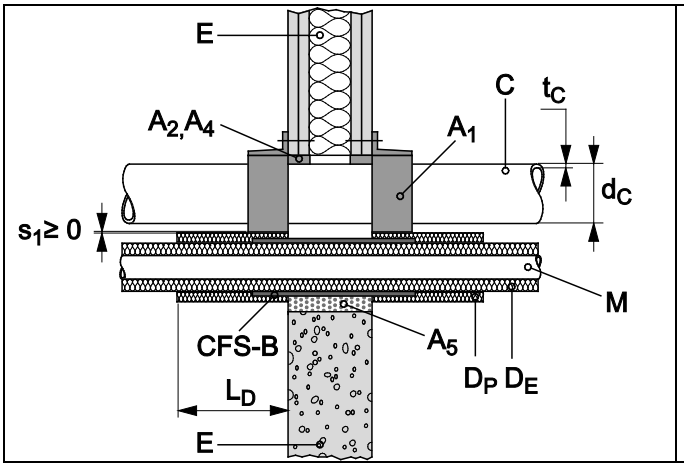
Metal pipes:
- Pipe diameter ($15 \text{ mm} \leq d \leq 42 \text{ mm}$)
- Pipewall thickness: ($1 \text{ mm} \leq t_M \leq 14{,}2 \text{ mm}$)
- C/U pipe end configuration
- Covered materials: copper and others, refer to 8.2.11

And:
- Pipe diameter ($15 \text{ mm} \leq d \leq 76 \text{ mm}$)
- Pipewall thickness: ($1 \text{ mm} \leq t_M \leq 14{,}2 \text{ mm}$)
- C/U pipe end configuration
- Covered materials: refer to 8.2.11, but copper excluded

Insulation:
- Used type of FEF-insulation: refer to 8.2.12
- Insulation thickness t_D: ($9 \text{ mm} \leq t_D \leq 35 \text{ mm}$) – for metal pipes ($d_C \leq 42$ mm)
- Insulation thickness t_D: ($9 \text{ mm} \leq t_D \leq 40{,}5 \text{ mm}$) – for metal pipes ($42{,}1 \text{ mm} \leq d_C \leq 76 \text{ mm}$)
- CS situation

Additional Protect insulation (D_P):
- Used type of FEF-insulation: refer to 8.2.12
- Insulation thickness t_D: ≥ 19 mm)
- Insulation length ($L_D \geq 250$ mm) on both sides of the wall
- LI situation

Gap seal:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict. 8.3.2.18 A:

Plastic pipe (C), sealed with CFS-C EL (A_1) in direct contact to CFS-B on FEF-insulated metal pipes (M)
An additional Protect insulation D_P is installed above CFS-B and insulation D_E

Figure 41: Plastic pipe sealed with CFS-C EL in direct contact to CFS-B on FEF-insulated metal pipes

Type of Penetrant	Classification
plastic pipes in DG 1, in direct contact to FEF-insulated metal pipes	EI 90 – U/U

Table **29**: Classification for Plastic pipe sealed with CFS-C EL in DG 1 in direct contact to CFS-B on FEF-insulated metal pipes

8.3.2.18.2 Zero distance between CFS-C EL and CFS-B on FEF insulation on Aluminium composite (MLC) and PP-R-pipes

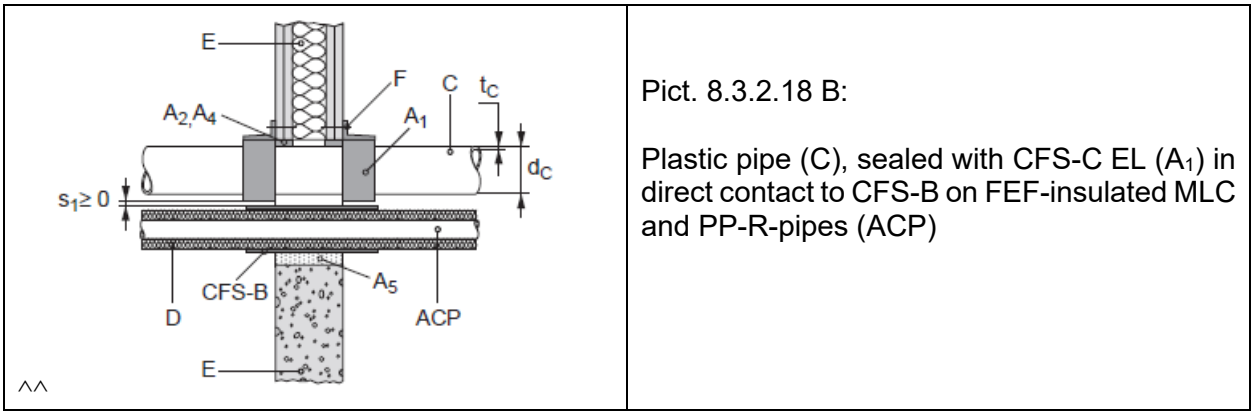
Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to FEF- insulation on MLC and PP-R-pipes, sealed with CFS-B

Plastic pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter d_C > 110 mm

MLC / PP-R- pipes:
- For brands/producer refer to Table 30
- For pipe dimension refer to Table 30
- U/C pipe end configuration

Insulation:
- Used type of FEF-insulation: refer to 8.2.12
- Insulation thickness t_D: refer to Table 30
- CS situation

Gap seal:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict. 8.3.2.18 B:

Plastic pipe (C), sealed with CFS-C EL (A_1) in direct contact to CFS-B on FEF-insulated MLC and PP-R-pipes (ACP)

Figure 42: Plastic pipe sealed with CFS-C EL in direct contact to CFS-B on FEF-insulated metal pipes

Pipe producer / brand / material	Pipe Ø (mm)	Wall thickness (mm)	Pipe Insulation Thickness (mm)
Fränkische Rohrwerke - Alpex F50 Profi material: PE-X/Al/PE-X	16 - 40	2,0 - 3,5	8,0 - 36,5
Geberit Mepla material: PE-Xb/Al/PE-Xb	16 - 40	2,0 - 3,5	8,0 - 36,5
Viega - SANIFIX Fosta-Rohr material: PE-Xc/Al/PE-Xc	16 - 40	2,2 – 3,5	8,0 - 36,5

Table **30**: Plastic pipes in direct contact to FEF insulated MLC/PP-R-pipes, sealed by CFS-B

Type of Penetrant	Classification
plastic pipes in DG 1, in direct contact to FEF insulated MLC / PP-R-pipes	EI 60 – U/U

Table **31**: Classification for Plastic pipe sealed with CFS-C EL in DG 1 in direct contact to CFS-B on FEF-insulated MLC/PP-R pipes

8.3.2.18.3 Zero distance between CFS-C EL and CFS-B on FEF insulation on Aluminium composite (MLC) and PP-R-pipes

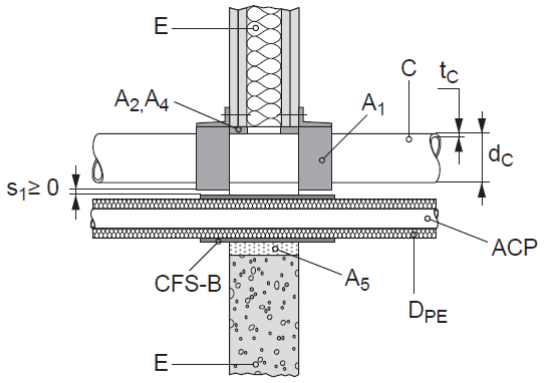
Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to FEF- insulation on MLC and PP-R-pipes, sealed with CFS-B

Plastic pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter $d_C > 110$ mm

MLC / PP-R- pipes:
- For brands/producer refer to Table 32
- For pipe dimension refer to Table 32
- U/C pipe end configuration

Insulation:
- Used type of FEF-insulation: refer to 8.2.12
- Insulation thickness t_D: refer to Table 32
- CS situation

Gap seal:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict. 8.3.2.18 B:

Plastic pipe (C), sealed with CFS-C EL (A_1) in direct contact to CFS-B on FEF-insulated MLC and PP-R-pipes (ACP)

Figure 43: Plastic pipe sealed with CFS-C EL in direct contact to CFS-B on FEF-insulated metal pipes

Pipe producer / brand / material / standard	Pipe Ø d_C (mm)	Pipe wall thickness t_C (mm)	Pipe Insulation thickness (mm)
Aquatherm green – material: PP-R – standard: EN 15874, DIN 8077/78	20 - 110	1,9 - 10,0	8,0 - 40,5
Fränkische Rohrwerke - Alpex F50 Profi – material: PE-X/Al/PE-X	16	2,0	8,0 - 32
	16 - 32	2,0 - 3,0	8,0 - 9,0
	16 - 75	2,0 - 5,0	32,0 - 40,5
Geberit Mepla – material: PE-Xb/Al/PE-Xb	16 - 32	2,25 - 3,5	8,0 - 9,0
	16 - 75	2,25 - 4,75	32,0 - 40,5
Georg Fischer - Sanipex – material: PE-Xc/Al/PE-Xb	16 - 63	2,25 - 4,5	9,0 - 39
Kekelit Kelox – material: PE-RT/Al/PE-RT	16 - 75	2,0 - 7,0	8,0 - 40,5
Kekelit Ketrix – material: Cryolen Polyolefinblend (POB) – standard: EN 15847	20 - 75	1,9 - 6,8	8,0 - 40,5
Polo-Polymutan – material: PP-R 80 – standard: DIN 8077/78	20 - 75	1,9/6,8 - 12,5	8,0 - 40,5
Polo-Polymutan ML5– material: PP-R	20 - 75	2,8 - 10,8	8,0 - 40,5
Prineto Stabil Rohr – material: PE-Xb/Al/PE-HD	17 - 42	2,8 - 4,6	8,0 - 36,5
	17 - 63	2,8 - 6,0	32,0 - 39,0
Rehau Rautitan Flex – material: PE-Xa – standard: EN 151875	16 - 63	2,2 - 8,6	8,0 - 39
Rehau Rautitan Stabil – material: PE-Xa	40	6,0	9,0 - 38,5
TECEflex Verbundrohr – material: PE-Xc/Al/PE	16 - 63	2,2 – 6,0	9,0 - 39
Uponor Unipipe Plus – material: PE-RT/Al/PE-RT	16 - 32	2,0 – 3,0	8,0 – 35,0
Viega - SANIFIX Fosta-Rohr – material: PE-Xc/Al/PE-Xc	16 - 32	2,2 – 3,2	8,0 – 9,0
	16 - 63	2,2 – 4,5	32,0 - 39
Viega Raxofix – material: PE-Xc/Al/PE-Xc	16 - 32	2,2 – 3,2	8,0 - 33,0

Table **32**: Plastic pipes in direct contact to FEF insulated MLC/PP-R-pipes, sealed by CFS-B

Type of Penetrant	Classification
plastic pipes in DG 1, in direct contact to FEF insulated MLC / PP-R-pipes	EI 90 – U/U

Table **33**: Classification for Plastic pipe sealed with CFS-C EL in DG 1 in direct contact to CFS-B on FEF-insulated MLC/PP-R pipes

8.3.2.18.4 Zero distance between CFS-C EL and CFS-B on PE insulation or PE protection tube on Aluminium composite (MLC)

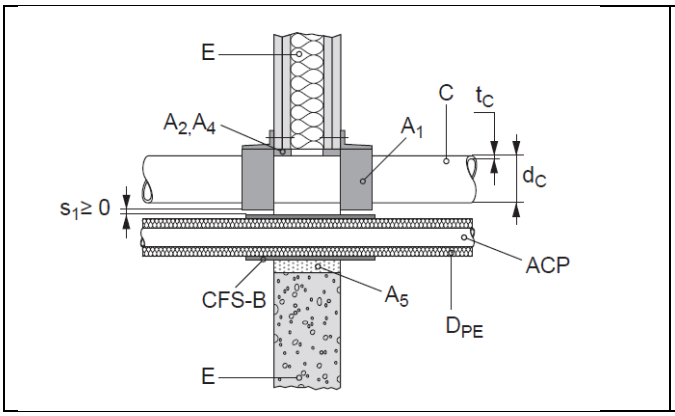
Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to PE- insulated or PE-protected cover on MLC - pipes, sealed with CFS-B

Plastic pipes:
- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter $d_C > 110$ mm

MLC - pipes:
- For brands/producer refer to Table 34
- For pipe dimension refer to Table 34
- U/C pipe end configuration

Insulation:
- Could either be pre-installed by producer or later added
- PE (polyethylene) foamed insulation, for brand/producer refer to 8.2.13
- PE-HD tube on top of PE-insulated MLC-pipes
- Insulation thickness t_D: refer to Table 34
- For insulation situation refer to Table 34

Gap seal:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict. 8.3.2.18 C:

Plastic pipe C, sealed with CFS-C EL (A_1) in direct contact to CFS-B on insulated MLC-pipes (ACP)

Figure 44: CFS-C EL in direct contact to CFS-B on PE-insulated MLC-pipes

Pipe Ø d_C (mm)	Pipe wall thickness t_C (mm)	Pipe Insulation		
		Type	Thickness (mm)	Configuration
Geberit Mepla – material: PE-Xb/Al/PE-Xb				
16 - 26	2,2 - 3,0	PE-foam	6,0 – 13,0	CS
Kekelit Kelox – material: PE-RT/Al/PE-RT				
14 - 32	2,0 - 3,0	PE-foam	4,0 – 9,0	CS
16 – 20	2,0 - 2,25	PE-HD tube		LS ≥ 250
16 - 20	2,0 - 2,25	PE Foam + PE-HD tube	4,0	CS
Uponor Unipipe MLC – material: PE-RT/Al/PE-RT				
16 – 20	2,0 - 2,25	PE-HD tube		LS ≥ 250
Uponor Unipipe Plus – material: PE-RT/Al/PE-RT				
16 - 25	2,0 - 2,5	PE foam	4,0 -10,0	CS

Table **34**: PE-insulated/PE protected MLC-pipes, to be sealed with CFS-B

Type of Penetrant	Classification
plastic pipes in DG 1, in direct contact to PE insulated/ PE protected MLC pipes	EI 90 – U/U

Table **35**: Classification for CFS-C EL sealed plastic pipes in direct contact to PE-insulated/PE protected MLC-pipes, to be sealed with CFS-B

8.3.2.19 **CFS-C EL used as single pipe seal used in coated board CFS-CT B 1S**

Situation:

- Collar CFS-C EL on plastic pipe installed in coated board CFS-CT B 1S
- Distance between the pipes penetrating the board is (s_1 ≥ 80 mm)
- Pipes must be grouped in line only
- Pipes in line could be vertical or horizontal
- Pipes in line cover corner arrangements
- Distance between parallel lines: (s ≥ 100 mm)
- The number of penetrating pipes in line is not limited.
- Pipe are assessed with zero distance to building element (s_3 ≥ 0 mm)
- For assessed boards refer to 8.2.14
- For fixation/installation refer to 8.2.4.4

Plastic pipes:

- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter d_C > 110 mm

Insulation:

- No thermal pipe insulation permitted
- No need for acoustic decoupling

Gap closure:

In flexible wall and rigid wall (t_E ≥ 100 mm):

- Gap seal around the board to building element is CFS-S ACR
- For gap dimension refer to 7.2.6
- Gap seal between pipes to board is CFS-S ACR
- Annular Gap width: 0 – 5 mm
- Depth: (t_{A2} ≥ 25 mm)

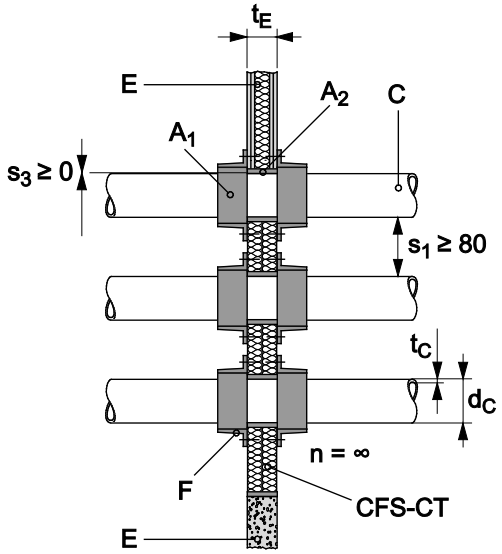
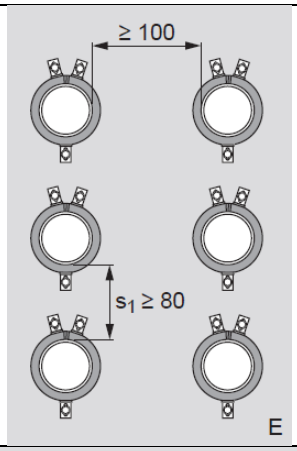
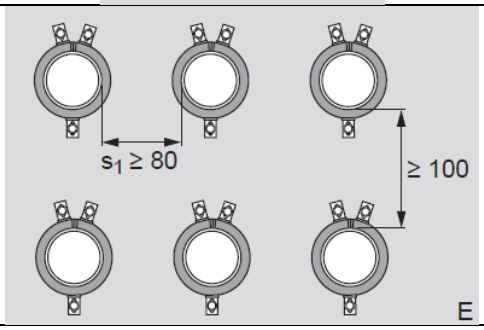
	Pict. 8.3.2.19 A: CFS-C EL (A_1) installed in coated board, sealed with CFS-S ACR (A_2) Sectional view
	Pict. 8.3.2.19 B: CFS-C EL installed in coated board, sealed with CFS-S ACR (A_2) Vertical installation line of CFS-C EL Frontal view
	Pict. 8.3.2.19 C: CFS-C EL installed in coated board, sealed with CFS-S ACR (A_2) Frontal view

Figure 45: Collar CFS-C EL, installed in coated board

Type of Penetrant	Classification
Plastic pipes in DG 1, installed in coated board CFS-CT B 1S	EI 90 – U/U

Table **36**: Classification for CFS-C EL in DG 1, installed in coated board

8.3.2.20 CFS-C EL used as a multiple pipe seal for parallel plastic pipes, penetrating CFS-CT B 1S

Situation:
- Two identical plastic pipes, running parallel, penetrating the double board seal
- Two boards CFS-CT B 1S installed in wall, back-to-back, no airgap in between, coated side outside
- Boards to be sealed with CFS-S ACR into aperture
- Pipes perpendicular to coated board, zero distance in between (s ≥ 0 mm)
- Pipes sealed with CFS-C EL in DG 1 or DG 2 (both assessed)

Plastic pipes:
- PE acc. EN 1519-1
- Pipe diameter d_c = 110mm, wall thickness t_C = 4,2mm
- Pipe end configuration: U/U

Insulation:
- No thermal insulation, no acoustic decoupling permitted

Gap seal:
- Gap to be sealed with CFS-S ACR, no backfilling
- Gap width: w = (0 – 15) mm
- Gap depth: t = 20 mm from both sides

Collar CFS-C EL:
- Could be applied in DG 1 or DG 2
- One/two collar covers both pipes in circular matter, tightly following pipe surface
- Minimum number of hooks for this application: 6x short (DG 1) or 6x long (DG 2)
- Hooks to be fixed by threaded rod M8 with nut and washer on both sides

Type of Penetrant	Classification
Parallel plastic PE-pipes sealed by CFS-C EL with DG 1 or DG 2 in direct contact to each other, penetrating a double board seal	EI 120 – U/U

Table **37**: Classification for parallel PE-pipes, sealed by CFS-C EL in DG 1 or DG 2 in double board seal

8.3.2.21 **CFS-C EL - zero distance collar to collar**

Situation:

- Collar CFS-C EL on plastic pipe installed in zero distance to next CFS-C EL ($s_1 \geq 0$ mm)
- Pipes must be grouped in line only
- Pipes in line could be vertical or horizontal
- Pipes in line cover corner arrangements too
- Distance between parallel lines: ($s \geq 100$ mm)
- The number of penetrating pipes in line is not limited.

Plastic pipes:

- Type of pipes and dimension – refer to section 8.3.2.1, 8.3.2.2, 8.3.2.3, 8.3.2.4, 8.3.2.5, 8.3.2.6, 8.3.2.7
- Pipe end configuration: U/U
- Excluded are pipes with outside nominal diameter $d_C > 110$ mm

Insulation:

- No thermal pipe insulation permitted
- For Acoustic decoupling refer to 8.2.7

Gap seal:

- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2

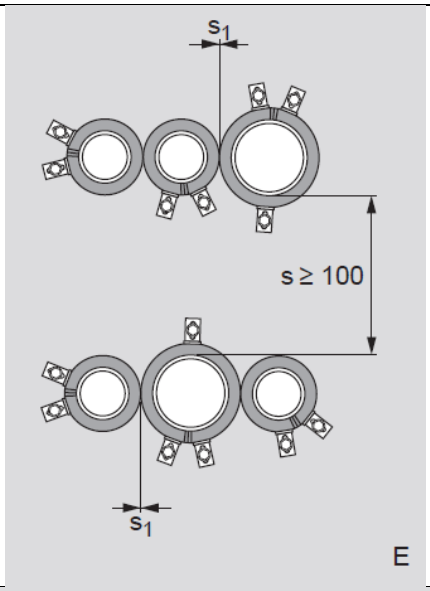
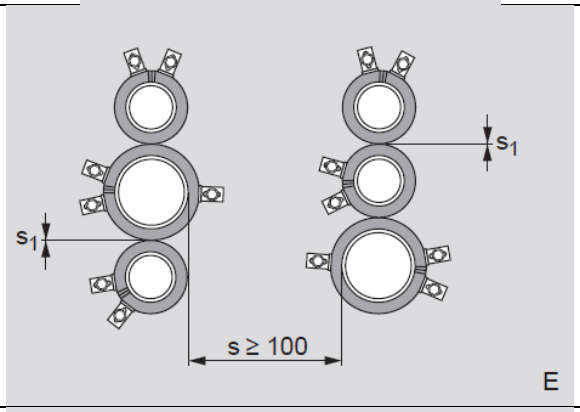
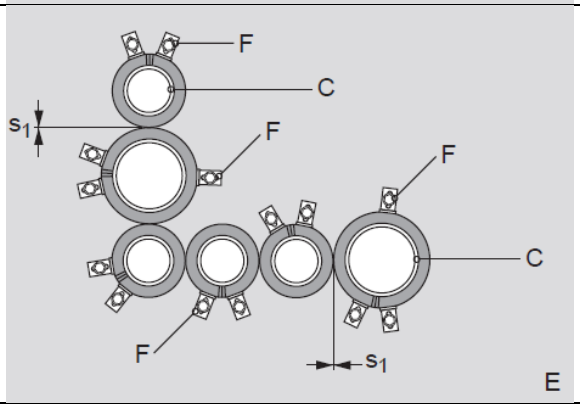
	Pict. 8.3.2.20 A: Zero distance collar to collar in DG 1 Horizontal linear arrangement
	Pict. 8.3.2.20 B: Zero distance collar to collar in DG 1 Vertical linear arrangement
	Pict. 8.3.2.20 C: Zero distance collar to collar in DG 1 Corner arrangement

Figure 46: CFS-C EL - direct contact collar to collar

Type of Penetrant	Classification
Plastic pipes in DG 1, CFS-C EL in direct contact to CFS-C EL	EI 90 – U/U

Table **38**: Classification for direct contact CFS-C EL to CFS-C EL in DG 1

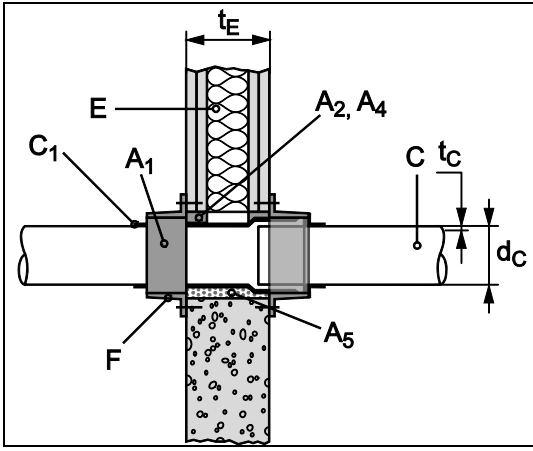
8.3.2.22 **PP-pipes acc. EN 1451-1 with pipe coupling**

Situation:
- PP-pipes according EN 1451-1 with pipe coupling, sealed with CFS-C EL
- Coupling inside the wall, half in the wall or outside the wall, covered by CFS-C EL
- With and without acoustic decoupling – refer to 8.2.7

Plastic pipes:
- For dimension refer to Figure 49
- Pipe end configuration: U/U

Insulation:
- No thermal pipe insulation permitted
- For Acoustic decoupling refer to 8.2.7

Gap seal:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict. 8.3.2.21:

PP-pipes acc. EN 1451-1 with coupling, sealed with CFS-C EL

Figure 47: PP-pipes acc. EN 1451-1 with coupling, sealed with CFS-C EL

Number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (incoming pipe / outgoing pipe)		
(mm)	0	4	9
40	2 / 2	2 / 2	2 / 2
41 - 75	3 / 3	3 / 3	3 / 3

Figure 48: Number of hooks for PP-pipes acc. EN 1451-1 with coupling, sealed with CFS-C EL

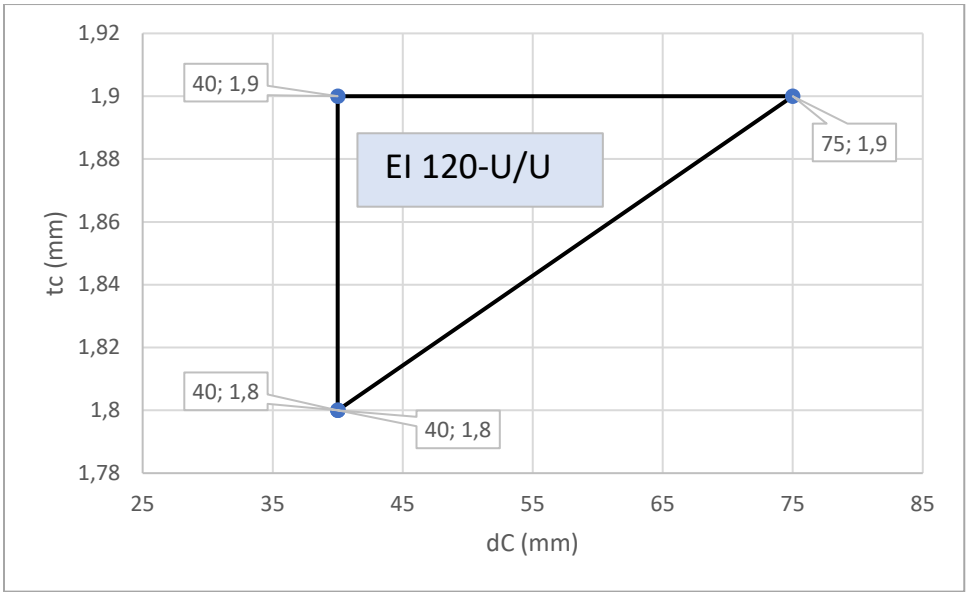


Figure 49: Classified Pipe range of PP-pipes acc. EN 1451-1 with coupling

8.3.2.23 **PVC-pipes acc. EN1452-2 with elbow 87°**

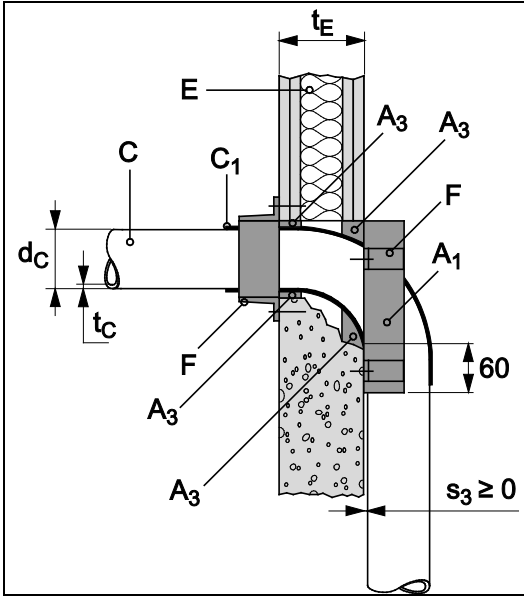
Situation:
- PVC-pipes with 87° elbow, sealed with CFS-C EL
- Elbow inside the wall, half in the wall or outside the wall, covered by CFS-C EL
- On one side of the wall pipe runs parallel to wall with zero distance ($s_3 \geq 0$ mm)
- With and without acoustic decoupling – refer to 8.2.7

Plastic pipes:
- PVC-pipes acc. EN 1452-2, EN 1329-1, EN 1453-1, EN 15493
- PVC-C acc. EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- Carefully consider disclaimer 8.2.16
- For dimension refer to Figure 51
- Pipe end configuration: U/U

Insulation:
- No thermal pipe insulation permitted
- For Acoustic decoupling refer to 8.2.7

Gap closure:

In flexible wall and rigid walls ($t_E \geq 100$ mm):
- Gap filler: Hilti CFS-S FIL
- Annular Gap width: 5 – 40 mm
- Depth: ($t_{A2} \geq 25$ mm)
- no backfilling required



Pict. 8.3.2.22:

PVC-pipes acc. EN 1452-2 with 87°-elbow, sealed with CFS-C EL

Figure 50: PVC-pipes acc. EN 1452-2 with coupling, sealed with CFS-C EL in DG 1

Number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (incoming pipe / outgoing pipe)		
(mm)	0	4	9
32	3 / 3	3 / 3	3 / 3
50	3 / 3	3 / 3	3 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	4 / 4	4 / 4	4 / 4

Table **39**: Number of hooks for PVC-pipes acc. EN 14512-2 with 87°-elbow, sealed with CFS-C EL

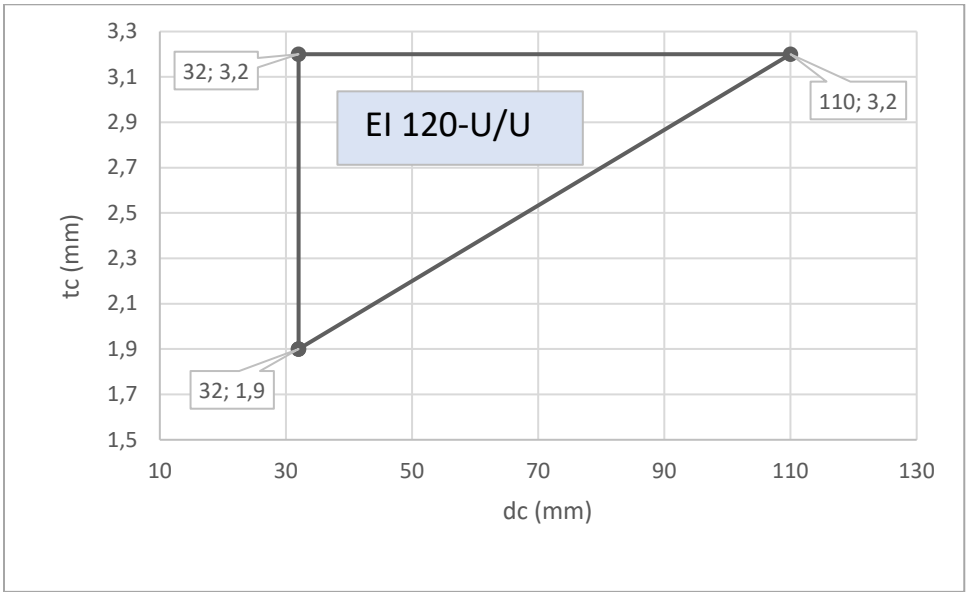


Figure 51: Classified pipe range of PVC-pipes in DG 1 with 87°-elbow

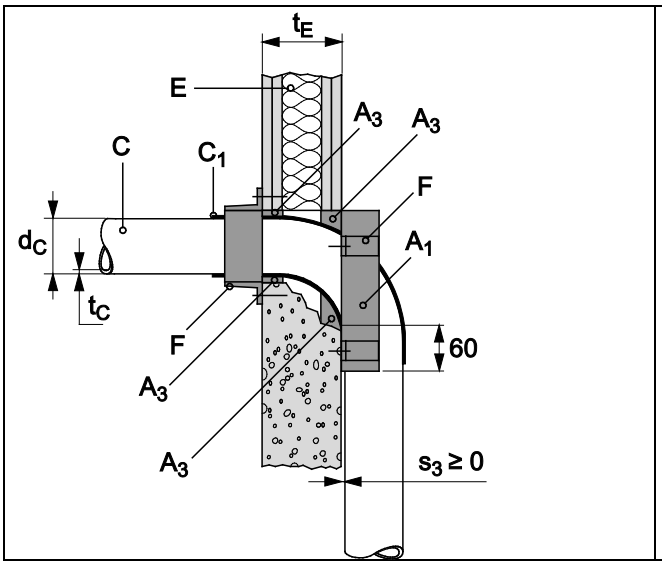
8.3.2.24 **PP-pipes acc. EN 1451-1 with 87°- elbow**

Situation:
- PP-pipes according EN 1451-1 with pipe coupling, sealed with CFS-C EL
- elbow inside the wall, half in the wall or outside the wall, covered by CFS-C EL
- On one side of the wall pipe runs parallel to wall with zero distance ($s_3 \geq 0$ mm)
- With and without acoustic decoupling – refer to 8.2.7

Plastic pipes:
- For dimension refer to Figure 53
- Pipe end configuration: U/U

Insulation:
- No thermal pipe insulation permitted
- For Acoustic decoupling refer to 8.2.7

Gap seal:
- For flexible wall ($t_E \geq 100$ mm) refer to 8.3.1.2
- For rigid wall ($t_E \geq 100$ mm) refer to 8.4.3.2



Pict. 8.3.2.23:

PP-pipes acc. EN 1451-1 with 87°-elbow, sealed with CFS-C EL

Figure 52: PP-pipes acc. EN 1451-1 with 87° - elbow, sealed with CFS-C EL

Number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm. If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm. (incoming pipe / outgoing pipe)		
(mm)	0	4	9
40 - 74	3 / 3	3 / 3	3 / 3
75 - 109	3 / 3	3 / 3	3 / 3
110	3 / 4 (on elbow side)	3 / 4 (on elbow side)	3 / 4 (on elbow side)

Table **40**: Number of hooks for PP-pipes acc. EN 1451-1 with 87°-elbow, sealed with CFS-C EL

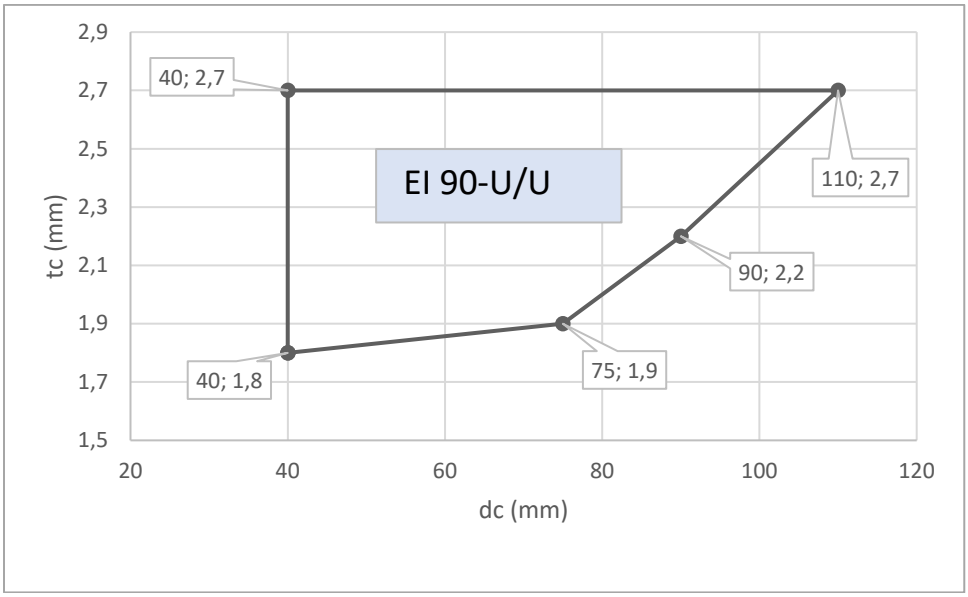


Figure 53: Classified Pipe range of PP-pipes in DG 1 acc. EN 1451-1 with 87°- elbow

8.4 Rigid walls

8.4.1 Specific characteristics for Rigid walls ($t_E \geq 70$ mm)

8.4.1.1 Rigid walls

- minimum thickness of ($t_E \geq 70$ mm)
- minimum density: ($\rho_E \geq 550$ kg/m³)
- comprise concrete, aerated concrete, brickwork, lime malm bricks or masonry.

8.4.1.2 Annular gap

- Annular gap fill:
- Gap filler: Cementious mortar M10 acc. EN 998-2
- Annular Gap width: 0– 15 mm
- Depth to be filled: over entire thickness t_E

or

- Gap filler: Hilti CFS-S ACR or CFS-S IS on both sides of the wall
- Annular Gap width: 0– 15 mm
- Depth: ($t_{A2} \geq 25$ mm)
- With or without backfilling (B) – mineral wool, density ≥ 40kg/m³, Reaction to fire class: min. A2-s1, d0.

8.4.1.3 Collar fixing

Hilti Firestop Collar Endless CFS-C EL (A_1) to be fixed with hooks (F) on the wall.
For number of hooks refer to 8.2.4
For hooks fixing refer to 8.2.4.2

Bent hooks are not assessed.

8.4.2 Penetration services rigid walls ($t_E \geq 70$ mm)

8.4.2.1 Wavin Tigris PE-X One - pipes

Situation:
- Single penetration seal (C) or multiple seal (bunched pipes)
- Pipe (C) penetrates perpendicular the wall
- Pipes may be sealed for single side fire load and double side fire load, refer to Figure 54
- Triangular clusters and pipes in line (horizontal/vertical)
- Minimum distance between pipes in cluster or in line: $s_2 \geq 0$mm

Pipes:
- Brand: Wavin Tigris PE-X-One R-I-R insulated
- for pipe dimension refer to Table 41below

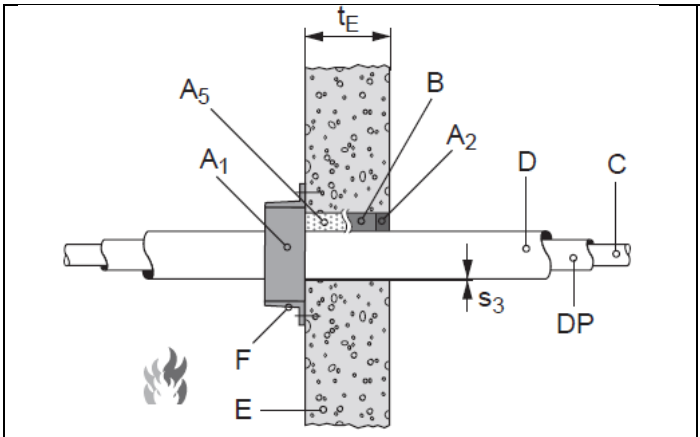
Insulation:
- Insulation: PE-foam, CS, for dimension refer to table below
- Additional Protection DP: R-I-R Hardcover, PE-HD, CS and CI, covering pipe

No.	Material Standard	Pipe diameter (mm)	Pipe wall thickness (mm)	Pipe insulation thickness (mm)
1	PE-X in PE hardcover	12	2,0	9
2	PE-X in PE hardcover	15	2,5	10
3	PE-X in PE hardcover	18	2,5	10 - 20
4	PE-X in PE hardcover	22	3,0	10 - 20

Table **41**: Insulated Wavin Tigris-pipes, sealed with CFS-C EL

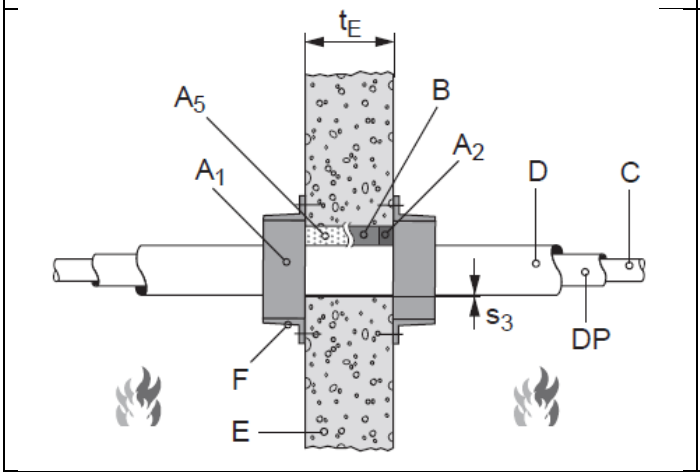
Pipe seal / Collar fixing:
- CFS-C EL fits tightly around the cluster or linear arrangement
- Max. collar diameter: 80 mm
- Max. collar perimeter length: 550 mm
- Fixing with 3 hooks for single and multiple penetration (clusters)

Gap seal:
- Refer to 8.4.1.2



Pict. 8.4.2.1 A:

Wavin Tigris PE-X-One R-I-R insulated with single-side fire load



Pict. 8.4.2.1 B:

Wavin Tigris PE-X-One R-I-R insulated with double-side fire load

Figure 54: Wavin Tigris pipe with single side / double side fire load

Type of Penetrant	Classification
Wavin Tigris PE-X One pipes as described in Table 41	EI 90 – U/C

Table **42**: Classification CFS-C EL – sealed Wavin Tigris PE-X ONE - pipes

8.4.3 Specific characteristics for Rigid walls ($t_E \geq 100$ mm)

8.4.3.1 Rigid walls:

- minimum thickness of ($t_E \geq 100$ mm)
- minimum density: ($\rho_E \geq 650$ kg/m³)
- comprise concrete, aerated concrete, brickwork, lime malm bricks or masonry.

8.4.3.2 Annular gap:

Annular gap fill:
- Gap filler: Cementious mortar M10 acc. EN 998-2
- Annular Gap width: 0– 40 mm
- Depth to be filled: over entire thickness t_E

or
- Gap filler: Hilti CFS-S ACR on both sides of the wall
- Annular Gap width: 0– 40 mm
- Depth: ($t_{A2} \geq 25$ mm)
- Mineral wool backfilling required

or
- Gap filler: Hilti CFS-S ACR on both sides of the wall
- Annular Gap width: 0– 15 mm
- Depth: ($t_{A2} \geq 25$ mm)
- No backfilling required

8.4.3.3 Collar fixing

Hilti Firestop Collar Endless CFS-C EL (A_1) to be fixed with hooks (F) on the wall.
For number of hooks refer to 8.2.4
For hooks fixing refer to 8.2.4.2

Bent hooks could be pressed into the wet gap seal, made of cementious mortar. For details refer to 8.2.4.7

8.4.4 Penetration services rigid walls ($t_E \geq 100$ mm)

8.4.4.1 PE pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1

Classification shown in Figure 55 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producers

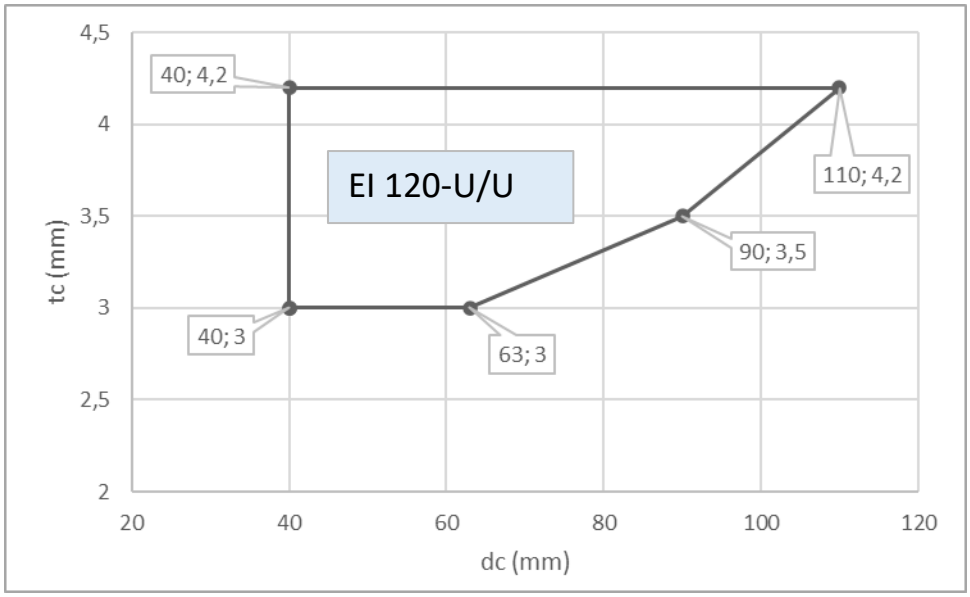


Figure 55: Classified pipe range for pipes made of PE, PE-X, ABS, SAN+PVC in DG 1 for EI120-U/U

8.4.4.2 PE-pipes acc. EN ISO 15494 in DG 1

Classification shown in Figure 56 and Figure 57 is valid for pipes made from:

- PE according EN 5494, EN 12201-2 and DIN 8074/75
- No limitation for brands/producer

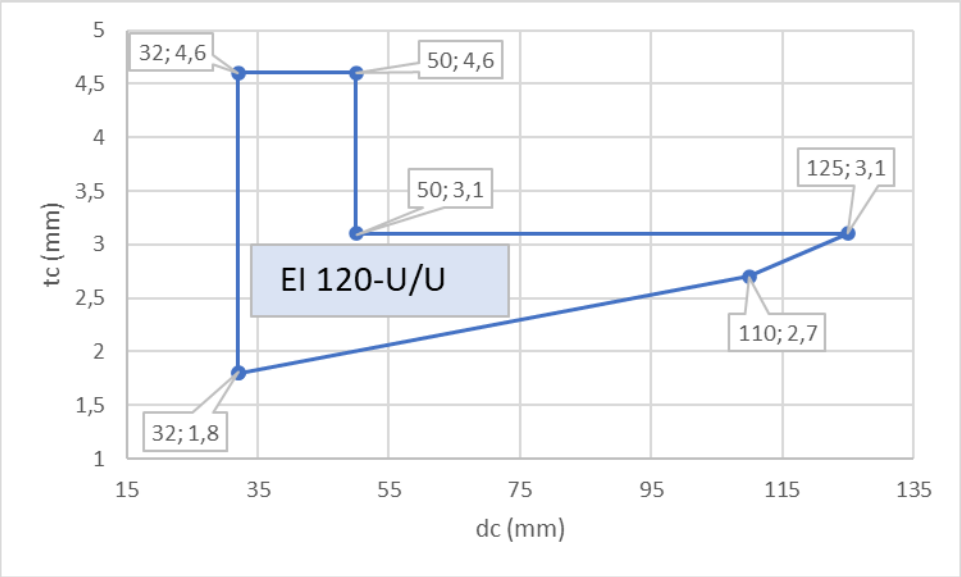


Figure 56: Classified pipe range for pipes in DG 1 made of PE for EI120-U/U

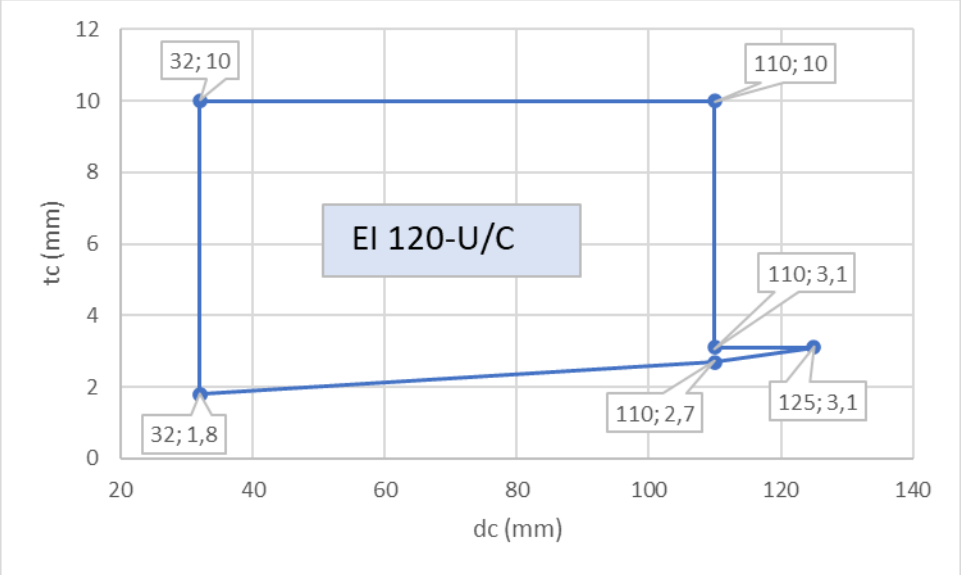


Figure 57: Classified pipe range for pipes in DG 1 made of PE for EI120-U/C

8.4.4.3 PVC-pipes acc. EN 1452-2 in DG 1

Classification shown in Figure 58 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Carefully consider disclaimer in 8.2.16

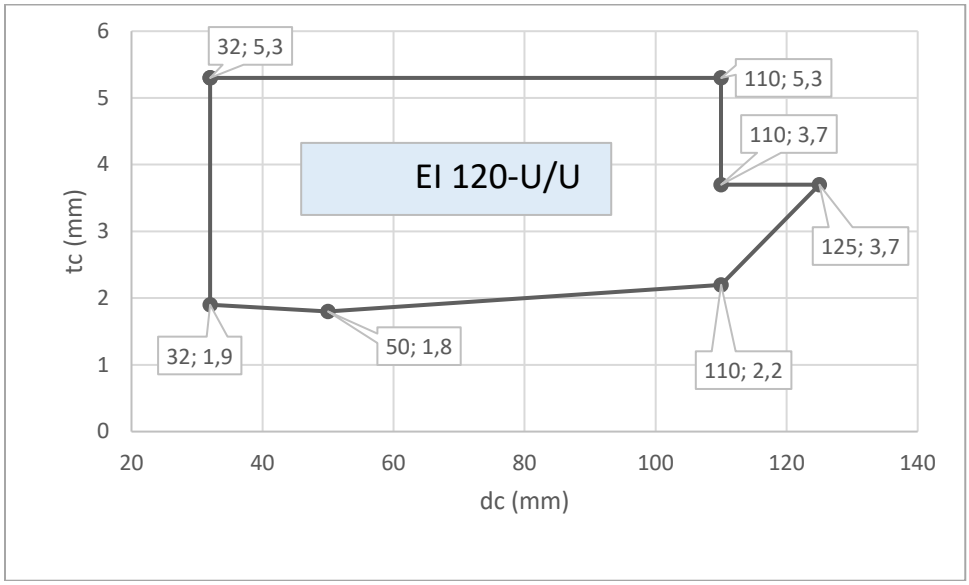


Figure 58: Classified pipe range for pipes made of PVC in DG 1 for EI120-U/U

8.4.4.4 PP-pipes, non-regulated in DG 1

Classification shown in Figure 59 is valid for pipes made from:

- For assessed brands/producers refer to section 8.2.15

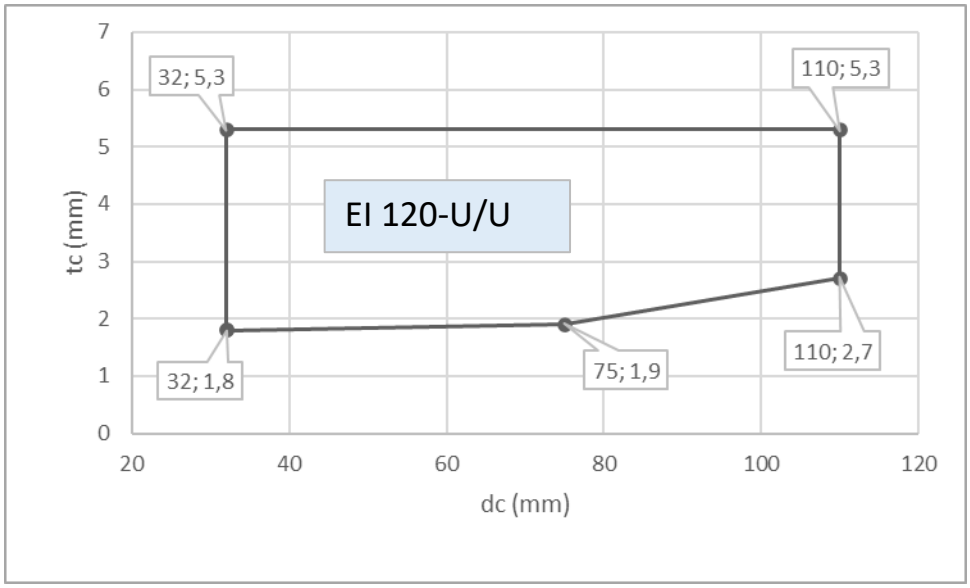


Figure 59: Classified pipe range for pipes made of PP (non-regulated) in DG 1 for EI120-U/U

8.4.4.5 PP-pipes acc. EN 1451-1 in DG 1

Classification shown in Figure 60 and Figure 61 is valid for pipes made from:

- PP according EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producers

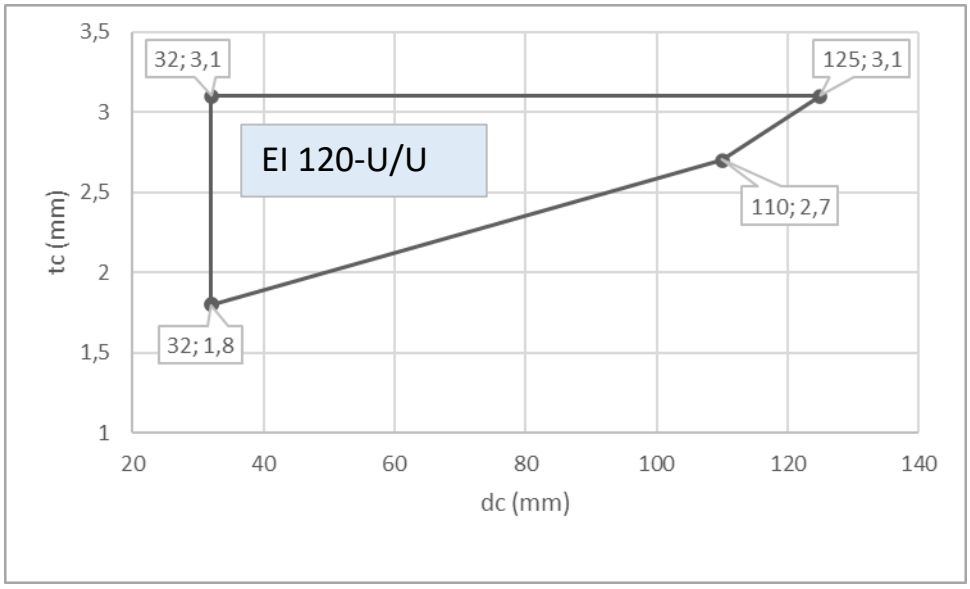


Figure 60: Classified pipe range for pipes in DG 1 made of PP (EN 1451-1) for EI120-U/U

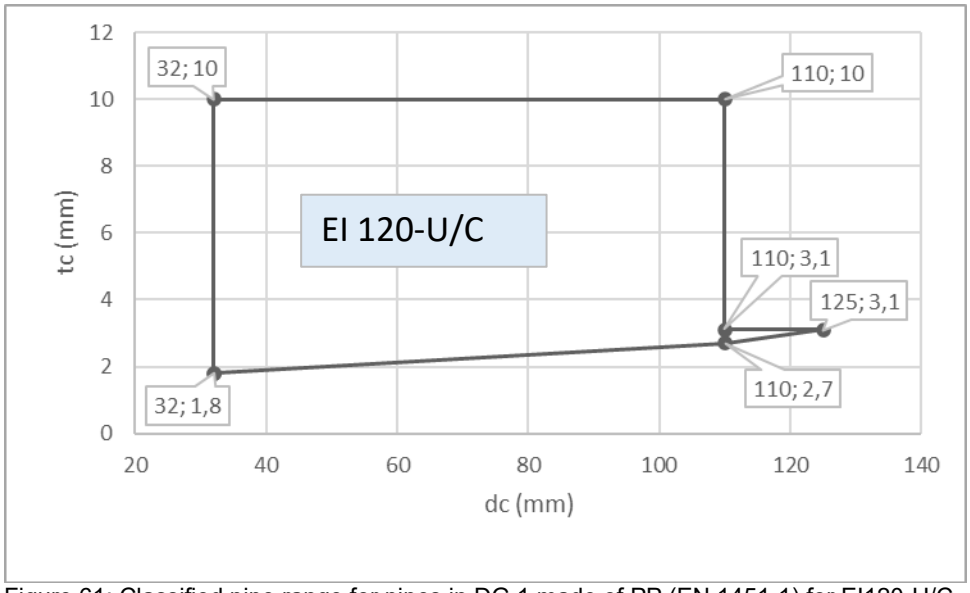


Figure 61: Classified pipe range for pipes in DG 1 made of PP (EN 1451-1) for EI120-U/C

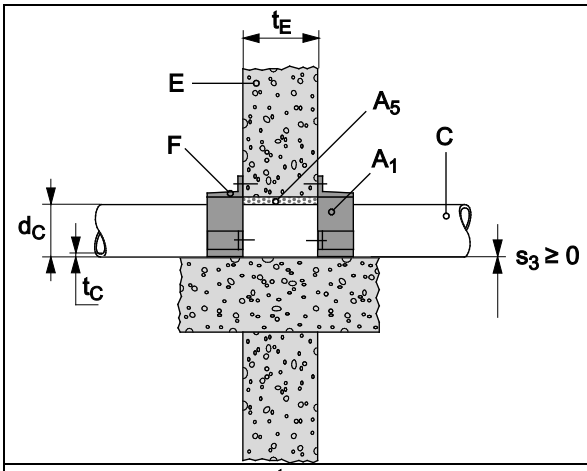
8.4.4.6 Pipes mounted directly onto the wall, DG 1

Situation:
- The pipes run with zero distance directly on wall ($s_3 \geq 0$ mm) before penetrating a wall.
- For pipes in Design group 1 only - refer to 8.2.2
- Excluded are pipes with outside nominal diameter ($d_C > 110$ mm)
- Collar CFS-C EL cannot completely cover the circumference of sealed pipe
- With and without acoustic decoupling – refer to 8.2.7

Plastic pipes:
- For pipes, covered in section 8.4.4.1, 8.4.4.2 (only Figure 56), 8.4.4.3, 8.4.4.4, 8.4.4.5 (only Figure 60)
- Pipe end configuration: U/U

Insulation:
- No thermal pipe insulation permitted
- For Acoustic decoupling refer to 8.2.7

Gap closure:
- Gap filler: Cementious mortar M10 acc. EN 998-2
- Annular Gap width: 0– 40 mm
- Depth to be filled: over entire thickness t_E

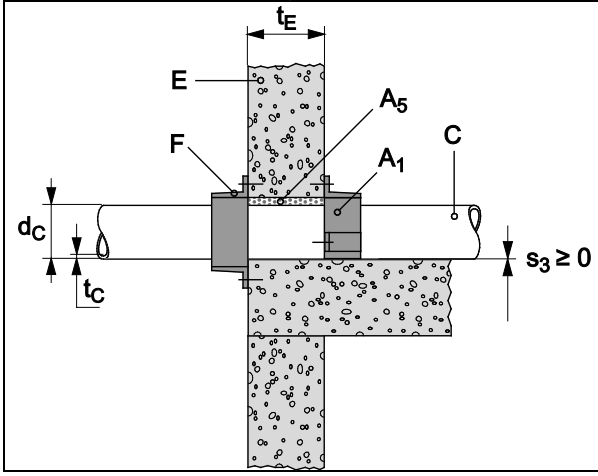


Pict. 8.4.4.6 A:

View from above

Plastic pipe (C), with or without sound decoupling insulation, penetrates a wall. Collar CFS-C EL (A_1) cannot cover the pipe completely.

Identical situation on both sides.



Pict. 8.4.4.6 B:

View from above

Plastic pipe (C), with or without sound decoupling insulation, penetrates a wall. Collar CFS-C EL (A_1) cannot cover the pipe completely on one side of the penetrated wall.

Several sealing situations on both sides.

Figure 62: Plastic pipe mounted directly on a wall, penetrating a wall

For the number of hooks to be used refer to 8.2.5

For fixing the hooks refer to 8.2.4.2

Type of Penetrant	Classification
Plastic pipes in DG 1 up to (d_C ≤. 110mm), Mounted directly on the wall Collar CFS-C EL cannot cover the pipe completely on one or two sides of the wall	EI 120 – U/U

Table **43**: Classification for Plastic pipes in DG 1, mounted directly on the wall

8.4.4.7 Pipes mounted directly in the corner, DG 1

Situation:
- Pipe runs directly in a horizontal corner between wall and floor
- zero distance ($s_3 \geq 0$ mm) to both; adjacent wall and floor, before penetrating a wall
- Pipes in Design group 1 only - refer to 8.2.2
- Excluded are pipes with outside nominal diameter ($d_C > 110$ mm)
- Collar CFS-C EL covers completely the circumference of sealed pipe
- Some building material from adjacent wall and/or floor must be removed to give free access for the collar
- With and without acoustic decoupling – refer to 8.2.7

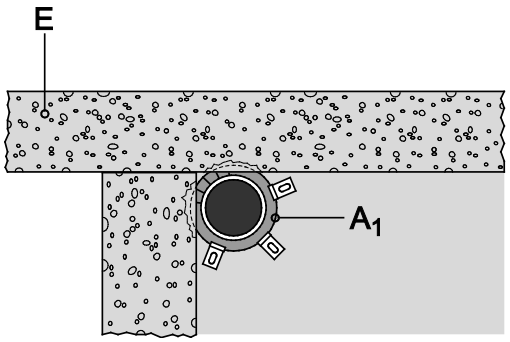
Plastic pipes:
- For pipes, covered in section 8.4.4.1, 8.4.4.2 (only Figure 56), 8.4.4.3, 8.4.4.4, 8.4.4.5 (only Figure 60)
- Pipe end configuration: U/U

Insulation:
- No thermal pipe insulation permitted
- For Acoustic decoupling refer to 8.2.7

Gap closure:
- For annular gap fill refer to 8.4.3.2

For the number of hooks to be used refer to 8.2.5

For fixing the hooks refer to 8.2.4.2



Pict. 8.4.4.7:

Frontal view

Horizontal plastic pipe (C) mounted in a corner, with or without sound decoupling insulation, penetrates a wall. Collar CFS-C EL (A_1) covers the pipe completely on both sides of the penetrated wall.
Wall and floor construction material had to be removed.

Figure 63: Plastic pipe mounted directly in a corner, penetrating a wall

Type of Penetrant	Classification
Plastic pipes in DG 1 up to ($d_C \leq$. 110mm), Mounted directly in a corner Collar CFS-C EL cannot cover the pipe completely on one or two sides of the wall	EI 120 – U/U

Table **44**: Classification for Plastic pipes in DG 1, mounted directly on the wall

8.4.4.8 **Multiple pipe penetration, FEF-insulated, DG 1**

Situation:
- Collar CFS-C EL covers the two or three pipes together within one bigger jacket
- Pipes grouped in line only (horizontal/vertical), no cluster arrangement
- Max. one PE pipe together one or two FEF-insulated PP-R or PE-X pipes
- All the pipes closest distance together

Pipes:

For PE pipe:
- Pipe acc. EN 1519-1, EN 12666-1, EN 12201-2
- Pipe end configuration: U/U
- Pipe outside diameter is (40 mm ≤ d_c ≤ 90 mm)
- Pipe wall thickness (t_C= 3,5 mm)
- With or without sound decoupling insulation
- For type, thickness and situation of sound decoupling insulation refer to 8.4.4.8
- No thermal insulation

For PP-R or PE-X pipes:
- Pipe acc. EN 15874 and EN 15875
- Brand / producer: Aquatherm fusiolen (aquatherm green pipe S) and Rehau Rautitan flex
- Pipe end configuration: U/C
- Pipe outside diameter is (d_c = 40 mm)
- Pipe wall thickness (t_C = 5,5 mm)
- With FEF-insulation

Insulation
- For material/brand refer to 8.2.12
- Insulation thickness is (9 mm ≤ t_D ≤ 32) mm
- Installation situation is LS and CS
- Minimum insulation length (L_D ≥ 250 mm) on both sides of the wall

Collar fixing:
- For hook fixing refer to 8.2.4.2
- Number of hooks to be used: at least 4 for two pipes, at least 5 for three pipes

For gap fill: refer to 8.4.3.2

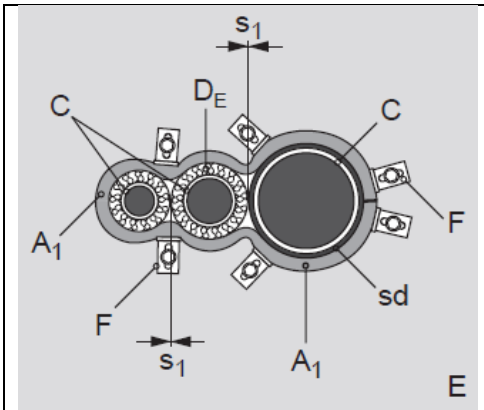
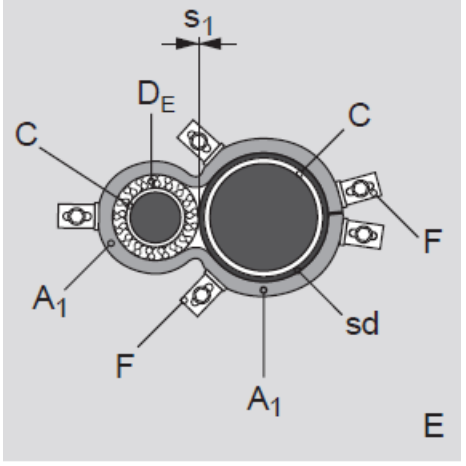
	Pict. 8.4.4.8 A: Multiple pipe seal in zero distance, Sealed with one collar CFS-C EL
	Pict. 8.4.4.8 B: Multiple pipe seal in zero distance, Sealed with one collar CFS-C EL

Figure 64: Multiple pipe seal, FEF-insulated, sealed with CFS-C EL

Type of Penetrant	Classification
Multiple pipe seal of linear pipe arrangement, FEF-insulated, covered by one collar CFS-C EL	EI 120 – U/U and U/C

Table **45**: Classification for Multiple pipe seal, FEF-insulated, sealed with CFS-C EL in DG 1

8.4.4.9 Multiple pipe penetration, mounted on floor, FEF-insulated, DG 1

Situation:
- Collar CFS-C EL covers one or two pipes together within one bigger jacket
- Pipes grouped in line only (horizontal/vertical)
- Pipes mounted directly on floor
- Pipes with FEF-insulated
- All the pipes closest distance together
- Collar CFS-C EL cannot completely cover the pipe circumstances

For pipes:
- Pipe types: PP-R or PE-X acc. EN 15874 and EN 15875
- Brand / producer: Aquatherm fusiolen (aquatherm green pipe S) and Rehau Rautitan flex
- Pipe end configuration: U/C
- Pipe outside diameter is (d_c = 40 mm)
- Pipe wall thickness (t_C = 5,5 mm)
- With FEF-insulation

Insulation
- For material/brand refer to 8.2.12
- Insulation thickness is (t_D = 25 mm)
- Installation situation is LS and CS
- Minimum insulation length (L_D ≥ 250 mm) on both sides of the wall

Collar fixing:
- For hook fixing refer to 8.2.4.2
- Number of hooks to be used: at least 3 for one pipe, at least 4 for two pipes

For gap fill: refer to 8.4.3.2

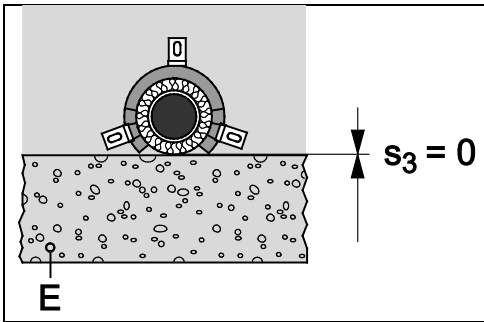
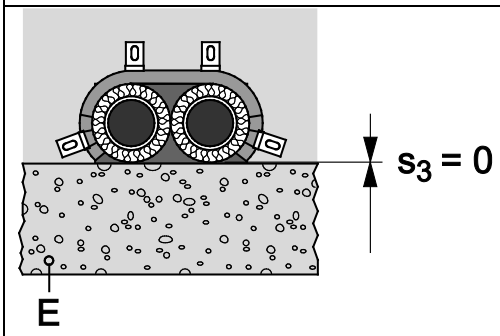
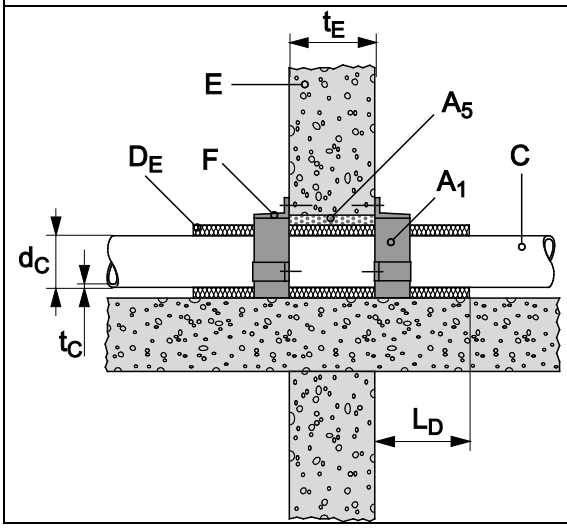
	Pict. 8.4.4.9 A: Front view Single FEF-insulated pipe, mounted directly on floor (E), sealed with collar CFS-C EL
	Pict. 8.4.4.9 B: Front view Single FEF-insulated pipe, mounted directly on floor (E), sealed with collar CFS-C EL
	Pict. 8.4.4.9 C: Sectional view Single or double FEF-insulated pipe, mounted directly on floor (E), sealed with collar CFS-C EL (A_1)

Figure 65: Single or double insulated pipe, mounted directly on floor, sealed with collar CFS-C EL

Type of Penetrant	Classification
Single or Multiple pipe seal of linear pipe arrangement, mounted directly on the floor, FEF-insulated, covered by one collar CFS-C EL	EI 120 – U/C

Table **46**: Classification for Multiple pipe seal, FEF-insulated, mounted on floor, sealed with CFS-C EL

8.4.4.10 **PE pipes, Geberit Silent dB20, DG 1, with elbow 2x45°**

Situation:
- Single pipe seal
- Pipe perpendicular to wall one side
- On one side of the wall pipe runs parallel to wall with zero distance ($s_3 \geq 0$mm)
- Pipe elbow inside the wall, half in the wall or outside the wall, covered by CFS-C EL

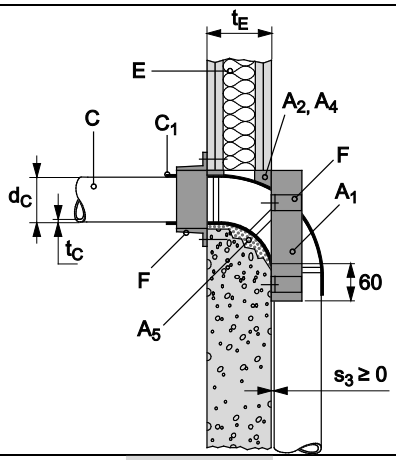
Pipes:
- PE – pipe, non-regulated
- Brand/Producer: Geberit Silent dB20
- Elbow-connector 45°, brand: Geberit Silent dB20, electric-welding wire inside
- Pipe diameter d_C = 110mm
- Pipe wall thickness t_C = 6 mm

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Gap filler: Hilti CFS-FIL
- Annular Gap width: 5– 40 mm
- Depth ($t_{A2} \geq 25$ mm) on both sides of the wall
- backfilling with mineral wool

For collar fixing – refer to 8.2.4.2

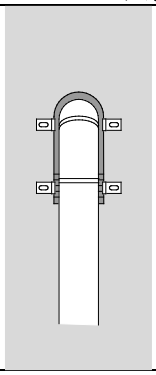
For number of hooks to be used - refer to 8.3.2.15



Pict. 8.4.4.10 A:

Non-regulated PE – pipes Geberit Silent dB20 with 2x45° elbow, sealed with CFS-C EL (A_1)

Side view/sectional view



Pict. 8.4.4.10 B:

Non-regulated PE – pipes Geberit Silent dB20 –with 2x45° elbow, sealed with CFS-C EL (A_1)

Frontal view

Figure 66: Geberit Silent dB20 pipe with 2x45° elbow

Type of Penetrant	Classification
Non-regulated PE – pipes Geberit Silent dB20 - with 2 x 45° elbow, sealed with CFS-C EL	EI 120 – U/U

Table **47**: Classification for non-regulated PE – pipes Geberit Silent dB20 – with 2x45° elbow

8.4.4.11 **PE pipes, Geberit Silent dB20, DG 1, with pipe coupling**

Situation:
- Single pipe seal
- Pipe perpendicular to wall
- Pipe elbow inside the wall, half in the wall or outside the wall, covered by CFS-C EL

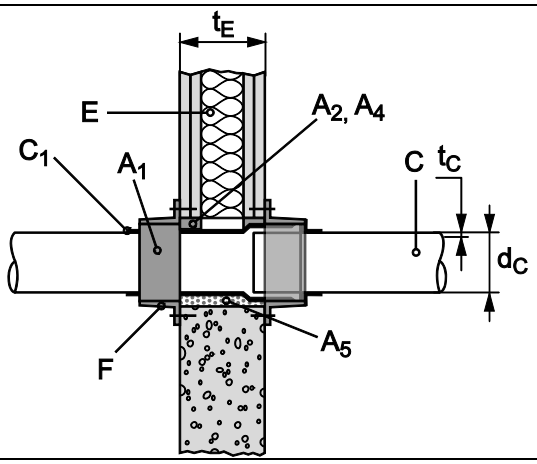
Pipes:
- PE–pipe, non-regulated
- Brand/Producer: Geberit Silent dB20
- Coupling, brand: Geberit Silent dB20, electric-welding wire inside
- Pipe diameter d_C = 110mm
- Pipe wall thickness t_C = 6 mm

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- For annular gap fill refer to 8.4.3.2

For collar fixing – refer to 8.2.4.2

For number of hooks to be used - refer to 8.3.2.21



Pict. 8.4.4.11:

Non-regulated PE–pipe Geberit Silent dB20 with coupling, sealed with CFS-C EL (A_1)

Side view/sectional view

Figure 67: Geberit Silent dB20 pipe with 2x45° elbow

Type of Penetrant	Classification
Non-regulated PE-pipes Geberit Silent dB20 with coupling, sealed with CFS-C EL	EI 30 – U/U

Table 48: Classification for Geberit Silent dB 20 with coupling, sealed with CFS-C EL in DG 1

8.4.4.12 **PP pipes, non-regulated, DG 1, with elbow 87°**

Situation:
- Single pipe seal
- Pipe perpendicular to wall on one side
- On one side of the wall pipe runs parallel to wall with zero distance ($s_3 \geq 0$mm)
- Pipe elbow 87° inside the wall, half in the wall or outside the wall, covered by CFS-C EL

Pipes:
- PP–pipe, non-regulated
- Brand/Producer: refer to 8.2.15
- For pipe dimension - refer to 8.4.4.4

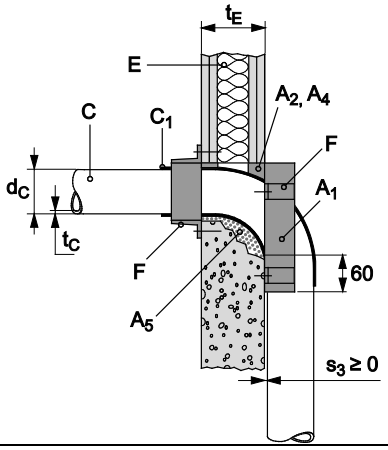
Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:

- Gap filler: Hilti CFS-FIL
- Annular Gap width: 5– 40 mm
- Depth ($t_{A2} \geq 25$ mm) on both sides of the wall
- backfilling with mineral wool

For collar fixing – refer to 8.2.4.2

For number of hooks to be used - refer to 8.3.2.13



Pict. 8.4.4.12:

Non-regulated PP – pipes with 87° elbow, sealed with CFS-C EL (A_1)

Side view/sectional view

Figure 68: Non-regulated PP-pipe with 87° elbow, sealed with CFS-C EL

Type of Penetrant	Classification
Non-regulated PP – pipes with 87° elbow, sealed with CFS-C EL	EI 90 – U/U

Table 49: Classification for non-regulated PP – pipes with 87° elbow in DG 1

8.4.4.13 **PP pipes, non-regulated, DG 1, with elbow 2x45°**

Situation:
- Single pipe seal
- Pipe perpendicular to wall on one side
- On one side of the wall pipe runs parallel to wall with zero distance ($s_3 \geq 0$mm)
- Pipe elbow 2x45° inside the wall, half in the wall or outside the wall, covered by CFS-C EL

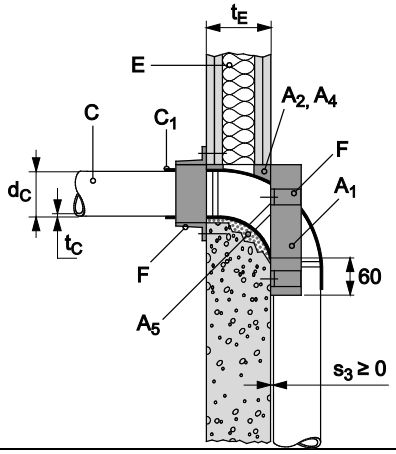
Pipes:
- PP–pipe, non-regulated
- Brand/Producer: refer to 8.2.15
- For pipe dimension - refer to 8.4.4.4

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Gap filler: Hilti CFS-FIL
- Annular Gap width: 5– 40 mm
- Depth ($t_{A2} \geq 25$ mm) on both sides of the wall
- backfilling with mineral wool

For collar fixing – refer to 8.2.4.2

For number of hooks to be used - refer to 8.3.2.15



Pict. 8.4.4.13:

Non-regulated PP–pipes with 2x45° elbow, sealed with CFS-C EL (A_1)

Side view/sectional view

Figure 69: Non-regulated PP-pipe with 2x45° elbow, sealed with CFS-C EL

Type of Penetrant	Classification
Non-regulated PP–pipes with 2 x 45° elbow, sealed with CFS-C EL	EI 120 – U/U

Table 50: Classification for non-regulated PP – pipes with 2x45° elbow in DG 1

8.4.4.14 **Roof drainage, plastic pipes covered with FEF, DG 1**

Situation:
- Single PE or PP-pipe insulated with elastomeric foamed insulation, sealed with CFS-C EL
- Pipe penetrates the wall in perpendicular and inclined (45°) situation
- Any pipe inclination in between 45° and 90° assessed

Classification is valid for:

Pipes:
- For pipe material refer to Table 51
- For pipe dimension refer to Table 51
- U/U – pipe end configuration

Insulation:
- For material type / brand refer to 8.2.12
- Installation situation is LS and CS
- For minimum insulation length ($L_D \geq 250$ mm) on both sides of the wall
- For insulation thickness refer to Table 51

Gap closure:
- Gap filler: Hilti CFS-FIL
- Annular Gap width: 5– 40 mm
- Depth ($t_{A2} \geq 25$ mm) on both sides of the wall
- backfilling with mineral wool

For collar fixing – refer to 8.2.4.2

For number of hooks to be used - refer to 8.3.2.15

Rigid walls ($t_E \geq 100$ mm)		
Pipe material	PE	PE
Norm/standard/ Producer/product	EN 1519-1, EN12666-1, EN 12201-2	Non-regulated, Geberit Silent dB20
Pipe diameter d_C	($40 \leq d_C \leq 110$ mm)	($40 \leq d_C \leq 110$ mm)
Pipe wall thickness t_C	(t_C= 4,2 mm)	(t_C= 6,0 mm)
insulation thickness t_D	(t_D = 19 mm)	(t_D = 19 mm)

Table 51: Specification for roof drainage with FEF-insulated PE - pipes

Type of Penetrant	Classification
Roof drainage, PE - plastic pipes covered with FEF, DG 1, sealed with CFS-C EL	EI 120 – U/U

Table 52: Classification for FEF-insulated PE-pipes in DG 1 as roof drainage

8.4.4.15 **PE–pipes (Wavin W), FEF-insulated, in DG 1**

Situation:
- Single PE - pipe insulated with FEF elastomeric foamed insulation, sealed with CFS-C EL
- Pipe penetrates the wall in perpendicular situation

Classification is valid for:

Pipes:
- PE according EN 12201
- Brand: Wavin W
- U/C – pipe end configuration
- For pipe dimension refer to Figure 70

Insulation:
- For material type / brand refer to 8.2.12
- Installation situation is LS and CS
- For minimum insulation length (L_D ≥ 250 mm) on both sides of the wall
- Insulation thickness t_D = 9 mm

Gap closure:
- For annular gap fill refer to 8.4.3.2

For collar fixing – refer to 8.2.4.2

For number of hooks to be used - refer to 8.3.2.15

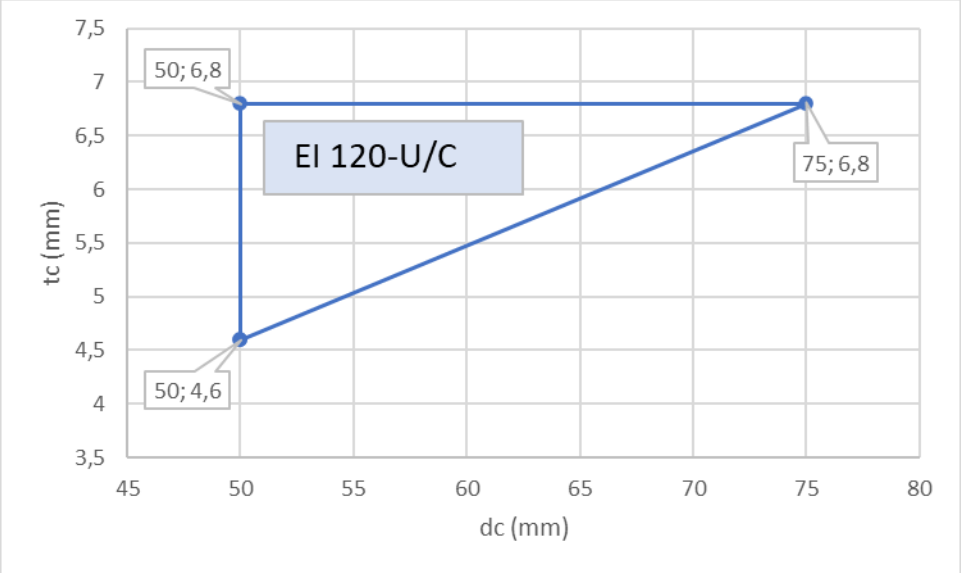


Figure 70: Classified pipe range for Wavin W–pipes, FEF-insulated, sealed with CFS-C EL

Type of Penetrant	Classification
Wavin W–pipes, FEF-insulated, sealed with CFS-C EL in DG 1, sealed with CFS-C EL	EI 120 – U/C

Table 53: Classification for Wavin W–pipes, FEF-insulated, sealed with CFS-C EL

8.4.5 Specific characteristics for Rigid walls ($t_E \geq 150$ mm)

8.4.5.1 Rigid walls:

- minimum thickness of ($t_E \geq 150$ mm)
- minimum density: ($\rho_E \geq 650$ kg/m³)
- comprise concrete, aerated concrete, brickwork, lime malm bricks or masonry.

8.4.5.2 Annular gap

Annular gap fill:
- Gap filler: Cementious mortar M10 acc. EN 998-2
- Annular Gap width: 0– 40 mm
- Depth to be filled: over entire thickness t_E

or
- Gap filler: Hilti CFS-S ACR on both sides of the wall
- Annular Gap width: 0– 40 mm
- Depth: ($t_{A2} \geq 25$ mm)
- Mineral wool backfilling required

or
- Gap filler: Hilti CFS-S ACR on both sides of the wall
- Annular Gap width: 0– 15 mm
- Depth: ($t_{A2} \geq 25$ mm)
- No backfilling required

8.4.5.3 Collar fixing

Hilti Firestop Collar Endless CFS-C EL (A_1) to be fixed with hooks (F) on the wall.
For number of hooks refer to 8.2.4
For hooks fixing refer to 8.2.4.2

Bent hooks could be pressed into the wet gap seal, made of cementious mortar. For details refer to 8.2.4.7.

8.4.6 Penetration services rigid walls ($t_E \geq 150$ mm)

Results from 8.3.2 and 8.4.4 are valid.

8.4.6.1 PE-pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 2

Classification shown in Figure 71is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according to ISO 19220
- No limitation for brands/producers

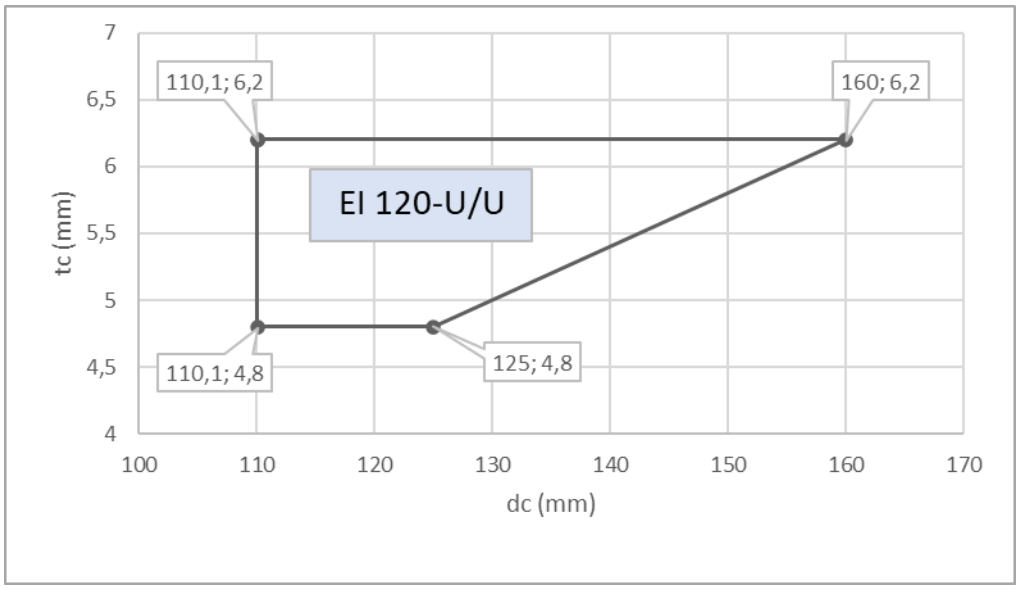


Figure 71: Classified pipe range for PE-, PE-X-, ABS-, SAN+PVC-pipes in DG2

8.4.6.2 ABS–pipes acc. EN 1455-1 in DG 2

Classification shown in Figure 72 and Figure 73 is valid for pipes made from:

- ABS according EN 1455-1 and EN ISO 15493
- No limitation for brands/producer

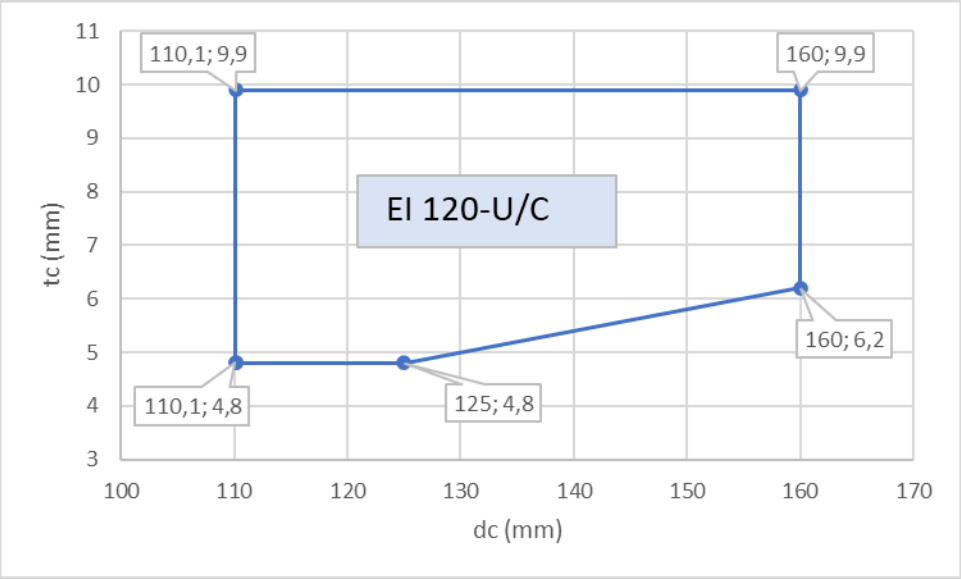


Figure 72: Classified pipe range for ABS-pipes in U/C end configuration in DG2

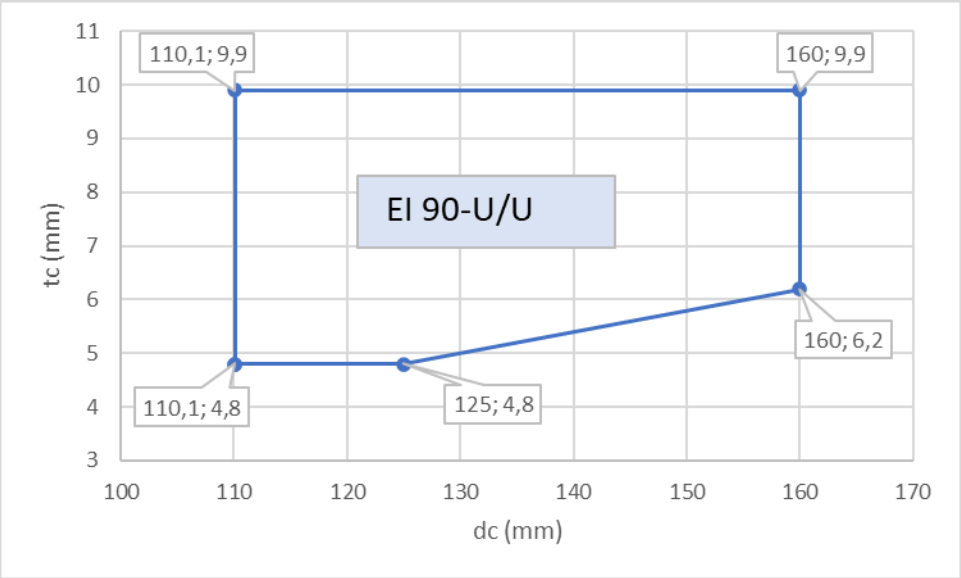


Figure 73: Classified pipe range for ABS-pipes in U/U end configuration in DG2

8.4.6.3 **PE-pipes acc. EN ISO 15494 in DG 2**

Classification shown in Figure 74 is valid for pipes made from:

- PE according EN ISO 15494, EN 12201-2 and DIN 8074/75
- No limitation for brands/producer

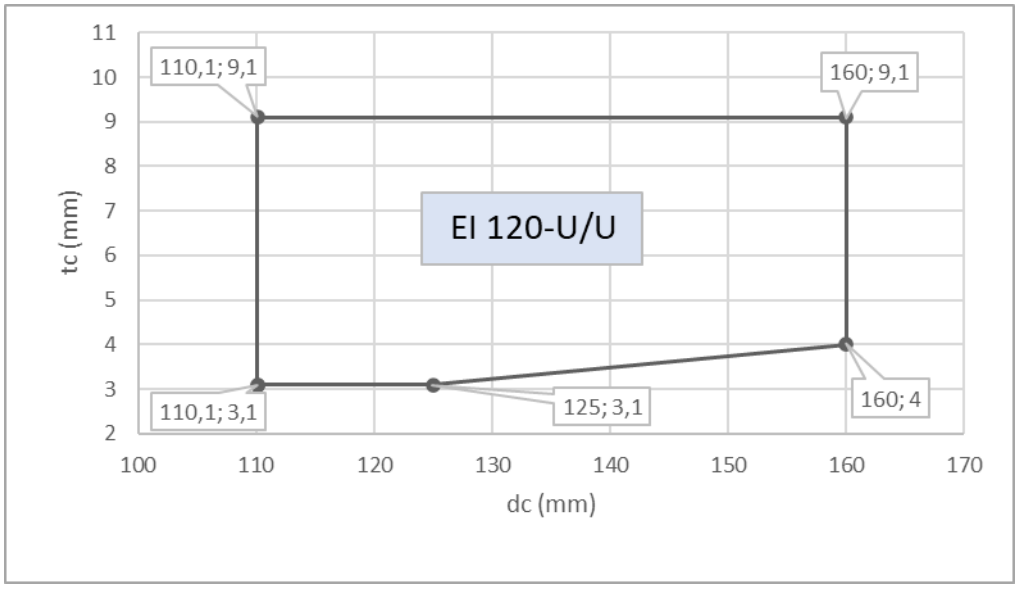


Figure 74: Classified pipe range for PE-pipes acc. EN ISO 15494 in DG2

8.4.6.4 PVC-pipes acc. EN 1452-2 in DG 2

Classification shown in Figure 75 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Carefully consider disclaimer in 8.2.16

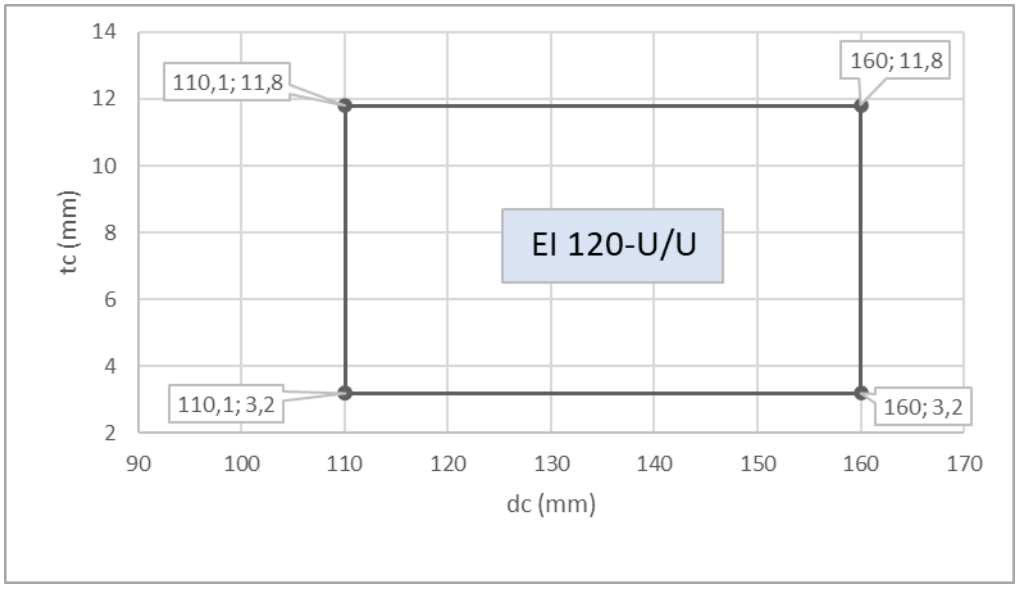


Figure 75: Classified pipe range for PVC-pipes in DG2

8.4.6.5 PP-pipes, non-regulated in DG 2

Classification shown in Figure 76 is valid for pipes made from:

- For assessed brands/producers refer to section 8.2.15

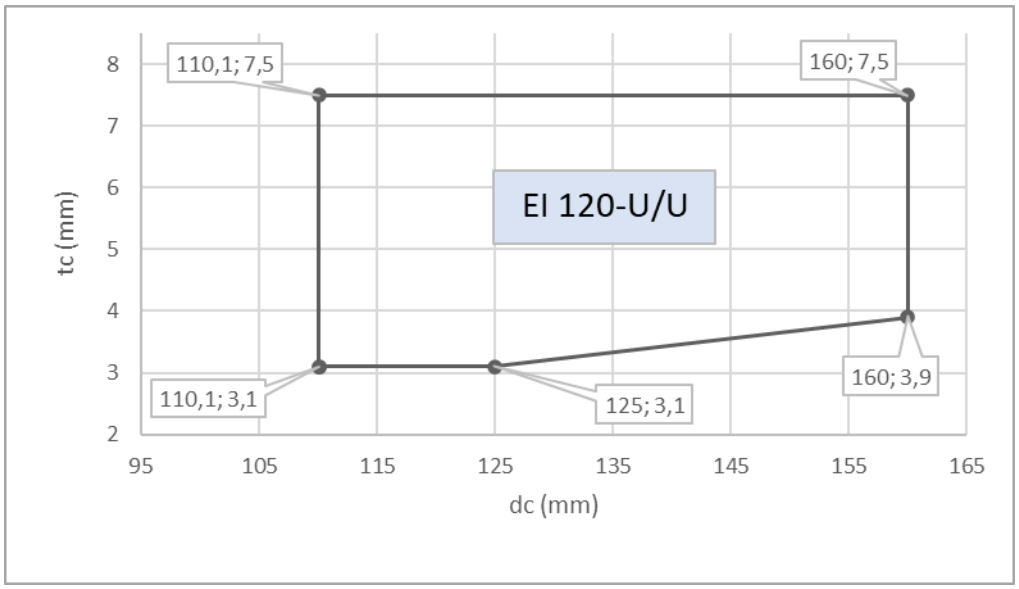


Figure 76: Classified pipe range for non-regulated PP-pipes in DG2

8.4.6.6 PP-pipes acc. EN 1451-1 in DG 2

Classification shown in Figure 77, Figure 78 and Figure 79 is valid for pipes made from:

- PP according to EN 1451-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer

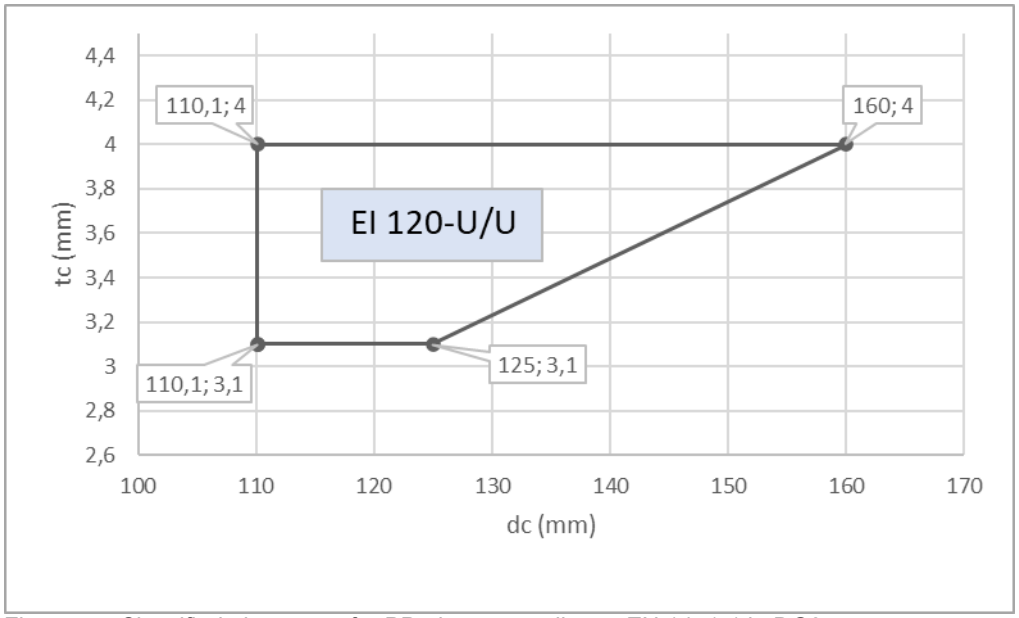


Figure 77: Classified pipe range for PP-pipes according to EN 1451-1 in DG2

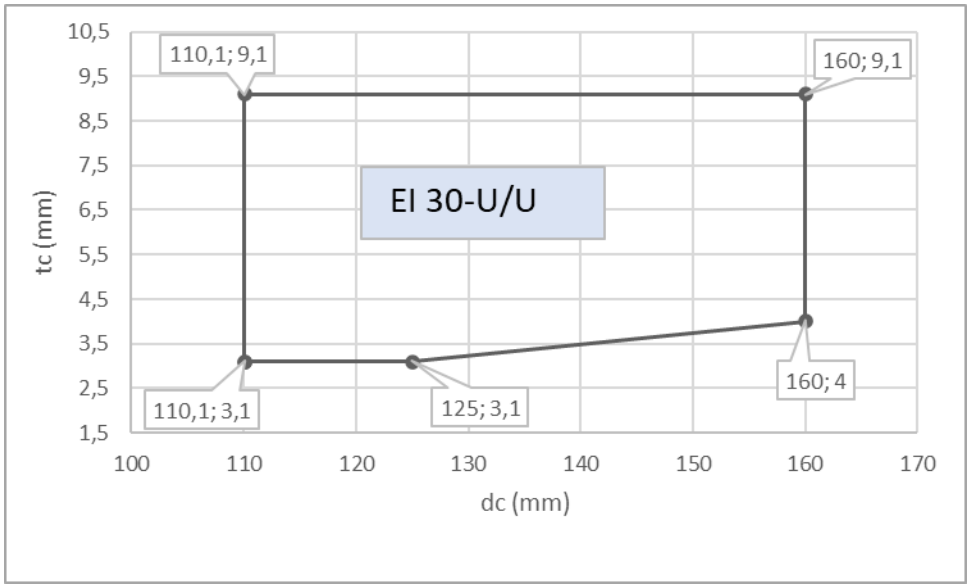


Figure 78: Classified pipe range for PP-pipes according to EN 1451-1 in DG2

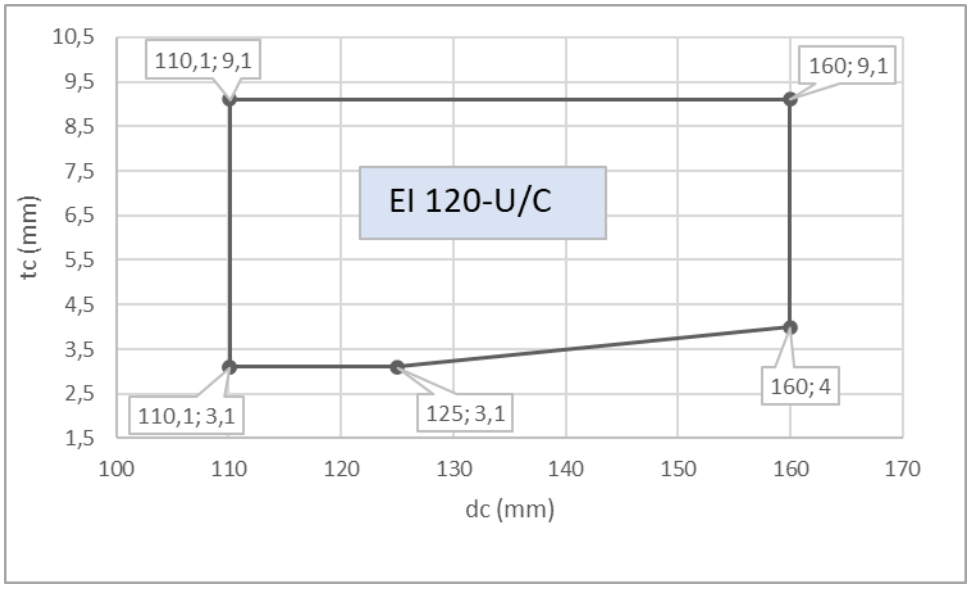


Figure 79: Classified pipe range for PP-pipes according to EN 1451-1 in DG2

8.4.6.7 **PE-pipes, Geberit Silent db20 in DG 2**

Classification shown in Figure 80 is valid for pipes made from:

- Pipe material: PE, non-regulated
- Brand/producer: Geberit Silent dB20

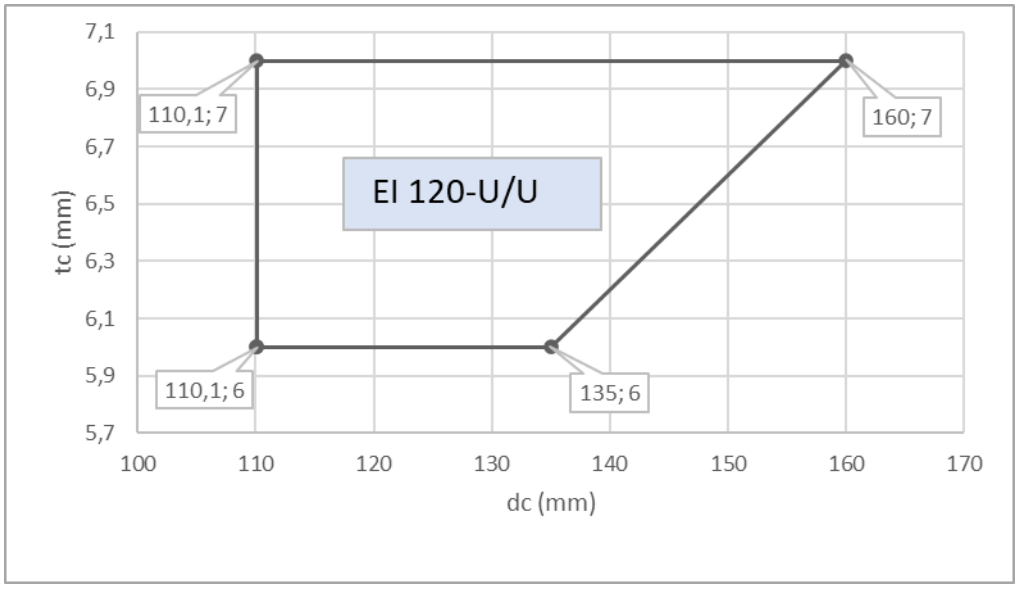


Figure 80: Classified pipe range for Geberit dB20 in DG2

8.4.6.8 PVC-pipes, Friatec Friaphon in DG 2

Classification shown in Figure 81 valid for pipes made from:

- Pipe material: PVC, non-regulated
- Brand/producer: Friatec, Friaphon
- Carefully check disclaimer in 8.2.16

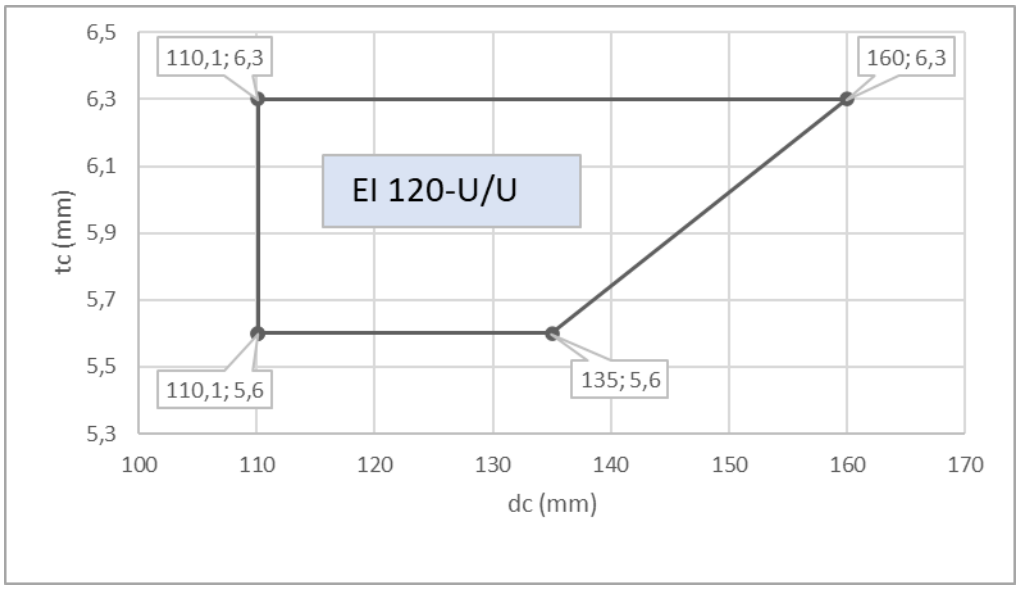


Figure 81: Classified pipe range for Friatec Friaphon–pipes in DG2

8.4.6.9 Pneumatic dispatch system in DG 2

Situation:
- Mixed seal
- Single pipe together with three pipes, sealed with CFS-C EL
- Cable in direct contact to pipe (single or bunched cables assessed)
- Pipe and cables penetrate the wall in perpendicular situation only

Classification is valid for:

Pipe (C):
- PVC pipe acc. DIN 6660
- Pipe diameter (110,1 mm ≤ d_C ≤ 160 mm)
- Pipe wall thickness (t_C = 3,2 mm)
- U/U – pipe end configuration

Insulation:
- No insulation on pipe or cable
- For sound decoupling (sd) refer to 8.2.7

Cable (R, RB):
- NYM-J 3x2,5 mm²
- J-Y (St) Y 6 x 2 x 0,6 mm²
- 2 x 2,5 mm²

Gap closure:
- For gap closure details refer to 8.4.3.2

For collar fixing – refer to 8.2.4.2

For number of hooks to be used - refer to 8.2.5

Type of Penetrant	Classification
Pneumatic dispatch system in DG 2, sealed with CFS-C EL	EI 90 – U/U

Table 54: Classification for plastic pipes in DG2, used in pneumatic dispatch systems

8.4.6.10 Pipes in rigid wall ($t_E \geq 150$ mm), Zero distance collar to collar, DG2

Situation:
- Single pipe seal
- Pipes penetrate the wall in perpendicular situation only
- Zero distance between two CFS-C EL collars, sealing two plastic pipes ($s_1 \geq 0$ mm)
- Pipes must be grouped in line only
- Max. 2 pipes parallel side by side in one group
- Minimum distance group to group must be ($s_2 \geq 60$ mm)
- Number of groups is unlimited

Classification is valid for:

Pipes:
- For pipe dimension and material refer to 8.4.6.1, 8.4.6.3, 8.4.6.4, 8.4.6.5, 8.4.6.6, 8.4.6.7

Insulation:
- No insulation on pipe
- For sound decoupling (sd) refer to 8.2.7

Gap closure:
- For gap closure details refer to 8.4.3.2

For collar fixing – refer to 8.2.4.2

For number of hooks to be used - refer to 8.2.5

Type of Penetrant	Classification
Pipes in DG 2, in linear arrangement, zero distance collar to collar, sealed with CFS-C EL	EI 90 – U/U

Table 55: Classification for zero distance collar to collar in DG2

8.4.6.11 PP pipes acc. EN 1451-1 in rigid wall ($t_E \geq 150$ mm), DG2, pipe coupling

Situation:
- Single pipe seal
- Pipes penetrate the wall in perpendicular situation only
- Pipe coupling inside the wall, half in the wall or outside the wall, covered by CFS-C EL

Classification is valid for:

Pipe:
- PP pipes acc. EN 1451-1
- For pipe dimension refer to Figure 83

Insulation:
- No insulation on pipe
- For sound decoupling refer to 8.2.7

Gap closure:
- Gap filler: Hilti CFS-FIL
- Annular gap: 5 – 40 mm
- Depth t_{A2} to filled with Hilti CFS-FIL: ($t_{A2} \geq 25$ mm)
- No backfilling required

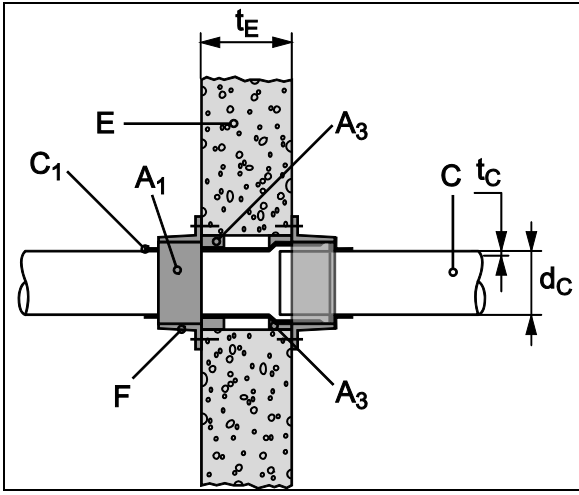
For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (incoming pipe / outgoing pipe)		
(mm)	0	4	9
40	2 / 2	2 / 2	2 / 2
41 - 75	3 / 3	3 / 3	3 / 3
76 - 90	3 / 3	3 / 3	3 / 3
91 - 110	3 / 4 (on coupling)	3 / 4	3 / 4

Table 56: number of short hooks to be used for collar fixing on coupled PP-pipes

If pipe insulation thickness is between 0 and 4mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.



Pict. 8.4.6.11:

Pipe coupling in rigid wall ($t_E \geq 150$mm), sealed with CFS-C EL

Figure 82: PP-pipes with coupling in rigid wall, sealed with CFS-C EL

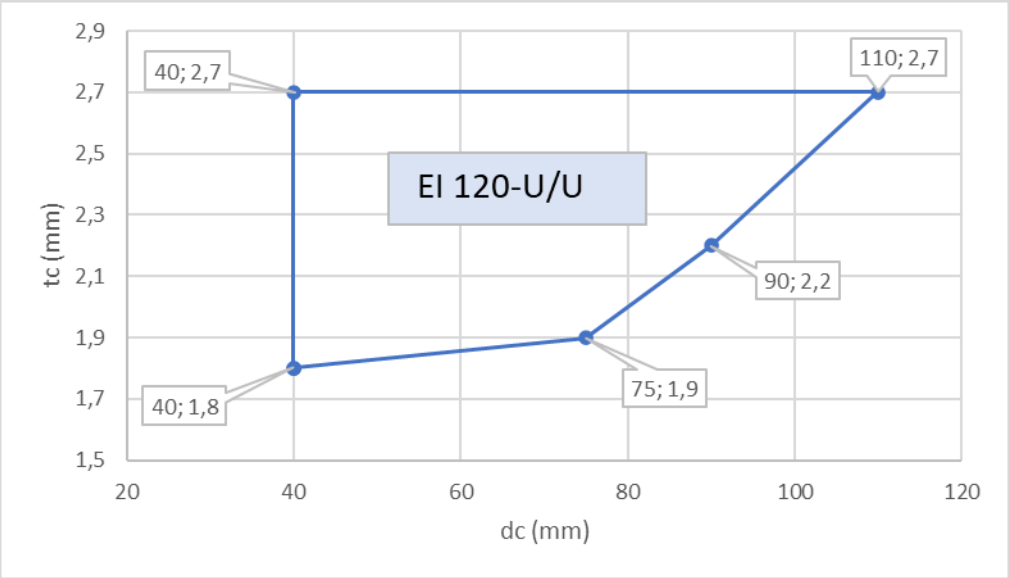


Figure 83: Classified pipe range of PP-pipes with coupling in DG1 in rigid wall

8.5 Cross Laminated Timber (CLT) Walls

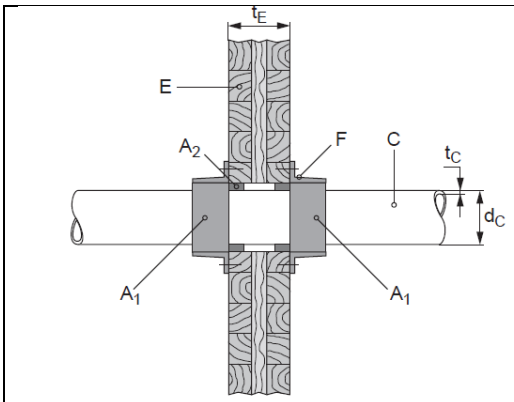
8.5.1 Binderholz Brettsperrholz BBS

8.5.1.1 Specific characteristics Brettsperrholz BBS

- Wall material acc. ETA-06/0009
- minimum element thickness (t_E ≥ 80 mm), having ≥ 3 layers of softwood
- or minimum element thickness (t_E ≥ 100 mm), having ≥ 5 layers of softwood
- minimum outer layer thickness ≥ 20 mm,
- shall comprise Polyurethane and MUF based adhesives,
- no request for edge glue

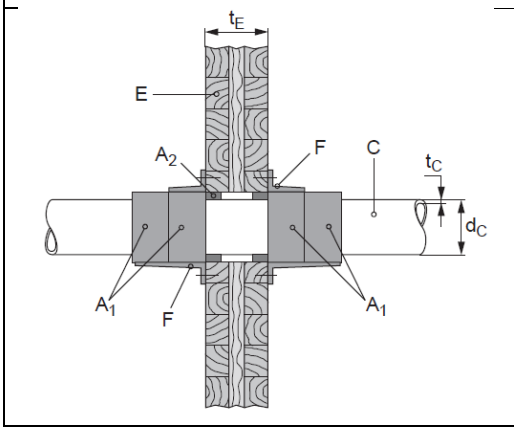
8.5.1.2 Penetrating items

- For assessed penetrants refer to section 8.5.1.11 and 8.5.1.12
- Single pipe penetration



Pict. 8.5.1.2 A:

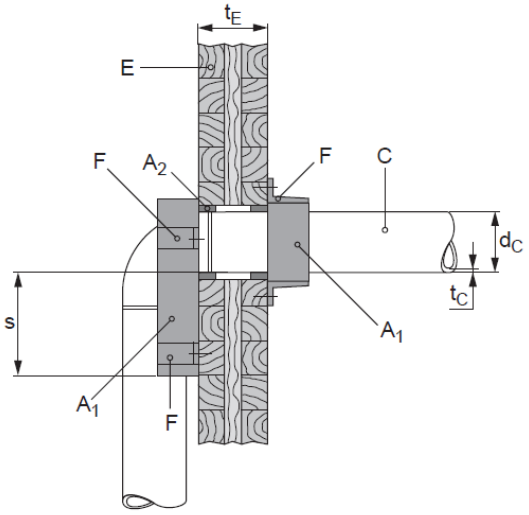
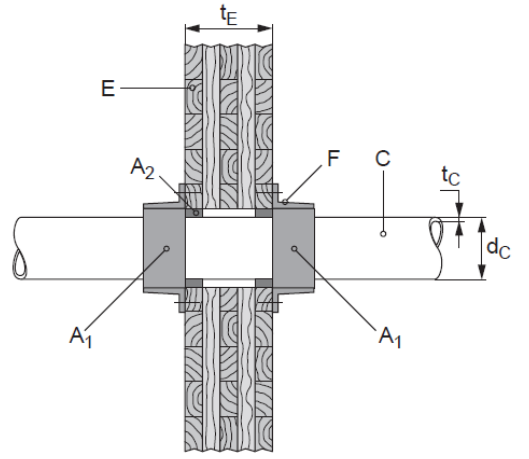
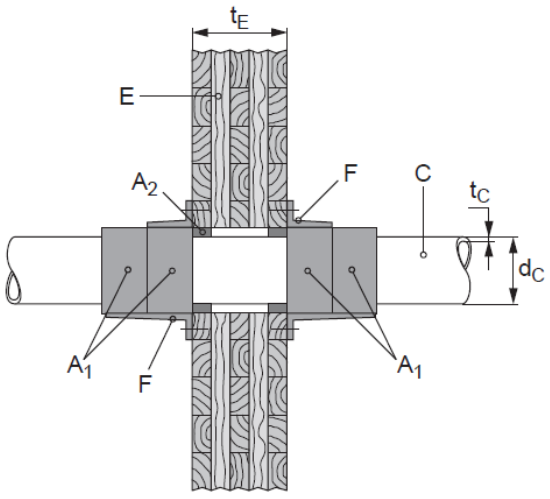
Plastic pipe penetration in DG 1 in BBS, minimum element thickness (t_E) ≥ 80 mm, having ≥ 3 layers of softwood

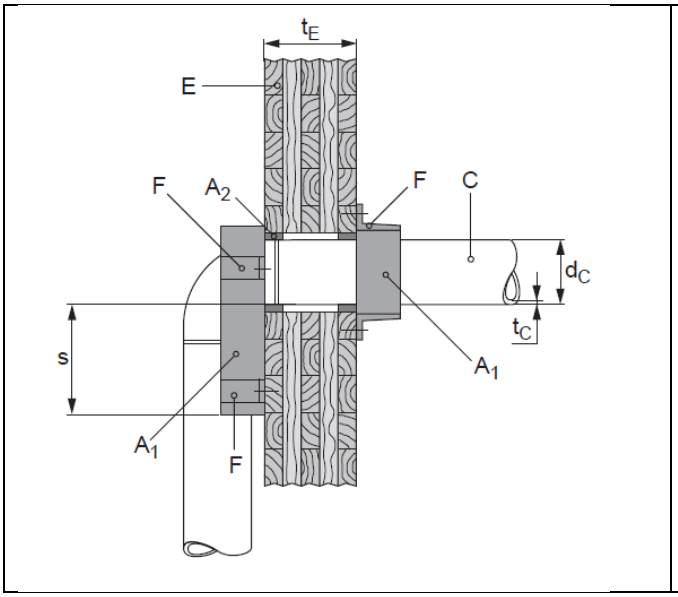


Pict. 8.5.1.2 B:

Plastic pipe penetration in DG 2 in BBS, minimum element thickness (t_E) ≥ 80 mm, having ≥ 3 layers of softwood

Figure 84: Plastic pipe seal in CLT – BBS in DG 1 and DG 2, (t_E) ≥ 80mm

	Pict. 8.5.1.2 C: Plastic pipe penetration in DG 1 in BBS, minimum element thickness (t_E) ≥ 80 mm, having ≥ 3 layers of softwood. Perpendicular penetrating plastic pipe is combined with an 87° elbow. Distance s ≥ 60mm, so final collar length should be increased by ≥ 120mm on elbow side. Elbow direction is not defined.
	Pict. 8.5.1.2 D: Plastic pipe penetration in DG 1 in BBS, minimum element thickness (t_E) ≥ 100 mm, having ≥ 5 layers of softwood
	Pict. 8.5.1.2 E: Plastic pipe penetration in DG 2 in BBS, minimum element thickness (t_E) ≥ 100 mm, having ≥ 5 layers of softwood



Pict. 8.5.1.2 F:

Plastic pipe penetration in DG 12 in BBS, using a 1x87° elbow on one side.

Length (s) of open collar flanks should be ≥ 60mm.

Minimum element thickness (t_E) ≥ 80 mm

Figure 85: Plastic pipe seal in CLT – BBS in DG 1 and DG 2, (t_E) ≥ 80mm and (t_E) ≥ 100mm

8.5.1.3 Annular Gap and gap filler in Binderholz Brettsperrholz BBS

- Annular gap width (0 mm ≤ w ≤ 15 mm)
- Annular gap depth (t_{A2}) ≥ 25 mm
- Gap Filler: CFS-S ACR (A_2)
- No backfilling requested
- Installation identically on both sides of the wall
- Installation flush to wall surface

8.5.1.4 Collar fixing in Binderholz Brettsperrholz BBS

- For number of hooks (perpendicular pipe penetration): refer to 8.2.5
- For number of hooks, using 1x87° elbow – refer to 8.3.2.13
- For hook fixing: refer to 8.2.4 and 8.2.4.5
- Long and short hooks are requested, depending on pipe DG

For hook fixing:
- Hilti HUS H6 x 60
- Hilti S-WS 11Y x 75
- Hex.head wood screws 6x60
- Hilti S-WS 11 Zx75

8.5.1.5 Pipe support in Binderholz Brettsperrholz BBS

- maximum 450 mm away from both sides of wall constructions (first support)

8.5.1.6 Recycling of oddments in Binderholz Brettsperrholz BBS

- No oddments should be used.

8.5.1.7 Pipe orientation in Binderholz Brettsperrholz BBS

- perpendicular orientation only, no inclined pipe
- specific 87° elbow solution accepted

8.5.1.8 Sound decoupling on plastic pipes in in Binderholz Brettsperrholz BBS

- No sound decoupling assessed

8.5.1.9 Distances to other penetrating items in Binderholz Brettsperrholz BBS

In BBS wall (80 mm ≤ t_E ≤ 100 mm):

- Always 100 mm to openings of other collar or other firestop systems

In BBS wall (t_E ≥ 100 mm):

- (s ≥ 50 mm) between openings (not between products), refer to Figure 86, Pict. 8.5.1.9 B: and Table 57
- all assessed penetrant solutions with their specific EI-ratings (refer to 8.8.1.11, 8.8.1.12, 8.8.1.13) might be installed in (s ≥ 50 mm) by maintaining their original EI-rating
- The only exception from this rule: combination with CFS-B on copper pipes (independent from size) is limited to EI 60.

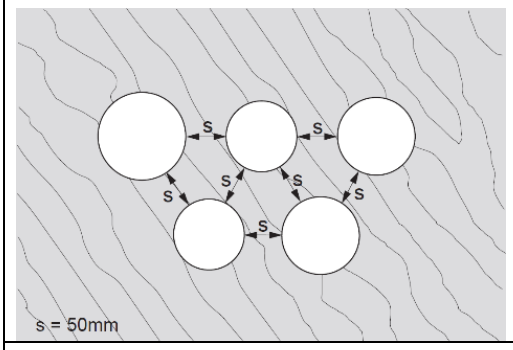
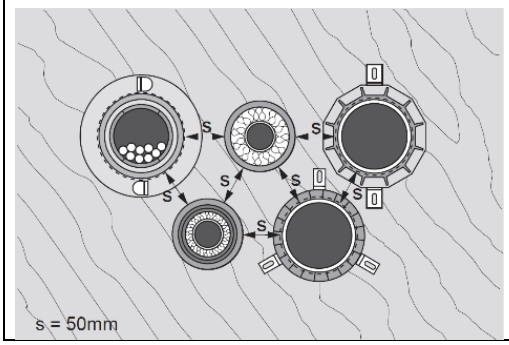
	Pict. 8.5.1.9 A: Minimum distance (s) in between openings in BBS Brettsperrholz (thickness t_E ≥ 100 mm)
	Pict. 8.5.1.9 B: Minimum distance (s) in between openings in BBS Brettsperrholz (thickness t_E ≥ 100 mm, filled with several penetrants

Figure 86: Minimum distances penetrant to penetrant in BBS-wall, thickness ≥ 100mm

Distances to each other (opening to opening)	CFS-C EL All assessed pipes	CFS-B All assessed solution	CFS-S ACR All assessed solution	CFS-CC All assessed solution	CFS-SL GA All assessed solution	Lower, upper side edge of support construction
CFS-C EL All assessed pipes	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-B All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-S ACR All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-CC All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-SL GA All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-SL GA All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
Lower, upper side edge of support construction	≥ 100mm	≥ 100mm	≥ 100mm	≥ 100mm	≥ 100mm	≥ 100mm

Table 57: Minimum distance between openings for several penetrants in CLT-BBS wall

8.5.1.10 **Pipe insulation**

- In wall thickness (80 mm ≥ t_E ≥ 100 mm): no insulation assessed on plastic pipe
- In wall thickness (t_E ≥ 100 mm): no insulation assessed on plastic pipe

8.5.1.11 **Penetration service in Binderholz Brettsperrholz BBS wall, $t_E \geq 80$mm**

8.5.1.11.1 PE pipes acc.EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 and DG 2 in BBS wall

Classification shown in Figure 87 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer
- Perpendicular installation only

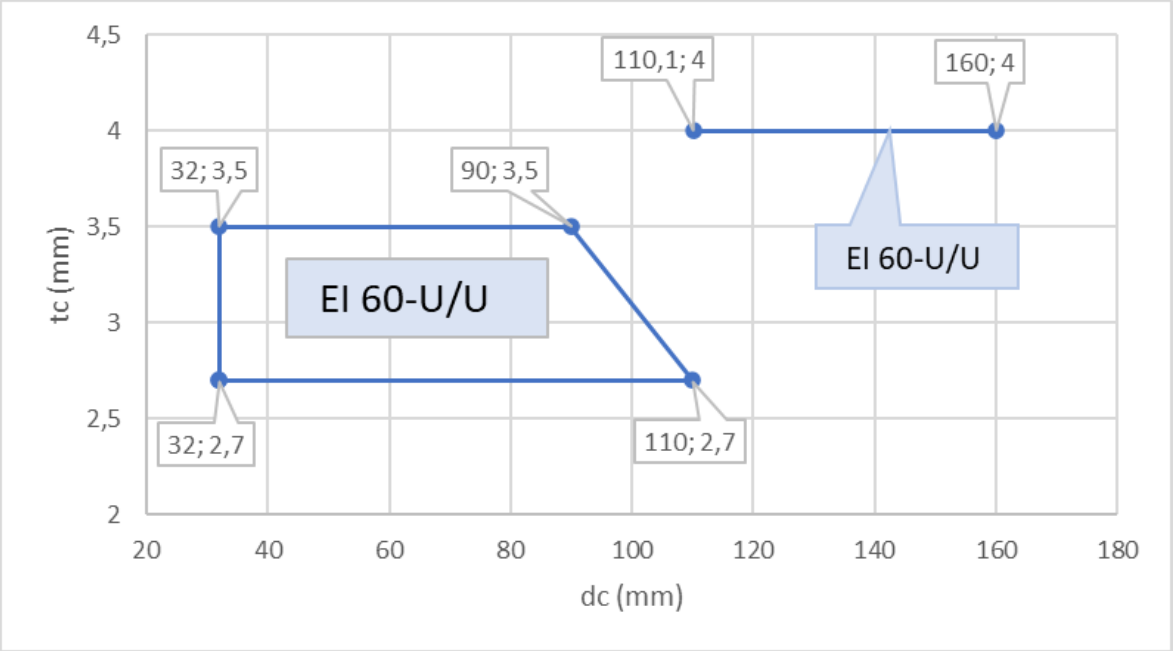


Figure 87: Classified pipe range for PE, ABS-pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 80$ mm

8.5.1.11.2 PP-pipes acc. EN 1451-1 in DG 1 and DG 2 in BBS wall

Classification shown in Figure 88 is valid for pipes made from:

- PP according EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL
- Perpendicular installation only

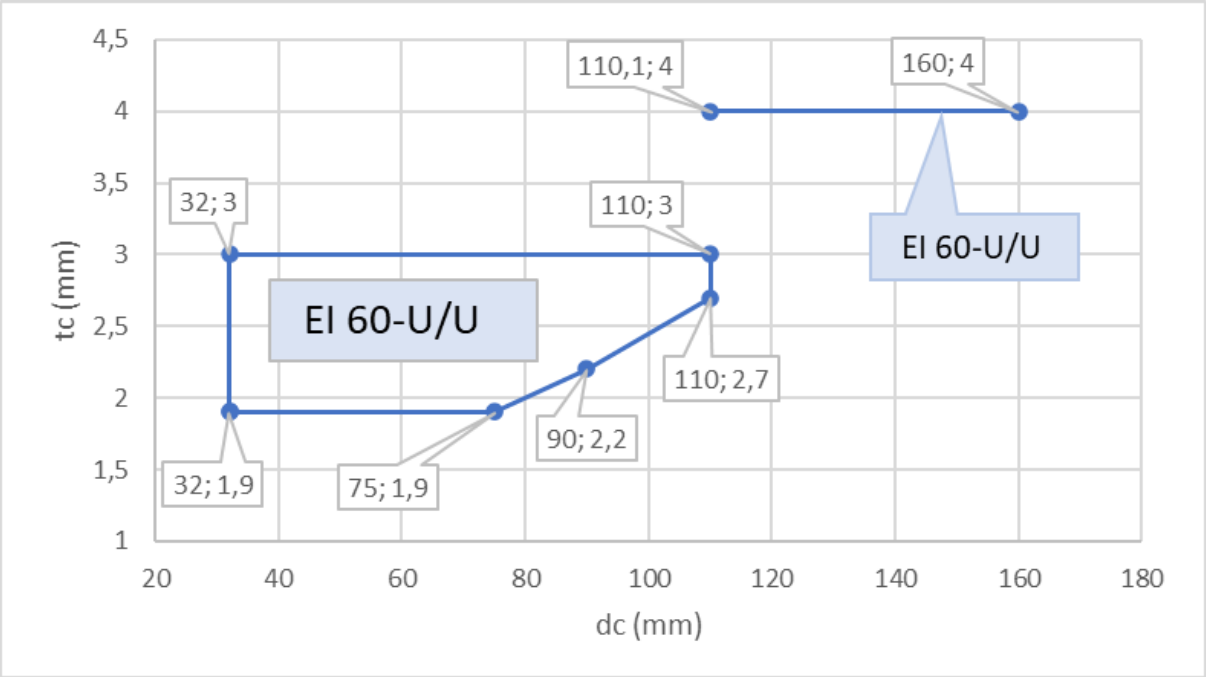


Figure 88: Classified pipe range for PP-pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 80$ mm

8.5.1.11.3 PP-pipes, non-regulated (Poloplast POLO-KAL NG/XS) in DG 1 and DG 2 in BBS wall

Classification shown in Figure 89 is valid for pipes made from:

- For Poloplast POLO-KAL NG/XS only
- Consider relevant Design Group (DG) for CFS-C EL
- Perpendicular installation only

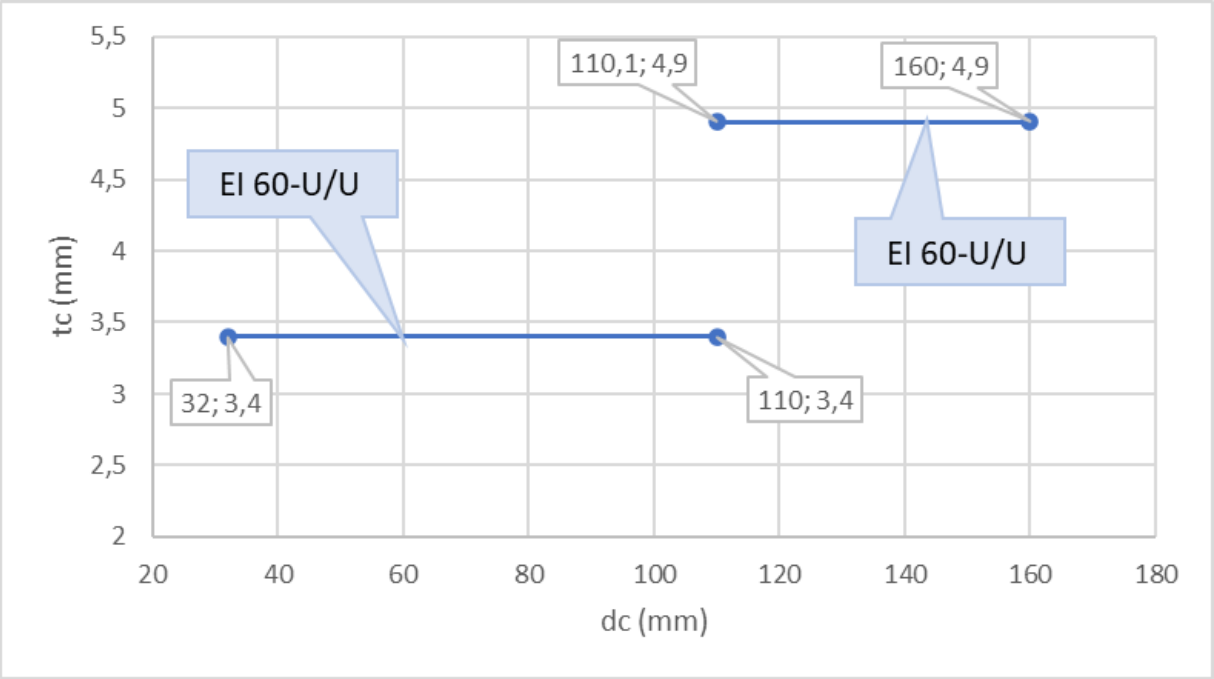


Figure 89: Classified pipe range for Poloplast POLO-KAL NG/XS-pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 80$ mm

8.5.1.11.4 PP-pipes, non-regulated (Rehau Raupiano Plus) in DG 1 in BBS wall

Classification shown in Figure 90 is valid for pipes made from:

- For Rehau Raupiano Plus only, Perpendicular installation only

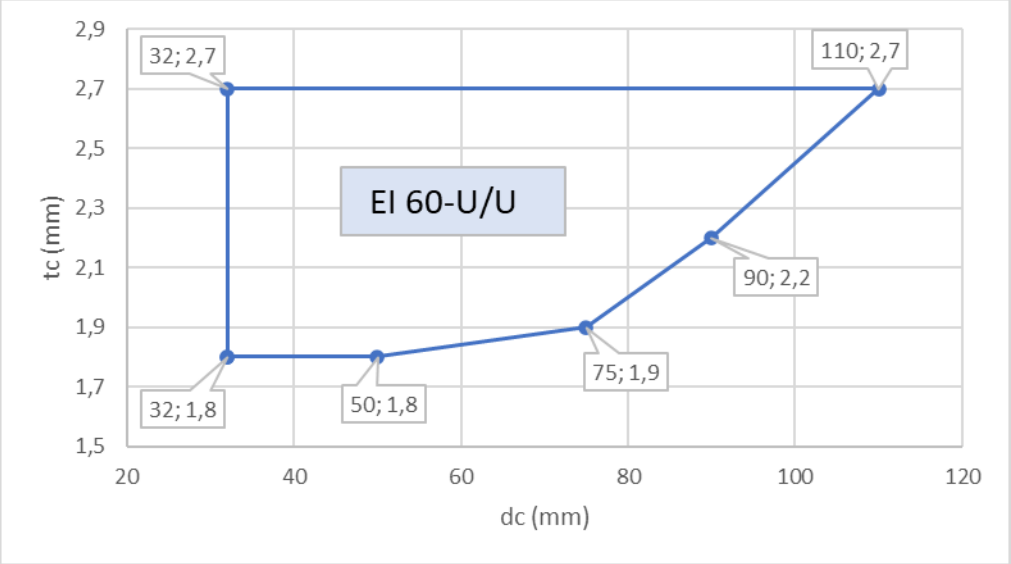


Figure 90: Classified pipe range for Rehau Raupiano Plus-pipes in DG 1, sealed with CFS-C EL in BBS-wall, $t_E \geq 80$ mm

8.5.1.11.5 PP-pipes, non-regulated (Wavin AS) in DG 1 in BBS wall

Classification shown in Figure 91 is valid for pipes made from:

- For Wavin AS only, perpendicular installation only

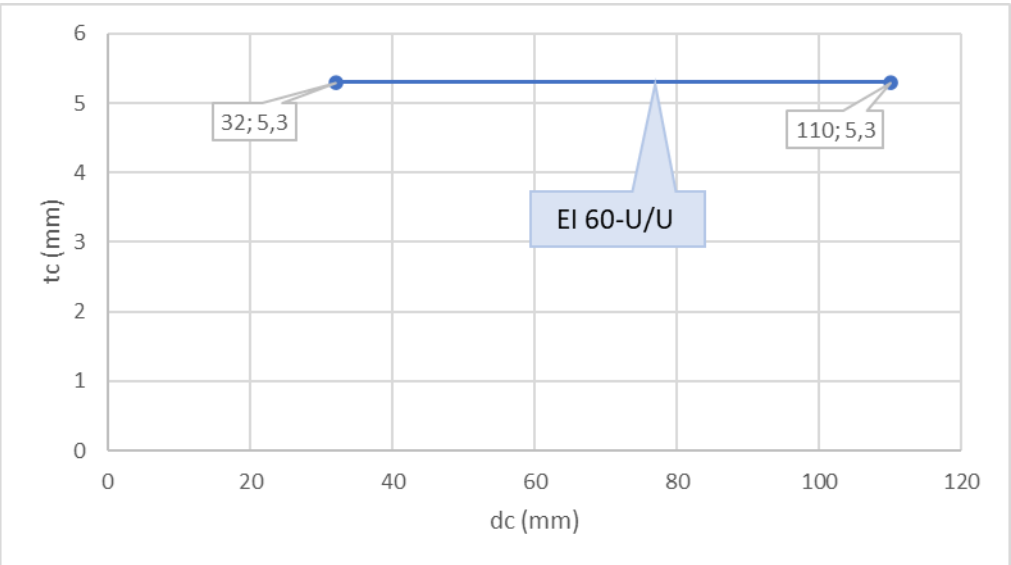


Figure 91: Classified pipe range for Wavin AS-pipes in DG 1, sealed with CFS-C EL in BBS-wall, $t_E \geq 80$ mm

8.5.1.11.6 PE-pipes, non-regulated (Geberit Silent dB20) in DG 1 in BBS wall

Classification shown in Figure 92 is valid for pipes made from:

- For Geberit Silent dB20 only, perpendicular installation only

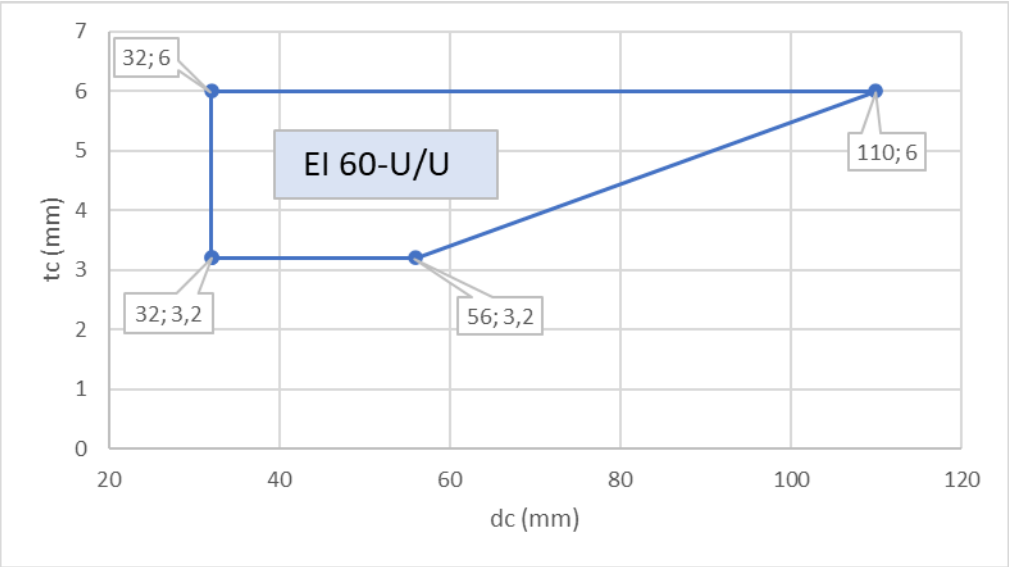


Figure 92: Classified pipe range for Geberit Silent dB20-pipes in DG 1, sealed with CFS-C EL in BBS-wall, $t_E \geq 80$ mm

8.5.1.11.7 PP-pipes, non-regulated (Poloplast POLO-KAL NG) in DG 1 in BBS wall

Classification shown in Figure 93 is valid for pipes made from:

- For Poloplast POLO-LAL NG only
- 1x87° elbow on one side, the other side is perpendicular to wall

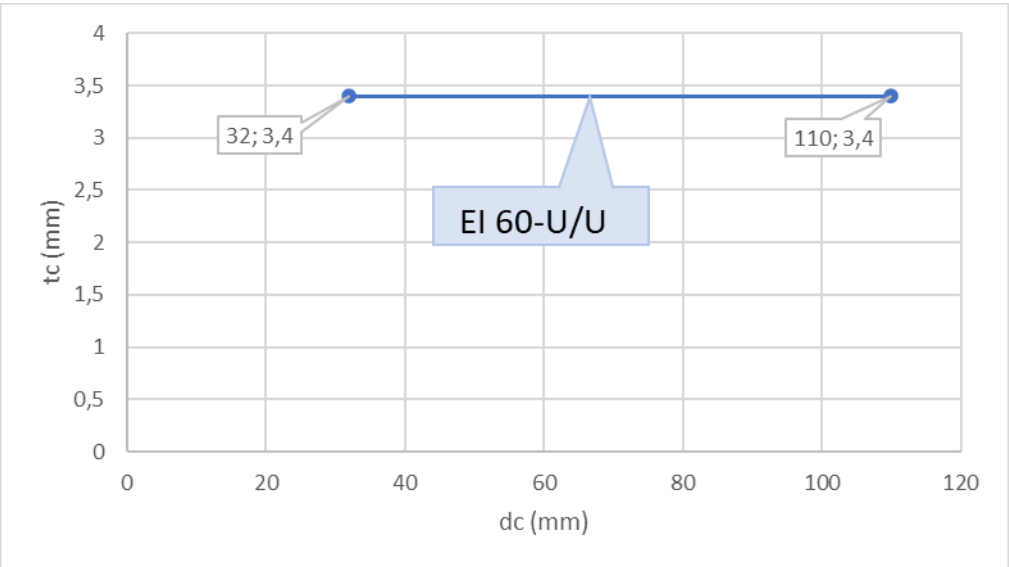


Figure 93: Classified pipe range Poloplast POLO-KALNG-pipes in DG 1, sealed with CFS-C EL in BBS-wall, $t_E \geq 80$ mm, in 1x87° elbow situation

8.5.1.12 **Penetration services in Binderholz Brettsperrholz BBS wall, $t_E \geq 100$mm**

8.5.1.12.1 PE pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 and DG 2 in BBS wall

Classification shown in Figure 94, Figure 95, Figure 96 and Figure 97 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2, SAN+PVC according ISO 19220
- ABS according EN 1455-1 and EN ISO 15493
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL, perpendicular installation only

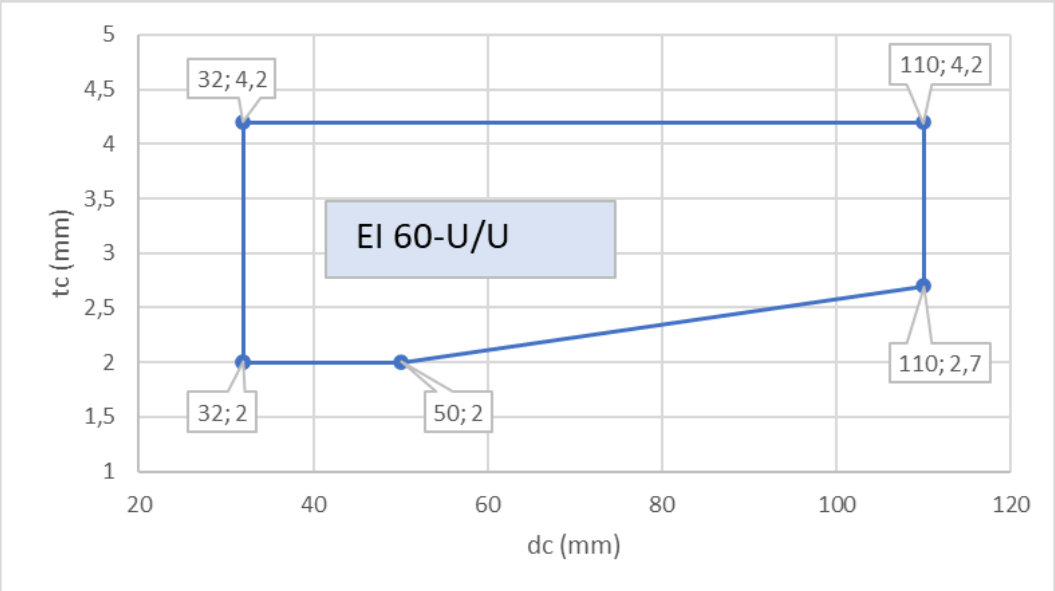


Figure 94: Classified pipe range for PE, ABS-pipes in DG 1, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

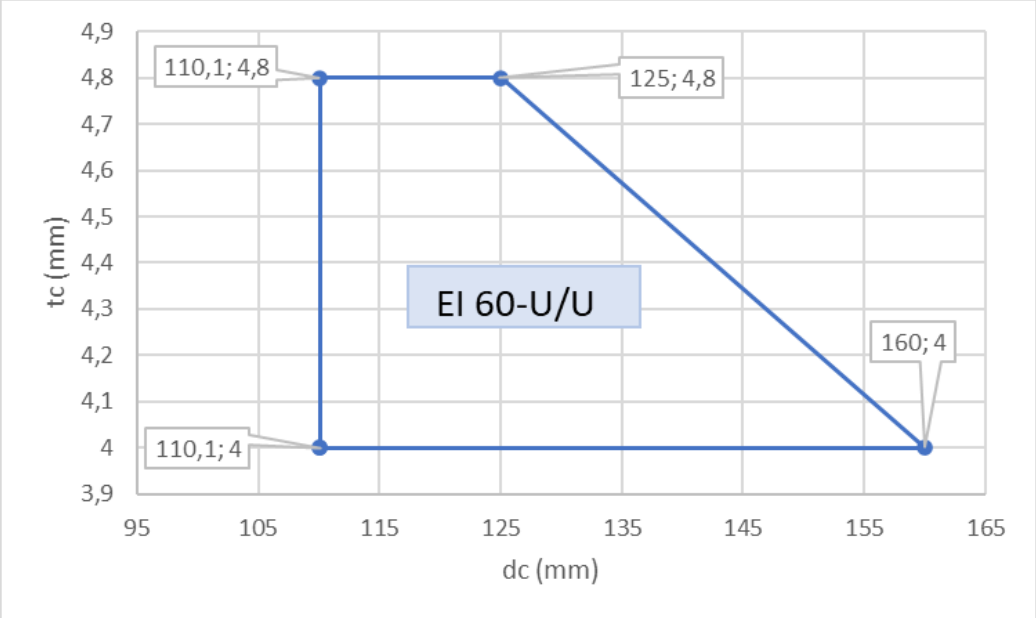


Figure 95: Classified pipe range for PE, ABS-pipes in DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

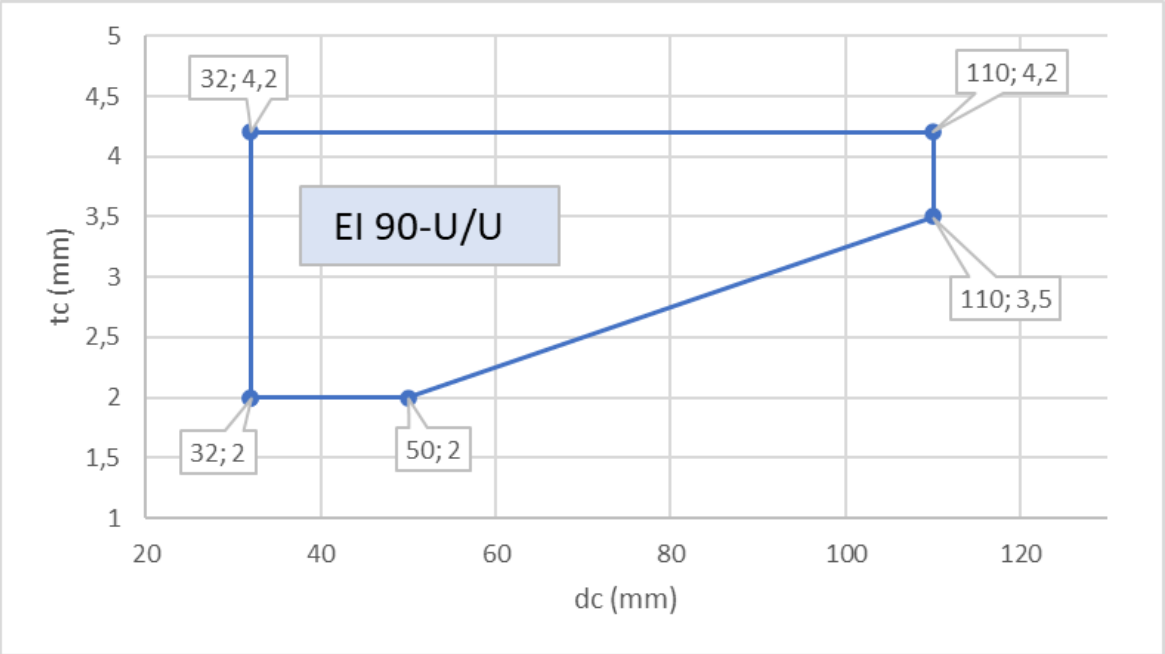


Figure 96: Classified pipe range for PE, ABS-pipes in DG 1, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

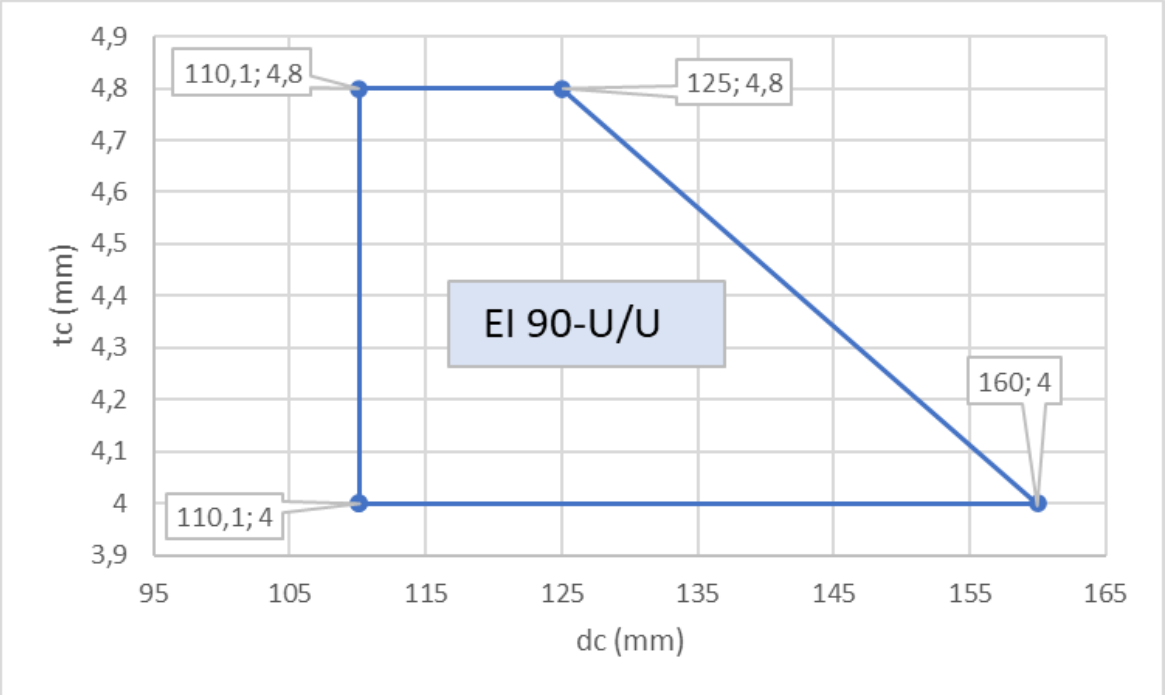


Figure 97: Classified pipe range for PE, ABS-pipes in DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.2 PVC - pipes acc. EN 1452-2 in DG 1 and DG 2 in BBS wall

Classification shown in Figure 98 and Figure 99 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Perpendicular installation only
- Consider relevant Design Group (DG) for CFS-C EL
- Carefully consider disclaimer in 8.2.16

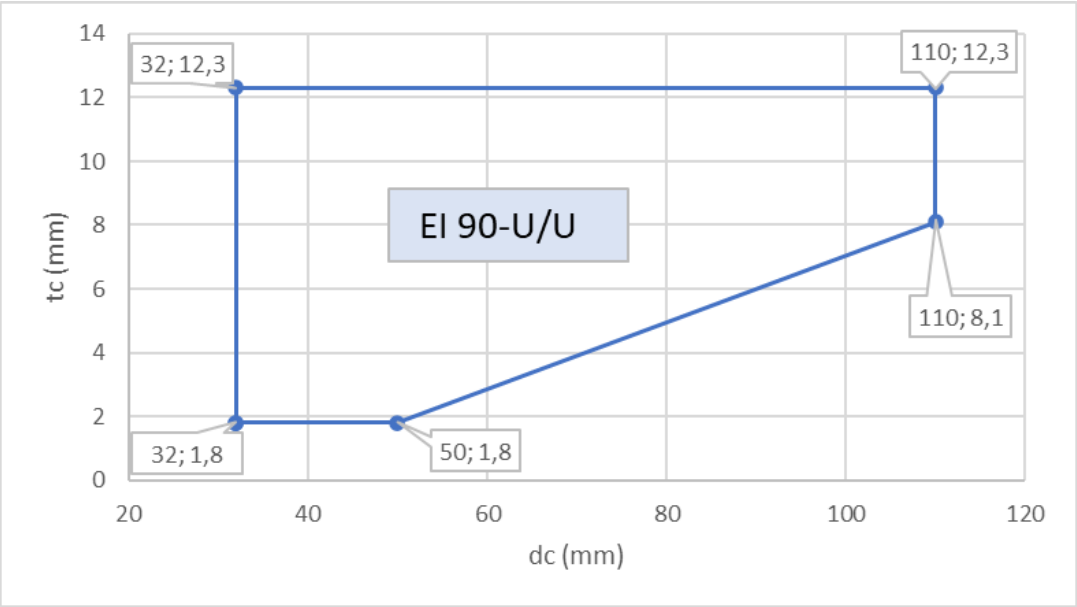


Figure 98: Classified pipe range for PVC-pipes in DG 1, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

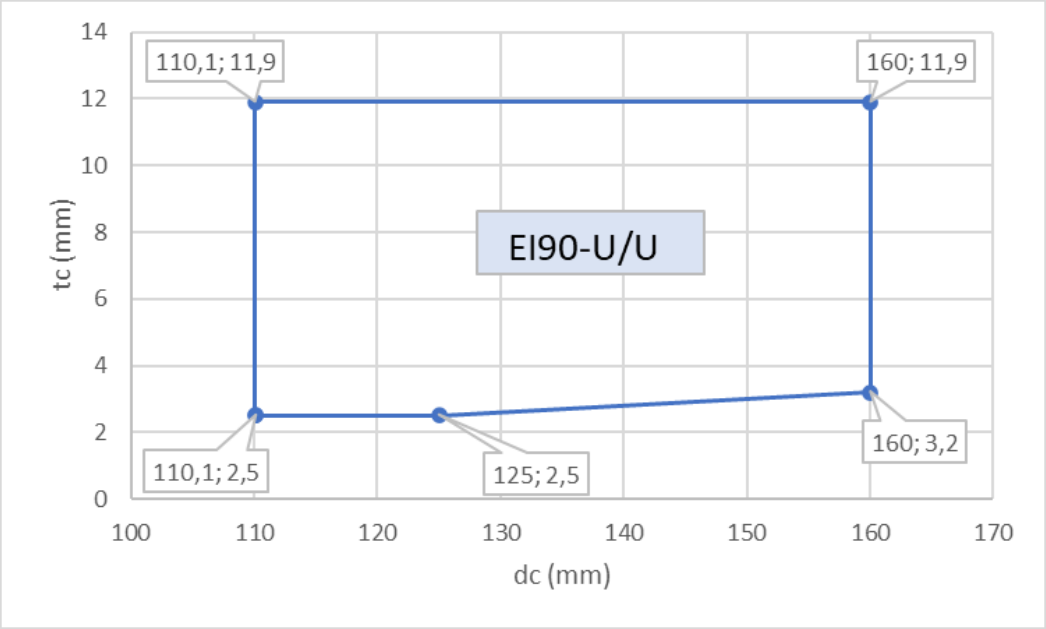


Figure 99: Classified pipe range for PVC-pipes in DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.3 PP-pipes acc. EN 1451-1 in DG 1 in BBS wall

Classification shown in Figure 100 and Figure 101 is valid for pipes made from:

- PP according EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer, perpendicular installation only
- Consider relevant Design Group (DG) for CFS-C EL

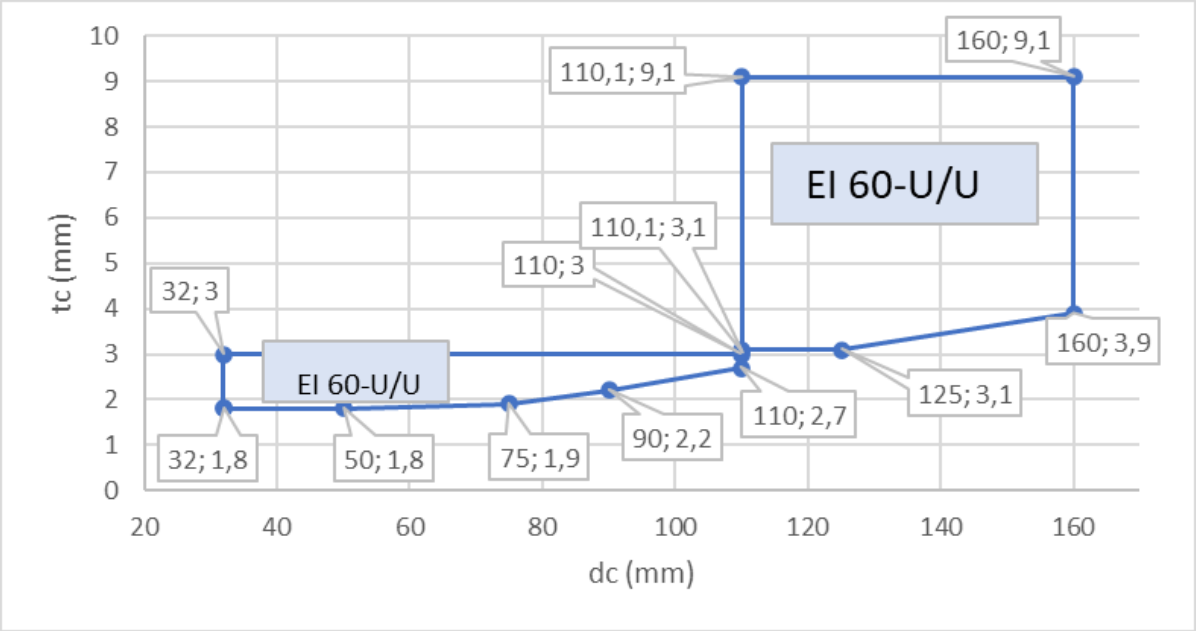


Figure 100: Classified pipe range for PP-pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

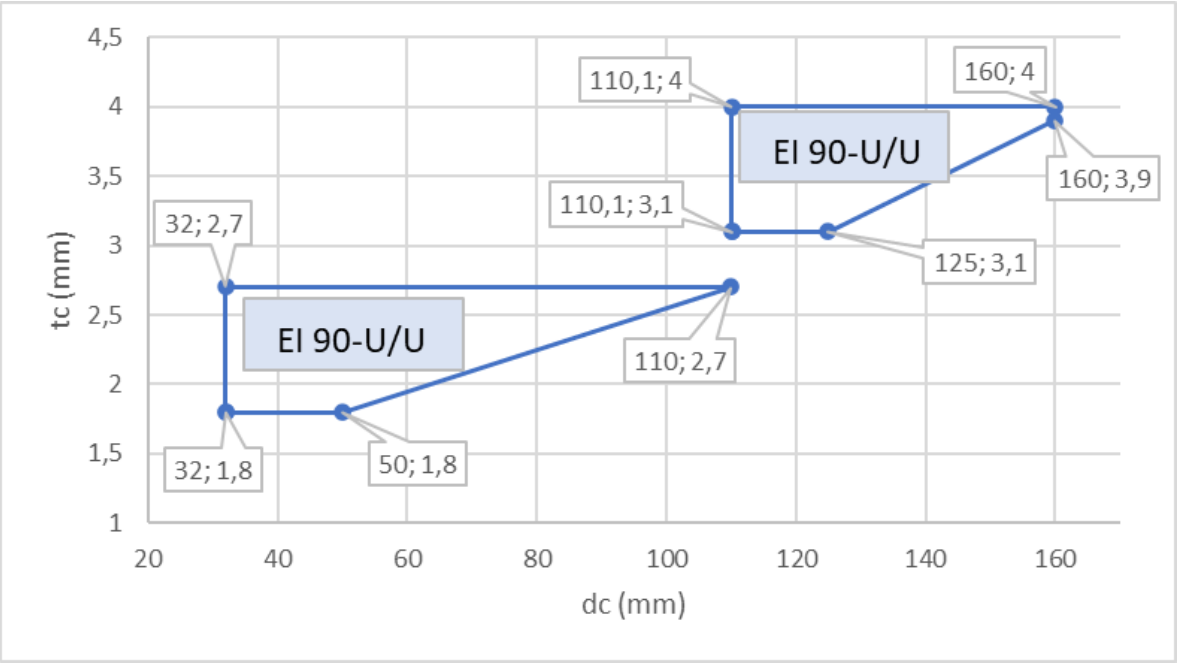


Figure 101: Classified pipe range for PP - pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.4 PE-pipes, non-regulated (Geberit Silent dB20) in DG 1 and DG 2 in BBS wall

Classification shown in Figure 102 is valid for pipes made from:

- For Geberit Silent dB20 only
- perpendicular installation only
- Consider relevant Design Group (DG) for CFS-C EL

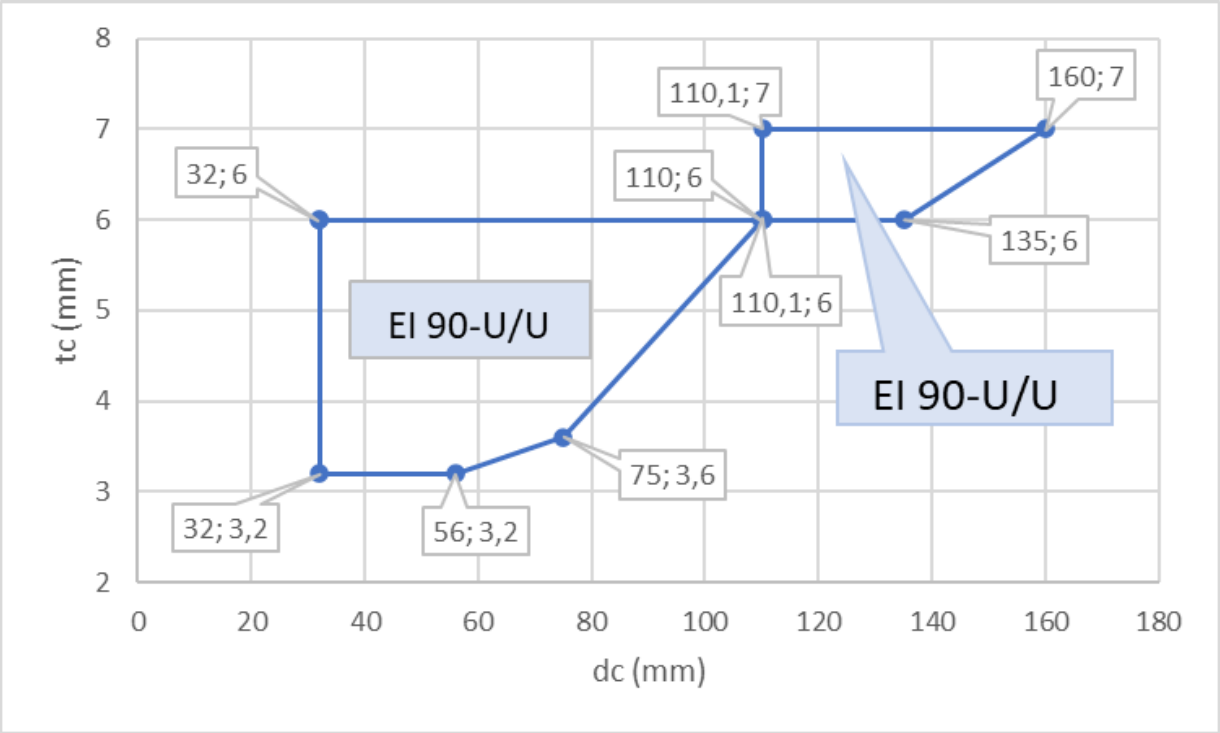


Figure 102: Classified pipe range for Geberit Silent dB20 - pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.5 PP - pipes, non-regulated (Geberit Silent Pro) in DG 1 and DG 2 in BBS wall

Classification shown in Figure 103 is valid for pipes made from:

- For Geberit Silent Pro only
- perpendicular installation only
- Consider relevant Design Group (DG) for CFS-C EL

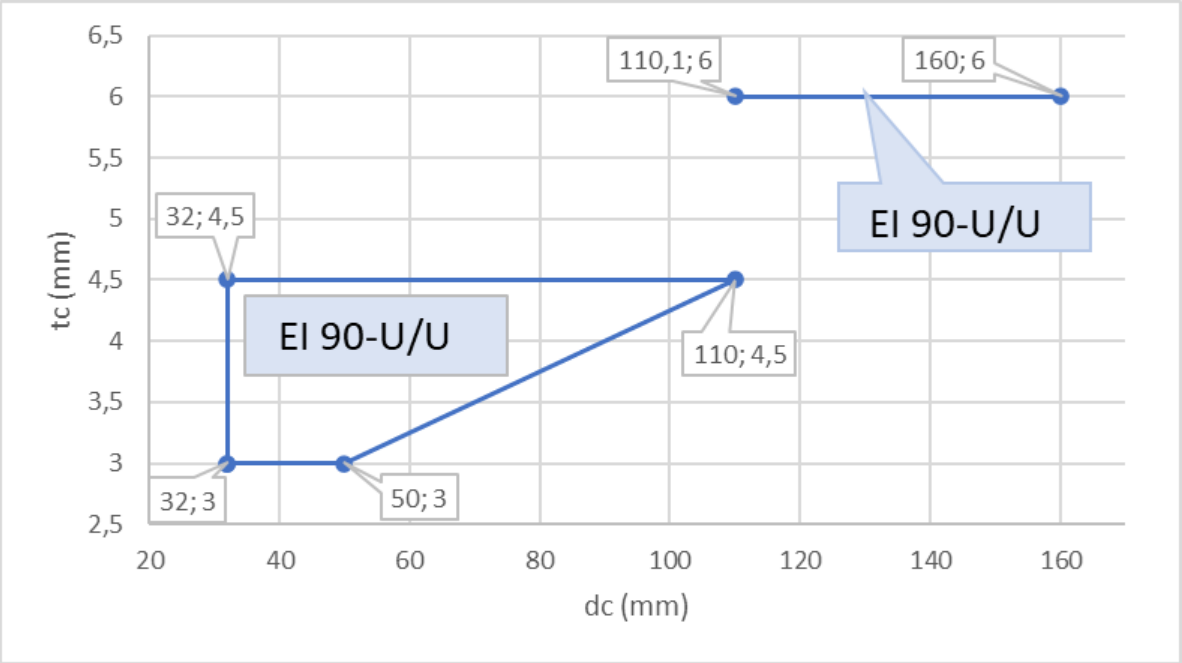


Figure 103: Classified pipe range for Geberit Silent Pro - pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.6 PP-pipes, non-regulated (Geberit Silent Pro) in DG 1 and DG 2 in BBS wall

Classification shown in Figure 104 is valid for pipes made from:

- For Rehau Raupiano Plus only
- Perpendicular installation only
- Consider relevant Design Group (DG) for CFS-C EL

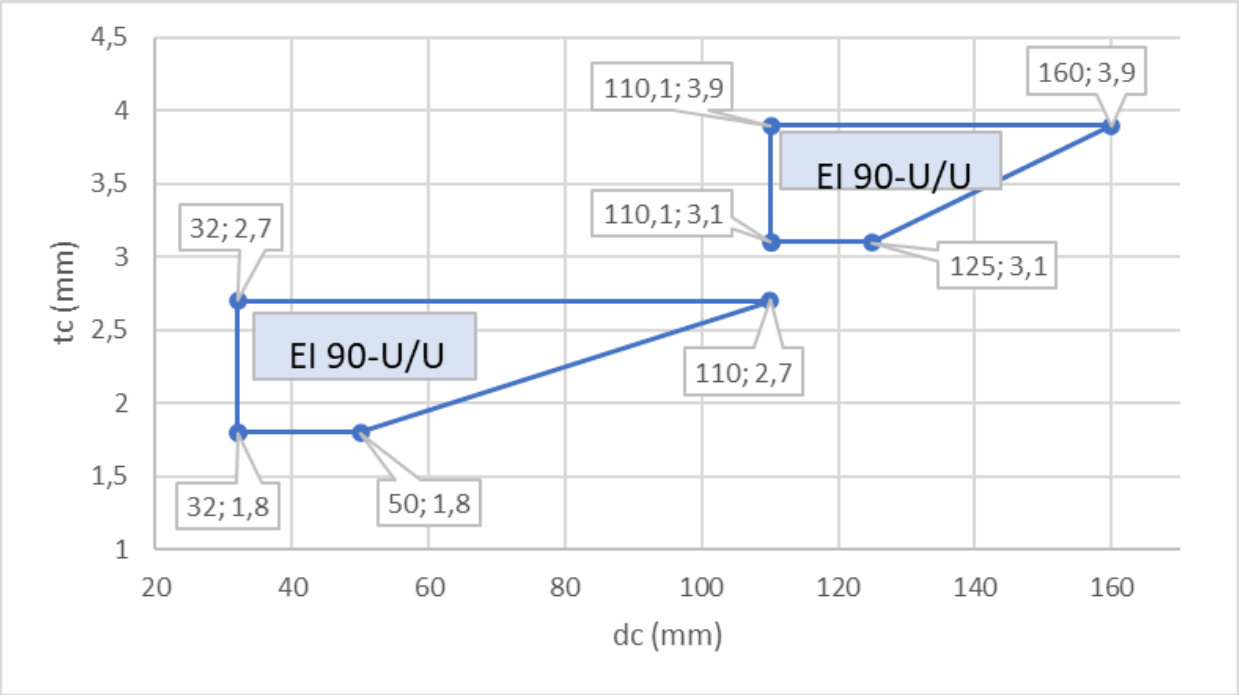


Figure 104: Classified pipe range for Rehau Raupiano Plus - pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.7 PP - pipes, non-regulated (Poloplast POLO-KAL NG/XS) in DG 1 and DG 2 in BBS wall

Classification shown in Figure 105 is valid for pipes made from:

- For Poloplast POLO-KAL NG/XS only
- Consider relevant Design Group (DG) for CFS-C EL
- Perpendicular installation only

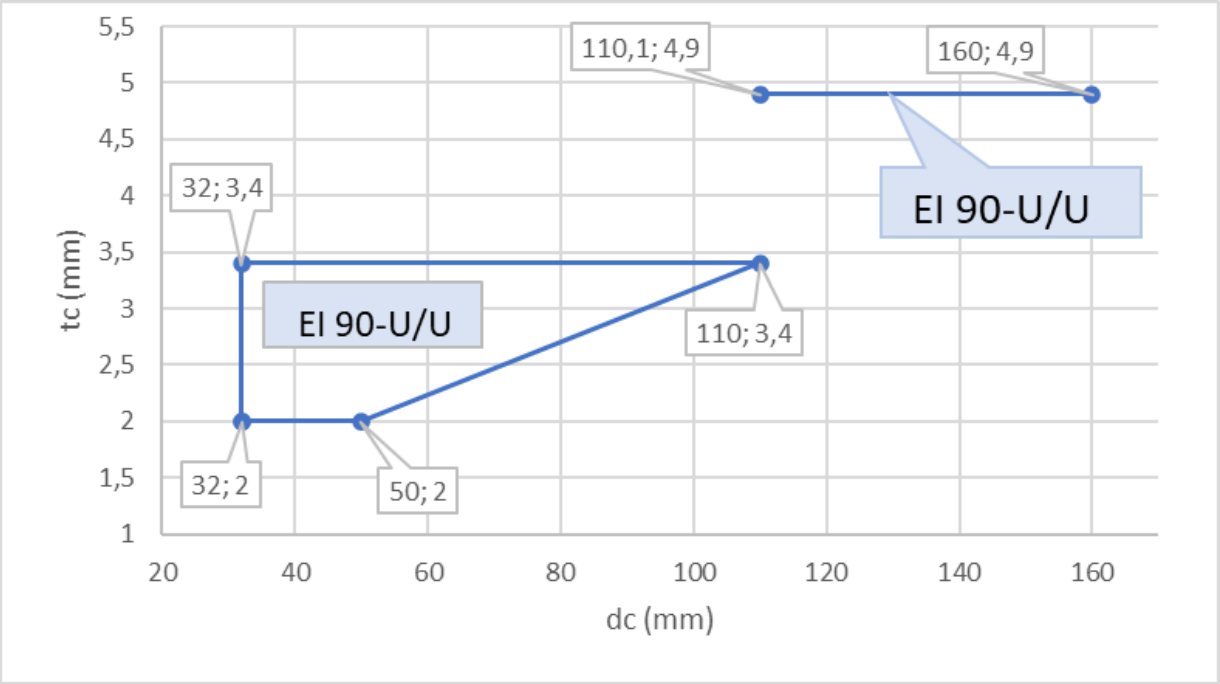


Figure 105: Classified pipe range for Poloplast POLO-KAL NG/XS - pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.8 PP - pipes, non-regulated (GF Silenta Premium) in DG 1 and DG 2 in BBS wall

Classification shown in Figure 106 is valid for pipes made from:

- For Georg Fischer Silenta Premium only
- Consider relevant Design Group (DG) for CFS-C EL
- Perpendicular installation only

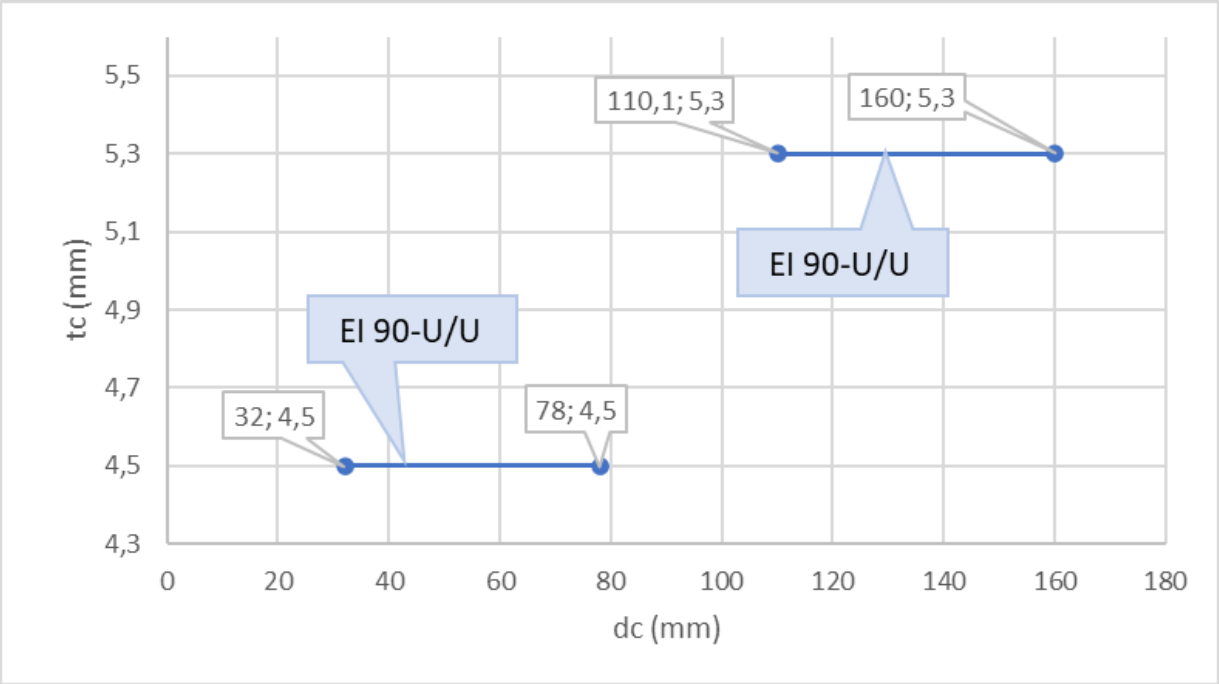


Figure 106: Classified pipe range for GF Silenta Premium - pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.9 PP - pipes, non-regulated (Wavin SiTech+) in DG 1 and DG 2 in BBS wall

Classification shown in Figure 107 is valid for pipes made from:

- For Wavin SiTech+ only
- Consider relevant Design Group (DG) for CFS-C EL
- Perpendicular installation only

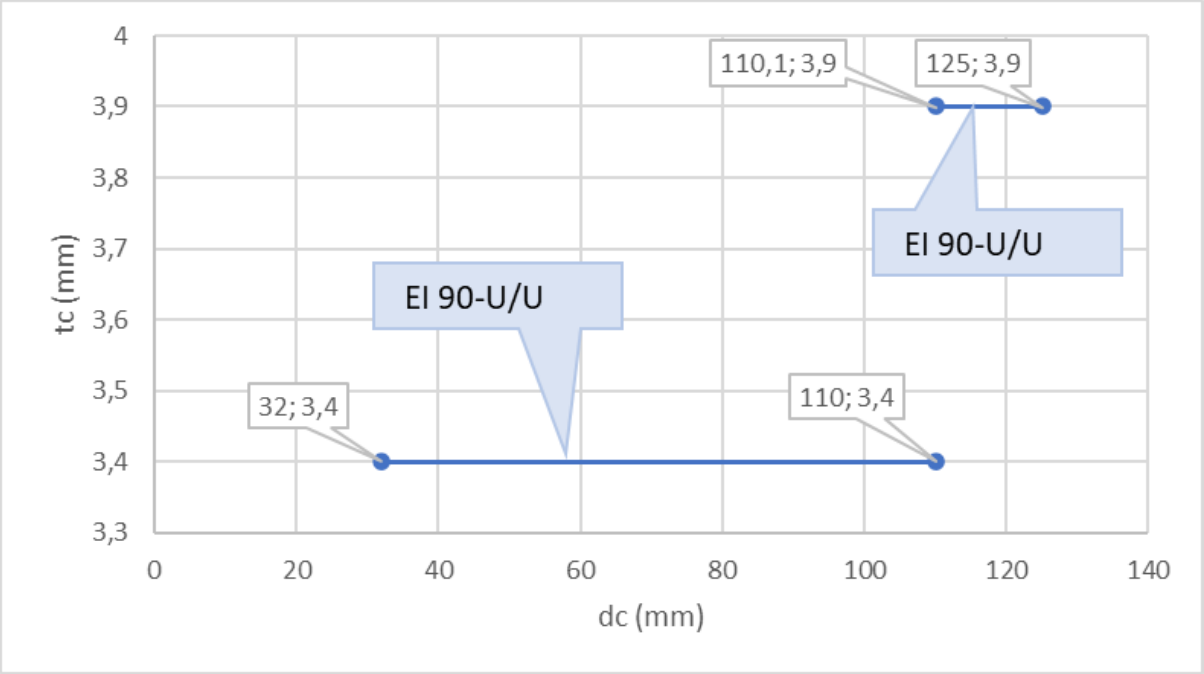


Figure 107: Classified pipe range for Wavin SiTech+- pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.10 PP - pipes, non-regulated (Poloplast POLO-KAL 3S) in DG 2 in BBS wall

Classification shown in Figure 108 is valid for pipes made from:

- For Poloplast POLO-KAL 3S only, perpendicular installation only
- Consider relevant Design Group (DG) for CFS-C EL

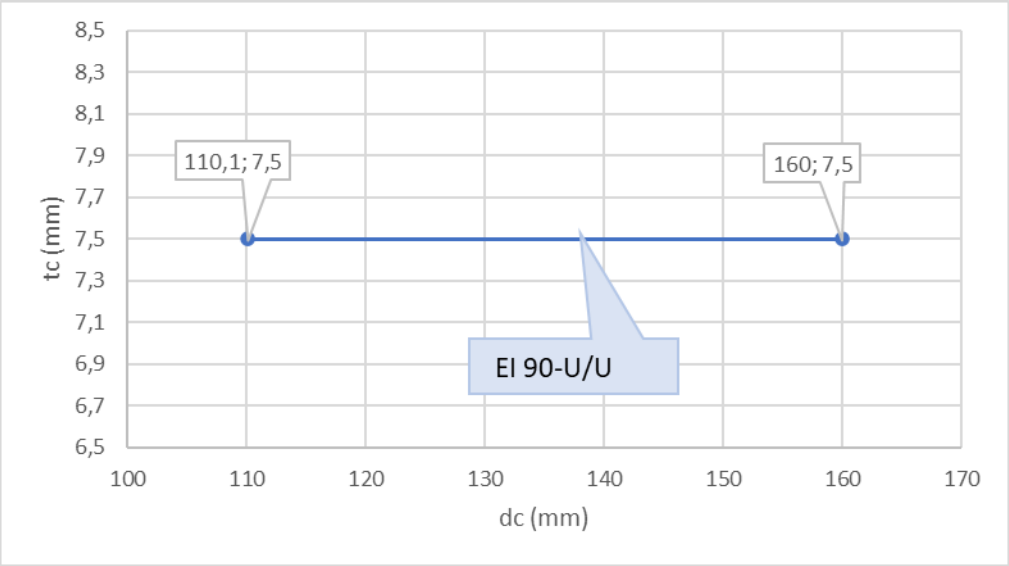


Figure 108: Classified pipe range for Poloplast POLO-KAL 3S - pipes in DG 2, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.5.1.12.11 PP-pipes, non-regulated (Poloplast POLO-KAL NG) in DG 1 in BBS wall

Classification shown in Figure 112 is valid for pipes made from:

- For Poloplast POLO-KAL NG only
- Consider relevant Design Group (DG) for CFS-C EL
- Perpendicular installation and 1x87° ellbow solution assessed

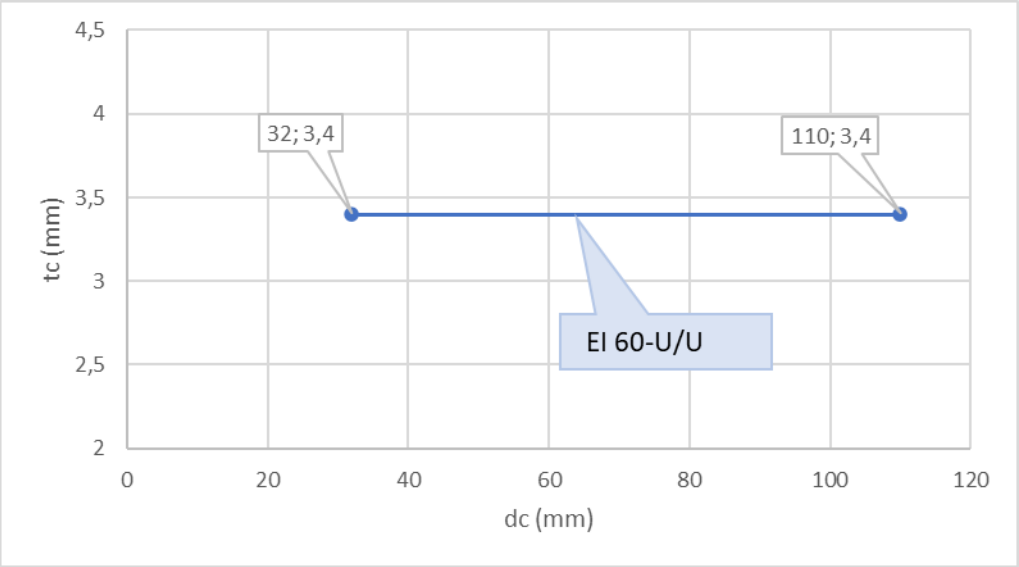


Figure 109: Classified pipe range for Poloplast POLO-KAL 3S - pipes in DG 12, sealed with CFS-C EL in BBS-wall, $t_E \geq 100$ mm

8.6 Shaft walls

8.6.1 Specific characteristics for Shaft walls

8.6.1.1 Suitable Shaft wall system A: 2 x 25 mm

Hilti Firestop Collar Endless CFS-C EL (A_1) can be used to seal plastic pipes installed in shaft wall systems classified at least with EI 90 according EN 13501-2. The mechanical resistance and stability have to be proven for the required fire resistance period. The Shaft Wall should consist of the following components:

Plates:

- Two layers Knauf Fireboard plates (acc. EN 15283-1)
- Reaction to fire class A1 acc. EN 13501-1
- each of 25 mm thickness

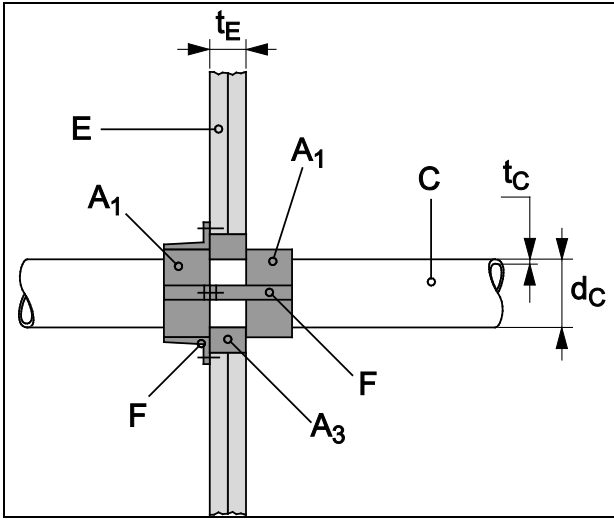
Track and Studs:

- CW and UW Profil 75,
- Track should be minimum a 75 mm x 40 mm x 0,6 mm thick galvanized mild steel
- Stud should be minimum a 73,5 mm x 43,5 mm x 0,55 mm thick galvanized mild steel

Fixing/Screws:

- First layer should be fixed using 35 mm long x 3,5 mm diameter flexible wall screws,
- second layer should be fixed with 55 mm long x 3,5 mm diameter flexible wall screws.

Gypsum: KNAUF FIREBOARD SPACHTEL, gypsum-based plaster or similar.



Pict. 8.6.1.1:

Single plastic pipe penetration in Shaft wall system A

Figure 110: Single plastic pipe penetration in Shaft wall system A

8.6.1.2 Specific characteristic for shaft wall systems B: 3 x 15 mm

Hilti Firestop Collar Endless CFS-C EL (A_1) can be used to seal plastic pipes, aluminum composite pipes and electrical application installed in shaft wall systems classified at least with EI 90 according EN 13501-2. The mechanical resistance and stability have to be proven for the required fire resistance period. The Shaft Wall should consist of the following components:

Plates:

- Minimum three layers each of ≥ 15 mm gypsum boards (acc. EN 520), type DF

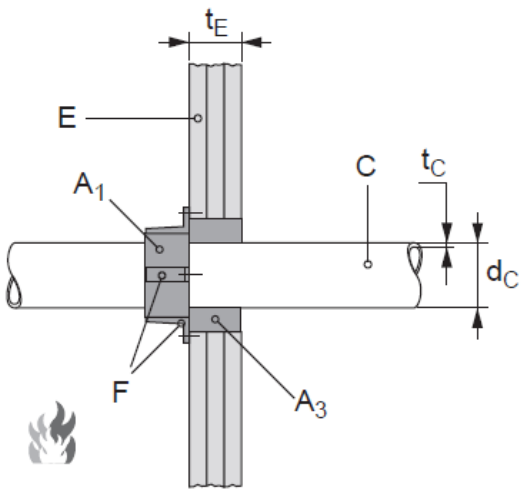
Track and Studs:

- CW and UW Profile size 50 or bigger (acc. EN 14195),
- Profiles should be minimum a 50 mm x 50 mm x 0,6 mm thick
- galvanized preformed steel sheet

Fixing/Screws:

- First layer should be fixed using 25 mm long x 3,5 mm diameter flexible wall screws,
- second layer should be fixed with 45 mm long x 3,5 mm diameter flexible wall screws, third layer should be fixed using 55 mm long x 3,5 mm diameter flexible wall screws

Gypsum: gypsum-based plaster.

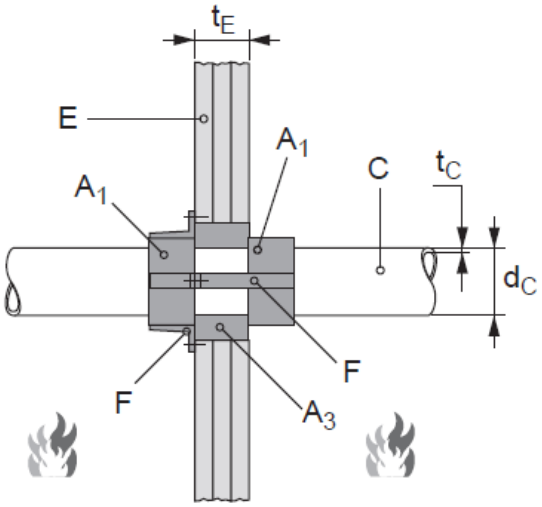


Pict. 8.6.1.2 A:

For shaft wall system B only.

Fire load is definitely from one side only, so firestop has to be installed on one side only.

A second firestop on the other side of the firewall is not necessary.



Pict. 8.6.1.2 B:

For shaft walls system B only.

Fire load from both sides possible, so firestop must be done on both sides of the wall.

Installation from one side of the wall possible (no access from the other side).

Figure 111: Single plastic pipe penetration in Shaft wall system B with fire load from one/ two sides

8.6.1.3 **Penetrating pipes/cables/conduits:**

For shaft walls system A: 2 x 25 mm (refer to 8.6.1.1)

- Plastic pipes in Design group 1, nominal pipe outside diameter ($d_C \leq 110$ mm),
- only single penetration seals,
- Hilti Firestop Collar Endless CFS-C EL (A_1) on both sides of the shaft wall,
- For pipe material and pipe dimension refer to 8.6.2

For shaft walls system B: 3 x 15 mm (refer to 8.6.1.2)

- Plastic pipes in Design group 1, nominal pipe outside diameter ($d_C \leq 110$ mm) in perpendicular installation, coupling and elbow configuration,
- Polyethylene insulated aluminum composite pipes,
- Cables, all types, up to 21 mm diameter, bunched cables,
- Rigid, flexible and pliable conduits,
- Single penetration seal, multiple and mixed penetration seal,
- Hilti Firestop Collar Endless CFS-C EL (A1) on both sides of the shaft wall,
- For pipe-, conduit-, and cable-specification, dimension and installation details refer to 8.6.2

8.6.1.4 **Annular Gap**

- For shaft wall system A (refer to 8.6.1.1): annular gap around single penetrating plastic pipes should be 15 - 20 mm.
- For shaft wall system B (refer to 8.6.1.2): annular gap around single penetrating items (plastic pipes, aluminum composite pipes, cables, bunched cables, conduits) and multiple or mixed seals using CFS-C EL collar is 5 - 15 mm (if only one collar on pipe has been used) or 15 - 20 mm (if two collars on pipe have been used). For CFS-W P wrap application annular gap is always 0 - 15 mm.

8.6.1.5 **Gap Filler in Shaft Walls**

- Hilti CFS-FIL to be used as filler for shaft wall system A and B
- CFS-FIL has to be applied from one side over the entire thickness of the wall.
- For some specific annular gap details around cable penetration, multiple or mixed seals for shaft wall type B only: refer to 8.6.3

8.6.1.6 **Firestop installation**

- Collar CFS-C EL installation in shaft walls system A and B can be done from one side only (limited access to the other side)
- CFS-W P wrap installation can be done from one side only (in shaft wall system B only)

8.6.1.7 **Collar fixing**

- For number of hooks refer to 8.2.5
- For hook fixing refer to 8.2.4 and 8.2.4.3
- Fixing of all hooks from one side of the wall possible
- Due to one side installation long and short hooks are requested
- Consider the identical number of long and short hooks
- One long and one short hook may be fixed to the wall using a single point of fixing or using separate hooks

8.6.1.8 **Pipe support**

- Maximum 250 mm away from both faces of wall constructions system A and B (first support)

8.6.1.9 **Recycling of oddments**

- No oddments should be used

8.6.1.10 **Pipe orientation**

- All pipes must penetrate the shaft wall in a perpendicular orientation only

8.6.1.11 **Minimum distance pipe to pipe in shaft walls**

- For shaft wall type A: 100 mm
- No direct contact pipe to pipe

- For shaft wall type B: refer to 8.6.3
- Direct contact pipe to pipe assessed for specific situation - refer to 8.6.3

8.6.1.12 **Sound decoupling C_1 on plastic pipes**

For shaft wall type A - 8.6.1.1: no sound decoupling should be applied

For shaft wall type B - 8.6.1.2:

- Material: soft polyethylene foam/foil, refer to 8.2.7
- Thickness: 0 - 4 mm
- Position: on the pipe penetrating the wall, below the collar or collars (only within the wall and beneath the collar/collars)
- Length: minimum 95 or 145 mm (one or two collars have been used in DG 1), maximum length unlimited

8.6.2 Penetration service in shaft walls system A: 2 x 25 mm

8.6.2.1 PE pipes acc.EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 in shaft wall system A

Classification shown in Figure 112 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer

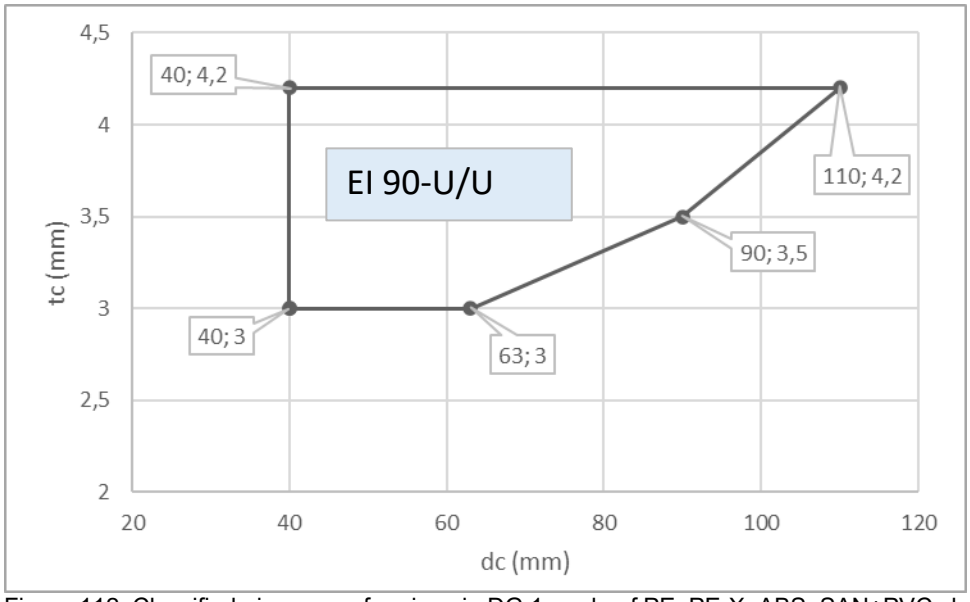


Figure 112: Classified pipe range for pipes in DG 1 made of PE, PE-X, ABS, SAN+PVC shaft wall system A

8.6.2.2 PE-pipes acc. EN ISO 15494 in DG 1 in shaft wall system A

Classification shown in Figure 113 is valid for pipes made from:

- PE according EN ISO 15494, EN 12201-2 and DIN 8074/75
- No limitation for brands/producer

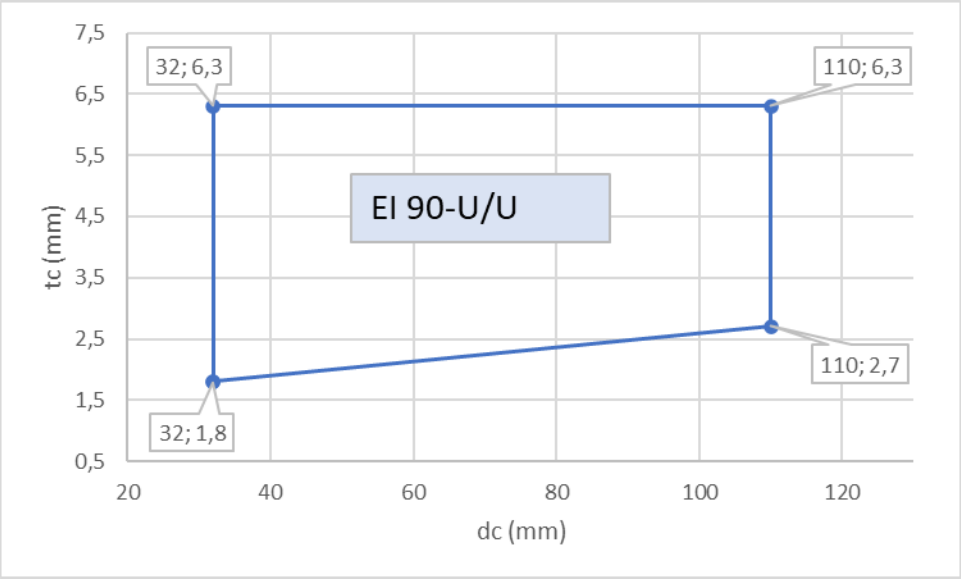


Figure 113: Classified pipe range for PE-pipes in DG 1 acc. EN ISO 15494 shaft wall system A

8.6.2.3 PVC - pipes acc. EN 1452-2 in DG 1 in shaft wall system A

Classification shown in Figure 114 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Carefully consider disclaimer in 8.2.16

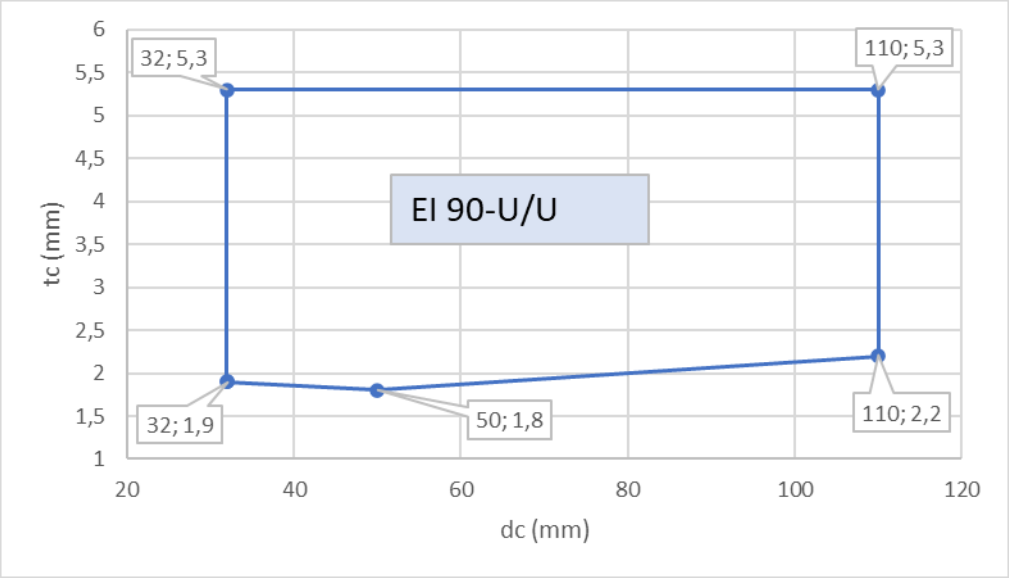


Figure 114: Classified pipe range for PVC-pipes in DG 1 in shaft wall system A

8.6.2.4 PP-pipes, non-regulated in DG 1 in shaft wall system A

Classification shown in Figure 115 is valid for pipes made from:

- For assessed brands/producers refer to section 8.2.15

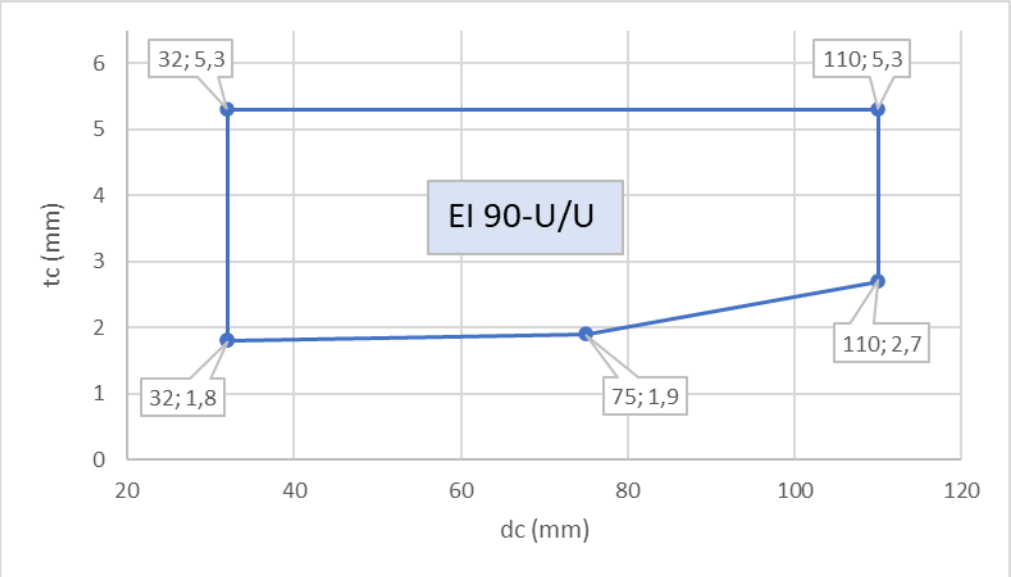


Figure 115: Classified pipe range for non-regulated PP pipes in DG 1 in shaft wall system A

8.6.2.5 PP-pipes acc. EN 1451-1 in DG 1 in shaft wall system A

Classification shown in Figure 116 is valid for pipes made from:

- PP according EN 1451-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer

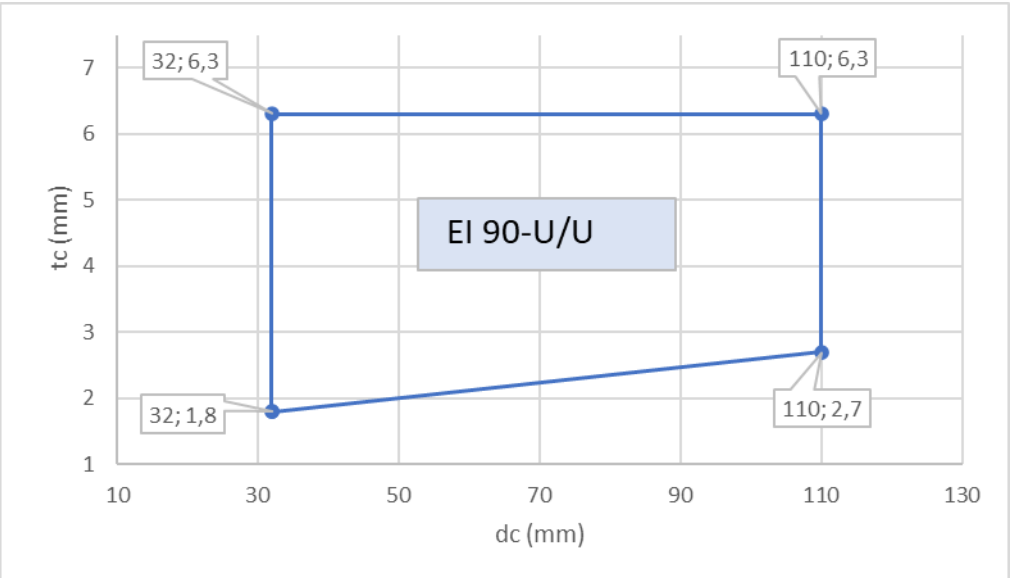


Figure 116: Classified pipe range for PP-pipes acc. EN 1451-1 in DG 1 in shaft wall system A

8.6.2.6 PE-pipes, Geberit Silent db20 in DG 1 in shaft wall system A

Classification shown in Figure 117 is valid for pipes made from:

- Pipe material: PE, non-regulated
- Brand/producer: Geberit Silent dB20

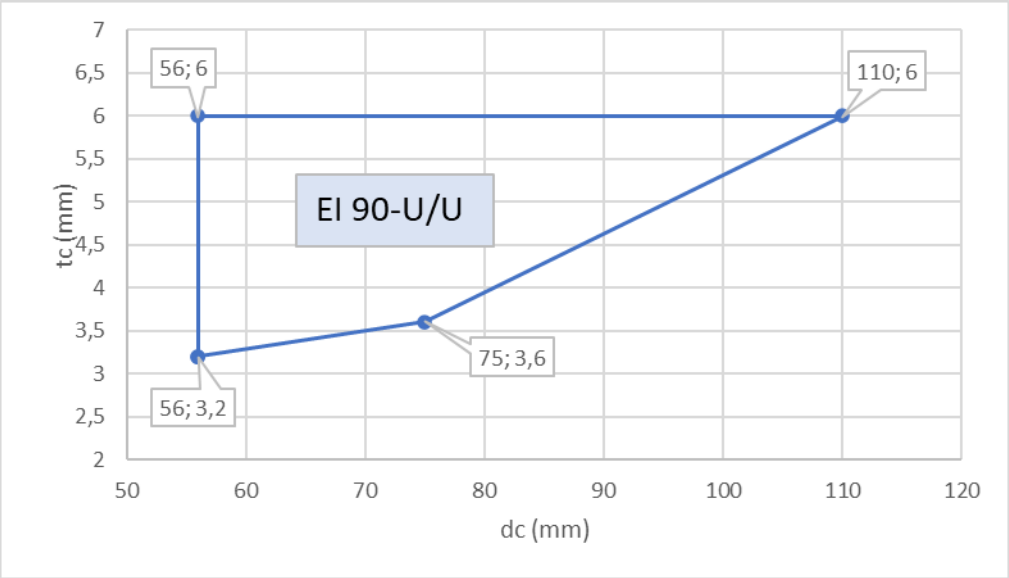


Figure 117: Classified pipe range for Geberit Silent dB20-pipes in DG1 in shaft wall system A

8.6.2.7 ABS–pipes acc. EN 1455-1 in DG 1

Classification shown in Figure 118 is valid for pipes made from:

- ABS according EN 1455-1 and EN ISO 15493
- No limitation for brands/producer

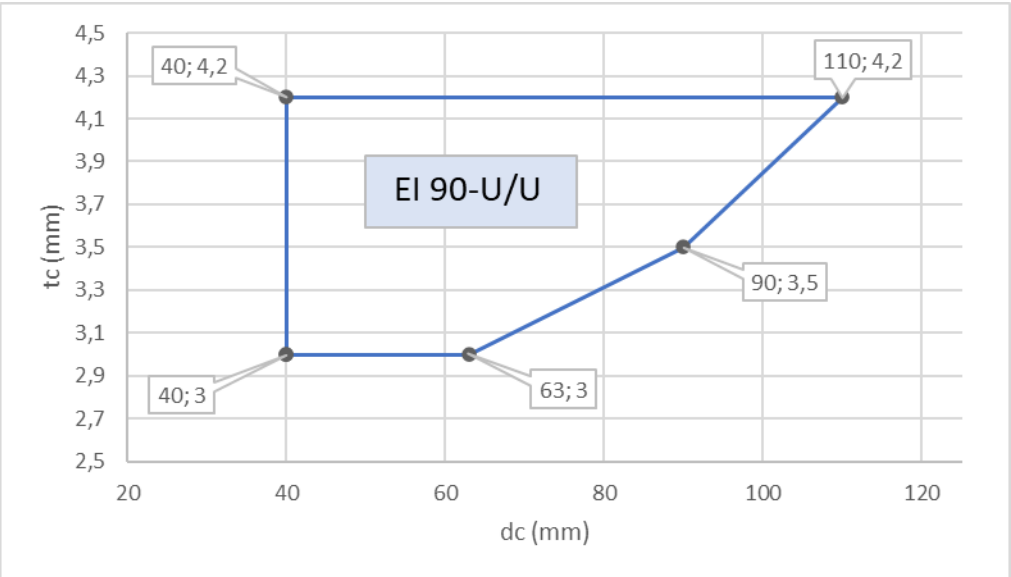


Figure 118: Classified pipe range for ABS-pipes in DG 1 in shaft wall system A

8.6.3 Penetration service in shaft walls system B: 3 x 15 mm

8.6.3.1 PE pipes acc.EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 in shaft wall system B

Classification shown in Figure 119i s valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer

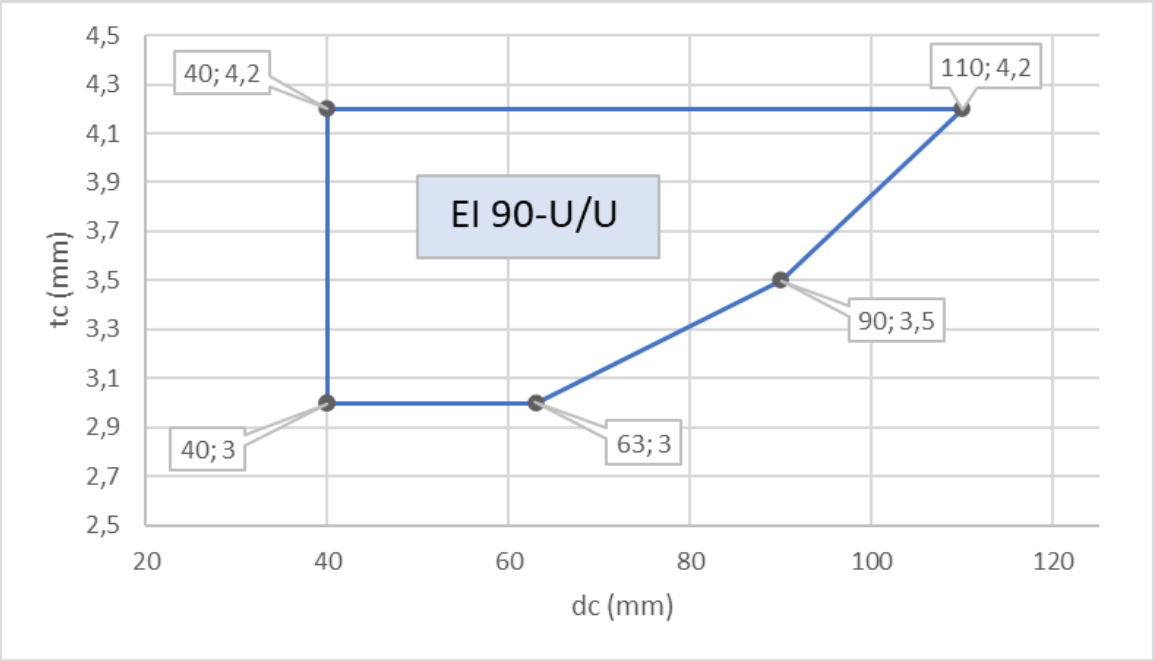


Figure 119: Classified pipe range for pipes made of PE, PE-X, ABS, SAN+PVC in DG 1 in shaft wall system B

8.6.3.2 PP-pipes, non-regulated in DG 1 in shaft wall system B

Classification shown in Figure 120 is valid for pipes made from:

- For assessed brands/producers refer to section 8.2.15

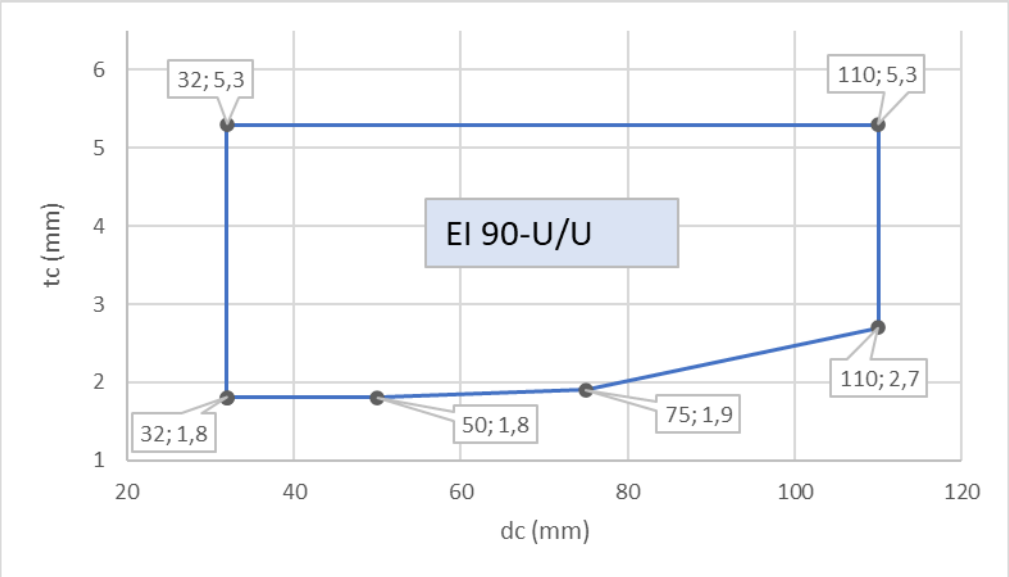


Figure 120: Classified pipe range for PP-pipes, non-regulated, in DG1 in shaft wall system B

8.6.3.3 PE-pipes, Geberit Silent db20 in DG 1 in shaft wall system B

Classification shown in Figure 121 is valid for pipes made from:

- Pipe material: PE, non-regulated
- Brand/producer: Geberit Silent dB20

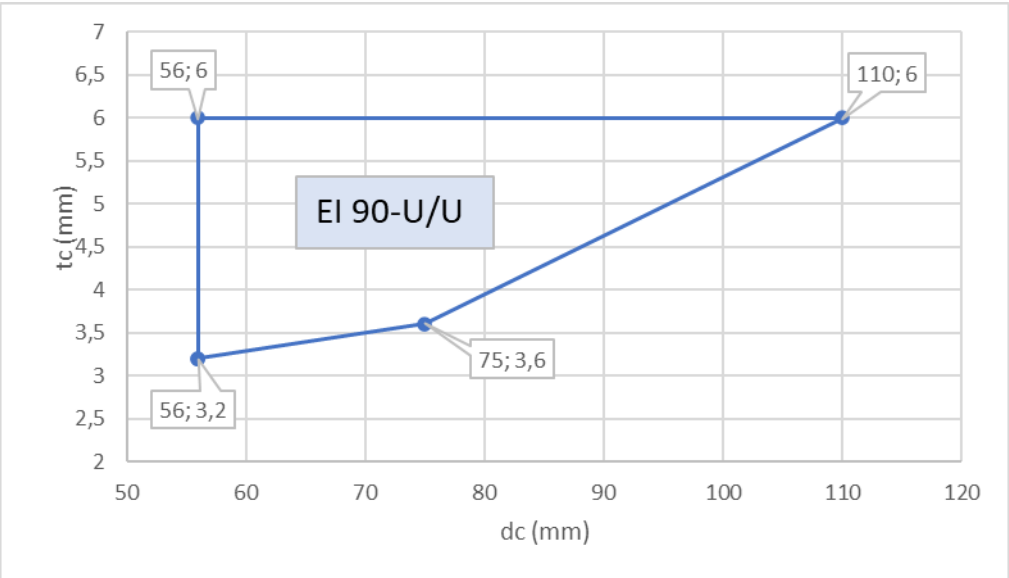


Figure 121: Classified pipe range for Geberit Silent dB20-pipes in DG1 in shaft wall system B

8.6.3.4 Plastic pipes, with 1x 87° elbow in shaft wall system B

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Single pipe seal
- Elbow Pipe 87° inside the wall or half in the wall, covered by CFS-C EL collar
- On one side the pipe may run with zero distance to penetrated wall ($s_3 \geq 0$ mm)
- One or two collars can be used, depending from possible fire load (refer to 8.6.1.6)

Pipe:
- For pipe material, pipe brand/producer or pipe dimension refer to 8.6.3.1, 8.6.3.2, 8.6.3.3

Insulation:
- No thermal insulation might be used
- For sound decoupling refer to 8.6.1.12

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: 5 – 15 mm for one-collar application (collar has not to pass through the wall)
- Annular gap: 15 – 20 mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Collar fixing:
- Refer to 8.2.4.3
- For requested number of hooks to be used refer to Table 58 below

Pipe outside nominal diameter d_C (mm)	Number of hooks to be used: (no elbow side - horizontal running pipe / elbow side - vertical running pipe)	
	One collar only – one side fire load only	Two collars used – potential fire load from both sides
32	2 / 0	2 / 4
40	3 / 0	3 / 4
50	3 / 0	3 / 4
56	3 / 0	3 / 4
63	4 / 0	4 / 4
75	4 / 0	4 / 4
90	4 / 0	4 / 4
110	4 / 0	4 / 5

Table 58: Number of hooks for elbow solution in shaft wall type B

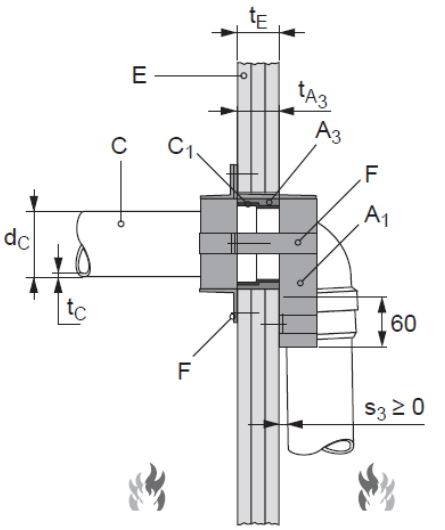
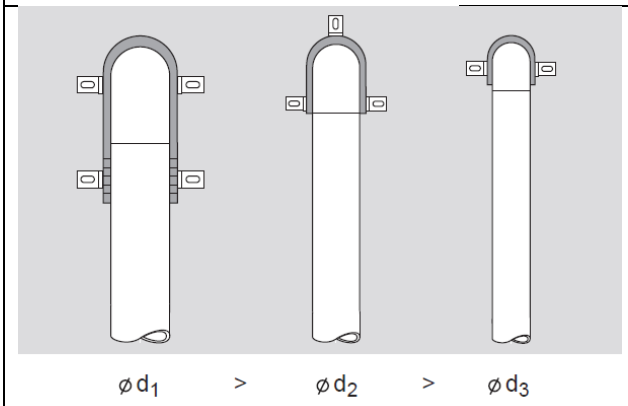
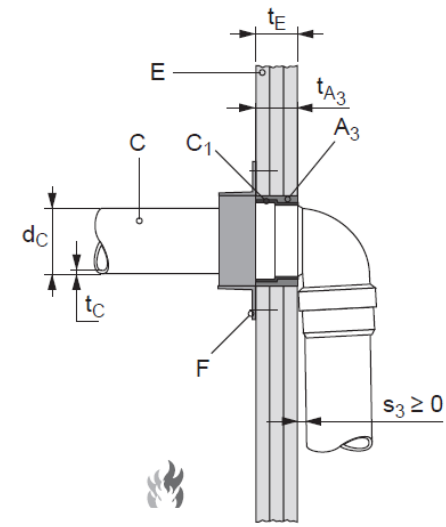
	Pict. 8.6.3.4 A: Elbow installation with double side potential fire load.
	Pict. 8.6.3.4 B: Hook configuration on vertical running pipes, depending on pipe diameter
	Pict. 8.6.3.4 C: Elbow installation with single side potential fire load.

Figure 122: Hook and collar positioning for single/double side fire load of plastic pipes with 1 x 87° elbow in shaft wall system B

Type of Penetrant	Classification
Plastic pipes, with 1x 87° elbow in shaft wall system B	EI 90 – U/U

Table 59: Classification for Plastic pipes, with 1x 87° elbow in shaft wall system B

8.6.3.5 Plastic pipes, with 2 x 45° elbow in shaft wall system B

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Single pipe seal
- Elbow Pipe 2 x 45° inside the wall or half in the wall, covered by CFS-C EL collar
- On one side the pipe may run with zero distance to penetrated wall ($s_3 \geq 0$ mm)
- One or two collars can be used, depending on possible fire load (refer to 8.6.1.6)

Pipe:
- For pipe material, pipe brand/producer refer to 8.6.3.1, 8.6.3.2, 8.6.3.3
- For pipe dimension: refer to Table 60

Pipe material / standard	Pipe brand/producer	Pipe outside nominal diameter d_C (mm)	Pipe wall thickness t_C (mm)
PP, non-regulated	Refer to 8.2.15	110	2,7 – 5,3
PE, non-regulated	Geberit Silent dB 20	110	6,0
PE, EN 1519-1	Open, not defined	110	4,2

Table 60: Dimension of assessed pipes with 2 x 45° elbow in shaft wall system B

Insulation:
- No thermal insulation might be used
- For sound decoupling refer to 8.6.1.12

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: 5 – 15 mm for one-collar application (collar has not to pass through the wall)
- Annular gap: 15 – 20 mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Collar fixing:
- Refer to 8.2.4.3
- For requested number of hooks to be used refer to Table 61 below

Pipe outside nominal diameter d_C (mm)	Number of hooks to be used: (no elbow side - horizontal running pipe / elbow side - vertical running pipe)	
	One collar only – one side fire load only	Two collars used – potential fire load from both sides
110	4 / 0	4 / 5

Table 61: Number of hooks for elbow solution in shaft wall type B

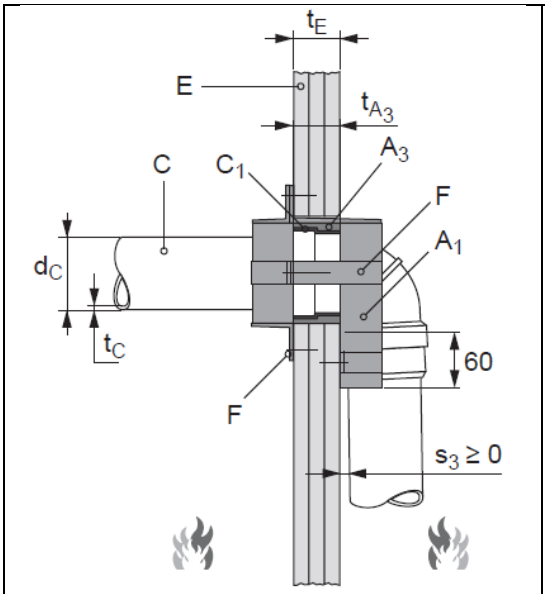
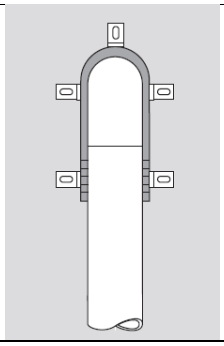
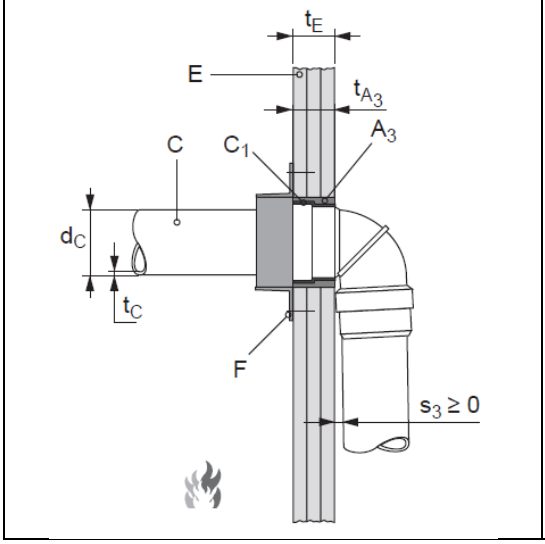
	Pict. 8.6.3.5 A: Elbow installation with double side potential fire load.
	Pict. 8.6.3.5 B: Elbow installation with double side potential fire load, seen from elbow side
	Pict. 8.6.3.5 C: Elbow installation with single side potential fire load

Figure 123: Hook and collar positioning for single/double side fire load of plastic pipes with 2 x 45° elbow in shaft wall system B

Type of Penetrant	Classification
Plastic pipes, with 2 x 45° elbow in shaft wall system B	EI 90 – U/U

Table 62: Classification for Plastic pipes, with 2 x 45° elbow in shaft wall system B

8.6.3.6 Plastic pipes, with pipe coupling in shaft wall system B

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Single pipe seal
- Pipe Coupling inside the wall or half in the wall, covered by CFS-C EL collar
- On one side the pipe may run with zero distance to penetrated wall ($s_3 \geq 0$ mm)
- One or two collars can be used, depending on possible fire load (refer to 8.6.1.6)

Pipe:
- For pipe material, pipe brand/producer or pipe dimension refer to 8.6.3.1, 8.6.3.2, 8.6.3.3

Insulation:
- No thermal insulation might be used
- For sound decoupling refer to 8.6.1.12

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: 5 – 15 mm for one-collar application (collar has not to pass through the wall)
- Annular gap: 15 – 20 mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Collar fixing:
- Refer to 8.2.4.3
- For requested number of hooks to be used refer to Table 63 below

Pipe outside nominal diameter d_C (mm)	Number of hooks to be used: (no elbow side - horizontal running pipe / elbow side - vertical running pipe)	
	One collar only – one side fire load only	Two collars used – potential fire load from both sides
32	2 / 0	2 / 2
40	3 / 0	3 / 3
50	3 / 0	3 / 3
63	4 / 0	3 / 3
75	4 / 0	3 / 3
90	4 / 0	4 / 4
110	4 / 0	4 / 4

Table 63: Number of hooks for coupling solution in shaft wall type B

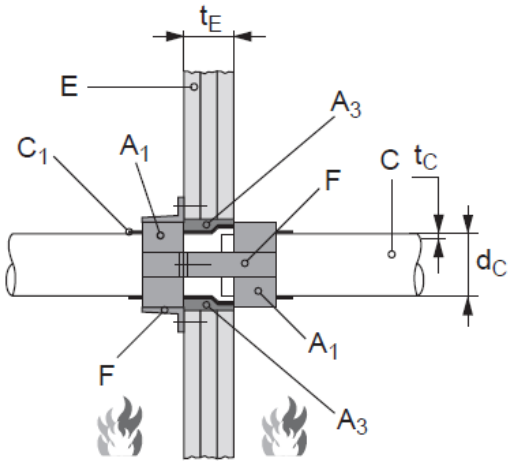
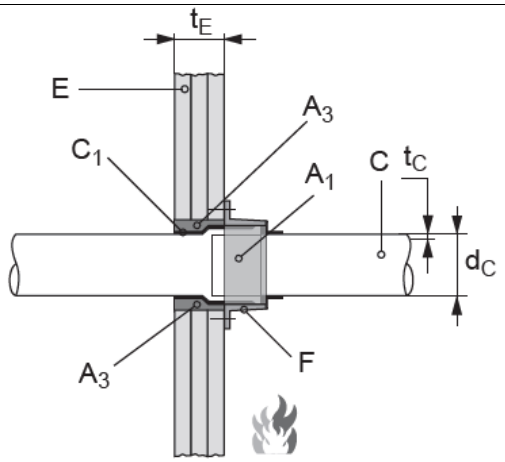
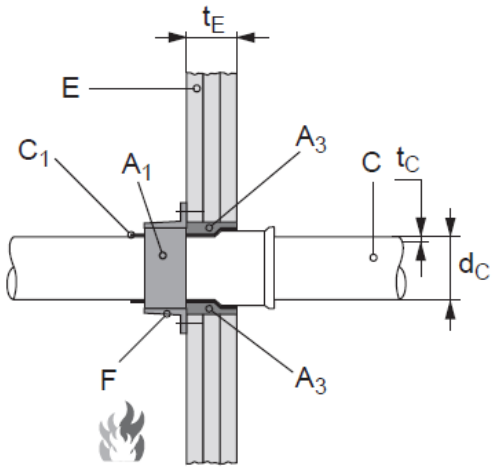
	Pict. 8.6.3.6 A: Pipe coupling installation with double side potential fire load.
	Pict. 8.6.3.6 B: Pipe coupling installation with single side potential fire load.
	Pict. 8.6.3.6 C: Pipe coupling installation with single side potential fire load.

Figure 124: Hook and collar positioning for single/double side fire load of plastic pipes with pipe coupling in shaft wall system B

Type of Penetrant	Classification
Plastic pipes, with pipe coupling in shaft wall system B	EI 90 – U/U

Table 64: Classification for Plastic pipes in DG 1 with pipe coupling in shaft wall system B

8.6.3.7 Zero distance between plastic pipes in shaft wall system B

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Single pipe seal in zero distance ($s_1 \geq 0$ mm) collar to collar
- Pipes have been mounted directly onto a floor or onto a wall, before penetrating a shaft wall system B ($s_3 \geq 0$ mm)
- Linear arrangement of pipes only, no cluster arrangement
- Horizontal or vertical arrangement
- Number of pipes in line: unlimited
- Single side fire load (requesting one collar CFS-C EL) or double side fire seal (requesting two collars CFS-C EL) assessed – refer to 8.6.1.2
- Each single pipe is covered by an individual, uncompleted CFS-C EL collar

Pipe:
- For pipe material, pipe brand/producer or pipe dimension refer to 8.6.3.1, 8.6.3.2, 8.6.3.3

Insulation:
- No thermal insulation might be used
- For sound decoupling refer to 8.6.1.2

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: 5 – 15 mm for one-collar application (collar has not to pass through the wall)
- Annular gap: 15 – 20 mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Collar fixing:
- Refer to 8.2.4.3
- Always one hook has to be fixed at the end of the collar strip. Place the first hook here.
- If distance collar to collar (s_1) becomes very small a hook can't be installed here. So, both ends of the collar strip remains free of hook, clamped between adjacent pipes
- At the furthest position from firstly placed hook a second hook should be placed. Here it is recommended to fix two hooks of adjacent pipes with one fixing point (refer to 8.2.4)
- Every pipe diameter ($d_c \leq 63$ mm): 2 hooks
- Every pipe diameter ($63 \leq d_c \leq 110$) mm: 3 hooks
- If 3 hooks to be installed on one pipe, the middle hook should be positioned centered between outer hooks

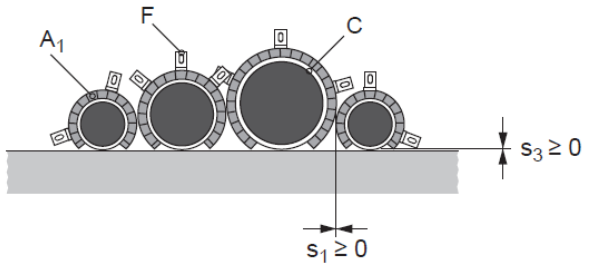
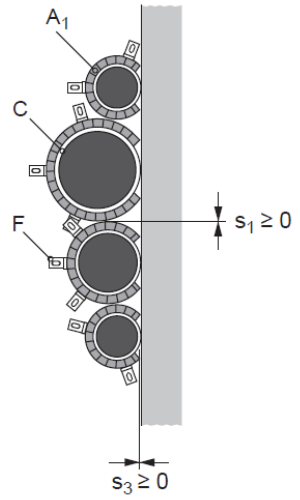
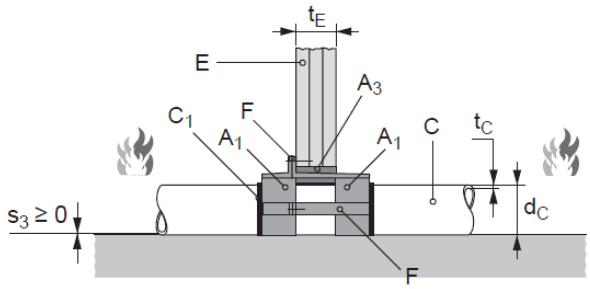
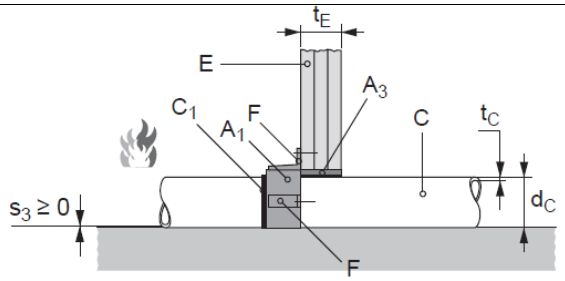
	Pict. 8.6.3.7 A: Plastic pipes, sealed with individual collars CFS-C EL in direct contact collar to collar (s_1), mounted directly at floor (s_3), penetrating a shaft wall system B
	Pict. 8.6.3.7 B: Plastic pipes, sealed with individual collars CFS-C EL in direct contact collar to collar (s_1), mounted directly at wall (s_3), penetrating a shaft wall system B
	Pict. 8.6.3.7 C: Plastic pipes, sealed with individual collars CFS-C EL in direct contact collar to collar (s_1), mounted directly at floor or wall (s_3), penetrating a shaft wall system B. Possible fire access from both sides of the wall.
	Pict. 8.6.3.7 D: Plastic pipes, sealed with individual collars CFS-C EL in direct contact collar to collar (s_1), mounted directly at floor or wall (s_3), penetrating a shaft wall system B. Possible fire access from one sides of the wall only.

Figure 125: Plastic pipes, side by side in zero distance, sealed separately, mounted onto floor or onto wall

Type of Penetrant	Classification
Plastic pipes, side by side in zero distance, sealed separately, in shaft wall system B	EI 90 – U/U

Table 65: Classification for plastic pipes, side by side in zero distance, sealed separately, in shaft wall system B

8.6.3.8 MLC-pipes, Pipe to pipe in minimum distance in shaft wall system B

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Multiple pipe seal in zero distance ($s_2 \geq 0$ mm) pipe to pipe
- Pipes have been mounted directly onto a floor or onto a wall, before penetrating a shaft wall system B ($s_3 \geq 0$ mm)
- Linear arrangement of insulated pipes only, no cluster arrangement
- Number of insulated MLC (aluminum composite) pipes in line: unlimited
- Sequence of insulated pipes in line: not defined
- Single side fire load (requesting one collar CFS-C EL) or double side fire seal (requesting two collars CFS-C EL) assessed – refer to 8.6.1.2
- The collar CFS-C EL should follow the arrangement outside geometry as much as possible to prevent any pap between insulated pipes and collar

Pipes:
- Pipe brand/producer and dimension of MLC (aluminum composite) pipes: see Table 66
- Pipe end configuration: U/C
- Only insulated pipes according Table 66 are assessed

Insulation (D):
- PE-foam insulation assessed only, for dimension refer to Table 66
- Pipe insulation situation: CS

Additional Protect Insulation (D_P):
- To be installed over insulation (D)
- D_P: made of FEF-foam
- For FEF- type/brand/Producer: refer to 8.2.12
- Insulation situation LI
- Thickness t_{DP} = 9mm, L_{DP} = 250mm on both sides of the wall

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: 5 – 15 mm for one-collar application (collar has not to pass through the wall)
- Annular gap: 15 – 20 mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Collar fixing:
- Refer to 8.2.4.3
- Always one hook must be fixed at the furthest end of the collar strip on both sides.
- At the point, where two pipes come together a hook should be placed.

Number of hooks to be used:
- Number of hooks for parallel aluminum composite pipes with direct contact (s_2 = 0mm), **= (x+1)**, where x= number of all pipes to be covered with **one** collar

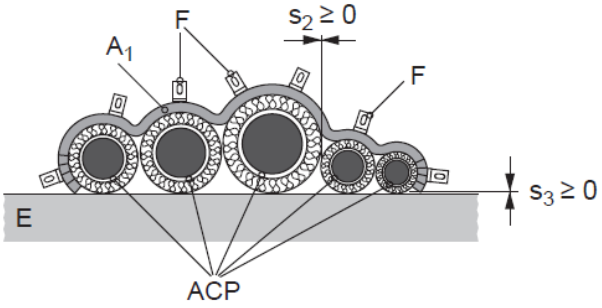
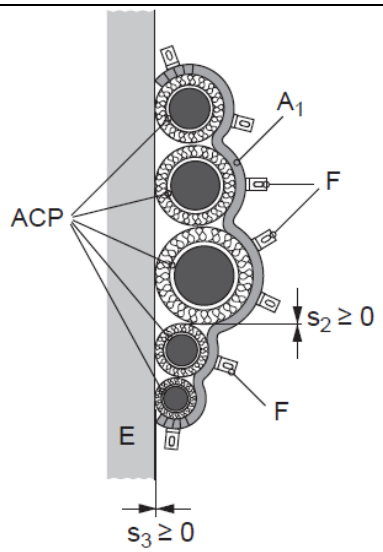
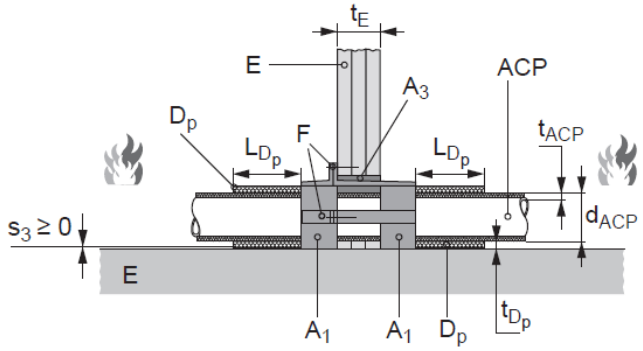
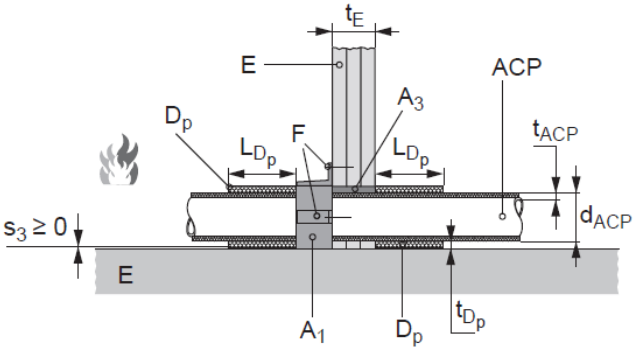
	Pict. 8.6.3.8 A: MLC (Aluminum composite) - pipes sealed with one open collar CFS-C EL, mounted directly at floor (s_3), penetrating a shaft wall system B
	Pict. 8.6.3.8 B: MLC (Aluminum composite) - pipes sealed with one open collar CFS-C EL, mounted directly at wall (s_3), penetrating a shaft wall system B
	Pict. 8.6.3.8 C: MLC (Aluminum composite) - pipes sealed with one open collar CFS-C EL, mounted directly at floor or wall (s_3), penetrating a shaft wall system B. Possible fire access from both sides of the wall.
	Pict. 8.6.3.8 D: MLC (Aluminum composite) - pipes, sealed with one open collar CFS-C EL, mounted directly at floor or wall (s_3), penetrating a shaft wall system B. Possible fire access from one sides of the wall only.

Figure 126: Insulated MLC-pipes in zero distance, penetrating a shaftwall type B

Aluminum. composite. pipe brand/name/producer	Assessed pipe diameter d_c (mm)	Assessed pipe wall thickness tc (mm)	Assessed pipe insulation thickness t_D (mm)
Kelox Ke Kelit	16 – 32	2,0 – 3,0	4 – 13
Uponor Unipipe Plus	16 – 32	2,0 – 3,0	4 – 10
TECE TECEflex	16 – 32	2,75 – 4,0	4 – 13
Geberit Mepla	20	2,5	6 – 13
Geberit Mepla	32	3,0	4 – 13
Rehau Rautitan Stabil	16,2 – 32	2,6 – 4,7	4 – 13

Table 66: MLC-pipes with insulation assessed for direct contact solution in shaft wall B

Type of Penetrant	Classification
MLC-pipes with insulation assessed for direct contact solution in shaft wall B	EI 90 – U/C

Table 67: Classification for MLC- pipes in DG 1 in zero distance in shaft wall system B

8.6.3.9 Plastic pipes with MLC - pipes, Pipe to pipe minimum distance in shaft wall system B

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Multiple pipe seal in zero distance ($s_2 \geq 0$ mm) plastic pipe to MLC-pipe
- Pipes have been mounted directly onto a floor or onto a wall, before penetrating a shaft wall system B ($s_3 \geq 0$ mm)
- Linear arrangement of pipes only, no cluster arrangement
- All insulated aluminum composite pipes are covered by one uncompleted CFS-C EL collar
- Number of parallel, insulated MLC (aluminum composite) pipes in line: unlimited
- Number of parallel plastic pipes in line: unlimited
- Sequence of insulated MLC-pipes in line: not defined
- Sequence of plastic pipes in line: not defined
- Single side fire load (requesting one collar CFS-C EL) or double side fire seal (requesting two collars CFS-C EL) assessed – refer to 8.6.1.2
- The collar CFS-C EL should follow the MLC-pipe arrangement outside geometry as much as possible to prevent any pap between insulated pipes and collar

Plastic pipes:
- For pipe material, pipe brand/producer or pipe dimension refer to 8.6.3.1, 8.6.3.2, 8.6.3.3
- Unlimited number of parallel plastic pipes, side by side
- Each single pipe is covered by an individual, uncompleted CFS-C EL collar
- There must be no gap between plastic pipes and collar
- distance collar to collar ($s_1 \geq 0$) mm
- Collar in DG 1
- Pipe end configuration: U/U

Insulation on plastic pipe:
- No thermal insulation might be used
- For sound decoupling refer to 8.6.1.12

MLC - Pipes:
- Pipe brand/producer and dimension of MLC (aluminum composite) pipes: refer to Table 68
- Number of insulated aluminum composite pipes in line: unlimited
- Pipe end configuration: U/C
- Only insulated pipes according Table 68 are assessed

Insulation (D) on MLC – pipes:
- PE-foam insulation assessed only, for dimension refer to Table 68
- Pipe insulation situation: CS

Additional Protect Insulation (D_P) on MLC – pipes:
- To be installed over insulation (D_P)
- D_P: made of FEF-foam
- For FEF- type/brand/Producer: refer to 8.2.12
- Thickness t_{DP} = 9mm,
- Insulation situation LI
- Insulation length L_{DP} = 250mm on both sides of the wall

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: 5 – 15 mm for one-collar application (collar has not to pass through the wall)
- Annular gap: 15 – 20 mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Aluminum. composite. pipe brand/name/producer	Assessed pipe diameter d_c (mm)	Assessed pipe wall thickness tc (mm)	Assessed pipe insulation thickness t_D (mm)
Kelox Ke Kelit	16 – 32	2,0 – 3,0	4 – 13
Uponor Unipipe Plus	16 – 32	2,0 – 3,0	4 – 10
TECE TECEflex	16 – 32	2,75 – 4,0	4 – 13
Geberit Mepla	20	2,5	6 – 13
Geberit Mepla	32	3,0	4 – 13
Rehau Rautitan Stabil	16,2 – 32	2,6 – 4,7	4 – 13

Table 68: MLC-pipes with insulation assessed for direct contact solution in shaft wall B

Collar fixing:
- Refer to 8.2.4.3

Collar fixing for plastic pipes:
- Always one hook has to be fixed at the end of the collar strip. Place the first hook here.
- If distance collar to collar (s1) becomes very small a hook can't be installed here. So, both ends of the collar strip remains free of hook, clamped between adjacent pipes
- At the furthest position from firstly placed hook a second hook should be placed. Here it is recommended to fix two hooks of adjacent pipes with one fixing point (refer to 8.2.4)
- Every pipe diameter ($d_c \leq 63$ mm): 2 hooks
- Every pipe diameter ($63 \leq d_c \leq 110$) mm: 3 hooks
- If 3 hooks to be installed on one pipe, the middle hook should be positioned centered between outer hooks

Collar fixing for MLC – pipes:
- Always one hook must be fixed at the furthest end of the collar strip on both sides.
- At the point, where two pipes come together a hook should be placed
- Number of hooks to be used: Number of hooks for parallel aluminum composite pipes with direct contact (s_2 = 0mm), **= (x+1)**, where x= number of all pipes to be covered with **one** collar

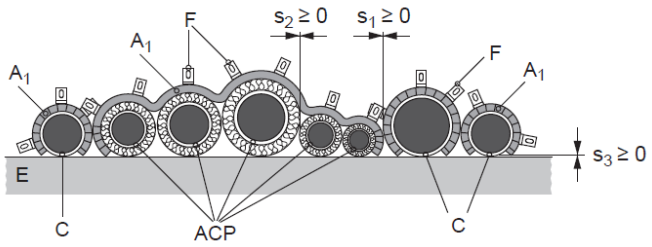
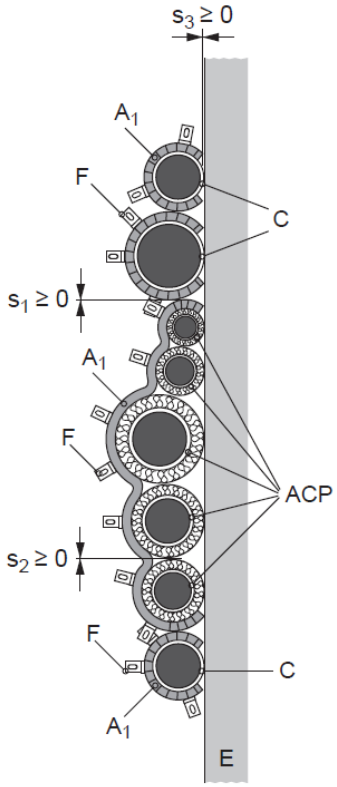
	Pict. 8.6.3.9 A: Plastic pipes (C) and MLC-(Aluminum composite) pipes (ACP) in minimum distance to each other, mounted directly onto the floor (E), penetrating a shaft wall system B
	Pict. 8.6.3.9 B: Plastic pipes (C) and MLC- (Aluminum composite) pipes (ACP) in minimum distance to each other, mounted directly onto a wall (E), penetrating a shaft wall system B

Figure 127: Insulated MLC pipes in direct contact to plastic pipes, penetrating a shaft wall system B

Type of Penetrant	Classification
Insulated MLC-pipes in zero distance side by side to plastic pipes - assessed for direct contact solution in shaft wall B	EI 90 – U/C for MLC-pipe EI 90 – U/U for plastic pipe

Table 69: Classification for insulated MLC- pipes side by side to plastic pipes in shaft wall system B

8.6.3.10 MLC-pipes with electric conduits, Pipe to conduit in minimum distance in shaft wall system B

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Mixed pipe seal in zero distance ($s_2 \geq 0$ mm) electric conduit to MLC-pipe
- Insulated MLC – pipes and conduits have been mounted directly onto a floor or onto a wall, before penetrating a shaft wall system B ($s_3 \geq 0$ mm)
- Parallel, insulated aluminum composite pipes and plastic conduits, side by side, distance pipe to pipe/conduit ($s_2 \geq 0$) mm
- Linear arrangement of pipes/conduits only, no cluster arrangement
- All insulated aluminum composite pipes and plastic conduits are covered by one uncompleted CFS-C EL collar
- Number of insulated MLC (aluminum composite) pipes in line: unlimited
- Number of parallel plastic conduits in line: max.2
- Sequence of insulated MLC-pipes in line: not defined
- Sequence of electric conduits in line: not defined
- Single side fire load (requesting one collar CFS-C EL) or double side fire seal (requesting two collars CFS-C EL) assessed – refer to 8.6.1.2
- The collar CFS-C EL should follow the MLC-pipe arrangement mixed with plastic conduits outside geometry as much as possible to prevent any pap between insulated pipes and collar
- There must be no gap between plastic conduits or insulated MLC - pipe and collar CFS-C EL
- Collar CFS-C EL in DG 1

Plastic electric conduits:
- Type of single conduits (RC): all rigid, flexible and pliable plastic conduits
- Conduit material: all plastic material assessed; metal excluded
- conduit end configuration: U/U
- conduits assessed empty or filled with cables (R)
- usable cables (R): filled with all sizes of common sheathed cables, max. single cable diameter is 28mm, including optical fibre cables
- projecting length $L_{RC} \geq 600$mm on each side of the wall
- Dimension of plastic conduits d_{RC}: max.40mm diameter

Insulation on plastic conduits:
- With mineral wool insulation (D)
- Thickness $t_D = 20$mm
- Insulation situation: LI
- Length L_{DP}: 250mm on each side

MLC - Pipes:
- Pipe brand/producer and dimension of MLC (aluminum composite) pipes: refer to Table 70
- Pipe end configuration: U/C
- Only insulated pipes according to Table 70 are assessed

Insulation (D) on MLC – pipes:
- PE-foam insulation assessed only, for dimension refer to Table 70
- Pipe insulation situation: CS

Additional Protect Insulation (D_P) on MLC – pipes:
- To be installed over insulation (D_P)
- D_P: made of FEF-foam
- For FEF- type/brand/Producer: refer to 8.2.12
- Insulation thickness t_{DP} = 9mm
- Insulation situation LI
- Length L_{DP} = 250mm on both sides of the wall

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: (5 – 15) mm for one-collar application (collar has not to pass through the wall)
- Annular gap: (15 – 20) mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Aluminum. composite. pipe brand/name/producer	Assessed pipe diameter d_c (mm)	Assessed pipe wall thickness tc (mm)	Assessed pipe insulation thickness t_D (mm)
Kelox Ke Kelit	16 – 32	2,0 – 3,0	4 – 13
Uponor Unipipe Plus	16 – 32	2,0 – 3,0	4 – 10
TECE TECEflex	16 – 32	2,75 – 4,0	4 – 13
Geberit Mepla	20	2,5	6 – 13
Geberit Mepla	32	3,0	4 – 13
Rehau Rautitan Stabil	16,2 – 32	2,6 – 4,7	4 – 13

Table 70: Insulated MLC-pipes mixed for direct contact with plastic conduits in shaft wall system B

Collar fixing of mixed MLC – pipes/ electric plastic conduits:
- Always one hook must be fixed at the furthest end of the collar strip on both sides.
- At the point, where two pipes come together a hook should be placed
- Number of hooks to be used: Number of hooks for parallel aluminum composite pipes with direct contact (s_2 = 0mm), **= (x+1)**, where x= number of all pipes to be covered with **one** collar

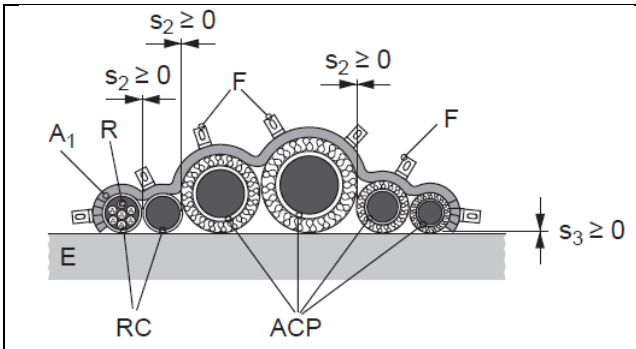
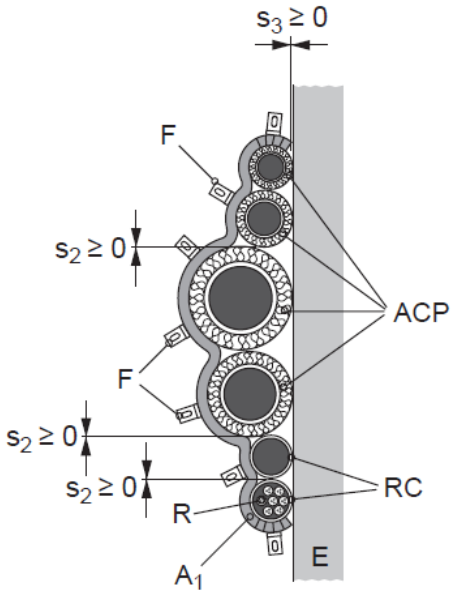
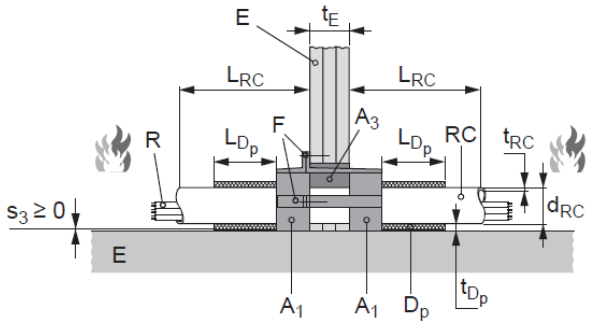
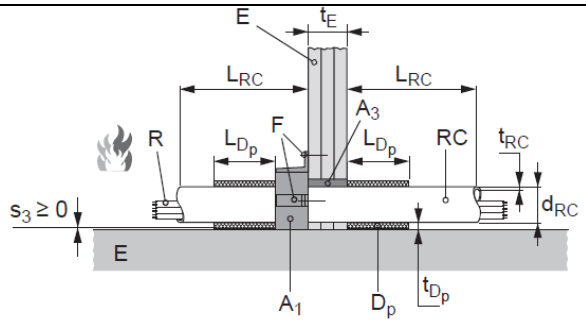
	Pict. 8.6.3.10 A: Parallel plastic conduits (RC) in zero distance to isolated Aluminum composite pipes (ACP), mounted directly onto the floor (E), penetrating a shaft wall system B.
	Pict. 8.6.3.10 B: Parallel plastic conduits (RC) in zero distance to isolated Aluminum composite pipes (ACP), mounted directly onto a wall (E), penetrating a shaft wall system B.
	Pict. 8.6.3.10 C: Parallel plastic conduits (RC) mounted directly onto the floor (E), penetrating a shaft wall system B. Conduits must be in projecting length L_{RC}. Fire load expected on both sides of shaft wall.
	Pict. 8.6.3.10 D: Parallel plastic conduits (RC) in zero distance to isolated Aluminum composite pipes (ACP), mounted directly onto the floor, penetrating a shaft wall system B. Fire load expected from one side only

Figure 128: Mixed seal (plastic conduits and MLC-pipes) in zero distance in shaft wall system B

Type of Penetrant	Classification
Insulated MLC-pipes in zero distance side by side to plastic conduits with/without cables - assessed for direct contact solution in shaft wall B	EI 90

Table 71: Classification for insulated MLC- pipes side by side to plastic pipes in shaft wall system B

8.6.3.11 MLC-pipes with electric conduits and plastic pipes in minimum distance in shaft wall system B

Situation:

- For shaft wall system B (refer to 8.6.1.2) only
- Mixed seal in zero distance ($s_2 \geq 0$ mm) to single seal
- Insulated MLC pipes, conduits and plastic pipes have been mounted directly onto a floor or onto a wall, before penetrating a shaft wall system B ($s_3 \geq 0$ mm)
- Parallel, insulated MLC (aluminum composite) - pipes and plastic conduits, side by side to plastic pipes, distance pipe to pipe/conduit ($s_2 \geq 0$) mm
- Linear arrangement of pipes/conduits only, no cluster arrangement
- All insulated MLC (aluminum composite) - pipes and plastic conduits are covered by one uncompleted CFS-C EL collar
- Plastic pipes are covered by individual collar section
- Number of insulated MLC (aluminum composite) pipes in line: unlimited
- Number of parallel plastic conduits in line: max.2
- Number of plastic pipes in line: unlimited
- Sequence of insulated MLC-pipes in line: not defined
- Sequence of electric conduits in line: not defined
- Sequence of plastic pipes in line: not defined
- Single side fire load (requesting one collar CFS-C EL) or double side fire seal (requesting two collars CFS-C EL) assessed – refer to 8.6.1.2
- The collar CFS-C EL should follow the MLC-pipe arrangement mixed with plastic conduits outside geometry as much as possible to prevent any pap between insulated pipes and collar
- There must be no gap between plastic conduits/ insulated MLC - pipe and collar
- Collar CFS-C EL in DG 1

Plastic pipes:

- For pipe material, pipe brand/producer or pipe dimension refer to 8.6.3.1, 8.6.3.2, 8.6.3.3
- Each single pipe is covered by an individual, uncompleted CFS-C EL collar
- There must be no gap between plastic pipes and collar
- distance collar to collar ($s_1 \geq 0$) mm
- Pipe end configuration: U/U

Insulation on plastic pipe:

- No thermal insulation might be used
- For sound decoupling refer to 8.6.1.2

Plastic electric conduits:

- Type of single plastic conduits RC: all rigid, flexible, and pliable conduits
- Conduit material: all plastic material assessed; metal excluded
- conduit end configuration: U/U
- conduits assessed empty or filled with cables (R)
- usable cables (R): filled with all sizes of common cables, max. single cable diameter is 28mm, including optical fibre cables
- projecting length $L_{RC} \geq 600$mm on each side of the wall
- Dimension of plastic conduits d_{RC}: max.40mm diameter

Insulation on plastic conduits:
- With mineral wool insulation (D)
- Thickness t_D = 20mm
- Insulation situation: LI
- Length L_{DP}: 250mm on each side

MLC - Pipes:
- Pipe brand/producer and dimension of MLC (aluminum composite) pipes: refer to Table 72
- Pipe end configuration: U/C
- Only insulated pipes according to Table 72

Insulation (D) on MLC pipes:
- PE-foam insulation assessed only, for dimension refer to Table 72
- Pipe insulation situation: CS

Additional Protect Insulation (D_P) on MLC pipes:
- To be installed over insulation (D_P)
- DP: made of FEF-foam
- For FEF- type/brand/Producer: refer to 8.2.12
- Insulation thickness t_{DP} = 9mm
- Insulation situation LI
- Length L_{DP} = 250mm on both sides of the wall

Gap fill:
- Gap filler: Hilti CFS-FIL
- Annular gap: (5 – 15) mm for one-collar application (collar has not to pass through the wall)
- Annular gap: (15 – 20) mm for two-collar application (collar must pass through the wall)
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

Aluminum composite. pipe brand/name/producer	Assessed pipe diameter d_c (mm)	Assessed pipe wall thickness tc (mm)	Assessed pipe insulation thickness t_D (mm)
Kelox Ke Kelit	16 – 32	2,0 – 3,0	4 – 13
Uponor Unipipe Plus	16 – 32	2,0 – 3,0	4 – 10
TECE TECEflex	16 – 32	2,75 – 4,0	4 – 13
Geberit Mepla	20	2,5	6 – 13
Geberit Mepla	32	3,0	4 – 13
Rehau Rautitan Stabil	16,2 – 32	2,6 – 4,7	4 – 13

Table 72: Insulated MLC-pipes mixed for direct contact with plastic conduits in shaft wall system B

Collar fixing of mixed MLC – pipes/ electric plastic conduits:

- Always one hook must be fixed at the furthest end of the collar strip on both sides.
- At the point, where two pipes come together a hook should be placed
- Number of hooks to be used: Number of hooks for parallel aluminum composite pipes with direct contact (s_2 = 0mm), **= (x+1)**, where x= number of all pipes to be covered with **one** collar

Collar fixing:

- Refer to 8.2.4.3
- Always one hook has to be fixed at the end of the collar strip. Place the first hook here.
- If distance collar to collar (s_1) becomes very small a hook can't be installed here. So, both ends of the collar strip remains free of hook, clamped between adjacent pipes
- At the furthest position from firstly placed hook a second hook should be placed. Here it is recommended to fix two hooks of adjacent pipes with one fixing point (refer to 8.2.4)
- Every pipe diameter ($d_c \leq 63$ mm): 2 hooks
- Every pipe diameter ($63 \leq d_c \leq 110$) mm: 3 hooks
- If 3 hooks to be installed on one pipe, the middle hook should be positioned centered between outer hooks

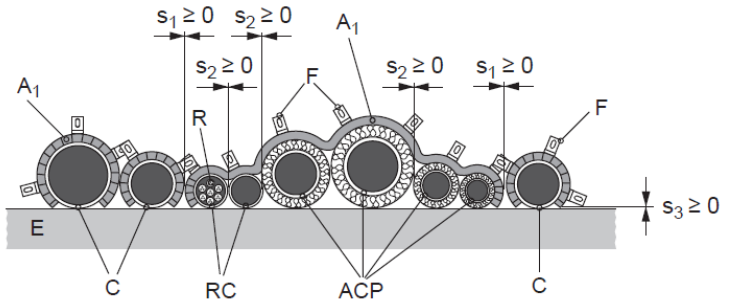
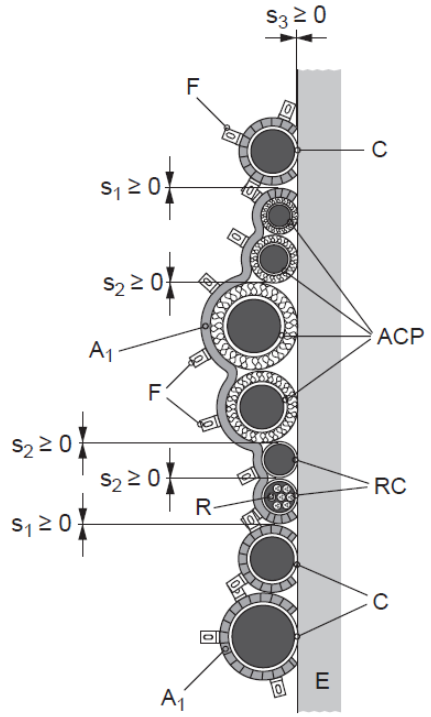
	Pict. 8.6.3.11 A: Aluminum composite pipes with electric conduits and plastic pipes in minimum distance, mounted directly onto a floor (E), penetrating a shaft wall system B.
	Pict. 8.6.3.11 B: Aluminum composite pipes with electric conduits and plastic pipes in minimum distance, mounted directly onto the wall (E), penetrating a shaft wall system B

Figure 129: Aluminum composite (MLC) - pipes with electric conduits and plastic pipes in minimum distance, mounted directly onto the wall /floor (E), penetrating a shaft wall system B

Type of Penetrant	Classification
Insulated MLC (aluminum composite) - pipes with electric conduits and plastic pipes in minimum distance, mounted directly onto the wall /floor (E), penetrating a shaft wall system B	EI 90

Table 73: Classification of mixed seals of insulated MLC-pipes, electric conduits and plastic pipes as mixed seal in shaft wall system B

8.6.3.12 Electric cables, bunched cables and conduits in shaft wall system B

Hilti Firestop mastic Filler CFS-FIL is an ancillary product to the endless collar CFS-C EL, refer to 7.2.5 of this ETA.
CFS-FIL is even an essential component of Hilti Firestop Block CFS-BL, described in detail in ETA -13/0099.

Situation:
- For shaft wall system B (refer to 8.6.1.2) only
- Multiple seal
- Applicable identical for single or double side fire access, depending on possible fire load (refer to 8.6.1.2).
- All penetrating items parallel, in zero distance ($s_2 \geq 0$ mm) to each other
- All penetrating items are mounted onto a floor or wall or directly into the shaftwall with no contact to adjacent building elements

Single cable (R):
- All sheathed cable types currently used up to 21 mm single cable diameter
- Optical fibre cables included
- No waveguides, no non-sheathed cables
- No cable support – system
- Cable with insulation

Single cable insulation (D):
- Insulation material: Mineral wool
- Insulation thickness t_D: ≥ 20 mm
- Insulation case: LI
- Insulation length L_D: ≥ 250mm on each side

Cable bundles (RB):
- Max. diameter of tied cable bundle: 50 mm
- All sheathed cable types currently used up to 21 mm single cable diameter, including optical fibre cables
- Bundle with insulation

Cable bundle insulation (D):
- Insulation material: Mineral wool
- Insulation thickness t_D: ≥ 20mm
- Insulation case: LI
- Insulation length L_D: ≥ 250mm on each side

Plastic electric conduits (RC):
- Type of single plastic conduits RC: all rigid, flexible, and pliable conduits
- Conduit material: all plastic material assessed; metal excluded
- conduit end configuration: U/U
- conduits assessed empty or filled with cables R
- usable cables R: filled with all sizes of common cables, max. single cable diameter is 28 mm, including optical fibre cables
- projecting length L_{RC} ≥ 600 mm on each side of the wall
- Dimension of plastic conduits d_{RC}: max. 40 mm diameter
- With or without insulation

Insulation on plastic conduits (D):

- Type: mineral wool insulation
- Thickness t_D = 20mm
- Insulation situation: LI
- Length L_{DP}: 250mm on each side

Gap seal:

- Gap filler: Hilti CFS-FIL
- Annular gap width: ($0 \leq s_3 \leq 50$) mm
- Depth t_{A3} of installed gap filler: over the entire wall thickness t_E
- No backfilling required

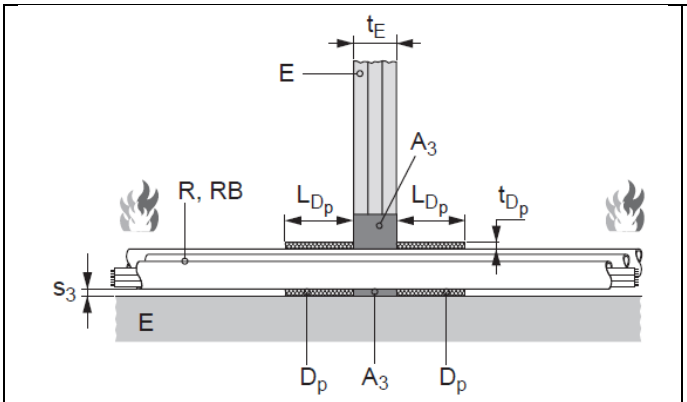
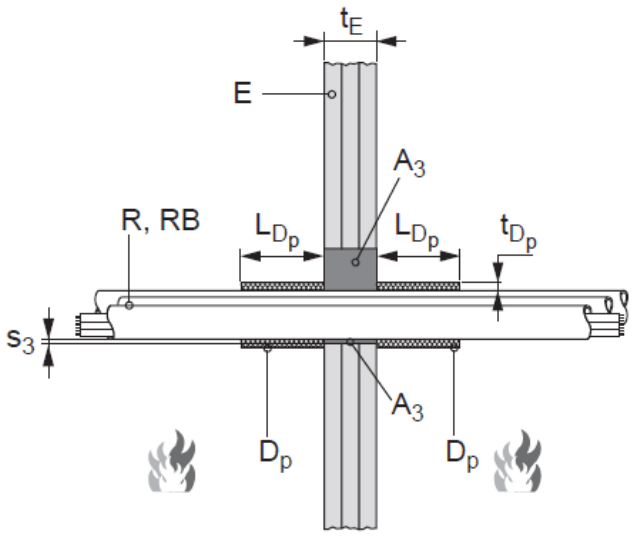
	Pict. 8.6.3.12 A Single (R) or bunched (RB) cables, isolated with a mineral wool protect insulation D_P, penetrating a shaft wall system B with single or double-side fire load, mounted directly onto a floor E
	Pict. 8.6.3.12 B: Single (R) or bunched (RB) cables, isolated with a mineral wool protect insulation D_P, penetrating a shaft wall system B with single or double-side fire load, mounted into the shaft wall

Figure 130: Several electric penetrants in zero distance, mounted onto floor, in shaft wall system B

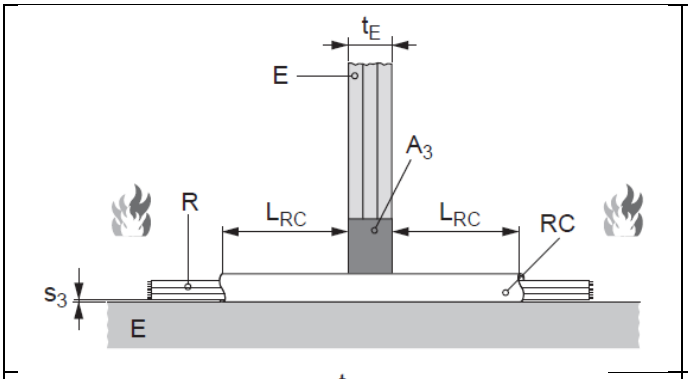
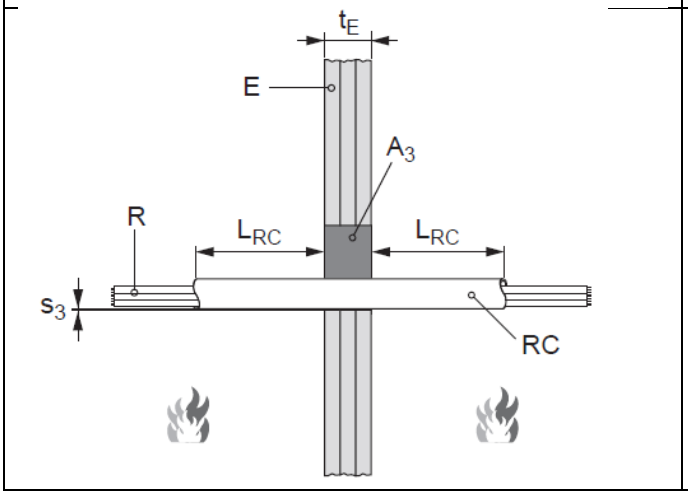
	Pict. 8.6.3.12 C: Cable conduits RC (empty or filled with cables R), non-insulated, mounted directly onto a floor E, with single or double-side fire load
	Pict. 8.6.3.12 D: Cable conduits RC (empty or filled with cables R), non-insulated, penetrating a shaft wall type B, with single or double-side fire load

Figure 131: Several electric penetrants in zero distance, mounted onto floor or free in wall, in shaft wall system B

Type of Penetrant	Classification
Single or bunched cables, isolated with a mineral wool together with plastic conduits, non-insulated or insulated, penetrating a shaft wall system B with single or double-side fire load, mounted directly onto a floor E or free in the wall	EI 90

Table 74: Classification for multiple cable/conduits in shaft wall system B

8.7 Rigid floor

8.7.1 Specific characteristics for Rigid floor ($t_E \geq 150$ mm)

8.7.1.1 Rigid floor:

The floor must have a minimum thickness of 150 mm with a minimum density of $\rho_E \geq 650$ kg/m^3 and comprise concrete, aerated concrete, or masonry.

8.7.1.2 Annular gap seal:

Annular gap around penetrating item has to be filled with:

- Cementious mortar acc. EN 998-2 group M10 over the entire thickness of the floor

or

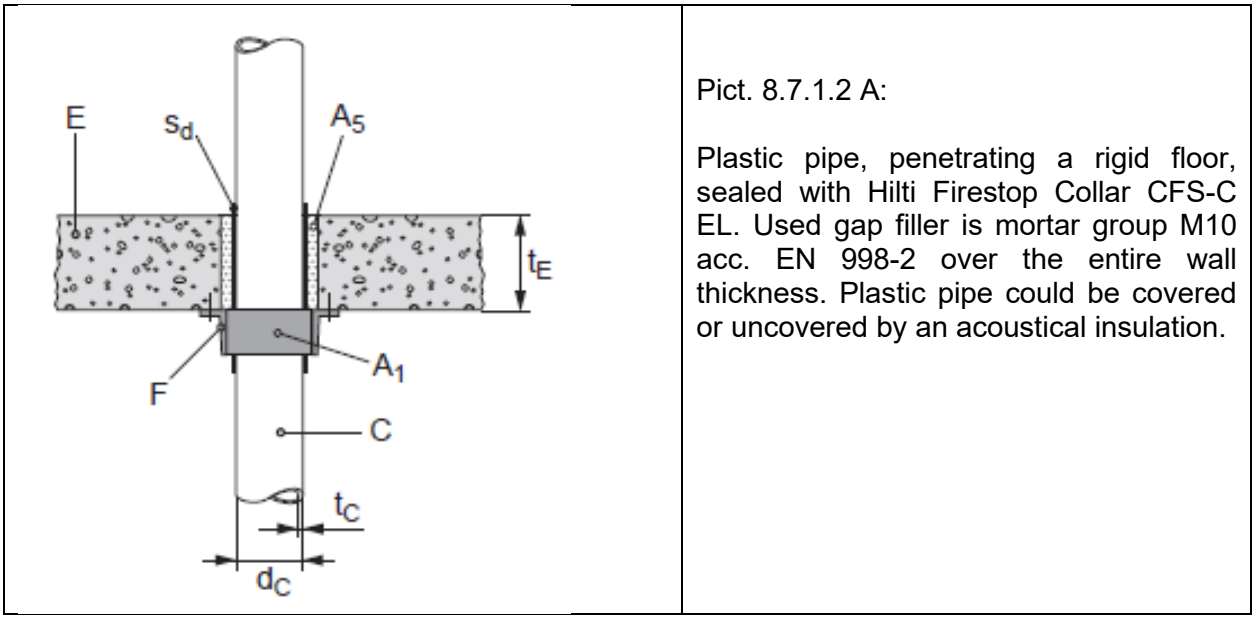
- Hilti Firestop Acrylic Sealant CFS-S ACR (A_2) on top side of floor only with a depth of minimum ($t_{A2} \geq 25$ mm), backfilled with mineral wool

or

- Hilti Firestop Acrylic Sealant CFS-S ACR (A_2) only, installation depth t_{A2} = ($t_{A2} \geq 25$ mm), installed on both sides of floor

Annular gap width should be:

- 0 – 40 mm (when sealed with mortar group M10 acc. EN 998-2 over the entire wall thickness
- 0 – 40 mm (when sealed with Hilti Firestop Acrylic Sealant CFS-S ACR and mineral wool backfilling)
- 0 –15 mm (when sealed with Hilti Firestop Acrylic Sealant CFS-S ACR only)



Pict. 8.7.1.2 A:

Plastic pipe, penetrating a rigid floor, sealed with Hilti Firestop Collar CFS-C EL. Used gap filler is mortar group M10 acc. EN 998-2 over the entire wall thickness. Plastic pipe could be covered or uncovered by an acoustical insulation.

Figure 132: Gap seal with mortar/concrete around a plastic pipe, penetrating a floor

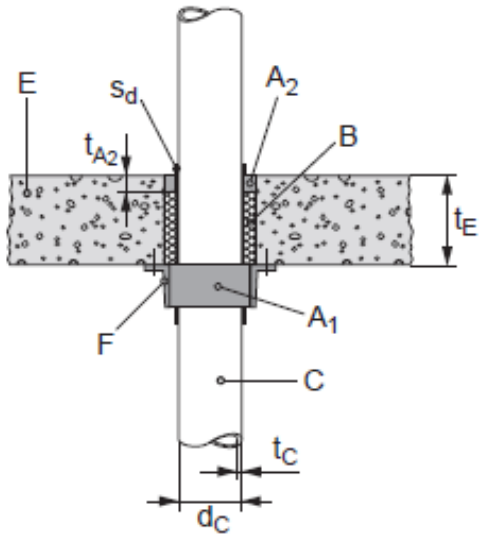
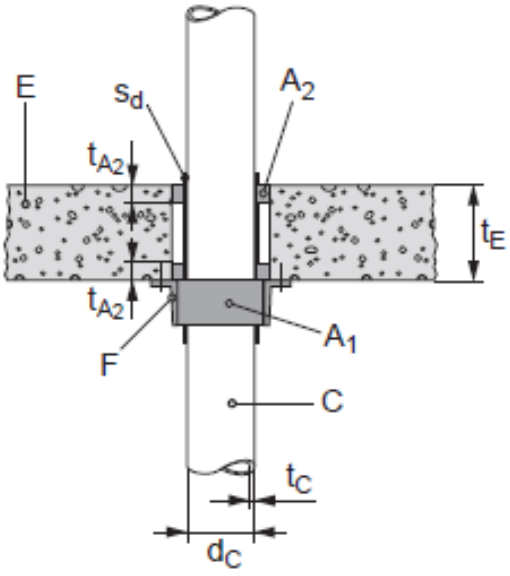
	Pict. 8.7.1.2 B: Plastic pipe, penetrating a rigid floor, sealed with Hilti Firestop Collar CFS-C EL. Used gap filler is CFS-S ACR in a thickness of (t_{A2} ≥ 25 mm) from the upper surface of the floor only, backfilled with mineral wool. Plastic pipe could be covered or uncovered by an acoustical insulation.
	Pict. 8.7.1.2 C: Plastic pipe, penetrating a rigid floor, sealed with Hilti Firestop Collar CFS-C EL. Used gap filler is CFS-S ACR in a thickness of (t_{A2} ≥ 25 mm) from both surfaces of the floor, no backfilling is requested. Plastic pipe could be covered or uncovered by an acoustical insulation.

Figure 133: Gap seal with CFS-S ACR with/without backfilling around a plastic pipe, penetrating a floor

8.7.1.3 **Collar fixing**

- Hilti Firestop Collar Endless CFS-C EL (A_1) has to be fixed with hooks (F) on the bottom side of the floor only
- For requested number and type of hooks refer to 8.2.5
- For hook fixing refer to 8.2.4
- For bended hooks in wet mortar refer to 8.2.4.7

Mortar must be fully cured before fire rating is available.

8.7.2 Penetration services in rigid floor (t_E ≥150 mm)

8.7.2.1 PE-pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 and DG 2

Classification shown in Figure 134, Figure 135 and Figure 136 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according to ISO 19220
- No limitation for brands/producers
- Carefully consider relevant Design Group (DG) of CFS-C EL

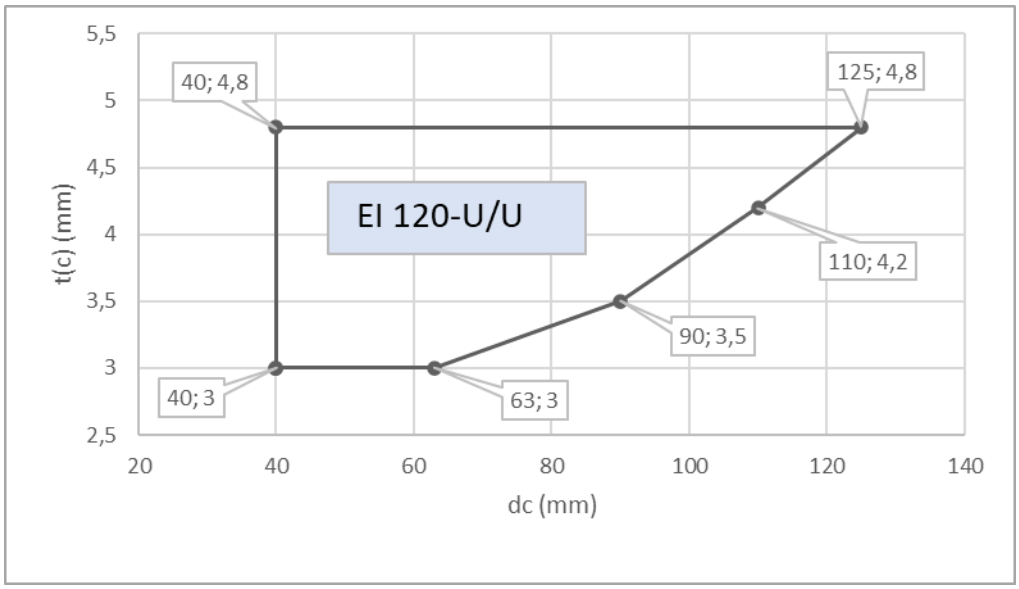


Figure 134: Classified range for PE-pipes acc.to EN 1519-1, DG 1 in rigid floor, sealed with CFS-C EL for EI 120-U/U

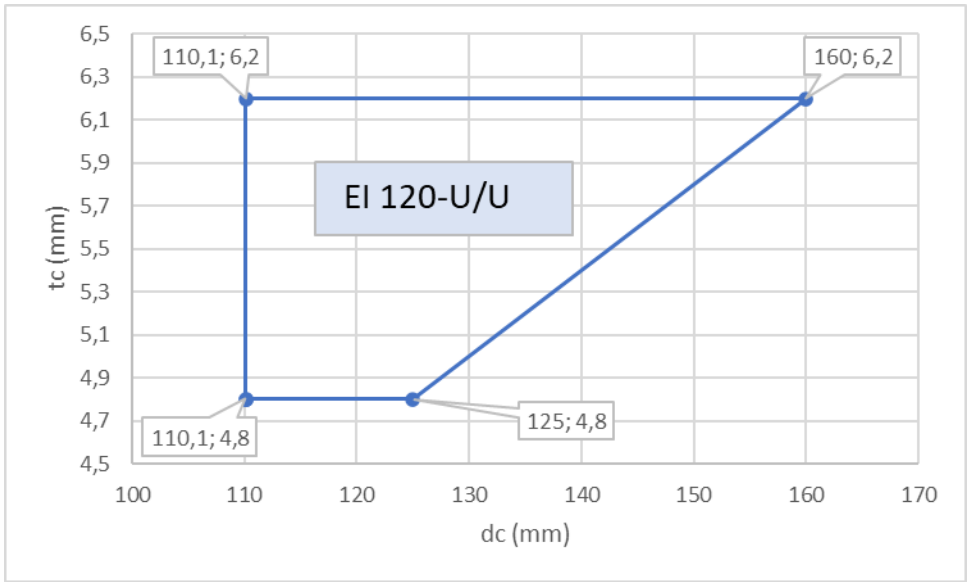


Figure 135: Classified range for PE-pipes acc.to EN 1519-1, DG 2 in rigid floor, sealed with CFS-C EL for EI 120-U/U

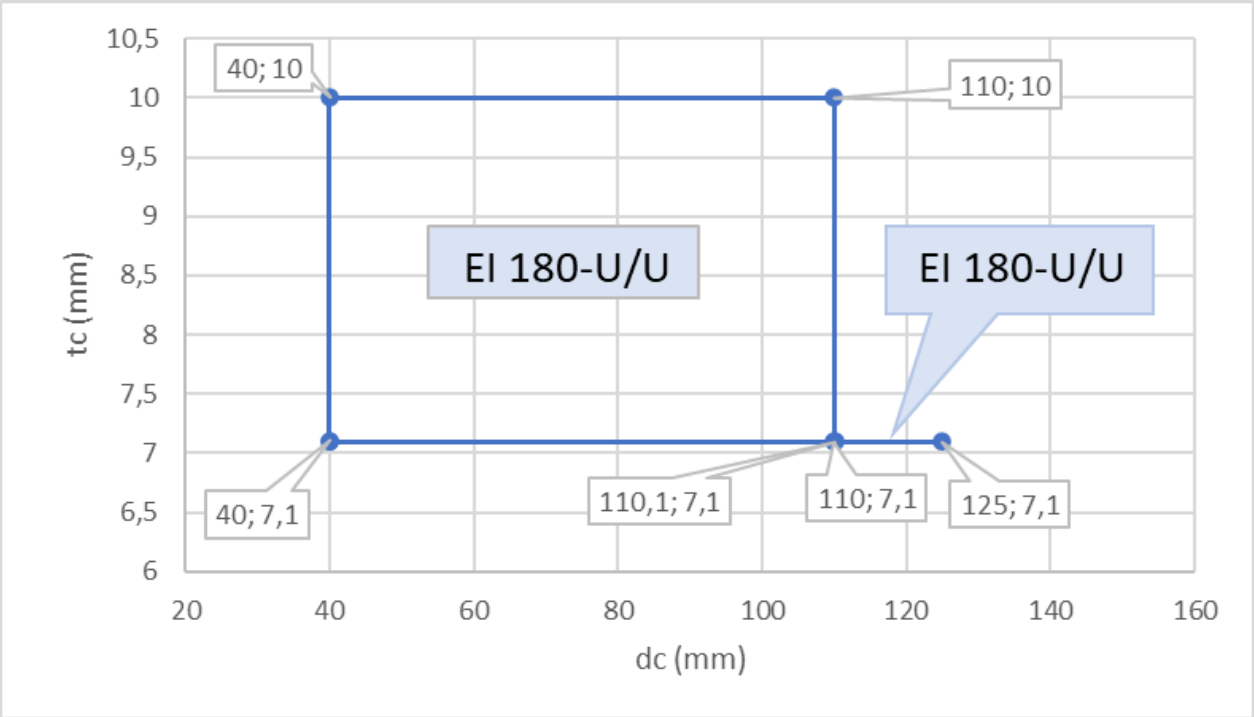


Figure 136: Classified range for PE-pipes acc.to EN 1519-1, DG 1 and DG 2 in rigid floor, sealed with CFS-C EL for EI 180-U/U

8.7.2.2 ABS – pipes acc. EN 1455-1 in DG 1 and DG 2

Classification shown in Figure 137 and Figure 138 is valid for pipes made from:

- ABS according EN 1455-1 and EN ISO 15493
- No limitation for brands/producer
- Carefully consider relevant Design Group (DG) of CFS-C EL

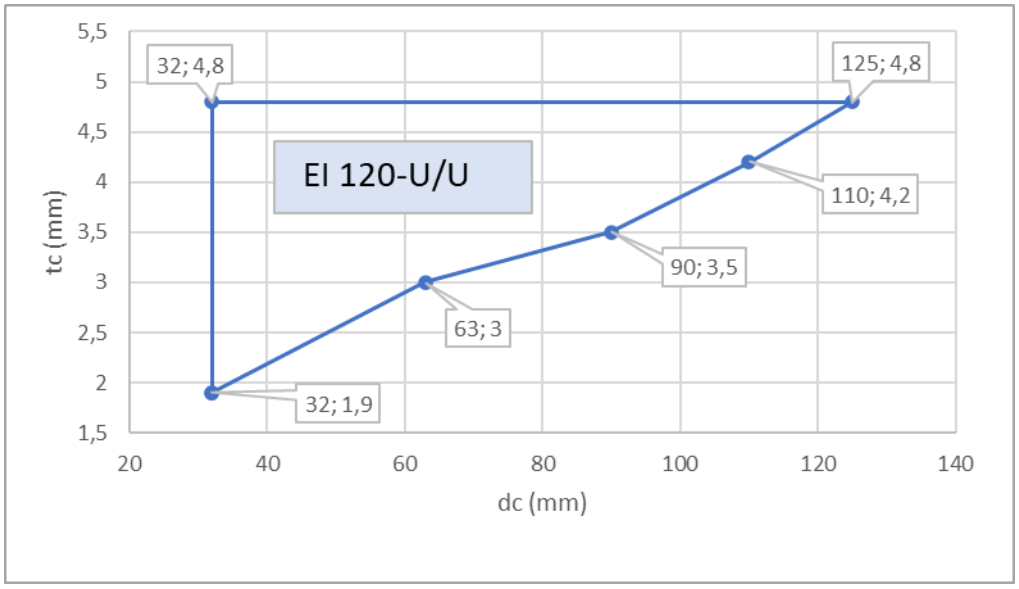


Figure 137: Classified range for ABS-pipes in rigid floor, sealed with CFS-C EL in DG1 for EI 120-U/U

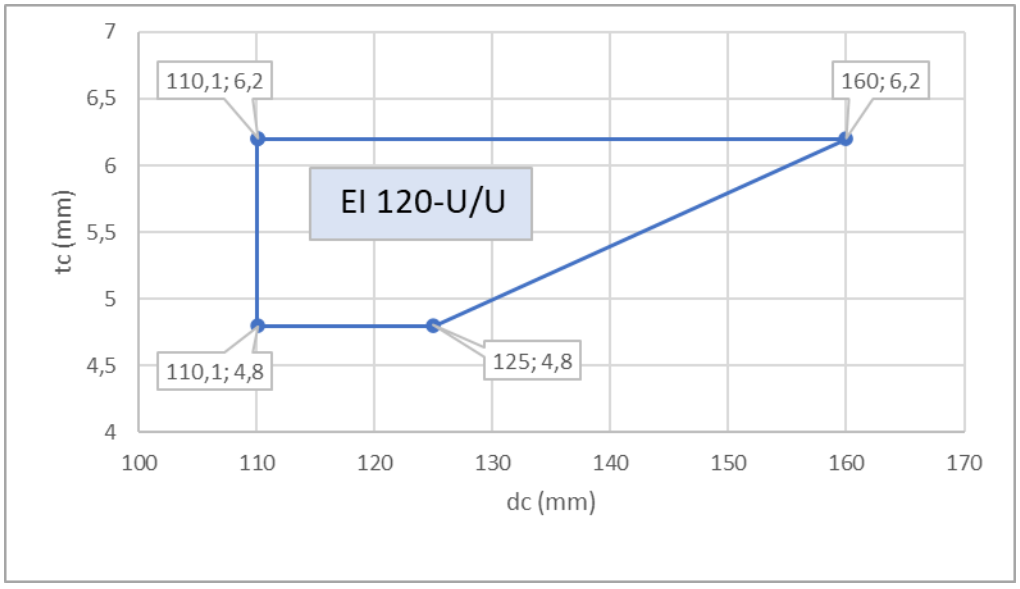


Figure 138: Classified range for ABS-pipes in rigid floor, sealed with CFS-C EL in DG 2 for EI 120-U/U

8.7.2.3 PE-pipes acc. EN ISO 15494 in DG 1 and DG 2

Classification shown in Figure 139, Figure 140, Figure 141 and Figure 142 is valid for pipes made from:

- PE according EN ISO 15494, EN 12201-2 and DIN 8074/75
- No limitation for brands/producer
- Carefully consider relevant Design Group (DG) of CFS-C EL

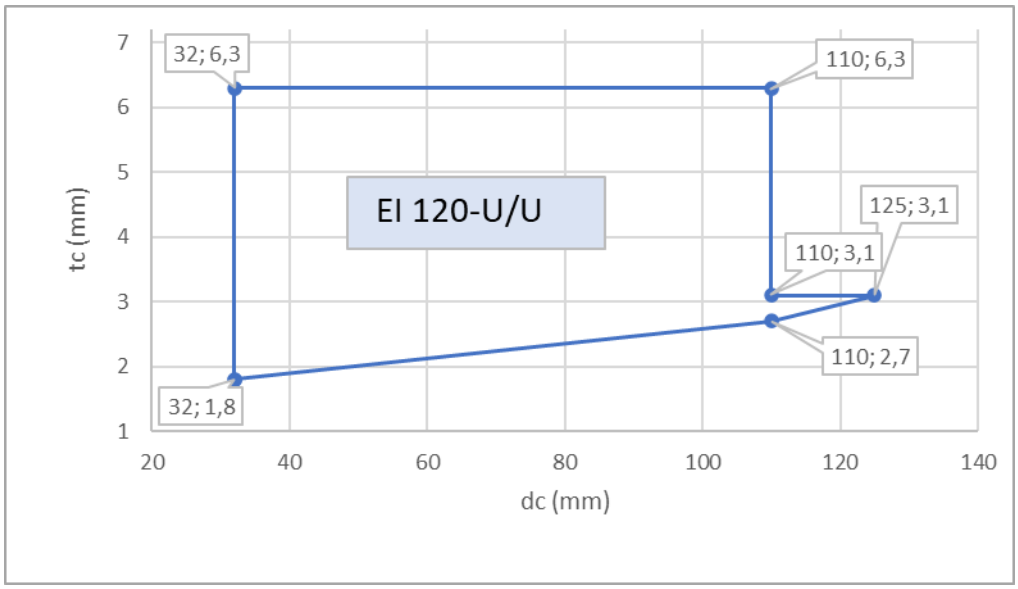


Figure 139: Classified range for PE-pipes acc.to EN ISO 15494 in rigid floor, sealed with CFS-C EL in DG 1 for EI 120-U/U

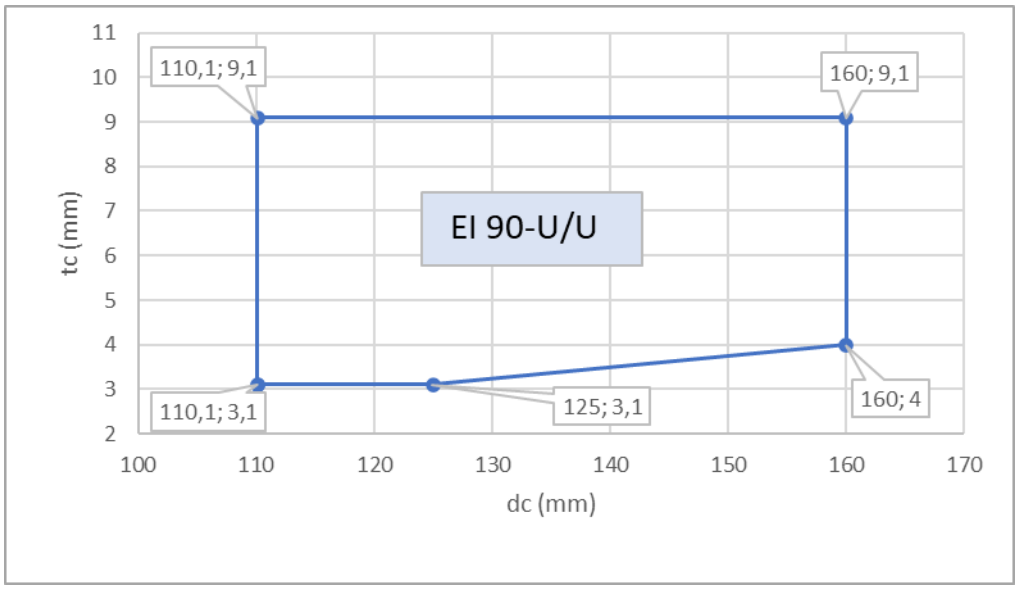


Figure 140: Classified range for PE-pipes acc.to EN ISO 15494 in rigid floor, sealed with CFS-C EL in DG 2 for EI 90-U/U

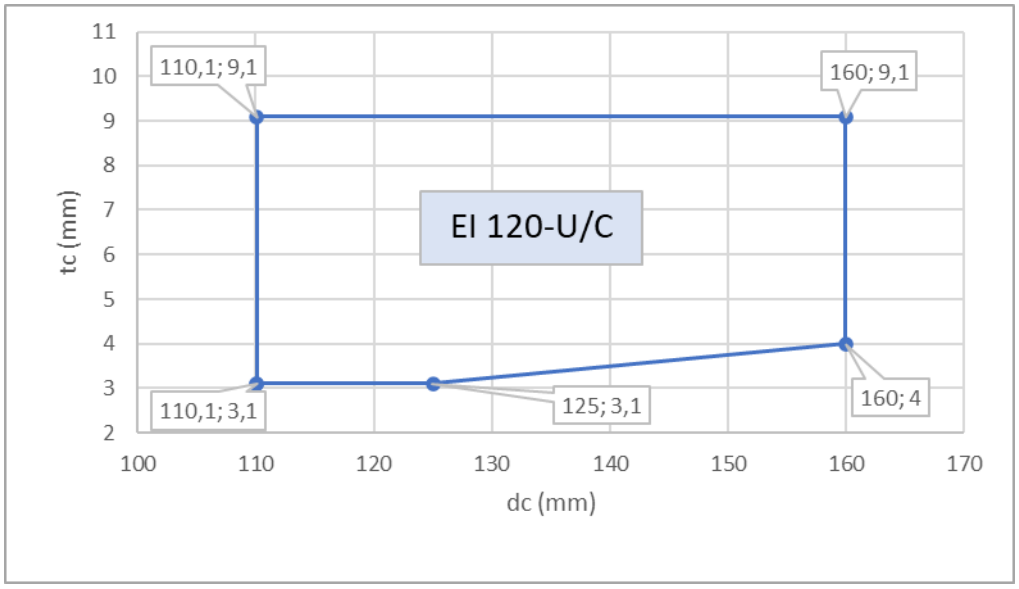


Figure 141: Classified range for PE-pipes acc.to EN ISO 15494 in rigid floor, sealed with CFS-C EL in DG 2 for EI120-U/C

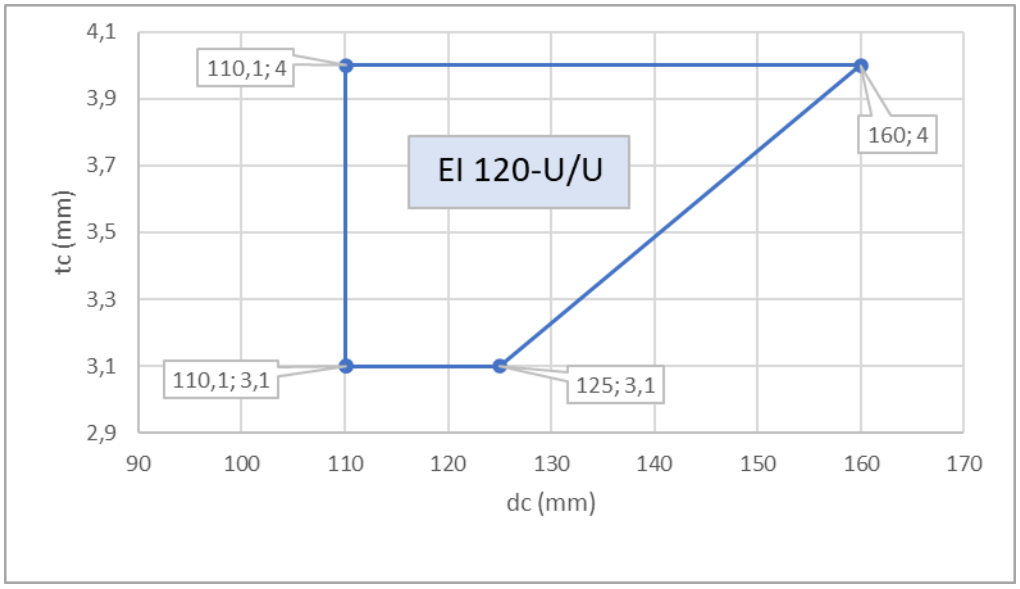


Figure 142: Classified range for PE-pipes acc.to EN ISO 15494 in rigid floor, sealed with CFS-C EL in DG 2 for EI120-U/U

8.7.2.4 PVC - pipes acc. EN 1452-2 in DG 1 and DG 2

Classification shown in Figure 143, Figure 144, Figure 145 and Figure 146 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Consider relevant Design Group (DG) of CFS-C EL
- Carefully consider disclaimer in 8.2.16

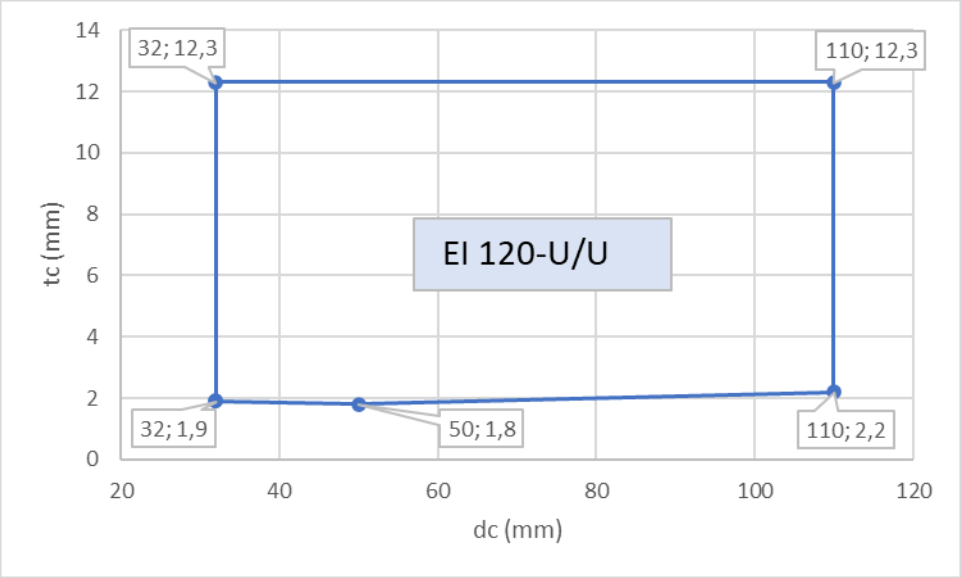


Figure 143: Classified range for PVC-pipes in rigid floor, sealed with CFS-C EL in DG 1 for EI120-U/U

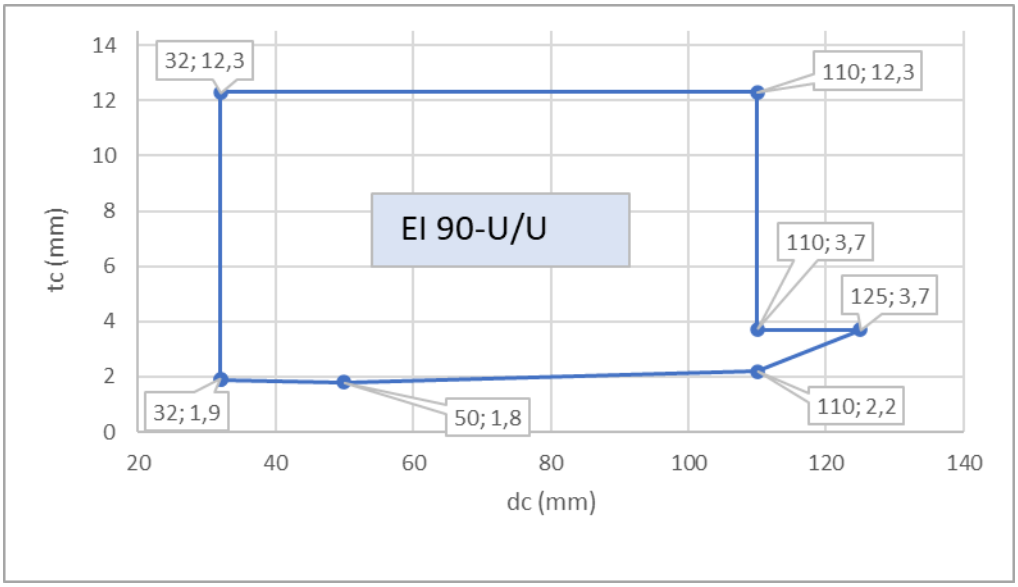


Figure 144: Classified range for PVC-pipes in rigid floor, sealed with CFS-C EL in DG 1 for EI 90-U/U

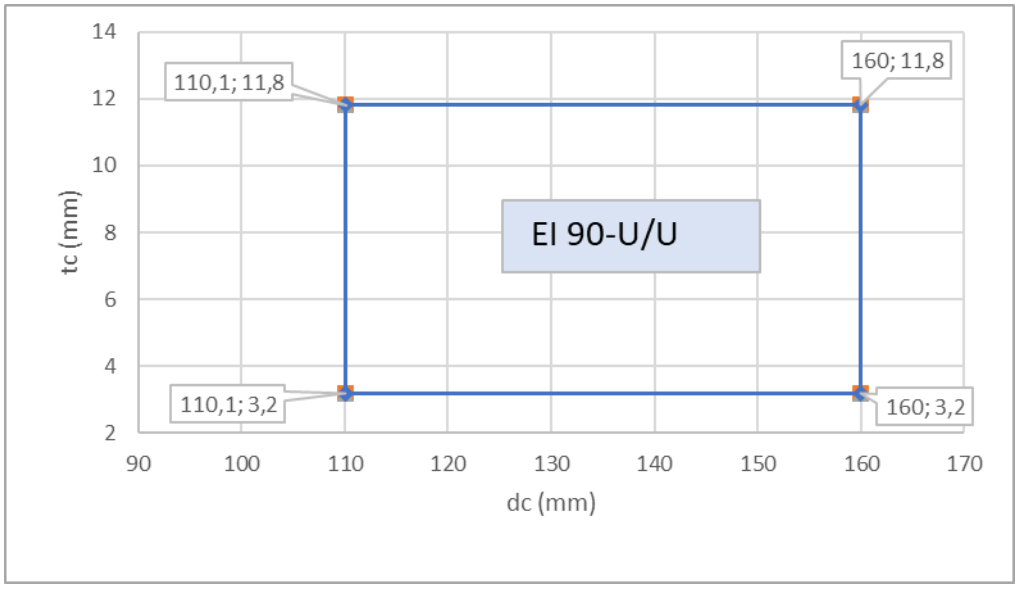


Figure 145: Classified range for PVC-pipes in rigid floor, sealed with CFS-C EL in DG 2 for EI 90-U/U

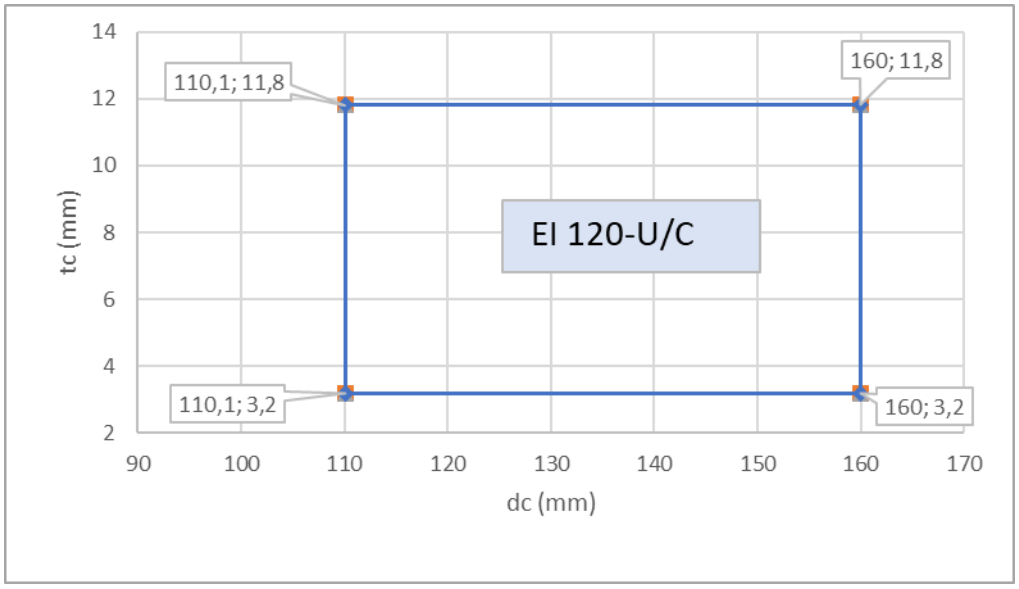


Figure 146: Classified range for PVC-pipes in rigid floor, sealed with CFS-C EL in DG 2 for EI120-U/C

Further Classification for PVC-pipes in rigid floor:

Pipe diameter d_c	Pipe wall thickness t_c	Design Group CFS-C EL	Achieved Rating
$d_c \leq 125$mm	t_c = 9,2 mm	2	EI 120-U/U

Table 75: Additional Classification for PVC-pipes in DG 2 for EI120-U/U

8.7.2.5 PP-pipes, non-regulated in DG 1 and DG 2

Classification shown in Figure 147, Figure 148 and Figure 149 is valid for pipes made from:

- For assessed brands/producers refer to section 8.2.15
- Carefully consider relevant Design Group (DG) of CFS-C EL

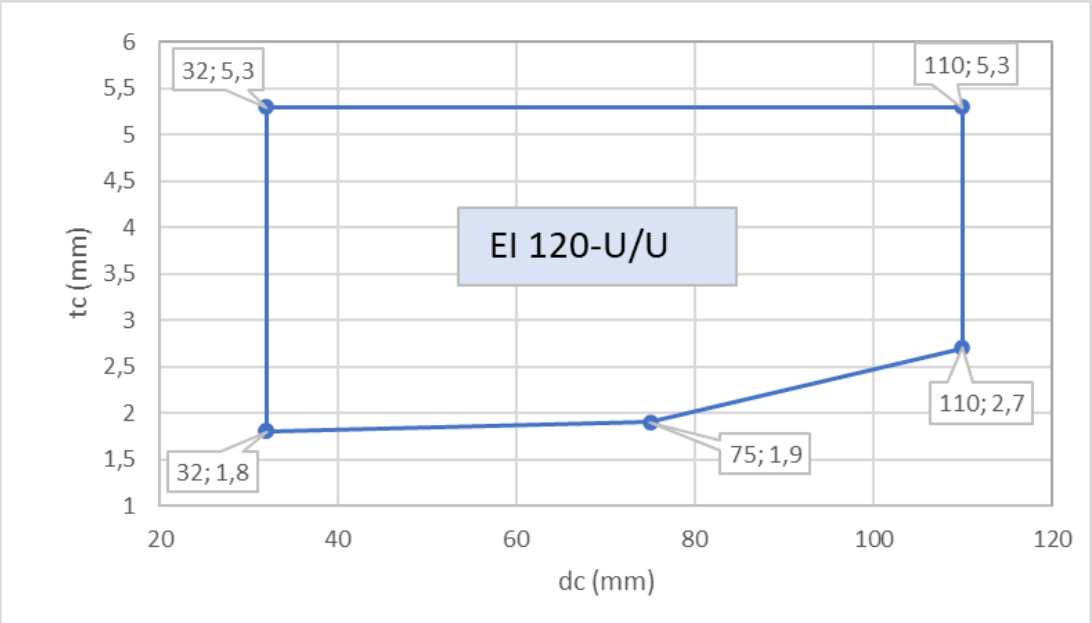


Figure 147: Classified range for PP-pipes - non-regulated - in rigid floor, sealed with CFS-C EL in DG 1 for EI120-U/U

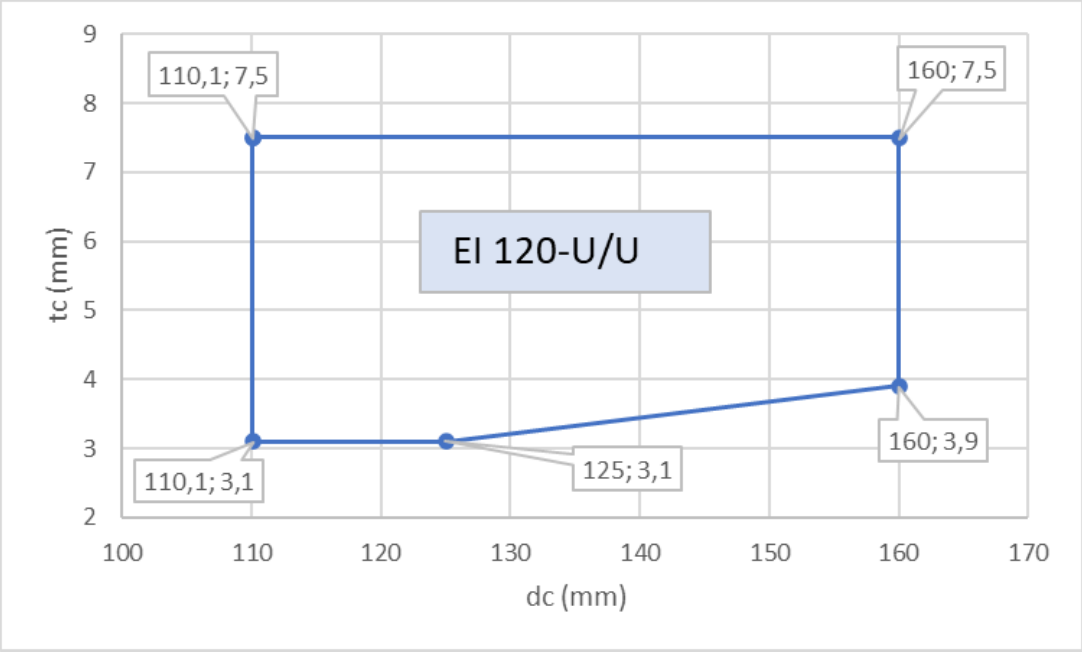


Figure 148: Classified range for PP-pipes - non-regulated - in rigid floor, sealed with CFS-C EL in DG 2 for EI120-U/U

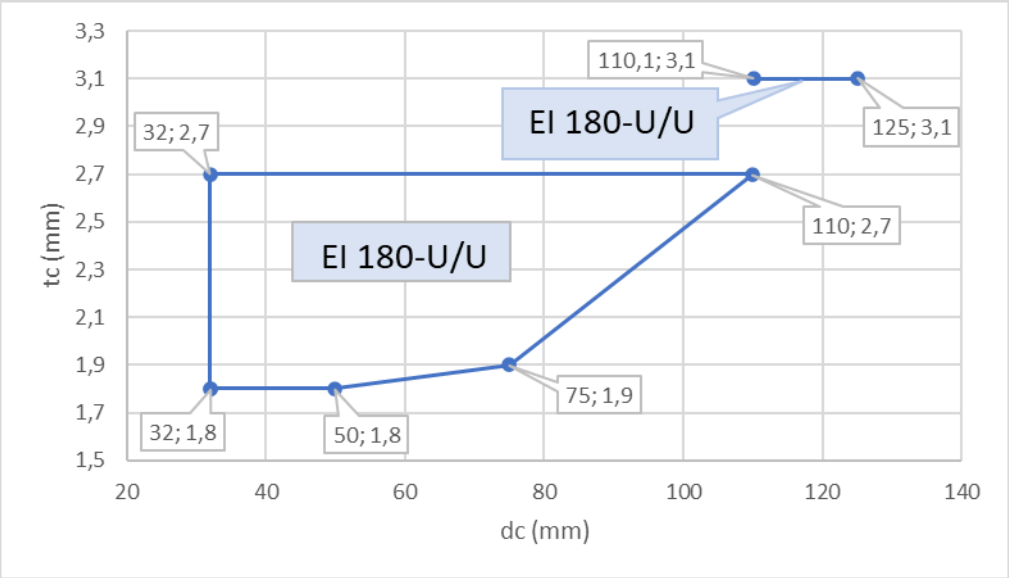


Figure 149: Classified range for PP-pipes - non-regulated - in rigid floor, sealed with CFS-C EL in DG 1 and DG 2 for EI180-U/U

8.7.2.6 Wavin AS + (non-regulated PP- pipe) in DG 1

Classification shown in Figure 150 is valid for pipes made from:

- PP non-regulated
- For Wavin AS + only
- For Design Group 1 (DG 1) of CFS-C EL

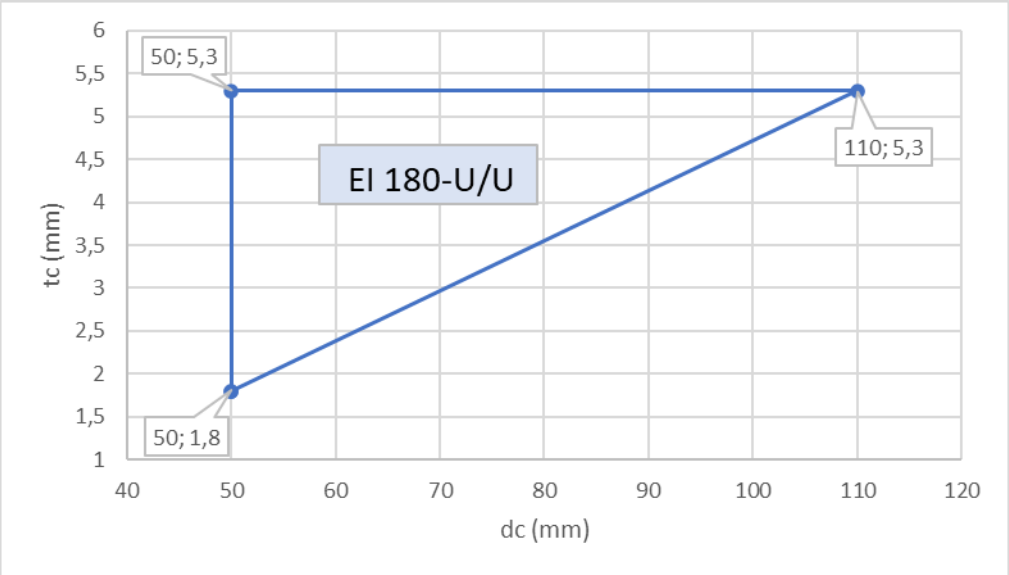


Figure 150: Classified range for Wavin AS+ (non-regulated PP-pipe) in rigid floor, sealed with CFS-C EL in DG 1 for EI180-U/U

8.7.2.7 PP-pipes acc. EN 1451-1 in DG 1 and DG 2

Classification shown in Figure 151, Figure 152, Figure 153, Figure 154 and Figure 155 is valid for pipes made from:

- PP according EN 1451-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer
- Carefully consider relevant Design Group (DG) of CFS-C EL

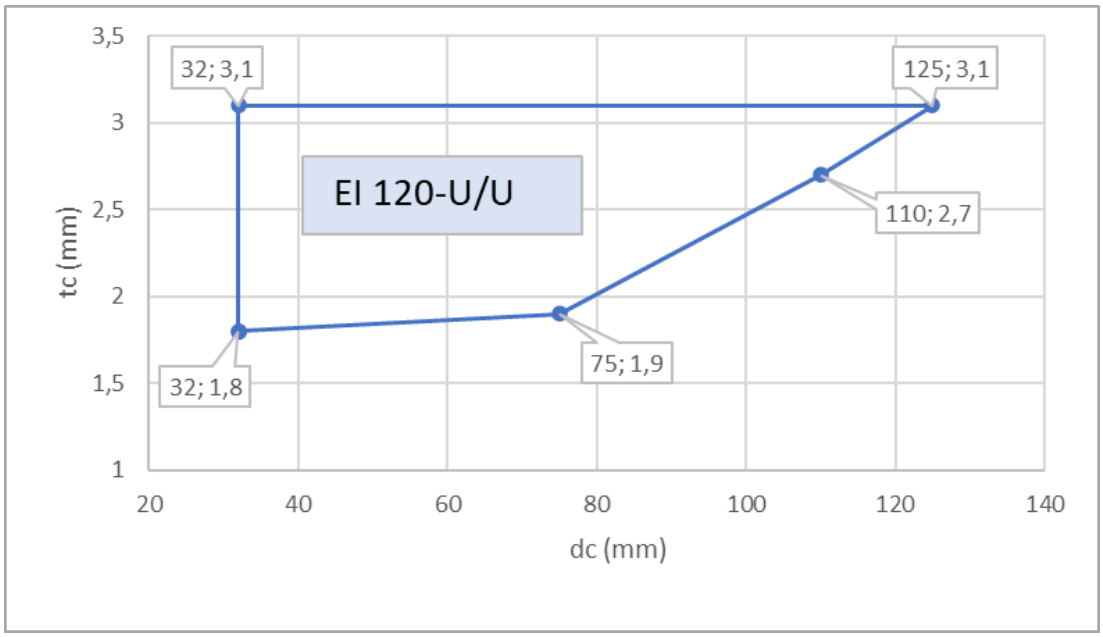


Figure 151: Classified range for PP-pipes acc.to EN 1451-1 in rigid floor, sealed with CFS-C EL in DG 1 for EI120-U/U

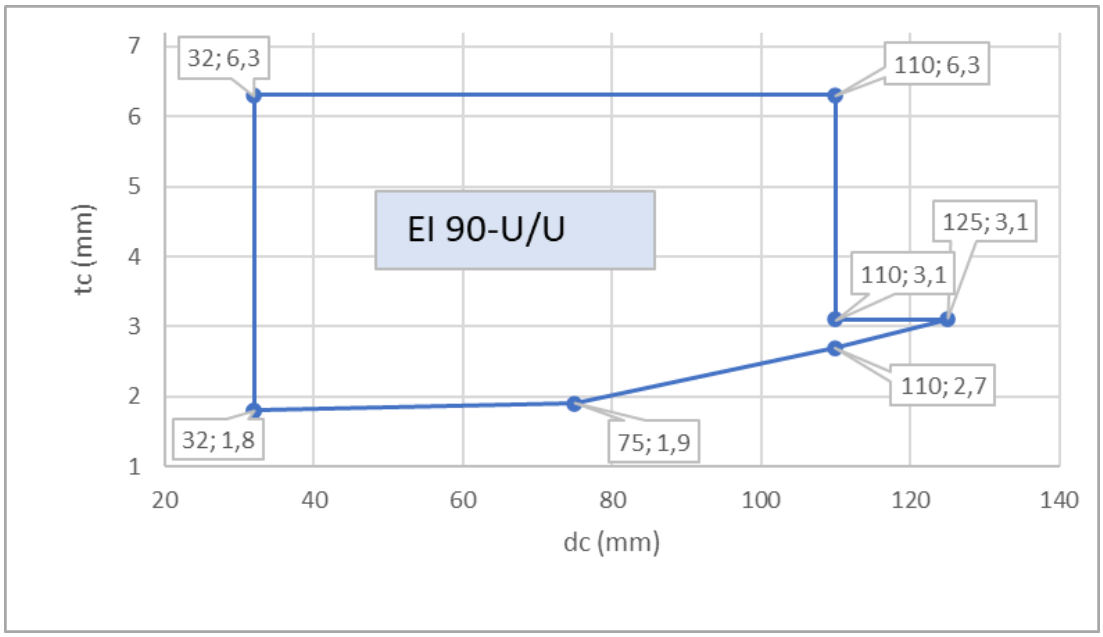


Figure 152: Classified range for PP-pipes acc.to EN 1451-1 in rigid floor, sealed with CFS-C EL in DG 1 for EI 90-U/U

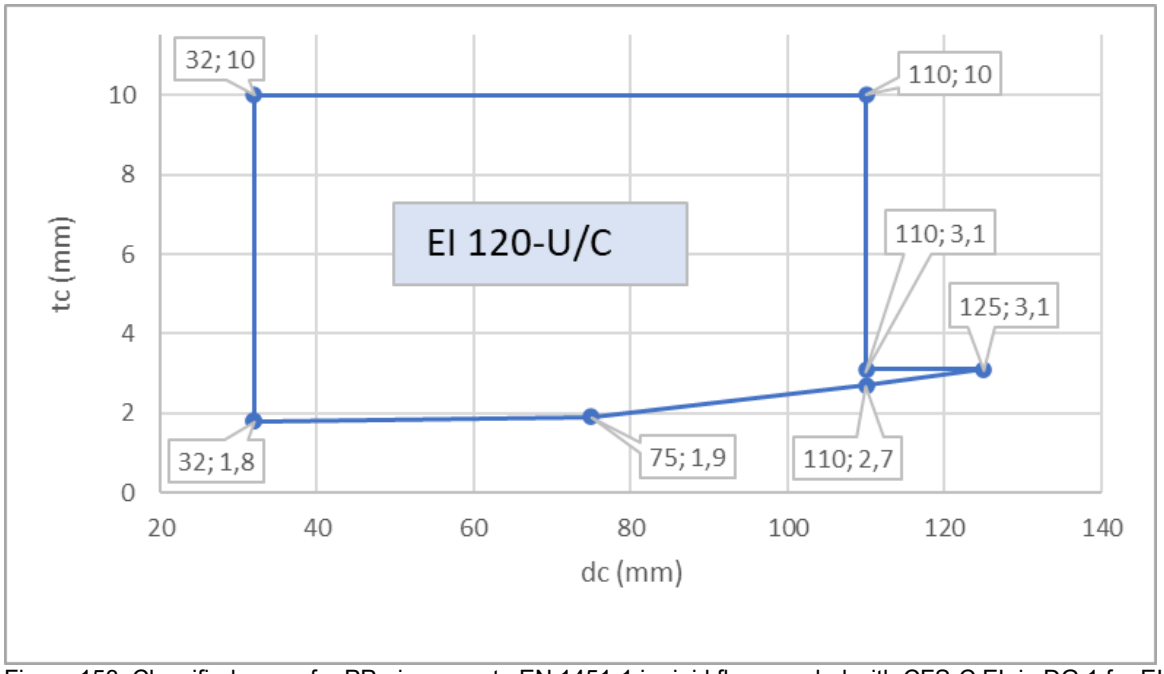


Figure 153: Classified range for PP-pipes acc.to EN 1451-1 in rigid floor, sealed with CFS-C EL in DG 1 for EI120-U/C

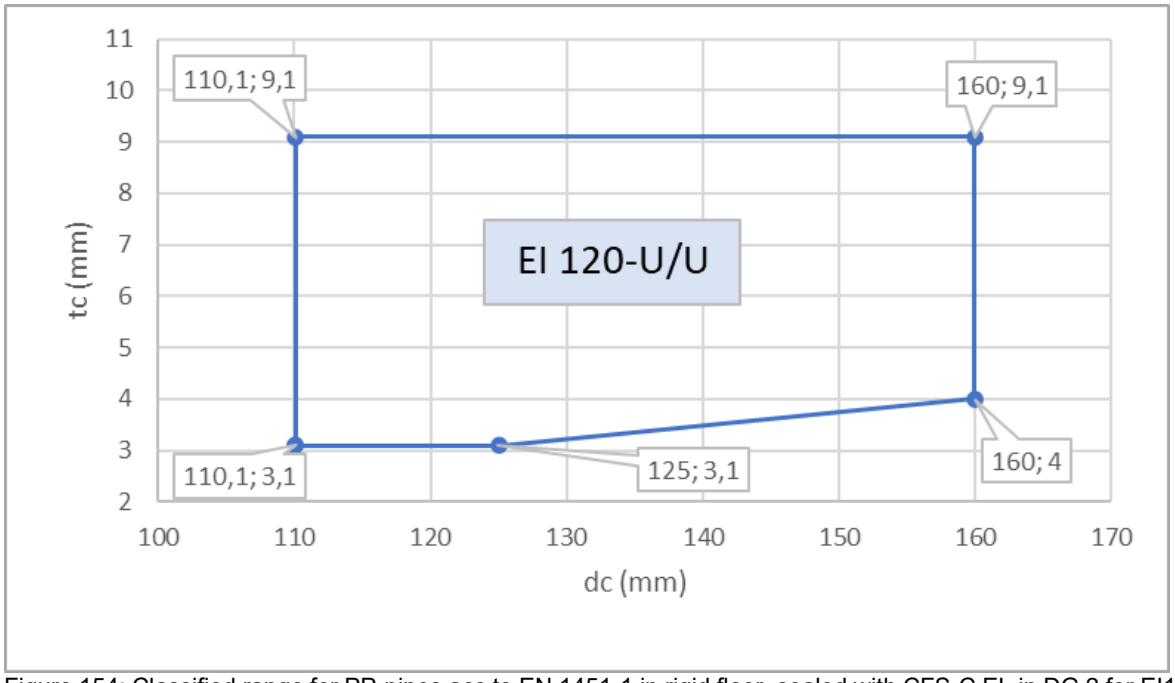


Figure 154: Classified range for PP-pipes acc.to EN 1451-1 in rigid floor, sealed with CFS-C EL in DG 2 for EI120-U/U

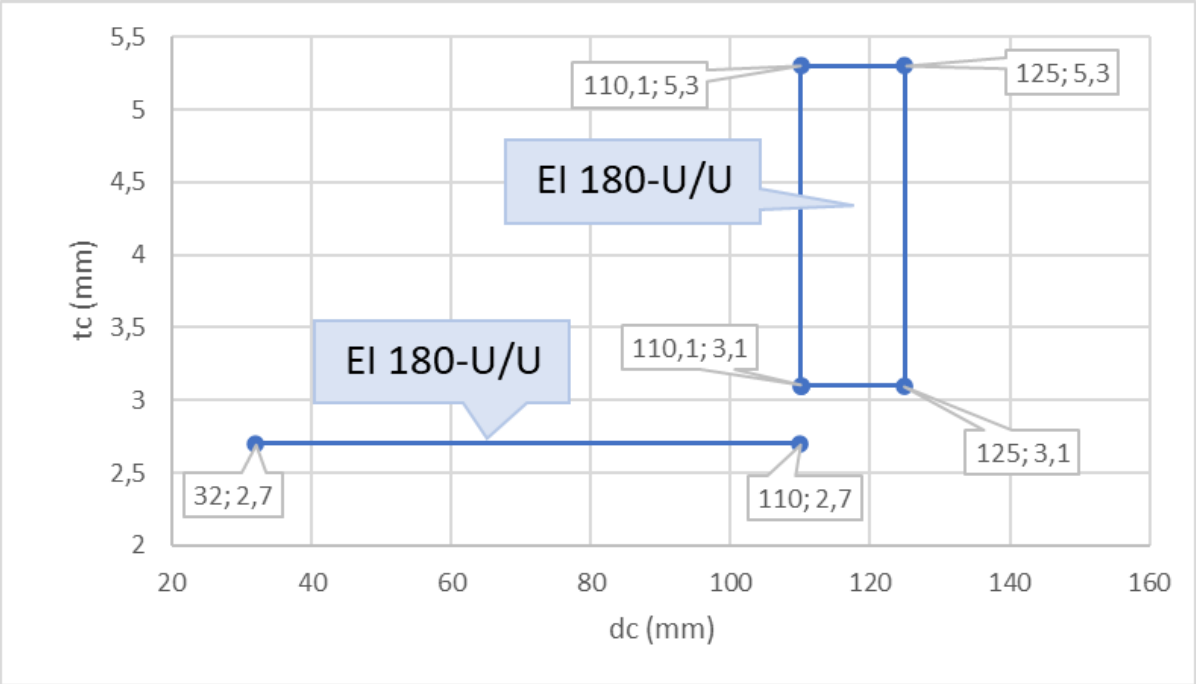


Figure 155: Classified range for PP-pipes acc.to EN 1451-1 in rigid floor, sealed with CFS-C EL in DG 1 and DG 2 for EI180-U/U

8.7.2.8 PE-pipes, Geberit Silent db20 in DG 1 and DG 2

Classification shown in Figure 156 and Figure 157 is valid for pipes made from:

- Pipe material: PE, non-regulated
- Brand/producer: Geberit Silent dB20

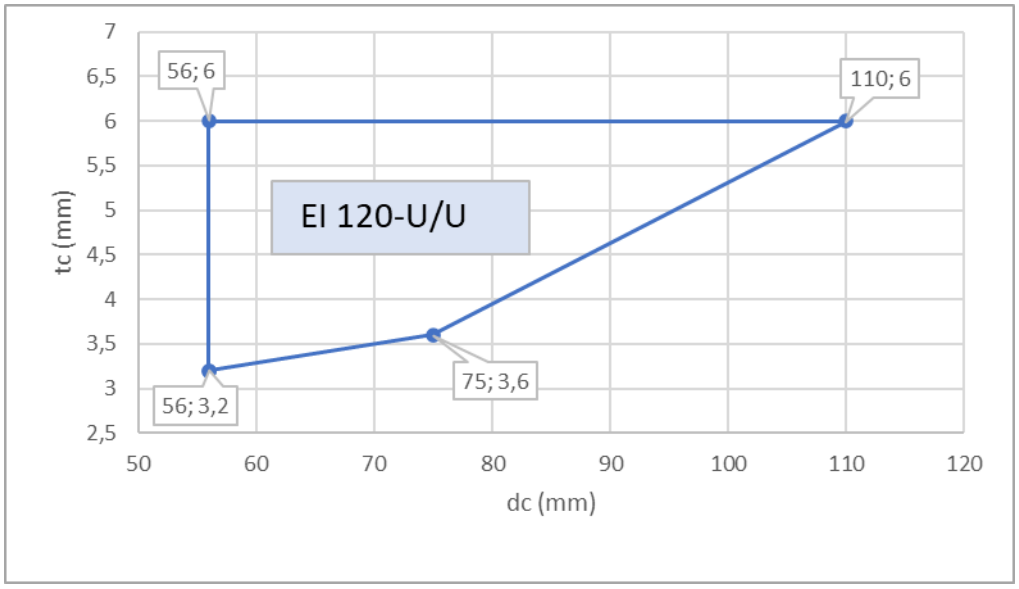


Figure 156: Classified range for Geberit Silent dB20-pipes in rigid floor, sealed with CFS-C EL in DG 1

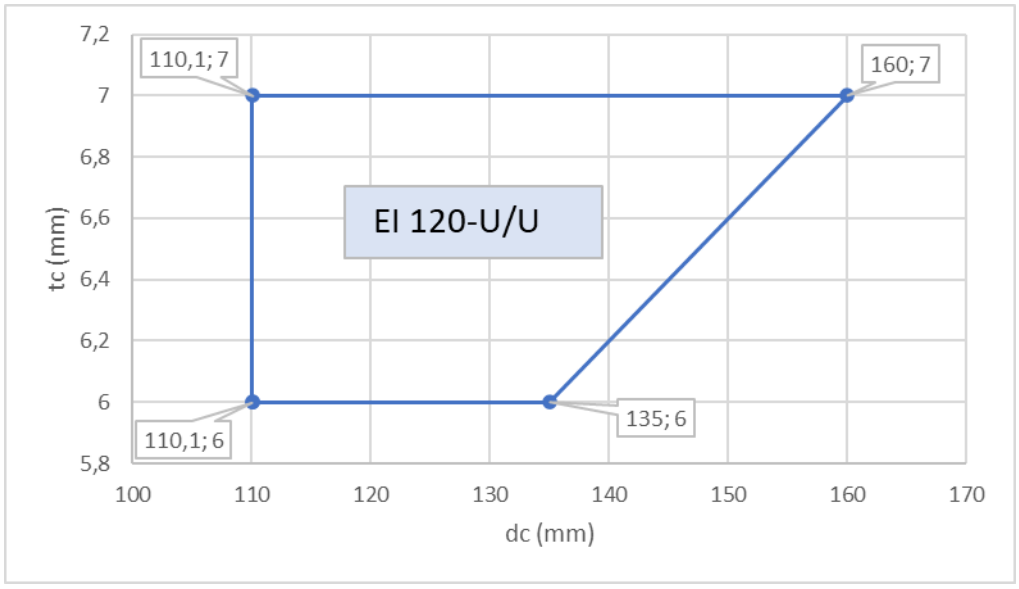


Figure 157: Classified range for Geberit Silent dB20-pipes in rigid floor, sealed with CFS-C EL in DG 2

8.7.2.9 PVC-pipes, Friatec Friaphon in DG 1 and DG 2

Classification shown in Figure 158 and Figure 159 is valid for pipes made from:

- Pipe material: PVC, non-regulated
- Brand/producer: Friatec, Friaphon
- Carefully check disclaimer in 8.2.16

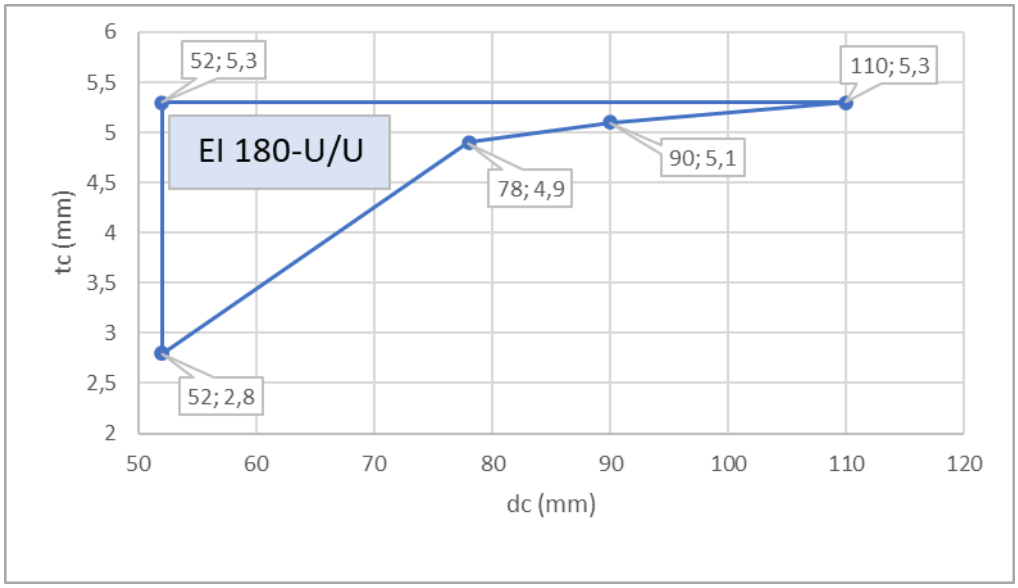


Figure 158: Classified range for Friatec Friaphon - pipes in rigid floor, sealed with CFS-C EL in DG 1

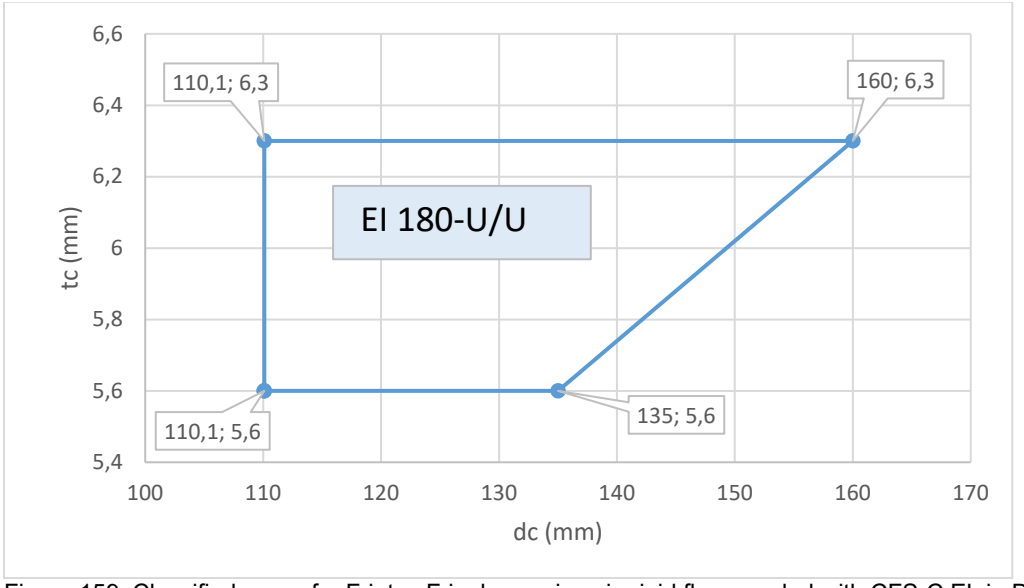


Figure 159: Classified range for Friatec Friaphon - pipes in rigid floor, sealed with CFS-C EL in DG 2

8.7.2.10 **Pipe in the corner application, penetrating a rigid floor ($t_E \geq 150$ mm)**

Situation:
- Pipes directly mounted in the corner, zero distance to two walls
- Zero distance ($s_3 \geq 0$ mm) pipe to two walls at same time
- Collar CFS-C EL cannot completely cover the circumference of sealed pipe
- Collar CFS-C EL in DG 1

Pipe:
- For pipe material and pipe dimension refer to all EI 90-U/U classified pipes in section 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- Excluded are pipes with outside nominal diameter ($d_C > 110$ mm)

Insulation:
- No thermal insulation permitted
- For sound decoupling refer to 8.2.7

Gap fill:

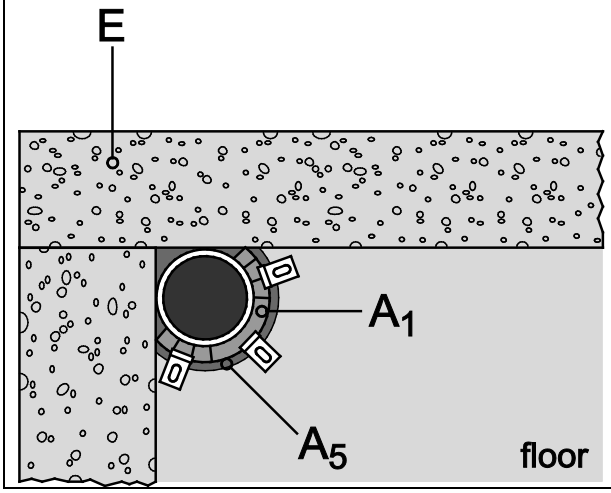
With CFS-S ACR:
- Gap size is 0 to 15 mm
- Gap filler is CFS-S ACR
- Installation depth: ($t_{A3} \geq 25$ mm) on each side of the floor
- No backfilling

Or
- Gap size is 0 to 40 mm
- Gap filler is CFS-S ACR
- Installation depth: $t_{A3} \geq 25$ mm) on the upper side of the floor only
- Backfilling with mineral wool, refer to 7.2.4

Or
- With cementious mortar of group M10 acc. EN 998-2
- Gap size is (0 to 40 mm)
- Installation depth: over the entire thickness of the floor

For collar fixing:
- Refer to 8.2.4

For number of hooks:
- Refer to 8.2.5



Pict. 8.7.2.10:

Pipe in the corner application between two walls, penetrating a floor

View from above downwards

Figure 160: Pipe in the corner application, penetrating a floor, sealed with CFS-C EL

Type of Penetrant	Classification
Pipe in the corner application, penetrating a floor, sealed with CFS-C EL	EI 90 – U/U

Table 76: Classification for Pipe in the corner application, penetrating a rigid floor

8.7.2.11 **Pipe on the wall application, penetrating a rigid floor ($t_E \geq 150$ mm)**

Situation:
- Pipes directly mounted on the wall,
- Zero distance ($s_3 \geq 0$ mm) pipe to one wall
- Collar CFS-C EL cannot completely cover the circumference of sealed pipe
- Collar CFS-C EL in DG 1

Pipe:
- For pipe material and pipe dimension refer to all EI120-U/U classified pipes in section 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- Excluded are pipes with outside nominal diameter ($d_C > 110$ mm)

Insulation:
- No thermal insulation permitted
- For sound decoupling refer to 8.2.7

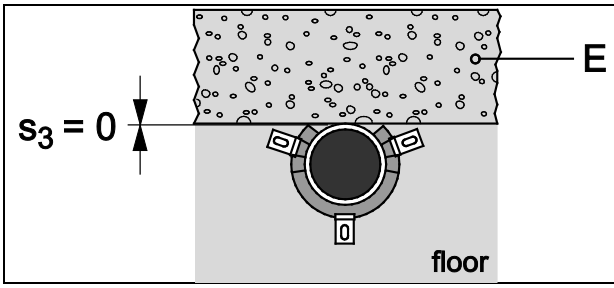
Gap fill:
With CFS-S ACR:
- Gap size is 0 to 15 mm
- Gap filler is CFS-S ACR
- Installation depth: ($t_{A3} \geq 25$ mm) on each side of the floor
- No backfilling

Or
- Gap size is 0 to 40 mm
- Gap filler is CFS-S ACR
- Installation depth: $t_{A3} \geq 25$ mm) on the upper side of the floor only
- Backfilling with mineral wool, refer to 7.2.4

Or
- With cementious mortar of group M10 acc. EN 998-2
- Gap size is (0 to 40 mm)
- Installation depth: over the entire thickness of the floor

For collar fixing:
- Refer to 8.2.4

For number of hooks:
- Refer to 8.2.5



Pict. 8.7.2.11:

Pipes mounted directly onto the wall, penetrating a rigid floor

View from above downwards

Figure 161: Pipes mounted directly onto the wall, sealed with CFS-C EL

Type of Penetrant	Classification
Pipe in the corner application, penetrating a floor, sealed with CFS-C EL	EI 120 – U/U

Table 77: Classification for Pipe on the wall application, penetrating a rigid floor

8.7.2.12 **Multiple pipe penetration, FEF-insulated, DG 1**

Classification is valid for:

Situation:
- Collar CFS-C EL covers the two or three pipes together within one bigger jacket
- Pipes grouped in line only (horizontal/vertical), no cluster arrangement
- Max. one PE pipe together one or two FEF-insulated PP-R or PE-X pipes
- All the pipes closest distance together
- Collar CFS-C EL in DG 1

Pipes:

For PE pipe:
- Pipe acc. EN 1519-1, EN 12666-1, EN 12201-2
- Pipe end configuration: U/U
- Pipe outside diameter is ($40\ mm \leq d_c \leq 90\ mm$)
- Pipe wall thickness ($t_c = 3{,}5\ mm$)
- With or without sound decoupling insulation
- For type, thickness and situation of sound decoupling insulation refer to 8.2.7
- No thermal insulation

For PP-R or PE-X pipes:
- Pipe acc. EN 15874 and EN 15875
- Brand / producer: Aquatherm fusiolen (aquatherm green pipe S) and Rehau Rautitan flex
- Pipe end configuration: U/C
- Pipe outside diameter is ($d_c = 40\ mm$)
- Pipe wall thickness ($t_C = 5{,}5\ mm$)
- With FEF-insulation

Insulation:
- For material/brand refer to 8.2.12
- Insulation thickness is ($9\ mm \leq t_D \leq 32\ mm$)
- Installation situation is LS and CS
- Minimum insulation length ($L_D \geq 250\ mm$) on both sides of the wall

Collar fixing:
- For hook fixing refer to 8.2.4.2
- Number of hooks to be used: at least 4 for two pipes, at least 5 for three pipes

For gap fill: refer to 8.4.3.2

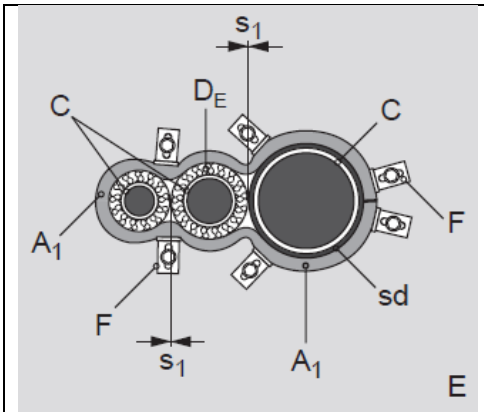
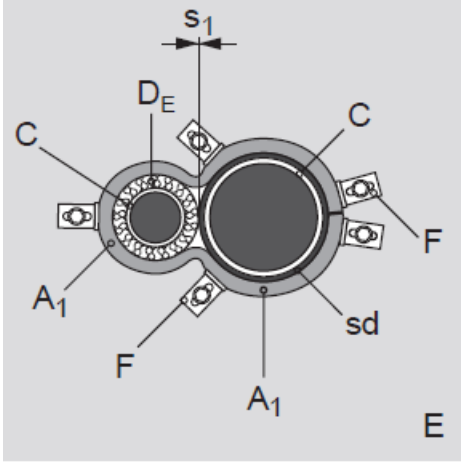
	Pict. 8.7.2.12 A: Multiple pipe seal in zero distance, Sealed with one collar CFS-C EL
	Pict. 8.7.2.12 B: Multiple pipe seal in zero distance, Sealed with one collar CFS-C EL

Figure 162: Multiple pipe seal, FEF-insulated, sealed with CFS-C EL

Type of Penetrant	Classification
Multiple pipe seal of linear pipe arrangement, FEF-insulated, covered by one collar CFS-C EL	EI 120 – U/U and U/C

Table 78: Classification for Multiple pipe seal, FEF-insulated, sealed with CFS-C EL

8.7.2.13 **PE pipes, Geberit Silent dB20, DG 1, with elbow 2x45°**

Situation:
- Pipe elbow-connector 2x45° is below the floor or half in the floor
- Elbow-connector or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)
- Collar CFS-C EL in DG 1

Pipe:
- PE–pipe, non-regulated
- Brand/Producer: Geberit Silent dB20
- Elbow-connector 2x45°, brand: Geberit Silent dB20, electric-welding wire inside
- Pipe diameter d_C = 110mm
- Pipe wall thickness t_C = 6 mm

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

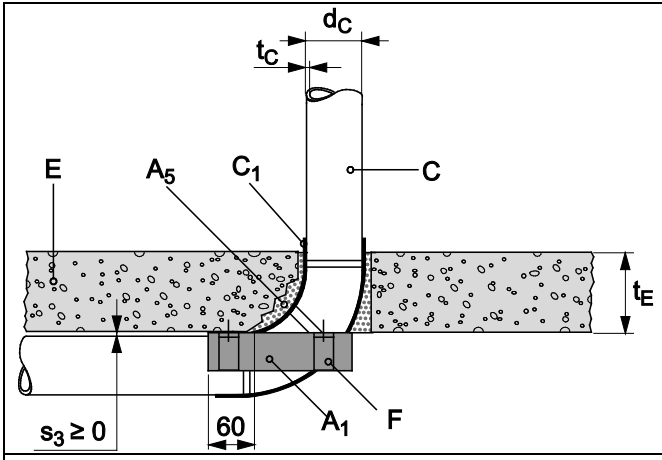
For collar fixing – refer to 8.2.4.2

For number of hooks:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (no elbow side - horizontal running pipe / elbow side - vertical running pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table 79: Number of hooks for sealing a Geberit Silent dB20 2x45° elbow connector by CFS-C EL

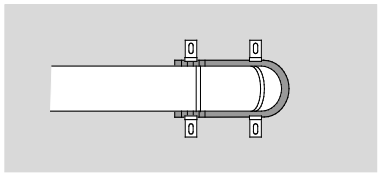
If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.



Pict. 8.7.2.13 A:

Non-regulated PE–pipes Geberit Silent dB20 with 2x45° elbow, sealed with CFS-C EL (A_1)

Side view/sectional view



Pict. 8.7.2.13 B:

Non-regulated PE–pipes Geberit Silent dB20 with 2x45° elbow, sealed with CFS-C EL (A_1)

View from below to soffit

Figure 163: Geberit Silent dB20 pipe with 2x45° elbow connector, sealed in rigid floor

Type of Penetrant	Classification
Non-regulated PE–pipes Geberit Silent dB20 - with 2 x 45° elbow, sealed with CFS-C EL	EI 120 – U/U

Table 80: Classification for non-regulated PE–pipes Geberit Silent dB20 – with 2x45° elbow in rigid floor

8.7.2.14 **PE pipes, Geberit Silent dB20, DG1, pipe coupling**

Situation:
- Pipe coupling is below the floor, half in the floor or within the floor
- Pipe coupling or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$ mm)
- Collar CFS-C EL in DG 1

Pipe:
- PE–pipe, non-regulated
- Brand/Producer: Geberit Silent dB20
- Elbow-connector 2x45°, brand: Geberit Silent dB20, electric-welding wire inside
- Pipe diameter d_C = 110 mm
- Pipe wall thickness t_C = 6 mm

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

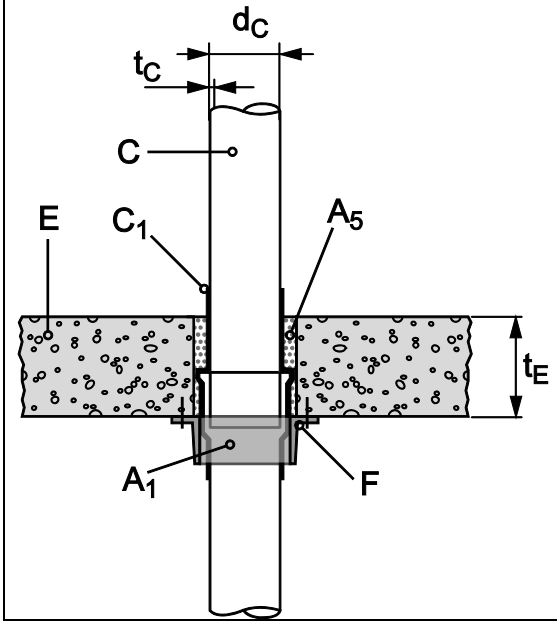
For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (no elbow side - horizontal running pipe / elbow side - vertical running pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table 81: Number of hooks for sealing a Geberit Silent dB20 pipe coupling by CFS-C EL

If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.



Pict. 8.7.2.14:

Non-regulated PE–pipes Geberit Silent dB20 with pipe coupling, sealed with CFS-C EL (A_1)

Side view/sectional view

Figure 164: Geberit Silent dB20 pipe with pipe coupling, sealed in rigid floor

Type of Penetrant	Classification
Non-regulated PE–pipes Geberit Silent dB20 - with pipe coupling, sealed with CFS-C EL	EI 120 – U/U

Table 82: Classification for non-regulated PE–pipes Geberit Silent dB20 – with coupling in rigid floor

8.7.2.15 **PP pipes non-regulated, DG 1, pipe elbow 87°**

Situation:
- Pipe elbow-connector 87° is below the floor or half in the floor
- Elbow-connector or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)
- Collar CFS-C EL in DG 1

Pipe:
- PP–pipe, non-regulated
- Brand/Producer: refer to 8.2.15
- Elbow-connector 87°, brand: refer to 8.2.15
- For pipe dimension: refer to 8.7.2.5
- pipes in DG1 only
- pipes rated for EI 120-U/U only

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

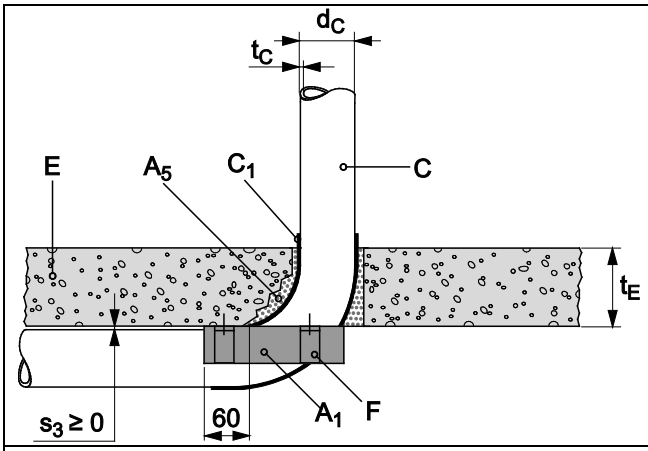
For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (no elbow side - horizontal running pipe / elbow side - vertical running pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table 83: Number of hooks for sealing a non-regulated PP-pipe with 1x87° elbow by CFS-C EL

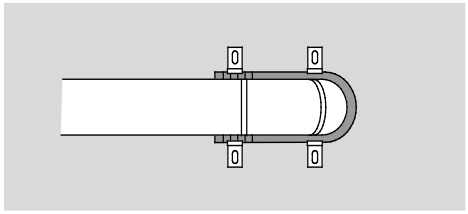
If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.



Pict. 8.7.2.15 A:

Non-regulated PP–pipes with 1x87° elbow, sealed with CFS-C EL (A_1)

Side view/sectional view



Pict. 8.7.2.15 B:

Non-regulated PP–pipes with 1x87° elbow, sealed with CFS-C EL (A_1)

View from below to soffit

Figure 165: PP-pipes, non-regulated, with 1x87° elbow connector, sealed in rigid floor

Type of Penetrant	Classification
Non-regulated PP-pipes in DG1 with pipe 1x87° elbow, sealed with CFS-C EL	EI 120 – U/U

Table 84: Classification for non-regulated PP-pipes with 1x87° elbow in rigid floor, sealed with CFS-C EL

8.7.2.16 **PP pipes, non-regulated, in DG 1 with 2 x 45°elbow connector**

Situation:
- Pipe elbow-connector 2x45° is below the floor or half in the floor
- Elbow-connector or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)

Pipe:
- PP–pipe, non-regulated
- Brand/Producer: refer to 8.2.15
- Elbow-connector 87°, brand: refer to 8.2.15
- For pipe dimension: refer to 8.7.2.5, pipes in DG1 and EI 120-U/U rating only

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

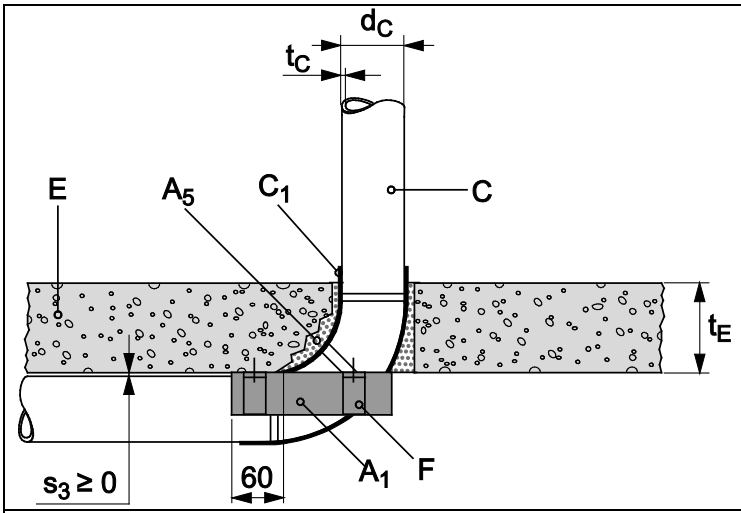
For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (no elbow side - horizontal running pipe / elbow side - vertical running pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table 85: Number of hooks for sealing a non-regulated PP-pipe with 2x45° elbow by CFS-C EL

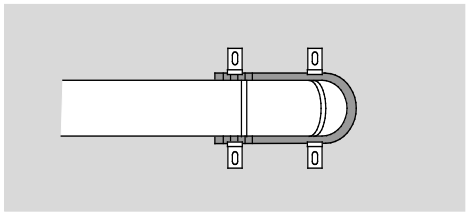
If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.



Pict. 8.7.2.16 A:

Non-regulated PP–pipes with 2x45° elbow, sealed with CFS-C EL (A_1)

Side view/sectional view



Pict. 8.7.2.16 B:

Non-regulated PP–pipes with 2x45° elbow, sealed with CFS-C EL (A_1)

View from below to soffit

Figure 166: PP-pipes, non-regulated, with 2x45° elbow connector, sealed in rigid floor

Type of Penetrant	Classification
Non-regulated PP-pipes in DG1 with pipe 1x87° elbow, sealed with CFS-C EL	EI 120 – U/U

Table 86: Classification for non-regulated PP-pipes with 2x45° elbow in rigid floor, sealed with CFS-C EL

8.7.2.17 **PP pipes, non-regulated, in DG 1, with pipe coupling**

Situation:
- Pipe coupling is below the floor or half in the floor or above the floor
- Elbow-connector or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)

Pipe:
- PP–pipe, non-regulated
- Brand/Producer: refer to 8.2.15
- Pipe connector (coupling), brand: refer to 8.2.15
- For pipe dimension: refer to 8.7.2.5, pipes in DG1 and EI 120-U/U rating only

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

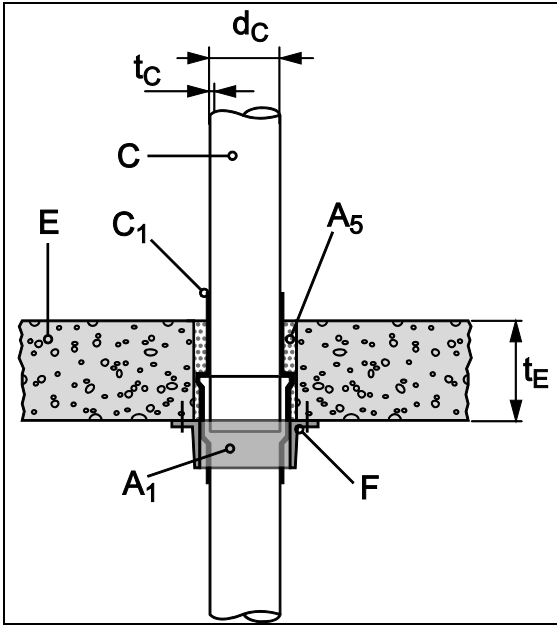
For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (incoming pipe / outgoing pipe)		
(mm)	0	4	9
32	2 / 2	2 / 2	2 / 2
50	2 / 2	2 / 2	2 / 3
75	3 / 3	3 / 3	3 / 3
90	3 / 3	3 / 3	3 / 3
110	3 / 4	3 / 4	3 / 4

Table 87: Number of hooks for sealing a non-regulated PP- pipe with coupling by CFS-C EL

If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.



Pict. 8.7.2.17:

Non-regulated PP–pipes in DG1 with pipe coupling, sealed with CFS-C EL (A_1)

Side view/sectional view

Figure 167: PP-pipes, non-regulated, with coupling, sealed with CFS-C EL in rigid floor

Type of Penetrant	Classification
Non-regulated PP-pipes in DG1 with pipe coupling sealed with CFS-C EL	EI 120 – U/U

Table 88: Classification for non-regulated PP-pipes with coupling in rigid floor, sealed with CFS-C EL

8.7.2.18 **PP pipes acc. EN 1451-1, DG 1, pipe elbow 87°**

Situation:
- Pipe elbow-connector 87° is below the floor or half in the floor
- Elbow-connector or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)

Pipe:
- PP–pipe acc. EN 1451-1 and DIN 8077/78
- Elbow-connector 87°
- For pipe dimension: refer to Classification below

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (no elbow side - horizontal running pipe / elbow side - vertical running pipe)		
(mm)	0	4	9
40 - 74	3 / 3	3 / 3	3 / 3
75 - 109	3 / 3	3 / 3	3 / 3
110	4 / 4	4 / 4	4 / 4

Table 89: Number of hooks for sealing a non-regulated PP-pipe with 1x87° elbow by CFS-C EL

If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.

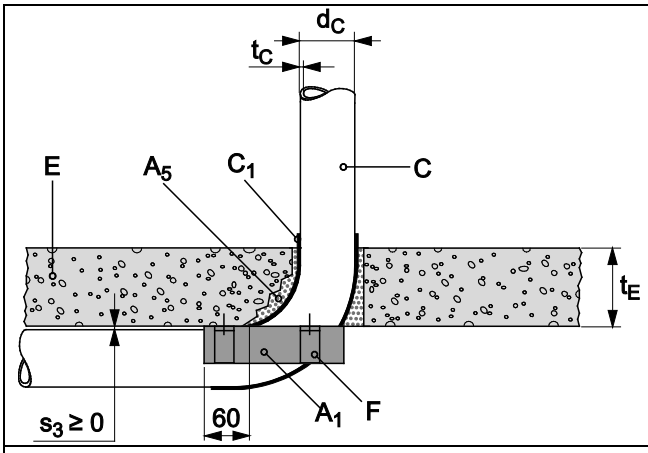
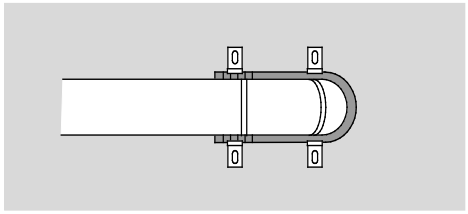
	Pict. 8.7.2.18 A: Non-regulated PP–pipes with 1x87° elbow, sealed with CFS-C EL (A_1) Side view/sectional view
	Pict. 8.7.2.18 B: Non-regulated PP–pipes with 1x87° elbow, sealed with CFS-C EL (A_1) View from below to soffit

Figure 168: PP-pipes, non-regulated, with 1x87° elbow connector, sealed in rigid floor

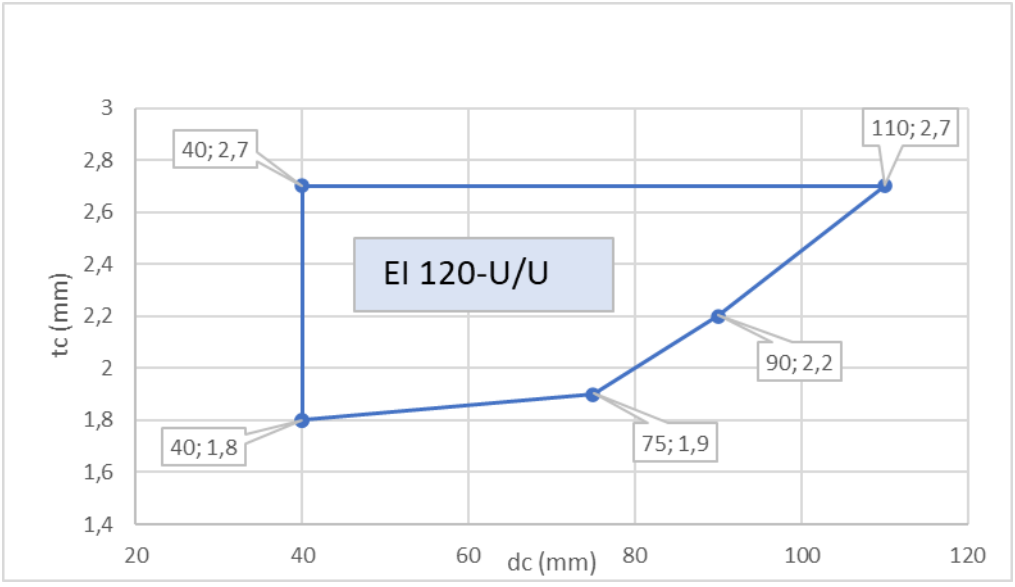


Figure 169: Classification for PP-pipes acc. EN 1451-1 with 1x87° elbow in rigid floor, sealed with CFS-C EL

8.7.2.19 **PP pipes acc. EN 1451-1 in DG 1, with pipe coupling**

Situation:
- Pipe coupling is below the floor or half in the floor or above the floor
- Elbow-connector or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)

Pipe:
- PP–pipe acc. EN 1451-1 and DIN 8077/78
- Pipe connector (coupling)
- For pipe dimension: refer to Classification below

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

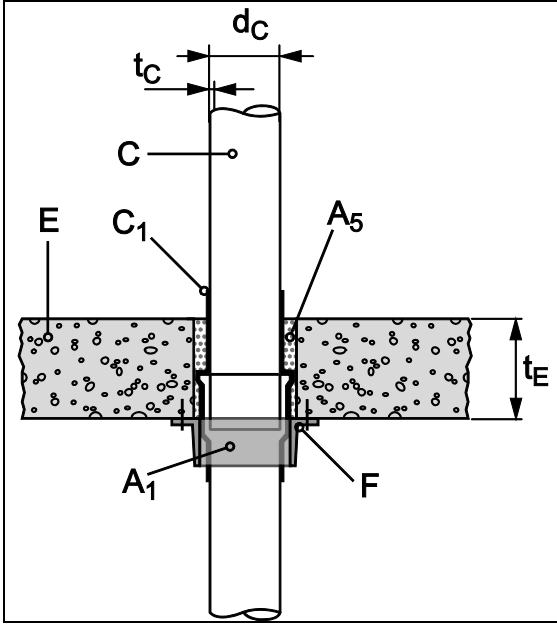
For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (no elbow side - horizontal running pipe / elbow side - vertical running pipe)		
(mm)	0	4	9
40	2 / 2	2 / 2	2 / 2
40 - 75	3 / 3	3 / 3	3 / 3
76 - 90	3 / 3	3 / 3	3 / 3
91 - 110	4 / 4	4 / 4	4 / 4

Table 90: Number of hooks for sealing a non-regulated PP-pipe with coupling by CFS-C EL

If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.



Pict. 8.7.2.19:

Non-regulated PP–pipes in DG1 with pipe coupling, sealed with CFS-C EL (A_1)

Side view/sectional view

Figure 170: PP-pipes, non-regulated, with coupling, sealed with CFS-C EL in rigid floor

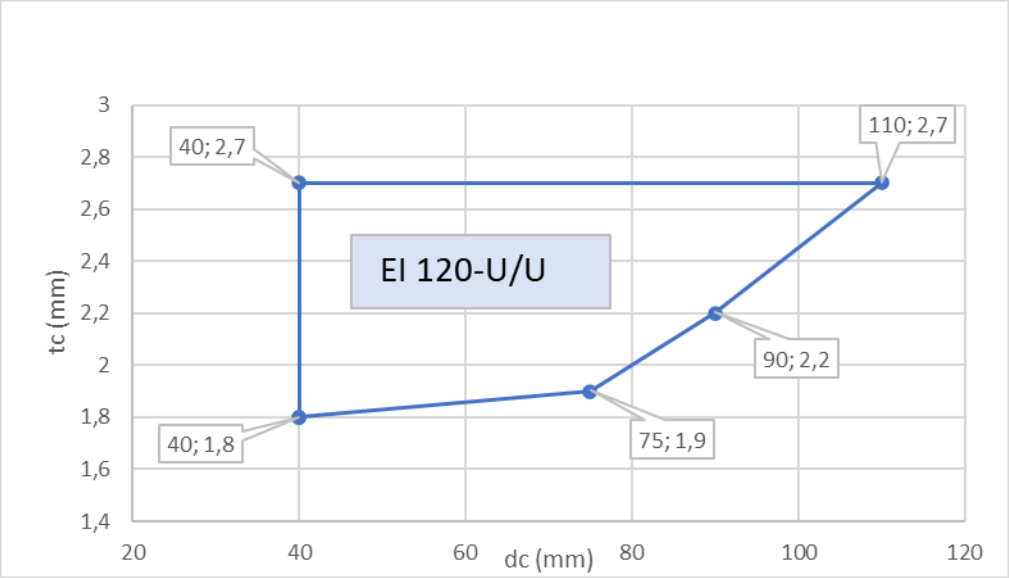


Figure 171: Classification for non-regulated PP-pipes with coupling in rigid floor, sealed with CFS-C EL

8.7.2.20 **PVC pipes acc. EN 1452-2, DG 1, pipe elbow 87°**

Situation:
- Pipe elbow-connector 87° is below the floor or half in the floor
- Elbow-connector or pipe to be sealed with CFS-C EL from soffit only
- On one side of the floor pipe runs nearly parallel to floor with zero distance ($s_3 \geq 0$mm)

Pipe:
- PVC–pipe acc. EN 1452-2, EN 1329-1, EN 1453-1, EN 1566-1, EN ISO 15493 and DIN 8061/62
- Elbow-connector 87°
- For pipe dimension: refer to Classification below

Insulation:
- No thermal insulation assessed
- For sound decoupling: refer to 8.2.7

Gap closure:
- Refer to 8.7.1.2

For collar fixing – refer to 8.2.4.2

For number of hooks to be used:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm) (no elbow side - horizontal running pipe / elbow side - vertical running pipe)		
(mm)	0	4	9
32 - 109	3 / 3	3 / 3	3 / 3
110	4 / 4	4 / 4	4 / 4

Table 91: Number of hooks for sealing a non-regulated PVC-pipe with 1x87° elbow by CFS-C EL

If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.

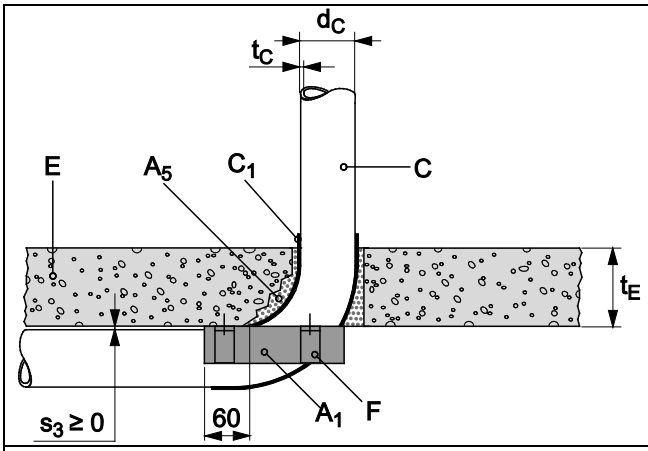
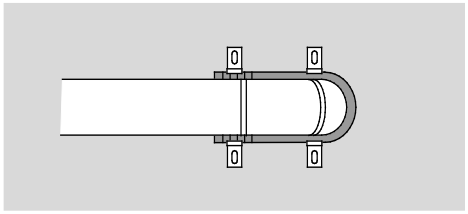
	Pict. 8.7.2.20 A: Non-regulated PVC–pipes with 1x87° elbow, sealed with CFS-C EL (A_1) Side view/sectional view
	Pict. 8.7.2.20 B: Non-regulated PVC–pipes with 1x87° elbow, sealed with CFS-C EL (A_1) View from below to soffit

Figure 172: PVC-pipes, non-regulated, with 1x87° elbow connector, sealed in rigid floor

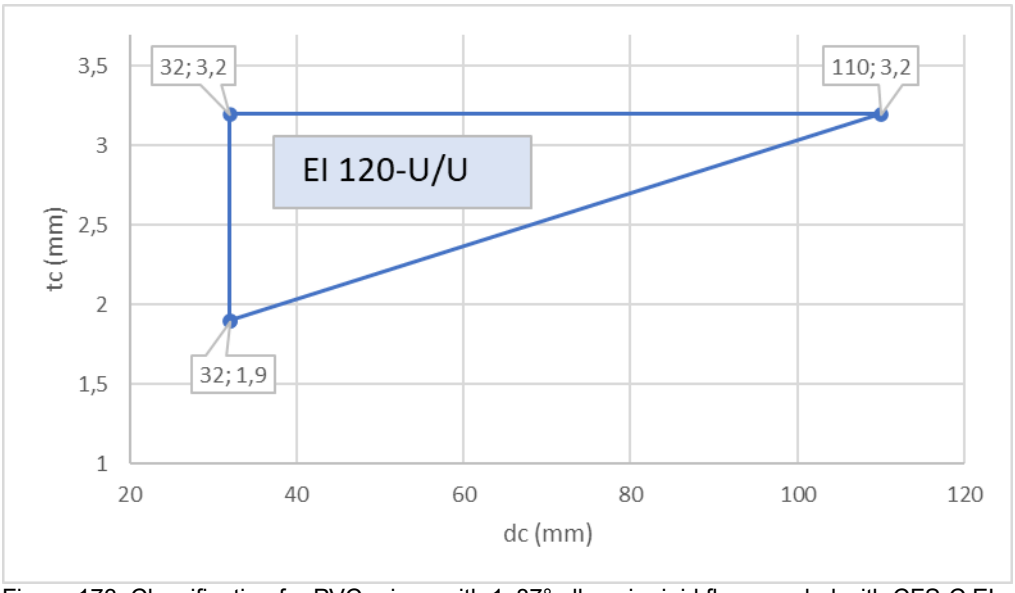


Figure 173: Classification for PVC- pipes with 1x87° elbow in rigid floor, sealed with CFS-C EL

8.7.2.21 **Pneumatic dispatch system, DG 1 and DG 2 in rigid floor**

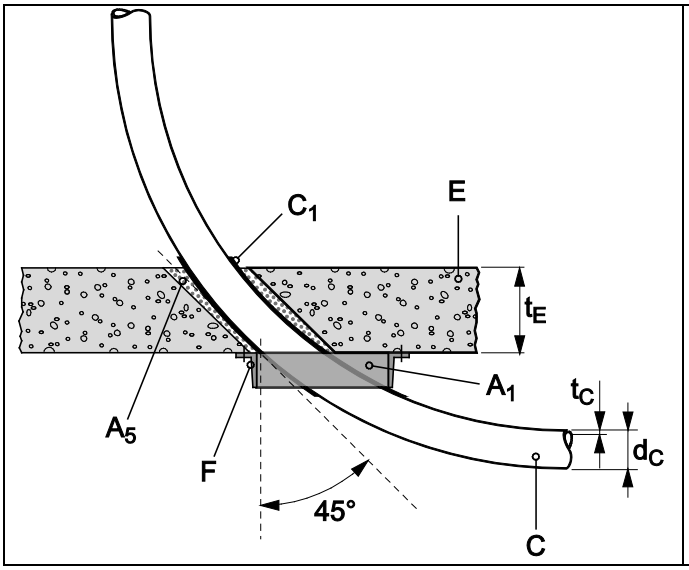
Situation:
- Mixed seal
- One pipe together with max. three cables penetrating the floor
- Pipe inclination: (45° ≤ pipe inclination ≤ 90°)
- Direct contact pipe and cable
- Cable might be single or bunched

Pipes:
- PVC pipe acc. DIN 6660
- For DG 1: pipe diameter (d_c ≤ 110 mm) and pipe wall thickness (t_C = 2,3 mm)
- For DG 2: pipe diameter (110,1 mm ≤ d_c ≤ 160mm) and pipe wall thickness (t_C = 2,3 mm)

Insulation:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Cable:
- Max. 3 cables
- NYM-J 3x2,5 mm²
- J-Y (St) Y 6 x 2 x 0,6 mm²
- 2 x 2,5mm²

Gap seal:
Refer to 8.7.1.2



Pict. 8.7.2.21:

Pneumatic dispatch system, penetrating a rigid floor, sealed by CFS-C EL (A_1) in DG 1

Figure 174: Pneumatic dispatch system, penetrating a flexible/rigid wall

Type of Penetrant	Classification
Pneumatic dispatch system in rigid floor, mixed seal, sealed with CFS-C EL in DG 1 and DG 2	EI 120 – U/U

Table 92: Classification for pneumatic dispatch systems in wall

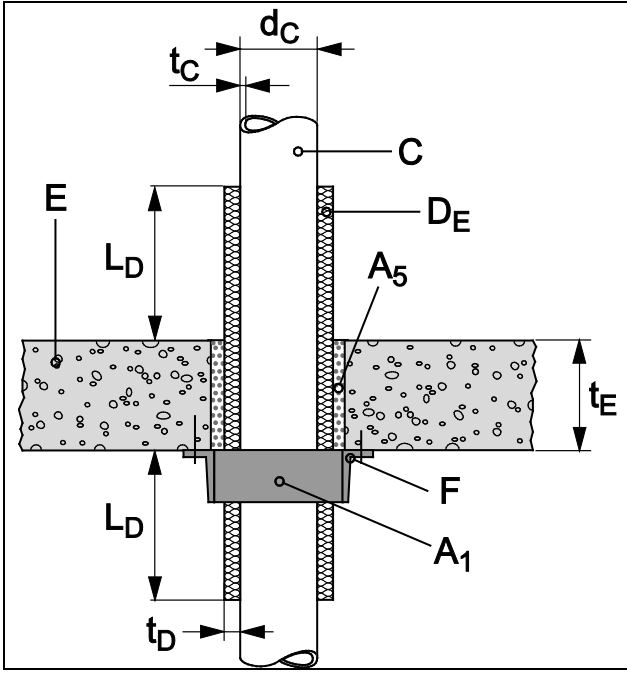
8.7.2.22 **PE-X-pipes (Rehau Rautitan flex), insulated**

Situation:
- Single penetration seal
- Pipe perpendicular to floor

Pipe:
- PE-X acc. EN 15875 (Rehau Rautitan flex),
- Pipe diameter (16 mm ≤ d_c ≤ 32 mm)
- Pipe wall thickness (2,2 mm ≤ t_C ≤ 4,4 mm)

Insulation:
- FEF-insulation
- Type of material: refer to 8.2.12
- LS/CS situation
- Thickness of D_E: (9 mm ≤ t_D ≤ 25 mm)
- Insulation length: (L_D ≥ 250 mm) on pipes on both sides of the floor.

Gap seal:
- Refer to 8.7.1.2



Pict. 8.7.2.22:

PE-X pipes, FEF-insulated, penetrating a rigid floor

Figure 175: PE-X pipes with FEF-insulation in rigid floor

Type of Penetrant	Classification
PE-X pipes with FEF-insulation, penetrating a rigid floor	EI 120 – U/C

Table 93: Classification for PE-X pipes in rigid floor, sealed with CFS-C EL

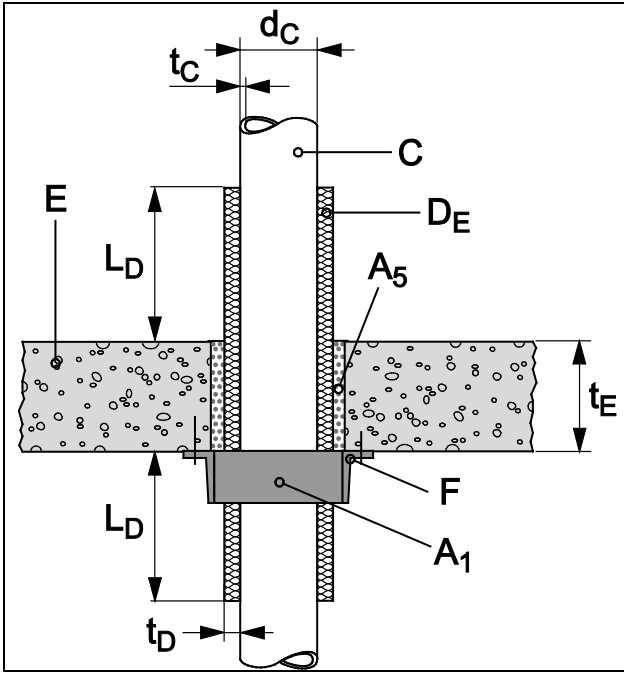
8.7.2.23 **PP-R-pipes (Aquatherm fusiolen = aquatherm green pipe S), insulated**

Situation:
- Single penetration seal
- Pipe perpendicular to floor

Pipe:
- PP-R-pipes acc. EN 15874 Aquatherm fusiolen = aquatherm green pipe S
- Pipe diameter (16 mm ≤ d_c ≤ 32 mm)
- Pipe wall thickness (2,2 mm ≤ t_C ≤ 4,4 mm)

Insulation:
- FEF-insulation
- Type of material: refer to 8.2.12
- LS/CS situation
- Thickness of D_E: (9 mm ≤ t_D ≤ 25 mm)
- Insulation length: (L_D ≥ 250 mm) on pipes on both sides of the floor.

Gap seal:
- Refer to 8.7.1.2



Pict. 8.7.2.23:

PP-R pipes, FEF-insulated, penetrating a rigid floor

Figure 176: PP-R pipes with FEF-insulation in rigid floor

Type of Penetrant	Classification
PP-R pipes with FEF-insulation, penetrating a rigid floor	EI 120 – U/C

Table 94: Classification for PP-R pipes in rigid floor, sealed with CFS-C EL

8.7.2.24 **Use of oddments of CFS-C EL in DG 1 and DG 2**

Situation:
- Single penetration seal
- Pipe perpendicular to floor
- reuse of oddments – for details refer to 8.2.8

Pipe:
For DG 1 and DG 2:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- included are pipes with rating EI 120-U/U only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter (d_C > 110 mm). These must be sealed as mentioned for relevant DG 2

Insulation:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Gap seal - refer to 8.7.1.2

Type of Penetrant	Classification
Pipes in DG 1 and DG 2, sealed with CFS-C EL, containing an oddment	EI 120 – U/U

Table 95: Classification for plastic pipes in DG 1 and 2, sealed with CFS-C EL, containing an oddment

8.7.2.25 **Hooks of CFS-C EL in wet mortar in DG 1 and DG 2**

Situation:
- Single penetration seal
- Pipe perpendicular to floor
- Bended hooks in wet mortar gap seal – for details refer to 8.2.4.7

Pipe:
For DG 1 and DG 2:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- included are pipes with rating EI 120-U/U only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C \geq 110$ mm). These have to be sealed as mentioned for relevant DG 2

Insulation:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Gap seal:
- Refer to 8.7.1.2 – mortar seal only

Type of Penetrant	Classification
Pipes in DG 1 and DG 2, sealed with CFS-C EL, bended hooks in wet mortar	EI 120 – U/U

Table 96: Classification for plastic pipes in DG 1 and 2, sealed with CFS-C EL, containing an oddment

8.7.2.26 **Inclined Pipes 45° in DG 1**

Situation:
- Single penetration seal
- Pipe inclination (45° ≤ inclination ≤ 90°)
- For DG 1 only

Pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- included are pipes with rating EI 90 or higher
- included are pipes with U/U-end configuration only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter (d_C > 110 mm).

Insulation:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Gap seal:
- Refer to 8.7.1.2

Number of hooks:

Pipe outside nominal diameter d_C	Acoustic Pipe Insulation Thickness t_D (mm)		
(mm)	0	4	9
32	3	3	3
50	3	3	3
75	3	4	4
90	4	4	5
110	5	5	5

Table 97: Number of hooks for inclined pipes in rigid floor in DG 1

If pipe insulation thickness is between 0 and 4 mm use the number of hooks indicated for 4 mm.
If pipe insulation thickness is between 4 and 9 mm use the number of hooks indicated for 9 mm.

Type of Penetrant	Classification
Inclined pipes in DG 1, sealed with CFS-C EL, in rigid floor	EI 90 – U/U

Table 98: Classification for Inclined pipes in DG 1, sealed with CFS-C EL, in rigid floor

8.7.2.27 **Zero distance collar to collar application (in line) in DG 1 and DG 2**

Situation:
- Single penetration seal
- Zero distance between two CFS-C EL collars, sealing two plastic pipes ($s_1 \geq 0$ mm)
- Pipes must be group in line, no cluster
- Number of pipes in line is unlimited

Pipes in DG 1:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- included are pipes with rating EI 120 or higher
- included are pipes with U/U-end configuration only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C >$ 110 mm)

Pipes in DG 2:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- included are pipes with rating EI 120 or higher
- included are pipes with U/U-end configuration only

Insulation:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Gap seal:
- Refer to 8.7.1.2

Type of Penetrant	Classification
Zero distance collar to collar by sealing single plastic pipes in DG 1 and DG 2	EI 120 – U/U

Table 99: Classification for zero distance collar to collar in rigid floor in DG 1 and DG 2

8.7.2.28 **Zero distance CFS-C EL to mineral wool insulated copper pipes**

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to mineral wool insulation on metal pipe
- Both pipes (metal and plastic) running parallel
- Plastic pipe in U/U-end configuration, metal pipe in C/U end configuration

Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C > 110$ mm)
- included are pipes with rating EI 120 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Metal pipe and insulation:
- Covered material types: copper and others, refer to 8.2.11
- Pipes diameter ($d_C \leq 35$ mm), wall thickness (1,0 mm $\leq t_c \leq$ 14,2 mm)
- Pipes diameter ($d_C \leq 42$ mm), wall thickness (1,2 mm $\leq t_c \leq$ 14,2 mm)
- Pipes diameter ($d_C \leq 89$ mm), wall thickness (2,0 mm $\leq t_c \leq$ 14,2 mm)
- Pipe end configuration: C/U

Insulation on metal pipe:
- Used type of Insulation: refer to 8.2.10.2
- Insulation thickness ($t_D \geq 19$ mm) with Rockwool Conlit within the floor ($t_E = L_D$) in LS
- Insulation thickness ($t_D \geq 20$ mm) with Rockwool RW800 on metal pipes (LI and CI) for 1000mm on both sides of the floor

Gap seal - refer to 8.7.1.2

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to MW-insulated copper pipe	EI 120 – U/U

Table 100: Classification for Zero distance collar CFS-C EL on plastic pipe to MW-insulated copper pipe

8.7.2.29 **Zero distance CFS-C EL to mineral wool insulated steel pipes**

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to mineral wool insulation on metal pipe
- Both pipes (metal and plastic) running parallel
- Plastic pipe in U/U-end configuration, metal pipe in C/U end configuration
- For more information and insulation material refer to 8.2.10.2

Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C > 110$ mm)
- included are pipes with rating EI 120 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Metal pipes:
- Covered material types: steel and others, refer to 8.2.11 – copper excluded
- Pipes wall thickness ($1{,}2$ mm $\leq t_c \leq 14{,}2$ mm)
- Pipe end configuration: C/U

Insulation for metal pipe diameter ($d_C \leq 42$ mm):
- Insulation thickness ($t_D \geq 19$ mm) within the rigid floor ($t_E = L_D$), situation LS
- Insulation thickness ($t_D \geq 20$ mm, $L_D \geq 1000$mm) on metal pipes on both sides of the floor, situation LI

Insulation for metal pipe diameter (42 mm $\leq d_C \leq 114{,}3$ mm):
- Insulation thickness ($t_D \geq 30$ mm) within the rigid floor, situation LS ($L_D = t_E$)
- Insulation thickness ($t_D \geq 30$ mm, $L_D \geq 1000$mm) outside the floor, on both sides of the floor, situation LI

Gap seal - refer to 8.7.1.2

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to MW-insulated steel pipe	EI 120

Table 101: Classification for Zero distance collar CFS-C EL on plastic pipe to MW-insulated steel pipe

8.7.2.30 **Zero distance CFS-C EL to mineral wool insulated MLC- pipes**

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to mineral wool insulation on MLC- pipe
- Both pipes (MLC and plastic) running parallel
- Plastic pipe in U/U-end configuration, MLC pipe in U/C end configuration

Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter (d_C > 110 mm)
- included are pipes with rating EI 120 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

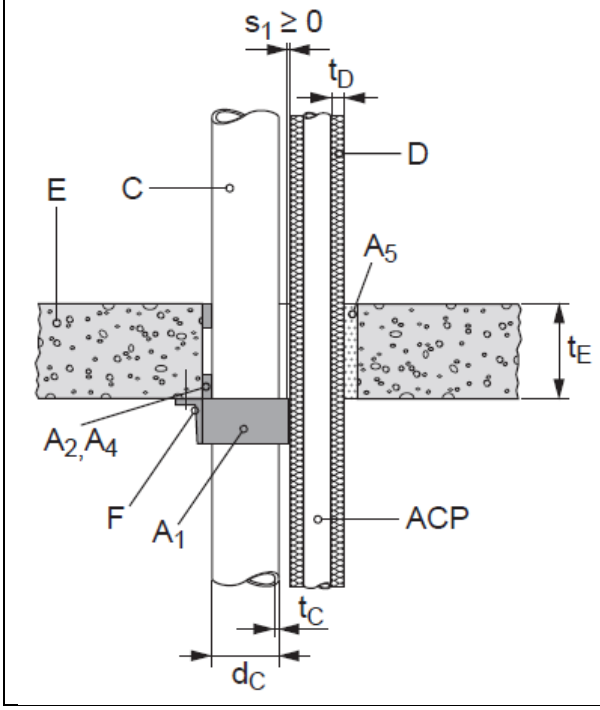
MLC- pipe and insulation:
- For pipe brand – refer to Table 102
- For Pipes diameter and wall thickness refer to Table 102
- Pipe end configuration: U/C

Insulation on MLC pipe:
- Used type of Insulation: Rockwool RW800
- Insulation situation: LS and CS
- Insulation thickness (20 mm ≤ t_D ≤ 60 mm), refer to Table 102
- Insulation thickness (L_D ≥ 1000 mm) on both sides of the floor

Gap seal - refer to 8.7.1.2

Pipe brand	Material MLC-pipe	Pipe Ø (mm)	Wall thickness (mm)	Insulation Thickness (mm)
Geberit Mepla	PE-Xb/Al/PE-Xb	16 - 63	2,25 - 4,5	20 - 60
Kelox Kekelit	PE-RT/Al/PE-RT	16 - 63	2,0 - 6,0	20 - 60
Rehau Rautitan Flex	PE-Xa – standard: EN 151875	16 - 63	2,2 - 8,6	20 - 60
TECEflex Verbundrohr	PE-Xc/Al/PE	16 - 63	2,75 - 6,0	20 - 60
Uponor Unipipe MLC	PE-RT/Al/PE-RT	16 - 63	2,0 - 6,0	20 - 60
Uponor Unipipe Plus	PE-RT/Al/PE-RT	16 - 32	2,0 - 3,0	20 - 60
Viega Raxofix	PE-Xc/Al/PE-Xc	16 - 63	2,2 - 4,5	20 - 60
Wavin Tigris	PE-Xc/Al/PE	16 - 63	2,0 - 6,0	20 - 60

Table 102: Possible combination MLC-pipe with mineral wool insulation



Pict. 8.7.2.30

Plastic Pipe (C), sealed with CFS-C EL (A_1) in rigid floor,
In direct contact to mineral wool insulated (D) MLC- pipes (ACP)

Figure 177: Plastic Pipe, sealed with CFS-C EL, in direct contact to mineral wool insulated MLC- pipes

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to MW-insulated steel pipe	EI 120

Table 103: Classification for Zero distance collar CFS-C EL on plastic pipe to MW-insulated MLC-pipes

8.7.2.31 **Zero distance CFS-C EL to PE- insulated MLC- pipes, sealed with CFS-B**

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to polyethylene insulation on MLC- pipe
- Insulated MLC – pipe sealed with CFS-B (2 layers, installed on both sides of floor)
- Both pipes (MLC and plastic) running parallel
- Plastic pipe in U/U-end configuration, MLC pipe in U/C end configuration

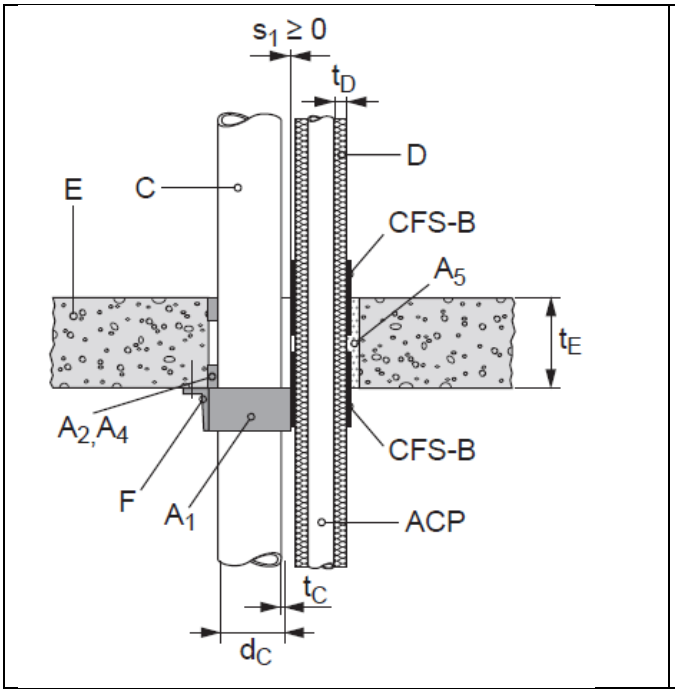
Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C > 110$ mm)
- included are pipes with rating EI 90 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

MLC- pipe:
- For pipe brand refer to Table 104
- Pipes diameter wall thickness refer to Table 104
- Pipe end configuration: U/C

Insulation on MLC- pipe:
- Used type of Insulation: foamed polyethylene
- For brands refer to 8.2.13
- Insulation situation: CS
- For Insulation thickness refer to Table 104

Gap seal - refer to 8.7.1.2



Pict. 8.7.2.31:

Insulated MLC-pipe (ACP), sealed with CFS-B, in direct contact to Collar CFS-C EL on plastic pipe (C), penetrating a floor

Figure 178: Insulated MLC pipe with CFS-B in direct contact to collar CFS-C EL

Pipe brand	Material MLC-pipe	Pipe Ø (mm)	Wall thickness (mm)	Insulation Thickness (mm)
Geberit Mepla	PE-Xb/Al/PE-Xb	16 - 26	2,25 – 3,0	6 – 13 PE-Foam
Kelox Kekelit	PE-RT/Al/PE-RT	14 - 32	2,0 - 3,0	4 – 9 PE-Foam
Kelox Kekelit	PE-RT/Al/PE-RT	16 - 20	2,0 – 2,25	PE-HD Tube LS ≥ 250mm both sides
Kelox Kekelit	PE-RT/Al/PE-RT	16 - 20	2,0 – 2,25 PE foam + PE-HD Tube	4 PE-Foam
Uponor Unipipe MLC	PE-RT/Al/PE-RT	16 - 20	2,0 – 2,25	PE-HD Tube LS ≥ 250mm both sides
Uponor Unipipe Plus	PE-RT/Al/PE-RT	16 - 25	2,0 – 2,5	4 – 10 PE-Foam

Table 104: MLC-pipes with insulation for direct contact to CFS-C EL

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to PE-insulated MLC-pipes	EI 90

Table 105: Classification for Zero distance collar CFS-C EL on plastic pipe to PE-insulated MLC-pipes

Type of Penetrant	Classification
All mentioned in Table 104 MLC pipes with described insulation – no contact to CFS-C EL	EI 120 – U/C

Table 106: Classification for insulated MLC-pipes itself

8.7.2.32 **Zero distance CFS-C EL to FEF insulated copper pipes, sealed with CFS-B**

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to FEF- insulation on metal pipe
- Insulated metal – pipe sealed with CFS-B (2 layers, installed on both sides of floor)
- Both pipes (metal and plastic) running parallel
- Plastic pipe in U/U-end configuration, metal pipe in C/U end configuration

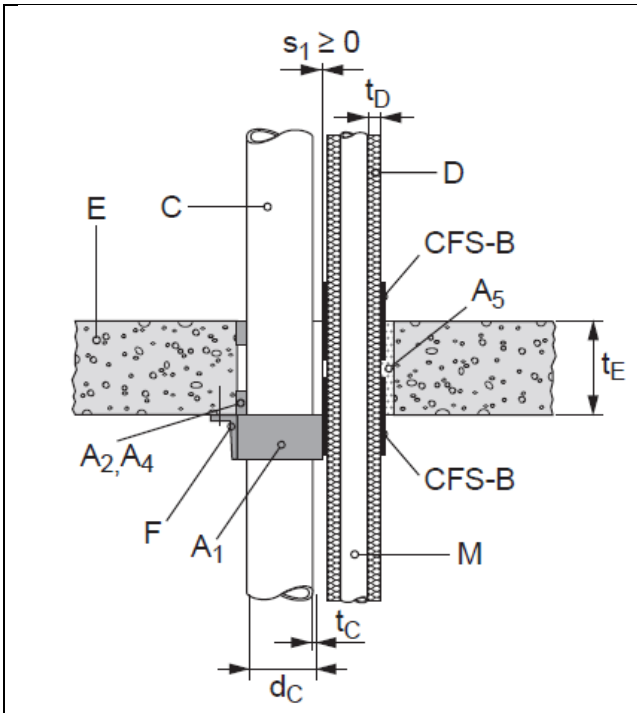
Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C > 110$ mm)
- included are pipes with rating EI 90 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Metal pipe:
- Covered material types: copper and others, refer to 8.2.11
- Pipes diameter ($d_C \leq 15$mm), wall thickness (1,0 mm $\leq t_c \leq$ 14,2 mm)
- Pipes diameter ($d_C \leq 42$ mm), wall thickness (1,2 mm $\leq t_c \leq$ 14,2 mm)
- Pipe end configuration: C/U

Insulation on metal pipe:
- Used FEF-type of Insulation: refer to 8.2.10.2
- Insulation thickness (9 mm $\leq t_D \leq$ 35 mm)
- Insulation in CS situation

Gap seal - refer to 8.7.1.2



Pict. 8.7.2.32:

Insulated metal - pipe (M), sealed with CFS-B, in direct contact to Collar CFS-C EL on plastic pipe (C), penetrating a floor

Figure 179: Insulated metal - pipe with CFS-B in direct contact to collar CFS-C EL

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to FEF-insulated copper pipe	EI 90

Table 107: Classification for Zero distance collar CFS-C EL on plastic pipe to FEF-insulated copper pipe

8.7.2.33 **Zero distance CFS-C EL to FEF insulated steel pipes, sealed with CFS-B**

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to FEF insulation on metal pipe
- Insulated metal – pipe sealed with CFS-B (2 layers, installed on both sides of floor)
- Both pipes (metal and plastic) running parallel
- Plastic pipe in U/U-end configuration, metal pipe in C/U end configuration

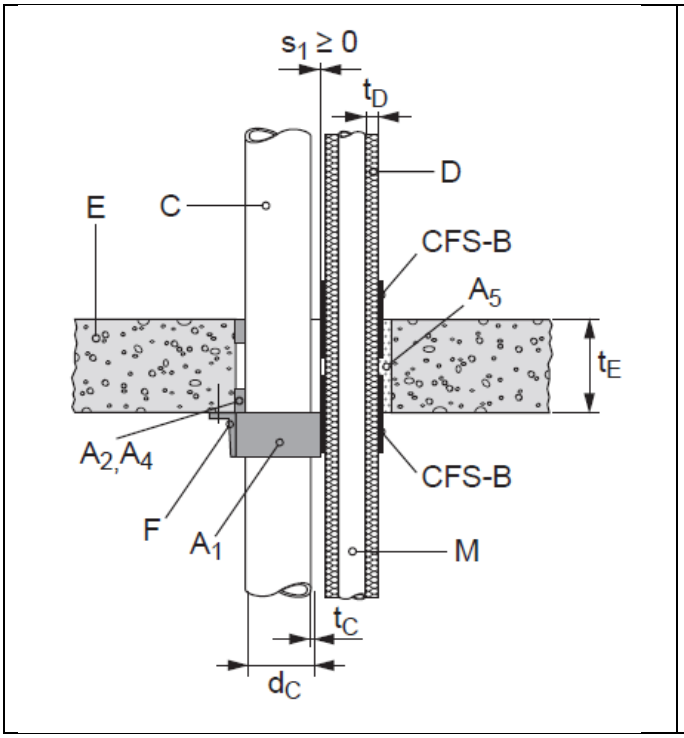
Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C > 110$ mm)
- included are pipes with rating EI 90 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Metal pipe:
- Covered material types: steel and others, refer to8.2.11, copper excluded
- Pipes diameter ($d_C \leq 15$mm), wall thickness (1,0 mm $\leq t_c \leq$ 14,2 mm)
- Pipes diameter ($d_C \leq 76$ mm), wall thickness (1,8 mm $\leq t_c \leq$ 14,2 mm)
- Pipe end configuration: C/U

Insulation on metal pipe:
- Used FEF-type of Insulation: refer to 8.2.10.2
- Insulation thickness (9 mm $\leq t_D \leq$ 35 mm)
- Insulation in CS situation

Gap seal - refer to 8.7.1.2



Pict. 8.7.2.33:

Insulated metal-pipe (M), sealed with CFS-B, in direct contact to Collar CFS-C EL on plastic pipe (C), penetrating a floor

Figure 180: Insulated metal-pipe with CFS-B in direct contact to collar CFS-C EL

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to FEF-insulated steel pipe	EI 90

Table 108: Classification for Zero distance collar CFS-C EL on plastic pipe to FEF-insulated steel pipe

8.7.2.34 **Zero distance CFS-C EL to FEF insulated MLC and PP-R pipes, sealed with CFS-B**

Situation:
- Collar CFS-C EL on plastic pipe in direct contact ($s_1 \geq 0$ mm) to FEF insulation on MLC pipe
- Insulated MLC or PP_R – pipe sealed with CFS-B (2 layers, installed on both sides of floor)
- Both pipes (MLC/PP-R and plastic) running parallel
- Plastic pipe in U/U-end configuration, MLC/PP-R pipe in U/C end configuration

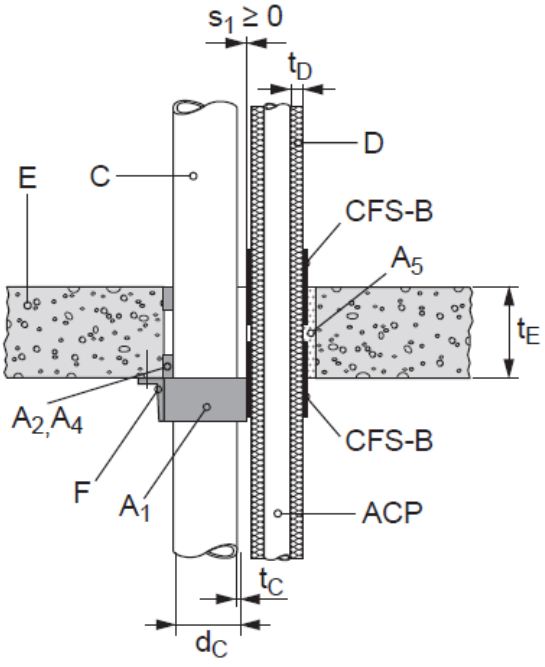
Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter (d_C > 110 mm)
- included are pipes with rating EI 90 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

MLC or PP-R-pipe:
- For brands refer to Table 109
- Pipes diameter and wall thickness refer to Table 109
- Pipe end configuration: U/C

Insulation on MLC-pipe:
- Used FEF-type of Insulation: refer to 8.2.10.2
- Insulation thickness refer to Table 109
- Insulation in CS situation

Gap seal - refer to 8.7.1.2



Pict. 8.7.2.34:

Insulated ML or PP-R-pipes (ACP), sealed with CFS-B, in direct contact to Collar CFS-C EL on plastic pipe (C), penetrating a floor

Figure 181: Insulated MLC / PP-R-pipes with CFS-B in direct contact to collar CFS-C EL

Pipe brand	Material MLC-pipe	Pipe Ø (mm)	Wall thickness (mm)	FEF Insulation Thickness (mm)
Aquatherm green	PP-R–standard: EN 15874, DIN 8077/78	20 - 110	1,9 - 10,0	8,0 - 40,5
Fränkische Rohrwerke - Alpex F50 Profi	PE-X/Al/PE-X	16 - 40	2,0 - 3,5	8,0 - 36,5
Fränkische Rohrwerke - Alpex F50 Profi	PE-X/Al/PE-X	63 - 75	4,5 -5	39,0 - 40,5
Geberit Mepla	PE-Xb/Al/PE-Xb	16 - 63	2,25 - 4,5	9,0 – 39,0
Georg Fischer Sanipex	PE-Xc/Al/PE-Xb	16 - 63	2,25 - 4,5	9,0 – 39,0
Kelox Kekelit	PE-RT/Al/PE-RT	16 - 75	2,0 - 7,0	8,0 - 40,5
Kekelit Ketrix	Cryolen Polyolefinblend (POB) – standard: EN 15847	20 - 75	1,9 - 6,8	8,0 - 40,5
Polo-Polymutan	material: PP-R 80 – standard: DIN 8077/78	20 - 75	1,9/6,8 - 12,5	8,0 - 40,5
Polo-Polymutan ML5	PP-R	20 - 75	2,8 - 10,8	8,0 - 40,5
Prineto Stabil Rohr	PE-Xb/Al/PE-HD	17 - 63	2,8 - 6,0	8,0 - 39,0
Rehau Rautitan Flex	PE-Xa – standard: EN 151875	16 - 63	2,2 – 8,6	8,0 – 39,0
TECEflex Verbundrohr	PE-Xc/Al/PE	16 - 63	2,75 – 6,0	9,0 – 39,0
Uponor Unipipe MLC	PE-RT/Al/PE-RT	16 - 63	2,0 - 6,0	8,0 – 35,0
Uponor Unipipe Plus	PE-RT/Al/PE-RT	16 - 32	2,0 – 3,0	8,0 – 35,0
Viega Raxofix	PE-Xc/Al/PE-Xc	16 - 63	2,2 – 4,5	8,0 – 39,0
Wavin TS	PE 100	50 - 75	4,6 – 6,8	9,0 – 40,5

Table 109: MLC-pipes with insulation, sealed by CFS-B

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to FEF-insulated copper pipe	EI 90 – U/U

Table 110: Classification for CFS-C EL on plastic pipe in direct contact to CFS-B on FEF-insulated MLC-pipes

Type of Penetrant	Classification
All mentioned in Table 104 MLC pipes with described insulation – no contact to CFS-C EL	EI 120 – U/C

Table 111: Classification for FEF-insulated MLC-pipes, sealed with CFS-B

8.7.2.35 **Pipes in DG 1 installed in mineral wool board CFS-CT B, sealed with CFS-C EL Collar**

Situation:
- Plastic pipes, penetrating a wall seal made off mineral wool board, sealed with CFS-C EL
- Distance between the pipes penetrating the board is ($s_1 \geq 100$ mm)
- Pipes must be grouped in line only
- The number of penetrating pipes in line is not limited.
- Pipe are assessed with zero distance to building element ($s_3 \geq 0$ mm)
- Gap seal around the board to building element is CFS-S ACR
- Gap seal around the pipes to board or building element is CFS-S ACR

Plastic pipe:
- for pipe material and dimension refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9
- for pipes in DG 1 only
- Excluded from assessed pipe range in DG 1 are pipes with outside nominal diameter ($d_C > 110$ mm)
- included are pipes with rating EI 90 or higher
- included are pipes with U/U-end configuration only

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Mineral wool board:
- Brand: CFS-CT B 1S, refer to 7.2.6
- One board flush to soffit, one board flush to upper surface
- Boards fixed by friction fit and CFS-S ACR as gap seal between board and aperture
- In between both boards around penetrating pipe a separate hollow cylinder must be installed, tight fit to penetrating pipe
- Hollow cylinder to be made of mineral wool plates, refer to 8.2.14 and 7.2.6
- High cylinder (h) = high empty space between the boards h = (t_E – 100mm)
- Width cylinder ≥ 100m around the pipes, inner diameter = pipe outside diameter d_C
- Instead of hollow cylinder a rectangular mineral wool section might be used
- For details see Figure 182
- No sealant requested cylinder/section/pipe and board, but tight fit to penetrating pipe

Gap seal:
- To be done by CFS-S ACR
- Around the board to aperture - gap width ≤ 2mm, installation depth: entire board thickness
- Between penetrating pipe and board/hollow cylinder/board segment: gap width ≤ 5mm, installation depth: ≥ 20mm from both sides
- No seal requested in horizontal layer CFS-CT B 1S and hollow cylinder/board segment

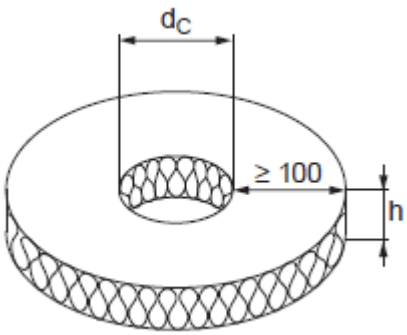
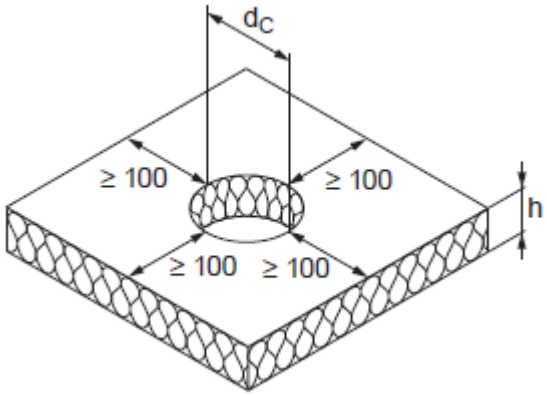
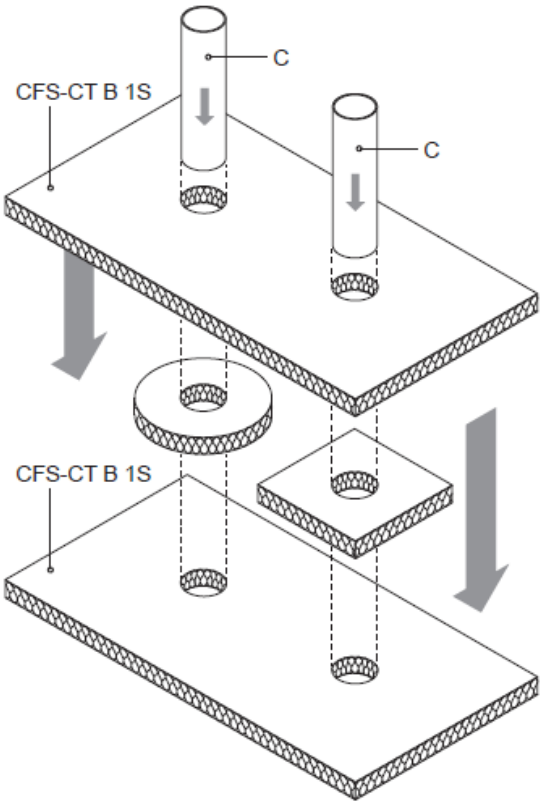
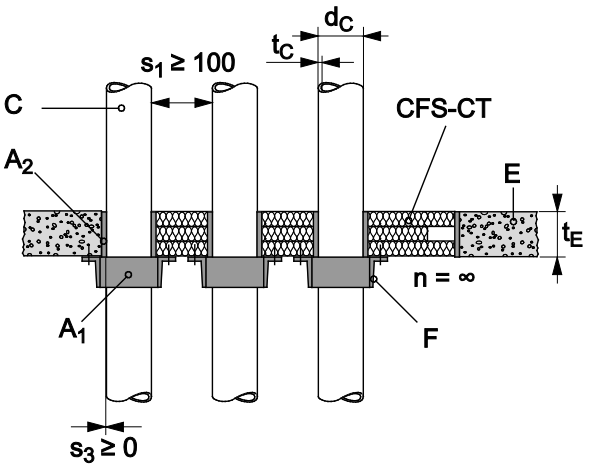
	Pict. 8.7.2.35 A: Hollow cylinder, to be used between mineral wool boards as volume filler in between the boards
	Pict. 8.7.2.35 B: Rectangular mineral wool section, to be used between mineral wool boards as volume filler
	Pict. 8.7.2.35 C: Hollow cylinder or Rectangular mineral wool section to be used in between the mineral wool boards. In case plastic pipes C comes closely together it might be useful to take a third board instead the cylinder/section, to prevent any empty space around penetrating pipes in between the CFS-CT B 1S-boards.

Figure 182: Hollow cylinder or rectangular mineral wool section to be installed on between the boards



Pict. 8.7.2.35 D:

Plastic pipes, penetrating mineral wool boards installed in rigid floor, sealed with collar CFS-C EL.

Boards installed flush to both floor surfaces.

In between the boards there are hollow cylinder or rectangular mineral wool section or a third boards, ensuring a tight fit around the pipes (C) in between outside boards.

Figure 183: Sealed plastic pipes in rigid floor – side view

Type of Penetrant	Classification
Zero distance collar CFS-C EL on plastic pipe to FEF-insulated copper pipe	EI 90 – U/U

Figure 184: Classification for plastic pipes in coated board, sealed with CFS-C EL in rigid floor

8.7.2.36 **Roof drainage in DG 1 and DG 2 in rigid floor**

Situation:
- Single pipe seal
- One pipe (U/U) insulated with elastomeric foamed insulation, sealed with CFS-C EL
- Perpendicular installed to floor

Plastic pipe:
- for pipe material and dimension refer to Table 112

Insulation on plastic pipe:
- For FEF-material type refer to 8.2.12
- Insulation thickness: 19mm
- Installation situation is LS and CS
- Minimum insulation length for LS: (L_D ≥ 250 mm) on both sides of the floor

Gap seal:
- Gap size is 5 mm to 30 mm
- Gap filler is CFS-FIL
- Installation depth: (t_{A3} ≥ 25 mm) on each side of the floor

Collar fixing:
- Refer to section 8.2.4 and 8.2.5

Pipe material	**PE**	**PE**	**PP**
Norm/ standard/ Producer/ product	EN 1519-1, EN12666-1, EN 12201-2	Non-regulated, Geberit Silent dB20	Non-regulated, See 7.1.16
Pipe diameter d_c	**DG 1:** (40 ≤ d_c ≤ 110 mm) **DG 2:** refer to Figure 185	**DG 1:** (40 ≤ d_c ≤ 110 mm) **DG 2:** Refer to Figure 186	**DG 1:** Refer to Figure 187 **DG 2:** Refer to Figure 188
Pipe wall thickness t_C	**DG 1:** (t_C = 4,2 mm) **DG 2:** refer to Figure 185	**DG 1:** (t_C = 6,0 mm) **DG 2:** Refer to Figure 186	**DG 1:** Refer to Figure 187 **DG 2:** Refer to Figure 188

Table 112: Dimension for roof drainage applications sealed with CFS-C EL in rigid floor in DG 1 and DG 2

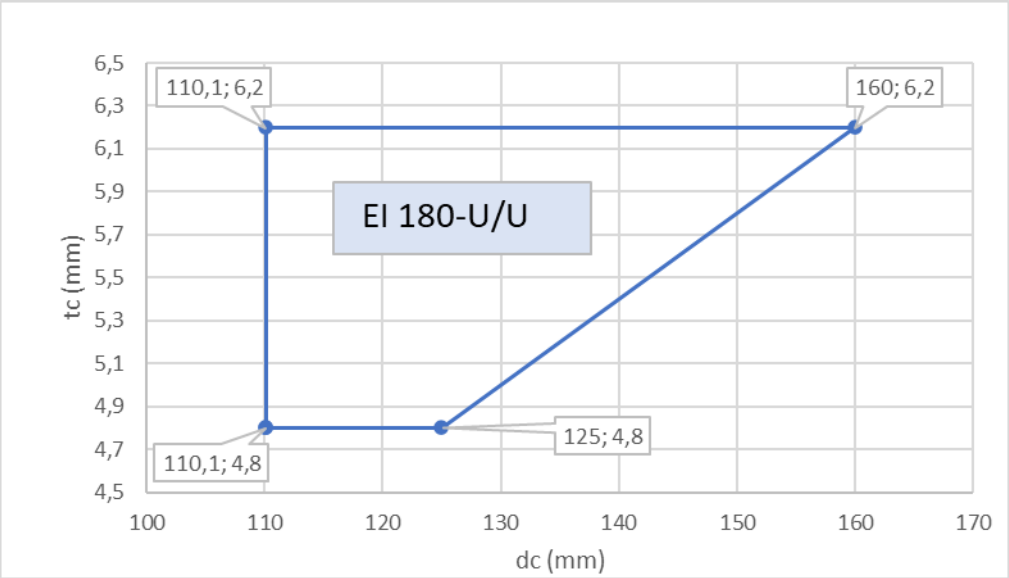


Figure 185: Classification for FEF-insolated PE-pipes acc. EN 1519-1 in DG 2

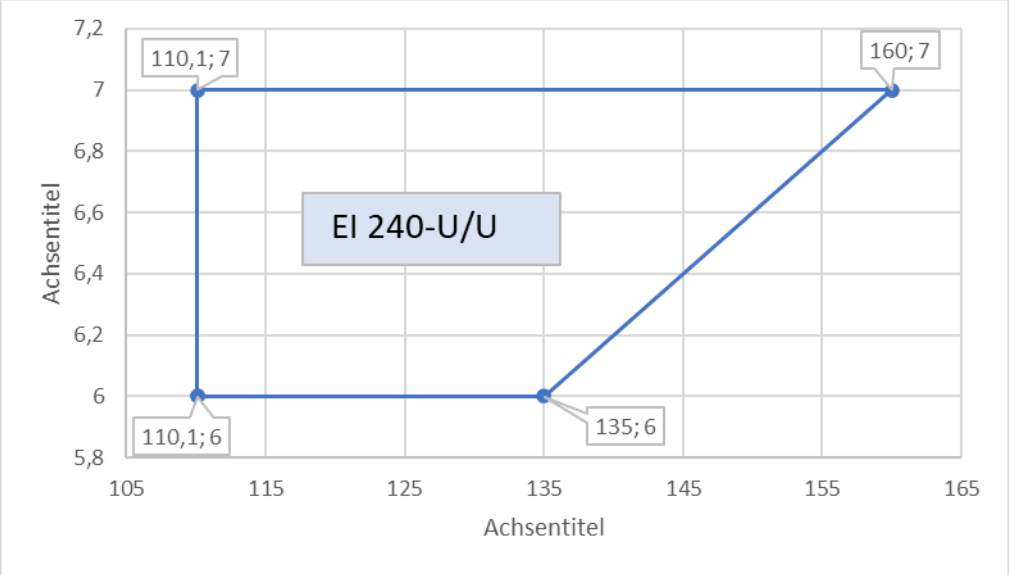


Figure 186: Classification for FEF-insolated Geberit Silent dB20-pipes in DG 2

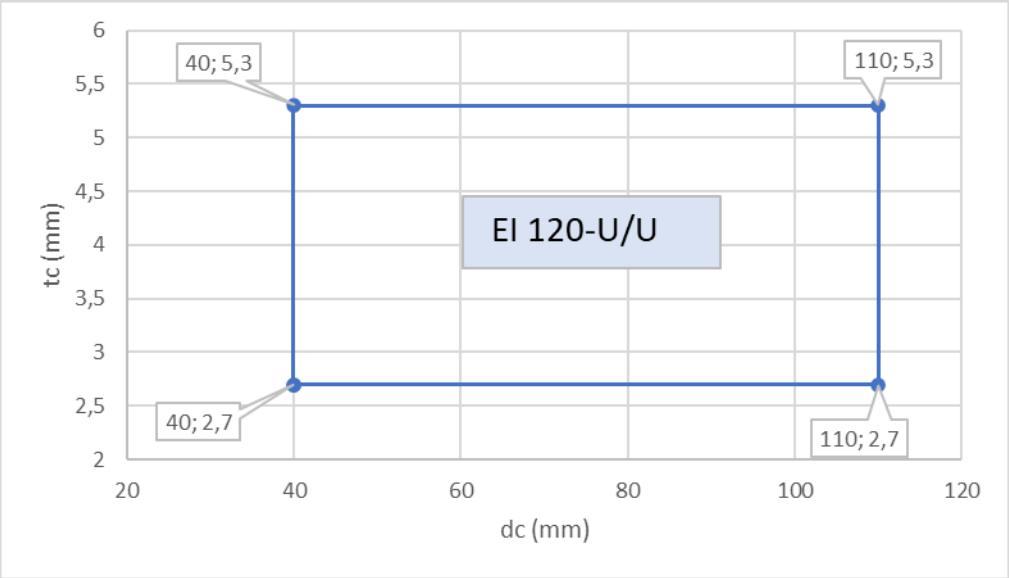


Figure 187: Classification for FEF-insulated non-regulated PP-pipes in DG 1

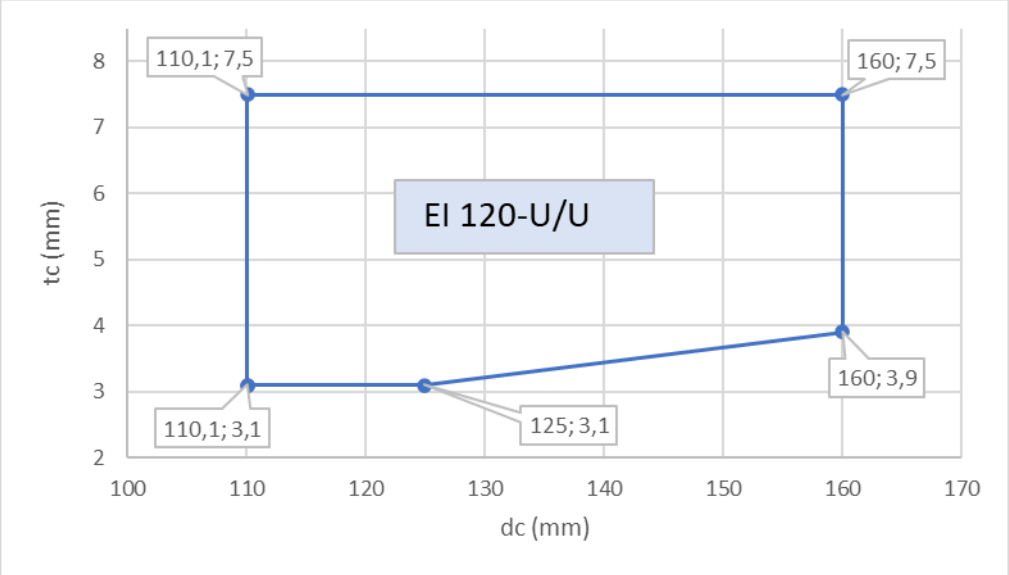


Figure 188: Classification for FEF-insulated non-regulated PP-pipes in DG 2

8.7.2.37 **Pipe junction/manifold inside the floor in DG 1 and DG 2**

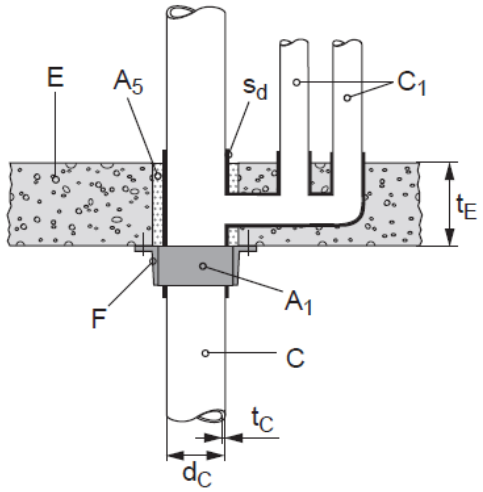
Situation:
- Single pipe seal
- A U/U classified waste water pipe (C) penetrates a floor in perpendicular situation, sealed with CFS-C EL on soffit only
- Inside the floor there are one or more pipe junctions/manifolds (C_1) into the central wastewater pipe, where horizontal running minor pipes flow into the central waste water pipe
- Those minor pipes are always in U/C constellation
- Arrangement of those smaller pipes in U/C constellation: in line
- Number of smaller pipes in U/C constellation: unlimited
- Distance (vertical) pipe to pipe between smaller pipes in U/C constellation: $s_1 \geq 15$mm
- Distance (vertical) between U/U classified main wastewater pipe (C) and smaller pipes in U/C constellation: $s_1 \geq 15$mm

Plastic pipe (C):
- for pipe material, dimension and basic EI-rating in rigid floor application refer to 8.7.2.1, 8.7.2.2, 8.7.2.3, 8.7.2.4, 8.7.2.5, 8.7.2.7, 8.7.2.8, 8.7.2.9

Insulation on plastic pipe:
- No thermal insulation assessed
- For acoustic decoupling refer to 8.2.7

Gap seal:
- Refer to 8.7.1.2

Collar fixing:
- Refer to section 8.2.4 and 8.2.5



Pict. 8.7.2.37

Manifold application in rigid floor

Only the big vertical wastewater pipe (C) must be sealed with collar CFS-C EL (A_1) and defines the rating of the complete manifold system.

Figure 189: Manifold system within rigid floor, sealed with CFS-C EL

Type of Penetrant	Classification
Manifold system, which consists of a major vertical pipe (sealed with CFS-C EL on soffit) and several smaller connected pipes (all U/C)	Rating of manifold system is defined by the major, vertical pipe only, defined for single pipe seal.

Table 113: Classification for pipe junction/manifold within rigid floor, sealed with CFS-C EL

8.7.2.38 **Wavin Tigris PE-X - One pipes in rigid floor DG 1**

Situation:
- Single and multiple pipe seal
- Pipe (C) or pipe bundles penetrates perpendicular the wall
- Triangular clusters and pipes in line (horizontal/vertical) allowed
- Number of pipes in cluster/linear arrangement is defined by max. collar diameter / perimeter - length see below
- Any pipe size combination allowed - refer to Table 114 below
- Minimum distance between clustered/linear arranged pipes: $s_2 \geq 0$mm
- CFS-C EL fits tightly around the cluster or linear arrangement

Plastic pipe:
- Type: Wavin Tigris PE-X-One R-I-R insulated
- for pipe dimension refer to Table 114 below

Insulation on plastic pipe:
- Insulation: PE-foam, CS, for dimension refer to table below
- Additional Protection: R-I-R Hardcover, PE-HD, CS and CI, covering pipe and insulation

Nr.	Material Standard	Pipe diameter (mm)	Pipe wall thickness (mm)	Pipe insulation thickness (mm)
1	PE-X in PE hardcover	12	2,0	9
2	PE-X in PE hardcover	15	2,5	10
3	PE-X in PE hardcover	18	2,5	10 - 20
4	PE-X in PE hardcover	22	3,0	13 - 20

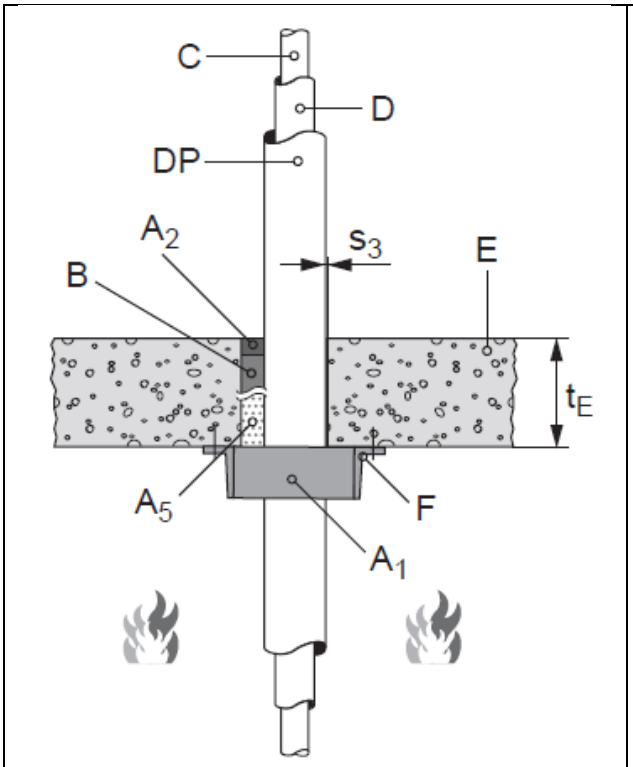
Table 114: PE-Insulated Wavin-Tigris pipes

Gap seal:

With mortar M10 acc. EN 998-2 (A_5):
- Annular gap width: $(0 \leq s_3 \leq 15)$ mm
- Installation depth: over the entire floor thickness t_E

With CFS-S ACR or CFS-IS (A_2):
- Annular gap width: $(0 \leq s_3 \leq 15)$ mm
- Installation depth: min. 15mm from both sides of the floor
- With or without backfilling B (mineral wool, density ≥ 40kg/m³), Reaction to Fire class: min. A2-s1, d0

Collar fixing:
- Refer to section 8.2.4 and 8.2.5
- Fixing the collar with 3 hooks for single and multiple penetration (clusters)
- Max. collar diameter: 80mm
- Max. collar perimeter length: 550mm



Pict. 8.7.2.38:

Wavin Tigris PE-X-One (C),
With PE-insulation (D), protected by
R-I-R hard cover (DP with,
penetrating a rigid floor,
sealed with CFS-C EL (A_1)

Figure 190: Wavin Tigris PE-X-One pipe, insulated and protected, sealed with CFS-C EL in rigid floor

Type of Penetrant	Classification
Wavin Tigris PE-X-One pipe, PE-insulated and RIR-protected, sealed with CFS-C EL in rigid floor, Single pipe and bunched pipes, sealed with one CFS-C EL collar	EI 90 – U/C

Table 115: Classification for single/multiple insulated Wavin Tigris pipes, sealed with CFS-C EL in rigid floor

8.7.3 Specific characteristics for Rigid floor ($t_E \geq 200$ mm)

8.7.3.1 Rigid floor:

The floor must have a minimum thickness of 200 mm with a minimum density of $\rho_E \geq 550$ kg/m^3 and comprise concrete, aerated concrete, or masonry.

8.7.3.2 Annular gap seal:

Annular gap around penetrating item has to be filled with:

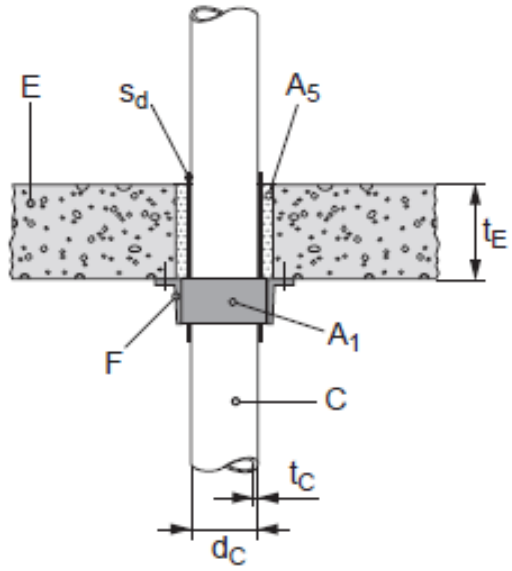
- Cementious mortar acc. EN 998-2 group M10 over the entire thickness of the floor

or

- Hilti Firestop Acrylic Sealant CFS-S ACR (A_2) only, installation depth t_{A2} = ($_{tA2} \geq 25$ mm), installed on both sides of floor, no backfill

Annular gap width should be:

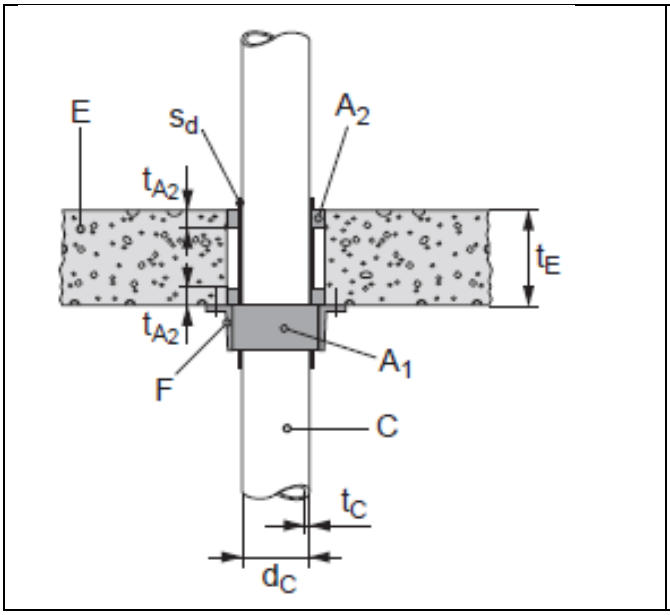
- 5 – 15 mm (when sealed with mortar group M10 acc. EN 998-2 over the entire wall thickness
- 5 – 15 mm (when sealed with Hilti Firestop Acrylic Sealant CFS-S ACR only)



Pict. 8.7.3.2 A:

Plastic pipe, penetrating a rigid floor, sealed with Hilti Firestop Collar CFS-C EL. Used gap filler is mortar group M10 acc. EN 998-2 over the entire wall thickness. Plastic pipe could be covered or uncovered by an acoustical insulation.

Figure 191: Gap seal with mortar/concrete around a plastic pipe, penetrating a floor



Pict. 8.7.3.2 B:

Plastic pipe, penetrating a rigid floor, sealed with Hilti Firestop Collar CFS-C EL. Used gap filler is CFS-S ACR in a thickness of (t_{A2} ≥ 25 mm) from both surfaces of the floor, no backfilling is requested. Plastic pipe could be covered or uncovered by an acoustical insulation.

Figure 192: Gap seal with CFS-S ACR with/without backfilling around a plastic pipe, penetrating a floor

8.7.3.3 Collar fixing

- Hilti Firestop Collar Endless CFS-C EL (A_1) has to be fixed with hooks (F) on the bottom side of the floor only
- For requested number and type of hooks refer to 8.2.5
- For hook fixing refer to 8.2.4
- For bended hooks in wet mortar refer to 8.2.4.7

Mortar must be fully cured before fire rating is available.

8.7.3.4 Insulation / Acoustic decoupling

- Any kind of acoustic decoupling is assessed
- Decoupling within the floor, below the jacket, should not exceed floor and jacket
- Max. thickness: 9mm
- Length: 250 mm (in DG 1) and 300 mm (in DG 2)
- No thermal insulation assessed

8.7.3.5 Distances

- To other CFS-C EL-seal: 100 mm
- To any other penetration seal: 100 mm
- To aperture: 200 mm

8.7.4 Penetration services in rigid floor ($t_E \geq 200$ mm)

8.7.4.1 PVC-pipes acc. EN 1452-2 in DG 1 and DG 2

Classification shown in Table 116 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Consider relevant Design Group (DG) of CFS-C EL
- Carefully consider disclaimer in 8.2.16

Pipe diameter d_c	Pipe wall thickness t_c	Design Group CFS-C EL	Gap filling	Classification
$d_c \leqq 110$ mm	t_c = 8,1 mm	1	With CFS-S ACR, See Figure 192	EI 90-U/U
$d_c \leqq 110$ mm	t_c = 8,1 mm	2	With mortar, See Figure 191	EI 120-U/U
$d_c \leqq 125$ mm	t_c = 9,2 mm	2	With mortar, See Figure 191	EI 120-U/U

Table 116: Classification for PVC-pipes in DG 1 and DG 2 in 200 mm rigid floor for EI 90-U/U and EI 120-U/U

8.8 Cross Laminated Timber (CLT) Floors

8.8.1 Binderholz Brettsperrholz BBS

8.8.1.1 Specific characteristics Brettsperrholz BBS

- Floor material acc. ETA-06/0009
- minimum element thickness (t_E) ≥ 80 mm, having ≥ 3 layers of softwood
- or minimum element thickness (t_E) ≥ 100 mm, having ≥ 5 layers of softwood
- or minimum element thickness (t_E) ≥ 140 mm, having ≥ 5 layers of softwood
- minimum outer layer thickness ≥ 20 mm (for 80 mm / 100 mm floor thickness)
- minimum outer layer thickness ≥ 40 mm (for 140 mm floor thickness)
- shall comprise Polyurethane and MUF based adhesives
- no request for edge glue

8.8.1.2 Penetrating items

- For assessed penetrants refer to section 8.8.1.11, 8.8.1.12, 8.8.1.13

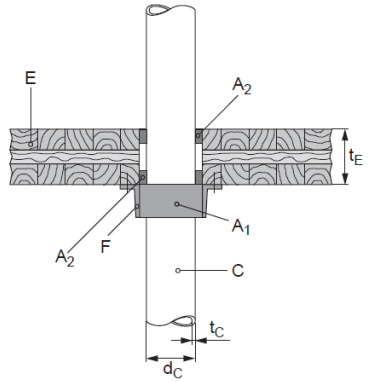
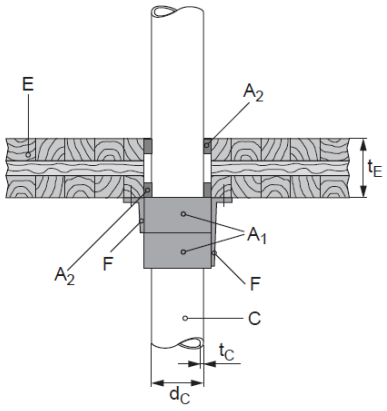
	Pict. 8.8.1.2 A: Plastic pipe penetration in DG 1 in BBS, minimum element thickness (t_E) ≥ 80 mm, having ≥ 3 layers of softwood
	Pict. 8.8.1.2 B: Plastic pipe penetration in DG 2 in BBS, minimum element thickness (t_E) ≥ 80 mm, having ≥ 3 layers of softwood

Figure 193: Plastic pipe seal in CLT–BBS in DG 1 and 2, (t_E) ≥ 80mm

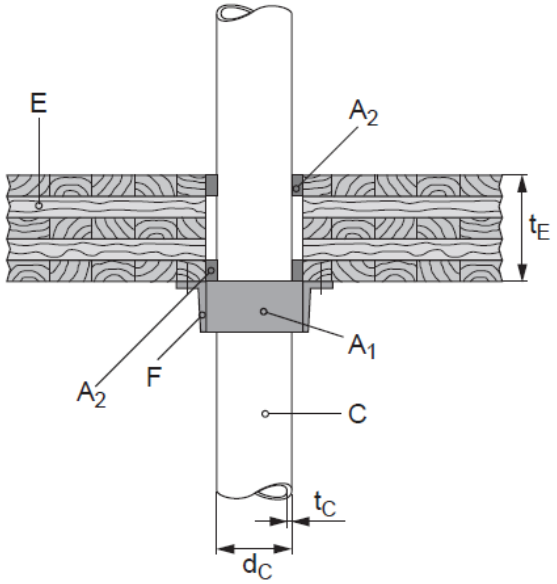
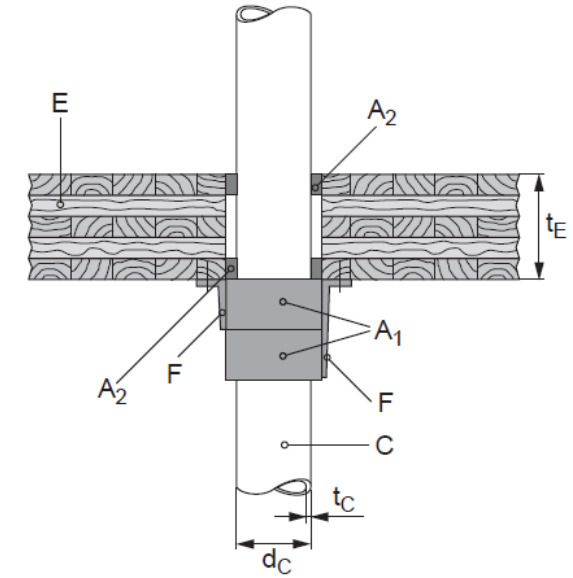
	Pict. 8.8.1.2 C: Plastic pipe penetration in DG 1 in BBS, minimum element thickness (t_E) ≥ 100 mm, having ≥ 5 layers of softwood.
	Pict. 8.8.1.2 D Plastic pipe penetration in DG 2 in BBS, minimum element thickness (t_E) ≥ 100 mm, having ≥ 5 layers of softwood

Figure 194: Plastic pipe seal in CLT–BBS in DG 1 and 2, (t_E) ≥ 100 mm

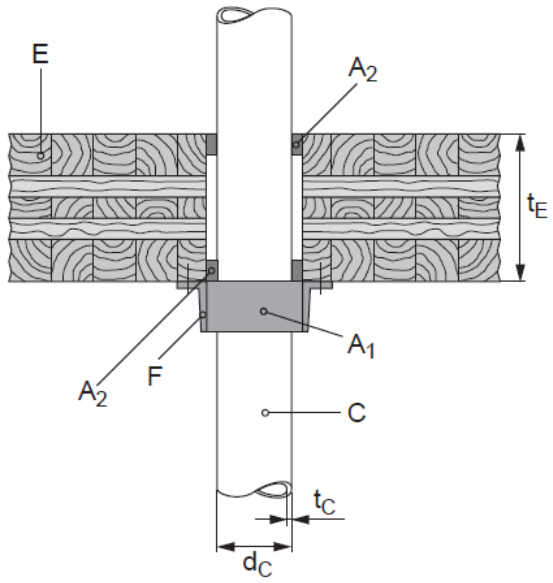
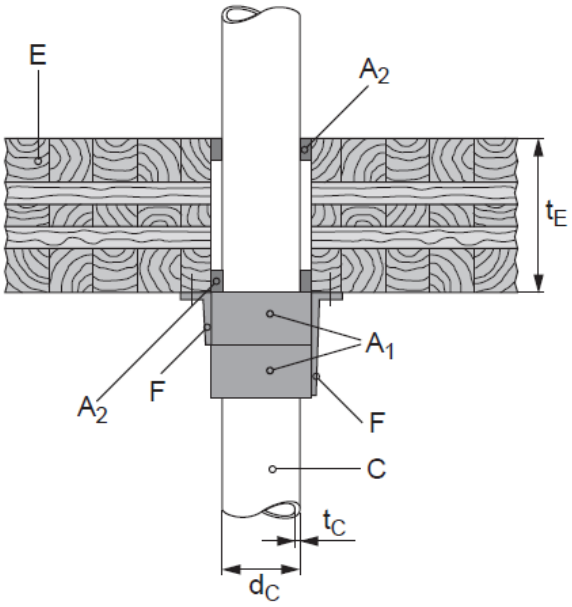
	Pict. 8.8.1.2 E: Plastic pipe penetration in DG 1 in BBS, minimum element thickness (t_E) ≥ 140 mm, having ≥ 5 layers of softwood
	Pict. 8.8.1.2 F: Plastic pipe penetration in DG 2 in BBS, minimum element thickness (t_E) ≥ 140 mm, having ≥ 5 layers of softwood

Figure 195: Plastic pipe seal in CLT–BBS in DG 1 and DG 2, (t_E) ≥ 140 mm

8.8.1.3 Annular Gap and gap filler in Binderholz Brettsperrholz BBS

- Annular gap width (0 mm ≤ w ≤ 15 mm)
- Annular gap depth (t_{A2}) ≥ 25 mm
- Gap Filler: CFS-S ACR (A_2)
- No backfilling requested
- Installation identically on both sides of the floor
- Installation flush to floor surface

8.8.1.4 Collar fixing in Binderholz Brettsperrholz BBS

- For number of hooks: refer to 8.2.5
- For hook fixing: refer to 8.2.4 and 8.2.4.5
- Long and short hooks are requested, depending on pipe DG

For hook fixing:
- Hilti HUS3 H6 x 60
- Hilti S-WS 11Y x 75
- Hex.head wood screws 6 x 60
- Hilti S-WS 11 Z x 75

8.8.1.5 Pipe support in Binderholz Brettsperrholz BBS

- maximum 450 mm away from top side of floor constructions (first support)

8.8.1.6 Recycling of oddments in Binderholz Brettsperrholz BBS

- No oddments should be used.

8.8.1.7 Pipe orientation in Binderholz Brettsperrholz BBS

- perpendicular orientation only, no pipe inclination

8.8.1.8 Sound decoupling on plastic pipes in in Binderholz Brettsperrholz BBS

- No sound decoupling assessed

8.8.1.9 Pipe insulation

- In floor thickness (80 mm ≥ t_E ≥ 100 mm): no insulation assessed
- In floor thickness (t_E ≥ 100 mm): FEF-insulation acc. EN 14304 assessed (CS)

Pipe outside diameter (dc) mm	FEF-insulation thickness (t_D) mm
50 - 110	9
110,1 - 160	10

Table 117: FEF insulation thickness on plastic pipes in BBS-floor thickness (t_E ≥ 100 mm)

- In floor thickness (t_E ≥ 140 mm): FEF-insulation acc. EN 14304 assessed (CS)

Pipe outside diameter (dc) mm	FEF-insulation thickness (t_D) mm
50 - 110	9
110,1 - 160	10

Table 118: FEF insulation thickness on plastic pipes in BBS-floor thickness (t_E ≥ 100 mm)

8.8.1.10 Distances to other penetrating items in Binderholz Brettsperrholz BBS floor

In floor thickness (80 mm ≤ t_E ≤ 140 mm):

- Always ≥ 100 mm between all penetrant openings and

In floor thickness (t_E ≥ 140 mm):

- (s ≥ 50 mm) between openings (not between products), refer to Figure 88, Pict. 8.5.1.9 B:
- all assessed penetrant solutions with their specific EI-ratings (refer to 8.8.1.11) might be installed in (s ≥ 50 mm) by maintaining their original EI-rating
- Exception from this rule: combination with CFS-B on copper pipes (independent from size) is limited to FEF-thickness t_D = (16 – 36,5) mm
- CFS-SL GA only linear, no cluster

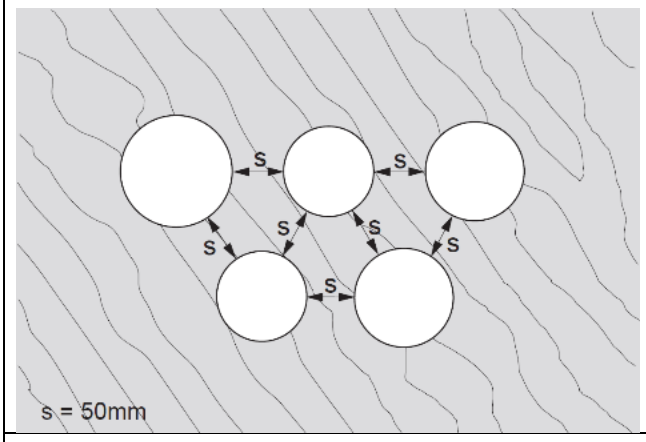
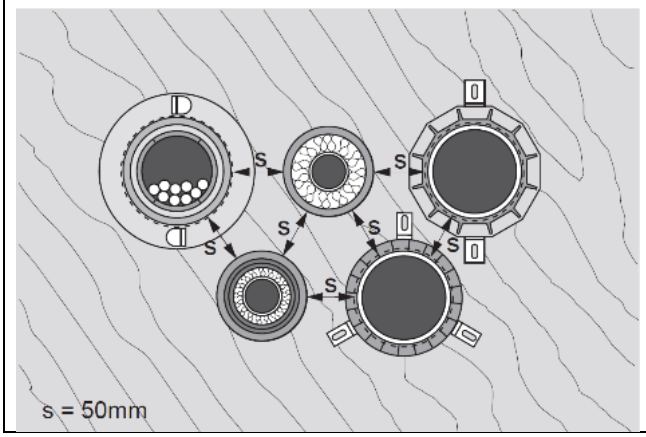
	Pict. 8.8.1.10 A: Minimum distance (s) in between openings in BBS Brettsperrholz (thickness (t_E) ≥ 140mm)
	Pict. 8.8.1.10 B: Minimum distance (s) in between openings in BBS Brettsperrholz (thickness (t_E) ≥ 140mm), filled with several penetrants

Figure 196: Minimum distances penetrant to penetrant in BBS-floor, thickness ≥ 100mm

Distances to each other (opening to opening)	CFS-C EL All assessed pipes	CFS-B All assessed solution	CFS-S ACR All assessed solution	CFS-CC All assessed solution	CFS-SL GA All assessed solution	edge of support construction
CFS-C EL All assessed pipes	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-B All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-S ACR All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-CC All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-SL GA All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
CFS-SL GA All assessed solution	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 50mm	≥ 100mm
edge of support construction	≥ 100mm	≥ 100mm	≥ 100mm	≥ 100mm	≥ 100mm	≥ 100mm

Table 119: Minimum distance between openings for several penetrants in CLT-BBS floor, thickness ≥ 100 mm

8.8.1.11 **Penetration service in Binderholz Brettsperrholz BBS-floor, $t_E \geq 80$mm**

8.8.1.11.1 PVC-pipes acc. EN 1452-2 in DG 1 in BBS floor

Classification shown in Figure 197 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Carefully consider disclaimer in 8.2.16

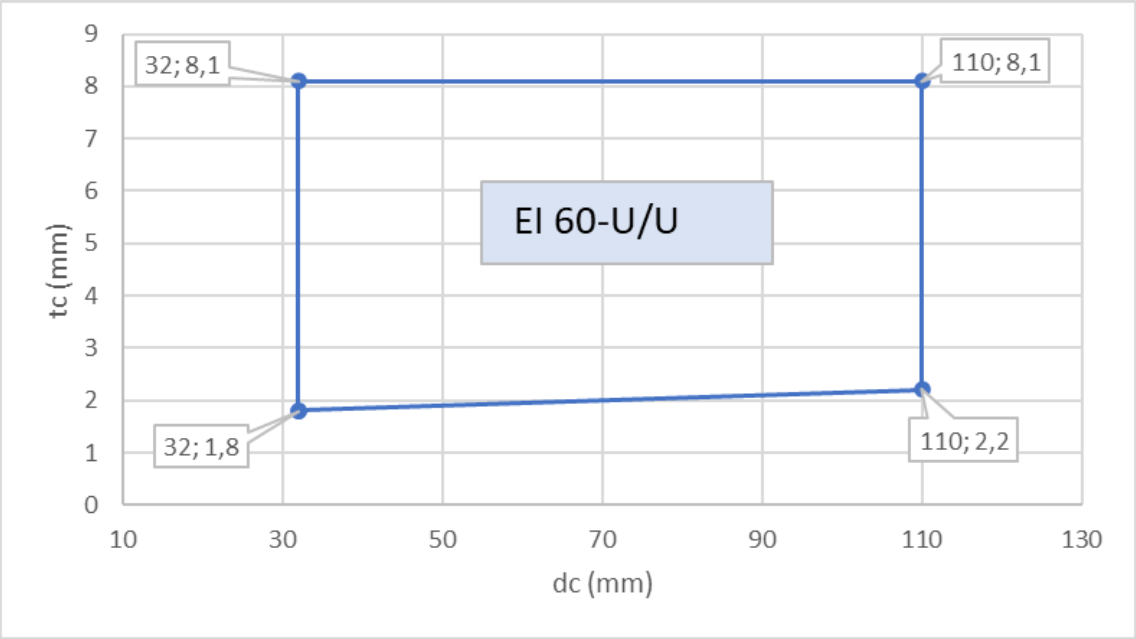


Figure 197: Classified PVC- pipe range, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$mm

8.8.1.11.2 PE pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 in BBS floor

Classification shown in Figure 198 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer

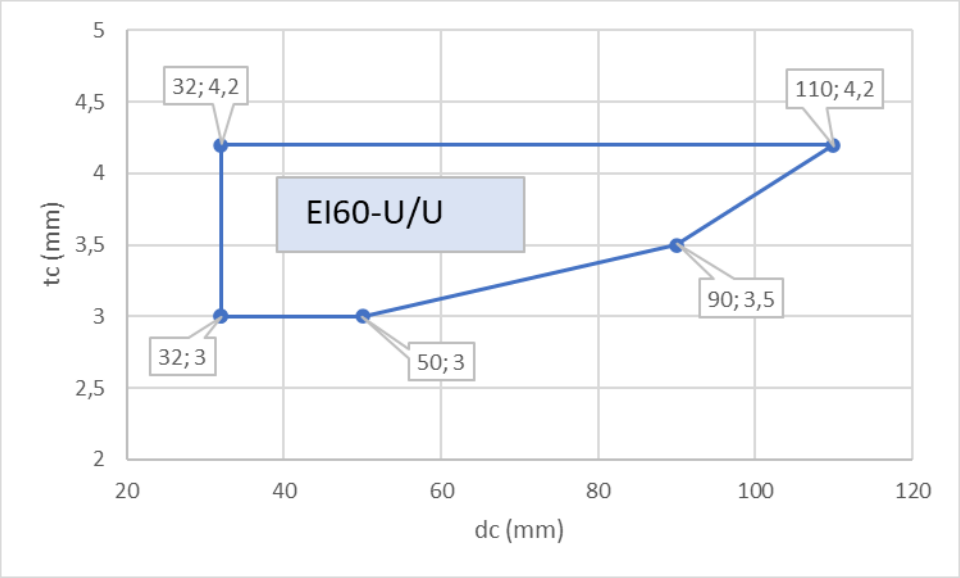


Figure 198: Classified PE, ABS-pipe range, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$mm

8.8.1.11.3 PP-pipes acc. EN 1451-1 in DG 1 in BBS floor

Classification shown in Figure 199 is valid for pipes made from:

- PP according EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer

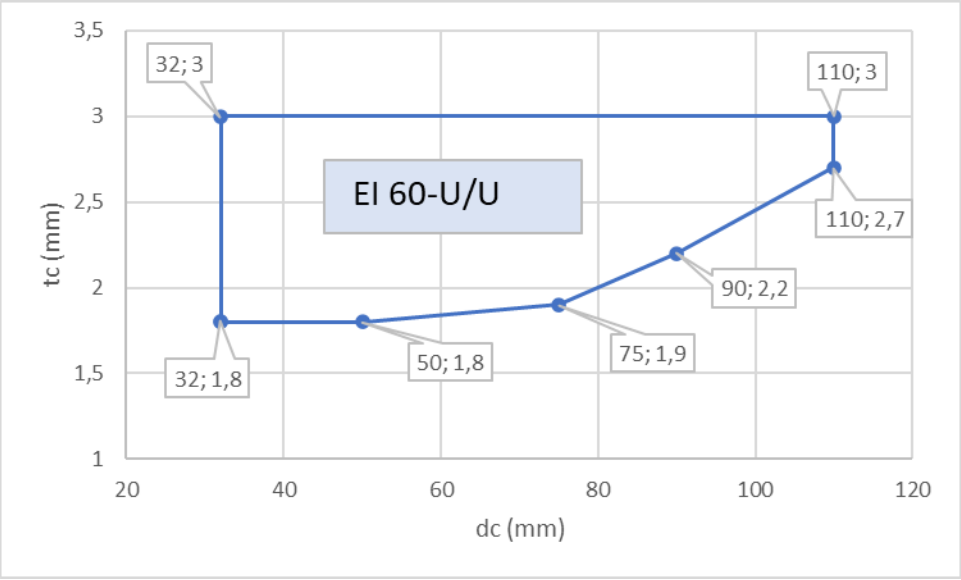


Figure 199: Classified PP-pipe range, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$ mm

8.8.1.11.4 PE-pipes, non-regulated (Geberit Silent dB20) in DG 1 in BBS floor

Classification shown in Figure 200 is valid for pipes made from:

- For Geberit Silent dB20 only

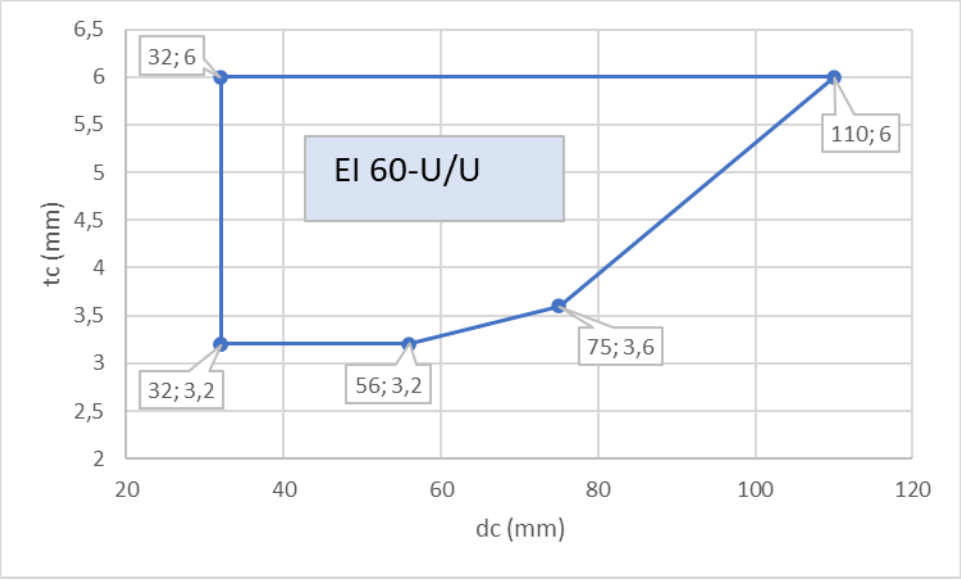


Figure 200: Classified Geberit Silent dB20 pipe range, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$ mm

8.8.1.11.5 PP-pipes, non-regulated (Geberit Silent Pro) in DG 1 in BBS floor

Classification shown in Figure 201 is valid for pipes made from:

- For Geberit Silent Pro only

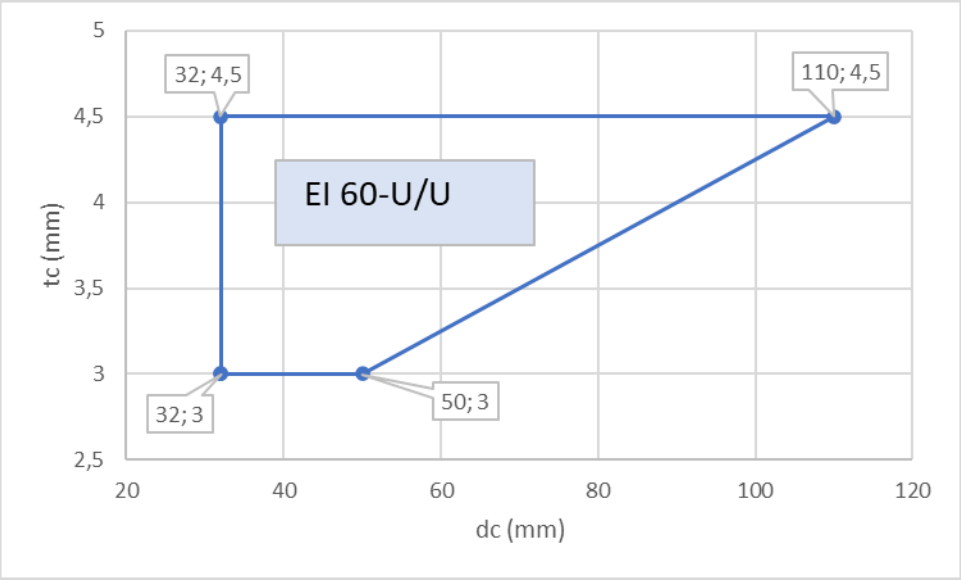


Figure 201: Classified Geberit Silent Pro pipe range, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$ mm

8.8.1.11.6 PP-pipes, non-regulated (Rehau Raupiano Plus) in DG 1 in BBS floor

Classification shown in Figure 202 is valid for pipes made from:

- For Rehau Raupiano Plus only

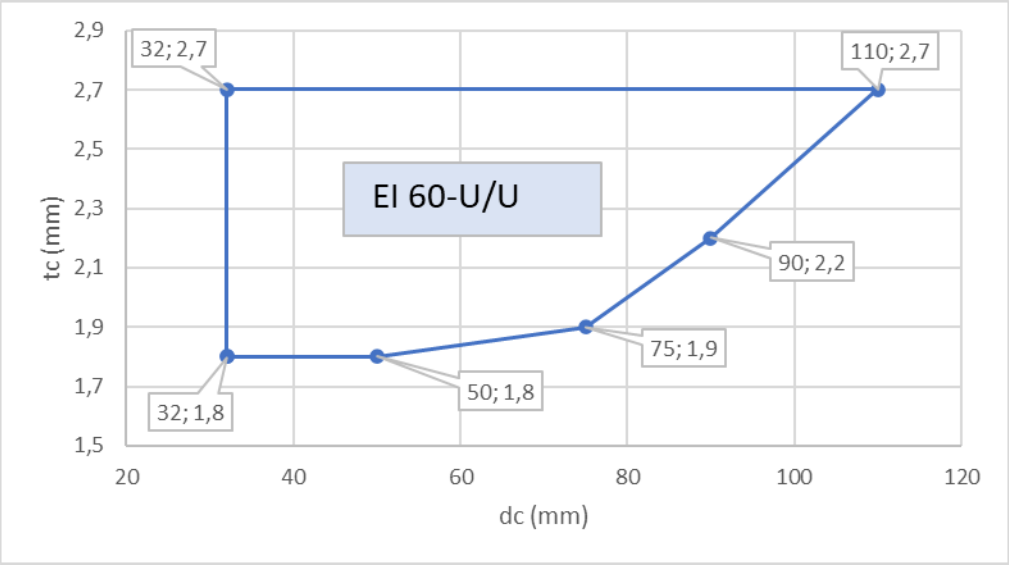


Figure 202: Classified Rehau Raupiano Plus pipe range, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$ mm

8.8.1.11.7 PP-pipes, non-regulated (Poloplast POLO-LAL NG/XS) in DG 1 in BBS floor

Classification shown in Figure 203 is valid for pipes made from:

- For Poloplast POLO-LAL NG/XS only

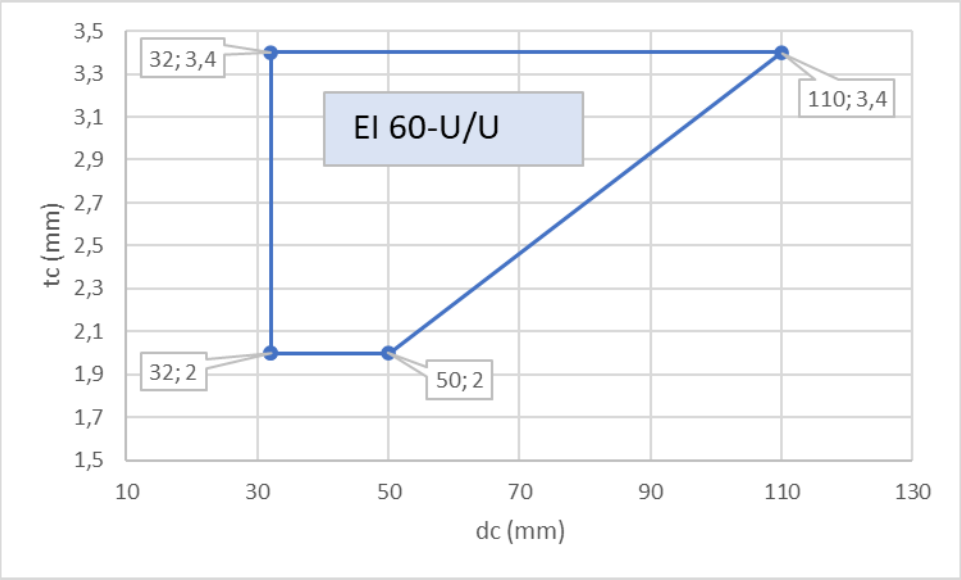


Figure 203: Classified Poloplast POLO-KAL NG/XS pipe range in DG 1, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$ mm

8.8.1.11.8 PP-pipes, non-regulated (Wavin AS) in DG 1 in BBS floor

Classification shown in Figure 204 is valid for pipes made from:

- For Wavin AS only

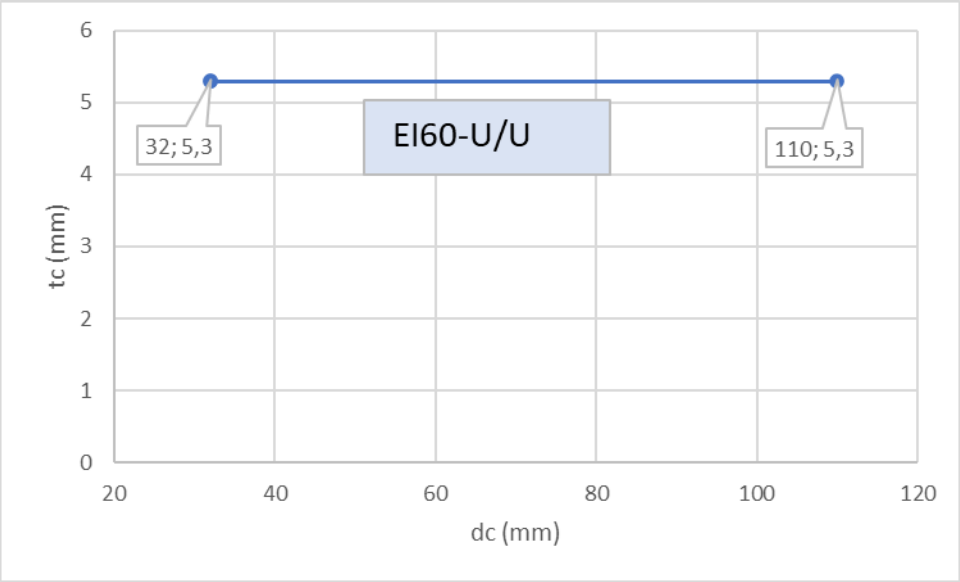


Figure 204: Classified Wavin AS pipe range n DG 1, sealed with CFS-C EL in BBS-floor, $t_E \geq 80$ mm

8.8.1.12 **Penetration service in Binderholz Brettsperrholz BBS-floor, $t_E \geq 100$mm**

8.8.1.12.1 PVC-pipes acc. EN 1452-2 in DG 1 and DG 2 in BBS floor

Classification shown in Figure 205 and Figure 206 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL
- Carefully consider disclaimer in 8.2.16

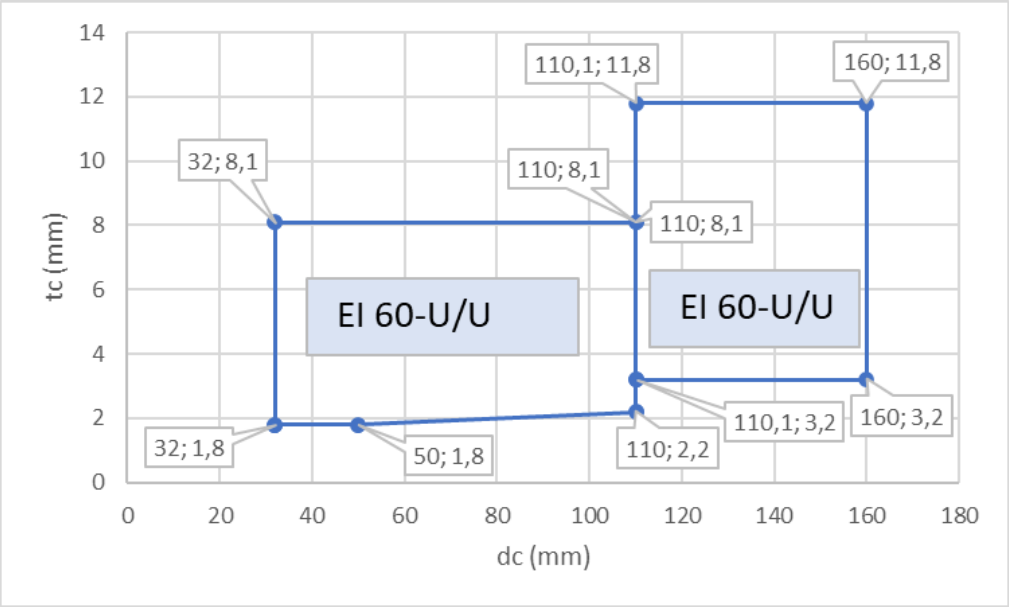


Figure 205: Classified PVC pipe range in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm EI 60 U/U

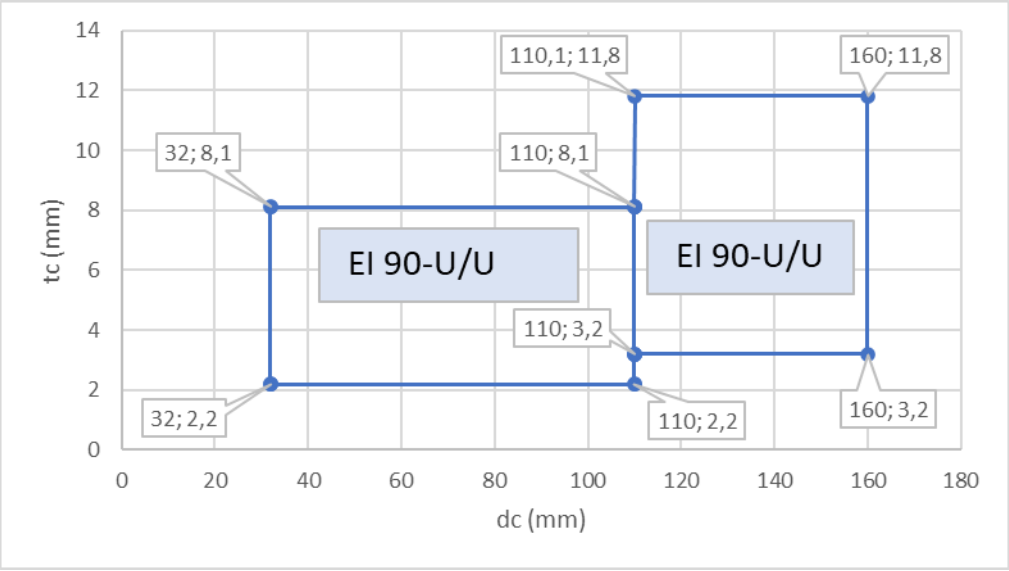


Figure 206: Classified PVC pipe range in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm EI 90 U/U

8.8.1.12.2 PE pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 and DG 2 in BBS floor

Classification shown in Figure 207 and Figure 208 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL

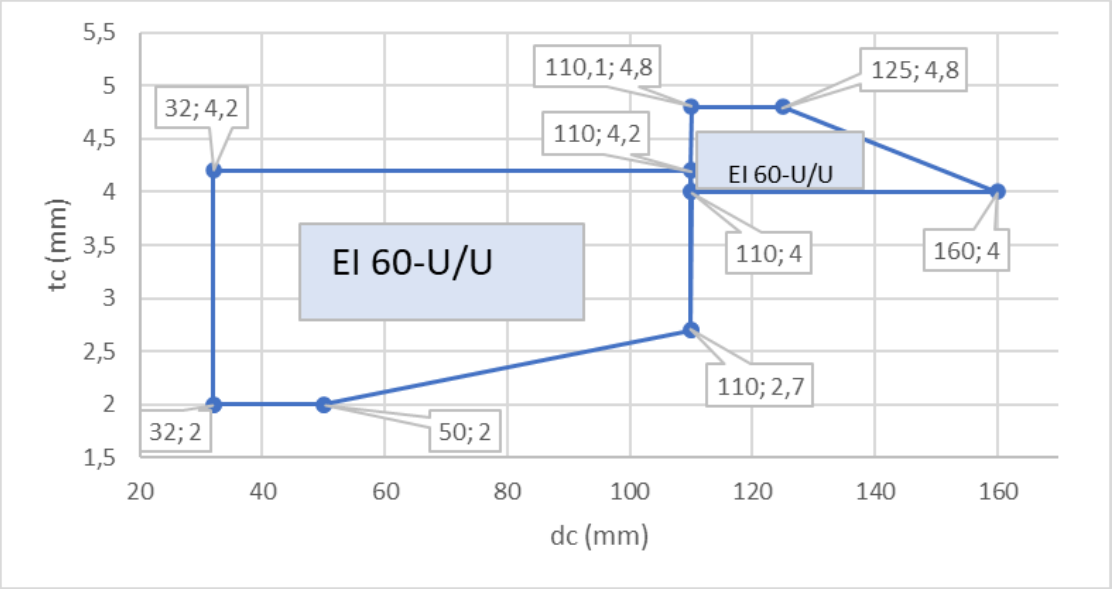


Figure 207: Classified PE, ABS pipe range in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm for EI 60 U/U

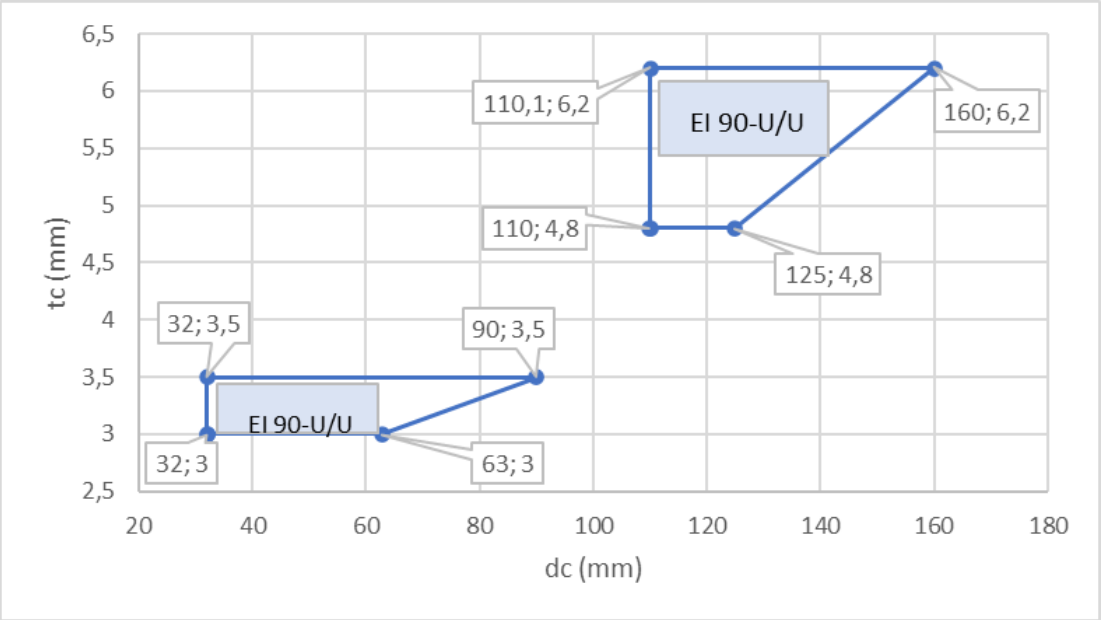


Figure 208: Classified PE, ABS pipe range in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm, for EI 90 U/U

8.8.1.12.3 PE pipes, non-regulated (Geberit Silent dB20) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 209 is valid for pipes made from:

- For Geberit Silent dB20 only
- Consider relevant Design Group (DG) for CFS-C EL

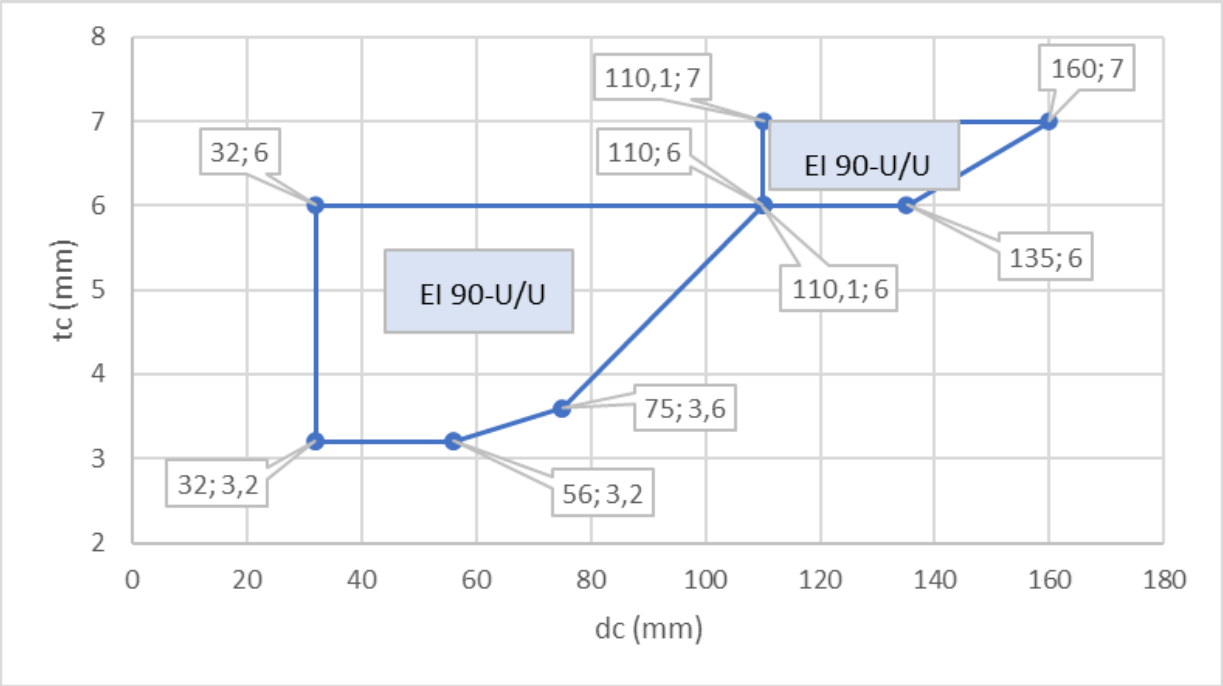


Figure 209: Classified pipe range for Geberit Silent dB20 in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm EI 90 U/U

8.8.1.12.4 PP pipes, non-regulated (Geberit Silent Pro) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 210 is valid for pipes made from:

- For Geberit Silent Pro only
- Consider relevant Design Group (DG) for CFS-C EL

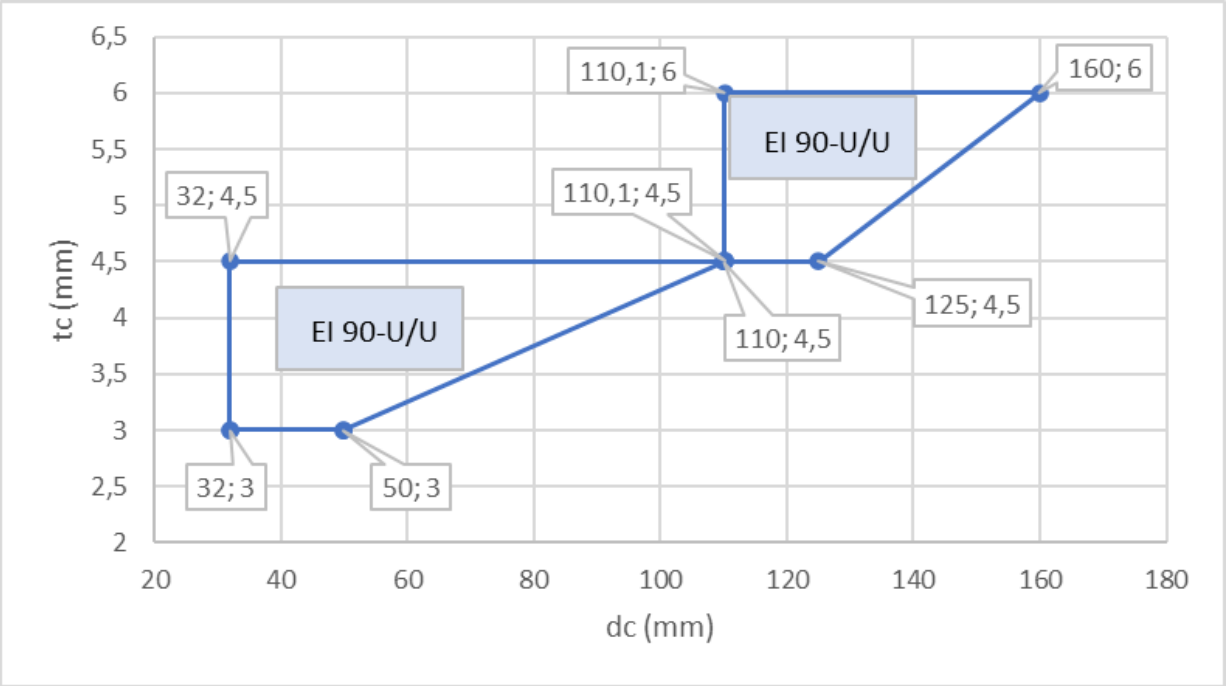


Figure 210: Classified pipe range for Geberit Silent Pro in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm EI 90 U/U

8.8.1.12.5 PP pipes, non-regulated (Rehau Raupiano Plus) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 211 and Figure 212 is valid for pipes made from:

- For Rehau Raupiano Plus only
- Consider relevant Design Group (DG) for CFS-C EL

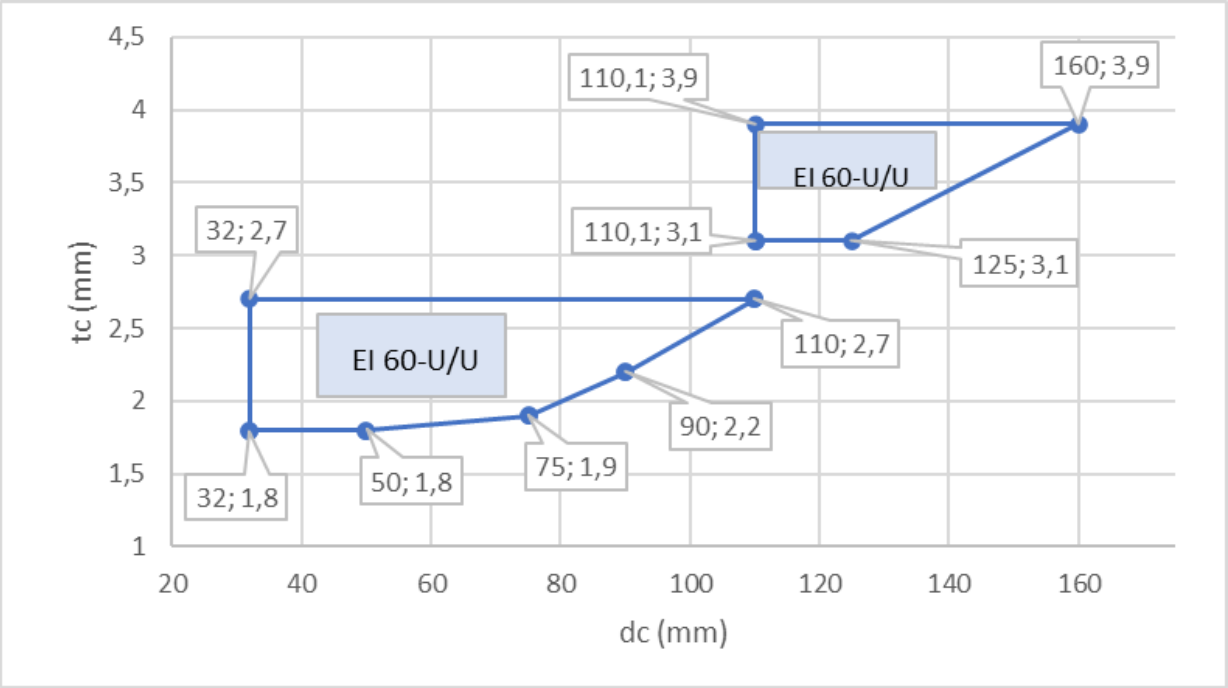


Figure 211: Classified pipe range for Rehau Rautitan Plus in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm for EI 60 U/U

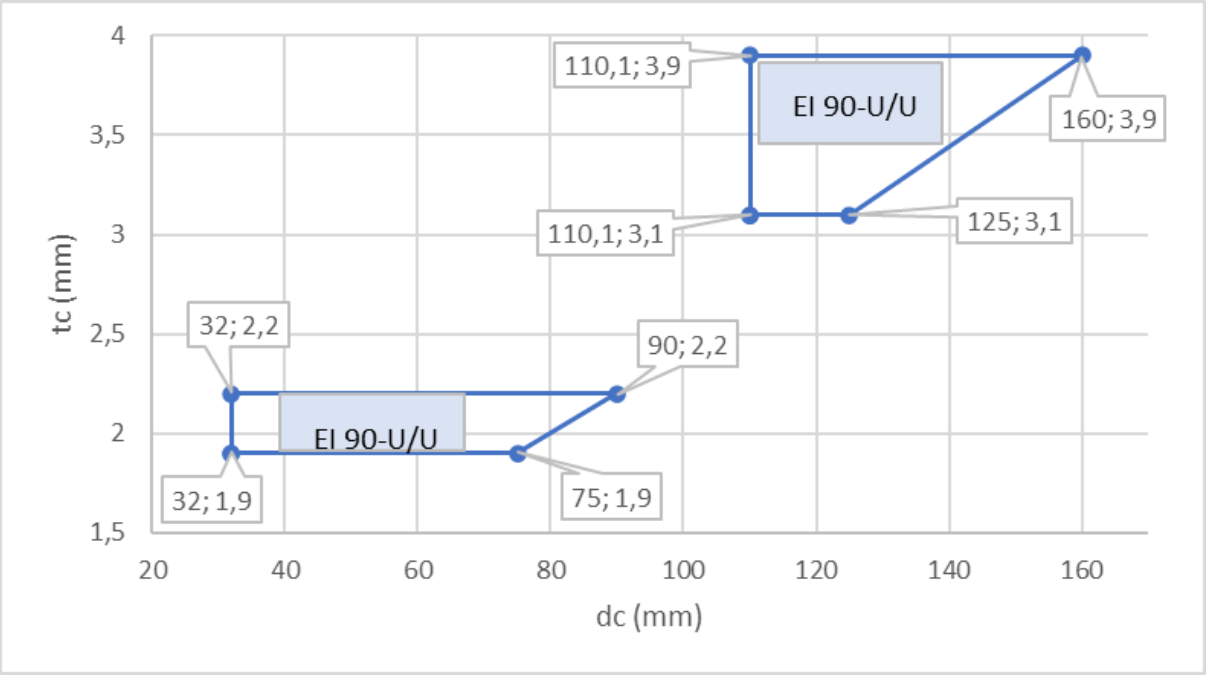


Figure 212: Classified pipe range for Rehau Rautitan Plus in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm for EI 90 U/U

8.8.1.12.6 PP pipes, non-regulated (Poloplast POLO-KAL NG/XS) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 213 and Figure 214 is valid for pipes made from:

- For Poloplast POLO-KAL NG/XS only
- Consider relevant Design Group (DG) for CFS-C EL

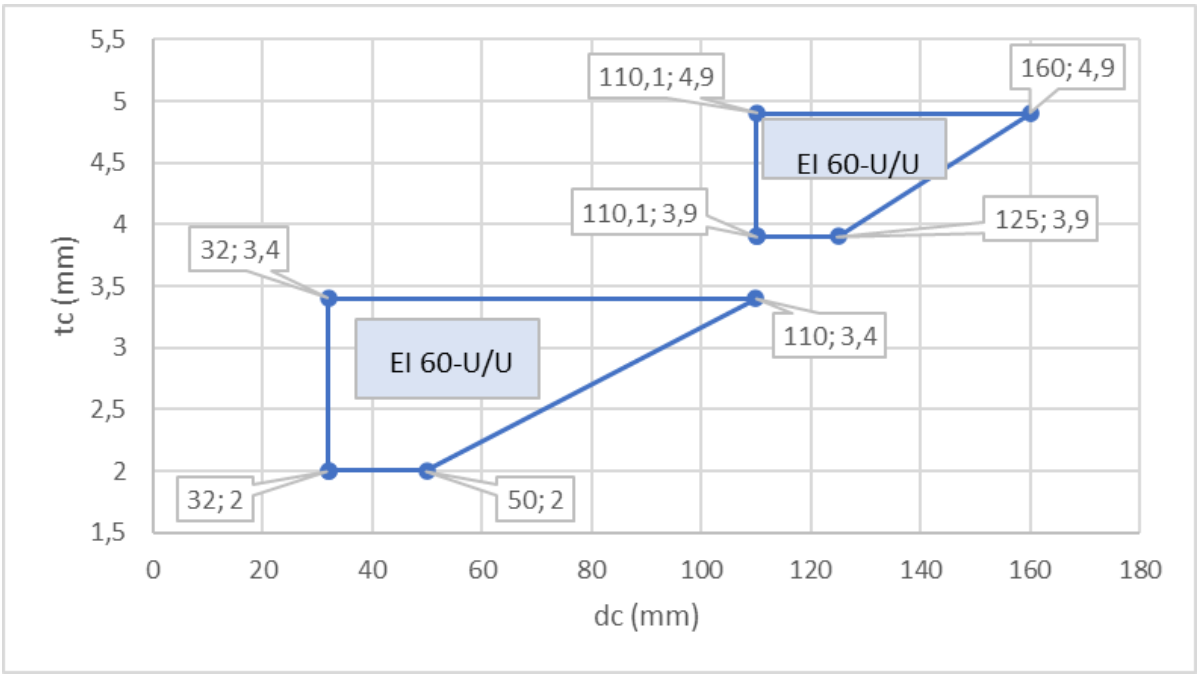


Figure 213: Classified pipe range for Poloplast POLO-KAL NG/XS in DG 1 and 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm for EI 60 U/U

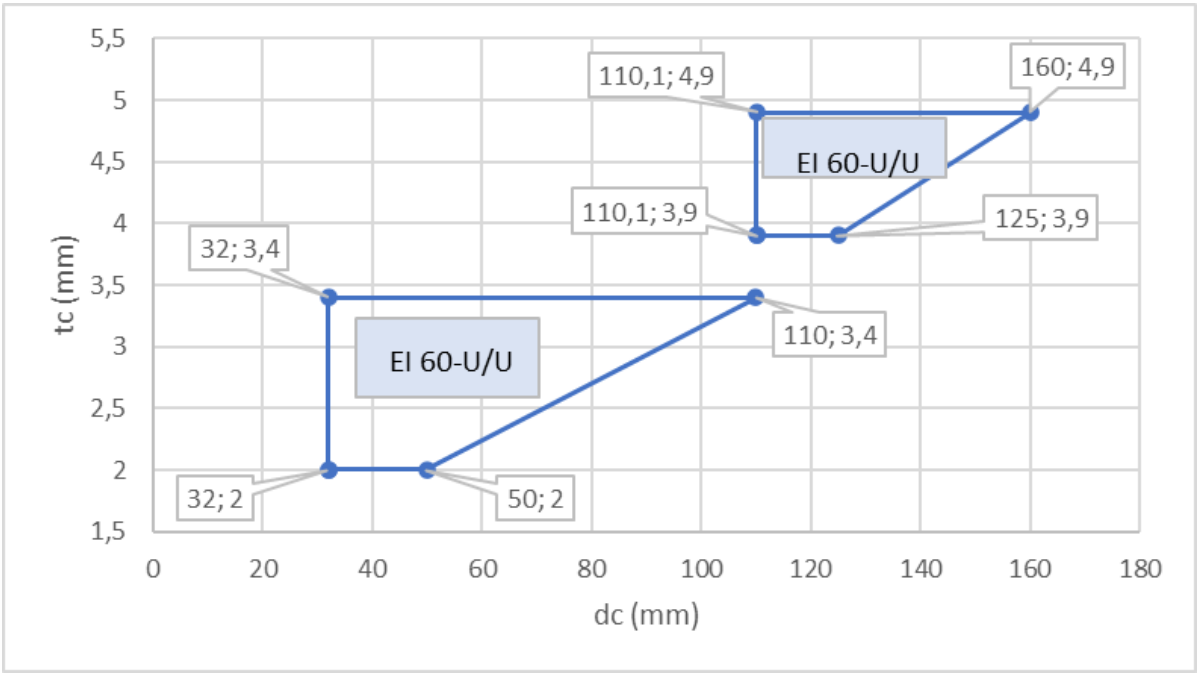


Figure 214: Classified pipe range for Poloplast POLO-KAL NG/XS in DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm for EI 90 U/U

8.8.1.12.7 PP pipes acc. EN 1451-1 in DG 1 in BBS floor

Classification shown in Figure 215 and Figure 216 is valid for pipes made from:

- PP according EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL

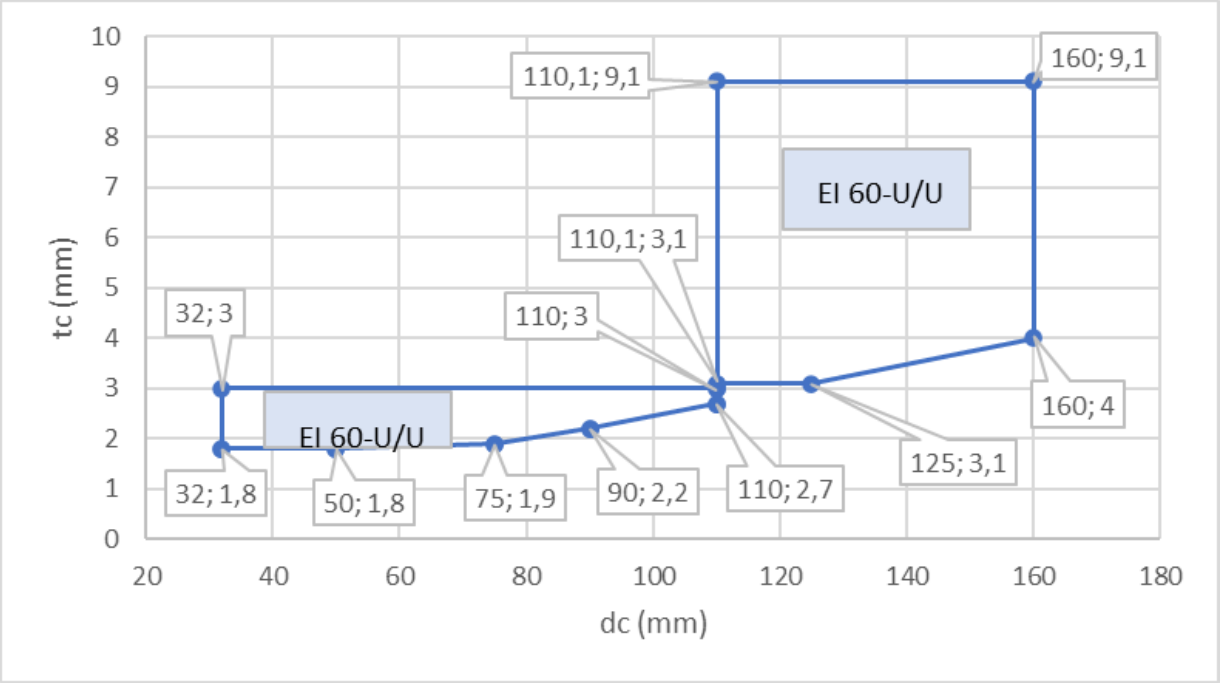


Figure 215: Classified pipe range for PP-pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$ mm for EI 60-U/U

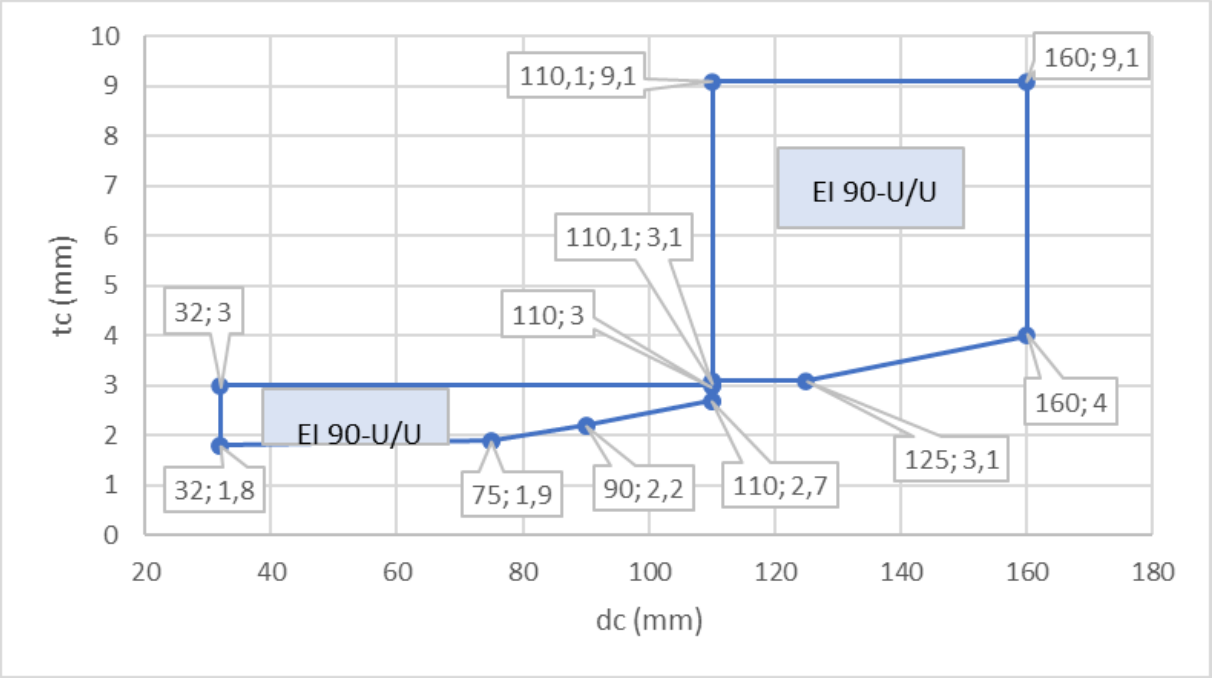


Figure 216: Classified pipe range for PP-pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$mm for E I 90-U/U

8.8.1.12.8 PP pipes, non-regulated (Wavin SiTech+) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 221 is valid for pipes made from:

- For Wavin SiTech+ only
- Consider relevant Design Group (DG) for CFS-C EL

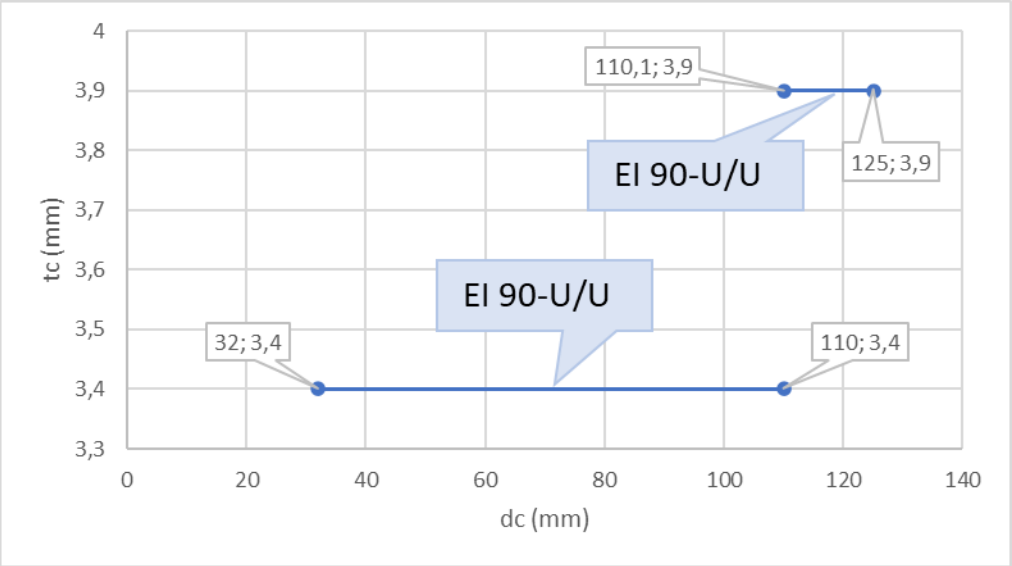


Figure 217: Classified pipe range for Wavin SiTech+ pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$mm for EI 90-U/U

8.8.1.12.9 PP pipes, non-regulated (GF Silenta Premium) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 222 is valid for pipes made from:

- For GF Silenta Premium only
- Consider relevant Design Group (DG) for CFS-C EL

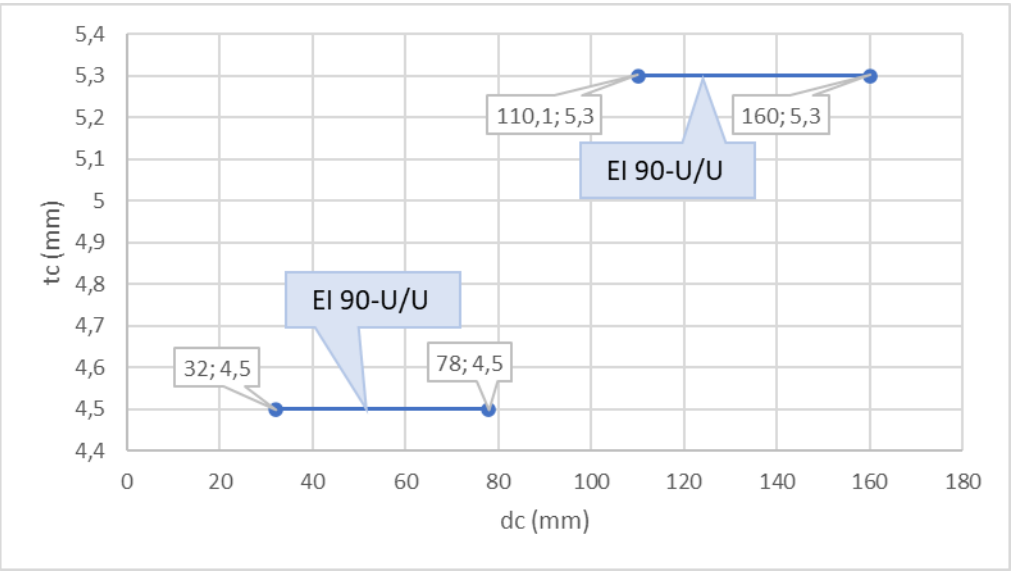


Figure 218: Classified pipe range for GF Silenta Premium pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 100$mm for EI 90-U/U

8.8.1.13 **Penetration service in Binderholz Brettsperrholz BBS-floor, $t_E \geq 140$mm**

8.8.1.13.1 PVC pipes acc. EN 1452-2 in DG 1 and DG 2 in BBS floor

Classification shown in Figure 219 and Figure 220 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL
- Carefully consider disclaimer in 8.2.16

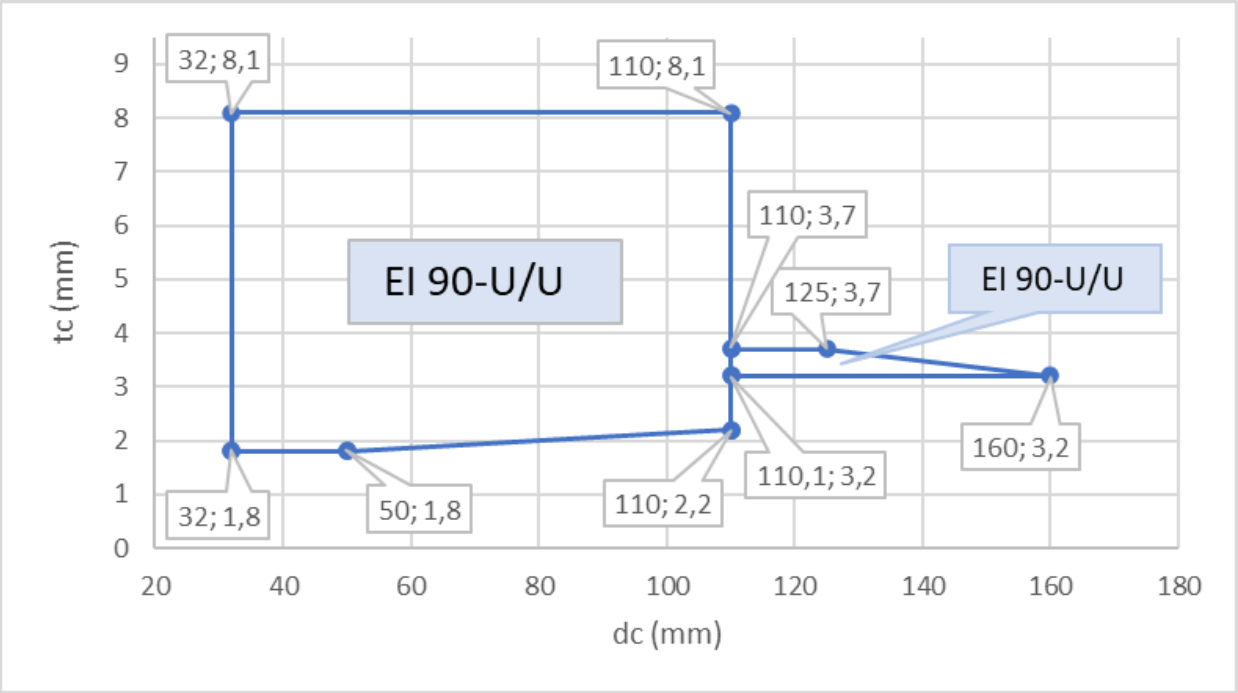


Figure 219: Classified pipe range for PVC pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

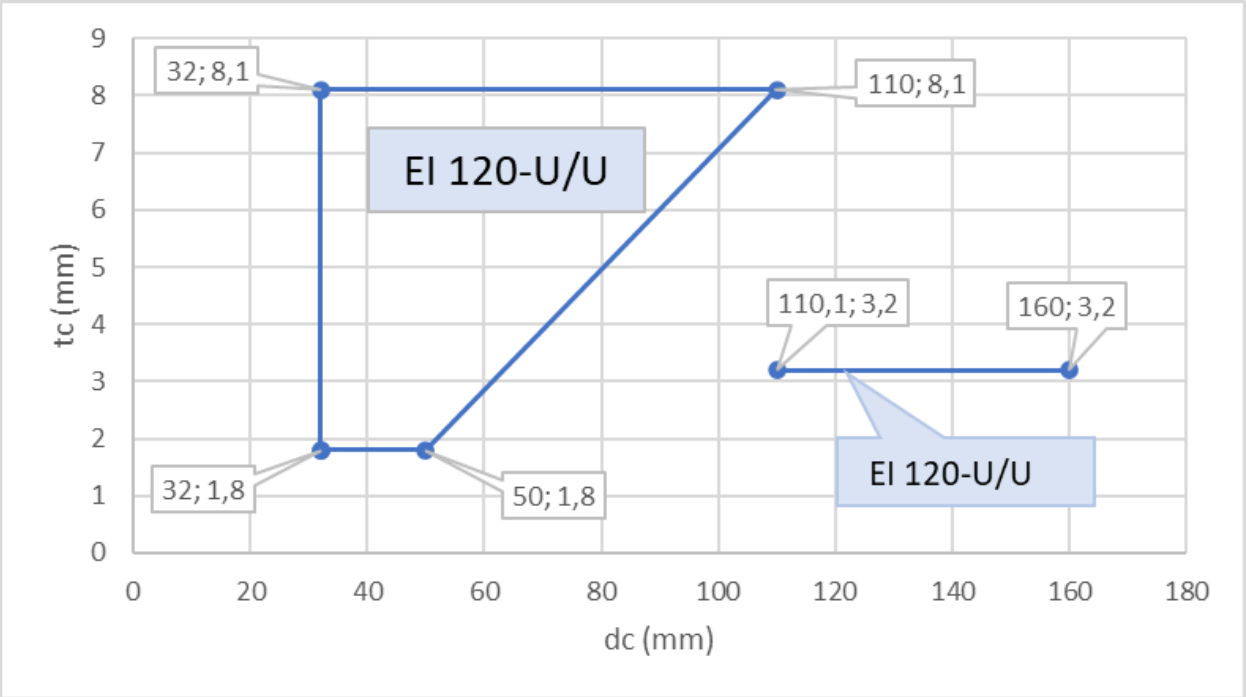


Figure 220: Classified pipe range for PVC pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 120-U/U

8.8.1.13.2 PE pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 and DG 2 in BBS floor

Classification shown in Figure 221 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL

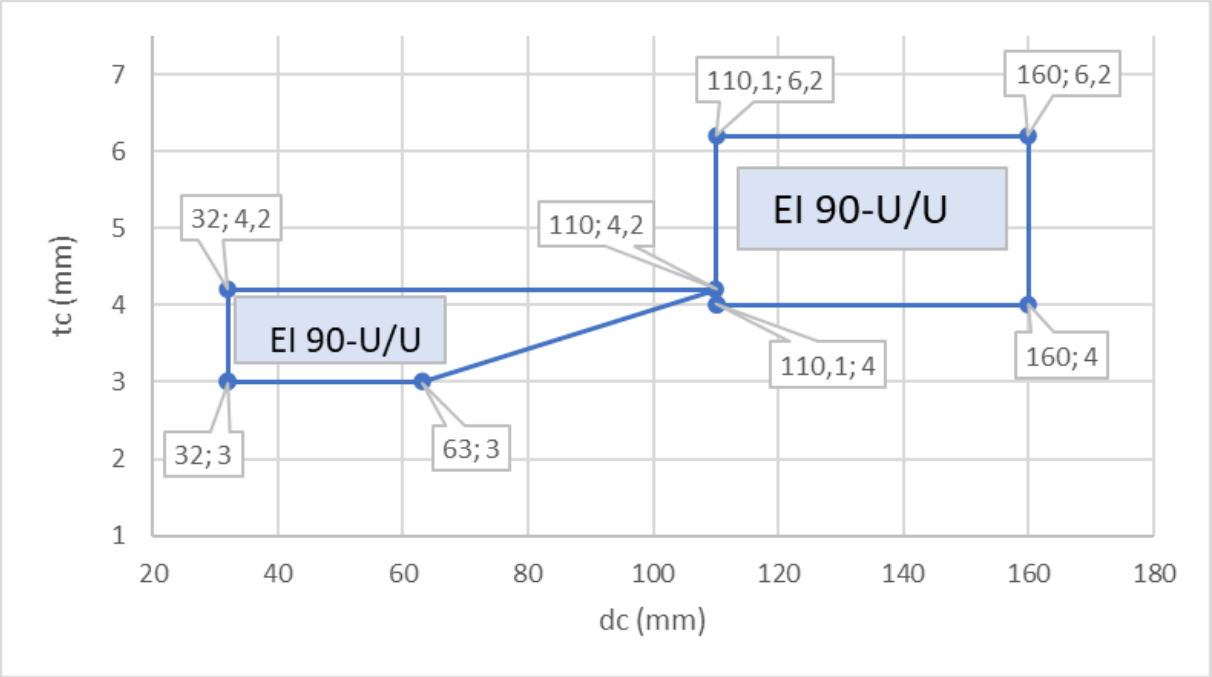


Figure 221: Classified pipe range for PE, ABS pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

8.8.1.13.3 PP pipes acc. EN 1451-1 in DG 1 and DG 2 in BBS floor

Classification shown in Figure 222 and Figure 223 is valid for pipes made from:

- PP according EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL

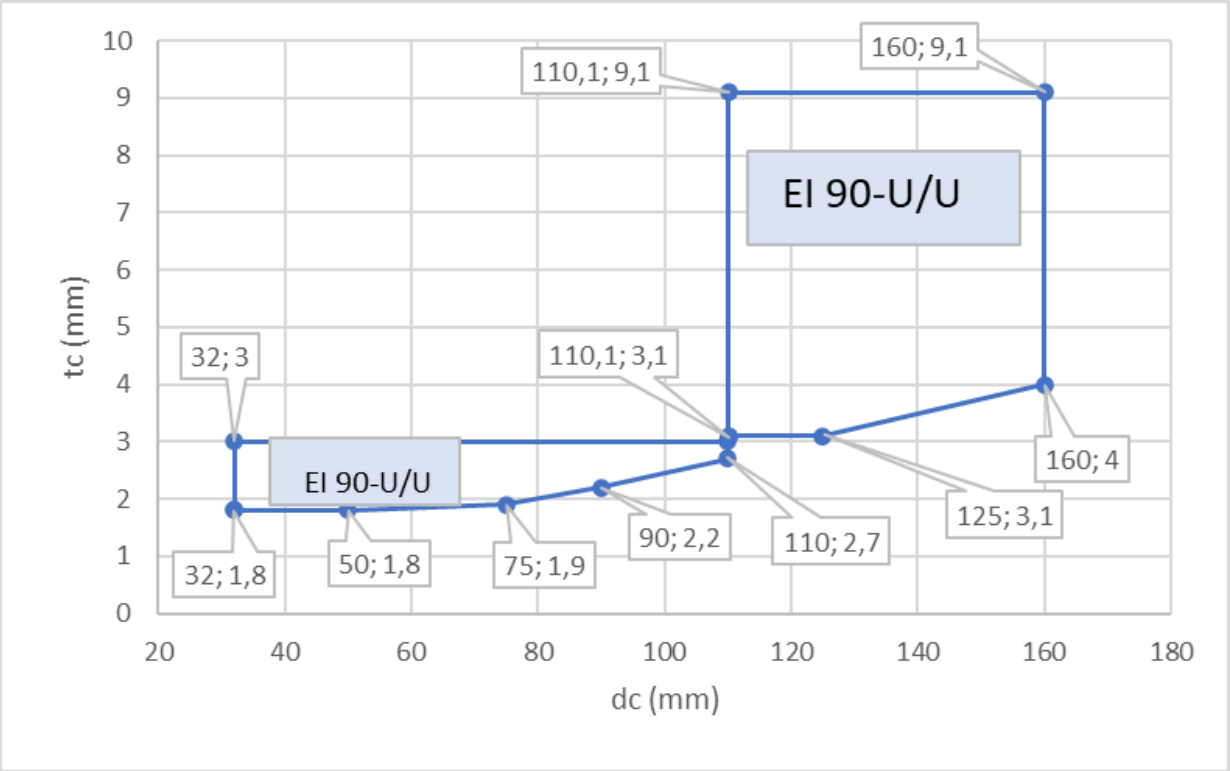


Figure 222: Classified pipe range for PP pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

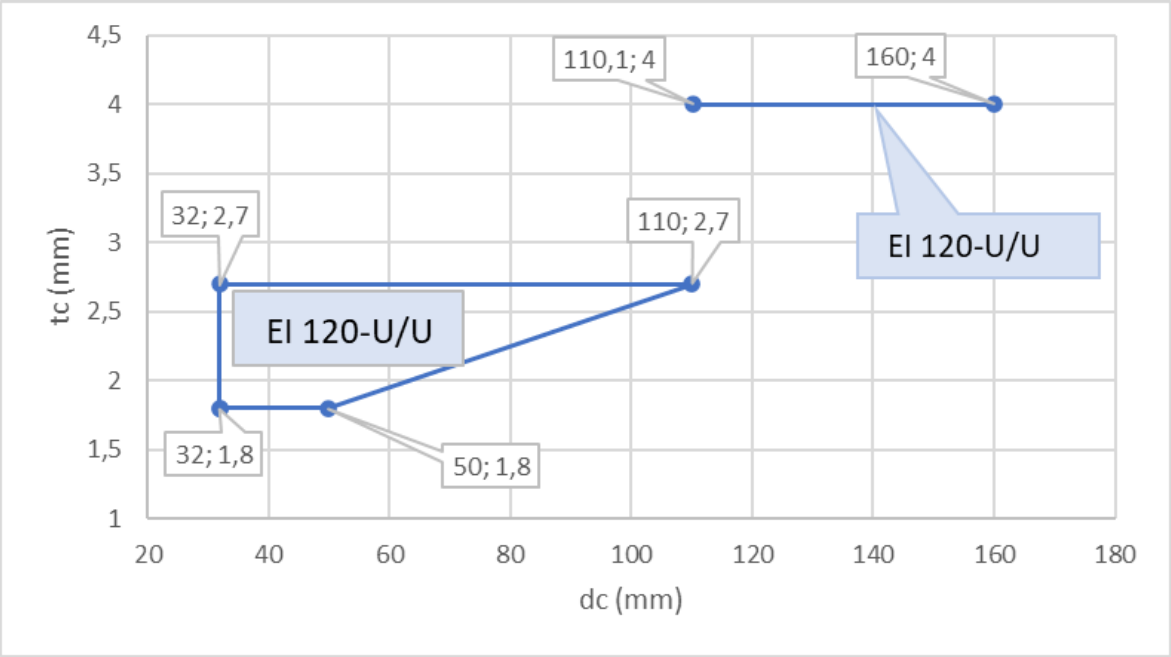


Figure 223: Classified pipe range for PP pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 120-U/U

8.8.1.13.4 PE pipes, non-regulated (Geberit Silent dB20) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 224 and Figure 225 is valid for pipes made from:

- For Geberit Silent dB20 only
- Consider relevant Design Group (DG) for CFS-C EL

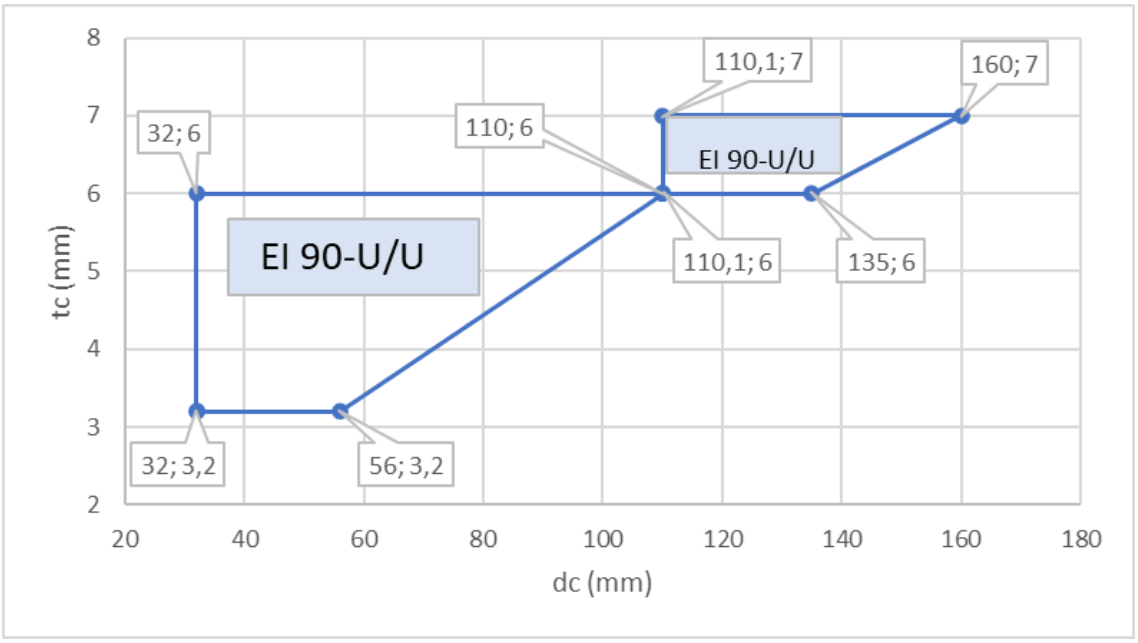


Figure 224: Classified pipe range for PP pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

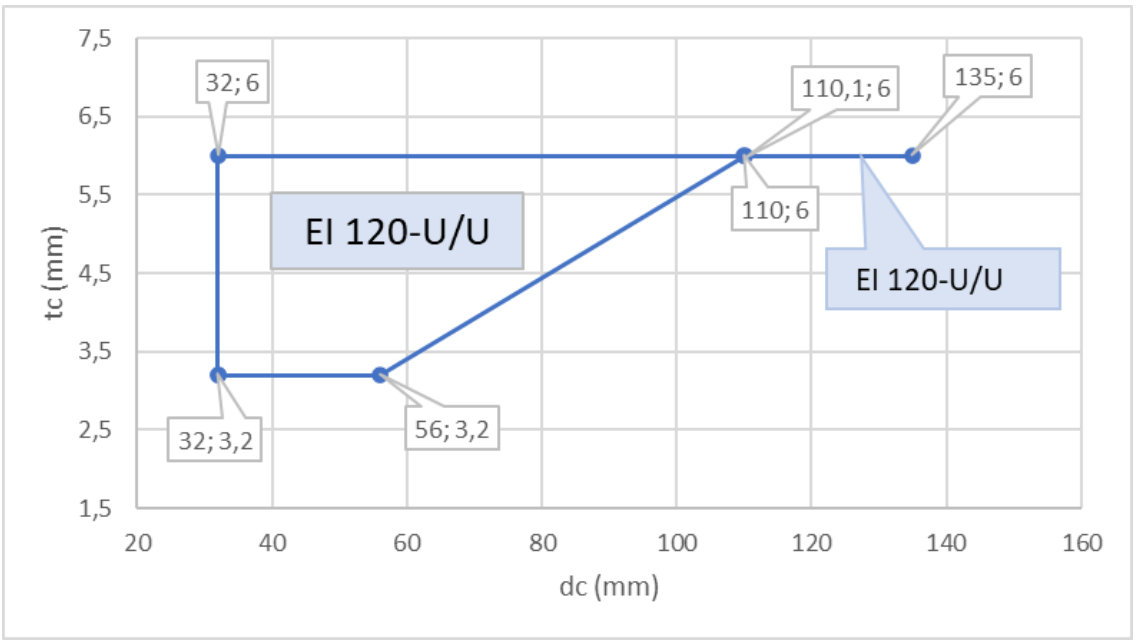


Figure 225: Classified pipe range for PP pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 120-U/U

8.8.1.13.5 PP pipes, non-regulated (Geberit Silent Pro) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 226 and Figure 227 is valid for pipes made from:

- For Geberit Silent Pro only
- Consider relevant Design Group (DG) for CFS-C EL

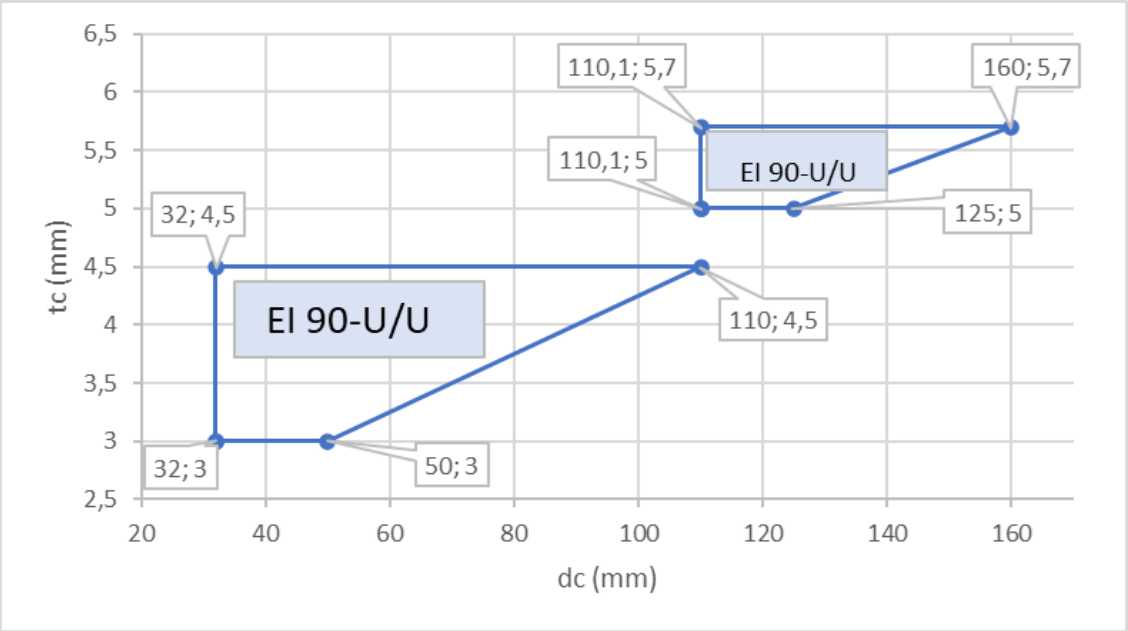


Figure 226: Classified pipe range for Geberit Silent Pro pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

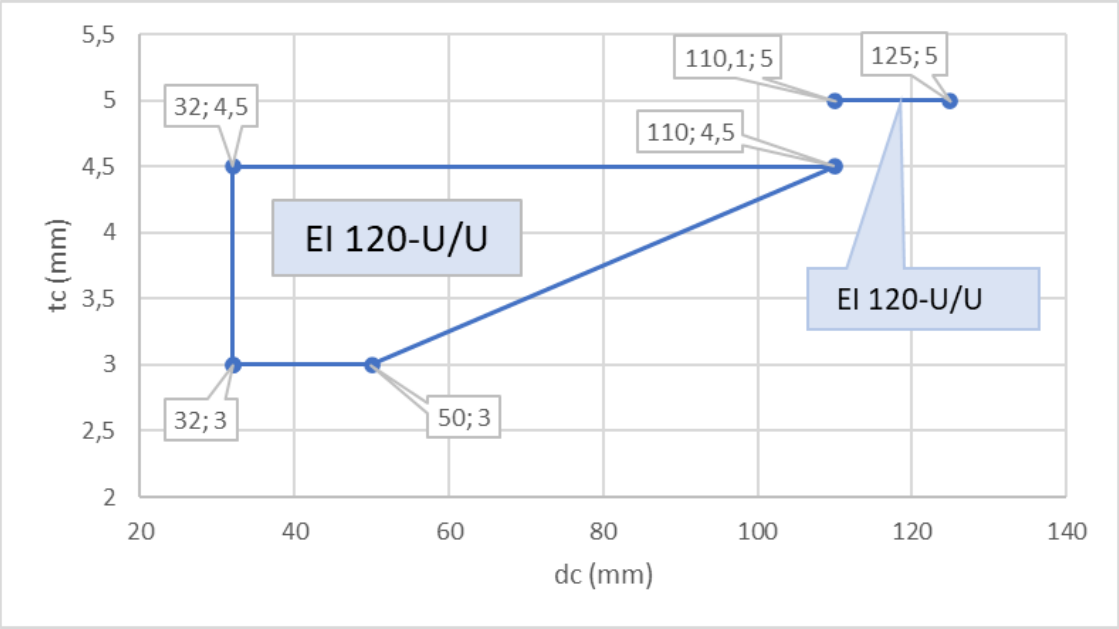


Figure 227: Classified pipe range for Geberit Silent Pro pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 120-U/U

8.8.1.13.6 PP pipes, non-regulated (Rehau Raupiano Plus) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 228 and Figure 229 is valid for pipes made from:

- For Rehau Raupiano Plus only
- Consider relevant Design Group (DG) for CFS-C EL

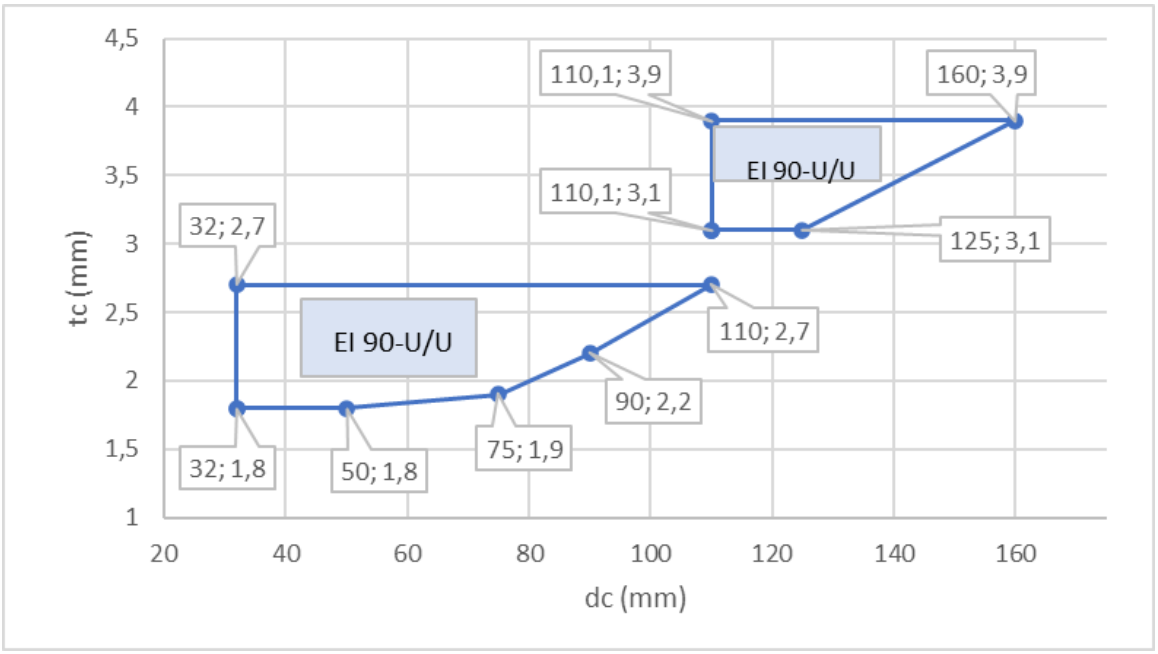


Figure 228: Classified pipe range for Rehau Raupiano Plus pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

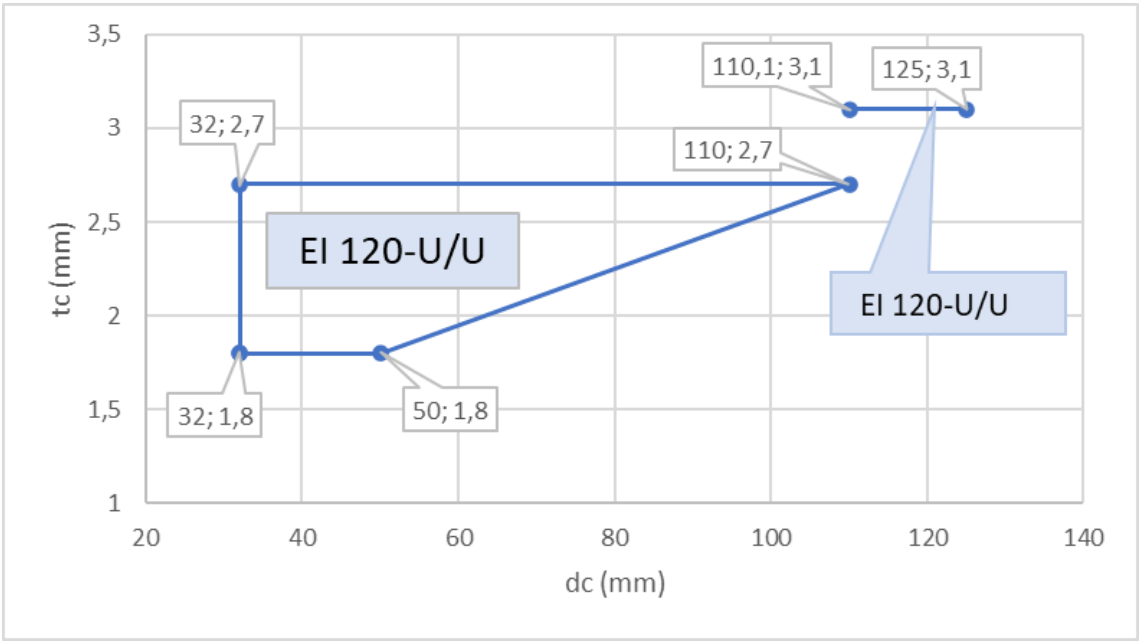


Figure 229: Classified pipe range for Rehau Raupiano Plus pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 120-U/U

8.8.1.13.7 PP pipes, non-regulated (Poloplast POLO-KAL NG/XS) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 230 and Figure 231 is valid for pipes made from:

- For Poloplast POLO-KAL NG/XS only
- Consider relevant Design Group (DG) for CFS-C EL

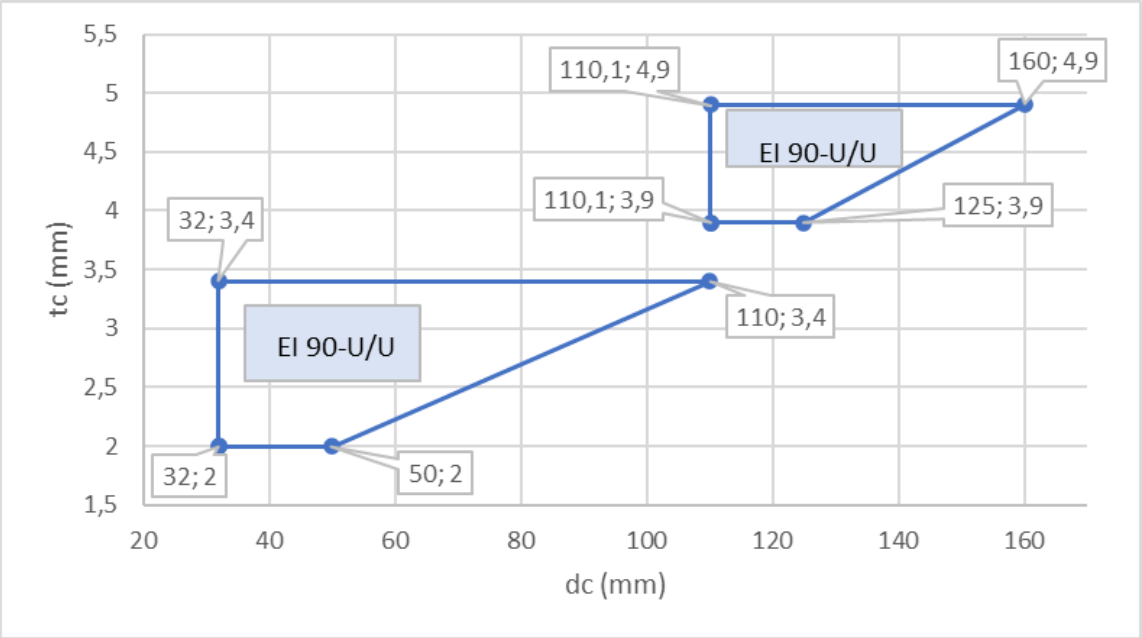


Figure 230: Classified pipe range for Poloplast POLO-KAL NG/XS pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

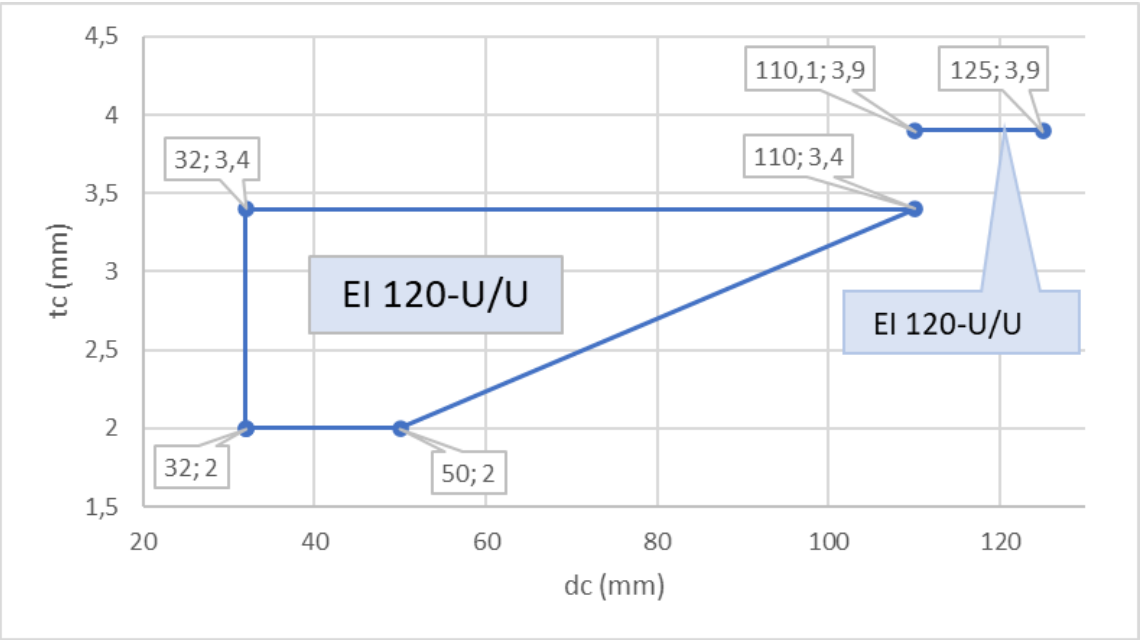


Figure 231: Classified pipe range for Poloplast POLO-KAL NG/XS pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 120-U/U

8.8.1.13.8 PP pipes, non-regulated (Wavin SiTech+) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 232is valid for pipes made from:

- For Wavin SiTech+ only
- Consider relevant Design Group (DG) for CFS-C EL

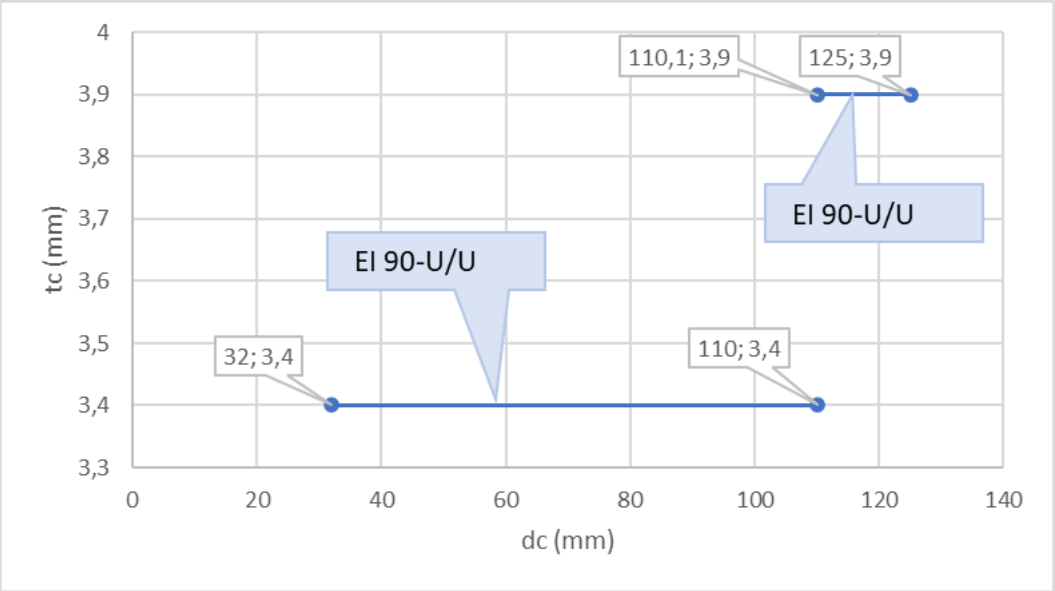


Figure 232: Classified pipe range for Wavin SiTech+ pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

8.8.1.13.9 PP pipes, non-regulated (GF Silenta Premium) in DG 1 and DG 2 in BBS floor

Classification shown in Figure 233 is valid for pipes made from:

- For GF Silenta Premium only
- Consider relevant Design Group (DG) for CFS-C EL

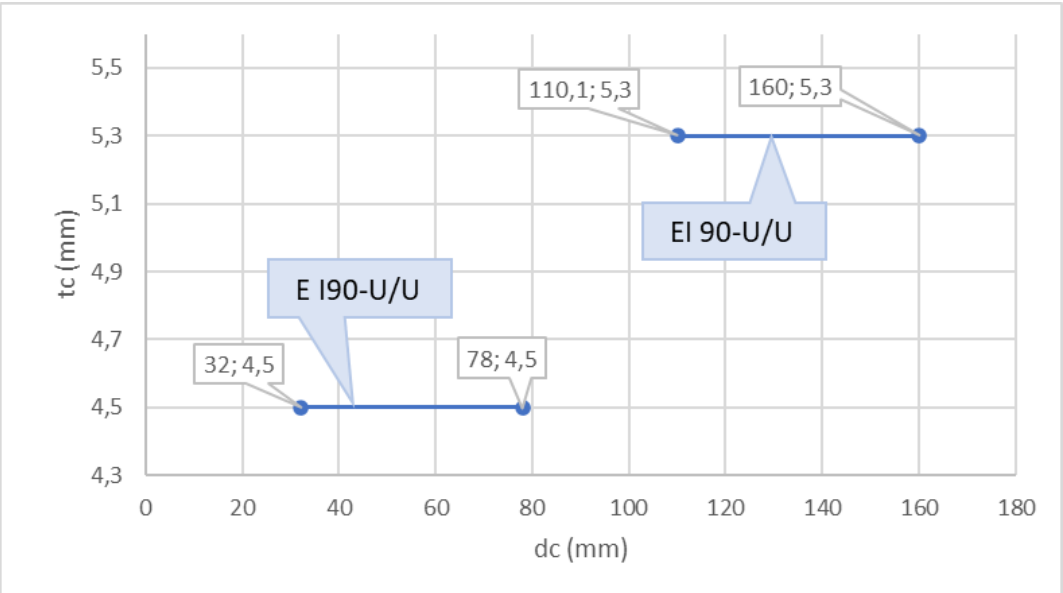


Figure 233: Classified pipe range for GF Silenta Premium pipes in DG 1 and DG 2, sealed with CFS-C EL in BBS-floor, $t_E \geq 140$ mm for EI 90-U/U

8.9 Other timber floors

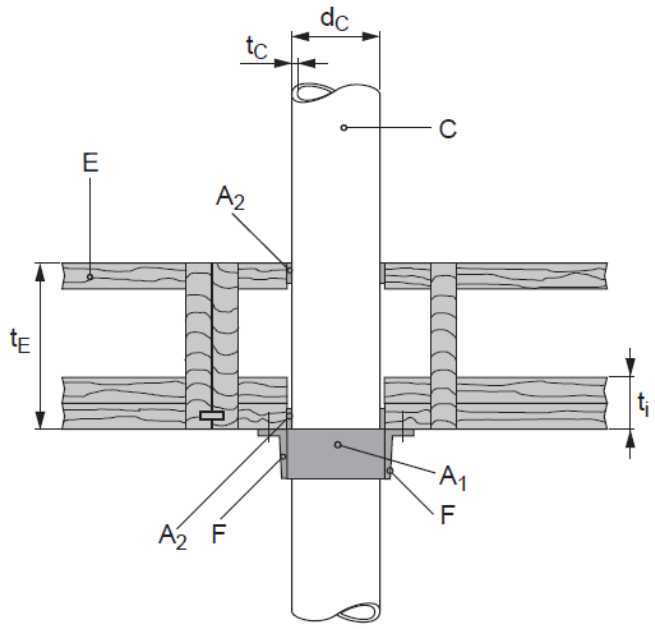
8.9.1 Lignatur timber floors

8.9.1.1 Specific characteristics Lignatur timber floors

- Lignatur floor element EI 60
- Overall element thickness t_E = 160 mm
- Lignatur floor element consists of horizontal layers, stabilized by vertical ribs
- Ribs and layers to be made of spruce-wood
- Ribs create in between lower and upper wood layer an empty space of 65 mm
- Two glued together layers of spruce wood on soffit; 31 mm and 33 mm (t_1)
- Upper wood layer is 31 mm
- For details see 8.9.1.2

8.9.1.2 Penetrating items

- For assessed penetrants refer to 8.9.1.9
- Single pipe penetration



Pict. 8.9.1.2 A:

Plastic pipe (C) in DG 1,
Penetrating a sprucewood Lignatur floor element.

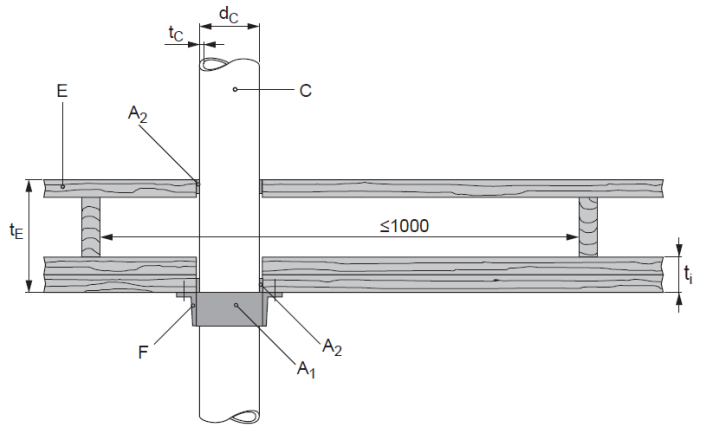
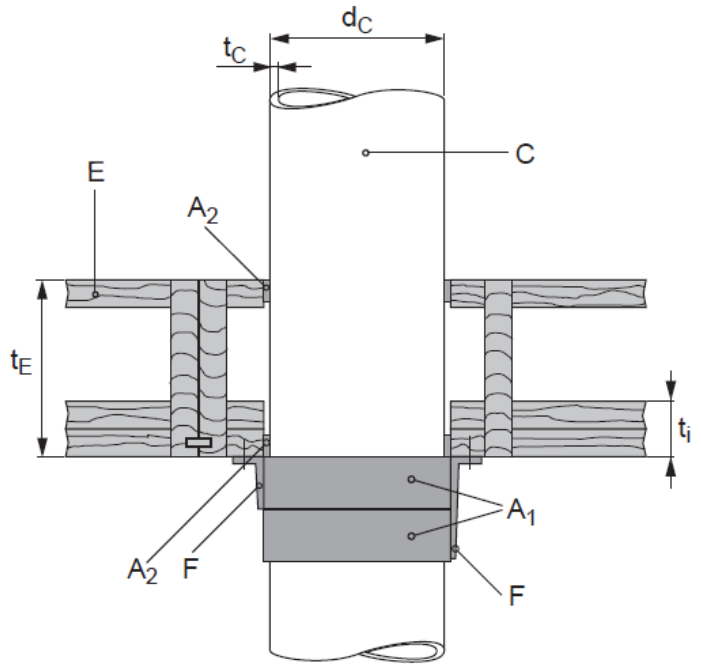
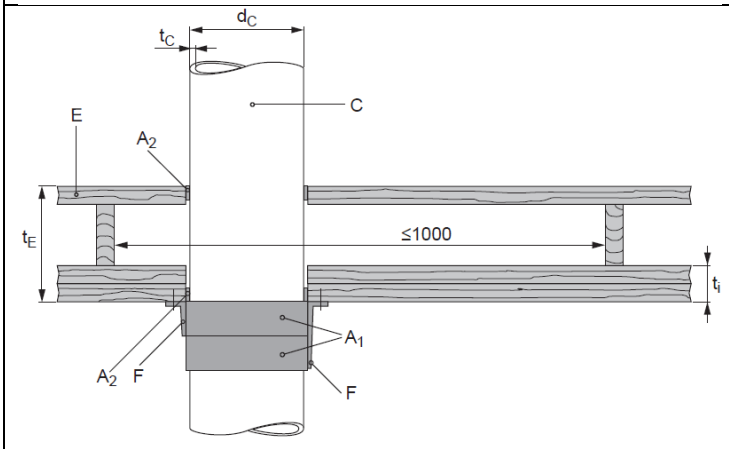
	Pict. 8.9.1.2 B: Plastic pipe (C) in DG 1, Penetrating a sprucewood Lignatur floor element.
	Pict. 8.9.1.2 C: Plastic pipe (C) in DG 2, Penetrating a sprucewood Lignatur floor element.
	Pict. 8.9.1.2 D: Plastic pipe (C) in DG 2, Penetrating a sprucewood Lignatur floor element.

Figure 234: Plastic pipes in DG 1 and DG 2, penetrating Lignatur floor elements in several position

8.9.1.3 Annular gap and gap filler in Lignatur floor elements

- Gap fill to be done with CFS-S ACR
- Gap width: 0 – 15 mm
- Filling depth: ≥ 25 mm from both sides of floor
- Backfilling: not requested

8.9.1.4 Collar fixing in Lignatur floor elements

- For number of hooks (perpendicular pipe penetration): refer to 8.2.5
- Long and short hooks are requested, depending on pipe DG

Hooks to be fixed with:
- HUS3 H 6x80mm,
- Wooden partially threaded screws 6x60mm,
- Hex.head wood screws 6 x 80mm
- Countersunk head screw 5 x 85mm

8.9.1.5 Pipe support in Lignatur floor elemente

- 350 mm from top side of floor element only

8.9.1.6 Receycling of oddments

- No oddments to be used

8.9.1.7 Sound decoupling and insulation on pipe

- No sound decoupling to be used on pipe
- No thermal insulation to be used on pipe

8.9.1.8 Distances

- To all other penetrants: ≥ 200 mm
- To all aperture of support construction: ≥ 200 mm

8.9.1.9 **Penetration service in 160 mm Lignatur floor elements**

8.9.1.9.1 PE pipes acc. EN 1519-1, PE-X, ABS, SAN+PVC pipes in DG 1 in Lignatur floor

Classification shown in Figure 235 is valid for pipes made from:

- PE according to EN 1519-1, EN 12666-1, EN 12201-2 and EN ISO 15494
- PE-X according EN ISO 15875-2
- ABS according EN 1455-1 and EN ISO 15493
- SAN+PVC according ISO 19220
- No limitation for brands/producer
- Consider for relevant Design group (DG) of CFS-C EL
- Perpendicular installation only

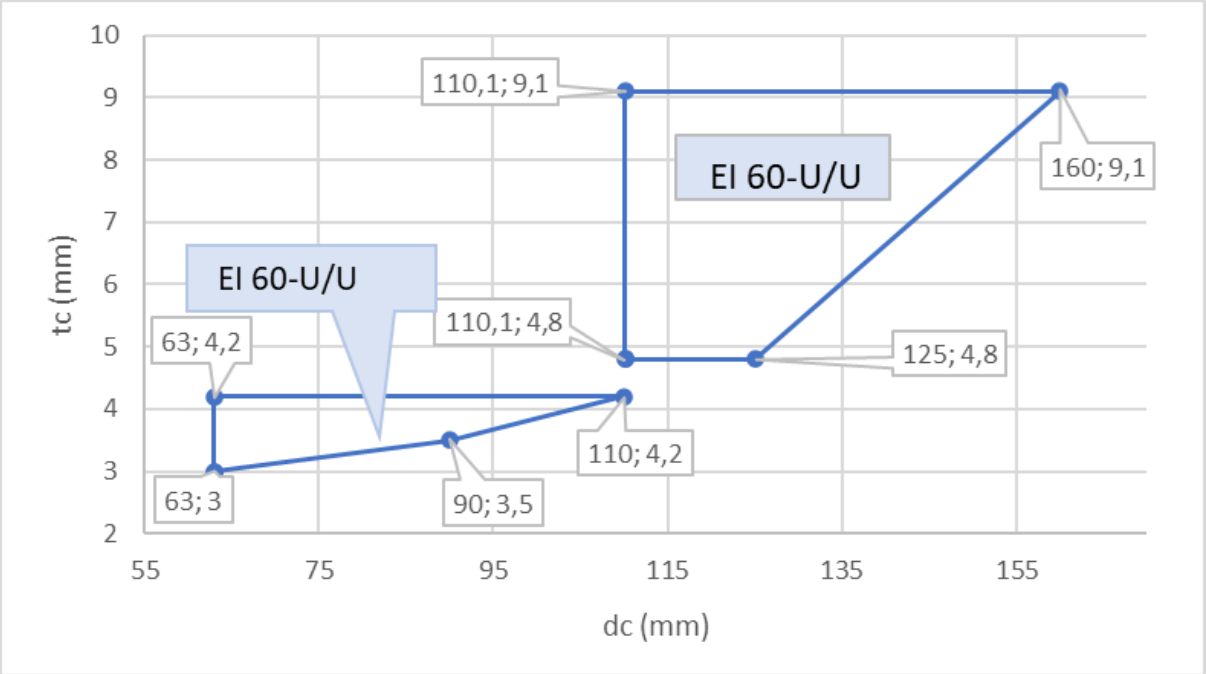


Figure 235: Classified pipe range for PP-pipes in 160 mm Lignatur-floor element, sealed with CFS-C EL in DG 1 and DG 2

8.9.1.9.2 PP pipes acc. EN 1451-1 in DG 1 and DG 2 in Lignatur floor

Classification shown in Figure 236 is valid for pipes made from:

- PP according EN 1452-1, EN ISO 15874, EN ISO 15494
- No limitation for brands/producer
- Consider relevant Design Group (DG) for CFS-C EL
- Perpendicular installation only

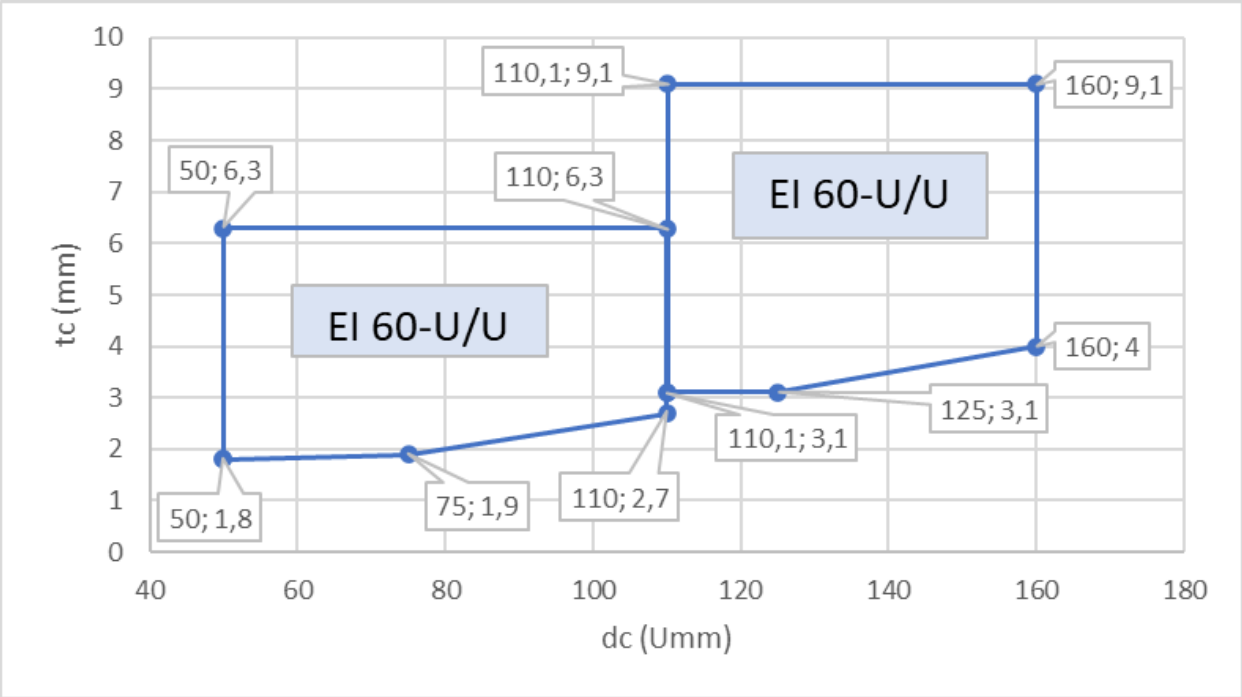


Figure 236: Classified pipe range for PE, ABS-pipes in 160 mm Lignatur-floor element, sealed with CFS-C EL in DG 1 and DG 2

8.9.1.9.3 PVC pipes acc. EN 1452-2 in DG 1 and DG 2

Classification shown in Figure 237 is valid for pipes made from:

- PVC according EN 1452-2, EN 1329-1, EN 1453-1, EN ISO 15493 and DIN 8061/62
- PVC-C according EN 1566-1, EN ISO 15493 and EN ISO 15877-2
- No limitation for brands/producer
- Consider for relevant Design group (DG) of CFS-C EL
- Carefully consider disclaimer in 8.2.16

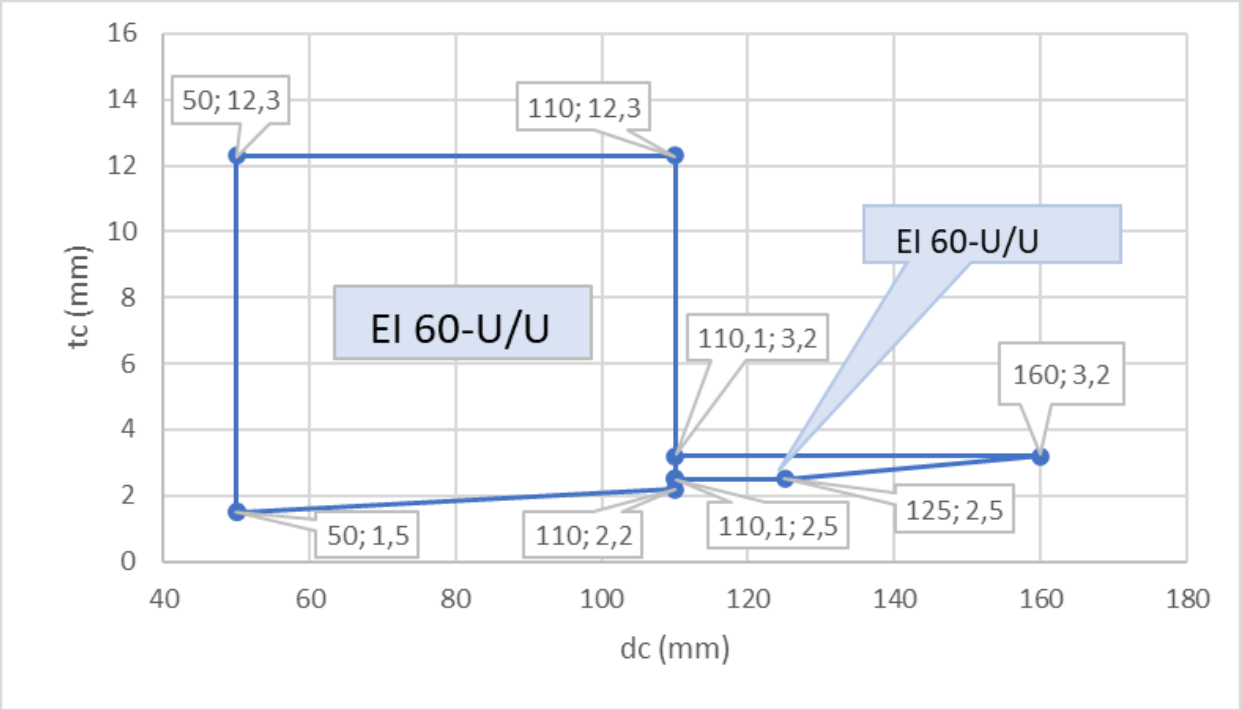


Figure 237: Classified pipe range for PVC pipes in 160 mm Lignatur-floor element, sealed with CFS-C EL in DG 1 and DG 2

8.9.1.9.4 PE pipes, non-regulated (Geberit Silent dB20) in DG 1 and DG 2 in Lignatur floor

Classification shown in Figure 238 is valid for pipes made from:

- For Geberit Silent dB20 only
- Consider relevant Design Group (DG) for CFS-C EL

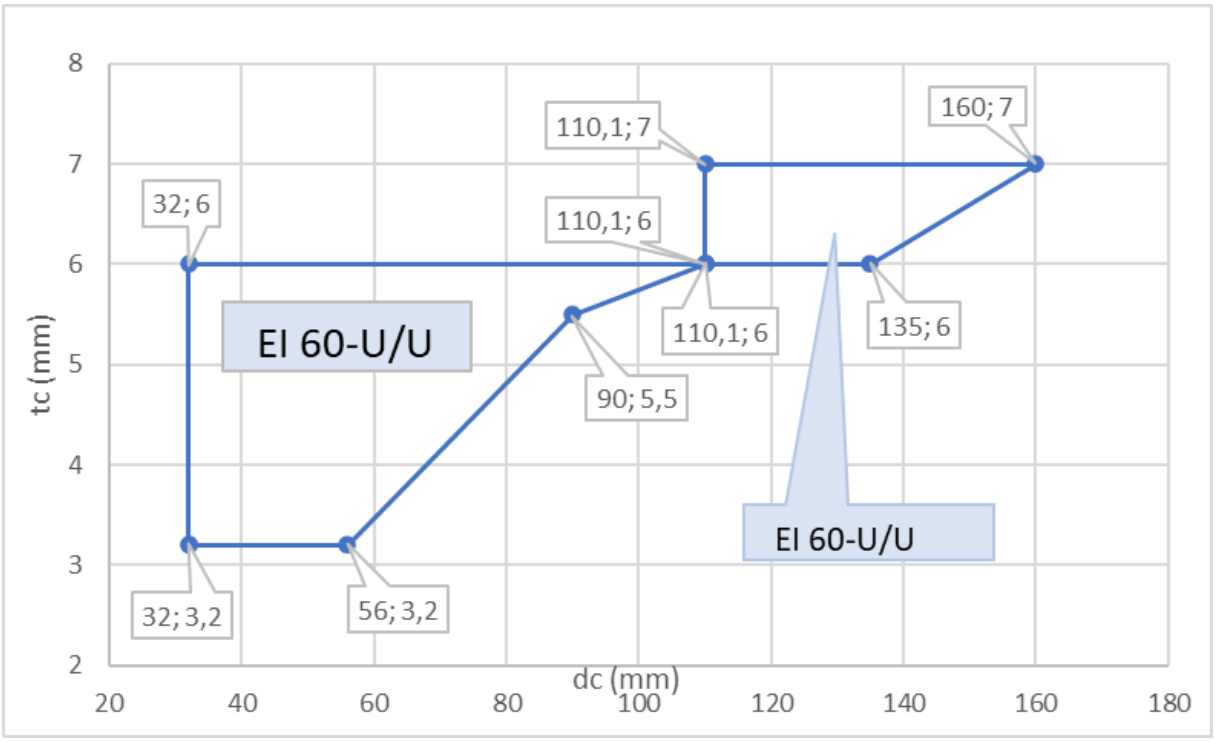


Figure 238: Classified pipe range for Geberit Silent dB20 pipes in 160 mm Lignatur-floor element, sealed with CFS-C EL in DG 1 and DG 2

8.9.1.9.5 PP pipes, non-regulated (Geberit Silent Pro) in DG 1 and DG 2 in Lignatur floor

Classification shown in Figure 239 is valid for pipes made from:

- For Geberit Silent Pro only
- Consider relevant Design Group (DG) for CFS-C EL

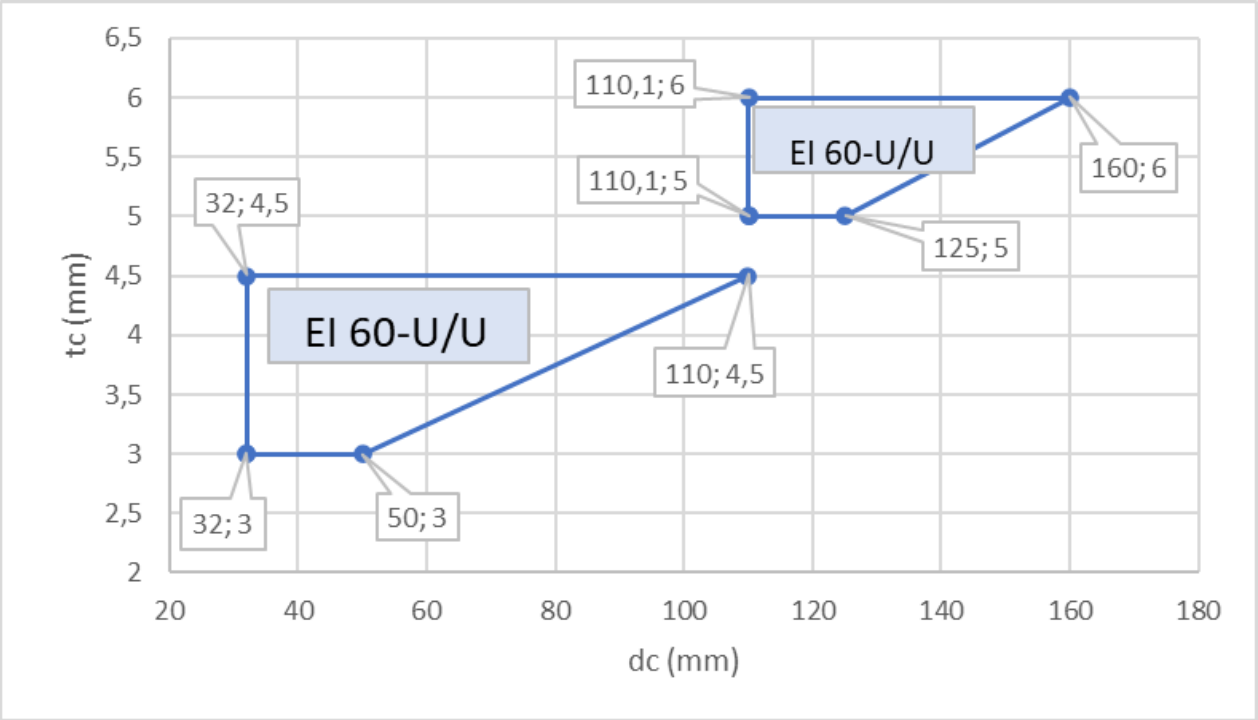


Figure 239: Classified pipe range for Geberit Silent Pro pipes in 160 mm Lignatur-floor element, sealed with CFS-C EL in DG 1 and DG 2

8.9.1.9.6 PP pipes, non-regulated (Rehau Raupiano Plus) in DG 1 and DG 2 in Lignatur floor

Classification shown in Figure 240 is valid for pipes made from:

- For Rehau Raupiano Plus only
- Consider relevant Design Group (DG) for CFS-C EL

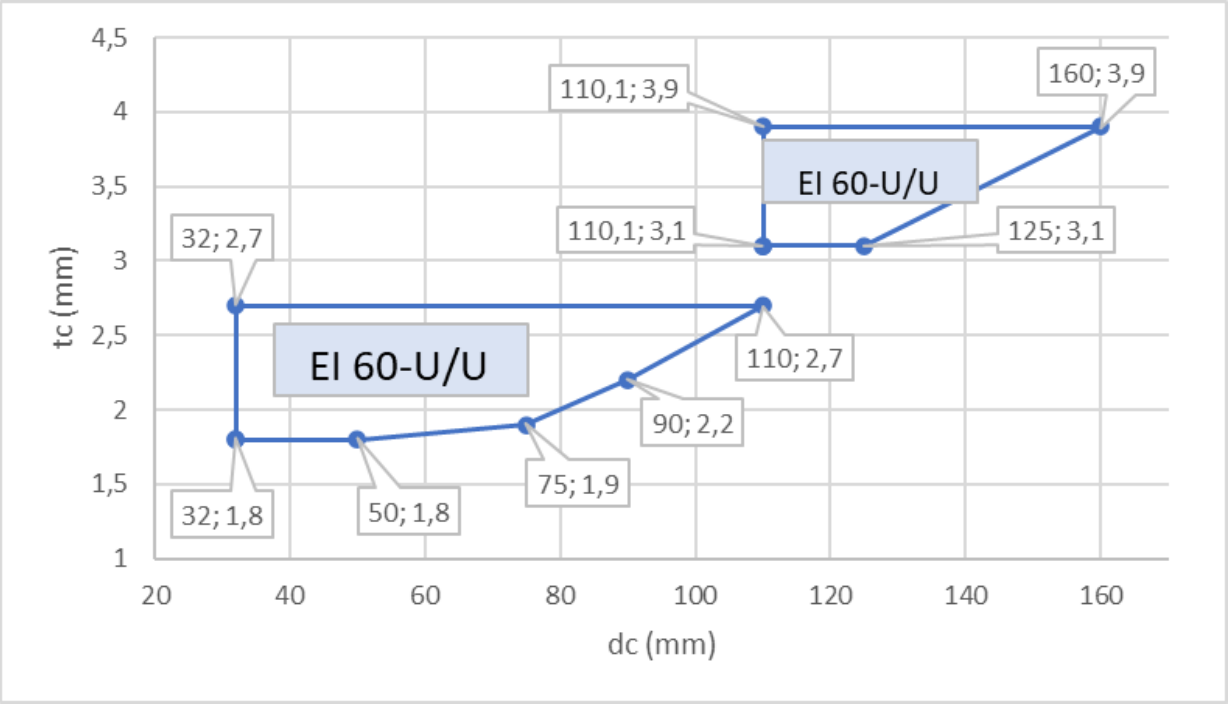


Figure 240: Classified pipe range for Rehau Raupiano Plus pipes in 160 mm Lignatur floor element, sealed with CFS-C EL in DG 1 and DG 2

8.9.1.9.7 PP pipes, non-regulated (Wavin Sitech) in DG 1 and DG 2 in Lignatur floor

Classification shown in Table 120 is valid for pipes made from:

- For Wavin Sitech only
- Consider relevant Design Group (DG) for CFS-C EL

Pipe brand, producer	Pipe outside nominal diameter (mm)	Pipe wall thickness (mm)	Design Group Collar CFS-C EL	Classification
Wavin Sitech	110	3,6	1	EI 60-U/U
Wavin Sitech	125	3,9	2	EI 60-U/U

Table 120: Classified pipe range for Wavin Sitech pipes in 160 mm Lignatur floor element, sealed with CFS-C EL in DG 1 and DG 2

8.9.1.9.8 PP pipes, non-regulated (Poloplast POLO-KAL 3S) in DG 1 and DG 2 in Lignatur floor

Classified pipe brand and range:

Pipe brand, producer	Pipe outside nominal diameter (mm)	Pipe wall thickness (mm)	Design Group Collar CFS-C EL	Classification
Poloplast POLO-KAL 3S	160	7,5	2	EI 60-U/U

Table 121: Classified non-regulated PP-pipes (Poloplast POLO-KAL 3S), sealed with CFS-C EL in Lignatur floor

8.9.2 Lignotrend timber floors

8.9.2.1 Specific characteristics Lignotrend timber floors

- Lignotrend floor element LIGNO Rib Q2 Acoustic Z2 169 – EI 60, overall element thickness t_E = 169mm and
- Lignotrend floor element LIGNO Rib Q2 Acoustic Z2 196 – EI 90, overall element thickness t_E = 196mm
- Lignatur floor elements consists of horizontal layers, stabilized by vertical ribs

8.9.2.2 Penetrating items

- For assessed penetrants refer to 8.9.1.9
- Single pipe penetration

8.9.2.3 Annular gap and gap filler in Lignotrend floor elements

- Gap fill to be done with CFS-S ACR
- Gap width: 0 – 23 mm
- Filling depth: ≥ 20 mm from both sides of floor
- Backfilling: not requested

8.9.2.4 Collar fixing in Lignotrend floor elements

- For number of hooks (perpendicular pipe penetration): refer to 8.2.5
- Long and short hooks are requested, depending on pipe DG

Hooks to be fixed with
- HUS H 6 x 100mm,

8.9.2.5 Pipe support in Lignotrend floor elemente

- 350 mm from top side of floor element only

8.9.2.6 Receycling of oddments

- No oddments to be used

8.9.2.7 Sound decoupling and insulation on pipe

- No sound decoupling to be used on pipe
- No thermal insulation to be used on pipe

8.9.2.8 Distances

- To all other penetrants: ≥ 100 mm

8.9.2.9 Hilti Firestop Bandage CFS-B to be used together with Hilti Firestop Collar CFS-C EL

- Hilti Firestop Bandage CFS-B (A_6) and collar CFS-C EL (A_1) to be used together in all penetration seals on plastic pipes in Lignotrend timber floors
- Number of layers CFS-B to be used: always two
- CFS-B to be wrapped tightly around the pipe, secured twice by metal wire
- Overlap CFS-B: approximately 20 mm
- CFS-B to be moved into the ceiling, flush to the underside of the ceiling
- Collar CFS-C EL to be installed below the bandage CFS-B

8.9.2.10 Penetration service in 169 mm Lignotrend floor elements (EI60)

8.9.2.10.1 PoloKal XS (PoloPlast) in 169 mm Lignotrend floor element in DG 1

Classification shown in Figure 241 is valid for:

- PoloKal XS pipes, made by PoloPlast
- CFS-C EL in DG 1 only

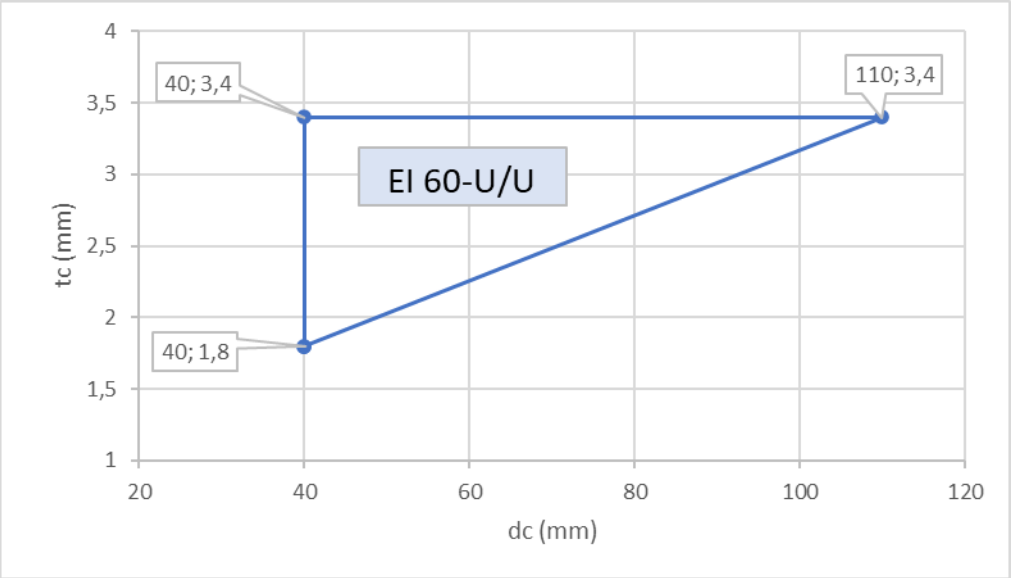


Figure 241: Classified range of PoloKal XS-pipes, sealed with CFS-C EL in DG 1 in 169 mm Lignotrend floor elements

8.9.2.10.2 Silenta Premium (GF) in 169 mm Lignotrend floor element in DG 1 and DG 2

Classification shown in Figure 242 is valid for:

- Silenta Premium pipes, made by Georg Fischer
- Consider for relevant Design group (DG) of CFS-C EL

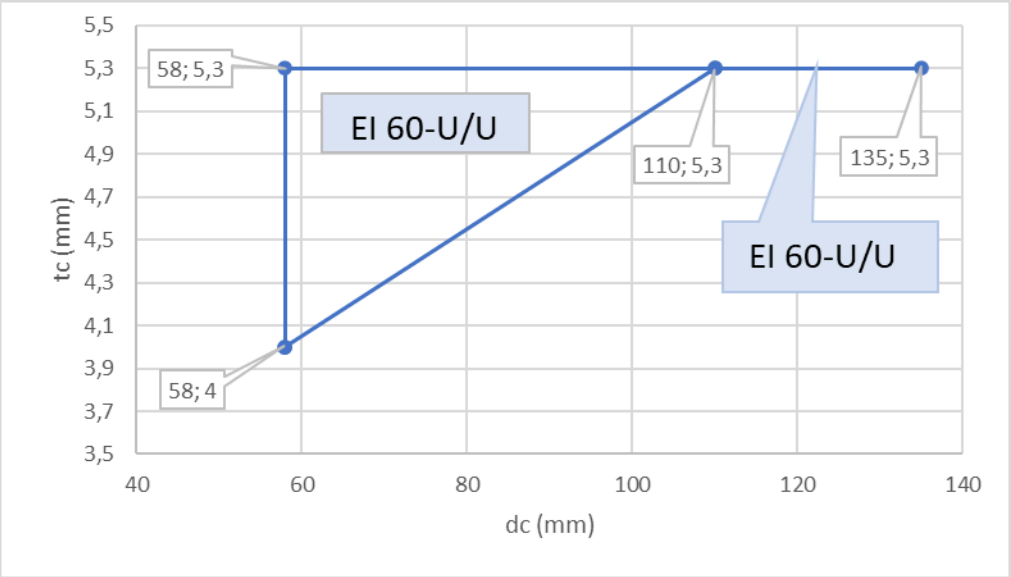


Figure 242: Classified range Silenta Premium pipes, sealed with CFS-C EL in DG 1 and 2 in 169 mm Lignotrend floor elements

8.9.2.10.3 Silenta Pro (Geberit) in 169 mm Lignotrend floor element in DG 1 and DG 2

Classification shown in Figure 243 is valid for:

- Silenta Pro pipes, made by Geberit
- Consider for relevant Design group (DG) of CFS-C EL

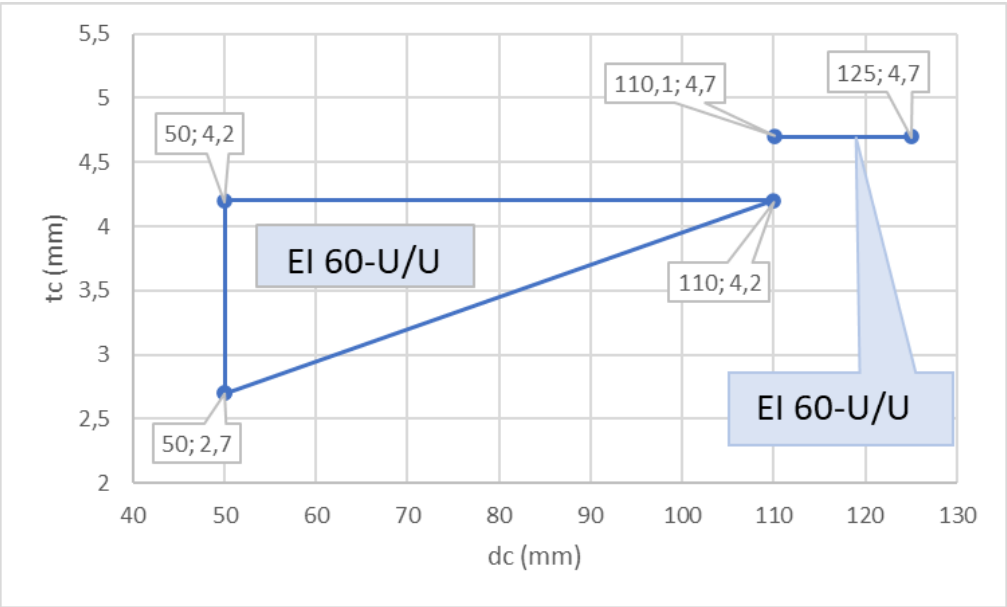


Figure 243: Classified range Silenta Pro - pipes, sealed with CFS-C EL in DG 1 and 2 in 169 mm Lignotrend floor elements

8.9.2.11 **Penetration service in 196 mm Lignotrend floor elements (EI 90)**

8.9.2.11.1 PoloKal XS (PoloPlast) in 196 mm Lignotrend floor element in DG 1

Classification shown in Figure 244 is valid for:

- PoloKal XS pipes, made by PoloPlast
- CFS-C EL in DG 1 only

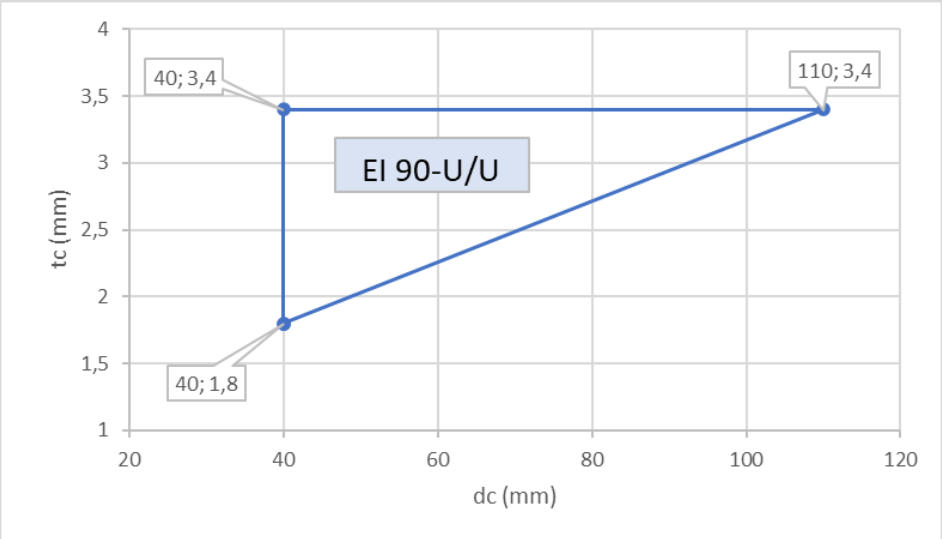


Figure 244: Classified range of PoloKal XS-pipes, sealed with CFS-C EL in DG 1 in 196 mm Lignotrend floor elements

8.9.2.11.2 Silenta Premium (GF) in 196 mm Lignotrend floor element in DG 1 and DG 2

Classification shown in Figure 245 is valid for:

- Silenta Premium pipes, made by Georg Fischer
- Consider for relevant Design group (DG) of CFS-C EL

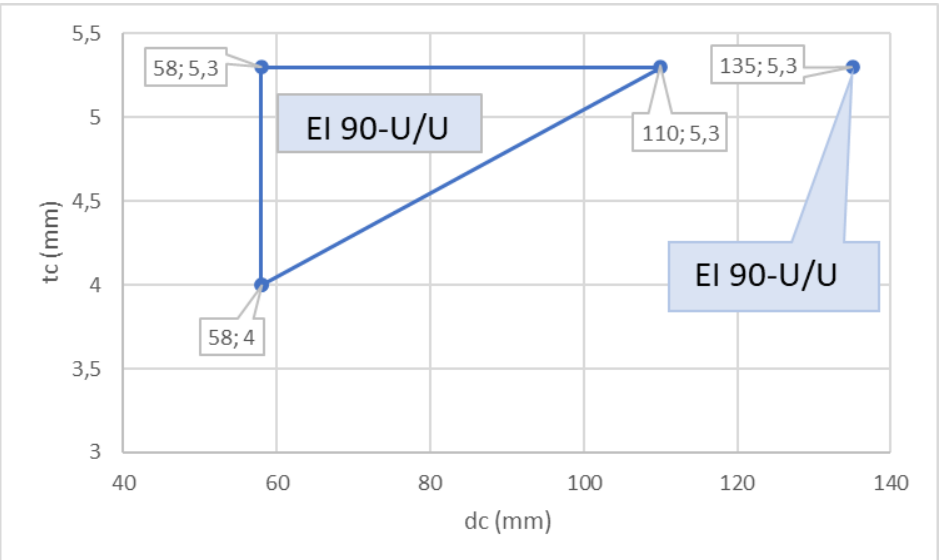


Figure 245: Classified range Silenta Premium pipes, sealed with CFS-C EL in DG 1 and 2 in 196 mm Lignotrend floor elements

8.9.2.11.3 Silenta Pro (Geberit) in 196 mm Lignotrend floor element in DG 1 and DG 2

Classification shown in Figure 246 is valid for:

- Silenta Pro pipes, made by Geberit
- Consider for relevant Design group (DG) of CFS-C EL

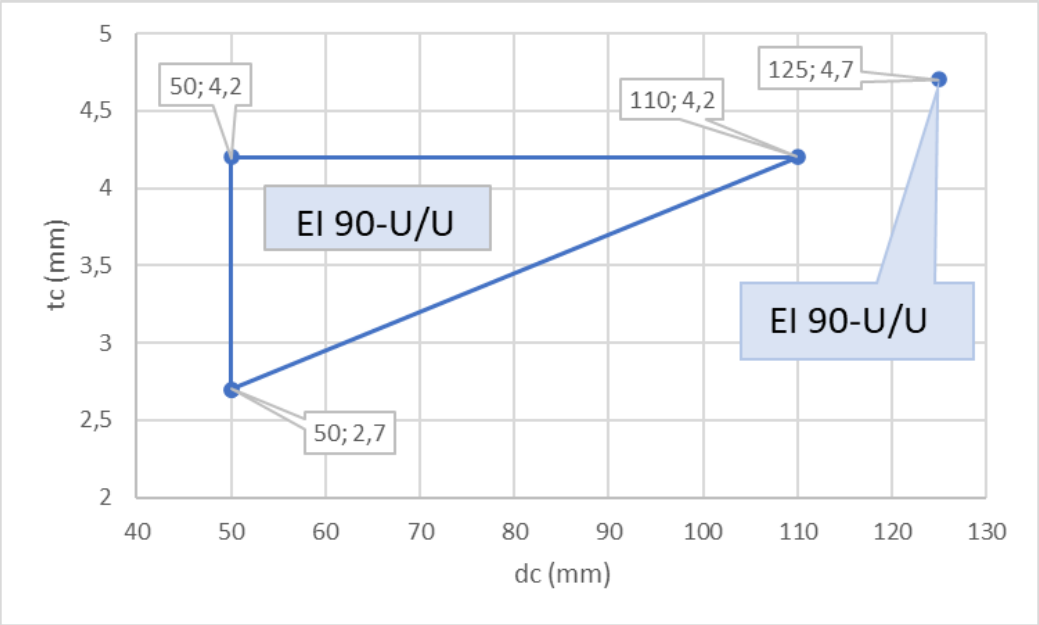


Figure 246: Classified range Silenta Pro pipes, sealed with CFS-C EL in DG 1 and DG 2 in 196 mm Lignotrend floor elements

9 ANNEX 4: ABBREVATIONS

Abbreviations used in drawings

Abbreviation	Description
A_1	Hilti Firestop Collar Endless CFS-C EL
A_10	Hilti Firestop Collar Endless CFS-C EL with oddment
A_2	Annular gap seal with Hilti Firestop Acrylic Sealant CFS-S ACR
A_3	Annular gap seal with Hilti CFS-FIL
A_4	Annular gap seal with gypsum plaster
A_5	Annular gap seal with cementious mortar acc. EN 998-2, group M10
A_6	Hilti Firestop Bandage CFS-B
ACP	Aluminum Composite Pipe (Multi-Layer Composite Pipes-MLC)
B	Backfilling material (mineral wool)
C, C_1, …C_n	Plastic Pipe
CLT	Cross Laminated Timber – specific wooden floor and wall set-up
D	Pipe insulation
DG	Design Group for pipe closure device CFS-C EL, former construction group
D_W	Pipe insulation, incombustible, based on mineral wool
D_E	Pipe insulation, combustible, based on elastomeric foamed material (FEF)
D_P	Pipe insulation - Protect insulation
D_{PE}	Pipe insulation, combustible, based on polyethylene foam
d_A	Aperture diameter in supporting construction E
d_C	Pipe diameter (nominal outside diameter) for plastic pipes
d_M	Pipe diameter (nominal outside diameter) for metal pipes
d_{ACP}	Pipe diameter (nominal outside diameter) for Aluminum composite pipes
d_{RC}	Pipe diameter (nominal outside diameter) for Cable conduits
E	Building element (wall, floor)
E_1	Aperture framing / beading / additional framing
F	Hooks (long or short) for fixing of the collar
FEF	Flexible elastomeric foamed insulation (butyl-rubber, highly filled)
h	high
h_{E1}	High of aperture framing / beading / additional framing
L	Length
L_D	Length of Insulation
L_{DP}	Length of Protect Insulation
L_{RC}	Projecting Length for electric conduits, filled or unfilled
n	amount, number of pieces
mp	Metal plate/strip for collar fixing
M	Metal pipe
MLC	Multi-Layer Composite Pipes
PG	Pipe group

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

Table 122: Abbreviations used in drawings

10 ANNEX 5: INSTRUCTION FOR USE

For the latest and continuously updated version of the Instruction for Use please refer to:
www.hilti.group