ASSESSMENT REPORT

The fire resistance performance of service penetrations protected by Protecta FR Putty if tested in accordance with AS1530.4-2014 and assessed in general accordance with AS4072.1-2005

EWFA Report No:

53619700-A.5

Report Sponsor:

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1 INTRODUCTION

This report presents an assessment of the fire resistance performance of service penetrations protected by Protecta FR Putty if tested in accordance with AS1530.4-2014 and AS4072.1-2005.

Protecta FR Putty is a flexible pad or cord used to reinstate the fire resistance performance of flexible, masonry or concretes walls and rigid floor constructions when penetrated by insulated or uninsulated metallic pipes, cables and the pipe or cable protrusion of socket boxes.

The tested prototypes described in Section 2 of this report, when subject to the proposed variations described in Section 3 and tested in accordance with the referenced test method described in Section 4 will likely achieve the conclusions summarised in section 5 and Appendix C.

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

Summaries of the test data along with the summary of critical issues leading to the assessment conclusions including the main points of argument are provided in the Appendices of the original assessment report.

2 TESTED PROTOTYPES

This assessment report is prepared based on referenced tests WF 390101, WF 389526, WF 384982, WF 383813 describing fire resistance testing of fire seals and service penetration protection in 100mm and 120mm flexible wall separating element, tested in accordance with BSEN 1366:3 2009 and WF 388867, WF 384988, WF 392115, WF 388973 Rev. A & WF 380112 describing fire resistance testing of fire seals and service penetration protection in various fire separating elements, tested in accordance with BSEN 1366-3: 2009. The tests were sponsored by Polyseam A and conducted by Exova Warringtonfire UK.

3 VARIATION TO TESTED PROTOTYPES

- Variation to the size and layers of plasterboard and Optional use of wall insulation
- Applicability to Masonry Walls
- Variation to thickness of rigid floors

4 REFERENCED TEST PROCEDURES

This report is prepared with reference to the requirements of AS1530.4-2014 and general accordance of AS4072.1-2005.

5 FORMAL ASSESSMENT SUMMARY

Based on the discussion presented in the referenced assessment report, it is the opinion of this testing authority that if the specimen described in section 1 had been modified within the scope of section 3, it will achieve the performance as stated below if tested in accordance with the test method referenced in Section 4 and subject to the requirements of Section 7

This assessment report provides a discussion permitting the translation of referenced test reports from EN1366 to AS1530.4-2014 as applicable.

The specific elements of construction that the system Protecta FR Putty may be used to provide a penetration seal in, are as follows:

a. Flexible Walls: The wall must have a minimum thickness of 100mm or as otherwise specified and consists of steel or timber studs lined on both faces with minimum 1 layer of 13mm thick board for 1 hour fire rated systems. For 2 hour fire rated systems, the wall must have a minimum thickness of 100mm and consists of steel or timber studs lined on both faces with minimum 2 layers of 13mm or 16mm thick board. Apertures are not required to be lined and wall cavity insulation is optional. It is considered that the proposed wall systems have been tested to achieve the required FRL and covered in a separate test report. In cases where the FRL of the wall is less than the maximum FRL of the seal as shown in Appendix C, the FRL of the seal shall be reduced to match the FRL of the wall.

b. Rigid Walls: The wall must have a minimum thickness of 100mm or as otherwise specified and comprise of concrete, aerated concrete or masonry, with a minimum density of 650 kg/m³, wall elements are required to be otherwise tested or assessed by others.

c. Rigid Floors: A floor thickness can vary from a minimum of 100mm up to 150mm or more. For rigid floors thickness of 150mm, floors must be made of aerated concrete or concrete, with minimum density of 650 kg/m³ and are required to be otherwise tested to achieve FRL of 240/240/240 or -/240/240. For lower floor thicknesses, floors shall be made of aerated concrete or concrete with a minimum density of 650 kg/m³ and required to be otherwise tested by others to achieve the nominated FRL. Otherwise, the insulation highlighted in Table 1 of this document under Appendix B shall be followed.

The system Protecta FR Putty may be used to provide a penetration seal for insulated or uninsulated metallic pipes, cables and the pipe or cable protrusion of socket boxes (for details see Appendix C)

The system Protecta FR Putty may be used to seal gaps between 0mm and 10mm surrounding cables, cable bundles, non-insulated and insulated pipes. It may also be used to seal a 137mm wide by 77mm high aperture containing socket box and be installed in accordance with the manufacturer's instructions. When used with HOiax socket boxes, the aperture in the wall shall be tight as possible to the penetration pipe or cable and any gaps be filled with plaster filler.

Test results for cables remain valid If the diameter of a single cable is reduced and/ or the number of cables in a bunch is reduced provided that the overall diameter of the bunch of any individual cable is not greater than that 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.

Results obtained from tests where the supports pass through the seal are applicable to those situations where the support is not continued by not vice versa.

The test results obtained using standard configuration for cable penetration systems are valid for:

- All type of steel cable trays and ladders;
- Any penetration size equal or smaller than that tested, provided the total amount of cross sections of the cables (core and insulation) does not exceed 60% of the penetration area.

Support of services in walls shall be maintained as per AS1530.4-2014 and AS4072.1-2005 requirements.

AS1530.4-2014 stipulates that for general pipe systems, the fire side capped/non-fire side open configuration shall be adopted (i.e. closed/open). Therefore, the assessment was prepared as per the following:

- C/U cases were found compliant to the requirements of AS1530.4-2014 and the FRL was given accordingly
- C/C cases were found compliant only for closed systems and the FRL was qualified accordingly.

6 DIRECT FIELD OF APPLICATION

This assessment applies to penetrations in walls exposed to fire from either side and to floors exposed to fire from below only.

The results of the assessment report are based on actual test data and the scope is necessarily limited to the specifications indicated Section 3 and discussed in the Appendices of the assessment.

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 AS1530.4-2014.

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.

It is required that the supporting construction be otherwise tested or assessed to achieve the required FRL of the penetration seal in accordance with AS1530.4-2014.

8 VALIDITY

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

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

Because of the nature of fire resistance 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 only 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

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9.3 AUTHORISATION ON BEHALF OF EXOVA WARRINGTONFIRE AUS PTY LTD

Prepared by:	Reviewed by:
	
M. Akl	O. Saad

9.4 DATE OF ISSUE

27/02/2019

9.5 EXPIRY DATE

30/11/2023

APPENDIX A – SUMMARY OF SUPPRORTING DATA

A.1 TEST REPORTS

A.1.1 Discussion

A.1.1.1 This assessment report is prepared based on referenced tests WF 390101, WF 389526, WF 384982, WF 383813 describing fire resistance testing of fire seals and service penetration protection in 100mm and 120mm flexible wall separating element, tested in accordance with BSEN 1366:3 2009 and WF 388867, WF 384988, WF 392115 & WF 388973 Rev. A describing fire resistance tests of fire seals and service penetration protection in 150mm thick Rigid flooring systems. The tests were sponsored by Polyseam and conducted by Exova Warringtonfire UK. Refer to Test Reports for full access to information.

A.2 RELEVANCE OF BSEN 1363-1:2012 TEST DATA WITH RESPECT TO AS1530.4-2014.

A.2.1 General

A.2.1.1 The above mentioned fire resistance tests were conducted in accordance with BSEN1366-3:2009 This standard differ from AS1530.4-2014. The effect of these differences has on the fire resistance performance of test specimens is discussed below.

Specimen Configuration

A.2.1.2 AS1530.4-2014 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.

A.2.1.3 Construction specimens in referenced test reports were checked and it was confirmed that there are no significant differences between relevant part of the tested construction and the specification in AS1530.4-2014.

Furnace Temperature Measurement

A.2.1.4 The furnace thermocouples specified in AS1530.4-2014 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.

A.2.1.5 The furnace thermocouples specified in BSEN 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.

A.2.1.6 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.

A.2.1.7 The measuring junction is to consist of nickel chromium / nickel aluminium (Type K) wire as defined in IEC 60584-1, 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.2.1.8 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.

A.2.1.9 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.

A.2.1.10 The relative location of the furnace thermocouples for the exposed face of the specimen, for AS1530.4-2014 and BSEN 1363-1:2012, s 100mm +10mm and 100mm +50mm respectively.

A.2.1.11 The furnace control thermocouples required by EN1363-1:2012 are less responsive than those specified by AS1530.4-2014. This variation in sensitivity can produce a potentially more onerous heating condition for specimens tested to EN 1363-1:2012, particularly when the furnace temperature is changing quickly in the early stages of the test.

Furnace Temperature Regime

A.2.1.12 The furnace temperature regime for fire resistance tests conducted in accordance with AS1530.4-2014 follows the same trend as EN1363-1:2012

A.2.1.13 The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4-2014 and BSEN1363-1:2012 are not appreciably different.

Furnace Pressure Regime

A.2.1.14 It is a requirement of AS1530.4-2014 that for vertical elements, a furnace gauge pressure of 15+3Pa is established at the centre of lowest penetration. In contrast, EN1366-3:2009 requires minimum 10Pa at the lowest point of lowest service.

A.2.1.15 It is a requirement of AS1530.4:2014 and for EN1363-1:2012 that for horizontal elements, a furnace gauge pressure of 20Pa is established at a height of 100mm below the floor soffit level.

A.2.1.16 The parameters outlining the accuracy of control of the furnace pressure in AS1530.4:2014 and EN1363-1:2012 are also not appreciably different.

Integrity Performance Criteria

A.2.1.17 The integrity criteria differ slightly between AS 1530.4:2014 and BS EN 1363-1:2012

A.2.1.18 While a specimen maintains its insulation performance, the specimen shall be deemed to have failed integrity criterion in accordance with AS1530.4-2014 if it collapses or sustains flaming or other conditions on the unexposed face, which ignite cotton pad when applied for up to 30 seconds.

A.2.1.19 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)

A.2.1.20 Except for minor technical variations, the integrity criteria in EN1363.1:2012 are generally applied in a comparable manner.

Specimen Temperature Measurement

A.2.1.21 The specimen thermocouple specification of service penetrations is generally the same for AS1530.4-2014 and BSEN1366-3.

A.2.1.22 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.

A.2.1.23 For penetrating sealing systems, BSEN 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.

A.2.1.24 Based on the above, the effect of the differences on the thermocouple locations of the tested construction and the specifications in AS1530.4-2014 discussed on case by case basis.

Insulation Performance Criteria

A.2.1.25 The general insulation criteria of AS 1530.4-2014 and EN1363.1:2012 are not appreciably different.

A.2.2 Application of Test Data to AS 1530.4-2014

A.2.2.1 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.

A.2.2.2 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 AS1530.4-2014

APPENDIX B ASSESSMENT OF SPECIFIC VARIATIONS

B.1 VARIATION TO PLASTERBOARD

B.1.1.1 It is proposed that the plasterboard wall partition tested in the referenced tests shall include an option of lining with two layers of 13mm thick fire grade plasterboard that has otherwise been tested or assessed as a wall to achieve an FRL -/120/120 on each side of steel framed wall.

B.1.1.2 It is also proposed that the tested wool cavity insulation shall be provided as an option.

B.1.1.3 With reference to the tested configuration in Test Reports WF 390101, WF389526, WF384982, WF383813, WF388867, WF384988, WF392115 & WF388973, although the wall was insulated with stone wool in the wall cavity, no stone wool insulation was placed 100mm around the openings in the flexible wall.

B.1.1.4 Based on the above observation, it is expected that the insulation performance of the plasterboard lined wall without wall cavity insulation would still be maintained for at least 120 minutes.

B.2 APPLICABILITY TO MASONRY, AAC OR CONCRETE WALLS

B.2.1.1 The scope of AS1530.4-2014, Clause 10.12.2 (c), allows the application of test results obtained in plasterboard-lined partitions to be applied to solid or hollow masonry or normal weight concrete walls of the same or greater thickness and or equivalent FRL.

B.2.1.2 The proposed construction also comprises bare walls having minimum thickness of 75mm. A minimum of two layers of 13mm or 16mm thick fire grade plasterboard strips (minimum 100mm wide and 100mm high) are required to be fixed to each side of the wall to make the thickness of the wall partition around the aperture of minimum 100mm. Further, the built-up pieces are required to extend 50mm from all directions (both sides, vertically and horizontally) from the penetration.

B.2.1.3 As the seal depth therefore maintains at least 25mm deep as tested, it is hence considered the performance of the penetrations will not be detrimentally affected if installed in bare walls that are less than 100mm thick.

B.2.1.4 As the proposed rigid wall thickness is less than the tested frame wall system, they are required to be tested or otherwise assessed by others to have equal or better established FRL of the separating wall element.

B.3 INSULATION PERFORMANCE OF CONCRETE SLABS THINNER TO THAT TESTED

B.3.1.1 It is proposed to reduce the concrete thickness of the separating element while maintaining the the minimum tested dimensions of the sealant system.

B.3.1.2 While its generally allowed to carry out this reduction, the insulation of the concrete slab shall be in line with the effective thickness stated in the below table unless it was tested to achieve a different FRL.

B.3.1.3 The concrete structure code AS3600-2009 states in clause 5.5.1 minimum slab thicknesses for prescribed insulation fire resistance levels. These are summarised in the below table:

FRP for insulation (min)	Effective Thickness (mm)
30	60
60	80
90	100
120	120
180	150
240	175

Table 1 Fire resistance periods (FRPs) for slabs

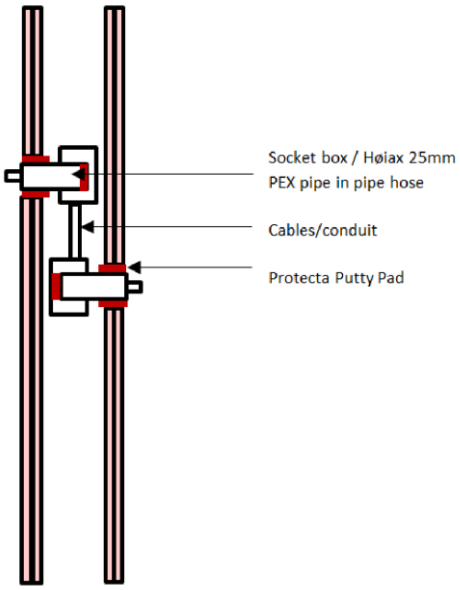
APPENDIX C FIRE RESISTANCE PERFORMANCE OF PROTECTA FR PUTTY & FIELD OF APPLICATION

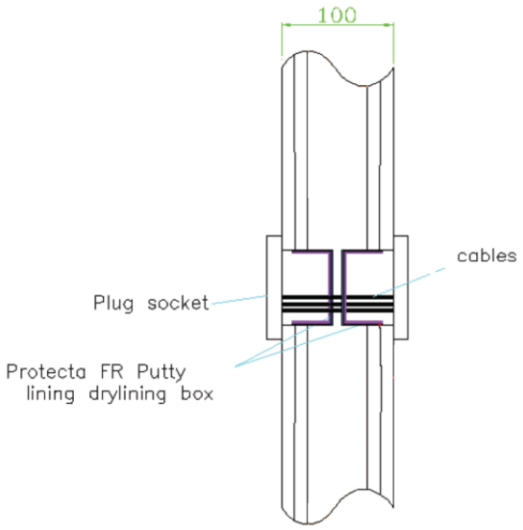
C.1 FLEXIBLE WALL CONSTRUCTIONS WITH WALL THICKNESS OF MINIMUM 100MM

C.1.1 Pipe and cable penetration seals with 4mm thick Protecta FR Putty in socket box.

Penetration Seal: Socket boxes with 15mm Protecta FR Putty wrapped around the pipe protrusion from the socket box. Min. 30mm between cable penetrations.

Construction Details:





C.1.1.1 Double side penetration seal with pipes in socket boxes

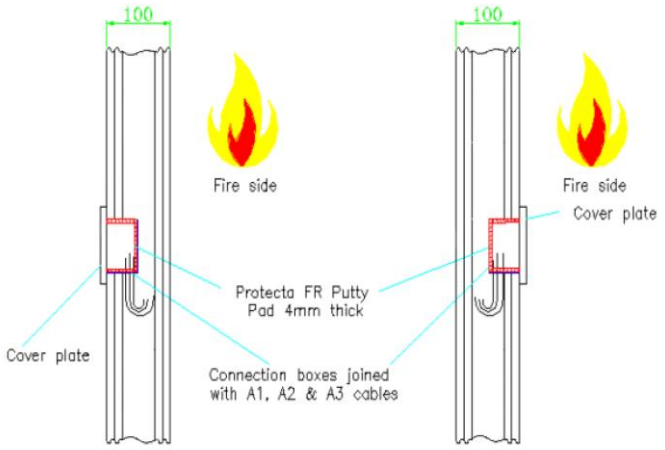
Services	Socket box	Protecta FR Putty (mm)	Aperture (mm)	FRL
HØiax 25mm PEX pipe in pipe hose	Single or double HØiax Push Wallbox 15mm*	174×64×4 mm pad around pipe/50Ø ×25mm at back of the box	63Ø	**-/90/90**
Cables up to 14mm diameter	UK standard double socket box, up to “130mm wide ×70mm high×47mm deep” in size, each with up to 22mm hole cut to accept the cables	Interior of box fully lined with pad	135 wide x 75 high	**-/60/60**

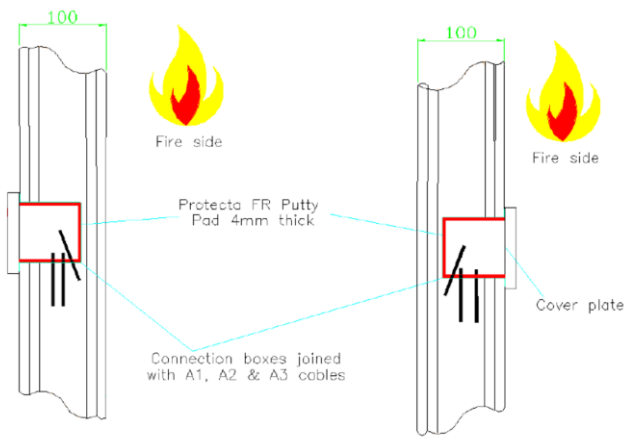
***Fixed directly to studs or with steel plate between studs.**

C.1.2 Cable penetration seals with 4mm thick Protecta FR Putty in socket box

Penetration Seal: Socket boxes with Protecta FR Putty wrapped around the cable protrusion from the socket box

Construction details





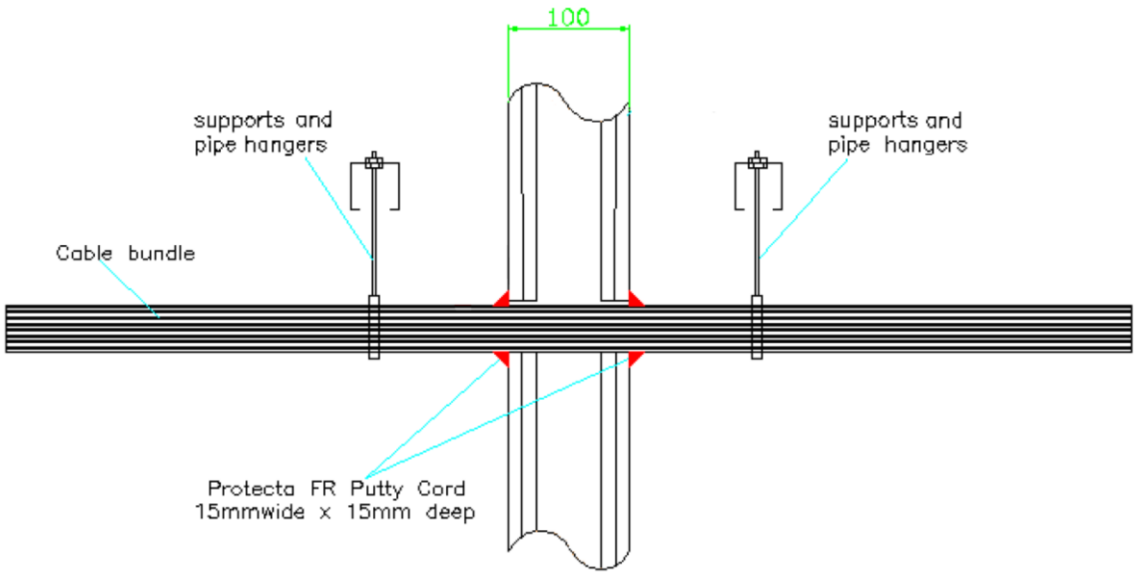
C.1.2.1 Single side penetration seal with cables in socket boxes

Services	Socket box	Protecta FR Putty	Position	Aperture (mm)	FRL
Cables up to 14mm diameter	Schneider Electric Ref. IMT 36026 connection box up to 72mm wide×90mm high×50mm deep	Fitted lining the back of the back box	Side by side-1 fitted to each face	73 wide × 91 high × 51 deep	**-/60/45**
Cables up to 14mm diameter	Elko 41891223720 connection box up to 72mm wide×90mm high×58mm deep	Interior of box fully lined with pad	Adjacent-1 fitted to each face	92 wide ×112 High	**-/90/90**
Cables up to 14mm diameter	ELKO5421 123740 connection box up to 73mm wide×73mm high×55mm deep	Interior of box fully lined with pad	Side by side-1 fitted to each face	74 wide ×74 High	**-/90/90**

C.1.3 Double sided penetration seal with cables

Penetration Seal: Cables (single or bundled up to 50mmØ) penetrating through a flexible or rigid wall construction and fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on both sides of the wall. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm (A2)

Construction details:

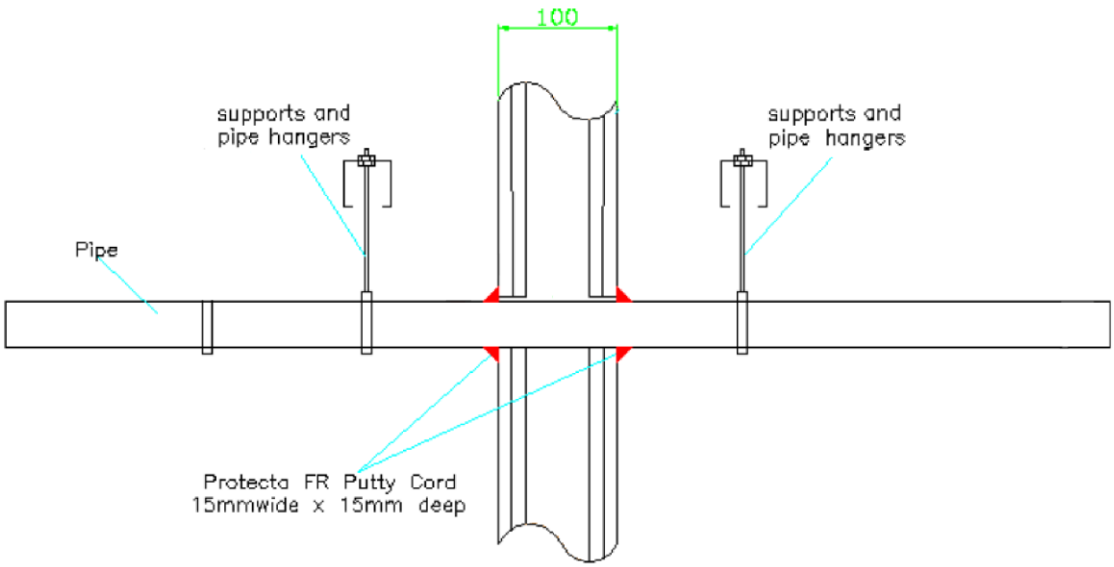


C.1.3.1

Services	FRL
Blank seal with a 15mm deep cord of Protecta FR Putty on both sides of the wall	**-/120/120**
Cables up to 21mm diameter, single or in a bundle up to 50mm diameter	**-/120/120**
Cables up to 80mm diameter, single or in a bundle up to 50mm diameter	**-/60/60**

C.1.4 Double sided penetration seal with metallic pipes

Penetration Seal: Metallic pipes penetrating through a flexible or rigid wall construction and fitted at any position within the aperture sealed with a 15mm diameter cord of Protecta FR Putty on both sides of the wall. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm (A2)
Construction details:

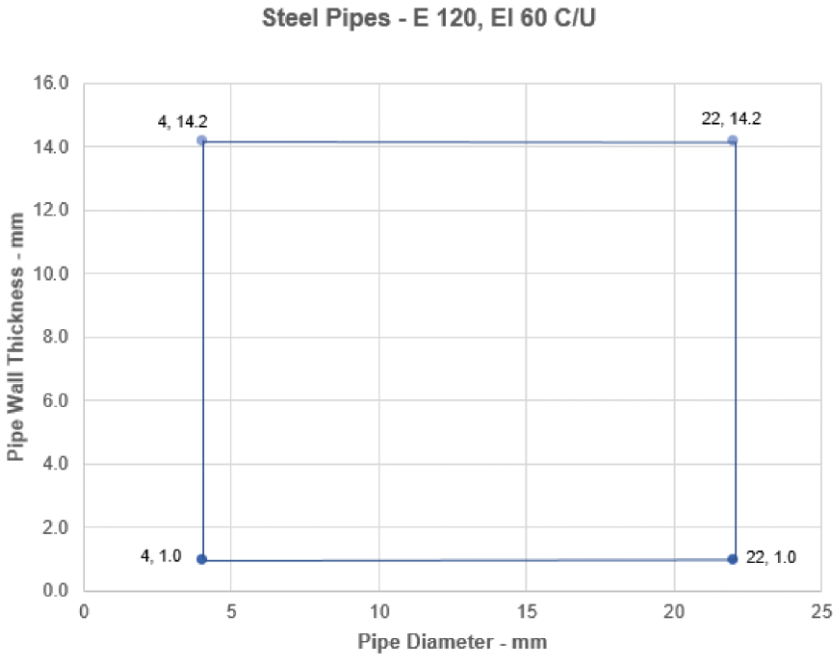


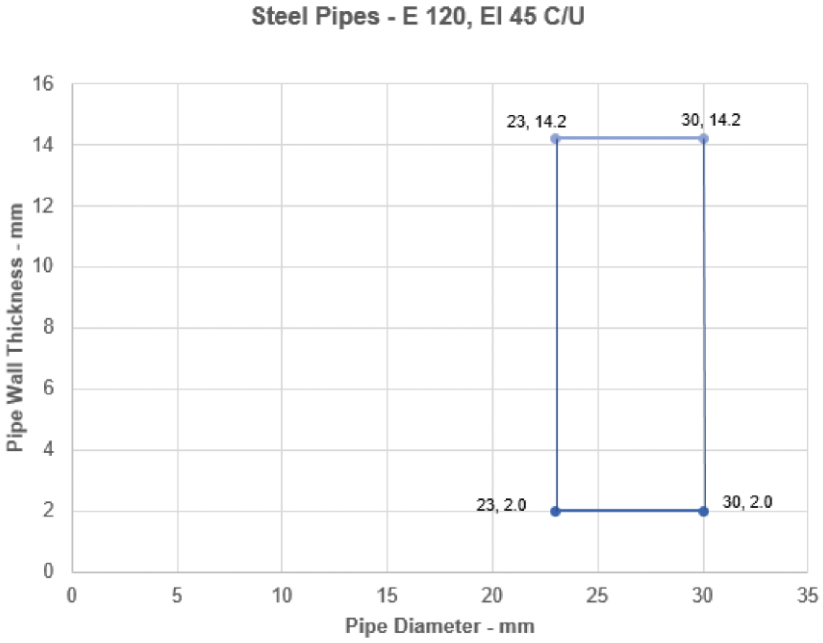
C.1.4.1

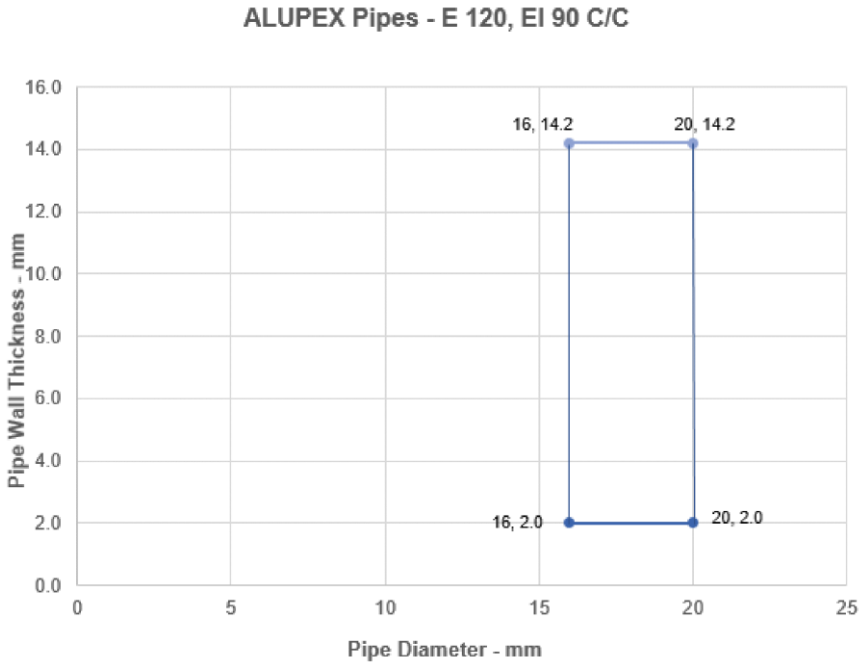
Services	Insulation	FRL
Mild or stainless steel pipe		
4-22mm diameter*	None needed	**-/120/60**
23-30mm diameter*		**-/120/45**
ALUPEX pipe		
16mm diameter*	None needed	**-/120/120****
17-20mm diameter*		**-/120/90****
Copper or Steel pipe		
6mm diameter*	None needed	**-/120/120****
7-12mm diameter*		**-/120/60****

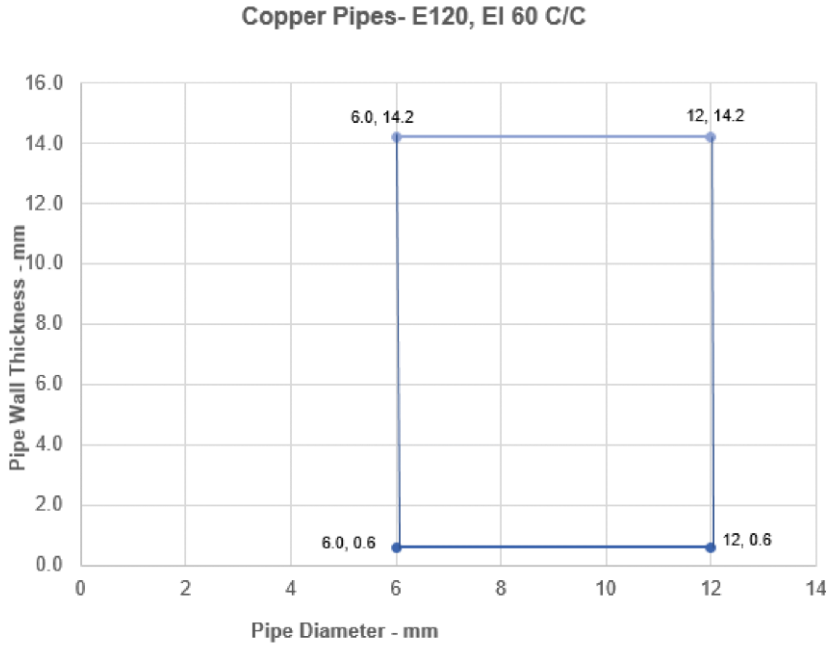
*See below graphs for interpolation pipe sizes

**FRL given is applicable to closed systems only.





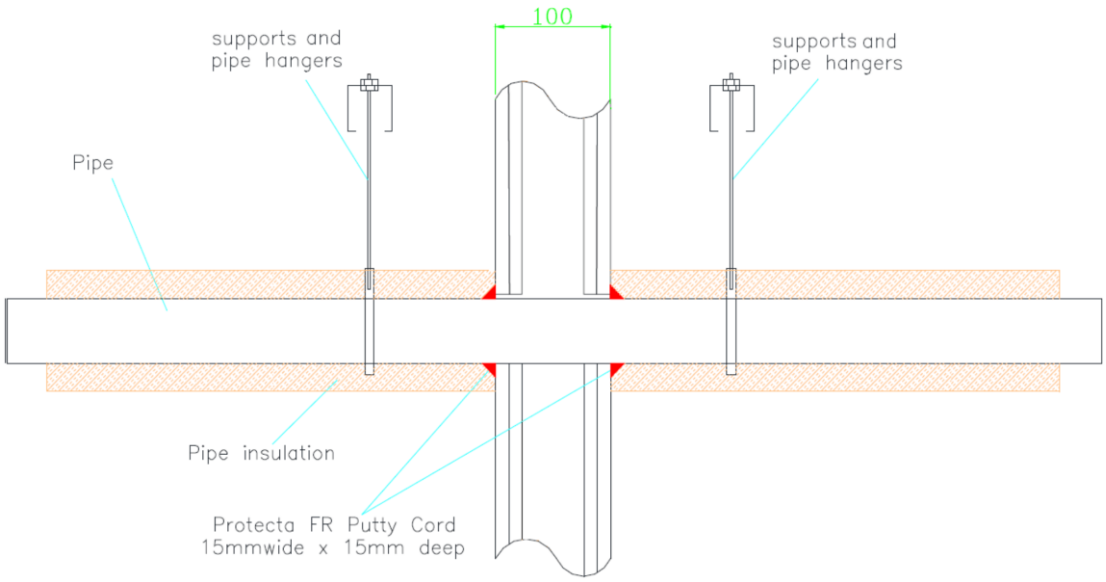




C.1.5 Double sided penetration seal with insulated metallic pipes, Local Interrupted (LI)

Penetration Seal: Metallic pipes insulated with minimum 80 kg/m³ density mineral wool insulation, Local Interrupted (LI), penetrating through a flexible or rigid wall construction, fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on both sides of the wall. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm (A2)

Construction Details:

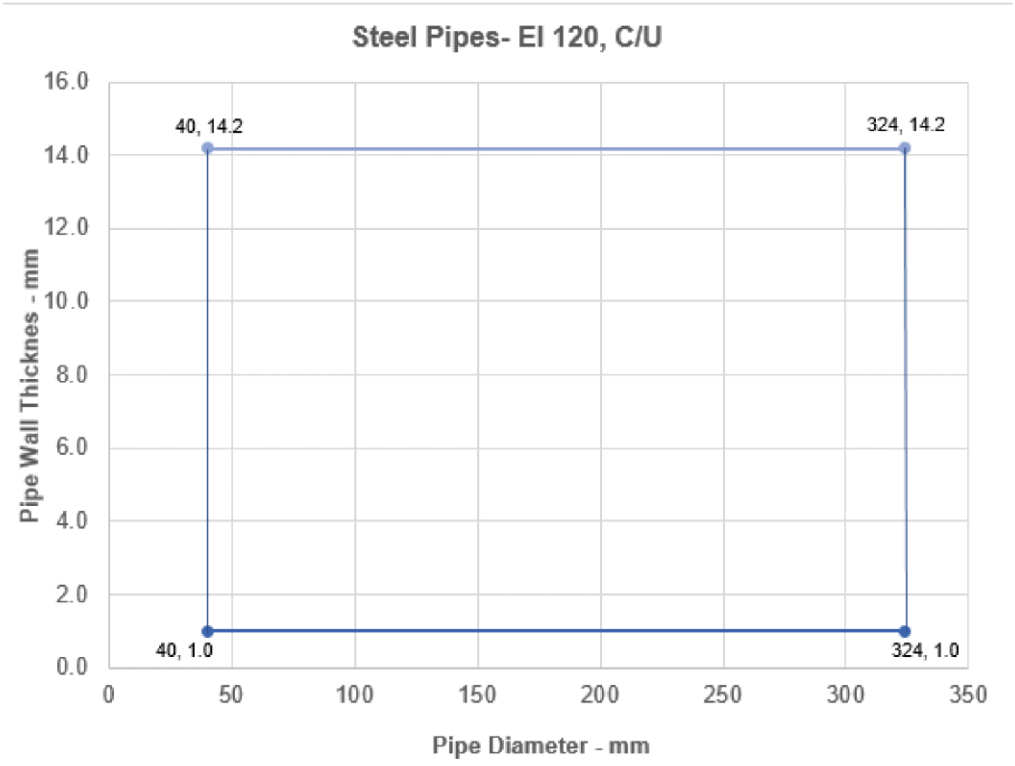


C.1.5.1

Services	Insulation	FRL
Mild or stainless steel pipe, with minimum 80 kg/m³ density mineral wool insulation		
Maximum 40mm diameter*	Minimum 20mm thick insulation, 500mm long butted up to the wall on both faces	**-/120/120**
40-324mm diameter*	Minimum 30mm thick insulation, 500mm long butted up to the wall on both faces	**-/120/120**
Copper or steel pipe with minimum 80kg/m³ density mineral wool insulation		
Maximum 54mm diameter/1.2-14.2mm wall	Minimum 20mm thick insulation, 500mm long butted up to the wall on both faces	**-/90/60****

*See below graphs for interpolation pipe sizes

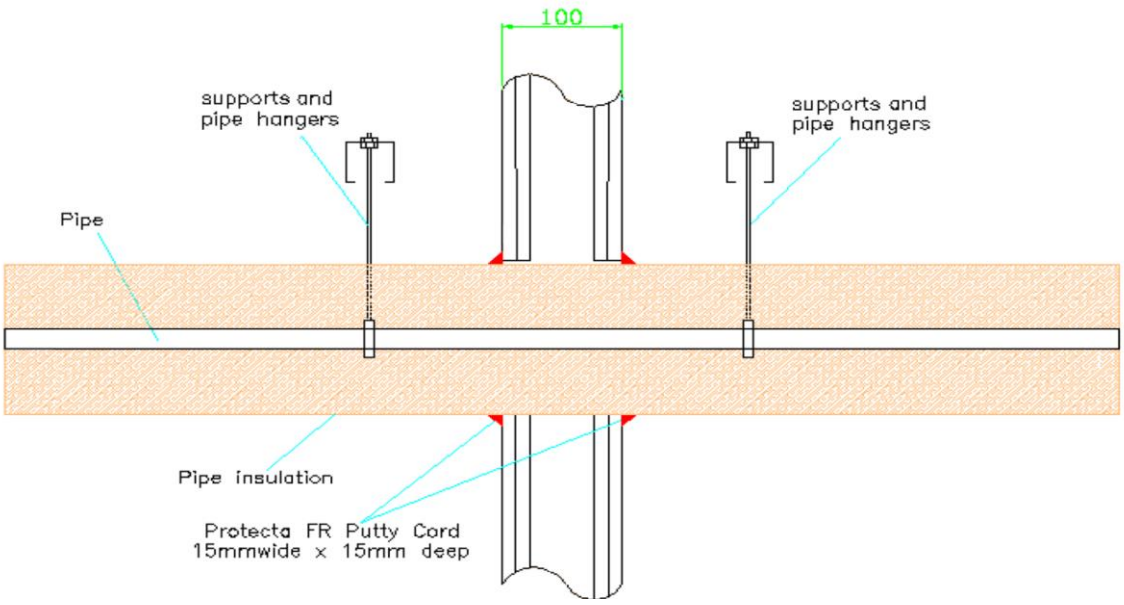
**FRL given is applicable to closed systems only



C.1.6 Double sided penetration with insulated metallic pipes, Continuous Sustained (CS)

Penetration Seal: Metallic Pipes insulated with minimum 80kg/m³ density mineral wool insulation, Continuous Sustained (CS), penetrating through a flexible or rigid wall construction, fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on both sides of the wall. Maximum annular space 10mm (A1) and minimum separation between seals 30mm (A2)

Construction details:

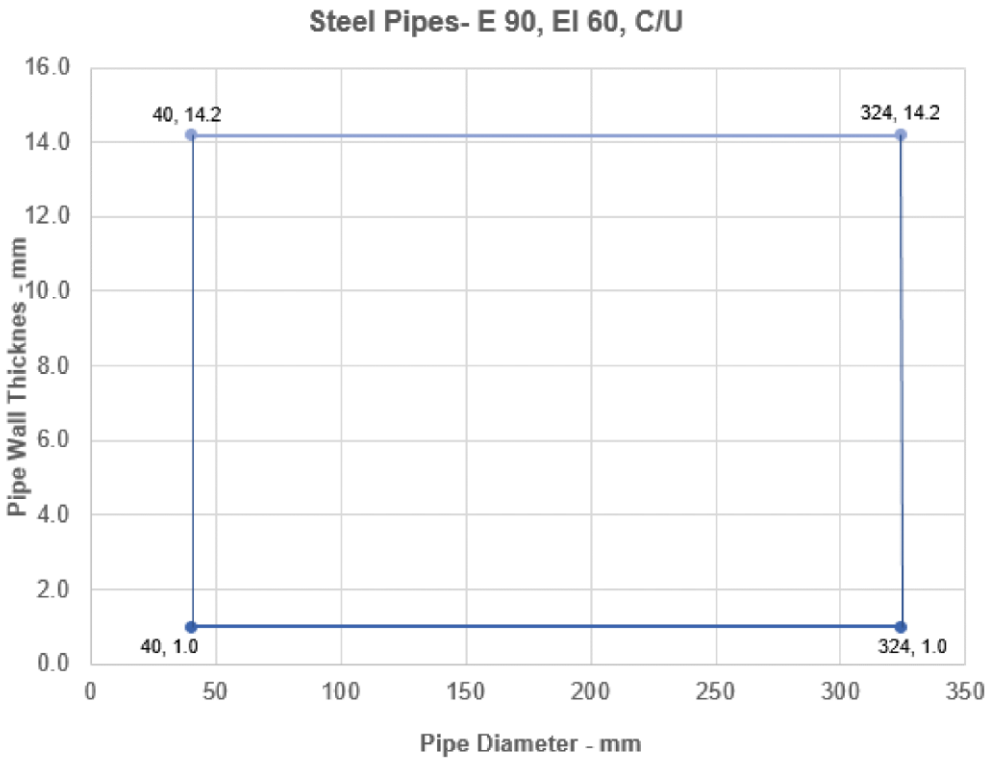


C.1.6.1

Services	Insulation	FRL
Mild or stainless steel pipe, with minimum 80kg/m³ density mineral wool insulation		
Maximum 40mm diameter*	20mm thick	**-/120/120**
40-324mm diameter*	30-80mm thick	**-/90/60**
Copper or steel pipe with minimum 80kg/m³ density mineral wool insulation		
Maximum 12mm diameter/0.7-6.0 wall*	20mm thick	**-/90/60****
Maximum 54mm diameter/1.2-14.2 mm wall	30-80mm thick	**-/90/60****

*see below graphs for interpolation pipe sizes

** FRL given is applicable to close systems only

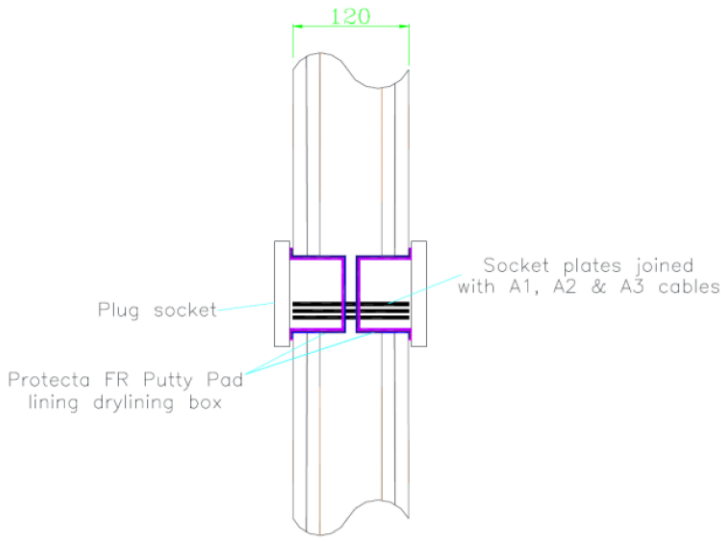


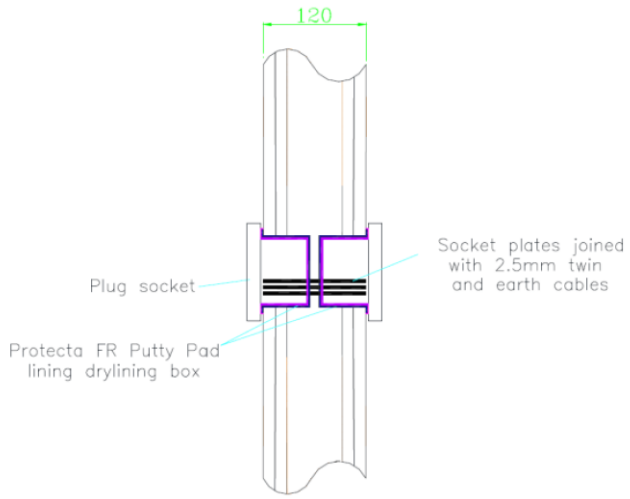
C.2 FLEXIBLE WALL CONSTRUCTIONS WITH WALL THICKNESS OF MINIMUM 120 MM

C.2.1 Cable penetration seals with 4mm thick Protecta FR Putty in socket box

Penetration Seal: Socket boxes with Protecta FR Putty wrapped around the cable protrusion from the socket box

Construction details:





C.2.1.1 Double side penetration seal with cables in socket boxes

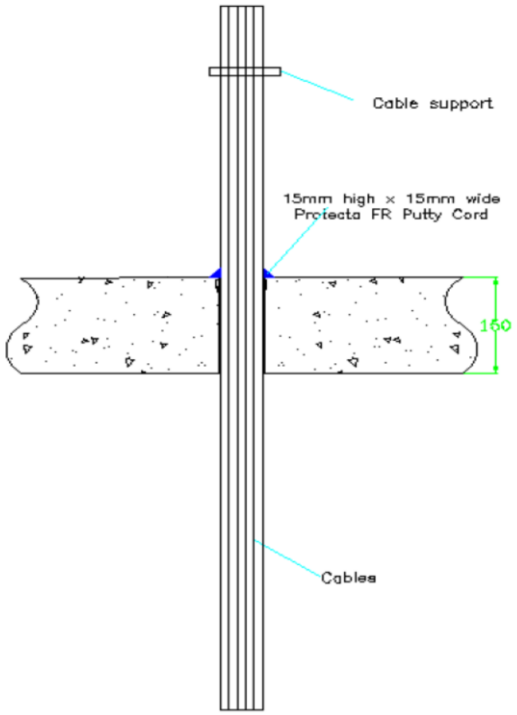
Services	Socket box	Protecta FR Putty	Position	Aperture	FRL
Cables up to 14mm diameter	UK standard double socket box, up to “135mm wide ×75mm high×50mm deep” size, each with up to 22mm hole cut to accept the cables	Interior of box fully lined with pad	Back to back-1 fitted to each face	137 wide ×77 High	**-/90/90**
2.5mm twin and earth cables		Interior of box fully lined with pad	Back to back-1 fitted to each face	137 wide ×77 High	**-/90/90**

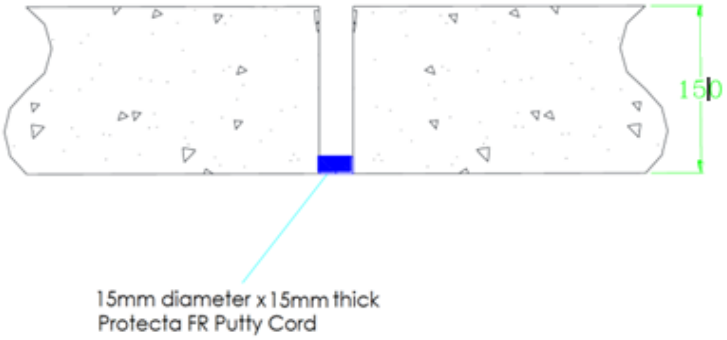
C.3 RIGID FLOOR CONSTRUCTIONS WITH FLOOR THICKNESS OF MINIMUM 150MM

C.3.1 Single sided penetration seal with cables

Penetration Seal: Cables (single or bundled up to 50mmØ) penetrating through a rigid floor construction and fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on the top face of the floor. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm(A2). When incorporating blank penetration seals, the aperture is sealed with 15mm wide by 15mm thick cord of Protecta FR Putty, applied with flush with the bottom face of the floor.

Construction details:





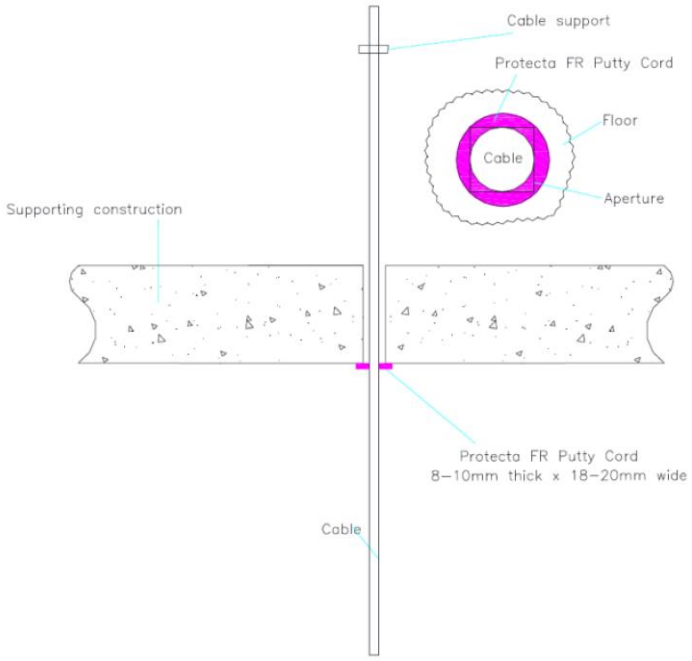
C.3.1.1

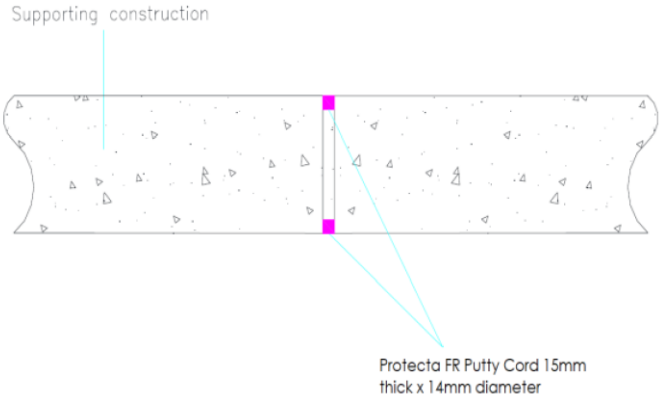
Services	FRL
None (blank)	**-/120/30**
Cables up to 21mm diameter in tied bundles up to 50mm diameter	**-/120/60**
Cables up to 21mm diameter	**-/120/120**
Cables 22-50mm diameter	**-/120/90**
Cables 51-80mm diameter	**-/120/60**
Single ‘A1’ type cable	**-/240/240**
Single ‘C3’ type cable	**-/240/240**
Single ‘E’ type cable	**-/120/120**
Single ‘D1’ type cable	**-/120/120**
Single ‘D2’ type cable	**-/120/120**
Single ‘D3’ type cable	**-/240/60**

C.3.2 Single sided penetration seal with cables

Penetration Seal: Cables (single or bundled up to 75mmØ) penetrating through a rigid floor construction and fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on the bottom face of the floor. Maximum annular space 10mm (A1) and minimum separation between seals 30mm (A2). When incorporating blank penetration seals, the aperture is sealed with 15mm wide by 15mm thick cord of Protecta FR Putty, applied flush with both faces of the floor.

Construction details:





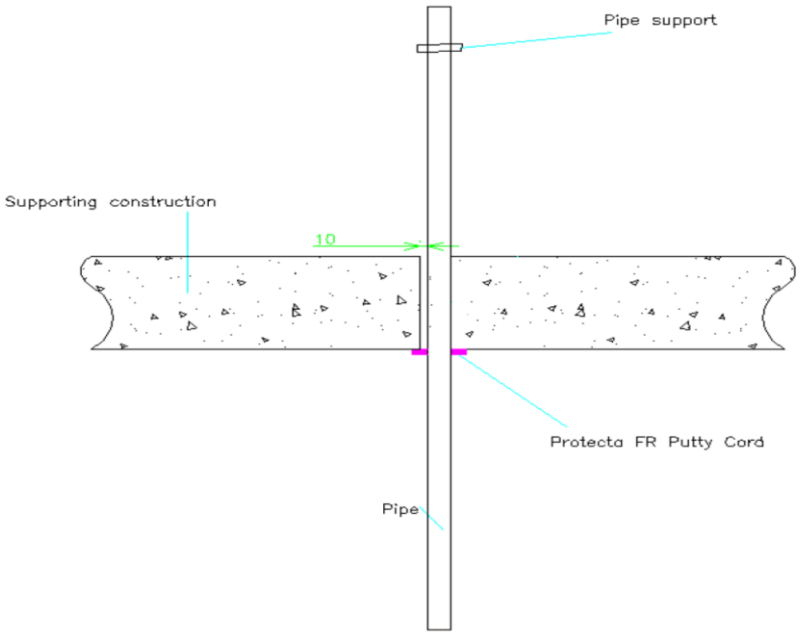
C.3.2.1

Services	Seal Size	FRL
None (blank)	15mm deep	**-/120/120**
Cables up to 21mm diameter in tied bundles up to 75mm diameter	15mm diameter cord	**-/60/45**
Cables up to 21mm diameter		**-/120/60**
Cables 22-80 diameter		**-/90/45**

C.3.3 Single sided penetration seal with metallic pipes

Penetration Seal: Metallic pipes penetrating through a rigid floor construction and fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on the bottom face of the floor. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm (A2)

Construction details:



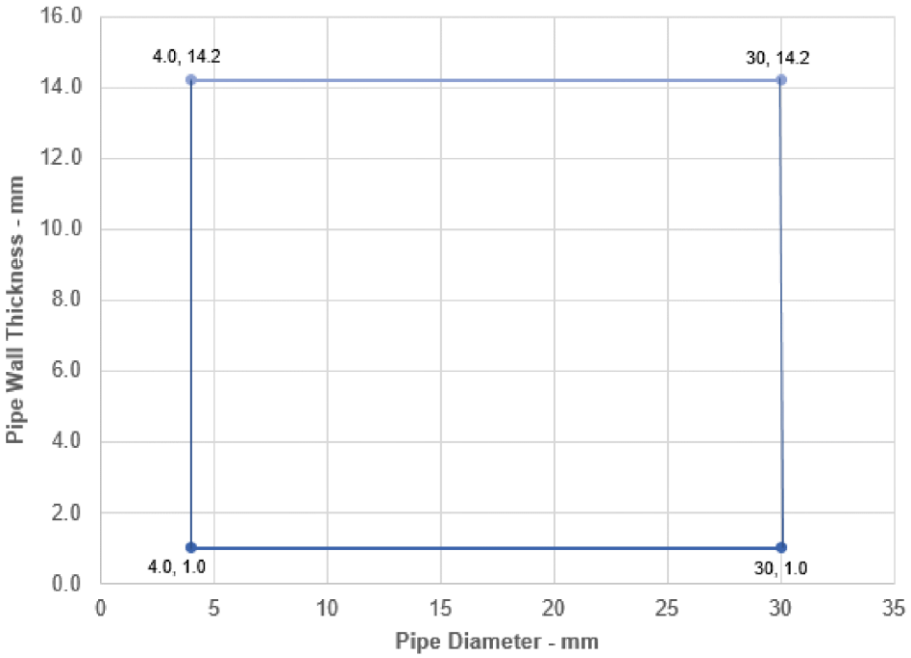
C.3.3.1

Services	Insulation	FRL
Mild or stainless steel pipe		
4mm diameter*	None needed	**-/120/120**
5-30mm diameter*	None needed	**-/120/45**
Copper or steel pipe		
6mm diameter*	None needed	**-/120/90****
7-12mm diameter*	None needed	**-/120/30****

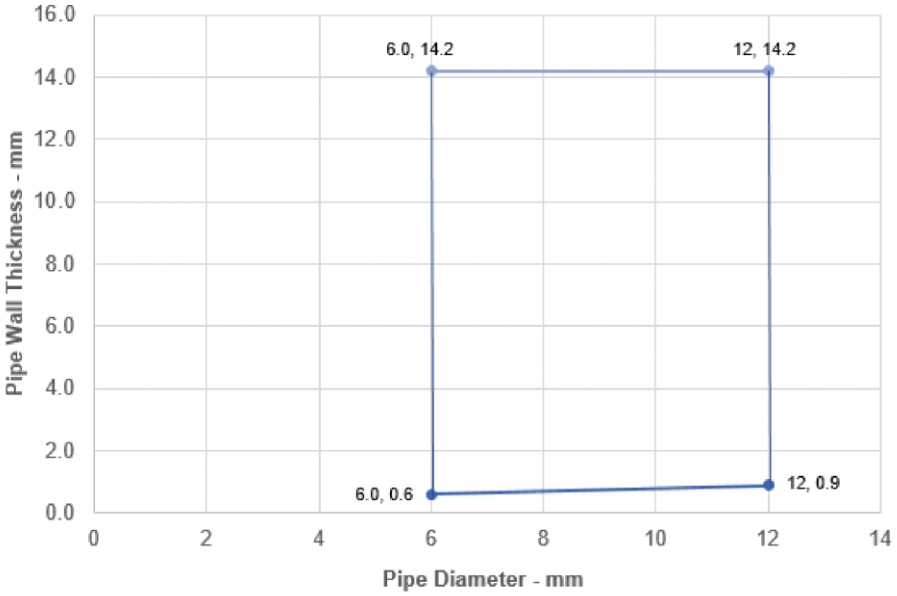
*See below graphs for interpolation pipe sizes

**FRL given is applicable to closed systems only

Steel Pipes - E 120, EI 45 C/U

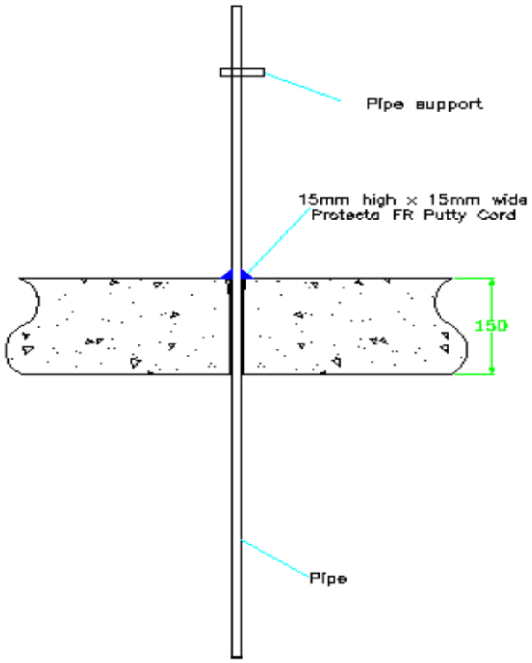


Copper Pipes - E 120, EI 30 C/C



C.3.4 Single sided penetration seal with metallic pipes

Penetration Seal: Metallic pipes penetrating through a rigid floor construction and fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on the top of face of the floor. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm (A2)

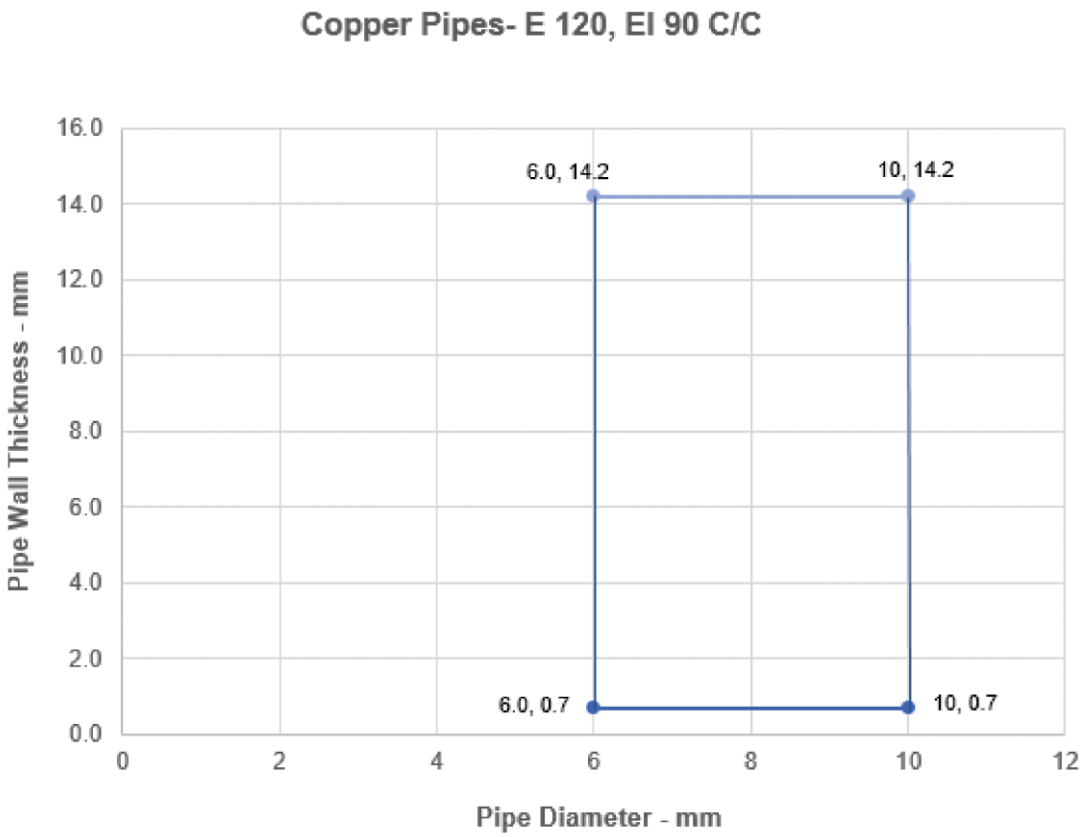


C.3.4.1

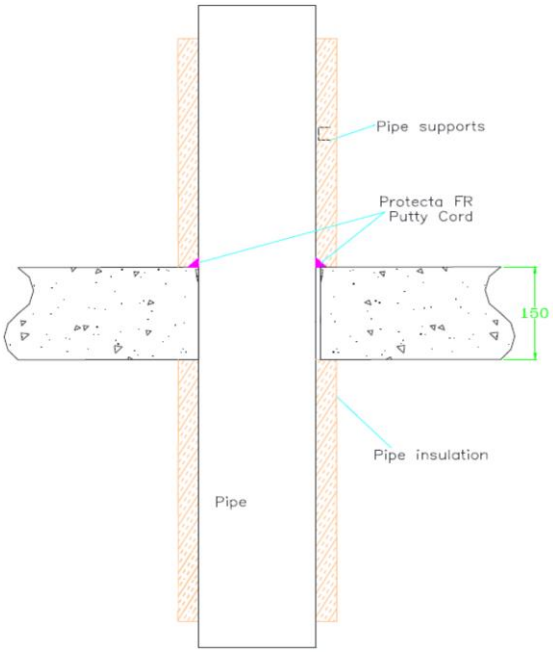
Services	Insulation	FRL
Mild or stainless steel pipe		
Maximum 22mm diameter/1.2-11.0mm wall	None needed	**-/120/120**
Copper or steel pipe		
6mm diameter*	None needed	**-/120/120****
7-10mm diameter*	None needed	**-/120/90****

*See below graphs for interpolation pipe sizes

**FRL given is applicable to closed systems only



C.3.5 Single sided penetration seal with insulated metallic pipes, Local Interrupted (LI)

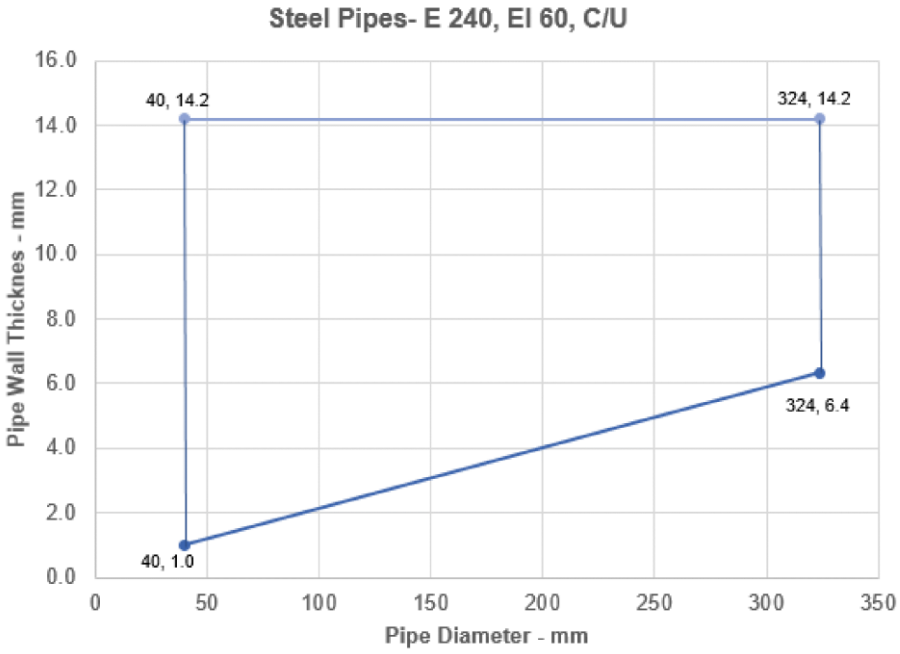
Penetration Seal: Metallic pipes insulated with minimum 80 kg/m³ density mineral wool insulation, Local Interrupted (LI), penetrating through a rigid floor construction, fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on the top face of the floor. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm (A2)
Construction details: 

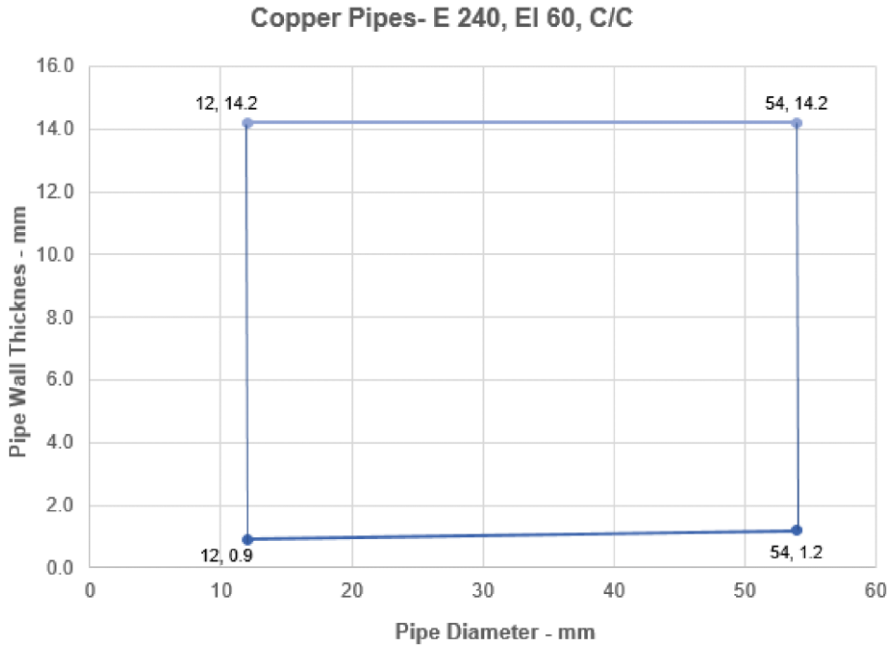
C.3.5.1 Single sided penetration seal with partially insulated metallic pipes

Services	Insulation	FRL
Mild or stainless steel pipe, with minimum 80kg/m³ density mineral wool insulation		
Maximum 40mm diameter*	Minimum 20mm thick insulation, 500mm long butted up to each face of the floor	**-/240/240**
41-324mm diameter*	Minimum 30mm thick insulation, 500mm long butted up to each face of the floor	**-/240/60**
Copper or steel pipe with minimum 80 kg/m³ density mineral wool insulation		
12mm diameter*	Minimum 20mm thick insulation, 500mm long butted up to each face of the floor	**-/240/240****
13-54mm diameter*		**-/240/60****

*See below graphs for interpolation pipe sizes

**FRL given is applicable to closed systems only

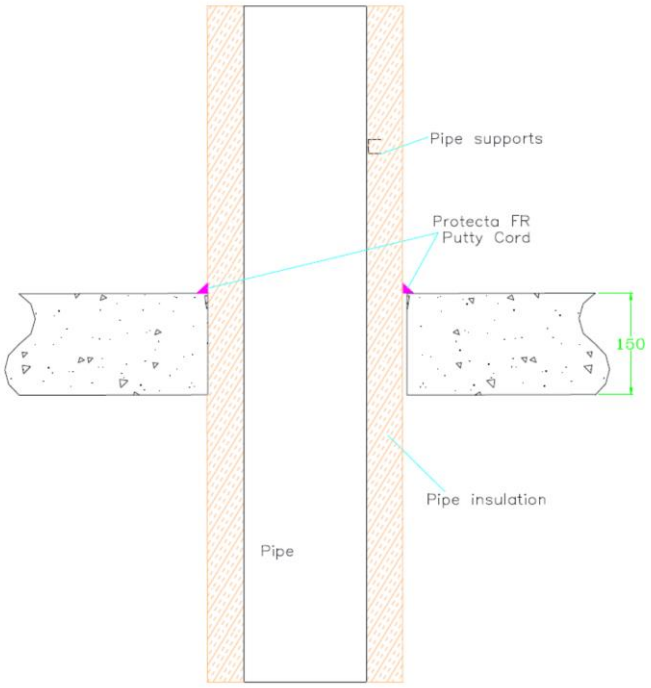




C.3.6 Single sided penetration seal with insulated metallic pipes, Continuous Sustained (CS)

Penetration Seal: Metallic pipes insulated with minimum 80kg/m³ density mineral wool insulation, Continuous Sustained (CS), penetrating through a rigid floor construction, fitted at any position within the aperture, sealed with a 15mm diameter cord of Protecta FR Putty on the top face of the floor. Maximum annular space 10mm (A1) and minimum separation between penetration seals 30mm (A2)

Construction Details:



C.3.6.1

Services	Insulation	FRL
Mild or stainless steel pipe, with minimum 80 kg/m³ density mineral wool insulation		
Maximum 40mm diameter/1.0-14.2mm wall	20mm thick	**-/240/240**
Maximum 324mm diameter*	30-80mm thick	**-/240/240**
Copper or steel pipe with minimum 80kg/m³ density mineral wool insulation		
Maximum 12mm diameter/0.7-6.0mm wall	20mm thick	**-/240/240****
Maximum 54mm diameter/1.2-14.2mm wall	30-80m thick	**-/240/240****

*See below graphs for interpolation pipe sizes

** FRL given is applicable to closed systems only