

FIRE ASSESSMENT REPORT

FC12496-001

FIRE RESISTANCE OF RAMSET BLAZEBRAKE SEALANT APPLIED TO WALL AND FLOOR PENETATIONS AND AS A CONTROL JOINT

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ASSESSMENT OBJECTIVE

To assess the fire resistance, in accordance with AS 1530.4:2014 with reference to AS 4072-2005, including amendment one, of Ramset Blazebrake sealant as a seal around pipe and cable penetrations, or as a control joint or deflection head seal, in steel framed plasterboard lined walls or masonry and concrete walls or concrete floors.

CONCLUSION

It is considered that the Ramset Blazebrake sealant used as a deflection head joint, wall to masonry joint or control joint or to seal pipe and cable bundle penetrations through a steel framed plasterboard lined wall or concrete or masonry wall or concrete floor slabs would achieve at least the stated FRL, in accordance with AS 1530.4:2014, as listed in Table 4 to Table 10.

LIMITATION

This report is subject to the accuracy and completeness of the information supplied.

BRANZ reserves the right to amend or withdraw this assessment if information becomes available which indicates the stated fire performance may not be achieved.

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TERMS AND CONDITIONS

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

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1. INTRODUCTION

This report gives BRANZ's assessment of the fire resistance of Ramset Blazebrake acrylic construction sealant installed in;

- Steel framed plasterboard lined walls as an edge joint, control joint or to seal pipe and cable penetrations through the wall; and
- In masonry or concrete walls or concrete floors as a control joint or to seal pipe and cable penetrations through the wall or floor.

2. BACKGROUND

2.1 BRANZ fire resistance test FP 3698

In BRANZ fire resistance test FP 3698 a steel framed wall lined with one layer of 16 mm thick fire rated plasterboard included a deflection head, edge joints, a control joint and pipe and cable penetrations.

For the deflection head, edge joints and control joint the plasterboard lining sheets were cut and fitted to leave the required gap between the edge of the sheet and the specimen holder at both sides and head of the specimen and between the edges of the sheets at the control joint. At the top and edges the sealant was gun applied into the gap to a thickness of 13 mm. For the expansion joint a polyurethane foam backing strip, 25 mm wide x 25 mm thick was compressed into the gap and the sealant was gun applied into the gap to a thickness of 13 mm. The same system of seal was used on both the exposed and unexposed faces of the wall.

The pipe penetration (Specimen E) consisted of a nominal 76 mm outside diameter x 1.8 mm wall thickness copper pipe passing through a 100 mm diameter hole through the wall. A sleeve 80 mm long x 100 mm diameter formed from 0.6 mm thick galvanised steel was installed around the pipe spanning the linings of the wall. The annular gap between the pipe and the sleeve was sealed to a depth of 16 mm from each face of the wall using gun applied the sealant to finish flush with the faces of the wall. A half-circumference, steel mesh radiation guard 450 mm long x 240 mm diameter was fitted concentrically around the right vertical half of the pipe where it protruded from the wall.

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The cable penetration (Specimen F) consisted of a bundle of electrical power and communication cables with an overall diameter of approximately 65 mm passing through an 80 mm diameter hole in the wall. The bundle included the following cables:

Number of cables	Outside diameter mm	Conductors No. x dia. mm
1	21	37 x 1.8
1	17	4 @ (7 X 1) + 1@ (7 X 0.65)
2	16	4 @ (7 X 1)
2	12.5	4 @ (7 X 0.6)
2	11	24 @ (5 X 0.16)
1	11 x 7.5	2 X 1.8
2	10.5	19 X 1.6 (38 mm^2)
1	9	19 X 1.3
1	8	7 X 1
1	4.2	7 X 0.8

The annular gaps between the bundle of cables and the plasterboard, on each face of the wall, were sealed using gun applied the sealant to the full 16 mm depth of the plasterboard to finish flush with the faces of the wall. All gaps between cables in the bundle were also sealed with the sealant.

The wall was tested in accordance with AS 1530.4-1990 for a duration of 77 minutes. The specimens tested and the results achieved are given in Table 1.

Table 1: Specimen summary for fire resistance test FP 3698

Specimen	Configuration	Fire Resistance	FRL
A	Deflection head 20 mm wide x 13 mm deep seal	-/77/77	-/60/60
B & C	Wall to masonry joint 10 mm and 15 mm wide x 13 mm deep seal	-/77/77	-/60/60
D	Control joint 20 mm wide x 13 mm deep seal over a PU backing strip	-/77/71	-/60/60
E	76 mm diameter copper pipe with a 12 mm annular gap and 16 mm deep seal- with circumferential screen	-/77/77	-/60/60
	76 mm diameter copper pipe with a 12 mm annular gap and 16 mm deep seal - without screen	-/77/18	-/60/0
F	65 mm diameter bundle of cables with a 7.5 mm annular gap and 16 mm deep seal	-/77/62	-/60/60

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2.2 BRANZ fire resistance test FP 3699

In BRANZ fire resistance test FP 3699 a steel framed wall lined with two layers of 13 mm thick fire rated plasterboard included a deflection head, edge joints, a control joint and pipe and cable penetrations.

For the deflection head, edge joints and control joint the plasterboard lining sheets were cut and fitted to leave the required gap between the edge of the sheet and the specimen holder at both sides and head of the specimen and between the edges of the sheets at the control joint. At the top and edges the sealant was gun applied into the gap to a thickness of 13 mm. For the expansion joint a polyurethane foam backing strip, 25 mm wide x 25 mm thick was compressed into the gap and the sealant was gun applied into the gap to a thickness of 13 mm. The same system of seal was used on both the exposed and unexposed faces of the wall.

The pipe penetration (Specimen E) consisted of a nominal 80 mm (79 mm OD) x 1.4 mm wall thickness copper pipe passing through a 98 mm diameter hole through the wall. A sleeve 80 mm long x 98 mm diameter formed from 0.6 mm thick galvanised steel was installed around the pipe spanning the linings of the wall. The annular gap between the pipe and the sleeve was sealed to a depth of 26 mm from each face of the wall using gun applied the sealant to finish flush with the faces of the wall. A half-circumference, steel mesh radiation guard 450 mm long x 240 mm diameter was fitted concentrically around the right vertical half of the pipe where it protruded from the wall.

The cable penetration (Specimen F) consisted of a bundle of electrical power and communication cables with an overall diameter of approximately 65 mm passing through an 80 mm diameter hole in the wall. The bundle included the following cables:

Number of cables	Outside diameter mm	Conductors No. x dia. mm
1	21	37 x 1.8
1	17	4 @ (7 X 1) + 1@ (7 X 0.65)
2	16	4 @ (7 X 1)
2	12.5	4 @ (7 X 0.6)
2	11	24 @ (5 X 0.16)
1	11 x 7.5	2 X 1.8
2	10.5	19 X 1.6 (38 mm^2)
1	9	19 X 1.3
1	8	7 X 1
1	4.2	7 X 0.8

The annular gaps between the bundle of cables and the plasterboard, on each face of the wall, were sealed using gun applied the sealant to the full 26 mm depth of the plasterboard to finish flush with the faces of the wall. All gaps between cables in the bundle were also sealed with the sealant.

The wall was tested in accordance with AS 1530.4-1990 for a duration of 154 minutes. The specimens tested and the results achieved are given in Table 2.

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Table 2: Specimen summary for fire resistance test FP 3699

Specimen	Configuration	Fire Resistance	FRL
A	Deflection head 20 mm wide x 13 mm deep seal	-/154/114	-/120/90
B	Wall to masonry joint 15 mm wide x 13 mm deep seal	-/154/141	-/120/120
C	Wall to masonry joint 10 mm wide x 13 mm deep seal	-/154/146	-/120/120
D	Control joint 20 mm wide x 13 mm deep seal over PU backing strip	-/154/113	-/120/90
E	80 mm diameter copper pipe with 9.5 mm annular gap and 26 mm deep seal - with circumferential screen	-/154/137	-/120/120
	80 mm diameter copper pipe with 9.5 mm annular gap and 26 mm deep seal - without screen	-/154/18	-/120/0
F	65 mm diameter bundle of cables with 7.5 mm annular gap and 26 mm deep seal	-/154/66	-/120/60

2.3 BRANZ fire resistance test FR 3700

In BRANZ fire resistance test FR 3700 a 170 mm thick concrete floor slab included a copper pipe (Specimen 20) and a cable penetration (Specimen 21).

The pipe penetration consisted of a nominal 80 mm diameter (79 mm OD) x 1.5 mm wall thickness copper pipe passing through a 100 mm diameter hole in the concrete floor slab. the sealant was gun applied from the unexposed side to a depth of 20 mm in the annular gap between the pipe and the concrete slab to finish flush with the unexposed surface. A half-circumference, steel mesh radiation guard 450 mm long x 240 mm diameter was fitted concentrically around the pipe where it protruded from the concrete slab.

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The cable penetration consisted of a bundle of electrical power cables with an overall diameter of 60 to 65 mm passing through an 80 mm diameter hole in the floor slab. The bundle included the following cables:

Number of cables	Outside diameter mm	Number of cores	Conductors No. x dia. mm
1	16.3	3	Screen 35 x 0.7, cores 7 x 1
4	9.3 x 6.7	3	7 x 0.7
2	10.8	23	7 x 0.2 (telecom)
1	10.5	1	19 x 1.6 (38 mm^2)
1	10.4	1	19 x 1.6
3	10.0	1	19 x 1.5
2	9.0	1	19 x 1.3
4	7.2	1	7 x 0.85

the sealant was gun applied from the unexposed side to a depth of 20 mm in the annular gap between the bundle and concrete to finish flush with the unexposed surface.

The specimens were tested in accordance with AS 1530.4-1990 for a duration of 248 minutes. The specimens tested and the results achieved are given in Table 3.

Table 3: Specimen summary for fire resistance test FR 3700

Specimen	Configuration	Fire resistance	FRL
20	80 mm diameter copper pipe with 10.5 mm annular gap and 20 mm deep seal - with circumferential screen	-/248/248	-/240/240
	80 mm diameter copper pipe with 10.5 mm annular gap and 20 mm deep seal - without circumferential screen	-/248/30	-/240/30
21	65 mm diameter bundle of cables with 10 mm to 7.5 mm annular gap and 20 mm deep seal	-/248/171	-/240/120

2.4 BRANZ fire resistance test FP 3701

In BRANZ fire resistance test FP 3701 a 180 mm thick concrete floor slab included a copper pipe penetration (Specimen 1).

The pipe penetration consisted of a nominal 200 mm diameter (203 mm OD) x 2.2 mm wall thickness copper pipe passing through a 244 mm diameter hole in the concrete floor slab. A foamed polyurethane former was inserted into the annular gap around the pipe to provide for the sealant gun applied from the unexposed side to a depth of 20 mm in the nominal 20 mm wide annular gap between the pipe and the concrete slab to finish flush with the unexposed surface.

The specimen was tested in accordance with AS 1530.4-1990 for a duration of 244 minutes and achieved an Integrity of 120 minutes and Insulation of 9 minutes.

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3. DISCUSSION

3.1 AS 1530.4-1990 vs AS 1530.4:2014

In the BRANZ fire resistance tests described in Section 2 above a number of penetration systems were tested in accordance with fire resistance test standard AS 1530.4-1990 and AS 4072:1992. The significant differences between the versions of the test standard are as follows:

3.1.1 Furnace temperature

Both test standards specify the same time/temperature curve except that AS 1530.4:2014 starts at 20°C rather than at ambient temperature at the start of the test. For the normal ambient temperatures experienced at BRANZ this is a minor difference in starting temperature and it is considered that the furnace temperature in the tests would meet the tolerance requirements of AS 1530.4:2014.

3.1.2 Pressure requirements

The pressure requirements between versions of the test standard is different for penetrations. AS 1530.4-1990/AS 4072.1-1992 specifies 8 Pa at the mid height of the lowest penetration. AS 1530.4:2014 specifies a minimum of 10 Pa at the mid height of the lowest penetration. In fire resistance tests FP 3698 and FP 3699 the pressure was set to the lowest penetration which was below the pipes and cable penetrations. Based on the pressure gradient in the furnace it is expected that the pipe and cable penetrations would have been subjected to at least the furnace pressure as required by AS 1530.4:2014 and therefore would have met the pressure requirements of the standard.

With respect to the deflection head, wall to concrete and control joint seals tested in the walls, the requirement set by AS 1530.4:2014 is that the furnace pressure be set at least 10 Pa at mid height of the lowest penetration. In fire resistance tests FP 3698 and FP 3699 the pressure was maintained at 8 Pa at 300 mm above the floor level and hence the joint seals were subjected to a higher pressure than required by the current test standard. It is therefore considered that the specimens as tested would also meet the requirements of the AS 1530.4:2014 test standard.

For the horizontal floor tests the pressure requirements between versions of the test standard is different for penetrations. AS 1530.4-1990/AS 4072.1-1992 specifies 8 Pa at 100 mm below the floor slab whereas AS 1530.4:2014 specifies 20 Pa at 100 mm below the horizontal supporting construction. It is considered that for penetration seals the difference in pressure within the furnace is not significant when no gaps or fissures develop in the seal to allow hot furnace gases to pass through. From the observations made during the tests, no gaps or fissures developed through the seals of the 80 mm copper pipe and cable bundle for the 248 minutes duration in fire resistance test FR 3700. It is therefore considered that these penetrations would achieve at least 240 minutes Integrity if they had been tested at the higher pressure in accordance with AS 1530.4:2014.

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3.1.3 Integrity failure criteria

The integrity failure criteria has changed between versions of the test standard. AS 1530.4-1990 determines integrity failure to be vision through gaps into the furnace or sustained flaming on the unexposed face. AS 1530.4:2014 determines integrity failure by ignition of a cotton pad in addition to sustained flaming but does not include the use of gap gauges. As discussed in 3.1.2 above as no gaps or fissures were observed during the FR 3700 test it is expected that flaming of a cotton pad is unlikely. However, for uninsulated penetrations, e.g. the copper pipes, ignition of the cotton pad may occur if the radiation from the pipe is sufficient. In fire resistance test FR 3700 the measured temperature on the pipe at 240 minutes test duration was approximately 350°C. Based on this surface temperature it is calculated that the emitted radiation from the pipe is less than 8 kW/m^2 which is substantially less than the 25 kW/m^2 radiation required to ignite cotton material after a long period of time. Hence it is not expected that the temperature of the pipe at 240 minutes would be insufficient to ignite a cotton pad held adjacent to the pipe where it protrudes from the wall or floor.

3.1.4 Insulation failure criteria

The insulation criteria and location of the specimen thermocouples are slightly different between the two versions of the test standard. However, it is considered the specimens as tested would also meet the requirements of AS 1530.4:2014.

3.2 Head edge and control joint seals

In fire resistance test FP 3698 the wall system consisted of nominal 64 mm deep steel studs lined with one layer of 16 mm thick fire rated plasterboard to each face. The wall system tested had an established fire resistance level (FRL) of at least -/60/60. The wall joints tested in FP 3698 consisted of a deflection head (Specimen A), a masonry-drywall joint (Specimens B and C) and a control joint (Specimen D). The width of the joints varied from 10 mm to 20 mm, but all had a seal nominally 13 mm deep. The three joint details did not fail the integrity and insulation criteria for in excess of 60 minutes in the 16 mm thick fire rated plasterboard lined wall.

Based on the performance of the Ramset Blazebrake sealant in the fire rated steel framed wall, and provided that there is no reduction in sealant thickness, it is considered that if the same jointing details up to the same maximum tested width of 20 mm were tested in a 30 minute fire rated wall of at least 13 mm thick plasterboard they would achieve an FRL of at least -/30/30 if tested in accordance with AS 1530.4:2014.

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3.3 Pipe penetrations

In fire resistance test FP 3698 a copper pipe nominally 80 mm in diameter was installed in a nominally 100 mm diameter hole in the plasterboard lined wall. A galvanised steel sleeve was installed spanning the wall linings then the 12 mm wide annular gap between the pipe and the sleeve was filled to a depth of 16 mm thick with Ramset Blazebrake sealant. The specimen also included a mesh radiation guard along the pipe. The pipe failed the insulation criteria at 18 minutes but did not fail the insulation criteria on the guard and did not fail the integrity criteria for the 77 minutes duration of the test. Therefore it is considered if the pipe penetration as tested in FP 3698 was installed into a 60/60/60 or -/60/60 fire rated plasterboard wall lined with at least 16 mm thick fire rated plasterboard it would be expected to achieve Integrity of at least 60 minutes and an FRL of at least -/60/0 without a radiation guard and at least -/60/60 with a full circumference radiation guard if tested in accordance with AS 1530.4:2014.

If the pipe was installed as described in fire resistance test FP 3698 into a 30 minute fire rated wall with at least 13 mm thick plasterboard it is expected that the penetration would achieve an FRL of at least -/30/0 without the radiation guard and an FRL of at least -/30/30 with a full circumference radiation guard.

In fire resistance test FP 3699 a copper pipe nominally 80 mm in diameter was installed in a nominally 100 mm diameter hole in the plasterboard lined wall. A galvanised steel sleeve was installed spanning the wall linings then the 9.5 mm wide annular gap between the pipe and the sleeve was filled to a depth of 26 mm with Ramset Blazebrake sealant. The specimen also included a mesh radiation guard along the pipe. The pipe failed the insulation criteria at 18 minutes but did not fail the insulation criteria on the guard and did not fail the integrity criteria for the 154 minutes duration of the test. Therefore it is considered if the pipe penetration as tested in FP 3699 was installed into a 120/120/120 or -/120/120 fire rated plasterboard wall lined with at least 26 mm thick fire rated plasterboard it would be expected to achieve Integrity of at least 120 minutes and an FRL of at least -/120/0 without a radiation guard and at least -/120/120 with a full circumference radiation guard.

In fire resistance test FP 3701 the 200 mm diameter copper pipe with the polyurethane backing strip failed the integrity criteria after 120 minutes, due to a gap developing with vision into the furnace where the seal had receded away from one third of the circumference of the pipe. In FR 3700 the 80 mm diameter pipe without the backing strip did not fail the integrity criteria for the 248 minutes of the test but failed the insulation criteria after 30 minutes. Both tests had a minimum depth of sealant around the pipe service of 20 mm, however the width of sealant varied from nominal 20 mm wide for the 200 mm pipe to 10 mm wide for the 80 mm diameter pipe. Therefore it is considered if the 200 mm pipe penetration was installed into a 120/120/120 or -/120/120 fire rated plasterboard wall lined with at least 26 mm thick fire rated plasterboard it would be expected to achieve Integrity of at least 120 minutes and an FRL of at least -/120/0 without a radiation guard and at least -/120/120 with a full circumference radiation guard.

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Mild and stainless steel pipes have a lower thermal conductivity than copper and it is therefore expected that steel or stainless steel pipes of comparable wall thickness to the pipes tested would achieve a similar integrity rating of 120 minutes. Further to this, Clause 10.12.3 of AS 1530.4:2014 allows for the results of the fire resistance test to be applied to copper and ferrous metal pipes having diameters and wall thicknesses equal or less than that successfully tested.

3.4 Cable bundles

In fire resistance test FP 3698 a bundle of cables with an outside diameter of 65 mm (Specimen F) was installed into an 80 mm diameter hole through the plasterboard wall. The annular gaps between the cables and hole in the plasterboard were filled with Ramset Blazebrake sealant to the full 16 mm depth of the lining. All visible gaps between the cables in the bundle were also sealed with Ramset Blazebrake sealant. The penetration achieved an FRL of -/60/60. Therefore it is considered if the cable penetration as tested in FP 3698 was installed into a 60/60/60 or -/60/60 fire rated plasterboard wall lined with at least 16 mm thick fire rated plasterboard it would be expected to achieve Integrity and Insulation of at least 60 minutes if tested in accordance with AS 1530.4:2014.

It is proposed to install the cable bundle as described in fire resistance test FP 3698 into a 30 minute fire rated wall with at least 13 mm thick plasterboard. In terms of the Insulation performance of the cables when the penetration did exceed the Insulation criteria it was measured on the cables 25 mm from the wall. Although this will reduce the wall thickness by 3 mm per side it is not expected to reduce the Insulation performance of the penetration system significantly. Therefore, it is expected the cables installed into a 30 minute fire rated wall would maintain the Insulation criteria for at least 30 minutes.

In terms of the Integrity criteria the penetration system did not fail the integrity criteria for the 77 minute duration of the test. By reducing the thickness of the lining and sealant it is expected to reduce the Integrity performance of the system. However, it is not expected to reduce it sufficiently to prejudice the fire resistance of the wall system. Therefore it is considered if the cable penetration as tested in FP 3698 was installed into a 30/30/30 or -/30/30 fire rated plasterboard wall lined with at least 13 mm thick fire rated plasterboard it would be expected to achieve Integrity and Insulation of at least 30 minutes if tested in accordance with AS 1530.4:2014.

In fire resistance test FP 3699 a bundle of cables with an outside diameter of 65 mm (Specimen F) was installed into an 80 mm diameter hole through the plasterboard wall. The annular gaps between the cables and hole in the plasterboard were filled with Ramset Blazebrake sealant to the full 26 mm depth of the lining. All visible gaps between the cables in the bundle were also sealed with Ramset Blazebrake sealant. The penetration achieved an FRL of -/120/60. Therefore it is considered if the cable penetration as tested in FP 3699 was installed into a 120/120/120 or -/120/120 fire rated plasterboard wall lined with at least 26 mm thick fire rated plasterboard it would be expected to achieve Integrity of at least 120 minutes and Insulation of at least 60 minutes if tested in accordance with AS 1530.4:2014.

Further to this it is considered that provided the annular gap and depth of sealant is maintained bundles of cables less than 65 mm diameter with copper conductors not greater than those tested would be expected to achieve the FRLs as discussed above.

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In fire resistance test FR 3700 a bundle of cables with an outside diameter of 65 mm (Specimen 21) was installed into an 80 mm diameter hole through the concrete floor slab. The annular gap between the cables and hole in the concrete slab was filled with Ramset Blazebrake sealant to a depth of 20 mm to finish flush with the unexposed surface. All visible gaps between the cables in the bundle were also sealed with Ramset Blazebrake sealant. The penetration achieved an FRL of -/240/120. Therefore it is considered if the cable penetration as tested in FR 3700 was installed into a concrete floor at least 120 mm or 180 mm thick it would be expected to achieve Integrity of at least 120 minutes and 240 minutes respectively and Insulation of at least 120 minutes if tested in accordance with AS 1530.4:2014.

3.5 Concrete or masonry walls

Clause 10.12.2 of AS 1530.4:2014 allows that test results obtained from penetrations through framed wall systems may be applied to the performance of a system in concrete or masonry walls of equal or greater thickness to that of the tested prototype. It is therefore considered that the deflection head, joint seals, copper pipes and cable bundles will achieve the fire resistance as discussed above if penetrating a concrete or masonry wall of at least 120 mm thick for a fire resistance of 120 minutes.

In fire resistance test FR 3700 the nominal 80 mm diameter copper pipe penetrated a 170 mm thick concrete floor. The 10.5 mm wide annular gap between the pipe and the concrete floor was sealed with gun applied Ramset Blazebrake sealant to a depth of 20 mm from the unexposed side. The pipe penetration specimen achieved Integrity of at least 240 minutes. This is considered a more severe situation for the sealant due to the high temperatures that the copper pipe would reach. Because the seal was applied to one side of the floor only and the large margin in integrity achieved it is considered that if the sealant was applied to a depth of at least 20 mm to both sides of a concrete or masonry wall with an FRL of up to 240 minutes, the 80 mm diameter copper pipe would achieve Integrity of at least 240 minutes. It is considered the pipe would achieve an Insulation of at least that of the wall if fitted with a concentric radiation screen or zero without the screen.

3.6 Concrete floor slab

In fire resistance tests FR 3700 a nominal 80 mm diameter copper pipe penetrated a 170 mm thick concrete floor slab. The nominal 10 mm wide annular gap between the pipe and the concrete floor was sealed with gun applied Ramset Blazebrake sealant to a depth of 20 mm from the unexposed side. The pipe penetration specimen achieved Integrity of at least 240 minutes. Although the seal was applied to one side of the floor only the Insulation measured on the floor slab 25 mm away from any penetration remained less than the 180 K rise failure criteria. However, for thinner concrete the Insulation rating of the concrete floor slab could be less due to the shorter conduction path that would result by the furnace gases passing into the annular gap in the floor. If the seal was provided on both the exposed face as well as the unexposed face it is expected that the Ramset Blazebrake sealant installed to a depth of 20 mm would also achieve Integrity of up to at least 240 minutes and Insulation relevant to the thickness of the floor slab.

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Similarly, a pipe penetration through a floor slab is expected to also achieve Insulation of at least 240 minutes with a radiation screen if the sealant is applied to the exposed face as well as the unexposed face. However, as discussed in Clause 3.5 above a bundle of cables passing through a concrete floor slab with the seal applied to both the exposed and unexposed face will be limited to a fire resistance of at least 120 minutes Integrity and 60 minutes Insulation due to the possibility of failure by flaming of the insulation after 120 minutes.

4. CONCLUSION

It is considered that the Ramset Blazebrake sealant used as a deflection head joint, wall to masonry joint or control joint or to seal pipe and cable bundle penetrations through a steel framed plasterboard lined wall or concrete or masonry wall or concrete floor slab would achieve at least the stated FRL, in accordance with AS 1530.4:2014, as listed in the following Table 4 to Table 10:

Table 4: Penetrations in steel framed wall lined each face with 13 mm thick fire rated plasterboard with FRL -/30/30

Penetration	Description of Ramset Blazebrake seal	FRL
Deflection head	Up to 20 mm wide with 13 mm deep to each face	-/30/30
Wall to masonry joint	Up to 15 wide with 13 mm deep to each face	-/30/30
Control joint	Up to 20 mm wide with 13 mm deep to each face	-/30/30
Copper or steel pipe[#] up to 80 mm dia. with radiation guard	Up to 12 mm wide with 13 mm deep to each face	-/30/30
Copper or steel pipe[#] up to 80 mm dia. without radiation guard	Up to 12 mm wide with 13 mm deep to each face	-/30/0
Copper or steel pipe[#] up to 200 mm dia. with radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/30/30
Copper or steel pipe[#] up to 200 mm dia. without radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/30/0
Bundle of cables up to 65 mm dia. up to 38 mm^2 conductor	Up to 7.5 mm wide with 13 mm deep to each face	-/30/30

[#] 0.6 mm thick steel sleeve x depth of wall

Note: Sealant application depth assumes a minimum thickness of 13 mm (unless otherwise stated). It is anticipated that a thicker depth would improve the FRL performance, however would need to be validated via additional testing.

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Table 5: Penetrations in steel framed wall lined each face with 16 mm thick fire rated plasterboard with FRL -/60/60

Penetration	Description of Ramset Blazebrake seal	FRL
Deflection head	Up to 20 mm wide with 13 mm deep to each face	-/60/60
Wall to masonry joint	Up to 15 mm wide with 13 mm deep to each face	-/60/60
Control joint	Up to 20 mm wide with 13 mm deep to each face	-/60/60
Copper or steel pipe[#] up to 80 mm dia. with radiation guard	Up to 12 mm wide with 16 mm deep to each face	-/60/60
Copper or steel pipe[#] up to 80 mm dia. without radiation guard	Up to 12 mm wide with 16 mm deep to each face	-/60/0
Copper or steel pipe[#] up to 200 mm dia. with radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/60/60
Copper or steel pipe[#] up to 200 mm dia. without radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/60/0
Bundle of cables up to 65 mm dia. up to 38 mm^2 conductor	Up to 7.5 mm wide with 16 mm deep to each face	-/60/60

[#] 0.6 mm thick steel sleeve x depth of wall

Note: Sealant application depth assumes a minimum thickness of 13 mm (unless otherwise stated). It is anticipated that a thicker depth would improve the FRL performance, however would need to be validated via additional testing.

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Table 6: Penetrations in steel framed wall lined each face with two layers of 13 mm thick fire rated plasterboard with FRL -/120/120

Penetration	Description of Ramset Blazebrake seal	FRL
Deflection head	Up to 20 mm wide with 13 mm deep to each face	-/120/90
	Up to 20 mm wide with 26 mm deep to each face	-/120/120
Wall to masonry joint	Up to 15 mm wide with 13 mm deep to each face	-/120/120
Control joint	Up to 20 mm wide with 13 mm deep to each face	-/120/90
	Up to 20 mm wide with 26 mm deep to each face	-/120/120
Copper or steel pipe[#] up to 80 mm dia. with radiation guard	Up to 10 mm wide with 26 mm deep to each face	-/120/120
Copper or steel pipe[#] up to 80 mm dia. without radiation guard	Up to 10 mm wide with 26 mm deep to each face	-/120/0
Copper or steel pipe[#] up to 200 mm dia. with radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/120/120
Copper or steel pipe[#] up to 200 mm dia. without radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/120/0
Bundle of cables up to 65 mm dia. up to 38 mm^2 conductor	Up to 7.5 mm wide with 26 mm deep to each face	-/120/60

[#] 0.6 mm thick steel sleeve x depth of wall

Note: Sealant application depth assumes a minimum thickness of 13 mm (unless otherwise stated). It is anticipated that a thicker depth would improve the FRL performance, however would need to be validated via additional testing.

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Table 7: Penetrations In masonry or concrete wall at least 120 mm thick or hollow block wall with equivalent FRL

Penetration	Description of Ramset Blazebrake seal	FRL
Deflection head	Up to 20 mm wide with 13 mm deep to each face over PU backing rod	-/120/90
	Up to 20 mm wide with 26 mm deep to each face over PU backing rod	-/120/120
Control joint	Up to 20 mm wide with 13 mm deep to each face over PU backing rod	-/120/90
	Up to 20 mm wide with 26 mm deep to each face over PU backing rod	-/120/120
Copper or steel pipe up to 80 mm dia. with radiation guard	Up to 10 mm wide with 26 mm deep to each face	-/120/120
Copper or steel pipe up to 80 mm dia. without radiation guard	Up to 10 mm wide with 26 mm deep to each face	-/120/0
Copper or steel pipe up to 200 mm dia. with radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/120/120
Copper or steel pipe up to 200 mm dia. without radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/120/0
Bundle of cables up to 65 mm dia. up to 38 mm^2 conductor	Up to 7.5 mm wide with 26 mm deep to each face	-/120/60

Note: Sealant application depth assumes a minimum thickness of 13 mm (unless otherwise stated). It is anticipated that a thicker depth would improve the FRL performance, however would need to be validated via additional testing.

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Table 8: Penetrations in concrete wall at least 180 mm thick or hollow block wall with equivalent FRL

Penetration	Description of Ramset Blazebrake seal	FRL
Copper or steel pipe up to 80 mm dia. with radiation guard	Up to 10 mm wide with 26 mm deep to each face	-/240/240
Copper or steel pipe up to 80 mm dia. without radiation guard	Up to 10 mm wide with 26 mm deep to each face	-/240/30

Note: Sealant application depth assumes a minimum thickness of 13 mm (unless otherwise stated). It is anticipated that a thicker depth would improve the FRL performance, however would need to be validated via additional testing.

Table 9: Penetrations in concrete floor slab at least 120 mm thick

Penetration	Description of Ramset Blazebrake seal	FRL
Copper or steel pipe up to 80 mm dia. with radiation guard	Up to 10 mm wide with 20 mm deep to each face	-/120/120
Copper or steel pipe up to 80 mm dia. without radiation guard	Up to 10 mm wide with 20 mm deep to each face	-/120/0
Copper or steel pipe up to 200 mm dia. with radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/120/120
Copper or steel pipe up to 200 mm dia. without radiation guard	Up to 20 mm wide with 20 mm deep to each face	-/120/0
Bundle of cables up to 65 mm dia. up to 38 mm^2 conductor	Up to 7.5 mm wide with 26 mm deep to each face	-/120/120

Note: Sealant application depth assumes a minimum thickness of 13 mm (unless otherwise stated). It is anticipated that a thicker depth would improve the FRL performance, however would need to be validated via additional testing.

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Table 10: Penetrations in concrete floor slab at least 180 mm thick

Penetration	Description of Ramset Blazebrake seal	FRL
Copper or steel pipe up to 80 mm dia. with radiation guard	Up to 10 mm wide with 20 mm deep to unexposed face only	-/240/240
Copper or steel pipe up to 80 mm dia. without radiation guard	Up to 10 mm wide with 20 mm deep to unexposed face only	-/240/30
Copper or steel pipe up to 200 mm dia. with radiation guard	Up to 20 mm wide with 20 mm deep to unexposed face only	-/120/120
Copper or steel pipe up to 200 mm dia. without radiation guard	Up to 20 mm wide with 20 mm deep to unexposed face only	-/120/0
Bundle of cables up to 65 mm dia. up to 38 mm^2 conductor	Up to 7.5 mm wide with 20 mm deep to each face	-/240/120

Note: Sealant application depth assumes a minimum thickness of 13 mm (unless otherwise stated). It is anticipated that a thicker depth would improve the FRL performance, however would need to be validated via additional testing.

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