



## **Laboratory for Fire Safety**

*Summary of the classification of the fire resistance in line with EN 13501-2:2016 concerning pipe and cable penetration seals fitted with the Mulcol® Multicollar Slim*

*Application in a rigid floor*



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*Summary of the classification of the fire resistance in line with EN 13501-2:2016 concerning pipe and cable penetration seals fitted with the Mulcol® Multicollar Slim*

*Application in a rigid floor*

Client	Mulcol International
Report number	C 1744-1E-RA-011
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All orders are accepted and executed according to 'De Nieuwe Regeling 2011' (The New Rules)

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mook – zoetermeer – groningen – düsseldorf – dortmund – berlijn – leuven – parijs – lyon

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## 1 Introduction

On behalf of Mulcol International, several tests were performed with respect to the fire resistance of pipe and cable penetrations seals fitted with the Mulcol® Multicollar Slim.

The system was tested in the Peutz Laboratory for Fire Safety in Mook in accordance with EN 1366-3:2009 and assessed according to the following criteria:

- integrity (E);
- insulation (I).

The system was tested using the standard heating curve as defined in EN 1363-1:1999.

Based on the test results, the Mulcol® Multicollar Slim was classified to the appropriate combinations of performance parameters and classes in accordance with the procedures given in EN 13501-2:2016. This summary<sup>1</sup> report defines the fire resistance assigned to several pipe and cable penetration seals fitted with the Mulcol® Multicollar Slim by classification in analogy with EN 13501-2:2016. For clearance in expressing the performance parameters of the fire resistance, the systematics of the European classification standard EN 13501-2:2016 are used.

The fire resistance as presented in this report is mainly based on the available test- and classification reports. Furthermore the knowledge and the experience gained by Peutz performing fire resistance tests on pipe and cable penetration seals in its Laboratory for Fire Safety and the knowledge of the Mulcol® Multicollar Slim were used for defining field of application and the expected fire resistance by expert judgement. The expected fire resistance of penetration seals determined by expert judgement is marked with "\*".

<sup>1</sup> The classified pipe and cable penetrations have an unlimited validity. The part of this summary by expert judgement is valid for 5 years. After expiry of that period, the validity may be extended if it is shown that the composition of the product has not been changed, also the direct and extended field of application in the relevant standards shall be not limited and no test results have become available that make an adjustment of the conclusions in this report necessary.

## 2 Normative references

This summary incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter in Table 2.1.

### 2.1 Used publications

Reference	Summary of title
EN 13501-2:2016	Fire classification of construction products and building elements – classification using data from fire resistance tests
EN 1366-3:2009	Fire resistance tests for service installations – part 3: penetration seals
prEN 1366-3:2017	Fire resistance tests for service installations – part 3: penetration seals
EN 1329-1	Plastic piping systems for soil and waste discharge within the building structure – unplasticized poly (vynil chloride) PVC-U
EN 1451-1	Plastic piping systems for soil and waste discharge (low and high temperature) within the building structure - polypropylene (PP)
EN 1452-1	Plastic piping systems for drinking water within the building structure – unplasticized poly (vynil chloride) PVC-U
EN 1453-1	Plastic piping systems with structured-wall pipes inside buildings – unplasticized poly (vynil chloride) PVC-U
EN 1455-1	Plastic piping systems for soil and waste discharge within the building structure – acrylonitrile-butadiene-styrene ABS
DIN 8061	Unplasticized polyvinyl chloride (PVC-U) pipes - general quality requirements and testing
DIN 8062	Unplasticized polyvinyl chloride (PVC-U) pipes – dimensions
DIN 8074	Polyethylene (PE) - pipes PE 80, PE 100 - dimensions
DIN 8075	Polyethylene (PE) pipes – PE 80, PE 100 - general quality requirements, testing
DIN 8077	Polypropylene (PP) pipes - PP-H, PP-B, PP-R, PP-RCT - dimensions
DIN 8078	Polypropylene (PP) pipes - PP-H, PP-B, PP-R, PP-RCT - general quality requirements and testing
EN 12449	Copper and copper alloys - Seamless, round tubes for general purposes
EN 1519-1	Plastic piping systems for soil and waste discharge within the building structure – polyethylene PE
EN 1565-1	Plastic piping systems for soil and waste discharge within the building structure – styrene copolymer blends SAN+PVC
EN 1566-1	Plastic piping systems for soil and waste discharge within the building structure – chlorinated poly (vynil chloride) PVC-C
EN 10255	Non-alloy steel tubes suitable for welding or threading - technical delivery conditions
EN 12201-2	Plastic piping systems for water supply, and for drainage and sewerage under pressure – polyethylene PE
EN 12666-1	Plastic piping systems for non-pressure underground drainage and sewerage – polyethylene PE
EN 998-2	Specification for mortar for masonry - part 2: masonry mortar
EN ISO 15493	Plastic piping systems for industrial applications - acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) - specifications for components and the system - metric series
EN ISO 15494	Plastic piping systems for industrial applications - polybutene (PB), polyethylene (PE), polyethylene of raised temperature resistance (PE-RT), crosslinked polyethylene (PE-X), polypropylene (PP)
EN 15874	Plastic piping systems for hot and cold water installations – polypropylene (PP)
EN 15874-2	Plastic piping systems for hot and cold water installations - polypropylene (PP)
EN 15874-2:2013	Plastic piping systems for hot and cold water installations polypropylene PP
DIN 16962	Pipe joints and elements for polypropylene pressure pipelines (PP)
DIN 19531-10	Pipes and fittings made of unplasticized polyvinyl chloride (PVC-U) socket for waste and soil discharge systems inside buildings
DIN 19535-10	High-density polyethylene (PE-HD) pipes and fittings for hot-water resistant waste and soil discharge systems (HT) inside buildings – Part 10: Fire behaviour, quality control and installation recommendations

### 3 List of the Mulcol® materials used

This summary incorporates many different Mulcol® materials. For clearance, the materials used are listed in Table 3.1. When available, the existing European Technical Approval (ETA) and the reaction to fire classification according to EN 13501-1 are given.

t3.1 Used Mulcol® materials and available information

Commercial name	Type of material	Number and date European Technical Approval (ETA)	Reaction to fire classification (EN 13501-1)
Mulcol® Multicollar Slim	Fire collar	N.a.	N.a.
Mulcol® Multiclip	Clip used for mounting the fire collar	N.a.	N.a.
Mulcol® Multiclip Large	Clip used for mounting two fire collars	N.a.	N.a.
Mulcol® Multiscrew 7.5 x 40 mm	Screw for rigid and flexible construction	N.a.	N.a.
Mulcol® Multiscrew FB 40	Pigtail screw for rock wool board system	N.a.	N.a.
Mulcol® Multisealant A	Acrylic sealant	ETA-16/0487 dated September 21, 2016	D-s1, d1
Mulcol® Multimastic FB1	Rock wool board seal system	ETA-16/0985 dated January 25, 2017	F (not determined)
Mulcol® Multimastic C	Coating penetration seal system	ETA-16/0563 dated August 23, 2016	F (not determined)
Mulcol® Multimastic SP	Acrylic sealant penetration seal system	ETA-16/0565 dated August 23, 2016	D-s1, d1
Mulcol® Multimortar	Mortar	ETA-16/0566 dated August 23, 2016	A1

## 4 Reports in support of this summary

An overview of the reports used is given in Table 4.1.

### t4.1 Used reports

Name of body	Name of client	Report reference number and date	Used methods	Test number
Peutz bv	Mulcol International	Test report Y 1518-1E-RA-005 dated February 7, 2017	EN 1363-1:1999 EN 1366-3:2009	1
Peutz bv	Mulcol International	Test report YA 1518-2E-RA-002 dated February 7, 2017	EN 1363-1:1999 EN 1366-3:2009	2
Peutz bv	Mulcol International	Test report YB 1518-2E-RA-001 dated February 7, 2017	EN 1363-1:1999 EN 1366-3:2009	3
Peutz bv	Mulcol International	Test report YC 1518-1E-RA-001 dated January 31, 2017	EN 1363-1:1999 EN 1366-3:2009	4
Peutz bv	Mulcol International	Test report Y 1732-1E-RA-001 dated January 31, 2017	EN 1363-1:1999 EN 1366-3:2009	5
Peutz bv	Mulcol International	Test report YA 1732-1E-RA dated February 7, 2017	EN 1363-1:1999 EN 1366-3:2009	6
Peutz bv	Mulcol International	Test report YB 1732-1E-RA dated February 7, 2017	EN 1363-1:1999 EN 1366-3:2009	7
Peutz bv	Mulcol International	Test report YC 1732-2E-RA-001 dated May 15, 2017	EN 1363-1:1999 EN 1366-3:2009	8
Peutz bv	Mulcol International	Extended application report YD1518-1E-RA dated October 20, 2017	EN 15882-3:2009 EN 15725:2010/AC:2012	1 to 8
Peutz bv	Mulcol International	Classification YE 1518-3E-RA-002 dated October 20, 2017	EN 13501-2:2016	1 to 8
Peutz bv	Mulcol International	Expert judgement C 1744-2E-RA-001 dated October 25, 2017	Various	1 to 8
UL International (UK) LTD.	Mulcol International	ETA-16/0566 Mulcol <sup>®</sup> Multimortar dated August 23, 2016	Various	N.a.
UL International (UK) LTD.	Mulcol International	ETA-16/0985 Mulcol <sup>®</sup> Multimastic FB1 penetration seal system dated January 25, 2017	Various	N.a.
UL International (UK) LTD.	Mulcol International	ETA-16/0563 Mulcol <sup>®</sup> Multimastic C dated August 23, 2016	Various	N.a.
UL International (UK) LTD.	Mulcol International	ETA-16/0487 Mulcol <sup>®</sup> Multisealant A dated September 21, 2016	Various	N.a.
UL International (UK) LTD.	Mulcol International	ETA-16/0565 Mulcol <sup>®</sup> Multimastic SP dated August 23, 2016	Various	N.a.

The client has stated that the provided reports may be used for this summary.



## 5 Fire resistance for floor applications

The conditions regarding the field of application are given in Paragraph 5.1 in which general conditions are given that apply to all penetration seals in this document. Additionally to the general conditions, specific conditions that apply to different pipe materials and cables are given in Paragraphs 5.2 to 5.9.

### 5.1 General conditions

#### 5.1.1 General conditions – reference to standards

Chapter 5 defines the fire resistance and field of application of pipe and cable penetration seals fitted with the Mulcol® Multicollar Slim. The fire resistance is mainly based on the available classifications in accordance with the European classification standard EN 13501-2:2016 and based on the direct field of application in accordance with EN 1366-3:2009. On request of the client, the field of application of several penetration seals is assessed and widened by an expert judgement. These penetration seals including their field of application are marked with an "\*" throughout this entire summary.

The fire resistance classes given in this Chapter also cover lower fire resistance classes with the same combinations of criteria (for example EI 90 also covers EI 60 and lower). The fire resistance classes given in this Chapter with the criteria E and I (EI) also covers the same fire resistance classes with only the criterion E (for example EI 90 also covers E 90).

#### 5.1.2 General conditions – orientation

Except for plastic pipes and plastic pipes (silent) placed under an angle (Paragraphs 5.2.3 and 5.3.2), the fire resistance is valid for a pipe and cable penetration seals passing through perpendicular to the floor.

#### 5.1.3 General conditions – rigid floor

The pipe penetrations can be applied in any type of floor of aerated concrete ( $600 \pm 200 \text{ kg/m}^3$ , class G4/600 or heavier) or concrete with a minimum thickness of 150 mm.

#### 5.1.4 General conditions – distance metal strap collar to floor, corner or wall

Except for pipe penetrations placed in a corner, a distance of at least 10 mm from the metal strap of the collar to a different floor, corner, wall or transfer to another type of floor (adjacent constructions) shall be taken into account to enable a proper working of the intumescent inlay.

## 5.1.5 General conditions – Mulcol® Multimastic FB1 (2 x 50 mm)

The aperture size in the floor may be up to 1200 mm wide and 2400 mm long. The Mulcol® Multimastic FB1 board system has a total thickness of 100 mm (2 x 50 mm) with a coating Mulcol® Multimastic C. The coating is applied with a thickness 1 mm on the outwards pointing faces of each panel (no coating between the boards). The coating shall also be applied circumferential over the opening of the rock wool with the adjacent construction (overlap minimal 25 mm). The joints between the different board elements and the aperture edge shall be glued together with Mulcol® Multimastic SP. A cavity of maximum 50 mm between the rock wool panels may be present.

For further information regarding the placing instructions and the field of application of the Mulcol® Multimastic FB1 (2 x 50 mm) penetration seal system reference is made to the European Technical Assessment ETA 16/0985 dated January 25, 2017.

The use of the Mulcol® Multimastic FB1 (2 x 50 mm) penetration seal system is recommended.

During the tests, several different penetration seal systems of other manufacturers were added to the test specimen. Added were Hensomastik®, Promastop® I and Promastop® CC. When rock wool penetration seal systems of other manufacturers are used, the installation instructions of that typical manufacturer apply and at least a fire resistance and the field of application of the desired performance class in accordance with EN 13501-2 must be verified.

## 5.1.6 General conditions – means of fixing

The Mulcol® Multicollar Slim shall be attached to the underside of the floor or rock wool penetration seal system with Mulcol® Multiclips or Mulcol® Multiclips Large. In Table 5.1.1, the exact assembly instructions are given sorted by installation diameter of the collar (outer diameter of the pipe, cable or insulation).

For the pipe penetration seals mentioned in Paragraphs 5.2.3, 5.2.5, 5.2.6, 5.3.5, 5.3.6 and 5.5.3 a different number of Mulcol® Multiclips is applicable (see these Chapters for detailed information).

### t5.1.1 Assembly instructions fixing

Outer diameter pipe, cable or insulation (mm)	Single collar	Double collar		Allowed fastenings	
	Number of Mulcol® Multiclips	First collar (Mulcol® Multiclips)	Second collar (Mulcol® Multiclips Large)	Rigid floor	Rock wool board system
≤ 90	2	1*	2	Mulcol® Multiscrew 7.5 x 40 mm	Mulcol® Multiscrew FB 40 or threaded rod and bolts M6
> 90 and < 160	3	1*	3		
≥ 160 and ≤ 200	4	1*	4		
> 200 and ≤ 285	5	2	5		
> 285 and ≤ 315	6	2	6		

\*Mechanical fixation to the floor is not necessary

## 5.1.7 General conditions – pipe end configuration

The fire resistance of plastic, aluminium composite and PP-R multilayer pipes applies to a certain pipe end configuration. In Table 5.1.2 the configuration to be tested versus intended use is given.

t5.1.2 Pipe end configuration versus intended use

Intended use	Plastic, aluminium composite and PP-R multilayer pipes	
	Uncapped / Uncapped (U/U)	Uncapped / capped (U/C)
Fluids	Allowed	Allowed
Gasses	Allowed	Allowed
Rainwater pipes	Allowed	Not allowed
Ventilated sewage pipes	Allowed	Not allowed
Unventilated sewage pipes	Allowed	Allowed

The fire resistance of metal pipes applies to a certain pipe end configuration. In Table 5.1.3 the configuration to be tested versus intended use is given.

t5.1.3 Pipe end configuration versus intended use

Intended use	Metal pipes	
	Capped / uncapped (C/U)	Uncapped / capped (U/C)
Fluids, supported by fire rated* suspension system	Allowed	Allowed
Fluids, supported by non fire rated suspension system	Not allowed	Allowed
Gasses, supported by fire rated* suspension system	Allowed	Allowed
Gasses, supported by non fire rated suspension system	Not allowed	Allowed

\*Shown by test or calculation (e.g. Eurocodes)

## 5.1.8 General conditions - normative references

In this Chapter several different pipe materials are mentioned. In Table 5.1.4, the normative reference is given.

## t5.1.4 Pipe materials

Generic material type	Specific material type	Normative reference (see also Chapter 2)
Plastic	PVC-U	DIN 8061 / DIN 8062 / DIN 19531-10 / EN 1329-1 / EN 1452-1 / EN 1453-1 / EN ISO 15493
	PVC-C	EN 1566-1 / EN ISO 15493
	PP	DIN 8077 / DIN 8078 / DIN 16962 / EN 1451-1 / EN 15874-2 / EN ISO 15494 / EN 15874 / EN 15874-2 / EN 15874-2:2013
	PE	DIN 8074 / DIN 8075 / EN 1519-1 / EN 12201-2 / EN 12666-1 / EN ISO 15494
	PE-HD	DIN 19535-10 / EN 1519-1 / EN 12666-1
	ABS	EN 1455-1 / EN ISO 15493
	SAN+PVC	EN 1565-1
Metal	Steel	EN 10255
	Copper	EN 12449
PP-R multilayer	PP	DIN 8077 / DIN 8078
Aluminium composite	Aluminium and PE	EN ISO 15494

### 5.1.9 General conditions – Mulcol® Multisealant A or Mulcol® Multimastic SP

Penetration seals mounted directly through round holes in walls and floors shall be sealed Mulcol® Multisealant A or Mulcol® Multimastic SP. Penetration seals through a Mulcol® Multimastic FB1 board penetration system shall be sealed with Mulcol® Multimastic SP.

## 5.2 Plastic pipes

In this Chapter the expected fire resistance and field of application of plastic pipes in several different applications is summarized.

### 5.2.1 Without insulation

*Plastic pipes*

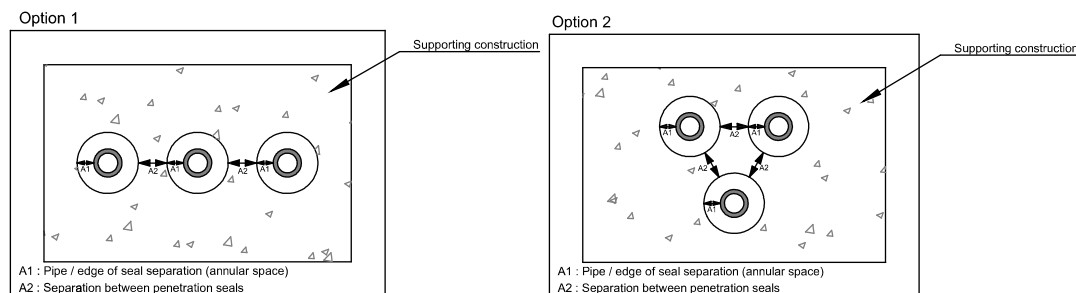
On the next pages, drawings RF-PP-11.0.10 and RF-PP-21.0.10 of the pipe penetration seals with plastic pipes without insulation are given for the pipes fitted with one or two Mulcol® Multicollar Slim placed below the floor. In Table 5.2.1 the installation details regarding the field of application are given.

#### t5.2.1 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 1)		Allowed annular space (distance 'a' in drawing)	
		Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A both faces	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth ≥ 10 mm	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 1. The annular gap A<sub>1</sub> is also visible in this Figure.

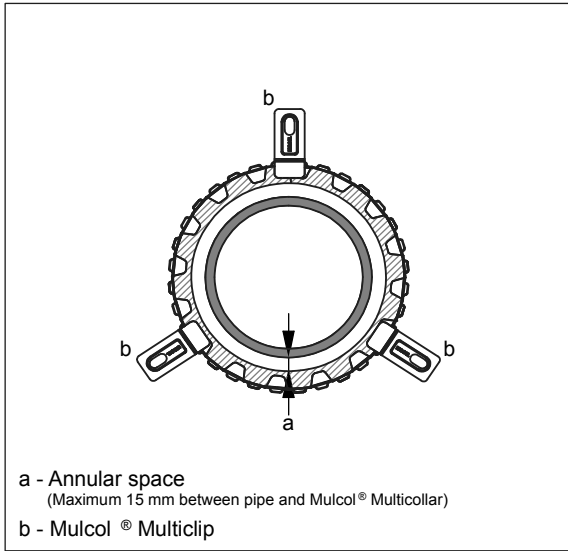
#### f1 Visualization single penetrations



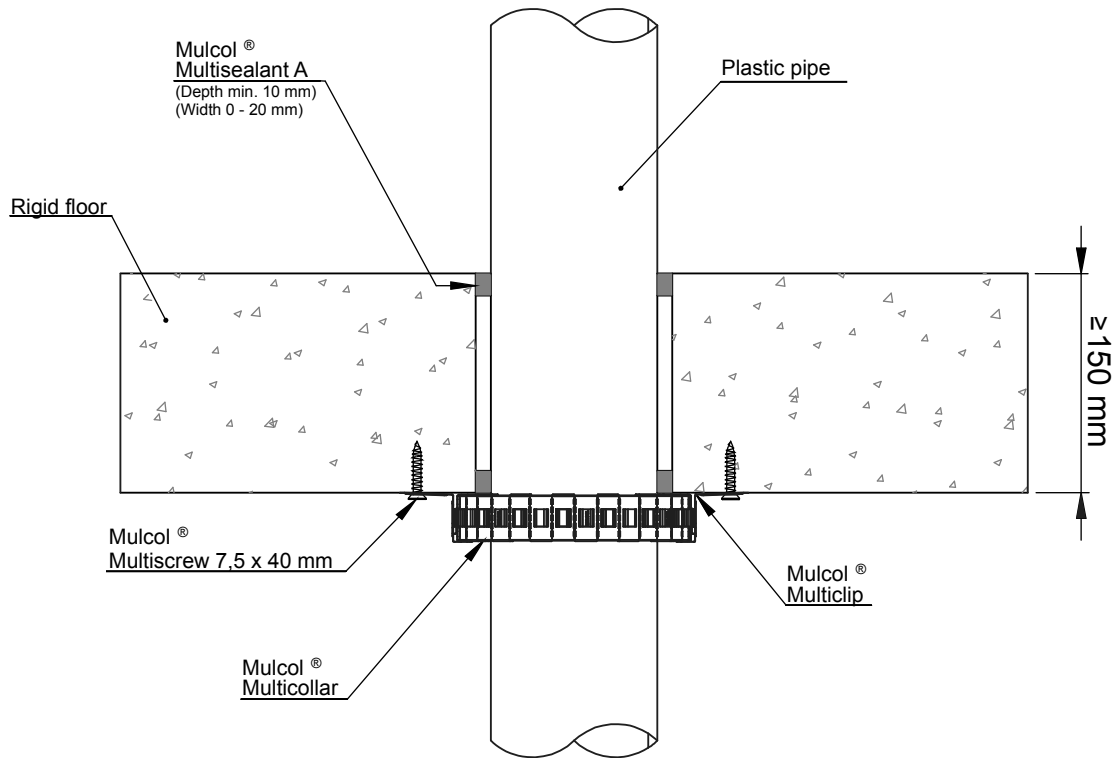
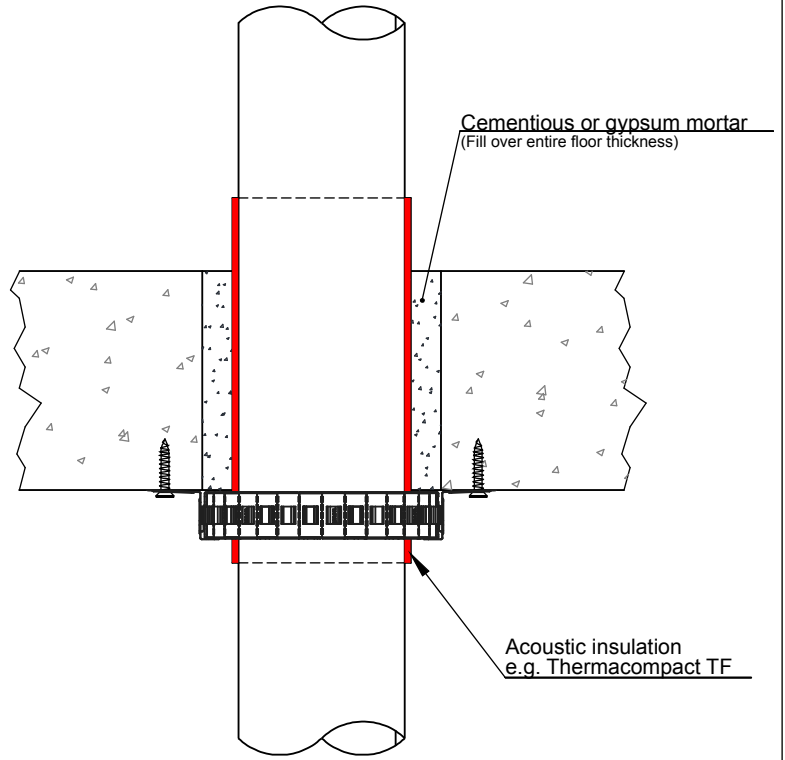
Based upon an assessment concerning other sound decoupling materials it is expected that the fire resistances given in this chapter will also be met for penetration seals with pipes fitted with the following types of insulation:

- Absound Sonocool Type PM;
- Jaco Massa Versterkt Alu, Jaco Massa Alu and Jaco Massa Zwart Alu;
- Merfisol Zilver ALU.

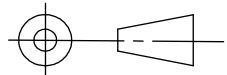
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 7-12-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

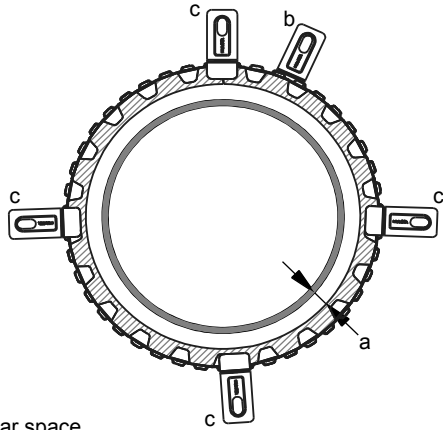
RF-PP-11.0.10

A4



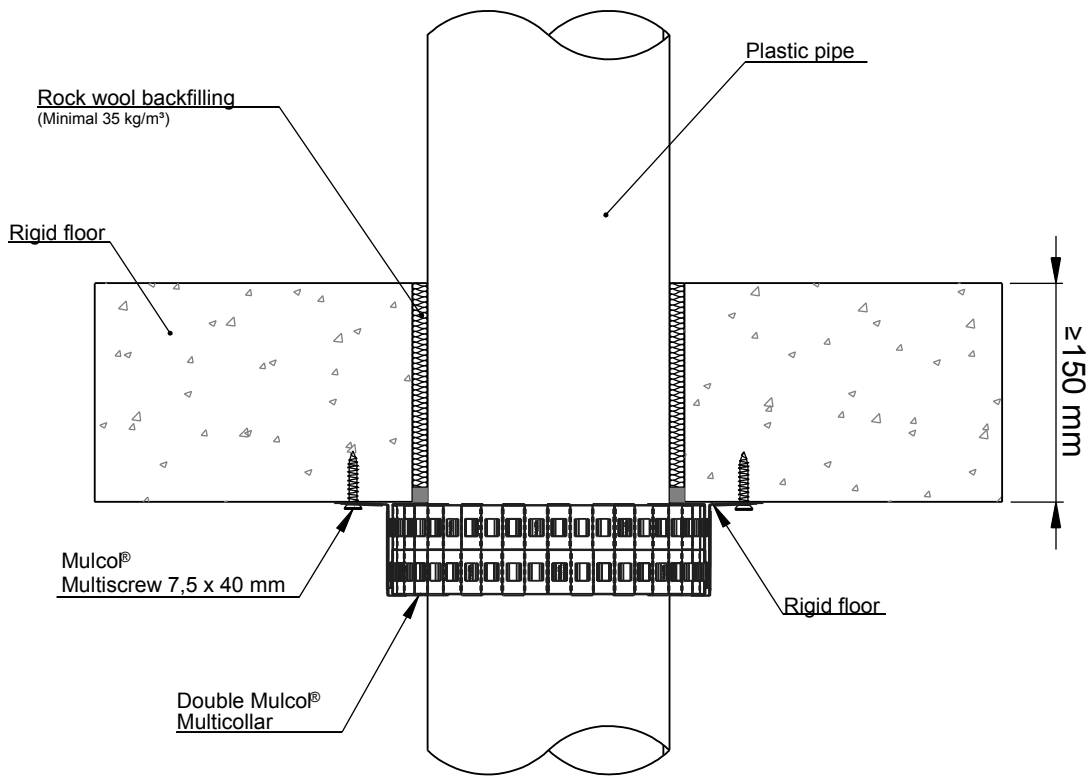
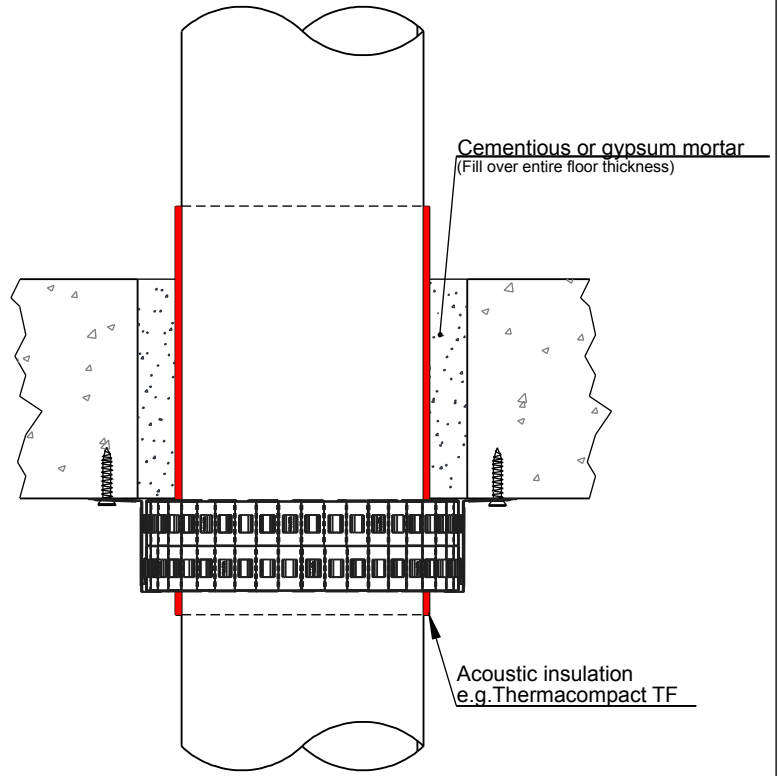
**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

Front view

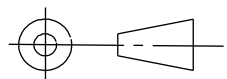


- a - Annular space  
(Maximum 15 mm between pipe and Mulco® Multicollar)
- b - Mulco® Multiclip
- c - Mulco® Multiclip Large

Side view



American projection



Scale : 1:5  
 Unit of measure : mm  
 Date : 7-12-2016

Company : Mulcol International B.V.  
 Department : Research & Development  
 Draftsman : K.J.

RF-PP-21.0.10

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

*PE-HD / PE / ABS / SAN+PVC pipes*

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

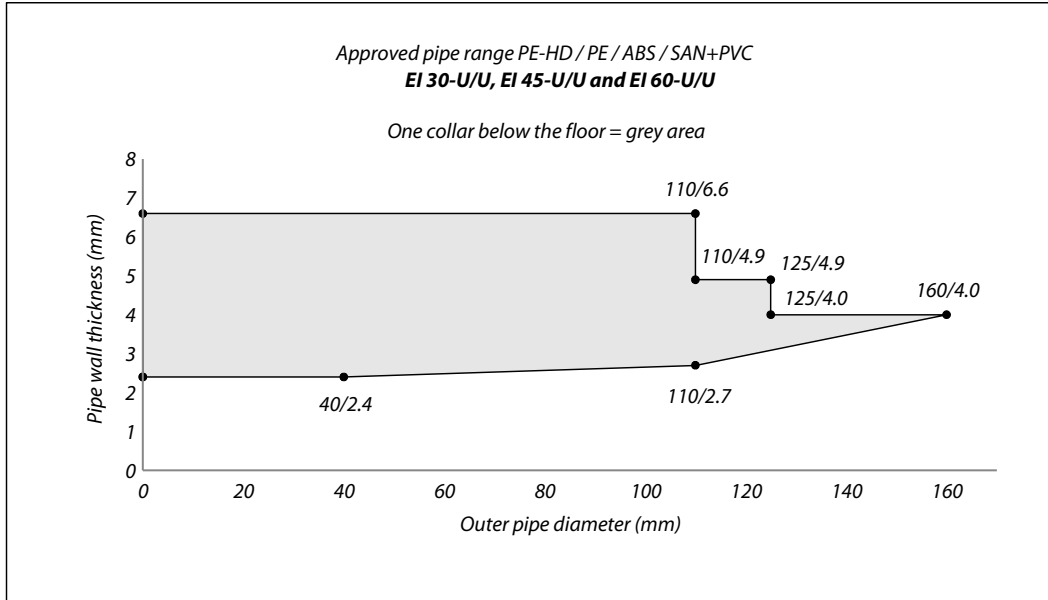
<b>Fire resistance</b>			
<b>One collar below the floor</b>			
<b>PE-HD / PE / ABS / SAN+PVC</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	
<b>Outer diameter</b>	<b>Wall thickness</b>		
≤ 40	2.4 to 3.7	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C
≤ 110	2.7 to 6.6	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 110	6.6	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C
≤ 125	4.9	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 160	4.0	EI 60-U/U E 60-U/U	EI 60-U/C E 60-U/C
≤ 160	14.6	EI 120-U/C E 120-U/C	

<b>Fire resistance</b>			
<b>Two collars below the floor</b>			
<b>PE-HD / PE / ABS / SAN+PVC</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	
<b>Outer diameter</b>	<b>Wall thickness</b>		
≤ 160	4.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 160	4.0 to 14.6	EI 90-U/C E 90-U/C	

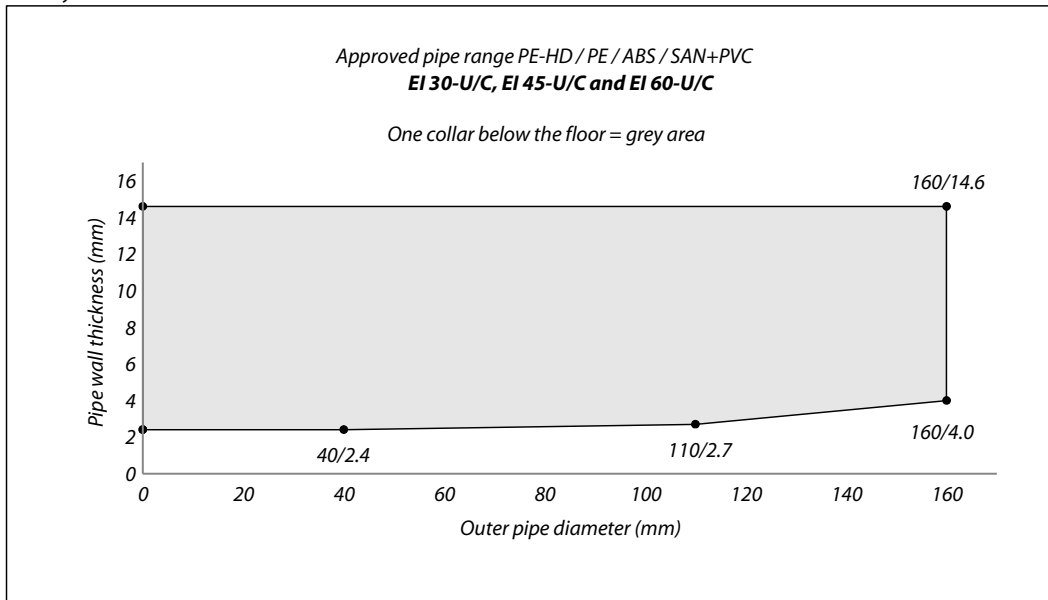
A visualization of the validity area for the fire resistance for EI 30, EI 45, EI 60, EI 90 and EI 120 is given in the Figures hereafter.



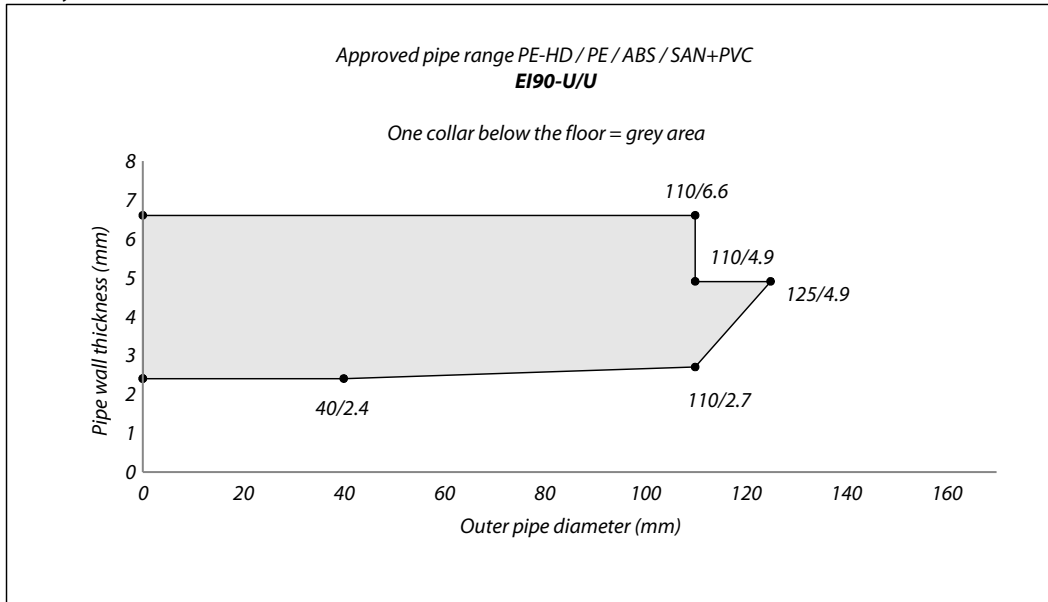
f2 Validity area



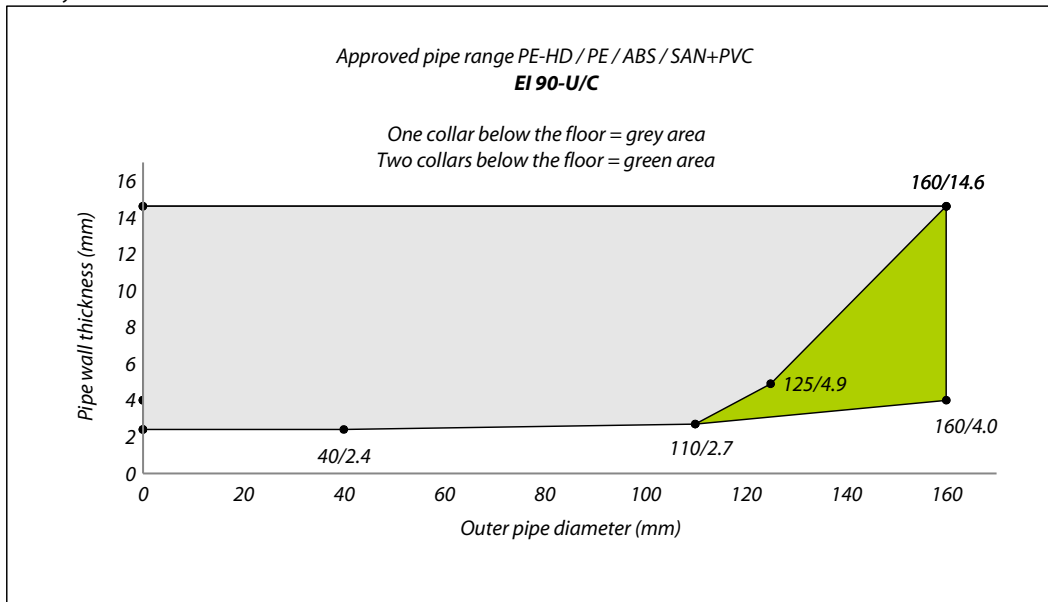
f3 Validity area



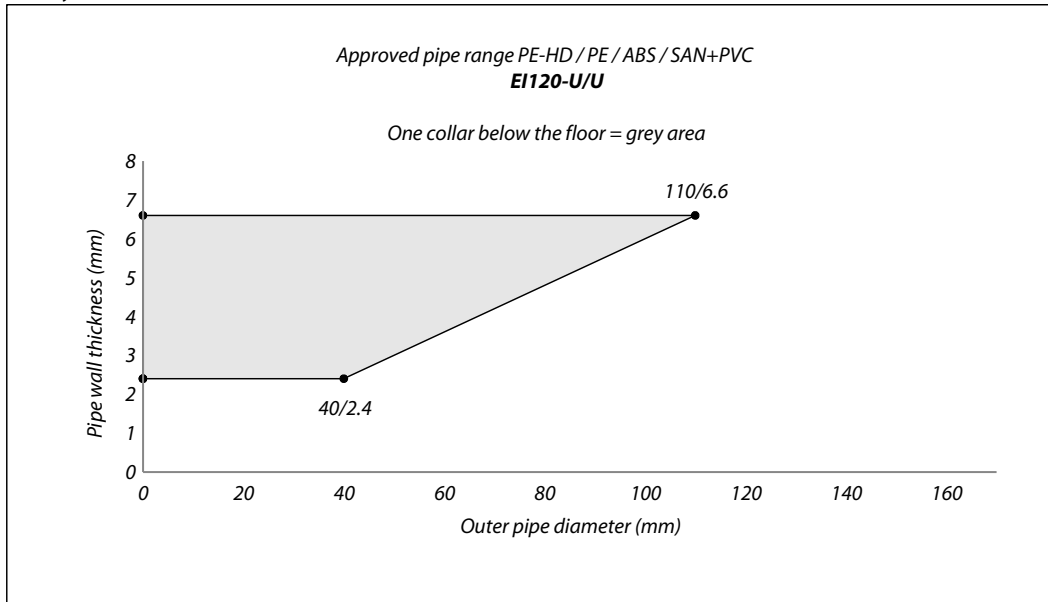
f4 Validity area



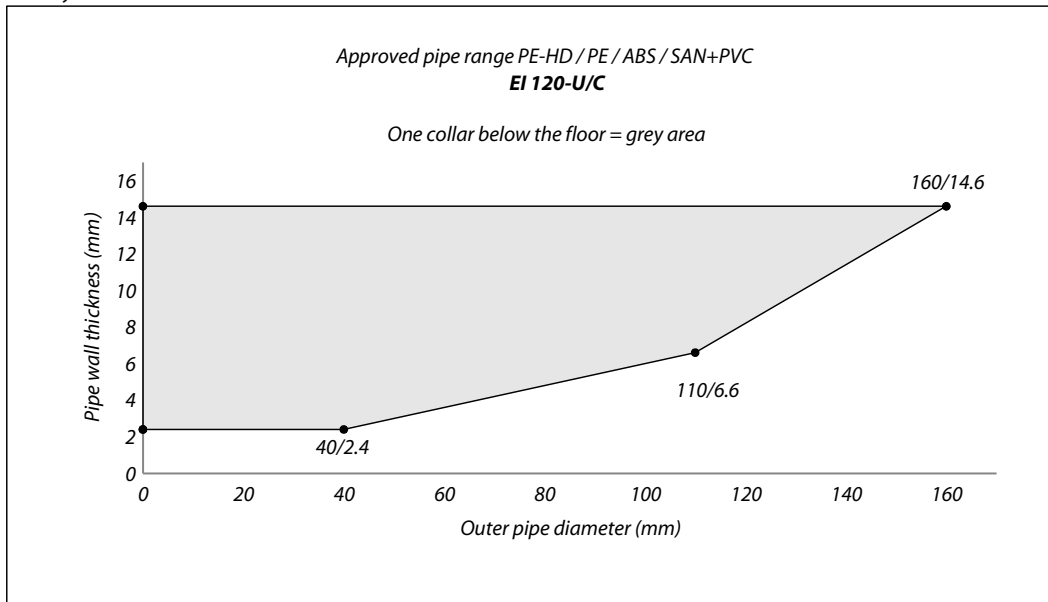
f5 Validity area



f6 Validity area



f7 Validity area



## PP pipes

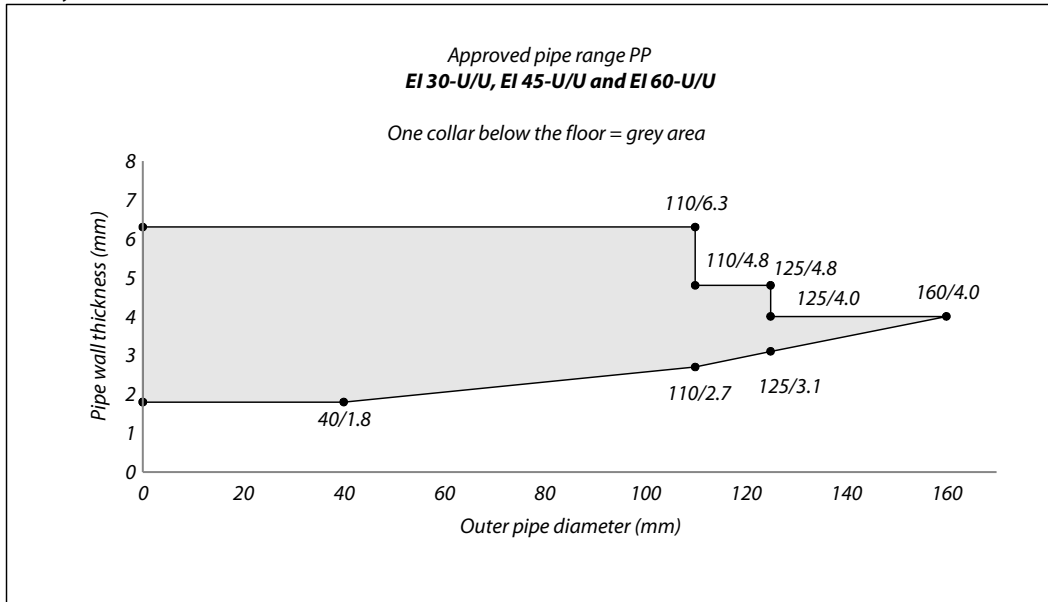
For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance One collar below the floor PP			
Pipe dimensions (mm)		Performance class with pipe end configuration	
Outer diameter	Wall thickness		
≤ 40	1.8 to 6.3	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C
≤ 110	2.7 to 6.3	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 125	3.1 to 4.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 125	3.1 to 4.8	EI 60-U/U E 60-U/U	EI 60-U/C E 60-U/C
≤ 160	4.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 160	4.0 to 14.6		EI 90-U/C E 90-U/C
≤ 160	14.6		EI 120-U/C E 120-U/C

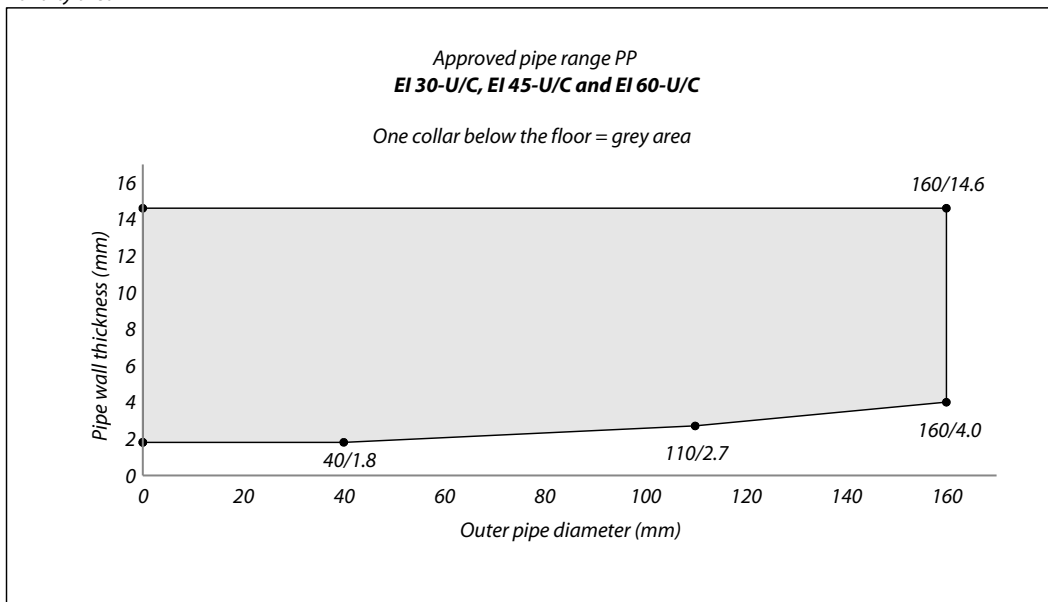
Fire resistance Two collars below the floor PP			
Pipe dimensions (mm)		Performance class with pipe end configuration	
Outer diameter	Wall thickness		
≤ 160	4.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 160	4.0 to 14.6		EI 90-U/C E 90-U/C

A visualization of the validity area for the fire resistance for EI 30, EI 45, EI 60, EI 90 and EI 120 is given in the Figures hereafter.

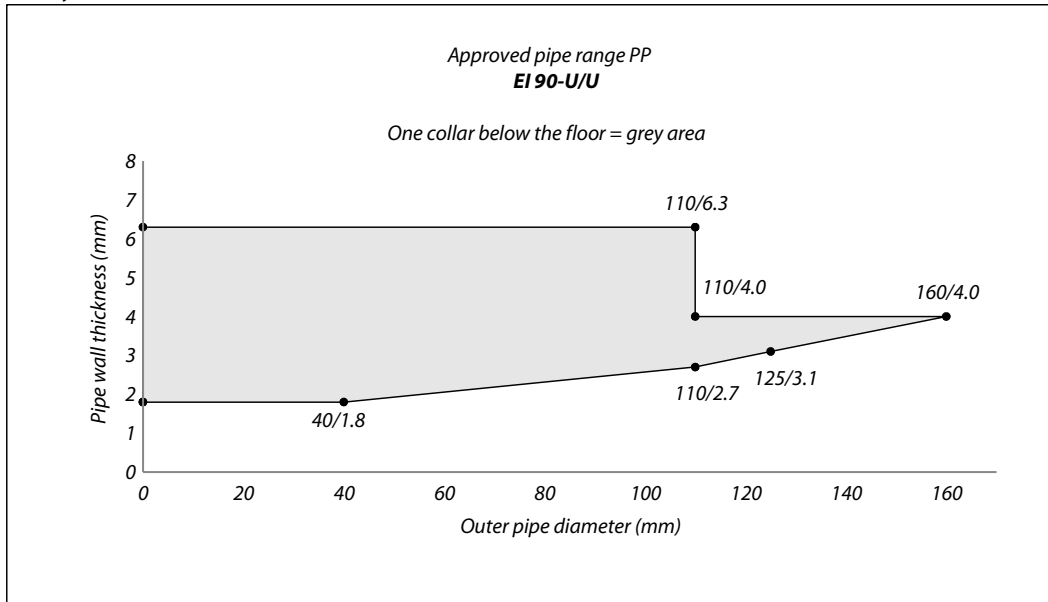
f8 Validity area



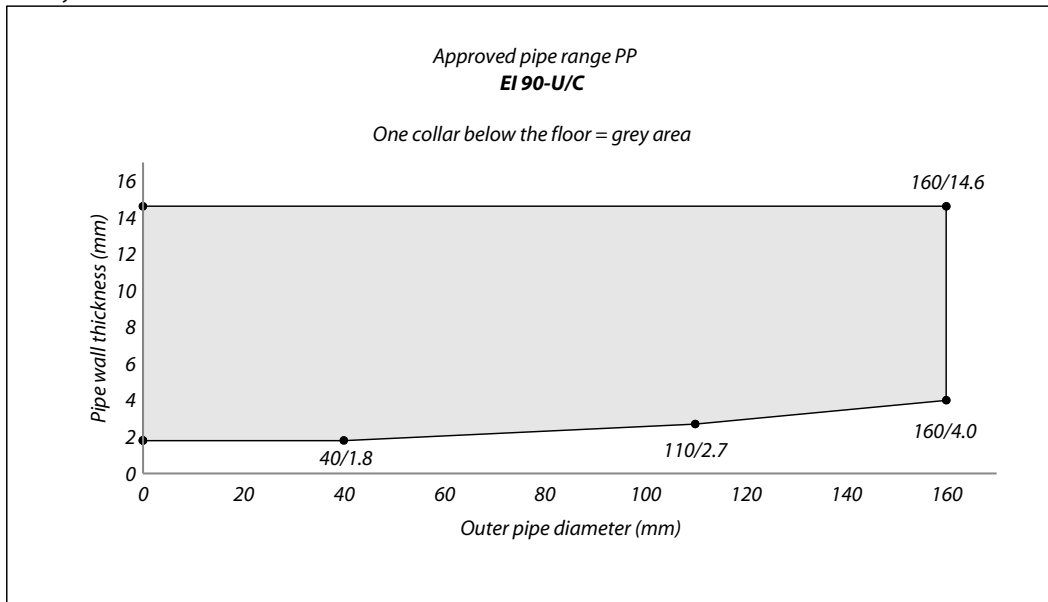
f9 Validity area



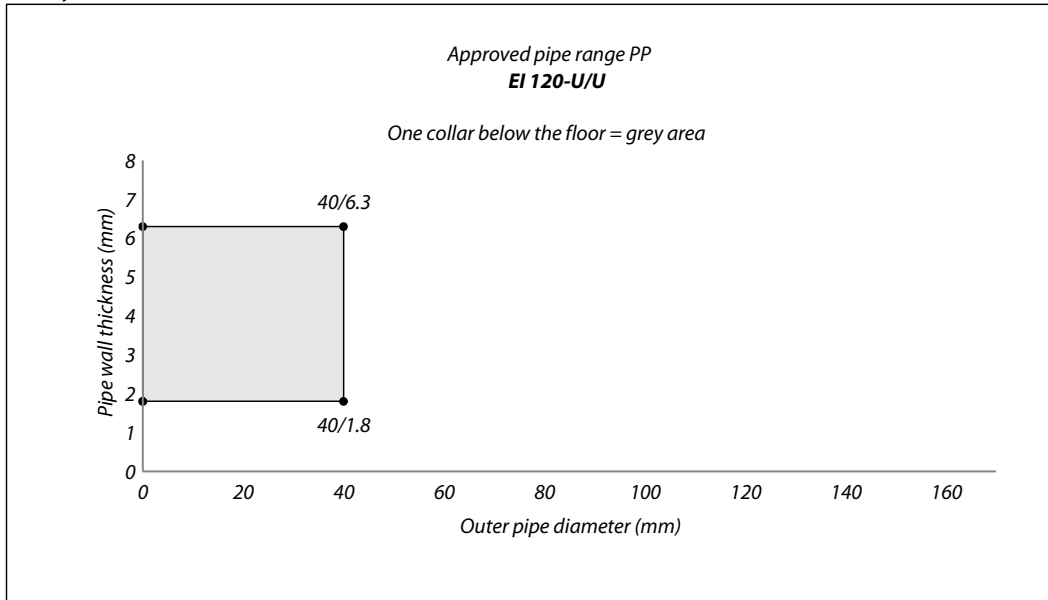
f10 Validity area



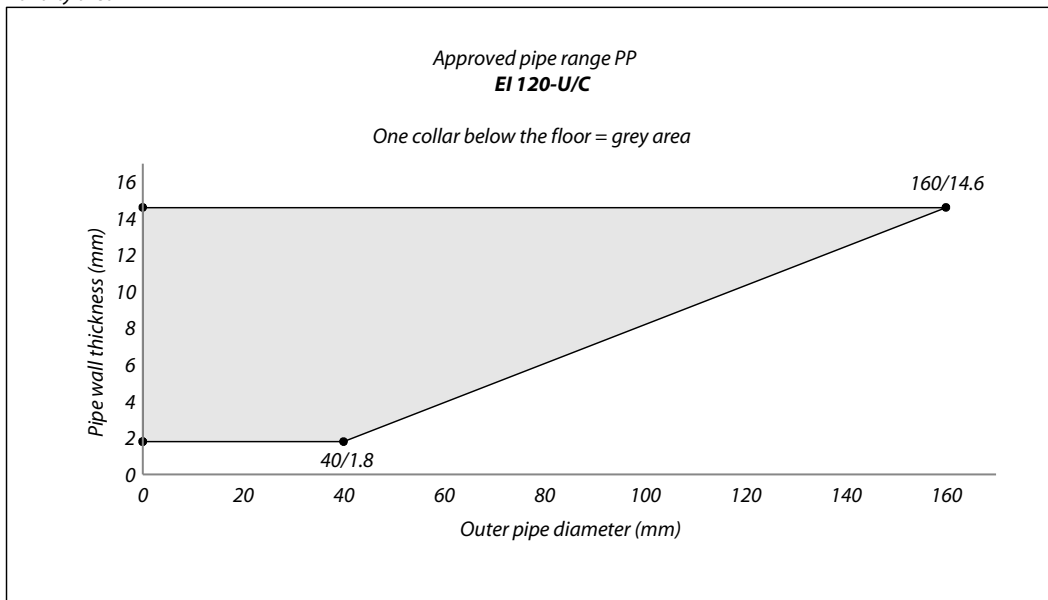
f11 Validity area



f12 Validity area



f13 Validity area



## PVC-U / PVC-C pipes

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

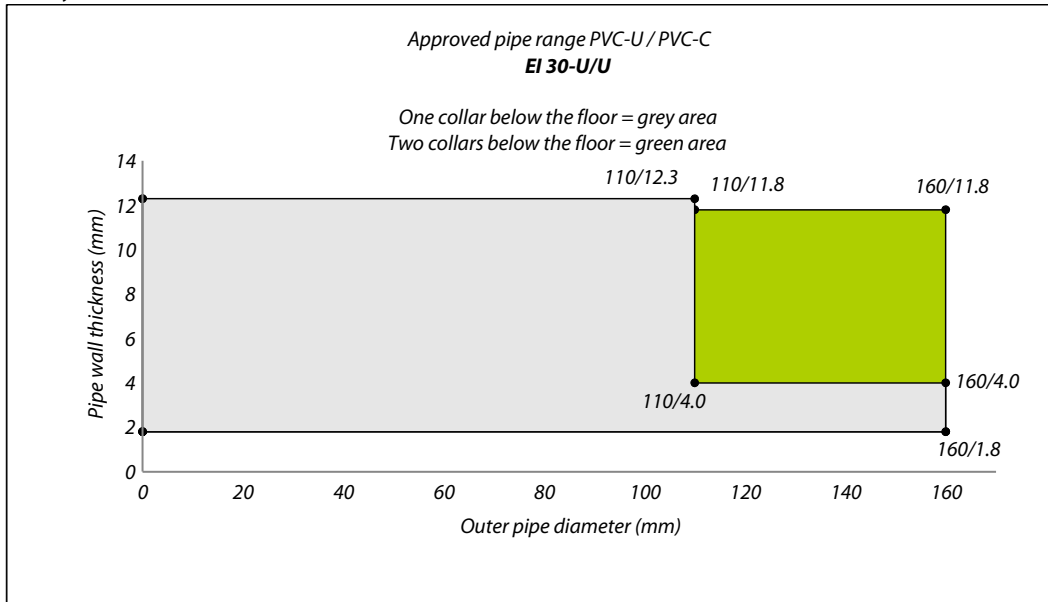
Fire resistance One collar below the floor PVC-U / PVC-C			
Pipe dimensions (mm)		Performance class with pipe end configuration	
Outer diameter	Wall thickness		
≤ 40	1.9 to 4.5	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C
≤ 110	2.2 to 8.2	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C
≤ 110	2.2 to 12.3	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*
≤ 125	2.5 to 14.6	EI 60-U/C E 60-U/C	
≤ 125	2.5	EI 60-U/U E 60-U/U	EI 60-U/C E 60-U/C
≤ 160	1.8 to 4.0	EI 30-U/U* E 30-U/U*	EI 30-U/C* E 30-U/C*
≤ 160	4.0	EI 60-U/U E 60-U/U	
≤ 160	4.0 to 14.6	EI 60-U/C E 60-U/C	
≤ 160	14.6	EI 120-U/C E 120-U/C	

Fire resistance Two collars below the floor PVC-U / PVC-C			
Pipe dimensions (mm)		Performance class with pipe end configuration	
Outer diameter	Wall thickness		
≤ 160	3.2 to 11.8	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C
≤ 315	7.7	EI 120-U/C E 120-U/C	

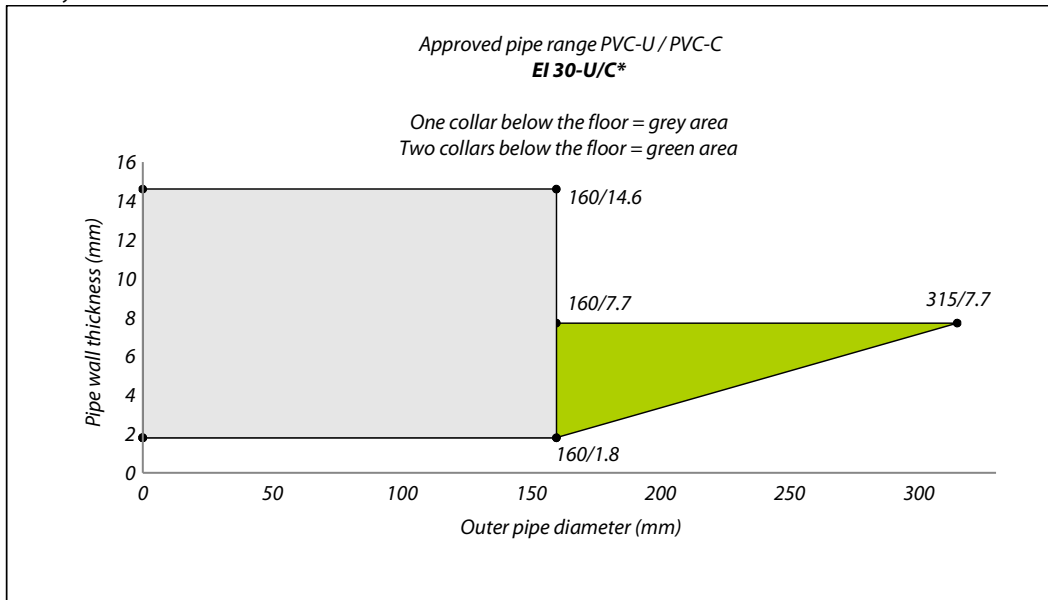
A visualization of the validity area for the fire resistance for EI 30, EI 45, EI 60, EI 90 and EI 120 is given in the Figures hereafter.



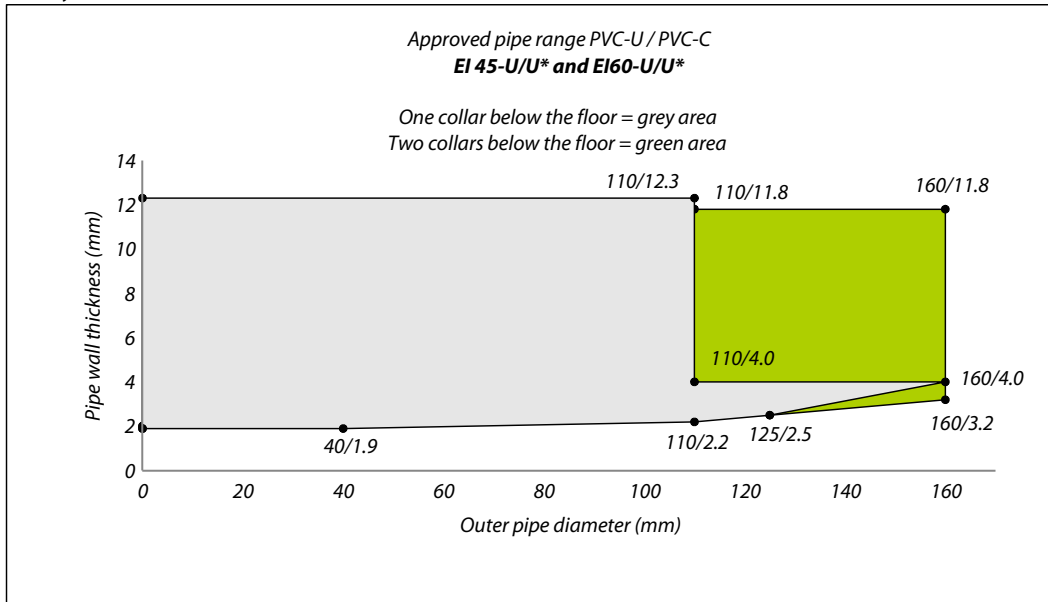
f14 Validity area



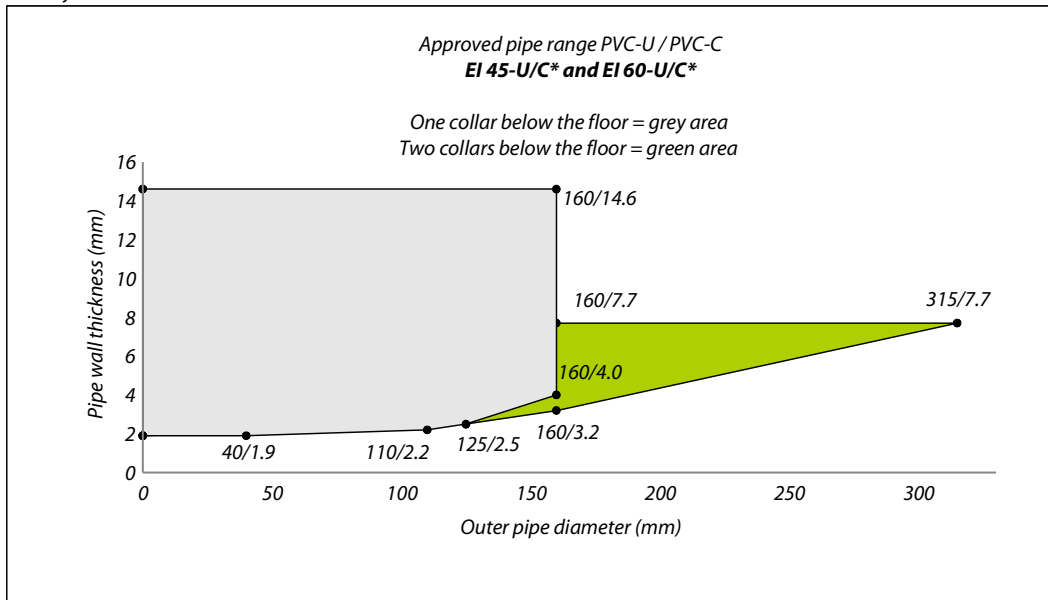
f15 Validity area



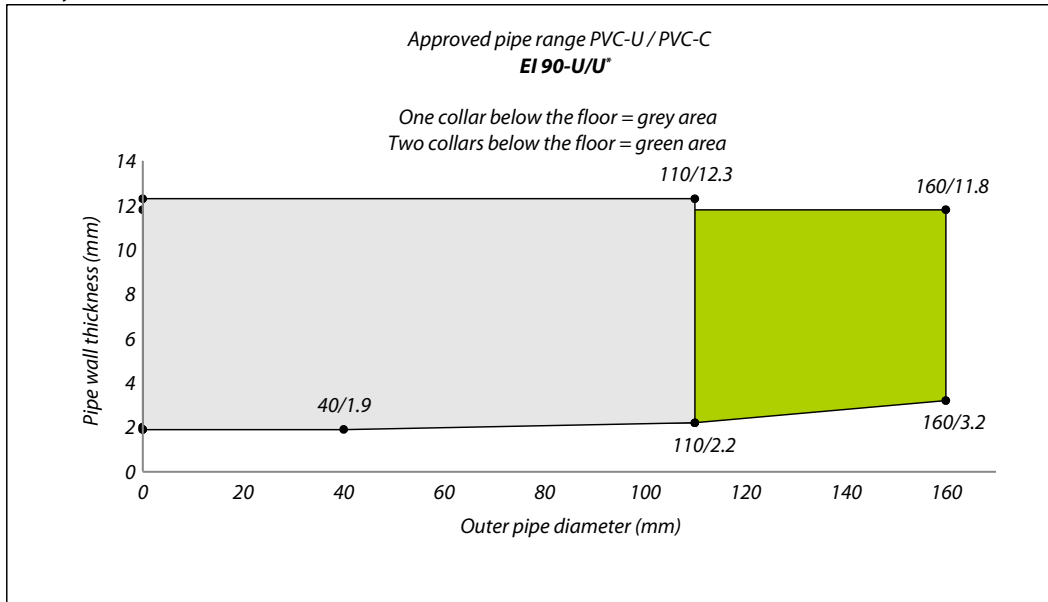
f16 Validity area



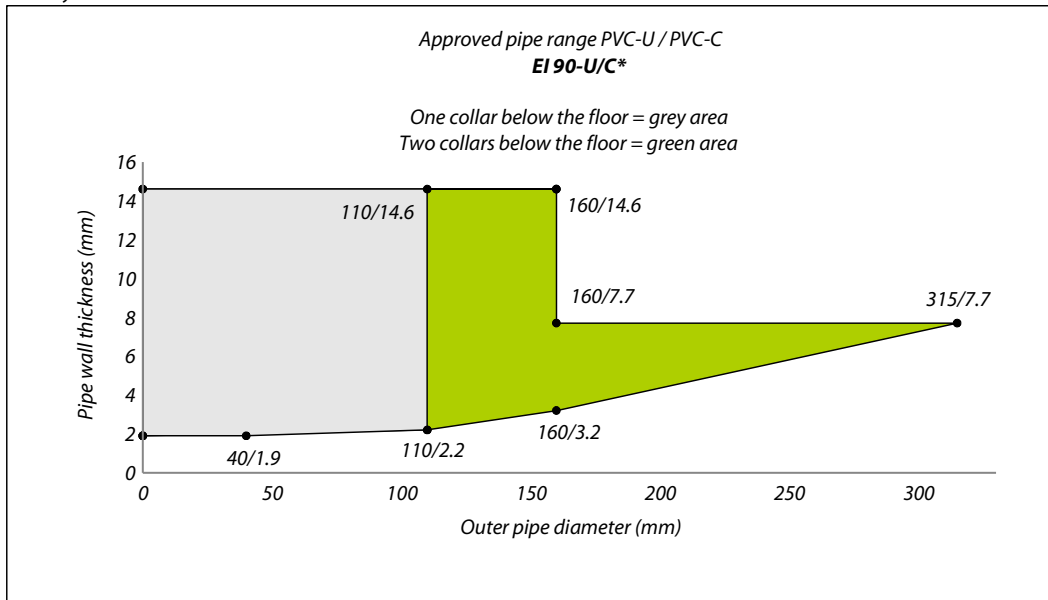
f17 Validity area



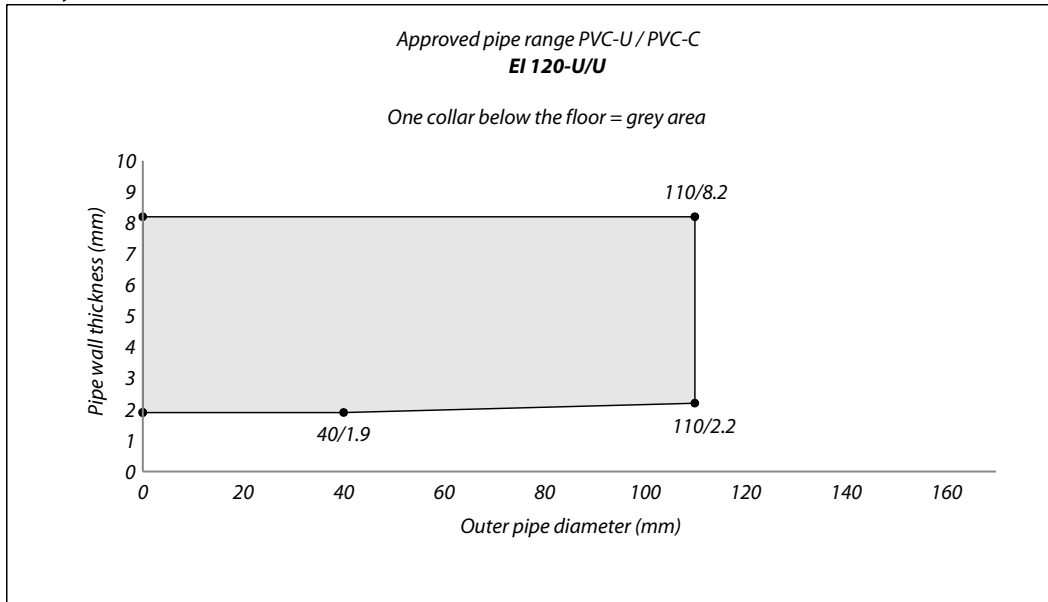
f18 Validity area



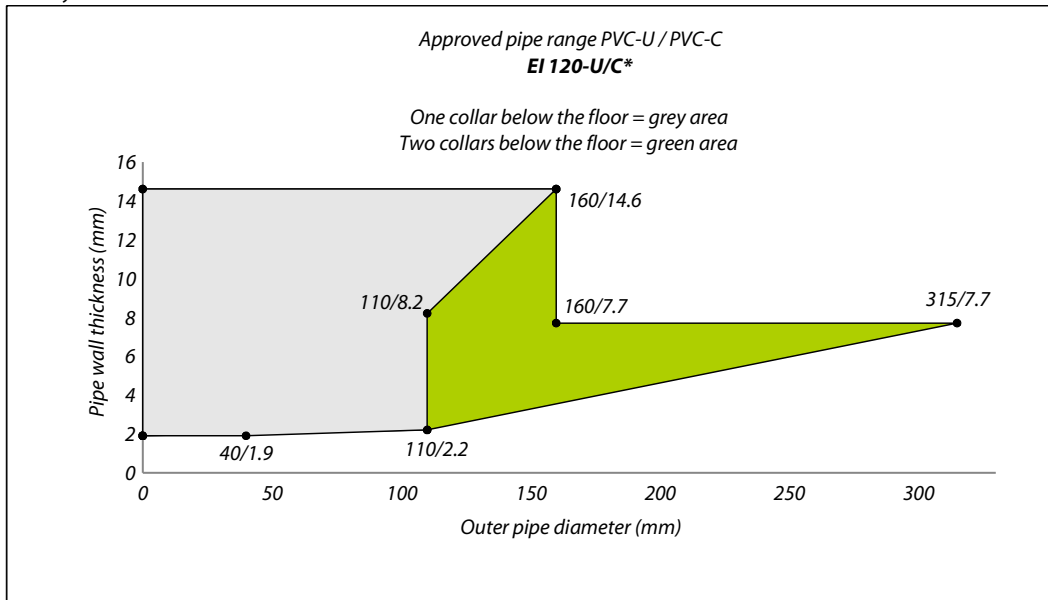
f19 Validity area



f20 Validity area



f21 Validity area



## 5.2.2 Without insulation (collar casted in)

Plastic pipes

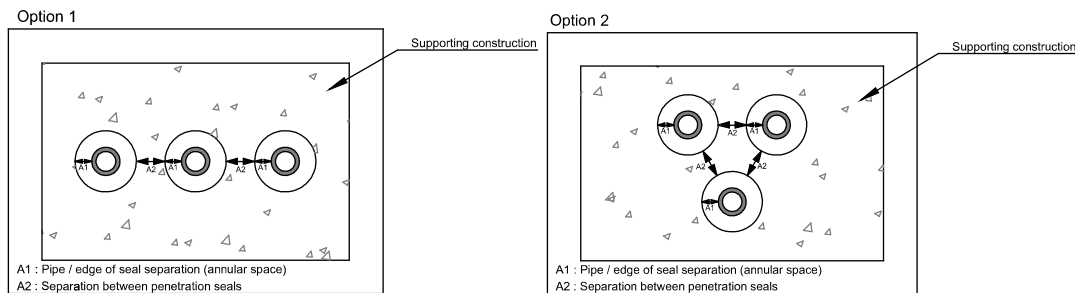
On the next page, drawing RF-PP-15.0.10 of the pipe penetration seals with plastic pipes without insulation is given for the pipes fitted with one Mulcol® Multicollar Slim casted in below the floor. In Table 5.2.2 the installation details regarding the field of application are given.

### t5.2.2 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 22) / Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap ≥ 10 mm / depth fully filled	Outer diameter ≤ 110 mm / 'a' ≤ 5 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 22. The annular gap A<sub>1</sub> is also visible in this Figure.

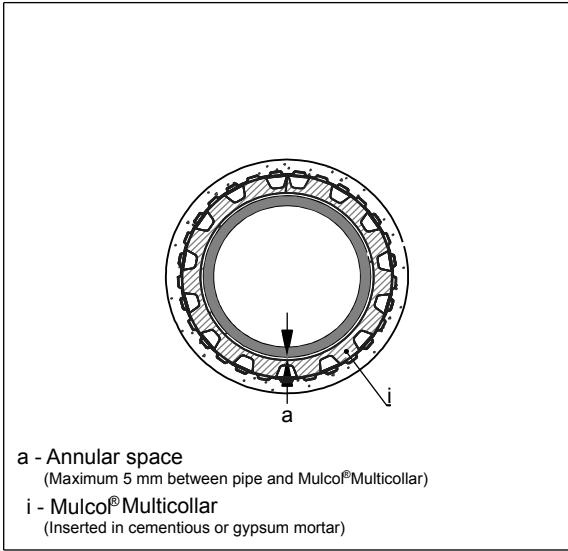
### f22 Visualization single penetrations



Based upon an assessment concerning other sound decoupling materials it is expected that the fire resistances given in this chapter will also be met for penetration seals with pipes fitted with the following types of insulation:

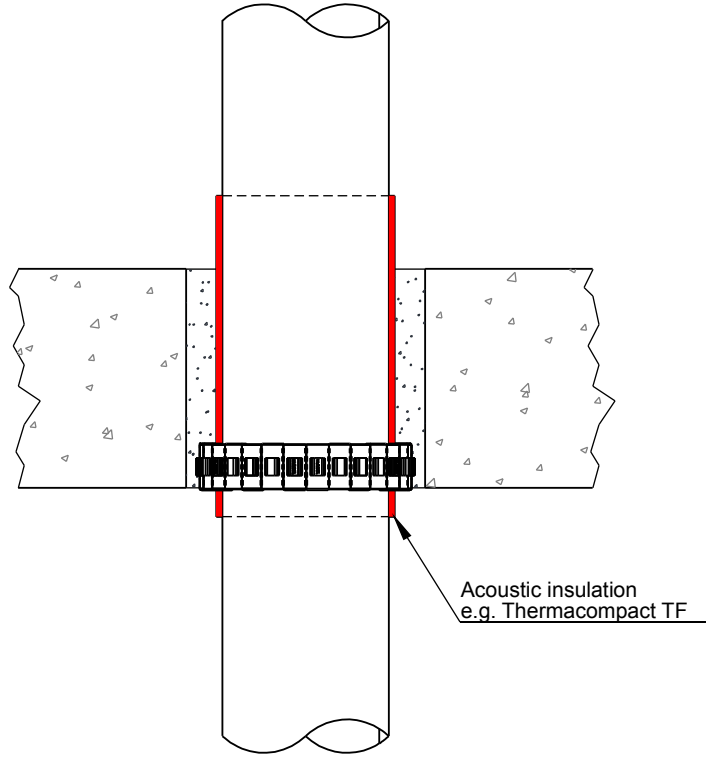
- ABSound Sonocool Type PM;
- Jaco Massa Versterkt Alu, Jaco Massa Alu and Jaco Massa Zwart Alu;
- Merfisol Zilver ALU.

Front view

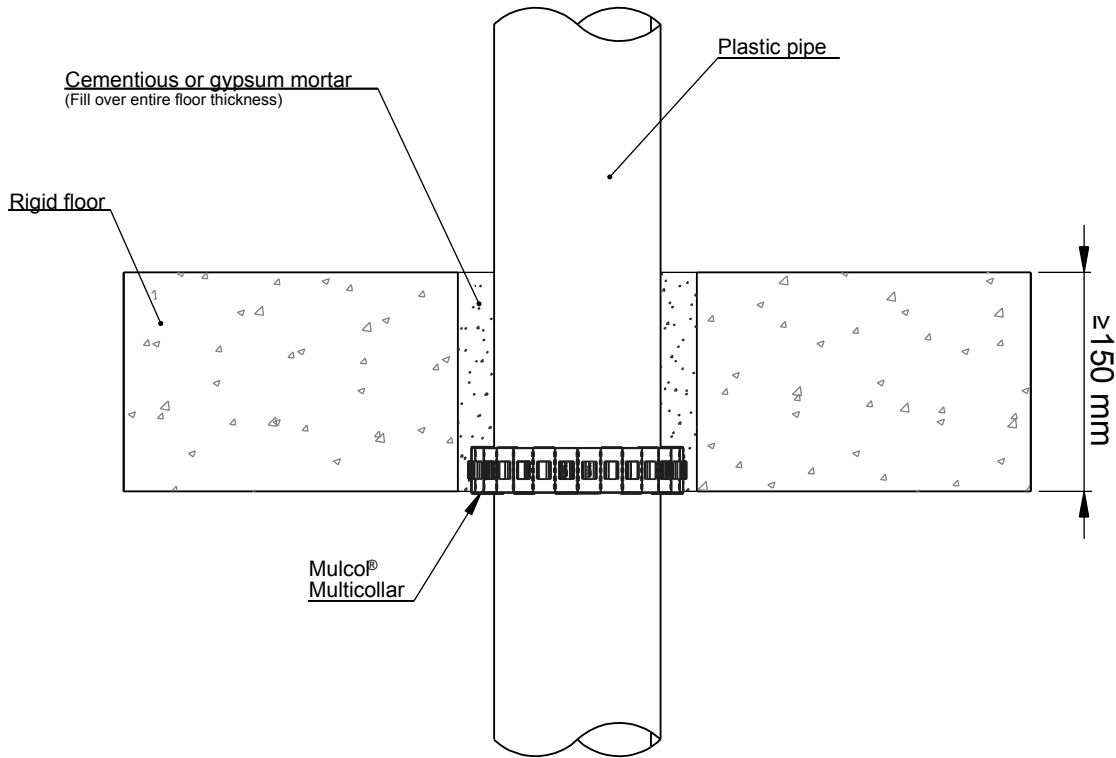


a - Annular space  
 (Maximum 5 mm between pipe and Mulcol® Multicollar)  
 i - Mulcol® Multicollar  
 (Inserted in cementitious or gypsum mortar)

Side view



Acoustic insulation  
 e.g. Thermacompact TF



Cementitious or gypsum mortar  
 (Fill over entire floor thickness)

Plastic pipe

Rigid floor

Mulcol®  
 Multicollar

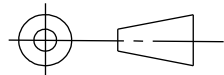
≥150 mm

American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-PP-15.0.10



Unit of measure : mm

Department : Research & Development

Date : 7-12-2016

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance PP</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	
<b>Outer diameter</b>	<b>Wall thickness</b>		
<b>≤ 110</b>	<b>6.3</b>	<b>EI 30-U/U</b> <b>E 30-U/U</b>	<b>EI 30-U/C</b> <b>E 30-U/C</b>

## 5.2.3 Without insulation under an angle of 45 degrees

Plastic pipes

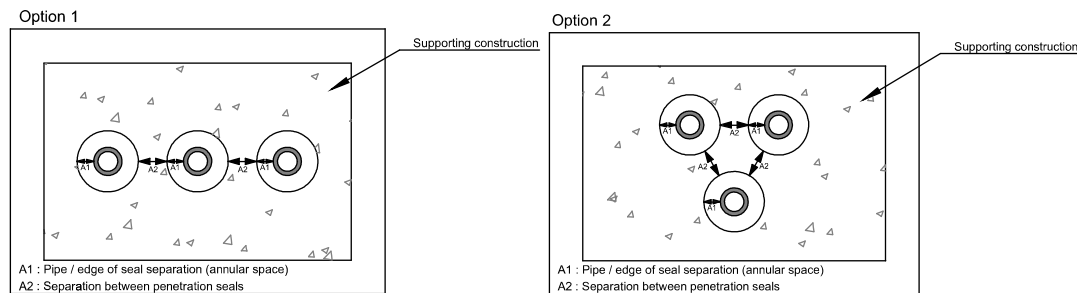
On the next pages, drawings RF-PP-11.1.10 RF-PP-21.1.10 of the pipe penetration seals with plastic pipes without insulation under an angle of 45 degrees are given for the pipes fitted with one or two Mulcol® Multicollar Slim placed below the floor. In Table 5.2.3 the installation details regarding the field of application are given.

### t5.2.3 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 23) / Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap ≥ 10 mm / depth fully filled	Outer diameter ≤ 110 mm / 'a' ≤ 15 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 23. The annular gap A<sub>1</sub> is also visible in this Figure.

### f23 Visualization single penetrations



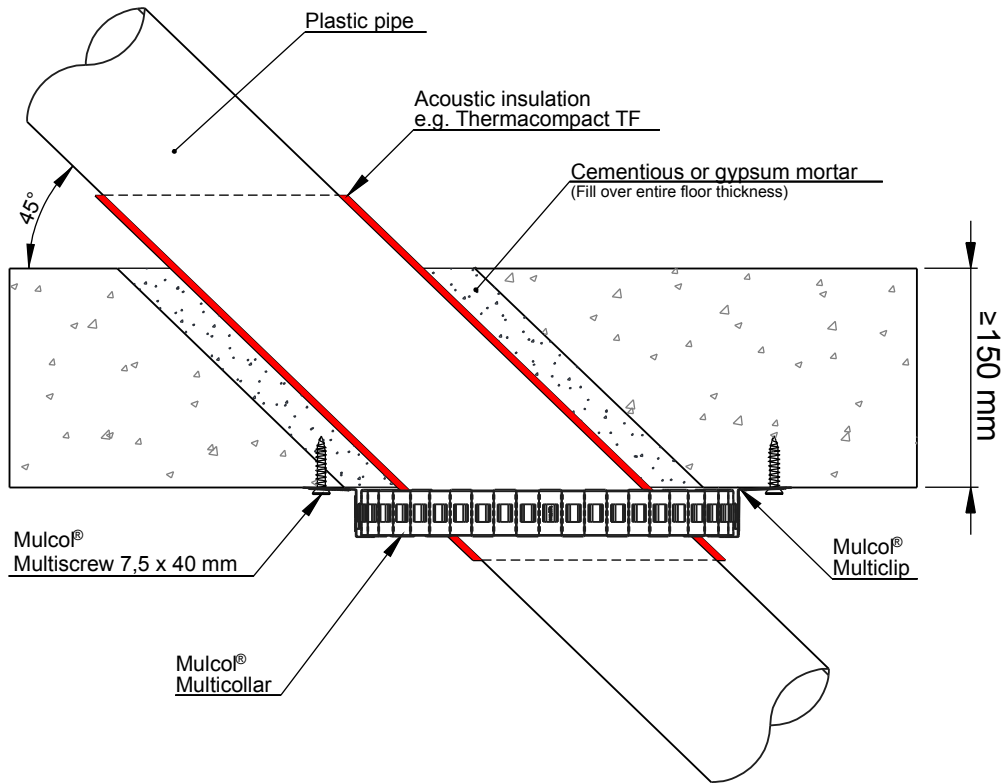
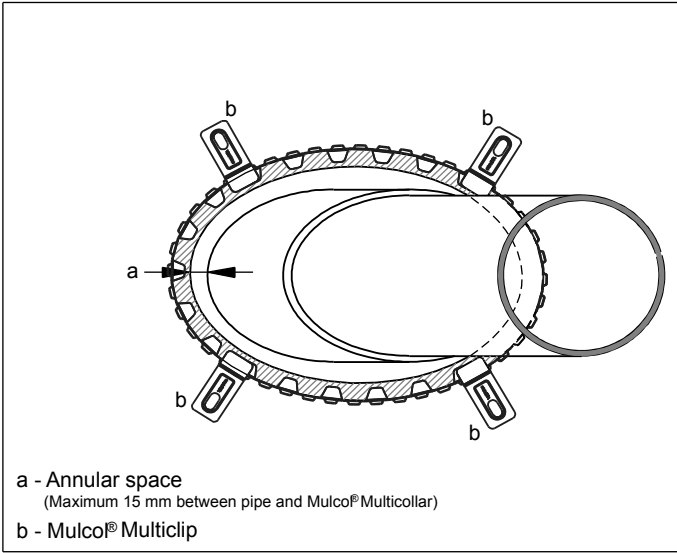
The fixing of the Mulcol® Multicollar Slim must be done by four Mulcol® Multiclips. Based upon an assessment concerning other sound decoupling materials it is expected that the fire resistances given in this chapter will also be met for penetration seals with pipes fitted with the following types of insulation:

- Absound Sonocool Type PM;
- Jaco Massa Versterkt Alu, Jaco Massa Alu and Jaco Massa Zwart Alu;
- Merfisol Zilver ALU.

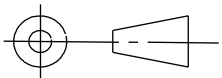
The fire resistance is valid in both directions for pipe passing through the wall every angle and orientation with a maximum 45° to the perpendicular, for clearance see visualization of prEN 1366-:2017 in Figure 24.



Front view



American projection



Scale	: 1:5
Unit of measure	: mm
Date	: 7-12-2016

Company	: Mulcol International B.V.
Department	: Research & Development
Draftsman	: K.J.

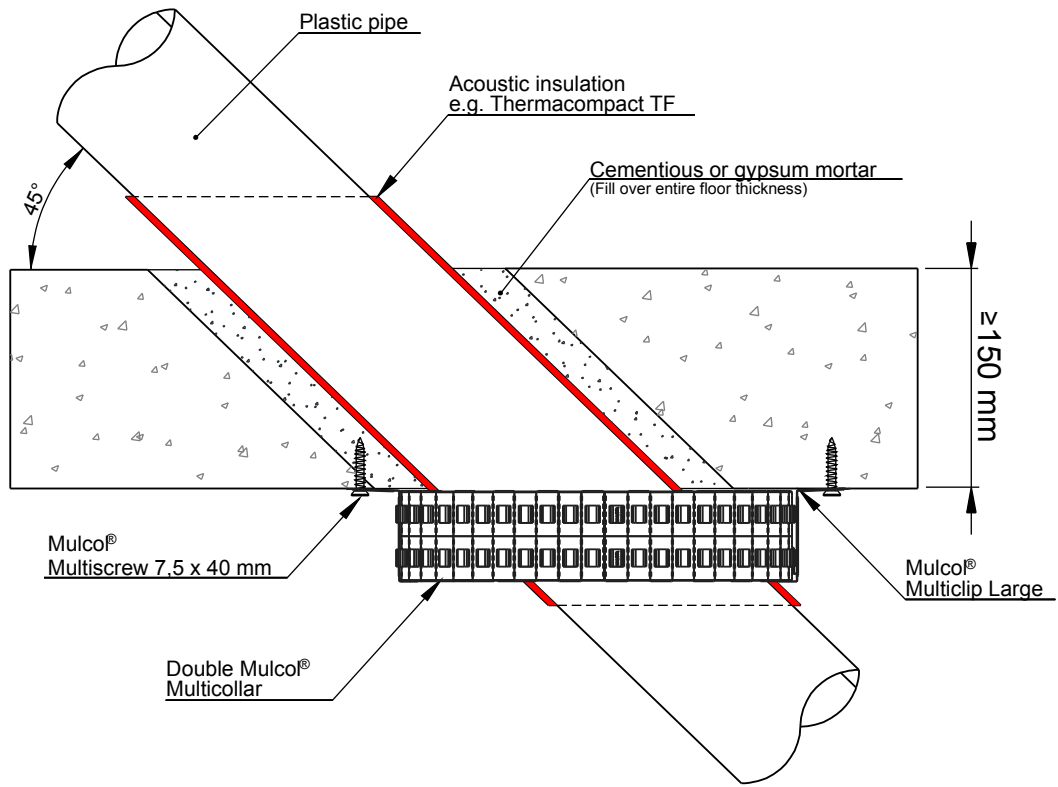
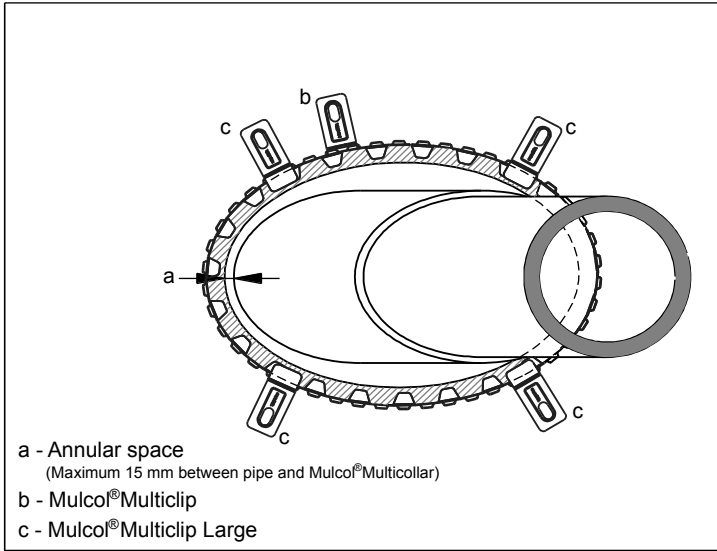
RF-PP-11.1.10

A4

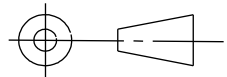


**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

Front view



American projection



Scale : 1:5

Unit of measure : mm

Date : 7-12-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

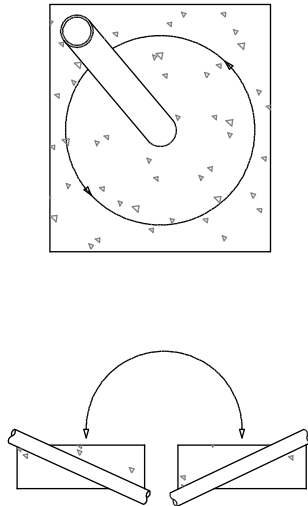
RF-PP-21.1.10

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

f24 Visualization of the allowed pipe orientation

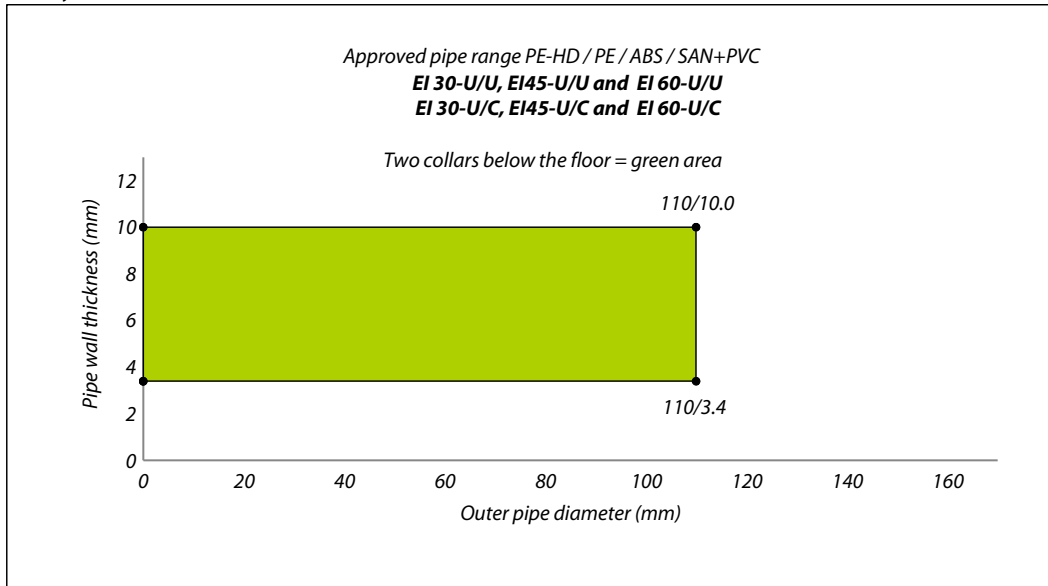


For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

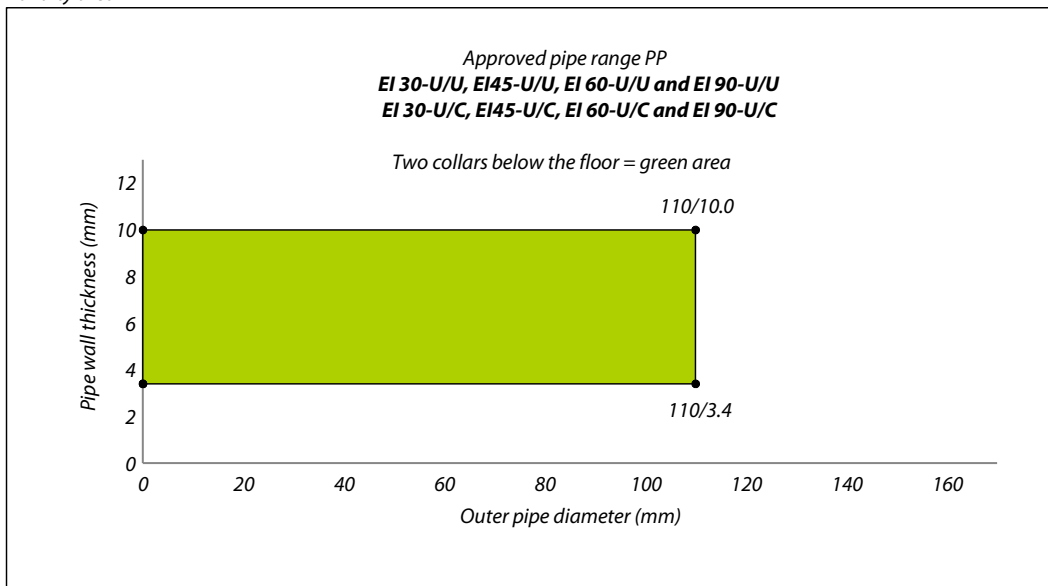
Fire resistance One collar below the floor PE-HD / PE / ABS / SAN+PVC			
Pipe dimensions (mm)		Performance class with pipe end configuration	
Outer diameter	Wall thickness		
≤ 110	3.4	EI 60-U/U E 60-U/U	EI 60-U/C E 60-U/C

Fire resistance Two collars below the floor					
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material	See Figure
Outer diameter	Wall thickness				
≤ 110	3.4 to 10.0	EI 60-U/U E 60-U/U	EI 60-U/C E 60-U/C	PE-HD / PE / ABS / SAN+PVC	25
≤ 110	10.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C		N.a.
≤ 110	3.4	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C	PP	N.a.
≤ 110	3.4 to 10.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C		26
≤ 110	3.4 to 10.0	EI 60-U/U E 60-U/U	EI 60-U/C E 60-U/C	PVC-U / PVC-C	27
≤ 110	10.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C		N.a.

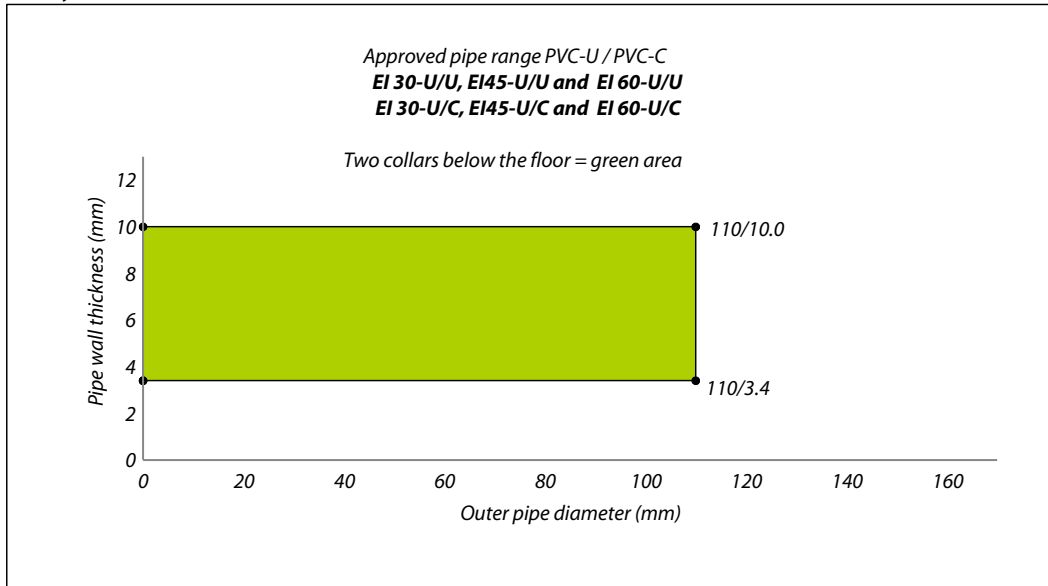
f25 Validity area



f26 Validity area



127 Validity area



## 5.2.4 Without insulation with moulded socket

Plastic pipes

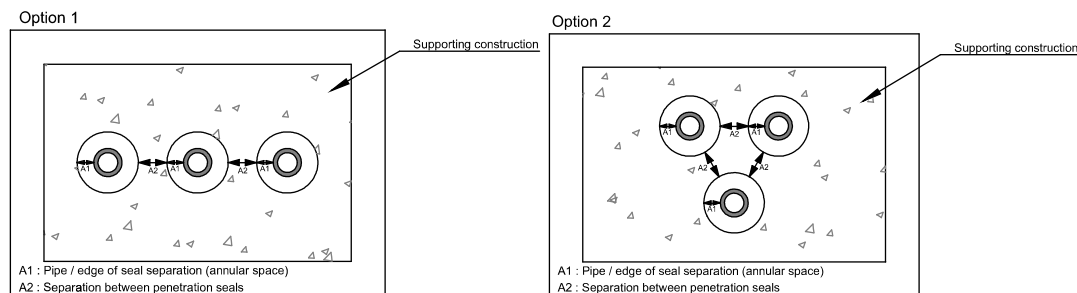
On the next page, drawing RF-PP-11.0.60 of the pipe penetration seals with plastic pipes with moulded socket is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.2.4 the installation details regarding the field of application are given.

### t5.2.4 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Type of coupling allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 28)		Allowed annular space (distance 'a' in drawing)
			Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Electric Geberit PE Ø110 mm (type: 368.771.16.1)	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 28. The annular gap A<sub>1</sub> is also visible in this Figure.

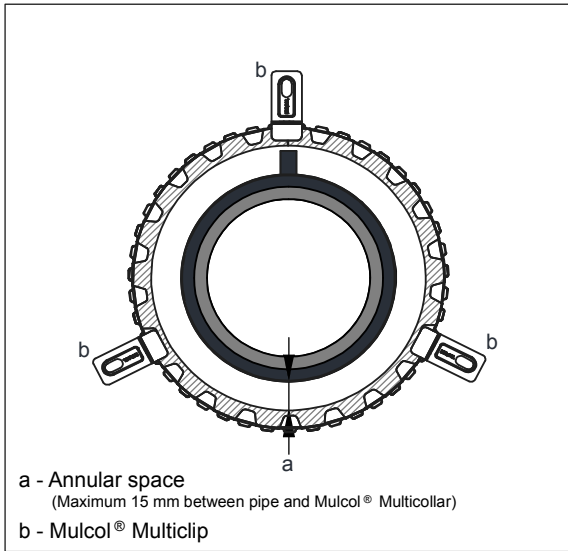
### f28 Visualization single penetrations



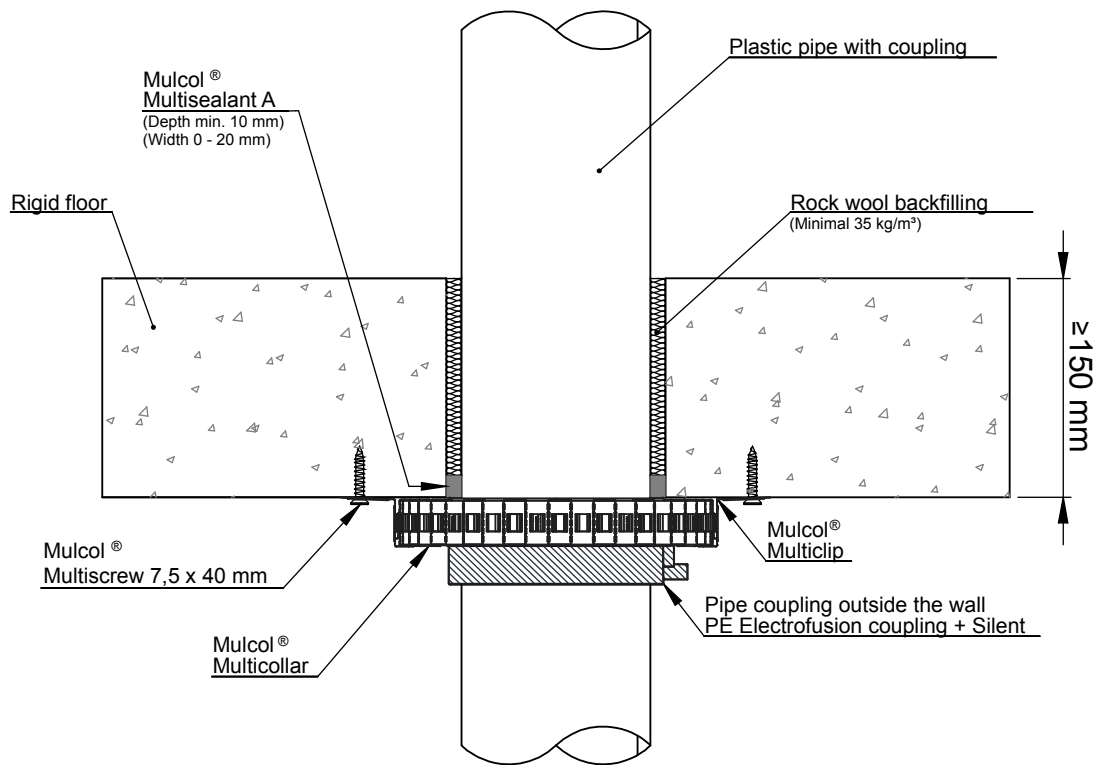
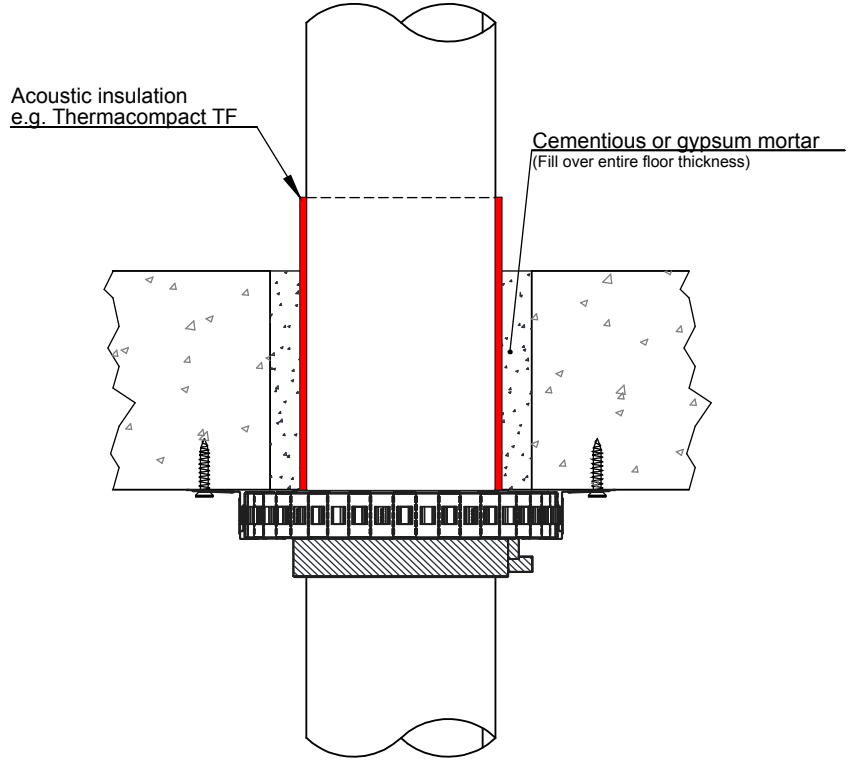
Based upon an assessment concerning other sound decoupling materials it is expected that the fire resistances given in this chapter will also be met for penetration seals with pipes fitted with the following types of insulation:

- Absound Sonocool Type PM;
- Jaco Massa Versterkt Alu, Jaco Massa Alu and Jaco Massa Zwart Alu;
- Merfisol Zilver ALU.

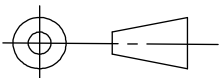
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 26-9-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-PP-11.0.60

A4

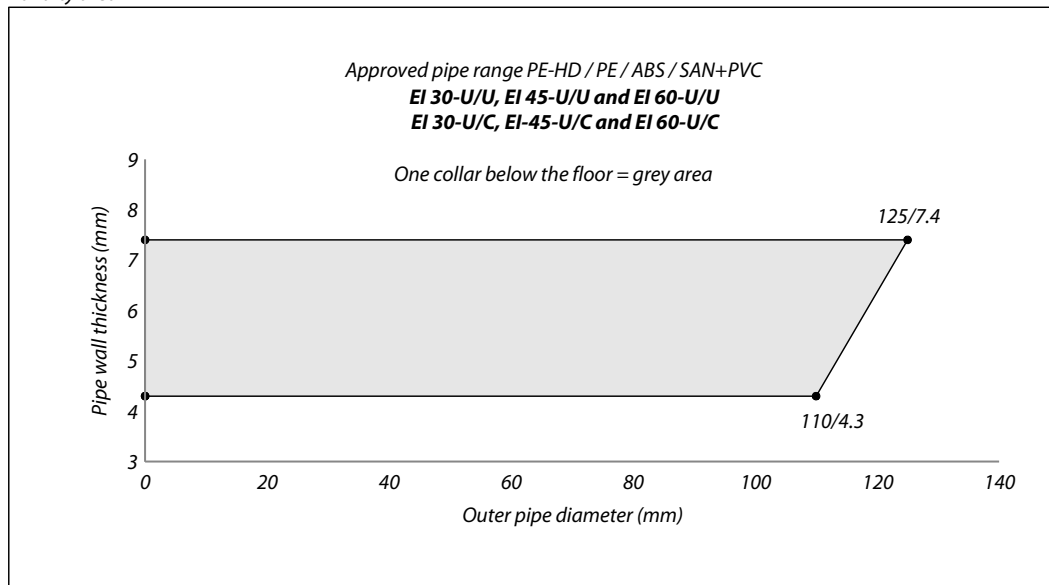


**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

Fire resistance					
Pipe dimensions (mm)		Performance class with pipe end configuration	Pipe material	Type socket	See Figure
Outer diameter	Wall thickness				
≤ 110	4.3	EI 90-U/C E 90-U/C	PE-HD / PE / ABS / SAN+PVC	Electric Geberit PE	29
≤ 125	7.4	EI 60-U/C E 60-U/C			

129 Validity area





## 5.2.5 Without insulation with elbow and collar in a U-shape

Plastic pipes

On the next page, drawing RF-PP-51.0.80 of the pipe penetration seals with plastic pipes without insulation with elbow is given for the pipes fitted with one Mulcol® Multicollar Slim in a U-shape placed below the floor. In Table 5.2.5 the installation details regarding the field of application are given.

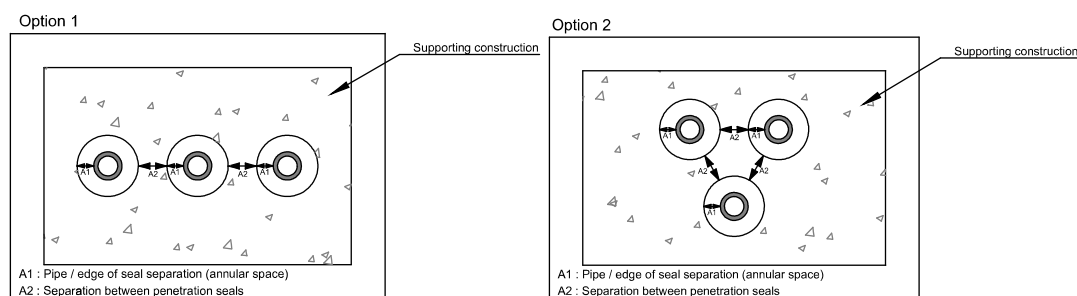
### t5.2.5 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Type of elbow allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 30) Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	PVC-U / PVC-C Ø50 mm x 45° ..... PVC-U / PVC-C Ø110 mm x 45°	Annular gap ≥ 10 mm / depth fully filled	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

The fixing of the Mulcol® Multicollar Slim must be done by four Mulcol® Multiclips and may be placed at any orientation.

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 30. The annular gap A<sub>1</sub> is also visible in this Figure.

### f30 Visualization single penetrations

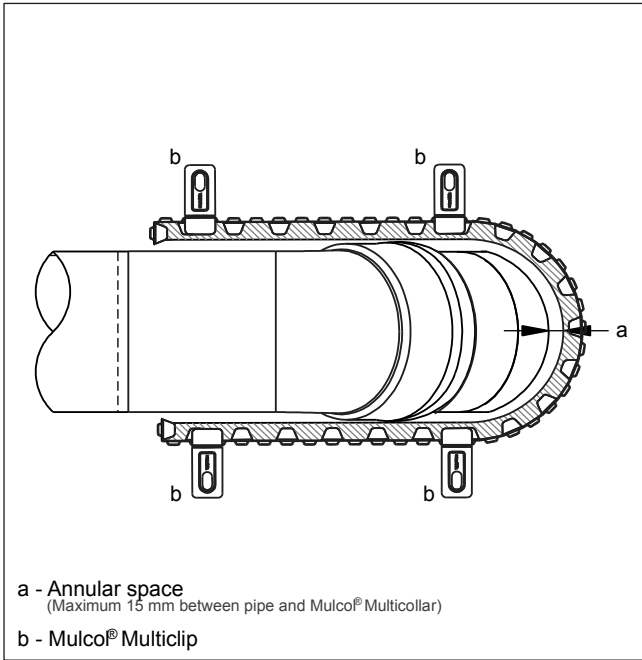


The length of the U-shape must be at least two times the diameter of the pipes. The metal ends of the U-shape must be folded (see drawing).

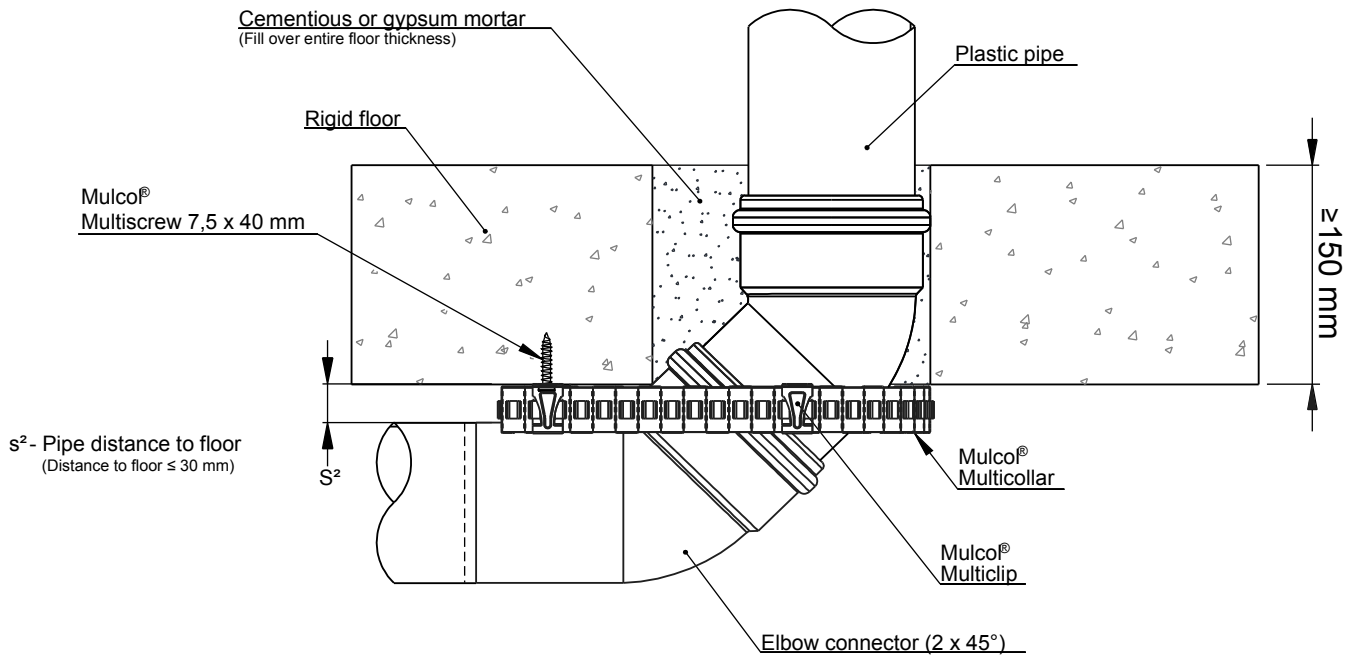
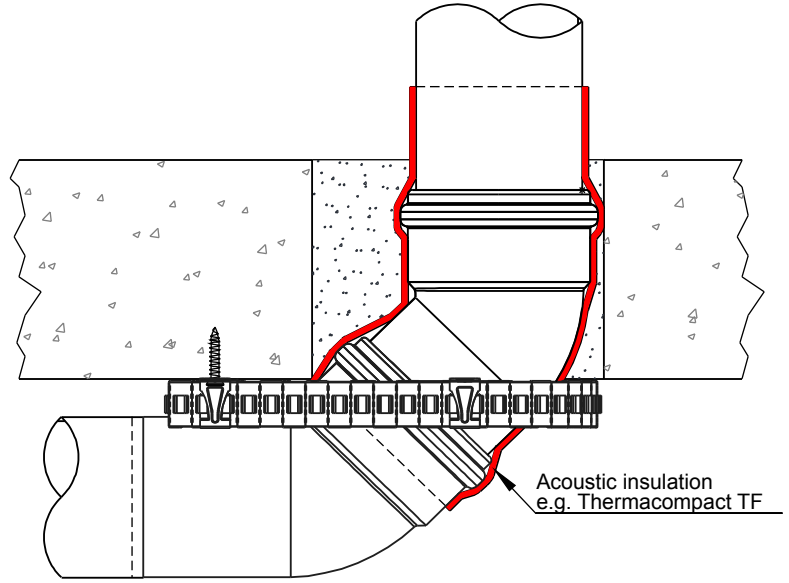
The distance from the floor to the pipe shall be at least 30 mm (see distance s<sub>2</sub> in the drawing). Based upon an assessment concerning other sound decoupling materials it is expected that the fire resistances given in this chapter will also be met for penetration seals with pipes fitted with the following types of insulation:

- ABSound Sonocool Type PM;
- Jaco Massa Versterkt Alu, Jaco Massa Alu and Jaco Massa Zwart Alu;
- Merfisol Zilver ALU.

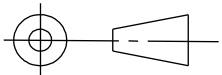
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 4-1-2017

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-PP-51.0.80

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material and elbow
Outer diameter	Wall thickness			
≤ 50	3.0	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*	PVC-U / PVC-C
≤ 110	3.2	EI 45-U/U E 60-U/U	EI 45-U/C E 60-U/C	

## 5.2.6 Without insulation in corner

Plastic pipes

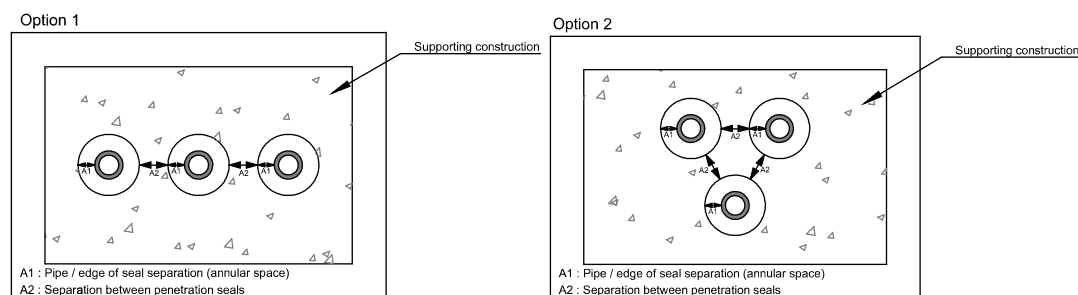
On the next page, drawing RF-PP-31.0.10 of the pipe penetration seals with plastic pipes placed in a corner is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.2.6 the installation details regarding the field of application are given.

### t5.2.6 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance $A_1$ , see Figure 31)		Allowed distance to element (distance $s^2$ in drawing)	Allowed annular space (distance 'a' in drawing)
		Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool $\geq 35 \text{ kg/m}^3$ unexposed face		
$\leq 450 \text{ mm}$	Thickness $\leq 4 \text{ mm}$ / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap $\geq 10 \text{ mm}$ / depth fully filled	Annular gap $\leq 20 \text{ mm}$ / depth sealant $\geq 10 \text{ mm}$	$\leq 5 \text{ mm}$	Outer diameter $\leq 125 \text{ mm}$ , 'a' $\leq 15 \text{ mm}$

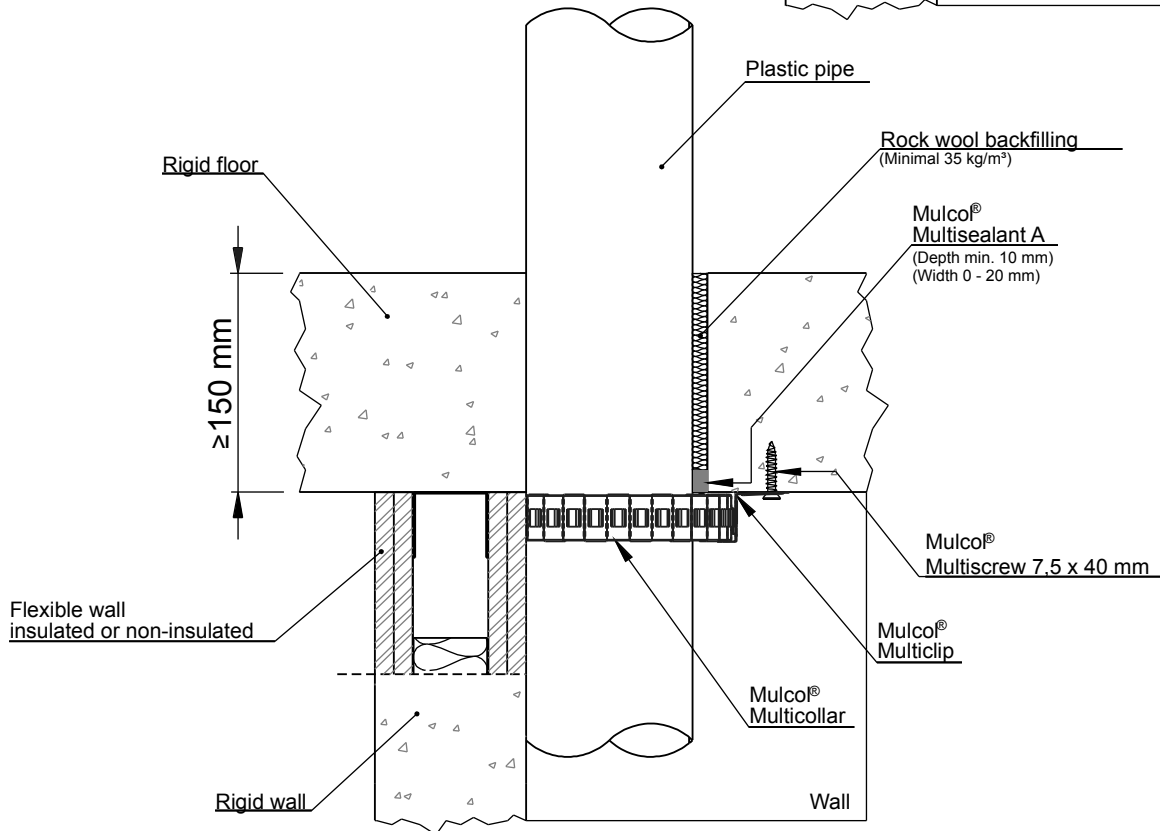
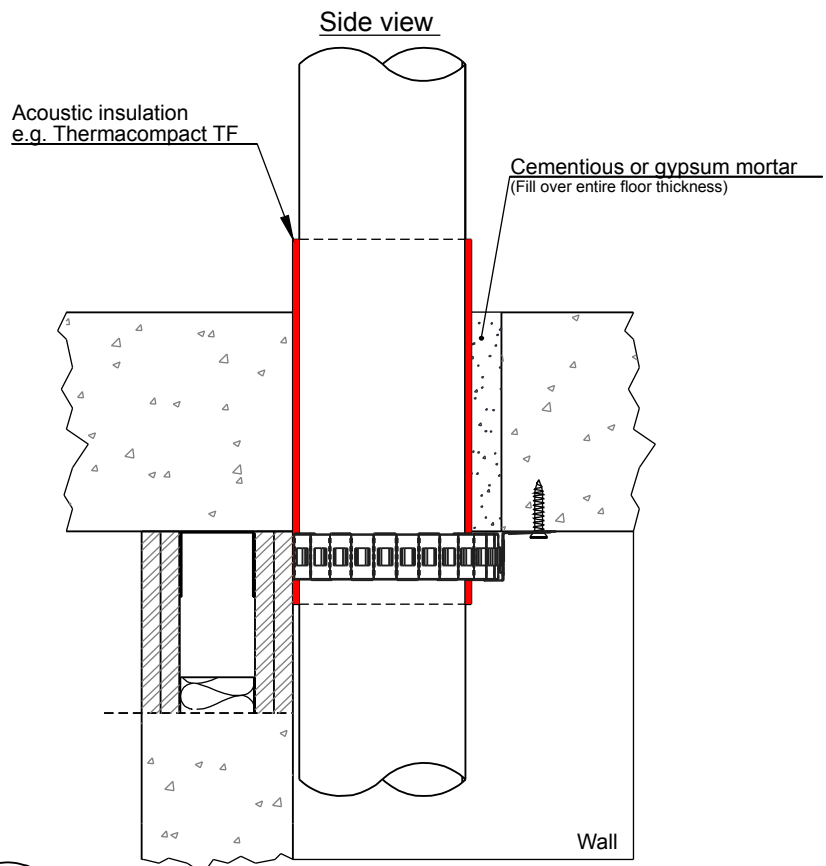
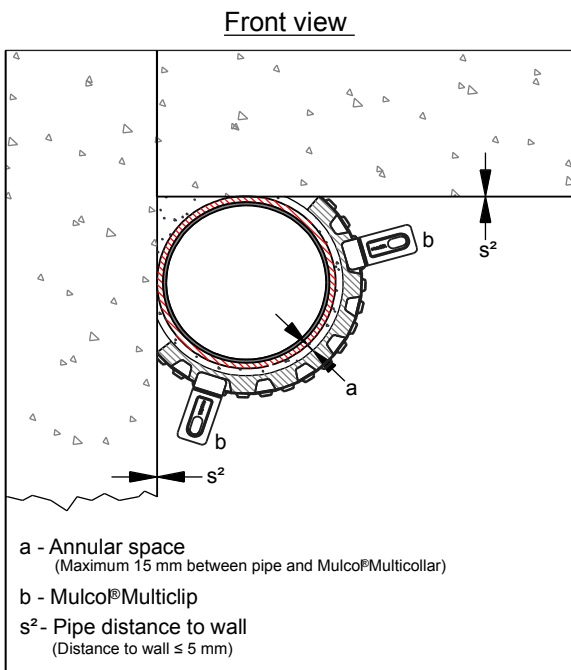
The fixing of the Mulcol® Multicollar Slim must be done by two Mulcol® Multiclips. If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 31. The annular gap  $A_1$  is also visible in this Figure. The pipe may be applied against a rigid or flexible wall.

### f31 Visualization single penetrations



Based upon an assessment concerning other sound decoupling materials it is expected that the fire resistances given in this chapter will also be met for penetration seals with pipes fitted with the following types of insulation:

- ABSound Sonocool Type PM;
- Jaco Massa Versterkt Alu, Jaco Massa Alu and Jaco Massa Zwart Alu;
- Merfisol Zilver ALU.



	Scale : 1:5	Company : Mulcol International B.V.	RF-PP-31.0.10
	Unit of measure : mm	Department : Research & Development	A4
	Date : 9-12-2016	Draftsman : K.J.	



**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance					
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material	Location
Outer diameter	Wall thickness				
≤ 110	6.6	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C	PE-HD / PE / ABS / SAN+PVC	In corner
≤ 110	6.3	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C	PP	In corner
≤ 110	6.3	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*	PVC-U / PVC-C	In corner
≤ 125	7.4	EI 60-U/C E 60-U/C			

## 5.2.7 Without insulation through a seal penetration system

### Plastic pipes

On the next page, drawing PBrf-PP-11.0.10 of the pipe penetration seals with plastic pipes without insulation through a seal penetration system is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the seal. In Table 5.2.7 the installation details regarding the field of application are given.

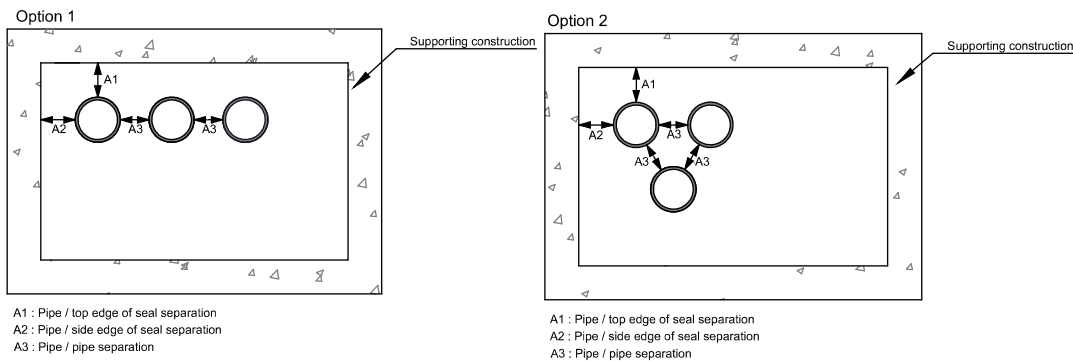
For multiple penetrations, the use of the Mulcol® Multimastic FB1 (2 x 50 mm) penetration seal system is recommended. The aperture size in the floor may be up to 2400 mm long and 1200 mm wide. A cavity of maximum 50 mm between the rock wool panels may be present. For further details see Paragraph 5.1.5.

### t5.2.7 Installation details

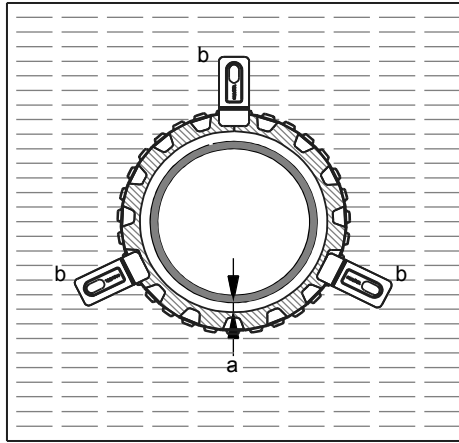
Distance to first pipe support above the floor	Distance between pipes (A <sub>1</sub> to A <sub>3</sub> , see Figure 32)	Allowed filling of annular gap		Allowed annular space (distance 'a' in drawing)
		Mulcol® Multisealant SP on both faces, with backing rock wool ≥ 35 kg/m <sup>3</sup>	No filling	
≤ 450 mm	≥ 100 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Approximately the same size as the pipe (tight fit)	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

If more pipe penetrations are placed in the penetration seal system, the minimum distance between the pipes is 100 mm, distances A<sub>1</sub> to A<sub>3</sub> Figure 32 (the presence of ≥ 60 mm of rock wool between the pipes is mandatory).

### f32 Visualization distance between pipes

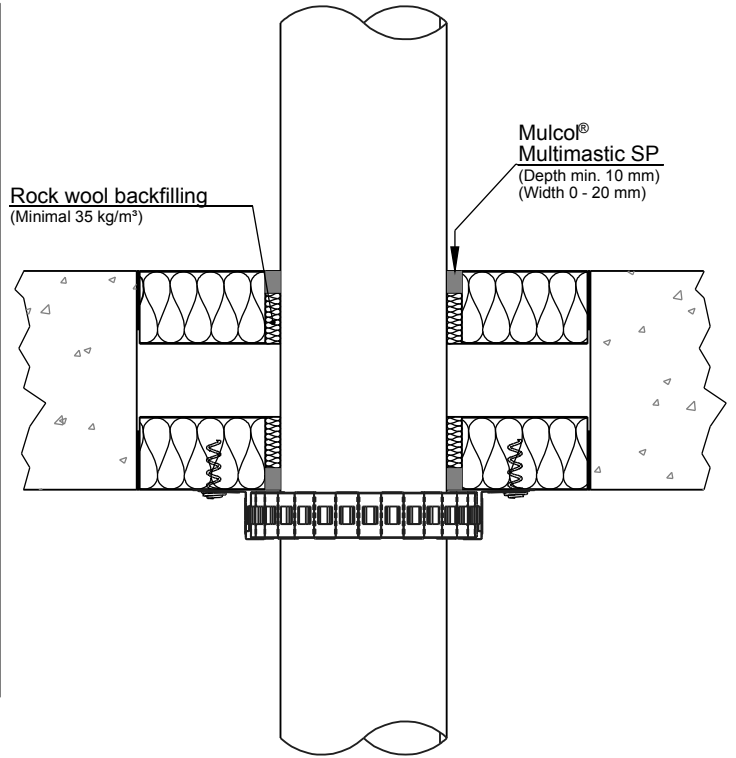


Front view



a - Annular space  
(Maximum 15 mm between pipe and Mulco® Multicollar)  
b - Mulco® Multiclip

Side view



Mulco®  
Multimastic FB1 2 x 50 mm  
(e.g. Penetration board)  
(≥ 140 kg/m³)

Rigid floor

Plastic pipe

Mulco® Multiscrew FB 40 mm  
or Threaded steel bolt with nuts M6

Mulco®  
Multicollar

Mulco®  
Multimastic SP

Mulco®  
Multiclip

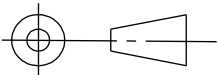
≥150 mm

American projection

Scale : 1:5

Company : Mulcol International B.V.

PBrf-PP-11.0.10



Unit of measure : mm

Department : Research & Development

Date : 9-12-2016

Draftsman : K.J.

A4



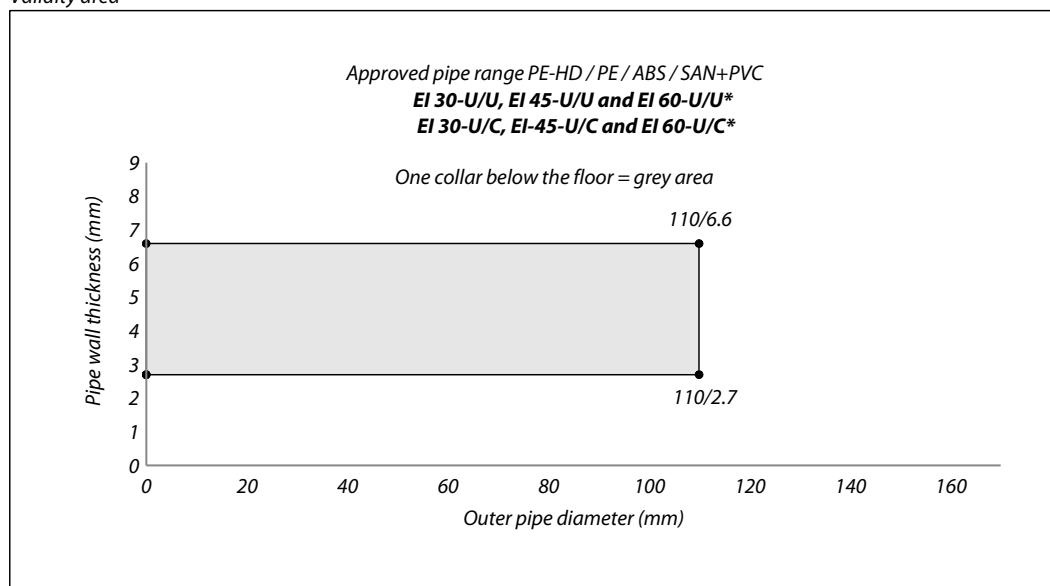
**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**



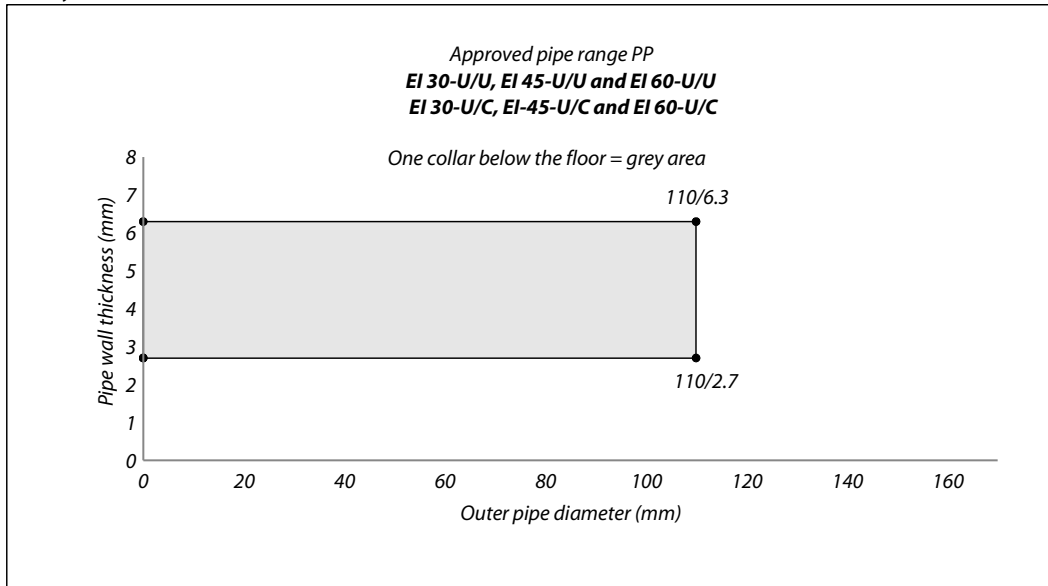
For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

Fire resistance					
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material	See Figure
Outer diameter	Wall thickness				
≤ 110	2.7	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C	PE-HD / PE / ABS / SAN+PVC	N.a.
≤ 110	2.7 to 6.6	EI 60-U/U* E 60-U/U*	EI 60-U/C* E 60-U/C*		33
≤ 110	2.7	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C	PP	N.a.
≤ 110	2.7 to 6.3	EI 60-U/U E 60-U/U	EI 60-U/C E 60-U/C		34
≤ 110	2.7	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C	PVC-U / PVC-C	N.a.
≤ 110	2.7 to 6.3	EI 60-U/U* E 60-U/U*	EI 60-U/C* E 60-U/C*		35

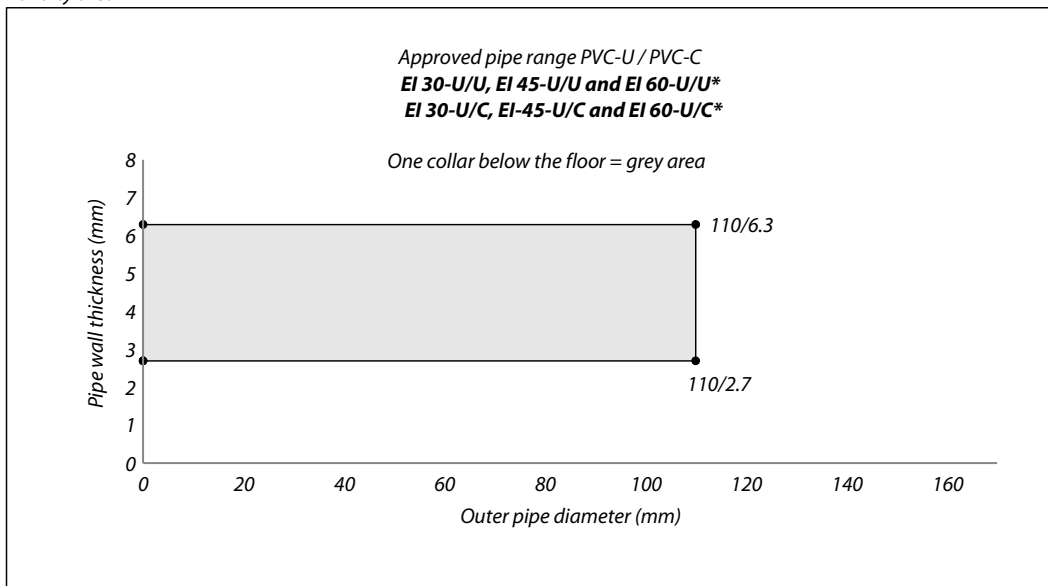
f33 Validity area



f34 Validity area



f35 Validity area



## 5.2.8 With elastomeric thermal insulation

### Plastic pipes

On the next page, drawing RF-PP-21.0.22 of the pipe penetration seals with plastic pipes with elastomeric thermal insulation is given for the pipes fitted with two Mulcol® Multicollar Slim placed below the floor. In Table 5.2.8 the installation details regarding the field of application are given.

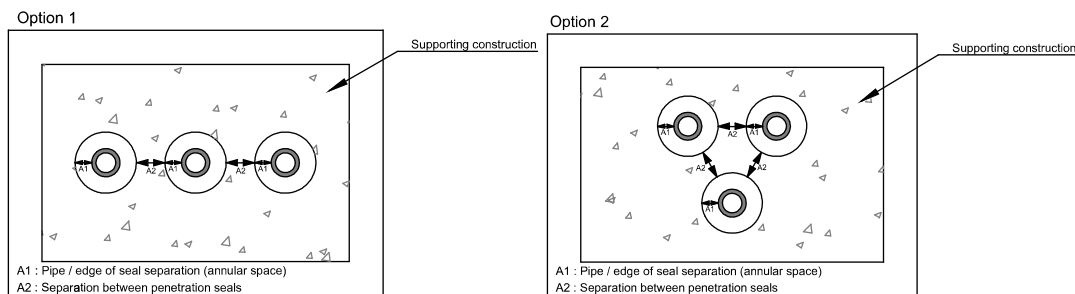
The fire resistance is valid for insulation AF/Armaflex made out of flexible elastomeric EPDM rubber foam with a reaction to fire class B<sub>L</sub>-s3, d0 or B-s3, d0 (or equal or better) in accordance with EN 13501-1. The insulation must be applied sustained or interrupted through the aperture with a minimum distance of 450 mm on both sides from the point where the pipe emerges from the floor (LS, CS, LI or CI in accordance with Table 1 of EN 1366-3:2009).

### 5.2.8 Installation details

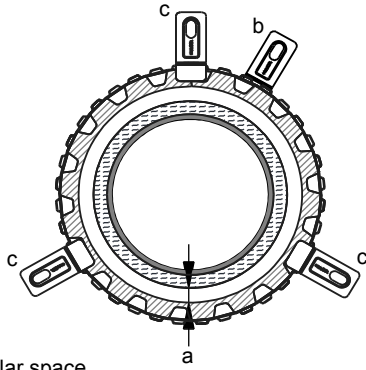
Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 1)	Allowed filling of annular gap Mulcol® Multisealant A both faces	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm		Outer diameter ≤ 110 mm / 'a' ≤ 15 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 36. The annular gap A<sub>1</sub> is also visible in this Figure.

### f36 Visualization single penetrations

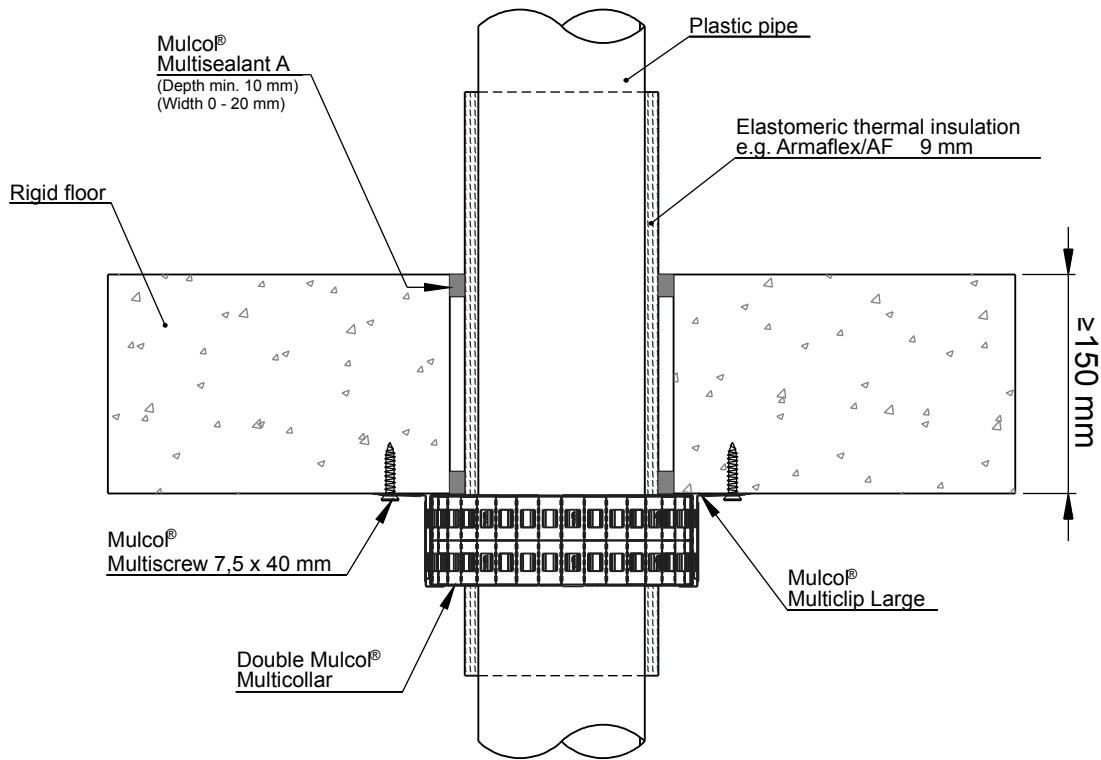
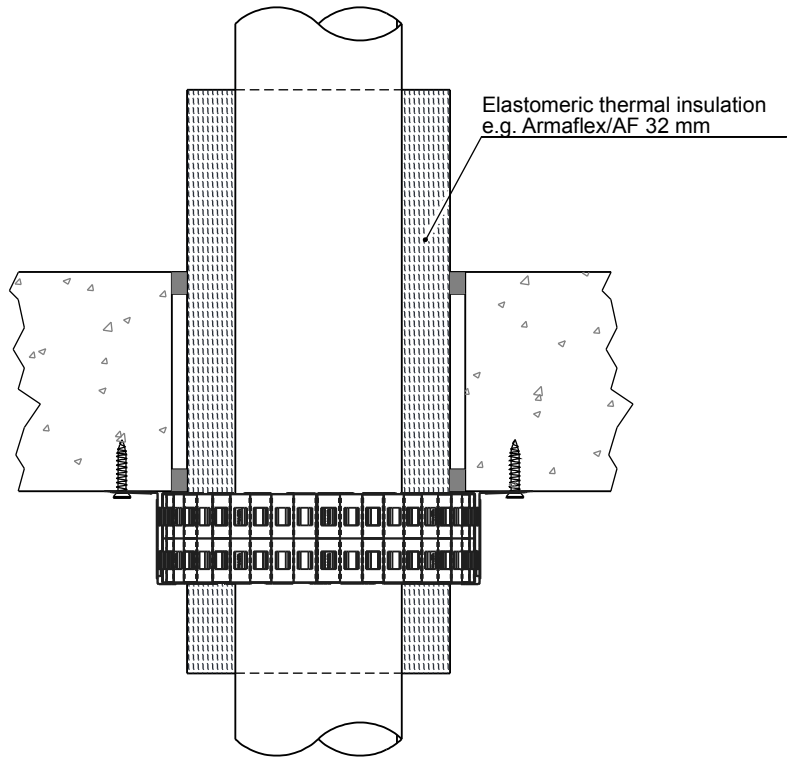


Front view



- a - Annular space  
(Maximum 15 mm between insulation and Mulco® Multicollar)
- b - Mulco® Multiclip
- c - Mulco® Multiclip Large

Side view

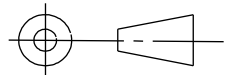


American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-PP-21.0.22



Unit of measure : mm

Department : Research & Development

Date : 2-1-2017

Draftsman : K.J.

A4



**Fire test pipe penetration seal  
Mulco® Multicollar  
Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance</b>					
<b>Two collars below the floor</b>					
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>		<b>Thickness insulation (mm)</b>	<b>Pipe material</b>
<b>Outer diameter</b>	<b>Wall thickness</b>				
<b>≤ 110</b>	<b>3.2</b>	<b>EI 120-U/U</b> <b>E 120-U/U</b>	<b>EI 120-U/C</b> <b>E 120-U/C</b>	<b>9 to 32</b>	<b>PVC-U / PVC-C</b>

Based upon an assessment concerning different insulation materials it is expected that the fire resistances given above will also be met for penetration seals fitted with insulation of the following types (the insulation dimensions shall correspond to the dimensions in the table):

- AF/Armaflex;
- SH/Armaflex for outer pipe diameters ≤ Ø39 mm;
- Kaiflex ST and Kaiflex KKplus s2;
- K-Flex EC, K-Flex EC AD, K-Flex EC, K-Flex ST, K-Flex ST/SK, K-Flex ST Frigo, K-Flex SRC and K-Flex SRC Eco.

## 5.3 Plastic pipes (silent)

In this Chapter the expected fire resistance and field of application of plastic pipes (silent) in several different applications is summarized.

### 5.3.1 Without insulation

*Plastic pipes (silent)*

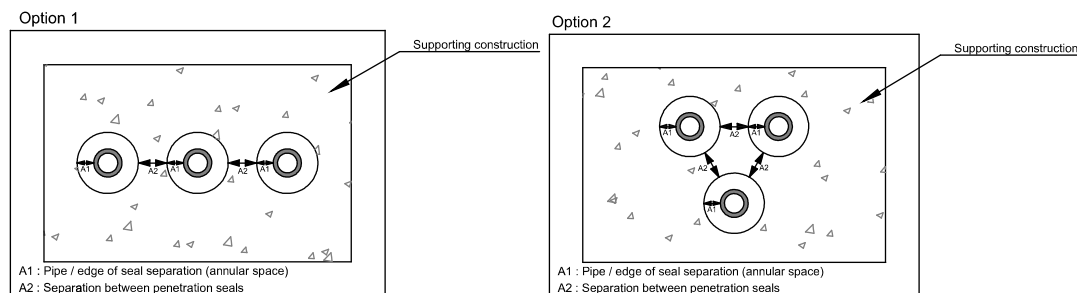
On the next pages, drawings RF-PPS-11.0.10 and RF-PPS-21.0.10 of the pipe penetration seals with plastic pipes (silent) without insulation are given for the pipes fitted with one or two Mulcol® Multicollar Slim placed below the floor. In Table 5.3.1 the installation details regarding the field of application are given.

#### t5.3.1 Installation details

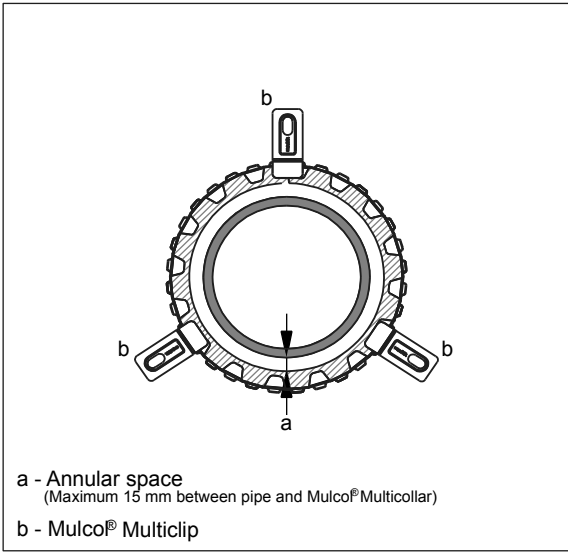
Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 37)		Allowed annular space (distance 'a' in drawing)	
		Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A both faces	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth ≥ 10 mm	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 37. The annular gap A<sub>1</sub> is also visible in this Figure.

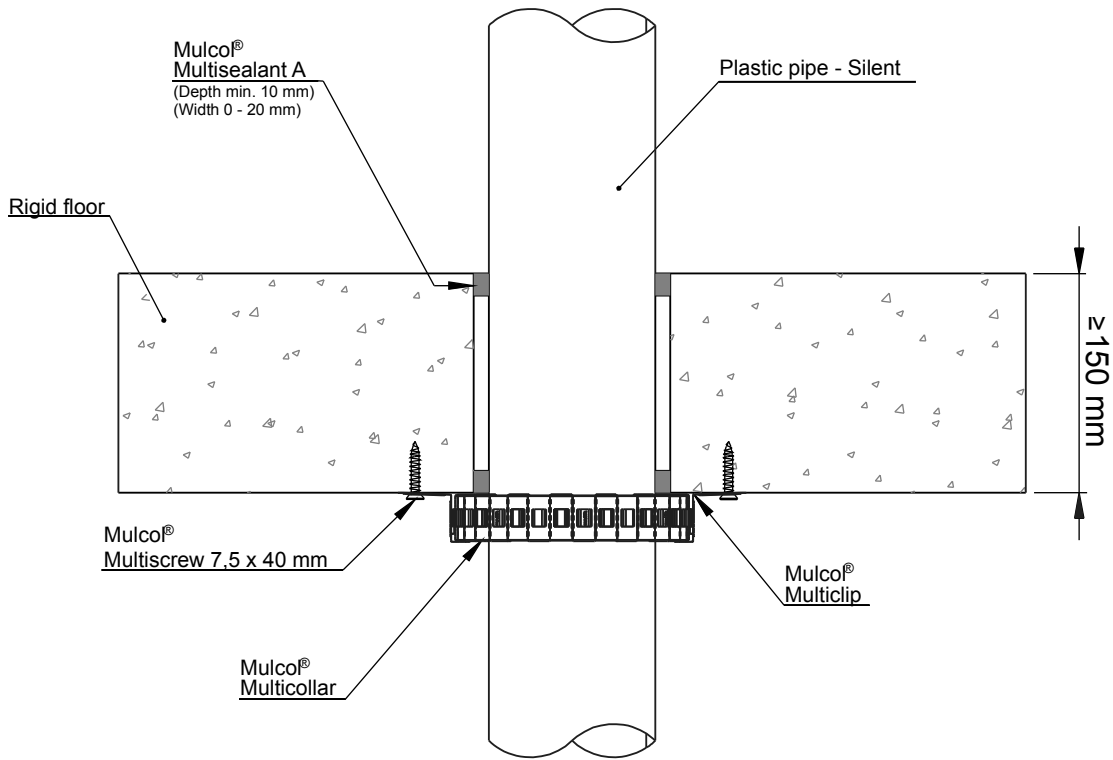
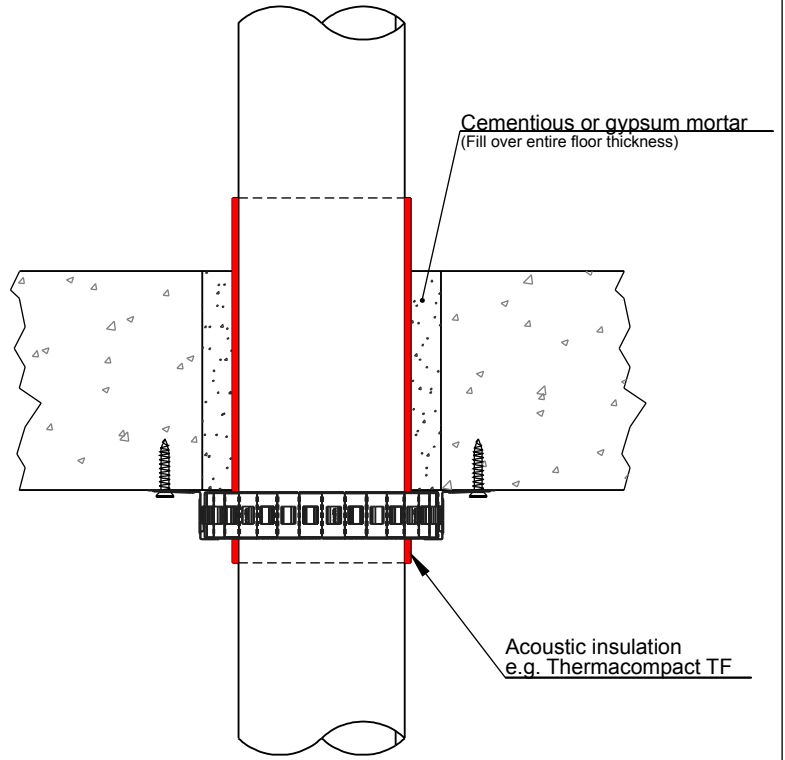
#### f37 Visualization single penetrations



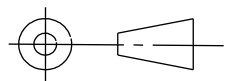
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 7-12-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

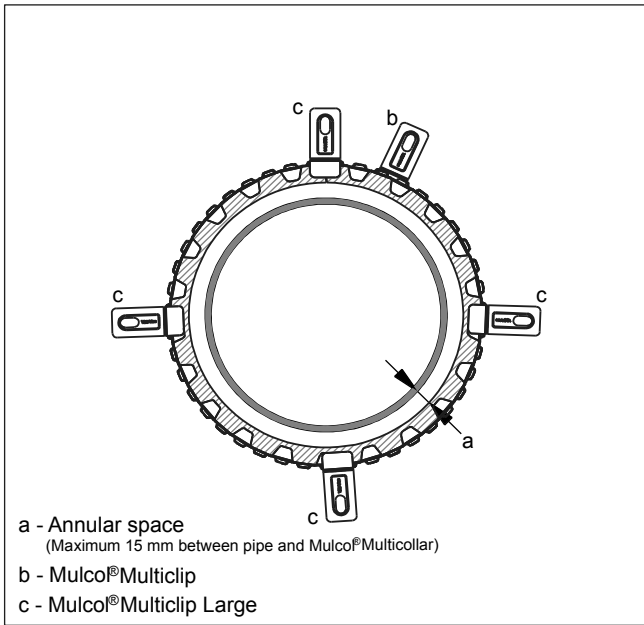
RF-PPS-11.0.10

A4

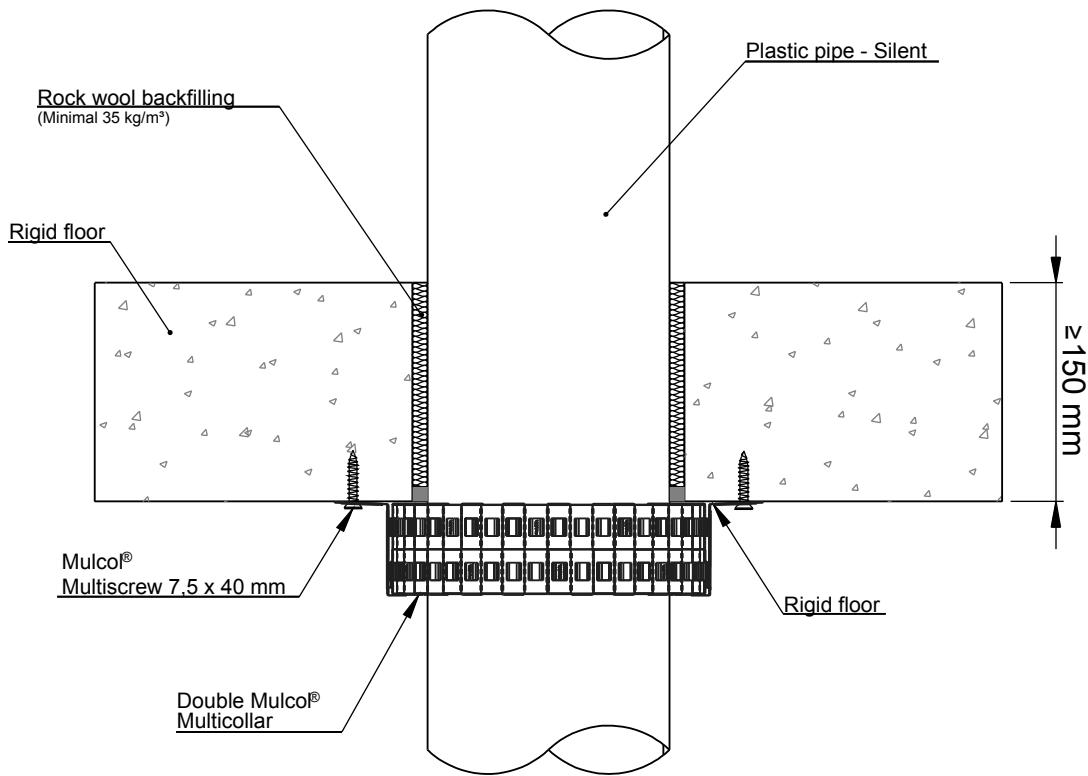
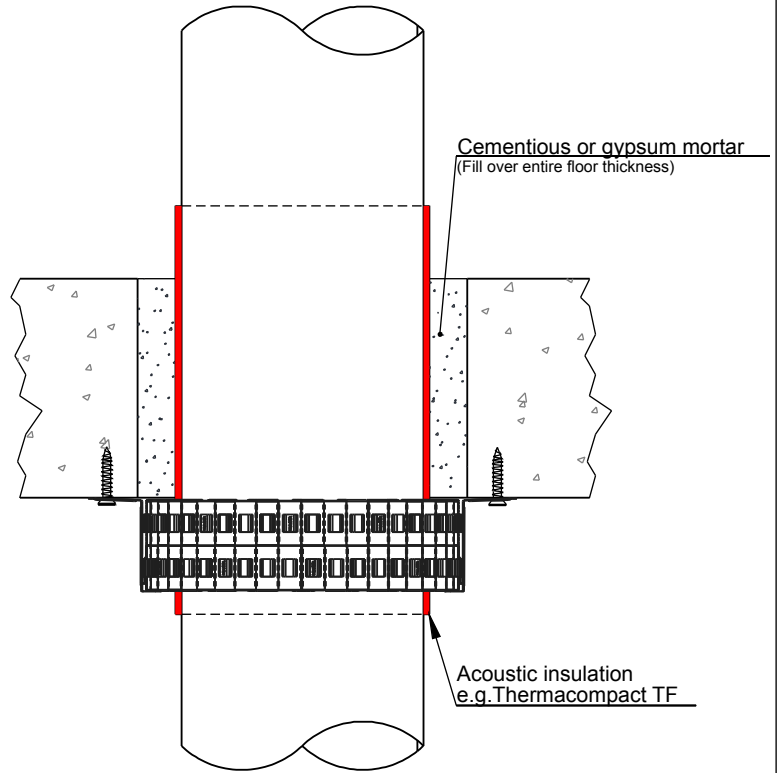


**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

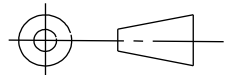
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 7-12-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-PPS-21.0.10

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

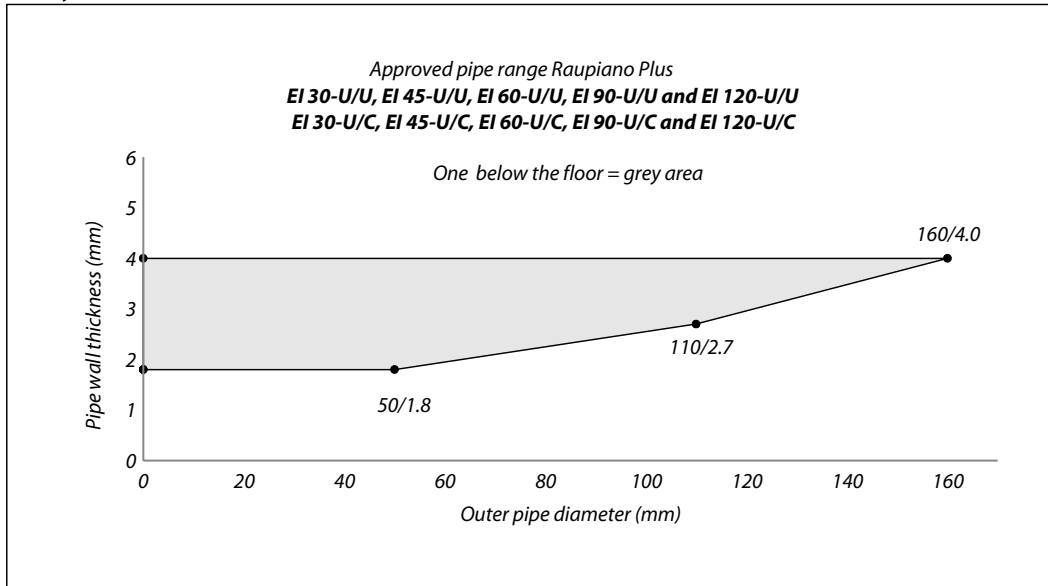
Fire resistance One collar below the floor					
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material (or equal)	See Figure
Outer diameter	Wall thickness				
≤ 50	1.8 to 4.0	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C	Raupiano Plus	38
≤ 110	2.7 to 4.0	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C		
≤ 160	4.0	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C		
≤ 56	3.2 to 7.0	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C	Geberit Silent dB 20	39
≤ 110	6.0 to 7.0	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C		
≤ 160	7.0	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C		
≤ 110	3.6	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C	Wavin SiTech+	N.a.

Fire resistance Two collars below the floor			
Pipe dimensions (mm)		Performance class with pipe end configuration	Pipe material (or equal)
Outer diameter	Wall thickness		
≤ 160	5.0	EI 120-U/C E 120-U/C	Wavin SiTech+

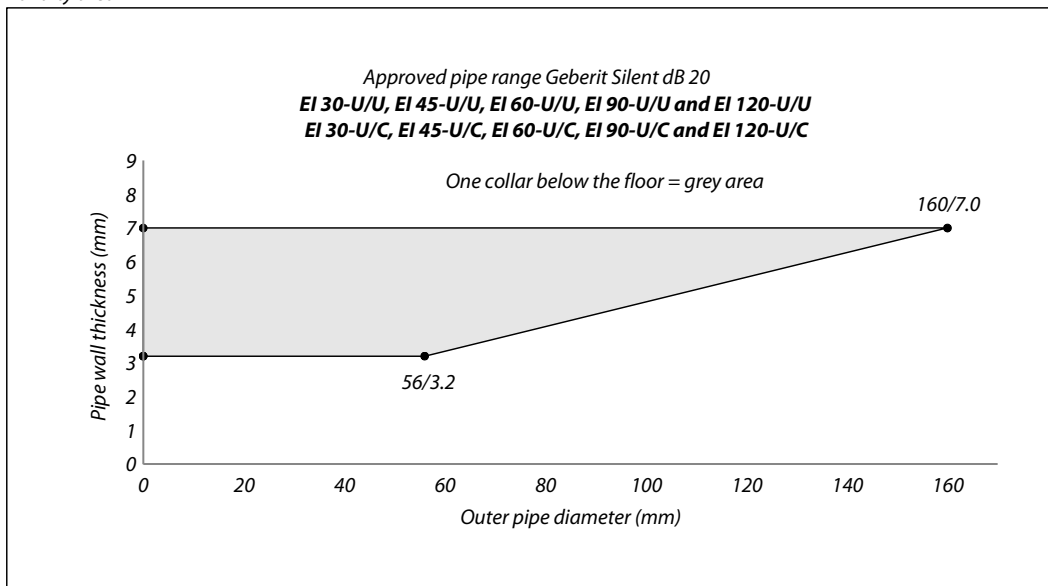
Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Coes PhoNoFire and Coestilen BluePower;
- Geberit Silent PP and Geberit Silent dB 20;
- Girpi Friaphon and Marley Silent;
- Pipelife Master 3 and PhonEX AS;
- Poloplast POLO-KAL NG and Poloplast POLO-KAL 3S;
- Skolan dB;
- Raupiano Plus;
- Valsir Triplus, Wavin SiTech+ and Wavin AS.

f38 Validity area



f39 Validity area



### 5.3.2 Without insulation under an angle of 45 degrees

Plastic pipes (silent)

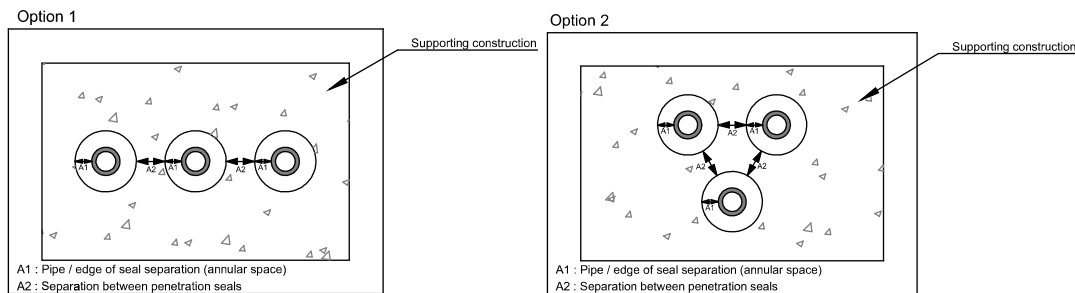
On the next page, drawing RF-PPS-21.1.10 of the pipe penetration seals with plastic pipes (silent) without insulation under an angle of 45 degrees is given for the pipes fitted with two Mulcol® Multicollar Slim placed below the floor. In Table 5.3.2 the installation details regarding the field of application are given.

#### t5.3.2 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 40) Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap ≥ 10 mm / depth fully filled	Outer diameter ≤ 110 mm / 'a' ≤ 15 mm

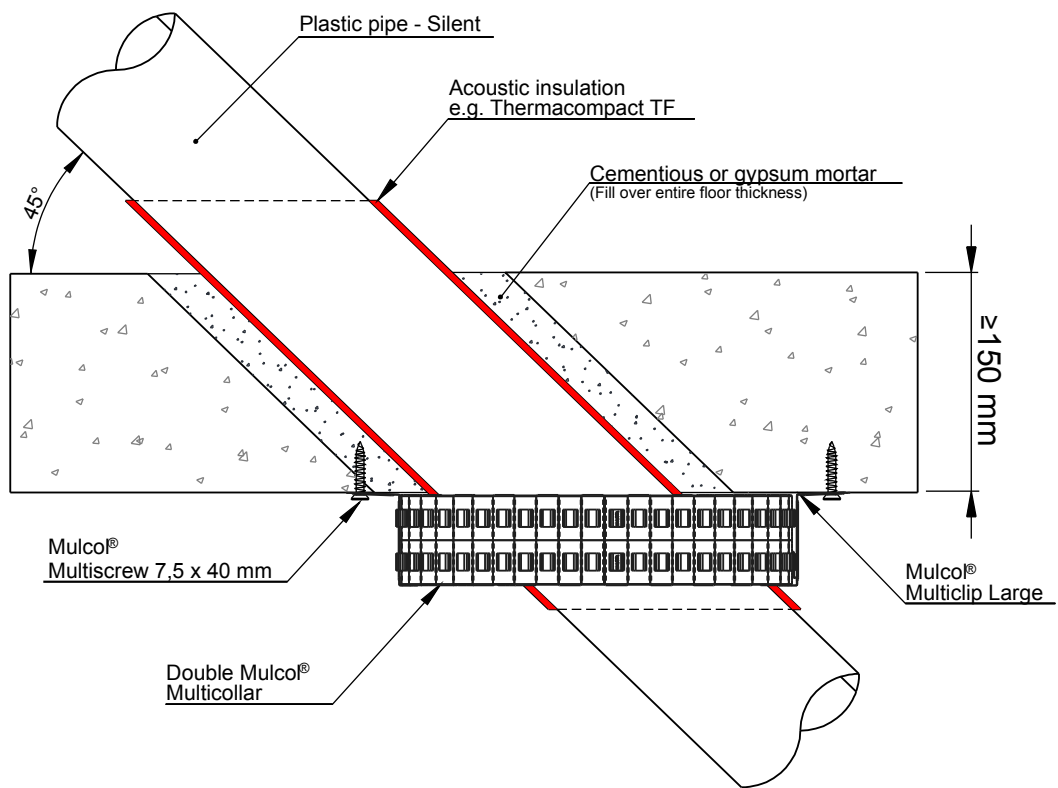
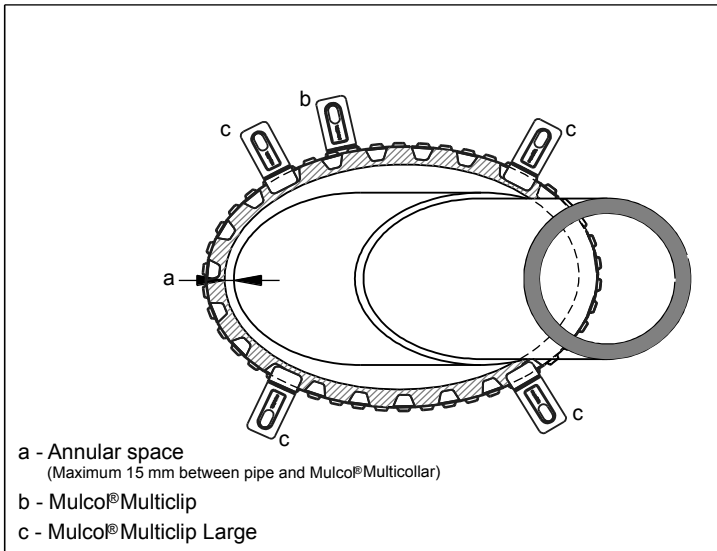
If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 40. The annular gap A<sub>1</sub> is also visible in this Figure.

#### f40 Visualization single penetrations

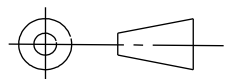


The fixing of the Mulcol® Multicollar Slim must be done by four Mulcol® Multiclips.

Front view



American projection



Scale : 1:5

Unit of measure : mm

Date : 7-12-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-PPS-21.1.10

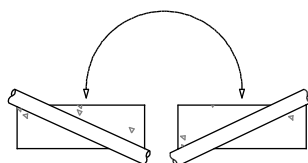
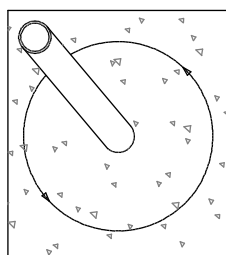
A4



**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**

The fire resistance is valid in both directions for pipe passing through the wall every angle and orientation with a maximum 45° to the perpendicular, for clearance see visualization of prEN 1366-3:2017 in Figure 41.

f41 Visualization of the allowed pipe orientation



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Two collars below the floor				
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material (or equal)
Outer diameter	Wall thickness	EI 120-U/U	EI 120-U/C	
≤ 110	6.0	E 120-U/U	E 120-U/C	Geberit Silent dB 20

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Coes PhoNoFire and Coestilen BluePower;
- Geberit Silent PP and Geberit Silent dB 20;
- Girpi Friaphon and Marley Silent;
- Pipelife Master 3 and PhonEX AS;
- Poloplast POLO-KAL NG and Poloplast POLO-KAL 3S;
- REHAU Raupiano Plus;
- Skolan dB;
- Valsir Triplus, Wavin SiTech+ and Wavin AS.

### 5.3.3 Without insulation with coupling

Plastic pipes (silent)

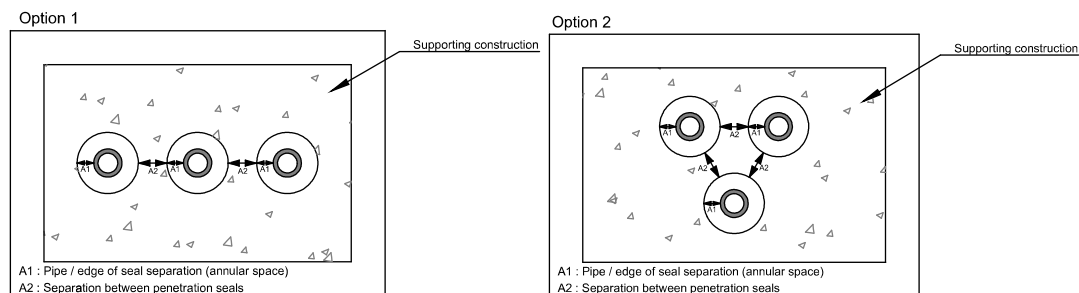
On the next page, drawing RF-PPS-11.0.60 of the pipe penetration seals with plastic pipes (silent) without insulation with coupling is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.3.3 the installation details regarding the field of application are given.

#### t5.3.3 Installation details

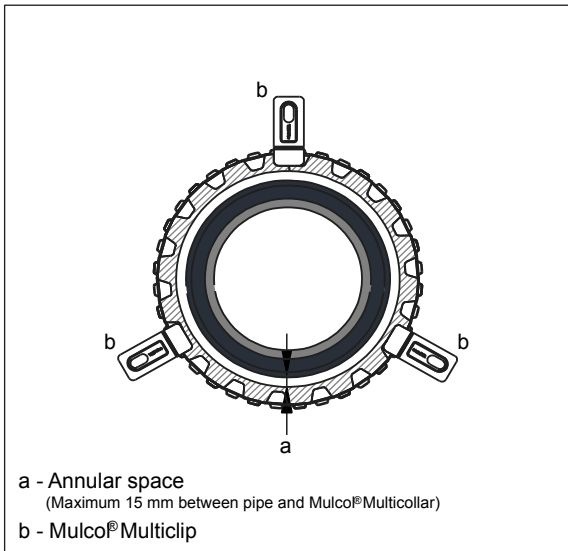
Distance to first pipe support above the floor	Sound decoupling insulation allowed	Type of socket allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 42)		Allowed annular space (distance 'a' in drawing)
			Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LL/CI)	Geberit Silent dB 20 Ø110 mm (type: 310.012.14.1) with extra electric socket Geberit PE Ø110 mm (type: 368.771.16.1) Raupiano Plus Ø110 mm (type: 120324-200) Wavin SiTech+ Ø110 mm (type: 3067729);	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 42. The annular gap A<sub>1</sub> is also visible in this Figure.

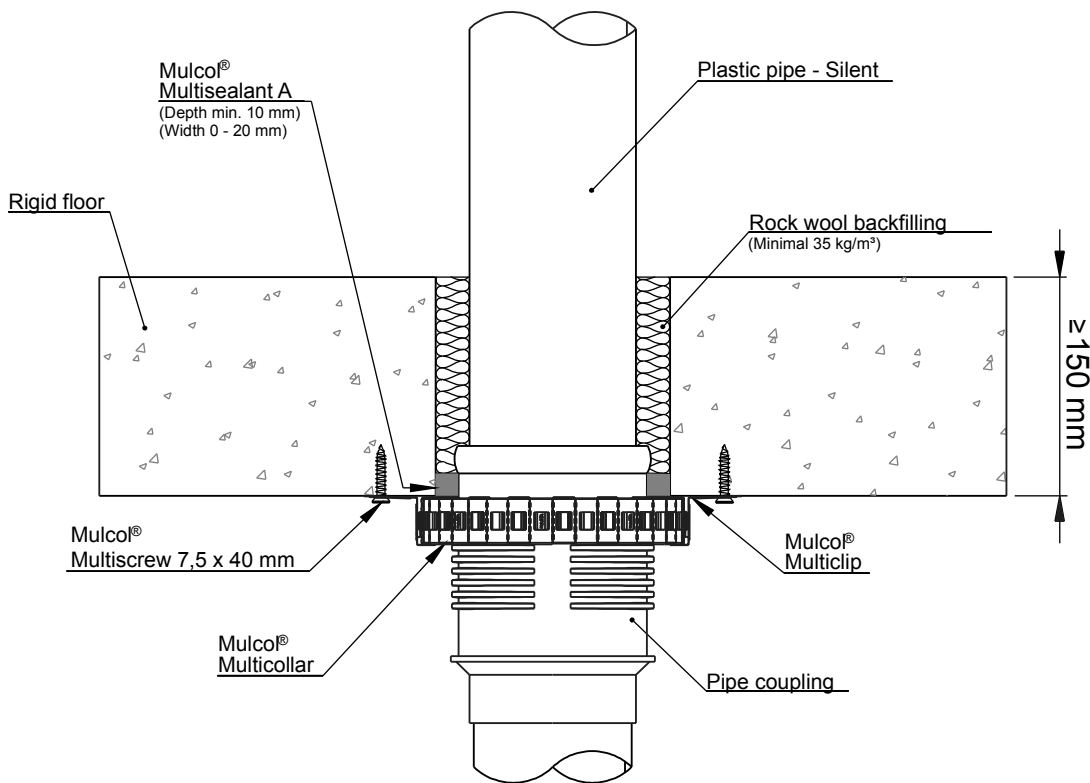
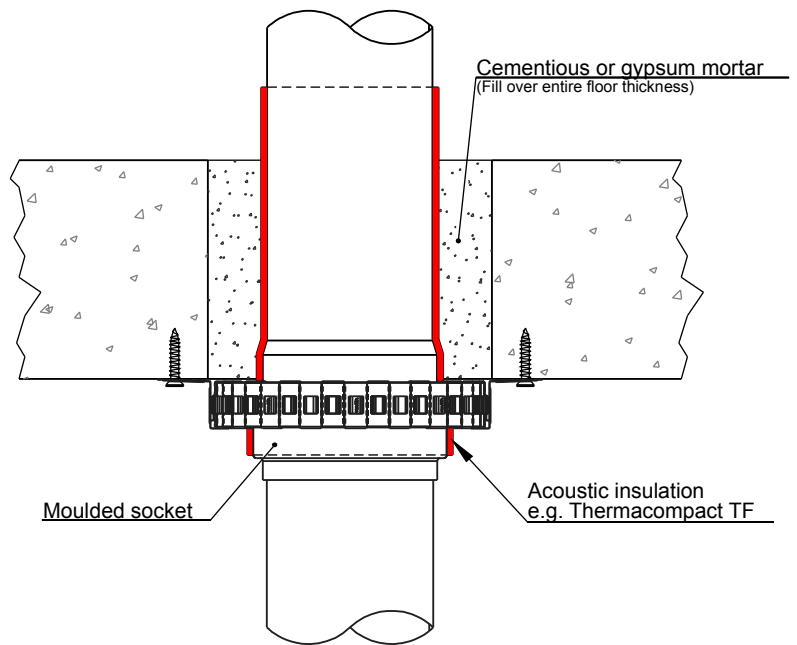
#### f42 Visualization single penetrations



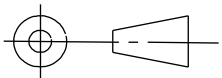
Front view



Side view



American projection



Scale : 1:5  
Unit of measure : mm  
Date : 26-9-2016

Company : Mulcol International B.V.  
Department : Research & Development  
Draftsman : K.J.

RF-PPS-11.0.60

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration	Pipe material and coupling (or equal)	
Outer diameter	Wall thickness			
≤ 110	6.0	EI 120-U/C E 120-U/C	Geberit Silent dB 20	
≤ 110	2.7	EI 120-U/C E 120-U/C	Raupiano Plus	
≤ 110	3.6	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C	Wavin AS

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Coes PhoNoFire and Coestilen BluePower;
- Geberit Silent PP and Geberit Silent dB 20;
- Girpi Friaphon and Marley Silent;
- Pipelife Master 3 and PhonEX AS;
- Poloplast POLO-KAL NG and Poloplast POLO-KAL 3S;
- Skolan dB;
- Raupiano Plus
- Valsir Triplus, Wavin AS and Wavin SiTech+.



### 5.3.4 Without insulation with elbow and collar in a circular shape

Plastic pipes (silent)

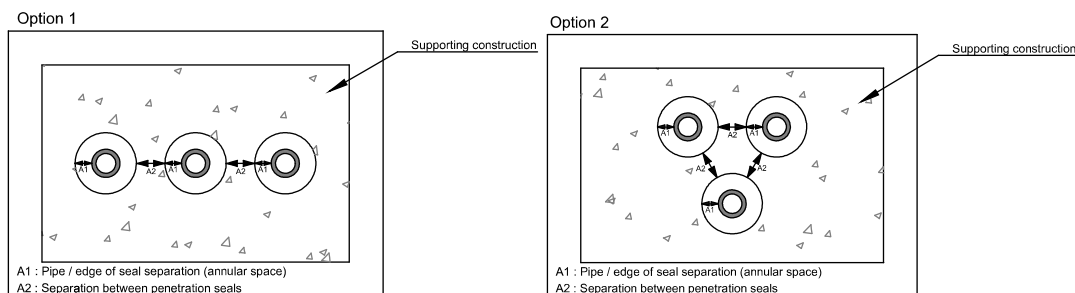
On the next page, drawing RF-PPS-11.0.80 of the pipe penetration seals with plastic pipes (silent) with elbow is given for the pipes fitted with one Mulcol® Multicollar Slim in a circular shape placed below the floor. In Table 5.3.4 the installation details regarding the field of application are given.

#### t5.3.4 Installation details

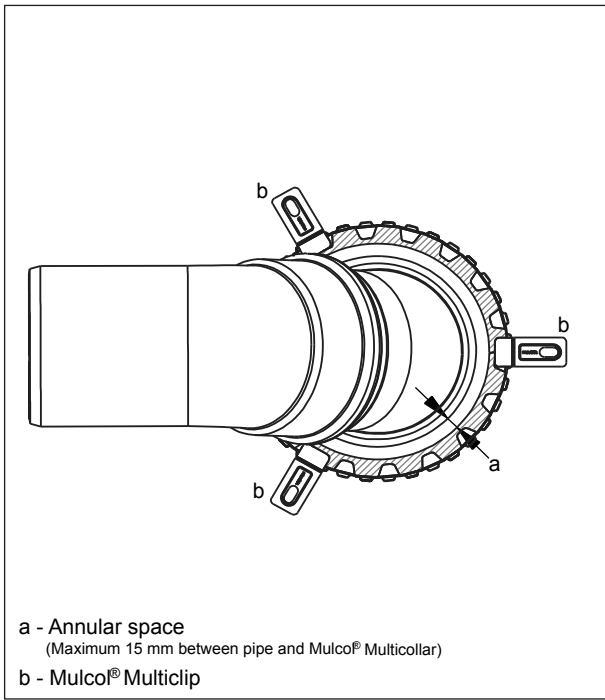
Distance to first pipe support above the floor	Sound decoupling insulation allowed	Type of elbow allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 43)		Allowed annular space (distance 'a' in drawing)
			Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Geberit Silent dB 20 Ø110 mm x 45° (type: 367.771.16.1) Wavin AS PP Ø110 mm x 45° (type: 344110004);	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 43. The annular gap A<sub>1</sub> is also visible in this Figure.

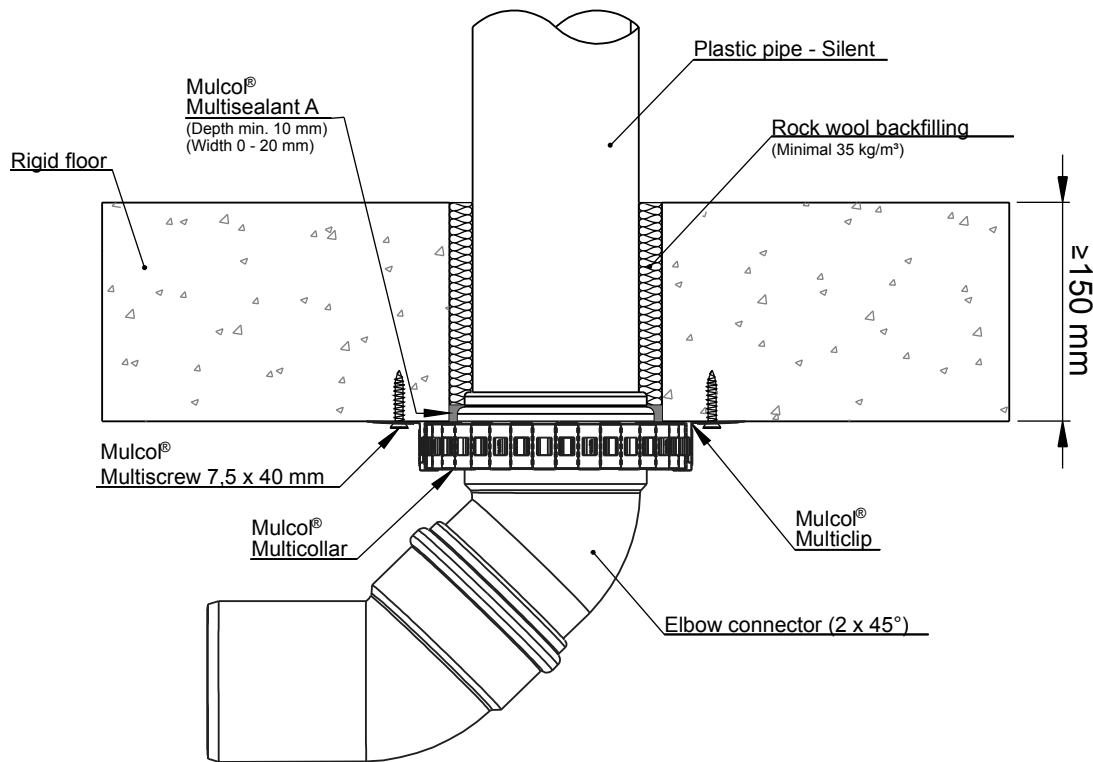
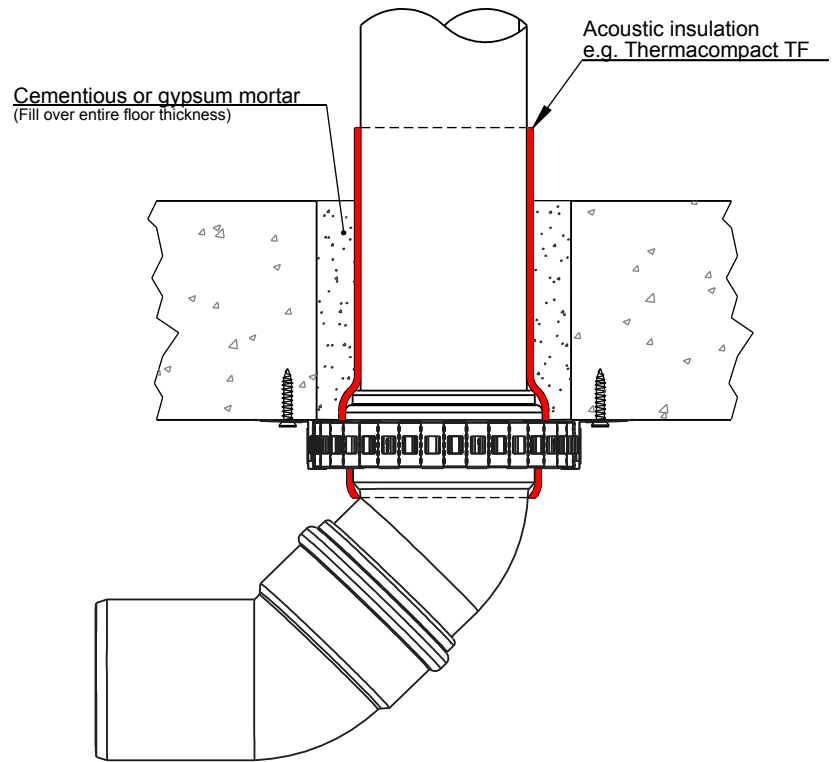
#### f43 Visualization single penetrations



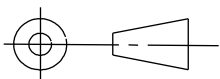
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

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Department : Research & Development

Draftsman : K.J.

RF-PPS-11.0.80

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration		Type material and elbow
Outer diameter	Wall thickness			
≤ 110	5.3	EI 120-U/U E 120-U/U	EI 120-U/C E 120-U/C	Wavin AS
≤ 110	6.0	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*	Geberit Silent dB 20

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Coes PhoNoFire and Coestilen BluePower;
- Geberit Silent PP and Geberit Silent dB 20;
- Girpi Friaphon and Marley Silent;
- Pipelife Master 3 and PhonEX AS;
- Poloplast POLO-KAL NG and Poloplast POLO-KAL 3S;
- REHAU Raupiano Plus;
- Skolan dB;
- Valsir Triplus, Wavin AS and Wavin SiTech+.

### 5.3.5 Without insulation with elbow and collar in a U-shape

Plastic pipes (silent)

On the next page, drawing RF-PPS-51.0.80 of the pipe penetration seals with plastic pipes (silent) without insulation with elbow is given for the pipes fitted with one Mulcol® Multicollar Slim in a U-shape placed below the floor.

In Table 5.3.5 the installation details regarding the field of application are given.

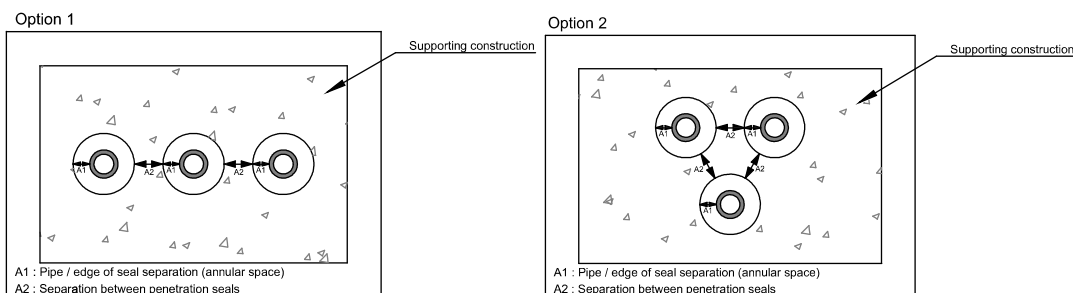
#### t5.3.5 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Type of elbow allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 44) Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Geberit Silent dB 20 Ø110 mm x 45° (type: 310.450.14.1) Wavin SiTech+ Ø110 mm x 45° (type: 3067798) Ruapiano Plus Ø110 mm x 45° (type: 123444-001)	Annular gap ≥ 10 mm / depth fully filled	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

The fixing of the Mulcol® Multicollar Slim must be done by four Mulcol® Multiclips and may be placed at any orientation.

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 44. The annular gap A<sub>1</sub> is also visible in this Figure.

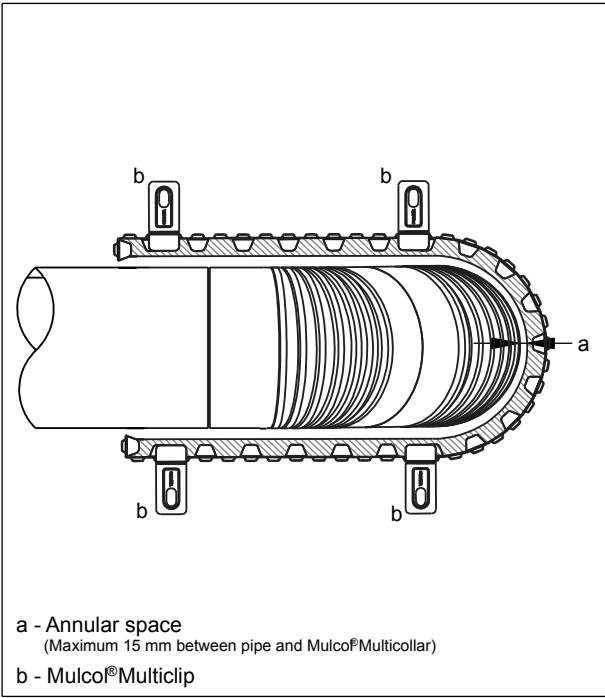
#### f44 Visualization single penetrations



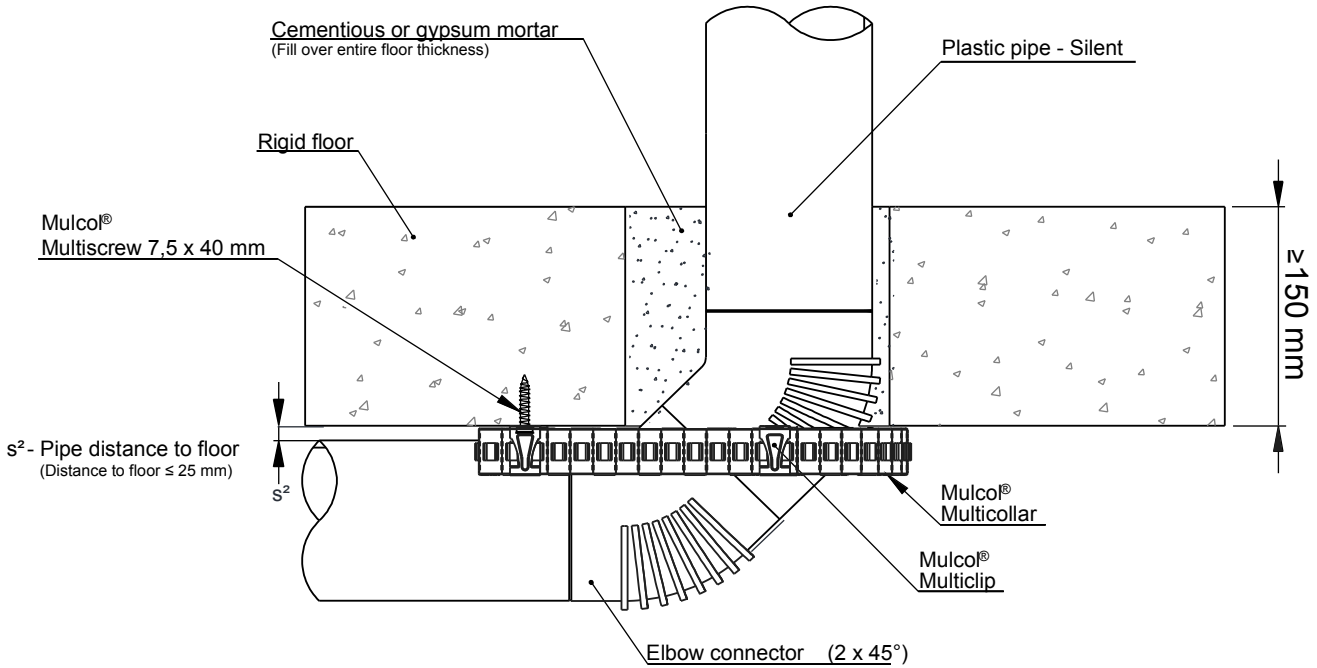
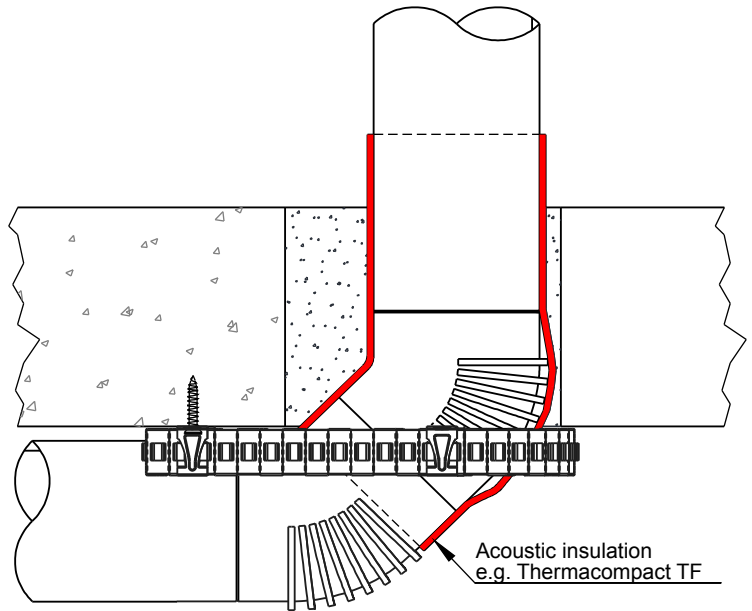
The length of the U-shape must be at least two times the diameter of the pipes. The metal ends of the U-shape must be folded (see drawing).

The distance from the pipe to the floor shall be maximum 25 mm (see distance s<sub>2</sub> in the drawing).

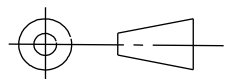
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 26-9-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-PPS-51.0.80

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe and elbow material (or equal)
Outer diameter	Wall thickness	EI 90-U/U*	EI 90-U/C*	Geberit Silent dB 20
≤ 110	6.0	E 90-U/U*	E 90-U/C*	

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Coes PhoNoFire and Coestilen BluePower;
- Geberit Silent PP and Geberit Silent dB 20;
- Girpi Friaphon and Marley Silent;
- Pipelife Master 3 and PhonEX AS;
- Poloplast POLO-KAL NG and Poloplast POLO-KAL 3S;
- REHAU Raupiano Plus;
- Skolan dB;
- Valsir Triplus, Wavin SiTech+ and Wavin AS.

### 5.3.6 Without insulation in corner

Plastic pipes (silent)

On the next page, drawing RF-PPS-31.0.10 of the pipe penetration seals with plastic pipes (silent) without insulation placed in a corner is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.3.6 the installation details regarding the field of application are given.

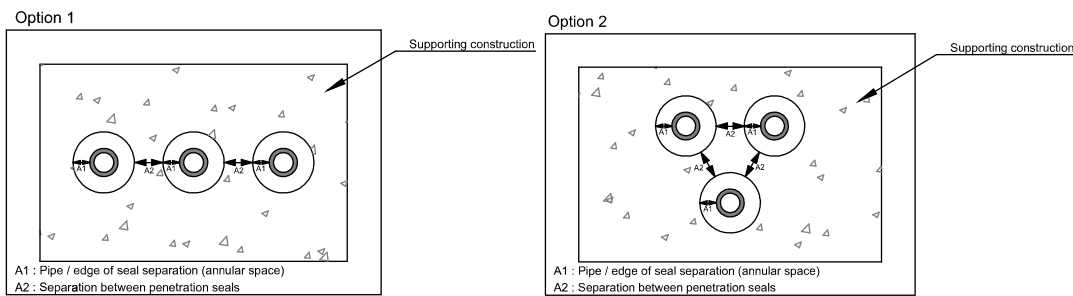
#### t5.3.6 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap		Allowed distance to element (distance $s^2$ in drawing)	Allowed annular space (distance 'a' in drawing)
		Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool $\geq 35 \text{ kg/m}^3$ unexposed face		
$\leq 450 \text{ mm}$	Thickness $\leq 4 \text{ mm}$ / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap $\geq 10 \text{ mm}$ / depth fully filled	Annular gap $\leq 20 \text{ mm}$ / depth sealant $\geq 10 \text{ mm}$	$\leq 5 \text{ mm}$	Outer diameter $\leq 110 \text{ mm}$ , 'a' $\leq 15 \text{ mm}$

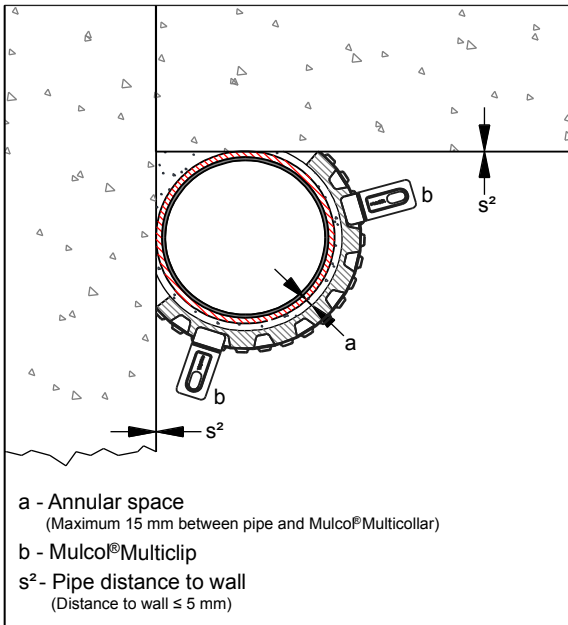
The fixing of the Mulcol® Multicollar Slim must be done by two Mulcol® Multiclips. The pipe may be applied against a rigid or flexible wall.

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 45. The annular gap  $A_1$  is also visible in this Figure.

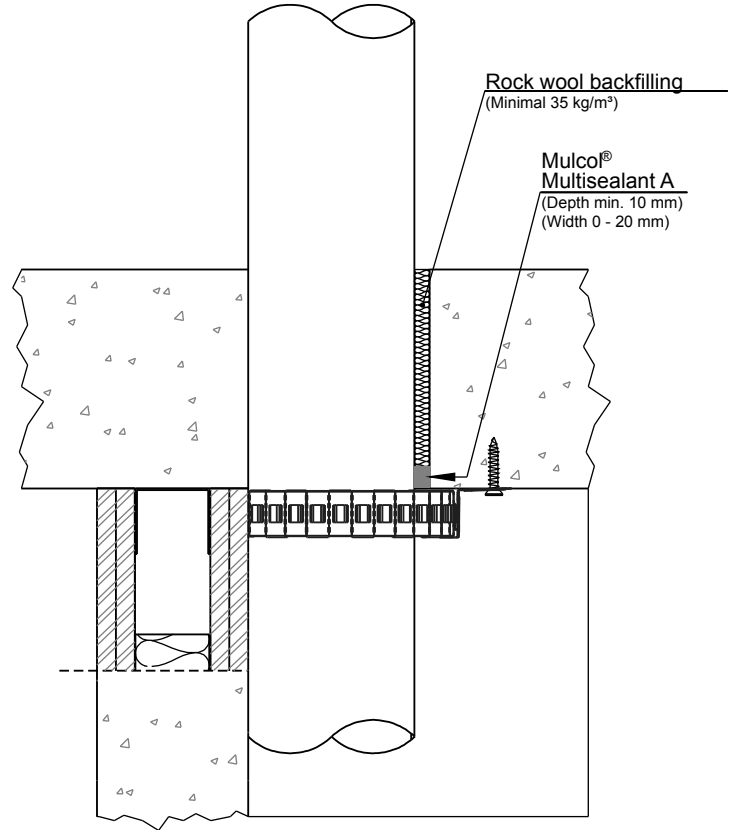
#### f45 Visualization single penetrations



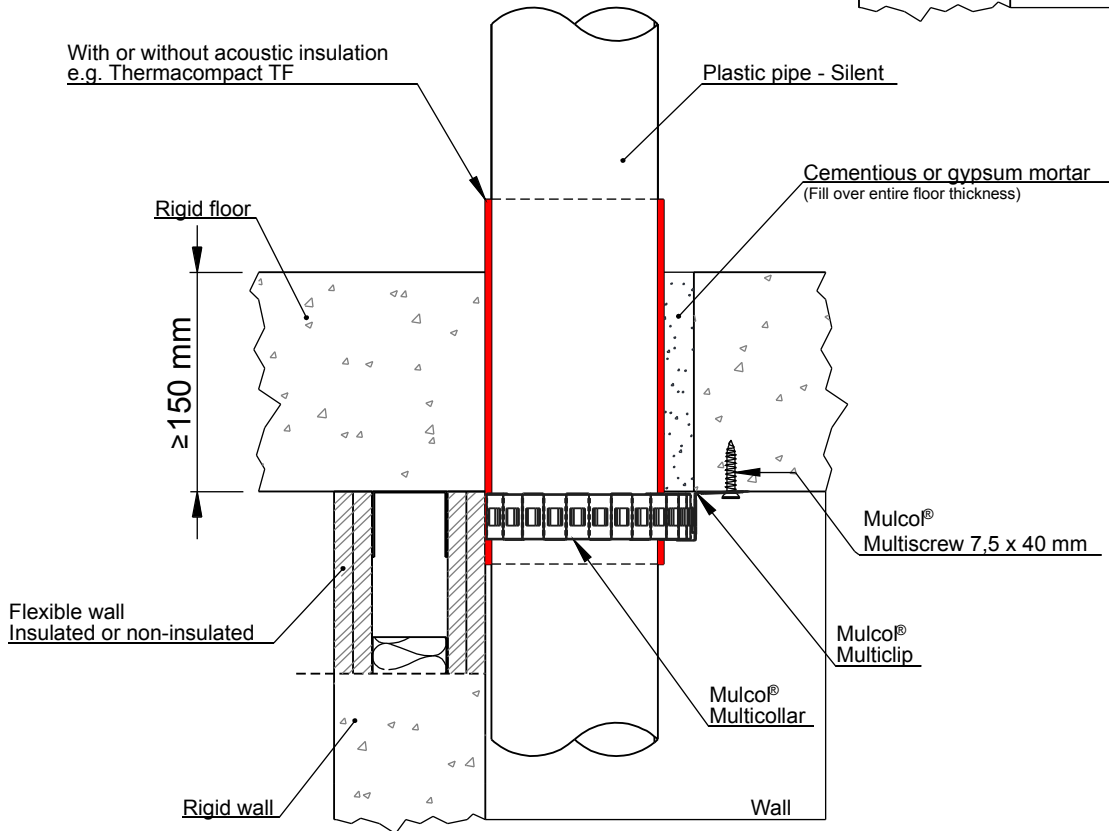
Front view



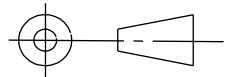
Side view



With or without acoustic insulation  
e.g. Thermacompact TF



American projection



Scale : 1:5

Unit of measure : mm

Date : 26-9-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-PPS-31.0.10

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**



The system is classified in accordance with the following combinations of performance parameters and classes.

<b>Fire resistance</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>
<b>Outer diameter</b>	<b>Wall thickness</b>		
<b>≤ 110</b>	<b>6.0</b>	<b>EI 120-U/C E 120-U/C</b>	<b>Geberit Silent dB 20</b>

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Coes PhoNoFire and Coestilen BluePower;
- Geberit Silent PP and Geberit Silent dB 20;
- Girpi Friaphon and Marley Silent;
- Pipelife Master 3 and PhonEX AS;
- Poloplast POLO-KAL NG and Poloplast POLO-KAL 3S;
- REHAU Raupiano Plus;
- Skolan dB;
- Valsir Triplus, Wavin SiTech+ and Wavin AS.

### 5.3.7 Without insulation through a seal penetration system

Plastic pipes (silent)

On the next page, drawing PBrf-PPS-11.0.10 of the pipe penetration seals with plastic pipes (silent) without insulation through a seal penetration system is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the seal. In Table 5.3.7 the installation details regarding the field of application are given.

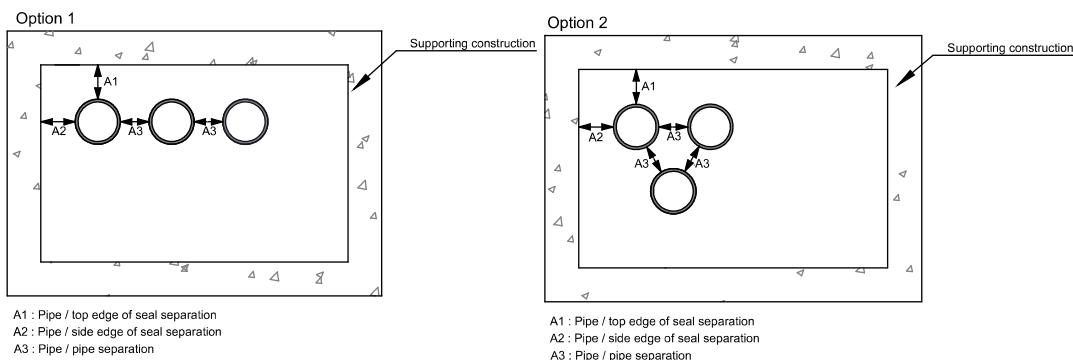
For multiple penetrations, the use of the Mulcol® Multimastic FB1 (2 x 50 mm) penetration seal system is recommended. The aperture size in the floor may be up to 2400 mm long and 1200 mm wide. A cavity of maximum 50 mm between the rock wool panels may be present. For further details see Paragraph 5.1.5.

#### t5.3.7 Installation details

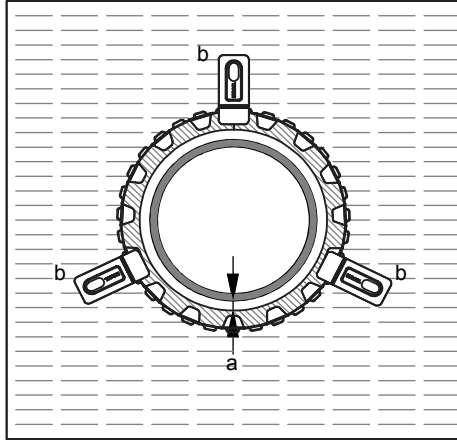
Distance to first pipe support above the floor	Distance between pipes (A <sub>1</sub> to A <sub>3</sub> , see Figure 46)	Allowed filling of annular gap		Allowed annular space (distance 'a' in drawing)
		Mulcol® Multisealant SP on both faces, with backing rock wool ≥ 35 kg/m <sup>3</sup>	No filling	
≤ 450 mm	≥ 100 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Approximately the same size as the pipe (tight fit)	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

If more pipe penetrations are placed in the penetration seal system, the minimum distance between the pipes is 100 mm, distances A<sub>1</sub> to A<sub>3</sub> Figure 46 (the presence of ≥ 60 mm of rock wool between the pipes is mandatory).

#### f46 Visualization distance between pipes

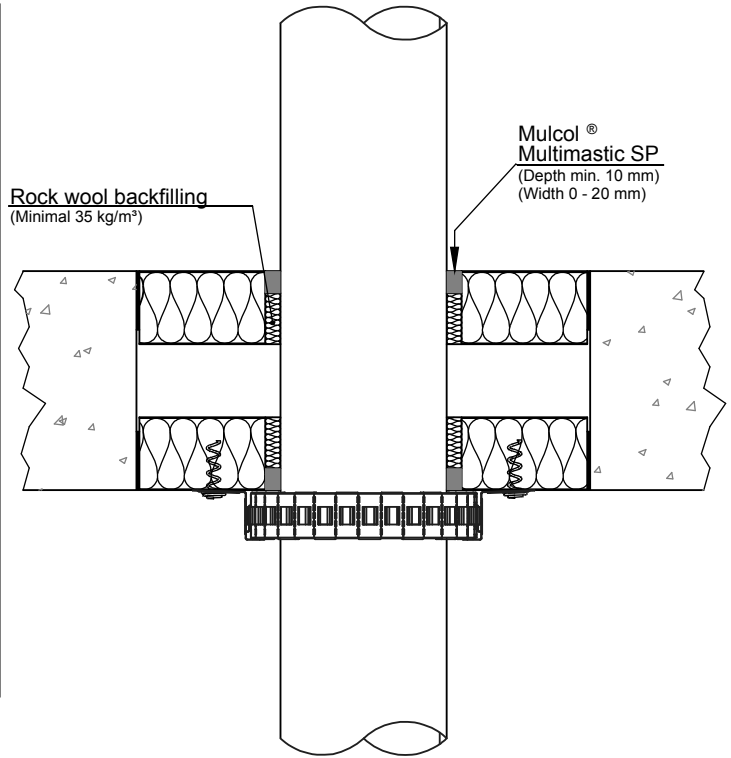


Front view



a - Annular space  
(Maximum 15 mm between pipe and Mulcol® Multicollar)  
b - Mulcol® Multiclip

Side view



Mulcol®  
Multimastic FB1 2 x 50 mm  
(e.g. Penetration board)  
(≥ 140 kg/m³)

Rigid floor

Plastic pipe - Silent

Mulcol® Multiscrew FB 40 mm  
or Threaded steel bolt with nuts M6

≥ 150 mm

Mulcol®  
Multimastic SP

Mulcol®  
Multiclip

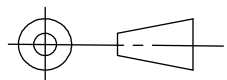
Mulcol®  
Multicollar

American projection

Scale : 1:5

Company : Mulcol International B.V.

PBrf-PPS-11.0.10



Unit of measure : mm

Department : Research & Development

Date : 4-1-2017

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material (or equal)
Outer diameter	Wall thickness			
≤ 110	6.0	EI 90-U/U E 90-U/U	EI 90-U/C E 90-U/C	Geberit Silent dB 20

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Coes PhoNoFire and Coestilen BluePower;
- Geberit Silent PP and Geberit Silent dB 20;
- Girpi Friaphon and Marley Silent;
- Pipelife Master 3 and PhonEX AS;
- Poloplast POLO-KAL NG and Poloplast POLO-KAL 3S;
- REHAU Raupiano Plus;
- Skolan dB;
- Valsir Triplus, Wavin SiTech+ and Wavin AS.

## 5.4 Aluminium composite pipes

In this Chapter the expected fire resistance and field of application of aluminium composite pipes in several different applications is summarized.

### 5.4.1 Without insulation

*Aluminium composite pipes*

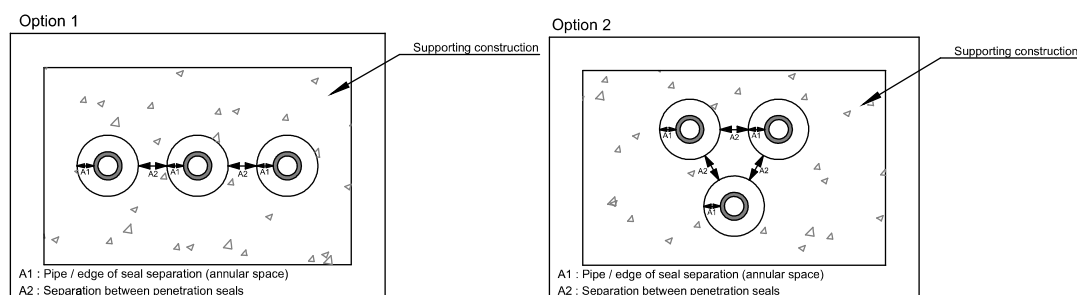
On the next pages, drawings RF-MLA-11.0.10 and RF-MLA-21.0.10 of the pipe penetration seals with aluminium composite pipes without insulation is given for the pipes fitted with one or two Mulcol® Multicollar Slim placed below the floor. In Table 5.4.1 the installation details regarding the field of application are given.

#### t5.4.1 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 47)			Allowed annular space (distance 'a' in drawing)
		Mulcol® Multisealant A both faces	Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	
≤ 350 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap ≤ 20 mm / depth ≥ 10 mm	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 75 mm, 'a' ≤ 15 mm

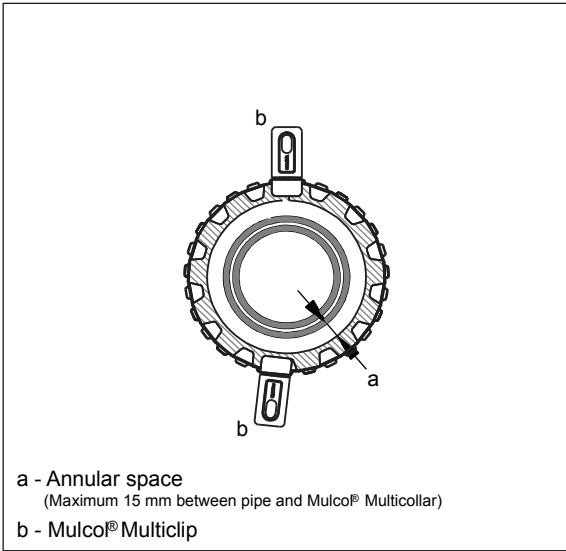
If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 47. The annular gap A<sub>1</sub> is also visible in this Figure.

#### f47 Visualization single penetrations

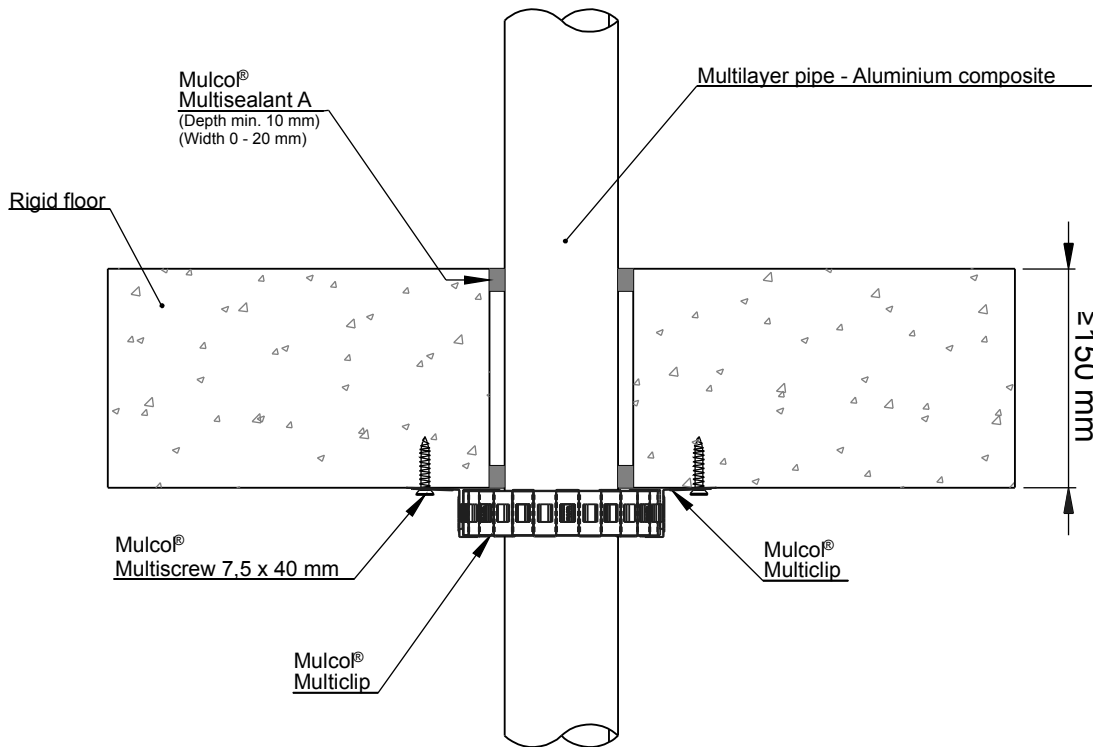
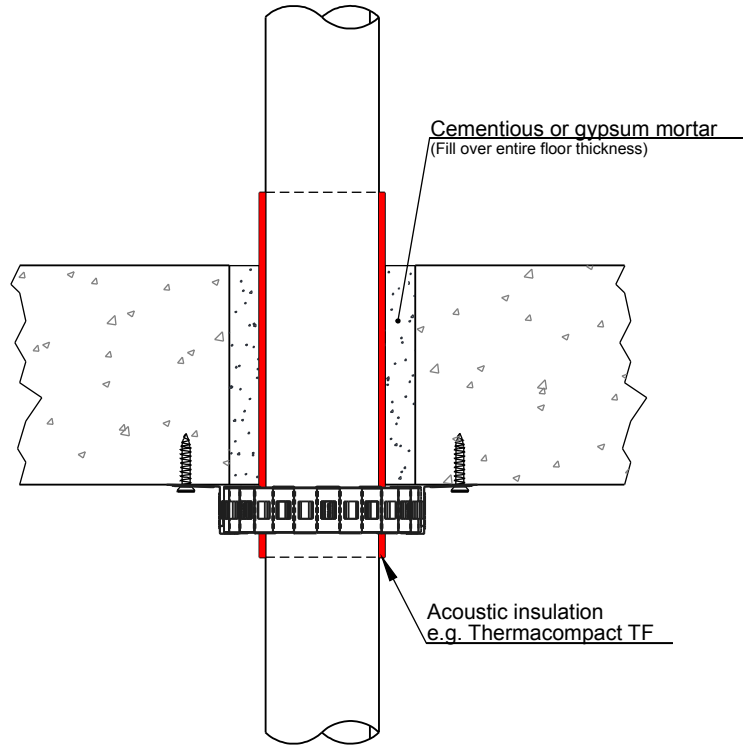


The fire resistance is valid aluminium composite pipes made out of an inner layer of cross-linked polyethylene, a layer aluminium in the middle and a layer of cross-linked polyethylene on top (Henco PE-Xc/AL/PE-Xc).

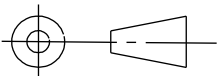
Front view



Side view



American projection



Scale : 1:5  
Unit of measure : mm  
Date : 26-9-2016

Company : Mulcol International B.V.  
Department : Research & Development  
Draftsman : K.J.

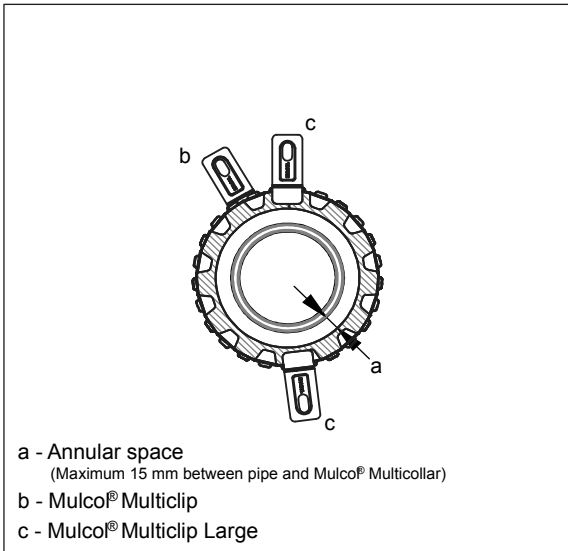
RF-MLA-11.0.10

A4

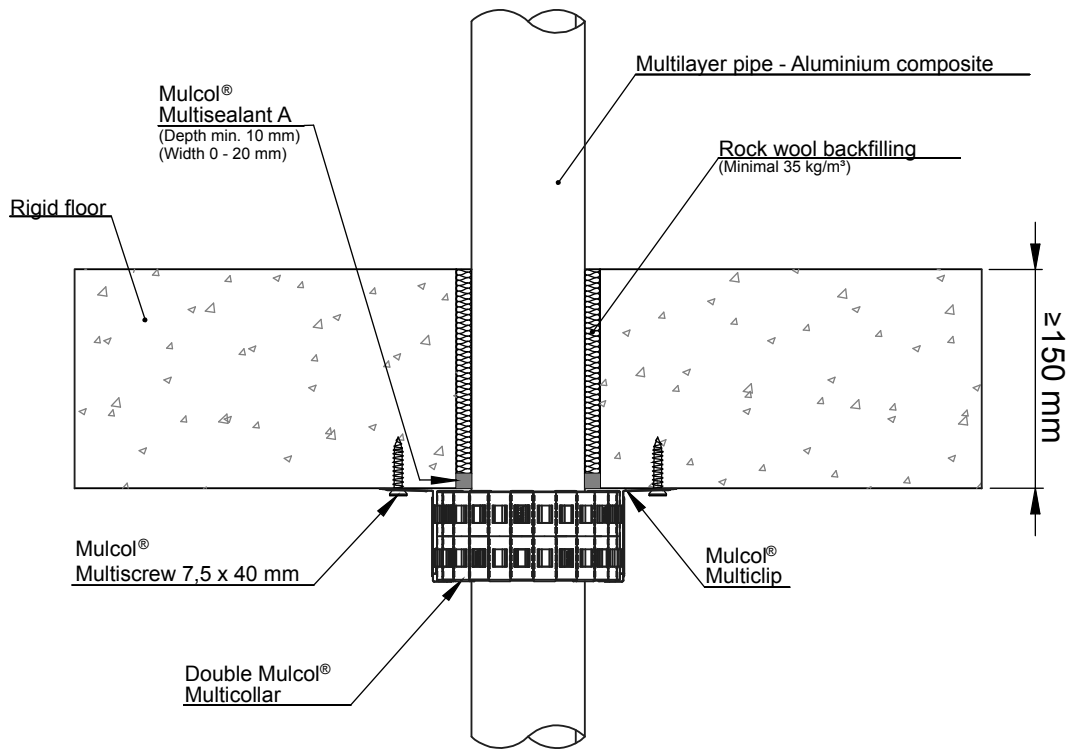
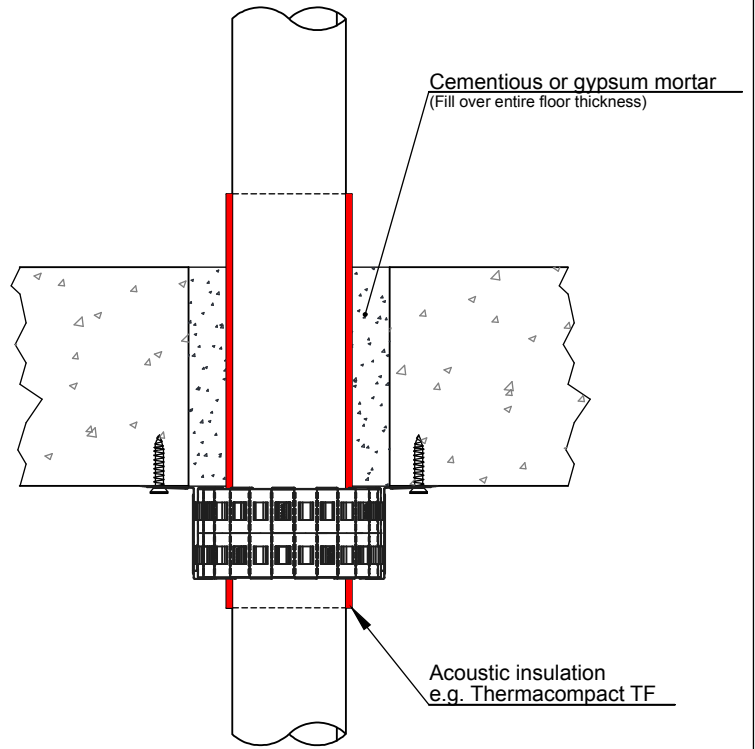


**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in flexible wall and rigid wall**

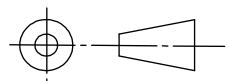
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 8-12-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-MLA-21.0.10

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance</b>			
<b>One collar below the floor</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>
<b>Outer diameter</b>	<b>Wall thickness</b>		
≤ 16 / ≤ 20*	2.0	EI 120-U/C* E 120-U/C*	Henco PE-Xc/AL/PE-Xc
≤ 25	3.5	EI 120-U/C* E 120-U/C*	Uponor PE-Xa Aqua Pipe
≤ 32	3.0	EI 120-U/C E 120-U/C	Henco PE-Xc/AL/PE-Xc
≤ 40	3.5	EI 120-U/C* E 120-U/C*	Henco PE-Xc/AL/PE-Xc
≤ 40	4.0	EI 120-U/C* E 120-U/C*	Uponor PE-RT/AL/PE-RT
≤ 50	4.0	EI 120-U/C E 120-U/C	Henco PE-Xc/AL/PE-Xc
≤ 63	4.5	EI 60-U/C* E 120-U/C*	Henco PE-Xc/AL/PE-Xc
≤ 75	6.0	EI 60-U/C E 120-U/C	Henco PE-Xc/AL/PE-Xc

<b>Fire resistance</b>			
<b>Two collars below the floor</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>
<b>Outer diameter</b>	<b>Wall thickness</b>		
≤ 63	4.5	EI 90-U/C* E 90-U/C*	Henco PE-Xc/AL/PE-Xc
≤ 75	6.0	EI 90-U/C E 90-U/C	Henco PE-Xc/AL/PE-Xc

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Alpex DUO, Valsir Pexal, Valsir Mixal and APE Plain (PE-Xb/AL/PE-Xb);
- Geberit Mepla and Uponor Unipipe (PE-RT/AL/PE-RT);
- Uponor and Henco (PE-Xc/AL/PE-Xc);
- Uponor and REHAU (PE-Xa) and REHAU (PE-Xc);
- SP Superpipe and POLYGON PEX (PE-X/AL/PE-X);
- Valsir Pexal and Valsir Mixal (PE/AL/PE-Xb);
- Wavin Tigris, Protecta-Line System and Alpex F50 Profi (PE-X/AL/PE).



## 5.4.2 With PE-foam insulation

### Aluminium composite pipes

On the next page, drawing RF-MLA\_pr-11.0.22 of the pipe penetration seals with aluminium composite pipes including PE-foam insulation is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.4.2 the installation details regarding the field of application are given.

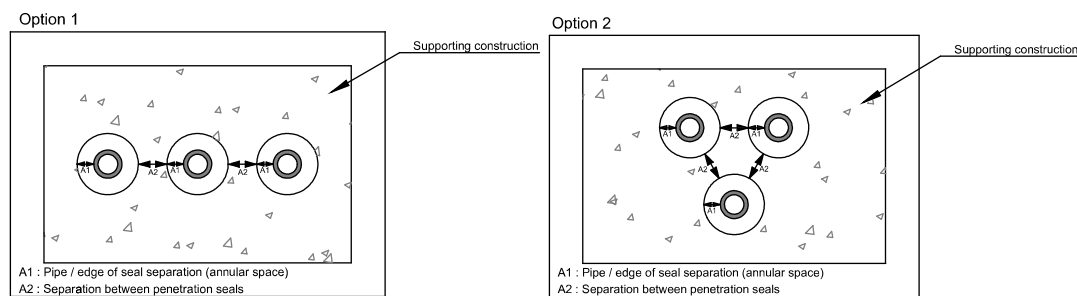
The fire resistance is valid for insulation PE-foam with a reaction to fire class C<sub>L</sub>-s1-d0 in accordance with EN 13501-1 or equal and a thickness of ≤ 6 mm. The insulation must be applied sustained or interrupted through the aperture with a minimum distance of 300 mm on both sides from the point where the pipe emerges from the floor (LS, CS, LI or CI in accordance with Table 1 of EN 1366-3:2009).

### t5.4.2 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 48) Mulcol® Multisealant A both faces	Allowed annular space (distance 'a' in drawing)
≤ 350 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm	Outer diameter ≤ 44 mm, 'a' ≤ 15 mm

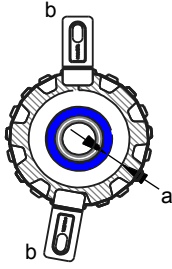
If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 48. The annular gap A<sub>1</sub> is also visible in this Figure.

### f48 Visualization single penetrations



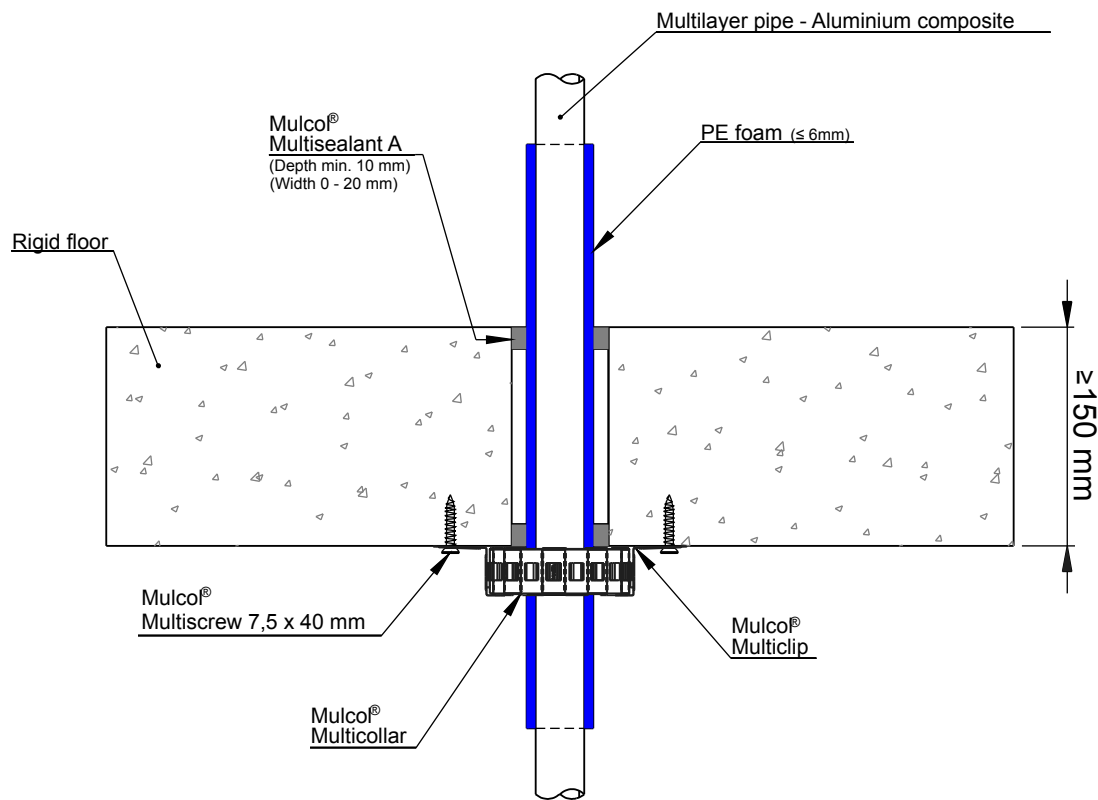
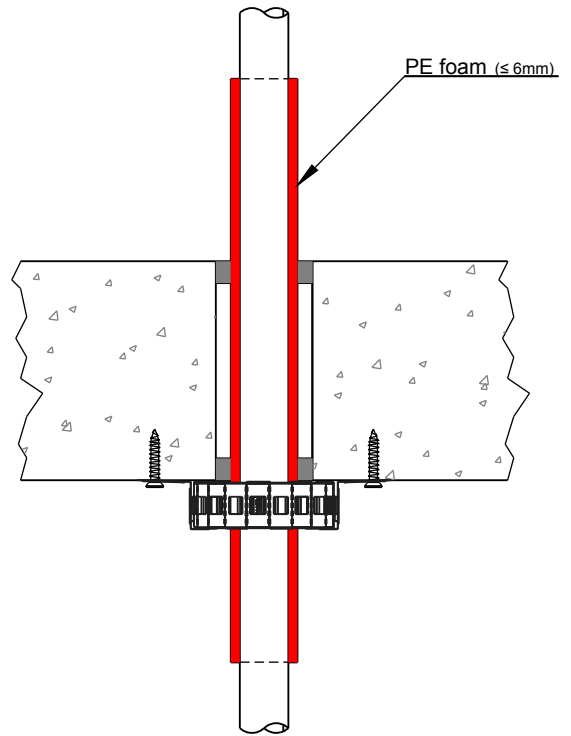
The fire resistance is valid aluminium composite pipes made out of an inner layer of cross-linked polyethylene, a layer aluminium in the middle and a layer of cross-linked polyethylene on top (Henco PE-Xc/AL/PE-Xc).

Front view



a - Annular space  
(Maximum 15 mm between insulation and Mulco® Multicollar)  
b - Mulco® Multiclip

Side view

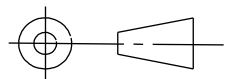


American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-MLA\_pr-11.0.22



Unit of measure : mm

Department : Research & Development

Date : 8-9-2016

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration	Thickness insulation (mm)	Pipe material (or equal)
Outer diameter	Wall thickness			
≤ 32	3.0	EI 120-U/C E 120-U/C	6	Henco PE-Xc/AL/PE-Xc

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Alpex DUO, Valsir Pexal, Valsir Mixal and APE Plain (PE-Xb/AL/PE-Xb);
- Geberit Mepla and Uponor Unipipe (PE-RT/AL/PE-RT);
- Uponor and Henco (PE-Xc/AL/PE-Xc);
- Uponor and REHAU (PE-Xa) and REHAU (PE-Xc);
- SP Superpipe and POLYGON PEX (PE-X/AL/PE-X);
- Valsir Pexal and Valsir Mixal (PE/AL/PE-Xb);
- Wavin Tigris, Protecta-Line System and Alpex F50 Profi (PE-X/AL/PE).

### 5.4.3 With elastomeric thermal insulation

Aluminium composite pipes

On the next page, drawing RF-MLA-11.0.22 of the pipe penetration seals with aluminium composite pipes with elastomeric thermal insulation is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.4.3 the installation details regarding the field of application are given.

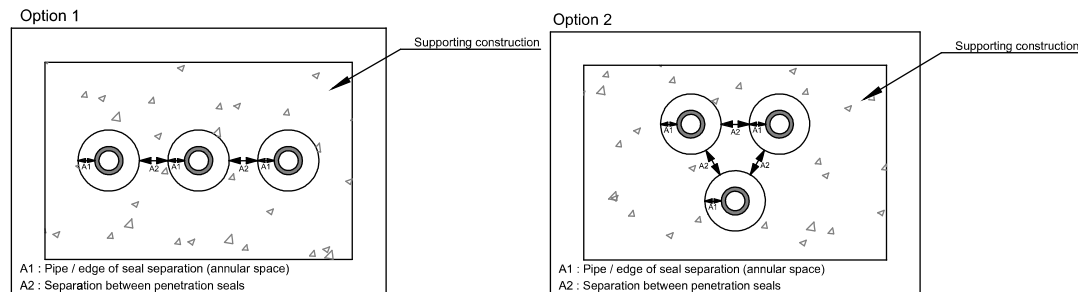
The fire resistance is valid for insulation AF/Armaflex made out of flexible elastomeric EPDM rubber foam with a reaction to fire class B<sub>L</sub>-s3, d0 or B-s3, d0 (or equal or better) in accordance with EN 13501-1. The insulation must be applied sustained or interrupted through the aperture with a minimum distance of 450 mm on both sides from the point where the pipe emerges from the floor (LS, CS, LI or CI in accordance with Table 1 of EN 1366-3:2009).

#### t5.4.3 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap		Allowed annular space (distance 'a' in drawing)	
	Mulcol® Multisealant A both faces	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 350 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm		

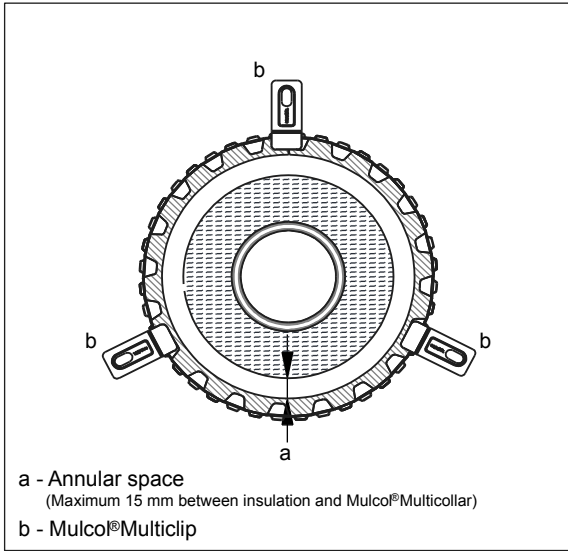
If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 49. The annular gap A<sub>1</sub> is also visible in this Figure.

#### f49 Visualization single penetrations

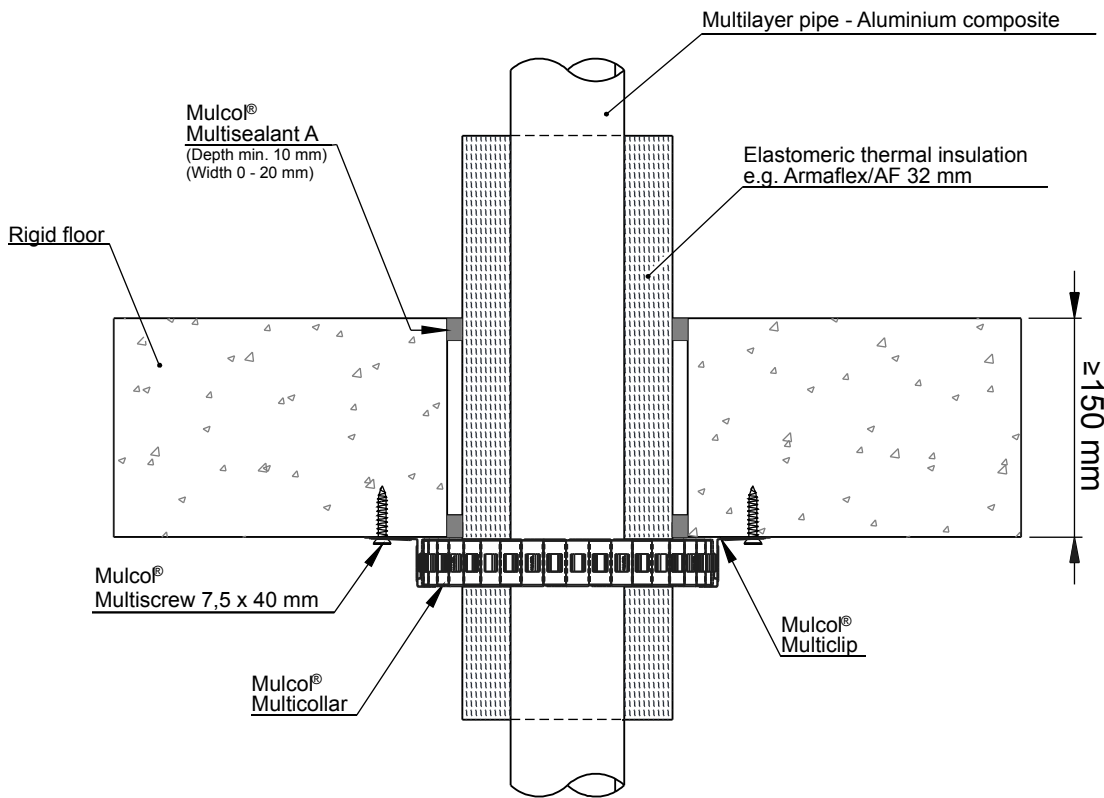
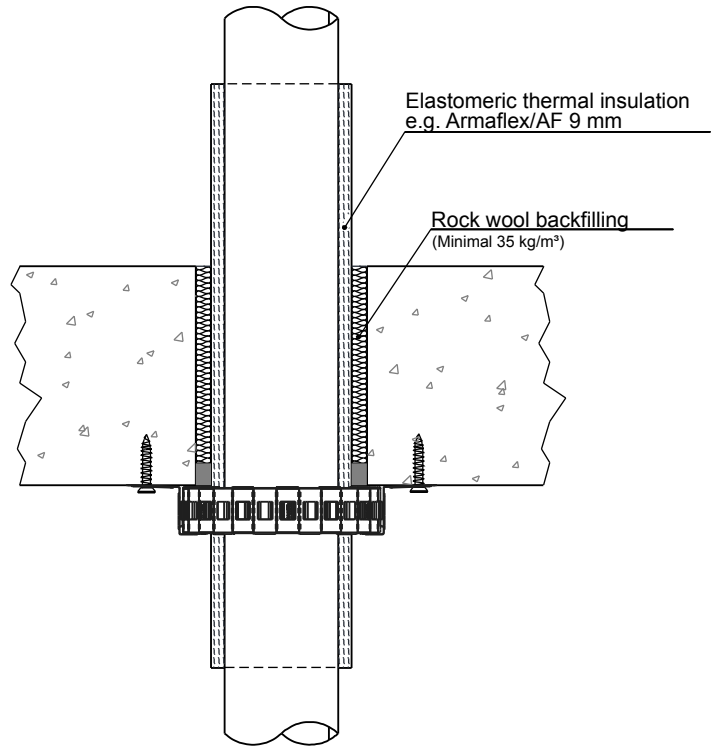


The fire resistance is valid aluminium composite pipes made out of an inner layer of cross-linked polyethylene, a layer aluminium in the middle and a layer of cross-linked polyethylene on top (Henco PE-Xc/AL/PE-Xc, Uponor PE-RT/AL/PE-RT).

Front view



Side view

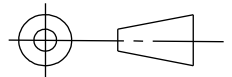


American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-MLA-11.0.22



Unit of measure : mm

Department : Research & Development

Date : 27-9-2016

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration	Thickness insulation (mm)	Pipe material (or equal)
Outer diameter	Wall thickness			
≤ 16 / ≤ 20*	2.0	EI 120-U/C* E 120-U/C*	9* to 32*	Henco PE-Xc/AL/PE-Xc
≤ 25	3.5	EI 120-U/C* E 120-U/C*	9* to 32*	Uponor PE-Xa Aqua Pipe
≤ 32	3.0	EI 120-U/C E 120-U/C	9 to 32	Henco PE-Xc/AL/PE-Xc
≤ 40	3.5	EI 120-U/C* E 120-U/C*	9* to 32*	
≤ 40	4.0	EI 120-U/C* E 120-U/C*	9* to 32*	Uponor PE-RT/AL/PE-RT
≤ 50	4.0	EI 120-U/C* E 120-U/C*	9* to 32*	Henco PE-Xc/AL/PE-Xc
≤ 63	4.5	EI 120-U/C* E 120-U/C*	9* to 32*	Alpex Duo PE-Xb/AL/PE-Xb
≤ 75	6.0	EI 120-U/C E 120-U/C	9 to 32	Henco PE-Xc/AL/PE-Xc
≤ 90	7.0	EI 90-U/C* E 120-U/C*	9* to 32*	
≤ 90	7.0	EI 120-U/C E 120-U/C	32	
≤ 110	10.0	EI 90-U/C* E 90-U/C*	9 to 32*	Uponor PE-RT/AL/PE-RT

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Alpex DUO, Valsir Pexal, Valsir Mixal and APE Plain (PE-Xb/AL/PE-Xb);
- Uponor and Geberit Mepla (PE-RT/AL/PE-RT);
- Uponor and Henco (PE-Xc/AL/PE-Xc);
- Uponor and REHAU (PE-Xa) and REHAU (PE-Xc);
- SP Superpipe and POLYGON PEX (PE-X/AL/PE-X);
- Valsir Pexal and Valsir Mixal (PE/AL/PE-Xb);
- Wavin Tigris, Protecta-Line System and Alpex F50 Profi (PE-X/AL/PE).



Based upon an assessment concerning different insulation materials it is expected that the fire resistances given above will also be met for penetration seals fitted with insulation of the following types (the insulation dimensions shall correspond to the dimensions in the table):

- AF/Armaflex;
- SH/Armaflex for outer pipe diameters  $\leq \varnothing 39$  mm;
- Kaiflex ST and Kaiflex KKplus s2;
- K-Flex EC, K-Flex EC AD, K-Flex EC, K-Flex ST, K-Flex ST/SK, K-Flex ST Frigo, K-Flex SRC and K-Flex SRC Eco.

## 5.4.4 With PE-conduit insulation

### Aluminium composite pipes

On the next page, drawing FW-MLA-10.0.30 of the pipe penetration seals with aluminium composite pipes with PE-conduit insulation (outer diameter  $\varnothing 40$  mm) is given for the pipes fitted with one Mulcol<sup>®</sup> Multicollar Slim placed below the floor. In Table 5.4.4 the installation details regarding the field of application are given.

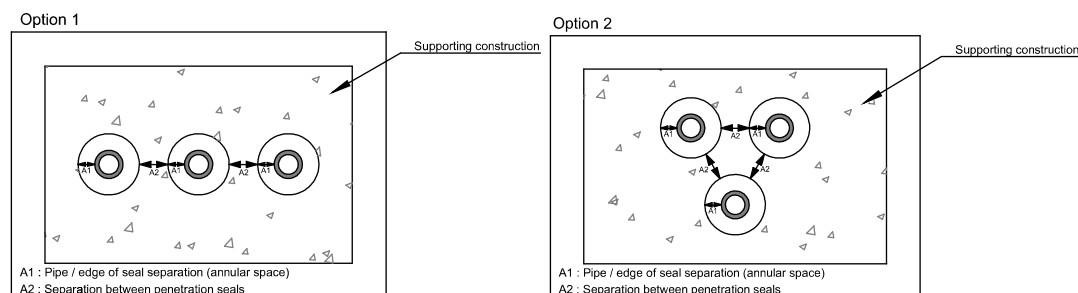
The PE-conduit insulation with an outer diameter of  $\varnothing 40$  mm must be applied sustained through the aperture with a minimum distance of 50 mm on both sides from the point where the pipe emerges from the floor (LS in accordance with Table 1 of EN 1366-3:2009). The insulation may also be applied continued (CS).

#### t5.4.4 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap (distance $A_1$ , see Figure 50) Mulcol <sup>®</sup> Multimortar or equal (mortar EN 13501-1: class A1)	Allowed annular space (distance 'a' in drawing)
$\leq 350$ mm	Annular gap $\geq 10$ mm / depth fully filled	Outer diameter $\leq 40$ mm, 'a' $\leq 15$ mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 50. The annular gap  $A_1$  is also visible in this Figure.

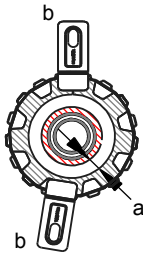
#### f50 Visualization single penetrations



The fire resistance is valid aluminium composite pipes made out of an inner layer of cross-linked polyethylene, a layer aluminium in the middle and a layer of cross-linked polyethylene on top (Henco PE-Xc/AL/PE-Xc).

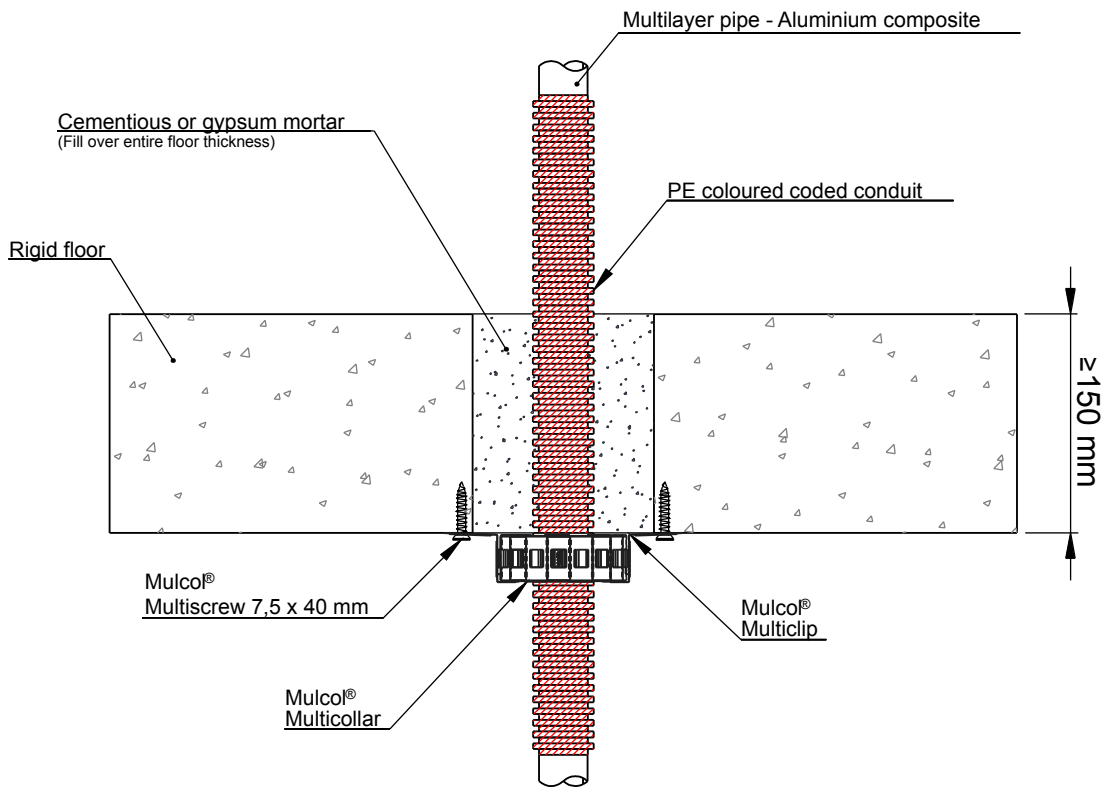
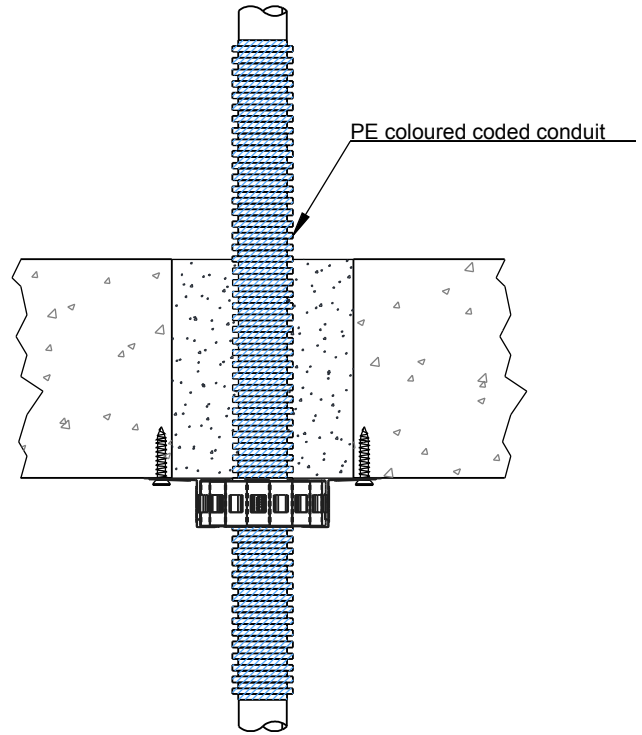


Front view

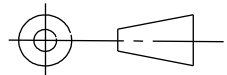


a - Annular space  
(Maximum 15 mm between conduit and Mulco® Multicollar)  
b - Mulco® Multiclip

Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 27-9-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-MLA-11.0.30

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance</b>			
<b>Wavin flexible PE-conduit ≤ Ø40 mm (or equal)</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>
<b>Outer diameter</b>	<b>Wall thickness</b>		
<b>≤ 32</b>	<b>3.0</b>	<b>EI 120-U/C*</b> <b>E 120-U/C*</b>	<b>Henco</b> <b>PE-Xc/AL/PE-Xc</b>

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Alpex DUO, Valsir Pexal, Valsir Mixal and APE Plain (PE-Xb/AL/PE-Xb);
- Geberit Mepla and Uponor Unipipe (PE-RT/AL/PE-RT);
- Uponor and Henco (PE-Xc/AL/PE-Xc);
- Uponor and REHAU (PE-Xa) and REHAU (PE-Xc);
- SP Superpipe and POLYGON PEX (PE-X/AL/PE-X);
- Valsir Pexal and Valsir Mixal (PE/AL/PE-Xb);
- Wavin Tigris, Protecta-Line System and Alpex F50 Profi (PE-X/AL/PE).

Based upon an assessment concerning different conduit materials it is expected that the fire resistances given above will also be met for penetration seals with GEWA flexible HD-PE-conduits (the conduit dimensions shall correspond to the dimensions in the table).

## 5.5 PP-R multilayer pipes

In this Chapter the expected fire resistance and field of application of PP-R multilayer pipes in several different applications is summarized.

### 5.5.1 Without insulation

*PP-R multilayer pipes*

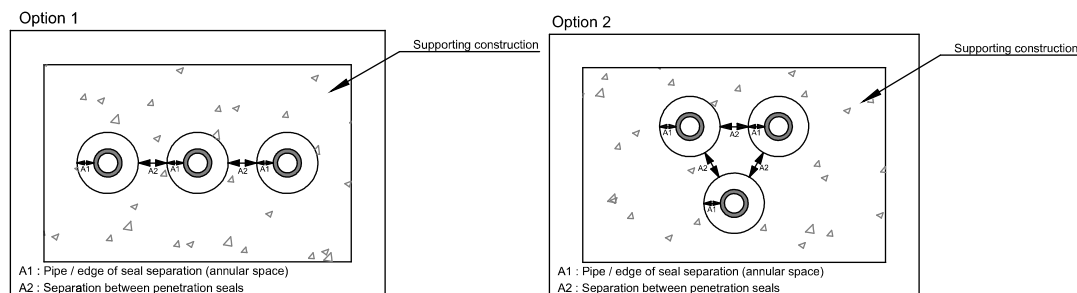
On the next pages, drawings RF-MLF-11.0.10 and RF-MLF-21.0.10 of the pipe penetration seals with PP-R multilayer pipes is given for the pipes fitted with one or two Mulcol® Multicollar Slim placed below the floor. In Table 5.5.1 the installation details regarding the field of application are given.

#### t5.5.1 Installation details

Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 51)		Allowed annular space (distance 'a' in drawing)	
		Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A both faces	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 450 mm	Thickness ≤ 4 mm / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth ≥ 10 mm	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm

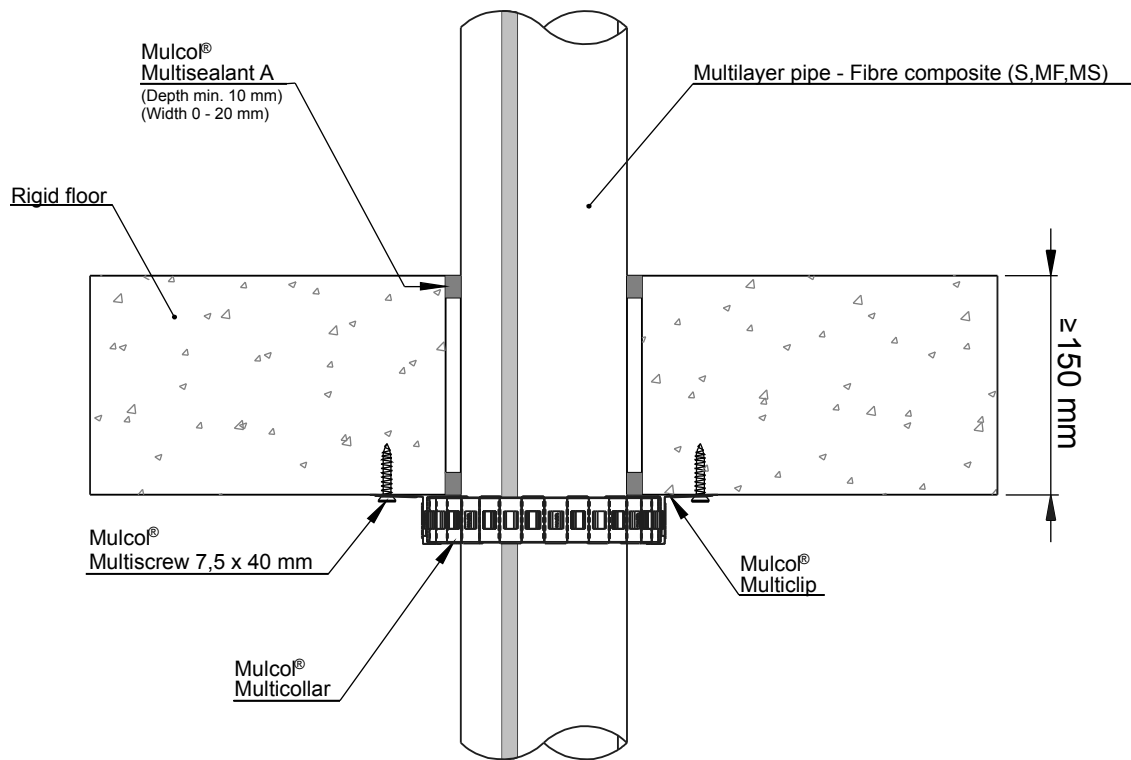
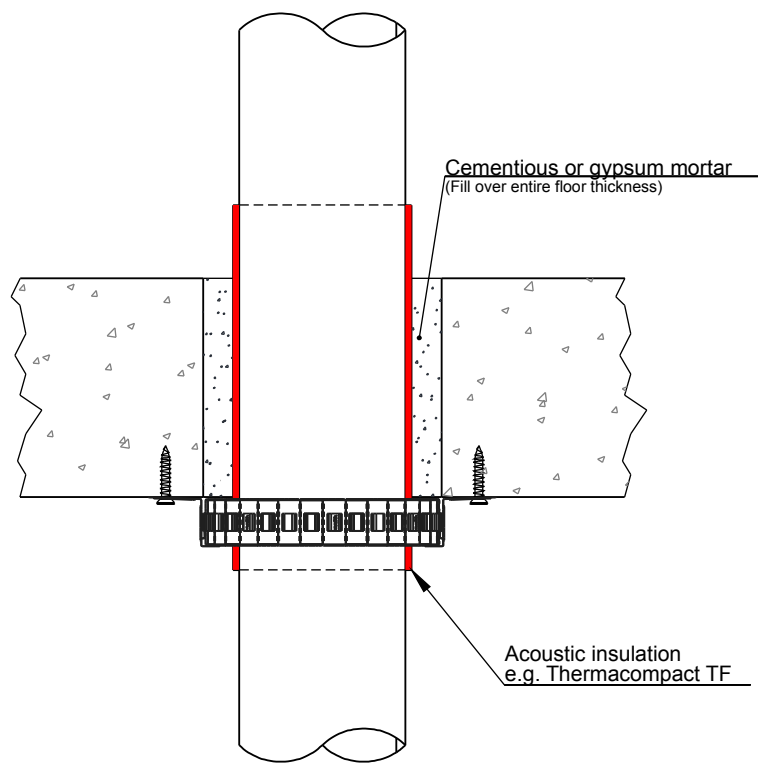
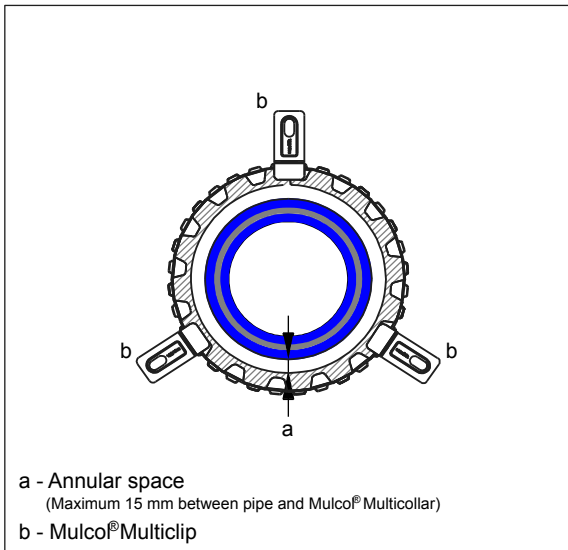
If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 51. The annular gap A<sub>1</sub> is also visible in this Figure.

#### f51 Visualization single penetrations



Front view

Side view

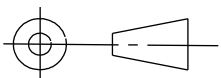


American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-MLF-11.0.10



Unit of measure : mm

Department : Research & Development

Date : 26-9-2016

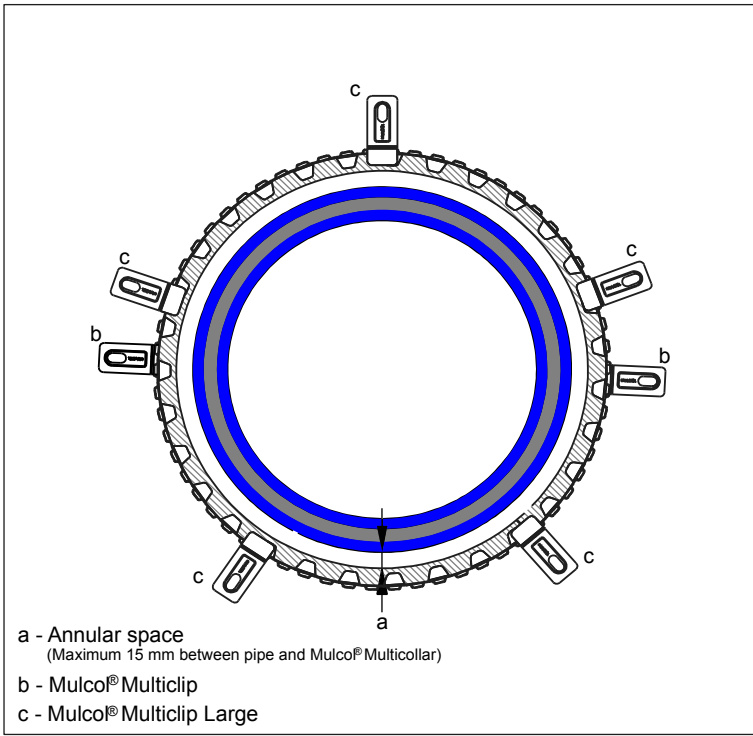
Draftsman : K.J.

A4

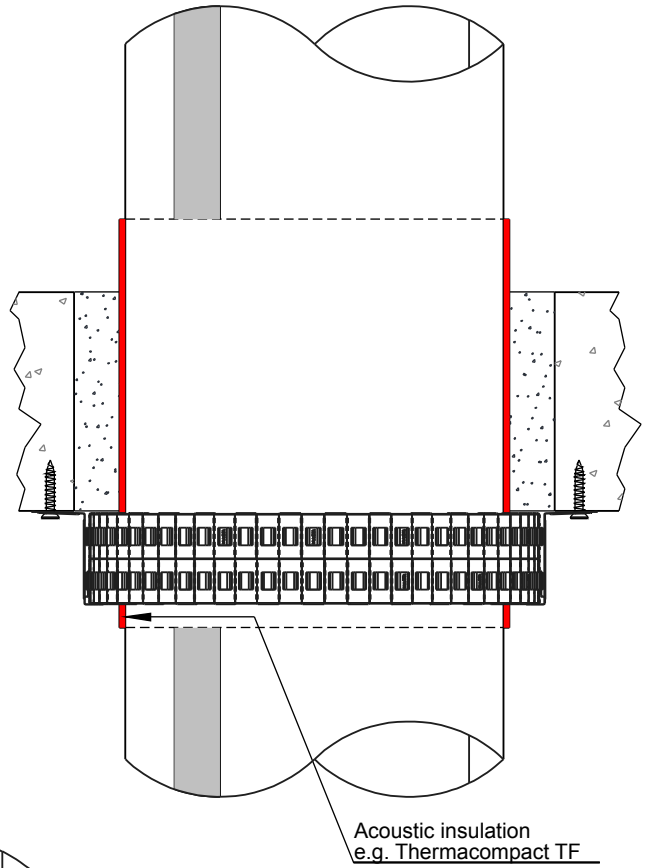


**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

Front view



Side view



Cementitious or gypsum mortar  
(Fill over entire floor thickness)

Rigid floor

Mulco®  
Multiscrew 7,5 x 40 mm

Double Mulco®  
Multicollar

Multilayer pipe - Fibre composite (S,MF,MS)

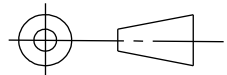
Mulco®  
Multiclip Large

American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-MLF-21.0.10



Unit of measure : mm

Department : Research & Development

Date : 8-12-2016

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

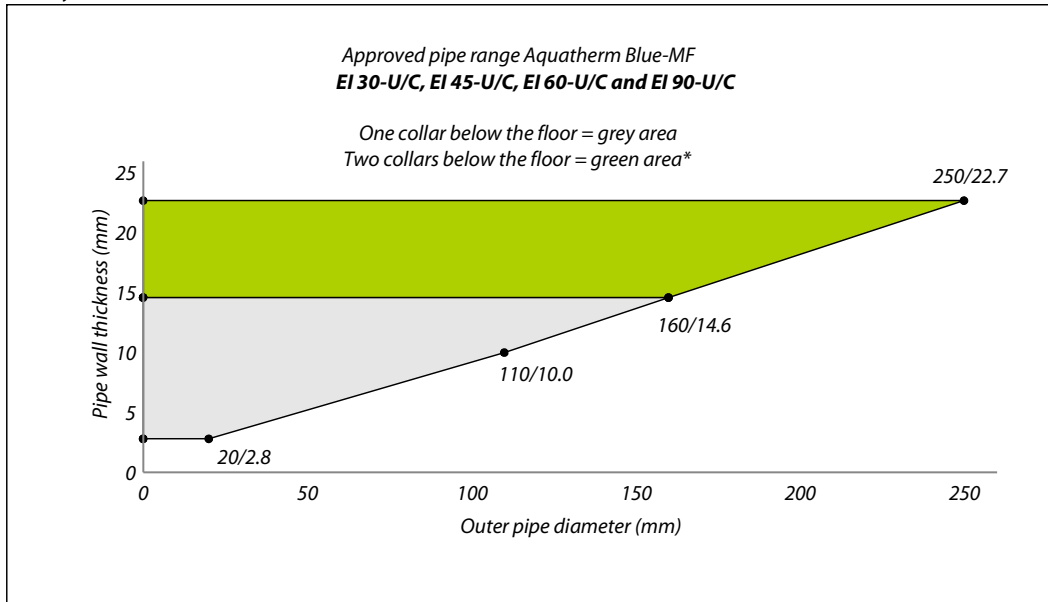
<b>Fire resistance PP-R multilayer One collar below the floor</b>				
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>	<b>See Figure</b>
<b>Outer diameter</b>	<b>Wall thickness</b>			
≤ 20	2.8	EI 120-U/C E 120-U/C	Aquatherm Blue-MF	53
≤ 110	10.0	EI 120-U/C E 120-U/C	Aquatherm Blue-MF	53
≤ 160	14.6	EI 90-U/C E 90-U/C	Aquatherm Blue-MF	52
≤ 110	15.1	EI 120-U/C E 120-U/C	Aquatherm Red-MF	N.a.

<b>Fire resistance PP-R multilayer Two collars below the floor</b>				
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>	<b>See Figure</b>
<b>Outer diameter</b>	<b>Wall thickness</b>			
≤ 250	22.7	EI 120-U/C E 120-U/C	Aquatherm Blue-MF	53

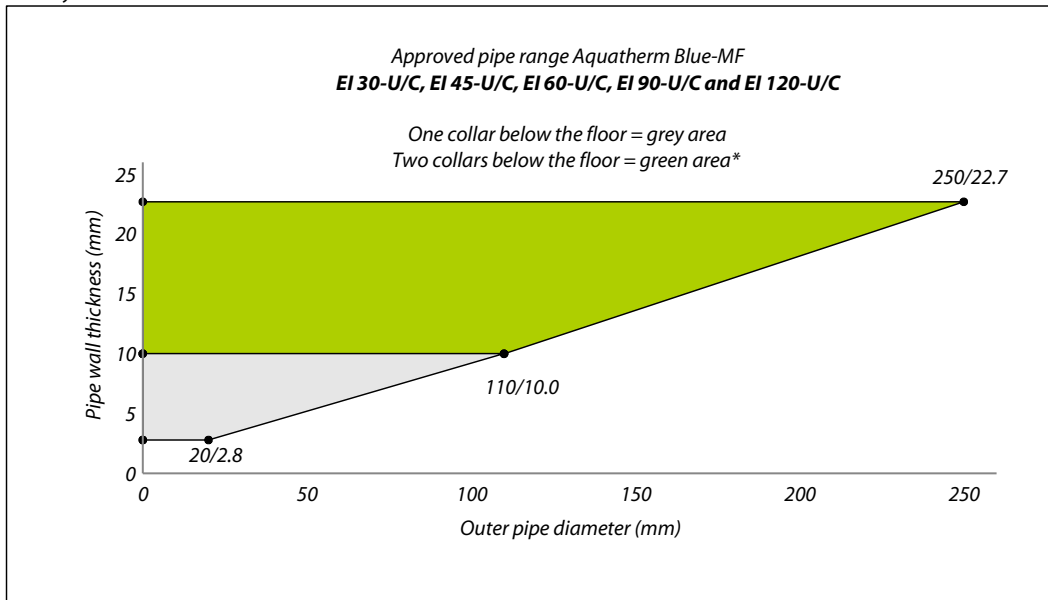
Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Aquatechnik Fusio PP-R 80, Aquatechnik Fusio PP-RCT;
- Aquatherm Blue-MF, Aquatherm Blue-S, Aquatherm Red-MF, Aquatherm Green-MF, Aquatherm Green-MS, Aquatherm Green-S, Aquatherm Lilac-S, Aquatherm Grey-MS and Aquatherm Orange M;
- Bänninger PP-R, Bänninger Climatec PP-RCT and Bänninger Watertec PP-RCT.

f52 Validity area



f53 Validity area



## 5.5.2 Without insulation through a seal penetration system

PP-R multilayer pipes

On the next page, drawing PBrf-MLF-11.0.10 of the pipe penetration seals with PP-R multilayer pipes without insulation through a seal penetration system is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the seal. In Table 5.5.2 the installation details regarding the field of application are given.

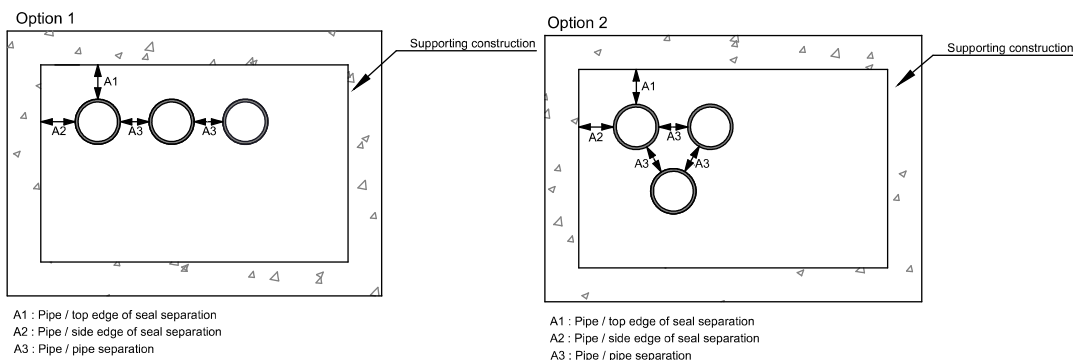
For multiple penetrations, the use of the Mulcol® Multimastic FB1 (2 x 50 mm) penetration seal system is recommended. A cavity of maximum 50 mm between the rock wool panels may be present. The aperture size in the floor may be up to 2400 mm long and 1200 mm wide. For further details see Paragraph 5.1.5.

### t5.5.2 Installation details

Distance to first pipe support above the floor	Distance between pipes (A <sub>1</sub> to A <sub>3</sub> , see Figure 54)	Allowed filling of annular gap		Allowed annular space (distance 'a' in drawing)
		Mulcol® Multisealant SP on both faces, with backing rock wool ≥ 35 kg/m <sup>3</sup>	No filling	
≤ 450 mm	≥ 100 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Approximately the same size as the pipe (tight fit)	Outer diameter ≤ 110 mm, 'a' ≤ 15 mm

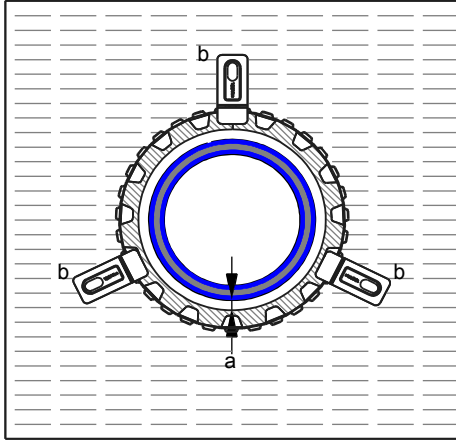
If more pipe penetrations are placed in the penetration seal system, the minimum distance between the pipes is 100 mm, distances A<sub>1</sub> to A<sub>3</sub> Figure 54 (the presence of ≥ 60 mm of rock wool between the pipes is mandatory).

### f54 Visualization distance between pipes



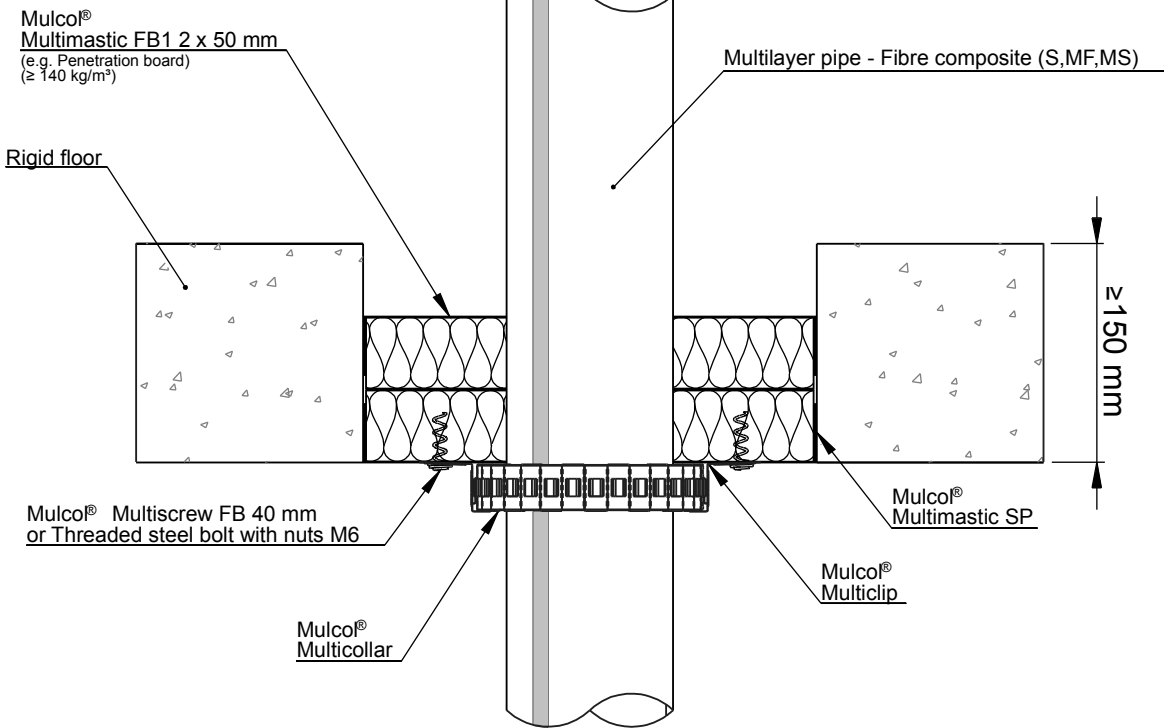
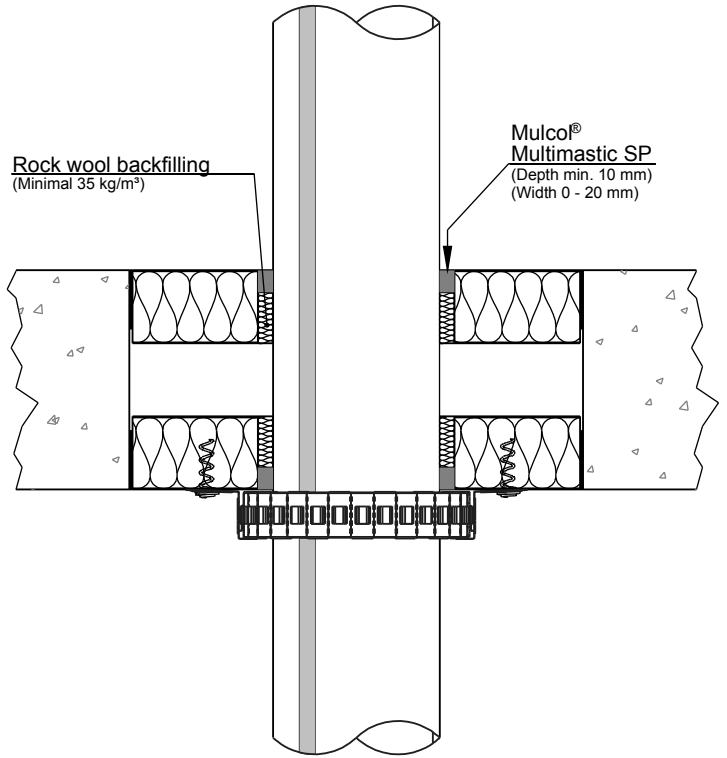


Front view



a - Annular space  
(Maximum 15 mm between pipe and Mulco® Multicollar)  
b - Mulco® Multiclip

Side view

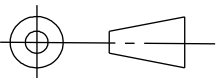


American projection

Scale : 1:5

Company : Mulcol International B.V.

PBrf-MLF-11.0.10



Unit of measure : mm

Department : Research & Development

Date : 9-12-2016

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance</b>			
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>
<b>Outer diameter</b>	<b>Wall thickness</b>		
<b>≤ 50</b>	<b>6.9</b>	<b>EI 90-U/C E 90-U/C</b>	<b>Aquatherm Green-MF</b>
<b>≤ 110</b>	<b>10.0</b>	<b>EI 120-U/C* E 120-U/C*</b>	<b>Aquatherm Blue-MF</b>

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Aquatechnik Fusio PP-R 80, Aquatechnik Fusio PP-RCT;
- Aquatherm Blue-S, Aquatherm Blue-MF, Aquatherm Red-M, Aquatherm Green-MS, Aquatherm Green-MF, Aquatherm Green-S, Aquatherm Lilac-S, Aquatherm Grey-MS and Aquatherm Orange M;
- Bänninger PP-R, Bänninger Climatec PP-RCT and Bänninger Watertec PP-RCT.

### 5.5.3 Without insulation in corner

PP-R multilayer pipes

On the next page, drawing RF-MLF-31.0.10 of the pipe penetration seals with PP-R multilayer pipes placed in a corner is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.5.3 the installation details regarding the field of application are given.

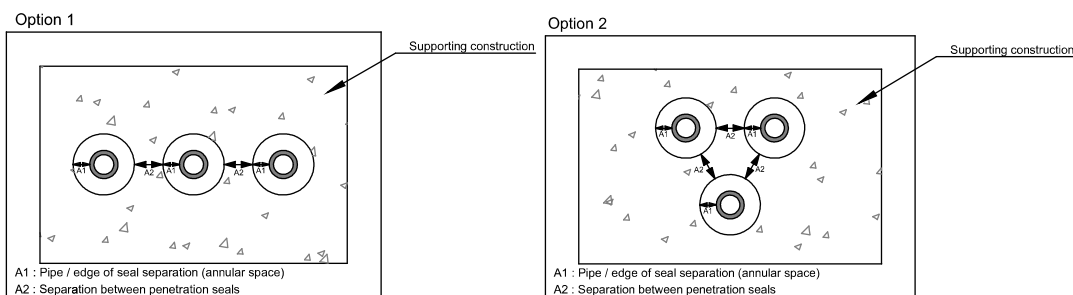
#### t5.5.3 Installation details

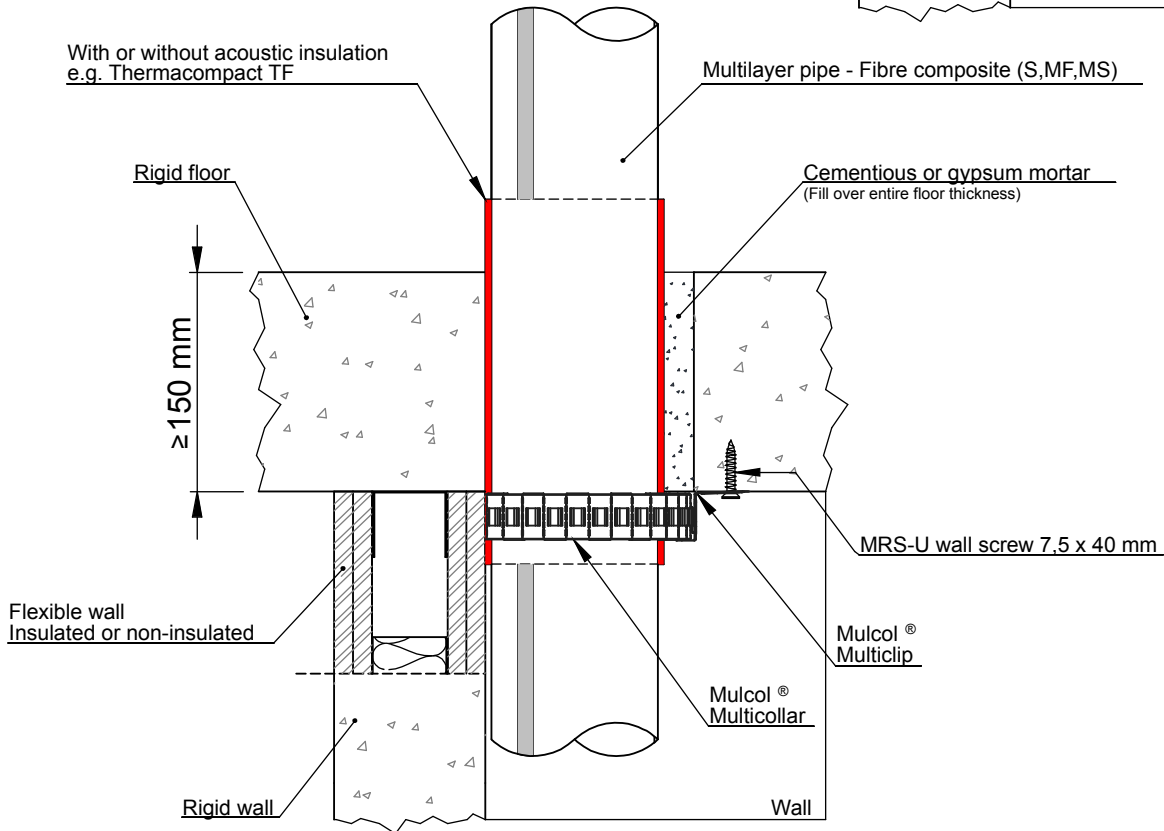
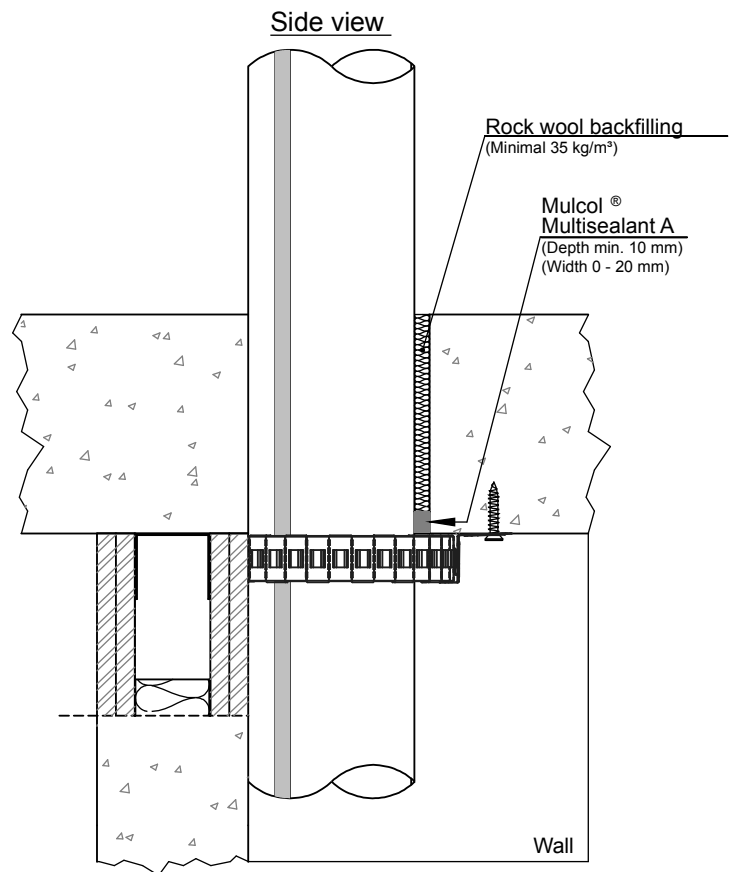
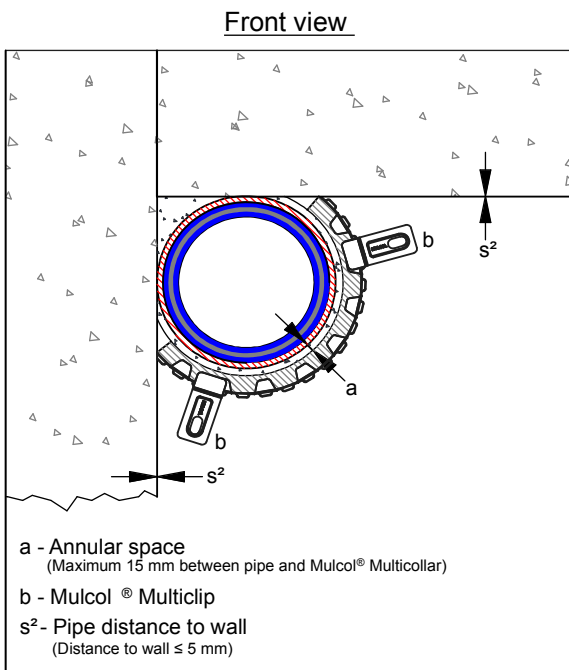
Distance to first pipe support above the floor	Sound decoupling insulation allowed	Allowed filling of annular gap (distance $A_1$ , see Figure 55)		Allowed distance to element (distance $s^2$ in drawing)	Allowed annular space (distance 'a' in drawing)
		Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool $\geq 35 \text{ kg/m}^3$ unexposed face		
$\leq 450 \text{ mm}$	Thickness $\leq 4 \text{ mm}$ / minimum insulation length 50 mm (LS/CS/LI/CI)	Annular gap $\geq 10 \text{ mm}$ / depth fully filled	Annular gap $\leq 20 \text{ mm}$ / depth sealant $\geq 10 \text{ mm}$	$\leq 5 \text{ mm}$	Outer diameter $\leq 110 \text{ mm}$ , 'a' $\leq 15 \text{ mm}$

The fixing of the Mulcol® Multicollar Slim must be done by two Mulcol® Multiclips. The pipe may be applied against a rigid or flexible wall.

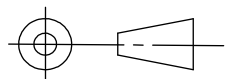
If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 55. The annular gap  $A_1$  is also visible in this Figure.

#### f55 Visualization single penetrations





American projection



Scale : 1:5

Unit of measure : mm

Date : 4-1-2017

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-MLF-31.0.10

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration	Pipe material (or equal)	Location
Outer diameter	Wall thickness			
≤ 110	10.0	EI 90-U/C E 90-U/C	Aquatherm Blue-MF	In corner

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Aquatechnik Fusio PP-R 80, Aquatechnik Fusio PP-RCT;
- Aquatherm Blue-S, Aquatherm Blue-MF, Aquatherm Red-MF, Aquatherm Green-MF, Aquatherm Green-MS, Aquatherm Green-S, Aquatherm Lilac-S, Aquatherm Grey-MS and Aquatherm Orange M;
- Bänninger PP-R, Bänninger Climatec PP-RCT and Bänninger Watertec PP-RCT.

## 5.5.4 With elastomeric thermal insulation

PP-R multilayer pipes

On the next page, drawing RF-MLF-11.0.22 of the pipe penetration seals with PP-R multilayer pipes with elastomeric thermal insulation is given for the pipes fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.5.4 the installation details regarding the field of application are given.

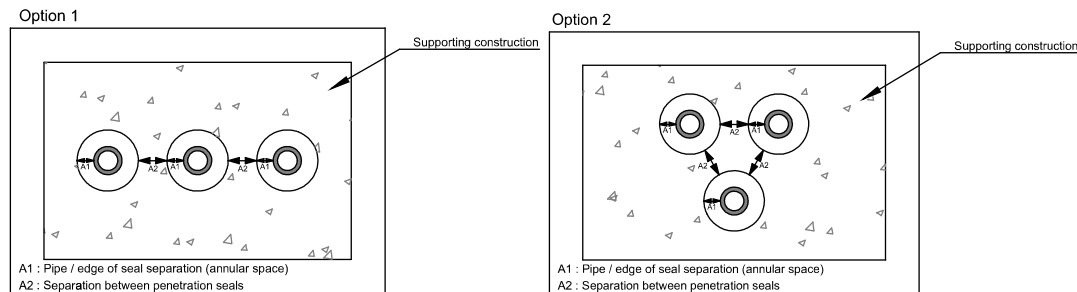
The fire resistance is valid for insulation AF/Armaflex made out of flexible elastomeric EPDM rubber foam with a reaction to fire class B<sub>L</sub>-s3, d0 or B-s3, d0 (or equal or better) in accordance with EN 13501-1. The insulation must be applied sustained or interrupted through the aperture with a minimum distance of 300 mm on both sides from the point where the pipe emerges from the floor (LS, CS, LI or CI in accordance with Table 1 of EN 1366-3:2009).

### t5.5.4 Installation details

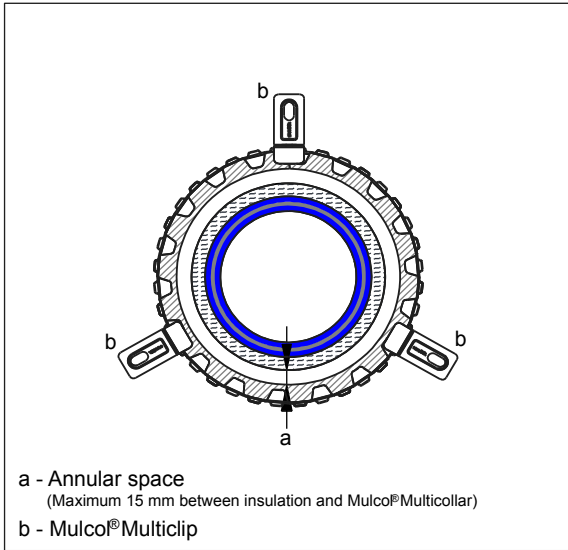
Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 56)		Allowed annular space (distance 'a' in drawing)	
	Mulcol® Multimortar or equal (mortar EN 13501-1: class A1)	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 450 mm	Annular gap ≥ 10 mm / depth fully filled	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm		

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 56. The annular gap A<sub>1</sub> is also visible in this Figure.

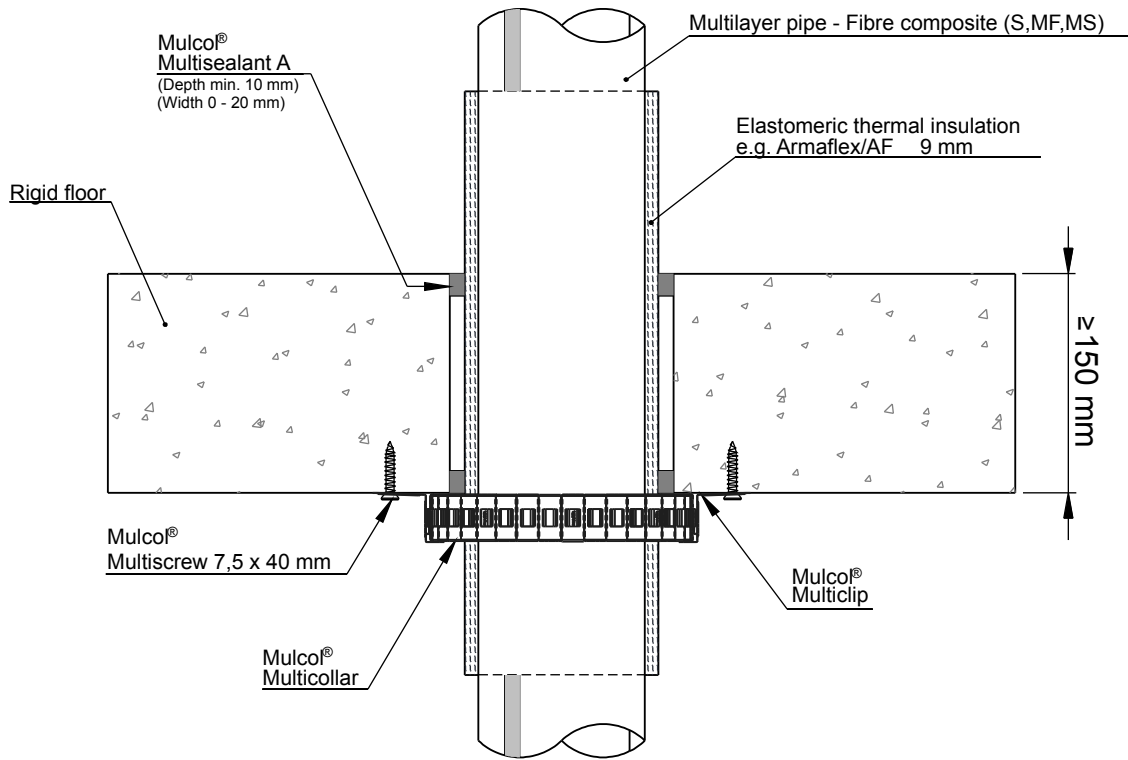
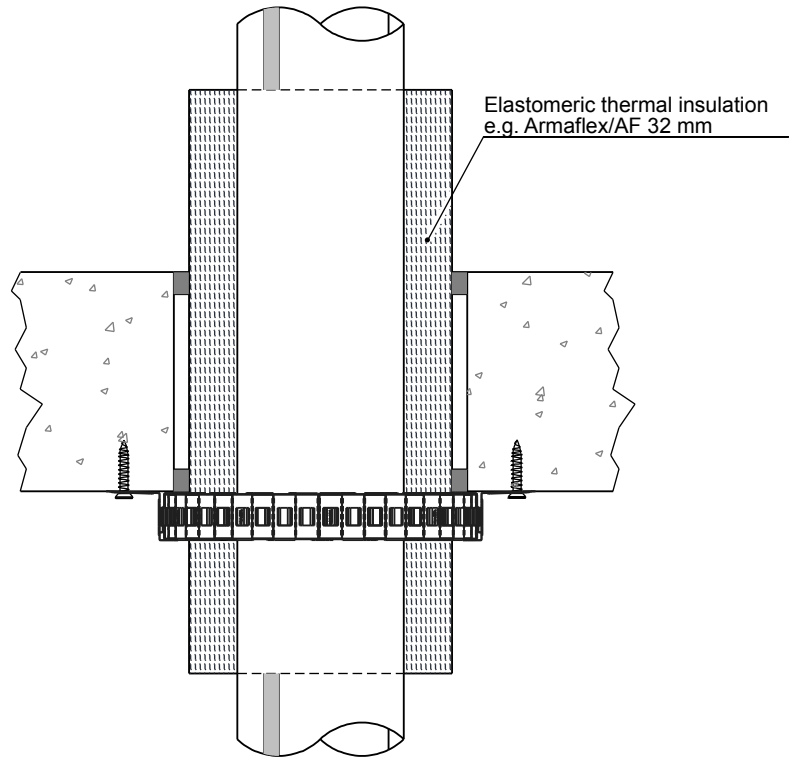
### f56 Visualization single penetrations



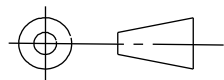
Front view



Side view



American projection



Scale : 1:5  
 Unit of measure : mm  
 Date : 8-9-2016

Company : Mulcol International B.V.  
 Department : Research & Development  
 Draftsman : K.J.

RF-MLF-11.0.22  
 A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

<b>Fire resistance</b>				
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Thickness insulation (mm)</b>	<b>See Figure</b>
<b>Outer diameter</b>	<b>Wall thickness</b>			
<b>Aquatherm Green-S</b>				
≤ 110	18.3	EI 120-U/C E 120-U/C	9* to 32	57
<b>Aquatherm Green-MS</b>				
≤ 110	15.2	EI 120-U/C E 120-U/C	9* to 32	57
<b>Aquatherm Green-MF</b>				
≤ 110	15.1	EI 120-U/C E 120-U/C	9* to 32	57
<b>Aquatherm Blue-MF</b>				
≤ 20	2.8	EI 120-U/C E 120-U/C	9 to 32*	57
≤ 110	10.0	EI 120-U/C E 120-U/C	9 to 32	57

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

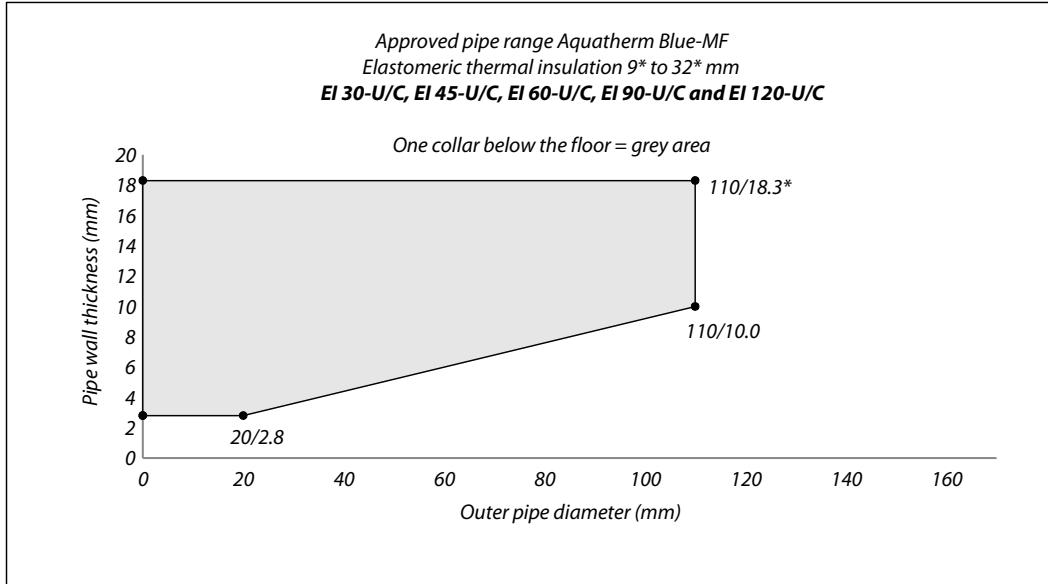
- Aquatechnik Fusio PP-R 80, Aquatechnik Fusio PP-RCT;
- Aquatherm Blue-S, Aquatherm Blue-MF, Aquatherm Blue-MS, Aquatherm Green-S, Aquatherm Green-MF Aquatherm Green-MS, Aquatherm Red-MF, Aquatherm Lilac-S, Aquatherm Grey-MS and Aquatherm Orange M;
- Bänninger PP-R, Bänninger Climatec PP-RCT and Bänninger Watertec PP-RCT.

Based upon an assessment concerning different insulation materials it is expected that the fire resistances given above will also be met for penetration seals fitted with insulation of the following types (the insulation dimensions shall correspond to the dimensions in the table):

- AF/Armaflex;
- SH/Armaflex for outer pipe diameters ≤ Ø39 mm;
- Kaiflex ST and Kaiflex KKplus s2;
- K-Flex EC, K-Flex EC AD, K-Flex EC, K-Flex ST, K-Flex ST/SK, K-Flex ST Frigo, K-Flex SRC and K-Flex SRC Eco.



f57 Validity area



## 5.6 Several different pipes in a multiple penetration

In this Chapter the expected fire resistance and field of application of pipes in multiple penetrations in several different applications is summarized.

### 5.6.1 In a multiple penetration without insulation (3 different pipes)

*Several different pipes*

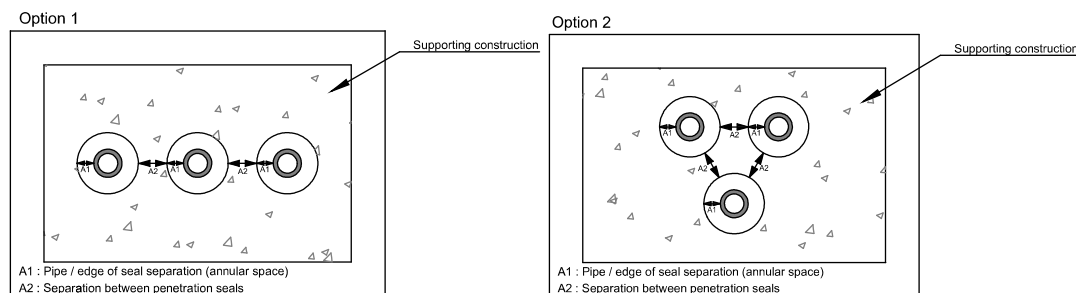
On the next page, drawing RF-MLP3-21.0.10 of the multiple pipe penetration seals without insulation with aluminium composite pipes, PP-R multilayer pipes, plastic pipes, electric cables and telecommunication cables fitted with two Mulcol® Multicollar Slim placed below the floor. In Table 5.6.1 the installation details regarding the field of application are given.

#### t5.6.1 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap (distance $A_1$ , see Figure 58) Mulcol® Multisealant A both faces	Distance between the pipes (distance $s^1$ in drawing)	Allowed annular space (distance 'a' in drawing)
PE-HD / PE / ABS / SAN+PVC / PP-R multilayer ≤ 450 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm	≤ 15 mm	Outer diameter ≤ 90 mm / 'a' ≤ 15 mm
Aluminium composite ≤ 350 mm			

If more multiple pipe penetrations are placed in the wall, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 58. The annular gap  $A_1$  is also visible in this Figure.

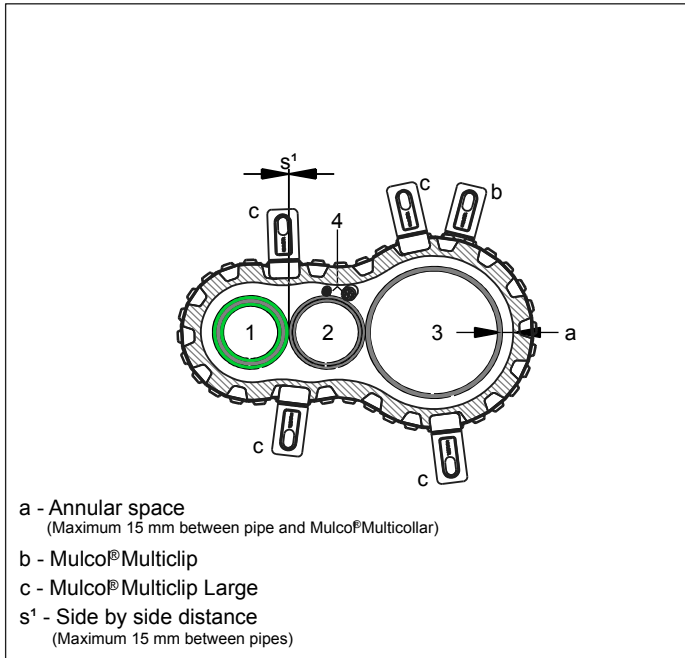
#### f58 Visualization single penetrations



The fire resistance is valid aluminium composite pipes made out of an inner layer of cross-linked polyethylene, a layer aluminium in the middle and a layer of cross-linked polyethylene on top (Henco PE-Xc/AL/PE-Xc).

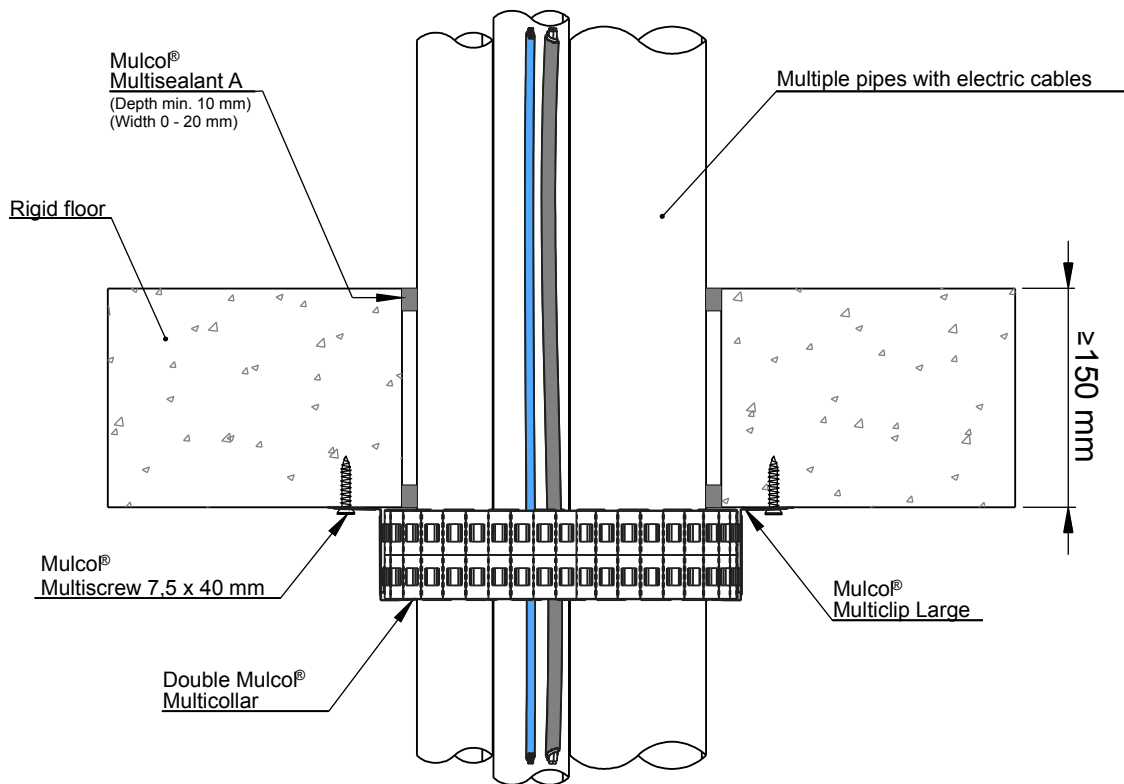
The fixing of the Mulcol® Multicollar Slim must be done by four Mulcol® Multiclips.

Front view

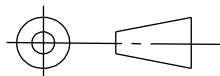


**Multiple pipe construction consisting of the following pipes:**

- 1 - Multilayer pipe - Fibre composite  
e.g. Aquatherm green pipe PP-R/GF7/E MF
- 2 - Multilayer pipe - Aluminium composite  
e.g. Henco PE-Xc/Al/PE-Xc
- 3 - Plastic pipe  
e.g. Agru PE-HD
- 4 - Electric cables  
e.g. UTP Cable Cat. 5, UTP Cable Cat. 6, YMKV 3 x 2,5 mm,  
YMKV Cable 5 x 1,5 mm or YMKV Cable 5 x 2,5 mm



American projection



Scale : 1:5  
Unit of measure : mm  
Date : 18-1-2017

Company : Mulcol International B.V.  
Department : Research & Development  
Draftsman : K.J.

RF-MLP3-21.0.10

A4



**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance Multiple penetration</b>				
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>		<b>Material</b>
<b>Outer diameter</b>	<b>Wall thickness</b>			
≤ 90	2.8	EI 120-U/U* E 120-U/U*	EI 120-U/C* E 120-U/C*	PE-HD / PE / ABS / SAN+PVC
≤ 50	4.0	EI 120-U/C* E 120-U/C*		Henco PE-Xc/AL/PE-Xc
≤ 50	6.9	EI 120-U/C* E 120-U/C*		Aquatherm Green-MF
<b>Cable</b>	<b>Amount</b>	<b>Performance class</b>		<b>Type</b>
<b>Telecommunication</b>	1	EI 120* E 120*		<b>UTP Cat. 5 or Cat. 6</b>
<b>Sheathed cable</b>	1			<b>YMKV 3 x 2.5 mm<sup>2</sup>, YMKV 5 x 1.5 mm<sup>2</sup> or YMKV 5x 2.5 mm<sup>2</sup></b>

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Aquatechnik Fusio PP-R 80, Aquatechnik Fusio PP-RCT;
- Aquatherm Blue-MF, Aquatherm Blue-S, Aquatherm Red-MF, Aquatherm Green-MF, Aquatherm Green-MS, Aquatherm Green-S, Aquatherm Lilac-S, Aquatherm Grey-MS and Aquatherm Orange M;
- Bänninger PP-R, Bänninger Climatec PP-RCT and Bänninger Watertec PP-RCT.

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Alpex DUO, Valsir Pexal, Valsir Mixal and APE Plain (PE-Xb/AL/PE-Xb);
- Geberit Mepla and Uponor Unipipe (PE-RT/AL/PE-RT);
- Uponor and Henco (PE-Xc/AL/PE-Xc);
- Uponor and REHAU (PE-Xa) and REHAU (PE-Xc);
- SP Superpipe and POLYGON PEX (PE-X/AL/PE-X);
- Valsir Pexal and Valsir Mixal (PE/AL/PE-Xb);
- Wavin Tigris, Protecta-Line System and Alpex F50 Profi (PE-X/AL/PE).

## 5.6.2 In a multiple penetration with insulation (4 pipes)

Several different pipes

On the next page, drawing RF-MLP4-21.0.40 of the multiple pipe penetration seal with insulation with aluminium composite pipes fitted with two Mulcol® Multicollar Slim placed below the floor. In Table 5.6.2 the installation details regarding the field of application are given.

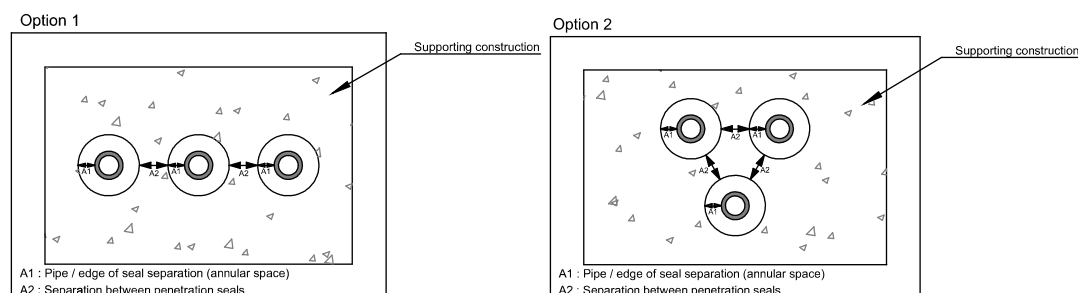
The fire resistance is valid for insulation PE-foam with a reaction to fire class C<sub>L</sub>-s1-d0 in accordance with EN 13501-1 or equal and a thickness of ≤ 6 mm. The insulation must be applied sustained or interrupted through the aperture with a minimum distance of 300 mm on both sides from the point where the pipe emerges from the floor (LS, CS, LI or CI in accordance with Table 1 of EN 1366-3:2009).

### t5.6.2 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 59) Mulcol® Multisealant A both faces	Distance between the pipes (distance s' in drawing)	Allowed annular space (distance 'a' in drawing)
≤ 350 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm	≤ 15 mm	Outer diameter ≤ 32 mm / 'a' ≤ 15 mm

If more multiple pipe penetrations are placed in the wall, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 59. The annular gap A<sub>1</sub> is also visible in this Figure.

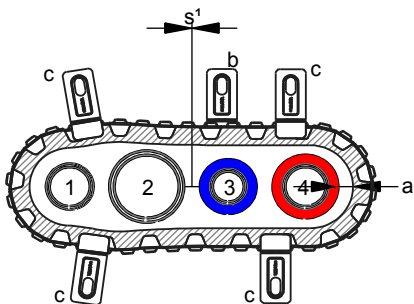
### f59 Visualization single penetrations



The fire resistance is valid aluminium composite pipes made out of an inner layer of cross-linked polyethylene, a layer aluminium in the middle and a layer of cross-linked polyethylene on top (Henco PE-Xc/AL/PE-Xc).

The fixing of the Mulcol® Multicollar Slim must be done by four Mulcol® Multiclips.

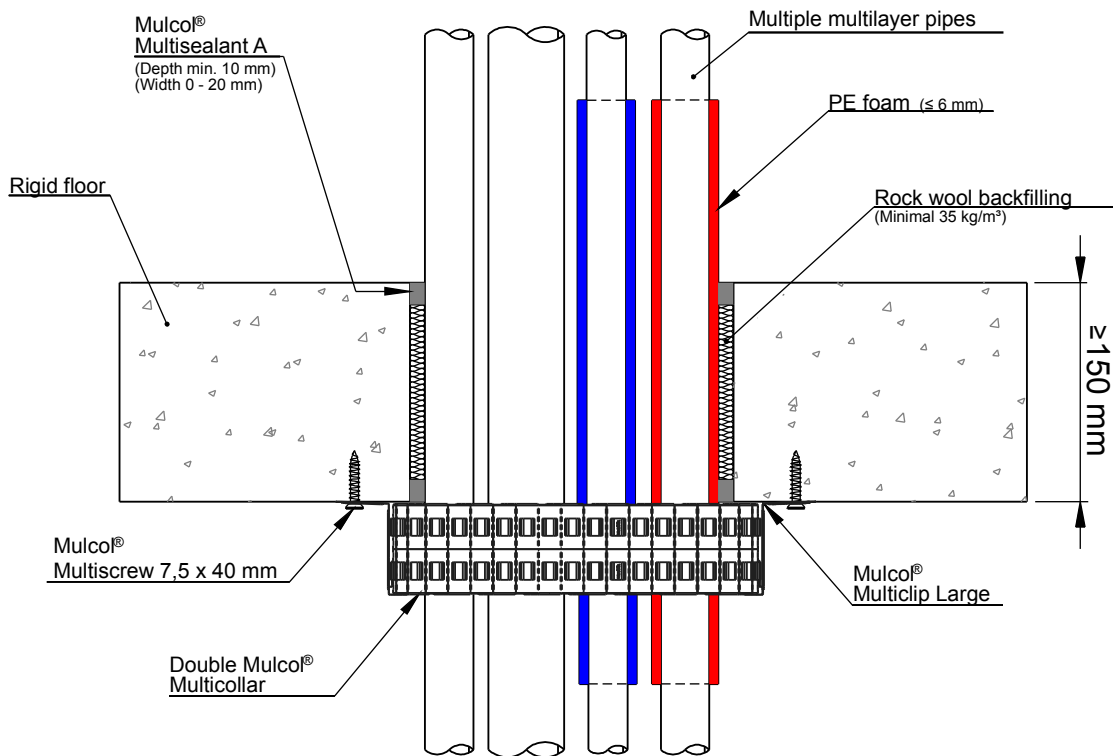
Front view



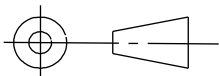
- a - Annular space  
(Maximum 15 mm between pipe and Mulco® Multicollar)
- b - Mulco® Multiclip
- c - Mulco® Multiclip Large
- s¹ - Side by side distance  
(Maximum 15 mm between pipes or insulation)

**Multiple pipe construction consisting of the following pipes:**

- 1 - Multilayer pipe - Aluminium composite  
e.g. Henco PE-Xc/Al/PE-Xc
- 2 - Multilayer pipe - Aluminium composite  
e.g. Henco PE-Xc/Al/PE-Xc
- 3 - Multilayer pipe - Aluminium composite + PE foam (Blue)  
e.g. Henco PE-Xc/Al/PE-Xc + PE foam (Blue)
- 4 - Multilayer pipe - Aluminium composite + PE foam (Red)  
e.g. Henco PE-Xc/Al/PE-Xc + PE foam (Red)



American projection



Scale : 1:5  
Unit of measure : mm  
Date : 25-1-2017

Company : Mulcol International B.V.  
Department : Research & Development  
Draftsman : K.J.

RF-MLP4-21.0.40  
A4



**Fire test pipe penetration seal  
Mulco® Multicollar  
Installation in rigid floor**

For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance Multiple penetration				
Pipe dimensions (mm)		Performance class with pipe end configuration	Pipe material (or equal)	Thickness insulation (mm)
Outer diameter	Wall thickness			
≤ 32	3.0	EI 120-U/C* E 120-U/C*	Henco PE-Xc/AL/PE-Xc	N.a.
≤ 50	4.0	EI 90-U/C* E 120-U/C*		
≤ 26	3.0	EI 120-U/C*		6
≤ 32	3.0	E 120-U/C*		

Based upon an assessment concerning different pipe materials it is expected that the fire resistances given above will also be met for penetration seals with pipes of the following types (the pipe dimensions shall correspond to the dimensions in the table):

- Alpex DUO, Valsir Pexal, Valsir Mixal and APE Plain (PE-Xb/AL/PE-Xb);
- Geberit Mepla and Uponor Unipipe (PE-RT/AL/PE-RT);
- Uponor and Henco (PE-Xc/AL/PE-Xc);
- Uponor and REHAU (PE-Xa) and REHAU (PE-Xc);
- SP Superpipe and POLYGON PEX (PE-X/AL/PE-X);
- Valsir Pexal and Valsir Mixal (PE/AL/PE-Xb);
- Wavin Tigris, Protecta-Line System and Alpex F50 Profi (PE-X/AL/PE).

### 5.6.3 In a multiple penetration with insulation (3 pipes and cables)

Several different pipes

On the next page, drawing RF-MLP5-21.0.40 of the multiple pipe penetration seal with copper pipes including PE-foam insulation, PVC-U / PVC-C pipes, electric cables and telecommunication cables fitted with two Mulcol® Multicollar Slim placed below the floor. In Table 5.6.3 the installation details regarding the field of application are given.

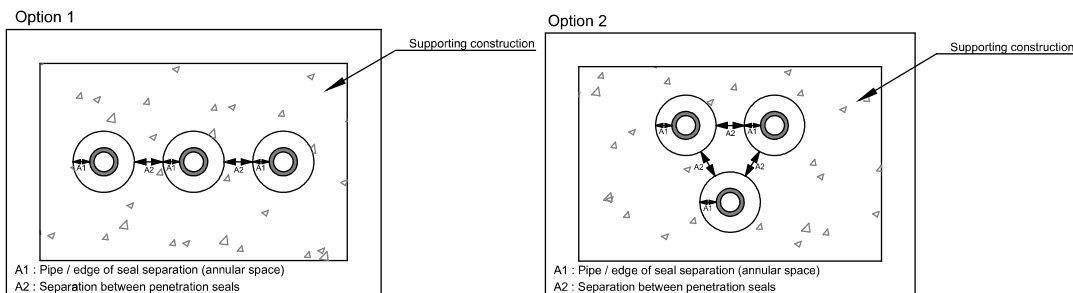
The fire resistance is valid for insulation PE-foam with a reaction to fire class E in accordance with EN 13501-1 or equal and a thickness of  $\leq 6$  mm. The insulation must be applied sustained or interrupted through the aperture with a minimum distance of 300 mm on both sides from the point where the pipe emerges from the floor (LS, CS, LI or CI in accordance with Table 1 of EN 1366-3:2009).

#### t5.6.3 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap (distance $A_1$ , see Figure 60) Mulcol® Multisealant A both faces	Distance between the pipes (distance $s^1$ in drawing)	Allowed annular space (distance 'a' in drawing)
$\leq 350$ mm	Annular gap $\leq 20$ mm / depth $\geq 10$ mm	$\leq 15$ mm	Outer diameter $\leq 90$ mm / 'a' $\leq 15$ mm

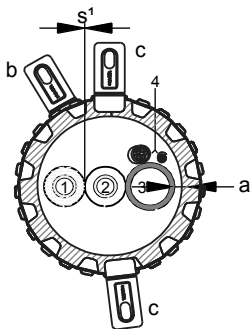
If more multiple pipe penetrations are placed in the wall, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 60. The annular gap  $A_1$  is also visible in this Figure.

#### f60 Visualization single penetrations





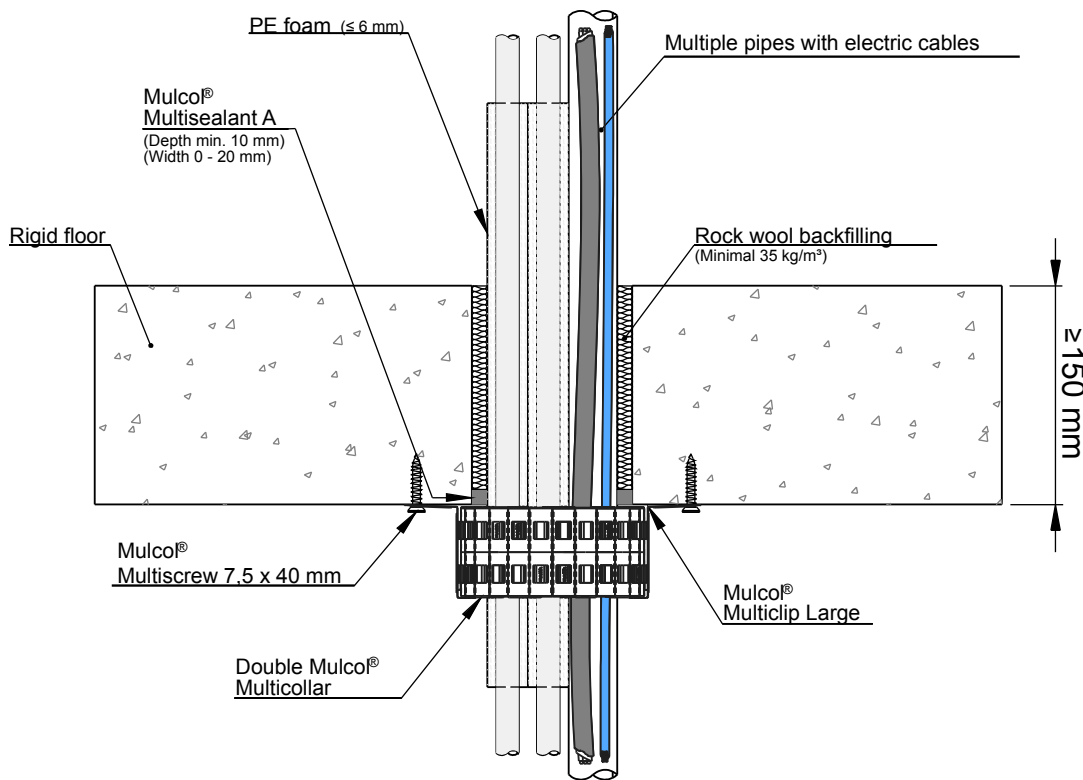
**Front view**



- a - Annular space  
(Maximum 15 mm between pipe and Mulco® Multicollar)
- b - Mulco® Multiclip
- c - Mulco® Multiclip Large
- s¹ - Side by side distance  
(Maximum 15 mm between pipes or insulation)

**Multiple pipe construction consisting of the following pipes:**

- 1 - Copper pipe + PE foam  
e.g. WICU® Flex
- 2 - Copper pipe + PE foam  
e.g. WICU® Flex
- 3 - Plastic pipe  
e.g. PVC-U
- 4 - Electric cables  
e.g. UTP Cable Cat. 5, UTP Cable Cat. 6, YMKV 3 x 2,5 mm,  
YMKV Cable 5 x 1,5 mm or YMKV Cable 5 x 2,5 mm

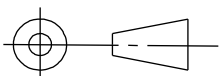


American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-MLP5-21.0.40



Unit of measure : mm

Department : Research & Development

Date : 24-1-2017

Draftsman : K.J.

A4



**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance Multiple penetration</b>				
<b>Pipe dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material (or equal)</b>	<b>Thickness insulation (mm)</b>
<b>Outer diameter</b>	<b>Wall thickness</b>			
15	1.5	EI 120-C/U* E 120-C/U*	Copper with Wicu-flex PE- foam insulation	6
≤ 32	3.0	EI 120-U/U*    EI 120-U/C* E 120-U/U*    E 120-U/C*	PVC-U / PVC-C	N.a.
<b>Cable</b>	<b>Amount</b>	<b>Performance class</b>	<b>Type</b>	
Telecommuni- cation	1	EI 120* E 120*	UTP Cat. 5 or Cat. 6	
Sheathed cable	1		YMKV 3 x 2.5 mm <sup>2</sup> , YMKV 5 x 1.5 mm <sup>2</sup> or YMKV 5x 2.5 mm <sup>2</sup>	

## 5.7 Penetration seals with cables

In this Chapter the expected fire resistance and field of application of cable penetration seals in several different applications is summarized.

### 5.7.1 PVC electrical pipes

Cables

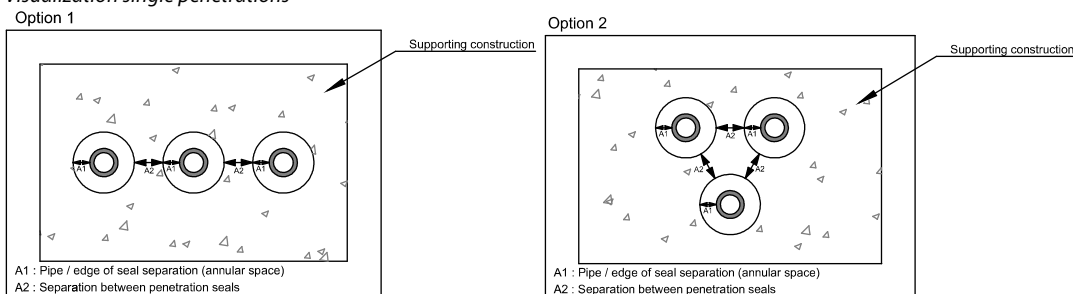
On the next page, drawing RF-EP-11.0.10 of the cable penetration seals with a bundle of PVC electrical pipes with cables is given fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.7.1 the installation details regarding the field of application are given.

#### t5.7.1 Installation details

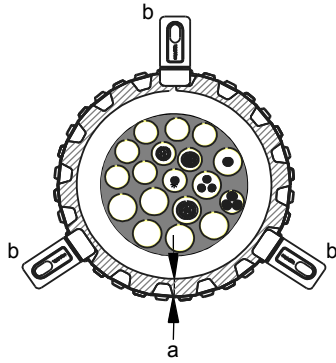
Distance to first pipe support above the floor	Filling of annular gap (distance $A_1$ , see Figure 61) Mulcol® Multisealant A both faces	Allowed bundle size	Allowed cables (in every possible number and combination)	Allowed annular space (distance 'a' in drawing)
$\leq 350$ mm	Annular gap $\leq 20$ mm / depth $\geq 10$ mm	$\leq \varnothing 100$ mm	Telecommunication cables UTP Cat. 5	Outer diameter $\leq 100$ mm, 'a' $\leq 15$ mm
			Telecommunication cables UTP Cat. 6	
			Sheathed cable YMVK 3 x 2.5 mm <sup>2</sup>	
			Sheathed cable YMVK 5 x 1.5 mm <sup>2</sup>	
			Sheathed cable YMVK 5 x 2.5 mm <sup>2</sup>	

If more single cable or pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 61. The annular gap  $A_1$  is also visible in this Figure. Empty pipes are allowed.

#### f61 Visualization single penetrations



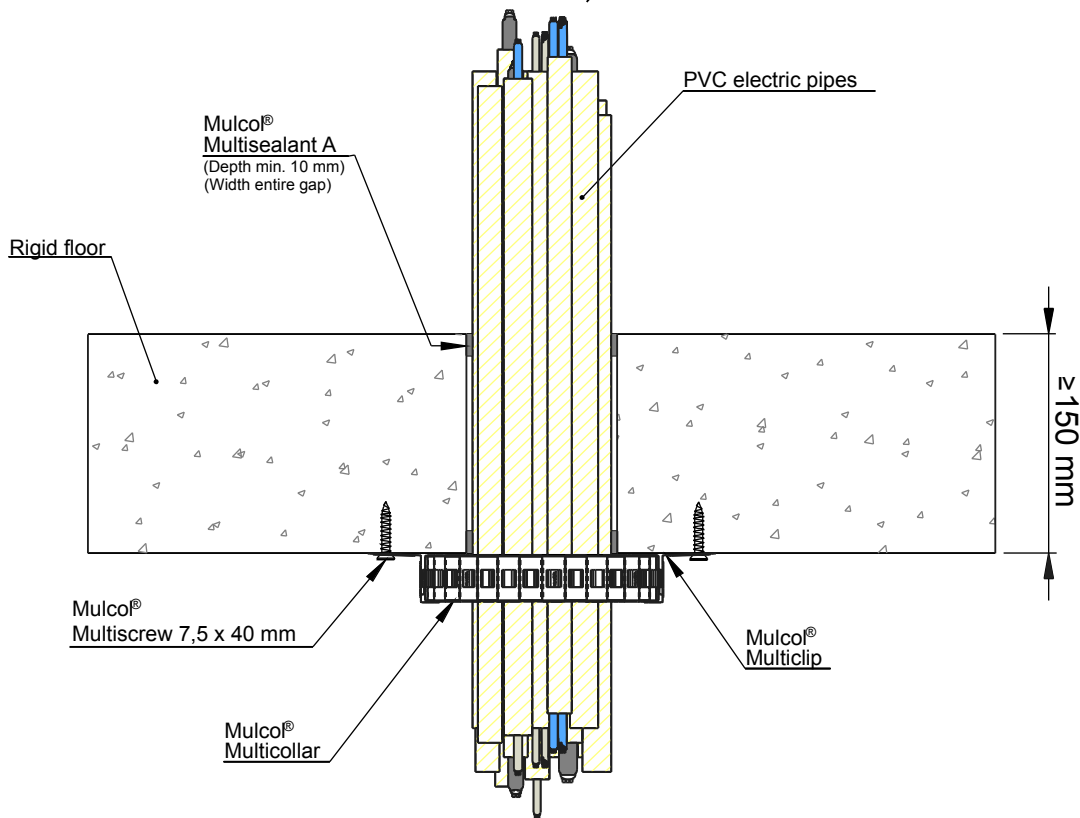
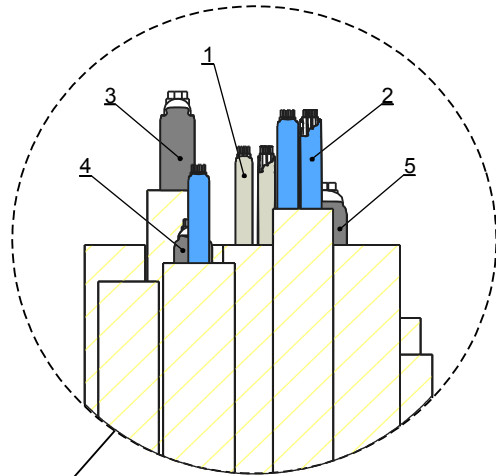
Front view



a - Annular space  
(Maximum 15 mm between pipes and Mulco® Multicollar)  
b - Mulco® Multiclip

PVC electric pipes in bundle filled with the following cables:

- 1 - UTP Cable Cat. 5
- 2 - UTP Cable Cat. 6
- 3 - YMVK Cable 3 x 2,5 mm
- 4 - YMVK Cable 5 x 1,5 mm
- 5 - YMVK Cable 5 x 2,5 mm

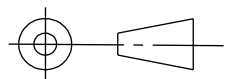


American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-EP-11.0.10



Unit of measure : mm

Department : Research & Development

Date : 9-9-2016

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance				
Aperture dimensions (mm or inch)		Performance class with pipe end configuration		Number of pipes
Outer diameter	Pipes			
≤ 100 mm	PVC pipes 5/8", 3/4" and Ø25 mm	EI 120-U/U* E 120-U/U*	EI 120-U/C* E 120-U/C*	≤ 18

## 5.7.2 Sheathed and telecommunication wires

### Cables

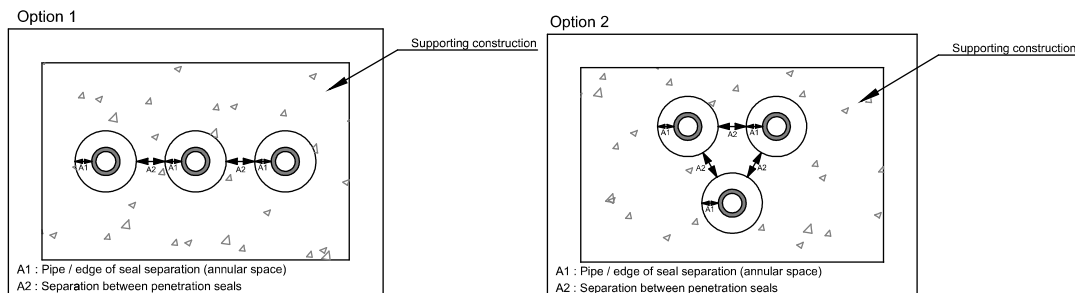
On the next page, drawing RF-EC-11.0.10 of the cable penetration seals with a bundle of sheathed and telecommunication cables is given fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.7.2 the installation details regarding the field of application are given.

#### t5.7.2 Installation details

Distance to first pipe support above the floor	Filling of annular gap (distance A <sub>1</sub> , see Figure 62) Mulcol® Multisealant A both faces	Allowed bundle size	Allowed cables (in every possible number and combination)	Allowed annular space (distance 'a' in drawing)
≤ 350 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm	≤ Ø80 mm	Telecommunication cables UTP Cat. 5 Telecommunication cables UTP Cat. 5 Sheathed cable YMVK 3 x 2.5 mm <sup>2</sup> Sheathed cable YMVK 5 x 1.5 mm <sup>2</sup> Sheathed cable YMVK 5 x 2.5 mm <sup>2</sup>	Outer diameter ≤ 80 mm, 'a' ≤ 15 mm

If more single cable or pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 62. The annular gap A<sub>1</sub> is also visible in this Figure.

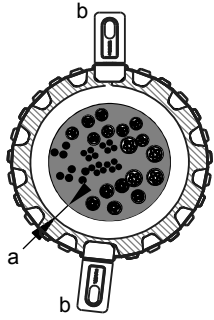
#### f62 Visualization single penetrations



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

Fire resistance			
Aperture dimensions (mm)		Performance class	Number of cables
Outer diameter	Cables		
≤ 80	See Table 5.7.2	EI 120* E 120*	≤ 42

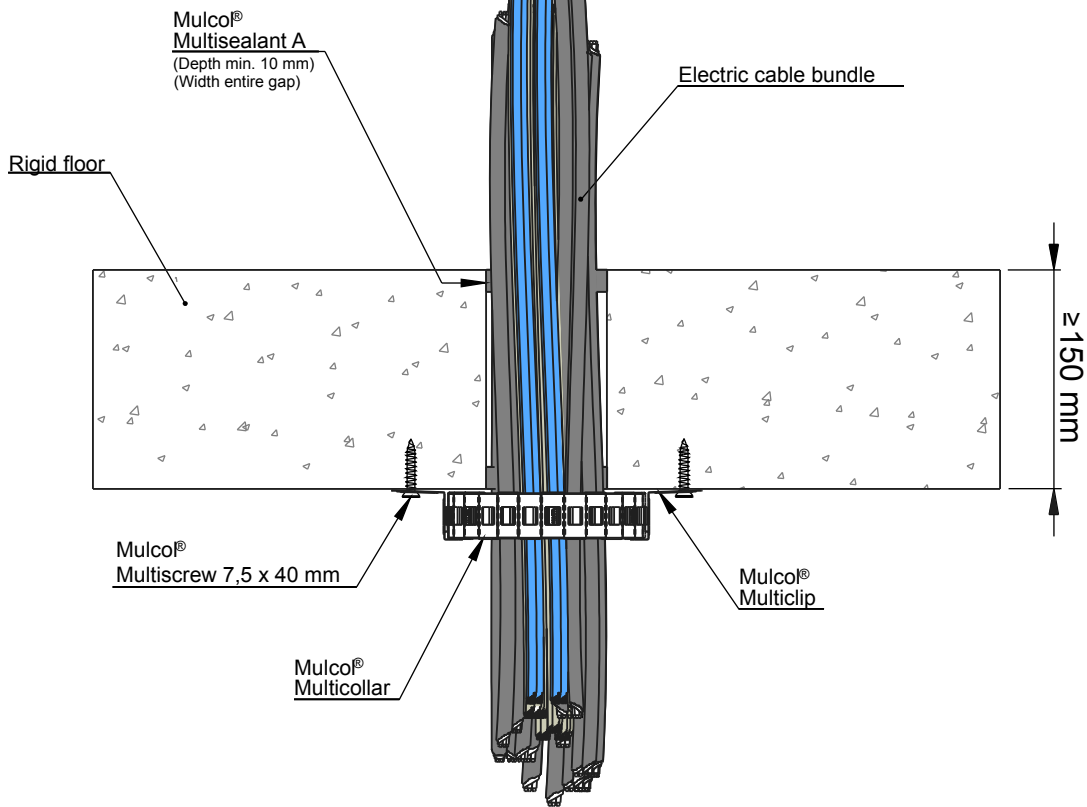
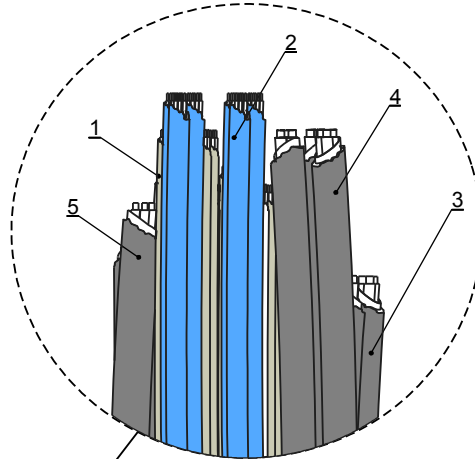
**Front view**



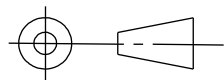
a - Annular space  
(Maximum 15 mm between cable bundle and Mulco® Multicollar)  
b - Mulco® Multiclip

**Cable bundle consisting of the following cables:**

- 1 - UTP Cable Cat. 5
- 2 - UTP Cable Cat. 6
- 3 - YMVK Cable 3 x 2,5 mm
- 4 - YMVK Cable 5 x 1,5 mm
- 5 - YMVK Cable 5 x 2,5 mm



American projection



Scale : 1:5

Unit of measure : mm

Date : 9-9-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-EC-11.0.10

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

## 5.7.3 PE-conduit pipes

### Cables

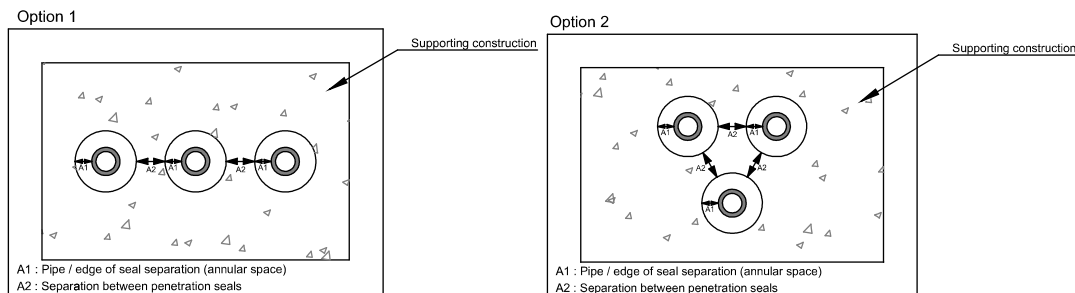
On the next page, drawing RF-EC-11.0.30 of the cable penetration seals made out of PE-conduits (outer diameter 50 mm) with bundles with sheathed and telecommunication cables is given for the system fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.7.3 the installation details regarding the field of application are given.

#### t5.7.3 Installation details

Distance to first pipe support above the floor	Filling of annular gap (distance A <sub>1</sub> , see Figure 63) Mulcol® Multisealant A both faces	Allowed bundle size	Allowed cables (in every possible number and combination)	Allowed annular space (distance 'a' in drawing)
≤ 350 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm	≤ Ø130 mm	Telecommunication cables UTP Cat. 5 Telecommunication cables UTP Cat. 5 Sheathed cable YMKV 3 x 2.5 mm <sup>2</sup> Sheathed cable YMKV 5 x 1.5 mm <sup>2</sup> Sheathed cable YMKV 5 x 2.5 mm <sup>2</sup>	Outer diameter ≤ 130 mm, 'a' ≤ 15 mm

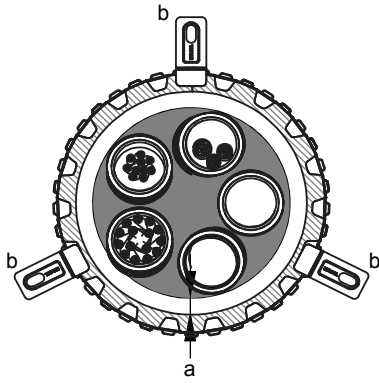
If more single cable or pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 63. The annular gap A<sub>1</sub> is also visible in this Figure. Empty pipes are allowed.

#### f63 Visualization single penetrations





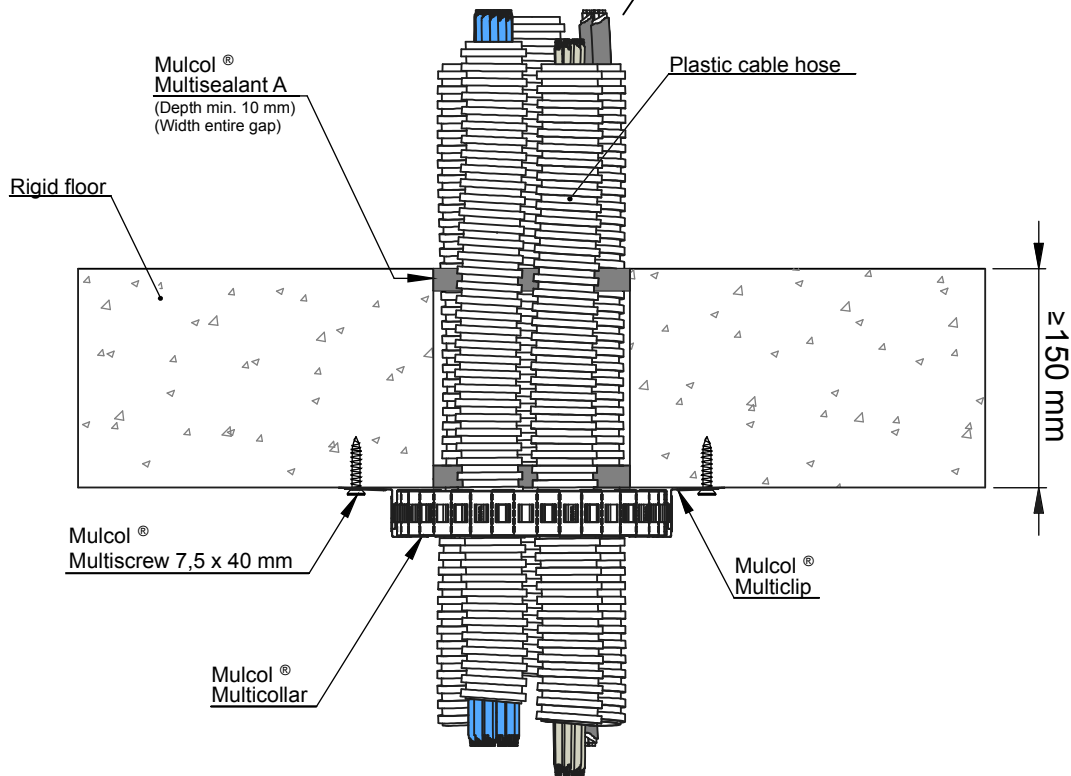
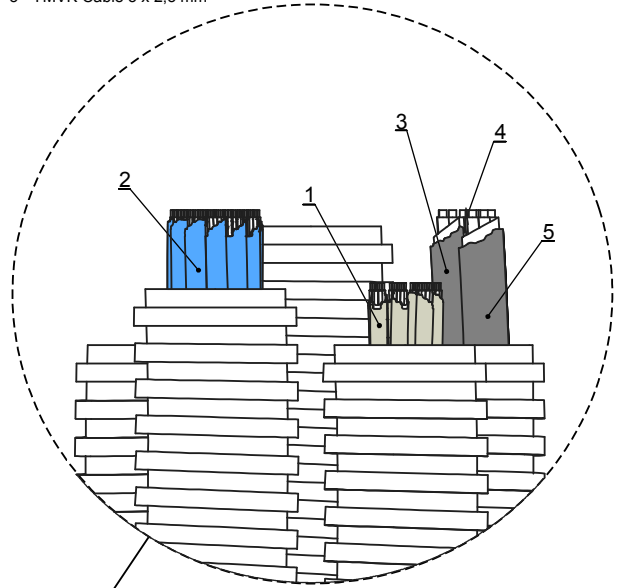
Front view



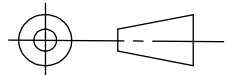
a - Annular space  
(Maximum 15 mm between cable hose and Mulcol® Multicollar)  
b - Mulcol® Multiclip

**Plastic cable hoses filled with the following cables:**

- 1 - UTP Cable Cat. 5
- 2 - UTP Cable Cat. 6
- 3 - YMKV Cable 3 x 2,5 mm
- 4 - YMKV Cable 5 x 1,5 mm
- 5 - YMKV Cable 5 x 2,5 mm



American projection



Scale : 1:5

Unit of measure : mm

Date : 27-9-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-EC-11.0.30

A4



**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies.

<b>Fire resistance</b>				
<b>Wavin flexible PE-conduit (or equal)</b>				
<b>Aperture dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Number of PE-conduits</b>	<b>Size of PE-conduits (mm)</b>
<b>Outer diameter</b>	<b>Cables</b>			
<b>≤ 130</b>	<b>See Table 5.7.3</b>	<b>EI 60-U/U* EI 60-U/C* E 60-U/U* E 60-U/C*</b>	<b>≤ 5</b>	<b>≤ Ø50</b>

Based upon an assessment concerning different conduit materials it is expected that the fire resistances given above will also be met for penetration seals with GEWA flexible HD-PE-conduits (the conduit dimensions shall correspond to the dimensions in the table).

## 5.8 Flue gas pipes

In this Chapter the expected fire resistance and field of application of flue gas pipes in several different applications is summarized.

### 5.8.1 Aluminium

*Flue gas pipes*

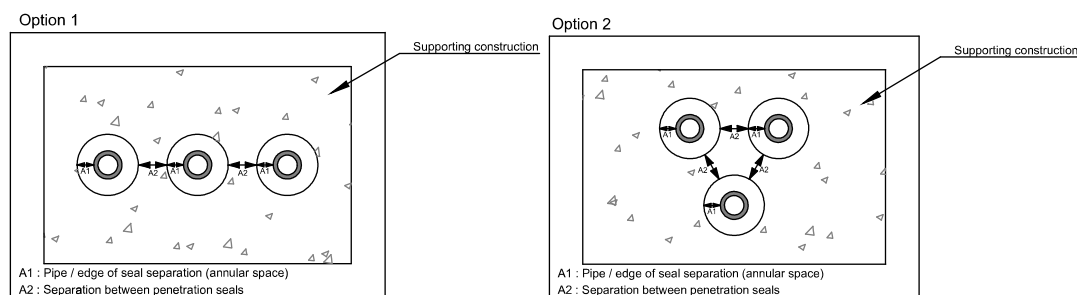
On the next page, drawing RF-RGA-21.0.10 of the pipe penetration seal with an aluminium flue gas pipe without insulation is given for the pipe fitted with two Mulcol® Multicollar Slim placed below the floor. In Table 5.8.1 the installation details regarding the field of application are given.

#### t5.8.1 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 64) Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Allowed annular space (distance 'a' in drawing)
≤ 350 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 130 mm / 'a' ≤ 5 mm

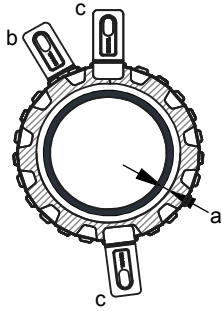
If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm see distance A<sub>2</sub>, see Figure 64. The annular gap A<sub>1</sub> is also visible in this Figure.

#### f64 Visualization single penetrations

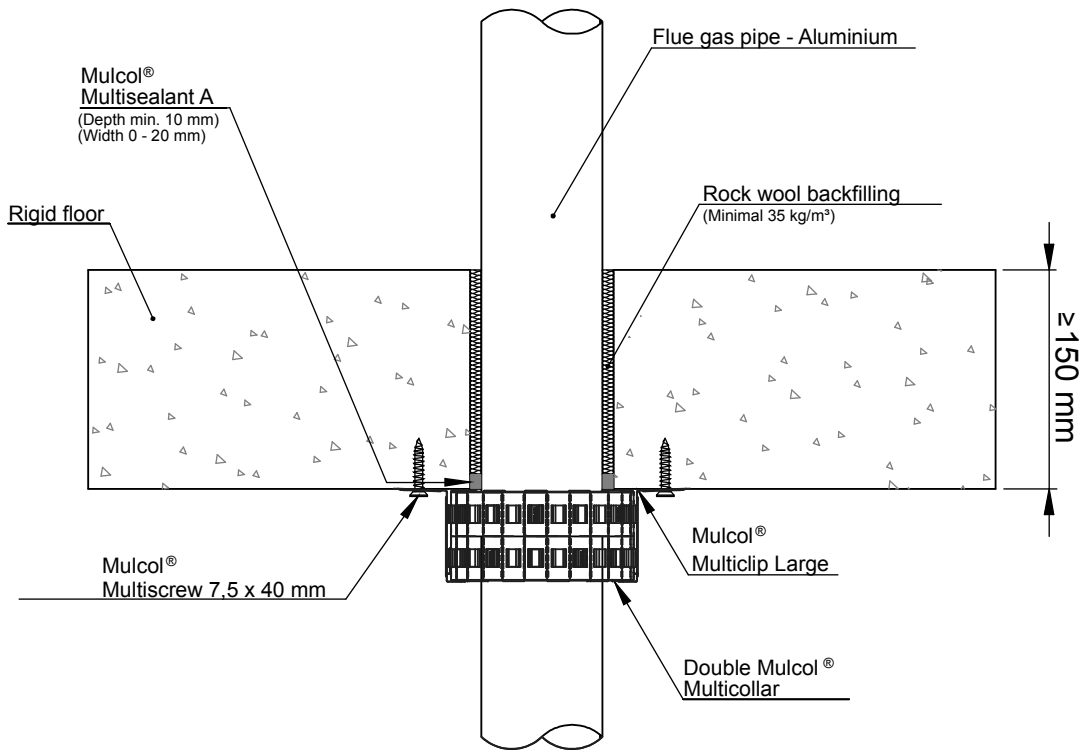


The fire resistance applies for flue gas systems and may be supported by a fire rated or non fire rated support system. The (heating) boiler must be situated at the exposed face (in the room below the floor).

Front view



- a - Annular space  
(Maximum 5 mm between pipe and Mulcol® Multicollar)
- b - Mulcol® Multiclip
- c - Mulcol® Multiclip Large

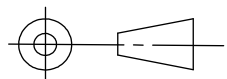


American projection

Scale : 1:5

Company : Mulcol International B.V.

RF-RGA-21.0.10



Unit of measure : mm

Department : Research & Development

Date : 25-4-2017

Draftsman : K.J.

A4



**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**

For this system, the fire resistance is valid in one direction (from below) according to the following combinations of performance parameters and classes.

Fire resistance Two collars below the floor Flue gas system (aluminium)			
Pipe dimensions (mm)		Performance class with pipe end configuration	Pipe material
Outer diameter	Wall thickness		
80	1.5	EI 15-U/C* E 90-U/C*	Aluminium
130	1.5	E 90-U/C*	

## 5.8.2 Concentric steel

Flue gas pipes

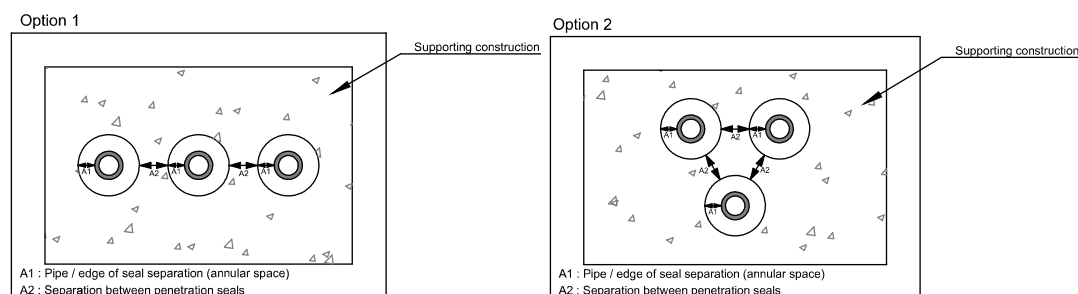
On the next page, drawing FW-RGAT-21.0.10 of the pipe penetration seal with a concentric steel flue gas pipe without insulation is given for the pipe fitted with two Mulcol® Multicollar Slim placed below the floor. In Table 5.8.2 the installation details regarding the field of application are given.

### t5.8.2 Installation details

Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 65) Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Allowed annular space (distance 'a' in drawing)
≤ 350 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 200 mm / 'a' ≤ 5 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm see distance A<sub>2</sub>, see Figure 65. The annular gap A<sub>1</sub> is also visible in this Figure.

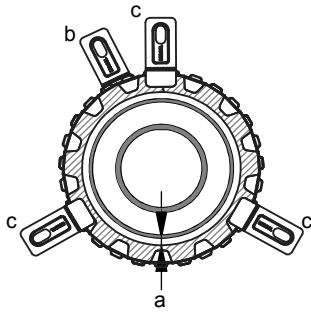
### f65 Visualization single penetrations



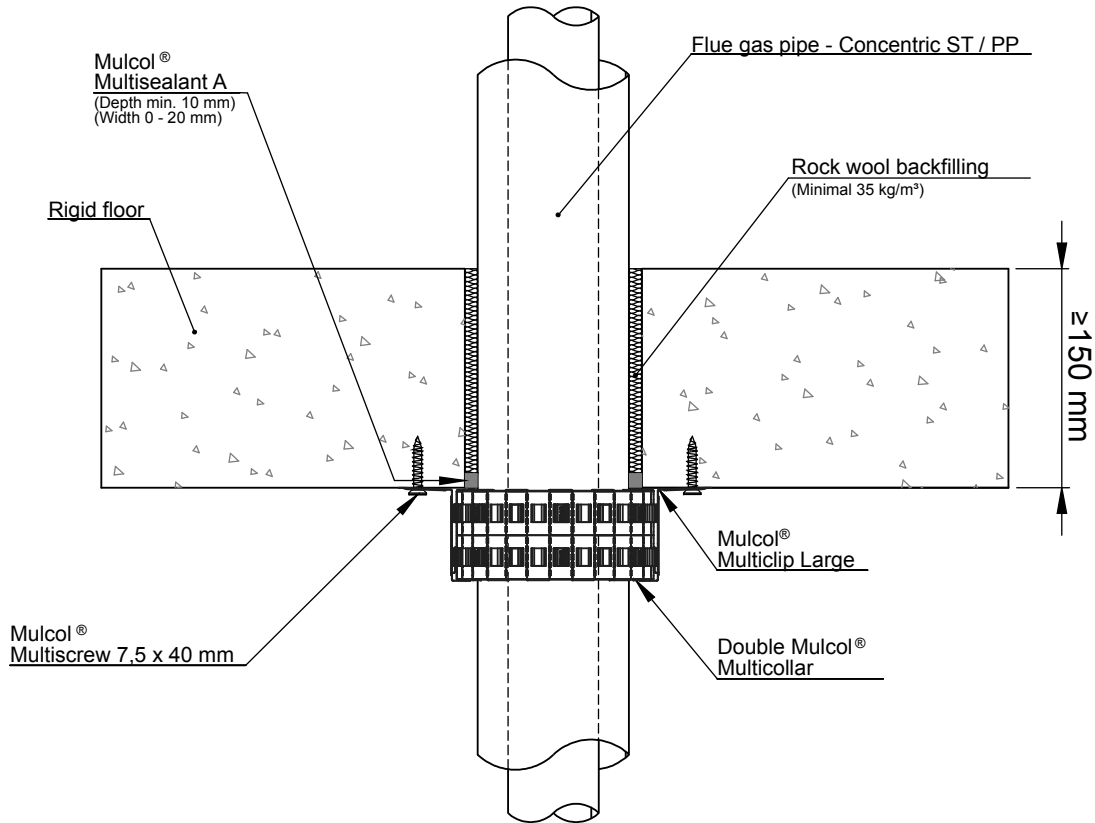
The fire resistance applies for flue gas systems and may be supported by a fire rated or non fire rated support system. The (heating) boiler must be situated at the exposed face (in the room below the floor).

The fire resistance is for example valid for Burgerhout Twinsafe Push-Fit, Burgerhout M&G or similar.

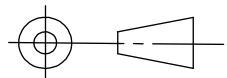
Front view



- a - Annular space  
(Maximum 5 mm between pipe and Mulcol® Multicollar)
- b - Mulcol® Multiclip
- c - Mulcol® Multiclip Large



American projection



Scale : 1:5  
 Unit of measure : mm  
 Date : 26-4-2017

Company : Mulcol International B.V.  
 Department : Research & Development  
 Draftsman : K.J.

RF-RGAT-21.0.10

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

For this system, the fire resistance is valid in one direction (from below) according to the following combinations of performance parameters and classes.

<b>Fire resistance</b> <b>Two collars below the floor</b> <b>Flue gas system (concentric steel)</b>			
<b>Dimensions (mm)</b>		<b>Performance class with pipe end configuration</b>	<b>Pipe material</b>
<b>Diameter inner pipe (PP)</b>	<b>Diameter outer pipe (steel)</b>		
60	100	E 90-U/C*	ST / PP
80	125	E 90-U/C*	
100	150	E 90-U/C*	
130	200	E 90-U/C*	



### 5.8.3 Plastic

#### Flue gas pipes

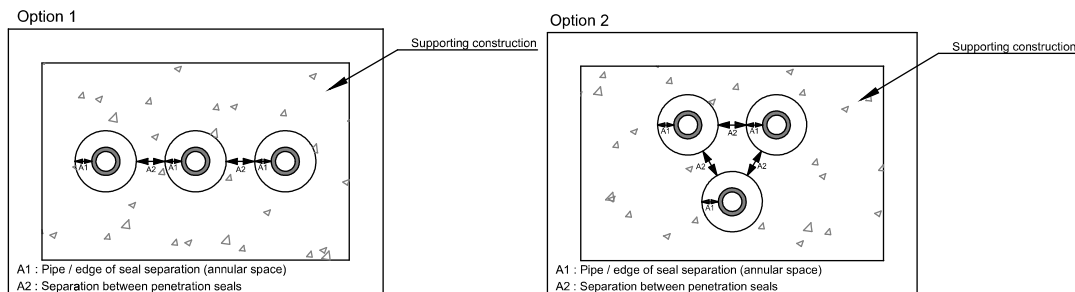
On the next page, drawing RF-RGA-11.0.10 of the pipe penetration seal with a plastic flue gas pipe without insulation is given for the pipe fitted with one Mulcol® Multicollars Slim placed below the floor. In Table 5.8.3 the installation details regarding the field of application are given.

t5.8.3 Installation details

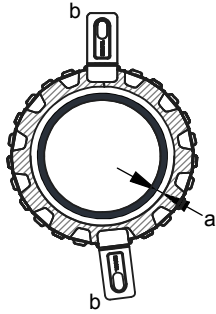
Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 66) Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 125 mm / 'a' ≤ 5 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm see distance A<sub>2</sub>, see Figure 66. The annular gap A<sub>1</sub> is also visible in this Figure.

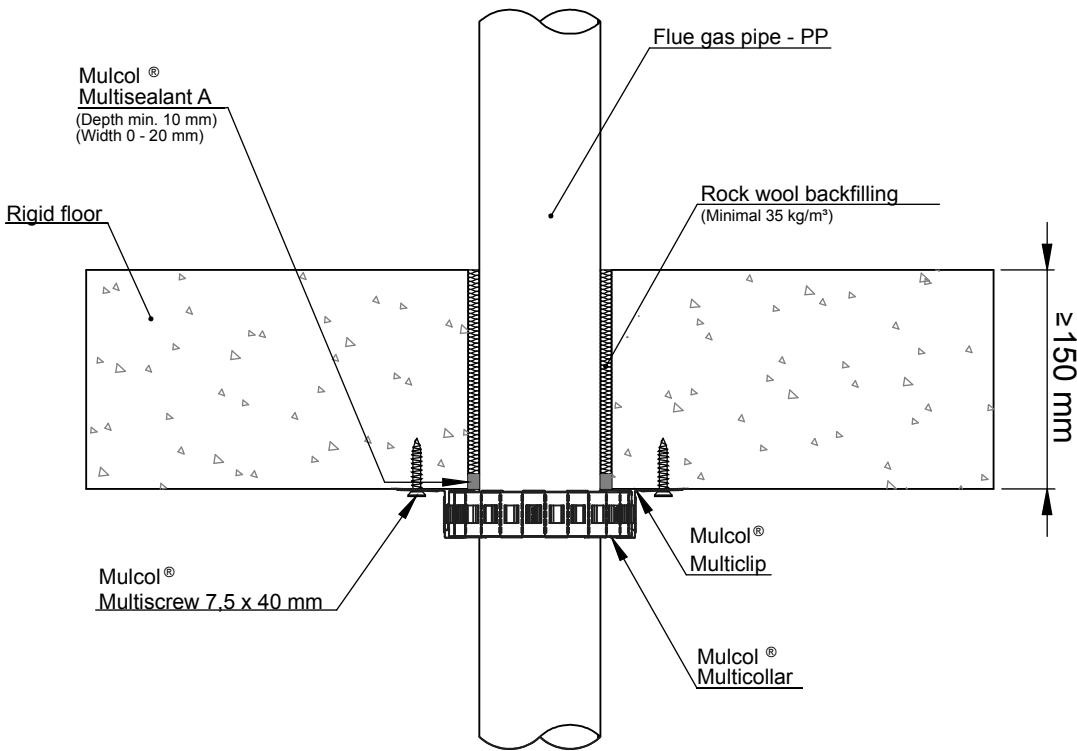
f66 Visualization single penetrations



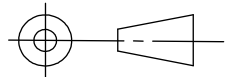
Front view



- a - Annular space  
(Maximum 5 mm between pipe and Mulcol® Multicollar)
- b - Mulcol® Multiclip



American projection



Scale : 1:5

Unit of measure : mm

Date : 25-4-2017

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-RGA-11.0.10

A4



**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**

The (heating) boiler must be situated at the exposed face (in the room below the floor).

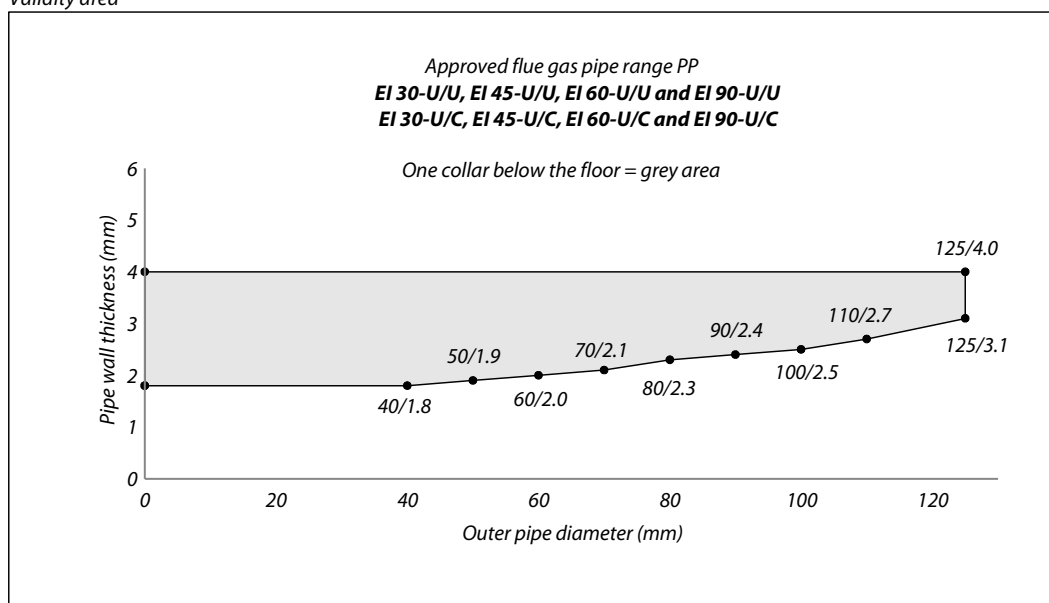
For this system, the fire resistance is derived from PP pipes as stated in Paragraph 5.2.1 and is valid in one direction (from below) according to the following combinations of performance parameters and classes.

Fire resistance One collar below the floor Flue gas system (plastic)				
Pipe dimensions (mm)		Performance class with pipe end configuration		Pipe material
Outer diameter	Wall thickness			
≤ 40	1.8 to 4.0	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*	PP
≤ 125	3.1 to 4.0	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*	PP

A visualization of the validity area for the fire resistance for EI 30, EI 45, EI 60 and EI 90 is given in the Figure hereafter.

The fire resistance is for example partly valid for Burgerhout Safe PP (wall thickness of 2.2 mm) or similar as long as the pipe dimensions meet the validity area.

f67 Validity area



## 5.8.4 Concentric plastic

Flue gas pipes

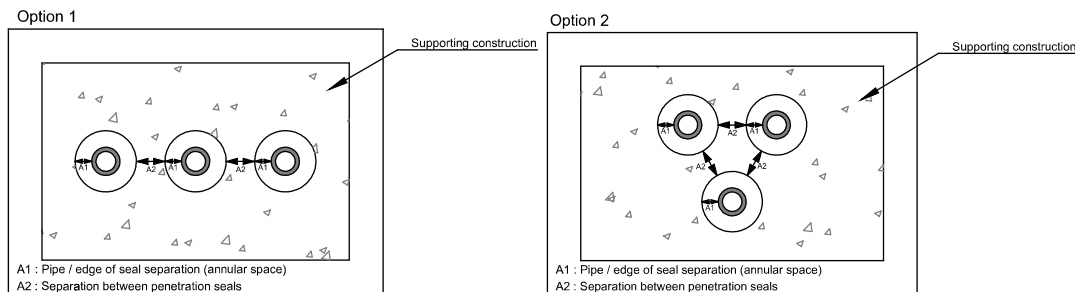
On the next page, drawing RF-RGA-11.0.10 of the pipe penetration seal with a concentric plastic flue gas pipe without insulation is given for the pipe fitted with one Mulcol® Multicollars Slim placed below the floor. In Table 5.8.4 the installation details regarding the field of application are given.

### t5.8.4 Installation details

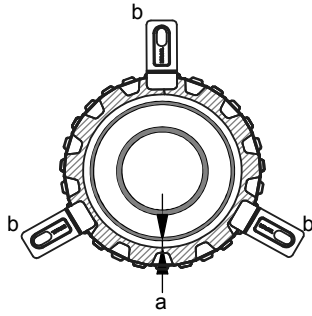
Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 68) Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Allowed annular space (distance 'a' in drawing)
≤ 450 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Outer diameter ≤ 125 mm / 'a' ≤ 5 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm see distance A<sub>2</sub>, see Figure 68. The annular gap A<sub>1</sub> is also visible in this Figure.

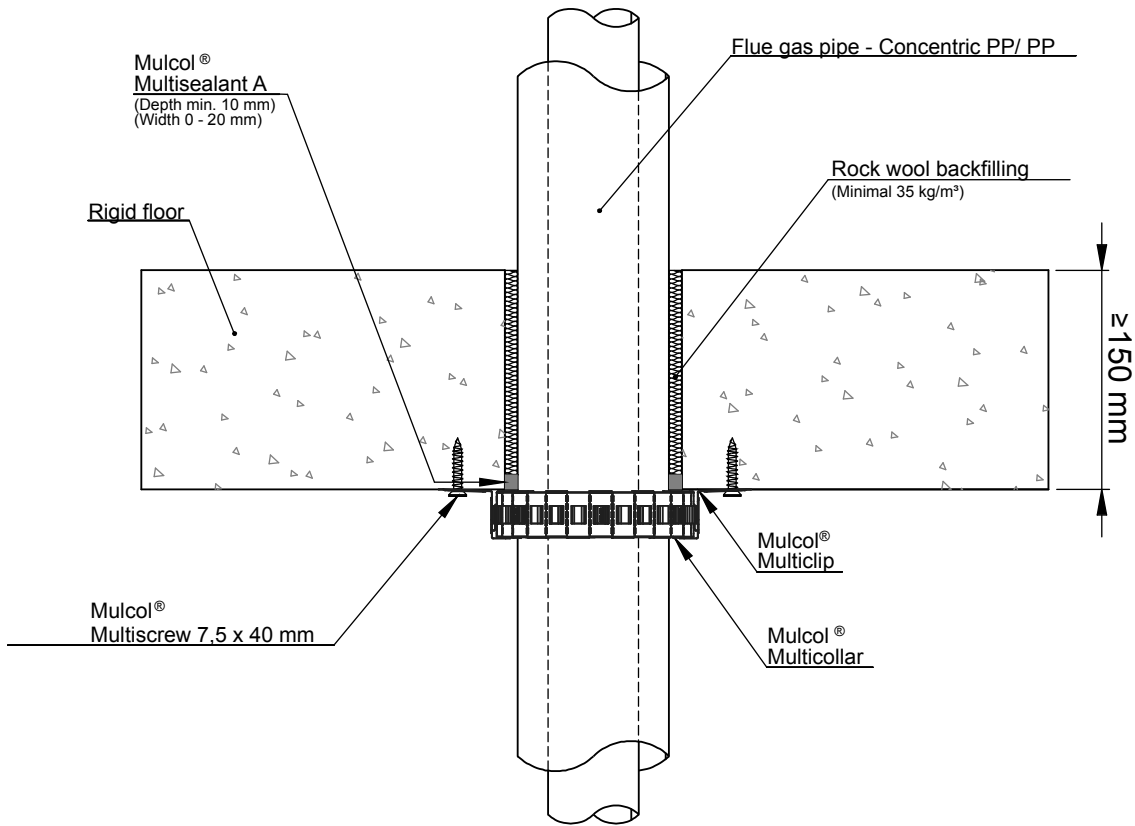
### f68 Visualization single penetrations



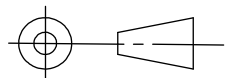
Front view



a - Annular space  
(Maximum 5 mm between pipe and Mulcol® Multicollar)  
b - Mulcol® Multiclip



American projection



Scale : 1:5  
Unit of measure : mm  
Date : 25-4-2017

Company : Mulcol International B.V.  
Department : Research & Development  
Draftsman : K.J.

RF-RGAT\_PP-11.0.10

A4



**Fire test pipe penetration seal**  
**Mulcol® Multicollar**  
**Installation in rigid floor**

The (heating) boiler must be situated at the exposed face (in the room below the floor). The fire resistance is valid for concentric pipes with the inner and outer pipe made of plastic.

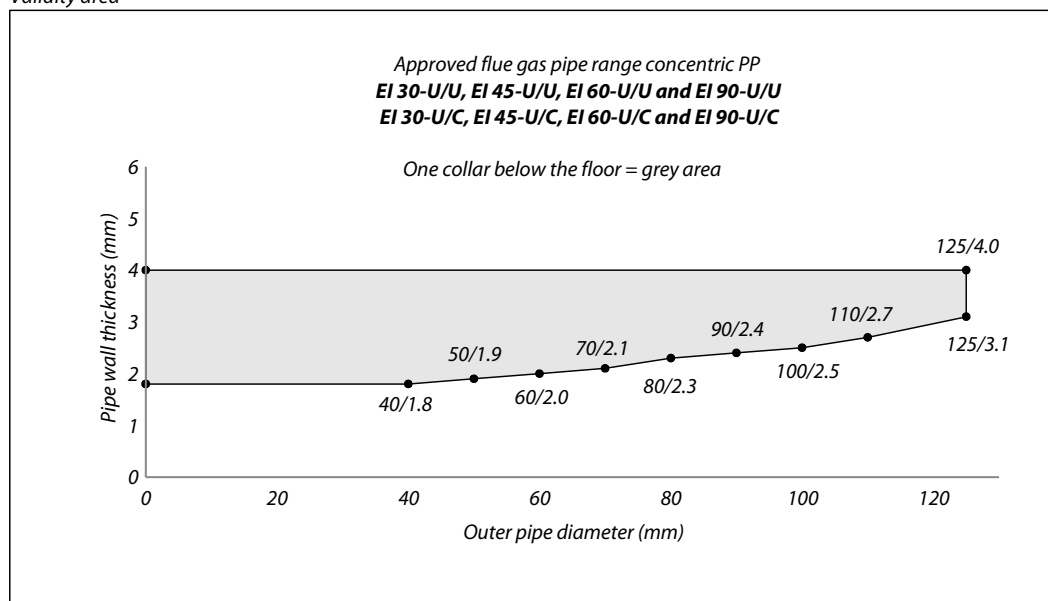
For this system, a fire resistance is derived from PP pipes as stated in Paragraph 5.2.1 and is valid in one direction (from below) according to the following combinations of performance parameters and classes.

Fire resistance				
One collar below the floor				
Flue gas system (concentric plastic)				
Pipe dimensions outer pipe (mm)		Performance class with pipe end configuration		Pipe material
Diameter	Wall thickness			
≤ 40	1.8 to 4.0	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*	PP / PP
≤ 125	3.1 to 4.0	EI 90-U/U* E 90-U/U*	EI 90-U/C* E 90-U/C*	PP / PP

The dimensions of the inner pipe made out of PP are not relevant for the given fire resistances in the Tables above (the fire resistances apply to any dimension of the inner pipe). A visualization of the validity area for the fire resistance for EI 30, EI 45, EI 60 and EI 90 is given in the Figure hereafter.

The fire resistance is for example partly valid for an Ubbink Rolux 5G floor transfer (pipe wall thickness outer pipe 1.8 to 2.0 mm), Ubbink Rolux PP floor transfer (pipe wall thickness outer pipe 2.0 mm) or similar as long as the pipe dimensions of the outer pipe meet the validity area.

f69 Validity area



## 5.9 Metal pipes

In this Chapter the expected fire resistance and field of application of metal pipes in several different applications is summarized.

### 5.9.1 Without insulation

*Metal pipes*

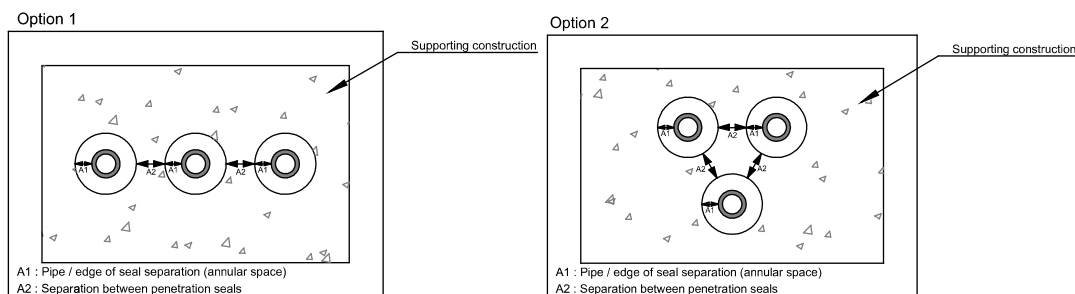
On the next page, drawing RF-ST-11.0.10 of the pipe penetration seals with metal pipes without insulation is given for the system fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.9.1 the installation details regarding the field of application are given.

#### t5.9.1 Installation details

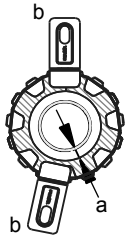
Distance to first pipe support above the floor	Allowed filling of annular gap (distance $A_1$ , see Figure 70) Mulcol® Multisealant A exposed face, rock wool $\geq 35 \text{ kg/m}^3$ unexposed face	Allowed annular space (distance 'a' in drawing)
$\leq 350 \text{ mm}$	Annular gap $\leq 20 \text{ mm}$ / depth sealant $\geq 10 \text{ mm}$	Outer diameter $\leq 35 \text{ mm}$ , 'a' $\leq 15 \text{ mm}$

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance  $A_2$ , see Figure 70. The annular gap  $A_1$  is also visible in this Figure.

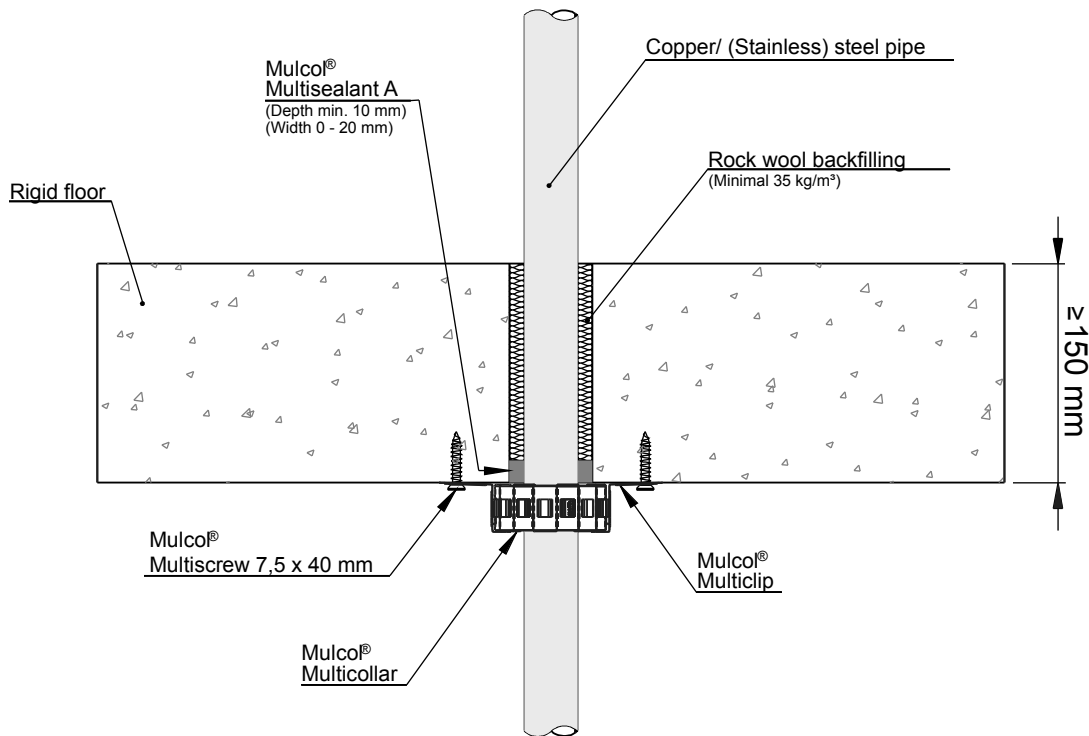
#### f70 Visualization single penetrations



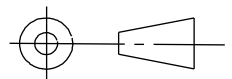
Front view



- a - Annular space  
(Maximum 15 mm between pipe and Mulco® Multicollar)
- b - Mulco® Multiclip



American projection



Scale : 1:5

Unit of measure : mm

Date : 27-9-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-ST-11.0.10

A4



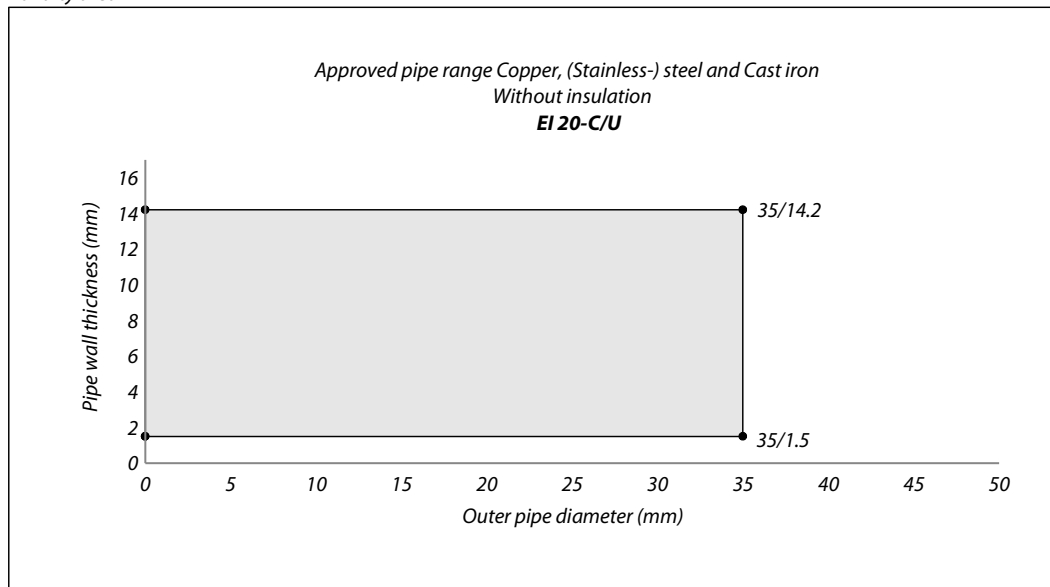
**Fire test pipe penetration seal  
Mulcol® Multicollar  
Installation in rigid floor**



For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

Fire resistance				
Pipe dimensions (mm)		Performance class with pipe end configuration	Pipe material	See Figure
Outer diameter	Wall thickness			
≤ 35	1.5 to 14.2	EI 20-C/U E 120-C/U	Copper / (Stainless-) steel / Cast iron	71

171 Validity area



## 5.9.2 With elastomeric thermal insulation (LI and CI)

### Metal pipes

On the next page, drawing RF-ST-11.0.22 of the pipe penetration seals with metal pipes with elastomeric thermal insulation is given for the system fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.9.2 the installation details regarding the field of application are given.

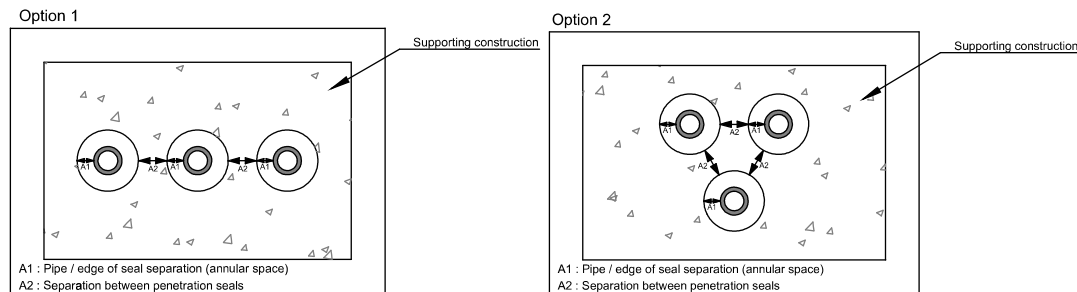
The fire resistance is valid for insulation AF/Armaflex made out of flexible elastomeric EPDM rubber foam with a reaction to fire class B<sub>L</sub>-s3, d0 or B-s3 or, d0 (or equal or better) in accordance with EN 13501-1. The insulation must be applied interrupted at the seal with a minimum distance of 300 mm on both sides from the point where the pipe emerges from the floor (LI in accordance with Table 1 of EN 1366-3:2009). The insulation may also be applied continued (CI).

### t5.9.2 Installation details

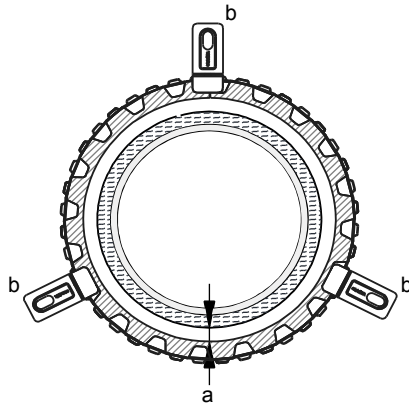
Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 72)		Allowed annular space (distance 'a' in drawing)	
	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Mulcol® Multisealant A both faces	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 350 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 72. The annular gap A<sub>1</sub> is also visible in this Figure.

### f72 Visualization single penetrations

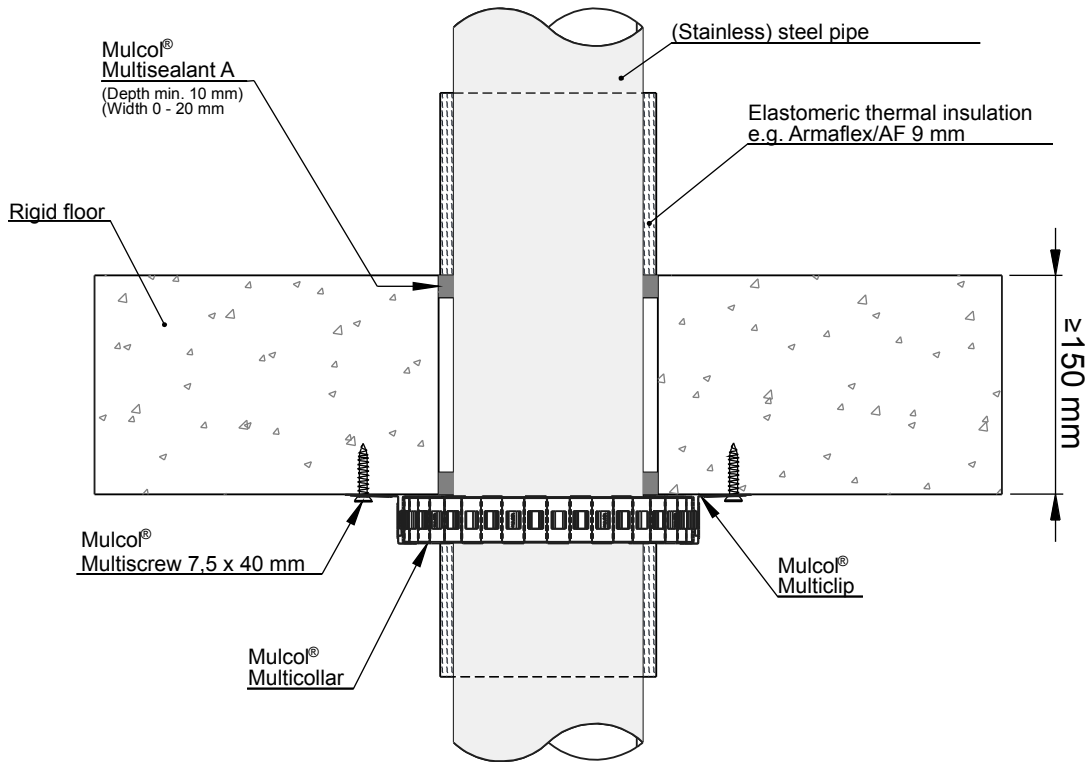
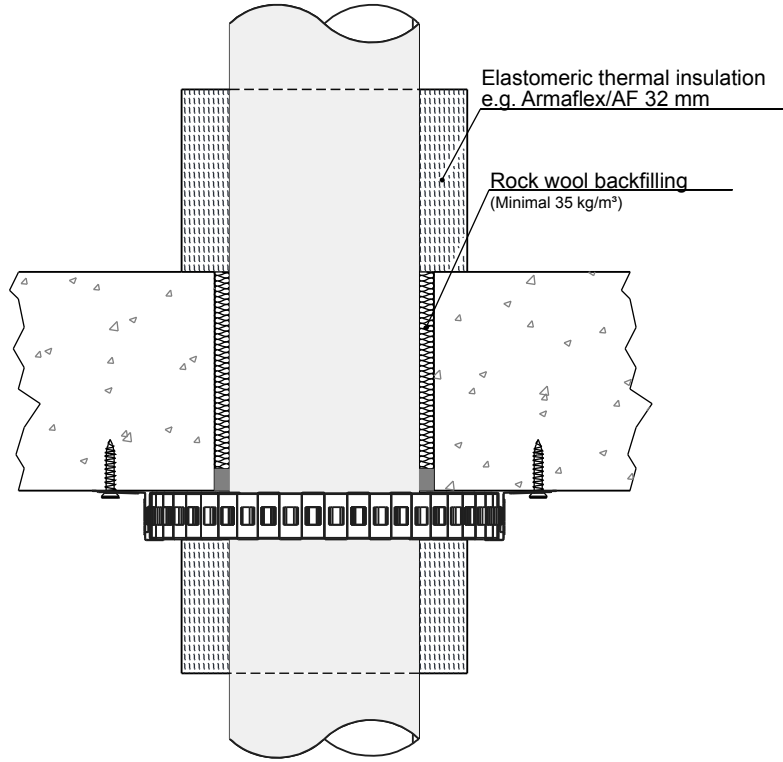


Front view

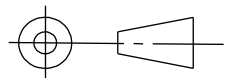


a - Annular space  
 (Maximum 15 mm between insulation and Mulco® Multicollar)  
 b - Mulco® Multiclip

Side view



American projection



Scale : 1:5  
 Unit of measure : mm  
 Date : 24-1-2017

Company : Mulcol International B.V.  
 Department : Research & Development  
 Draftsman : K.J.

RF-ST-11.0.22

A4

**Fire test pipe penetration seal  
 Mulco® Multicollar  
 Installation in rigid floor**

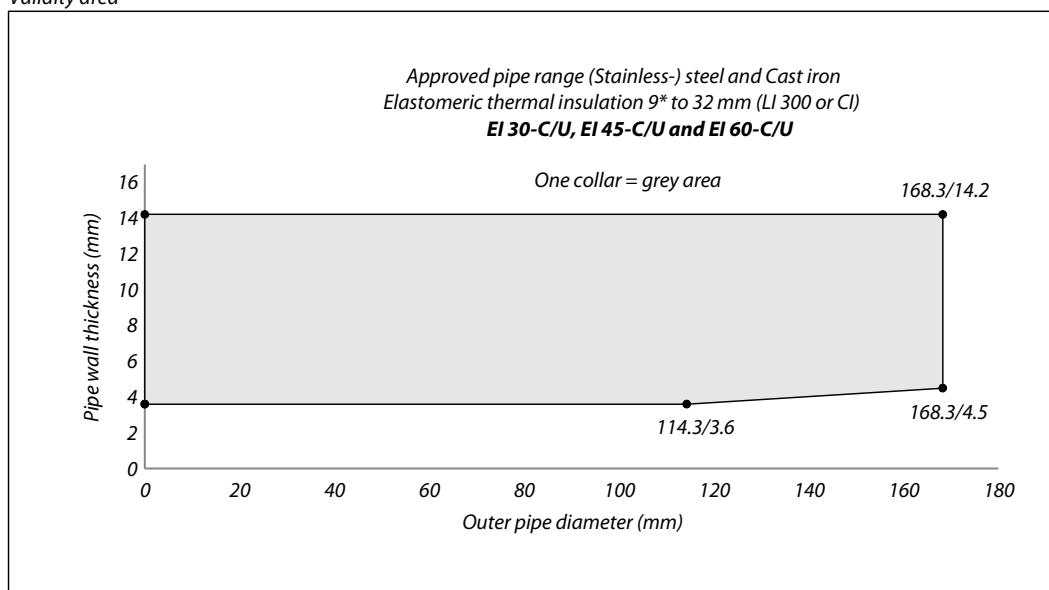
For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

Fire resistance					
Pipe dimensions (mm)		Performance class with pipe end configuration	Insulation thickness (mm)	Pipe material	See Figure
Outer diameter	Wall thickness				
≤ 114.3	3.6 to 14.2	EI 60-C/U* E 90-C/U*	9* to 32	(Stainless-) steel / Cast iron	73
≤ 168.3	4.5 to 14.2	EI 60-C/U* E 90-C/U*			
≤ 114.3	3.6 to 14.2	EI 90-C/U E 90-C/U	32	(Stainless-) steel / Cast iron	74
≤ 168.3	4.5 to 14.2	EI 90-C/U* E 90-C/U*			

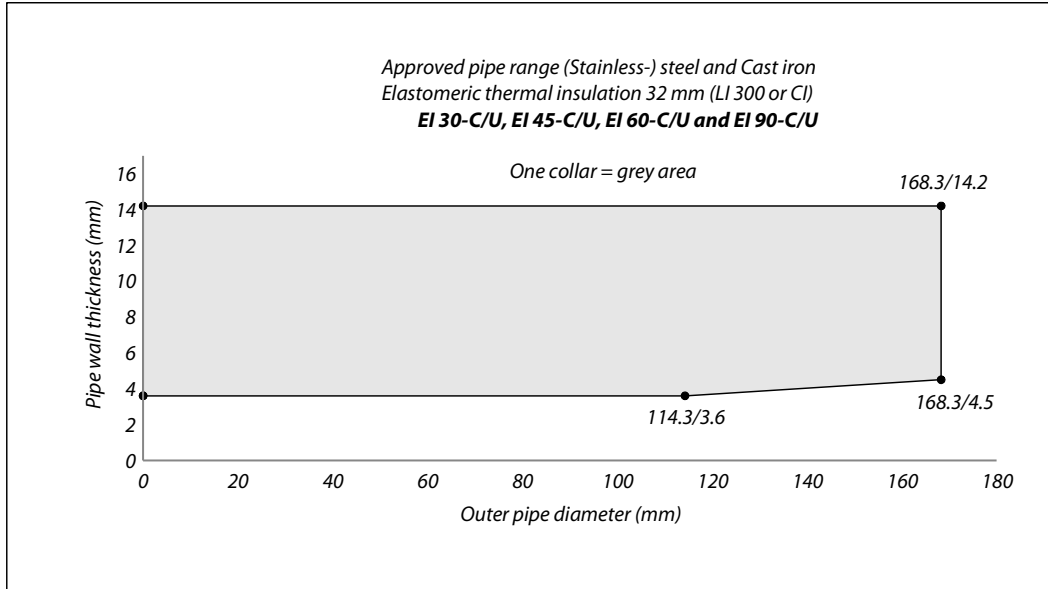
Based upon an assessment concerning different insulation materials it is expected that the fire resistances given above will also be met for penetration seals fitted with insulation of the following types (the insulation dimensions shall correspond to the dimensions in the table):

- AF/Armaflex and Armaflex XG;
- SH/Armaflex for outer pipe diameters ≤ Ø39 mm;
- Kaiflex ST and Kaiflex KKplus s2;
- K-Flex EC, K-Flex EC AD, K-Flex EC, K-Flex ST, K-Flex ST/SK, K-Flex ST Frigo, K-Flex SRC and K-Flex SRC Eco.

173 Validity area



174 Validity area



### 5.9.3 With elastomeric thermal insulation (LS and CS)

#### Metal pipes

On the next page, drawing RF-ST-11.0.22 of the pipe penetration seals with metal pipes with elastomeric thermal insulation is given for the system fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.9.3 the installation details regarding the field of application are given.

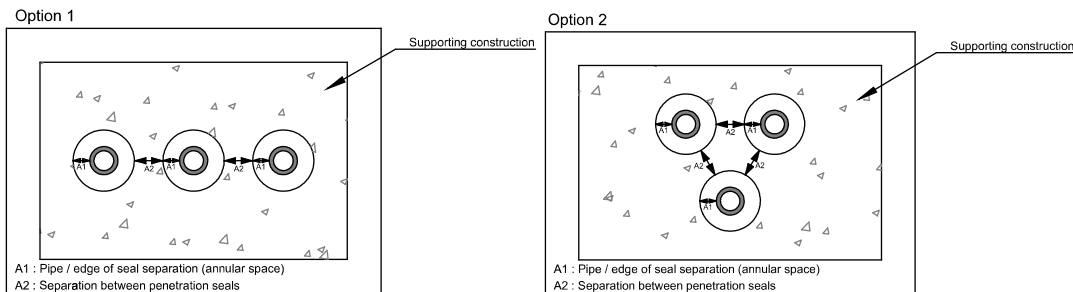
The fire resistance is valid for insulation AF/Armaflex made out of flexible elastomeric EPDM rubber foam with a reaction to fire class B<sub>L</sub>-s3, d0 or B-s3, d0 (or equal or better) in accordance with EN 13501-1. The insulation must be applied sustained through the aperture with a minimum distance of 450 mm on both sides from the point where the pipe emerges from the floor (LS in accordance with Table 1 of EN 1366-3:2009). The insulation may also be applied continued (CS).

#### t5.9.3 Installation details

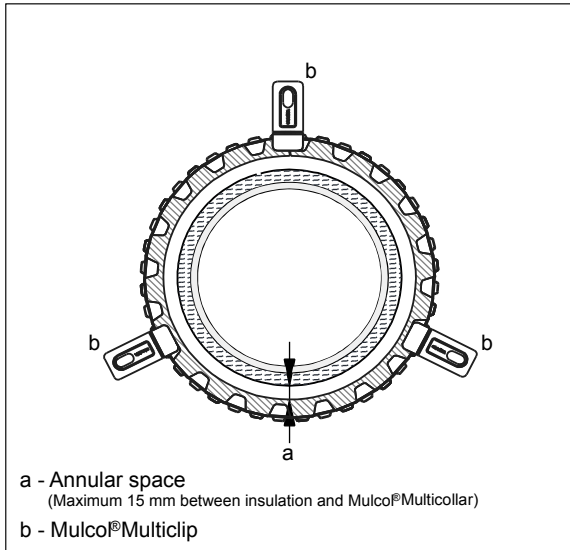
Distance to first pipe support above the floor	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 75)		Allowed annular space (distance 'a' in drawing)	
	Mulcol® Multisealant A exposed face, rock wool ≥ 35 kg/m <sup>3</sup> unexposed face	Mulcol® Multisealant A both faces	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 350 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Annular gap ≤ 20 mm / depth ≥ 10 mm		

If more single pipe penetrations are placed in the floor, the minimum distance between the aperture edges is 100 mm, distance A<sub>2</sub>, see Figure 75. The annular gap A<sub>1</sub> is also visible in this Figure.

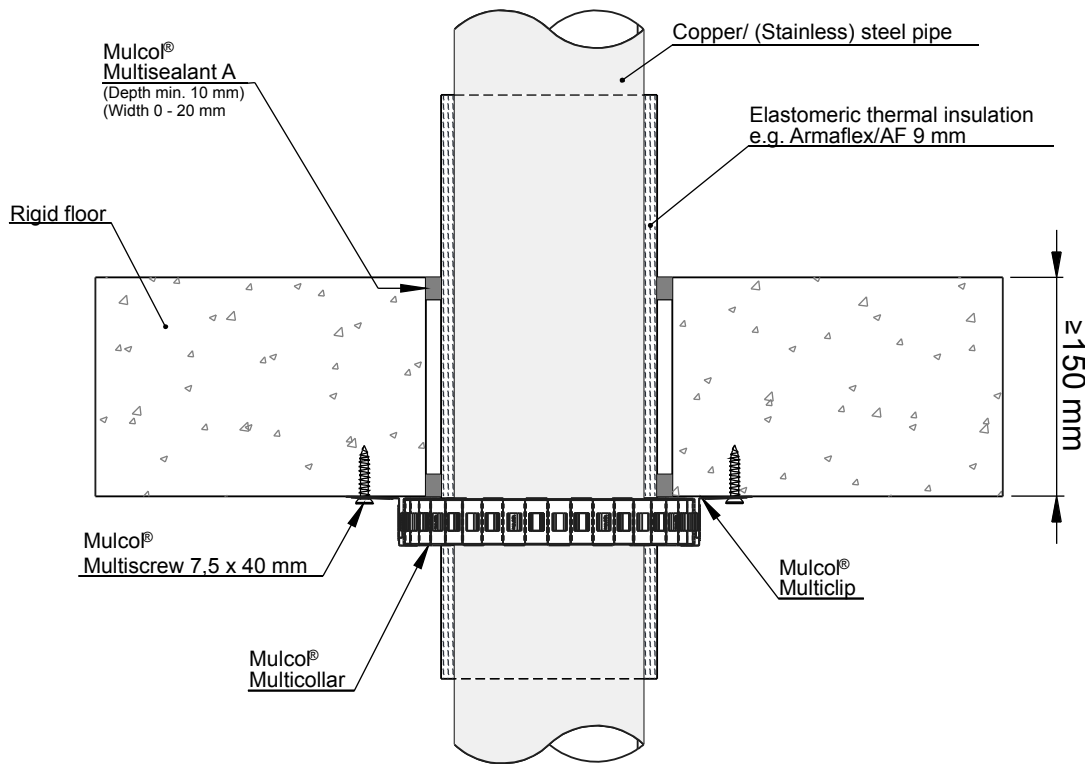
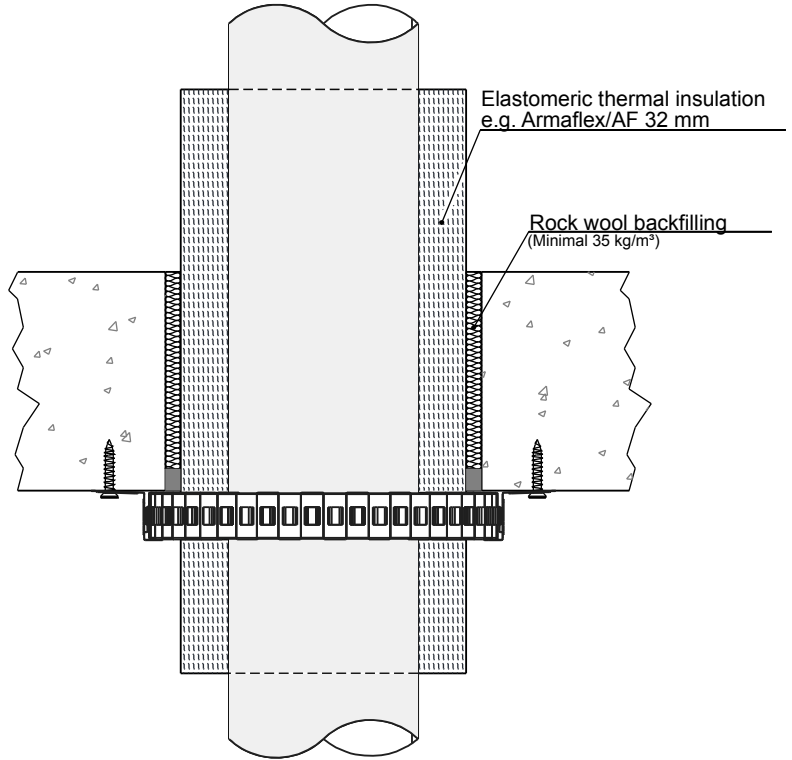
#### f75 Visualization single penetrations



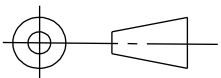
Front view



Side view



American projection



Scale : 1:5

Unit of measure : mm

Date : 8-12-2016

Company : Mulcol International B.V.

Department : Research & Development

Draftsman : K.J.

RF-ST-11.0.22

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

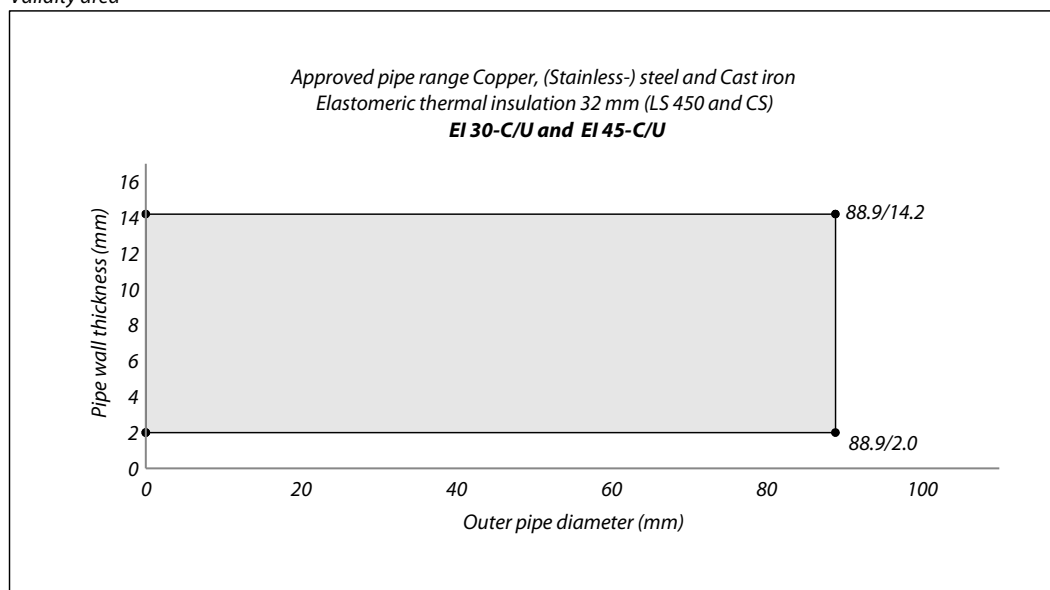
For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

Fire resistance					
Pipe dimensions (mm)		Performance class with pipe end configuration	Insulation thickness (mm)	Pipe material	See Figure
Outer diameter	Wall thickness				
≤ 88.9	2.0 to 14.2	EI 45-C/U (LS)   EI 60-C/U (CS)* E 90-C/U (LS)   E 90-C/U (CS)*	32	Copper / (Stainless-) steel / Cast iron	76 and 77
≤ 114.3	3.6 to 14.2	EI 60-C/U (LS and CS) E 90-C/U (LS and CS)	9 to 32*	(Stainless-) steel / Cast iron	78
≤ 168.3	4.5 to 14.2	EI 60-C/U (LS and CS) E 60-C/U (LS and CS)	9* to 32		

Based upon an assessment concerning different insulation materials it is expected that the fire resistances given above will also be met for penetration seals fitted with insulation of the following types (the insulation dimensions shall correspond to the dimensions in the table):

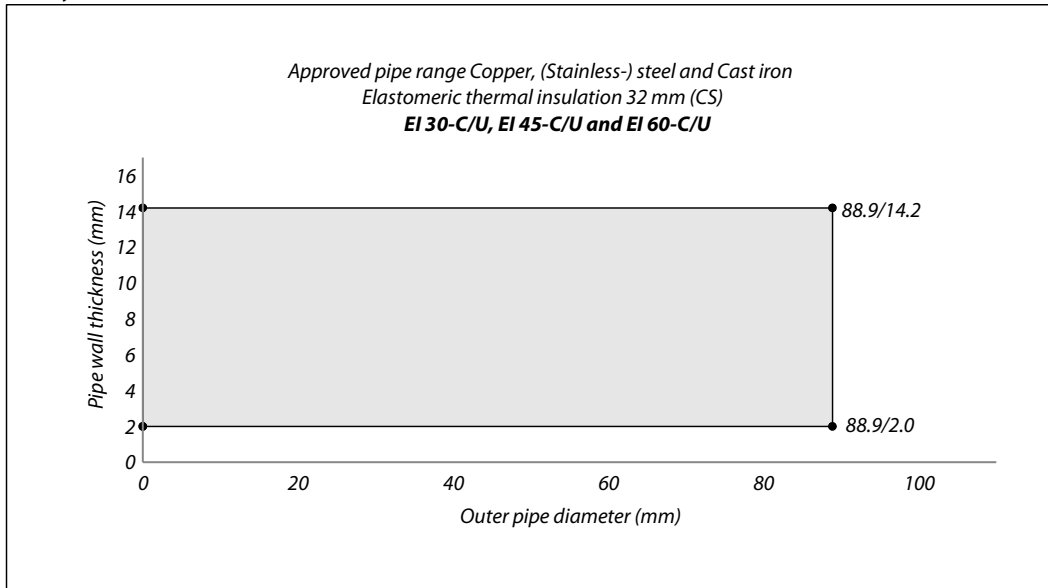
- AF/Armaflex and Armaflex XG;
- SH/Armaflex for outer pipe diameters ≤ Ø39 mm;
- Kaiflex ST and Kaiflex KKplus s2;
- K-Flex EC, K-Flex EC AD, K-Flex EC, K-Flex ST, K-Flex ST/SK, K-Flex ST Frigo, K-Flex SRC and K-Flex SRC Eco.

176 Validity area

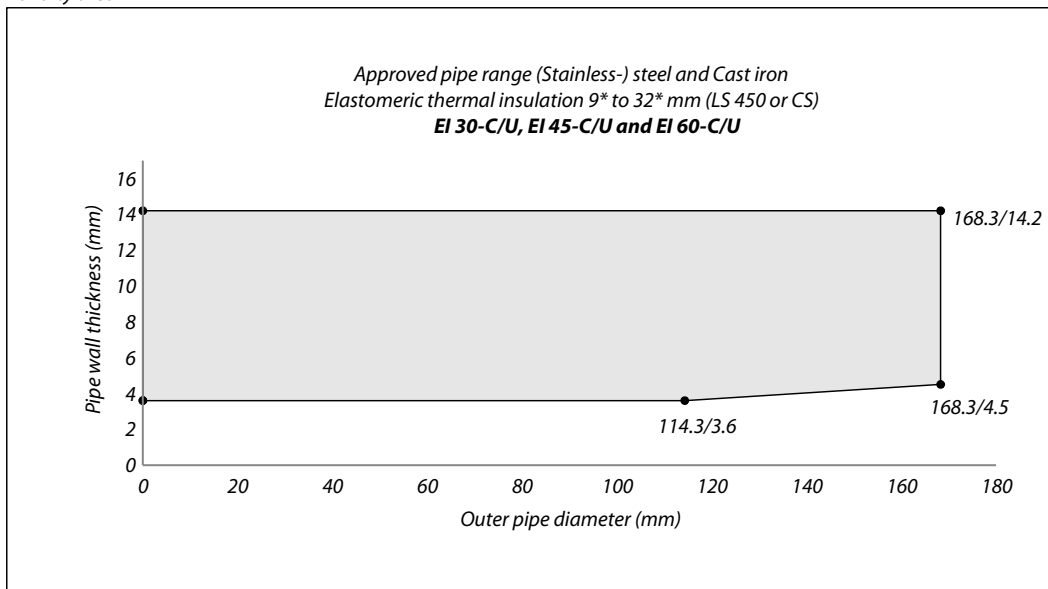




f77 Validity area



f78 Validity area



## 5.9.4 With elastomeric thermal insulation through a seal system (LI and CI)

### Metal pipes

On the next page, drawing PBrf-ST-11.0.22 of the pipe penetration seals with metal pipes with elastomeric thermal insulation through a seal is given for the system fitted with one Mulcol® Multicollar Slim placed below the floor. In Table 5.9.4 the installation details regarding the field of application are given.

For multiple penetrations, the use of the Mulcol® Multimastic FB1 (2 x 50 mm) penetration seal system is recommended. The aperture size in the floor may be up to 2400 mm long and 1200 mm wide. A cavity of maximum 50 mm between the rock wool panels may be present. For further details see Paragraph 5.1.5.

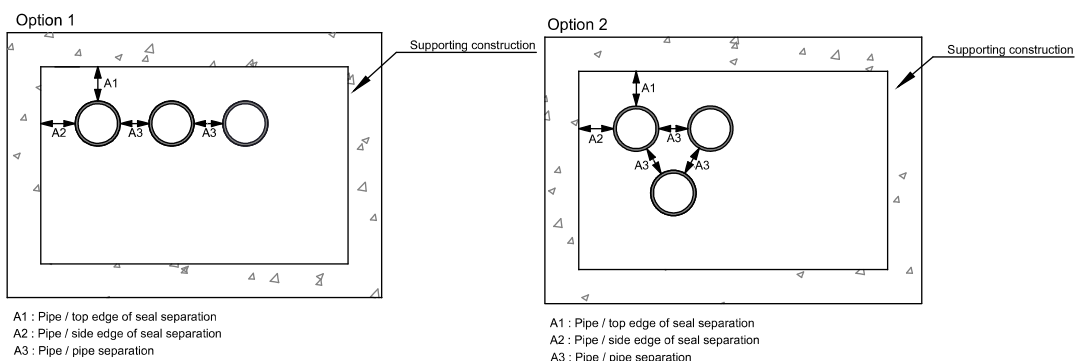
The fire resistance is valid for insulation AF/Armaflex made out of flexible elastomeric EPDM rubber foam with a reaction to fire class B<sub>1</sub>-s3, d0 or B-s3 or, d0 (or equal or better) in accordance with EN 13501-1. The insulation must be applied interrupted at the seal with a minimum distance of 300 mm on both sides from the point where the pipe emerges from the floor (LI in accordance with Table 1 of EN 1366-3:2009). The insulation may also be applied continued (CI).

### t5.9.4 Installation details

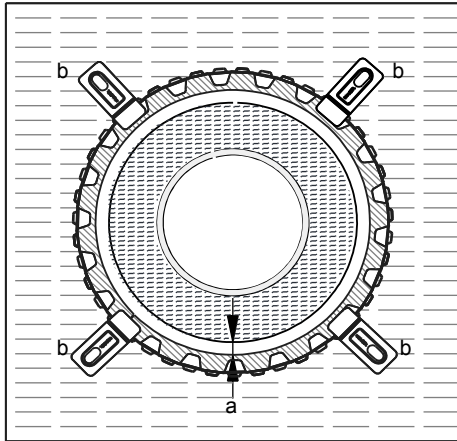
Distance to first pipe support above the floor	Distance between pipes (A <sub>1</sub> to A <sub>3</sub> , see Figure 79)	Allowed filling of annular gap (distance A <sub>1</sub> , see Figure 79)		Allowed annular space (distance 'a' in drawing)	
		Mulcol® Multisealant SP on both faces, with backing rock wool ≥ 35 kg/m <sup>3</sup>	No filling	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm
≤ 350 mm	≥ 100 mm	Annular gap ≤ 20 mm / depth sealant ≥ 10 mm	Approximately the same size as the pipe (tight fit)	Outer diameter ≤ 125 mm / 'a' ≤ 15 mm	Outer diameter > 125 mm / 'a' ≤ 5 mm

If more pipe penetrations are placed in the penetration seal system, the minimum distance between the pipes is 100 mm, distances A<sub>1</sub> to A<sub>3</sub> Figure 79 (the presence of ≥ 60 mm of rock wool between the pipes is mandatory).

### f79 Visualization distance between pipes

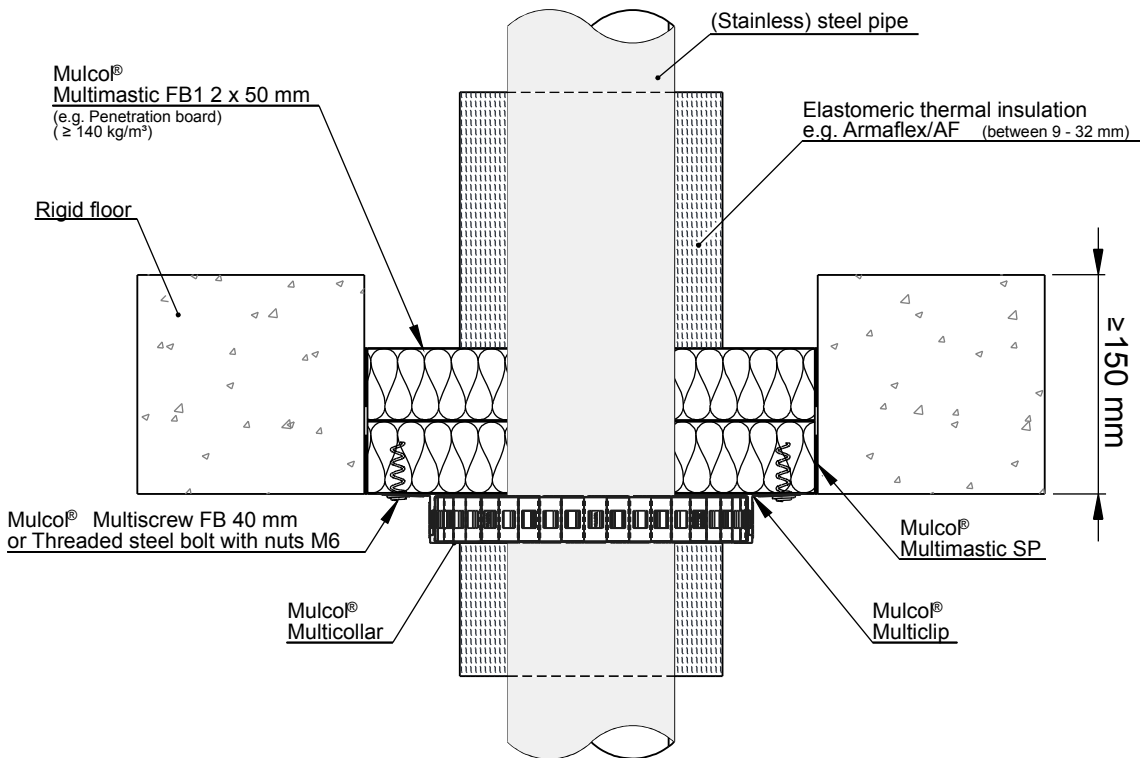
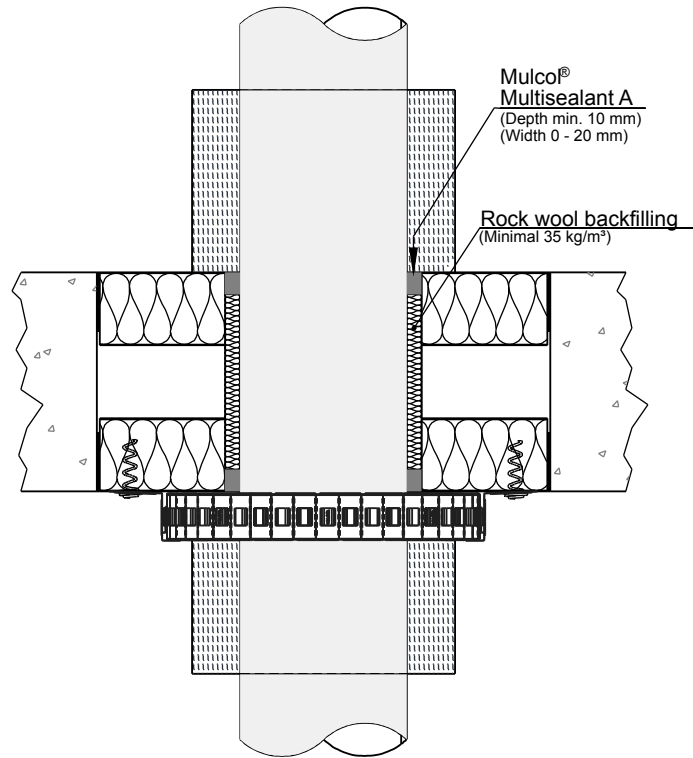


Front view



a - Annular space  
(Maximum 15 mm between insulation and Mulco® Multicollar)  
b - Mulco® Multiclip

Side view

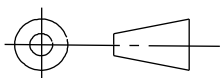


American projection

Scale : 1:5

Company : Mulcol International B.V.

PBrf-ST-11.0.22



Unit of measure : mm

Department : Research & Development

Date : 9-12-2016

Draftsman : K.J.

A4



**Fire test pipe penetration seal**  
**Mulco® Multicollar**  
**Installation in rigid floor**

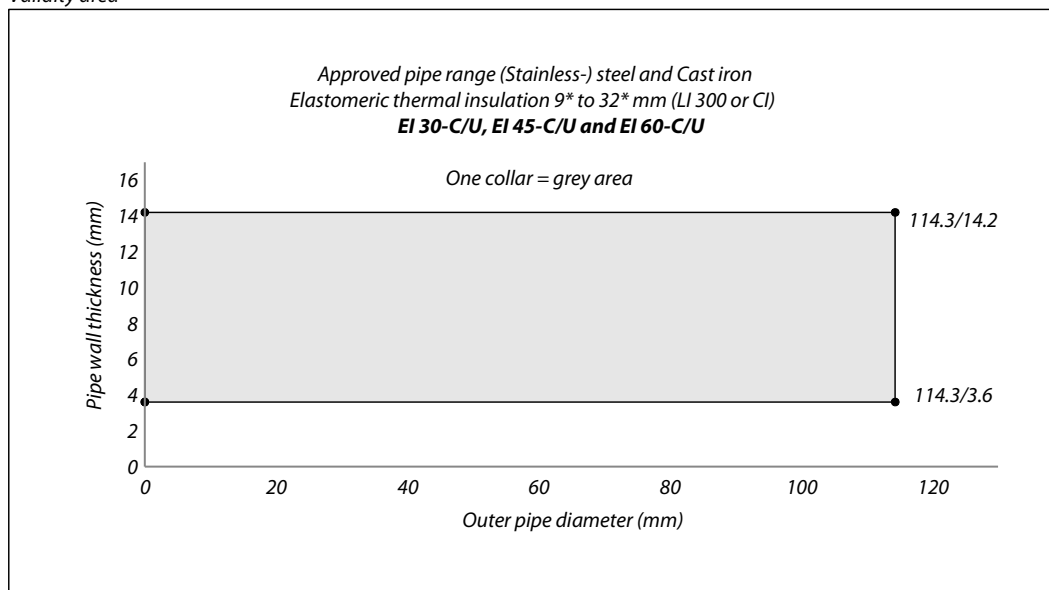
For this system, a fire resistance in one direction (from below) according to the following combinations of performance parameters and classes applies. A visualization of the validity area for the fire resistance for EI is given in the Figures as stated.

Fire resistance					
Pipe dimensions (mm)		Performance class with pipe end configuration	Insulation thickness (mm)	Pipe material	See Figure
Outer diameter	Wall thickness				
≤ 114.3	3.6 to 14.2	EI 60-C/U* E 90-C/U*	9* to 32	(Stainless-) steel / cast iron	80
≤ 114.3	3.6 to 14.2	EI 90-C/U E 90-C/U	32		81

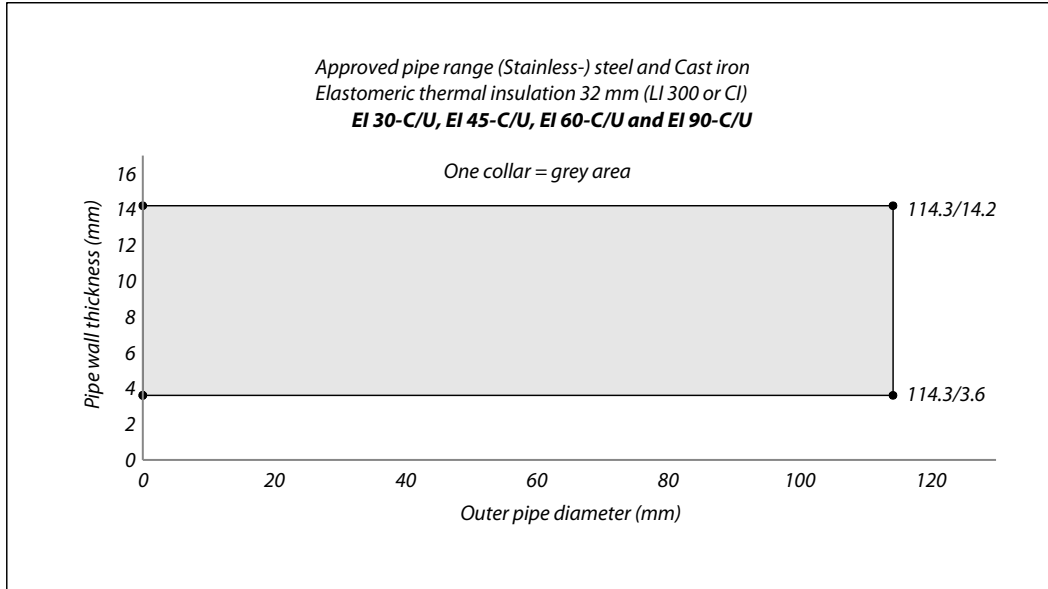
Based upon an assessment concerning different insulation materials it is expected that the fire resistances given above will also be met for penetration seals fitted with insulation of the following types (the insulation dimensions shall correspond to the dimensions in the table):

- AF/Armaflex and Armaflex XG;
- SH/Armaflex for outer pipe diameters ≤ Ø39 mm;
- Kaiflex ST and Kaiflex KKplus s2;
- K-Flex EC, K-Flex EC AD, K-Flex EC, K-Flex ST, K-Flex ST/SK, K-Flex ST Frigo, K-Flex SRC and K-Flex SRC Eco.

f80 Validity area



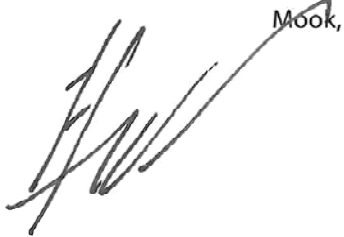
f81 Validity area



## 6 Status of this document

This report provides a summary of the possible classifications in line with EN 13501-2:2016 and does not represent a type approval or certification of this product.

This report contains 150 pages



Mook,