

## UK Technical Assessment

**0843-UKTA-23/0028**  
of 28/11/2023

**Technical Assessment Body Issuing the UKTA:**

UL International (UK) Ltd

**Trade name of the construction product**

ASTRO PFP FR Acrylic

**Product family to which the construction product belongs**

Fire Stopping and Sealing Product:  
• Penetration Seals

**Manufacturer**

Astroflame Fireseals Ltd  
Unit 8, The IO Centre,  
Stephenson Road,  
Segensworth,  
Fareham  
Hampshire,  
PO15 5RU

**Manufacturing plant(s)**

A/003

**This UK Technical Assessment contains**

95 pages including 1 Annex which forms an integral part of this assessment.

**This UK Technical Assessment\* is issued, on the basis of**

EAD 350454-00-1104, September 2017.

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

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## I. SPECIFIC PARTS OF THE UK TECHNICAL ASSESSMENT

### 1 Technical description of the product

- 1) ASTRO PFP FR Acrylic is a sealant used to form a penetration seal around metallic pipes, plastic pipes, composite pipes, combustible cable conduits and electrical cables to reinstate the fire resistance performance of wall and floor constructions, where they have been provided with apertures for the penetration of services.
- 2) The ASTRO PFP FR Acrylic is supplied in liquid form contained within 310 & 380 ml cartridges and 300 to 600 ml foil packs. The sealant is gunned into the aperture in the separating element/elements and around the service or services, to a specified depth utilising mineral fibre insulation backing material.
- 3) ASTRO PFP FR Acrylic contains no carcinogenic substances or mutagenic substances, flame retardants or antimicrobiological agents.
- 4) The applicant has submitted a written declaration that ASTRO PFP FR Acrylic does not contain substances which have to be classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the EGDS - taking into account the installation conditions of the construction product and the release scenarios resulting from there. An emission report has also been provided.

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

- 5) The use category of ASTRO PFP FR Acrylic in relation to BWR 3 (Hygiene, health and environment) is IA1, S/W2

### 2 Specification of the intended uses of the product in accordance with the applicable UK Assessment Document (Pre-Exit European Assessment Document): EAD 350454-00-1104, September 2017

Detailed information and data is given in Annex A.

- 1) The intended use of system ASTRO PFP FR Acrylic is to reinstate the fire resistance performance of flexible wall constructions, rigid wall constructions and rigid floor constructions where they are penetrated by various metal pipe services with and without combustible insulation, plastic pipes, combustible cable conduits, composite pipes and electrical cables.
- 2) The specific elements of construction that the system ASTRO PFP FR Acrylic may be used to provide a penetration seal in, are as follows:
  - a. Flexible walls: The wall must have a minimum thickness of 75 mm and comprise steel studs or timber studs\* lined on both faces with minimum 1 layer of 12.5 mm thick boards. Flexible wall solutions may also be used in rigid walls, with a minimum density of 350 kg/m<sup>3</sup>.
  - b. Timber walls: The wall must have a minimum thickness of 100 mm and comprise solid wood or cross-laminated timber.

- c. Rigid walls: The wall must have a minimum thickness of 75 mm and comprise concrete, aerated concrete or masonry, with a minimum density of 650 kg/m<sup>3</sup>.
- d. Rigid floors: The floor must have a minimum thickness of 150 mm and comprise aerated concrete or concrete with a minimum density of 650 kg/m<sup>3</sup>.
- e. Timber floors: The floor must have a minimum thickness of 150 mm and comprise solid wood or cross-laminated timber.

\* no part of the penetration seal may be closer than 100 mm to a stud, the cavity must be closed between the penetration seal and the stud, and minimum 100 mm of insulation of class A1 or A2 according to EN 13501-1 must be provided within the cavity between the penetration seal and the stud.

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

Astroflame Fireseals Ltd Fire Protection Systems which involve services penetrating both sides of a flexible wall may also be used in the situation where the services penetrates one side of the wall only and the remaining side of the wall is not penetrated at the same point (i.e. the services continues on the inside of the wall). All fire integrity and thermal insulation ratings for such single-sided penetrations remain the same as for the equivalent double-sided penetration.

- 3) The system ASTRO PFP FR Acrylic may be used to provide a penetration seal with specific single insulated metal pipes, uninsulated metal pipes, plastic pipes, combustible cable conduits, composite pipes and with specific electrical cables, single or in a bundle (for details see Annex A).
- 4) Apertures in the separating element shall be maximum  $\varnothing$  504 mm, 300 x 300 mm or 100 x 1000 mm. The annular space/gap around the services shall be infilled with ASTRO PFP FR Acrylic sealant and in some cases a mineral fibre insulation backing material. Blank seals up to 300 x 300 mm are permitted. For full details, see Annex A.
- 5) Pipes shall be supported at maximum 350 mm away from both faces of the wall constructions and 550 mm from the upper face of floor constructions.
- 6) Where a backing material is described in Annex A, this can be replaced with ASTRO PFP FR Acrylic if the total seal depth is the same or greater.
- 7) Where single sided top face seals are described in Annex A, these can also be used in composite floors if the thickness of the concrete where the seal is placed is the same or greater than the required depth of the fire seal.
- 8) Where PVC pipes are mentioned in Annex A, this includes PVC-U, PVC-C and similar if the pipe is according to EN 1329-1, EN 1452-2, EN 1453-1<sup>^</sup> and EN 1566-1. Where PP pipes are mentioned in Annex A, this includes PP-MV, PP-H, PP-R and similar if the pipe is according to EN 1451-1 or DIN 8077/8078. Where PE pipes are mentioned, this includes PE-LD, PE-MD, PE-HD, PE-X and similar according to EN 1519-1, EN 12201-2 or EN 12666-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1.
- 9) An aperture with or without penetrating services, fire sealed with the system ASTRO PFP FR Acrylic, can include a steel or plastic sleeve casted or friction fitted within rigid constructions. The plastic sleeve should have a maximum wall thickness of 14.6 mm.

- 10) Services through the system ASTRO PFP FR Acrylic may be used in all angles between 90° and 45° in all directions, subject to metallic pipes only.
- 11) The provisions made in this United Kingdom Technical Approval are based on an assumed working life of the ASTRO PFP FR Acrylic of 25 years, provided that the conditions laid down in sections 4.2/5.1/5.2 for the packaging/transport/ storage/installation/use/repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.
- 12) Type Z<sub>2</sub>: Intended for uses in internal conditions with humidity lower than 85 % RH excluding temperatures below 0°C, without exposure to rain or UV.

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

Product-type: Sealant		Intended use: Penetration Seal	
Basic requirement for construction work	Essential characteristic	Performance	
<b>BWR 2 Safety in case of fire</b>			
EN 13501-1	Reaction to fire	Class B-s1, d0	
EN 13501-2	Resistance to fire	Annex A	
<b>BWR 3 Hygiene, health and environment</b>			
EN 1026	Air permeability	Annex B	
EAD 350454-00-1104, Annex C	Water permeability	No performance determined	
Declaration of manufacturer & EN 16516	Content, emission and/or release of dangerous substances	Use categories: IA1, S/W2 Declaration of manufacturer	
<b>BWR 4 Safety in use</b>			
EOTA TR 001:2003	Mechanical resistance and stability	No performance determined	
EOTA TR 001:2003	Resistance to impact/movement	No performance determined	
EOTA TR 001:2003	Adhesion	No performance determined	
EAD 350454-00-1104, Clause 2.2.9	Durability	Z <sub>2</sub>	
<b>BWR 5 Protection against noise</b>			
EN 10140-1,2,4,5/ EN ISO 717-1	Airborne sound insulation	Rw(C;Ctr)= 62 (-1;-5) dB*	
<b>BWR 6 Energy economy and heat retention</b>			
EN 12664, EN 12667, EN 12939, EN ISO 8990, EN ISO 6946, EN ISO 14683, EN ISO 10211, EN ISO 10456	Thermal properties	No performance determined	
EN ISO 12572, EN 12086, EN ISO 10456	Water vapour permeability	No performance determined	

\* At 12 mm depth

**4 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE (HEREINAFTER AVCP) SYSTEM APPLIED, WITH REFERENCE TO ITS LEGAL BASE**

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

<b>Product(s)</b>	<b>Intended use(s)</b>	<b>Level(s) or class(es)</b>	<b>System(s)</b>
Fire stopping and Fire Sealing Products	For fire compartmentation and/or fire protection or fire performance	Any	1

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

**Tasks of the manufacturer:**

Factory production control

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

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

The factory production control shall be in accordance with the Control Plan of 7<sup>th</sup> February 2023 relating to the UK Technical Assessment 0843-UKTA-23/0028 issued on 28/11/2023 which is part of the technical documentation of this UK technical Assessment. The "Control Plan" is laid down in the context of the factory production control system operated by the manufacturer and deposited at UL International (UK) Ltd.

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

**Other tasks of the manufacturer:**

Additional information

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

- (a) Technical data sheet:
- Field of application:
  - Building elements for which the penetration seal is suitable, type and properties of the building elements like minimum thickness, density, and - in case of lightweight constructions – the construction requirements.
  - Limits in size, minimum thickness etc. of the penetration seal
  - Construction of the penetration seal including the necessary components and additional products (e.g. backfilling material) with clear indication whether they are generic or specific.
  - Services which the penetration seal is suitable, type and properties of the services like material, diameter, thickness etc. in case of pipes including insulation materials; necessary/allowed supports/fixings (e.g. pipe trays)
- (b) Installation instruction:
- Steps to be followed
  - Procedure in case of retrofitting
  - Stipulations on maintenance, repair and replacement

**6 Issued on:**

**28<sup>th</sup> November 2023**

Report by:



D. Yates  
Staff Engineer  
Built Environment

Reviewed by:



C. Johnson  
Senior Staff Engineer  
Built Environment

**For and on behalf of UL International (UK) Ltd.**



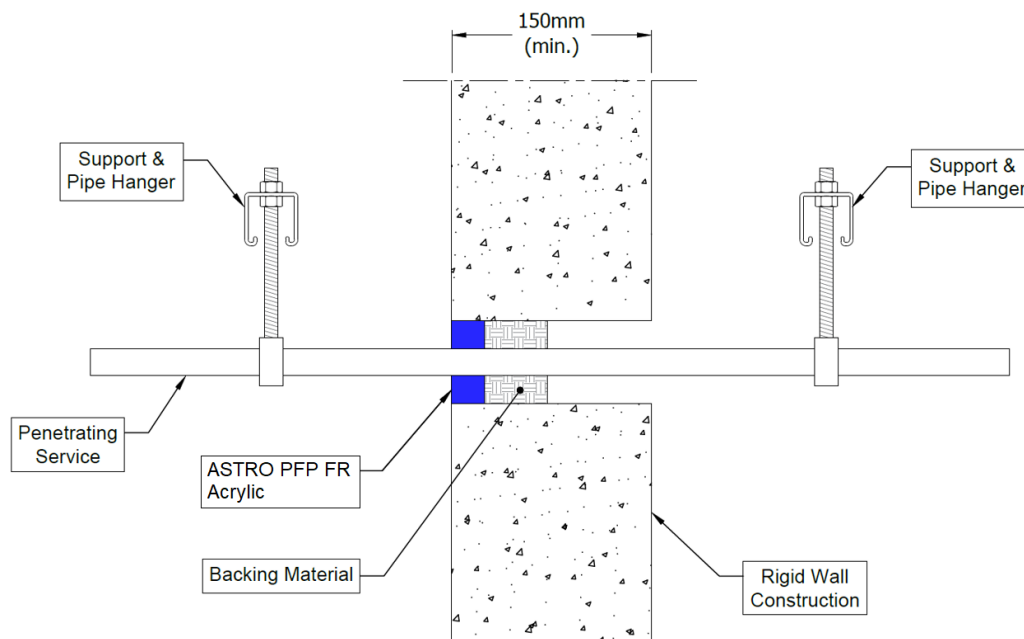
# ANNEX A – Resistance to Fire Classification – ASTRO PFP FR Acrylic

## A.1 Rigid wall constructions according to 1.2.1 with wall thickness of minimum 150 mm

### A.1.1 Single side penetration seal with cables

**Penetration Seal:** Cables (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to either side of the wall (or at any position in between), backed with 'AES Fibre  $\geq 128\text{kg/m}^3$ '. Minimum separation between cables and the edge of the seal of 7 mm.

Construction details:



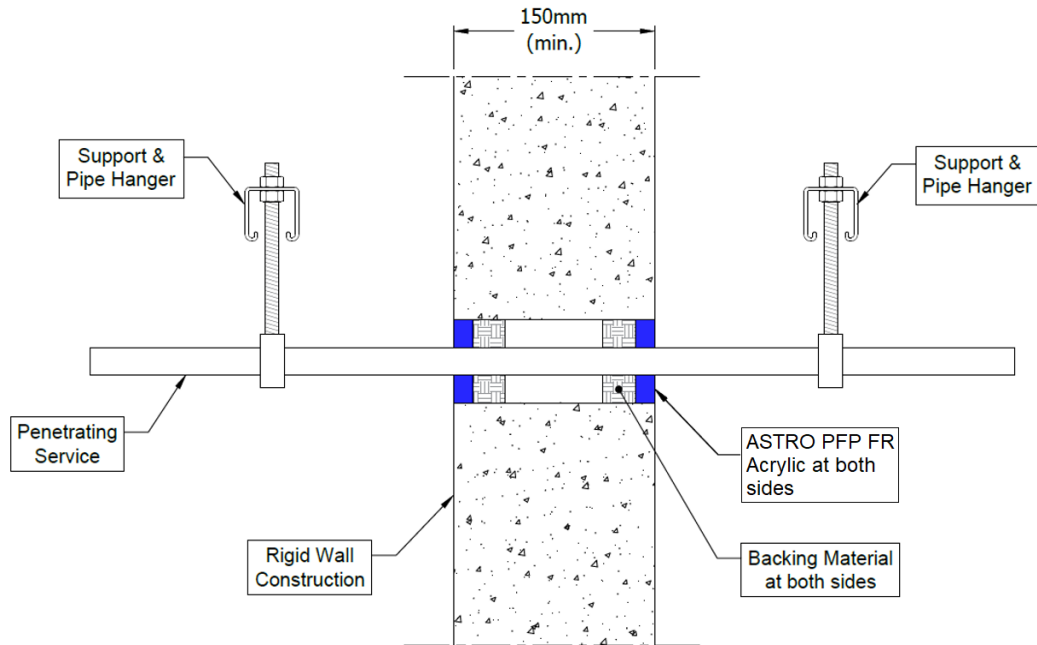
#### A.1.1.1

Services	Sealant depth	Backing	Maximum seal size	Classification
Single electrical cables up to 21 mm $\varnothing$	25 mm	48 mm deep AES Fibre $\geq 128\text{kg/m}^3$	87 mm $\varnothing$	E 240, EI 90
Blank seals	25 mm	48 mm AES Fibre $\geq 128\text{kg/m}^3$ insulation	300 x 300 mm	E 240, EI 60
Electric cables up to 21 mm diameter, single.			35 x 35 mm / 36 mm $\varnothing$	E 240, EI 120
Blank seals	25 mm	48 mm AES Fibre $\geq 128\text{kg/m}^3$ insulation	300 x 300 mm	E 240, EI 60
Electric cables up to 21 mm diameter, single.			35 x 35 mm / 36 mm $\varnothing$	E 240, EI 120

### A.1.2 Double side penetration seal with cables

**Penetration Seal:** Cables fitted with ASTRO PFP FR Acrylic to both sides of the wall, backed with stone wool or mineral fibre insulation. Maximum seal size of 300 x 300 mm and minimum separation between cables and the edge of the seal of 10 mm.

Construction details:



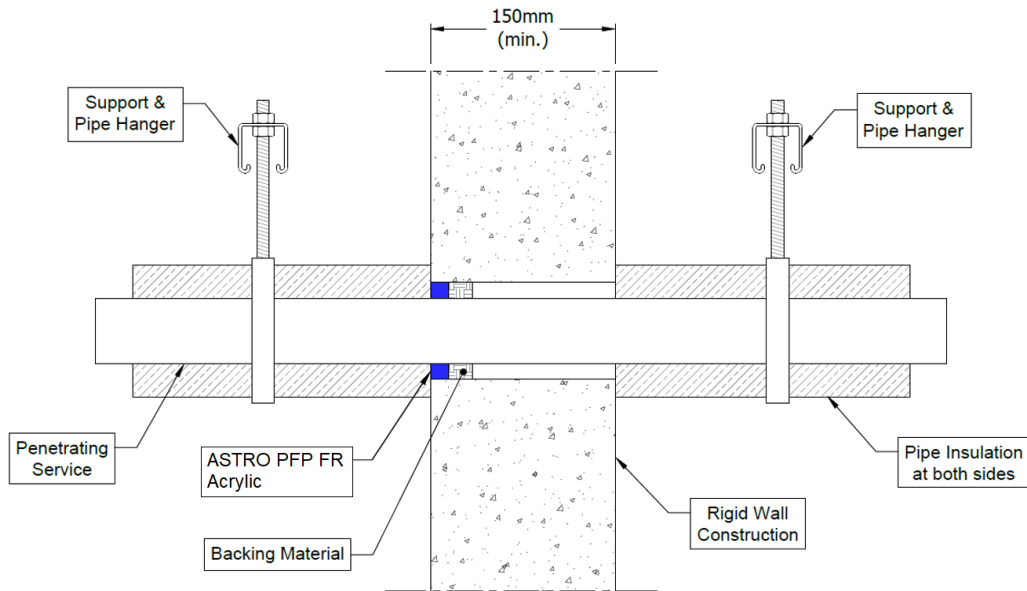
#### A.1.2.1

Services	Sealant depth	Backing (minimum)	Insulation	Classification
Blank seals	15 mm	25 mm Stone wool 35 kg/m <sup>3</sup>	None	EI 240
Electric cables up to 21 mm diameter, single or in a bundle.				E 240, EI 120
Electric cables 22-80 mm diameter, single or in a bundle.				E 120, EI 60
Blank seals	25 mm	48 mm AES Fibre ≥ 128kg/m <sup>3</sup>		EI 240
Electric cables up to 80 mm diameter, single or in a bundle.				E 240, EI 60
Cables up to 21 mm diameter, single or in a bundle up to 100 mm diameter				EI 240

### A.1.3 Single side penetration seal with metallic (and composite) pipes

**Penetration Seal:** LI (Local Interrupted) of minimum length stated below or CI (Continuous Interrupted) insulated metallic and composite pipes (single) fitted at any position within the aperture, with 15 mm deep ASTRO PFP FR Acrylic to either side of the wall (or at any position between), backed with 20 mm deep minimum 40 kg/m<sup>3</sup> stone wool insulation\*.

Construction details:



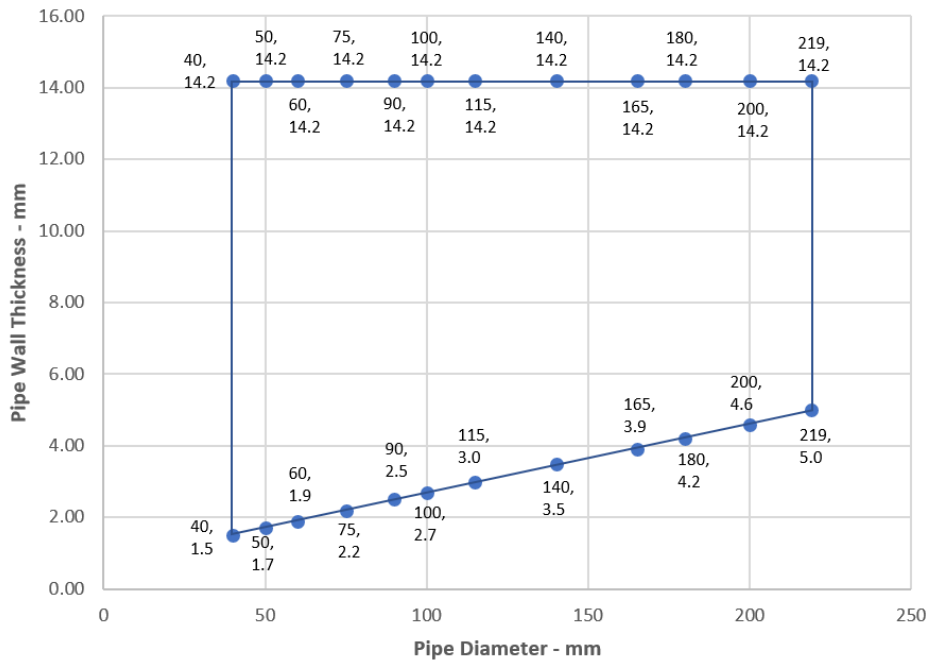
#### A.1.3.1

Services	Seal width around pipe	Insulation (minimum)	Classification
Copper or steel pipe up to 54 mm diameter/0.9-14.2 mm wall	8-9 mm	1000 mm length 20 mm Stone wool insulation 80 kg/m <sup>3</sup>	<b>E 240 C/U, EI 180 C/U</b>
Copper or steel pipe up to 12 mm diameter/0.9-5 mm wall	8 mm		<b>EI 240 C/U</b>
Alupex composite pipe 75 mm diameter/7.5 mm wall	30 mm	25 mm AES Fibre ≥ 128kg/m <sup>3</sup> insulation, 600 mm long (min.)	<b>EI 120 C/U</b>

Services	Seal width around pipe	Insulation (minimum)	Classification
Mild or stainless steel pipe			
40 mm diameter/1.5-14.2 mm wall*	6-18 mm	1000 mm length of 20 mm Stone wool insulation 80 kg/m <sup>3</sup>	EI 240 C/U
40 mm diameter/1.5-14.2 mm wall*		1000 mm length of 30 mm Stone wool insulation 80 kg/m <sup>3</sup>	E 180 C/U, EI 90 C/U
50 mm diameter/1.7-14.2 mm wall*			
60 mm diameter/1.9-14.2 mm wall*			
75 mm diameter/2.2-14.2 mm wall*			
90 mm diameter/2.5-14.2 mm wall*			
100 mm diameter/2.7-14.2 mm wall*			
115 mm diameter/3-14.2 mm wall*			
140 mm diameter/3.5-14.2 mm wall*			
165 mm diameter/ 3.9-14.2 mm wall*			
180 mm diameter/ 4.2-14.2 mm wall*			
200 mm diameter/ 4.6-14.2 mm wall*			
219 mm diameter/ 5.0-14.2 mm wall*			

\* Typical pipe diameters shown, see below graph for intermediate sizes

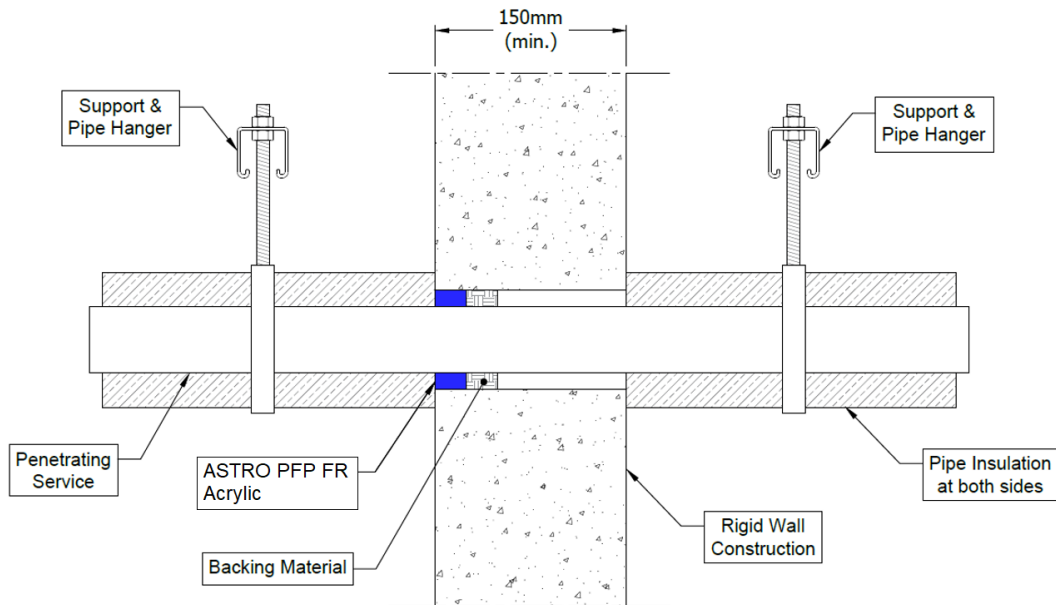
Steel Pipes with Mineral Wool Insulation - C/U



#### A.1.4 Single side penetration seal with metallic (and composite) pipes

**Penetration Seal:** LI (Local Interrupted) of minimum length stated below or CI (Continuous Interrupted) insulated metallic and composite pipes (single) fitted at any position within the aperture, with 25 mm deep ASTRO PFP FR Acrylic to either side of the wall (or at any position between), backed with 25 mm deep minimum 40 kg/m<sup>3</sup> stone wool insulation\*.

Construction details:



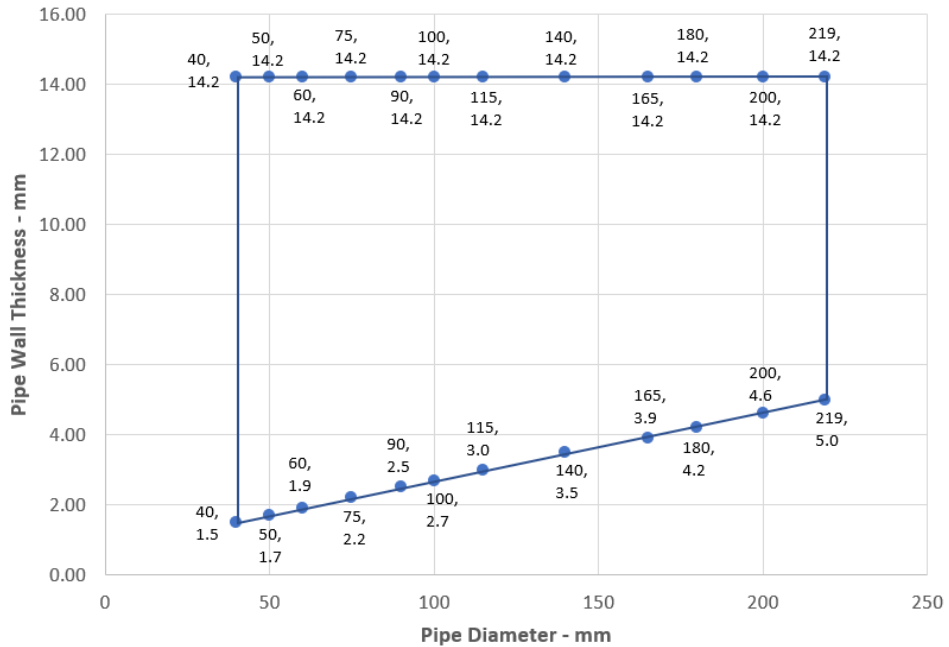
##### A.1.4.1

Services	Maximum Seal size	Insulation (minimum)	Classification
Copper or steel pipe up to 54 mm diameter/0.9-14.2 mm wall	300 x 300 mm	1000 mm length 20 mm Stone wool insulation 80 kg/m <sup>3</sup>	<b>E 240 C/U, EI 60 C/U</b>
Alupex composite pipe 75 mm diameter/7.5 mm wall		25 mm AES Fibre ≥ 128kg/m <sup>3</sup> insulation, 600 mm long (min.)	

Services	Maximum seal size	Insulation (minimum)	Classification
Mild or stainless steel pipe			
40 mm diameter/1.5-14.2 mm wall*	300 x 300 mm	1000 mm length of 20 mm Stone wool insulation 80 kg/m <sup>3</sup>	E 240 C/U, EI 60 C/U
40 mm diameter/1.5-14.2 mm wall*			
50 mm diameter/1.7-14.2 mm wall*		1000 mm length of 30 mm Stone wool insulation 80 kg/m <sup>3</sup>	
60 mm diameter/1.9-14.2 mm wall*			
75 mm diameter/2.2-14.2 mm wall*			
90 mm diameter/2.5-14.2 mm wall*			
100 mm diameter/2.7-14.2 mm wall*			
115 mm diameter/3-14.2 mm wall*			
140 mm diameter/3.5-14.2 mm wall*			
165 mm diameter/ 3.9-14.2 mm wall*			
180 mm diameter/ 4.2-14.2 mm wall*			
200 mm diameter/ 4.6-14.2 mm wall*			
219 mm diameter/ 5.0-14.2 mm wall*			

\* Typical pipe diameters shown, see below graph for intermediate sizes

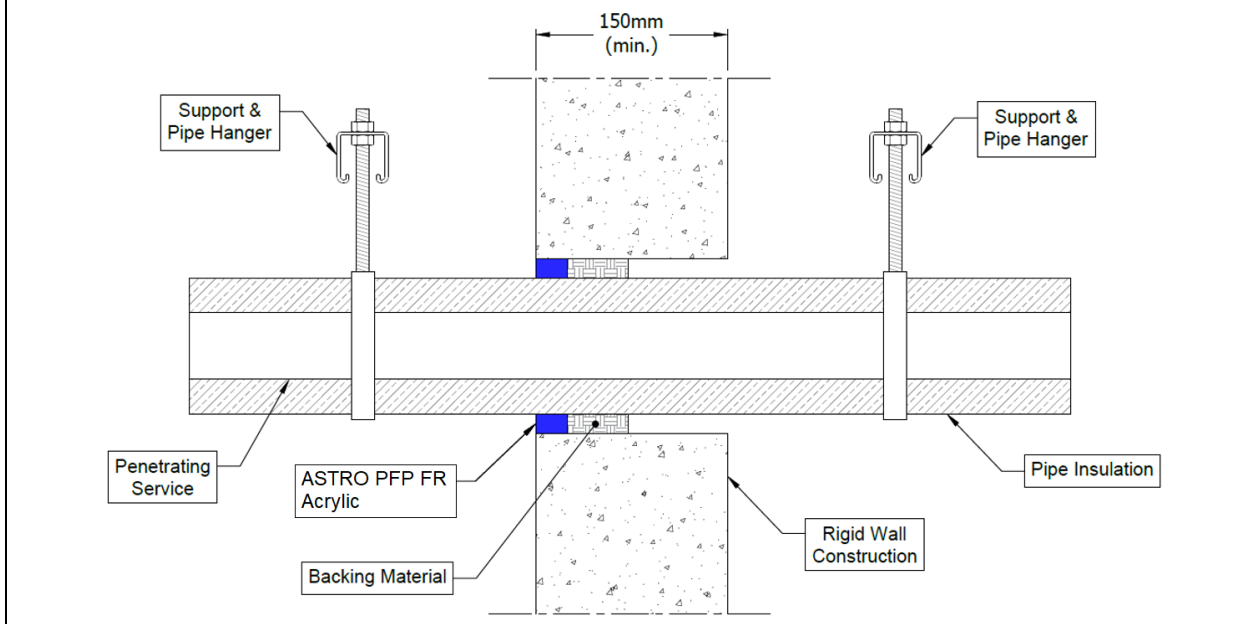
**Steel Pipes with Mineral Wool Insulation - C/U**



### A.1.5 Single side penetration seal with metallic pipes

**Penetration Seal:** CS (Continuous Sustained) insulated metallic (single), with 25 mm deep ASTRO PFP FR Acrylic to either side of the wall (or at any position between), backed with 48 mm deep AES Fibre  $\geq 128\text{kg/m}^3$  insulation. Minimum annular space 10 mm and minimum separation between penetrations seals of 30 mm. Maximum seal size 300 x 300 mm or 504 mm  $\varnothing$ .

Construction details:

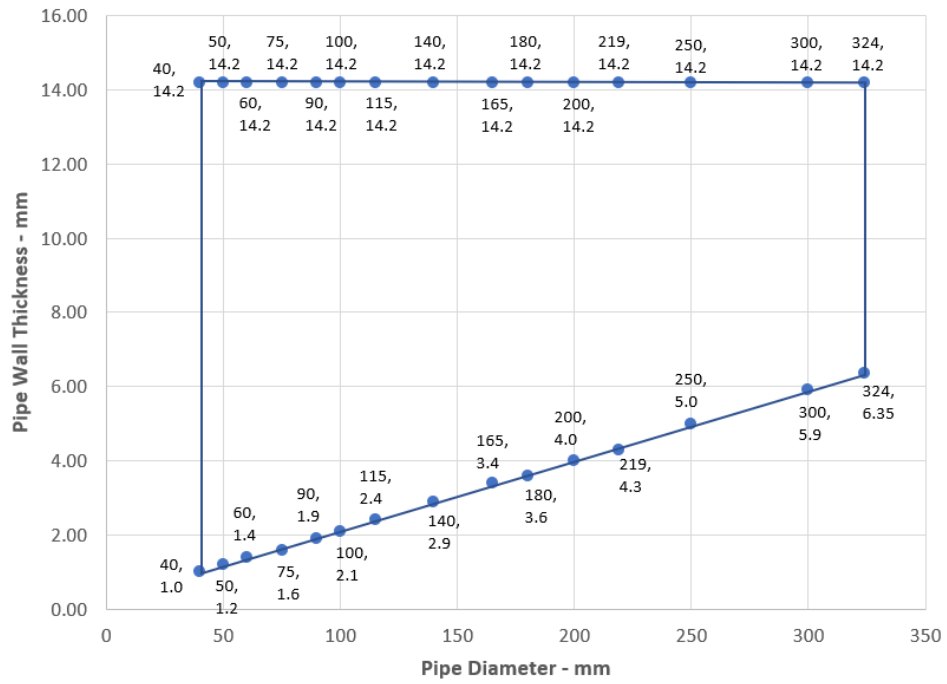


#### A.1.5.1 Single side penetration seal with pipes

Services	Insulation	Classification
Mild or stainless steel pipe		
40 mm diameter/1-14.2 mm wall	20 mm thick stone, mineral wool min. $80\text{ kg/m}^3$	<b>EI 240 C/U</b>
40 mm diameter/1-14.2 mm wall*	30-80 mm thick stone, mineral wool min. $80\text{ kg/m}^3$	<b>EI 180 C/U</b>
50 mm diameter/1.2-14.2 mm wall*		
60 mm diameter/1.4-14.2 mm wall*		
75 mm diameter/1.6-14.2 mm wall*		
90 mm diameter/1.9-14.2 mm wall*		
100 mm diameter/2.1-14.2 mm wall*		
115 mm diameter/2.4-14.2 mm wall*		
140 mm diameter/2.9-14.2 mm wall*		
165 mm diameter/ 3.4-14.2 mm wall*		
180 mm diameter/ 3.6-14.2 mm wall*		
200 mm diameter/ 4.0-14.2 mm wall*		
219 mm diameter/ 4.3-14.2 mm wall*		
250 mm diameter/ 5.0-14.2 mm wall*		
300 mm diameter/ 5.9-14.2 mm wall*		
324 mm diameter/ 6.35-14.2 mm wall*		

\* Typical pipe diameters shown, see below graph for intermediate sizes

### Steel Pipes with Mineral Wool Insulation - C/U

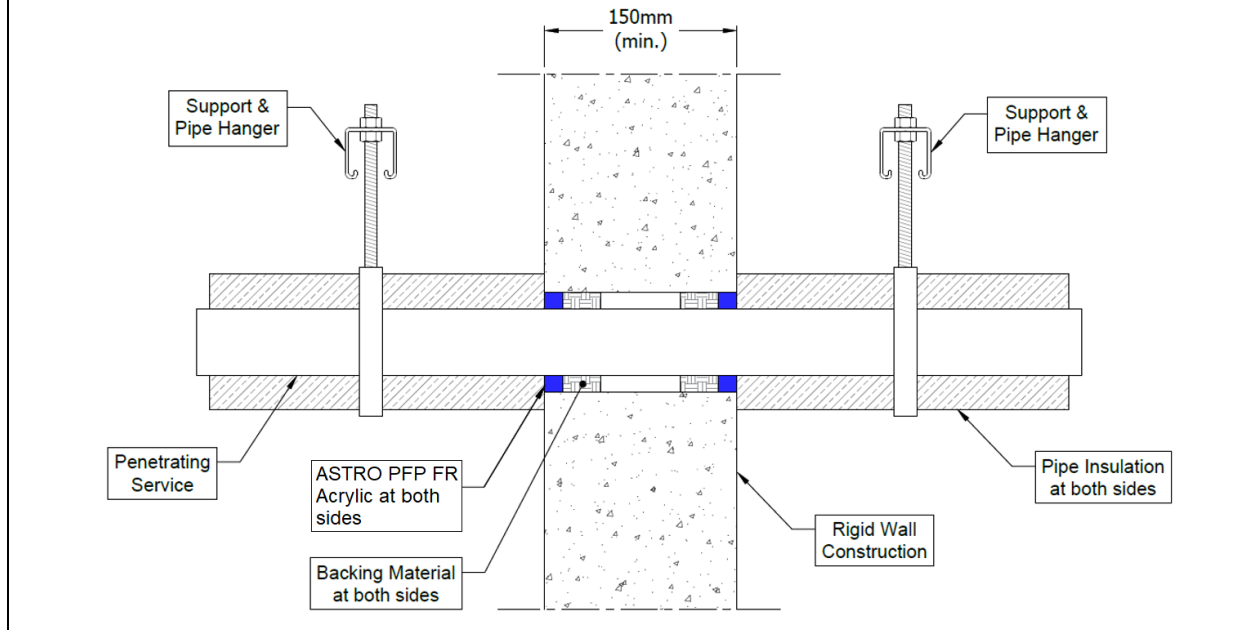




### A.1.6 Double side penetration seal with metallic pipes

**Penetration Seal:** 1000 mm (min.) LI (Local Interrupted) or CI (Continuous Interrupted) insulated metallic pipes (single) fitted at any position within the aperture, with 15 mm deep ASTRO PFP FR Acrylic to both sides of the wall, backed with 20 or 30 mm deep minimum 40 kg/m<sup>3</sup> stone wool insulation.

Construction details:

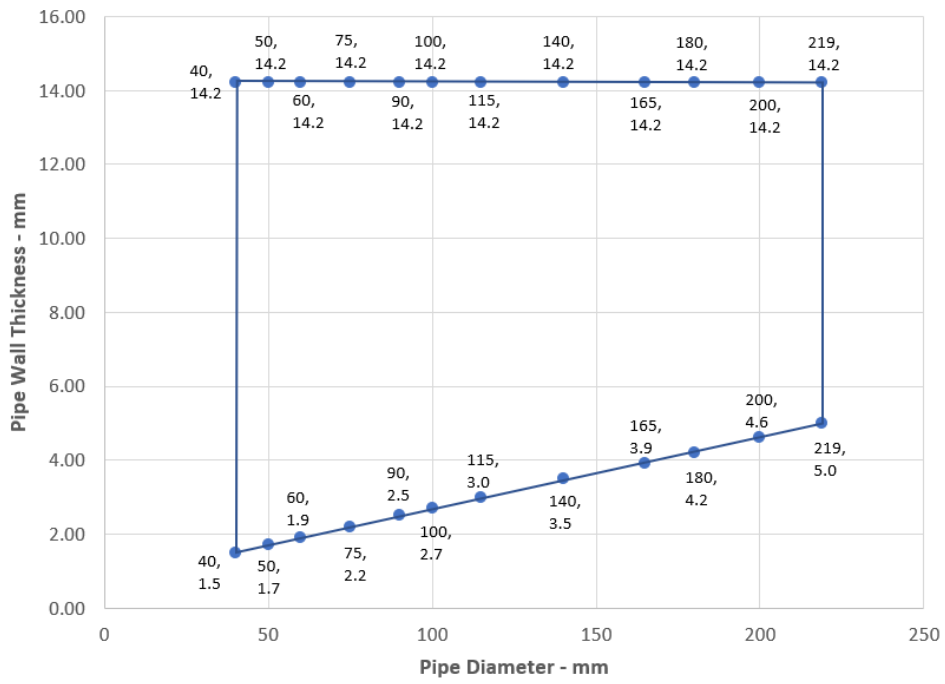


#### A.1.6.1

Services	Maximum seal size	Insulation (minimum)	Classification
Mild or stainless steel pipe			
40 mm diameter/1.5-14.2 mm wall*	300 x 300 mm	20 mm Stone wool insulation 80 kg/m <sup>3</sup>	EI 240 C/U
40 mm diameter/1.5-14.2 mm wall*			
50 mm diameter/1.7-14.2 mm wall*			
60 mm diameter/1.9-14.2 mm wall*			
75 mm diameter/2.2-14.2 mm wall*			
90 mm diameter/2.5-14.2 mm wall*			
100 mm diameter/2.7-14.2 mm wall*		30 mm Stone wool insulation 80 kg/m <sup>3</sup>	E 240, EI 120 C/U
115 mm diameter/3-14.2 mm wall*			
140 mm diameter/3.5-14.2 mm wall*			
165 mm diameter/ 3.9-14.2 mm wall*			
180 mm diameter/ 4.2-14.2 mm wall*			
200 mm diameter/ 4.6-14.2 mm wall*			
219 mm diameter/ 5.0-14.2 mm wall*			

\* Typical pipe diameters shown, see below graph for intermediate sizes

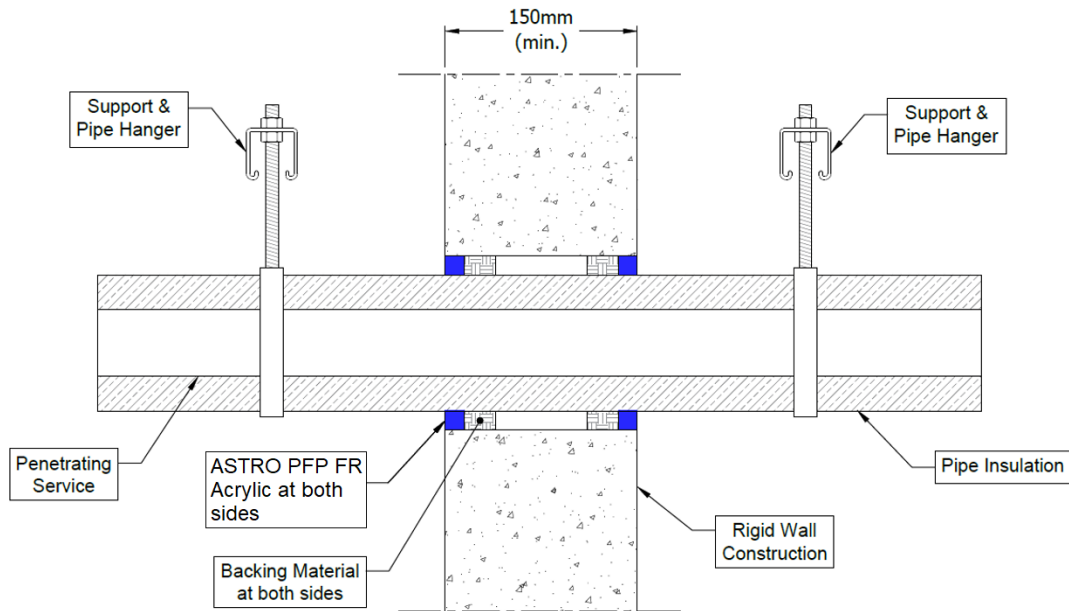
### Steel Pipes with Mineral Wool Insulation - C/U



### A.1.7 Double side penetration seal with metallic pipes

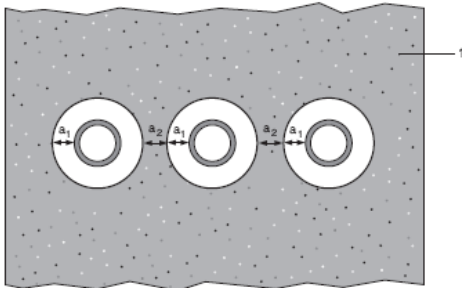
**Penetration Seal:** CS (Continuous Sustained) insulated metallic pipes (single) fitted at any position within the aperture, with 15 mm ASTRO PFP FR Acrylic to both sides of the wall, backed with 25 mm deep stone wool insulation minimum 35 kg/m<sup>3</sup>. Minimum annular space 10 mm (A1) and minimum separation between penetration seals 30 mm (A2). Maximum seal size 300 x 300 mm / 504 mm  $\varnothing$

Construction details:



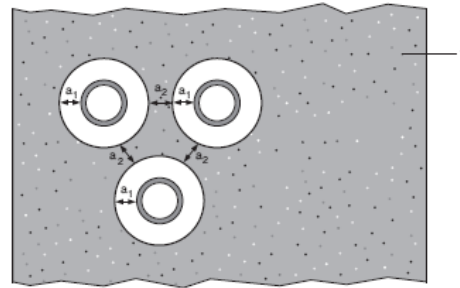
Configuration 1:

Option 1



Configuration 2:

Option 2



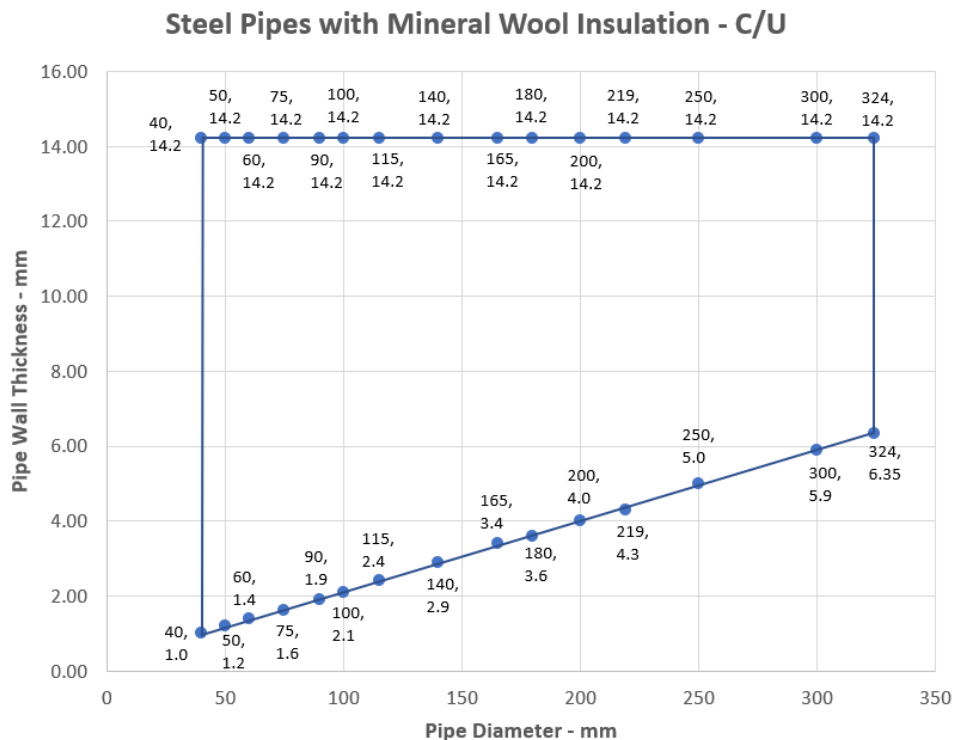
#### Key

- 1 Supporting construction
- a1 Pipe / top edge of seal separation
- a2 Pipe / side edge of seal separation
- a3 Pipe / pipe separation

### A.1.7.1 Double side penetration seal with pipes

Services	Insulation	Classification
Mild or stainless steel pipe		
40 mm diameter/1-14.2 mm wall	20 mm thick stone, mineral wool min. 80 kg/m <sup>3</sup>	EI 240 C/U
40 mm diameter/1-14.2 mm wall*	30-80 mm thick stone, mineral wool min. 80 kg/m <sup>3</sup>	
50 mm diameter/1.2-14.2 mm wall*		
60 mm diameter/1.4-14.2 mm wall*		
75 mm diameter/1.6-14.2 mm wall*		
90 mm diameter/1.9-14.2 mm wall*		
100 mm diameter/2.1-14.2 mm wall*		
115 mm diameter/2.4-14.2 mm wall*		
140 mm diameter/2.9-14.2 mm wall*		
165 mm diameter/ 3.4-14.2 mm wall*		
180 mm diameter/ 3.6-14.2 mm wall*		
200 mm diameter/ 4.0-14.2 mm wall*		
219 mm diameter/ 4.3-14.2 mm wall*		
250 mm diameter/ 5.0-14.2 mm wall*		
300 mm diameter/ 5.9-14.2 mm wall*		
324 mm diameter/ 6.35-14.2 mm wall*		

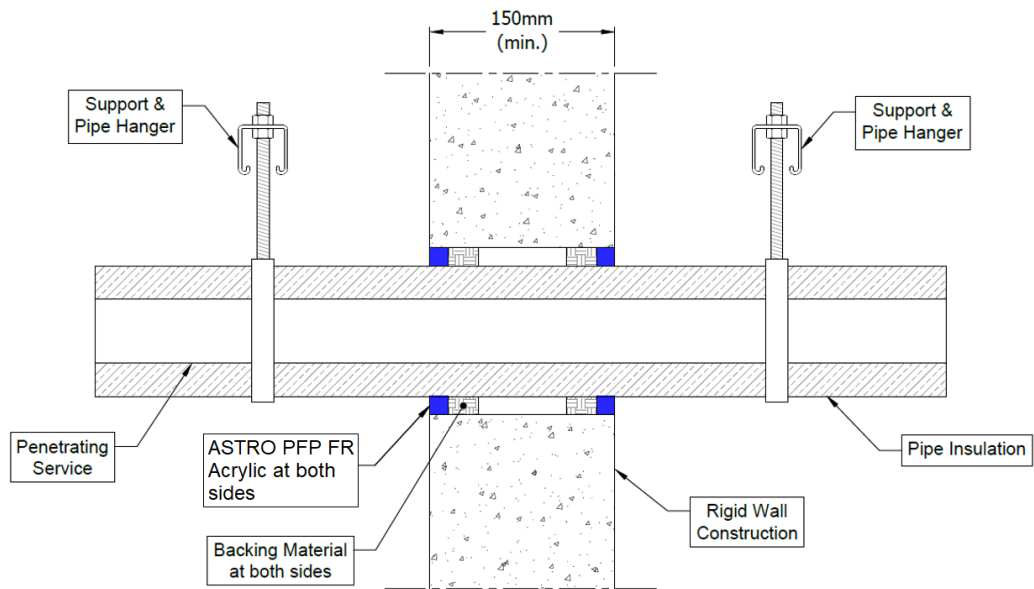
\* Typical pipe diameters shown, see below graph for intermediate sizes



### A.1.8 Double side penetration seal with metallic pipes with combustible insulation

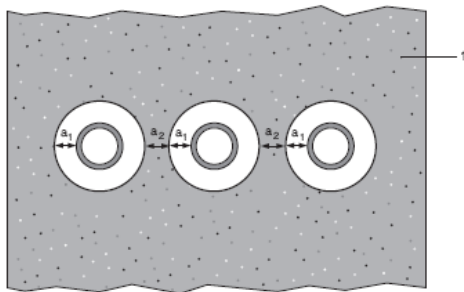
**Penetration Seal:** CS (Continuous Sustained) insulated metallic pipes (single) fitted at any position within the aperture, with 25 mm ASTRO PFP FR Acrylic to both sides of the wall, backed with 25 mm deep stone wool insulation minimum 35 kg/m<sup>3</sup>. Minimum annular space 10 mm (A1) and minimum separation between penetration seals 30 mm (A2). Maximum seal size 300 x 300 mm / 300 mm  $\varnothing$

Construction details:



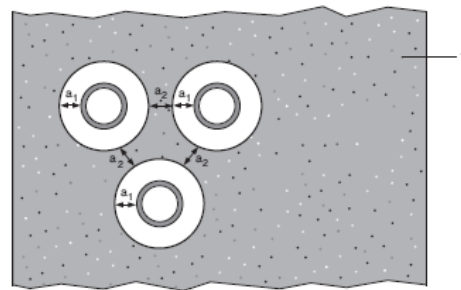
Configuration 1:

Option 1



Configuration 2:

Option 2



#### Key

- 1 Supporting construction
- a1 Pipe / top edge of seal separation
- a2 Pipe / side edge of seal separation
- a3 Pipe / pipe separation

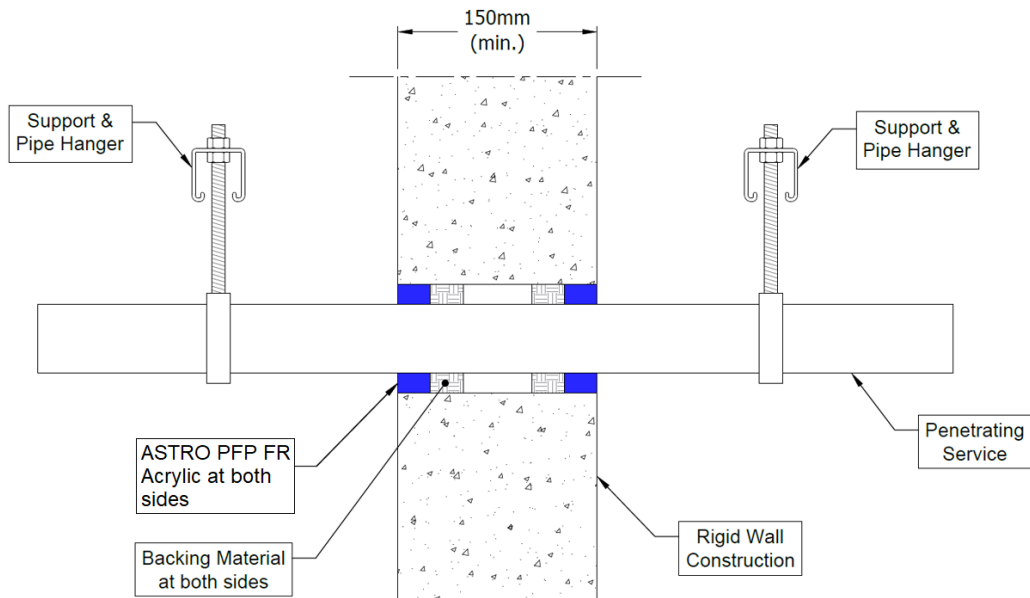
### A.1.8.1 Double side penetration seal with metallic pipes with combustible insulation

Services	Insulation	Classification
Mild or stainless steel pipe		
22 mm diameter/2-11 mm wall	13 mm thick Elastomeric insulation minimum class B-s3,d0	<b>E 240 C/U, EI 180 C/U</b>
22-114 mm diameter/2-14.2 mm wall	13-25 mm thick Elastomeric insulation minimum class B-s3,d0	<b>E 120 C/U, EI 90 C/U</b>
22-114 mm diameter/2-14.2 mm wall	25-50 mm thick Elastomeric insulation minimum class B-s3,d0	<b>EI 60 C/U</b>

### A.1.9 Double side penetration seal with plastic pipes

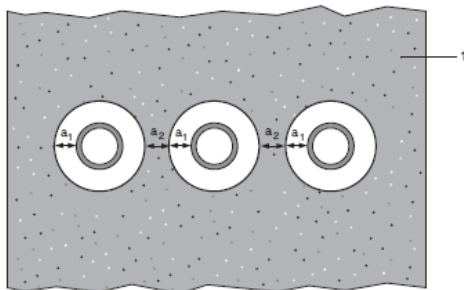
**Penetration Seal:** Plastic and metal pipes (single) fitted at any position within the aperture, with 25 mm ASTRO PFP FR Acrylic to both sides of the wall, backed with 25 mm deep stone wool insulation minimum 35 kg/m<sup>3</sup>. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 30 mm (a2). Maximum seal size 300 x 300 mm / 300 mm Ø

Construction details:



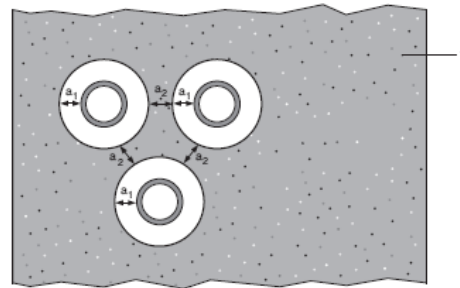
Configuration 1:

Option 1



Configuration 2:

Option 2



#### Key

1 Supporting construction

a1 Pipe / top edge of seal separation

a2 Pipe / side edge of seal separation

### A.1.9.1 Double side penetration seal with plastic pipes

Pipe material	Size	Classification
PVC-U pipe according to EN 1329-1, EN 1452-1 and EN 1453-1, PVC-C according to EN 1566-1	6-32 mm diameter/1.0-2.4 mm wall	EI 240 U/C
PVC with bundle of cables up to 21 mm diameter	6-32 mm diameter/1.0-2.4 mm wall	E 240 U/C, EI 120 U/C
PVC with bundle of cables up to 21 mm diameter	40 mm diameter/3.0 mm wall	E 240 U/C, EI 120 U/C
PP pipe according to EN 1451-1 or DIN 8077/8078	32 mm diameter/2.0-4.4 mm wall	EI 180 C/U
	12-32 mm diameter/1.8-4.4 mm wall	EI 240 C/U
PP with bundle of cables up to 21 mm diameter	12-32 mm diameter/1.8-4.4 mm wall	E 180 U/C, EI 120 U/C
PP with bundle of cables up to 21 mm diameter	40 mm diameter/3.7 mm wall	E 180 U/C, EI 120 U/C
PE pipe according to EN 1519-1, EN 12201-2 and EN 12666-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1	20-32 mm diameter/2.0 mm wall	EI 240 C/U
	20-32 mm diameter/2.0-4.4 mm wall	EI 120 C/U
PE with bundle of cables up to 21 mm diameter	20-32 mm diameter/2.0-4.4 mm wall	EI 120 U/C
PE with bundle of cables up to 21 mm diameter	40 mm diameter/3.7 mm wall	EI 240 U/C
Copper and steel pipe	6-12 mm diameter/0.6-6.0 mm wall	E 240 C/C, EI 120 C/C
Steel pipe	4-65 mm diameter/1.0-14.2 mm wall	E 240 C/U, EI 20 C/U

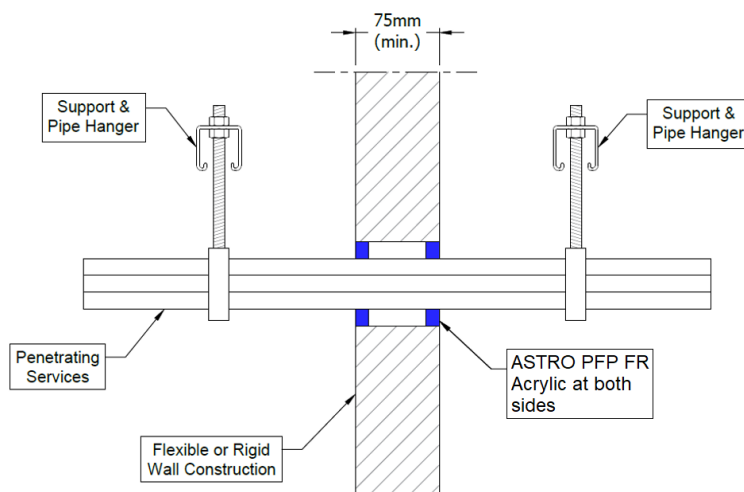


## A.2 Flexible and rigid wall constructions according to 2. 2) with wall thickness of minimum 75 mm

### A.2.1 Double side penetration seal with cables

**Penetration Seal:** Cables (single or bundles up to 100 mm  $\varnothing$ ) and pipes fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 30 mm (a2), maximum seal size 150 x 150 mm / 344 mm diameter (when incorporating a pipe of seal diameter -20 mm).

Construction details:

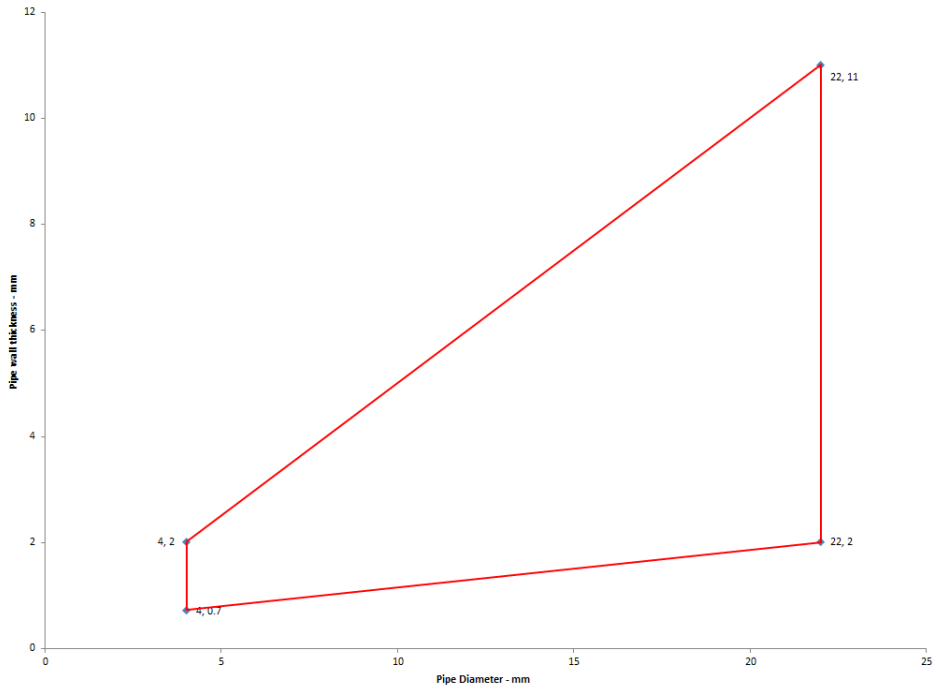


#### A.2.1.1

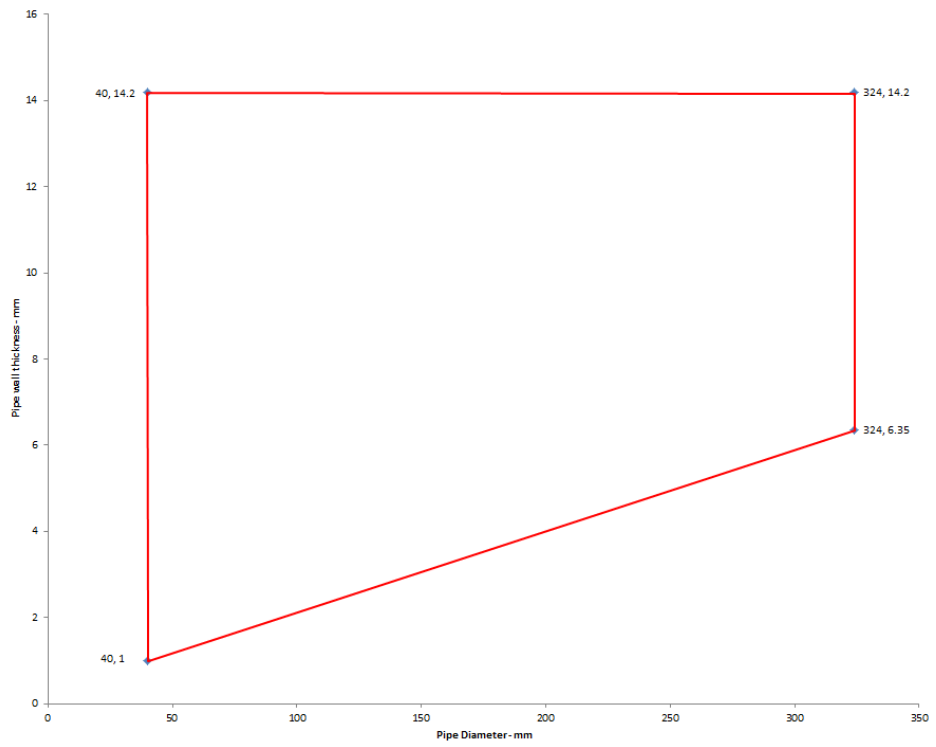
Services	Sealant depth	Backing	Classification
None (blank)	12.5 mm	Any material	EI 60
Cables up to 21 mm $\varnothing$ , single		None	E 60, EI 45
Cables up to 21 mm $\varnothing$ , in bundles up to 100 mm $\varnothing$			E 45, EI 30
Mild or stainless steel pipe			
4 mm diameter /0.7-2.0 mm wall	12.5 mm	None	E 60 C/U, EI 45 C/U
5-22 mm diameter /0.7-11 mm wall*			E 60 C/U, EI 30 C/U
Mild or stainless steel pipe with minimum 80 kg/m <sup>3</sup> density stone wool insulation Continuous Sustained (CS)			
40 mm diameter /1-14.2 mm wall, 20 mm insulation	12.5 mm	None	E 60 C/U, EI 45 C/U
40-324 mm diameter /1.0-14.2 mm wall, 30 mm insulation*			
PVC-U pipe according to EN 1329-1, EN 1452-1 and EN 1453-1, PVC-C according to EN 1566-1			
6-32 mm $\varnothing$ /1.0-1.8 mm wall, with bundle of cables up to 21 mm diameter*	12.5 mm	None	E 60 U/C, EI 45 U/C
PP pipe according to EN 1451-1 or DIN 8077/8078			
20 mm $\varnothing$ /2.3 mm wall	12.5 mm	None	EI 45 U/C
21-32 mm $\varnothing$ /2.3-4.4 mm wall*			EI 30 U/C
21-32 mm $\varnothing$ /2.3-4.4 mm wall, with bundle of cables up to 21 mm diameter*			E 45 U/C, EI 30 U/C
PE pipe according to EN 1519-1, EN 12201-2 and EN 12666-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1			
20 mm $\varnothing$ /2.0 mm wall	12.5 mm	None	EI 45 U/C
21-32 mm $\varnothing$ /2.0-3.0 mm wall*			EI 30 U/C
21-32 mm $\varnothing$ /2.0-3.0 mm wall, with bundle of cables up to 21 mm* diameter			E 45 U/C, EI 30 U/C

\* See below graphs for interpolated pipe sizes

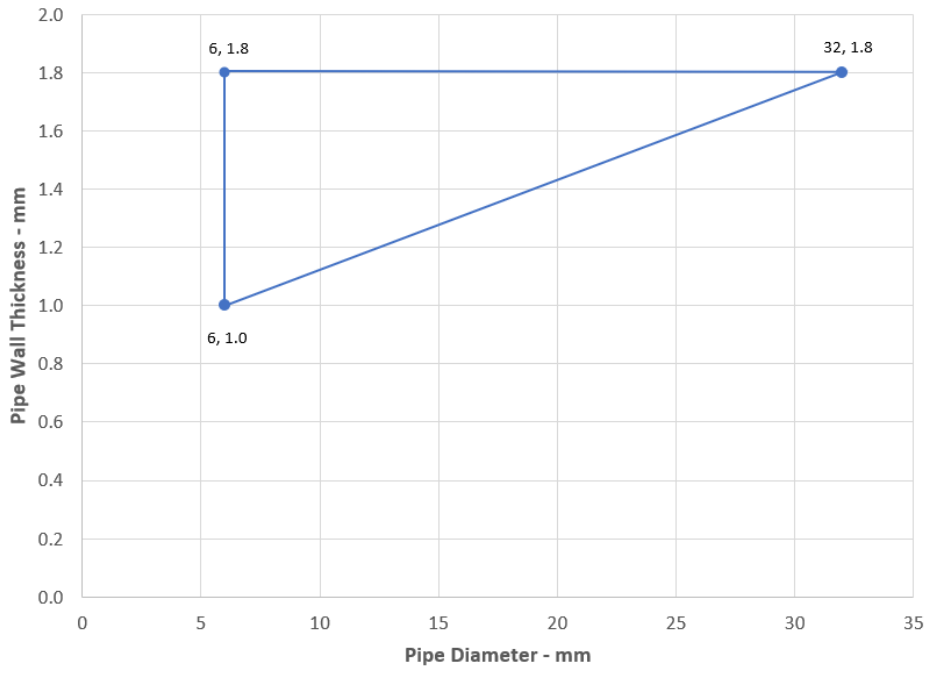
### Steel Pipe- E 60 U/C, EI 30 U/C



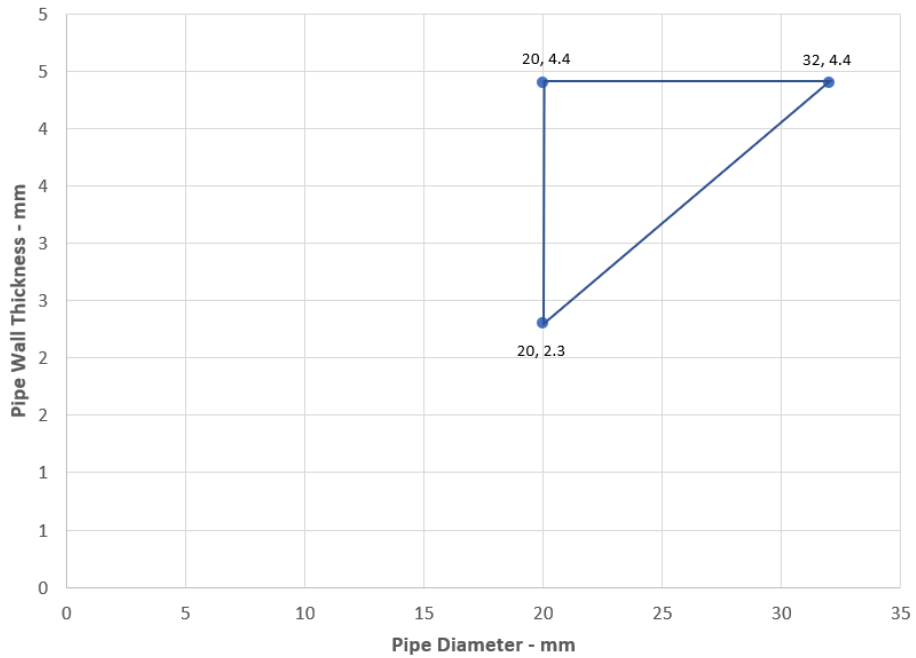
### Steel pipes with 30 mm Insulation



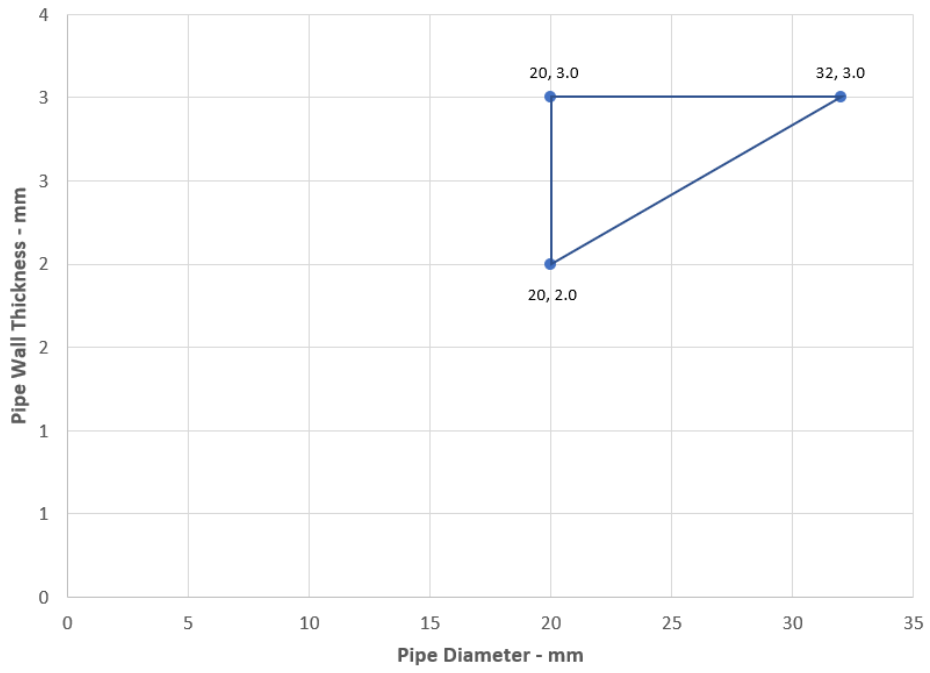
### PVC-U Pipes - U/C



### PP Pipes - EI 30 U/C



### PE Pipes - EI 30 U/C

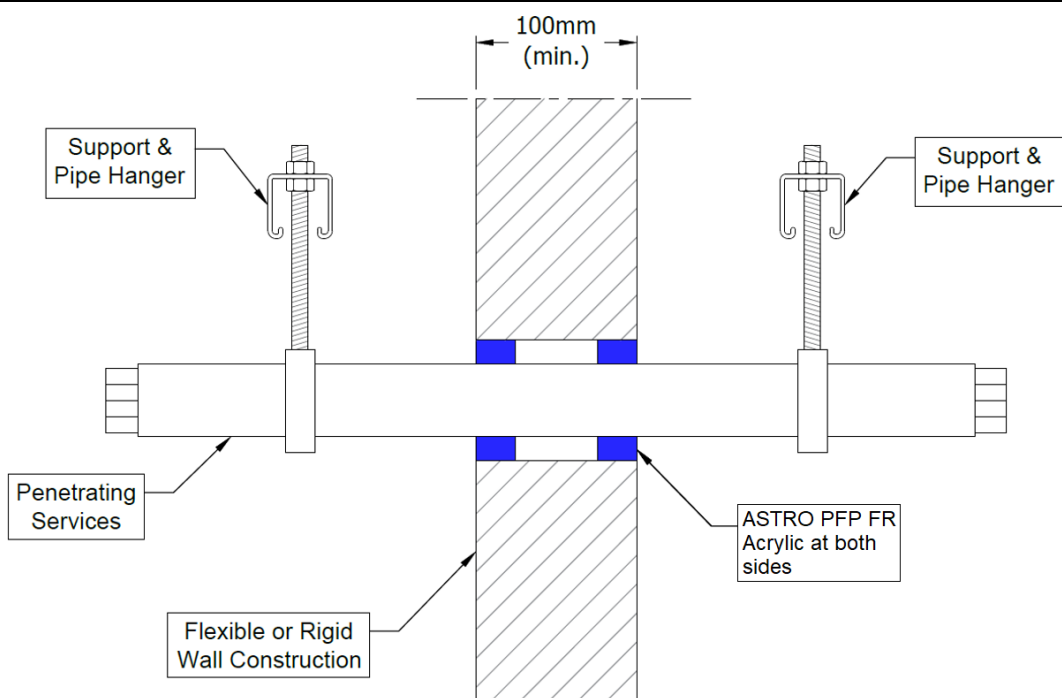
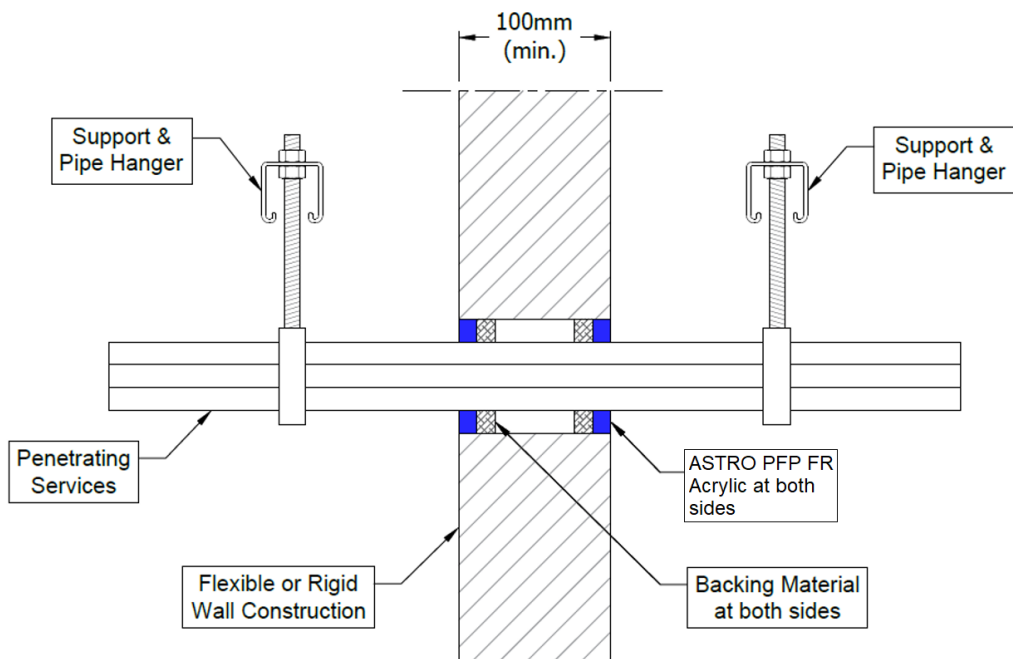


### A.3 Flexible and rigid wall constructions according to 2.2) with wall thickness of minimum 100 mm

#### A.3.1 Double side penetration seal with cables

**Penetration Seal:** Cables (single or bundles up to 100 mm  $\varnothing$ ) and conduits fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall.

Construction details:



### A.3.1.1

Services	Sealant depth	Backing	Maximum aperture	Classification
None (blank)	12.5 mm	Stone wool 20 mm deep 35-140 kg/m <sup>3</sup>	300 x 300 mm*	EI 120
Cables up to 21 mm Ø, single or in bundles up to 50 mm Ø	12.5 mm	Stone wool 12.5 mm deep min. 33 kg/m <sup>3</sup>		E 120, EI 90
Electrical cables up to 21 mm Ø, single or in bundles up to 100 mm Ø	25 mm	Stone wool 20 mm deep min. 40 kg/m <sup>3</sup>		EI 120
Electrical cables up to 80 mm Ø, single or in bundles up to 100 mm Ø		25 mm AES Fibre ≥ 128kg/m <sup>3</sup>		E 120, EI 60
Single 'E cable' - 1 x 185 mm <sup>2</sup> core HD603.3 electrical cable with PVC insulation, PVC sheath and 23-27 mm diameter	12.5 mm	Stone wool 20 mm deep min. 140 kg/m <sup>3</sup>		E 120, EI 60
Single or bundled electrical cables up to 21 mm Ø, with or without trays	12.5 mm	25 mm AES Fibre ≥ 128kg/m <sup>3</sup>	600 x 600 mm	E 90, EI 60
Single or bundled electrical cables up to 80 mm Ø, with or without trays				E 90, EI 30
Single or bundled electrical conduits up to 32 mm Ø, with or without trays				E 60, EI 45

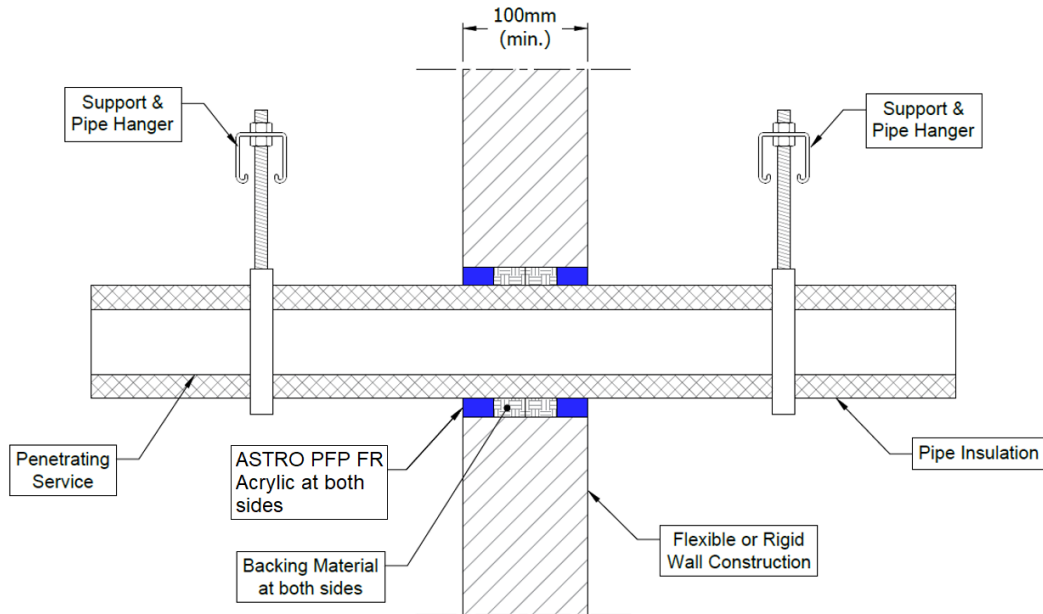
\* Or 30 mm wide x 3000 mm high for cables up to 21 mm Ø

Services	Sealant depth	Backing	Maximum Annular space	Classification
PVC-U pipe according to EN 1329-1, EN 1452-2 and EN 1453-1, PVC-C according to EN 1566-1				
Maximum diameter 40 mm, wall thickness 1.0-1.9 mm for PVC pipes, fully or partially filled conduits with cables up to 21 mm diameter	25 mm	none	30 mm	EI 120 U/C
PE pipe according to EN 1519-1, EN 12201-2 and EN 12006-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1				
Maximum diameter 40 mm, wall thickness 2.0-3.0 mm for PE pipes, fully or partially filled conduits with cables up to 21 mm diameter	25 mm	none	30 mm	EI 90 U/C
PP pipe according to EN 1852-1: 2009 or DIN 8077/8078				
Maximum diameter 40 mm, wall thickness 1.8-2.2 mm for PP pipes, fully or partially filled conduits with cables up to 21 mm diameter	25 mm	none	30 mm	EI 90 U/C

### A.3.2 Double side penetration seal with metallic pipes

**Penetration Seal:** CS (Continuous Sustained) insulated metallic pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall, backed with stone wool insulation or 'AES Fibre  $\geq 128\text{kg/m}^3$ , 300 x 300 mm maximum seal size.

Construction details:

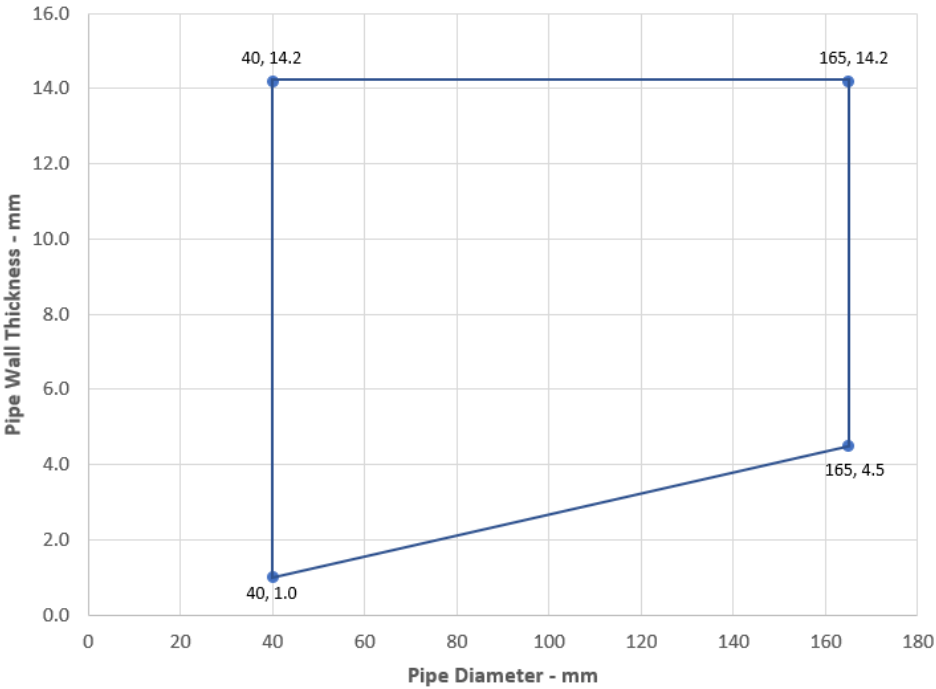


#### A.3.2.1

Services	Sealant depth	Backing (minimum)	Insulation	Classification
Mild or stainless steel pipe				
22 mm diameter/3-10 mm wall	25 mm	Stone wool 25 mm deep 35 kg/m <sup>3</sup>	None	EI 120 C/C
Maximum 165 mm diameter/ wall*	12.5 mm	12.5 mm stone wool 33 kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class D-s3, d0	E 90 C/U EI 45 C/U
			13 -25 mm Elastomeric insulation minimum class D-s3, d0	EI 60 C/U
40 mm diameter/1-14.2 mm wall*	12.5 mm	20 mm Stone wool 40 kg/m <sup>3</sup>	13 -19 mm Elastomeric insulation minimum class B-s3,d0	EI 120 C/C
40 mm diameter/1-14.2 mm wall*	25 mm	25 mm AES Fibre $\geq 128\text{kg/m}^3$		E 120 C/C EI 60 C/C
50 mm diameter/1.3-14.2 mm wall*				
60 mm diameter/1.6-14.2 mm wall*				
75 mm diameter/2-14.2 mm wall*				
90 mm diameter/2.4-14.2 mm wall*				
100 mm diameter/2.7-14.2 mm wall*				
115 mm diameter/3.1-14.2 mm wall*				
140 mm diameter/3.8-14.2 mm wall*				
165 mm diameter/4.5-14.2 mm wall*				

\* Typical pipe diameters shown, see below graph for intermediate sizes

### Steel Pipes with Elastomeric Insulation - C/U

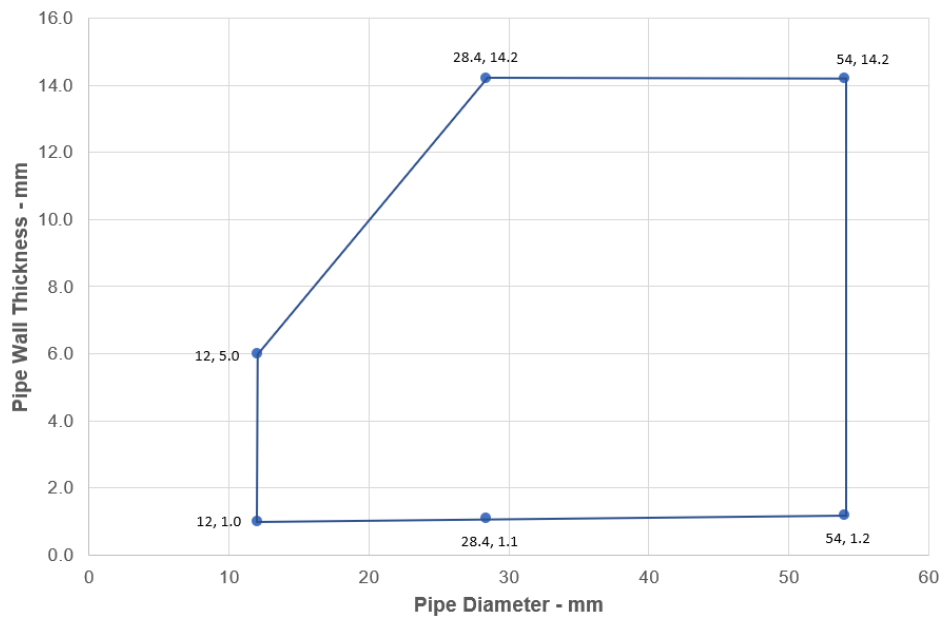




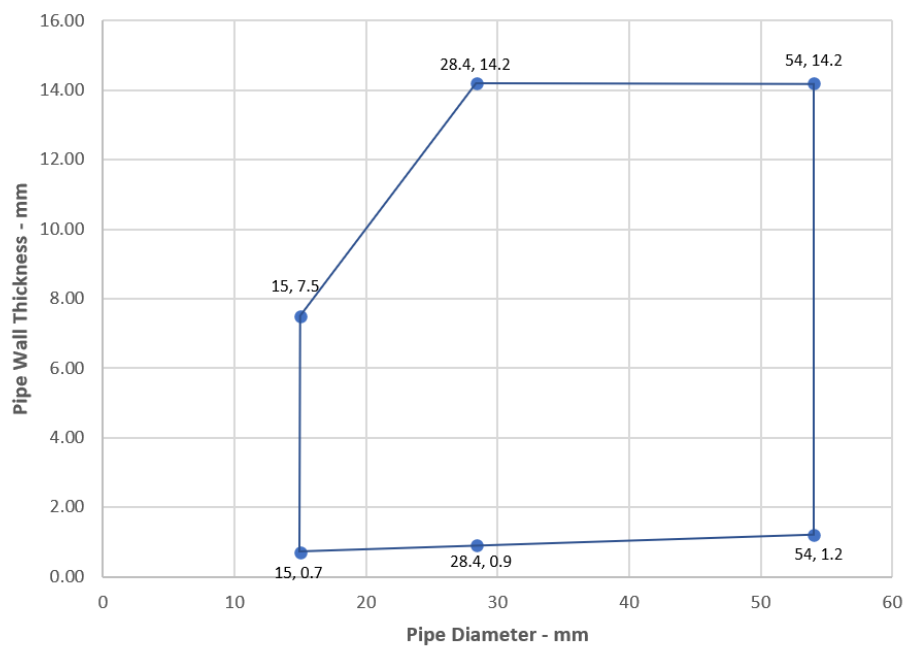
Services	Sealant depth	Backing	Insulation	Classification	
Copper or steel pipe					
12 mm diameter/1-6 mm wall	25 mm	25 mm AES Fibre $\geq$ 128kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class B-s3,d0	EI 120 C/C	
12-54 mm diameter/1-14.2 mm wall*			9-18 mm Elastomeric insulation minimum class B-s3,d0	E 120 C/C, EI 60 C/C	
12-54 mm diameter/1-14.2 mm wall*			19 mm Elastomeric insulation minimum class B-s3,d0	E 120 C/C, EI 90 C/C	
12-54 mm diameter/1-14.2 mm wall*			20-25 mm Elastomeric insulation minimum class B-s3,d0	EI 60 C/C	
15-54 mm diameter/0.7-14.2 mm wall*		None required	15 mm Phenolic foam insulation	E 120 C/C, EI 60 C/C	
15-54 mm diameter/0.7-14.2 mm wall*			16-30 mm Phenolic foam insulation	E 90 C/C, EI 60 C/C	
15-159 mm diameter/0.7-14.2 mm wall*			15-100 mm Phenolic foam insulation	E 45 C/C, EI 30 C/C	
15-159 mm diameter/0.7-14.2 mm wall*		25 mm around one layer of Astro PFP FR Pipe Wrap (1.8 x 50 mm)	100 mm Phenolic foam insulation	EI 60 C/C	
<b>Alupex Composite Pipe</b>					
16 mm diameter/ wall*		12.5 mm	12.5 mm stone wool 33 kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class D-s3, d0	E 120 C/C EI 90 C/C
Maximum 75 mm diameter/ wall*	13-24 mm Elastomeric insulation minimum class D-s3, d0			E 90 C/C EI 60 C/C	
	25 mm Elastomeric insulation minimum class D-s3, d0			EI 90 C/C	
16 mm diameter/2.25 mm wall	25 mm			25 mm AES Fibre $\geq$ 128kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class B-s3,d0
16 mm diameter/2.25 mm wall		9-25 mm Elastomeric insulation minimum class B-s3,d0	EI 60 C/C		
20 mm diameter/2.5 mm wall					
26 mm diameter/3 mm wall					
32 mm diameter/3 mm wall					
40 mm diameter/3.5 mm wall					
50 mm diameter/4 mm wall					
63 mm diameter/4.5 mm wall					
75 mm diameter/4.7 mm wall					

\* Typical pipe diameters shown, see below graph for intermediate sizes

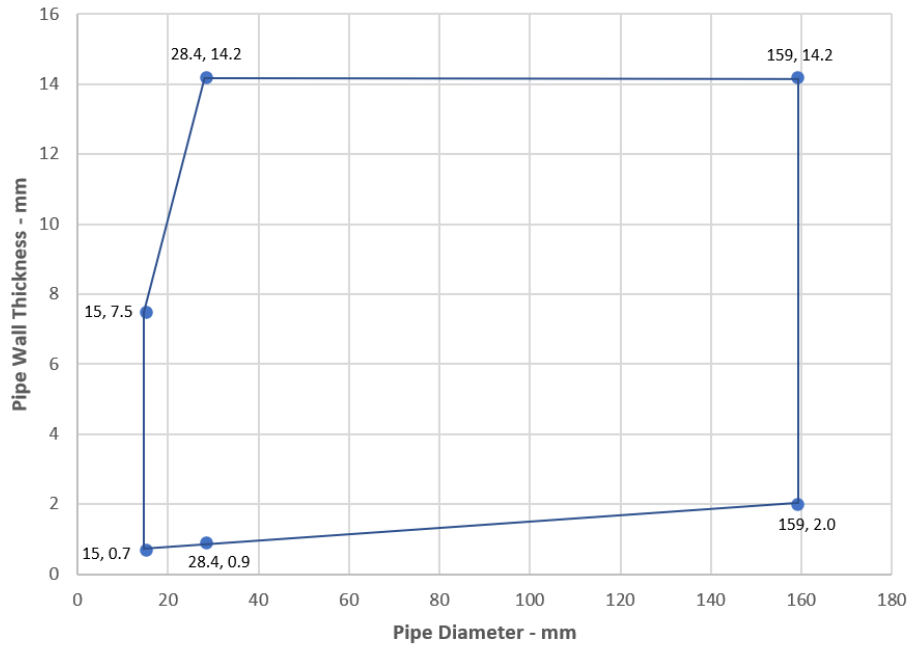
### Copper or Steel Pipes with Elastomeric Insulation - C/C



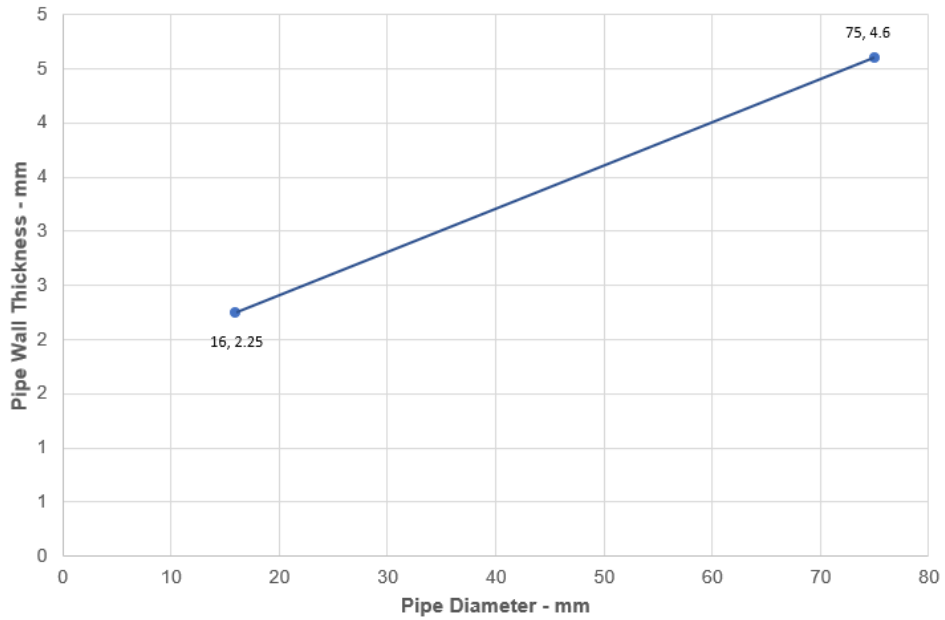
### Copper or Steel Pipes with Phenolic Foam Insulation - C/C



### Copper or Steel Pipes with Phenolic Foam Insulation - C/C



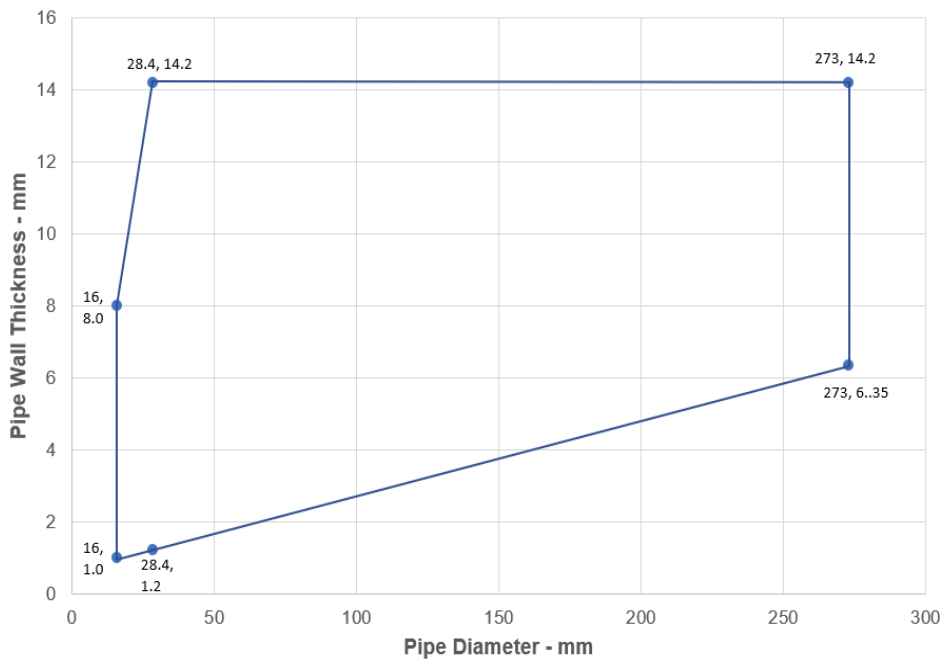
### Alupex Pipes with Elastomeric Insulation - C/C



Services	Sealant depth	Backing (minimum)	Insulation	Classification
Mild or stainless steel pipe				
16 mm diameter/ wall*	25 mm	None	15 mm thick phenolic insulation	EI 90 C/U
Maximum 273 mm/ wall*			25 mm thick phenolic insulation	E 90 C/U, EI 60 C/U
			26-100 mm thick phenolic insulation	EI 60 C/U

\* Typical pipe diameters shown, see below graph for intermediate sizes

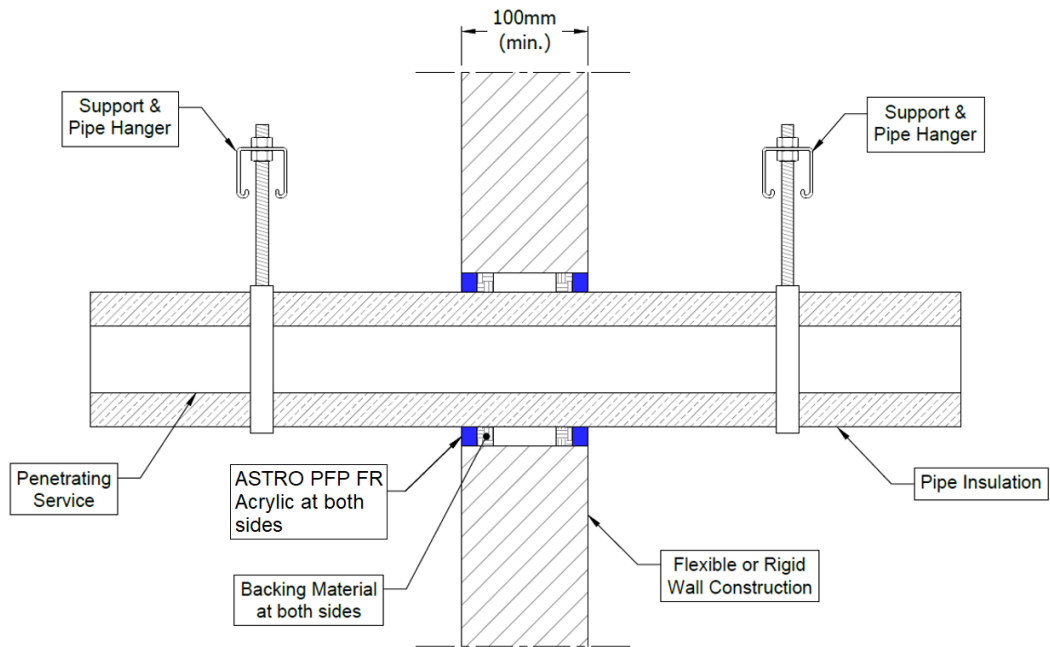
**Steel Pipes with Phenolic Insulation - C/U**



### A.3.3 Double side penetration seal with metallic pipes

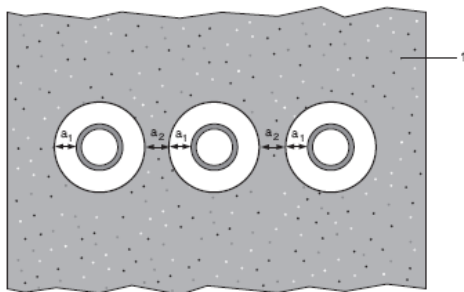
**Penetration Seal:** CS (Continuous Sustained) insulated metallic pipes (single) fitted at any position within the aperture, with 12.5 mm ASTRO PFP FR Acrylic to both sides of the wall, backed with 12.5 mm deep stone wool insulation minimum 35 kg/m<sup>3</sup>. Minimum annular space 10 mm (A1) and minimum separation between penetration seals 30 mm (A2). Maximum seal size 300 x 300 mm / 504 mm  $\varnothing$

Construction details:



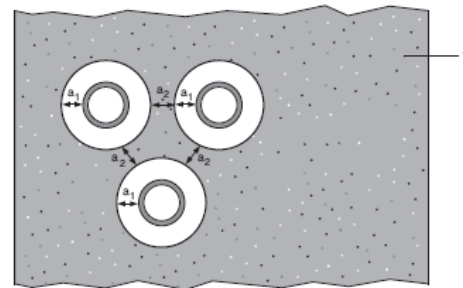
Configuration 1:

Option 1



Configuration 2:

Option 2



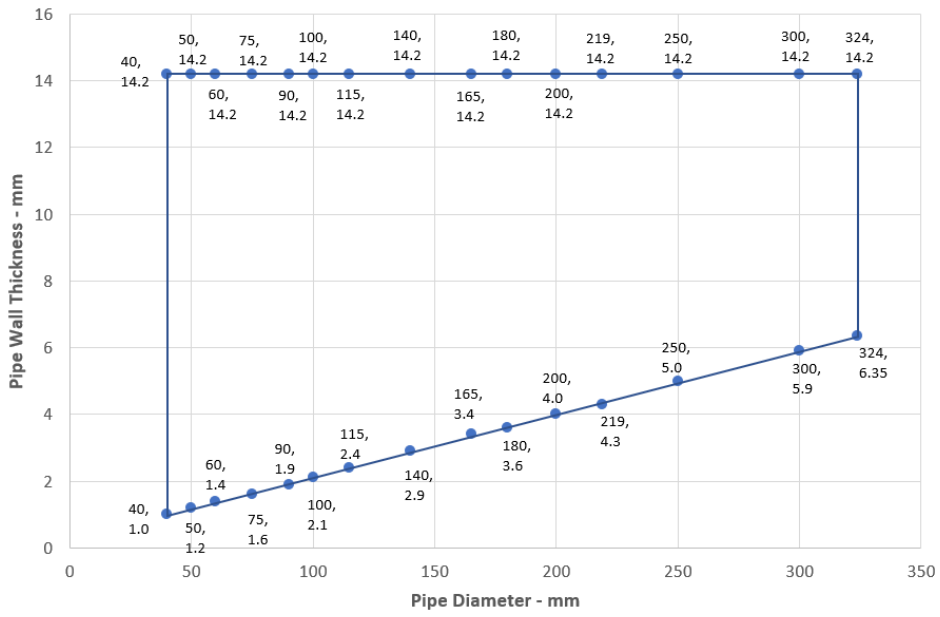
#### Key

- 1 Supporting construction
- a1 Pipe / top edge of seal separation
- a2 Pipe / side edge of seal separation
- a3 Pipe / pipe separation

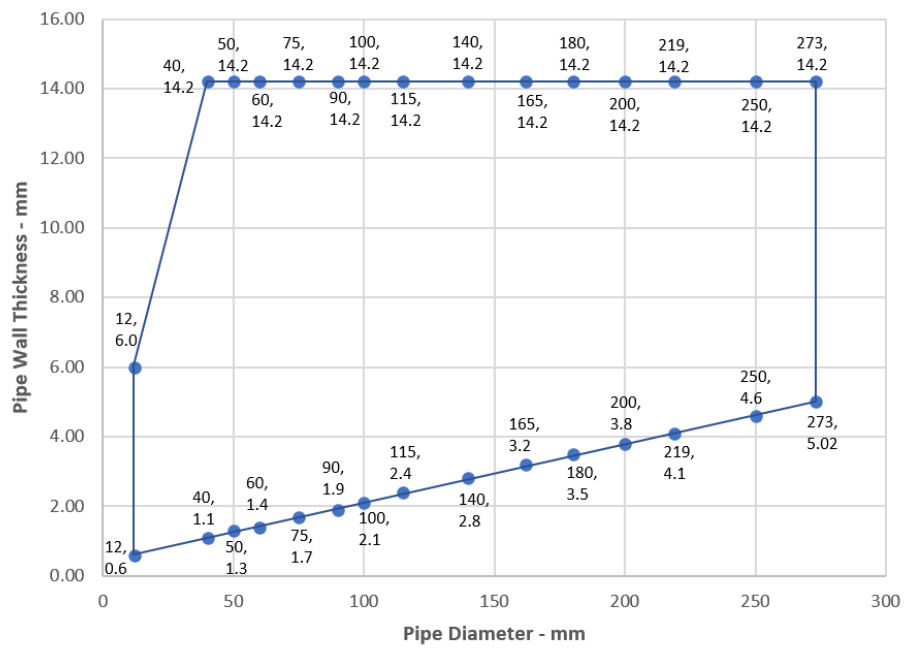
### A.3.3.1 Double side penetration seal with pipes

Services	Insulation	Classification
Mild or stainless steel pipe		
40 mm diameter/1-14.2 mm wall	20 mm thick stone, mineral wool min. 80 kg/m <sup>3</sup>	<b>E 120 C/U</b> <b>EI 90 C/U</b>
40 mm diameter/1-14.2 mm wall*	30-80 mm thick stone, mineral wool min. 80 kg/m <sup>3</sup>	
50 mm diameter/1.2-14.2 mm wall*		
60 mm diameter/1.4-14.2 mm wall*		
75 mm diameter/1.6-14.2 mm wall*		
90 mm diameter/1.9-14.2 mm wall*		
100 mm diameter/2.1-14.2 mm wall*		
115 mm diameter/2.4-14.2 mm wall*		
140 mm diameter/2.9-14.2 mm wall*		
165 mm diameter/ 3.4-14.2 mm wall*		
180 mm diameter/ 3.6-14.2 mm wall*		
200 mm diameter/ 4.0-14.2 mm wall*		
219 mm diameter/ 4.3-14.2 mm wall*		
250 mm diameter/ 5.0-14.2 mm wall*		
300 mm diameter/ 5.9-14.2 mm wall*		
324 mm diameter/ 6.35-14.2 mm wall*		
12 mm diameter/0.6-6.0 mm wall	20 mm thick glass or stone, mineral wool min. 75 kg/m <sup>3</sup> (CS, or LS at 550 mm each side)	<b>EI 60 C/C</b>
40 mm diameter/1.1-14.2 mm wall*	30-60 mm thick glass or stone, mineral wool min. 75 kg/m <sup>3</sup> (CS, or LS at 550 mm each side)	
50 mm diameter/1.3-14.2 mm wall*		
60 mm diameter/1.4-14.2 mm wall*		
75 mm diameter/1.7-14.2 mm wall*		
90 mm diameter/1.9-14.2 mm wall*		
100 mm diameter/2.1-14.2 mm wall*		
115 mm diameter/2.4-14.2 mm wall*		
140 mm diameter/2.8-14.2 mm wall*		
165 mm diameter/ 3.2-14.2 mm wall*		
180 mm diameter/ 3.5-14.2 mm wall*		
200 mm diameter/ 3.8-14.2 mm wall*		
219 mm diameter/ 4.1-14.2 mm wall*		
250 mm diameter/ 4.6-14.2 mm wall*		
273 mm diameter/ 5.0-14.2 mm wall*		

### Steel Pipes with Mineral Wool Insulation - C/U

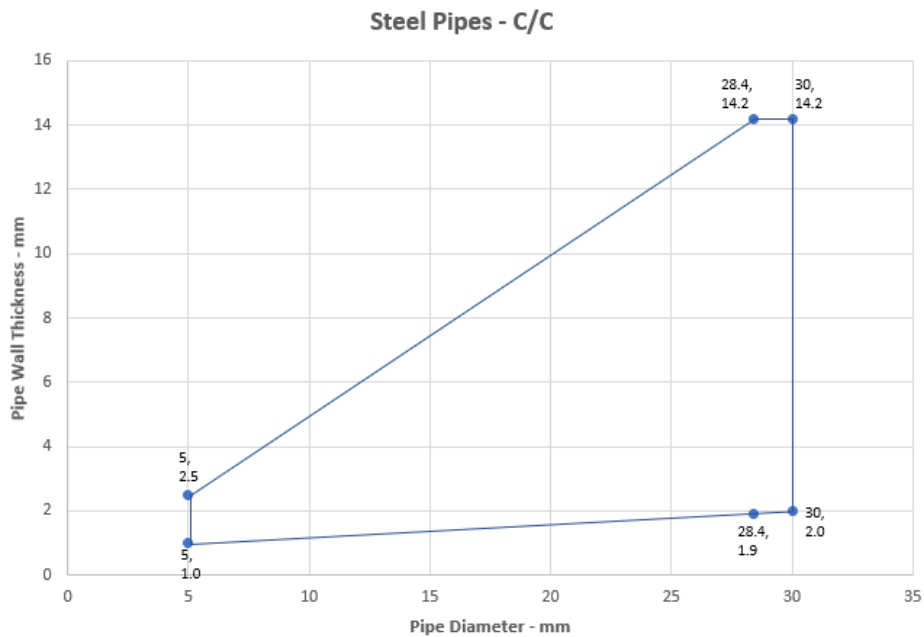


### Steel Pipes with Glass or Stone Wool Insulation - C/C



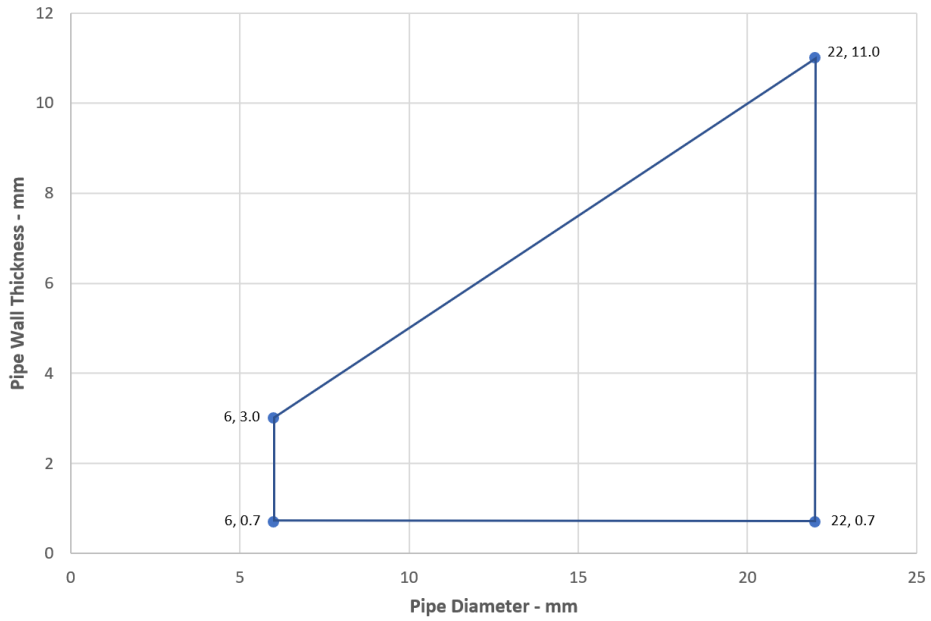
Services	Insulation	Classification
PEX pipe in pipe system		
15 mm diameter x 2.5 mm wall inner /25mm diameter outer	None	EI 120 C/C
Alupex pipe		
16-20 mm diameter/2.0 mm wall	None	EI 120 C/C
16-75 mm diameter/2.25-4.6 mm	20-50 mm thick glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup>	EI 120 C/C
16-75 mm diameter/2.25-4.7 mm	60 mm thick glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup>	EI 60 C/C
Mild or Stainless Steel pipe		
4 mm diameter/1.0-2.0 mm wall	None	EI 90 C/C
5-30 mm diameter/1.0-14.2 mm wall*		EI 120 C/U
30 mm diameter/2.0-14.2 mm wall		
Copper or Steel pipe		
6-12 mm diameter/0.7-6.0 mm wall*	None	E 90 C/C, EI 60 C/C
13-22 mm diameter/0.7-11 mm wall*		E 90 C/C, EI 30 C/C
12-54 mm diameter/0.9-14.2 mm wall*	20-80 mm thick stone, mineral wool min. 80 kg/m <sup>3</sup>	E 120 C/C, EI 60 C/C
12-54 mm diameter/0.6-14.2 mm wall*	20-60 mm thick glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> (CS, or LS at 550 mm each side)	EI 60 C/C

\* See below graphs for interpolated pipe sizes

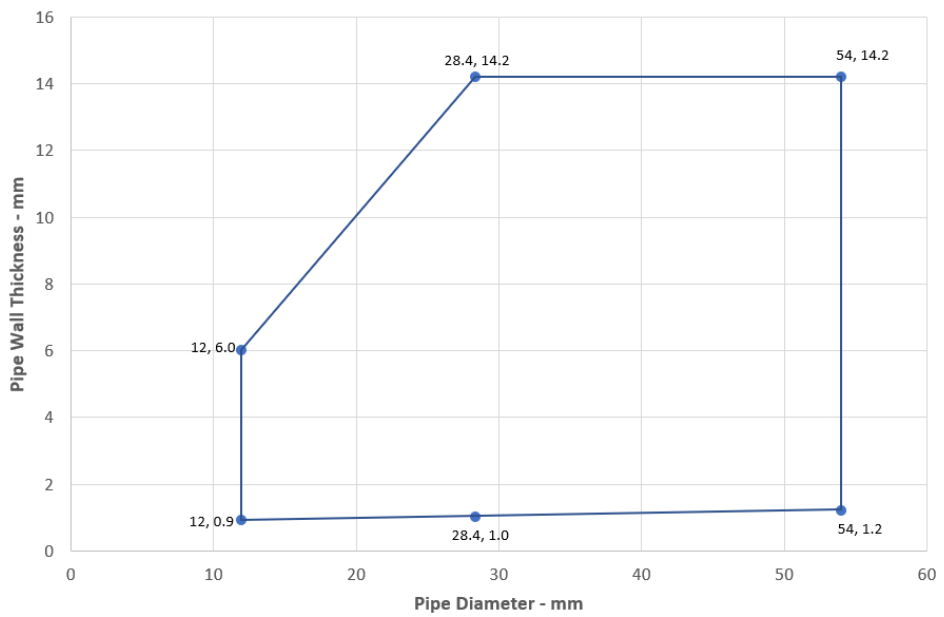




### Copper or Steel Pipes - C/C



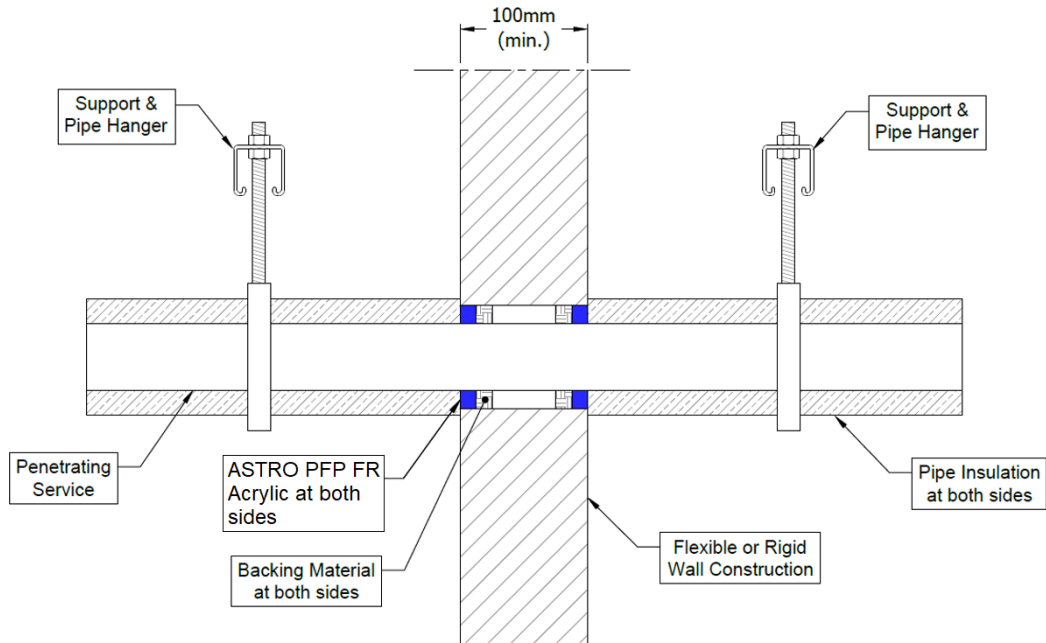
### Copper or Steel Pipes with Mineral Wool Insulation - C/C



### A.3.4 Double side penetration seal with composite pipes

**Penetration Seal:** CI (Continuous Interrupted) or LI (Locally Interrupted) insulated composite pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall, minimum 10 mm seal width around service, maximum seal size 300 x 300 mm, backed with stonewool.

Construction details:



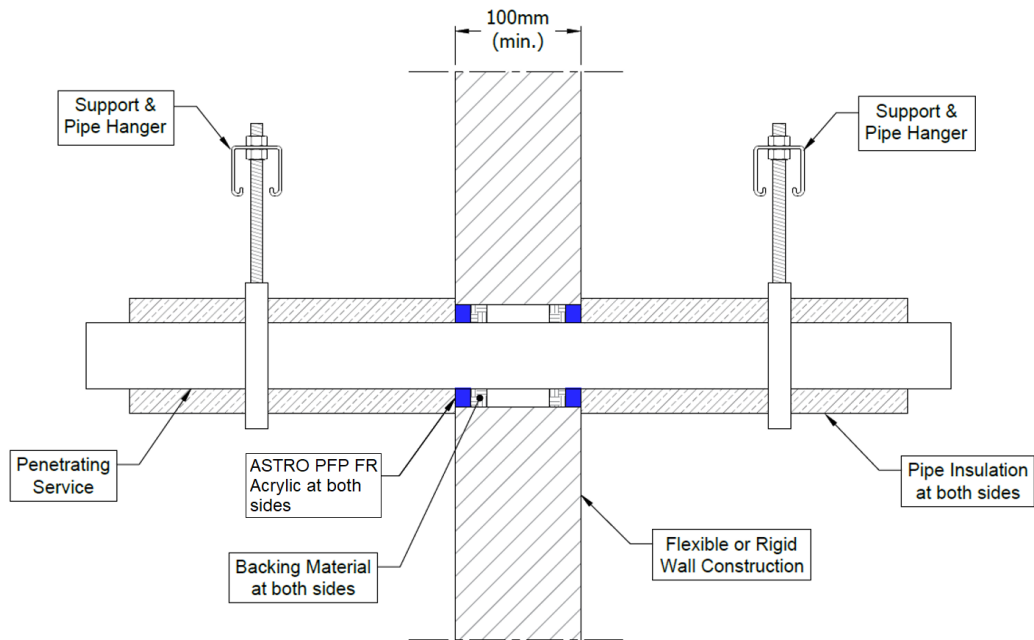
#### A.3.4.1

Services	Sealant depth	Backing (minimum)	Insulation (minimum)	Classification
Alupex Composite Pipe				
16 mm diameter/2.25 mm wall	12.5 mm	12.5 mm stonewool 40 kg/m <sup>3</sup>	20 mm stonewool 80 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>EI 120 C/C</b>
20 mm diameter/2.5 mm wall				
26 mm diameter/3 mm wall				
32 mm diameter/3 mm wall				
40 mm diameter/3.5 mm wall				
50 mm diameter/4 mm wall				
63 mm diameter/4.5 mm wall				
75 mm diameter/4.7 mm wall	12.5 mm	12.5 mm stonewool 33 kg/m <sup>3</sup>	20 mm glass wool 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>EI 120 C/C</b>
16 mm diameter/2.25 mm wall				
20 mm diameter/2.5 mm wall				
26 mm diameter/3 mm wall				
32 mm diameter/3 mm wall				
40 mm diameter/3.5 mm wall				
50 mm diameter/4 mm wall				
63 mm diameter/4.5 mm wall				
75 mm diameter/4.7 mm wall				

### A.3.5 Double side penetration seal with metallic (and composite) pipes

**Penetration Seal:** LI (Local Interrupted) of minimum length stated below or CI (Continuous Interrupted) insulated metallic pipes and composite (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall, min. 10 mm seal width around service, backed with stone wool insulation or 'AES Fibre  $\geq 128\text{kg/m}^3$ '.

Construction details:



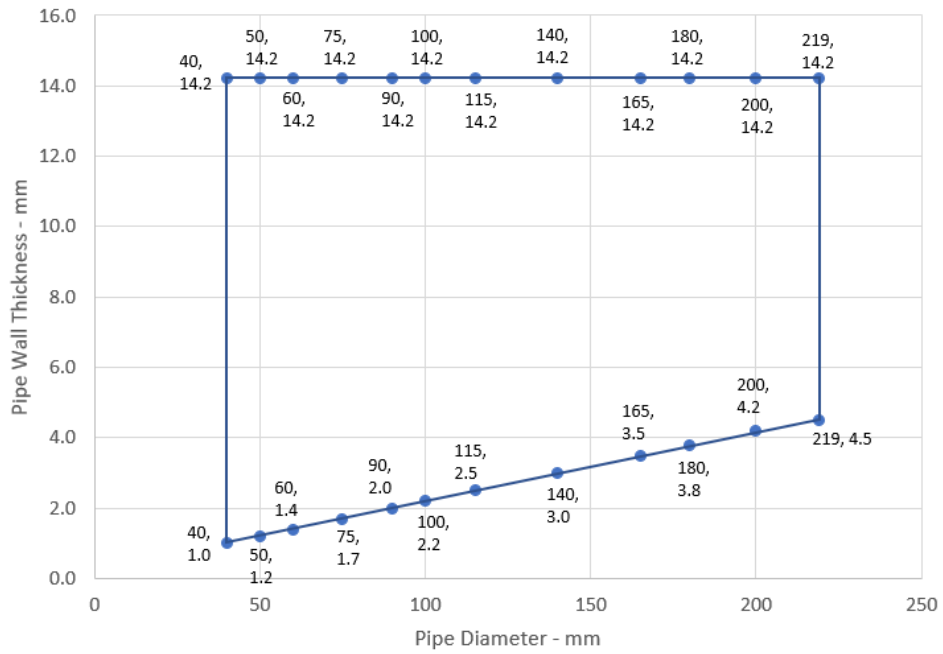
#### A.3.5.1

Services	Sealant depth	Backing (minimum)	Insulation (minimum)	Classification
<b>Maximum aperture size 300 x 300 mm</b>				
Copper or steel pipe up to 54 mm diameter/1-14.2 mm wall	12.5 mm	20 mm Stone wool 40 kg/m <sup>3</sup>	500 mm length of 20 mm stone wool 80 kg/m <sup>3</sup>	<b>EI 120 C/U</b>
Copper or steel pipe up to 159 mm diameter/0.6-14.2 mm wall		12.5 mm stone wool 33 kg/m <sup>3</sup>	1000 mm length of 30 mm stone wool 80 kg/m <sup>3</sup>	<b>EI 60 C/C</b>
Copper or steel pipe up to 54 mm diameter/0.6-14.2 mm wall		12.5 mm stone wool 33 kg/m <sup>3</sup>	500 mm length of 20 mm glass wool 75 kg/m <sup>3</sup>	<b>E 120 C/C, EI 60 C/C</b>
Copper or steel pipe up to 108 mm diameter/0.6-14.2 mm wall		12.5 mm stone wool 33 kg/m <sup>3</sup>	500 mm length of 30 mm glass wool 75 kg/m <sup>3</sup>	<b>E 120 C/C, EI 30 C/C</b>
Alupex composite pipe 75 mm diameter/7.5 mm wall		20 mm Stone wool 140 kg/m <sup>3</sup>	600 mm length of 25 mm AES Fibre $\geq 128\text{kg/m}^3$	<b>EI 60 C/U</b>

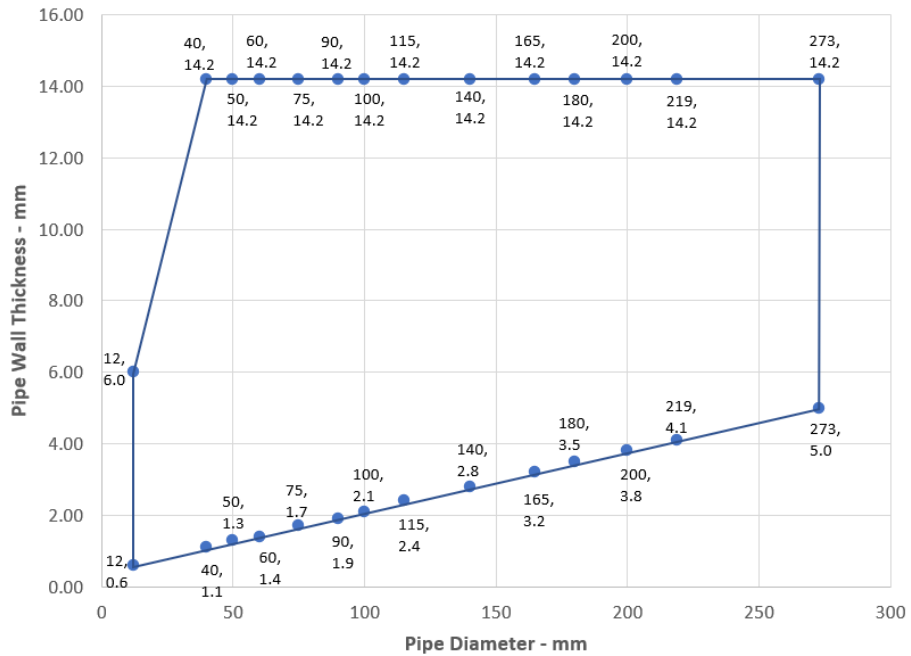
Services	Sealant depth	Backing (minimum)	Insulation (minimum)	Classification
Mild or stainless steel pipe				
<b>Maximum aperture size 300 x 300 mm</b>				
40 mm diameter/1-14.2 mm wall	12.5 mm	20mm Stone wool 40 kg/m <sup>3</sup>	500 mm length of 20 mm stone wool 80 kg/m <sup>3</sup>	<b>EI 120 C/U</b>
40 mm diameter/1-14.2 mm wall*			500 mm length of 30 mm stone wool 80 kg/m <sup>3</sup>	
50 mm diameter/1.2-14.2 mm wall*				
60 mm diameter/1.4-14.2 mm wall*				
75 mm diameter/1.7-14.2 mm wall*				
90 mm diameter/2-14.2 mm wall*				
100 mm diameter/2.2-14.2 mm wall*				
115 mm diameter/2.5-14.2 mm wall*				
140 mm diameter/3-14.2 mm wall*	12.5 mm	20mm Stone wool 40 kg/m <sup>3</sup>	500 mm length of 30 mm stone wool 80 kg/m <sup>3</sup>	<b>E 120 C/U, EI 90 C/U</b>
165 mm diameter/3.5-14.2 mm wall*				
180 mm diameter/3.8-14.2 mm wall*				
200 mm diameter/4.2-14.2 mm wall*				
219 mm diameter/4.5-14.2 mm wall*	12.5 mm	12.5mm Stone wool 33 kg/m <sup>3</sup>	500 mm length of 30 mm glass wool 75 kg/m <sup>3</sup>	<b>E 120 C/C, EI 60 C/C</b>
12 mm diameter/0.6-6.0 mm wall				
40 mm diameter/1.1-14.2 mm wall*				
50 mm diameter/1.3-14.2 mm wall*				
60 mm diameter/1.4-14.2 mm wall*				
75 mm diameter/1.7-14.2 mm wall*				
90 mm diameter/1.9-14.2 mm wall*				
100 mm diameter/2.1-14.2 mm wall*				
115 mm diameter/2.4-14.2 mm wall*				
140 mm diameter/2.8-14.2 mm wall*				
165 mm diameter/3.2-14.2 mm wall*				
180 mm diameter/3.5-14.2 mm wall*				
200 mm diameter/3.8-14.2 mm wall*				
219 mm diameter/4.1-14.2 mm wall*				
273 mm diameter/5.0-14.2 mm wall*				

\* Typical pipe diameters shown, see below graph for intermediate sizes

### Steel Pipes with Mineral Wool Insulation - C/U



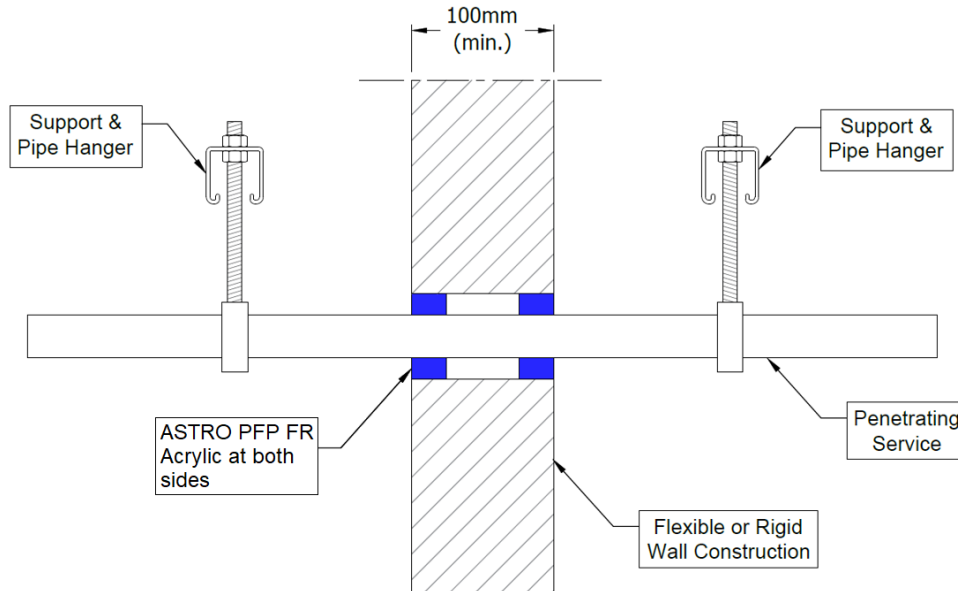
### Steel Pipes with Glass Wool Insulation - C/C



### A.3.6 Double side penetration seal with plastic pipes

**Penetration Seal:** Combustible pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall, Minimum annular space 10 mm and minimum separation between penetration seals 30 mm (a2).

Construction details:

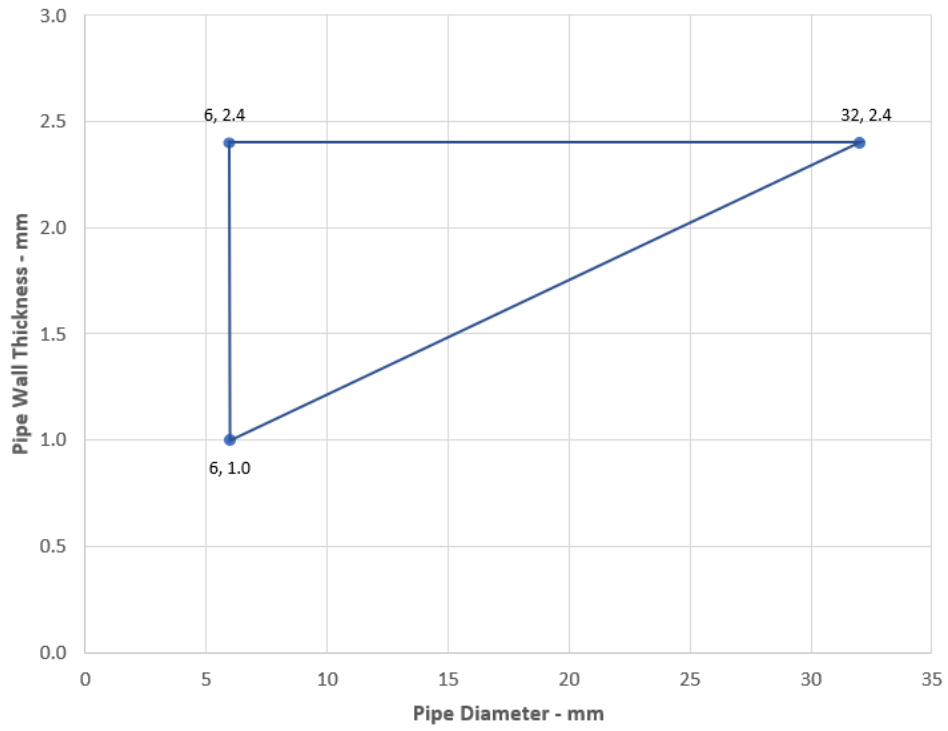


#### A.3.6.1

Pipe material	Sealant depth	Pipe size	Maximum Annular space	Classification
PVC-U pipe according to EN 1329-1, EN 1452-1 and EN 1453-1, PVC-C according to EN 1566-1	25 mm	6-32 mm $\varnothing$ /1.0-2.4 mm wall*	10 mm	EI 120 U/C
		6-32 mm $\varnothing$ /1.0-1.6 mm wall	30 mm	E 120 U/C, EI 90 U/C
20 mm $\varnothing$ /2.2 mm wall		EI 120 C/C		
PP pipe according to EN 1451-1 or DIN 8077/8078		20 mm $\varnothing$ /2.2-4.4 mm wall	30 mm	EI 60 U/C
		20-32 mm $\varnothing$ /1.8-4.4 mm wall		EI 60 C/C
PE pipe according to EN 1519-1, EN 12201-2 and EN 12666-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1		20 mm $\varnothing$ /2.0 mm wall	30 mm	EI 120 U/C
		20-32 mm $\varnothing$ /2.0-3.0 mm wall	30 mm	EI 90 C/C
Uponor Wirsbo PEX pipe in pipe system according to ISO 15875		Diameter up to 54 mm/0.4 mm wall thickness (outer pipe), 28 mm diameter/4.0 mm wall thickness (inner pipe)	30 mm	E 60 C/C, EI 45 C/C
Insulated pipe in pipe system according to ISO 15875		Diameter up to 34 mm/1.0 mm wall thickness (outer pipe), 22 mm diameter/3.0 mm wall thickness (inner pipe), insulated with 9 mm thick polyethylene foam	30 mm	EI 45 C/C

\* See below graphs for interpolated pipe sizes

### PVC-U Pipes - U/C

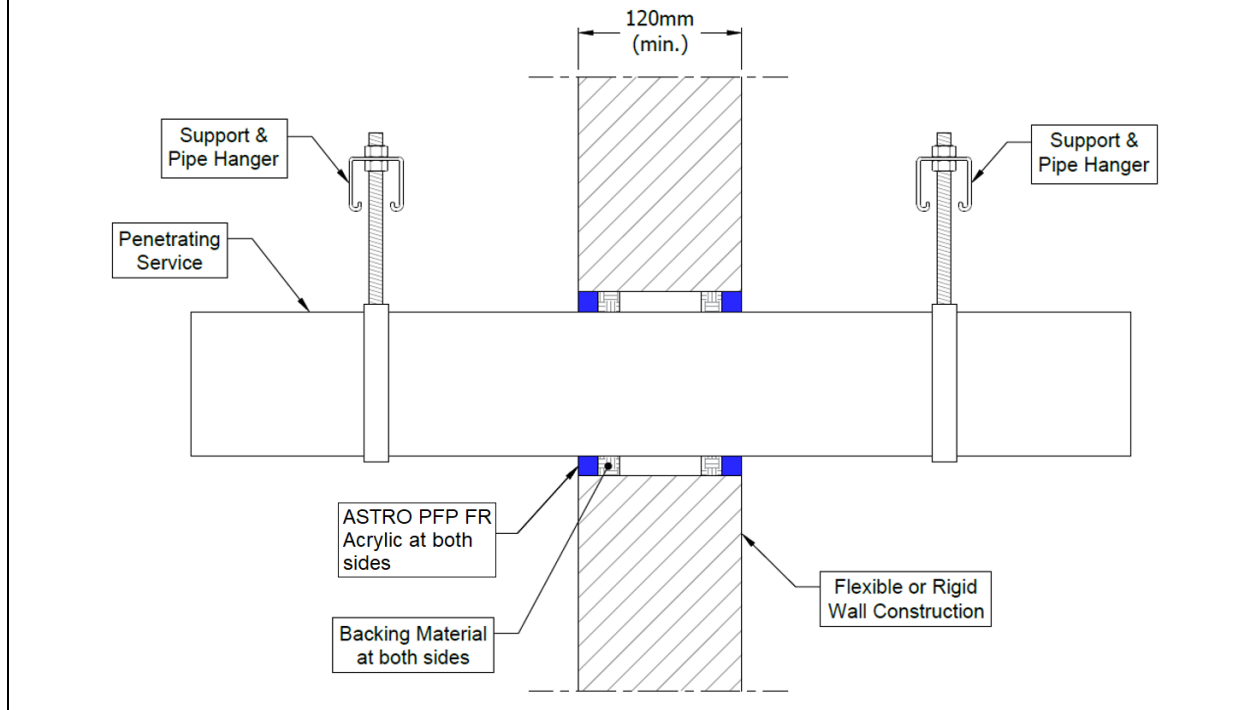


#### A.4 Flexible and rigid wall constructions according to 2.2) with wall thickness of minimum 120 mm

##### A.4.1 Double side penetration seal with cables

**Penetration Seal:** Non-insulated metallic pipes (single) fitted at any position within the aperture, with 15 mm deep ASTRO PFP FR Acrylic to both sides of the wall, backed with stone wool insulation.

Construction details:



##### A.4.1.1

Services	Sealant depth	Backing	Classification
Mild or stainless steel pipe			
30 -324 mm diameter /1.6-14.2 mm wall	15 mm	15 mm stone wool	E 120 C/U
Copper or steel pipe			
12 -54 mm diameter /0.9-14.2 mm wall	15 mm	15 mm stone wool	E 120 C/C
Alupex Pipe			
16-75 mm diameter/2.0-4.6 mm wall	15 mm	15 mm stone wool	E 120 C/C, EI 30 C/C

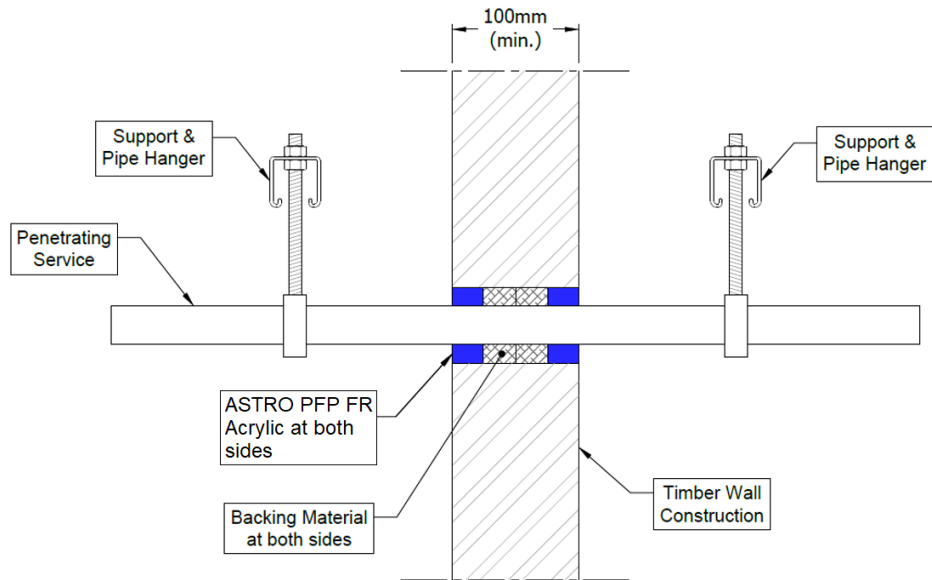


## A.5 Timber wall constructions with wall thickness of minimum 100 mm

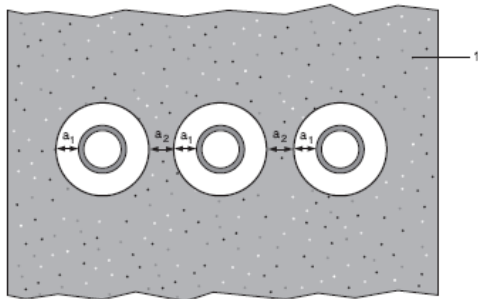
### A.5.1 Double side penetration seal with cables

**Penetration Seal:** Cables fitted at any position within the aperture, sealed with ASTRO PFP FR Acrylic, minimum 25 mm deep to both sides of the wall and backed with stone wool insulation (minimum 33kg/m<sup>3</sup>), minimum 25 mm deep. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



#### Key

- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

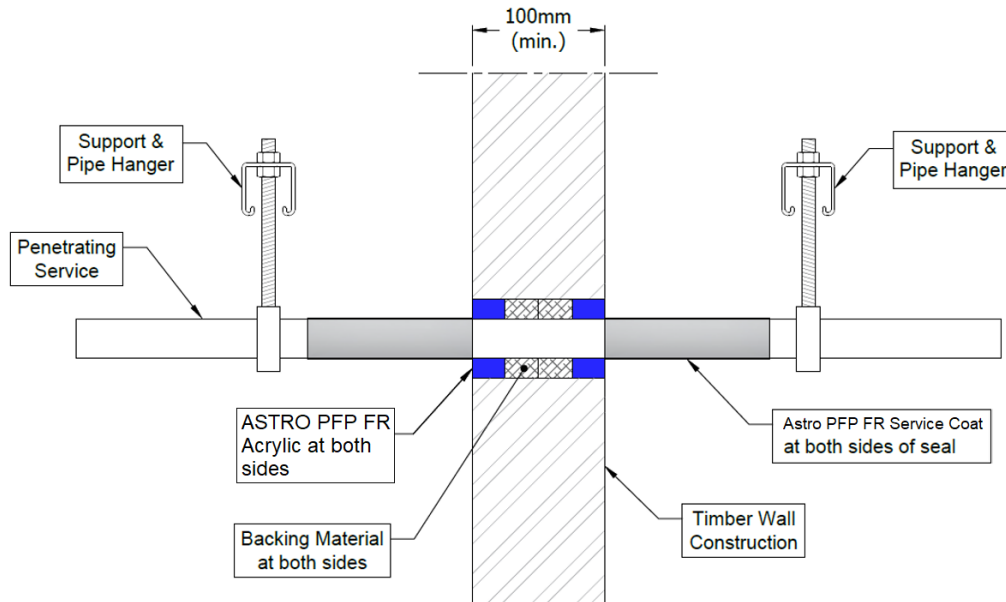
#### A.5.1.1

Services	Sealant depth	Backing	Maximum aperture	Classification
None (blank)	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	Ø 180 mm	EI 120
Cables up to 14 mm Ø, single or in bundles up to 100 mm Ø				EI 90
Cables up to 21 mm Ø, single or in bundles up to 100 mm Ø				E 90, EI 30
Cables up to 50 mm Ø, single or in bundles up to 100 mm Ø				E 90, EI 30
Telecom cables up to 14 mm Ø, single or in bundles up to 100 mm Ø				E 90, EI 60

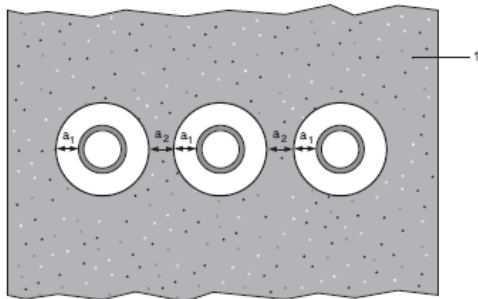
### A.5.2 Double side penetration seal with cables and Astro PFP FR Service Coat

**Penetration Seal:** Cables fitted at any position within the aperture with Astro PFP FR Service Coat, sealed with ASTRO PFP FR Acrylic, minimum 25 mm deep to both sides of the wall and backed with stone wool insulation (minimum 33kg/m<sup>3</sup>), minimum 25 mm deep. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



#### Key

- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

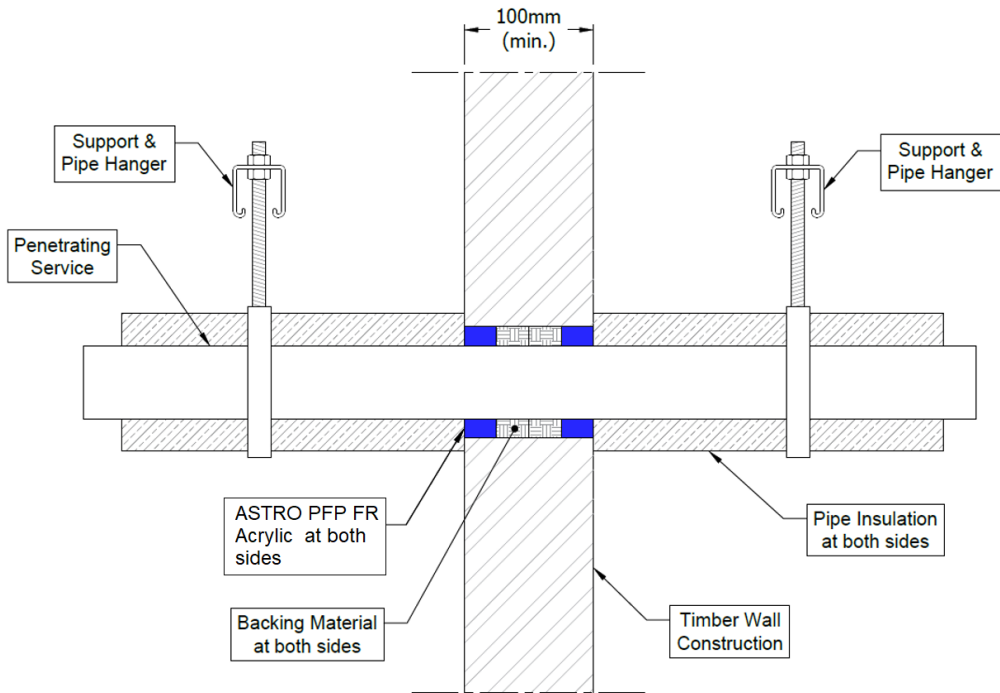
#### A.5.2.1

Services	Sealant depth	Backing	Maximum aperture	Insulation, minimum	Classification
None (blank)	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	Ø 180 mm	Astro PFP FR Service Coat, 260-micron DFT extending 150 mm from both sides of the seal	EI 120
Cables up to 21 mm Ø, single					EI 90
Cables up to 50 mm Ø, single or in bundles up to 100 mm Ø					E 90, EI 60

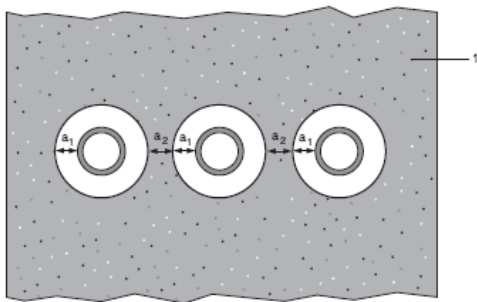
### A.5.3 Double side penetration seal with metallic pipes

**Penetration Seal:** 500 mm (min.) LI (Local Interrupted) or CI (Continuous Interrupted) insulated metallic pipes and composite pipes (single) with glass wool or stone, mineral wool min. 75 kg/m<sup>3</sup>, fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall, backed with stone wool insulation (minimum 33kg/m<sup>3</sup>), minimum 25 mm deep. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



#### Key

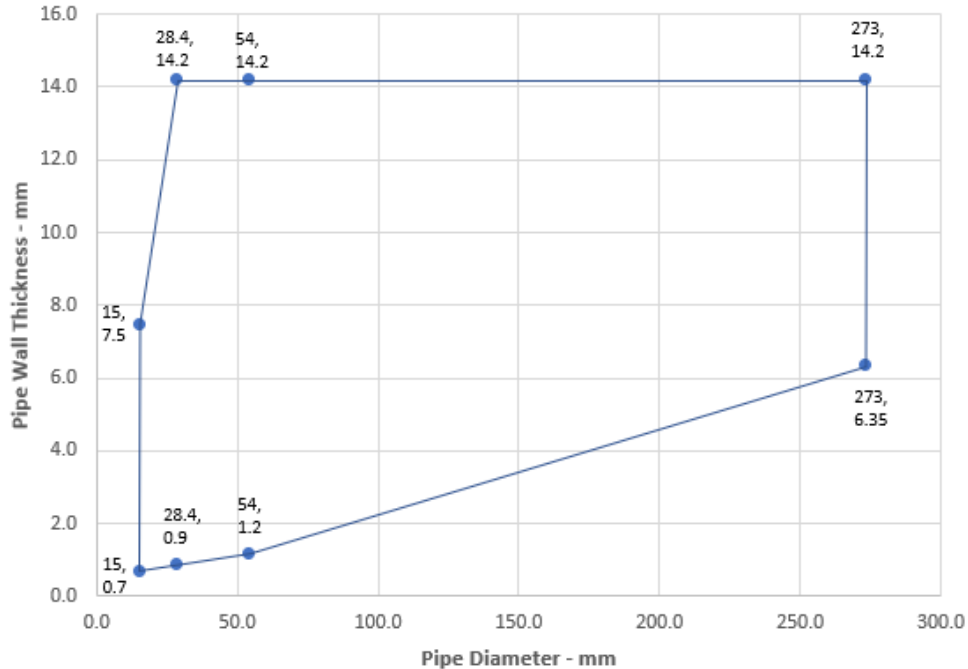
- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

### A.5.3.1

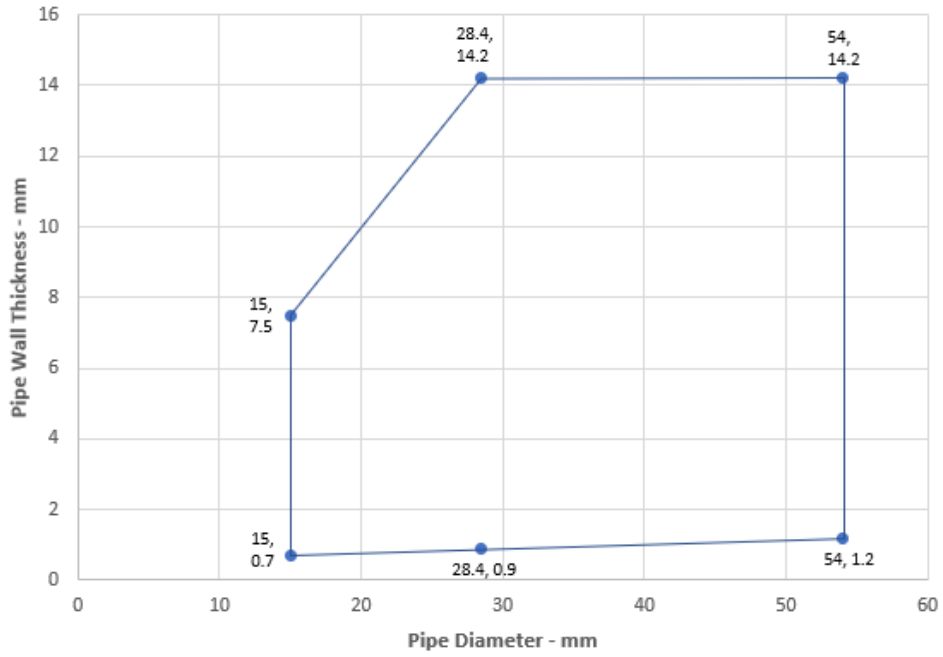
Services	Maximum aperture	Sealant depth	Backing	Insulation, minimum	Classification
Mild or stainless steel pipe					
Maximum 273 mm diameter /6.35-14.2 mm wall*	Ø 293 mm	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	25 mm glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>E 90 C/C, EI 60 C/C</b>
Copper or steel pipe					
Maximum 54 mm diameter /1.2-14.2 mm wall*	Ø 180 mm	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	20 mm glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>E 90 C/C, EI 60 C/C</b>
Alupex Pipe					
Maximum 75 mm diameter/wall 2.25-4.6 mm wall*	Ø 180 mm	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	25 mm glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>EI 90 C/C</b>

\* Typical pipe diameters shown, see below graph for intermediate sizes

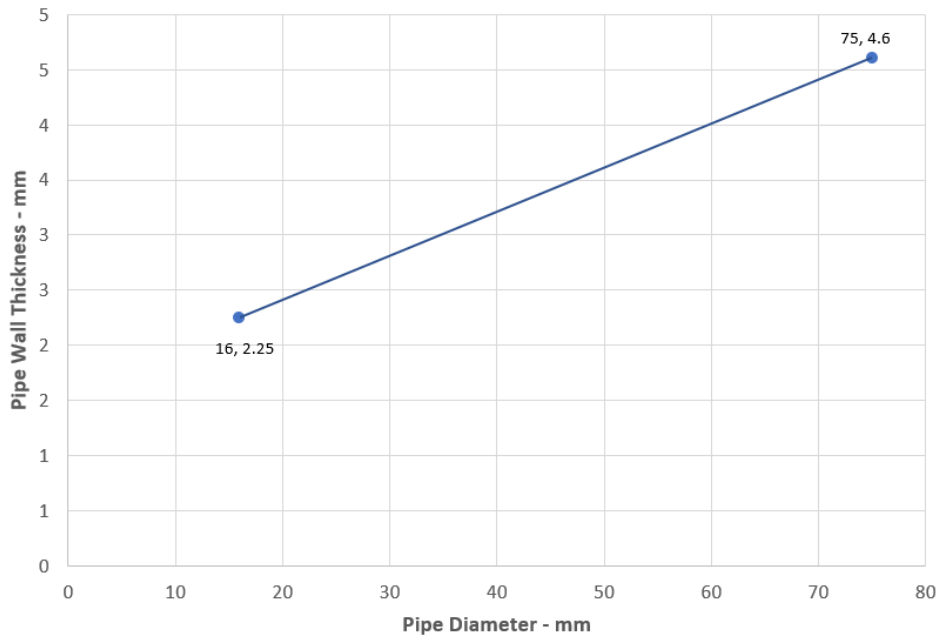
**Steel Pipes with Glass Wool or Mineral Wool Insulation - C/C**



**Copper or Steel Pipes with Glass Wool or Mineral Wool  
Insulation - C/C**



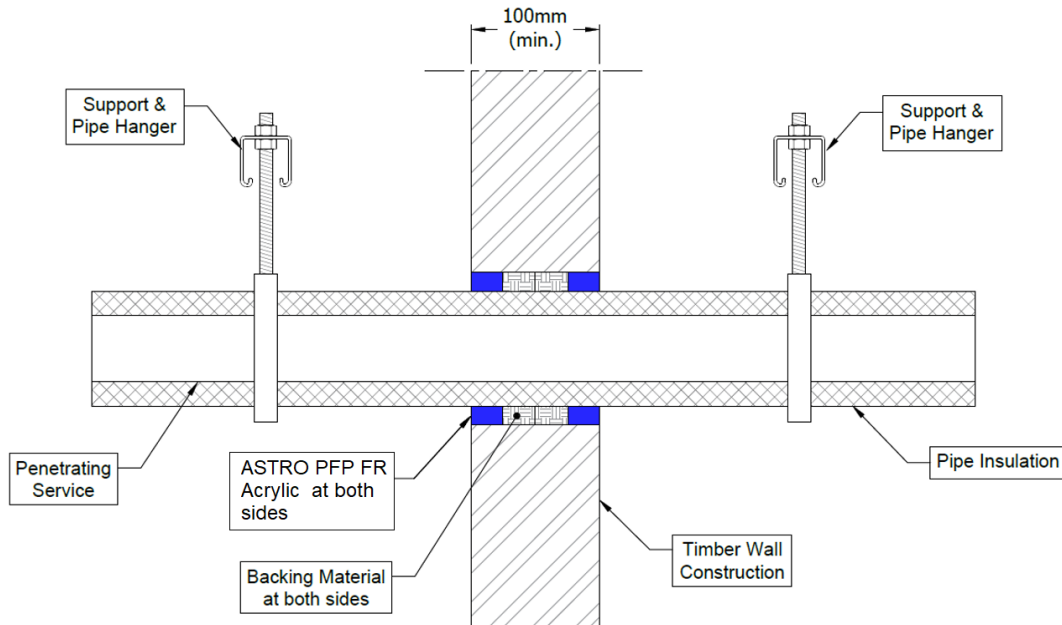
**Alupex Pipes with Glass Wool or Mineral Wool Insulation -  
C/C**



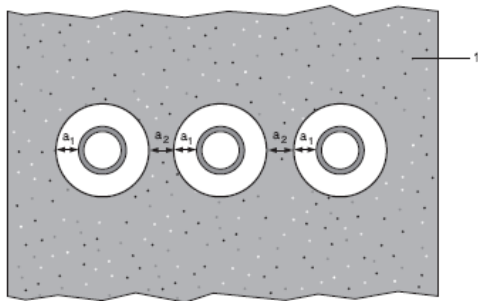
### A.5.4 Double side penetration seal with metallic pipes

**Penetration Seal:** CS (Continuous Sustained) insulated metallic pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall, min. 10 mm seal width around service, backed with stone, mineral wool min. 33 kg/m<sup>3</sup>. Minimum annular space 10 mm and maximum 30 mm (a1), and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



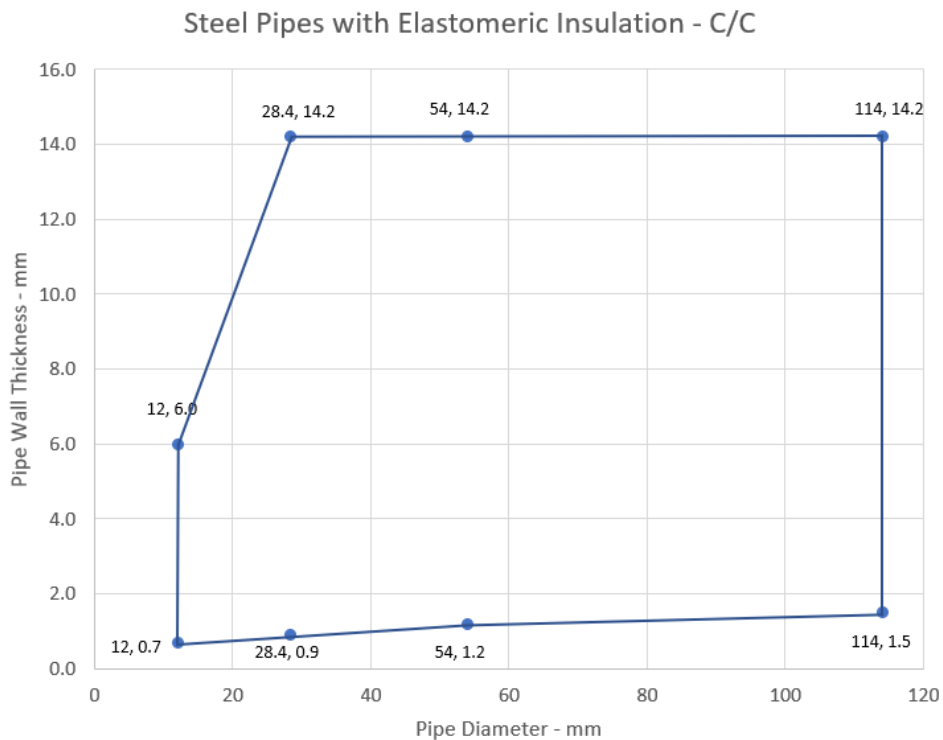
#### Key

- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

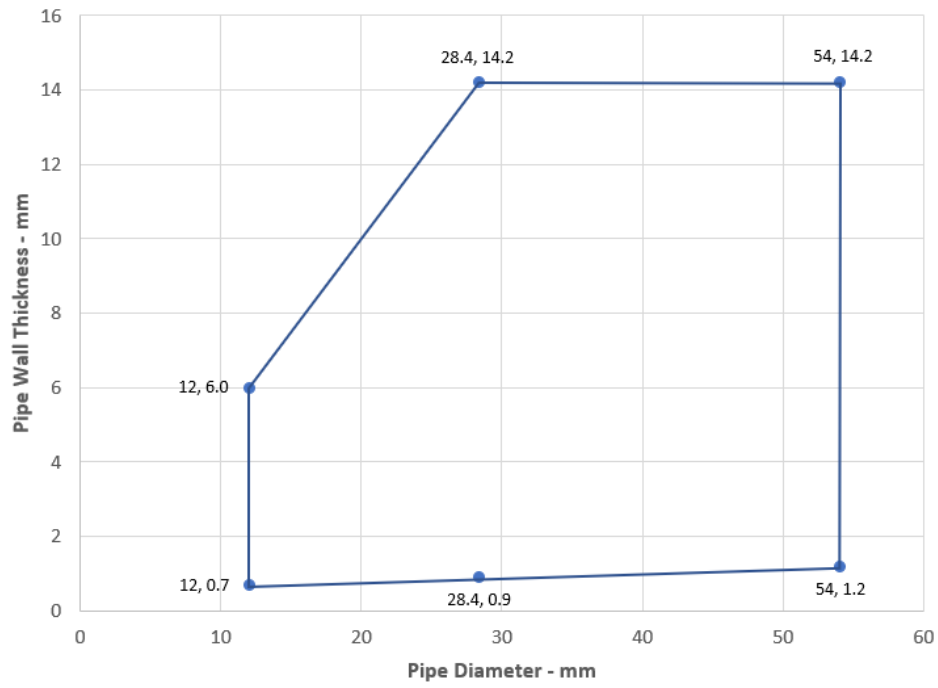
### A.5.4.1

Services	Sealant depth	Backing	Insulation, minimum	Classification
Mild or stainless steel pipe				
Maximum 114 mm diameter /1.5-14.2 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	9-25 mm Elastomeric insulation minimum class D-s3, d0	EI 30 C/U
Copper or steel pipe				
Maximum 12 mm diameter /0.7-6 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class D-s3, d0	E 90 C/C, EI 60 C/C
Maximum 54 mm diameter /1.2-14.2 mm wall*			10-25 mm Elastomeric insulation minimum class D-s3, d0	E 60 C/C, EI 30 C/C
Maximum 54 mm diameter /1.2-14.2 mm wall*			10-25 mm Elastomeric insulation minimum class D-s3, d0	E 30 C/C, EI 20 C/C
Alupex Pipe				
Maximum 16 mm diameter/wall 2.25 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class D-s3, d0	EI 90 C/C
Maximum 75 mm diameter/wall 4.6 mm wall*			10-25 mm Elastomeric insulation minimum class D-s3, d0	E 60 C/C, EI 45 C/C
Maximum 75 mm diameter/wall 4.6 mm wall*			10-25 mm Elastomeric insulation minimum class D-s3, d0	EI 45 C/C

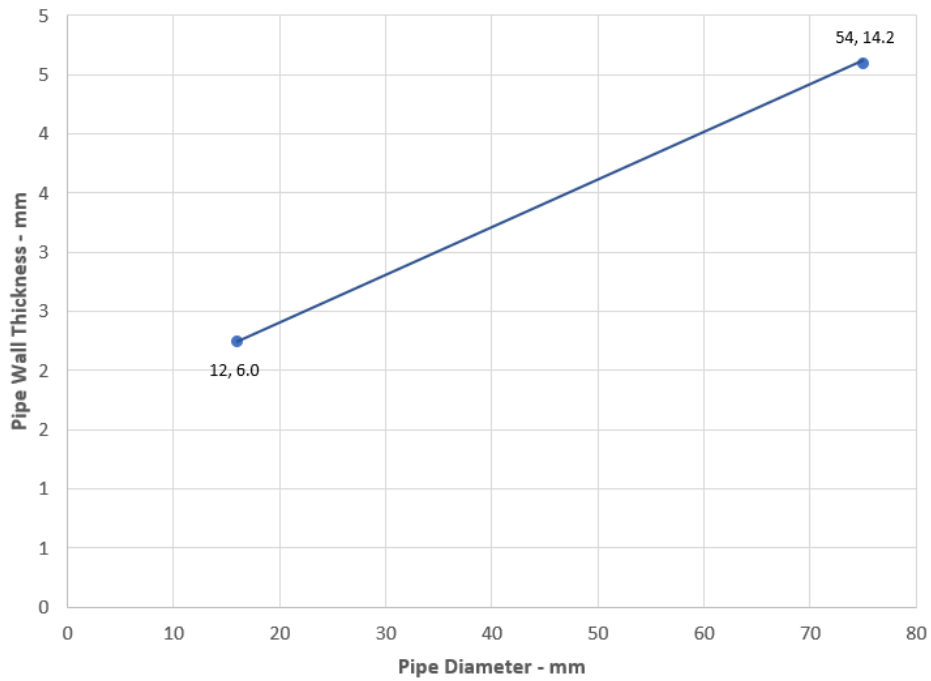
\* Typical pipe diameters shown, see below graph for intermediate sizes



### Copper or Steel Pipes with Elastomeric Insulation - C/C



### Alupex Pipes with Elastomeric Insulation - C/C

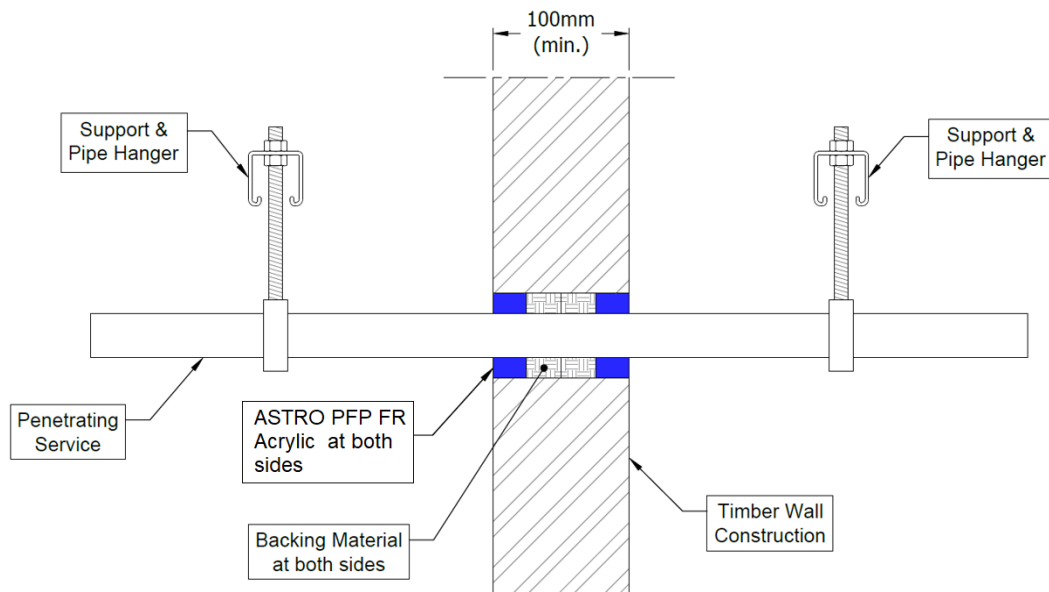




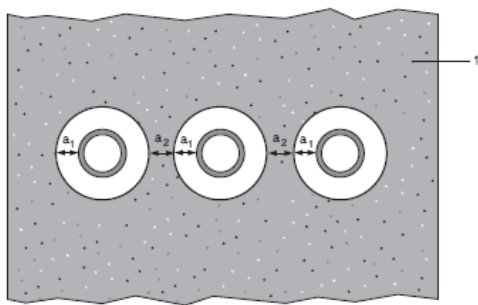
### A.5.5 Double side penetration seal with plastic pipes and composite pipes

**Penetration Seal:** Plastic and composite pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the wall, backed with stone, mineral wool min. 33 kg/m<sup>3</sup>. Minimum annular space 10 mm and maximum 30 mm (a1) and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



**Key**

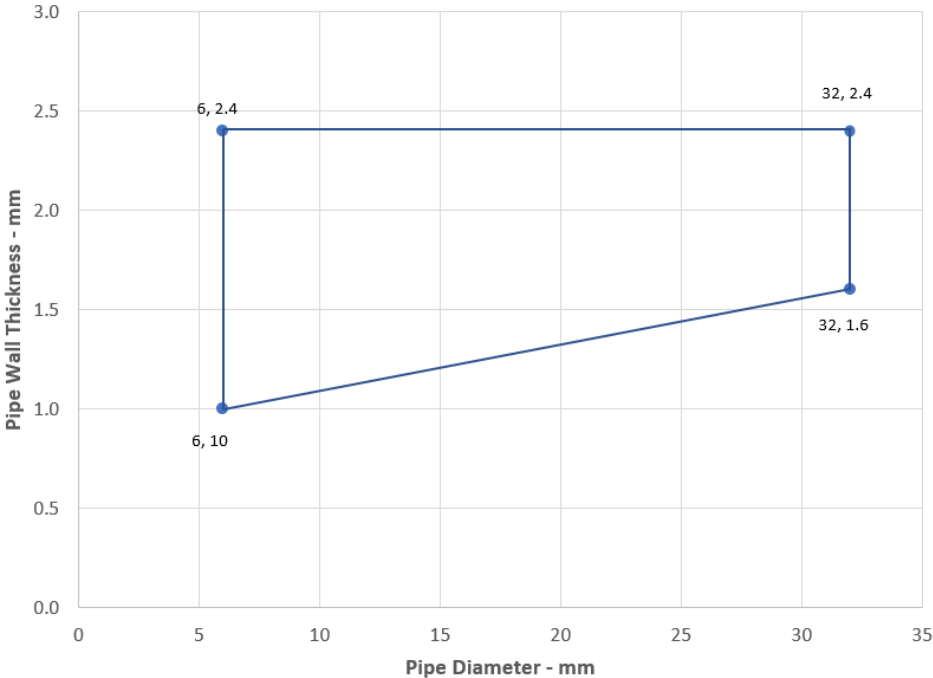
- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

#### A.5.5.1

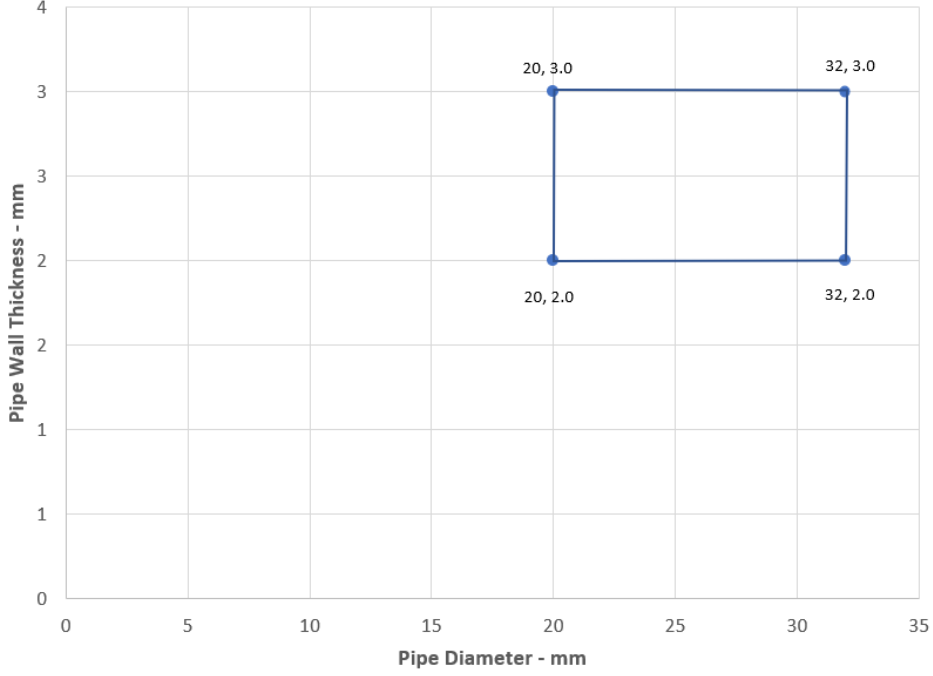
Services	Sealant depth	Backing	Classification
PVC-U pipe according to EN 1329-1, EN 1452-1 and EN 1453-1, PVC-C according to EN 1566-1			
Maximum 32 mm diameter/1.0-2.4 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 90 U/C
PE pipe according to EN 1519-1, EN 12201-2 and EN 12666-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1			
Maximum 32 mm diameter/2.0-3.0 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 90 U/C
PP pipe according to EN 1451-1 or DIN 8077/8078			
Maximum 32 mm diameter/1.8-4.4 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 90 U/C
PEX pipe in pipe system			
25 mm diameter outer /15 mm diameter x 2.5 mm wall inner	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 90 C/C

\* Typical pipe diameters shown, see below graph for intermediate sizes

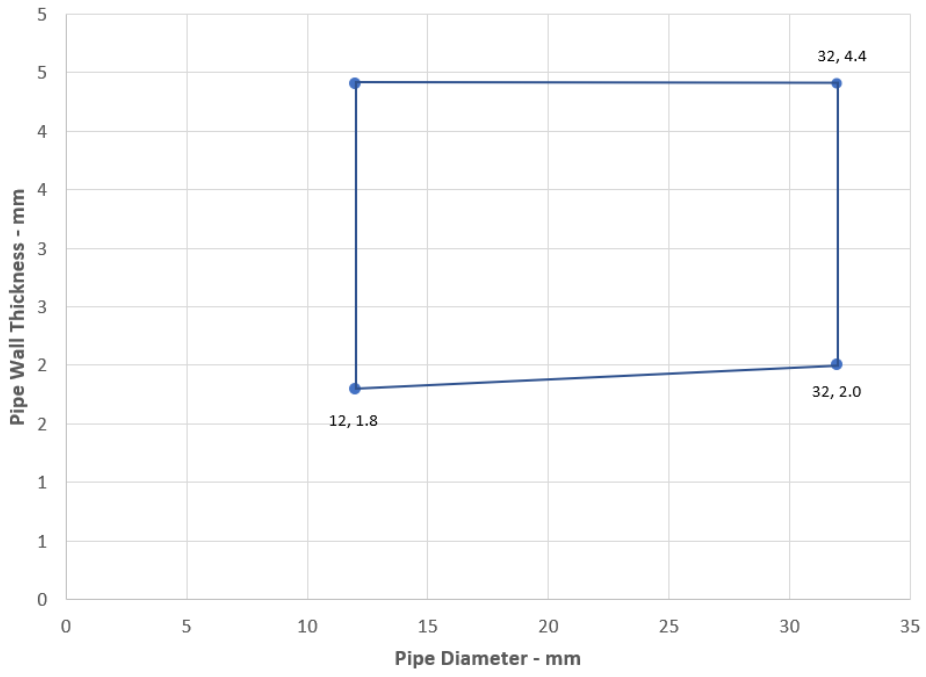
**PVC-U Pipes EI 90 - U/C**



**PE Pipes EI 90 - U/C**



### PP Pipes EI 90 - U/C

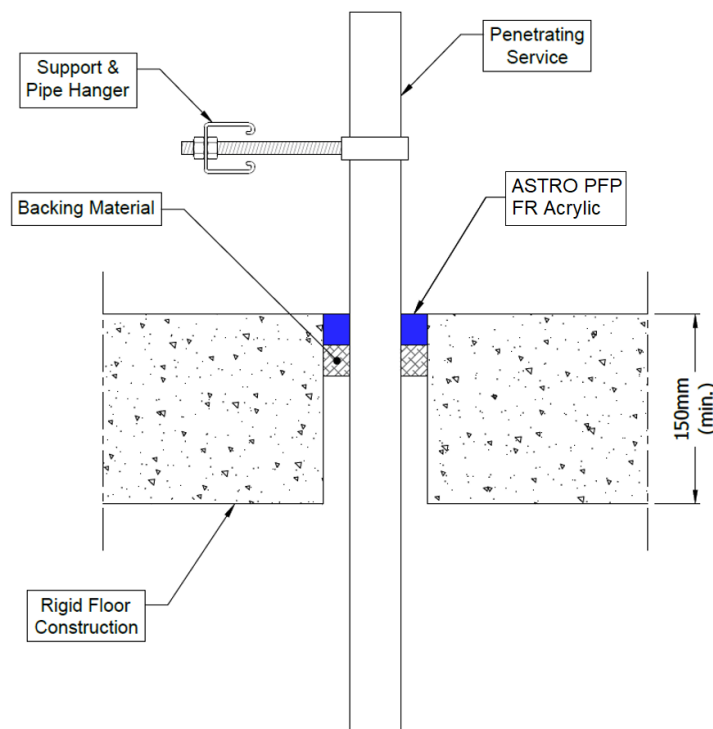
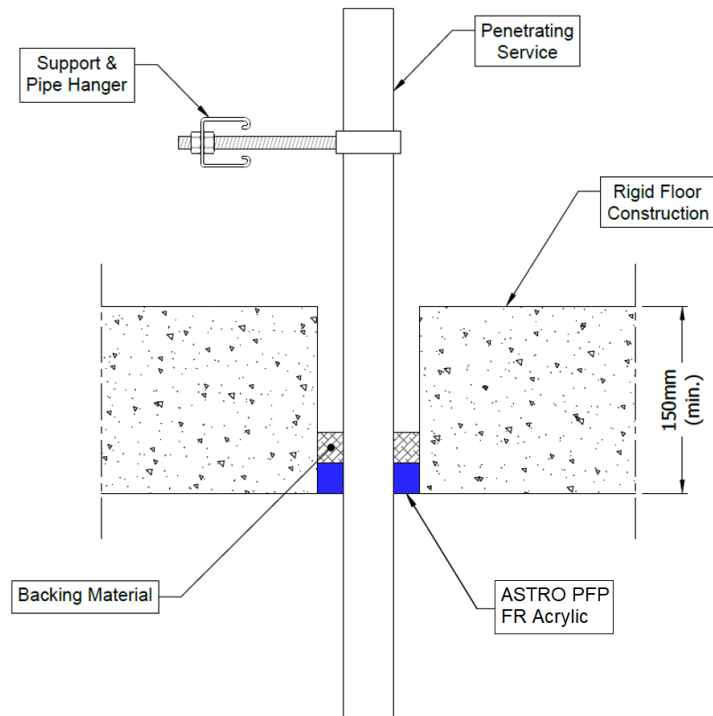


## A.6 Rigid floor constructions according to 1.2.1 with floor thickness of minimum 150 mm

### A.6.1 Single side penetration seal with cables

**Penetration Seal:** Cables (single) fitted at any position within the aperture, min. 10 mm from the edges, with ASTRO PFP FR Acrylic to either side of the floor (or at any position in between), backed with 'AES Fibre  $\geq 128\text{kg/m}^3$ '.

Construction details:



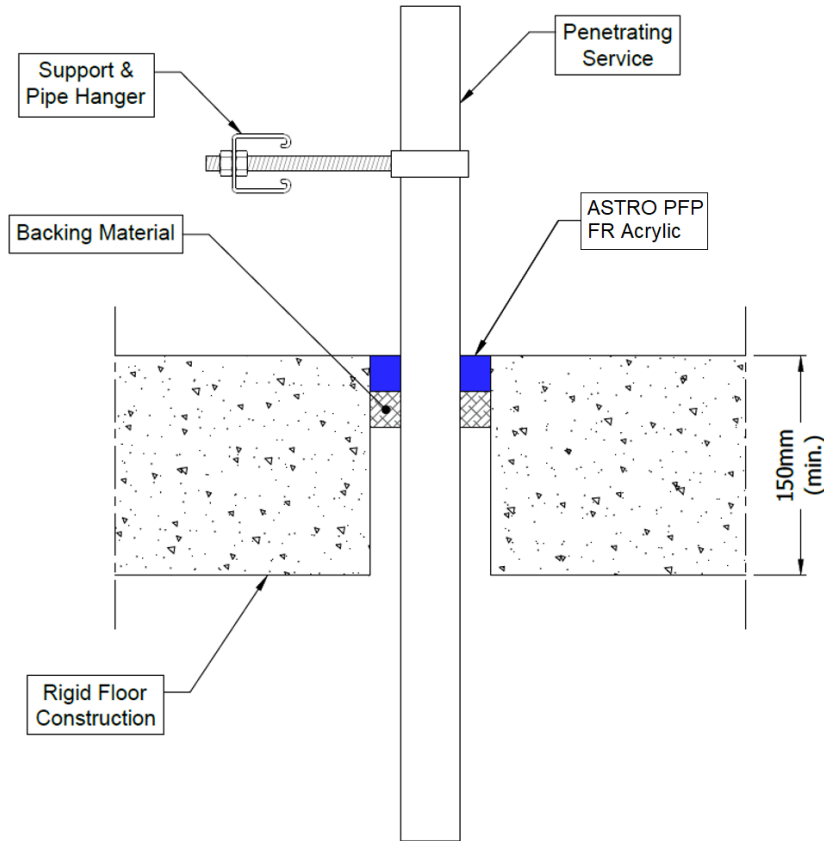
**A.6.1.1**

Services	Sealant depth	Backing (minimum)	Aperture (maximum)	Classification
Single electrical cables up to 21 mm $\varnothing$	25 mm	AES Fibre $\geq$ 128kg/m <sup>3</sup> 25 mm deep	82 mm $\varnothing$ or 100 x 1000 mm	<b>E 120, EI 60</b>

### A.6.2 Single side penetration seal with cables

**Penetration Seal:** Cables fitted with ASTRO PFP FR Acrylic to the top side of the floor, backed with stone wool insulation minimum 35kg/m<sup>3</sup> or AES Fibre ≥ 128kg/m<sup>3</sup>. Maximum seal size of 300 x 300 mm and minimum separation between cables and the edge of the seal of 10 mm.

Construction details:



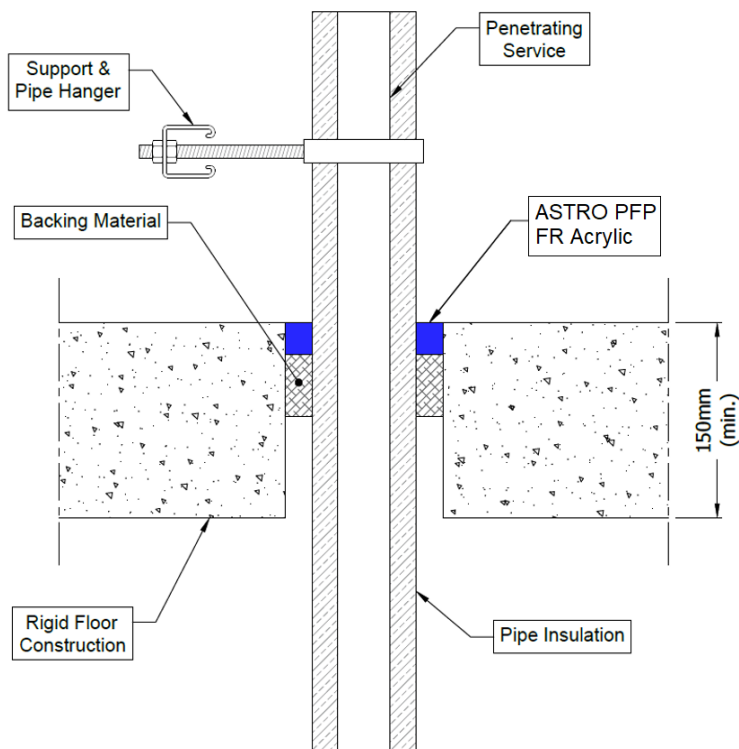
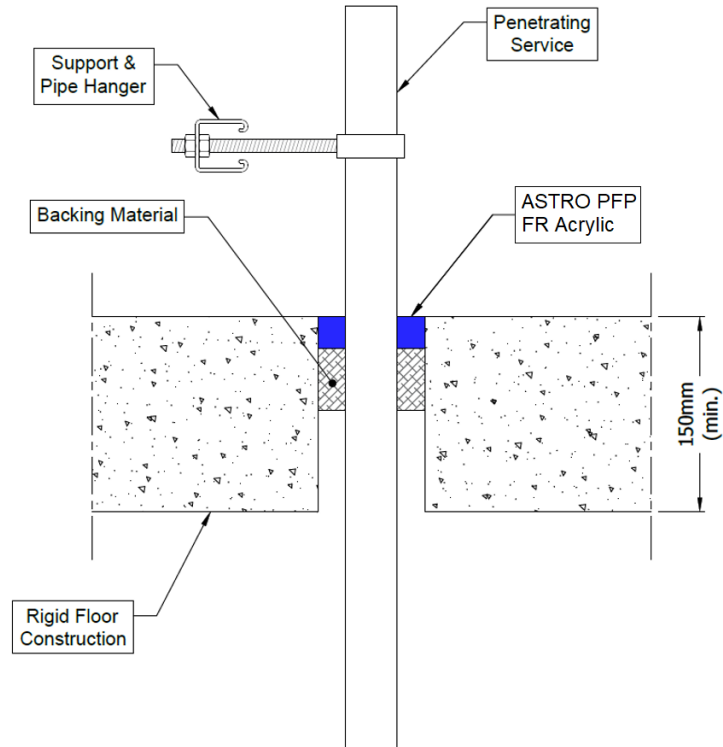
#### A.6.2.1

Services	Sealant depth	Backing (minimum)	Insulation	Classification
Blank seals	15 mm	20 mm Stone wool 35 kg/m <sup>3</sup>	None	E 90, EI 60
	25 mm	25 mm Stone wool 35 kg/m <sup>3</sup>		EI 120
48 mm AES Fibre ≥ 128kg/m <sup>3</sup>		EI 240		
		E 120, EI 90		
Electric cables up to 21 mm diameter, single.	25 mm	48 mm AES Fibre ≥ 128kg/m <sup>3</sup>	None	EI 240
23-27 mm diameter, 1 mm × 185 mm <sup>2</sup> core, PVC sheath and insulation electrical cable, single				E 120, EI 90

### A.6.3 Single side penetration seal with pipes

**Penetration Seal:** Pipes fitted at any position within the aperture, with ASTRO PFP FR Acrylic to the top face of the floor, backed with 48 mm stone wool minimum 33kg/m<sup>3</sup>. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 30 mm (a2), maximum seal size 300 x 300 mm / 300 mm diameter.

Construction details:

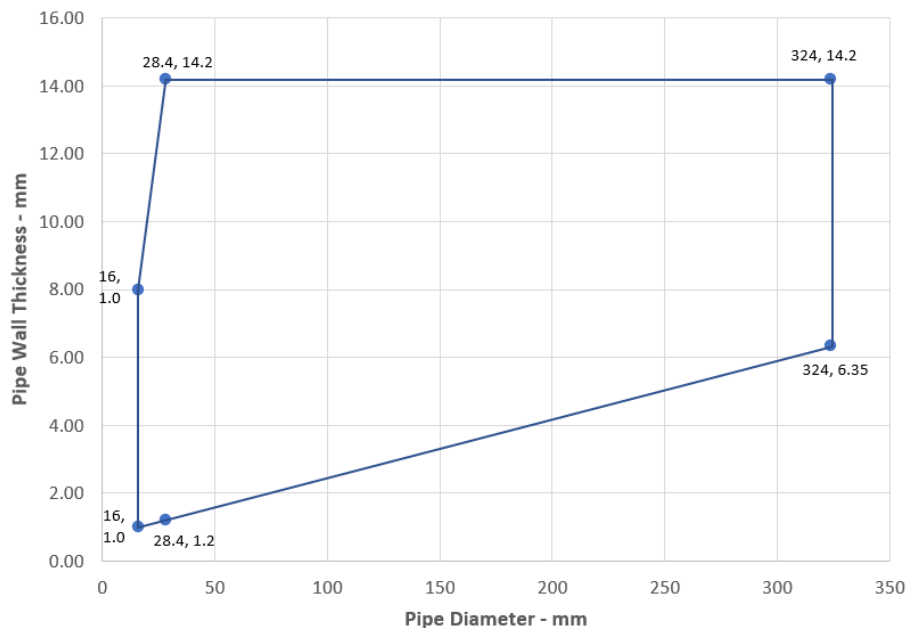


### A.6.3.1

Services	Sealant depth	Backing	Classification
Mild or stainless steel pipe			
4 -16 mm diameter /1.0-8.0 mm wall	25 mm	48 mm stone wool	EI 120 C/U
17 -324 mm diameter /1.0-14.2 mm wall*			E 120 C/U
Mild or stainless steel pipe with minimum 75 kg/m <sup>3</sup> density stone or glass wool insulation Continuous Sustained (CS)			
12-273 mm diameter/0.7-14.2 mm wall, 30 mm insulation*	25 mm	48 mm stone wool	E 120 C/C, EI 90 C/C
Copper or steel pipe			
6 mm diameter /0.7-3.0 mm wall	25 mm	48 mm stone wool	EI 120 C/C
6 -15 mm diameter /0.7-7.5 mm wall*			E 120 C/C, EI 60 C/C
16 - 54 mm diameter /0.7-14.2mm wall*			E 120 C/C
Copper or steel pipe with minimum 80 kg/m <sup>3</sup> density stone wool insulation Continuous Sustained (CS)			
12 mm diameter/0.9-6 mm wall, 20-80 mm insulation	25 mm	48 mm stone wool	EI 240 C/C
13-54 mm diameter/0.9-14.2 mm wall, 20-80 mm insulation*			E 240 C/C, EI 180 C/C
Copper or steel pipe with minimum 75 kg/m <sup>3</sup> density glass wool insulation Continuous Sustained (CS)			
12 mm diameter/0.7-6.0 mm wall, 20 mm insulation	25 mm	48 mm stone wool	EI 120 C/C
Alupex Pipe			
16 -20 mm diameter/2.0 mm wall	25 mm	48 mm stone wool	EI 120 C/C
21-75 mm diameter/2.0-4.6 mm wall			E 120 C/C, EI 90 C/C
16-75 mm diameter/2.25-4.6 mm wall with 20-50 mm thick glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> insulation Continuous Sustained (CS)			E 180 C/C, EI 120 C/C
16-75 mm diameter/2.25-4.7 mm wall with 60 mm thick glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> insulation Continuous Sustained (CS)*			E 120 C/C, EI 90 C/C

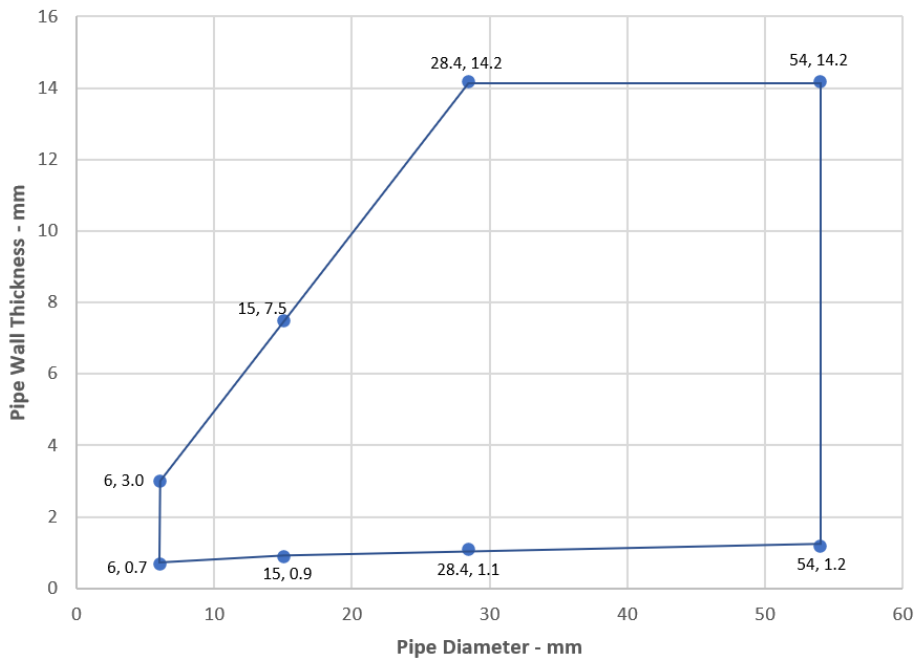
\*See below graphs for interpolated pipe sizes

Mild or Stainless Steel - C/U

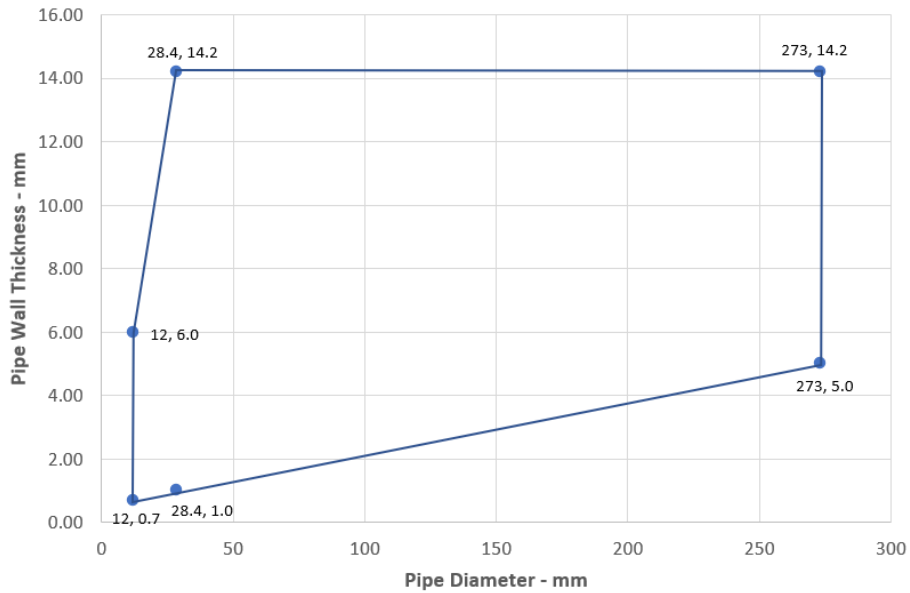




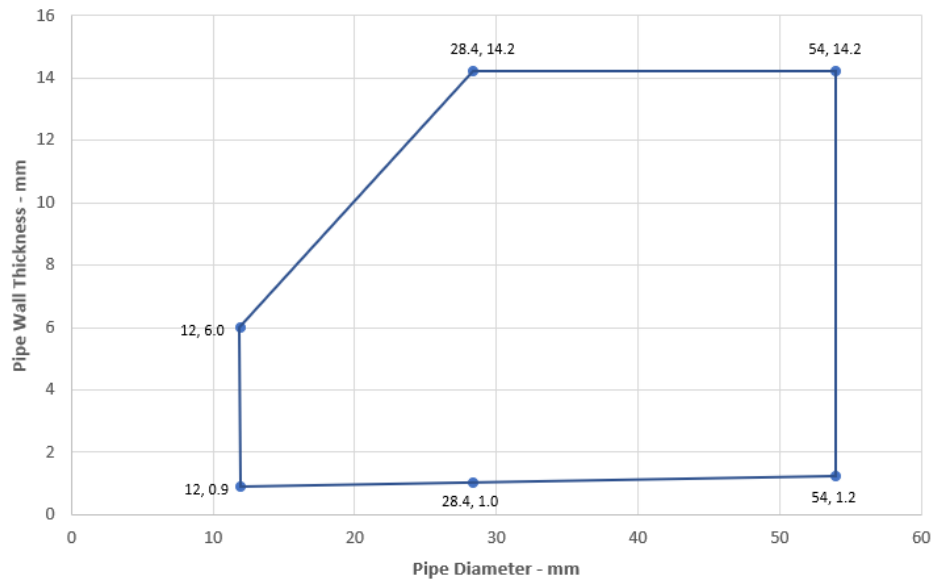
### Copper or Stainless Steel Pipes - C/C



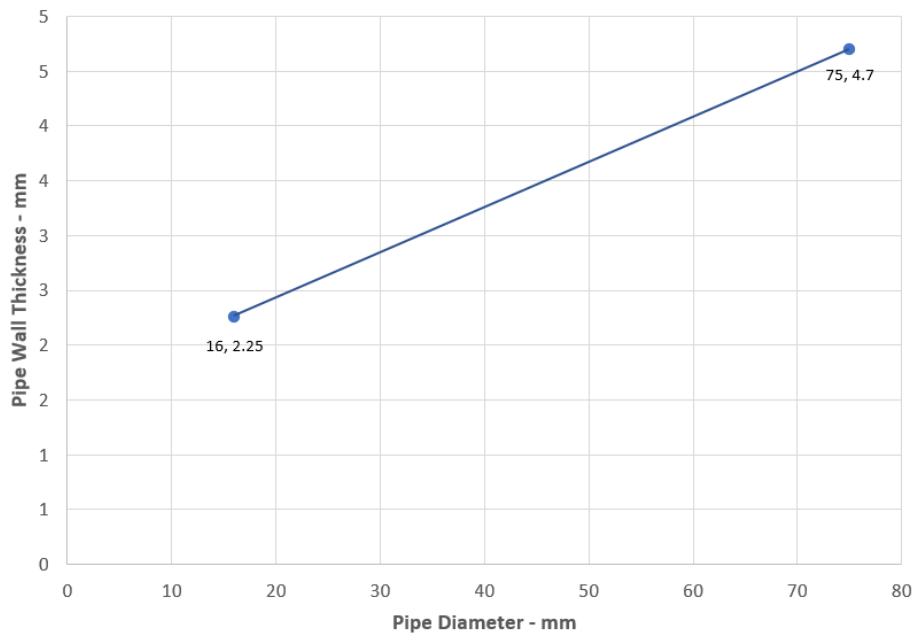
### Mild or Stainless Steel Pipes with Stone or Glass Wool Insulation - C/C



**Copper or Steel Pipes with 20-80 mm stone wool Insulation CS  
E 240 C/C, EI 180 C**



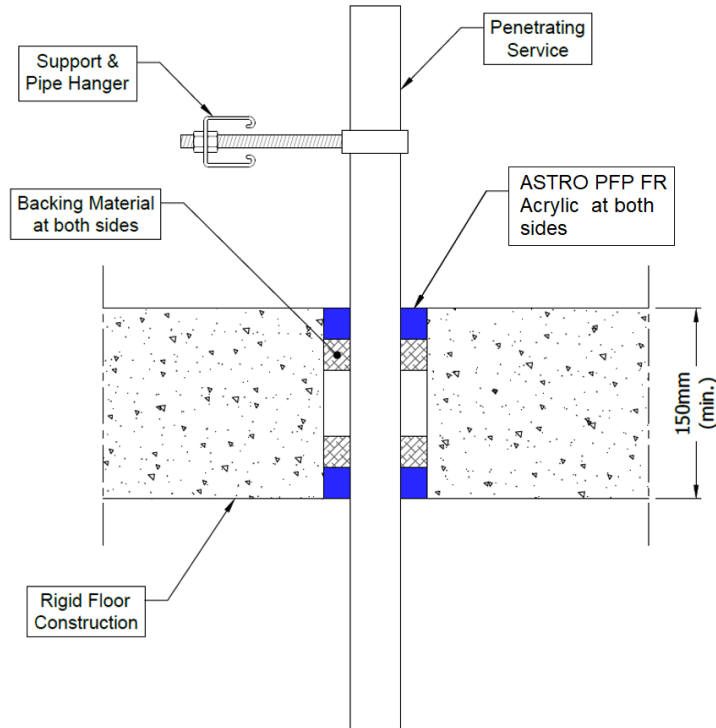
**Alupex Pipes with Stone or Glass Wool Insulation - C/C**



#### A.6.4 Double side penetration seal with pipes

**Penetration Seal:** Pipes fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both faces of the floor, backed with 25 mm stone wool minimum 33kg/m<sup>3</sup>. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 30 mm (a2), maximum seal size 300 x 300 mm / 300 mm diameter.

Construction details:

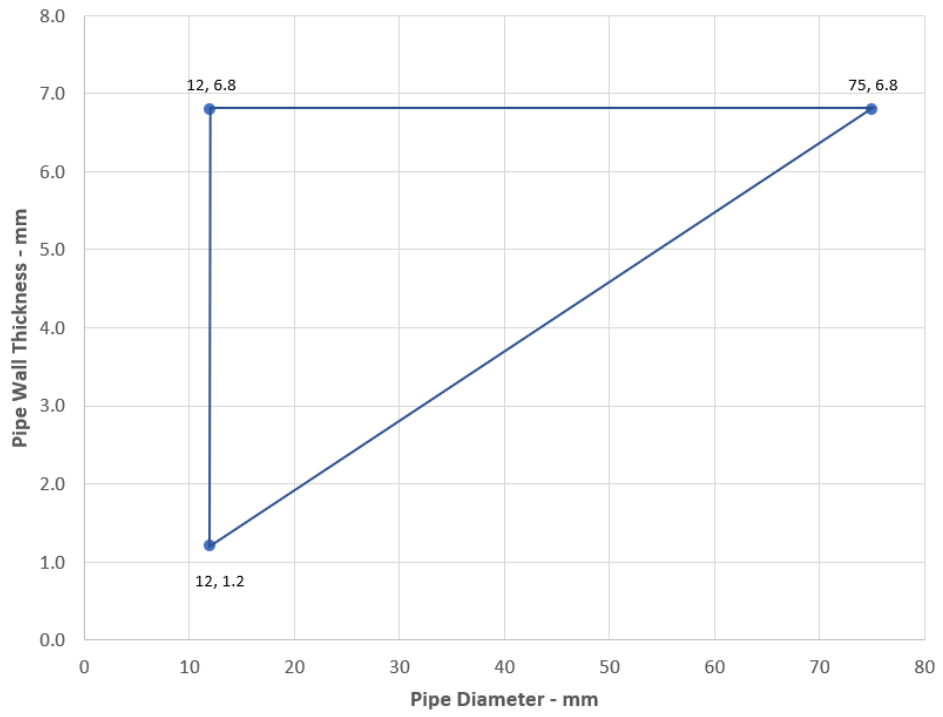


##### A.6.4.1

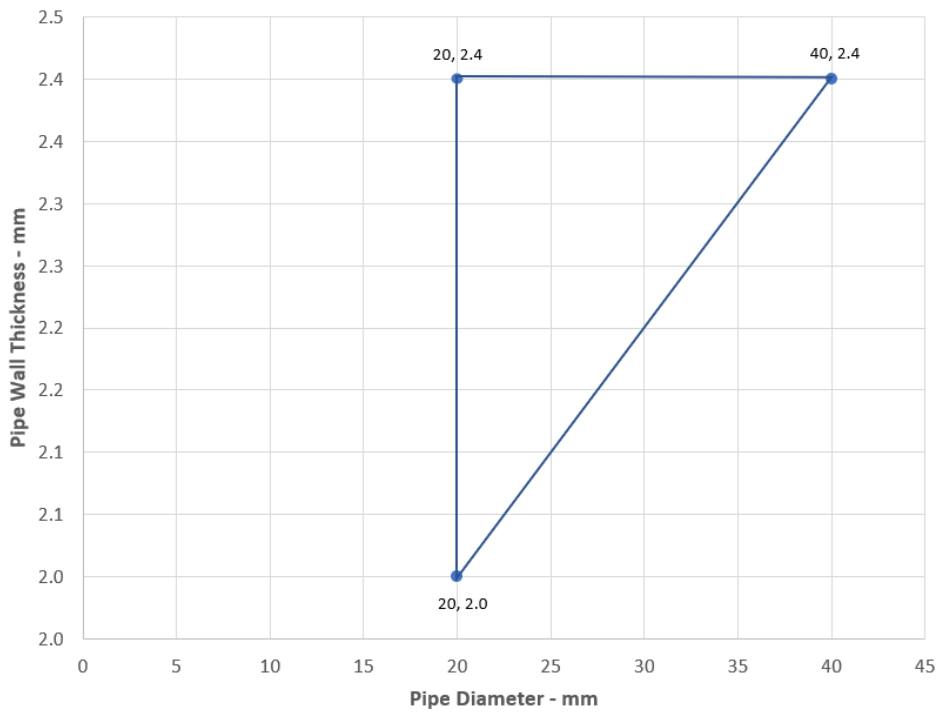
Services	Sealant depth	Backing	Classification
PVC-U pipe according to EN 1329-1, EN 1452-1 and EN 1453-1, PVC-C according to EN 1566-1			
Up to 50 mm Ø/1.6-3.7 mm wall	25 mm	25 mm Stone wool	EI 240 U/C
Up to 40 mm Ø/1.6-3.7 mm wall, with bundle of cables up to 21 mm diameter			
PP pipe according to EN 1451-1 or DIN 8077/8078			
12 mm Ø/1.2 mm wall	25 mm	25 mm Stone wool	EI 240 U/C
13-40 mm Ø/1.2-3.7 mm wall			EI 180 U/C
41-75 mm Ø/1.2-6.8 mm wall*			EI 90 U/C
Up to 40 mm Ø/1.2-3.7 mm wall, with bundle of cables up to 21 mm diameter			EI 180 U/C
PE pipe according to EN 1519-1, EN 12201-2 and EN 12666-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1			
20-40 mm Ø/2.0-3.7 mm wall*	25 mm	25 mm Stone wool	EI 240 U/C
Up to 40 mm Ø/2.0-3.7 mm wall, with bundle of cables up to 21 mm diameter			EI 180 U/C

\*See below graphs for interpolated pipe sizes

### PP Pipes - EI 190 U/C



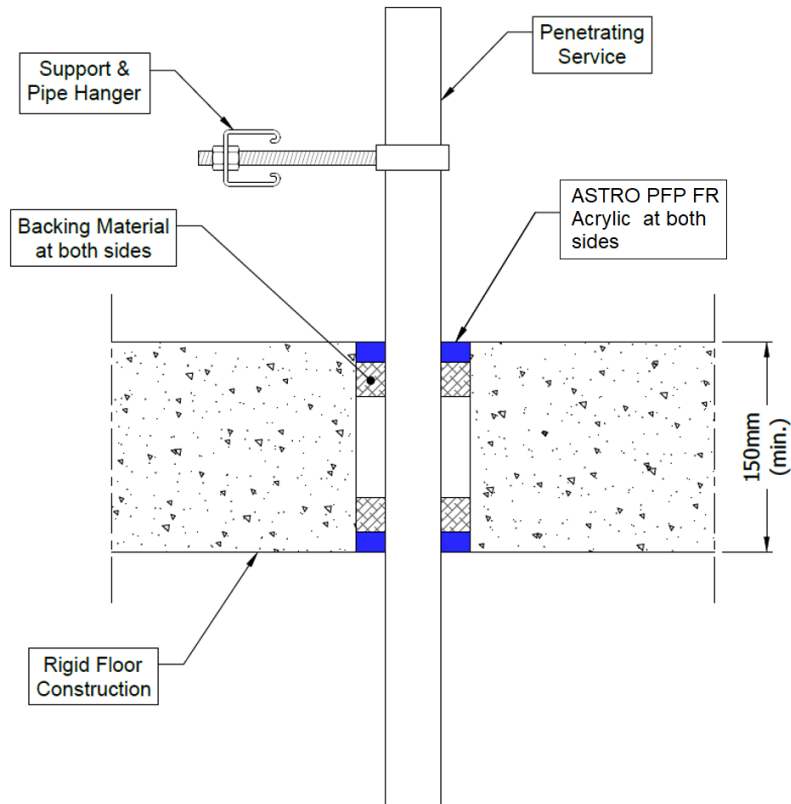
### PE Pipes - U/C



### A.6.5 Double side penetration seal with cables

**Penetration Seal:** Cables fitted circular apertures or min. 7 mm from the edges of rectilinear apertures, with ASTRO PFP FR Acrylic to both sides of the floor, backed with stone wool insulation minimum 35kg/m<sup>3</sup>.

Construction details:

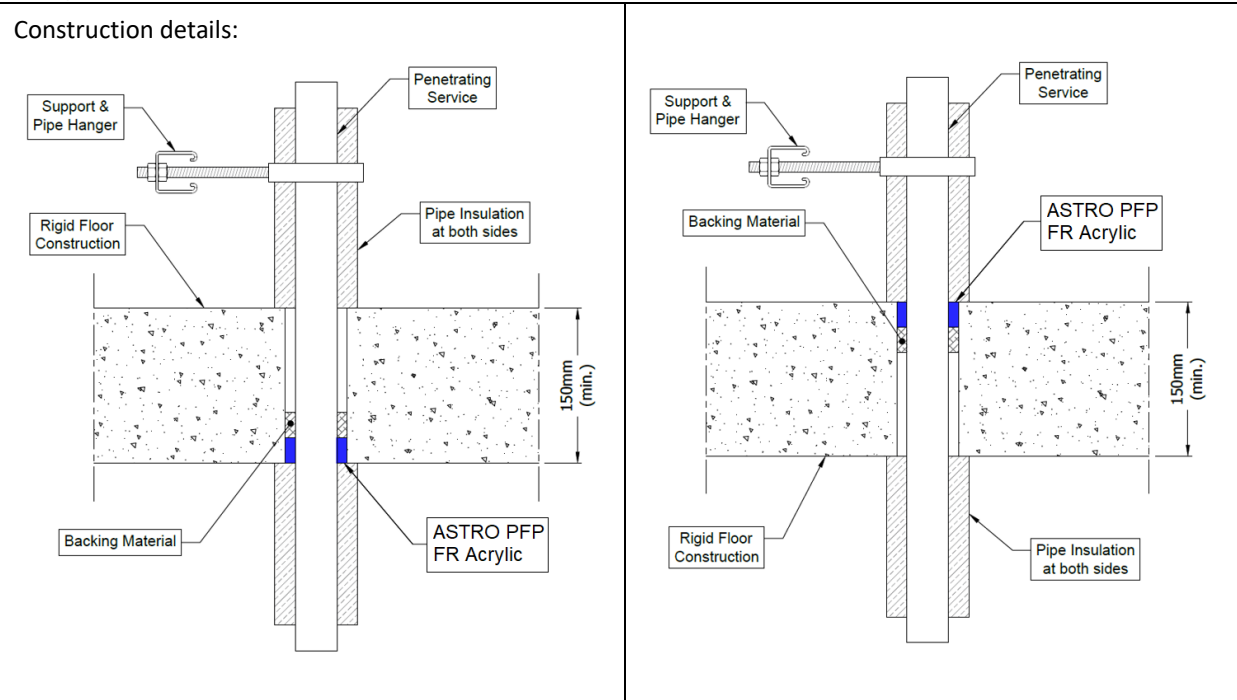


#### A.6.5.1

Services	Sealant depth	Backing	Maximum Aperture	Classification
Blank seals	15 mm	25 mm Stone wool 35 kg/m <sup>3</sup>	300 x 300 mm	EI 240
Electric cables up to 21 mm diameter, single or in a bundle.				EI 120
Electric cables 22-50 mm diameter, single or in a bundle.				E 120, EI 90
Electric cables 51-80 mm diameter, single or in a bundle.				E 120, EI 60

### A.6.6 Single side penetration seal with metallic pipes

**Penetration Seal:** 1000 mm (min.) LI (Local Interrupted) or CI (Continuous Interrupted) insulated metallic pipes (single) fitted at any position within the aperture, with 15 or 25 mm deep ASTRO PFP FR Acrylic to either side of the floor (or at any position between), backed with minimum 40 kg/m<sup>3</sup> stone wool insulation or AES Fibre ≥ 128kg/m<sup>3</sup>.



#### A.6.6.1

Services	Max. seal size	Insulation (min)	Sealant depth	Classification
Copper or steel pipe up to 54 mm diameter/0.9-14.2 mm wall	10 mm width around pipe	20 mm Stone wool insulation 80 kg/m <sup>3</sup>	15 mm	<b>E 240 C/U, EI 180 C/U</b>
Copper or steel pipe up to 12 mm diameter/0.9-5 mm wall				<b>EI 240 C/U</b>
Copper or steel pipe up to 54 mm diameter/0.9-14.2 mm wall	Up to 100 x 1000 mm		25 mm	<b>EI 120 C/U</b>
Copper or steel pipe up to 54 mm diameter/0.9-14.2 mm wall	300 x 300 mm	20 mm Stone wool insulation 80 kg/m <sup>3</sup>	15 mm	<b>E 90 C/U, EI 60 C/U</b>
Copper or steel pipe up to 12 mm diameter/0.9-5 mm wall				
Copper or steel pipe up to 54 mm diameter/0.9-14.2 mm wall			25 mm	<b>EI 120 C/U</b>

Services	Max. Seal Size	Insulation (min)	Sealant Depth	Classification
Mild or stainless steel pipe				
40 mm diameter/1-14.2 mm wall	10 mm width around pipe	20 mm Stone wool insulation 80 kg/m <sup>3</sup>	15 mm	EI 240 C/U
40 mm diameter/1-14.2 mm wall*		30 mm Stone wool insulation 80 kg/m <sup>3</sup>		E 240 C/U, EI 90 C/U
50 mm diameter/1.2-14.2 mm wall*				
60 mm diameter/1.4-14.2 mm wall*				
75 mm diameter/1.7-14.2 mm wall*				
90 mm diameter/2-14.2 mm wall*				
100 mm diameter/2.2-14.2 mm wall*				
115 mm diameter/2.5-14.2 mm wall*				
140 mm diameter/3-14.2 mm wall*				
165 mm diameter/3.5-14.2 mm wall*				
180 mm diameter/3.8-14.2 mm wall*				
200 mm diameter/4.2-14.2 mm wall*				
219 mm diameter/4.5-14.2 mm wall*				
40 mm diameter/1-14.2 mm wall*	Up to 100 x 1000 mm	20 mm Stone wool insulation 80 kg/m <sup>3</sup>	25 mm	E120 C/U, EI 90 C/U
50 mm diameter/1.2-14.2 mm wall*		30 mm Stone wool insulation 80 kg/m <sup>3</sup>		
60 mm diameter/1.4-14.2 mm wall*				
75 mm diameter/1.7-14.2 mm wall*				
90 mm diameter/2-14.2 mm wall*				
100 mm diameter/2.2-14.2 mm wall*				
115 mm diameter/2.5-14.2 mm wall*				
140 mm diameter/3-14.2 mm wall*				
165 mm diameter/3.5-14.2 mm wall*				
180 mm diameter/3.8-14.2 mm wall*				
200 mm diameter/4.2-14.2 mm wall*				
219 mm diameter/4.5-14.2 mm wall*				

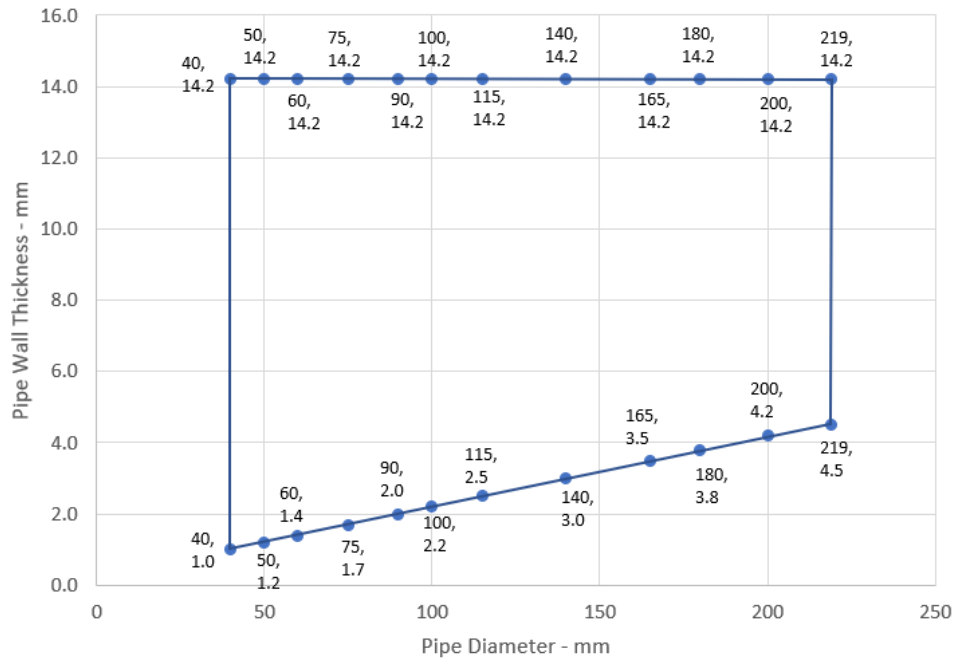
\* Typical pipe diameters shown, see below graph for intermediate sizes

Services	Max. Seal Size	Insulation (minimum)	Sealant Depth	Classification
Mild or stainless steel pipe				
40 mm diameter/1-14.2 mm wall	300 x 300 mm	20 mm Stone wool insulation 80 kg/m <sup>3</sup>	15 mm	E 90 C/U, EI 60 C/U
40 mm diameter/1-14.2 mm wall*		30 mm Stone wool insulation 80 kg/m <sup>3</sup>		
50 mm diameter/1.2-14.2 mm wall*				
60 mm diameter/1.4-14.2 mm wall*				
75 mm diameter/1.7-14.2 mm wall*				
90 mm diameter/2-14.2 mm wall*				
100 mm diameter/2.2-14.2 mm wall*				
115 mm diameter/2.5-14.2 mm wall*				
140 mm diameter/3-14.2 mm wall*				
165 mm diameter/3.5-14.2 mm wall*				
180 mm diameter/3.8-14.2 mm wall*				
200 mm diameter/4.2-14.2 mm wall*				
219 mm diameter/4.5-14.2 mm wall*				
40 mm diameter/1-14.2 mm wall*	300 x 300 mm		20 mm Stone wool insulation 80 kg/m <sup>3</sup>	25 mm
50 mm diameter/1.2-14.2 mm wall*		30 mm Stone wool insulation 80 kg/m <sup>3</sup>		
60 mm diameter/1.4-14.2 mm wall*				
75 mm diameter/1.7-14.2 mm wall*				
90 mm diameter/2-14.2 mm wall*				
100 mm diameter/2.2-14.2 mm wall*				
115 mm diameter/2.5-14.2 mm wall*				
140 mm diameter/3-14.2 mm wall*				
165 mm diameter/3.5-14.2 mm wall*				
180 mm diameter/3.8-14.2 mm wall*				
200 mm diameter/4.2-14.2 mm wall*				
219 mm diameter/4.5-14.2 mm wall*				

\* Typical pipe diameters shown, see below graph for intermediate sizes



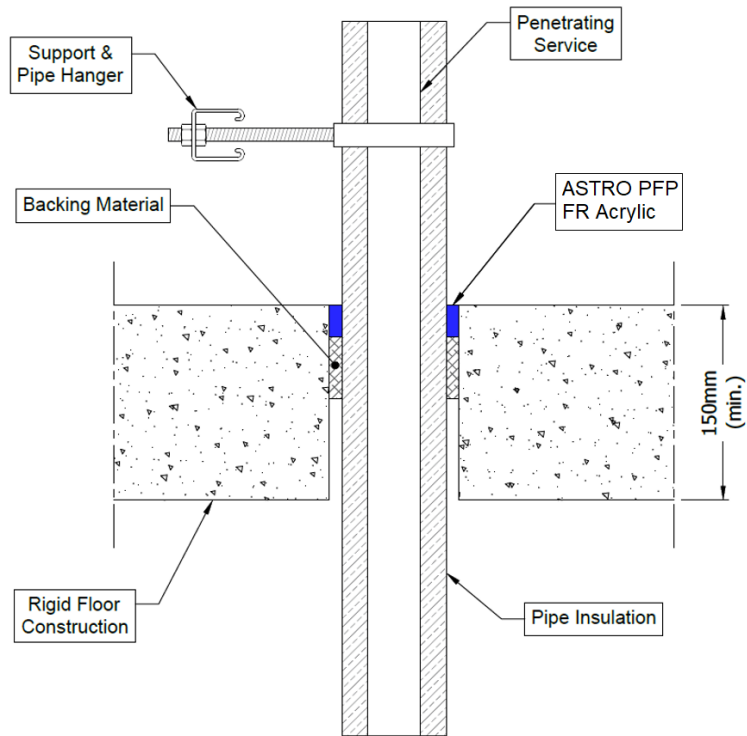
### Steel Pipes with Stone Wool Insulation - C/U



### A.6.7 Single side penetration seal with metallic pipes

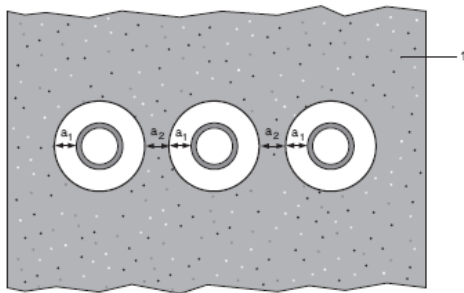
**Penetration Seal:** CS (Continuous Sustained) insulated metallic pipes (single) fitted at any position within the aperture, with 25 mm ASTRO PFP FR Acrylic to the top of the floor, backed with 48 mm deep AES Fibre  $\geq 128\text{kg/m}^3$  insulation. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 30 mm (a2). Maximum seal size 300 x 300 mm / 504 mm  $\varnothing$

Construction details:



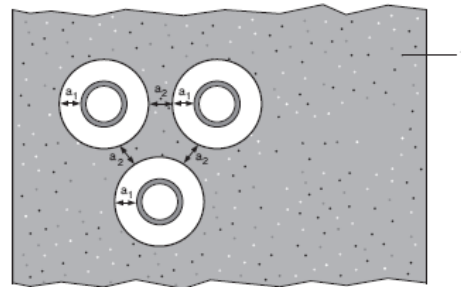
Configuration 1:

Option 1



Configuration 2:

Option 2



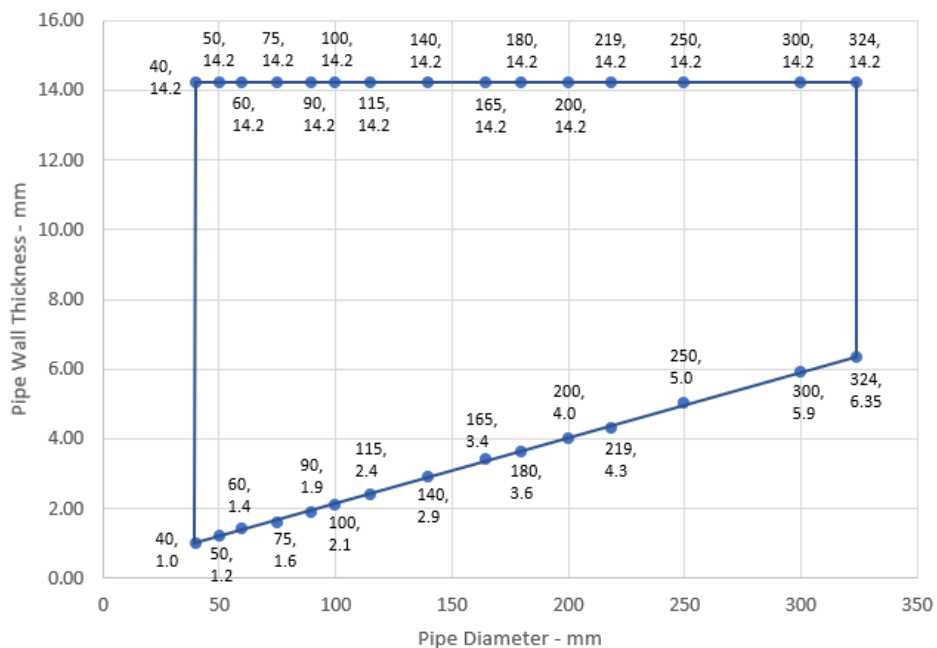
#### Key

- 1 Supporting construction
- a1 Pipe / top edge of seal separation
- a2 Pipe / side edge of seal separation
- a3 Pipe / pipe separation

### A.6.7.1 Single side penetration seal with pipes

Services	Insulation	Classification
Mild or stainless steel pipe		
40 mm diameter/1-14.2 mm wall	20 mm thick stone, mineral wool min. 80 kg/m <sup>3</sup>	<b>EI 240 C/U</b>
40 mm diameter/1-14.2 mm wall*	30-80 mm thick stone, mineral wool min. 80 kg/m <sup>3</sup>	
50 mm diameter/1.2-14.2 mm wall*		
60 mm diameter/1.4-14.2 mm wall*		
75 mm diameter/1.6-14.2 mm wall*		
90 mm diameter/1.9-14.2 mm wall*		
100 mm diameter/2.1-14.2 mm wall*		
115 mm diameter/2.4-14.2 mm wall*		
140 mm diameter/2.9-14.2 mm wall*		
165 mm diameter/ 3.4-14.2 mm wall*		
180 mm diameter/ 3.6-14.2 mm wall*		
200 mm diameter/ 4.0-14.2 mm wall*		
219 mm diameter/ 4.3-14.2 mm wall*		
250 mm diameter/ 5.0-14.2 mm wall*		
300 mm diameter/ 5.9-14.2 mm wall*		
324 mm diameter/ 6.35-14.2 mm wall*		
<b>PEX pipe in pipe system</b>		
15 mm diameter x 2.5 mm wall inner /25mm diameter outer	None	<b>EI 90 C/C</b>

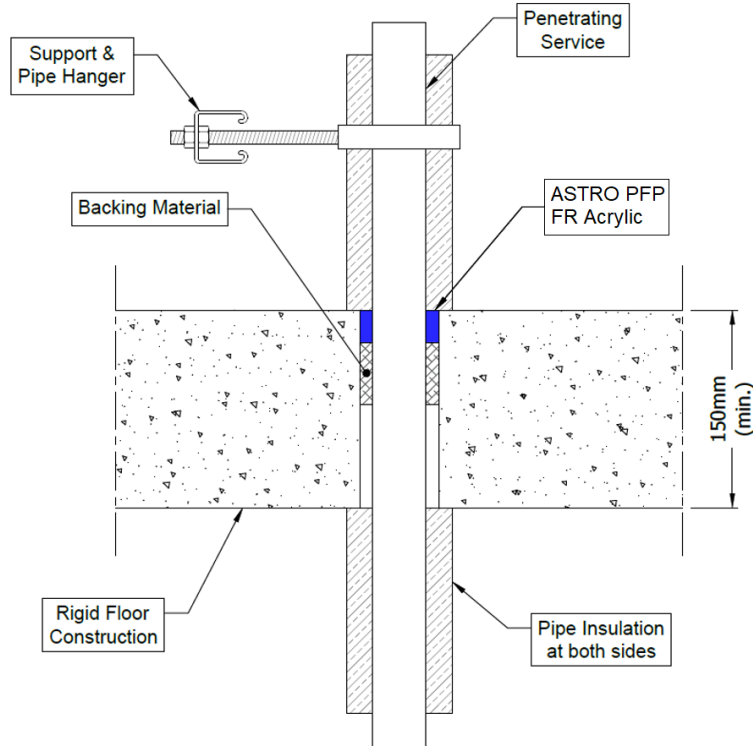
Steel Pipes with Mineral Wool Insulation - C/U



### A.6.8 Single side penetration seal with metallic pipes

**Penetration Seal:** LI (Local Interrupted) or CI (Continuous Interrupted) insulated metallic pipes (single) fitted at any position within the aperture, with 25 mm deep ASTRO PFP FR Acrylic to the top side of the floor, backed with 48 mm deep minimum 33 kg/m<sup>3</sup> stone wool insulation or AES Fibre ≥ 128kg/m<sup>3</sup>.

Construction details:



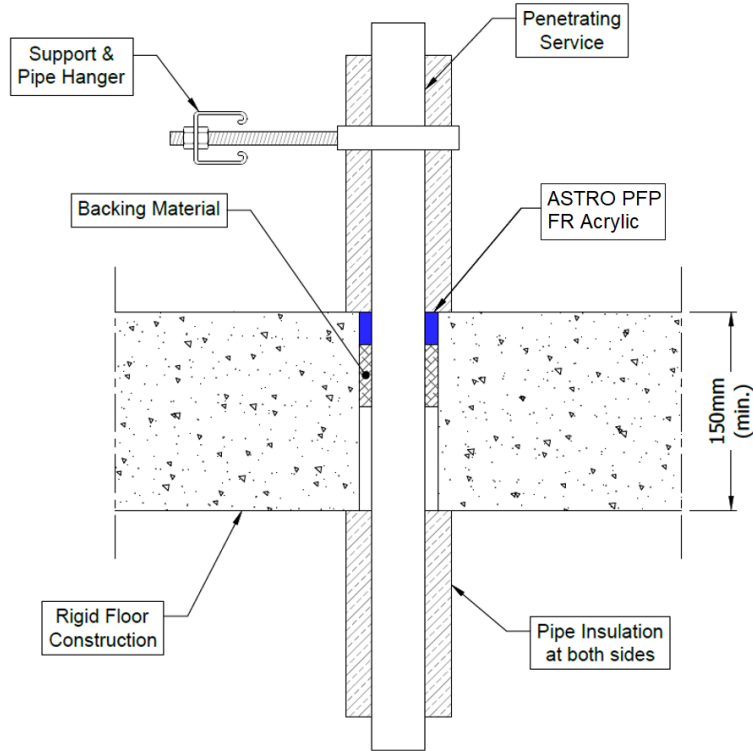
#### A.6.8.1

Services	Max. seal size	Insulation (min)	Sealant depth	Classification
Copper or steel pipe up to 54 mm diameter/0.7-14.2 mm wall	300 x 300 mm	20 mm Glass or Stone wool 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	25 mm	EI 180 C/C
Copper or steel pipe up to 108 mm diameter/0.7-14.2 mm wall	300 x 300 mm	30 mm Glass or Stone wool 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	25 mm	E 180 C/C, EI 30 C/C
Copper or steel pipe up to 159 mm diameter/0.7-14.2 mm wall	300 x 300 mm	30 mm Stone wool 80 kg/m <sup>3</sup> , 1000 mm length from both sides of the seal	25 mm	E 90 C/C, EI 20 C/C
Steel pipe up to 273 mm diameter/0.7-14.2 mm wall	300 x 300 mm	30 mm Glass or Stone wool 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	25 mm	E 180 C/C, EI 60 C/C
Alupex pipe up to 16 mm diameter/2.25 mm wall	300 x 300 mm	20 mm Glass or Stone wool 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	25 mm	EI 180 C/C
Alupex pipe up to 75 mm diameter/2.25-4.7 mm wall	300 x 300 mm	25 mm Glass or Stone wool 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	25 mm	E 180 C/C, EI 120 C/C

### A.6.9 Single side penetration seal with composite pipes

**Penetration Seal:** CI (Continuous Interrupted) or LI (Locally Interrupted) insulated composite pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic, minimum 10 mm seal width around service and maximum 300 x 300 mm seal, backed with 'AES Fibre  $\geq 128\text{kg/m}^3$ '.

Construction details:

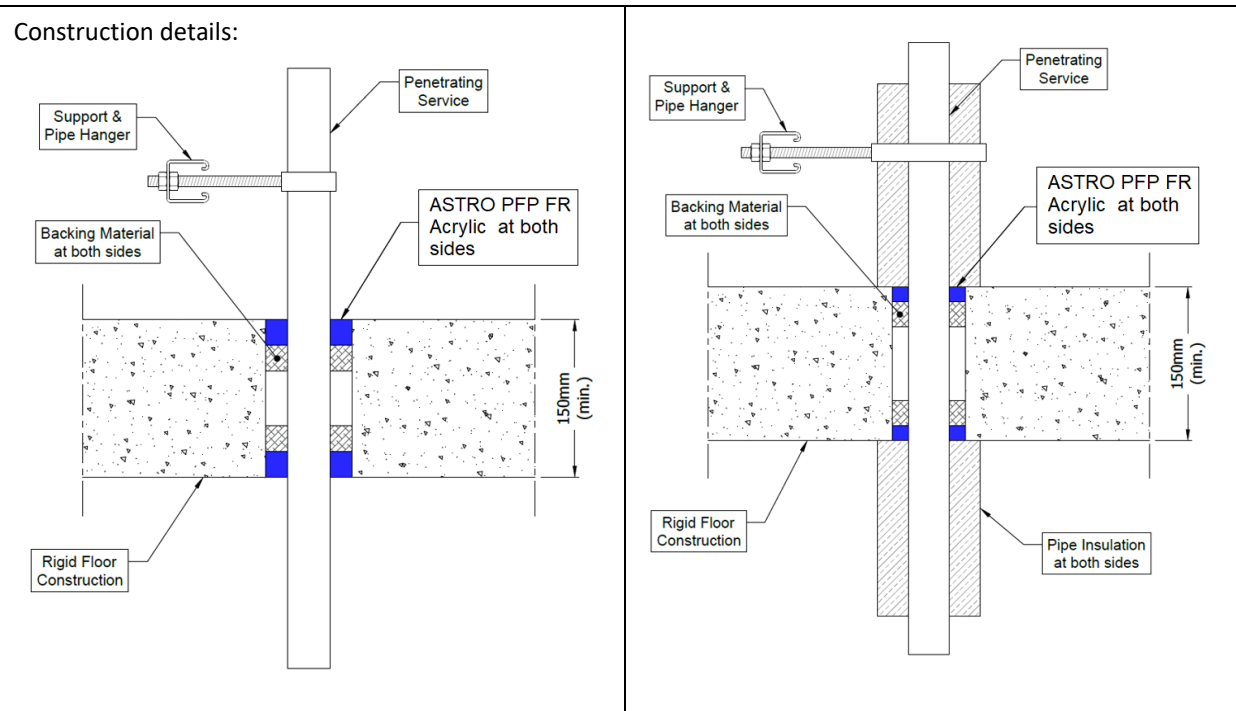


#### A.6.9.1

Services	Sealant depth	Backing	Insulation (minimums)	Classification
Alupex Composite Pipe	25 mm	48 mm AES Fibre $\geq 128\text{kg/m}^3$	20 mm stonewool $80\text{kg/m}^3$ , 500 mm length from both sides of the seal	EI 240 C/C
16 mm diameter/2.25 mm wall				
20 mm diameter/2.5 mm wall				
26 mm diameter/3 mm wall				
32 mm diameter/3 mm wall				
40 mm diameter/3.5 mm wall				
50 mm diameter/4 mm wall				
63 mm diameter/4.5 mm wall				
75 mm diameter/4.7 mm wall				

### A.6.10 Double side penetration seal with metallic pipes

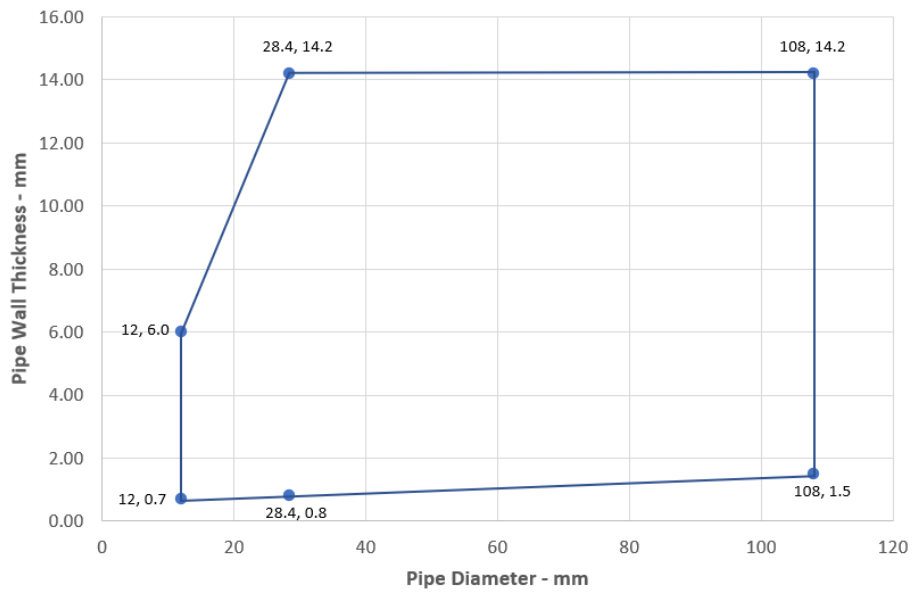
**Penetration Seal:** Non-insulated or insulated metallic pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the floor, backed with stone wool or mineral fibre insulation.



#### A.6.10.1

Services	Max. Seal Size	Insulation	Sealant depth	Backing (minimum)	Classification
Copper or steel pipe 54 mm diameter/2-14.2 mm wall	300 x 300 mm	None	25 mm	25 mm deep 140 kg/m <sup>3</sup> stone wool	E 120 C/U, EI 20 C/U
Copper or steel pipe maximum 108 mm diameter /0.7-14.2 mm wall*		30 mm Glass or Stone wool 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	15 mm	25 mm deep 33 kg/m <sup>3</sup> stone wool	E 120 C/C, EI 45 C/C
Mild steel pipe 16 mm diameter/1.5-7.5 mm wall		None	25 mm	25 mm deep 140 kg/m <sup>3</sup> stone wool	EI 240 C/U
Mild steel pipe maximum 63 mm diameter/1.5-14.2 mm wall			15 mm	25 mm deep 35 kg/m <sup>3</sup> stone wool	E 240 C/U EI 30 C/U
Mild steel pipe 16 mm diameter/1.5-7.5 mm wall	Up to 100 x 1000 mm		25 mm	AES Fibre ≥ 128kg/m <sup>3</sup> 25 mm deep	EI 120 C/U

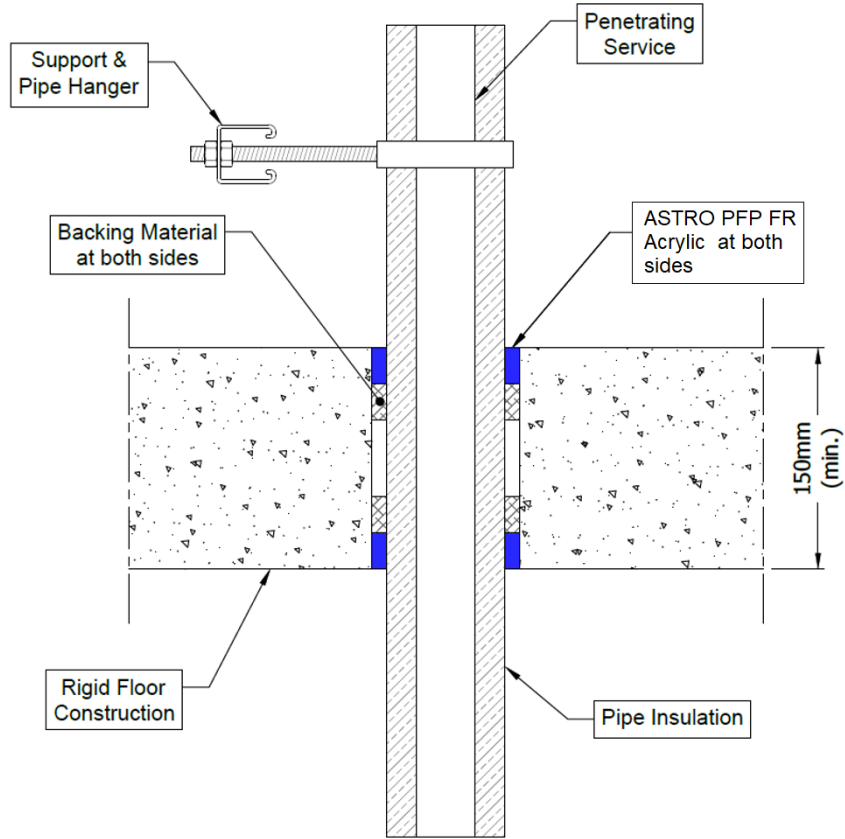
### Copper or Steel Pipes with Stone or Glass Wool Insulation - C/C



### A.6.11 Double side penetration seal with metallic pipes

**Penetration Seal:** CS (Continuous Sustained) insulated metallic pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the floor, maximum 300 x 300 mm seal width around service, backed with stone wool insulation or 'AES Fibre  $\geq 128\text{kg/m}^3$ '.

Construction details:

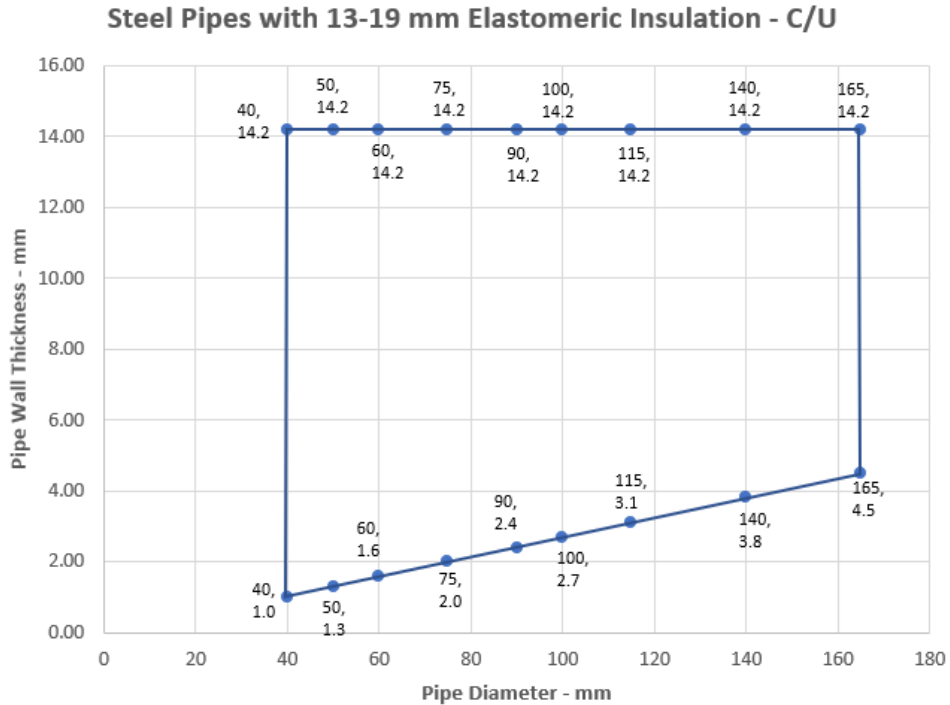




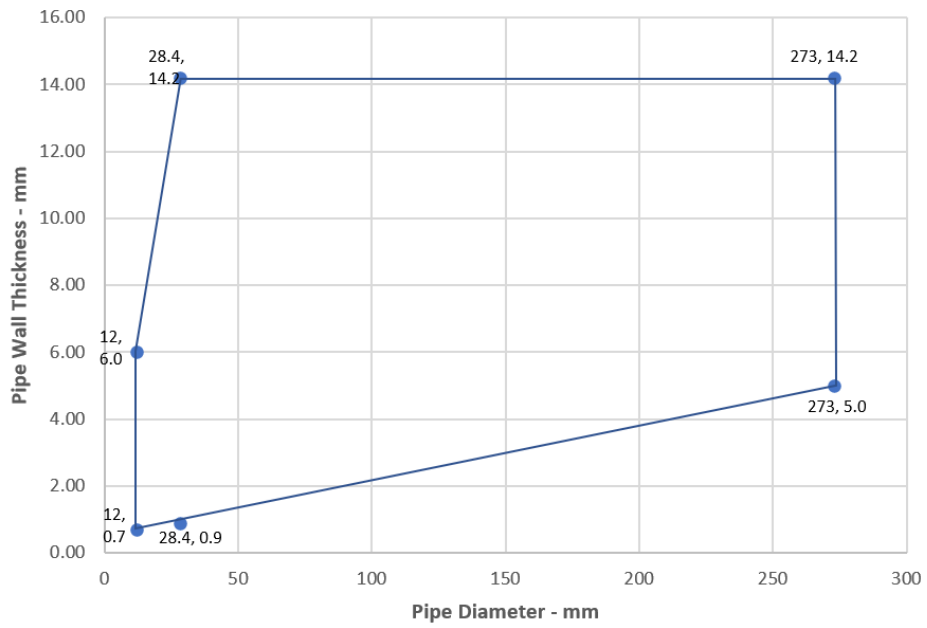
**A.6.11.1**

Services	Sealant depth	Backing (minimum)	Insulation	Classification
Mild or stainless steel pipe				
40 mm diameter/1-14.2 mm wall	25 mm	20 mm Stone wool 40 kg/m <sup>3</sup>	13 -19 mm Elastomeric insulation minimum class B-s3,d0, phenolic foam insulation or PU foam insulation	<b>EI 180 C/U</b>
40 mm diameter/1-14.2 mm wall*	25 mm	25 mm AES Fibre ≥ 128kg/m <sup>3</sup>		<b>EI 60 C/U</b>
50 mm diameter/1.3-14.2 mm wall*				
60 mm diameter/1.6-14.2 mm wall*				
75 mm diameter/2-14.2 mm wall*				
90 mm diameter/2.4-14.2 mm wall*				
100 mm diameter/2.7-14.2 mm wall*				
115 mm diameter/3.1-14.2 mm wall*				
140 mm diameter/3.8-14.2 mm wall*				
165 mm diameter/4.5-14.2 mm wall*				
12-273 mm diameter/0.7-14.2 mm wall	15 mm	25 mm Stone wool 33 kg/m <sup>3</sup>	30-60 mm thick glass or stone, mineral wool min. 75 kg/m <sup>3</sup>	<b>EI 60 C/U</b>

\* Typical pipe diameters shown, see below graph for intermediate sizes

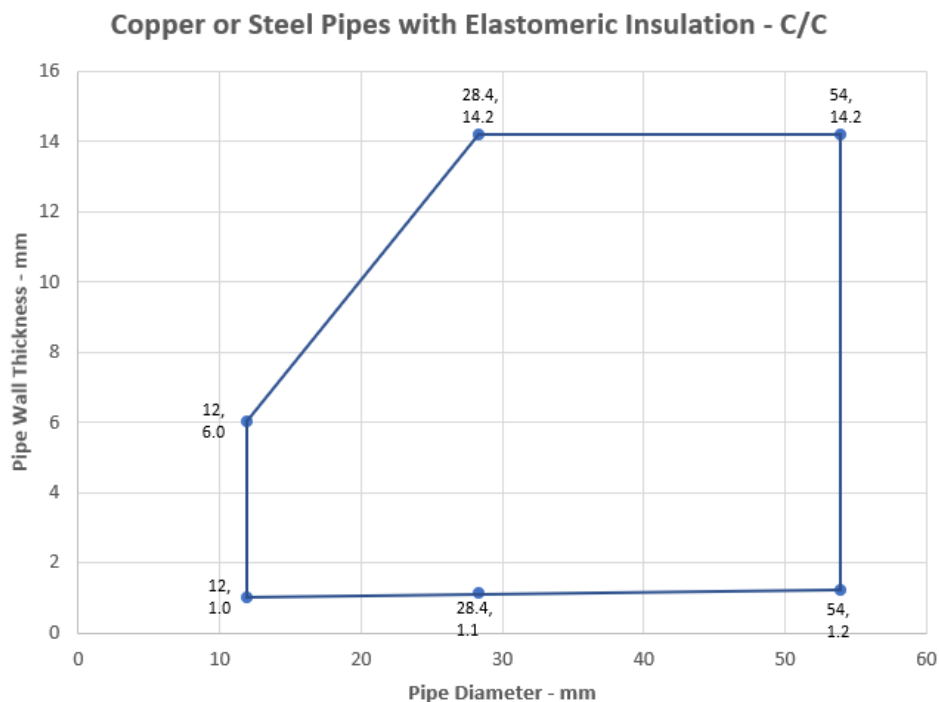


### Mild Steel Pipes with 30-60 mm Stone or Glass Wool Insulation - C/U



Services	Sealant depth	Backing (minimum)	Insulation	Classification
Copper or steel pipe				
12 mm diameter/1-6 mm wall	25 mm	25 mm AES Fibre $\geq$ 128kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class B-s3,d0, phenolic foam insulation or PU foam insulation	<b>E 240 C/C, EI 180 C/C</b>
12-54 mm diameter/1-14.2 mm wall*			9-13 mm Elastomeric insulation minimum class B-s3,d0, phenolic foam insulation or PU foam insulation	<b>E 180 C/C, EI 120 C/C</b>
12-54 mm diameter/1-14.2 mm wall*			13-25 mm Elastomeric insulation minimum class B-s3,d0, phenolic foam insulation or PU foam insulation	<b>E 90 C/C, EI 60 C/C</b>
12-54 mm diameter/0.7-14.2 mm wall	15 mm	25 mm Stone wool 33 kg/m <sup>3</sup>	20-60 mm thick glass or stone, mineral wool min. 75 kg/m <sup>3</sup>	<b>EI 120 C/C</b>

\* Typical pipe diameters shown, see below graph for intermediate sizes

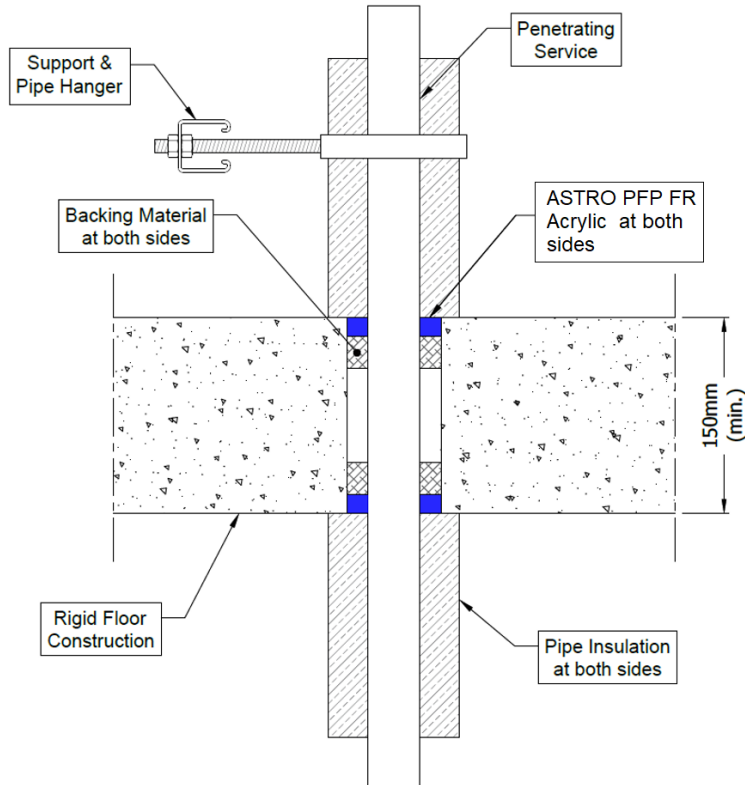


Services	Sealant depth	Backing (minimum)	Insulation	Classification
Alupex Composite Pipe				
16 mm diameter/2.25 mm wall	25 mm	25 mm AES Fibre $\geq$ 128kg/m <sup>3</sup>	9 mm Elastomeric insulation minimum class B-s3,d0, phenolic foam insulation or PU foam insulation	<b>EI 180 C/C</b>
16 mm diameter/2.25 mm wall			9-13 mm Elastomeric insulation minimum class B-s3,d0, phenolic foam insulation or PU foam insulation	
20 mm diameter/2.5 mm wall				
26 mm diameter/3 mm wall				
32 mm diameter/3 mm wall				
40 mm diameter/3.5 mm wall				
50 mm diameter/4 mm wall				
63 mm diameter/4.5 mm wall			13-25 mm Elastomeric insulation minimum class B-s3,d0, phenolic foam insulation or PU foam insulation	<b>EI 60 C/C</b>
75 mm diameter/4.7 mm wall				
16 mm diameter/2.25 mm wall				
20 mm diameter/2.5 mm wall				
26 mm diameter/3 mm wall				
32 mm diameter/3 mm wall				
40 mm diameter/3.5 mm wall				
50 mm diameter/4 mm wall				
63 mm diameter/4.5 mm wall				
75 mm diameter/4.7 mm wall				

### A.6.12 Double side penetration seal with metallic pipes

**Penetration Seal:** 1000 mm (min.) LI (Local Interrupted) or CI (Continuous Interrupted) insulated metallic pipes (single) fitted at any position within the aperture, with 15 mm deep ASTRO PFP FR Acrylic to both sides of the floor (or at any position between), backed with 20 mm deep minimum 40 kg/m<sup>3</sup> stone wool insulation\*.

Construction details:

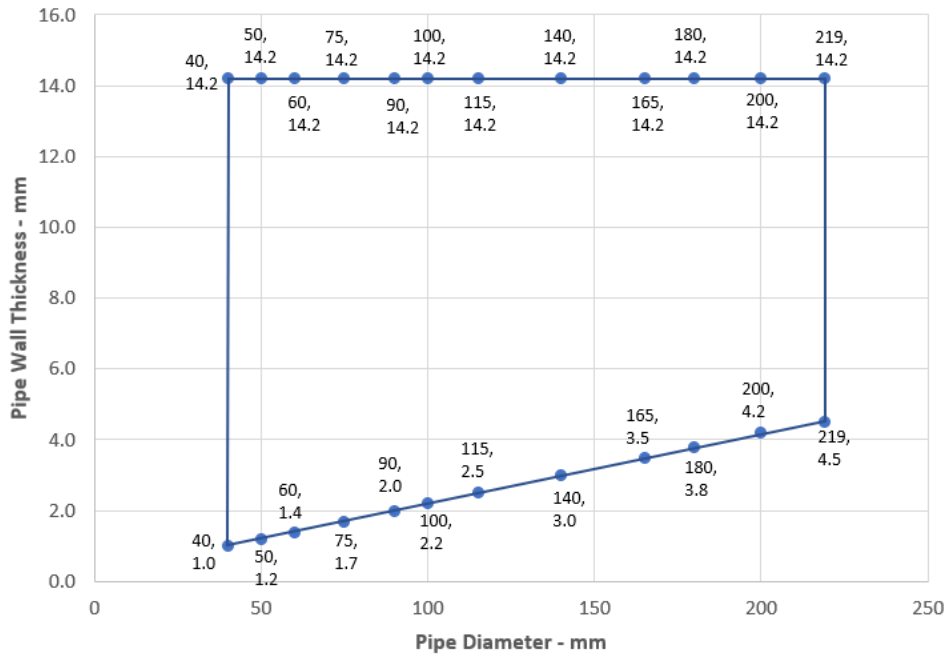


#### A.6.12.1

Services	Maximum seal size	Insulation (minimum)	Classification
Mild or stainless steel pipe			
40 mm diameter/1-14.2 mm wall	300 x 300 mm or 100 x 1000 mm	20 mm Stone wool insulation 80 kg/m <sup>3</sup>	EI 240 C/U
40 mm diameter/1-14.2 mm wall*			
50 mm diameter/1.2-14.2 mm wall*		30 mm Stone wool insulation 80 kg/m <sup>3</sup>	E 240 C/U, EI 120 C/U
60 mm diameter/1.4-14.2 mm wall*			
75 mm diameter/1.7-14.2 mm wall*			
90 mm diameter/2-14.2 mm wall*			
100 mm diameter/2.2-14.2 mm wall*			
115 mm diameter/2.5-14.2 mm wall*			
140 mm diameter/3-14.2 mm wall*			
165 mm diameter/3.5-14.2 mm wall*			
180 mm diameter/3.8-14.2 mm wall*			
200 mm diameter/4.2-14.2 mm wall*			
219 mm diameter/4.5-14.2 mm wall*			

\* Typical pipe diameters shown, see below graph for intermediate sizes

### Steel Pipes with Stone Wool Insulation - C/U

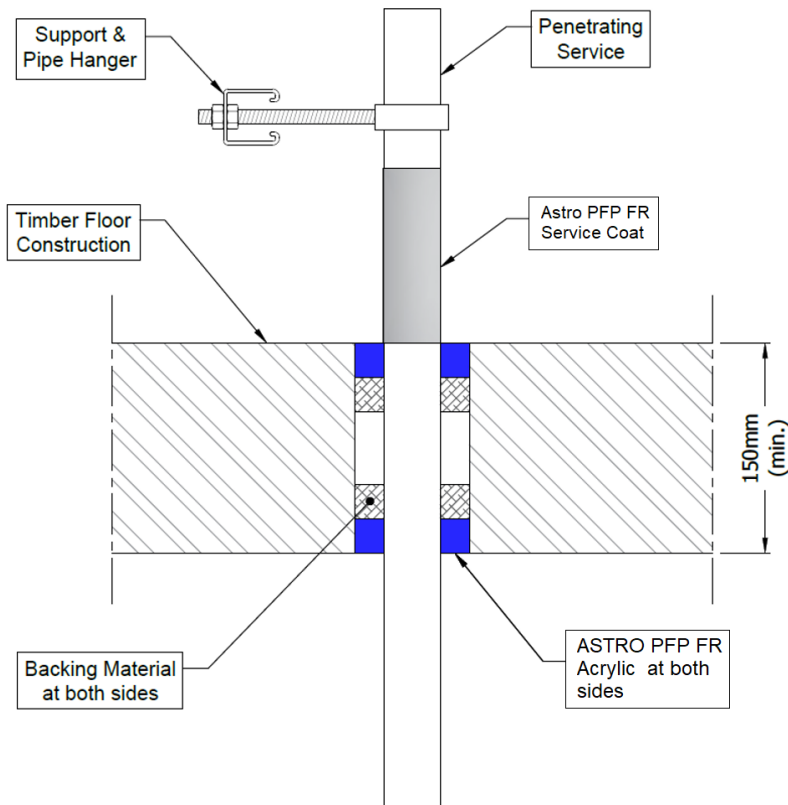


## A.7 Timber floor constructions with floor thickness of minimum 150 mm

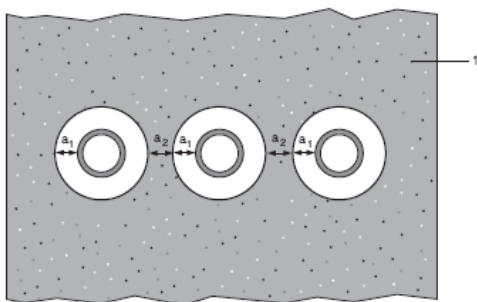
### A.7.1 Double sided penetration seal with cables

**Penetration Seal:** Cables fitted at any position within the aperture, sealed with ASTRO PFP FR Acrylic, minimum 25 mm deep to both sides of the floor and backed with stone wool insulation (minimum 33kg/m<sup>3</sup>), minimum 25 mm deep. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



#### Key

- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

### A.7.1.1

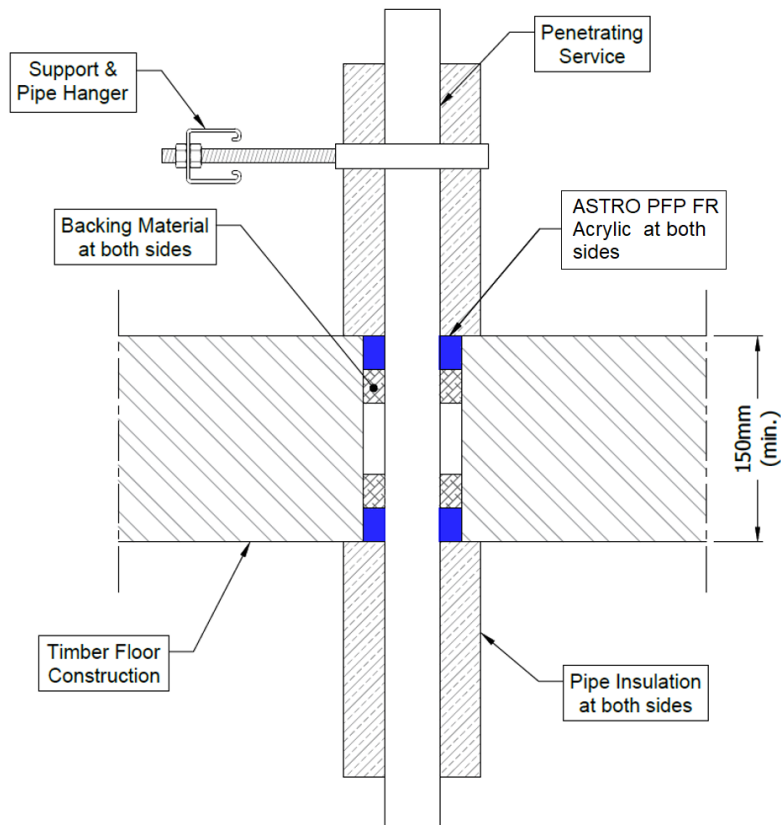
Services	Sealant depth	Backing	Maximum aperture	Insulation, minimum	Classification
None (blank)	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	Ø 220 mm	None	EI 120
Cables up to 14 mm Ø, single or in bundles up to 100 mm Ø					EI 120
Cables up to 21 mm Ø, single or in bundles up to 100 mm Ø				Astro PFP FR Service Coat, 260-micron DFT extending 150 mm from top side of the seal	E 120, EI 90
Cables up to 50 mm Ø, single or in bundles up to 100 mm Ø					E 120, EI 90
Telecom cables up to 14 mm Ø, single or in bundles up to 100 mm Ø					E 120, EI 90



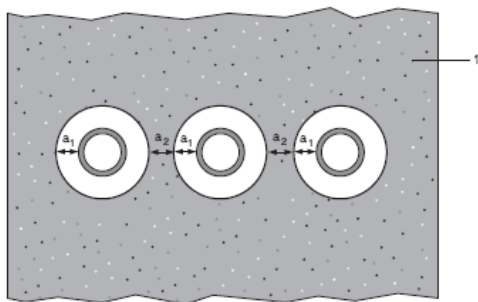
### A.7.2 Double side penetration seal with metallic pipes

**Penetration Seal:** 500 mm (min.) LI (Local Interrupted) or CI (Continuous Interrupted) insulated metallic pipes and composite pipes (single) with glass wool or stone, mineral wool min. 75 kg/m<sup>3</sup>, fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the floor, backed with stone wool insulation (minimum 33kg/m<sup>3</sup>), minimum 25 mm deep. Minimum annular space 10 mm (a1) and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



#### Key

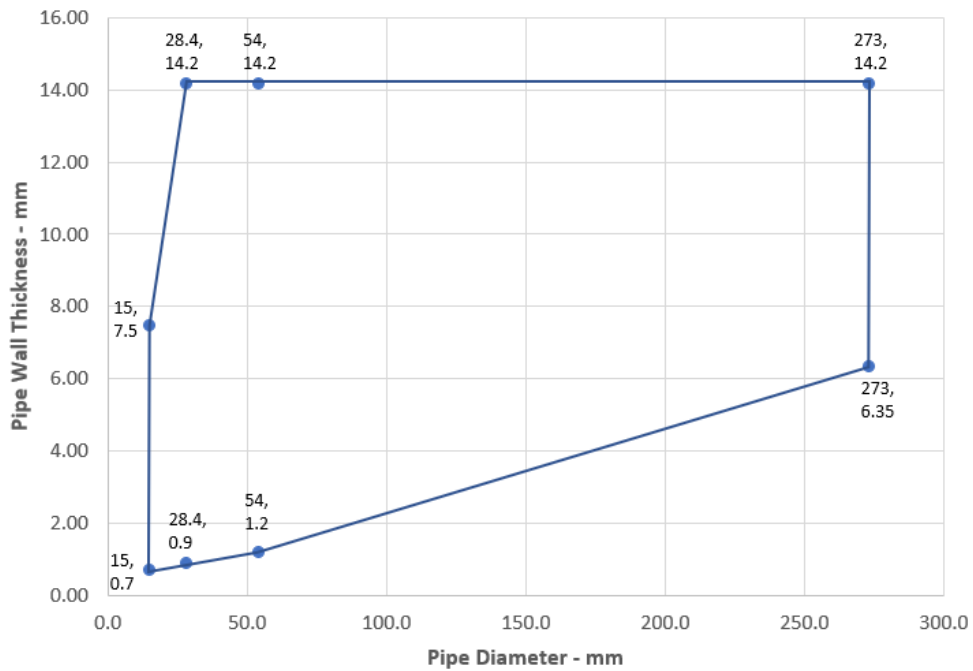
- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

### A.7.2.1

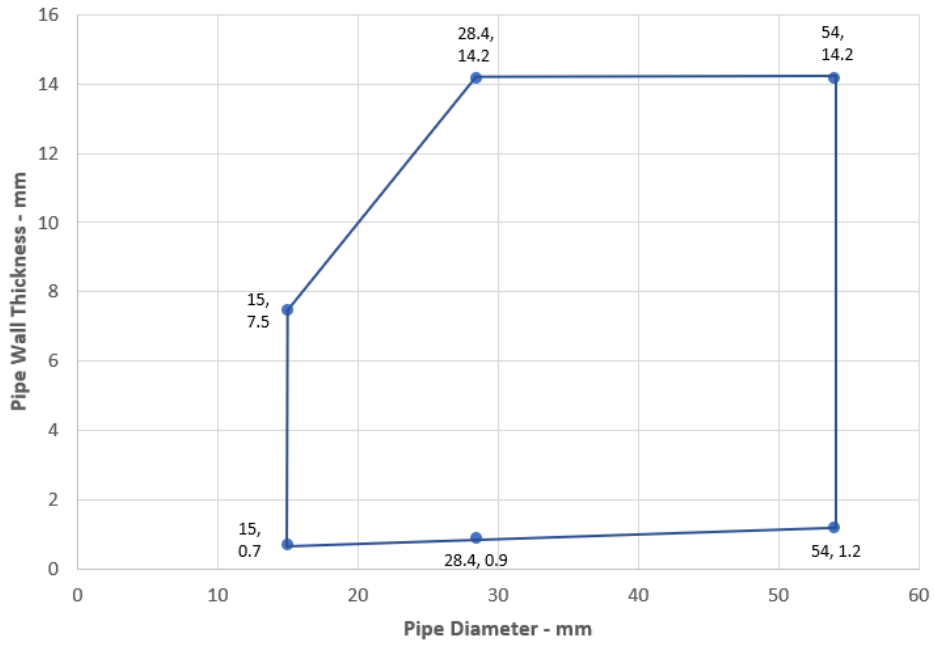
Services	Maximum aperture	Sealant depth	Backing	Insulation, minimum	Classification
Mild or stainless steel pipe					
Maximum 273 mm diameter /6.35-14.2 mm wall*	∅ 293 mm	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	25 mm glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>E 120 C/C, EI 60 C/C</b>
Copper or steel pipe					
Maximum 15 mm diameter /0.7-7.5 mm wall*	∅ 220 mm	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	20 mm glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>EI 120 C/C</b>
Maximum 54 mm diameter /1.2-14.2 mm wall*					<b>E 120 C/C, EI 90 C/C</b>
Alupex Pipe					
Maximum 16 mm diameter/ 2.25 mm wall*	∅ 220 mm	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	20 mm glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>EI 120 C/C</b>
Maximum 75 mm diameter/ 4.6 mm wall*				25 mm glass wool or stone, mineral wool min. 75 kg/m <sup>3</sup> , 500 mm length from both sides of the seal	<b>E 120 C/C, EI 90 C/C</b>

\* Typical pipe diameters shown, see below graph for intermediate sizes

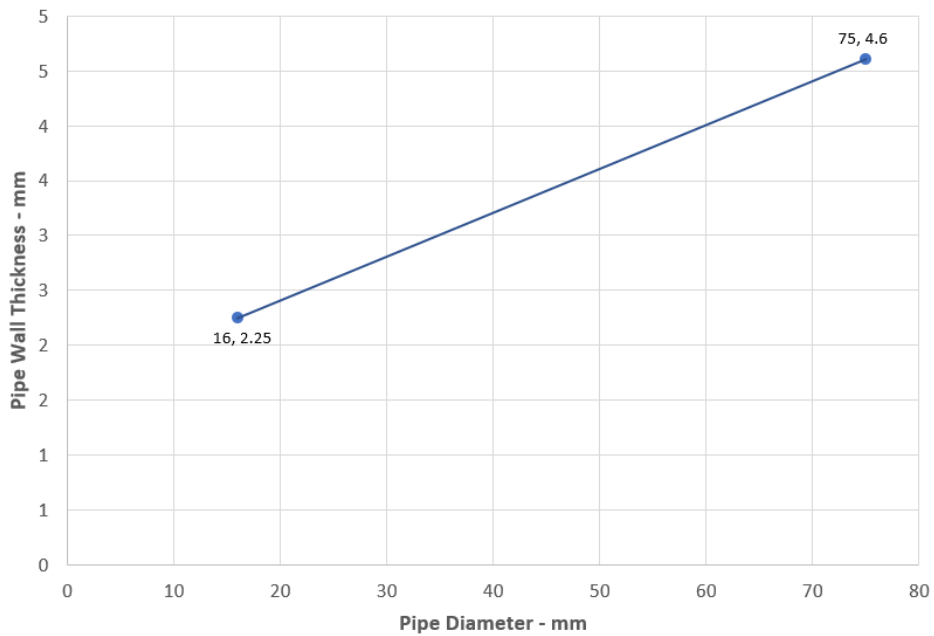
**Steel Pipes with Glass Wool or Mineral Wool Insulation - C/C**



**Copper or Steel Pipes with Glass Wool or Mineral Wool  
Insulation - C/C**



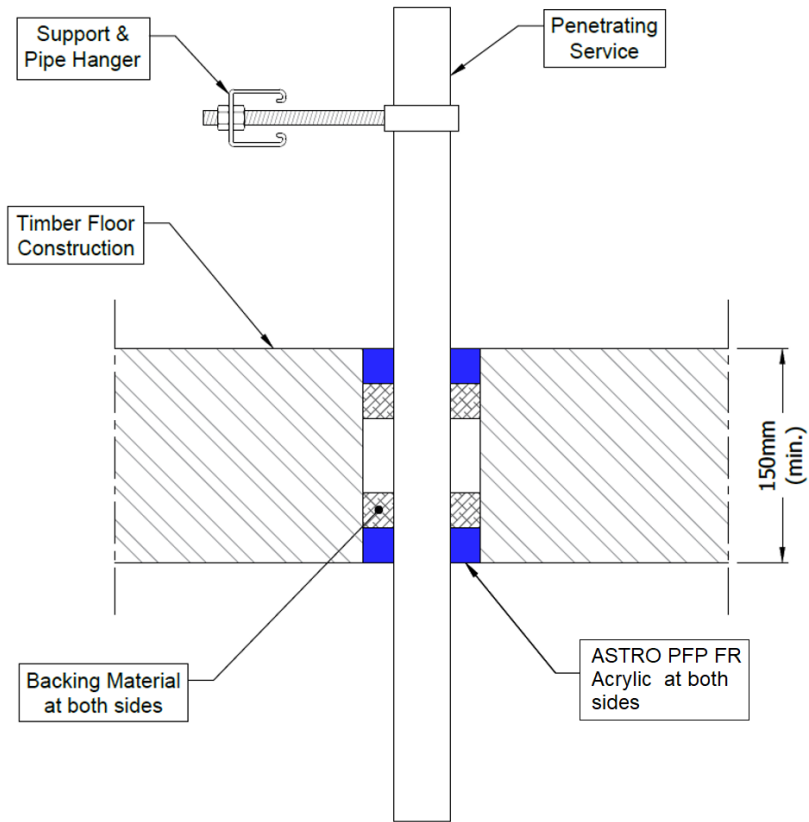
**Alupex Pipes with Glass Wool or Mineral Wool Insulation -  
C/C**



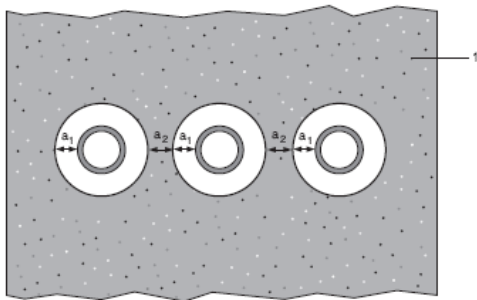
### A.7.3 Double side penetration seal with plastic pipes and composite pipes

**Penetration Seal:** Plastic and composite pipes (single) fitted at any position within the aperture, with ASTRO PFP FR Acrylic to both sides of the floor, backed with stone, mineral wool min. 33 kg/m<sup>3</sup>. Minimum annular space 10 mm and maximum 30 mm (a1) and minimum separation between penetration seals 0 mm (a2).

Construction details:



Configuration 1:



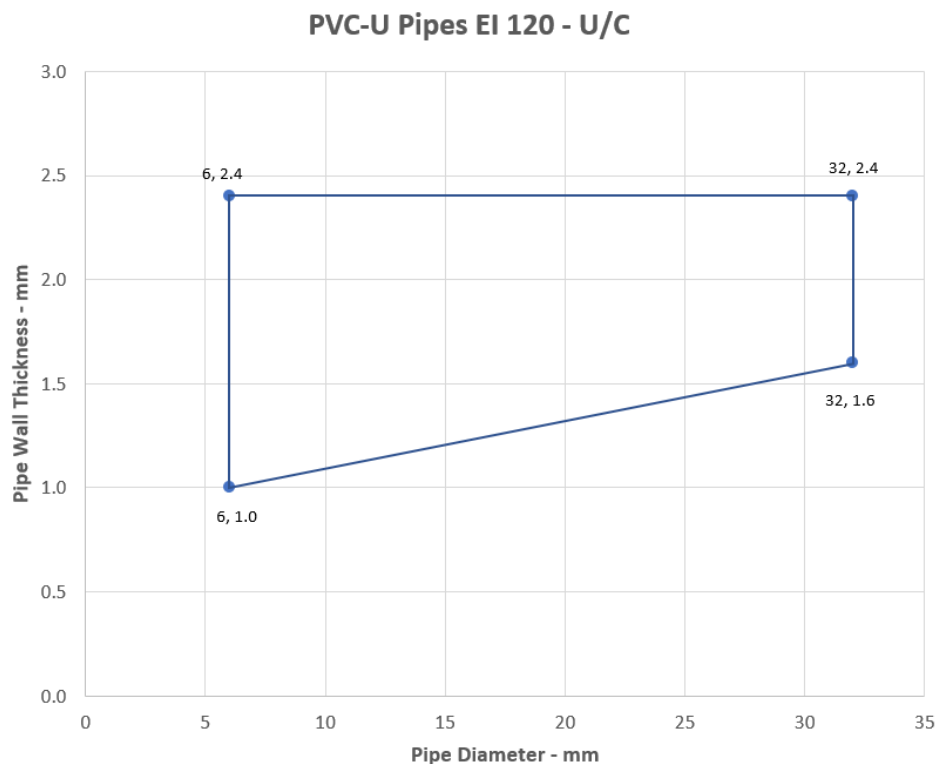
**Key**

- 1 Supporting construction
- a1 Pipe / edge of seal separation (annular space)
- a2 Separation between penetration seals

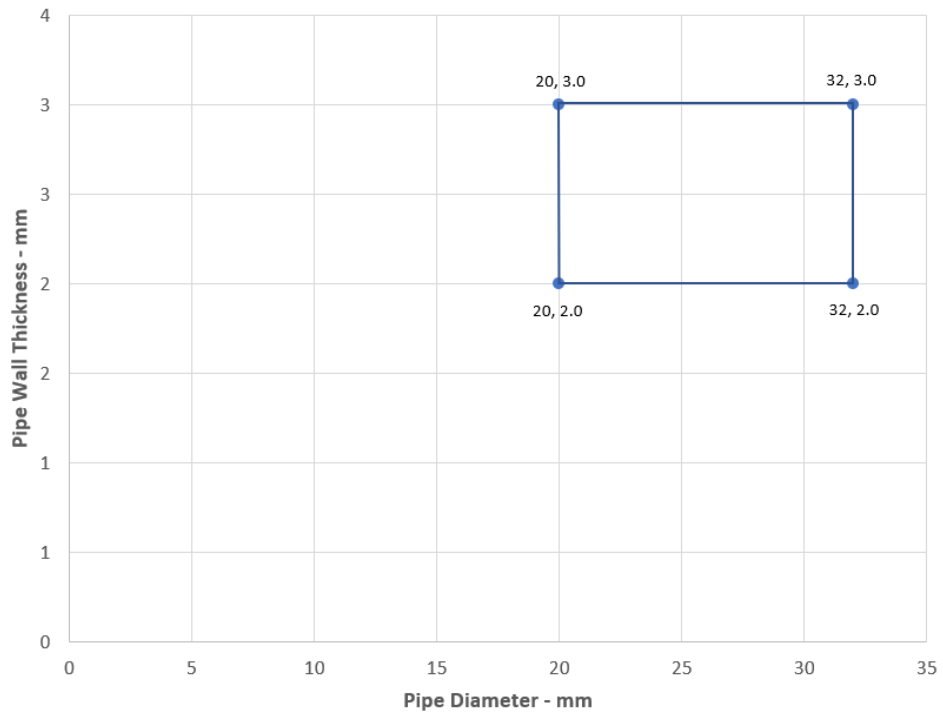
### A.7.3.1

Services	Sealant depth	Backing	Classification
PVC-U pipe according to EN 1329-1, EN 1452-1 and EN 1453-1, PVC-C according to EN 1566-1			
Maximum 32 mm diameter/1.0-2.4 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 120 U/C
PE pipe according to EN 1519-1, EN 12201-2 and EN 12666-1, ABS according to EN 1455-1 and pipes made from SAN+PVC according to EN 1565-1			
Maximum 32 mm diameter/2.0-3.0 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 120 U/C
PP pipe according to EN 1451-1 or DIN 8077/8078			
Maximum 32 mm diameter/1.8-4.4 mm wall*	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 120 U/C
PEX pipe in pipe system			
25 mm diameter outer /15 mm diameter x 2.5 mm wall inner	25 mm	Stone wool 25 mm deep min. 33kg/m <sup>3</sup>	EI 120 C/C

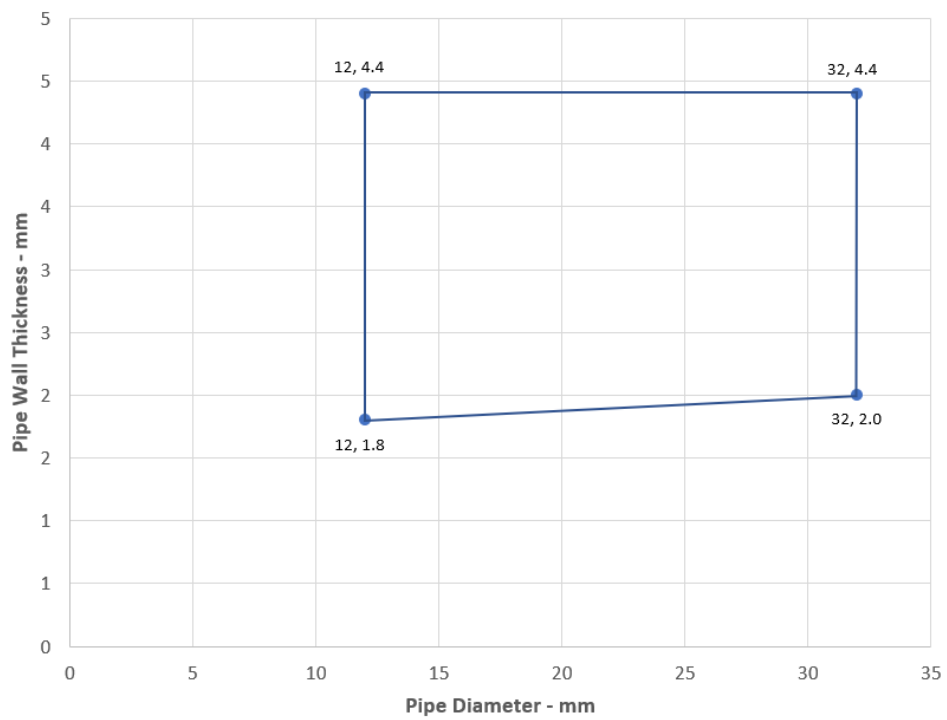
\* Typical pipe diameters shown, see below graph for intermediate sizes



### PE Pipes EI 120 - U/C



### PP Pipes EI 120 - U/C



## ANNEX B – Air Permeability – ASTRO PFP FR Acrylic

Product tested	10mm deep x 30mm wide ASTRO PFP FR Acrylic		
Summary of testing procedure		Result	
	Pressure (Pa)	Leakage (m <sup>3</sup> /h)	Leakage (m <sup>3</sup> /m <sup>2</sup> /h)
Results under negative chamber pressure	25	0.00	0.00
	50	0.00	0.00
	100	0.00	0.00
	200	0.00	0.00
	300	0.02	0.56
	450	0.06	1.67
	600	0.22	6.11
Results under positive chamber pressure	25	0.00	0.00
	50	0.00	0.00
	100	0.00	0.00
	200	0.00	0.00
	300	0.00	0.00
	450	0.04	1.11
	600	0.25	6.94

