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FIRE ASSESSMENT REPORT

FAR 4568

FIRE RESISTANCE OF 3M TUCK-IN WRAP STRIP PENETRATION SEALS FOR
PVC U PIPES

CLIENT

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PAGE:

1 of 10

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ASSESSMENT OBJECTIVE

To assess the fire resistance in accordance with AS 1530.4-2014 of 3M Tuck-in Wrap Strip penetration seals installed in fire rated walls to achieve an Integrity and Insulation of at least up to 180 minutes subject to the pipe diameter and number of Tuck-in Wrap Strips.

CONCLUSION

It is considered that 3M™ Tuck-In wrap penetration seals for PVC U pipes when installed in fire rated walls and floors would achieve the FRL given in Table 1 and Table 2 if they had been tested in accordance with AS 1530.4-2014.

The walls may be either masonry walls at least 100 mm thick or plasterboard lined walls with at least two layers of 12.5 mm thick fire rated plasterboard and at least 50 mm wide steel studs. The concrete floors are at least 150 mm thick.

It is considered that the penetration system shown in Figure 1 would achieve Integrity and Insulation of at least 30 minutes when tested in accordance with AS 1530.4:2014.

LIMITATION

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The results reported here relate only to the item/s described in this report.



REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

2 of 10

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CONTENTS

SIGNATORIES	4
DOCUMENT REVISION STATUS	4
1. INTRODUCTION	5
2. BACKGROUND	5
3. DISCUSSION	5
3.1 BSEN 1366-3: 2009 vs AS 1530.4-2005	5
3.1.1 General	5
3.1.2 Furnace conditions	6
3.1.3 Failure criteria.....	6
3.2 3M™ Fire Barrier Tuck-In Wrap Strips	6
3.3 Specification for plasterboard walls	6
3.4 Specification for 150 mm thick concrete floor slab.....	7
3.5 Plasterboard Wall type	7
3.6 Installation in 75 mm concrete floor.....	7
4. CONCLUSION	8

FIGURES

Figure 1: Tuck-In wrap in 75 mm concrete floor.....	9
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TABLES

Table 1: PVC-U FRL summary in a plasterboard wall system.....	10
Table 2: PVC-U FRL summary in 150 mm concrete floor slab	10



REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

3 of 10

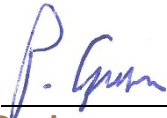


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REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

4 of 10

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1. INTRODUCTION

This report gives BRANZ's assessment of 3M™ Tuck-In wrap penetration seals for PVC-U pipes when installed in fire rated walls and floors. The walls may be either masonry walls at least 100 mm thick or plasterboard lined walls with at least two layers of 12.5 mm thick fire rated plasterboard and at least 50 mm wide steel studs. The concrete floors are at least 150 mm thick.

A special application is where the floor slab is 75 mm thick and is discussed below. Figure 1 shows the installation where two 3M™ Fire Barrier Tuck-In Wrap Strips are installed around the 110 mm diameter PVC-U pipe.

2. BACKGROUND

In Exova Warringtonfire fire resistance test report WF Report No. 320202, eighteen penetration systems using 3M™ Fire Barrier Tuck-In Wrap Strips were reported as having been tested in a steel stud plasterboard wall in accordance with BSEN 1366-3: 2009. The wall consisted of nominal 50 mm deep steel studs lined with two layers of 12.5 mm thick fire rated gypsum plasterboard. The cavity of the wall system was packed with 50 mm thick 100 kg/m³ mineral fibre insulation. The insulation material was removed from the core for a distance of 100 mm around each aperture. The overall thickness of the wall was nominally 100 mm.

The specimen configuration and result expressed as a Fire Resistance Level (FRL) is given in Table 1.

In Efectis Nederland fire resistance test report 2001-Efectis-R93991b, sixty penetration systems were tested in an AAC floor slab wall in accordance with BSEN 1366-3: 2009. Sixteen were installed directly into the 150 mm concrete slab with 3M™ Fire Barrier Tuck-In Wrap Strips and PVC U pipes.

The specimen configuration and result expressed as a Fire Resistance Level (FRL) is given in Table 2.

3. DISCUSSION

3.1 BSEN 1366-3: 2009 vs AS 1530.4-2005

3.1.1 General

Test standards BSEN 1366-3: 2009 and AS 1530.4-2014 are both based on the same ISO fire resistance time/temperature curve. There are some differences in terms of furnace conditions and specimen configurations. The significant difference in relation to the penetrations tested in fire resistance tests WF Report No. 320202 and 2001-Efectis-R93991b are discussed below.



REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

5 of 10

ES

PJC

3.1.2 Furnace conditions

BSEN 1366-3 refers to BSEN 1363-1 general requirements which defines the test conditions. BSEN 1363-1 specifies plate thermometers to be used to measure and control the furnace temperature. AS 1530.4 specifies 3 mm MIMS thermocouples but also allows for the use of plate thermometers as an alternative. Therefore it is considered that the furnace test conditions would also comply with the requirements of AS 1530.4.

The pressure in the fire resistance test was set to achieve a minimum of 10 Pa to the underside of the lowest penetration system in accordance with BSEN 1366-3. This is similar to what is specified to comply with AS 1530.4 where multiple penetrations are tested in a vertical element. Therefore it is considered the pressure conditions would also meet the requirements of AS 1530.4.

3.1.3 Failure criteria

The Integrity criteria for penetration systems is similar to both test standards and therefore would expect a similar Integrity performance had the test been undertaken in accordance with AS 1530.4.

The Insulation criteria for penetration system is similar between test standards with a maximum temperature rise limit of 180 K and placement of thermocouples 25 mm away from features in the test specimen. It is expected a similar Insulation performance would have been achieved if the test had been undertaken in accordance with AS 1530.4.

3.2 3M™ Fire Barrier Tuck-In Wrap Strips

Tuck-In strips were used in penetrations on specimens A1-A6, C1-C8 and D1-D8 as listed in Table 1 and Table 2.

The wrap strips are 64 mm wide x 5 mm thick with a length to suit the pipe diameter.

3.3 Specification for plasterboard walls

Various pipes were installed in the plasterboard wall. On each pipe 3M™ Fire Barrier Tuck-In Wrap Strips were applied on each face and installed as described below.

The number of 3M™ Fire Barrier Tuck-In Wrap Strips with the pipe diameter and wall thickness is given in Table 1.

The annular space between the 3M™ Fire Barrier Tuck-In Wrap Strips and aperture is infilled with 3M™ Fire Barrier Sealant IC 15WB+, applied to each face. Additionally, a bead of 3M™ Fire Barrier Sealant IC 15WB+ is applied around the 3M™ Fire Barrier Tuck-In Wrap Strips to pipe junction, on each face of the wall.



REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

6 of 10

ES

PJC

3.4 Specification for 150 mm thick concrete floor slab

The number of 3M™ Fire Barrier Tuck-In Wrap Strips in the floor, with the pipe diameter and wall thickness is given in Table 2.

The wrap/s are fitted closely to the pipe and recessed 12.5 mm from the top of the slab.

The annular space between the pipe and aperture is filled with 12.5 mm deep 3M™ Fire Barrier Water Tight Sealant 3000 WT finished flush with the top of the slab.

The annular space was from 9 to 21 mm wide.

3.5 Plasterboard Wall type

In Exova Warringtonfire fire resistance test report WF Report No. 320202 the penetrations were tested in a wall consisting of nominally 50 mm thick steel studs, lined with two layers of 12.5 mm fire rated plasterboard with the cavity filled with 50 mm thick 100 kg/m³ mineral fibre. The insulation material was removed from the core for a distance of 100 mm around each aperture. It is considered that a similar result would be expected if the pipe penetrations were installed into a similar fire rated wall with no insulation.

Section 10.12.2 of AS 1530.4-2014 permits variations to the wall construction as follows:

- *Results obtained from framed wall systems may be applied to the performance of a system in concrete, masonry or solid gypsum blocks of greater or equal thickness to that of the tested prototype.*
- *Results obtained from framed wall systems may be applied to similar walls having studs of the same material with sizes greater than the tested prototype.*
- *Results obtained from a prototype test may be applied to framed wall systems of similar construction but having thicker facings of the same material applied to the studs.*

3.6 Installation in 75 mm concrete floor.

The proposed floor slab is 75 mm thick, and an FRL of -/30/30 is specified for the penetration.

In Efectis Nederland fire resistance test report 2001-Efectis-R93991b it was demonstrated that a 110 mm diameter x 6.6 mm wall thickness PVC-U pipe with two 3M™ Fire Barrier Tuck-In Wrap Strips and a 21 mm annular gap could achieve an FRL of -/180/180. Refer to Table 2 specimen D6.

In accordance with AS 3600 a 150 mm thick concrete floor slab would achieve 180 minutes insulation which is commensurate with the result achieved by the specimen in fire resistance test 2001-Efetcis-R93991b.



REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

7 of 10

ES

PJC

The wrap demonstrated its ability to provide an FRL of at least -/180/180. This shows that the intumescent material can close off the 110 mm x 6.6 mm pipe and remain in place for 180 minutes. Reducing the thickness of the floor is not expected to be detrimental to the intumescent reacting. The intumescent material is closer to the furnace heating conditions than in a 150 mm thick slab, as tested in fire resistance test 2001-Efectis-R93991b, therefore would be expected to close as quickly thereby limiting the temperature rise on the unexposed face of the pipe to less than 180K. The intumescent essentially remains within the thickness of the concrete slab and the number and thickness of 3M™ Fire Barrier Tuck-In Wrap Strips is the same as tested therefore would be expected to maintain Integrity and Insulation for at least 30 minutes.

In the proposed system the annular gap is 15 mm which is less than the tested specimen and would therefore not be detrimental to its performance.

The PVC-U pipe wall thickness was 6.6 mm, therefore the result can apply to a wall thickness of 6.6 mm or less.

4. CONCLUSION

It is considered that 3M™ Tuck-In wrap penetration seals for PVC U pipes when installed in fire rated walls and floors would achieve the FRL given in Table 1 and Table 2 if they had been tested in accordance with AS 1530.4-2014.

The walls may be either masonry walls at least 100 mm thick or plasterboard lined walls with at least two layers of 12.5 mm thick fire rated plasterboard and at least 50 mm wide steel studs. The concrete floors are at least 150 mm thick.

It is considered that the penetration system shown in Figure 1, with a concrete slab thickness of 75 mm, would achieve Integrity and Insulation of at least 30 minutes when tested in accordance with AS 1530.4:2014.



REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

8 of 10

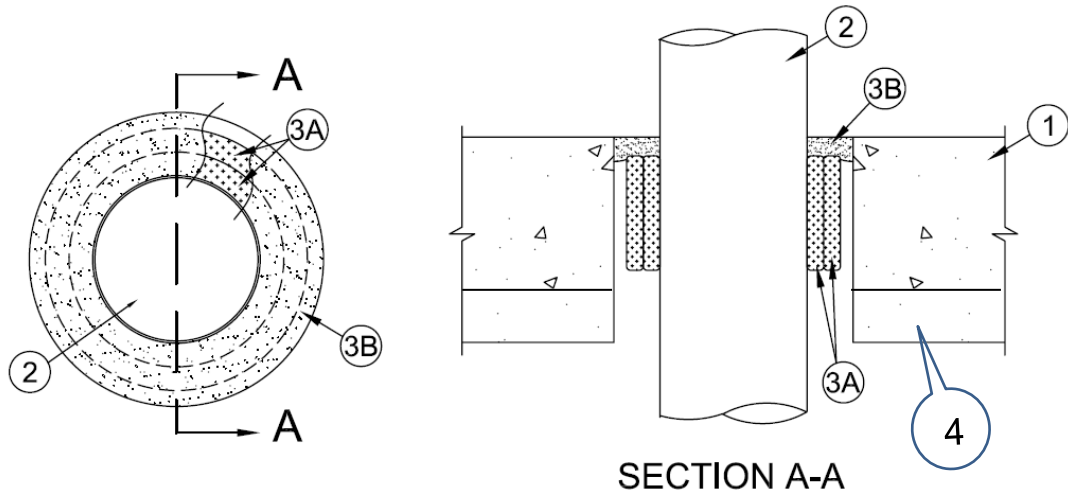
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Figure 1: Tuck-In wrap in 75 mm concrete floor.



- (1) 75 mm Concrete Floor slab
- (2) uPVC Pipe
- (3A) 3M™Fire Barrier Tuck-In Wrap Strip(s), recessed 10mm from the floor -line
- (3B) 3M™Fire Barrier 3000WT Sealant
- (4) 25 mm timber

Table 1: PVC-U FRL summary in a plasterboard wall system

Penetration number	Pipe diameter and wall thickness	No. of Wraps	FRL
A1	PVC-U 50 x 1.8 mm	1	-/120/120
A2	PVC-U 50 x 3.7 mm	1	-/120/120
A3	PVC-U 110 x 3.2 mm	2	-/120/120
A4	PVC-U 110 x 5.3 mm	2	-/120/120
A5	PVC-U 110 x 3.2 mm	1	-/120/90
A6	PVC-U 110 x 5.3 mm	1	-/60/60

Table 2: PVC-U FRL summary in 150 mm concrete floor slab

Penetration Number	Pipe diameter and wall thickness	Annular Space (mm)	No. of Wraps	FRL
C1	160 x 9.5 mm	21	2	-/180/180
C2	114 x 5 mm	19	2	-/180/180
C3	160 x 3.2 mm	21	2	-/180/180
C4	114 x 5 mm	19	1	-/180/180
C5	114 x 6 mm	19	2	-/180/180
C6	114 x 5 mm	9	1	-/180/180
C7	50 x 2.4 mm	21	1	-/180/180
C8	50 x 2.4 mm	11	1	-/180/180
D1	114 x 4.5 mm	9	2	-/180/180
D2	160 x 3.2 mm	11	2	-/180/180
D3	114 x 6 mm	9	2	-/180/180
D4	160 x 6.5 mm	11	2	-/180/180
D5	110 x 6.6 mm	11	1	-/120/120
D6	110 x 6.6 mm	21	2	-/180/180
D7	50 x 3.7 mm	21	1	-/180/180
D8	50 x 3.7 mm	11	1	-/180/180



REPORT NUMBER:

FAR 4568

ISSUE DATE:

22 July 2016

PAGE:

10 of 10

ES

PJC