ASSESSMENT REPORT

The fire resistance performance of uPVC, HDPE and Coestilen® HDPE pipe penetrations protected by PROMASEAL® FCS and FC retrofit collars in walls and floors if tested in accordance with AS1530.4-2005 and assessed in accordance with AS4072.1-2005

EWFA Report No:

29592300.3

Report Sponsor:

Promat Australia Pty Ltd
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Mile End
SA 5031

DOCUMENT REVISION STATUS

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04/06/2014	29592300	Initial Issue
30/07/2014	29592300.1	Revised to include Speedpanel wall option
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CONTENTS

1 INTRODUCTION

This report presents an assessment of the fire resistance performance of uPVC, HDPE and Coestilen® HDPE pipe penetrations protected by PROMASEAL® FCS and FC retrofit collars in walls and floors if tested in accordance with AS1530.4-2005 and assessed in accordance with AS4072.1-2005.

The tested prototypes described in Section 2 of this report, when subject to the proposed variations described in Section 3, are to perform satisfactorily if tested in accordance with the referenced test method described in Section 4. The conclusions of the report are summarised in Section 5.

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

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

2 TESTED PROTOTYPES

This assessment is based on reference test reports F91604, F91611, F91621 and F91624, being tests on pipe penetrations in floor systems tested in accordance with AS1530.4-1990 and AS4072.1-1992. The tests were sponsored by Promat Fyreguard Pty Ltd and were conducted by Warrington Fire Research (Aust) Pty Ltd.

The assessment references to test reports F91730, F91741, F91742, F91754, F91765, FSP 0643, F91797 and F91783A being tests on pipe penetrations in wall and floor systems tested in accordance with AS1530.4-1997 and AS4072.1-1992. The tests were sponsored by Promat Fyreguard Pty Ltd and were conducted by Warrington Fire Research (Aust) Pty Ltd and CSIRO respectively.

The assessment also references to test reports FSRG A-07-487, FSRG A-08-526, FSRG A-11-734, FSRG A-08-531, FSRG A-13-852a, FSRG A-08-527, FSRG A-10-672a.1, FSRG A-08-528, FSP 1464A, FSRG A-08-532, EWFA 2373900, FSRG A-13-853a, and BWA 2227801, being tests on pipe penetrations in wall systems tested in accordance with AS1530.4-2005 and AS4072.1-2005. The tests were sponsored by Promat Australia Pty Ltd and were conducted by Fire Science Research Group, Bodycote Warringtonfire (Aus) Pty Ltd, Exova Warringtonfire Aus Pty Ltd and CSIRO respectively.

This assessment is based on reference test reports EWFA 2517300.2, FSRG A-08-532, FSRG A-08-528, FSP 0643, FSP 1464, WFRA F91783A and FSP 1471, being tests on penetrations in various framed and panel walls, and WFRA 41088AS.1 and FR 4115 being tests on PROMATECT® boards.

Permission has been granted by Lend Lease Project Management and Construction (Australia) Pty Ltd and Speedpanel (VIC) Pty Ltd for the reference reports FSP 1464, FSP 1471 and EWFA 2517300.2 to be used by the sponsor of the assessment report.

Supplementary reference is made to test report 7745 being a test of fire resistance performance of pipe penetrations through a horizontal floor plate. The test was performed by Exova Warringtonfire Ghent and sponsored by N.V. Promat.

Refer to Appendix A for a full summary of the test data.

3 VARIATION TO TESTED PROTOTYPES

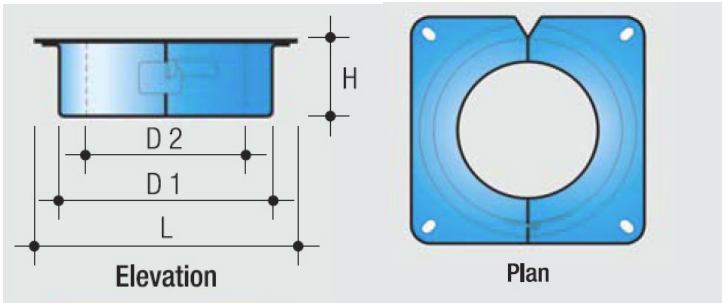
The proposed construction shall be uPVC, HDPE and Coestilen® HDPE pipes penetrating through walls and floors and protected with the PROMASEAL® FCS collars and PROMASEAL® FC collars.

The floor slabs shall be incorporated with or without LYSAGHT BONDEK® steel deck.

Pipe may be located as close as 40mm collar-to-collar.

The proposed construction is summarised in Table 1 and figures 1 to 15.

Table 1 – Schedule of Components

<table>
<tr><th>ID</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">1</td><td>Name</td><td>uPVC Pipe</td></tr>
<tr><td>Size</td><td>
<table>
<tr><th>Pipe Material</th><th>Nominal Outside Diameter OD (mm)</th><th>Pipe Wall Thickness (mm)</th></tr>
<tr><td rowspan="10">uPVC</td><td>43</td><td>2.2-2.6</td></tr>
<tr><td>55</td><td>2.2-3.0</td></tr>
<tr><td>69</td><td>2.8-3.2</td></tr>
<tr><td>83</td><td>3.0-3.4</td></tr>
<tr><td>110</td><td>3.4-4.3</td></tr>
<tr><td>161</td><td>4.5-6.5</td></tr>
<tr><td>225</td><td>6.5</td></tr>
<tr><td>251</td><td>6-6.5</td></tr>
<tr><td>315</td><td>8.2-10</td></tr>
</table>
</td></tr>
<tr><td></td><td>Installation</td><td>Pipes to be supported at 500mm and 1500mm from the support element.</td></tr>
<tr><td rowspan="3">2</td><td>Name</td><td>HDPE Pipes</td></tr>
<tr><td>Diameter</td><td>
<table>
<tr><th>Pipe Material</th><th>Nominal Outside Diameter OD (mm)</th><th>Pipe Wall Thickness (mm)</th></tr>
<tr><td rowspan="10">HDPE</td><td>40.9</td><td>3.15</td></tr>
<tr><td>50</td><td>3</td></tr>
<tr><td>56</td><td>3-3.4</td></tr>
<tr><td>63.5</td><td>3.3</td></tr>
<tr><td>75</td><td>3-4.0</td></tr>
<tr><td>110</td><td>4.3-5.0</td></tr>
<tr><td>125</td><td>3.9-6.0</td></tr>
<tr><td>150</td><td>4.9</td></tr>
<tr><td>254</td><td>8.0-10</td></tr>
<tr><td>317</td><td>13.5</td></tr>
</table>
</td></tr>
<tr><td>Installation</td><td>Pipes to be supported at 500mm and 1500mm from the support element.</td></tr>
<tr><td rowspan="2">3</td><td>Name</td><td>PROMASEAL® FC Fire Collar</td></tr>
<tr><td>Configuration</td><td> 
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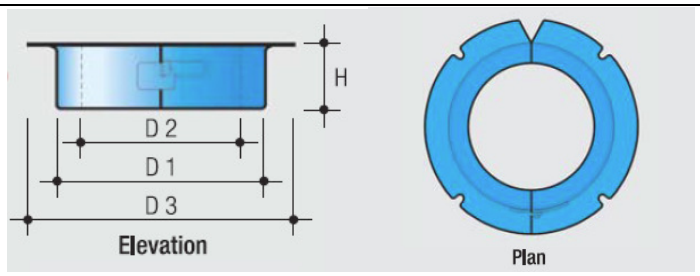
<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td></td><td>Size</td><td>
<table>
<tr><th rowspan="2">Code No.</th><th rowspan="2">Pipe Nom. Size (mm)</th><th colspan="3">Body (mm)</th><th>Flange (mm)</th></tr>
<tr><th>H</th><th>D1</th><th>D2</th><th>L</th></tr>
<tr><td>FC 40</td><td>40</td><td>43</td><td>77</td><td>45</td><td>112</td></tr>
<tr><td>FC 50</td><td>50</td><td>43</td><td>90</td><td>58</td><td>125</td></tr>
<tr><td>FC 65</td><td>65</td><td>43</td><td>103</td><td>71</td><td>138</td></tr>
<tr><td>FC 80</td><td>80</td><td>43</td><td>123</td><td>85</td><td>158</td></tr>
<tr><td>FC 100</td><td>100</td><td>53</td><td>150</td><td>112</td><td>185</td></tr>
<tr><td>FC 125</td><td>125</td><td>63</td><td>165</td><td>127</td><td>197</td></tr>
<tr><td>FC 150</td><td>150</td><td>73</td><td>200</td><td>162</td><td>235</td></tr>
<tr><td>FC 225*</td><td>225</td><td>100</td><td>290</td><td>228</td><td>364Ø</td></tr>
<tr><td>FC 250*</td><td>250</td><td>120</td><td>316</td><td>254</td><td>380Ø</td></tr>
<tr><td>FC 300*</td><td>300</td><td>160</td><td>402</td><td>318</td><td>466Ø</td></tr>
</table>
*FC200 to FC300 have circular bases
</td></tr>
<tr><td></td><td>Installation</td><td>Fixings are listed in item 8.</td></tr>
<tr><td rowspan="4">4</td><td>Name</td><td>PROMASEAL® FCS Fire Collar</td></tr>
<tr><td>Configuration</td><td> 
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<tr><td>Size</td><td>
<table>
<tr><th rowspan="2">Code No.</th><th rowspan="2">uPVC Pipe Nom. (mm)</th><th rowspan="2">HDPE Pipe Nom. (mm)</th><th colspan="3">Body (mm)</th><th>Flange (mm)</th></tr>
<tr><th>H</th><th>D1</th><th>D2</th><th>D3</th></tr>
<tr><td>FCS40</td><td>40</td><td>50</td><td>43</td><td>84</td><td>56</td><td>131</td></tr>
<tr><td>FCS50</td><td>50</td><td>56</td><td>43</td><td>98</td><td>70</td><td>145</td></tr>
<tr><td>FCS65</td><td>65</td><td>75</td><td>43</td><td>113</td><td>84</td><td>161</td></tr>
<tr><td>FCS80</td><td>80</td><td>90</td><td>43</td><td>138</td><td>98</td><td>186</td></tr>
<tr><td>FCS100</td><td>100</td><td>100</td><td>53</td><td>167</td><td>127</td><td>214</td></tr>
<tr><td>FCS225</td><td>225</td><td>225</td><td>100</td><td>290</td><td>228</td><td>364</td></tr>
<tr><td>FCS300</td><td>300</td><td>300</td><td>160</td><td>400</td><td>318</td><td>466</td></tr>
</table>
</td></tr>
<tr><td>Installation</td><td>Fixings are listed in item 8.</td></tr>
</table>

<table>
<tr><th>ID</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">5</td><td>Name</td><td>Sealant</td></tr>
<tr><td>Product</td><td>PROMASEAL® AN Acrylic sealant or PROMASEAL® Supa Mastic</td></tr>
<tr><td>Installation</td><td>Applied at the 2mm-5mm annular gaps between supporting walls or floors and pipes.
Gap between edge of pipe and inner surface of collar sealed with a fillet of sealant.
The voids in the BONDEK® steel deck that the collars go over when fixed are filled to the edge of the collar with PROMASEAL® AN Acrylic sealant.</td></tr>
<tr><td rowspan="2">6</td><td>Name</td><td>Supporting Plasterboard lined wall</td></tr>
<tr><td>Specification</td><td>Framed wall comprising min. 64mm steel studs clad with two layers of 16mm thick fire grade plasterboard each side.</td></tr>
<tr><td rowspan="2">7</td><td>Name</td><td>Supporting floor slab</td></tr>
<tr><td>Specification</td><td>Minimum 120mm thick reinforced concrete slab with or without LYSAGHT BONDEK® steel deck.</td></tr>
<tr><td rowspan="2">8</td><td>Name</td><td>Collar Fixing</td></tr>
<tr><td>Specification</td><td>
<table>
<tr><th>Collar Code</th><th>Floor</th><th>Plasterboard lined Wall</th><th>Speedpanel Wall</th></tr>
<tr><td>FC/FCS 40, 50, 65, 80, 100</td><td rowspan="3">fixed to underside with 4-off 6g × 40mm coarse thread bugle head screws</td><td rowspan="3">Fixed to both sides with 4-off 6g × 40mm coarse thread bugle head screws</td><td rowspan="3">Where collar fixed through one layer of 25mm PROMATECT® board, fixed with four 10g × 40mm coarse thread bugle head screws.

For multiple pipe penetrations, adjacent collar flanges must not overlap. In cases where collar flanges of adjacent pipes may overlap, the flange shall be cut in a single straight line in a manner to avoid overlap as shown in figure 16.</td></tr>
<tr><td>FC 125</td></tr>
<tr><td>FC/FCS 150</td></tr>
<tr><td>FC/FCS 225</td><td>Fixed to underside with 4-off 6g × 38mm masonry anchors</td><td>-</td></tr>
<tr><td>FC 250</td><td>Fixed to underside with 4-off 6.5mm × 35mm dynabolt fasteners</td><td>Fixed to each other through the wall using 8-off 6g × 150mm long galvanise hex bolts with stainless steel nuts</td></tr>
<tr><td>FC/FCS 300</td><td>Fixed to underside using 8-off 6.5mm × 50mm long masonry anchors.</td><td>Fixed to each other (through the wall) with 8-off 8mm × 150mm long nut bolt with a washer at each end</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>ID</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">9</td><td>Name</td><td colspan="2">Coestilen® HDPE</td></tr>
<tr><td>Size</td><td colspan="2">
<table>
<tr><th>Pipe Material</th><th>Outside Diameter (mm)</th><th>Pipe Wall Thickness (mm)</th></tr>
<tr><td rowspan="8">Coestilen® HDPE</td><td>56</td><td>3.0 (nom.)</td></tr>
<tr><td>75</td><td>4.0 (nom.)</td></tr>
<tr><td>110</td><td>5.0 (nom.)</td></tr>
<tr><td>125</td><td>6.0 (nom.)</td></tr>
<tr><td>160</td><td>7.5 (nom.)</td></tr>
<tr><td>200</td><td>7.0 (nom.)</td></tr>
<tr><td>250</td><td>8.0 (nom.)</td></tr>
</table>
</td></tr>
<tr><td rowspan="3">10</td><td>Name</td><td colspan="2">PROMATECT® 50 or PROMATECT® 100</td></tr>
<tr><td>Thickness</td><td colspan="2">One layer of 25mm thick each side of Speedpanel Panels.</td></tr>
<tr><td>Installation</td><td colspan="2">Board may be installed in one or more pieces. If board installed in multiple pieces, joins in board to be sealed with sealant (item 5). Installed such that aperture in board is the same as the aperture in the Speedpanel wall.
For 1 × 25mm thick systems, fixed to Speedpanel panels with 10g × 40mm coarse thread bugle head screws at 100mm maximum centres.
Daub of sealant (item 5) located at edge of plasterboard, between board and wall.
Gap between board and Speedpanel produced by Speedpanel profile to be filled with sealant (item 5). Fillet of sealant (item 5) applied from top edge of board to Speedpanel.
Annular gap around pipe filled to depth of board with sealant (item 5).</td></tr>
<tr><td rowspan="3">11</td><td>Name</td><td colspan="2">Speedpanel Wall</td></tr>
<tr><td>Thickness</td><td colspan="2">77mm</td></tr>
<tr><td>Pipe Aperture</td><td colspan="2">Aperture in wall for pipe services to be as tested in EWFA 2517300.2 or maximum 5mm greater than pipe diameter.</td></tr>
<tr><td rowspan="3">12</td><td>Specification</td><td colspan="2">Speedpanel wall shall be as tested in EWFA 2517300.2.</td></tr>
<tr><td>Name</td><td colspan="2">Speedpanel Channel</td></tr>
<tr><td>Material</td><td colspan="2">Galvanised mild steel</td></tr>
<tr><td>Size</td><td colspan="2">83mm wide × 58mm high × 1.2mm thick</td></tr>
<tr><td>Sealant</td><td colspan="2">Gap between channel and Speedpanel produced by Speedpanel profile to be filled with sealant (item 5).</td></tr>
</table>

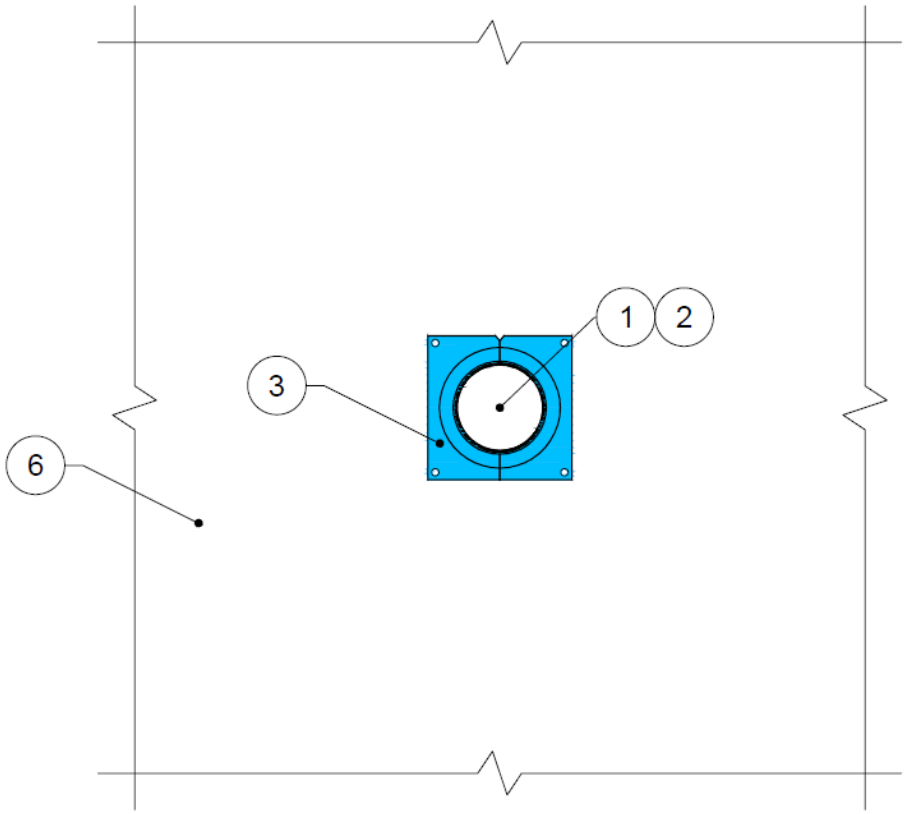

Figure 1 – Plastic Pipe with PROMASEAL® FC 40 – 150 Collars (Wall Elevation)

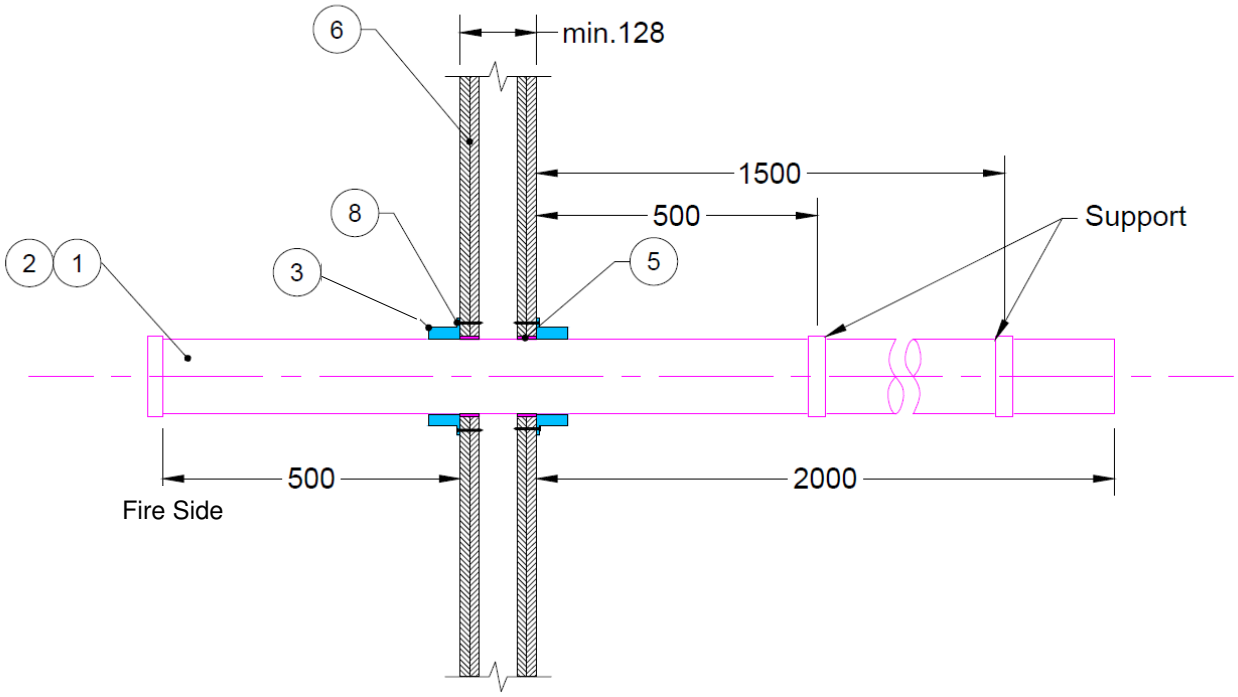

Figure 2 – Plastic Pipes with PROMASEAL® FC 40-150 Collars (Wall Side View)

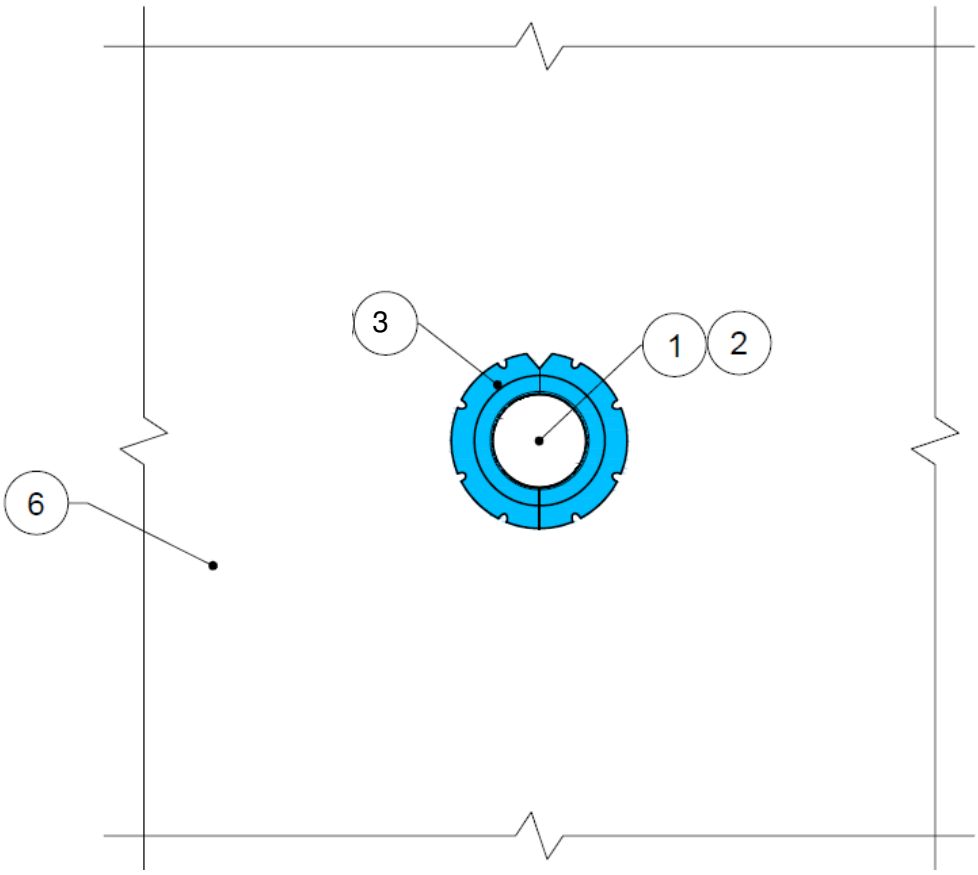

Figure 3 – Plastic Pipe with PROMASEAL® FC 200-300 Collars (Wall Elevation)

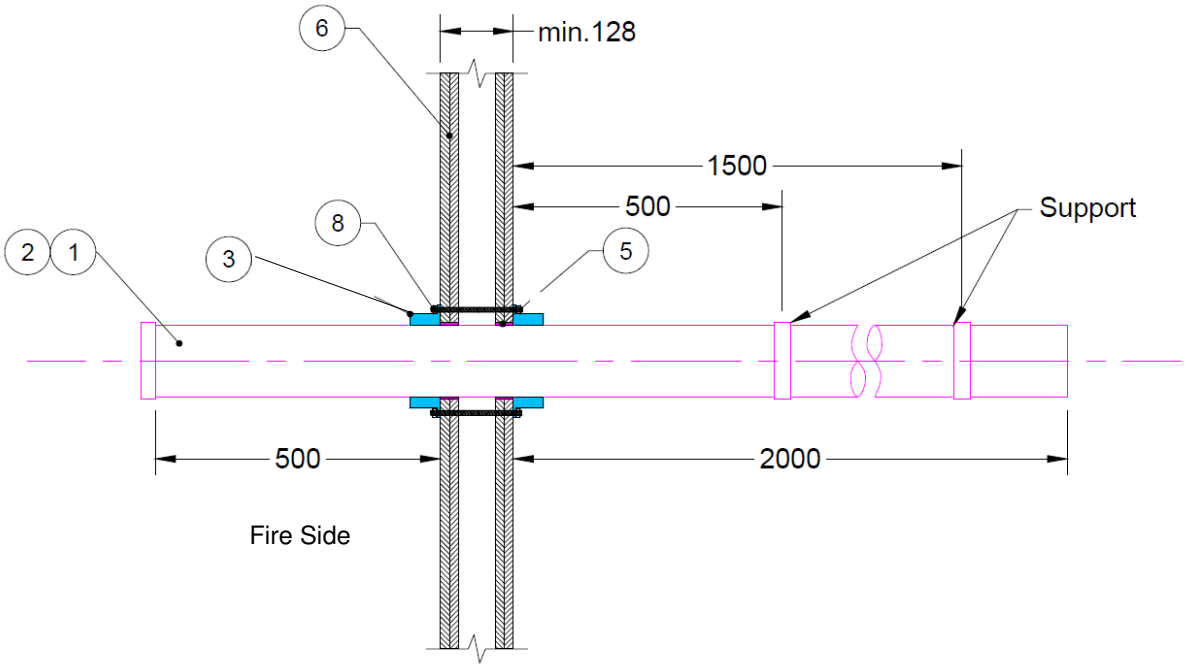

Figure 4 – Plastic Pipes with PROMASEAL® FC 200-300 Collars (Wall Side View)

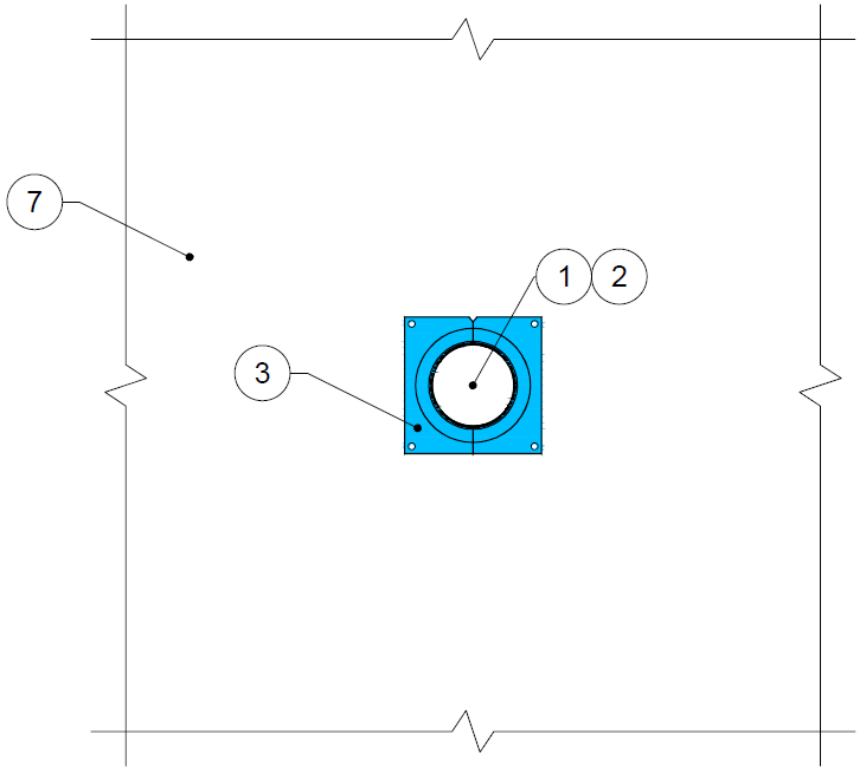

Figure 5 – Plastic Pipe with PROMASEAL® FC 40 – 150 Collars (Floor Underside Plan View)

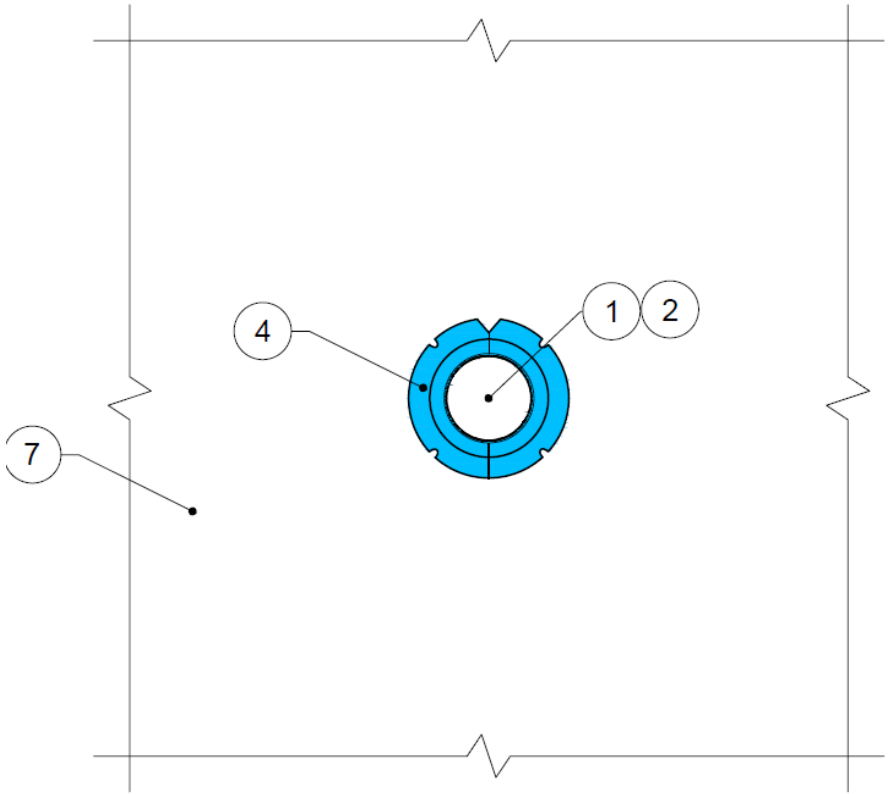

Figure 6 – Plastic Pipe with PROMASEAL® FCS 40 – 150 Collars (Floor Underside Plan View)

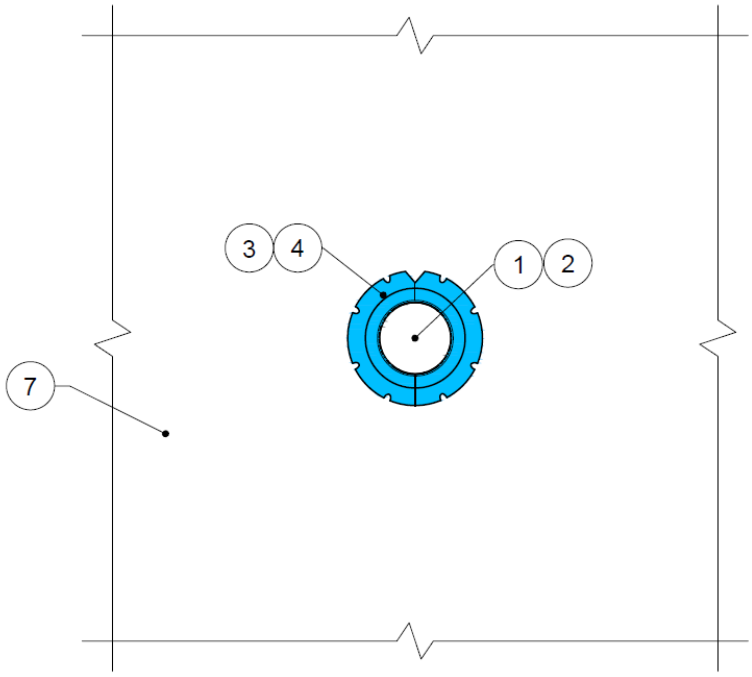

Figure 7 – Plastic Pipe with PROMASEAL® FC/FCS 200-300 Collars (Floor Underside Plan View)

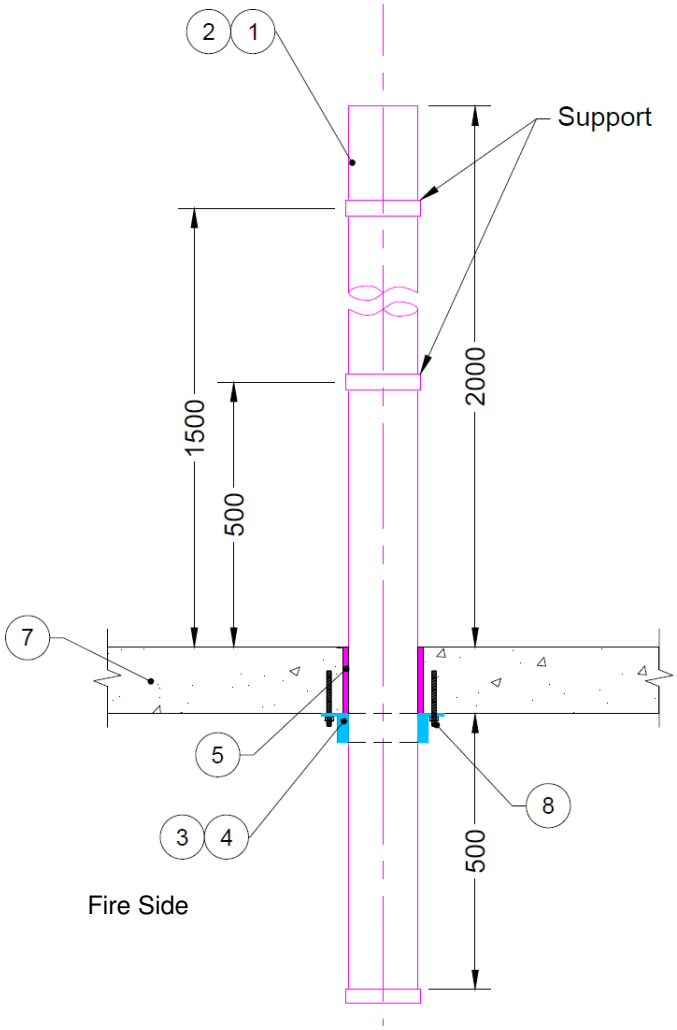

Figure 8 – Plastic Pipes with PROMASEAL® FC Collars (Floor Side View)

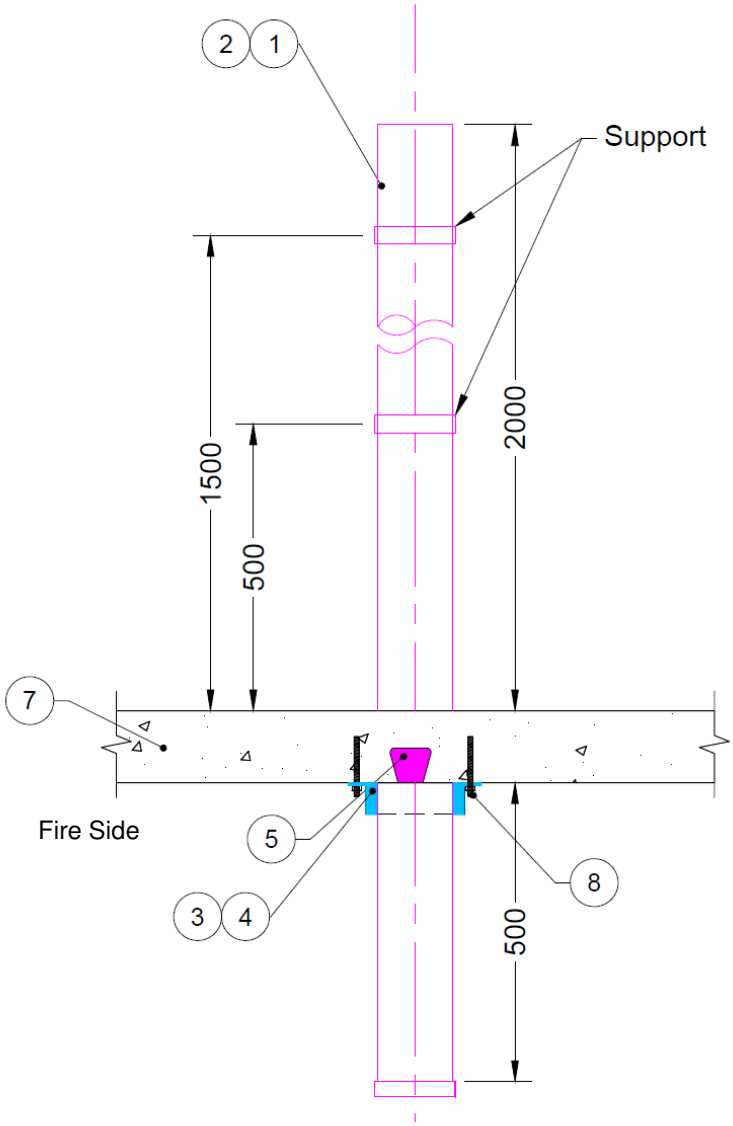

Figure 9 – Plastic Pipes with PROMASEAL® FC Collars in Floors with Bondek® Steel Deck

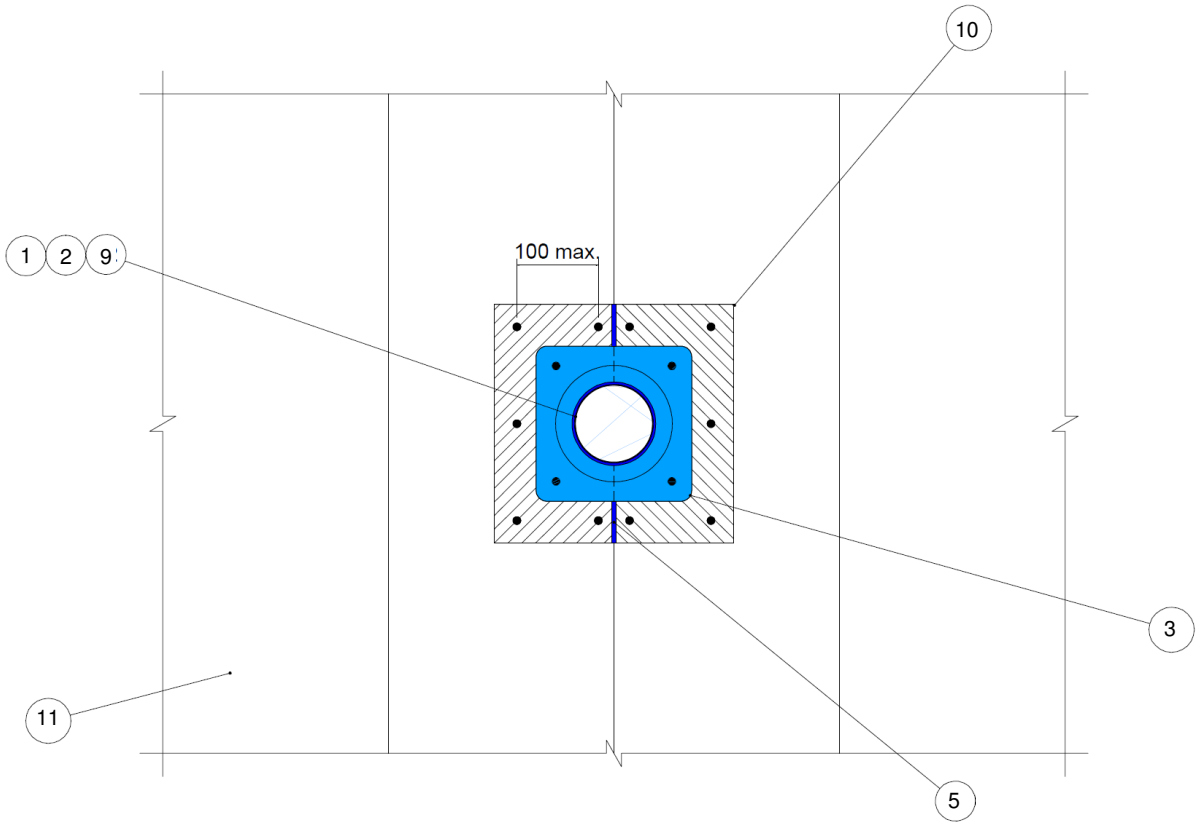

Figure 10 – Plastic Pipes up to Ø110mm (Elevation)

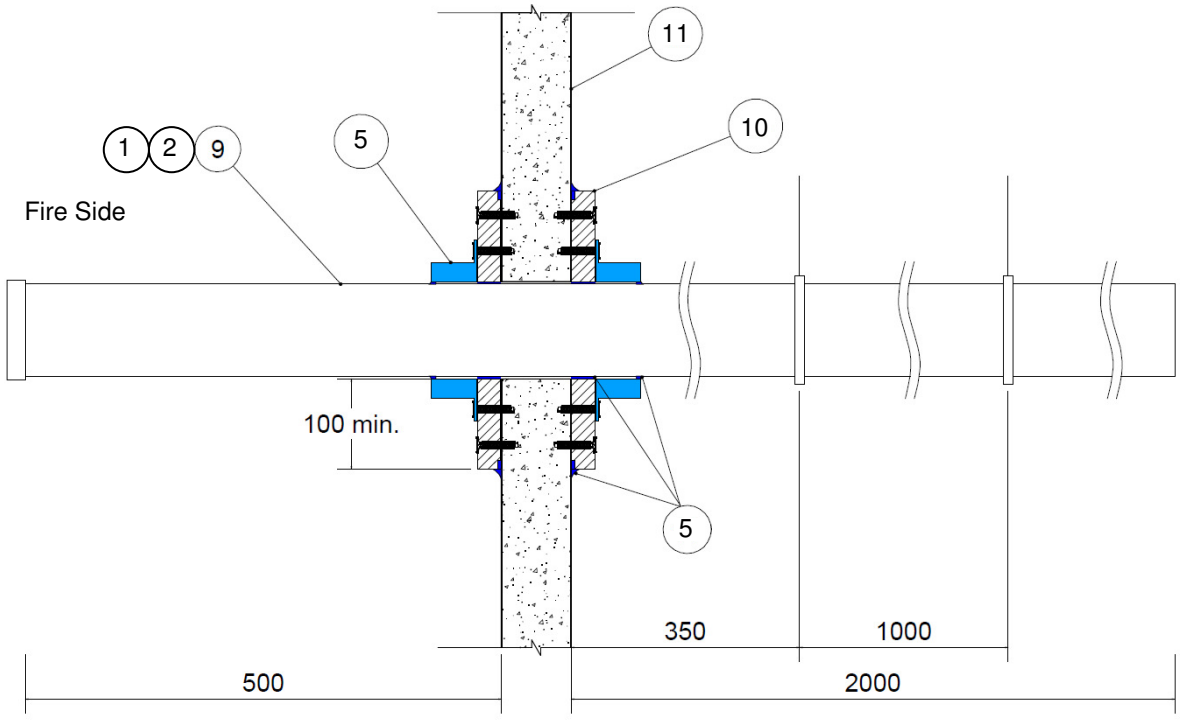

Figure 11 – Plastic Pipes up to Ø110mm (Side View)

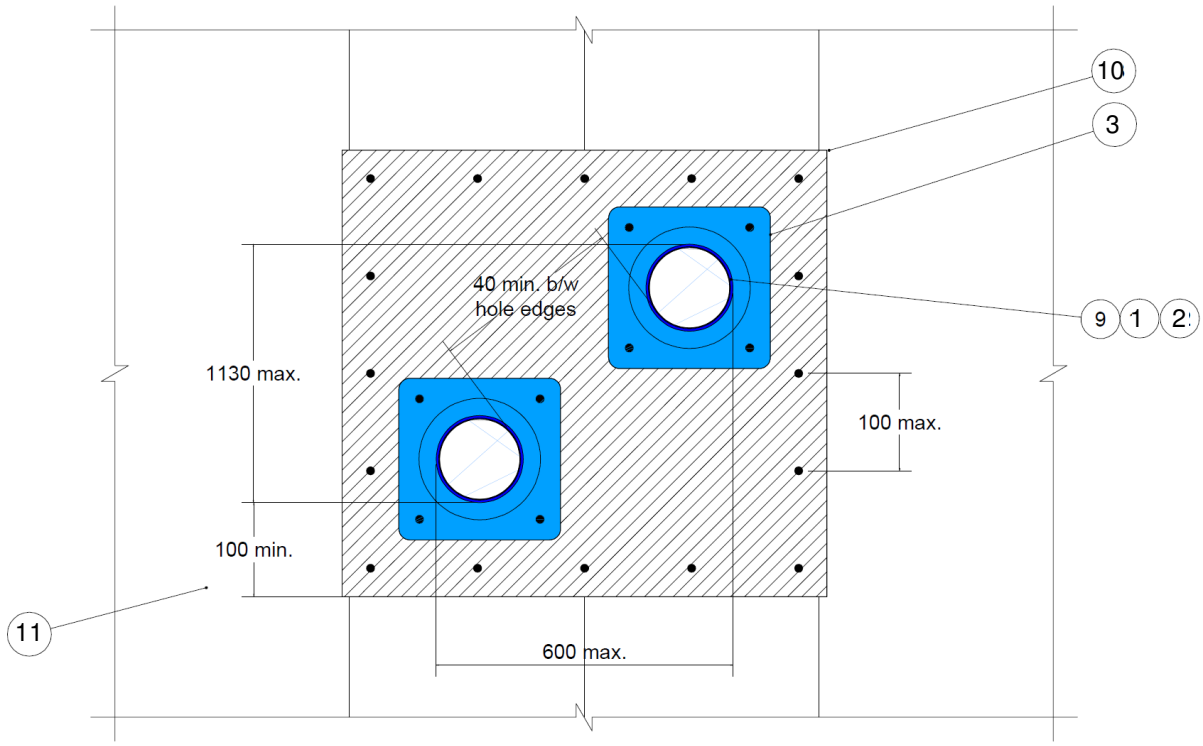

Figure 12 – Apertures in Speedpanel with Multiple Plastic Pipes up to Ø110mm

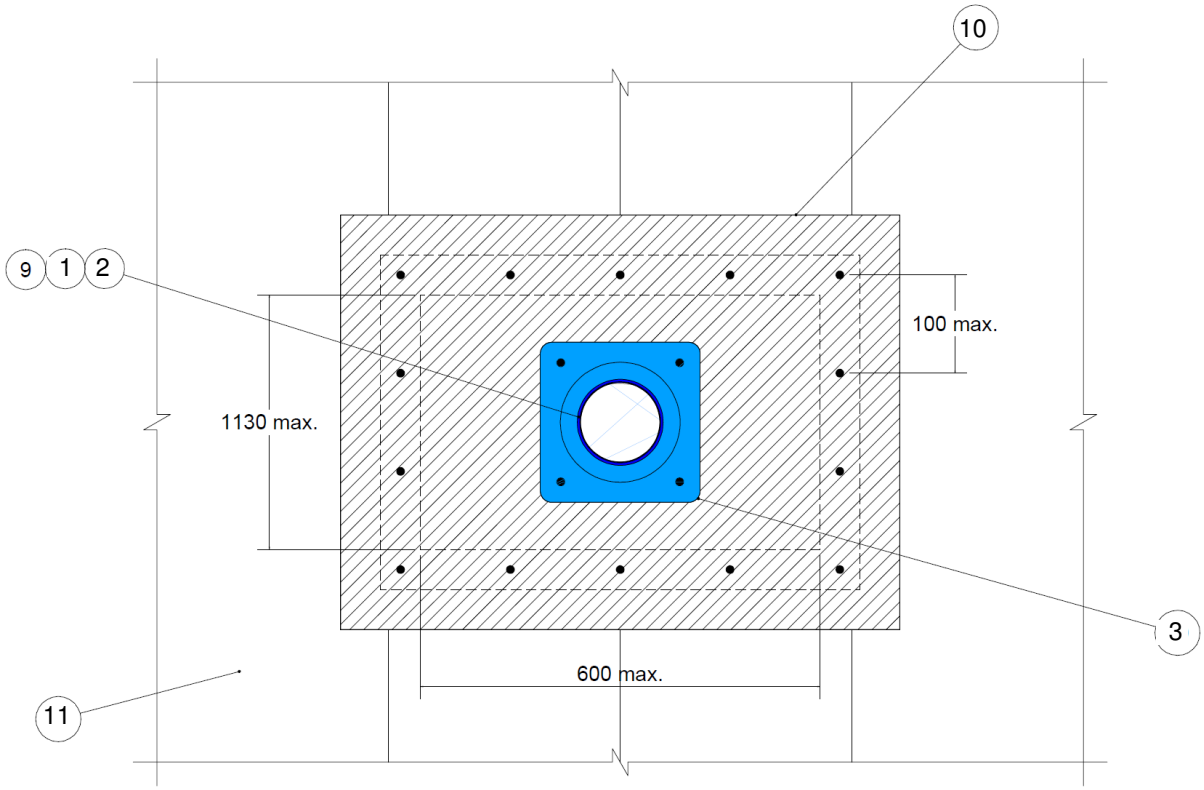

Figure 13 – Apertures in Speedpanel with Plastic Pipes up to Ø250mm (Elevation)

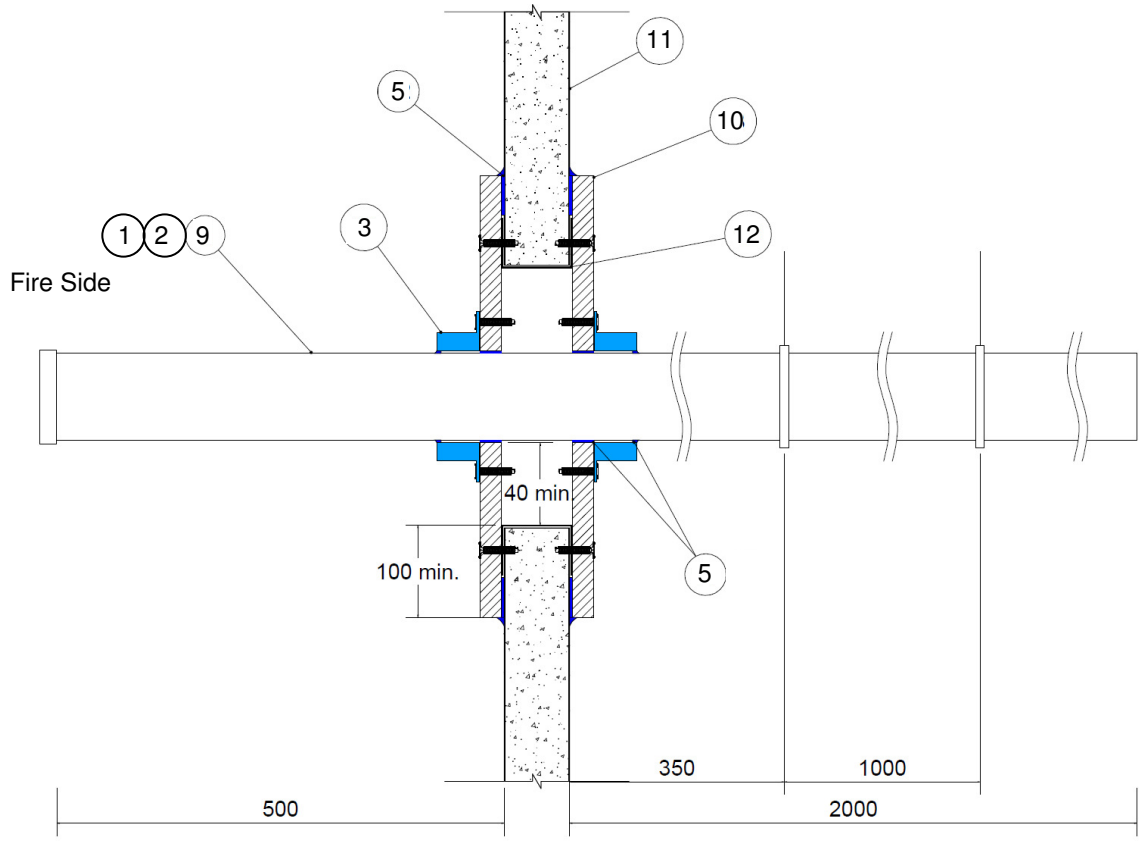

Figure 14 – Apertures in Speedpanel with Plastic Pipes up to Ø250mm (Side View)

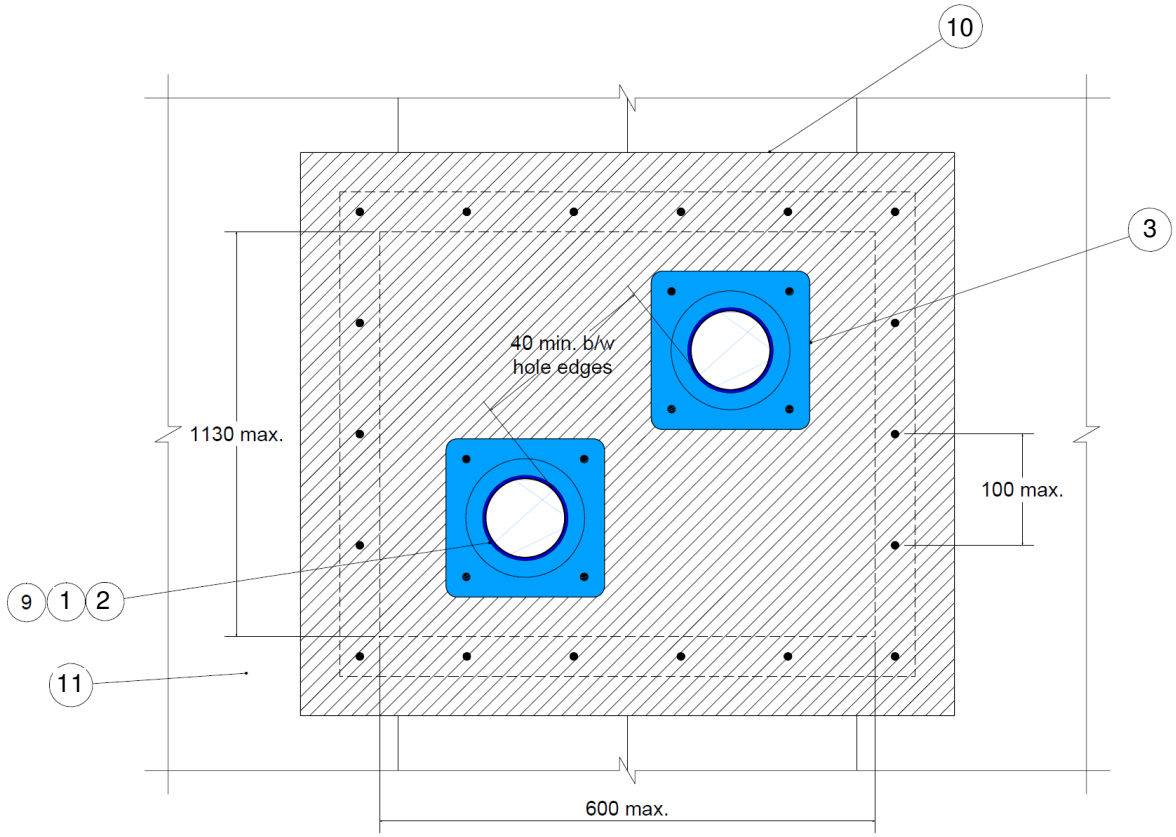

Figure 15 – Apertures in Speedpanel with Plastic Pipes up to Ø250mm (Side View)

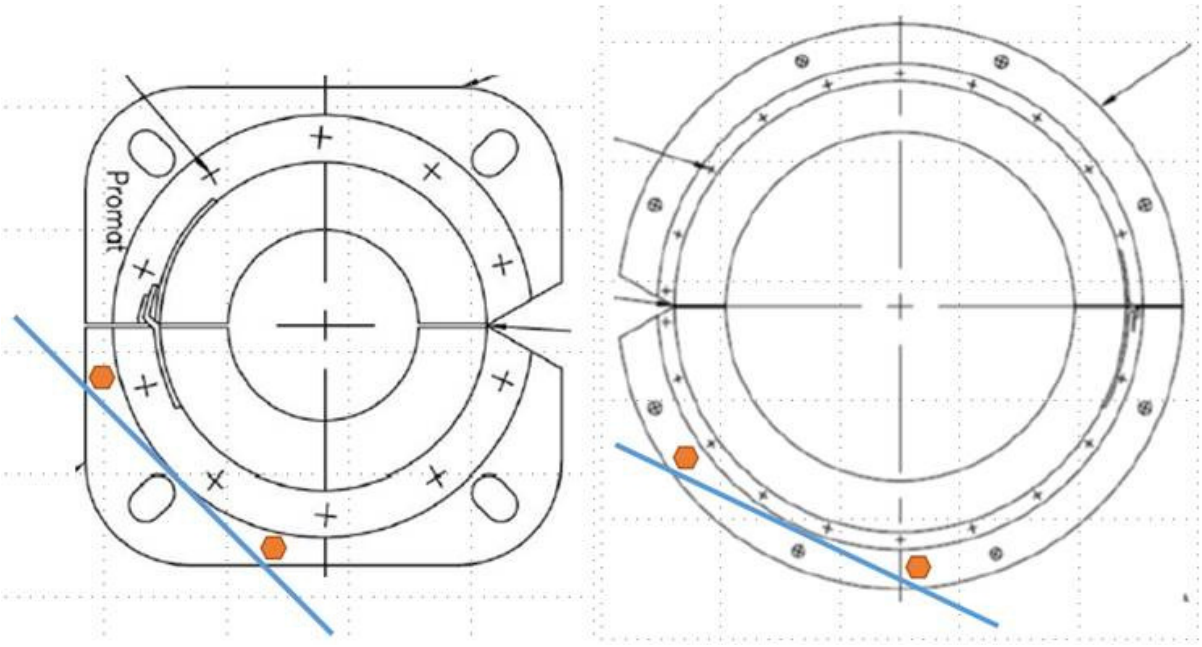

Figure 16 – Altered collar flange of FC Collars. Straight line cut shown in blue and additional 2 fixings shown in orange. For applications up to -/120/120.

4 REFERENCED TEST PROCEDURES

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

5 FORMAL ASSESSMENT SUMMARY

Based on the discussion presented in this 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 in if tested in accordance with the test method referenced in Section 4 and subject to the requirements of Section 7:

Table 2- uPVC Pipes Protected with PROMASEAL® FCS collars in Floors – fitting in collar body

Pipe Material	Outside Diameter (OD) (mm)	Pipe Wall Thickness (mm)	FC Collar Code	Refer Figure	FRL		
					120mm slab	150mm slab	170mm slab
uPVC	43	2.6	FCS40	6, 8 & 9	-/240/120	-/240/180	-/240/240
	56	2.2-3.0	FCS50		-/240/120	-/240/180	-/240/240
	69	2.8	FCS65		-/240/120	-/240/180	-/240/240
	83	3.4	FCS80		-/240/120	-/240/180	-/240/240
	110	3.4	FCS100		-/240/120	-/240/180	-/240/240
	225	6.6	FCS225	7, 8 & 9	-/240/120	-/240/180	-/240/240

Table 3- HDPE Pipes Protected with PROMASEAL® FCS collars in Floors

Pipe Material	Outside Diameter (OD) (mm)	Pipe Wall Thickness (mm)	FC Collar Code	Refer Figure	FRL		
					120mm slab	150mm slab	170mm slab
HDPE	50	3	FCS40	6, 8 & 9	-/180/120	-/180/180	-/180/180
	56	3	FCS50		-/180/120	-/180/180	-/180/180
	75	3	FCS65		-/180/120	-/180/180	-/180/180
	110	4.3	FCS100		-/240/120	-/240/180	-/240/240
	300	10	FCS300	7, 8 & 9	-/120/120	-/120/120	-/120/120

Table 4- uPVC Pipes Protected with PROMASEAL® FC collars in Floors

Pipe Material	Outside Diameter (OD) (mm)	Pipe Wall Thickness (mm)	FC Collar Code	Refer Figure	FRL		
					120mm slab	150mm slab	170mm slab
uPVC	43	2.6	FC40	5, 8, 9 & 16*	-/240/120	-/240/180	-/240/240
	56	2.2-3.0	FC50		-/240/120	-/240/180	-/240/240
	69	2.8	FC65		-/240/120	-/240/180	-/240/240
	83	3.4	FC80		-/240/120	-/240/180	-/240/240
	110	3.4	FC100		-/240/120	-/240/180	-/240/240
	161	5	FC150		-/240/120	-/240/120	-/240/120
	225	6.6	FC225	7, 8, 9 & 16*	-/240/120	-/240/180	-/240/240
	251	6	FC250		-/240/120	-/240/240	-/240/240
	315	10	FC300		-/240/120	-/240/180	-/240/240

*** Figure 16 for applications up to -/120/120**

Table 5- HDPE Pipes Protected with PROMASEAL® FC collars in Floors

Pipe Material	Outside Diameter (OD) (mm)	Pipe Wall Thickness (mm)	FC Collar Code	Refer Figure	FRL		
					120mm slab	150mm slab	170mm slab
HDPE	40.6	2.6	FC40	5, 8, 9 & 16*	-/240/120	-/240/180	-/240/240
	56	2.2-3.0	FC50		-/180/120	-/180/180	-/180/180
	63.5	3.3	FC65		-/240/120	-/240/180	-/240/240
	75	3	FC80		-/240/120	-/240/180	-/240/240
	110	3.4	FC100		-/240/120	-/240/180	-/240/240
	125	3.4	FC125		-/240/120	-/240/180	-/240/240
	150	5	FC150		-/180/120	-/180/180	-/180/180
	254	10	FC250	7, 8, 9 & 16*	-/240/120	-/240/180	-/240/240
	320	10	FC300		-	-	-/120/120

*** Figure 16 for applications up to -/120/120**

Table 6- uPVC Pipes Protected with PROMASEAL® FC collars in Walls

Pipe Material	Outside Diameter (OD) (mm)	Pipe Wall Thickness (mm)	FC Collar Code	Min. Wall Depth (mm)	Refer Figure	FRL
uPVC	43.6	2.4	FC40	128mm	1, 2 & 16*	-/240/180
	55.7	2.2	FC50			-/120/120
	69.4	3.2	FC65			-/180/180
	82.5	3.0	FC80			-/120/120
	110	4.3	FC100			-/120/120
	161	4.56	FC150			-/180/120
	250.1	6.56	FC250		3, 4 & 16*	-/180/180
	315	8.2	FC300			-/180/180

*** Figure 16 for applications up to -/120/120**

Table 7- HDPE Pipes Protected with PROMASEAL® FC collars in Walls

Pipe Material	Outside Diameter (OD) (mm)	Pipe Wall Thickness (mm)	FC Collar Code	Min. Wall Depth (mm)	Refer Figure	FRL
HDPE	40.9	3.15	FC40	128mm	1, 2 & 16*	-/180/180
	63.5	3.3	FC65			-/120/120
	75	4.0	FC80			-/120/120
	110.4	5.0	FC100			-/180/120
	125	6.0	FC150			-/120/120
	252	8.0	FC250		3, 4 & 16*	-/120/120
	317	13.5	FC300			-/180/180

***Figure 16 for applications up to -/120/120**

Table 8- uPVC Pipes protected with PROMASEAL® FC fire collars in Speedpanel Wall

Pipe Material	Pipe Diameter (OD mm)	Pipe Wall Thickness (mm)	FC Collar Code	Min. Wall Depth (mm)	Refer Figure	FRL
uPVC	42.8	2.2	FC40	78mm	10, 11, 12, 13, 14, 15 & 16*	-/120/120
	55.7	2.2	FC50			
	68.9	2.8	FC65			
	82.5	3.0	FC80			
	110.0	4.3	FC100			
	158.0	4.3	FC150		13, 14, 15 & 16*	

***Figure 16 for applications up to -/120/120**

Table 9- HDPE Pipes protected with PROMASEAL® FC fire collars in Speedpanel Wall

Pipe Material	Pipe Diameter (OD mm)	Pipe Wall Thickness (mm)	FC Collar Code	Min. Wall Depth (mm)	Refer Figure	FRL
HDPE	40.9	3.15	FC40	78mm	10, 11, 12, 13, 14, 15 & 16*	-/120/120
	55.7	3.4	FC50			
	63.5	3.3	FC65			
	110.4	5.0	FC100			

***Figure 16 for applications up to -/120/120**

Table 10- Coestilen® HDPE Pipes protected with PROMASEAL® FC fire collars in Speedpanel Wall

Pipe Material	Nominal Pipe Diameter (OD mm)	Nominal Pipe Wall Thickness (mm)	Fire Collar	Min. Wall Depth (mm)	Refer Figure	FRL
Coestilen® HDPE	56	3.0	FC65	78mm	10, 11, 12, 13, 14, 15 & 16*	-/120/120
	75	4.0	FC80			
	110	5.0	FC100			
	125	6.0	FC150		13, 14, 15 & 16*	
	160	7.5	FC150			
	200	7.0	FC250			
	250	8.0	FC250			

***Figure 16 for applications up to -/120/120**

6 DIRECT FIELD OF APPLICATION

This assessment applies to penetrations in walls exposed to fire from either side or floors exposed to fire from underside 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 AS1530.4.

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 up to -/120/120 in accordance with AS1530.4-2005.

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

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 Exova Warringtonfire Aus Pty Ltd.

9.3 AUTHORISATION ON BEHALF OF EXOVA WARRINGTONFIRE AUS PTY LTD

Prepared by:	Reviewed by:
	
S. Hu	K. Nicholls

9.4 DATE OF ISSUE

17/02/2015

9.5 EXPIRY DATE

31/05/2019

APPENDIX A - SUMMARY OF SUPPORTING DATA

A.1 TEST REPORT – F91604

A.1.1 Report Sponsor

A.1.1.1 Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.1.2 Test Laboratory

A.1.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 867, Mulgrave, Victoria 3170.

A.1.3 Test Date

A.1.3.1 The fire resistance test was conducted on 6th July 1994.

A.1.4 Test Standard

A.1.4.1 The test was performed in accordance with AS1530.4-1990 section, 2, 4 and 10 as appropriate.

A.1.5 General Description of Tested Specimen

A.1.5.1 The test assembly comprised various services penetrating a nominally 120mm thick concrete floor slab. The services were protected by Grafitex intumescent collar systems, since referred to as type FC retrofit collars.

A.1.5.2 The collars were fitted around the pipes into oversize holes and retained in position by bolting the steel flanges of the canisters to the soffit of the slab with four 6mm x 38mm dynabolts, with a water/smoke seal applied on the unexposed face of the slab in the form of an approximately 10mm x 10mm perimeter fillet of Fyreseal mastic. The oversize holes for services A and B were in filled from above the slab with a sand/cement grout before applying the water/smoke seal.

A.1.5.3 The pipe ends on the fire exposed side were each sealed and the ends on the non-fire exposed side were vented.

A.1.5.4 The specimen was subjected to the furnace heating conditions from the underside only. The pressure at the soffit of the concrete slab was 18-20 Pa during the test.

A.1.6 Instrumentation

A.1.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1990.

A.1.6.2 Additional instrumentation, in accordance with BS476: Part 20: 1987: Section 10 for cotton pad and gap gauge applications.

A.1.7 Test Results

A.1.7.1 The test was terminated after a period of 123 minutes at the request of the test sponsor.

A.1.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1990 for the following periods

Serv Ref	Service Description	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	150mm O.D. uPVC pipe protected with a retrofit Fyreguard FC150 collar	Not Applicable	123*	123*
B	100mm O.D. uPVC pipe protected with a retrofit Fyreguard FC100 collar	Not Applicable	123*	123*
C	80mm O.D. uPVC pipe protected with a retrofit Fyreguard FC80 collar	Not Applicable	123*	123*
D	65mm O.D. uPVC pipe protected with a retrofit Fyreguard FC65 collar	Not Applicable	123*	123*
E	50mm O.D. uPVC pipe protected with a retrofit Fyreguard FC50 collar	Not Applicable	123*	123*

*No failure at the conclusion of the test

A.2 TEST REPORT – F91611

A.2.1 Report Sponsor

A.2.1.1 Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.2.2 Test Laboratory

A.2.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 867, Mulgrave, Victoria 3170.

A.2.3 Test Date

A.2.3.1 The fire resistance test was conducted on14th March 1995.

A.2.4 Test Standard

A.2.4.1 The test was performed in accordance with AS1530.4-1990 section, 2, 4 and 10 as appropriate.

A.2.5 General Description of Tested Specimen

A.2.5.1 The test assembly comprised various services penetrating a nominally 120mm thick concrete floor slab. Service 3 comprised a nominal 80mm diameter “Python” brand Postmix beverage line penetrating a nominally 170mm thick reinforced concrete floor slab. The Postmix beverage line comprised 12 approximately 12mm diameter LDPE core bundle tubes which were stated to be encased within a PET/LDPE film sheath which in turn was enclosed within a PVC/Nitrile rubber foam, and penetrated a nominally 90mm diameter hole in the floor slab. The penetration was protected with a PROMASEAL FC80 collar retrofitted around the service and bolted to the soffit of the floor slab with four 6mm x 50mm dynabolts.

A.2.5.2 The specimen was subjected to the furnace heating conditions from the underside only.

A.2.6 Instrumentation

A.2.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1990.

A.2.7 Test Results

A.2.7.1 The specimen satisfied the performance requirements specified in AS1530.4-1990 for the following periods:

A.2.7.2 No failures under the criteria of integrity or insulation were recorded during the full 122 minute duration of the test.

A.2.7.3 The test was terminated after a period of 122 minutes at the request of the test sponsor.

A.3 TEST REPORT – F91621

A.3.1 Report Sponsor

A.3.1.1 Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.3.2 Test Laboratory

A.3.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 867, Mulgrave, Victoria 3170.

A.3.3 Test Date

A.3.3.1 The fire resistance test was conducted on 3rd October 1995.

A.3.4 Test Standard

A.3.4.1 The test was conducted in accordance with AS1530.4-1990 section, 2, 4 and 10 as appropriate. The procedures of AS4072.1-1992 were followed as appropriate.

A.3.5 General Description of Tested Specimen

A.3.5.1 The test assembly comprised various services penetrating a nominally 160mm thick concrete floor slab. Service A comprised a nominally 225mm uPVC pipe penetrating the slab, which was protected by an FC225 retrofit collar, fixed to the soffit of the concrete slab.

A.3.5.2 The pipe ends on the fire exposed side were each sealed with ceramic fibre and the ends on the non-fire exposed side were vented.

A.3.5.3 The specimen was subjected to the furnace heating conditions from the underside only.

A.3.5.4 The pressure at 100mm below the soffit of the concrete slab was 8Pa after the first 5 minutes.

A.3.6 Instrumentation

A.3.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1990.

A.3.7 Test Results

A.3.7.1 The test was terminated after a period of 241 minutes at the request of the test sponsor.

A.3.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1990 for the following periods.

Serv. Ref.	Service Description	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	225mm O.D. uPVC pipe protected with a retrofit Fyreguard FC225 collar	Not Applicable	241*	241*

*No failure at the conclusion of the test

A.4 TEST REPORT – F91624

A.4.1 Report Sponsor

A.4.1.1 Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.4.2 Test Laboratory

A.4.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 867, Mulgrave, Victoria 3170.

A.4.3 Test Date

A.4.3.1 The fire resistance test was conducted on 25th October 1995.

A.4.4 Test Standard

A.4.4.1 The test was conducted in accordance with AS1530.4-1990 section, 2, 4 and 10 as appropriate. The procedures of AS4072.1-1992 were followed as appropriate.

A.4.5 General Description of Tested Specimen

A.4.5.1 The test assembly comprised various services penetrating a nominally 180mm thick concrete floor slab. Service B comprised a nominally 315mm HDPE pipe penetrating the slab, which was protected by an FC300 retrofit collar, fixed to the soffit of the concrete slab with eight 6mm x 38mm dynabolts. The FC300 collar contained a spring, and the intumescent material contained SuperG.

A.4.5.2 Service C comprised a nominally 125mm HDPE pipe penetrating the slab, which was protected by an FC125 retrofit collar, fixed to the soffit of the concrete slab with four 6mm x 38mm dynabolts.

A.4.5.3 The pipe ends on the fire exposed side were each sealed with ceramic fibre. The ends on the non-fire exposed side were vented at the start of the test. The pipe end of the 315mm pipe was partially capped after approximately 6 minutes test duration.

A.4.5.4 The specimen was subjected to the furnace heating conditions from the underside only.

A.4.5.5 Furnace pressure measured at 100mm below the soffit of concrete slab was 8Pa after the first 5 minutes.

A.4.6 Instrumentation

A.4.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1990.

A.4.6.2 Additional instrumentation, in accordance with BS476: Part 20: 1987: Section 10 for cotton pad and gap gauge applications.

A.4.7 Test Results

A.4.7.1 The test was terminated after a period of 140 minutes at the request of the test sponsor.

A.4.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1990 for the following periods.

Serv. Ref.	Service Description	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
B	315mm O.D. HDPE pipe protected with a retrofit Fyreguard FC300 collar	Not Applicable	140*	140*
C	125mm O.D. HDPE pipe protected with a retrofit Fyreguard FC125 collar	Not Applicable	140*	140*

*No failure at the conclusion of the test

A.5 TEST REPORT – F91730

A.5.1 Report Sponsor

A.5.1.1 Promat Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.5.2 Test Laboratory

A.5.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 4282, Dandenong South, Victoria 3164.

A.5.3 Test Date

A.5.3.1 The fire resistance test was conducted on 18th June 1998.

A.5.4 Test Standard

A.5.4.1 The test was conducted in accordance with AS1530.4-1997 sections 2, 4 and 10 as appropriate as appropriate.

A.5.5 General Description of Tested Specimen

A.5.5.1 The test assembly comprised two uPVC and two HDPE pipes penetrating a nominal 160mm thick concrete slab. The results presented in this report are related to specimens identified as Services A to D. Test results related to an additional specimen identified as Service E are outlined in a separate letter dated 30th July 1998.

A.5.5.2 The PROMASEAL fire collars used in the fire resistance in order to protect the pipe penetrations test were of two types, identified as FCM100 split collar and FCCM100 solid body collar, being retrofit and cast-in respectively. The results in this summary relate to the FCM retrofit collars only.

A.5.5.3 The pipe services tested in this report are described below.

Service Ref.	Pipe nominal diameter (mm)	Pipe Material	Collar Type
B	100	uPVC	FCM100
D	100	HDPE	FCM100

A.5.5.4 The pipe services fitted with PROMASEAL FCM100 collars penetrated oversized holes in the slab. The PROMASEAL retrofit FCM100 collars were fitted around the pipes on the fire exposed side and fixed to the soffit of the slab with four Hilti 40mm long split anchors.

A.5.5.5 The penetrating services were each provided with a ceramic fibre plug on the fire exposed side of the slab and remained open ended on the non-fire side.

A.5.5.6 The specimen was subjected to the furnace heating conditions from the underside only.

A.5.5.7 The furnace pressure was measured at 100mm below the soffit of the concrete slab and maintained at 20Pa.

A.5.6 Instrumentation

A.5.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.5.7 Test Results

A.5.7.1 The test was terminated after a period of 301 minutes at the request of the test sponsor.

A.5.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1997 for the following periods.

Service Ref.	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
B	Not Applicable	No failure at 301	298
D	Not Applicable	No failure at 301	No failure at 301

A.6 TEST REPORT – F91741

A.6.1 Report Sponsor

A.6.1.1 Promat Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.6.2 Test Laboratory

A.6.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 4282, Dandenong South, Victoria 3164.

A.6.3 Test Date

A.6.3.1 The fire resistance test was conducted on 8th October 1998.

A.6.4 Test Standard

A.6.4.1 The test was conducted in accordance with AS1530.4-1997.

A.6.5 General Description of Tested Specimen

A.6.5.1 The fire resistance test conducted for a heating period of 241 minutes, on four uPVC pipes, each penetrating Fondue cement concrete blocks, of dimension 300mm × 300mm × 120mm. The concrete blocks encasing the pipes were fitted into openings in a refractory slab of nominal dimension 1200mm × 1200mm x 130mm thick. The refractory slab assembly was orientated in a horizontal position, above a pilot furnace with a nominal opening of 1m x 1m.

A.6.5.2 The uPVC pipe penetrations were protected by PROMASEAL FCM40, FCM50, FCM65 and FCM80 retrofit collars. The FCM retrofit fire collars were fixed to the soffit of the Fondue cement blocks with four 40mm split anchors. UPVC pipe fittings were located within the body of each collar.

Table 1: Service Penetration details

Service Ref.	Collar Type	Service Pipe
A	FCM40	43mm OD uPVC
B	FCM50	56mm OD uPVC
C	FCM65	69mm OD uPVC
D	FCM80	83mm OD uPVC

A.6.5.3 The penetrating services were each provided with a plastic end cap on the fire exposed side of the slab and were vented on the non-fire side.

A.6.5.4 The specimen was subjected to the furnace heating conditions from the underside only.

A.6.6 Instrumentation

A.6.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.6.7 Test Results

A.6.7.1 The test was terminated after a period of 241 minutes at the request of the test sponsor.

A.6.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1997 for the following periods:

Service Ref.	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	Not Applicable	No failure at 241	213
B	Not Applicable	No failure at 241	No failure at 241
C	Not Applicable	No failure at 241	No failure at 241
D	Not Applicable	No failure at 241	No failure at 241

A.7 TEST REPORT – F91742

A.7.1 Report Sponsor

A.7.1.1 Promat Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.7.2 Test Laboratory

A.7.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 4282, Dandenong South, Victoria 3164.

A.7.3 Test Date

A.7.3.1 The fire resistance test was conducted on 31st December 1998.

A.7.4 Test Standard

A.7.4.1 The test was conducted in accordance with AS1530.4-1997.

A.7.5 General Description of Tested Specimen

A.7.5.1 The fire resistance test conducted for a heating period of 241 minutes on four plastic pipes, each penetrating a Fondue cement concrete block, of dimension 300mm × 300mm × 130mm. The concrete blocks encasing the pipes, were fitted into openings in a refractory slab of nominal dimension 1200mm × 1200mm x 120mm thick. The refractory slab assembly was orientated in a horizontal position, above a pilot furnace with a nominal opening of 1m x 1m.

A.7.5.2 The plastic pipe penetrations were protected by PROMASEAL FCCM50 and FCCM80 cast-in collars and, a PROMASEAL FCM100 retro fit collar. The results in this summary relate to the PROMASEAL FCM100 collar only, ie, Services C.

A.7.5.3 The FCM100 retrofit fire collars was fitted around the nominally 110mm diameter uPVC service pipe, and fixed to the soffit of the Fondue cement block with four nominally 6mm x 50mm masonry anchors. Foam packing (approximately 12mm wide) was provided between the uPVC pipe and the oversized hole in the concrete block and was finished flush on the fire

exposed side with PROMASEAL acrylic mastic to an approximate depth of 10mm, prior to fixing the retrofit collar.

A.7.5.4 The penetrating services were each provided with a plastic end cap on the fire exposed side of the slab and were vented on the non-fire side.

A.7.5.5 The specimen was subjected to the furnace heating conditions from the underside only,

A.7.6 Instrumentation

A.7.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.7.7 Test Results

A.7.7.1 The test was terminated after a period of 241 minutes at the request of the test sponsor.

A.7.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1997 for the following periods:

Service Ref.	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
C	Not Applicable	No failure at 241	229*

* Recorded on concrete block, no failure on service pipe.

A.8 TEST REPORT – F91754

A.8.1 Report Sponsor

A.8.1.1 Promat Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.8.2 Test Laboratory

A.8.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 4282, Dandenong South, Victoria 3164.

A.8.3 Test Date

A.8.3.1 The fire resistance test was conducted on 9th January 1999.

A.8.4 Test Standard

A.8.4.1 The test was conducted in accordance with AS1530.4-1997 as appropriate.

A.8.5 General Description of Tested Specimen

A.8.5.1 The test assembly comprised four cable penetrations and an uPVC pipe penetration through a representative section of concrete floor slab of nominal dimensions 1200mm × 1200mm × 120mm thick. The results presented in this summary relate to the cable penetrations identified as Services A, C, D and E.

A.8.5.2 The cable services each passed through a nominal 100mm diameter seam welded steel pipe, 4.5mm thick, installed into an oversized holes cored into the slab which were then backfilled with a mortar containing Fondue cement. The steel sleeves extended approximately 130mm from the unexposed face in all cases, and 50mm from the exposed face in all cases, with the exception of Service A, where the steel sleeve was finished flush with the exposed face. The service penetrations were protected with retrofit PROMASEAL FCEG100 collars, fitted around the cable bundles and fixed to the soffit of the slab with nominal 6.5mm masonry anchors. The embedment depth of the anchors was nominally 25mm in each case. Gaps between the cable bundles and the steel pipes were sealed with PROMASEAL acrylic sealant on the fire exposed side to an approximate depth of 5mm.

A.8.5.3 The installation details for each service were as follows:

A.8.5.4 Service A - contained 27 BERTEC Optical Fibre cables, with the FCEG100 collar fixed directly to the soffit of the slab with four 6.5mm x 25mm masonry anchors.

A.8.5.5 Service C - contained 28 UTP Data cables, with the FCEG100 collar located directly beneath the opening of the steel pipe, and attached to the slab with four 6.5mm x 75mm masonry anchors through two nominally 200mm x 200mm x 25mm thick Promatect H board spacers.

A.8.5.6 Service D - contained one BERTEC Optical Fibre cable and one UTP Data cable, with the FCEG100 collar located directly beneath the opening of the steel pipe, and attached to the slab with four 6.5mm x 75mm masonry anchors through a nominally 50mm thick mineral fibre spacer with a nominal density of 100kg/m3. The gaps between the steel pipe and the cables were filled to full depth of the steel pipe with mineral fibre with a nominal density of 30kg/m3.

A.8.5.7 Service E - comprised 26 BERTEC Fibre Optical cables, and was fitted in the same manner as Service C.

A.8.5.8 The cables extended approximately 550mm from the unexposed face, and 400mm from the exposed face of the slab

A.8.5.9 The specimen was subjected to the furnace heating conditions from the underside only.

A.8.5.10 The furnace pressure was measured at 100mm below the soffit of the concrete slab and maintained at 20Pa.

A.8.6 Instrumentation

A.8.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.8.7 Test Results

A.8.7.1 The test was terminated after a period of 201 minutes at the request of the test sponsor.

A.8.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1997 for the following periods:

Service Ref.	Collar type	Structural Adequacy (minutes)	Integrity (minutes)	Insulation* (minutes)
A	FCEG100	Not Applicable	No failure at 201	133
C	FCEG100	Not Applicable	200	157
D	FCEG100	Not Applicable	No failure at 201	196
E	FCEG100	Not Applicable	No failure at 201	194

* All measured on the steel pipe sleeve

A.9 TEST REPORT – F91765

A.9.1 Report Sponsor

A.9.1.1 Promat International (Asia Pacific), 10-12 Rosslyn Street, Mile End, SA 5031.

A.9.2 Test Laboratory

A.9.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 4282, Dandenong South, Victoria 3164.

A.9.3 Test Date

A.9.3.1 The fire resistance test was conducted on 7th May 1999.

A.9.4 Test Standard

A.9.4.1 The test was conducted in accordance with AS1530.4-1997 as appropriate.

A.9.5 General Description of Tested Specimen

A.9.5.1 The test assembly comprised four uPVC and one HDPE pipes penetrating a nominal 120mm thick concrete slab. The results presented in this report are related to specimens identified as Services A to E.

A.9.5.2 The PROMASEAL fire collars used in the fire resistance test in order to protect the pipe penetrations were of two types, being retrofit or cast-in respectively.

A.9.5.3 The pipe services protected by retrofit collars tested in this report are described below.

Service Ref.	Collar Type	Pipe nominal diameter (mm)	Pipe Material
A	FCM150	160	uPVC
B	FCM80	83	uPVC
D	FCM100	110	uPVC

A.9.5.4 The retrofit FCM collars were fitted around the pipes on the fire exposed side of the slab and retained in position by four 6.5mm x 25mm sleeve anchors.

A.9.5.5 The penetrating services were capped on the fire exposed side of the slab and remained open ended on the non-fire side.

A.9.5.6 The specimen was subjected to the furnace heating conditions from the underside only.

A.9.5.7 The furnace pressure was measured at approximately 100mm below the soffit of the concrete slab and was maintained at approximately 20Pa above the laboratory atmosphere after the first 5 minutes of the test.

A.9.6 Instrumentation

A.9.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.9.7 Test Results

A.9.7.1 The test was terminated after a period of 242 minutes at the request of the test sponsor.

A.9.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1997 for the following periods:

Service Reference	Structural Adequacy	Integrity (minutes)	Insulation (minutes)	180 K Rise on Thermocouples on Services Exceeded (minutes)
A	N/A	No failure at 242	156	176
B	N/A	No failure at 242	198	Not exceeded at 242
D	N/A	No failure at 242	176	Not exceeded at 242

A.10 TEST REPORT – FSP 0643

A.10.1 Report Sponsor

A.10.1.1 Promat Fyreguard Pty Ltd, 10-12 Rosslyn Street, Mile End, SA 5031.

A.10.2 Test Laboratory

A.10.2.1 CSIRO – Division of Building, Construction and Engineering, 14 Julius Avenue, Riverside Corporate Park, North Ryde, NSW, 2113.

A.10.3 Test Date

A.10.3.1 The fire resistance test was conducted on 10th February 1999.

A.10.4 Test Standard

A.10.4.1 The test was conducted in accordance with AS1530.4-1997 as appropriate.

A.10.5 General Description of Tested Specimen

A.10.5.1 The test assembly comprised plastic pipe penetrations through a representative section of concrete floor slab and two plasterboard walls.

A.10.5.2 The pipe services penetrating the nominally 120mm thick reinforced concrete slab and protected by retrofit collars tested in this report are described below.

A.10.5.3 Service A was a nominal 160mm HDPE pipe protected by an FCM150 retrofit collar containing nominally 69mm wide x 18mm thick intumescent. The collar was retrofitted to the pipe and fixed to the soffit of the slab with four 6mm x 25mm Dynabolts.

A.10.5.4 Service B was a nominal 75mm HDPE pipe protected by an FCM65 retrofit collar containing nominally 40mm wide x 12mm thick intumescent. The collar was retrofitted to the pipe and fixed to the soffit of the slab with four 6mm x 25mm Dynabolts.

A.10.5.5 Service C was a nominal 56mm HDPE pipe protected by an FCM50 retrofit collar containing nominally 40mm wide x 12mm thick intumescent. The collar was retrofitted to the pipe and fixed to the soffit of the slab with four 6mm x 25mm Dynabolts.

A.10.5.6 Service D was a nominal 50mm HDPE pipe protected by an FCM40 retrofit collar containing nominally 40mm wide x 12mm thick intumescent. The collar was retrofitted to the pipe and fixed to the soffit of the slab with four 6mm x 25mm Dynabolts.

A.10.5.7 The service pipes all extended 2000mm from the unexposed face of the slab, and 500mm from exposed face.

A.10.5.8 The pipe end within the furnace was capped and was vented on the non-fire side.

A.10.5.9 The specimen was subjected to the furnace heating conditions from the underside only,

A.10.6 Instrumentation

A.10.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.10.7 Test Results

A.10.7.1 The test was terminated after a period of 186 minutes at the request of the test sponsor.

A.10.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1997 for the following periods:

Service Ref.	Collar type	Structural Adequacy (minutes)	Integrity (minutes)	Insulation (minutes)
A	FCM150	Not Applicable	No failure at 186	No failure at 186
B	FCM65	Not Applicable	No failure at 186	No failure at 186
C	FCM50	Not Applicable	No failure at 186	No failure at 186
D	FCM40	Not Applicable	No failure at 186	No failure at 186

A.11 TEST REPORT – F91797

A.11.1 Report Sponsor

A.11.1.1 Promat Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA 5031.

A.11.2 Test Laboratory

A.11.2.1 Warrington Fire Research (Aust.) Pty Ltd., PO Box 4282, Dandenong South, Victoria 3164.

A.11.3 Test Date

A.11.3.1 The fire resistance test was conducted on 22nd December 1999.

A.11.4 Test Standard

A.11.4.1 The test was conducted in accordance with AS1530.4-1997.

A.11.5 General Description of Tested Specimen

A.11.5.1 The test assembly comprised six plastic pipes penetrating a 120mm thick reinforced concrete slab, and six plastic pipes penetrating a plasterboard partition.

A.11.5.2 The plastic pipe penetration designated as service K was protected by PROMASEAL FC100 retrofit type collar containing 15mm thick intumescent material. The results in this summary relate to the PROMASEAL FC100 collar only, ie, Services K.

A.11.5.3 The FC100 retrofit fire collars was fitted around the nominally 110mm diameter uPVC service pipe, and fixed to the soffit of the concrete slab with four nominally 6mm x 25mm masonry anchors. The gap between the uPVC pipe and the oversize hole cored in the slab was filled to full depth with sand/cement mortar.

A.11.5.4 The penetrating service was provided with a plastic end cap on the fire exposed side of the slab and was vented on the non-fire side.

A.11.5.5 The specimen was subjected to the furnace heating conditions from the underside only,

A.11.6 Instrumentation

A.11.6.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.11.7 Test Results

A.11.7.1 The test was terminated after a period of 241 minutes at the request of the test sponsor.

A.11.7.2 The specimen satisfied the performance requirements specified in AS1530.4-1997 for the following periods:

Service Ref.	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
K	Not Applicable	No failure at 241	192*

A.11.7.3 * Recorded on concrete slab, no failure on service pipe.

A.12 TEST REPORT – FSRG A-07-487

A.12.1 Report Sponsor

A.12.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.12.2 Test Laboratory

A.12.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.12.3 Test Date

A.12.3.1 The fire resistance test was conducted on 27th of February 2007.

A.12.4 Test Standard

A.12.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.12.5 General Description of Tested Specimen

A.12.5.1 The test assembly comprised a 150mm thick concrete slab containing uPVC and HDPE penetrations.

A.12.5.2 Specimen A – 250mm diameter 6mm wall thickness uPVC pipe protruding 500mm on the exposed and 2000mm on the unexposed side of the concrete slab. The pipe was joined together with a coupling joiner at a height of 695mm from the unexposed side of the element. The pipe was protected with a PROMASEAL FC 250 retrofit collar fixed underneath the concrete slab on the exposed side. The collar was fixed with 6.5mm x 35mm dyna bolt fasteners at four fix points into the slab. The exposed side of the slab was capped with an uPVC cap and the unexposed side remained vented to the atmosphere.

A.12.5.3 Specimen B - 250mm diameter 10mm wall thickness HDPE pipe protruding 500mm on the exposed and 2000mm on the unexposed side of the concrete slab. The pipe was joined together with a coupling joiner at a height of 695mm from the unexposed side of the element. The pipe was protected with a PROMASEAL FC 250 retrofit collar fixed underneath the concrete slab on the exposed side. The collar was fixed with 6.5mm x 35mm dyna bolt fasteners at four fix points into the slab. The exposed side of the slab was capped with a uPVC cap and the unexposed side remained vented to the atmosphere.

A.12.5.4 Both pipes were supported on the unexposed side with two 250mm pipe clamps located at 740mm and at 1495mm from the unexposed side.

A.12.6 Instrumentation

A.12.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.12.7 Test Results

A.12.7.1 At 9 minutes into the test it was observed that the service penetration of specimens A and B had appeared to have closed with slight venting still visible.

A.12.7.2 Temperature on the unexposed side of the slab increased at variable rates during the test reaching a maximum 207.7 degrees at 243 minutes into the test.

A.12.7.3 Temperature on the unexposed side of specimen A reached a maximum of 129.9 degrees at 9 minutes into the test before falling rapidly and steadily increasing to 113.9 degrees at 243 minutes.

A.12.7.4 Temperature on the unexposed side of specimen B reached 103.5 degrees at 14minutes into the test before falling rapidly and steadily increasing to a maximum 111.9 degrees at 243 minutes into the test.

A.12.7.5 The test was terminated after a period of 243 minutes at the request of the sponsor.

A.12.7.6 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	N/A	243	243
B	N/A	243	243

A.13 TEST REPORT – BWA 2227800.1

A.13.1 Report Sponsor

A.13.1.1 Promat Australia P/L, 1 Scotland Road, Mile End, SA 5031

A.13.2 Test Laboratory

A.13.2.1 Bodycote Warringtonfire (Aus) Pty Ltd, Unit 2, 409 - 411 Hammond Road, Dandenong, Victoria 3175, Australia.

A.13.3 Test Date

A.13.3.1 The fire resistance test was conducted on 19th of December 2007.

A.13.4 Test Standard

A.13.4.1 The test was conducted in accordance with AS1530.4-2005.

A.13.5 General Description of Tested Specimen

A.13.5.1 The test assembly comprised a nominal 1750mm long × 1200mm wide × 120mm thick concrete slab penetrated by various plastic pipes.

A.13.5.2 The concrete slab was penetrated by five plastic pipe stack systems and one plastic floor waste system. The pipes were protected by various cast-in and retrofit fire collars designated as Services A – F.

A.13.5.3 The assembly was tested in the horizontal orientation on a pilot furnace with a nominal opening of 1200mm × 1200mm.

A.13.5.4 For the purposes of this assessment only Service C is relevant and summarised below:

A.13.5.5 Service C – Pipe System

A.13.5.6 Product name: 300mm uPVC DWV pipe.

A.13.5.7 Pipe dimensions: 315mm (measured) diameter (OD) × 10mm thick (measured) pipe that protruded nominal 525mm on the exposed side and minimum 2000mm on the unexposed side, capped on the exposed side with kao wool and sealant to a depth of 25mm.

A.13.5.8 Pipe Support : The pipe was supported on the unexposed side with appropriately sized pipe clamps 500mm and 1500mm from the unexposed face.

A.13.5.9 Service C – Collar

A.13.5.10 Product Name: PROMASEAL® FC 300 collar - Collar containing NG GRAFITEX™

A.13.5.11 Collar size: Overall dimension of the collar was nominal 404mm in diameter × nominal 150mm high with an internal diameter to the intumescent of nominal 317mm. The flange is nominal 30mm wide. The outer shell of the collar is made from nominal 1mm thick steel.

A.13.5.12 Intumescent: The intumescent was made from 2-off laminated strips, 1-off 17mm thick × nominal 150mm wide with the other 17mm thick × nominal 140mm wide to give room to the spring (see below), with an approximate total density of 1000kg/m3 (measured).

A.13.5.13 Spring: A nominal 12mm diameter × 1.6mm gauge spring was positioned between the inner intumescent layer and the outer metal casing.

A.13.5.14 Fixing: Collar fixed to the exposed side of the concrete slab at 8-off points with 6mm × 50mm long masonry anchors.

A.13.6 Instrumentation

A.13.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.13.7 Test Results

Service	T/C No.	Description	Temp (°C) at t (minutes)					Limit (Mins)
			t=0	t=60	t=120	t=180	t=240	
C	B8	25mm from pipe on the slab	29	91	134	233	353	163
	B9	25mm from pipe on the slab	29	79	122	221	337	170
	B10	25mm from slab on the pipe	31	64	77	110	146	-
	B11	25mm from slab on the pipe	30	69	84	110	138	-

Time Min	Sec	Observation
0	00	Fire Resistance Test was commenced and ambient service temperature was approximately 32°C.
4	20	A large quantity of black smoke had become evident from the service.
10	30	Smoke emissions from the service had dramatically reduced.
58	00	No smoke emissions were evident from the end of the service.
157	00	Some blackening had become evident at the base of the pipe.
163	**00**	**Failure on insulation in accordance with AS 1530.4-2005, where an individual temperature on the unexposed face (on slab) exceeded the initial temperature by more than 180°C.**
226	00	The pipe had begun to vent slightly at the pipe/slab interface.
237	30	A 30 second cotton pad test was carried out. No glowing or flaming of the cotton pad had become evident.
241	00	Test Stopped at the request of the sponsor.

A.13.7.1 The test was terminated after a period of 241 minutes at the request of the sponsor.

A.13.7.2 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Service	Criteria	Result
C	**Structural Adequacy**	Not applicable
	Integrity	No failure at 241 minutes
	Insulation	163 minutes
	FRL	-/240/120

A.14 TEST REPORT – FSRG A-11-734

A.14.1 Report Sponsor

A.14.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.14.2 Test Laboratory

A.14.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.14.3 Test Date

A.14.3.1 The fire resistance test was conducted on 10th of August 2011.

A.14.4 Test Standard

A.14.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.14.5 General Description of Tested Specimen

A.14.5.1 The test assembly comprised a 120mm thick concrete slab containing uPVC and HDPE penetrations.

A.14.5.2 For the purpose of this assessment only Specimens A and B are relevant and summarised below:

A.14.5.3 Specimen A – A PROMASEAL FC40 retrofitted to the underside of a concrete slab protecting a 40mm uPVC pipe in a 120mm thick concrete slab. The collar is fixed with 20mm x 5mm masonry hammer-in anchors through the Bondek into the slab, the voids in the Bondek the collars go over when fixed are filled to the edge of the collar with PROMASEAL AN Acrylic Sealant The pipe protruded 500mm from the exposed face and 2000mm from the unexposed face. A 40mm uPVC end cap was glued with Bostik Plumb-Weld PVC pipe cement to the exposed end of the pipe, the pipe was left open to the atmosphere on the unexposed side. The service was supported twice on the unexposed side at 300mm and 1500mm.

A.14.5.4 Specimen B – A PROMASEAL FC40 retrofitted to the underside of a concrete slab protecting a 40mm HDPE pipe in a 120mm thick concrete slab. The collar is fixed with 20mm x 5mm masonry hammer-in anchors through the Bondek into the slab, the voids in the Bondek the collars go over when fixed are filled to the edge of the collar with PROMASEAL AN Acrylic Sealant. The pipe protruded 500mm from the exposed face and 2000mm from the unexposed face. A layer of 25mm thick ceramic fibre was as the end cap and sealed with PROMASEAL AN Acrylic Sealant, the pipe was left open to the atmosphere on the unexposed side. The service was supported twice on the unexposed side at 300mm and 1500mm.

A.14.6 Instrumentation

A.14.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.14.7 Test Results

A.14.7.1 Specimen A observations:

Time Min	Sec	Observation
1	00	Smoke has begun to vent from end of pipe.
8	00	Smoke venting has ceased
15	00	Spalling sound has come from inside the furnace
179	00	No cotton pad test done, specimen in good order
229	00	Specimen has failed insulation criteria, recorded on TC A4, located on concrete slab
240	00	Test discontinued

A.14.7.2 Specimen B observations:

Time Min	Sec	Observation
3	00	Smoke has begun to vent from end of pipe.
8	00	Smoke venting has ceased
15	00	Spalling sound has come from inside the furnace
179	00	No cotton pad test done, specimen in good order
187	00	Smoke has begun to vent again from the end of the pipe
201	00	Specimen has failed insulation criteria, recorded on TC B4, located on concrete slab
240	00	Test discontinued

A.14.7.3 The test was terminated after a period of 241 minutes at the request of the sponsor.

A.14.7.4 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	N/A	241	229
B	N/A	241	201

A.15 TEST REPORT – FSRG A-08-531

A.15.1 Report Sponsor

A.15.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.15.2 Test Laboratory

A.15.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.15.3 Test Date

A.15.3.1 The fire resistance test was conducted on 10th of August 2011.

A.15.4 Test Standard

A.15.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.15.5 General Description of Tested Specimen

A.15.5.1 The test assembly comprised a 120mm thick concrete slab containing uPVC and HDPE penetrations.

A.15.5.2 For the purpose of this assessment only Specimens C and D are relevant and summarised below:

A.15.5.3 Specimen C – 65mm uPVC pipe protruding 500mm on the exposed and 2000mm on the unexposed side of the 120mm thick concrete slab. Pipe protected with one PROMASEAL FC65 retrofit collar fixed on the exposed side of the slab at four fix points with 6.5mm 35mm DBZ masonry anchors. The 65mm uPVC pipe was joined together with a coupling joiner at a height of 67mm above the unexposed side of the concrete slab. The exposed side of the pipe was capped with ceramic wool and the unexposed side remained vented to the atmosphere.

A.15.5.4 Specimen D – 65mm HDPE pipe protruding 500mm on the exposed and 2000mm on the unexposed side of the 120mm thick concrete slab. Pipe protected with one PROMASEAL FC65 retrofit collar fixed on the exposed side of the slab at four fix points with 6.5mm 35mm DBZ masonry anchors. The 65mm HDPE pipe was joined together with a coupling joiner at a height of 67mm above the unexposed side of the concrete slab. The exposed side of the pipe was capped with ceramic wool and the unexposed side remained vented to the atmosphere.

A.15.6 Instrumentation

A.15.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.15.7 Test Results

A.15.7.1 Specimen C observations:

Time Min	Sec	Observation
14	00	Slight venting from unexposed opening of pipe
75	00	Concrete slab is beginning to deflect
237	00	30 second integrity measurement test carried out with cotton pad with no failure
241	00	Test discontinued at request of sponsor

A.15.7.2 Specimen D observations:

Time Min	Sec	Observation
106	00	Slight venting from unexposed opening of pipe
118	00	Venting has ceased
193	**00**	**Specimen has failed insulation criteria recorded on TC 10 located on concrete slab**
237	00	30 second integrity measurement test carried out with cotton pad with no failure
241	00	Test discontinued at request of sponsor

A.15.7.3 The test was terminated after a period of 241 minutes at the request of the sponsor.

A.15.7.4 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
C	N/A	241	241
D	N/A	241	193

A.16 TEST REPORT – FSRG A-13-852A

A.16.1 Report Sponsor

A.16.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.16.2 Test Laboratory

A.16.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.16.3 Test Date

A.16.3.1 The fire resistance test was conducted on 8th of November 2013.

A.16.4 Test Standard

A.16.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.16.5 General Description of Tested Specimen

A.16.5.1 The test assembly comprised a 128mm thick plasterboard partition containing various types of pipe being protected with various retrofit collars.

A.16.5.2 For the purpose of this assessment only Specimen D is relevant and summarised below:

A.16.5.3 Specimen D – A 150mm uPVC pipe protected by PROMASEAL FC150 collars on either side of the wall. The collars were fixed with 40mm long X 10g stitching screws, a 3/16 washer was also used in conjunction with the screws. The 5mm annular gap on both the unexposed and exposed side was sealed with PROMASEAL AN Acrylic sealant. The pipe protruded 500mm from the exposed face and 2000mm from the unexposed face. The 150mm uPVC end cap was glued with Bostik Plumb-Weld PVC pipe cement to the exposed end of the pipe. The unexposed end was left open to the atmosphere, the service was supported twice on the unexposed side at 300mm and 1500mm.

A.16.6 Instrumentation

A.16.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.16.7 Test Results

A.16.7.1 Specimen D observations:

Time Min	Sec	Observation
4	00	Venting has begun at end of pipe
25	00	Venting subsiding
60	00	No cotton pad test done, specimen in good order
91	00	Venting starting to increase
124	00	Pipe starting to soften at collar, intumescent staring to expand
167	**00**	**Specimen has failed insulation on TC D1 located on the separating element**
181	00	Test discontinued

A.16.7.2 The test was terminated after a period of 181 minutes at the request of the sponsor.

A.16.7.3 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
D	N/A	181	167

A.17 TEST REPORT – FSRG A-08-527

A.17.1 Report Sponsor

A.17.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.17.2 Test Laboratory

A.17.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.17.3 Test Date

A.17.3.1 The fire resistance test was conducted on 4th of February 2008.

A.17.4 Test Standard

A.17.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.17.5 General Description of Tested Specimen

A.17.5.1 The test assembly comprised a 128mm thick plasterboard partition containing 40mm and 65mm uPVC services protected by PROMASEAL FC40 and PROMASEAL FC65 retrofit collars.

A.17.5.2 For the purpose of this assessment only Specimen A is relevant and summarised below:

A.17.5.3 Specimen A – 40mm uPVC pipe protruded 500mm from the exposed face and 2000mm from the unexposed face. Protected by PROMASEAL FC40 collars on either side of the wall. The collars were fixed with 40mm long X 10g laminating screws. The 4mm annular gap was sealed with PROMASEAL AN Acrylic sealant to the depth of the board. The exposed end of the pipe was capped with ceramic wool and the unexposed end was left open to the atmosphere, the service was supported twice on the unexposed side at 450mm and 1950mm.

A.17.6 Instrumentation

A.17.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.17.7 Test Results

A.17.7.1 Specimen A observations:

Time Min	Sec	Observation
2	00	Slight venting from unexposed side of opening
15	00	Venting from specimen ceased
103	00	Slight venting resumed
125	00	Venting slightly increased
203	00	Smoke emitting from intumescent char on unexposed side
219	00	Specimen failed insulation criteria of AS 1530.4-2005 recorded on TC3 located on unexposed collar
225	00	Separating element beginning to discolour around specimen
242	20	30 second integrity measurement with cotton pad – no failure
243	25	Test discontinued

A.17.7.2 The test was terminated after a period of 243 minutes at the request of the sponsor.

A.17.7.3 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	N/A	243	219

A.18 TEST REPORT – F91783

A.18.1 Report Sponsor

A.18.1.1 Promat Fyreguard Pty Ltd, 12 Rosslyn Street, Mile End, SA, 5031.

A.18.2 Test Laboratory

A.18.2.1 Warrington Fire Research (Aust) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, VIC, 3175.

A.18.3 Test Date

A.18.3.1 The fire resistance test was conducted on 27th August, 1999.

A.18.4 Test Standard

A.18.4.1 The test was conducted in accordance with AS1530.4-1997 and AS4072.1-1992.

A.18.5 Variations to Test Method

A.18.5.1 None stated.

A.18.6 General Description of Tested Specimen

A.18.6.1 The supporting construction comprised a 3m × 3m steel-framed plasterboard wall. The studs were 64mm “C-H” studs and were clad with a single layer of 25mm thick CSR shaft liner on the exposed side and two layers of 16mm thick CSR Gyprock Fyrchek on the unexposed side.

A.18.6.2 Several penetrations were included within the wall system. Only service 5 is relevant to this assessment, the details of which are provided below:

Specimen	Description	Protection	Support
5	Ø55.7mm × 2.2mm uPVC pipe	Annular gap between pipe and wall sealed to with PROMASEAL® Acrylic sealant to depth of board. PROMASEAL® FC50 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.

A.18.6.3 The plastic pipe above extended between 495 on the exposed side and 2000mm on the unexposed side, and was capped on the exposed side.

A.18.7 Instrumentation

A.18.7.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.18.8 Test Results

A.18.8.1 The test duration was 121 minutes.

A.18.8.2 The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-1997:

Specimen	Integrity	Insulation
5	No failure at 121 minutes.	No failure at 121 minutes.

A.19 TEST REPORT – FSRG A-10-672A.1

A.19.1 Report Sponsor

A.19.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.19.2 Test Laboratory

A.19.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.19.3 Test Date

A.19.3.1 The fire resistance test was conducted on 21st of May 2010.

A.19.4 Test Standard

A.19.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.19.5 General Description of Tested Specimen

A.19.5.1 The test assembly comprised a 128mm thick fire resistant plasterboard partition penetrated by various services protected by various PROMASEAL retrofit collars.

A.19.5.2 For the purpose of this assessment only Specimen C is relevant and summarised below:

A.19.5.3 Specimen C – A 250 uPVC pipe protected by PROMASEAL FC250 fire collar on both sides of the penetration. Pipe protruded 680mm from the exposed side and 2277mm from the unexposed side. The end of the pipe was capped with ceramic fibre on the exposed side and open to the atmosphere on the unexposed side. The ceramic fibre was sandwiched by two layers of wire and sealed with PROMASEAL AN Acrylic Sealant on the exposed side. The service was supported twice on the unexposed side at 350mm and 1500mm from the unexposed face.

A.19.6 Instrumentation

A.19.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.19.7 Test Results

A.19.7.1 Specimen A observations:

Time Min	Sec	Observation
2	00	Smoke has begun to vent from end of pipe
16	00	Venting slowed down
125	00	The pipe has begun to deform with the collar on the unexposed side. The spring has activated and there is an approximate 10mm gap between the inside of the collar and pipe. Expanding intumescent material can be seen with the collar, filling approximately 50% of the cavity where the pipe deformed
170	00	Intumescent material has begun to push out of the collar on unexposed side.
178	00	Cotton pad integrity test passed on specimen
185	00	Test discontinued.

A.19.7.2 The test was terminated after a period of 185 minutes at the request of the sponsor.

A.19.7.3 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
C	N/A	185	185

A.20 TEST REPORT – FSRG A-08-528

A.20.1 Report Sponsor

A.20.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.20.2 Test Laboratory

A.20.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.20.3 Test Date

A.20.3.1 The fire resistance test was conducted on 4th of February 2008.

A.20.4 Test Standard

A.20.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.20.5 General Description of Tested Specimen

A.20.5.1 The test assembly comprised a 128mm thick fire resistant plasterboard partition penetrated by various services protected by various PROMASEAL retrofit collars.

A.20.5.2 For the purpose of this assessment only Specimen A is relevant and summarised below:

A.20.5.3 Specimen A – 40mm HDPE pipe protruded 500mm from the exposed face and 2000mm from the unexposed face. Protected by two PROMASEAL FC40 collars on either side of the wall. The 4mm annular gap was sealed with PROMASEAL AN Acrylic sealant to the depth of the board. The exposed end of the pipe was capped with ceramic wool and the unexposed end was left open to the atmosphere, the service was supported twice on the unexposed side at 450mm and 1950mm.

A.20.6 Instrumentation

A.20.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.20.7 Test Results

A.20.7.1 Specimen A observations:

Time Min	Sec	Observation
5	00	Pipe has been pushed out of separating element on unexposed side by 35mm
36	00	Smoke emitting from collar on unexposed side
78	00	Venting from pipe
165	00	Venting ceased
191	00	Venting increased again
194	00	Specimen failed insulation criteria on TC 5 located on unexposed side of pipe. Specimen failed integrity criteria – Glowing of cotton pad observed Test terminated

A.20.7.2 The test was terminated after a period of 185 minutes at the request of the sponsor.

A.20.7.3 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	N/A	195	195

A.21 TEST REPORT – FSP 1464A

A.21.1 Report Sponsor

A.21.1.1 Lend Lease Project management & Construction (Aust) Pty Ltd.

A.21.2 Test Laboratory

A.21.2.1 CSIRO – Materials Science and Engineering, 14 Julius Ave, Riverside Corporate Park, North Ryde NSW 2113.

A.21.3 Test Date

A.21.3.1 The fire resistance test was conducted on 25th of March 2011.

A.21.4 Test Standard

A.21.4.1 The test was conducted in accordance with AS1530.4-2005.

A.21.5 General Description of Tested Specimen

A.21.5.1 The test assembly comprised a 136mm thick Powerscape plasterboard partition penetrated by various services protected by various PROMASEAL retrofit collars.

A.21.5.2 For the purpose of this assessment only Specimen B is relevant and summarised below:

A.21.5.3 Specimen B – A nominally 75mm OD HDPE Coestilen pipe penetrated the wall through a 77mm hole. The resulting gap was sealed with PROMASEAL Supa Mastic polyurethane sealant on both faces before fitting the PROMASEAL FC80 fire collars to each side of the wall. The pipe projected 2000mm on the unexposed side and 500mm on the exposed side of the wall. The pipe was supported at 500mm and 1500mm from the unexposed face. The pipe was open at the unexposed side and capped on the exposed side with a HDPE cap.

A.21.6 Instrumentation

A.21.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.21.7 Test Results

A.21.7.1 The test was terminated after a period of 121 minutes at the request of the sponsor.

A.21.7.2 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
B	N/A	No failure 121	No failure 121

A.22 TEST REPORT – FSRG A-08-532

A.22.1 Report Sponsor

A.22.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.22.2 Test Laboratory

A.22.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.22.3 Test Date

A.22.3.1 The fire resistance test was conducted on 27th of February 2008.

A.22.4 Test Standard

A.22.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.22.5 General Description of Tested Specimen

A.22.5.1 The test assembly comprised a 128mm thick fire resistant plasterboard partition penetrated by various services protected by various PROMASEAL retrofit collars.

A.22.5.2 For the purpose of this assessment only Specimen A is relevant and summarised below:

A.22.5.3 Specimen A – 100mm uPVC pipe protruded 500mm from the exposed face and 2000mm from the unexposed face. Protected by two PROMASEAL FC100 collars on either side of the wall. The 4mm annular gap was sealed with PROMASEAL AN Acrylic sealant to the depth of the board. The exposed end of the pipe was capped with ceramic wool and the unexposed end was left open to the atmosphere, the service was supported twice on the unexposed side at 350mm and 1850mm.

A.22.6 Instrumentation

A.22.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.22.7 Test Results

A.22.7.1 Specimen A observations:

Time Min	Sec	Observation
2	00	Venting from opening of pipe
2	15	Venting ceased
8	00	Venting resumed
105	00	Venting increased
140	00	Pipe on unexposed side in beginning to deform and sag adjacent to collar/pipe interface. Smoke emitting from gap between collar and pipe.
171	00	Roving thermocouple max temp measured 177°C
177	**00**	**Roving thermocouple max temp measured 205°C on collar. Specimen failed insulation criteria**
182	00	Test terminated

A.22.7.2 The test was terminated after a period of 185 minutes at the request of the sponsor.

A.22.7.3 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	N/A	182	177

A.23 TEST REPORT – EWFA 2373900

A.23.1 Report Sponsor

A.23.1.1 Bovis Lend Lease Pty Ltd, Level 4, 30 The Bond,30 Hickson Road, Millers Point, NSW 2000

A.23.2 Test Laboratory

A.23.2.1 Exova Warrington Fire Aus Pty Ltd, Unit 2, 409-411 Hammond Road Dandenong Victoria 3175.

A.23.3 Test Date

A.23.3.1 The fire resistance test was conducted on 15th of July 2009.

A.23.4 Test Standard

A.23.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.23.5 General Description of Tested Specimen

A.23.5.1 The test specimen comprised a 48mm thick double leaf doorset with each door leaf nominally 2090mm wide × 1150mm high that was installed within a wall system incorporating two (2-off) layers of 16mm USG Powerscape board fixed to a 92mm steel framing system. Above the double door system three pipe penetration systems were installed and protected by various sealing systems. For the purpose of this assessment only service B is relevant and summarised below:

Pipe System

A.23.5.2 Product name: 250mm HDPE pipe.

A.23.5.3 Pipe dimensions: 252 mm (measured) diameter (OD) × 8 mm thick (measured) pipe that protruded nominal 525 mm on the exposed side past the wall and minimum 2000 mm on the unexposed side, capped on the exposed side with kaowool plug to a depth of 25mm.

A.23.5.4 Pipe Support : The pipe was supported on the unexposed side with 25mm wide steel strapping 500mm and 1500mm from the unexposed face.

Collar

A.23.5.5 Product Name: Promat PROMASEAL® FC 250.

A.23.5.6 Collar location: One on the exposed side and one on the unexposed side.

A.23.5.7 Collar size: Overall dimension of the collar body was nominal 315 mm in diameter × nominal 120 mm high with an internal diameter to the intumescent of nominal 255 mm. The outer shell of the collar is made from 1 mm thick steel with a nominal 32mm wide lip around the collar for fixing.

A.23.5.8 Intumescent: The intumescent in the collar was nominal 118 mm high × 30 mm thick, with an approximate density of 960 kg/m3.

A.23.5.9 Fixing: The opening for the pipe was framed out, and the collars were effectively fixed to each other through the framing in the wall using 8mm diameter threaded rod and nut arrangement to both sides at four (4-off) locations as seen in the picture above.

A.23.6 Instrumentation

A.23.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.23.7 Test Results

A.23.7.1 Service B observations:

Time Min	Sec	Observation
00	00	Fire-Resistance Test was commenced and ambient air temperature was approximately 15℃.
7	15	Smoke emissions from the pipe's end had become evident.
9	50	Intumescent blowing from the pipe end had become evident.

15	00	A reduction in smoke emissions from the pipe end had become evident.
115	00	Smoke had become evident between the pipe and collar.
120	00	Specimen had continued to maintain integrity and insulation in accordance with AS1530.4-2005.
121	00	The test is stopped at the request of the sponsor.

A.23.7.2 The test was terminated after a period of 185 minutes at the request of the sponsor.

A.23.7.3 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Service	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
B	N/A	121	121

A.24 TEST REPORT – FSRG A-13-853A

A.24.1 Report Sponsor

A.24.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead NSW 2152.

A.24.2 Test Laboratory

A.24.2.1 Fire Science Research Group (Adelaide Division), 1 Scotland Road, Mile End South, Adelaide SA 5031.

A.24.3 Test Date

A.24.3.1 The fire resistance test was conducted on 22nd of November 2013.

A.24.4 Test Standard

A.24.4.1 The test was conducted in accordance with AS1530.4-2005.

A.24.5 General Description of Tested Specimen

A.24.5.1 The test assembly comprised a 128mm thick fire resistant plasterboard partition penetrated by a 300mm uPVC pipe protected by PROMASEAL FC300 retrofit collar.

A.24.5.2 For the purpose of this assessment only Specimen A is relevant and summarised below:

A.24.5.3 Specimen A – 300mm uPVC pipe protected by two PROMASEAL FC300 collars on either side of the wall. The pipe protruded 500mm from the exposed face and 2000mm from the unexposed face. The 5mm annular gap was sealed with PROMASEAL AN Acrylic sealant to the depth of the board. The exposed end of the pipe was capped with ceramic wool and PROMASEAL AN Acrylic sealant and the unexposed end was left open to the atmosphere, the service was supported twice on the unexposed side at 400mm and 1500mm.

A.24.6 Instrumentation

A.24.6.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.24.7 Test Results

A.24.7.1 Specimen A observations:

Time Min	Sec	Observation
6	00	Venting has begun at end of pipe
22	00	Venting decreased
117	00	Roving thermocouple placed over bolt read 72^{O}Cafter 90 seconds
140	00	Smoke starting to come from between pipe and collar
206	**00**	**Specimen failed insulation criteria on TC A1 located on the separating element**

224	00	Test terminated

A.24.7.2 The test was terminated after a period of 185 minutes at the request of the sponsor.

A.24.7.3 The specimen satisfied the performance requirements specified in AS1530.4-2005 for the following periods:

Specimen	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
A	N/A	224	206

A.25 TEST REPORT – FSRG A-08-528

A.25.1 Report Sponsor

A.25.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead, NSW, 2152.

A.25.2 Test Laboratory

A.25.2.1 Fire Science Research Group, 1 Scotland Road, Mile End South, Adelaide, SA, 5031.

A.25.3 Test Date

A.25.3.1 The fire resistance test was conducted on 1st February, 2008.

A.25.4 Test Standard

A.25.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.25.5 Variations to Test Method

A.25.5.1 None.

A.25.6 General Description of Tested Specimen

A.25.6.1 The separating element frame consisted of 64mm wide steel studs and tracks (0.5mm) with vertical studs spaced at 600mm centres. Two layers of 16mm Fyrchek boards were fixed to both faces of the frame into the vertical studs with 6g × 40mm S-point screws at 300mm centres. Horizontal joints were sealed with one layer of Easy-Finish topping compound.

A.25.6.2 One pipe penetrations was included within the wall system, the details of which are provided below:

Specimen	Description	Protection	Support
A	Ø317mm × 13.5mm HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® AN Acrylic sealant. PROMASEAL® FC300 collar fixed to both sides of the wall.	On unexposed side, 500mm, 1250mm and 2270mm from the unexposed face.

A.25.6.3 The plastic pipes above extended 500mm and 4200mm on the exposed and unexposed sides respectively, and were capped on the exposed side.

A.25.7 Instrumentation

A.25.7.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.25.8 Test Results

A.25.8.1 The test duration was 1182minutes.

A.25.8.2 The specimen achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
A	No failure at 182 minutes	No failure at 182 minutes

A.26 RELEVANCE OF AS1530.4-1990 TEST DATA TO AS1530.4-2005

A.26.1 General

A.26.1.1 The referenced test reports F91604, F91611, F91621 and F91624 describe tests conducted in accordance with AS1530.4-1990, which differs from the current standard AS1530.4-2005 and AS4072.1-2005.

A.26.1.2 The potential effect of these differences on specimen performance is discussed below.

Furnace Temperature Measurement

A.26.1.3 The specifications for furnace thermocouples in AS1530.4-2005 are similar to as specified in AS1530.4-1990.

Furnace Temperature Regime

A.26.1.4 AS1530.4-2005 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4\text{-}2005} = 345\log_{10}(8t+1) + 20$$

A.26.1.5 AS1530.4-1990 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4\text{-}1997} = 345\log_{10}(8t+1) + T_0;\ 10℃ \leq T_0 \leq 40℃$$

A.26.1.6 The parameters outlining the accuracy of control of the furnace temperature in AS1530.4-2005 and AS1530.4-1990 are not appreciably different.

Furnace Pressure Regime

A.26.1.7 For floors, AS1530.4-2005 specifies that the pressure of 20Pa is established at a position 100mm below the underside of the test specimen above that of the laboratory atmosphere.

A.26.1.8 Test report F91604 and F91611 state the pressure measured at the soffit of the concrete slab was 18-20Pa.

A.26.1.9 Test report F91621 and F91624 state the pressure measured at 100mm below the soffit of concrete slab was 8Pa after the first 5 minutes.

A.26.1.10 The pressure conditions therefore were less than prescribed by AS1530.4-2005 and this could have affected the integrity performance of the specimen particularly after gaps formed in the specimen and consideration of the results on a case by case basis is required.

Specimen

A.26.1.11 The AS1530.4-2005 standard prescribes that, for plastic pipes, the penetrating services shall extend a minimum of 500mm past the separating element into the furnace and a minimum of 2000mm past the separating element away from the furnace. The AS1530.4-1990 standard has the same minimum 2000mm extension requirement away from the furnace, but prescribes only 100mm minimum extension into the furnace. It is confirmed that some of the referenced test specimens did not meet the AS1530.4-2005 requirement for length of extension into the furnace.

A.26.1.12 Since the pipes are plastic, and have a corresponding low melting temperature, the length of the pipe extending into the furnace is not considered to be critical to the performance of the collar, as this length will melt away very early in the test regardless of length. The important aspect of specimen size is the length of pipe extending away from the furnace. This length requirement is 2000mm minimum and identical between the AS1530.4-1990 and AS1530.4-2005 standards.

Specimen Temperature Measurement

A.26.1.13 AS 1530.4-2005 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless steel sheaf having a wire diameter not exceeding 0.5 mm and an overall diameter of 3mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12mm diameter × 0.2mm thick copper disc. The disc shall be covered by 30 ± 0.5mm × 30 ± 0.5mm × 2.0 ± 0.5mm thick inorganic insulating pad having a density of 900 ± 100kg/m3.

A.26.1.14 AS 1530.4-1990 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless steel sheaf having a wire diameter not exceeding 0.5 mm and an overall diameter of 3mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12mm diameter × 0.2mm thick copper disc. The disc shall be covered by an oven-dry pad, not less than 30mm square, made from material having a √kQC value not greater than 150℃, and of such thickness as will give a thermal resistance (R = t/K) of 0.015 K/W – 0.025 K/W at 150℃.

A.26.1.15 For penetrating elements, AS1530.4-2005 requires thermocouples to be located as follows:

- At not less than two points located approximately 25mm from the edge of the hole made for the passage of the service (one in uppermost vertical plane).
- At least two points 25mm from the plane of the penetrated element and insulated topping, if any (one in uppermost vertical plane). Where the insulation or packing is taped or stepped, two additional thermocouples beyond the end of the step/taper if higher temperatures are expected at these points.
- Where practicable, at two points on the packing around the penetrating service.
- Before/during the heating period, additional thermocouples at any point appearing hotter than the points being measured.
- For the specimen constructions considered in this assessment, AS1530.4-1907 differs only in that it does not require thermocouples 400mm from the separating element.

Integrity Performance Criteria

A.26.1.16 AS1530.4-2005 deems integrity failure to have occurred upon collapse, sustained (10 seconds) flaming, ignition of an applied cotton pad or if a 6mm gap gauge can protrude into the furnace and can be moved 150mm along the gap (not applicable at the sill), or if a 25mm gap gauge can protrude into the furnace.

A.26.1.17 AS 1530.4-1990 deems integrity failure to occur upon collapse, the development of cracks, fissures or, other openings through which flames or hot gases can pass. AS1530.4-1990 differs in that it does not require the application of a cotton pad.

A.26.1.18 The integrity performance of the specimen tested in WFRA F91566, FP 1613, NI 4290 and NI 3790 should be used with caution after gaps formed in the specimen as the report does not include details of the cotton pads applied.

Insulation Performance Criteria

A.26.1.19 For plastic pipe services, AS1530.4-2005 deems insulation failure to have occurred upon a measured temperature rise of 180K by any of the specimen thermocouples. The insulation failure criterion in AS1530.4-1990 is the same.

A.26.2 Application of Test Data to AS1530.4-2005

A.26.2.1 The minor variations in furnace heating regimes and specimen thermocouple specification are not considered to significantly affect the behaviour of the specimens relevant to this assessment.

A.26.2.2 For the specimens tested in WFRA F91604, F91611 and F91624, supplementary standard BS476: Part 20: 1987 was used. There were no observations made for the specimens, which are considered to have warranted the application of a cotton pad. It is therefore considered the lower furnace pressure would not introduce significant weakness to the integrity performance.

A.26.2.3 For the specimens tested F91621, no integrity failure was observed during the test duration, it is therefore considered the lower furnace pressure would not introduce significant weakness to the integrity performance.

A.26.2.4 In light of the above, it is considered that the behaviour of the specimens relevant to this assessment in tests WFRA F91604, F91611 F91621 and F91624can be used as indicative of the relative insulation performance and integrity performance if similar specimens were tested in accordance with AS1530.4-2005.

A.27 RELEVANCE OF AS1530.4-1997 TEST DATA TO AS1530.4-2005

A.27.1 General

A.27.1.1 The referenced test reports WFRA F91730, F91741, F91742, F91754, F91765, FSP 0643, F91797 and WFRA F91783A describe tests conducted in accordance with AS1530.4-1997 and AS4072.1-1992, which differ from the current equivalent standards, AS1530.4-2005 and AS4072.1-2005.

A.27.1.2 The differences in test method considered capable of significantly altering specimen performance are discussed below.

Furnace Temperature Measurement

A.27.1.3 The specification for furnace thermocouples in AS1530.4-2005 is the same as specified in AS1530.4-1997.

Furnace Temperature Regime

A.27.1.4 AS1530.4-2005 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4\text{-}2005} = 345\log_{10}(8t+1) + 20$$

A.27.1.5 AS1530.4-1997 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4\text{-}1997} = 345\log_{10}(8t+1) + T_0;\ 10℃ \leq T_0 \leq 40℃$$

A.27.1.6 The heating regimes in AS1530.4-1997 and AS1530.4-2005 vary in that the former is an expression of the temperature rise in the furnace above an initial ambient temperature, and the latter although similar, assumes that the initial furnace temperature (T_0) is 20℃ irrespective of the actual ambient temperature. A test conducted in accordance with AS1530.4-1997 on a warm day (ambient temperature above 20℃) could therefore be slightly more onerous than that in accordance with AS1530.4-2005.

A.27.1.7 The parameters outlining the accuracy of control of the furnace temperature in AS1530.4-2005 and AS1530.4-1997 are not appreciably different.

Furnace Pressure Regime

A.27.1.8 The furnace pressure level and control parameters in AS1530.4-2005 and AS1530.4-1997 are not appreciably different.

A.27.1.9 For horizontal element, AS1530.4-2005 and AS1530.4-1997 specifies that a pressure of 20Pa shall be established at 100mm below the soffit of the concrete slab.

Furnace Thermocouples

A.27.1.10 The furnace thermocouples specified in both AS1530.4-2005 and AS1530.4-1997are 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.27.1.11 The relative location of the furnace thermocouples to the exposed face of the specimen, for both AS1530.4-2005 and AS1530.4-1997, is 100mm +10mm.

Specimen Size, Support and End Conditions

A.27.1.12 The AS1530.4-2005 standard prescribes that, for plastic pipes, the penetrating services shall extend a minimum of 500mm past the separating element into the furnace and a minimum of 2000mm past the separating element away from the furnace. The AS1530.4-1997 standard has the same minimum 2000mm extension requirement away from the furnace, but prescribes only 100mm minimum extension into the furnace. It is confirmed that some of the referenced test specimens did not meet the AS1530.4-2005 requirement for length of extension into the furnace.

A.27.1.13 Since the pipes are plastic, and have a corresponding low melting temperature, the length of the pipe extending into the furnace is not considered important, as this length will melt away very early in the test. The important aspect of specimen size is the length of pipe extending away from the furnace, a requirement which is identical between the AS1530.4-1997 and AS1530.4-2005 standards.

Specimen Temperature Measurement

A.27.1.14 AS 1530.4-2005 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless steel sheaf having a wire diameter not exceeding 0.5 mm and an overall diameter of 3mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12mm diameter × 0.2mm thick copper disc. The disc shall be covered by 30 ± 0.5mm × 30 ± 0.5mm × 2.0 ± 0.5mm thick inorganic insulating pad having a density of 900 ± 100kg/m3.

A.27.1.15 AS 1530.4-1997 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless steel sheaf having a wire diameter not exceeding 0.5 mm and an overall diameter of 3mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12mm diameter × 0.2mm thick copper disc. The disc shall be covered by an oven-dry pad, not less than 30mm square, made from material having a √kQC value not greater than 150℃, and of such thickness as will give a thermal resistance (R = t/K) of 0.015 K/W – 0.025 K/W at 150℃.

A.27.1.16 For penetrating elements, AS1530.4-2005 requires thermocouples to be located as follows:

- At not less than two points located approximately 25mm from the edge of the hole made for the passage of the service (one in uppermost vertical plane).
- At least two points 25mm from the plane of the penetrated element and insulated topping, if any (one in uppermost vertical plane). Where the insulation or packing is taped or stepped, two additional thermocouples beyond the end of the step/taper if higher temperatures are expected at these points.
- Where practicable, at two points on the packing around the penetrating service.
- Before/during the heating period, additional thermocouples at any point appearing hotter than the points being measured.
- For the specimen constructions considered in this assessment, AS1530.4-1997 differs only in that it does not require one of the thermocouples on the separating element and 25mm from the plane of the separating element to be located in the uppermost vertical plane.

Integrity Performance Criteria

A.27.1.17 For plastic pipe services, AS1530.4-2005 deems integrity failure to have occurred upon collapse, sustained (10 seconds) flaming, ignition of an applied cotton pad or if a 6mm gap gauge can protrude into the furnace and can be moved 150mm along the gap (not applicable at the sill), or if a 25mm gap gauge can protrude into the furnace.

A.27.1.18 AS 1530.4-1997 deems integrity failure to occur upon collapse, the development of cracks, fissures, or other openings through which flames or hot gases can pass.

A.27.1.19 The integrity requirements for AS1530.4-2005 are different after the formation of gaps on the specimen that would require the application of the cotton pad tests. Prior to the formation of gaps, the criteria are not appreciably different.

A.27.1.20 It is possible for a gap or opening to form which does not allow a straight line of sight into the furnace but allows sufficient passage of hot gases to ignite a cotton wool pad. Nevertheless, such circumstances did not occur according to the observations of the referenced tests WFRA F91730, F91741, F91742, F91754, F91765, FSP 0643, F91797 and WFRA F91783A.

A.27.1.21 As those specimens which failed the integrity criterion were due to sustained flaming or the formation of a through gap with an uninterrupted view, the slight variations in integrity criterion would not be expected to significantly affect the integrity performance of the service penetrations in the referenced tests if tested in accordance with AS1530.4-2005.

Insulation Performance Criteria

A.27.1.22 For plastic pipe services, AS1530.4-2005 deems insulation failure to have occurred upon a measured temperature rise of 180K by any of the specimen thermocouples. The insulation failure criterion in AS1530.4-1997 is the same.

A.27.2 Application of Test Data to AS1530.4-2005

A.27.2.1 The minor variations in furnace heating regimes and specimen thermocouple specification are not considered to significantly affect the behaviour of the specimens relevant to this assessment.

A.27.2.2 It is confirmed that the data referenced in WFRA F91730, F91741, F91742, F91754, F91765, FSP 0643, F91797 and WFRA F91783A can be used as indicative of the performance if similar specimens were tested in accordance with AS1530.4-2005.

A.28 TEST REPORT – EWFA 2517300.2

A.28.1 Report Sponsor

A.28.1.1 Speedpanel (VIC) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137.

A.28.2 Test Laboratory

A.28.2.1 Exova Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, VIC, 3175.

A.28.3 Test Date

A.28.3.1 The fire resistance test was conducted on 27th October, 2010.

A.28.4 Test Standard

A.28.4.1 The test was conducted in accordance with AS1530.4-2005.

A.28.5 Variations to Test Method

A.28.5.1 The dampers were not tested in full accordance with AS1530.4-2005, as a pressure difference was not applied across the dampers.

A.28.5.2 The cable system included cables which protruded 75mm (less than the required 200mm minimum) beyond the extents of the penetration sealing system.

A.28.6 General Description of Tested Specimen

A.28.6.1 The supporting construction comprised 77mm thick Speedpanel panels vertically oriented to form a vertical wall system.

A.28.6.2 Several penetrations were included within the wall system. Only the cable and plastic pipe penetrations are relevant to this assessment, the details of which are provided below:

Specimen	Description	Protection	Support
E	Ø158mm × 4.3mm uPVC pipe	Annular gap between pipe and wall sealed to 5mm depth with PROMASEAL® SupaMastic sealant. PROMASEAL® FC150 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
G	Ø105mm × 3.5mm uPVC pipe	Annular gap between pipe and wall sealed to 5mm depth with PROMASEAL® SupaMastic sealant. PROMASEAL® FC100 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
H	Ø42.8mm × 2.2mm uPVC pipe	Annular gap between pipe and wall sealed to 5mm depth with PROMASEAL® SupaMastic sealant. PROMASEAL® FC40 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
J	PVC-insulated power cables, as per AS1530.4-2005 Appendix D1 Group A. Cables were secured to LT3-300-3 Burndy® Ladder-tray.	Annular space between penetrating service and wall filled with PROMASEAL® IBS™ material. PROMASEAL® SupaMastic sealant applied on both exposed and unexposed sides to 10mm depth. Entire service wrapped in PromaBlanket® CS, which was secured with 25mm wide hook-and-loop fabric straps at 250mm centres. The sealant was then formed into a fillet that extended nominally 50mm along the blanket and on the wall.	On unexposed side, 200mm, 500mm and 1400mm from the unexposed face.

A.28.6.3 The plastic pipes above extended 525mm and 2000mm on the exposed and unexposed sides respectively, and were capped on the exposed side.

A.28.6.4 The cable penetration extended 525mm and 1400mm on the exposed and unexposed sides respectively.

A.28.7 Instrumentation

A.28.7.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.28.8 Test Results

A.28.8.1 The test duration was 195 minutes.

A.28.8.2 The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
E	147 minutes – flaming for 10 seconds or more at wall-collar interface.	67 minutes on side of collar
G	No failure at 195 minutes.	76 minutes on wall 25mm from collar edge
H	No failure at 195 minutes.	139 minutes on wall 25mm from collar
J	142 minutes – flaming for 10 seconds or more at wall-collar interface.	102 minutes

A.28.8.3 The cable service was instrumented with thermocouples at several locations on the blanket material and on the surface of the cables (inside the blanket).

A.28.8.4 A thermocouple was placed on a cable (single-core, 630mm^2) in line with the exposed face of the wall, and one was placed on the same cable in line with the unexposed face of the wall. The difference between the temperatures measured at these locations remained below 50°C for approximately 53 minutes, at which time the difference rose steadily to approximately 240°C at around 90 minutes. The difference then decreased steadily to approximately 170°C at 120 minutes. At 120 minutes, the temperatures measured on the cable in line with the exposed and unexposed wall faces were 853°C and 683°C respectively.

A.28.8.5 A thermocouple was positioned on the blanket material directly above the single-core, 630mm^2 cable, 25mm from the edge of the sealant fillet. The temperature measured at this location rose reasonable steadily to 253°C at 120 minutes.

A.29 RELEVANCE OF EWFA 2517300.2 TEST DATA TO AS1530.4-2005

A.29.1 Specimen Size

A.29.1.1 AS1530.4-2005 specifies that the cable service shall project a minimum of 500mm on both sides of the supporting construction, of which at least 200mm (and maximum 500mm on the unexposed side) must extend beyond the extremities of the penetration sealing system (any coating, wrapping or other protection to the service).

A.29.1.2 The cable system tested in EWFA 2517300.2 included cables that penetrated 75mm from the penetration sealing system on the unexposed side (125mm shorter than the minimum required by the standard). The cable tray itself extended 1400mm on the unexposed side of the wall, and was supported at 200mm, 500mm and 1400mm from the unexposed face.

A.29.1.3 In this particular case, the variation in unprotected cable length is not considered to be a less onerous condition than the standard requires in regard to thermal performance. The AS1530.4-2005 standard requires thermocouples to be placed 25mm after the termination of the penetration sealing system only. It is considered having less cable length after this point than is required allows less heat transfer out of the cables via radiation and convection.

A.29.1.4 It is noted that less copper volume is less onerous in regard to the structural performance of the cable tray. The tested cable system was supported at 200mm, 500mm and 1400mm from the unexposed face. The proposed construction prescribes support at 200mm from the unexposed wall face, then at 300mm from the face of the wall.

A.29.1.5 In light of the above discussion it is considered that the behaviour of the cable specimen tested in EWFA 2517300.2 may be used as indicative of the behaviour of a similar specimen, with supports as described above, tested in full accordance with AS1530.4-2005.

A.30 TEST REPORT – FSP 1464

A.30.1 Report Sponsor

A.30.1.1 Lend Lease Project Management and Construction (Australia) Pty Ltd.

A.30.2 Test Laboratory

A.30.2.1 CSIRO, 14 Julius Avenue, Riverside Corporate Park, North Ryde, NSW 2113.

A.30.3 Test Date

A.30.3.1 The fire resistance test was conducted on 25th March, 2011.

A.30.4 Test Standard

A.30.4.1 The test was conducted in accordance with AS1530.4-2005.

A.30.5 Variations to Test Method

A.30.5.1 None stated.

A.30.6 General Description of Tested Specimen

A.30.6.1 The supporting construction comprised 92mm wide steel studs clad each side with two layers of 16mm Powerscape board.

A.30.6.2 Several penetrations were included within the wall system. Only the plastic pipes protected with FC collars are relevant to this assessment. These specimens are summarised below:

Specimen	Description	Protection	Support
A	Ø56mm × 3mm Coestilen® HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® SupaMastic sealant. PROMASEAL® FC65 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
B	Ø75mm × 4mm Coestilen® HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® SupaMastic sealant. PROMASEAL® FC80 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
C	Ø125mm × 6mm Coestilen® HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® SupaMastic sealant. PROMASEAL® FC150 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
D	Ø200mm × 7mm Coestilen® HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® SupaMastic sealant. PROMASEAL® FC250 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.

A.30.6.3 The plastic pipes above extended 525mm and 2000mm on the exposed and unexposed sides respectively, and were capped on the exposed side.

A.30.7 Instrumentation

A.30.7.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.30.8 Test Results

A.30.8.1 The test duration was 121 minutes.

The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
A	120*	120* (max. temp. rise 50K)
B	120*	120* (max. temp. rise 50K)
C	120*	120* (max. temp. rise 45K)
D	120*	120* (max. temp. rise 45K)

A.31 TEST REPORT – FSRG A-07-508A

A.31.1 Report Sponsor

A.31.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead, NSW, 2152.

A.31.2 Test Laboratory

A.31.2.1 Fire Science Research Group, 1 Scotland Road, Mile End South, Adelaide, SA, 5031.

A.31.3 Test Date

A.31.3.1 The fire resistance test was conducted on 13th September, 2007.

A.31.4 Test Standard

A.31.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.31.5 Variations to Test Method

A.31.5.1 None stated.

A.31.6 General Description of Tested Specimen

A.31.6.1 The separating element frame consisted of an 1860 × 1860 × 104mm thick partition comprising 64mm wide steel studs and tracks (0.5mm) with vertical studs spaced at 600mm centres. One layer of 20mm thick PROMATECT® 100 board was screw fixed to the frame each side of the frame at 300mm centres. Horizontal joints were sealed with one layer of Easy-Finish topping compound.

A.31.6.2 Pipe penetrations were included within the wall system. Only the uPVC pipe is relevant to this assessment, the details of which are provided below:

Specimen	Description	Protection	Support
A	Ø160mm uPVC pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® AN Acrylic sealant. PROMASTOP® UniCollar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.

A.31.6.3 The plastic pipe above extended 500mm and 2000mm on the exposed and unexposed sides respectively, and was capped on the exposed side.

A.31.7 Instrumentation

A.31.7.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.31.8 Test Results

A.31.8.1 The test duration was 121 minutes.

A.31.8.2 The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
A	No failure at 121 minutes.	No failure at 121 minutes (max. temp. rise on collar, wall and pipe were 106K, 101K and 143K respectively).

A.32 TEST REPORT – FSRG A-08-532

A.32.1 Report Sponsor

A.32.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead, NSW, 2152.

A.32.2 Test Laboratory

A.32.2.1 Fire Science Research Group, 1 Scotland Road, Mile End South, Adelaide, SA, 5031.

A.32.3 Test Date

A.32.3.1 The fire resistance test was conducted on 27th February, 2008.

A.32.4 Test Standard

A.32.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.32.5 Variations to Test Method

A.32.5.1 None stated.

A.32.6 General Description of Tested Specimen

A.32.6.1 The separating element frame consisted of 64mm wide steel studs and tracks (0.5mm) with vertical studs spaced at 600mm centres. Two layers of 16mm Fyrchek boards were fixed to both faces of the frame into the vertical studs with 6g × 40mm S-point screws at 300mm centres. Horizontal joints were sealed with one layer of Easy-Finish topping compound.

A.32.6.2 Two pipe penetrations were included within the wall system, the details of which are provided below:

Specimen	Description	Protection	Support
A	Ø110.7mm × 3.4mm uPVC pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® AN Acrylic sealant. PROMASEAL® FC100 collar fixed to both sides of the wall.	On unexposed side, 350mm and 1850mm from the unexposed face.
B	Ø110.4mm × 5.0mm HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® AN Acrylic sealant. PROMASEAL® FC100 collar fixed to both sides of the wall.	On unexposed side, 350mm and 1850mm from the unexposed face.

A.32.6.3 The plastic pipes above extended 500mm and 2000mm on the exposed and unexposed sides respectively, and were capped on the exposed side.

A.32.7 Instrumentation

A.32.7.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.32.8 Test Results

A.32.8.1 The test duration was 182 minutes.

A.32.8.2 The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
A	No failure at 182 minutes.	177 minutes – Roving thermocouple on casing of collar.
B	156 minutes – ignition of cotton pad applied at pipe-collar interface.	153 minutes – Thermocouple on side of pipe, 25mm from the collar.

A.33 TEST REPORT – FSRG A-08-528

A.33.1 Report Sponsor

A.33.1.1 Promat Australia Pty Ltd, Unit 1/175 Briens Road, Northmead, NSW, 2152.

A.33.2 Test Laboratory

A.33.2.1 Fire Science Research Group, 1 Scotland Road, Mile End South, Adelaide, SA, 5031.

A.33.3 Test Date

A.33.3.1 The fire resistance test was conducted on 8th February, 2008.

A.33.4 Test Standard

A.33.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.33.5 Variations to Test Method

A.33.5.1 None.

A.33.6 General Description of Tested Specimen

A.33.6.1 The separating element frame consisted of 64mm wide steel studs and tracks (0.5mm) with vertical studs spaced at 600mm centres. Two layers of 16mm Fyrchek boards were fixed to both faces of the frame into the vertical studs with 6g × 40mm S-point screws at 300mm centres. Horizontal joints were sealed with one layer of Easy-Finish topping compound.

A.33.6.2 Two pipe penetrations were included within the wall system, the details of which are provided below:

Specimen	Description	Protection	Support
A	Ø40.9mm × 3.15mm HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® AN Acrylic sealant. PROMASEAL® FC40 collar fixed to both sides of the wall.	On unexposed side, 450mm and 1950mm from the unexposed face.
B	Ø63.5mm × 3.3mm HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® AN Acrylic sealant. PROMASEAL® FC65 collar fixed to both sides of the wall.	On unexposed side, 450mm and 1950mm from the unexposed face.

A.33.6.3 The plastic pipes above extended 500mm and 2000mm on the exposed and unexposed sides respectively, and were capped on the exposed side.

A.33.7 Instrumentation

A.33.7.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.33.8 Test Results

A.33.8.1 The test duration was 194 minutes.

A.33.8.2 The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
A	194 minutes – ignition of cotton pad applied at pipe-collar interface.	194 minutes – Thermocouple on top of pipe, 25mm from the collar
B	168 minutes – ignition of cotton pad applied at pipe-collar interface.	168 minutes – Thermocouple on top of pipe, 25mm from the collar.

A.34 TEST REPORT – FSP 1471

A.34.1 Report Sponsor

A.34.1.1 Lend Lease Project Management and Construction (Australia) Pty Ltd.

A.34.2 Test Laboratory

A.34.2.1 CSIRO, 14 Julius Avenue, Riverside Corporate Park, North Ryde, NSW 2113.

A.34.3 Test Date

A.34.3.1 The fire resistance test was conducted on 6th May, 2011.

A.34.4 Test Standard

A.34.4.1 The test was conducted in accordance with AS1530.4-2005.

A.34.5 Variations to Test Method

A.34.5.1 None stated.

A.34.6 General Description of Tested Specimen

A.34.6.1 The supporting construction comprised 92mm wide steel studs clad each side with two layers of 16mm Powerscape board.

A.34.6.2 Three polyethylene pipe penetrations were included within the wall system. These specimens are summarised below:

Specimen	Description	Protection	Support
A	Ø160mm × 7.5mm Coestilen® HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® SupaMastic sealant. PROMASEAL® FC150 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
B	Ø110mm × 5mm Coestilen® HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® SupaMastic sealant. PROMASEAL® FC100 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
C	Ø250mm × 8mm Coestilen® HDPE pipe	Annular gap between pipe and wall sealed to depth of board with PROMASEAL® SupaMastic sealant. PROMASEAL® FC250 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.

A.34.6.3 The plastic pipes above extended 500mm and 2000mm on the exposed and unexposed sides respectively, and were capped on the exposed side.

A.34.7 Instrumentation

A.34.7.1 The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.34.8 Test Results

A.34.8.1 The test duration was 121 minutes.

The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
A	120*	120* (max. temp. rise 66K)
B	120*	120* (max. temp. rise 83K)
C	120*	120* (max. temp. rise 68K after initial 83K rise spike at around 10 minutes)

A.35 TEST REPORT – FSP 0643

A.35.1 Report Sponsor

A.35.1.1 Promat Fyreguard Pty Ltd, 12 Rosslyn Street, Mile End, SA, 5031.

A.35.2 Test Laboratory

A.35.2.1 CSIRO – Division of Building, Construction and Engineering, 14 Julius Avenue, Riverside Corporate Park, North Ryde, NSW, 2113.

A.35.3 Test Date

A.35.3.1 The fire resistance test was conducted on 10th February, 1999.

A.35.4 Test Standard

A.35.4.1 The test was conducted in accordance with AS1530.4-1997 and AS4072.1-1992.

A.35.5 Variations to Test Method

A.35.5.1 None stated.

A.35.6 General Description of Tested Specimen

A.35.6.1 The test construction comprised a drywall construction penetrated by pipe service penetrations. The mounting frame comprised an 1150mm × 1150mm four sided construction with two opposing double brick walls and two plasterboard walls. The top of the construction was closed off with 120mm thick reinforced concrete slab.

A.35.6.2 The drywalls were constructed of two layers of 16mm fire rated plasterboard on each side of 64 CS 55 studs.

A.35.6.3 Only specimen H is relevant to this assessment, the details of which are provided below:

Specimen	Description	Protection	Support
H	Ø43mm (nominal) uPVC pipe	PROMASEAL® FC40 collar fixed to both sides of the wall.	Supported on unexposed side at 1000mm intervals

A.35.6.4 The plastic pipe above extended 100mm and 2000mm on the exposed and unexposed sides respectively, and was capped on the exposed side.

A.35.7 Instrumentation

A.35.7.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.35.8 Test Results

A.35.8.1 The test duration was 186 minutes.

A.35.8.2 The specimen achieved the following performance when evaluated against the failure criteria of AS1530.4-1997:

Specimen	Integrity	Insulation
H	No failure at 186 minutes.	131 minutes – Thermocouple on top of collar, 25mm from the wall.

A.36 TEST REPORT – WFRA F91783A

A.36.1 Report Sponsor

A.36.1.1 Promat Fyreguard Pty Ltd, 12 Rosslyn Street, Mile End, SA, 5031.

A.36.2 Test Laboratory

A.36.2.1 Warrington Fire Research (Aust) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, VIC, 3175.

A.36.3 Test Date

A.36.3.1 The fire resistance test was conducted on 27th August, 1999.

A.36.4 Test Standard

A.36.4.1 The test was conducted in accordance with AS1530.4-1997 and AS4072.1-1992.

A.36.5 Variations to Test Method

A.36.5.1 None stated.

A.36.6 General Description of Tested Specimen

A.36.6.1 The supporting construction comprised a 3m × 3m steel-framed plasterboard wall. The studs were 64mm "C-H" studs and were clad with a single layer of 25mm thick CSR shaft liner on the exposed side and two layers of 16mm thick CSR Gyprock Fyrchek on the unexposed side.

A.36.6.2 Several penetrations were included within the wall system. Only services 5, 6, 7 and 8 are relevant to this assessment, the details of which are provided below:

Specimen	Description	Protection	Support
5	Ø55.7mm × 2.2mm uPVC pipe	Annular gap between pipe and wall sealed to with PROMASEAL® Acrylic sealant to depth of board. PROMASEAL® FC50 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
6	Ø68.9mm × 2.8mm uPVC pipe	Annular gap between pipe and wall sealed to with PROMASEAL® Acrylic sealant to depth of board. PROMASEAL® FC65 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
7	Ø82.5mm × 3.0mm uPVC pipe	Annular gap between pipe and wall sealed to with PROMASEAL® Acrylic sealant to depth of board. PROMASEAL® FC80 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face.
8	Ø110mm × 4.3mm uPVC pipe	Annular gap between pipe and wall sealed to with PROMASEAL® Acrylic sealant to depth of board. PROMASEAL® FC100 collar fixed to both sides of the wall.	On unexposed side, 500mm and 1500mm from the unexposed face

A.36.6.3 The plastic pipes above extended between 490 and 565mm on the exposed side and 2000mm on the unexposed side, and were capped on the exposed side.

A.36.7 Instrumentation

A.36.7.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.36.8 Test Results

A.36.8.1 The test duration was 121 minutes.

A.36.8.2 The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-1997:

Specimen	Integrity	Insulation
5	No failure at 121 minutes.	No failure at 121 minutes.
6	No failure at 121 minutes.	No failure at 121 minutes.
7	No failure at 121 minutes.	No failure at 121 minutes.
8	No failure at 121 minutes.	No failure at 121 minutes.

A.37 TEST REPORT – WFRA 41088AS.1

A.37.1 Report Sponsor

A.37.1.1 Promat International (Asia Pacific) Ltd, 7E Jalan 1/57D, Off Jalan Segambut, 51200 Kuala Lumpur, Malaysia.

A.37.2 Test Laboratory

A.37.2.1 Warrington Fire Research (Aust) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, VIC, 3175.

A.37.3 Test Date

A.37.3.1 The fire resistance test was conducted on 22nd April, 2004.

A.37.4 Test Standard

A.37.4.1 The test was conducted in accordance with AS1530.4-1997.

A.37.5 Variations to Test Method

A.37.5.1 None.

A.37.6 General Description of Tested Specimen

A.37.6.1 The test assembly comprised a nominal 3000mm × 3000mm non-loadbearing PROMATECT® 100 steel stud partition system installed within a concrete block lined steel restraint frame. The partition consisted of 20mm thick PROMATECT® 100 board fixed to each side of 64mm steel studs and tracks with plasterboard screws. The west edge of the partition replicated a free edge and was backfilled with nominally 20mm thick ceramic fibre and the other edge was secured to the concrete block lined steel restraint frame.

A.37.7 Instrumentation

A.37.7.1 The instrumentation was provided and applied in accordance with AS1530.4-1997.

A.37.8 Test Results

A.37.8.1 The test duration was 132 minutes.

A.37.8.2 The board joints on the fire side were noted to open during the test, however no observations were made on the non-fire side which suggest integrity failure.

A.37.8.3 Insulation was maintained for a period of 128 minutes, when the average temperature rise on the wall was measured to exceed 140K.

A.37.8.4 Thermocouples were placed within the partition cavity on the studs and on the internal side of the board. These measurements indicate that at 120 minutes, the temperature drop across the fire side board was approximately 417K, and the temperature drop across the non-fire side board was approximately 370K.

A.38 RELEVANCE OF AS1530.4-1997 TEST DATA TO AS1530.4-2005

A.38.1 General

A.38.1.1 The referenced test reports FSP 0643, WFRA F91783A and WFRA 41088AS.1 describe tests conducted in accordance with AS1530.4-1997 and AS4072.1-1992, which differ from the current equivalent standards, AS1530.4-2005 and AS4072.1-2005.

A.38.1.2 The differences in test method considered capable of significantly altering specimen performance are discussed below.

Furnace Temperature Measurement

A.38.1.3 The specification for furnace thermocouples in AS1530.4-2005 is the same as specified in AS1530.4-1997.

Furnace Temperature Regime

A.38.1.4 AS1530.4-2005 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4-2005} = 345\log_{10}(8t+1)+20$$

A.38.1.5 AS1530.4-1997 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4-1997} = 345\log_{10}(8t+1)+T_o\ ,\ 10^oC \le T_o \le 40^oC$$

A.38.1.6 The parameters outlining the accuracy of control of the furnace temperature in AS1530.4-2005 and AS1530.4-1997 are not appreciably different.

Furnace Pressure Regime

A.38.1.7 For penetrations, AS1530.4-2005 specifies that a pressure of 15 ± 3Pa shall be established at the centre of the lowest penetration service.

A.38.1.8 For walls, AS1530.4-2005 specifies that the neutral axis shall be established 500mm from the base.

A.38.1.9 It has been confirmed that for the specimens of interest in test reports FSP 0643, WFRA F91783A and WFRA 41088AS.1, the pressure was more than 12Pa for the test duration. The pressure conditions thus adhered to that prescribed by AS1530.4-2005.

Specimen

A.38.1.10 AS1530.4-2005 specifies that plastic pipe services shall project 500mm minimum on the exposed side and 2000mm minimum on the unexposed side of the supporting construction, of which at least 200mm (and maximum 500mm on the unexposed side) must extend beyond the extremities of the penetration sealing system (any coating, wrapping or other protection to the service).

A.38.1.11 The service relevant to this assessment in FSP 0643 was stated to project 100mm on the exposed side and 2000mm on the unexposed side. The fire side extension is thus below that required by AS1530.4-2005.

A.38.1.12 The services relevant to this assessment in WFRA F91783 were stated to project between 490mm and 565mm on the exposed side and 2000mm on the unexposed side. The fire side extension in some instances was slightly below that required by AS1530.4-2005.

Specimen Temperature Measurement

A.38.1.13 AS 1530.4-2005 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless steel sheaf having a wire diameter not exceeding 0.5 mm and an overall diameter of 3mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12mm diameter × 0.2mm thick copper disc. The disc shall be covered by 30 ± 0.5mm × 30 ± 0.5mm × 2.0 ± 0.5mm thick inorganic insulating pad having a density of 900 ± 100kg/m^3.

A.38.1.14 AS 1530.4-1997 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless steel sheaf having a wire diameter not exceeding 0.5 mm and an overall diameter of 3mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12mm diameter × 0.2mm thick copper disc. The disc shall be covered by an oven-dry pad, not less than 30mm square, made from material having a

$\sqrt{kQC}$ value not greater than 150°C, and of such thickness as will give a thermal resistance (R = t/K) of 0.015 K/W – 0.025 K/W at 150°C.

A.38.1.15 For penetrating elements installed in vertical separating elements, AS1530.4-2005 requires thermocouples to be located as follows:

a) At not less than two points located approximately 25mm from the edge of the hole made for the passage of the service (one in uppermost vertical plane).

b) At least two points 25mm from the plane of the penetrated element and insulated topping, if any (one in uppermost vertical plane). Where the insulation or packing is taped or stepped, two additional thermocouples beyond the end of the step/taper if higher temperatures are expected at these points.

c) Where practicable, at two points on the packing around the penetrating service.

d) Before/during the heating period, additional thermocouples at any point appearing hotter than the points being measured.

A.38.1.16 For the specimen constructions considered in this assessment, AS1530.4-1997 differs only in that it does not require one of the thermocouples on the separating element and 25mm from the plane of the separating element to be located in the uppermost vertical plane

A.38.1.17 FSP 0643 does not explicitly state the location of specimen thermocouples; however the photos of the specimen relevant to this assessment confirm that on thermocouple on the wall and one 25mm form the plane of the wall were located in the uppermost vertical plane.

A.38.1.18 The description of thermocouple locations in WFRA F91783A confirms that the specimens relevant to this assessment contained thermocouples in the locations prescribed by AS1530.4-2005.

A.38.1.19 Since the data from WFRA 41088AS.1 is to be used only for stickability-related behaviour and for indicative values of temperature drop across the board, any variations in prescribed temperature measurement locations are not significant in this instance.

Integrity Performance Criteria

A.38.1.20 For plastic pipe services, AS1530.4-2005 deems integrity failure to have occurred upon collapse, sustained (10 seconds) flaming, ignition of an applied cotton pad or if a 6mm gap gauge can protrude into the furnace and can be moved 150mm along the gap (not applicable at the sill), or if a 25mm gap gauge can protrude into the furnace.

A.38.1.21 AS 1530.4-1997 deems integrity failure to occur upon collapse, the development of cracks, fissures, or other openings through which flames or hot gases can pass.

A.38.1.22 There were no observations made for the specimen relevant to this assessment in FSP 0643 which are considered to have warranted the application of a cotton pad.

A.38.1.23 There were no observations made for the specimens relevant to this assessment in WFRA F91783A which are considered to have warranted the application of a cotton pad.

A.38.1.24 Since the data from WFRA 41088AS.1 is to be used only for stickability-related behaviour and for indicative values of temperature drop across the board, any variations in integrity performance criteria are not significant in this instance.

Insulation Performance Criteria

A.38.1.25 For plastic pipe services, AS1530.4-2005 deems insulation failure to have occurred upon a measured temperature rise of 180K by any of the specimen thermocouples. The insulation failure criterion in AS1530.4-1997 is the same.

Application of Test Data to AS1530.4-2005.

A.38.1.26 The minor variations in furnace heating regimes and specimen thermocouple specification are not considered to significantly affect the behaviour of the specimens relevant to this assessment.

A.38.1.27 For the specimens tested in WFRA F91783, considering the materials and processes involved, the minor variations on specimen size (less than 10mm difference) are not considered to reduce the tested specimen performance below -/120/120 minutes.

A.38.1.28 For the specimen tested in FSP 0643, considering the materials and processes involved, and since a large margin of performance was attained (-/186/131), the variation in specimen size is not considered to reduce the tested specimen performance below -/120/120 minutes.

A.38.1.29 In light of the above, it is considered that the behaviour of the specimens relevant to this assessment in tests FSP 0643 and WFRA F91783A can be used as indicative of the performance if similar specimens were tested in accordance with AS1530.4-2005 up to 120 minutes.

A.38.1.30 Also, in light of the above, it is considered that the stickability and thermal behaviour (temperature drop across board) of the board tested in WFRA 41088AS.1 can be used as indicative of the behaviour if a similar specimen were tested in accordance with AS1530.4-2005 up to 120 minutes.

A.39 TEST REPORT – FR 4115

A.39.1 Report Sponsor

A.39.1.1 Promat Building Systems Pty Ltd, 10 Science Park Road, 3 – 14 The Alpha, Singapore Science Park II, Singapore 117684.

A.39.2 Test Laboratory

A.39.2.1 BRANZ Limited, Moonshine Road, Judgeford, Porirua City, New Zealand.

A.39.3 Test Date

A.39.3.1 The fire resistance test was conducted on 4th February, 2009.

A.39.4 Test Standard

A.39.4.1 The test was conducted in accordance with BS476-22:1987.

A.39.5 Variations to Test Method

A.39.5.1 None stated.

A.39.6 General Description of Tested Specimen

A.39.6.1 The test assembly comprised a nominal 3000mm wide × 4000mm high non-loadbearing partition. The frame was a 64mm wide steel frame with studs at nominal 610mm centres. The frame was lined on each face with one layer of 20mm thick PROMATECT® 50 board, which was fixed to the studs at 200mm maximum centres.

A.39.7 Instrumentation

A.39.7.1 The instrumentation was provided and applied in accordance with BS476-22:1987.

A.39.8 Test Results

A.39.8.1 The test duration was 154 minutes.

A.39.8.2 No integrity failure was recorded for the test duration.

A.39.8.3 The average temperature measured on the unexposed face exceeded the 140K rise at 132 minutes. The maximum temperature measured on the unexposed face exceeded the 180K rise at approximately 140 minutes.

A.40 RELEVANCE OF BS476-22:1987 TEST DATA TO AS1530.4-2005

A.40.1 General

A.40.1.1 The fire resistance test FR 4115 was conducted in accordance with BS476-22:1987, which differs from AS1530.4-2005.

A.40.1.2 The differences in test method considered capable of significantly altering specimen performance are discussed below.

Furnace Temperature Measurement

A.40.1.3 The furnace thermocouples specified in AS1530.4-2005 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.40.1.4 The furnace thermocouples specified in AS1530.4-2005 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.40.1.5 The furnace thermocouple types in BS476-20:1987 shall be one of the following two types:

- Bare nickel chromium/nickel aluminium wires, 0.75mm to 1.5mm in diameter, welded or crimped together at their ends and supported and insulated from each other in a twin bore porcelain insulator except that the wires for 25mm approximately from the weld/crimp shall be exposed and separated from each other by at least 5mm. (replace or recalibrate after 6hrs of usage).
- Nickel chromium/nickel aluminium wire contained within a mineral insulation and in a heat resisting steel sheath of diameter 1.5mm, the hot junctions being electrically insulated from the sheath. The thermocouple hot junction shall project 25mm from a porcelain insulator. The assembly shall have a response time on cooling in air of not greater than 30s.

A.40.1.6 The relative location of the furnace thermocouples to the exposed face of the specimen, for both AS1530.4-2005 and BS476-20:1987, is 100mm +10mm.

Furnace Temperature Regime

A.40.1.7 The furnace temperature regime for fire resistance tests conducted in accordance with AS1530.4-2005 is the same as that specified in BS476-20:1987.

A.40.1.8 The parameters outlining the accuracy of control of the furnace temperature in AS1530.4-2005 and BS476-20:1987 are not appreciably different.

Furnace Pressure Regime

A.40.1.9 For walls, AS1530.4-2005 specifies that the neutral axis shall be established 500mm from the base.

A.40.1.10 For walls, BS476-20:1987 specifies that the neutral axis shall be established 1000mm from the base.

Specimen Temperature Measurement

A.40.1.11 The specimen thermocouple specification is generally the same for AS1530.4-2005 and BS476-20:1987.

A.40.1.12 For walls, AS1530.4-2005 specifies maximum temperature thermocouple locations as –

- at the head of the specimen at mid-width
- at the head of the specimen in line with a stud
- at the junction of a horizontal and vertical joint in a framed or prefabricated wall system
- at the mid-height of one fixed edge
- at the mid-height of one free edge (100mm from the edge)
- At mid-width, where possible, with the centre of the pad 15mm from the edge of a horizontal joint (positive pressure zone)

- At mid-height, where possible, with the centre of the pad 15mm from the edge of a vertical joint (positive pressure zone)

A.40.1.13 BS476-22:1987 does not nominate specific locations for measuring maximum temperature rise.

A.40.1.14 FR 4115 confirms that thermocouples for measuring maximum temperature were not placed in accordance with AS1530.4-2005.

A.40.1.15 Both standards prescribe the same locations for measuring specimen average temperature, being at the centre and four quarter points.

Integrity Performance Criteria

A.40.1.16 The integrity criteria for AS1530.4-2005 and BS476-20:1987 are not appreciably different.

Insulation Performance Criteria

A.40.1.17 Apart from the variation in specimen thermocouple locations, the insulation criteria for AS1530.4-2005 and BS476-20:1987 are not appreciably different.

A.40.2 Application of Test Data to AS1530.4-2005

A.40.2.1 The variations in furnace thermocouples specification and responses are not considered to have significant effect on the outcome of the referenced fire resistance test.

A.40.2.2 In regards to furnace pressure, using a furnace pressure differential of 8.0Pa/m, it is calculated that the specimen tested in FR 4115 was exposed to a pressure 4Pa lower than that required by AS1530.4-2005.

A.40.2.3 In regards to specimen thermocouple location, it is considered that the variations between test methods could have a significant impact on maximum temperature rise performance. These issues must be considered on a case-by-case basis.

A.40.2.4 In light of the above, it is considered that the stickability and average temperature rise performance of the PROMATECT® 50 boards tested in FR 4115 can be used as indicative of the performance if a similar specimen were tested in accordance with AS1530.4-2005. Integrity and maximum temperature rise performance must be considered on a case-by-case basis.

A.41 TEST REPORT – 7745

A.41.1 **Report Sponsor**

A.41.1.1 N.V. Promat Pty Ltd, Kuiermanstraat 1, 1880 KAPELLE-OP-DEN-BOS.

A.41.2 **Test Laboratory**

A.41.2.1 Laboratorium voor Aanwending der Brandstoffen en Warmteoverdracht (Exova Warringtonfire Ghent), St Pietersnieuwstraat, 41 B – 9000 Gent.

A.41.3 **Test Date**

A.41.3.1 The fire resistance test was conducted on September 18, 1995.

A.41.4 **Test Standard**

A.41.4.1 The test was conducted in accordance with NBN 713.020 – edition 1968 and prEN 1366 – part 3 (1993).

A.41.5 **Variations to Test Method**

A.41.5.1 None stated.

A.41.6 **General Description of Tested Specimen**

A.41.6.1 The test comprised three horizontally orientated Promatect-L plates with 6 service penetrations. For the purposes of this assessment, only penetrations 1 and 5 are relevant and described below.

A.41.6.2 Penetration 1 and 5 consisted of a 110mm diameter PE pipe, wall thickness 4.3mm, protected with a 110mm FC 110 collar. The collar protecting penetration 1 was fixed at 3 corners with

Winglin screws to the underside of the plate. Penetration 5 was fixed with 4 Winglin screws to the underside of the plate.

A.41.7 **Instrumentation**

A.41.7.1 The instrumentation was provided and applied in accordance with ith NBN 713.020 – edition 1968 and prEN 1366 – part 3 (1993).

A.41.8 **Test Results**

A.41.8.1 The test duration was 132 minutes.

A.41.8.2 No integrity or insulation failure was recorded for the test duration.

APPENDIX B - ASSESSMENT OF SPECIFIC VARIATIONS

B.1 UPVC AND HDPE PIPES PROTECTED WITH PROMASEAL® FC COLLARS IN FLOORS

B.1.1 Discussion

Summary of Supporting Information for Floors

B.1.1.1 Table B.1 presents the relevant test data for floors, extracted from the supporting test data. Refer to Appendix A for further details.

B.1.1.2 This assessment considers PROMASEAL retrofit collar Types FCS, FCM and FC, as shown in Table B.2. The FCM collars are approximately the same construction and size as the FCS collars, but differ marginally in the dimensions of the collar body and the thickness of intumescent in some cases. The FC collars are similar in construction to the FCM and FCS collars, but with changes in the collar body dimensions in some cases, and with the addition of a steel base at the flange end of the collar to retain the intumescent material. The dimensions of the body of the collars and the intumescent material are provided in Table B.2. Also shown in Table B.2 is the calculated volume of collar body: volume of intumescent ratio for each collar type.

Table B.1- Relevant Data- Floors

Test Reference	Collar Type	Pipe Type	Pipe Diameter	Pipe Fitting	Element Thickness (mm)	Integrity (Minutes)	Insulation (Minutes)
F91730	FCM100	uPVC	110	Y	160	301[1]	298
F91730	FCM100	HDPE	110	N	160	301[1]	301[1]
F91741	FCM40	uPVC	43	Y	120	241[1]	213
F91741	FCM50	uPVC	55	Y	120	241[1]	241[1]
F91741	FCM65	uPVC	69	Y	120	241[1]	241[1]
F91741	FCM80	uPVC	82	Y	120	241[1]	241[1]
F91742	FCM100	uPVC	110	N	120	241[1]	229
FSP0643	FCM40	HDPE	50	N	120	180	180
FSP0643	FCM50	HDPE	56	N	120	180	180
FSP0643	FCM65	HDPE	75	N	120	180	180
FSP0643	FCM150	HDPE	162	N	120	180	180
F91765	FCS80	uPVC	83	Y	120	242[1]	242[1]
F91765	FCS100	HDPE	125	N	120	242[1]	242[1]
F91754	FCEG100	Cable			120	201[1]	133
F91754	FCEG100	Cable			120	200	157
F91754	FCEG100	Cable			120	201[1]	196
F91754	FCEG100	Cable			120	201[1]	194
A-11-734	FC40	HDPE	40	N	120	241[1]	201
A-08-531	FC65	HDPE	63.5	N	120	241[1]	193
2227800.1	FC80	HDPE	75	N	120	241[1]	176
A-07-487	FC250	HDPE	254	N	150	243[1]	243[1]
F91624	FC300	HDPE	315	N	180	120[1]	120[1]
F91624	FC125	HDPE	125	N	180	120[1]	120[1]
F91611	FC80	Postmix	80	N	170	120	120
F91604	FC150	uPVC	162	N	120	120	120
F91604	FC100	uPVC	110	N	120	120	120
F91604	FC80	uPVC	83	N	120	120	120
F91604	FC65	uPVC	70	N	120	120	120
F91604	FC50	uPVC	57	N	120	120	120
F91621	FC225	uPVC	200	N	160	240	240
F91797	FC100	uPVC	110	N	120	241[1]	192

Test Reference	Collar Type	Pipe Type	Pipe Diameter	Pipe Fitting	Element Thickness (mm)	Integrity (Minutes)	Insulation (Minutes)
A-07-487	FC250	uPVC	251	N	150	243[1]	243[1]
2227800.1	FC300	uPVC	315	N	120	241[1]	163

[1]No Failure at termination of test

Table B.2 – Collar Dimensions

Collar Type	Collar			Intumescent Materials			Volume Ratio (Collar: Grafitex)
	OD (mm)	Height (mm)	ID (Pipe) (mm)	Length (mm)	Height (mm)	Thickness (mm)	
FC40	75	43	45	188.5	39	15	1.723
FC50	88	43	58	229.3	39	15	1.949
FC65	101	43	71	270.2	39	15	2.180
FC80	121	53	85	323.6	39	18	2.683
FC100	148	53	112	417.8	49	15	2.969
FC150	198	73	162	565.5	69	18	3.200
FC225	288	100	228	816.8	95	30	2.837
FC300	400	160	318	1143.5	155	36	3.151
FC125	165	63	127	461.8	63	18	2.572
FCM40	80	46	50	213.6	40	12	2.255
FCM50	94	46	70	257.6	40	12	2.582
FCM65	108	46	83	301.6	40	12	2.911
FCM80	134	57	98	364.4	50	18	2.451
FCM100	165	52	127	461.8	45	18	2.972
FCEG100	146	48	127	402.1	48	18	2.313
FCM150	208	72	172	596.9	68	18	3.349
FCS40	82	43	56	219.9	40	12	2.151
FCS50	96	43	70	263.9	40	12	2.457
FCS65	109	60	83	304.7	57	12	2.686
FCS80	138	70	98	377.0	65	18	2.374
FCS100	165	53	127	461.8	50	18	2.727
FCS225	290	100	228	816.8	95	30	2.837
FCS300	400	160	318	1143.5	155	36	3.151

uPVC Pipes in Floors

B.1.1.3 The performance of the PROMASEAL FCM collars protecting uPVC pipes with nominal diameters of 40mm to 80mm inclusive penetrating a nominally 120mm thick reinforced concrete floor slab was demonstrated in test F91741.

B.1.1.4 No failures under the criteria of insulation or integrity were observed for the 50, 65 or 80mm pipes during the 241 minute duration of the test. A failure under the criteria of insulation was recorded on the slab for the 40mm service pipe after approximately 214 minutes duration of the test, however no failures were recorded on the service pipe. The 40mm pipe satisfied the criteria of integrity for the full 241 minute duration of the test.

B.1.1.5 Pipe fittings were installed within the body of each collar.

B.1.1.6 The PROMASEAL FCM40 and FCM50 collars in test F91741 varied only in the height of the collar body in relation to the FCS collars, with the same amount of intumescent, which resulted in a larger volume of collar body: volume of intumescent ratio for the FCM collars. It is considered that the FCS40 and FCS50 collars, with a relatively smaller volume of collar body: volume of intumescent ratio for the FCS collars, would have performed at least as well as the corresponding FCM collars if tested in accordance with AS1530.4-2005, provided that a slab of suitable thickness is used.

B.1.1.7 The PROMASEAL FCM65 and FCM80 collars in test F91741 varied both in the dimensions of the collar body and the dimensions of the intumescent material in relation to the FCS collars, which resulted in a larger volume of collar body: volume of intumescent ratio for the FCM collars. It is considered that the FCS65 and FCS80 collars, with a relatively smaller volume of collar body: volume of intumescent ratio for the FCS collars, would have performed at least as well as the corresponding FCM collars if tested in accordance with AS1530.4-2005, provided that a slab of suitable thickness is used.

B.1.1.8 Based on the above discussion, it is therefore considered reasonable to use the data from test F91741 to assess the performance of the FCS40, FCS50, FCS65 and FCS80 collars when protecting uPVC pipes penetrating reinforced concrete slabs of sufficient thickness for periods of up to 240 minutes for both integrity and insulation.

B.1.1.9 When tested no failure of insulation or integrity were observed for the 242 minute duration of the test. A pipe fitting was installed within the body of the collar for the test.

B.1.1.10 The FCS80 collar varies from the FCM80 collar in test F91765 and test F91741, in both collar height, intumescent height and intumescent thickness, resulting in a slightly larger volume of collar body : volume of intumescent ratio for the FCM80 collar, supporting the conclusions B.1.1.15.

B.1.1.11 The performance of the PROMASEAL FCM100 Collar protecting a nominal 100mm diameter uPVC pipe penetrating a reinforced concrete floor slab was demonstrated in tests F91730 and F91742.

B.1.1.12 Test F91730 comprised an FCM100 PROMASEAL Retrofit Collar protecting a nominally 100mm diameter uPVC pipe penetrating a nominally 160mm thick reinforced concrete slab. Test F91742 comprised an FCM100 PROMASEAL Retrofit Collar protecting a nominally 100mm diameter uPVC pipe penetrating a nominally 120mm thick concrete block. Both FCM100 collars contained nominally 18mm thick intumescent material.

B.1.1.13 The FCM100 collar in test F91730 satisfied the criteria of insulation for a period of 298 minutes, and the criteria of integrity for the full 301 minute duration of the test. The FCM100 collar in test F91742 satisfied the criteria of insulation for a period of 229 minutes, and the criteria of integrity for the 241 minute duration of the test. This insulation failure was recorded on the concrete slab, with no failures recorded on the service pipe.

B.1.1.14 When tested a pipe fitting was installed within the body of the collar for test F91730 only. The manufacturer confirmed the FCM100 retrofit collar is identical to the FCS100 collar.

B.1.1.15 Based on the above discussion, it is therefore considered reasonable to use the data from tests F91730 and F91742 to assess the performance of the FCS100 collars when protecting uPVC pipes penetrating reinforced concrete slabs of sufficient thickness for periods of up to 240 minutes for both integrity and insulation.

B.1.1.16 The performance of the PROMASEAL FCM150 Collar protecting a nominal 150mm diameter uPVC pipe penetrating a nominally 120mm thick reinforced concrete floor slab was demonstrated in test F91765.

B.1.1.17 The performance of the PROMASEAL FC225 Retrofit collar when protecting a nominally 225mm diameter uPVC pipe penetrating a nominally 160mm thick normal weight reinforced concrete floor was demonstrated in test F91621. No failures under the criteria of integrity or insulation were observed during the 241 minute duration of the test.

B.1.1.18 Test F91621 was performed in accordance with AS1530.4-1990. As discussed previously in Appendix A.26, it has confirmed that the behaviour of the specimens relevant to this assessment in test WFRA F91621 can be used as indicative of the relative insulation performance and integrity performance if similar specimens were tested in accordance with AS1530.4-2005.

B.1.1.19 The FC225 collar is identical to the FCS225 collar, with the exception that the steel base for retaining the intumescent material has been omitted from the FCS225 collar. The collar is to be attached to the underside of the reinforced concrete slab, with the flange attached to the slab and the body of the collar protruding below the slab. It is considered that the concrete slab will provide sufficient restraint for the intumescent material to react against. The PROMASEAL FC225 retrofit collar in test F91621 contained intumescent material which also contained an ingredient referred to as “Super G”.

B.1.1.20 When tested no pipe fitting was located within the body of the collar.

B.1.1.21 Based on the above discussion, it is therefore considered reasonable to use the data from test F91621 to assess the performance of the PROMASEAL FCS225 collar protecting a nominally 225mm diameter uPVC pipe penetrating a reinforced floor slab in situations where the pipe is capped at both ends.

B.1.1.22 Pipe fittings were located within the body of the collar for each service pipe for all tests reviewed, with the exception of the nominally 100mm diameter pipe in test F91742, and the nominally 225mm diameter pipe in test F91621. The location of a pipe fitting within the body of the collar would be expected to delay the closure of the service penetration by the collar, due to a delay in heating and softening two layers of uPVC material, and to the increased stiffness of the service pipe. The location of a pipe fitting within the body of the collar is not expected to significantly impact on the performance of the collar after closure.

B.1.1.23 It is therefore expected that a collar that performs satisfactorily when it has to close both a uPVC pipe fitting and uPVC pipe would perform at least as well when a uPVC pipe only was required to be closed. This was demonstrated in tests F91742 and F91730 for the nominally 100mm diameter pipe.

B.1.1.24 Based on the above discussion it is expected that the results of tests performed with pipes and pipe fittings located within the body of the collar would also apply to collars with pipes only located within the body of the collar, for pipe sizes of 43mm to 160mm diameter inclusive.

B.1.1.25 Based on the above discussion it is expected that the results of tests performed with pipes and pipe fittings located within the body of the collar would also apply to collars with pipes only located within the body of the collar, for pipe sizes of 43mm to 160mm diameter inclusive.

B.1.1.26 Based on the above discussion, the following results would be expected for the PROMASEAL FCS Retrofit Collars protecting uPVC pipes penetrating a normal weight reinforced concrete slab of minimum thickness of 120mm, 150mm or 170mm for 120minutes, 180minutes and 240 minutes insulation respectively, if tested in accordance with AS1530.4-2005.

Collar	Integrity (Minutes)	Insulation (Minutes)	Intumescent Thickness (mm)
FCS40	240	240	12
FCS50	240	240	12
FCS65	240	240	12
FCS80	240	240	18
FCS100	240	240	18
FCS225	240	240	30*

*Intumescent contains SuperG.

HDPE Pipes in Floors

B.1.1.27 The performance of the FCM collars protecting nominally 50mm, 56mm, 75mm and 160mm diameter HDPE pipes was demonstrated in test FSP0643.

B.1.1.28 Test FSP0643 comprised PROMASEAL FCM40, FCM50, FCM65 and FCM150 retrofit collars protecting a nominally 50mm, 56mm, 75mm and 160mm diameter HDPE pipes penetrating a nominally 120mm thick reinforced concrete floor slab. The criteria of insulation or integrity were satisfied for the full test duration of 186 minutes for each service penetration.

B.1.1.29 The PROMASEAL FCM40, FCM50 and FCM65 collars in test FSP0643 varied in the dimensions of the collar body and the intumescent in relation to the FCS collars, which resulted in a slightly larger volume of collar body: volume of intumescent ratio for the FCM collars. It is considered that the FCS40, FCS50 and FCS65 collars, with a smaller volume of collar body: volume of intumescent ratio than the FCM collars, would have performed at least as well as the corresponding FCM collars if tested in accordance with AS1530.4-2005.

B.1.1.30 The performance of the FCM collars protecting a nominally 110mm diameter HDPE pipe was demonstrated in test F91730.

B.1.1.31 Test F91730 comprised PROMASEAL FCM100 retrofit collar protecting a nominally 110mm diameter HDPE pipe penetrating a 160mm thick normal weight reinforced concrete floor slab. No failures under the criteria of integrity or insulation were observed for the 301 minute duration of the test.

B.1.1.32 The FCM100 retrofit collar is identical to the FCS100 collar, and therefore these results can be used to assess the performance of the FCS collar protecting HDPE pipes penetrating reinforced concrete slabs of suitable thickness.

B.1.1.33 The performance of the collar FCS100 collar containing 17mm intumescent when protecting a nominally 125mm diameter HDPE pipe penetrating a nominally 120mm thick normal weight reinforced concrete slab was demonstrated in test F91765. This represents a decrease in the volume of collar body: volume of intumescent ratio for the proposed FCS100 collar, which is therefore expected to perform at least as well as the FCS100 collar in test F91765. The FCS100 collar satisfied the criteria of integrity and insulation for the full 242 minute test duration.

B.1.1.34 Based on the above discussion, it is therefore considered reasonable to use the data from tests F91730 and F91765 to assess the performance of the FCS100 collar when protecting HDPE pipes penetrating reinforced concrete slabs, for a period of up to 240 minutes for both insulation and integrity.

B.1.1.35 The performance of the FC collars protecting nominally 125mm diameter and 315mm diameter HDPE pipes penetrating a nominally 180mm thick normal weight reinforced concrete floor was demonstrated in test F91624.

B.1.1.36 Test F91624 was performed in accordance with AS1530.4-1990. The 315mm diameter HDPE pipe was “partially capped” on the non-fire exposed side after approximately 6 minutes test duration. Both the FC125 and FC300 collars satisfied the criteria of integrity and insulation for the full 140 minute duration of the test.

B.1.1.37 As discussed previously in Appendix A.26, the behaviour of the specimens relevant to this assessment in test WFRA F91624 can be used as indicative of the relative insulation performance and integrity performance if similar specimens were tested in accordance with AS1530.4-2005.

B.1.1.38 The PROMASEAL FC300 retrofit collar in test F91624 contained a spring in the collar body, and the intumescent material contained an ingredient referred to as “Super G”.

B.1.1.39 The FC125 collar is replaced by the FCS100 collar, the performance of which was detailed in B.1.1.33. The FC300 collar is identical to the FCS300 collar, with the exception that the steel base for retaining the intumescent material has been omitted from the FCS300 collar. The collar is to be attached to the underside of the reinforced concrete slab, with the flange attached to the slab and the body of the collar protruding below the slab. It is considered that the concrete slab will provide sufficient restraint for the intumescent material to react against.

B.1.1.40 No pipe fittings was located within the body of the collars in test F91624.

B.1.1.41 Based on the above discussion, it is therefore considered reasonable to use the data from test F91624 to assess the performance of the PROMASEAL FCS300 collar protecting a nominally 315mm diameter HDPE pipe penetrating a reinforced floor slab, with the pipe capped on both the non-fire exposed side and the fire exposed face.

B.1.1.42 Based on the above discussion, the following results would be expected for the PROMASEAL FCS Retrofit Collars protecting HDPE pipes penetrating a normal weight reinforced concrete slab, if tested in accordance with AS1530.4-2005.

Collar	Integrity (Minutes)	Insulation (Minutes)	Intumescent Thickness (mm)
FCS40	180	180	12
FCS50	180	180	12
FCS65	180	180	12
FCS100	240	240	18
FCS300	120	120	36*

*Intumescent contains SuperG, collar contains a spring, pipe capped on both sides.

Fixing of Collars in Floors

B.1.1.43 All collars up to the FCS100 have been successfully tested with four 6mm x 25mm masonry anchors, in tests F91754, F91765 and FSP0643. The FC225 collar was successfully tested with four 6mm x 38mm masonry anchors in test F91621. The FC300 collar was successfully tested with eight 6mm x 38mm masonry anchors in test F91624.

B.1.1.44 Based on these test results, it is considered that four 6mm x 25mm masonry anchors are required for the FCS40 to FCS100 retrofit collars, four 6mm x 38mm masonry anchors are required for FCS200 retrofit collar, and eight 6mm x 38mm masonry anchors are required for the FCS300 collar.

FC Collars

B.1.1.45 The FC collars are similar in construction to the FCS collars, but with changes in the collar body diameter in some cases, and with the addition of a steel base at the flange end of the collar to retain the intumescent material. It is proposed to reduce the intumescent thickness in the FC40, FC50, FC65 and FC100 collars, and to retain the intumescent thickness in the remainder of the FC Type collars. The dimensions of the body of the collars and the intumescent material are provided in Table B.3 (Refer to Table B.2 for tested intumescent thicknesses). Also shown in Table B.3 is the calculated *volume of collar body: volume of intumescent ratio* for each collar type.

B.1.1.46 Observation of Table B.3 indicates that the proposed reduction in intumescent thickness results in a larger volume of collar body: volume of intumescent ratio for the FCS collars for the FCS40, FCS50 and FCS65. It is considered that the PROMASEAL Type FC40, FC50 and FC65 collars, with a relatively smaller volume of collar body : volume of intumescent ratio than the FCS collars, would have performed at least as well as the corresponding FCS collars if tested in accordance with AS1530.4-2005, provided that a slab of suitable thickness is used.

Table B.3 – FC Collar Dimensions with Reduced Intumescent

Collar	Collar			Intumescent Materials			Volume Ratio (Collar: Grafitex) Total
	OD (mm)	Height (mm)	Pipe OD (mm)	Length (mm)	Height (mm)	Thickness (mm)	
FC40	75	43	45	197.9	39	12	2.051
FC50	88	43	58	238.8	39	12	2.341
FC65	101	43	71	279.6	39	12	2.633
FC80	121	53	85	323.6	39	18	2.683
FC100	148	53	112	408.4	49	18	2.531
FC150	198	73	162	565.5	69	18	3.200
FC225	290	100	228	816.8	95	30	2.837
FC300	400	160	318	1143.5	155	36	3.151
FC125	165	63	127	461.8	63	18	2.572

Collar	Collar			Intumescent Materials			Volume Ratio (Collar: Grafitex) Total
	OD (mm)	Height (mm)	Pipe OD (mm)	Length (mm)	Height (mm)	Thickness (mm)	
FCS40	82	43	56	219.9	40	12	2.151
FCS50	96	43	70	263.9	40	12	2.457
FCS65	109	60	83	304.7	57	12	2.686
FCS80	138	70	98	377.0	65	18	2.374
FCS100	165	53	127	461.8	50	18	2.727
FCS225	290	100	228	816.8	95	30	2.837
FCS300	400	160	318	1143.5	155	36	3.151

B.1.1.47 Observation of Table B.3 indicates that the FC80 collar represents an increase in the volume of collar body: volume of intumescent ratio for the FC collars, and therefore the results for the FCS collars cannot be applied.

B.1.1.48 The performance of the PROMASEAL FC100 Collar with 15mm thick intumescent protecting a nominal 100mm diameter uPVC pipe penetrating a nominally 120mm thick reinforced concrete floor slab was demonstrated in test F91797.

B.1.1.49 The FC100 collar in test F91797 satisfied the criteria of insulation for a period of 192 minutes, and the criteria of integrity for the full 241 minute duration of the test. This insulation failure was recorded on the concrete slab, with no failures recorded on the service pipe.

B.1.1.50 No pipe fitting was installed within the body of the collar for test F91797.

B.1.1.51 The insulation failures on the FC100 collar in test F91797 was recorded on the nominally 120mm thick concrete slab. AS3600 Concrete Structures Code indicates that a 120mm thick normal weight concrete slab will provide an FRL of -/120/120, and that for an FRL of –180/180 and -/240/240 a minimum slab thickness of 150mm and 170mm respectively is required.

B.1.1.52 Based on the above discussion, it is considered reasonable to use the data from test F91797 to assess the performance of the FC100 collar containing 15mm thick intumescent when protecting uPVC pipes penetrating reinforced concrete slabs of sufficient thickness for periods of up to 240 minutes for both integrity and insulation.

B.1.1.53 Observation of Table B.3 indicates that the FC100 collar with 18mm thick intumescent has a slightly smaller volume of collar body: volume of intumescent ratio than the FCS100 collar. For the case of the FC100 collar protecting HDPE pipes, it would therefore be expected that the FC100 collar containing 18mm intumescent would have performed at least as well as the corresponding FCS collar if tested in accordance with AS1530.4-2005, provided that a slab of suitable thickness was used.

B.1.1.54 Observation of Table B.3 indicates that the FC150, FC225 and FC300 collars are almost identical to the corresponding FCS collars, with a marginally smaller volume of collar body: volume of intumescent ratio for the FC collar in each case. It would therefore be expected that the FC150, FC225 and FC300 collars would have performed at least as well as the corresponding FCS collars if tested in accordance with AS1530.4-2005, provided that a slab of suitable thickness was used.

B.1.1.55 The FC250 collar penetrated by a nominal Ø251mm (OD) uPVC pipe in a 150mm thick concrete slab in test FSRG A-07-487 satisfied the criteria of insulation performance of 243 minutes and the criteria of integrity performance of 243 minutes with no integrity and insulation performance recorded during the test duration.

B.1.1.56 The FC300 collar penetrated by a nominal Ø315mm (OD) uPVC pipe in a 120mm thick concrete slab in test BWA 2227800.1 satisfied the criteria of insulation for a period of 163 minutes, and the criteria of integrity for the full 241 minute duration of the test. This insulation failure was recorded on the concrete slab, with no failures recorded on the service pipe.

B.1.1.57 Based on the above discussion, the following results would be expected for the PROMASEAL FC Retrofit Collars protecting uPVC pipes penetrating a normal weight reinforced concrete slab of minimum thickness of 120mm, 150mm or 170mm for 120minutes, 180minutes and 240 minutes insulation respectively, if tested in accordance with AS1530.4-2005:

Collar	Integrity (Minutes)	Insulation (Minutes)	Intumescent Thickness (mm)
FC40	240	240	12
FC50	240	240	12
FC65	240	240	12
FC80	240	240	18
FC100	240	240	15
FC150	240	120	18
FC225	240	240	30*
FC250	240	240	30
FC300	240	240	36

*Intumescent contains SuperG.

B.1.1.58 The FC40 collar penetrated by a nominal Ø40mm (OD) HDPE pipe in a 120mm thick concrete slab in test FSRG A-11- 734 satisfied the criteria of insulation for a period of 201 minutes, and the criteria of integrity for the full 241 minute duration of the test. This insulation failure was recorded on the concrete slab, with no failures recorded on the service pipe.

B.1.1.59 The FC65 collar penetrated by a nominal Ø63.5mm (OD) HDPE pipe in a 120mm thick concrete slab in test FSRG A-08-531 satisfied the criteria of insulation for a period of 193 minutes, and the criteria of integrity for the full 241 minute duration of the test. This insulation failure was recorded on the concrete slab, with no failures recorded on the service pipe.

B.1.1.60 The FC80 collar penetrated by a nominal Ø75mm (OD) HDPE pipe in a 120mm thick concrete slab in test BWA 2227800.1 satisfied the criteria of insulation for a period of 176 minutes, and the criteria of integrity for the full 241 minute duration of the test. This insulation failure was recorded on the concrete slab, with no failures recorded on the service pipe.

B.1.1.61 The FC250 collar penetrated by a nominal Ø254mm (OD) HDPE pipe in a 150mm thick concrete slab in test FSRG A-07-487 satisfied the criteria of insulation performance of 243 minutes and the criteria of integrity performance of 243 minutes with no integrity and insulation performance recorded during the test duration.

B.1.1.62 Based on the above discussion, the following results would be expected for the PROMASEAL FC Retrofit Collars protecting HDPE pipes penetrating a normal weight reinforced concrete slab of minimum thickness of 120mm, 150mm or 170mm for 120minutes, 180minutes and 240 minutes insulation respectively,, if tested in accordance with AS1530.4-2005:

Collar	Integrity (Minutes)	Insulation (Minutes)	Intumescent Thickness (mm)
FC40	240	240	12
FC50	180	180	12
FC65	240	240	12
FC80	240	240	18
FC100	240	240	18
FC125	240	240	18
FC150	180	180	18
FC250	240	240	30
FC300	120	120	36*

*Intumescent contains SuperG, collar contains a spring

Floor with BONDEK® Steel Deck

B.1.1.63 It is proposed that the pipe penetrations shall be penetrated through concrete floor slabs with LYSAGHT BONDEK® steel deck as the form work. The voids in the BONDEK® deck the collars go over when fixed shall be filled to the edge of the collar with PROMASEAL® AN Acrylic sealant.

B.1.1.64 The test specimen tested in test FSRG A-11-734 comprised PROMASEAL® FC collars protecting 40mm and 110mm uPVC and HDPE pipes within a 120mm concrete slab with LYSAGHT BONDEK® steel deck as the formwork. The collars were fixed underside of the concrete slab through the Bondek, and the voids in the Bondek the collars go over when fixed were filled to the edge of the collar with PROMASEAL® AN Acrylic sealant.

B.1.1.65 With reference to the test observations of test FSRG A-11-734, it was observed the PROMASEAL® AN Acrylic sealant stayed in place during the test duration. The PROMASEAL® FC collars stayed in place for the duration of the test and activated and closed the pipes in first 10 minutes of the test.

B.1.1.66 The proposed construction is in a similar manner to that tested in FSRG A-11-734 and based on the above observation, it is considered the proposed construction will not introduce any foreseeable weakness to the performance of uPVC and HDPE pipes if tested in accordance with AS1530.4-2005.

B.2 UPVC PIPES PROTECTED WITH PROMASEAL® FC COLLARS IN WALLS

B.2.1 Discussion

B.2.1.1 The penetration systems used in the series of fire resistance tests contained a range of plastic pipes of different materials, diameters and wall thicknesses and they were tested in the following configuration:

- The service penetration was through a minimum 128mm thick, two hour fire-rated plasterboard lined partition comprising two layers of 16mm thick fire grade plasterboard lining and was protected with PROMASEAL® FC collars on both sides of the wall.

B.2.1.2 The fire resistance performance obtained in tests FSRG A-08-527, F91783A, FSRG A-08-527, FSRG A-13-852, FSRG A-10-672a and FSRG A-13-853 is specific for a particular penetration system and generally cannot be applied to other systems and configurations, subject to the permissible variations specified in AS4072.1-2005 Section 4.

B.2.1.3 Some of the fire resistance tests considered in the assessment were conducted in accordance with AS1530.4-1997, Section 2, 4 and 10, and AS4072.1-1992 as appropriate, and others were in accordance with AS1530.4-2005 and AS4072.1-2005.

B.2.1.4 As discussed previously in Appendix A, no variations from the standards mentioned above were observed in the fire resistance tests referenced.

B.2.1.5 The specimens tested satisfied or were deemed to satisfy the performance criteria specified in AS1530.4-2005 for the following periods:

For uPVC Pipes penetrating a 2 hour fire rated plasterboard partition protected by one PROMASEAL® FC collar each side

Nom. Pipe Size (mm)	Pipe Diameter (OD)	Pipe Thickness	Collar Type	Integrity (min)	Insulation (min)
40	43.6mm	2.4mm	FC40	No failure at 243 mins	219 mins
50	55.7mm	2.2mm	FC50	No failure at 121 mins	No failure at 121 mins
65	69.4mm	3.2mm	FC65	199 mins	197 mins
80	82.5mm	3.0mm	FC80	No failure at 121 mins	No failure at 121 mins

Nom. Pipe Size (mm)	Pipe Diameter (OD)	Pipe Thickness	Collar Type	Integrity (min)	Insulation (min)
100	110mm	4.3mm	FC100	No failure at 121 mins	No failure at 121 mins
150	161mm	4.56mm	FC150	No failure at 181 mins	167 mins*
250	250.1mm	6.56mm	FC250	No failure at 185 mins	No failure at 185 mins
300	315mm	8.2mm	FC300	No failure at 224 mins	206 mins*

Note: * No failures were recorded on service pipes, but on separating element

B.2.1.6 In the referenced tests carried out on pipe penetrations through a min. 128mm thick, 2 hour fire rated plasterboard lined partition, the 2mm to 5mm annular gaps between the pipes and the wall partition were sealed with PROMASEAL® AN Acrylic sealant.

B.2.1.7 Based on the above, the performance of uPVC pipes in the range 40mm-300mm would achieve the performance listed in Section 5 of this report if protected with PROMASEAL® FC collars each side of the wall if tested in accordance with AS1530.4-2005.

B.3 HDPE PIPES PROTECTED WITH PROMASEAL® FC COLLARS IN WALLS

B.3.1 Discussion

B.3.1.1 The penetration systems used in the series of fire resistance tests contained a range of plastic pipes of different materials, diameters and wall thicknesses and they were tested in the following configuration:

- The service penetration was through a minimum 128mm thick, two hour fire-rated plasterboard lined partition comprising two layers of 16mm thick fire grade plasterboard lining and was protected with PROMASEAL® FC collars on both sides of the wall.

B.3.1.2 The fire resistance performance obtained in tests FSRG A-08-528, FSP 1464A, FSRG A-08-532, EWFA 2373900 and FSRG A-08-526 is specific for a particular penetration system and generally cannot be applied to other systems and configurations, subject to the permissible variations specified in AS4072.1-2005 Section 4.

B.3.1.3 The specimens tested satisfied or were deemed to satisfy the performance criteria specified in AS1530.4-2005 for the following periods:

For HDPE Pipes penetrating a 2 hour fire rated plasterboard partition protected by one PROMASEAL® FC collar each side

Nom. Pipe Size (mm)	Pipe Diameter (OD)	Pipe Thickness	Collar Type	Integrity (min)	Insulation (min)
40	40.9mm	3.15mm	FC40	194 mins	194 mins
65	63.5mm	3.3mm	FC65	169 mins	168 mins
80	75mm	4.0mm	FC80	No failure at 121 mins	No failure at 121 mins
100	110.4	5.0mm	FC100	156 mins	153 mins
150	125mm	6.0mm	FC150	No failure at 121 mins	No failure at 121 mins
250	252mm	8.0mm	FC250	No failure at 121 mins	No failure at 121 mins
300	317mm	13.5mm	FC300	No failure at 182 mins	No failure at 182 mins

B.3.1.4 In the referenced tests carried out on pipe penetrations through a min. 128mm thick, 2 hour fire rated plasterboard lined partition, the 2mm to 5mm annular gaps between the pipes and the wall partition were sealed with either PROMASEAL® AN Acrylic sealant or PROMASEAL Supa Mastic polyurethane sealant.

B.3.1.5 Based on the above, the performance of HDPE pipes in the range 40mm-300mm would achieve the performance listed in Section 5 of this report if protected with PROMASEAL® FC collars each side of the wall if tested in accordance with AS1530.4-2005.

B.4 VARIOUS UPVC AND HDPE PIPE PENETRATIONS UP TO 100MM DIAMETER

B.4.1 Proposal

B.4.1.1 The proposed construction shall be as tested for the plastic pipes in EWFA 2517300.2, subject to the following variation:

- For 40mm to 110mm uPVC and HDPE pipes protected with FC40, FC50, FC65, FC80 and FC100 collars addition of a layer of 25mm thick PROMATECT® 50 or 100 added to each side of the wall, between the collar and the wall, in the vicinity of the service.

B.4.2 Discussion

Summary of Tested Specimen Performance

B.4.2.1 The results of the tested pipe services are summarised below:

Support Construction	Pipe (mm)	Collar	Integrity (minutes)	Insulation (minutes)
128mm thick wall comprising 64mm wide steel frame clad with 2 × 16mm layers Fyrchek each side.	110.7 × 3.4 uPVC	FC100	182*	177
	110.4 × 5.0 HDPE	FC100	156	153
128mm thick wall comprising 64mm wide steel frame clad with 2 × 16mm layers Fyrchek each side.	40.9 × 3.15 HDPE	FC40	194	194
	63.5 × 3.3 HDPE	FC65	168	168
128mm thick wall comprising 64mm wide steel frame clad with 2 × 16mm layers fire rated plasterboard each side.	43 (nominal) uPVC	FC40	186*	131
121mm thick wall comprising 64mm wide steel frame clad with 1 × 25mm Shaft Liner on fire side, 2 × 16mm layers Fyrchek non-fire side.	55.7 × 2.2 uPVC	FC50	121*	121*
	68.9 × 2.8 uPVC	FC65	121*	121*
	82.5mm × 3.0 uPVC	FC80	121*	121*
	110mm × 4.3 uPVC	FC100	121*	121*
77mm nominal thick Speedpanel wall	42.8 × 2.2 uPVC	FC40	195*	139
	105 × 3.5 uPVC	FC100	195*	76
	158 × 4.3 uPVC	FC150	147	67

* No failure.

Tested Framed Walls

B.4.2.2 As previously stated, the referenced test data for framed walls includes supporting constructions of the following form:

a) 64mm steel stud with two layers of 16mm Fyrchek each side

b) 64mm steel stud with two layers of 16mm fire rated plasterboard each side

c) 64mm steel stud with one layer CSR Shaft Liner on fire side, two layers of 16mm fire rated plasterboard on non-fire side.

B.4.2.3 By observation of the nature of the materials involved (paper-lined plasterboard materials), it is considered that the FC collars of the proposed construction would perform similarly on any of the steel-framed support constructions listed above, up to 120 minutes. It is thus considered that the behaviour of the penetrations noted in one framed wall system can be used as indicative of the performance of a similar penetration installed one of the other framed wall systems listed above, up to 120 minutes.

Pipe Sizes

B.4.2.4 AS4072.1-2005 clause 4.6.4 states that results from uPVC pipes may be applied to pipes of other plastic and wall thickness provided –

a) The maximum and minimum sizes of the plastic have been tested in the subject separating element and achieved the required FRL

b) The outside diameter of the largest pipe does not exceed 120mm

c) The outside diameter of the smallest pipe is not less than 40mm

d) The following uPVC pipes were tested in the subject separating element and achieved the required FRL:

(i) 40mm

(ii) 50mm

(iii) 65mm

(iv) 85mm

(v) 100mm

B.4.2.5 The referenced test data for 64mm steel-framed walls includes uPVC pipes of nominal sizes which comply with the proviso (d) above, and includes HDPE pipes between 40mm and 100mm diameter, all of which achieved the required FRL (-/120/120). Although the framed wall cladding differs between test reports, in this particular case it is considered the FC collars are to perform similarly if tested in any of the tested framed walls, up to 120 minutes.

B.4.2.6 In light of the above, it is considered that AS4072.1-2005 clause 4.6.4 may be applied to the uPVC pipes tested in 64mm steel-framed walls, and thus the results may be applied to uPVC pipes and HDPE pipes of other wall thickness if installed in the same support construction (being any of the listed framed walls).

PROMATECT® 50 or 100 Cladding on Speedpanel Wall

B.4.2.7 The proposed construction prescribes uPVC and HDPE pipes protected with PROMASEAL® FC collars installed in a 77mm thick Speedpanel wall (as per EWFA 2517300.2).

B.4.2.8 Installation in Speedpanel introduces effects that are not observed in framed-wall tests. The applicability of the framed wall tests when installed in Speedpanel must thus be addressed.

B.4.2.9 Reference test EWFA 2517300.2 included uPVC pipe penetrations with nominal diameters 150mm, 100mm and 40mm. The pipes were protected with FC collars as in the proposed construction.

B.4.2.10 PROMASEAL® SupaMastic sealant was used to fill the gap caused by the Speedpanel profile and was also used to a depth of 5mm in the annular gap around the pipes.

B.4.2.11 The tested 150mm, 100mm and 40mm uPVC pipes protected with FC collars maintained integrity in excess of 120 minutes, providing confidence to the integrity of the proposed construction, it therefore follow that each pipe listed previously, tested in framed walls, would be expected to maintain integrity for 120 minutes if they were instead installed in the Speedpanel with sealant applied as in EWFA 2517300.2.

B.4.2.12 The 40mm pipe tested in Speedpanel maintained insulation for 120 minutes; however the two larger pipes exceeded the insulation criterion before this time.

Behaviour of tested uPVC pipes in Speedpanel

B.4.2.13 In EWFA 2517300.2, the PROMASEAL® SupaMastic sealant used was observed to undergo melting/flowing during the test. The sealant employed to fill the profile of the panels on the fire side would thus have melted away, allowing hot gases to enter the annular gap between the pipe and the panels. This gas could then pass to the non-fire side, where it, assuming some de-bonding of the Speedpanel faces occurred, could enter between the steel facing and the concrete of the panels (heating the steel facing). The gas would also reach the non-fire side collar (contributing to temperature increase at that location).

B.4.2.14 The heating of the collar is not considered to be attributable to its contact with the Speedpanel, since there was no clear correlation between collar temperature and adjacent wall temperature for any of the pipe penetrations tested.

B.4.2.15 For the 150mm service, the collar was much hotter than the adjacent pipe. This is most easily explained by closure of the non-fire side collar, which was observed in the test photographs, thus keeping heat from reaching the non-fire side section of pipe. For the smaller services, the closure on the non-fire side was less extensive (as per the photographs) and accordingly the pipe temperatures were similar (or hotter in some cases) to the adjacent collar.

B.4.2.16 Not previously mentioned, the fire side collar, once closed, will act as a radiant plug of intumescent, emitting radiation towards the non-fire side elements. Also, the uPVC pipe is capable of conducting some heat along its length.

B.4.2.17 In short, three modes of heat transfer have been identified:

- Heat conduction along the plastic pipe
- Hot gas flow through the opening caused by Speedpanel profile (and melted sealant within it), into the annular gap between pipe and panels and to the non-fire side elements
- Radiation from fire side intumescent plug

Expected behaviour of HDPE Pipes in Speedpanel

B.4.2.18 The thermal conductivity of HDPE is higher than (more than twice) that of PVC. The HDPE pipes, when installed in Speedpanel, will thus tend to carry more heat via conduction to the non-fire side than the tested uPVC pipes.

B.4.2.19 Provided the same sealant is used (and provided the fire side collar remains closed), the gas venting effects should be similar whether the pipe is uPVC or HDPE.

B.4.2.20 The FC collars tested on the HDPE pipes (in FSRG A-08-528 and FSRG A-08-532) have demonstrated their ability to close the HDPE pipes such that integrity is maintained for at least 120 minutes. Since the collars are considered capable of closing both plastic types, the radiation for either uPVC or HDPE (for the same pipe size) should be similar.

B.4.2.21 Due to the low value of thermal conductivity for both plastics, heat conduction along the plastic is considered to be the weakest mode of transfer. The dominant transfer modes will be convection from the venting gases and radiation from the heated intumescent plug.

B.4.2.22 In light of the above it is considered that if the HDPE pipes (tested in FSRG A-08-528 and FSRG A-08-532) were installed in Speedpanel as per EWFA 2517300.2, they would behave similarly to similarly sized uPVC pipes installed in the same wall (up to 120 minutes).

B.4.2.23 In EWFA 2517300.2, it was observed that, generally, as pipe size increases (from 40mm to 100mm), so too does the temperature rises recorded on the non-fire side (collar and adjacent wall). This can be explained most readily by a larger radiant area of the fire side intumescent plug, and increased hot gas venting effects on larger pipes.

B.4.2.24 The above discussion suggests that the behaviour of the 40mm diameter HDPE pipe installed in Speedpanel can be estimated from the behaviour of the 40mm uPVC pipe tested in said Speedpanel. Accordingly, the behaviour of the 50, 65 and 110mm HDPE pipes can be estimated from the behaviour of the tested 100mm uPVC pipe.

Expected behaviour of Intermediate-Size uPVC Pipes in Speedpanel

B.4.2.25 As stated previously, in EWFA 2517300.2 it was observed that, generally, as pipe size increases (from 40mm to 100mm), so too do the temperature rises recorded on the non-fire side collar and adjacent wall.

B.4.2.26 The above suggests that the behaviour of the 56mm, 65mm and 80mm diameter uPVC pipes installed in Speedpanel can be estimated from the behaviour of the 100mm uPVC pipe tested in the Speedpanel in EWFA 2517300.2.

Addition of Cladding each side of Speedpanel

uPVC and HDPE Pipes up to 110mm in Diameter

B.4.2.27 The proposed construction includes one layer of 25mm thick PROMATECT® 100 or 50 each side of the 77mm thick Speedpanel wall, between the collar and the wall. It is expected that this will reduce the effect of the heat transfer modes described in the previous section.

B.4.2.28 The 100mm pipe tested in EWFA 2517300.2 exceeded the insulation criterion at 76 minutes, when a thermocouple located to the side of the service on the Speedpanel, 25mm from the edge of the collar, exceeded a 180K temperature rise. At this time and up to at least 120 minutes, no other thermocouples associated with the service exceeded the 180K rise. These observations can be explained by the non-fire side steel facing of the Speedpanel panel de-bonding from the aerated concrete, allowing hot gas to enter between the materials, predominantly causing the insulation failure on the steel.

B.4.2.29 It is expected that the cladding material, which will cover the panel around the service, will decrease the tendency for de-bonding to occur. The claddings presence will also minimising the ramifications of any de-bonding by insulating the non-fire side form the hottest part of the panel around the service.

B.4.2.30 The highest temperature rise recorded on the Speedpanel wall in the vicinity of the 100mm pipe penetration was approximately 434K at 120 minutes.

B.4.2.31 Reference test WFRA 41088AS.1 comprised a 64mm wide steel frame clad with one layer of 20mm thick PROMATECT® 100 board each side.

B.4.2.32 Thermocouples were placed within the partition cavity on the studs and on the internal side of the board. These measurements indicate that at 120 minutes, the temperature drop across the fire side board was approximately 417K, and the temperature drop across the non-fire side board was approximately 370K.

B.4.2.33 It is thus considered that a temperature differential of at least 254K could be maintained across the non-fire side (25mm PROMATECT® 100) board attached to the Speedpanel in the proposed construction for at least 120 minutes, which would prevent the (180K rise) insulation criterion being exceeded in that location. At locations beyond the PROMATECT® board, the temperature of the wall is expected to approach that of the wall temperature without a penetration (which is required to maintain insulation for at least 120 minutes).

B.4.2.34 Although no cavity temperatures were recorded for the PROMATECT® 50 partition (reference test FR 4115), it is noted that the average non-fire side temperature rise responses for this partition was very similar to that for the PROMATECT® 100 partition. Specifically, the PROMATECT® 50 partition exceeded the average 140K rise criteria at 132 minutes, and the PROMATECT® 100 partition, at 128 minutes. It is thus considered reasonable to expect that a 25mm thick PROMATECT® 50 board could maintain a temperature differential of at least 254K across the thickness, in line with the discussion above.

B.4.2.35 The proposed PROMATECT® board on the fire side will also prevent direct exposure of the separating element in the vicinity of the service, adding confidence to the proposed construction.

B.4.2.36 The PROMATECT® board may be installed in pieces. The join between adjacent pieces is sealed with either PROMASEAL® SupaMastic sealant or PROMASEAL® AN Acrylic sealant. The join between adjacent pieces of PROMATECT® board is not considered to pose an insulation weakness, since the nominal gap will be zero and the joins are sealed.

B.4.2.37 In light of the above discussion, it is considered that the proposed construction for pipe diameters up to 110mm will maintain integrity and insulation for at least 120 minutes if tested in accordance with AS1530.4-2005.

B.5 VARIOUS COESTILEN® HDPE PIPE PENETRATIONS

B.5.1 Proposal

B.5.1.1 The proposed construction shall be as tested for the plastic pipes in EWFA 2517300.2, subject to the following alterations:

- Consideration will be given to the performance of 56mm, 75mm and 110mm Coestilen® HDPE pipes protected with FC65, FC80 and FC100 collars when a layer of 25mm thick PROMATECT® 50 or 100 added to each side of the wall, between the collar and the wall, in the vicinity of the service.

B.5.2 Discussion

B.5.2.1 Reference test FSP 1464 and FSP 1471 included various Coestilen® HDPE pipes in a support construction comprising 92mm steel studs clad each side with two layers of 16mm thick Powerscape board. The results of said pipes are summarised below (along with the performance of the pipes tested in EWFA 2517300.2, for convenience):

Support Construction	Pipe (mm)	Collar	Integrity (minutes)	Insulation (minutes)
92mm wide steel frame clad with 2 × 16mm layers Powerscape each side.	56 × 3 Coestilen® HDPE	FC65	120*	120*
	75 × 4 Coestilen® HDPE	FC80	120*	120*
	110 × 5 Coestilen® HDPE	FC100	120*	120*
	125 × 6 Coestilen® HDPE	FC150	120*	120*
	160 × 7.5 Coestilen® HDPE	FC150	120*	120*
	200 × 7 Coestilen® HDPE	FC250	120*	120*
	250 × 8 Coestilen® HDPE	FC250	120*	120*
77mm thick Speedpanel	42.8 × 2.2 uPVC	FC40	195*	139
	105 × 3.5 uPVC	FC100	195*	76
	158 × 4.3 uPVC	FC150	147	67

* No failure

B.5.2.2 The FC collars tested on the Coestilen® HDPE pipes (in FSP 1464 and FSP 1471) have demonstrated their ability to close the Coestilen® HDPE pipes such that integrity is maintained for at least 120 minutes (photographs of fire side show intumescent plugs intact at completion of test).

B.5.2.3 As discussed previously, for plastic pipes installed as per EWFA 2517300.2 (in Speedpanel), the modes of heat transfer to the non-fire side include

- Heat conduction along the plastic pipe
- Hot gas venting through the gap caused by Speedpanel profile (and melted sealant within it) and into the annular gap between pipe and panels
- Radiation from fire side intumescent plug

Expected behaviour of Coestilen® HDPE Pipes in Speedpanel

B.5.2.4 The thermal conductivity of Coestilen® HDPE is higher (approximately 30%) than that of PVC. The Coestilen® HDPE pipes, when installed in Speedpanel, will thus tend to carry more heat via conduction to the non-fire side than the tested uPVC pipes.

B.5.2.5 Provided the same sealant is used (and provided the fire side collar remains closed), the gas venting effects should be similar whether the pipe is uPVC or Coestilen® HDPE.

B.5.2.6 Since the collars are considered capable of closing both plastic types, the radiation for either uPVC or Coestilen® HDPE should be similar.

B.5.2.7 Due to the low value of thermal conductivity for both plastics heat conduction along the plastic is considered to be the weakest mode of transfer. The dominant transfer modes will be convection from the venting gases and radiation from the heated intumescent plug.

B.5.2.8 In light of the above it is considered that if the Coestilen® HDPE pipes tested in FSP 1464 and FSP 1471 were installed in Speedpanel as per EWFA 2517300.2, they would behave similarly to similarly sized uPVC pipes installed in the same wall (up to 120 minutes).

B.5.2.9 In EWFA 2517300.2, it was observed that, generally, as pipe size increases (from 40mm to 100mm), so too does the temperature rises recorded on the non-fire side. This can be explained most readily by a larger radiant area of the fire side intumescent plug, and increased hot gas venting effects on larger pipes.

B.5.2.10 The above discussion suggests that the behaviour of the 56mm, 75mm and 110mm diameter Coestilen® HDPE pipes installed in Speedpanel can be estimated from the behaviour of the 100mm uPVC pipe tested in said Speedpanel.

Addition of Cladding each side of Speedpanel

Coestilen® HDPE Pipes up to 110mm in Diameter

B.5.2.11 The proposed construction includes one layer of 25mm thick PROMATECT® 100 or 50 each side of the 77mm thick Speedpanel wall, between the collar and the wall. This is an attempt to reduce the effect of the heat transfer modes described in the previous section.

B.5.2.12 By observation, the discussion presented earlier regarding the performance of uPVC and HDPE pipes up to 110mm diameter installed in Speedpanel with cladding each side is directly applicable the proposed Coestilen® HDPE construction.

B.5.2.13 It is thus considered that the proposed construction for pipe diameters up to 110mm will maintain integrity and insulation for at least 120 minutes if tested in accordance with AS1530.4-2005.

B.6 APERTURES IN SPEEDPANEL PROTECTED WITH PROMATECT

B.6.1 Proposal

B.6.1.1 The proposed construction shall be as tested for the plastic pipes in EWFA 2517300.2, subject to the following alterations:

- Consideration will be given to the performance of 40mm to 150mm uPVC pipes, 40mm to 100mm HDPE pipes and 56mm to 250mm Coestilen® HDPE pipes protected with FC collars when penetrating an aperture in the 77mm thick Speedpanel wall clad each side with one layer of 25mm thick PROMATECT® 100 or 50 each side. Refer to figures 13, 14 and 15 for clarification.

B.6.2 Discussion

uPVC and HDPE Pipes up to 100mm Diameter

B.6.2.1 It has previously been concluded that uPVC and HDPE pipes up to 110mm in diameter installed in framed walls nominally 128mm thick are considered capable of maintaining integrity and insulation for at least 120 minutes. This conclusion was based on several tests incorporating pipes of the mentioned sizes. It is worth noting that in all cases, integrity and insulation was maintained in excess of 120 minutes, as shown below:

Support Construction	Pipe (mm)	Collar	Integrity (minutes)	Insulation (minutes)
64mm wide steel frame clad with 2 × 16mm layers Fyrchek each side.	110.7 × 3.4 uPVC	FC100	182*	177
	110.4 × 5.0 HDPE	FC100	156	153
64mm wide steel frame clad with 2 × 16mm layers Fyrchek each side.	40.9 × 3.15 HDPE	FC40	194	194
	63.5 × 3.3 HDPE	FC65	168	168
64mm wide steel frame clad with 2 × 16mm layers fire rated plasterboard each side.	43 (nominal) uPVC	FC40	186*	131
64mm wide steel frame clad with 1 × 25mm Shaft Liner on fire side, 2 × 16mm layers Fyrchek non-fire side.	55.7 × 2.2 uPVC	FC50	121*	121* (max. temp. rise 79K)
	68.9 × 2.8 uPVC	FC65	121*	121* (max. temp. rise 149K)
	82.5mm × 3.0 uPVC	FC80	121*	121* (max. temp. rise 74K)
	110mm × 4.3 uPVC	FC100	121*	121* (max. temp. rise 121K)

* No failure

B.6.2.2 The proposed supporting construction differs from the above mentioned framed walls, in that it is a small aperture in Speedpanel which is clad both sides. The cladding, in all cases, is considered approximately equivalent (120 minute system).

B.6.2.3 One could argue that the proposed construction (small cavity) is more onerous since the larger cavity would have a larger area of non-fire side board, which could cool down the air which inevitably enters said cavity. This argument could be offset to some degree, however, by noting that the steaming effects of the Speedpanel panel edges could have a positive effect on cavity gas temperatures. It is also noteworthy that the proposed cavity is 77mm wide, compared to the tested 64mm.

B.6.2.4 In light of the above, it is considered that the effect of transplanting the pipes tested in the full size framed walls into a small clad aperture would not reduce the performance below 120 minutes. In line with the discussion of section B.4.2.2 – B.4.2.6, it is considered that this argument applies to all uPVC and HDPE sizes between 40mm and 110mm.

Coestilen® HDPE Pipes up to 250mm Diameter

B.6.2.5 The test data for Coestilen® HDPE pipes comprises that in a framed wall. Each of the tested pipes maintained integrity and insulation in excess of 120 minutes, as shown below:

Support Construction	Pipe (mm)	Collar	Integrity (minutes)	Insulation (minutes)
92mm wide steel frame clad with 2 × 16mm layers Powerscape each side.	56 × 3 Coestilen® HDPE	FC65	120*	120* (max. temp. rise 50K)
	75 × 4 Coestilen® HDPE	FC80	120*	120* (max. temp. rise 50K)
	110 × 5 Coestilen® HDPE	FC100	120*	120* (max. temp. rise 83K)
	125 × 6 Coestilen® HDPE	FC150	120*	120* (max. temp. rise 45K)
	160 × 7.5 Coestilen® HDPE	FC150	120*	120* (max. temp. rise 66K)
	200 × 7 Coestilen® HDPE	FC250	120*	120* (max. temp. rise 45K)
	250 × 8 Coestilen® HDPE	FC250	120*	120* (max. temp. rise 83K)

* No failure

B.6.2.6 The discussion presented previously (regarding the difference between a framed wall and a clad Speedpanel aperture) for uPVC and HDPE pipes up to 110mm diameter is directly applicable, however in this case the effect of the proposed construction is to reduce the cavity width (92mm to 77mm).

B.6.2.7 However in light of the large temperature margin at 120 minutes, it is considered that the effect of transplanting the pipes tested in the full size framed wall into a small clad aperture would not reduce any of the achieved performance parameters below 120 minutes.

uPVC Pipe of 150mm Diameter

B.6.2.8 The 150mm uPVC pipe tested in the Speedpanel wall in EWFA 2517300.2 exceeded the (180K rise) insulation criterion on the Speedpanel 25mm from the collar (98 minutes) and on the collar 25mm from the wall (67 minutes) before 120 minutes. At 120 minutes, the maximum temperature rises recorded on the wall and collar were 236K and 286K respectively.

B.6.2.9 Inspection of the post-test photographs suggests that the fire side collar was unsuccessful in fully closing the pipe at that location. It is considered, however, that a similar collar would perform to a higher standard if tested in a partition rather than Speedpanel. This notion is given credibility by the performance of the PROMASTOP® UniCollar® tested in FSRG A-07-508A, which was observed to successfully close a 160mm uPVC pipe such that integrity and insulation were maintained for 120 minutes without failure (at which time, the maximum temperature rise was 143K).

B.6.2.10 The UniCollar® was tested in a framed wall comprising 64mm steel studs clad either side with one layer of 20mm thick PROMATECT® 100. The discussion presented previously (regarding the difference between a framed wall and a clad Speedpanel aperture) for uPVC and HDPE pipes up to 100mm diameter is directly applicable.

B.6.2.11 Additional confidence is added to the proposed 150mm uPVC pipe by the previous discussion on uPVC, HDPE and Coestilen® HDPE pipes of various diameters (one larger than 150mm), which concluded that each of the pipes will maintain integrity and insulation for 120 minutes

when installed in the clad Speedpanel aperture. It has been stated previously that, provided the fire side collar remains closed, the behaviour of different types of plastic in regard to heat transfer to the non-fire side is considered to be largely equivalent.

B.6.2.12 In light of this, and reinforcing the notion that the proposed FC150 collar is expected to successfully close and remain so for the test duration, it is considered that the proposed 150mm diameter uPVC pipe installed in the clad Speedpanel aperture will maintain integrity and insulation for at least 120 minutes.

B.7 PIPE SPACING REQUIREMENTS

B.7.1 Proposal

B.7.1.1 It is proposed that pipes be located as close as 40mm collar-to-collar.

B.7.2 Discussion

B.7.2.1 AS4072.1-2005 (clause 4.9.3) states that “the minimum distance between penetrations in a modular system shall be not less than 40mm, unless otherwise tested in specimen form”. It is noted that AS4072.1-2005 (clause 1.4.10) defines a “penetration” as “an aperture through a fire-separating element for the passage of a service or services”.

B.7.2.2 Reference test EWFA 2517300.2, comprising the proposed Speedpanel wall, included a cluster of damper penetrations. The cluster nominally measured 680mm wide × 1130mm high, and demonstrated that the Speedpanel wall is capable of remaining viable as a support construction, even when a significant portion is removed, in excess of 120 minutes.

B.7.2.3 In light of the above, it is considered that the AS4072.1-2005 clause mentioned is applicable to the pipes considered in this assessment report. The minimum spacing of said pipes is thus 40mm from aperture-to-aperture. The pipe cluster size shall be limited to a maximum 600mm wide × 1130mm high, to limit the span between board fixings to approximately that which was tested.

B.8 VARIATION TO FC COLLAR FLANGE

B.8.1 Proposal

B.8.1.1 In cases where collar flanges of adjacent pipes may overlap, the FC collar flange shall be cut in a single straight line in a manner to avoid overlap and fixed as shown in figure 16.

B.8.2 Discussion

B.8.2.1 The detail shown in figure 16 presents an alteration to the collar flange is limited to a single straight line cut. The cut will remove at most one fixing location. The proposal includes the addition of another two fixings to replace the one removed. The additional fixings will be spaced closer together than the original fixing for collars with square bases. Collars with round bases will have the additional fixing spaced marginally further apart.

B.8.2.2 The modified fixing specification will act to improve the fixity of the collar body to the substrate and not impair the activation of the collar.

B.8.2.3 Therefore it is considered that any removed fixing position is replace with an additional 2 fixings, the risk of detachment of the collar is considered to be negated.

B.8.2.4 Further confidence is gained from referenced test 7745 which included a PE pipe penetration in a floor protected with a Promastop-A FC 110 Fire collar fixed at only 3 locations. An identical collar and penetration was also tested with 4 fixings. Both collars successfully closed the pipes and the systems maintained integrity and insulation criteria in excess of 120 minutes, with no discernible difference in performance between the two specimens.

B.8.2.5 Based on the discussion above the alteration of collar flanges shown in figure 16 is not expected to detrimentally affect the performance of the collar for applications up to -/120/120.