



ASSESSMENT REPORT

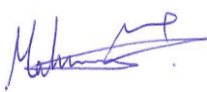


The fire resistance performance of service penetrations protected by Protecta FR Collar if tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1-2005

Client: Polyseam Ltd, 15 St Andrews Road, Huddersfield West Yorkshire HD1 6SB

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Amendment schedule

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			Prepared by	Reviewed by	Approved by
	Expiry: 31/05/2023	Name	Mahmoud Akl	Omar Saad	Omar Saad
		Signature			
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			Prepared by	Reviewed by	Approved by
	Expiry: 31/08/2023	Name	Mahmoud Akl	Omar Saad	Omar Saad
		Signature			

Contact Information

Warringtonfire Aus Pty Ltd - ABN 81 050 241 524

NATA Registered Laboratory
Unit 2, 409-411 Hammond Road
Dandenong Victoria 3175
Australia
T: +61 (0)3 9767 1000

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1. Introduction

This report presents an assessment of the fire resistance performance of service penetrations protected by Protecta FR Collar if tested in accordance with AS 1530.4:2014¹ and assessed in accordance with AS 4072.1-2005².

The tested prototypes described in section 2 of this report, when subjected to the proposed variations described in section 1 and tested in accordance with the relevant standards described in section 4, are assessed to achieve performance as summarised in section 5.

The validity of this assessment is conditional on compliance with sections 6, 7, 8 and 9 of this report.

Summaries of the test data on which this assessment is based are provided in Appendix A. A summary of the critical issues leading to the assessment conclusions including the main points of argument is discussed in Appendix B.

2. Tested prototypes

This assessment is based on reference tests WF 372505, WF 377302, WF 380977, WF 16029, WF375800, WF 380963, WF 369908, WF 375797, WF 394232, WF 372808, WF 382336, WF 394948, WF 394021, WF 397678, WF 397686, WF 396820, WF 397686, WF 390963 & WF 390800 being tests describing various plastic pipes penetrating a 150mm thick concrete slab and protected with Protecta FR Collar.

This assessment also references test reports F16151, WF 376483, WF 380112, WF 384982, WF 392646, WF 395179, WF 398928, WF 398517, WF 384982, WF 376483 being tests describing various plastic pipes penetrating a 100mm flexible wall system protected with Protecta FR Collar.

The tests were conducted in accordance with BS EN 1363-1 : 2012³, BS EN 1366-3:2009⁴ and BS EN 1366-4:2006⁵. The tests were sponsored by Polyseam and conducted by Exova Warringtonfire UK

3. Variation to tested prototypes

In wall systems, the proposed construction shall be as tested in the above referenced test reports with consideration of following variations:

- Performance of various plastic pipes and cables protected with Protecta FR Collar if tested in accordance with AS 1530.4:2014 and assessed in general accordance with AS 4072.1-2005.
- Extension of FRLs to intermediate pipe sizes based on the testing of the maximum and minimum pipe size. This is applicable to pipe sizes between 40mm-100mm.
- Flexible wall systems must have a minimum thickness of 100mm and consists of steel or timber studs lined on both faces with 2 layers of minimum 12.5mm thick fire rated plasterboard.
- The wall system can optionally be insulated with optional lining of the aperture.
- For timber framed walls, it is required that no part of the penetration seal is closer than 100mm to a stud, the cavity is closed between the penetration seal and the stud, and minimum 100mm of insulation is provided with the cavity between the penetration seal and the stud.
- Rigid walls must have a minimum thickness of 100mm or as otherwise specified and consist of concrete, aerated concrete or masonry with minimum density of 650 kg/m³

¹ Methods for fire tests on building materials, components and structures Fire-resistance tests for elements of construction

² Components for the protection of openings in fire-resistant separating elements Service penetrations and control joints

³ FIRE RESISTANCE TESTS - PART 1: GENERAL REQUIREMENTS

⁴ FIRE RESISTANCE TESTS FOR SERVICE INSTALLATIONS - PART 3: PENETRATION SEALS

⁵ FIRE RESISTANCE TESTS FOR SERVICE INSTALLATIONS - PART 4: LINEAR JOINT SEALS

- The flexible or rigid wall thickness can be reduced; however, the local thickness of the aperture shall be built up to a minimum thickness of 100mm by installing additional layers of minimum 13mm fire rated plasterboard around the opening (100mm×100mm from the edge of the aperture)
- Single layer walls are permitted provided that the area around the penetration is built up with an additional layer of fire rated plasterboard. (100mm×100mm from the edge of the aperture)

In floor systems, the proposed construction shall be as tested in the above referenced test reports with consideration of the following variations

- Performance of various plastic pipes and cables protected with Protecta FR Collar if tested in accordance with AS 1530.4:2014
- Extension of FRLs to intermediate pipe sizes based on the testing of the maximum and minimum pipe size
- Rigid floor thickness shall be limited to 150mm (as tested) and comprise aerated concrete with a minimum density of 650kg/m³, floors are required to be otherwise tested to achieve FRL of 240/240/240 or -/240/240/240
- Applicability of FRLs to thinner concrete slab of minimum thickness of 100mm is permissible provided that local aperture beading is provided using 13mm or 16mm fire rated plasterboard or Protecta FR Board 50mm or greater, single or double-sided such that the overall thickness of the separating floor element is not less than 150mm. Insulation performance of the system will be governed by the concrete slab thickness as stated in AS 3600:2018⁶. The overall FRL of the system will be governed by the FRL extracted from AS 3600:2018

The following is applicable to both systems penetrated by services protected with Protecta FR Collars:

- It was confirmed that the tested Polyethylene pipes were PE100 which as confirmed by report sponsor and pipe manufacturer is similar to HDPE pipes. Therefore, the FRLs shown for PE pipes in section 5 are applicable to HDPE pipes.
- The Protecta FR Collars were tested oversize- i.e, the internal diameter of the collar can be larger than the pipe diameter. An oversize collar can therefore be used in situations where the penetration size is greater than the pipe diameter and/or where the pipe is inserted at an angle.
- The Protecta FR Collars shall be attached with steel screws, anchors or fixings that are suitable for the substrate that the pipe collar is fitted to.
- Test results for cables remain valid if the diameter of a single cable is reduced and/or number of cables in a bunch is reduced provided that overall diameter of the bunch of any individual cable is not greater than tested.
- The test results obtained with standard configuration covers all types of insulated cables with copper or aluminium conductors, fibre optic cables and bundled communication cables, except hollow cables.
- Support of services in walls and floors shall be maintained as per AS 1530.4:2014 and AS 4072.1:2005 requirements.

⁶ Concrete structures

4. Referenced test standard

This report is prepared with reference to the requirements of AS 1530.4:2014 and general requirements of AS 4072.1-2005

5. Formal assessment summary

On the basis of the discussion presented in this report, it is the opinion of this testing authority that if the tested prototype described in section 2 had been varied as in section 3, it will achieve the fire resistance performance as stated below if tested in accordance with the test method referenced in section 4 when subject to the requirements of section 7.

Flexible or Rigid wall constructions with wall thickness of minimum 100mm

Penetration Seals, in plasterboard walls and concrete/masonry walls

Penetration Seal: Combustible pipes fitted with Protecta FR Collar, to both sides of the wall

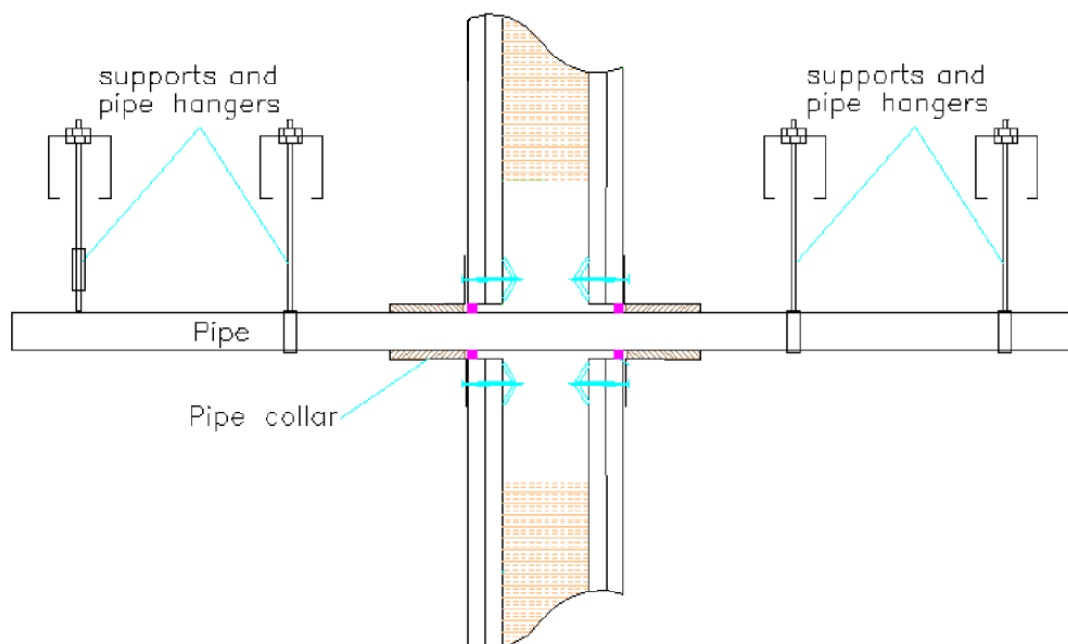


Figure 1 General arrangement of plastic pipes protected with Protecta FR collar installed at both sides of the wall

Table 1 Assessment summary of PVC-U pipes (32-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	1.2-3.7	30x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/90/60
40	1.2-3.7			
50	1.2-4.6			
55	1.3-4.7	30x3.2		-/60/60
63	1.5-5.0	30x3.6		
75	1.8-5.4	30x4.2		
82	2.0-5.6	30x4.6		
90	2.2-5.9	30x5.0		
110	2.7-6.6	30x6.0		

Table 2 Assessment summary of PVC-U pipes (110-160mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	50x6.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
125	2.9-7.4	50x8.8		
140	3.0-8.3	50x11.5		
160	3.2-9.5	50x15.0	Tested in U/C, FRL applicable to U/C & C/C only	-/60/60

Table 3 Assessment summary of PVC-U pipes (32-110mm) with thicker wall thickness installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	2.4-4.6	30x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
40	2.4-4.6			
50	2.4-4.6			
55	2.5-4.7	50x3.2		
63	2.5-5.0	50x3.6		
75	2.6-5.4	50x4.2		
82	2.6-5.6	50x4.6		
90	2.6-5.9	50x5.0		
110	2.7-6.6	50x6.0		

Table 4 Assessment summary of PVC-U pipes (110-315mm) with different collar inlay size installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	60x6.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
125	2.9-7.4	60x9.0		
140	3.0-8.3	60x11.5		
160	3.2-9.5	60x15.0		-/60/60
315	9.2	75x18	Tested in C/C, FRL applicable to C/C only	-/60/60

Table 5 Assessment summary of PE pipes (32-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-4.6	30x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/45
40				
50				
32	3.0-5.6	30x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/90/60
40				
50				
55	3.0-6.0	30x3.2	Tested in U/C, FRL applicable to U/C & C/C only	-/60/60
63	3.1-6.6	30x3.6		
75	3.2-7.5	30x4.2		
82	3.2-8.0	30x4.6		
90	3.3-8.6	30x5.0		
110	3.4-10.0	30x6.0		

Table 6 Assessment summary of PE pipes (110-160mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	3.4-10.0	50x6.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
125	4.2-9.8	50x9.0	Tested in U/C, FRL applicable to U/C & C/C only	-/60/60
140	5.1-9.6	50x11.5		
160	6.2-9.5	50x15.0		

Table 7 Assessment summary of PE pipes (32-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-4.6	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/120/90
40				
50				
55	3.0-5.0	50x3.2	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
63	3.1-5.7	50x3.6		
75	3.2-6.8	50x4.2		
82	3.2-7.4	50x4.6		
90	3.3-8.1	50x5.0		
110	3.4-10.0	50x6.0		

Table 8 Assessment summary of PE pipes (110-250mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	3.4-10.0	60x6.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
125	4.2-9.8	60x8.8		
140	5.1-9.6	60x11.5		
160	4.9-14.6	60x15.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/90
200	18.2	75x10.8	Tested in C/C, FRL applicable to C/C only	-/60/60
250	22.7	75x12.6		

Table 9 Assessment summary of PP pipes (32-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-5.6	30x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/90/60
40				
50				
32	1.8-4.6		Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
40				
50				
50	1.8-5.6	30x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/90/60
55	2.0-5.7	30x3.2		
63	2.2-5.8	30x3.6		
75	2.5-5.9	30x4.2		
82	2.7-6.0	30x4.6		
90	2.9-6.1	30x5.0		
110	3.4-6.3	30x6.0		

Table 10 Assessment summary of PP pipes (50-160mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	1.8-5.6	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/90/60
55	2.0-6.0	50x3.2	Tested in U/C, FRL applicable to U/C & C/C only	-/60/60
63	2.2-6.6	50x3.6		
75	2.5-7.6	50x4.2		
82	2.7-8.2	50x4.6		

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
90	2.9-8.9	50x5.0		
110	3.4-10.5	50x6.0		
125	3.8-11.7	50x8.8		
140	4.2-12.9	50x11.5		
160	4.9-14.6	50x15.0		

Table 11 Assessment summary of PP pipes (50-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	1.8-4.6	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
55	2.0-4.7	50x3.2		
63	2.2-5.0	50x3.6		
75	2.5-5.4	50x4.2		
82	2.7-5.6	50x4.6		
90	2.9-5.9	50x5.0		
110	3.4-6.6	50x6.0		

Table 12 Assessment summary of PP pipes (110-160mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	3.4-6.6	60x6.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
125	3.9-9.0	60x9.0		-/60/60
140	4.4-11.4	60x11.5		
160	4.9-14.6	60x15.0		

Table 13 Assessment summary of Wavin SiTech+PP-M B (32-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/120/120
50	1.8	50x3.2		
75	1.8-2.5	50x4.2		-/120/60
90	1.8-2.9	50x5.0		
110	1.8-3.4	50x6.0		

Table 14 Assessment summary of Aquatherm Green SDR9 MF PP-RP (32-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-5.6	30x3.0	Tested in C/C, FRL applicable to C/C systems only	-/120/120
40		50x3.0		
50		50x3.2		
63	3.6-7.0	50x3.6		-/120/60
75	4.1-8.4	50x4.2		
90	4.7-10.1	50x5.0		
110	5.6-12.3	50x6.0		

Table 15 Assessment summary of Geberit Silent PP (32-110mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-50	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/120/120
75	1.8-2.5	50x4.2		-/120/60
90	1.8-2.9	50x5.0		
110	1.8-3.4	50x6.0		

Table 16 Assessment summary of Polo-Kal NG Poloplast PP-MV (32-160mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	1.8-2.0	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/120/120
50		50x3.2		
75	1.9-2.6	50x4.2		-/120/90
90	1.9-2.9	50x5.0		
110	2.0-3.4	50x6.0		
125	3.9	60x9.0	Tested in U/C, FRL applicable to U/C & C/C only	-/120/120
			Tested in U/U, applicable to all pipe end configurations	-/120/0
160	4.9	60x15.0	Tested in U/U, FRL applicable to all pipe end configurations	-/120/120

Table 17 Assessment summary of Rehau Raupiano Plus PP-DD (40-160mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
40	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/120/90
50		50x3.2		
75	1.9-2.6	50x4.2		-/120/60
90	1.9-2.9	50x5.0		
110	2.0-3.4	50x6.0		-/120/120
125	3.9	60x9.0		
160	4.9	60x15.0		

Table 18 Assessment summary of BluePower Multilayer pipe-TR02-PP (32-160mm) installed as per Figure 1

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/120/90
50		50x3.2		
75	1.8-2.5	50x4.2	Tested in C/U, applicable to all pipe end configurations except U/U	-/120/60
90	1.8-2.9	50x5.0		
110	1.8-3.4	50x6.0		-/60/60
125	2.3-3.8	60x9.0		
160	3.4-4.9	60x15.0		

Flexible or Rigid wall constructions with wall thickness of minimum 120mm
Penetration Seals, in plasterboard walls and concrete/masonry walls
Penetration Seal: Combustible pipes fitted with Protecta FR Collar to both sides of the wall

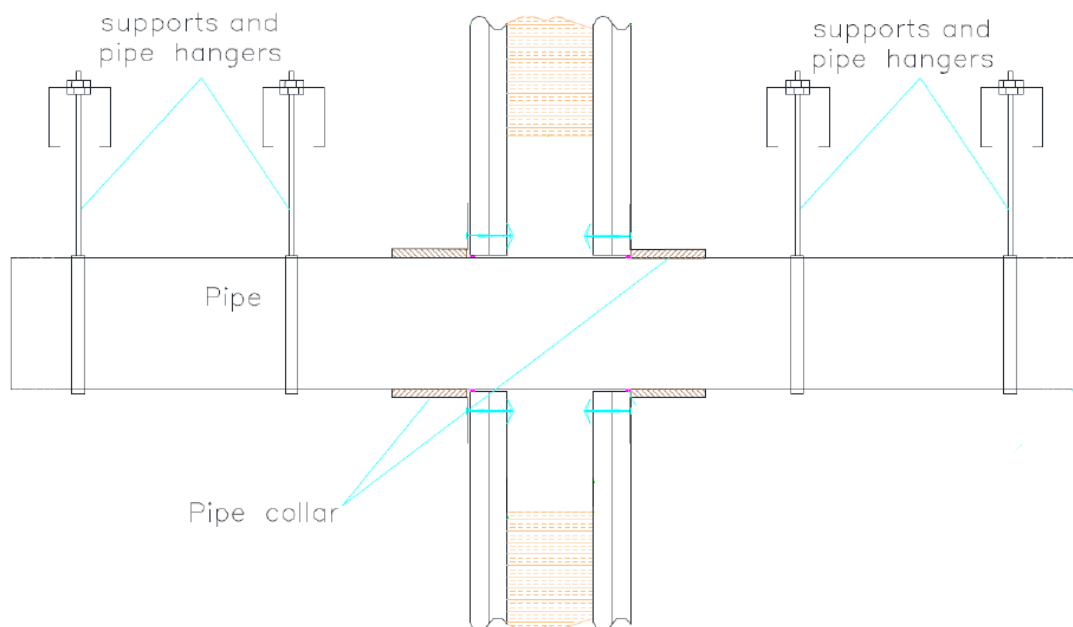


Figure 2 General arrangement of various plastic pipes protected with Protecta FR Collar installed at both sides of the wall

Table 19 Assessment summary of PVC-U (32-100mm) installed as per Figure 2

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-50	2.4-3.7	50x3.0	Tested in C/C, FRL applicable to C/C only	-/120/120
55	2.4-3.9	50x3.2		
63	2.5-4.3	50x3.6		
75	2.5-4.9	50x4.2		
82	2.6-5.2	50x4.6		
90	2.6-5.6	50x5.0		
110	2.7-6.6	50x6.0		

Table 20 Assessment summary of PVC-U (110-160mm) installed as per Figure 2

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	50x6.0	Tested in C/C, FRL applicable to C/C only	-/120/120
125	3.1-7.5	60x8.8		
140	3.5-8.4	60x11.5		
160	4.0-9.5	60x15.0		

Table 21 Assessment summary of PE pipes (32-110mm) installed as per Figure 2

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-50	3.0-4.6	50x3.0	Tested in C/C, FRL applicable to C/C only	-/120/120
55	3.1-5.0	50x3.2		-/120/90
63	3.1-5.7	50x3.6		-/120/90
75	3.2-6.8	50x4.2		-/120/90
82	3.2-7.5	50x4.6		-/120/90
90	3.3-8.2	50x5.0		-/120/90
110	3.4-10.0	50x6.0		-/120/90
110	3.4	50x6.0		-/120/120

Table 22 Assessment summary of PE pipes (110-160mm) installed as per Figure 2

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	50x6.0	Tested in C/C, FRL applicable to C/C only	-/120/90
125	3.1-7.5	60x8.8		-/90/90
140	3.5-8.4	60x11.5		-/90/90
160	4.0-9.5	60x15.0		-/90/90
160	9.5	60x15.0		-/120/120

Table 23 Assessment summary of PP pipes(32-110mm) installed as per Figure 2

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-50	2.9-4.6	50x3.0	Tested in C/C, FRL applicable to C/C only	-/120/90
55	2.0-5.0	50x3.2		
63	2.9-5.7	50x3.6		
75	2.8-6.8	50x4.2		
82	2.8-7.5	50x4.6		
90	2.8-8.2	50x5.0		
110	2.7-10.0	50x6.0		

Table 24 Assessment summary of PP pipes (110-160mm) installed as per Figure 2

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-10.0	50x6.0	Tested in C/C, FRL applicable to C/C only	-/120/90

125	3.3-11.3	60x8.8	
140	4.0-12.8	60x11.5	
160	4.9-14.6	60x15.0	

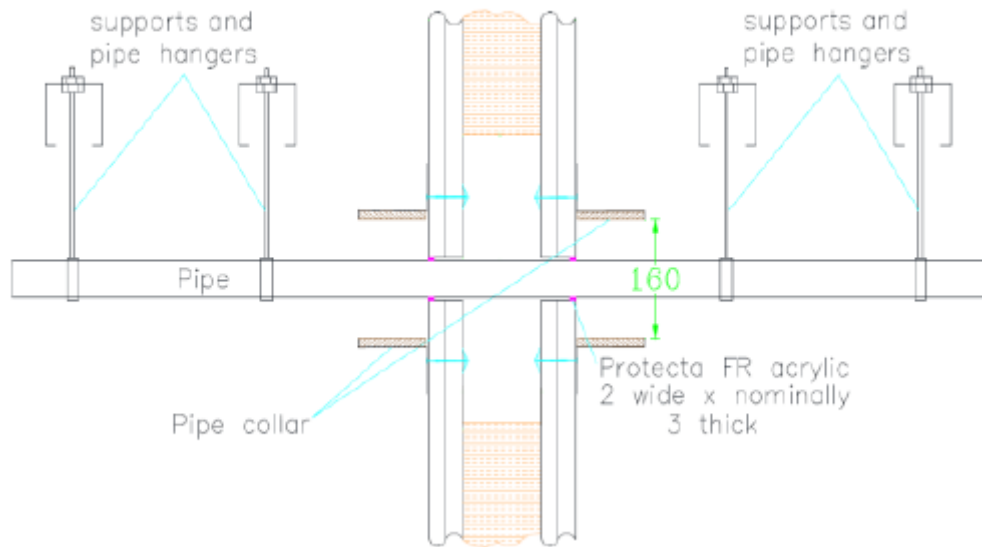


Figure 3 General arrangement of plastic pipes protected with oversized Protecta FR Collar

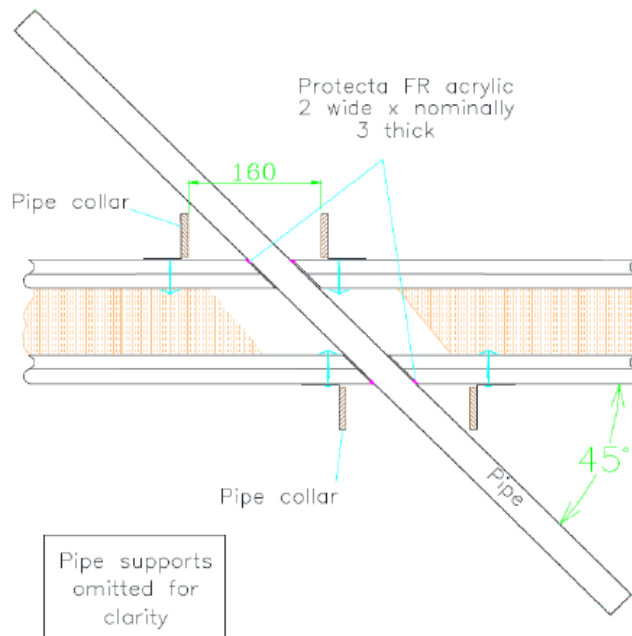


Figure 4 General arrangement of plastic pipes installed at an angle and protected with Protecta FR Collar

Table 25 Assessment summary of uPVC pipe installed at an angle (45°) as shown in Figure 4

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	2.4	60x15.0	Tested in C/C, FRL applicable to C/C only	-/90/90

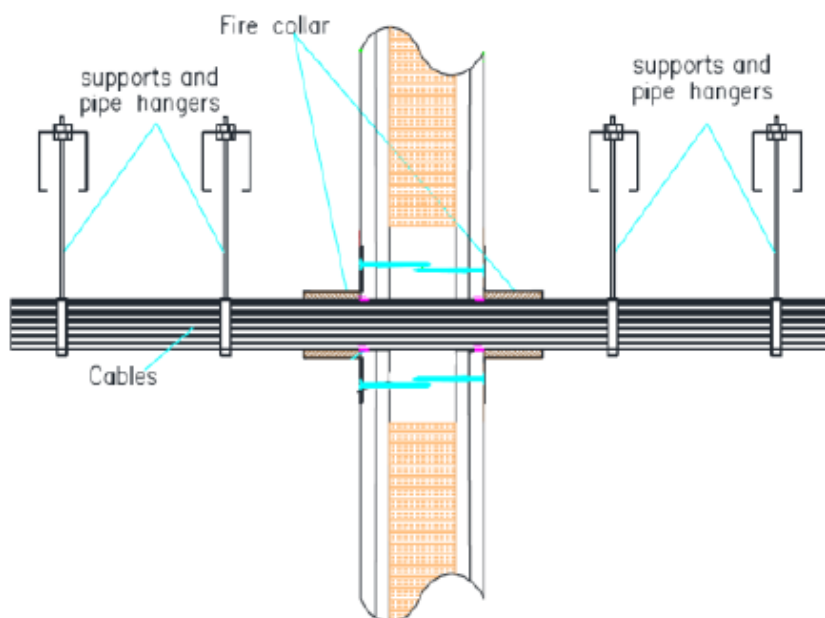


Figure 5 General arrangement of cables protected with Protecta FR Collar installed at both sides of the wall

Table 26 Assessment summary of cables installed as shown in Figure 5

Services	Collar	Collar Inlay (mm)	FRL
Cables up to 21mmØ, in partial or fully tied bundles up to 110mmØ (Collar internal diameter to match cable bundle size)	Up to 110mm collar at 30mm height	Between 3 and 6.0mm	-/120/60
Cables up to 80mmØ, in partial or fully tied bundles up to 160mmØ (Collar internal diameter to match cable bundle size)	Up to 110mm collar at 50mm height, 125-160mm at 60mm height	Between 3 and 15.0mm	-/120/60

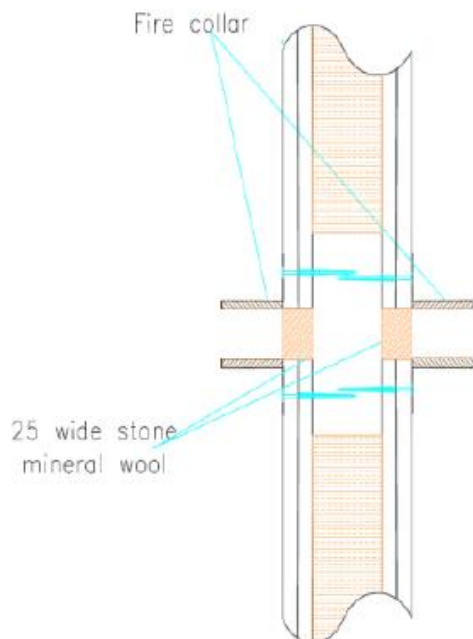


Figure 6 General arrangement of blank hole filled with 25mm thick stone wool and protected with Protecta FR Collar

Table 27 Assessment summary of services installed as per Figure 6

Services	Collar	Collar Inlay (mm)	FRL
None(blank). Hole behind collar to be fitted with minimum 25mm thick stone mineral wool insulation at minimum 33 kg/m ³	Up to 110mmm collar at 30mm height	Between 3 and 6.0mm	-/120/60
None (blank). Hole behind collar to be fitted with minimum 25mm thick stone mineral wool insulation at minimum 33 kg/m ³	Up to 110mmm collar at 50mm height, 125-160mm at 60mm height	15.0	-/120/120

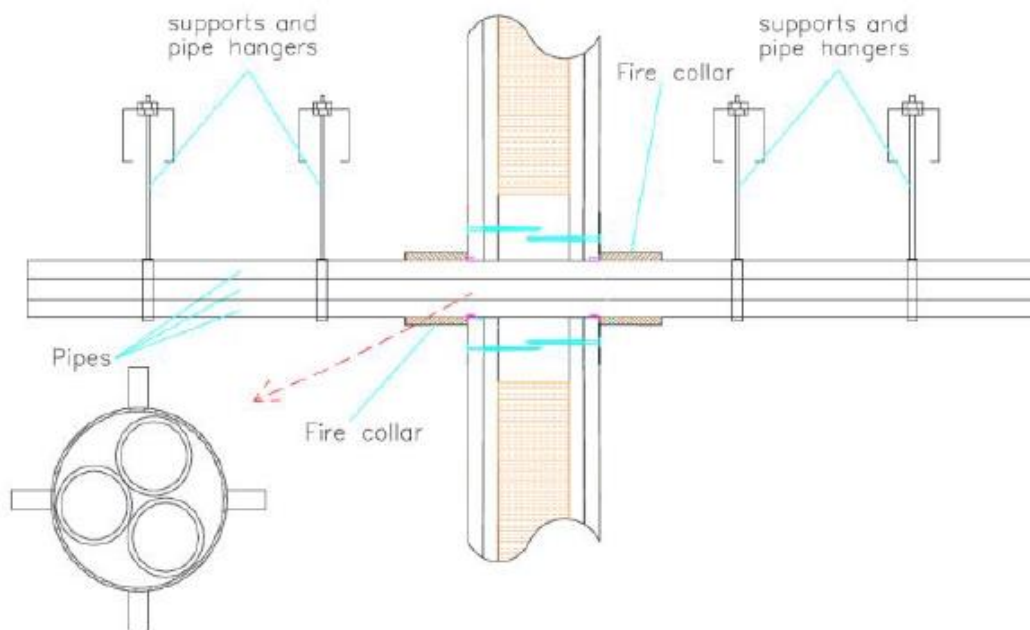


Figure 7 General arrangement of pipes bundle protected with Protecta FR Collar installed at both sides of the wall

Table 28 Assessment summary of Uponor Aqua PEX pipe in pipe system installed as per Figure 7

Services	Collar	Collar Inlay (mm)	Pipe end configurations	FRL
Diameter up to 25mm pipes, wall thickness 0.6mm, in bundles up to 55mm	55mm collar at 30mm height	3.2mm	Tested in C/C configuration	-/120/90

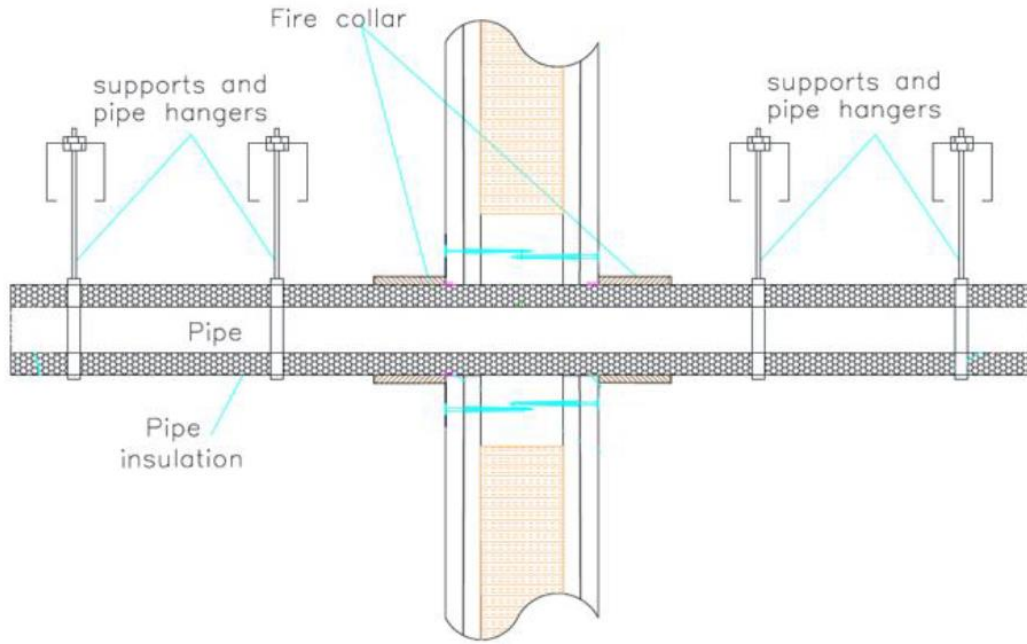


Figure 8 General arrangement of metallic pipes protected with Protecta FR Collar installed at both sides of the wall

Table 29 Assessment summary of metallic pipes installed as per Figure 8

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Insulation	Pipe End Configuration	FRL
54	1.2	Ø110x50x6.0	19mm thick Elastomeric insulation minimum class	Tested in C/C, FRL applicable to C/C only	-/120/90
54	1.2	Ø110x50x6.0	25mm thick Phenolic Foam insulation		-/120/60
54	1.2	Ø110x50x6.0	20mm thick PE foam insulation		-/120/90

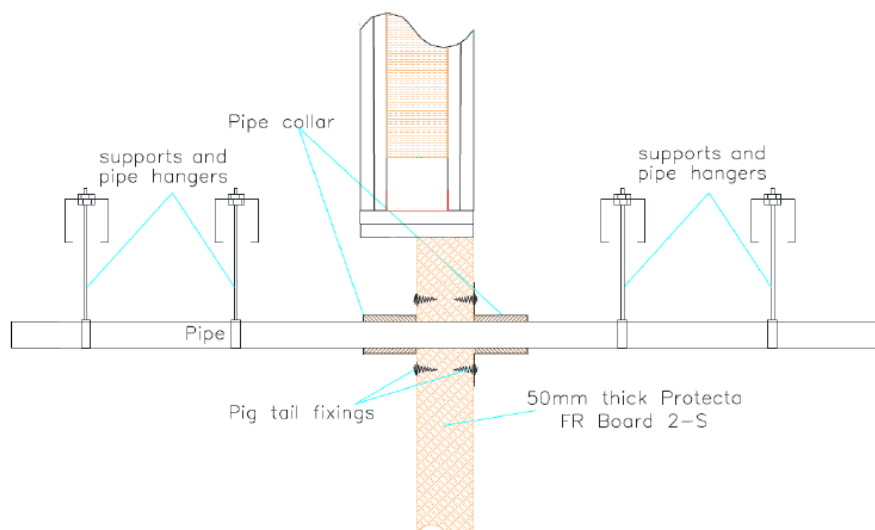


Figure 9 General arrangement of plastic pipes penetrating a minimum 50mm thick Protecta FR Board installed in drywalls and concrete/masonry walls and protected with Protecta FR Collar installed at both sides of the wall

Table 30 Assessment summary of uPVC pipes (32-110mm) installed as per Figure 9

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-50	1.9-3.7	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/120/60
55	1.9-4.0	50x3.2		-/90/60
63	2.0-4.4	50x3.6		
75	2.2-4.9	50x4.2		
82	2.3-5.3	50x4.6		
90	2.4-5.7	50x5.0		
110	2.7-6.6	50x6.0		

Table 31 Assessment summary of PE pipes installed as per Figure 9

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-50	3.0-4.6	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/120/60
55	3.0-5.2	50x3.2		-/90/60
63	3.0-5.9	50x3.6		
75	3.1-6.9	50x4.2		
82	3.1-7.6	50x4.6		
90	3.2-8.3	50x5.0		
110	3.4-10.0	50x6.0		

Rigid wall constructions with wall thickness of minimum 150mm

Penetration Seals in concrete and masonry walls

Penetration Seal: Combustible pipes fitted with Protecta FR Collar to both sides of the wall

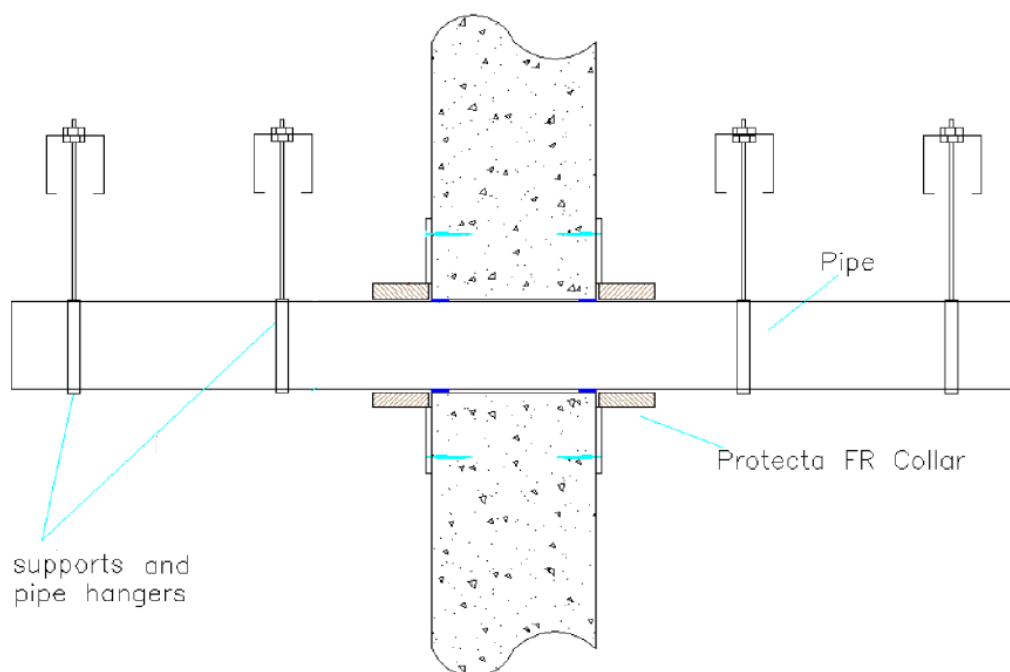


Figure 10 General arrangement of plastic pipes protected with Protecta FR Collar installed at both sides of a rigid wall

Table 32 Assessment summary of PVC-U pipes installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	2.0-3.7	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/180
40	2.0-3.7			
50	2.0-3.7			
55	2.1-3.9	50x3.2		-/180/180
63	2.2-4.3	50x3.6		
75	2.3-4.9	50x4.2		
82	2.4-5.2	50x4.6		
90	2.5-5.6	50x5.0		
110	2.7-6.6	50x6.0		

Table 33 Assessment summary of PVC-U (110-315mm) pipes installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	50x6.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/180/180
125	3.1-7.5	60x8.8		-/240/240
140	3.5-8.4	60x11.5		-/180/180
160	4.0-9.5	60x15.0		-/180/180
315	9.2	75x18	Tested in C/C, FRL applicable to C/C only	-/120/120

Table 34 Assessment summary of PE pipes (32-110mm) installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-4.6	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/240
40	3.0-4.6			
50	3.0-4.6			
55	3.1-4.5	50x3.2		-/240/180
63	3.1-4.3	50x3.6		
75	3.2-4.1	50x4.2		
82	3.3-3.9	50x4.6		
90	3.3-3.8	50x5.0		
110	3.4	50x6.0		

Table 35 Assessment summary of PE pipes (110-250mm) installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	3.4	50x6.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/180
125	3.9-5.2	60x9.0		-/180/180
140	4.3-7.0	60x11.5		
160	4.9-9.5	60x15.0		
200	18.2	75x10.8	Tested in C/C, FRL applicable to C/C only	-/60/60
250	22.7	75x12.6		-/120/90

Table 36 Assessment summary of PP pipes (32-110mm) installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	1.6-5.5	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only.	-/240/240
40	1.6-5.5			
50	1.5-5.5			
55	1.7-5.9	50x3.2		
63	1.8-6.5	50x3.6		
75	2.1-7.3	50x4.2		
82	2.2-7.9	50x4.6		
90	2.3-8.5	50x5.0		
110	2.7-10.0	50x6.0		

Table 37 Assessment summary of PP pipes (110-160mm) installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-10	50x6.0	Tested in U/C, FRL applicable to U/C & C/C pipe end configurations only	-/240/240
125	3.3-11.4	60x9.0		-/240/180
140	4.0-12.8	60x11.5		
160	4.9-14.6	60x15.0		

Table 38 Assessment summary of PP pipes (32-50mm) with 30mm Collar Inlay installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	1.6-5.5	30x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/240
40	1.6-5.5			
50	1.6-5.5			

Table 39 Assessment summary of PP pipes (50-110mm) with 50mm Collar Inlay installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	1.6-5.5	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/240
55	1.7-5.9	50x3.2		
63	1.8-6.5	50x3.6		
75	2.1-7.3	50x4.2		-/240/60

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
82	2.2-7.9	50x4.6		
90	2.3-8.5	50x5.0		
110	2.7-10.0	50x6.0		

Table 40 Assessment summary of PP pipes (50-110mm) installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	1.6-5.5	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/240
55	1.7-5.6	50x3.2		
63	1.8-5.7	50x3.6		
75	2.0-5.9	50x4.2		-/240/90
82	2.1-6.0	50x4.6		
90	2.3-6.1	50x5.0		
110	2.7-6.3	50x6.0		

Table 41 Assessment summary of PP pipes (110-160mm) installed as per Figure 10

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-10.0	60x6.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/60
125	3.3-11.4	60x8.8		
140	4.0-12.8	60x11.5		
160	4.9-14.6	60x15.0		-/240/180

**Rigid floor constructions with floor thickness of minimum 150mm
Penetration seals, surface mounted in concrete floors**

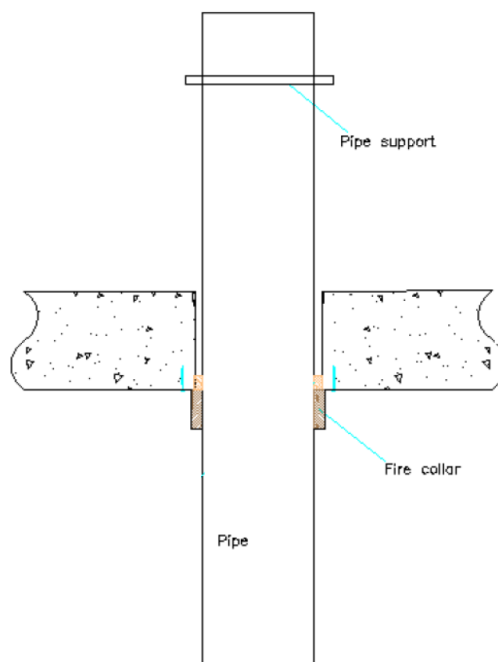


Figure 11 General arrangement of plastic pipes penetrating a 150mm thick concrete slab protected with Protecta FR Collar installed at the exposed side

Table 42 Assessment summary of PVC-U pipes (32-110mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	1.9-3.7	30x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/90/60
40	1.9-3.7			
50	2.0-3.7			
55	2.1-3.9	30x3.2		-/60/60
63	2.2-4.3	30x3.6		
75	2.5-4.9	30x4.2		
82	2.6-5.2	30x4.6		
90	2.8-5.6	30x5.0		
110	3.2-6.6	30x6.0		

Table 43 Assessment summary of PVC-U pipes (32-110mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	2.0-3.7	50x3.0	Tested in U/C, FRL applicable to U/C to C/C only	-/120/120
40	2.0-3.7			
50	2.0-3.7			

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
55	2.4-3.9	50x3.2		-/120/120
63	3.0-4.3	50x3.6		
75	3.8-4.8	50x4.2		
82	4.3-5.1	50x4.6		
90	4.9-5.4	50x5.0		
110	6.3	50x6.0		

Table 44 Assessment summary of PVC-U pipes (50-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	2.0-3.7	50x3.0	Tested in U/C, FRL applicable to U/C to C/C only	-/120/90
55	2.1-4.0	50x3.2		
63	2.2-4.4	50x3.6		
75	2.4-5.0	50x4.2		
82	2.4-5.4	50x4.6		
90	2.5-5.8	50x5.0		
110	2.7-6.9	50x6.0		
125	2.9-7.6	50x8.8		
140	3.0-8.4	50x11.5		
160	3.2-9.5	50x15.0		
160	3.2-9.5	50x15.0		-/180/90

Table 45 Assessment summary of PVC-U pipes (110-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	6.3	60x6.0	Tested in U/C, FRL applicable to U/C & C/C only.	-/120/120
125	5.6-7.3	60x8.8		
140	5.0-8.2	60x11.5		
160	4.0-14.6	60x15.0		

Table 46 Assessment summary of PVC-U pipes (110-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.3	60x6.0	Tested in U/C, FRL applicable to U/C & C/C only.	-/60/60
125	2.8-7.2	60x8.7		
140	3.0-8.2	60x11.4		
160	3.2-9.5	60x15.0		

Table 47 Assessment summary of PVC-U pipes (110-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	3.2-6.6	60x6.0	Tested in U/U, FRL applicable to all pipe end configurations	-/60/60
125	3.2-7.4	60x8.7		
140	3.2-8.3	60x11.4		
160	3.2-9.5	60x15.0		

Table 48 Assessment summary of PVC-U pipes (110-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	60x6.0	Tested in C/U, FRL applicable to all pipe end configurations except U/U	-/60/60
125	2.8-7.4	60x8.7		
140	3.0-8.3	60x11.4		
160	3.2-9.5	60x15.0		

Table 49 Assessment summary of PE pipes (32-110mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-4.6	30x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/60/60
40	3.0-4.6			
50	3.0-4.3			
110	3.2-9.5	30x6.0	Tested in U/C, FRL applicable to U/C & C/C only	-/180/180

Table 50 Assessment summary of PE pipes (50-110mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	3.0-4.6	30x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/60/60
55	3.0-5.2	30x3.2		
63	3.0-5.9	30x3.6	Tested in U/C, FRL applicable to U/C & C/C only	-/60/60
75	3.1-6.9	30x4.2		
82	3.1-7.6	30x4.6		
90	3.2-8.3	30x5.0		
110	3.4-10.0	30x6.0		

Table 51 Assessment summary of PE pipes (32-110mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	3.4-4.6	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/240/240
50	3.0-4.6	50x3.2		
32-40	3.0	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/240
50	3.0	50x3.2		
50	3.0-4.6	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/60/60
55	3.1-5.1	50x3.2		
63	3.1-5.8	50x3.6		
75	3.2-6.9	50x4.2		
82	3.3-7.5	50x4.6		
90	3.3-8.2	50x5.0		
110	3.4-10.0	50x6.0		

Table 52 Assessment summary of PE pipes (110-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	3.4-10.0	60x6.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/60/60
125	3.9-11.3	60x8.8		
140	4.3-12.7	60x11.5		
160	4.9-14.6	60x15.0		

Table 53 Assessment summary of PE pipes (32-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-4.6	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only.	-/120/120
40	3.0-4.6			
50	3.0-4.6			
55	3.1-5.0	50x3.2		
63	3.1-5.8	50x3.6		
75	3.2-6.9	50x4.2		
82	3.3-7.5	50x4.6		
90	3.3-8.2	50x5.0		
110	3.4-10.0	50x6.0		
125	3.9-11.3	50x8.8		
140	4.4-12.7	50x11.5		
160	4.9-14.6	50x15.0		

Table 54 Assessment summary of PP pipes (32-50mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	1.8-4.6	30x3.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/120/120
40	1.8-4.6			
50	1.8-4.6			

Table 55 Assessment summary of PP pipes (50-110mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	2.3	50x3.2	Tested in U/U, FRL applicable to all pipe end configurations.	-/240/240
50	1.8-4.6	50x3.0		-/120/120
55	1.9-4.8	50x3.2		-/60/60
63	2.0-5.0	50x3.6		
75	2.2-5.4	50x4.2		
82	2.3-5.6	50x4.6		
90	2.4-5.9	50x5.0		

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	50x6.0		

Table 56 Assessment summary of PP pipes (50-110mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	1.8-4.6	50x3.0	Tested in U/C, FRL applicable to U/C & C/C	-/120/120
55	1.9-4.8	50x3.2		
63	2.0-5.0	50x3.6		
75	2.2-5.4	50x4.2		
82	2.3-5.6	50x4.6		
90	2.4-5.9	50x5.0		
110	2.7-6.6	50x6.0		

Table 57 Assessment summary of PP pipes (50-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
50	1.8-4.6	30x3.0	Tested in U/C, FRL applicable to U/C & C/C	-/60/60
55	1.9-5.1	50x3.2		
63	2.0-5.8	50x3.6		
75	2.2-6.9	50x4.2		
82	2.3-7.5	50x4.6		
90	2.5-8.2	50x5.0		
110	2.7-10.1	50x6.0		
125	4.7-11.4	50x8.8		
140	6.8-12.8	50x11.5		
160	9.5-14.6	50x15.0		

Table 58 Assessment summary of PP pipes (110-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	60x6.0	Tested in U/C, FRL applicable to U/C & C/C only.	-/120/120
125	3.4-8.9	60x8.8		
140	4.1-11.2	60x11.5		

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
160	4.9-14.6	60x15.0		-/180/180

Table 59 Assessment summary of PP pipes (110-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
110	2.7-6.6	50x6.0	Tested in U/U, FRL applicable to all pipe end configurations.	-/60/60
125	3.6-8.9	60x8.8		
140	4.7-11.3	60x11.5		
160	6.2-14.7	60x15.0		
160	6.2	60x15.0		-/90/90

Table 60 Assessment summary of Wavin Sitech+PP-MP pipes installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/240/240
50	1.8	50x3.2		
75	1.8-2.5	50x4.2	Tested in C/U, FRL applicable to all pipe end configurations except U/U	-/180/180
90	1.8-2.9	50x5.0		
110	1.8-3.4	50x6.0		

Table 61 Assessment Summary of Aquatherm Green SDR9 MF PP-RP pipes installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.6-5.6	30x3.0	Tested in C/C, FRL applicable to C/C systems only	-/240/240
40	3.6-5.6	50x3.0		
50	3.6-5.6	50x3.2		
63	5.6-12.3	50x3.6		-/120/120
75	4.4-8.4	50x4.2		
90	4.9-10.0	50x5.0		
110	5.6-12.3	50x6.0		

Table 62 Assessment summary of Geberit Silent PP installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/240/240
50	1.8	50x3.2		
75	1.8-2.4	50x4.2	Tested in C/U, FRL applicable to all pipe end configurations except U/U	-/180/180
90	1.8-2.8	50x5.0		
110	1.8-3.4	50x6.0		

Table 63 Assessment summary of Polo Kal NG PP-MV pipes installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	1.8-2.0	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/240/240
50		50x3.2		
75	1.9-2.6	50x4.2	Tested in C/U, FRL applicable to all pipe end configurations except U/U	-/180/180
90	2.0-2.9	50x5.0		
110	2.0-3.4	50x6.0		
125	3.9	60x9.0	Tested in U/C, FRL applicable to U/C & C/C only	-/120/120
160	4.9	60x15.0	Tested in C/U, FRL applicable to all pipe end configurations except U/U	-/120/120

Table 64 Assessment summary of Rehau Raupiano Plus-DD pipes installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
40	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/240/240
50		50x3.2		
75	1.8-2.2	50x4.2	Tested in C/U, FRL applicable to all pipe end configurations except U/U	-/120/120
90	1.8-2.4	50x5.0		
110	1.8-2.7	50x6.0		
125	3.1	60x9.0	Tested in C/U, FRL applicable to all pipe end configurations except U/U	-/180/180
160	3.9	60x15.0	Tested in U/C, FRL applicable to U/C & C/C	-/240/240

Table 65 Assessment summary of BluePlower Multiplayer pipes (32-160mm) installed as per Figure 11

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32-40	1.8	50x3.0	Tested in U/U, FRL applicable to all pipe end configurations	-/180/180

50		50x3.2	Tested in C/U, applicable to all pipe end configurations except U/U	-/180/180
75	1.8-3.4	50x4.2		
90	1.8-3.4	50x5.0		
110	1.8-3.4	50x6.0		
125	3.4-4.9	60x9.0		
160	3.4-4.9	60x15.0		-/240/240

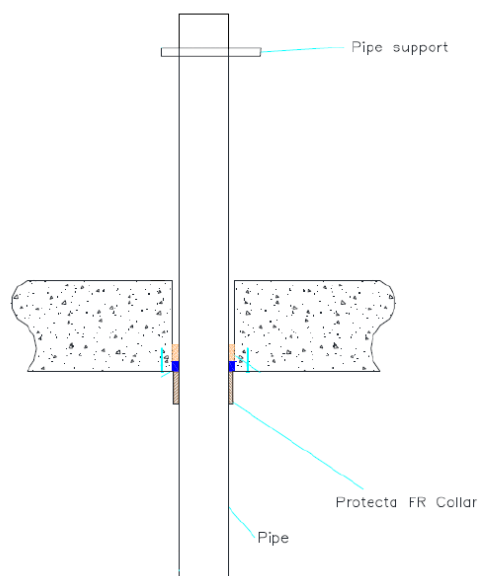


Figure 12 General arrangement of plastic pipes penetrating a 150mm thick concrete slab protected with Protecta FR Collar installed at the exposed side

Table 66 Assessment summary of PVC-U pipes (32-110mm) if installed as per Figure 12

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	2.0-3.7	50x3.0	Tested in C/C, FRL applicable to C/C systems only	-/120/120
40	2.0-3.7			
50	2.0-3.7			
55	2.1-3.9	50x3.2		
63	2.2-4.3	50x3.6		
75	2.3-4.8	50x4.2		
82	2.4-5.1	50x4.6		
90	2.5-5.4	50x5.0		
110	2.7-6.3	50x6.0		

Table 67 Assessment summary of PVC-U pipes (200-400mm) if installed as per Figure 12

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
200mm	4.9-11.9	60x18	Tested in C/C, FRL applicable to C/C systems only	-/120/60
250mm	6.1-11.9	75x24		-/60/60
315mm	7.7-12.1	75x30		
400mm	15.3	100x39		

Table 68 Assessment summary of PE pipes (200-400mm) if installed as per Figure 12

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
200mm	6.2-18.2	60x18	Tested in C/C, FRL applicable to C/C systems only	-/240/120
250mm	11.5-18.4	75x24		-/240/240
315mm	18.7	75x30		
400mm	36.3	100x39		

Table 69 Assessment summary of PP pipes (200-400mm) if installed as per Figure 12

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
200mm	4.9-18.2	60x18	Tested in C/C, FRL applicable to C/C systems only	-/120/120
250mm	15.1-22.7	75x24		-/60/60
315mm	28.6	75x30		
400mm	9.8-22.7	100x39		

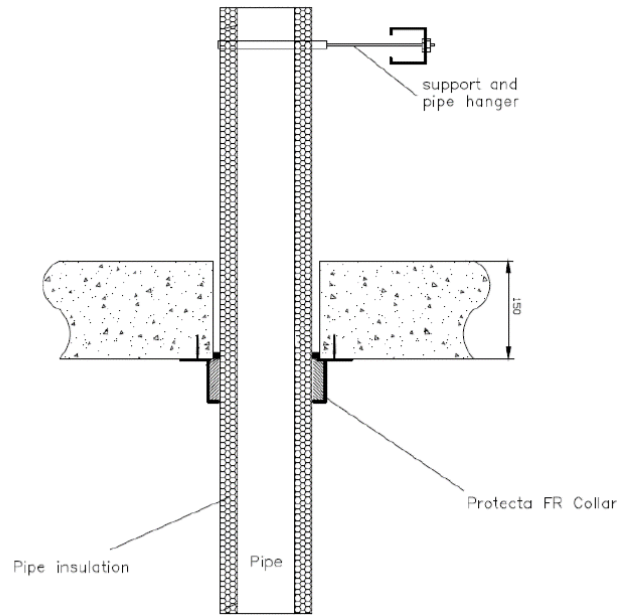


Figure 13 General arrangement of insulated metallic pipes penetrating a 150mm thick concrete slab and protected with Protecta FR Collar

Table 70 Assessment summary of metallic pipes installed as per Figure 13

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Insulation	Pipe End Configuration	FRL
54	1.2	Ø110x50x6.0	19mm thick Elastomeric insulation minimum class	Tested in C/C, FRL applicable to C/C only	-/240/60

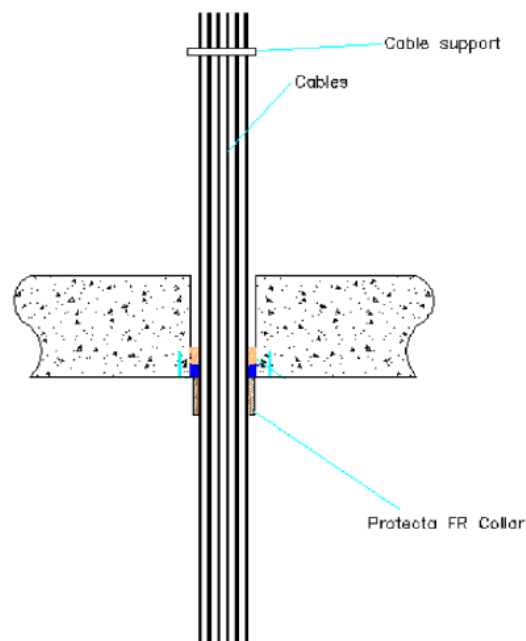


Figure 14 General arrangement of cables penetrating a 150mm thick concrete slab and protected with Protecta FR Collar

Table 71 Assessment summary of cable bundles installed as per Figure 14

Services	Collar	Collar Inlay (mm)	FRL
Cables up to 21mmØ, in bundles up to 55mmØ	55mmØ	30x3.2mm	-/120/120
Cables up to 21mmØ in bundles up to 100mmØ	110mmØ	50x6mm	-/90/90
Cables up to 21mmØ, in bundles up to 160mmØ	160mmØ	60x15mm	-/180/180

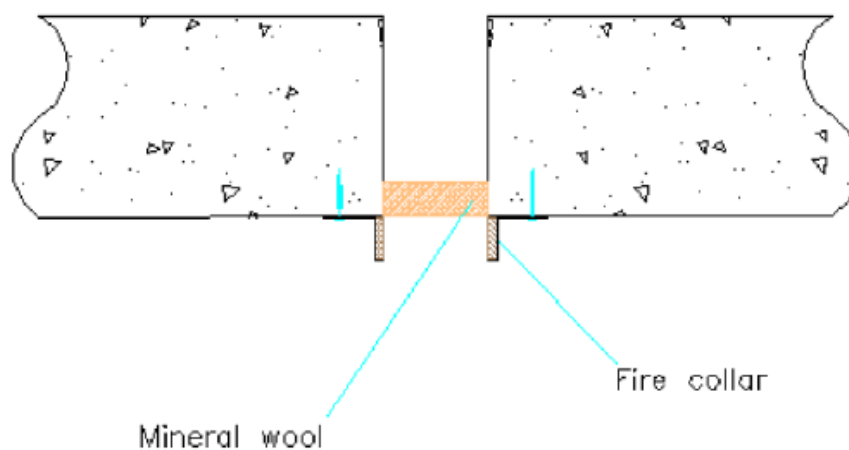


Figure 15 General arrangement of blank seal filled with mineral wool and protected with Protecta FR Collar

Table 72 Assessment summary of services protected as shown in Figure 15

Services	Collar	Collar Inlay (mm)	FRL
None (Blank)	55mmØ	30x3.2mm	-/240/60
None (Blank)	160mmØ	60x15mm	-/120/120

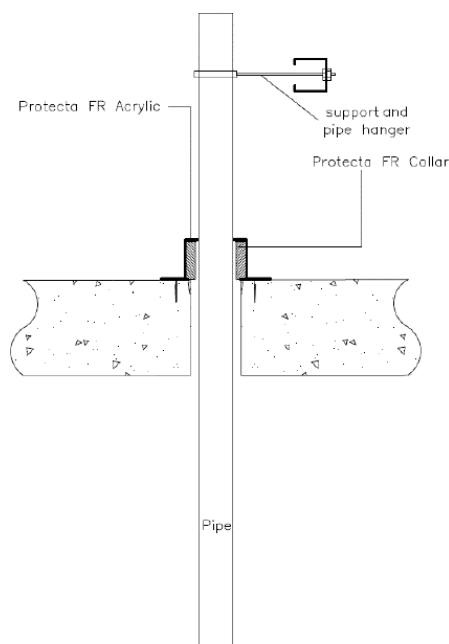


Figure 16 General arrangement of various plastic pipes penetrating a 150mm thick concrete slab protected with Protecta FR Collar installed on the unexposed side

Table 73 Assessment summary of PVC-U pipes (32-160mm) installed as per Figure 16

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	1.9-3.7	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/240/240
40	1.9-3.7	50x3.0		
50	1.9-3.7	50x3.2		
55	2.0-4.0	50x3.2		-/120/120
63	2.1-4.4	50x3.6		
75	2.4-5.0	50x4.2		
82	2.5-5.3	50x4.6		
90	2.7-5.7	50x5.0		
110	3.2-6.6	50x6.0		
125	5.0-7.5	60x8.8		-/240/180
140	6.9-8.3	60x11.5		
160	9.5	60x15.0		

Table 74 Assessment summary of PE pipes (32-160mm) installed as per Figure 16

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	3.0-4.6	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/240/240
40	3.0-4.6	50x3.0		

50	3.0-4.6	50x3.2		-/240/60
55	3.0-5.1	50x3.2		
63	3.0-5.8	50x3.6		
75	3.1-6.9	50x4.2		
82	3.2-7.5	50x4.6		
90	3.2-8.2	50x5.0		
110	3.4-10.0	50x6.0		
125	5.2-9.9	60x8.8		
140	7.0-9.7	60x11.5		
160	9.5	60x15.0		

Table 75 Assessment summary of PP pipes (32-160mm) if installed as per Figure 16

Pipe Diameter (mm)	Wall Thickness (mm)	Collar Inlay (mm)	Pipe End Configuration	FRL
32	2.9-4.6	50x3.0	Tested in U/C, FRL applicable to U/C & C/C only	-/240/180
40	2.9-4.6	50x3.0		
50	2.9-4.6	50x3.2		
55	3.5-5.1	50x3.2		-/180/90
63	4.4-5.8	50x3.6		
75	5.8-6.9	50x4.2		
82	6.6-7.5	50x4.6		
90	7.5-8.2	50x5.0		
110	10	50x6.0		
125	11.3	60x8.8		
140	12.7	60x11.5		-/240/60
160	14.6	60x15.0		

6. Direct field of application

The results of the referenced assessment are applicable to penetrations in walls exposed to fire from either side and floors from below only.

7. Requirements

This report details the methods of construction, test conditions and assessed results that would have been expected had the specific elements of construction described herein been tested in accordance with AS 1530.4:2014.

All services shall be supported in the manner in which they are assessed as described in section 1. Alternatively, support of services in floors and walls shall be maintained as per AS 1530.4:2014 and AS 4072.1:2005 requirements.

Any further variations with respect to size, constructional details, loads, stresses, edge or end conditions, other than those identified in this report, may invalidate the conclusions drawn in this report.

8. Validity

This assessment report does not provide an endorsement by Warringtonfire Aus Pty Ltd of the actual products supplied.

The conclusions of this assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

Because of the nature of fire testing, and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

The assessment can therefore relate only to the actual prototype test specimens, testing conditions, and methodology described in the supporting data, and does not imply any performance abilities of constructions of subsequent manufacture.

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are the subject of constant review and improvement and it is recommended that this report be reviewed on or, before, the stated expiry date.

The information contained in this report shall not be used for the assessment of variations other than those stated in the conclusions above. The assessment is valid provided no modifications are made to the systems detailed in this report. All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

9. Authority

9.1 Applicant undertakings and conditions of use

By using this report as evidence of compliance or performance, the applicant(s) confirms that:

- To their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made, and
- They agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment, and
- They are not aware of any information that could adversely affect the conclusions of this assessment and if they subsequently become aware of any such information, agree to ask the assessing authority to withdraw the assessment.

9.2 General conditions of use

This report may only be reproduced in full without modifications by the report sponsor. Copies, extracts or abridgments of this report in any form shall not be published by other organisations or individuals without the permission of Warringtonfire Aus Pty Ltd.

Appendix A Summary of supporting data

A.1 Test reports

A.1.1 Discussion

This assessment report is prepared based on referenced test reports WF 372505, WF 377302, WF 380977, WF 16029, WF375800, WF 380963, WF 369908, WF 375797, WF 394232, WF 372808, WF 382336, WF 394948, WF 394021, WF 397678, WF 397686, WF 396820, WF 397686, WF 390963 & WF 390800 F16151, WF 376483, WF 380112, WF 384982, WF 392646, WF 395179, WF 398928, WF 398517, WF 384982, WF 376483

The tests were sponsored by Polyseam and conducted by Exova Warringtonfire UK. Refer to Test Reports for full access to information.

A.1.2 Relevance of BS EN 1363-1:2013 test data with respect to AS 1530.4:2014

General

The fire resistance referenced tests were conducted in accordance with BS EN1366-3:2009 and BS EN 1363-1 : 2012. These standards differ from AS 1530.4:2014. The effect of these differences has on the fire resistance performance of test specimens is discussed below

Furnace Temperature Measurement

The furnace thermocouples specified in AS 1530.4:2014 are type K, mineral insulated metal sheathed (MIMS) with a stainless steel sheath having a wire of diameter of less than 1.0mm and an overall diameter of 3mm. The measuring junction protrudes at least 25mm from the supporting heat resistant tube.

The furnace thermocouples specified in BS EN 1363-1: 2012 is made from folded steel plate that faces the furnace chamber. A thermocouple is fixed to the side of the plate facing the specimen with the thermocouple hot junction protected by a pad of insulating material.

The plate part is to be constructed from 150 ±1mm long by 100 ±1 mm wide by 0.7 ±0.1mm thick nickel alloy sheet strips.

The measuring junction is to consist of nickel chromium / nickel aluminium (Type K) wire as defined in IEC 60584-1⁷, contained with mineral insulation in a heat- resisting steel alloy sheath of nominal diameter 1mm, the hot junctions being electrically insulated from the sheath.

A thermocouple hot junction is to be fixed to the geometric centre of the plate, by a small steel strip made from the same material as the plate. The steel strip can be welded to the plate or may be screwed to it to facilitate replacement of the thermocouple. The strip should be approximately 18mm by 6mm if it is spot-welded to the plate, and nominally 25mm by 6mm if it is to be screwed to the plate. The screw is to be 2mm in diameter.

The assembly of plate and thermocouple should be fitted with a pad of inorganic insulation material 97 ±1mm by 97±1 mm by 10±1mm thick with a density of 280 ±30kg/m³.

The relative location of the furnace thermocouples for the exposed face of the specimen, for AS 1530.4:2014 and BS EN 1363-1 : 2012, is 100mm +10mm and 100mm +50mm respectively.

The furnace control thermocouples required by BS EN 1363-1 : 2012 are less responsive than those specified by AS 1530.4:2014. This variation in sensitivity can produce a potentially more onerous heating condition for specimens tested to BS EN 1363-1:2012, particularly when the furnace temperature is changing quickly in the early stages of the test.

Furnace Temperature Regime

The furnace temperature regime for fire resistance tests conducted in accordance with AS 1530.4:2014 follows the same trend as BS EN 1363-1:2012

⁷ Thermocouples - Part 1: EMF specifications and tolerances

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and BS EN1363-1:2012 are not appreciably different.

Furnace Pressure Regime

It is a requirement of AS 1530.4:2014 that for vertical elements, a furnace gauge pressure of 15+3Pa is established at the centre of lowest penetration. In contrast, BS EN 1366-3:2009 requires minimum 10Pa at the lowest point of lowest service.

It is a requirement of AS 1530.4:2014 and for BS EN 1363-1:2012 that for horizontal elements, a furnace gauge pressure of 20Pa is established at a height of 100mm below the floor soffit level.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and BS EN 1363-1:2012 are also not appreciably different.

Integrity Performance Criteria

The integrity criteria differ slightly between AS 1530.4:2014 and BS EN 1363-1:2012

While a specimen maintains its insulation performance, the specimen shall be deemed to have failed integrity criterion in accordance with AS 1530.4:2014 if it collapses or sustains flaming or other conditions on the unexposed face, which ignite cotton pad when applied for up to 30 seconds.

Specimens shall be deemed to have failed the integrity criterion in accordance with AS 1530.4:2014 when any of the following occur:

- Sustained flaming for 10 seconds
- A gap form that allows the passage of hot gases to the unexposed face and ignite the cotton pad when applied for up to 30 seconds
- A gap forms that allows the penetration of a 25mm gap gauge anywhere on the specimen
- A gap forms that allows a 6 x 150mm gap gauge to penetrate the specimen (anywhere on the specimen)

Except for minor technical variations, the integrity criteria in BS EN 1363-1: 2012 are generally applied in a comparable manner.

Specimen Temperature Measurement

The specimen thermocouple specification of service penetrations is generally the same for AS 1530.4:2014 and BS EN1366-3.

For the penetration construction considered. AS 1530.4:2014 specifies the following locations for thermocouples to be placed.

- At not less than two points approximately 25mm from the edge of the hole made for the passage of the service (one in uppermost vertical plane).
- On the surface of the penetrating service, at least two thermocouples located approximately 25mm from the plane of the general surface of the penetrated element (one in uppermost vertical plane).
- At least two positions 25mm from the interface of the separating element and main penetration seal.

For penetrating sealing systems, BS EN 1363-1 : 2012 specifies thermocouples are fixed in generally similar locations on the unexposed face: on the supporting construction and/or seal and on the penetrating service adjacent at the plane of penetration, and on the penetrating service some distance from the plane of penetration.

Based on the above, the effect of the differences on the thermocouple locations of the tested construction and the specifications in AS 1530.4:2014 discussed on case by case basis

Insulation Performance Criteria

The general insulation criteria of AS 1530.4:2014 and BS EN1363-1:2012 are not appreciably different.

Specimen Configuration

AS 1530.4:2014 specifies that the service(s) shall be installed so that it projects a minimum 500mm on each side of the supporting construction, of which at least 200mm shall extend beyond the extremities of the penetration sealing system. The penetration sealing system shall include any coating, wrapping or other protections to the services. The length of unprotected service on the unexposed face shall not be greater than 500mm. For plastic pipes, the external projection away from the furnace shall be increased to a minimum of 2000mm. The measurements shall not include any part of the plug or cap used to seal a pipe within the furnace.

Whereas EN standard stipulates the following field of application based on the tested pipe end configuration:

Table 76 Field of application rules for pipe end configurations

		Tested			
		U/U	C/U	U/C	C/C
Covered	U/U	Y	N	N	N
	C/U	Y	Y	N	N
	U/C	Y	Y	Y	N
	C/C	Y	Y	Y	Y
Y=acceptable, N=not acceptable					

Based on the review of the test data and the above field of application, it is the opinion of this testing authority that services tested with an open/open end fire configuration are considered to be the worst-case scenario as the hot gases will have a clear path to the unexposed side. As a result, the thermocouple placed on the service will likely record the highest temperature when compared to the rest of the pipe end configurations. Therefore, FRL achieved in U/U configuration can be extended to services tested in any of the pipe end configurations.

With respect to the services tested in an open/closed configuration or closed/closed configuration, it is considered that both configurations are not in line with the general requirement of the AS 1530.4:2014. However, AS 1530.4:2014 stipulates that “service end conditions shall be representative of those intended to be used in practice”, therefore, it is reasonable to extend the FRL achieved in both configurations provided that they are representative of the system used in practice.

With respect to the difference in the pipe projection from the wall and the floor system, it is considered that this difference will not likely introduce any detrimental effect to the wall system as the plastic pipe is expected to melt in the first few minutes in a test, and once the activation of the sealant in the collar is activated, this difference can be negligible.

In case of a floor system, it is argued that having a 2000mm projection out of the floor slab at the unexposed side may include a detrimental effect due to stack effect but it is also argued that 500mm projection as stipulated in the BS EN standard could also be considered as the most onerous case as more hot gases are expected to pass from the exposed to the unexposed side at a faster rate, hence increasing the temperature recorded by the TC placed on the service before the activation and closure of the collar. In conclusion, considerable amount of research and test history has showed that the extension of the pipe from the unexposed side will not likely have an impact on the performance of the plastic pipes, hence it can be positively assessed.

Application of test data to AS 1530.4:2014

The variations in furnace heating regimes, furnace thermocouples and the responses of the different thermocouples types to the furnace conditions are not expected to have significant effect on the outcome of the referenced fire resistance test.

Based on the above discussion, it is considered that the results relating to the integrity and insulation performance of the referenced tests can be used as a basis to assess the FRL of the specimens if tested in accordance with AS 1530.4:2014

Appendix B Assessment of specific variations

B.1 Assessment of plastic pipes protected with Protecta FR Collar installed in flexible wall system if tested in accordance with AS 1530.4:2014

B.1.1 Proposed construction

1. The proposed construction shall be as tested in F16151, WF 376483, WF 380112, WF 384982, WF 392646, WF 395179, WF 398928, WF 398517, WF 384982, WF 376483 and subject to the following variations:
 - Flexible wall systems must have a minimum thickness of 100mm and consists of steel or timber studs lined on both faces with 2 layers of minimum 12.5mm thick fire rated plasterboard. The achieved FRLs are applicable to a flexible wall system with optional insulation and the aperture can optionally be lined.
 - For timber framed walls, it is required that no part of the penetration seal is closer than 100mm to a stud, the cavity is closed between the penetration seal and the stud, and minimum 100mm of insulation is provided with the cavity between the penetration seal and the stud
 - Rigid walls must have a minimum thickness of 100mm or as otherwise specified and consist of concrete, aerated concrete or masonry with a minimum density of 650 kg/m³
 - Extension of FRLs to intermediate pipe sizes based on the testing of the maximum and minimum pipe size
 - The separating element thickness can be reduced; however, the local thickness of the aperture shall be built up to a minimum thickness of 100mm by installing additional layers of minimum 13mm fire rated plasterboard around the opening (100mm×100mm from the edge of the aperture)

B.1.2 Discussion

2. Reference to the above referenced tests, the tested construction consisted of a flexible wall system that comprise of a 50mm steel stud clad with two layers of 12.5mm on each side. The cavity between the plasterboard and steel studs was friction fitted with 50mm thick mineral wool which was cut back 100mm from all around the aperture.
3. The Protecta FR collars were fitted on both faces of the separating element and fixed to the separating element by 4 No. M5 x72mm hollow wall anchor fixings.
4. As the insulation was cut all around the aperture, the FRL achieved can be applicable to wall systems with insulation and without insulation. Moreover, as the aperture was not lined in the referenced tests, the FRL will also be applicable to apertures with lining.
5. In flexible walls, It is considered that the gaps between the pipe and the construction must be sealed by a bead of Protecta FR Acrylic sealant. A bead of Protecta FR Acrylic shall be sufficient for any gaps that are less than 8mm. Any bigger gaps shall be sealed with 25mm deep FR Acrylic sealant.
6. Similarly, in rigid walls, gaps that are less than 8mm must be sealed by a bead of FR Acrylic sealant. However, in larger gaps, 20mm deep FR Acrylic sealant shall be used backed with 20mm stone wool.
7. Based on the applicability established in Appendix A and the above discussion, it is considered that the pipe and the cable services summarized in section 5 will likely achieve the FRLs summarized in section 5 if tested in accordance with AS 1530.4:2014

B.2 Assessment of plastic pipes protected with Protecta FR Collar installed in floor system if tested in accordance with AS 1530.4:2014

B.2.1 Proposed construction

1. The proposed construction shall be as tested in WF 372505, WF 377302, WF 380977, WF 16029, WF375800, WF 380963, WF 369908, WF 375797, WF 394232, WF 372808, WF 382336, WF 394948, WF 394021, WF 397678, WF 397686, WF 396820, WF 397686, WF 390963 & WF 390800 and subject to the following variations:
 - Performance of various plastic pipes and cables protected with Protecta FR Collar if tested in accordance with AS 1530.4:2014
 - Extension of FRLs to intermediate pipe sizes based on the testing of the maximum and minimum pipe size
 - Rigid floor thickness shall be limited to 150mm (as tested) and comprise aerated concrete with a minimum density of 650kg/m³, floors are required to be otherwise tested to achieve FRL of 240/240/240 or -/240/240/240
 - Applicability of FRLs to thinner concrete slab of minimum thickness of 100mm is permissible provided that local aperture beading is provided using 13mm or 16mm fire rated plasterboard or Protecta FR Board 50mm or greater, single or double-sided such that the overall thickness of the separating floor element is not less than 150mm. Insulation performance of the system will be governed by the concrete slab thickness as stated in AS 3600:2018 . The overall FRL of the system will be governed by the FRL extracted from AS 3600:2018 as shown below:

Table 77 Maximum Fire Resistance for Given Slab Thickness

Effective Slab Thickness	Maximum Fire Resistance
100mm	90 minutes
120mm	120 minutes
150mm	180 minutes
175mm	240 minutes

B.2.2 Discussion

2. It is considered that the proposed construction will be similar to the construction referenced in the above tests which consisted of various plastic pipes and cable services installed within a reinforced AAC lintel floor slab on top of a 1.5m×1.5m furnace aperture.
3. The referenced tests covered the installation of the Protecta FR Collar installed at the exposed side in some tests and on the unexposed in others with both fixed to the concrete slab with 4 No. 50mm long masonry screws
4. For collars installed on the exposed side, the gaps between the pipe and the construction that are below 10mm must have a 20mm deep stonewool to seal the opening, and for gaps of 10mm and above the seal must be plugged with 10mm deep FR Acrylic on 40mm deep backing of stonewool. Whereas, collars installed on the unexposed side, gaps between the pipe and the top side of the collar must have a bead of Protecta FR Acrylic to cover the opening.
5. Based on the applicability from EN to AS established in the discussion in Appendix A and the above discussion, it is considered that the various plastic pipes and cable services summarized in section 5 will achieve the summarized FRLs if tested in accordance with AS 1530.4:2014.