



FIRE ASSESSMENT REPORT

FC11190-001 ISSUE 2

FIRE RESISTANCE OF TRAFALGAR FYRECHOKE COLLARS

CLIENT

Trafalgar Group Pty Ltd
26a Ferndell Street
South Granville
NSW 2142



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ASSESSMENT OBJECTIVE

To assess the fire resistance, in accordance with AS 1530.4:2014 with reference to AS 4072.1-2005 (including Amendment 1), of Trafalgar Fyrechoke collars used to protect a variety of services penetrating different fire-resistant elements.

CONCLUSION

It is considered that the Fyrechoke collars of appropriate size fitted each side of service penetrations passing through walls, or to the underside of penetrations passing through a concrete floor slab as described in Section 3.2 and Figure 1 and Figure 2, and installed as shown in Figure 3 to Figure 6, will achieve the FRLs listed in the following table, if tested in accordance with AS 1530.4:2014 with reference to AS 4072.1-2005 (including Amendment 1).

FRL of Fyrechoke collars and penetrations

Fire barrier	Service (nominal sizes)	FRL
Single layer 13 mm FR plasterboard each face	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/60/30
	uPVC pipes up to 100 mm Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm Copper pipes up to 20 mm with FR insulation uPVC pipes or conduits up to 50 mm # Up to three pair coil A/C bundles with FR insulation	-/60/60
Single layer 16 mm FR plasterboard each face	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/90/30
	Up to three pair coil A/C bundles with FR insulation Copper pipes up to 20 mm with FR insulation	-/90/60
	uPVC pipes up to 100 mm Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm uPVC conduits up to 50 mm # Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap over the collar and penetration	-/90/90
Maxilite 60 mm thick board	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/90/30
	Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap over the collar and penetration. Copper pipes up to 20 mm with FR insulation with 300 mm TWrap over the collar and penetration.	-/90/60
	100 mm uPVC pipes	-/120/90
	uPVC pipes and conduits # up to 80 mm	-/120/120
Maxilite 90 mm thick board	Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap over the collar and penetration.	-/120/120
	100 mm uPVC pipes	-/120/120



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Fire barrier	Service (nominal sizes)	FRL
AAC walls (min. 75 mm) e.g. Hebel PowerPanel	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/90/30
	Up to three pair coil A/C bundles with FR insulation Copper pipes up to 20 mm with FR insulation	-/90/60
	Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap insulation to each side Copper pipes up to 20 mm with FR insulation with 300 mm TWrap insulation to each side	-/90/90
	Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm	-/90/90
	uPVC pipes up to 100 mm	-/90/90
	uPVC pipes and conduits # up to 50 mm	-/90/90
Double layer 13 mm FR plasterboard each face Speedpanel 78 mm thick wall with 60 mm Maxilite panel Concrete floor slabs minimum 120 mm thick	uPVC pipes up to 100 mm Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm PVC conduits up to 50 mm # Copper pipes up to 20 mm with FR and 300 mm TWrap insulation to each side \$ Up to three pair coil A/C bundles with 300 mm TWrap insulation to each side \$	-/120/120
Concrete floor slabs minimum 150 mm thick	Up to two pair coil A/C bundles with non-FR and FR insulation	-/120/120
Concrete floor slabs minimum 170 mm thick	PP-R80 pipe 100 mm	-/60/60
	PP-R80 pipe up to 50 mm	-/240/240
	uPVC pipe 65 mm & 150 mm	-/180/180
	uPVC pipes up to 100 mm uPVC pipe 50 mm with elbow or socket with 65 mm collar uPVC pipe 100 mm with elbow or socket with 130 mm collar HDPE pipes up to 100 mm	-/240/240

- The conduits may contain any combination of the following up to the maximum that can be accommodated; 2C & E 2.5mm² TPS cable, CAT5/CAT6 data cables, 3C & E PVC sheathed power cables up to 19 mm diameter or fibre optic cables.

\$ - For floor slab applications TWrap is only required to the top side of the slab.

In accordance with Clause 4.9.3 of AS 4072.1-2005 the clearances between multiple penetration systems shall not be less than 40 mm apart.



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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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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, in accordance with AS 1530.4:2014 with reference to AS 4072.1-2005 (including amendment 1) of Fire Containment Pty Ltd, Trafalgar Fyrechoke collars when used to protect a variety of services penetrating different fire-resistant elements.

2. BACKGROUND

2.1 BRANZ Fire Resistance Test Report FP 4368

In the fire resistance test described in BRANZ Fire Resistance Test Report FP 4368, the test specimens consisted of a 170 mm thick concrete floor slab, with an established FRL of -/240/240, 1,000 mm wide x 2,200 mm long, and included;

- A Fusiotherm SDR 11, 50 mm OD x 5.1 mm thick, PP-R pipe (Specimen 1) passing through a 65 mm hole and sealed with a 50 mm Fyrechoke collar fixed to the underside of the floor slab.
- An Iplex Novacor DN100, 111 mm OD x 3.2 mm thick PVC DWV pipe (Specimen 4) passing through a 116 mm hole and sealed with a 130 mm Fyrechoke collar fixed to the underside of the floor slab. Two PVC 90° elbows were fitted end to end on the exposed face of the specimen with the socket of one of the elbows enclosed within the collar.
- A Coeslen PE80, 110 mm OD x 4.2 mm thick HDPE pipe (Specimen 5) passing through a 116 mm hole and sealed with a 100 mm Fyrechoke collar fixed to the underside of the floor slab.
- A Fusiotherm SDR 11, 110 mm OD x 10 mm thick, PP-R80 pipe (Specimen 6) passing through a 116 mm hole and sealed with a 100 mm Fyrechoke collar fixed to the underside of the floor slab.
- A Coeslen S12.5, 50 mm OD x 3 mm thick, HDPE pipe (Specimen 7) passing through a 65 mm hole and sealed with a 50 mm Fyrechoke collar fixed to the underside of the floor slab.

The specimen was tested in accordance with AS 1530.4-2005 for a duration of 245 minutes and achieved a fire resistance of;

• Specimen 1	-/245/245	FRL -/240/240
• Specimen 4	-/245/245	FRL -/240/240
• Specimen 5	-/245/245	FRL -/240/240
• Specimen 6	-/70/69	FRL -/60/60
• Specimen 7	-/245/245	FRL -/240/240

2.2 BRANZ Fire Resistance Test Report FP 6033

In the fire resistance test described in BRANZ Fire Resistance Test Report FP 6033, the test specimen consisted of a 64 mm steel stud wall, 1,000 mm wide x 2,200 mm high, lined with one layer of 13 mm fire rated plasterboard on each side, with an established FRL of -/60/60 and included;

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- an air conditioning bundle consisting of 9 mm and 19 mm pair coil with 25 mm thick FR insulation, one 2C + E 2.5 mm² power cable and a 5 mm OD CAT6 data cable (Specimen 6) passing through a 60 mm diameter hole with a 50 mm Trafalgar Fyrechoke collar 60 mm high fixed to both sides of the wall and with the annular gap around the pair coils and cables sealed with Fyreflex intumescent acrylic sealant to the full depth of each collar. A 25 mm thick TWrap blanket was then wrapped around the services covering 300 mm from the exit of the collar on both the unexposed and exposed sides. The TWrap was secured with 100 mm wide foil tape wrapped around the circumference of the TWrap at each end.
- three air conditioning bundles (Specimen 7) passing through a 111 mm diameter hole. a 100 mm Trafalgar Fyrechoke collar 60 mm high fixed to both sides of the wall and with the annular gap around the pair coils and cables sealed with Fyreflex intumescent acrylic sealant to the full depth of each collar. Two of the bundles consisted of pair coil 9 & 19 mm copper pipes, with 25 mm FR insulation, a 2C + E 2.5 mm² power cable and a Cat6 data cable. The third bundle consisted of 9 mm and 19 mm pair coil with 19 mm thick non-FR insulation, one 2C + E 2.5 mm² power cable and a 5 mm OD CAT6 data cable. A 20 mm PVC pipe was also included. A 25 mm thick TWrap blanket was then wrapped around the services, covering 300 mm from the exit of the collar on both the unexposed and exposed sides. The TWrap was secured with 100 mm wide foil tape wrapped around the circumference of the TWrap at each end.

The specimens were tested in accordance with AS 1530.4:2014 for a duration of 92 minutes, and the specimens achieved a fire resistance of -/92/62 and -/92/71 respectively; an FRL of -/90/60 for both.

2.3 BRANZ Fire Resistance Test Report FP 6202

In the fire resistance test described in BRANZ Fire Resistance Test Report FP 6202, the test specimen consisted of a 64 mm steel stud wall, 1,000 mm wide x 2,200 mm high, lined with two layers of 13 mm fire rated plasterboard on each side, with an established FRL of -/120/120, and included a 60 mm thick Maxilite panel 800 mm wide x 610 mm high, identified as Specimen 4, which was penetrated by;

- a 65 mm OD PVC pipe (Specimen 6) passing through a 76 mm diameter hole with the annular gap filled to a nominal depth of 15 mm from both sides off the panel with Fyreflex sealant and a 65 mm Fyrechoke collar fixed each side of the Maxilite panel; and
- a 50 mm OD PVC pipe (Specimen 7) passing through a 60 mm diameter hole with the annular gap filled to a nominal depth of 15 mm from both sides off the panel with Fyreflex sealant and a 50 mm Fyrechoke collar fixed each side of the Maxilite panel; and
- a 25 mm PVC pipe (Specimen 9) passing through a 30 mm diameter hole with the annular gap filled to a nominal depth of 15 mm from both sides off the panel with Fyreflex sealant and a 25 mm Fyrechoke collar fixed each side of the Maxilite panel; and
- a 32 mm OD PVC pipe (Specimen 10) passing through a 44 mm diameter hole with the annular gap filled to a nominal depth of 15 mm from both sides off the panel with

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Fyreflex sealant and a 32 mm Fyrechoke collar fixed each side of the Maxilite panel;
and

- a 40 mm OD PVC pipe (Specimen 11) passing through a 44 mm diameter hole with the annular gap filled to a nominal depth of 15 mm from both sides off the panel with Fyreflex sealant and a 40 mm Fyrechoke collar fixed each side of the Maxilite panel;
and

The specimens were tested in accordance with AS 1530.4:2014 for a duration of 122 minutes and the specimens achieved a fire resistance of;

- | | | |
|---------------|-----------|---------------|
| • Specimen 6 | -/122/122 | FRL -/120/120 |
| • Specimen 7 | -/122/122 | FRL -/120/120 |
| • Specimen 9 | -/122/122 | FRL -/120/120 |
| • Specimen 10 | -/122/122 | FRL -/120/120 |
| • Specimen 11 | -/122/122 | FRL -/120/120 |

2.4 BRANZ Fire Resistance Test Report FP 6251

In the fire resistance test described in BRANZ Fire Resistance Test Report FP 6251, the test specimen consisted of a 64 mm steel stud wall, 1,000 mm wide x 2,200 mm high, lined with two layers of 13 mm fire rated plasterboard on each side, with an established FRL of -/120/120 and included a 60 mm thick Maxilite panel 770 mm wide x 565 mm high, identified as Specimen 4, which was penetrated by;

- an 80 mm OD x 3.1 mm uPVC pipe (Specimen 5) passing through an 89 mm diameter hole with the annular gap filled to the full depth of the panel with Fyreflex sealant and an 80 mm Fyrechoke collar fixed each side of the Maxilite panel; and
- a 100 mm OD x 3.4 mm uPVC pipe (Specimen 6). passing through a 120 mm diameter hole with the annular gap filled to the full depth of the panel with Fyreflex sealant and a 100 mm Fyrechoke collar fixed each side of the Maxilite panel.

The specimens were tested in accordance with AS 1530.4:2014 for a duration of 122 minutes and the specimens achieved a fire resistance of -/122/122 and -/122/107 respectively, an FRL of -/120/120 and -/120/90 respectively. The insulation failure on Specimen 6 occurred on the Maxilite panel but the pipe did not fail insulation for the duration of the test.

2.5 BRANZ Fire Resistance Test Report FP 6372

In the fire resistance test described in BRANZ Fire Resistance Test Report FP 6372, the test specimen consisted of a 75 mm thick Hebel PowerPanel wall, with an established FRL of -/90/90, 1,000 mm wide x 2,200 mm high, penetrated by;

- a 100 mm OD x 3.2 mm DWV100 uPVC pipe (Specimen 1) passing through a 125 mm diameter hole with a 100 mm Trafalgar Fyrechoke collar fixed each side of the wall;
and
- a 25 mm OD x 2.05 mm uPVC conduit (Specimen 2a) containing a fibre-optic cable passing through a 32 mm diameter hole with a 25 mm Trafalgar Fyrechoke collar each side of the wall.



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The specimens were tested in accordance with AS 1530.4:2014 for a duration of 125 minutes and both the specimens achieved a fire resistance of -/125/125, an FRL of -/120/120.

2.6 BRANZ Fire Resistance Test Report FR 3402

In the fire resistance test described in BRANZ Fire Resistance Test Report FR 3402, the test specimens consisted of a 170 mm thick concrete floor slab, with an established FRL of -/240/240, 3,000 mm wide x 4,000 mm long, and included;

- A 110 mm OD x 3.2 mm thick, nominal 100 mm uPVC pipe (Specimen 8) passing through a 110 mm hole and sealed with an Abesco Z120 collar (an early version of the 100 mm Fyrechoke collar) fixed to the underside of the floor slab. The collar contained three layers of "G" type intumescent each 1.8 mm thick.

The specimen was tested in accordance with AS 1530.4:1997 for a duration of 245 minutes and the specimen achieved a fire resistance of -/245/245, an FRL of -/240/240.

2.7 BRANZ Fire Resistance Test Report FR 3981

In the fire resistance test described in BRANZ Fire Resistance Test Report FR 3981, the test specimens consisted of a 120 mm thick concrete floor slab, with an established FRL of -/120/120, 3,000 mm wide x 4,000 mm long, and included;

- A 225 mm OD x 5.9 mm thick, nominal 225 mm uPVC pipe (Specimen N) passing through a 250 mm hole and sealed with an Abesco SS 120, 225 mm pipe collar (an early version of the Fyrechoke collar) fixed to the underside of the floor slab. The collar contained two layers of 10 mm thick and one layer of 2 mm thick intumescent. Intumescent acrylic mastic was applied around the circumference of the collar and also around the pipe where it exited from the unexposed face of the slab.
- An 82 mm OD x 3.4 mm thick, nominal 80 mm uPVC pipe (Specimen P) passing through an 86 mm hole and sealed with an Abesco Z120, 80 mm pipe collar (an early version of the Fyrechoke collar) fixed to the underside of the floor slab. The collar contained three layers of 1.8 mm thick intumescent. Intumescent acrylic mastic was applied around the circumference of the collar and also around the pipe where it exited from the unexposed face of the slab.
- A 69 mm OD x 2.9 mm thick, nominal 65 mm uPVC pipe (Specimen Q) passing through a 76 mm hole and sealed with an Abesco Z120, 65 mm pipe collar (an early version of the Fyrechoke collar) fixed to the underside of the floor slab. The collar contained three layers of 1.8 mm thick intumescent. Intumescent acrylic mastic was applied around the circumference of the collar and also around the pipe where it exited from the unexposed face of the slab.
- A 160 mm OD x 5 mm thick, nominal 150 mm uPVC pipe (Specimen S) passing through a 172 mm hole and sealed with an Abesco Z120, nominal 150 mm pipe collar (an early version of the Fyrechoke collar) fixed to the underside of the floor slab. The collar contained one 10 mm thick layer and one 2 mm thick layer of intumescent. Intumescent acrylic mastic was applied around the circumference of the collar and also around the pipe where it exited from the unexposed face of the slab.



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The specimens were tested in accordance with AS 1530.4-2005 for a duration of 241 minutes and the specimens achieved a fire resistance of;

- Specimen N -/241/241 FRL -/240/240
- Specimen P -/156/241 FRL -/120/240
- Specimen Q -/233/230 FRL -/180/180
- Specimen S -/204/203 FRL -/180/180

2.8 Warringtonfire Fire Resistance Test Report FRT180323.2

In the fire resistance test described in Warringtonfire Fire Resistance Test Report FRT180323.2, the test specimen consisted of a 78 mm thick Speedpanel wall penetrated by 18 services across 15 systems including;

- a 100 mm diameter uPVC pipe (Specimen M) passing through a 110 mm diameter hole with the annular gap sealed with Trafalgar Fyreflex Sealant and a Trafalgar 100 mm Fyrechoke Collar fixed to each face of the wall.
- a 50 mm diameter uPVC pipe (Specimen N) passing through a 60 mm diameter hole with the annular gap sealed with Trafalgar Fyreflex Sealant and a Trafalgar 50 mm Fyrechoke Collar fixed to each face of the wall.
- a 25 mm diameter uPVC conduit containing a fibre optic cable (Specimen O) passing through a 30 mm diameter hole with the annular gap sealed with Trafalgar Fyreflex Sealant and a Trafalgar Fyrechoke Micro Collar fixed to each face of the wall.

The specimens were tested in accordance with AS 1530.4:2014 for a duration of 121 minutes and the specimens achieved a fire resistance of;

- Specimen M -/121/72 FRL -/120/60
- Specimen N -/121/85 FRL -/120/60
- Specimen O -/121/113 FRL -/120/90

For specimens M and O the insulation failure occurred on the Speedpanel separating element with no failure on the collar or pipe.

2.9 Warringtonfire Fire Resistance Test Report FRT190298.1

In the fire resistance test described in Warringtonfire Fire Resistance Test Report FRT190298.1, the test specimen consisted of a 78 mm thick Speedpanel wall penetrated by three services including a 100 mm diameter uPVC pipe (Specimen B) passing through a 121 mm diameter hole with the annular gap sealed with Trafalgar Fyreflex Sealant and a Trafalgar 100 mm Fyrechoke Collar fixed to each face of the wall. Prior to fixing the collar to the unexposed face of the wall a panel of 300 mm x 300 mm x 60 mm thick calcium silicate Maxilite board, stated density 330 kg/m³, was fixed in two halves around the pipe to provide a thicker wall around the penetration.

The specimens were tested in accordance with AS 1530.4:2014 for a duration of 121 minutes and Specimen B achieved a fire resistance of 121 minutes without failure, an FRL of -/120/120.



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2.10 CSIRO Fire Resistance Test Report FSP 1709

In the fire resistance test described in CSIRO Fire Resistance Test Report FSP 1709, the test specimen consisted of a 150 mm thick concrete floor slab, with an established FRL of -/180/180, 1,000 mm long, penetrated by service penetrations including;

- a 50 mm OD x 4 mm uPVC conduit (Specimen 2) containing two 19 mm OD 4-core power cables passing through a 77 mm diameter hole with the 13 mm annular gap sealed with Fyreflex intumescent acrylic sealant to a depth of 10 mm on the fire side and a 50 mm Trafalgar Fyrechoke collar 60 mm high x 72 mm OD fixed to the underside of the floor.
- a 40 mm OD x 3.3 mm uPVC conduit (Specimen 3) containing two TPS power cables and five 5 mm OD CAT5 cables passing through a 51 mm diameter hole with the 6 mm annular gap sealed with Fyreflex intumescent acrylic sealant to a depth of 10 mm on the fire side and a 40 mm Trafalgar Fyrechoke Micro collar 50 mm high x 53 mm OD fixed to the underside of the floor.
- a 25 mm OD x 2.6 mm uPVC conduit (Specimen 4) containing one TPS power cable and three 5 mm OD CAT5 cables passing through a 34 mm diameter hole with the 5 mm annular gap sealed with Fyreflex intumescent acrylic sealant to a depth of 10 mm on the fire side and a 25 mm Trafalgar Fyrechoke Micro collar 50 mm high x 53 mm OD fixed to the underside of the floor.
- two air conditioning bundles consisting of 3/8 and 3/4 inch pair coils each insulated with a non-FR foam sleeve, one TPS cable and two 5 mm OD CAT5 cables (Specimen 5) passing through a 77 mm diameter hole with the annular gap around the pair coils and cables sealed with Fyreflex intumescent acrylic sealant and a 80 mm Trafalgar Fyrechoke collar 60 mm high x 101 mm OD fixed to the underside of the floor.

The specimens were tested in accordance with AS 1530.4-2005 for a duration of 121 minutes and all four specimens achieved a fire resistance of -/121/121, an FRL of -/120/120.

2.11 CSIRO Fire Resistance Test Report FSP 1729A

In the fire resistance test described in CSIRO Fire Resistance Test Report FSP 1729A, the test specimen consisted of a 64 mm steel stud wall with one layer of 16 mm fire rated plasterboard on each side, with an established FRL of -/60/60, and included;

- a 20 mm OD uPVC conduit (Specimen 1) containing three 6 mm OD 4-core fibre optic cables passing through a 30 mm diameter hole with the 5 mm annular gap sealed with Fyreflex intumescent acrylic sealant to the depth of the plasterboard on each side and a 25 mm Trafalgar Micro-Collar 50 mm high x 35 mm OD fixed to both sides of the wall.

The specimen was tested in accordance with AS 1530.4-2005 for a duration of 121 minutes and achieved a fire resistance of -/121/97, an FRL of -/120/90. The wall failed Insulation at 97 minutes but the collar and conduit did not fail Integrity or Insulation for the 121 minutes duration of the test.

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2.12 CSIRO Fire Resistance Test Report FSP 1753

In the fire resistance test described in CSIRO Fire Resistance Test Report FSP 1753, the test specimen consisted of a 75 mm thick Hebel wall with an established FRL of -/90/90 and included;

- three penetrations (Specimen 2) through 40 mm holes located horizontally at 80 mm centres. The penetrations consisted of two 25 mm OD water Pex pipes and one 25 mm OD gas Pex-Al-Pex pipe. Each penetration was sealed in the annular gap with Fyreflex mastic to a depth of 10 mm from each side of the wall and a Fyrechoke Micro collar fitted each side of the wall with Fyreflex between the service and collar for the full depth of each collar.

The specimen was tested in accordance with AS 1530.4:2014 for a duration of 121 minutes and achieved a fire resistance of -/121/18, an FRL of -/120/0. The early insulation failure occurred briefly on one of the 25 mm Pex pipes but the other Pex pipe and the Pex-Al-Pex pipe did not fail the insulation criteria for the duration of the test. Because the temperature on the failed pipe reduced below the failure criteria very quickly and remained comparable with the other 25 mm pipe for the rest of the test duration it is considered that this is an unexplained anomaly and for the purpose of this assessment is not indicative of the performance of single Pex pipe sealed with Fyrechoke collars, which would be expected to achieve an FRL of -/120/120.

2.13 CSIRO Fire Resistance Test Report FSP 1795

In the fire resistance test described in CSIRO Fire Resistance Test Report FSP 1795, the test specimen consisted of a 75 mm thick Hebel wall, with an established FRL of -/90/90, and included a service penetration of two air conditioning bundles consisting of 9 mm and 19 mm pair coils with 10 mm thick insulation and one 3C& E 19 mm OD power cable (Specimen 3) passing through an 80 mm diameter hole with the annular gap around the pair coils and cables sealed with Fyreflex intumescent acrylic sealant and a 80 mm Trafalgar Fyrechoke collar 50 mm high x 99 mm OD fixed each side of the wall with the gaps between the services and the collar filled with Fyreflex sealant to the full depth of the collar.

The specimen was tested in accordance with AS 1530.4:2014 for a duration of 96 minutes and achieved a fire resistance of -/96/65, an FRL of -/90/60. The insulation failure occurred on one of a bare copper pipe after the insulation melted away.

2.14 CSIRO Fire Resistance Test Report FSP 1801

In the fire resistance test described in CSIRO Fire Resistance Test Report FSP 1801, the test specimen consisted of a 64 mm steel stud wall, 1,000 mm wide x 1,000 mm high, lined with one layer of 16 mm fire rated plasterboard on each side, with an established FRL of -/60/60, and included;

- a 40 mm OD PVC conduit containing a 3C&E power cable and a TPS power cable (Specimen 2B) passing through a 45 mm diameter hole. The annular gap between the conduit and the plasterboard was filled to the full depth of the plasterboard with Fyreflex sealant and a 40 mm Fyrechoke Micro-Collar was fitted to each side of the wall with the gaps between the conduit and the collars filled with Fyreflex sealant for the full depth of the collars.

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- a 16 mm OD PVC conduit containing a 6 mm OD 12 core fibre cable (Specimen 2C) penetrating a 20 mm diameter hole. The annular gap between the conduit and the plasterboard was filled to the full depth of the plasterboard with Fyreflex sealant and a 25 mm Fyrechoke Micro-Collar was fitted to each side of the wall with the gaps between the conduit and the collars filled with Fyreflex sealant for the full depth of the collars.
- an air conditioning bundle consisting of 9 mm and 19 mm OD pair coils with 19 mm thick non-FR insulation and two TPS power cables and two CAT6 cables (Specimen 3) passing through a 75 mm diameter hole with the annular gap around the pair coils and cables sealed with Fyreflex intumescent acrylic sealant and an 80 mm Trafalgar Fyrechoke collar 50 mm high x 99 mm OD fixed each side of the wall with the gaps between the services and the collar filled with Fyreflex sealant to the full depth of the collar.
- a 50 mm OD PVC conduit containing a 3C & E PVC sheathed power cable and a TPS power cable (Specimen 4) passing through a 60 mm diameter hole. The annular gap between the conduit and the plasterboard was filled to the full depth of the plasterboard with Fyreflex sealant and a 50 mm Fyrechoke Collar was fitted to each side of the wall with the gaps between the conduit and the collars filled with Fyreflex sealant for the full depth of the collars.

The specimen was tested in accordance with AS 1530.4:2014 for a duration of 102 minutes and achieved a fire resistance of;

- | | | |
|--------------|----------|-------------|
| • Specimen 2 | -/102/81 | FRL -/90/60 |
| • Specimen 3 | -/102/45 | FRL -/90/30 |
| • Specimen 4 | -/102/84 | FRL -/90/60 |

The insulation failure of Specimen 3 occurred on a copper pipe after the insulation melted away and the insulation failures on Specimens 2 and 4 occurred on the unexposed face of the wall.

2.15 Summary of test results for Fyrechoke collars

A summary of the test results for the various penetrating services through a range of walls and floors sealed with Fyrechoke collars from the tests described in Section 2 above are given in Table 1.



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Table 1: Summary of test results for Fyrechoke collars

Barrier	Test / Specimen	Service	Hole size (mm)	Collar size (mm)	FRL
Single layer plasterboard	FSP 1729A/1	20 mm PVC conduit with fibre optic cables	30	25	-/120/120
	FSP 1801/2b	40 mm PVC conduit with two power cables	45	40	-/90/60
	FSP 1801/2c	16 mm PVC conduit with fibre optic cable	20	25	-/90/60
	FSP 1801/3	A/C Pair coil (non-FR) with 2 x TPS power cables & 2 x CAT6 cables	75	80	-/90/30
	FSP 1801/4	50 mm PVC conduit with two power cables	60	50	-/90/60
	FP 6033/6	A/C Pair coil (FR) with a TPS power cable & a CAT6 cable wrapped with TWrap 300 mm long	60	50	-/90/60
	FP 6033/7	3 x A/C Pair coil with a TPS power cable & a CAT6 cable wrapped with TWrap 300 mm long	111	100	-/90/60
Hebel wall 75 mm	FSP 1795/3	2 x A/C Pair coil (FR) with a TPS power cable	80	80	-/90/60
	FSP 1753/2	25 mm Pex pipe	40	25	-/120/120
	FSP 1753/2	25 mm Pex-Al-Pex pipe	40	25	-/120/120
	FP 6372/1	100 mm uPVC pipe	125	100	-/120/120
	FP 6372/2a	25 mm uPVC conduit	32	25	-/120/120
Speedpanel wall 78 mm	FRT180323/M	100 mm uPVC pipe	110	100	-/120/60
	FRT180323/N	50 mm uPVC pipe	60	50	-/120/60
	FRT180323/O	25 mm PVC pipe	30	25	-/120/90
	FRT190298/B	100 mm uPVC pipe with Maxilite panel	121	100	-/120/120



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Table 1 continued:

Barrier	Test / Specimen	Service	Hole size (mm)	Collar size (mm)	FRL
Maxilite 60 mm board	FP 6202/6	65 mm PVC pipe	76	65	-/120/120
	FP 6202/7	50 mm PVC pipe	60	50	-/120/120
	FP 6202/9	25 mm PVC pipe	30	25	-/120/120
	FP 6202/10	32 mm PVC pipe	44	32	-/120/120
	FP 6202/11	40 mm PVC pipe	44	40	-/120/120
	FP 6251/5	80 mm uPVC pipe	89	80	-/120/120
	FP 6251/6	100 mm uPVC pipe	120	100	-/120/90
Concrete slab	FSP 1709/2	50 mm uPVC conduit with 2 x power cables	77	50	-/120/120
	FSP 1709/3	40 mm uPVC conduit with 2 x power cables & 5 x CAT5 cables	51	40	-/120/120
	FSP 1709/4	25 mm uPVC conduit with a power cable & 3 x CAT5 cables	34	25	-/120/120
	FSP 1709/5	2 x A/C Pair coil (non-FR) with a TPS power cable & 2 x CAT5 cables	77	80	-/120/120
	FR 3981/N	225 mm uPVC pipe	250	225	-/240/240
	FR 3981/P	80 mm uPVC pipe	86	80	-/120/240
	FR 3981/Q	65 mm uPVC pipe	76	65	-/180/180
	FR 3981/S	150 mm uPVC pipe	172	150	-/180/180
	FR 3402/8	100 mm uPVC pipe	110	100	-/240/240
	FP 4368/1	50 mm PP-R pipe	65	50	-/240/240
	FP 4368/4	100 mm PVC DWV pipe with elbow	116	130	-/240/240
	FP 4368/5	100 mm HDPE pipe	116	100	-/240/240
	FP 4368/6	100 mm PP-R80 pipe	116	100	-/60/60
FP 4368/7	50 mm HDPE pipe	65	50	-/240/240	



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3. DISCUSSION

3.1 Equivalence of test standards

The fire resistance tests described in Section 2 above were undertaken in accordance with the 1997, 2005 and 2014 versions of AS 1530.4. However, for the testing of service penetrations it is considered that the versions are sufficiently similar in terms of furnace control, and failure criteria that they can be considered to be equivalent.

3.2 Trafalgar Fyrechoke collars

The Trafalgar Fyrechoke and Fyrechoke Micro collars consist of one- and two-piece cylindrical collars respectively, manufactured from 0.7 mm thick electro plated mild steel and powder coated. One end has a turned end flange to hold the intumescent material and the other end is fitted with two or four angle strips through which the collar is fixed to the wall or floor. The Fyrechoke Micro collars are 50 mm high and the Fyrechoke collars are 60 mm high and of a range of internal and external diameters to suit the size of penetration it is intended to seal as shown in Table 2. The table also includes the respective maximum diameter of aperture through the wall/floor to accommodate the penetration services. Strips of intumescent material are fitted within the inner circumference of the collar with varying number and thickness to suit the diameter of the penetrating service.

Table 2: Range of Fyrechoke collars

Collar type	Size (mm)	Inside diameter (mm)	Height (mm)	Maximum aperture diameter (mm)
Fyrechoke 2-piece Micro	25	27	50	30
Fyrechoke 2-piece Micro	32	40	50	40
Fyrechoke 2-piece Micro	40	45	50	45
Fyrechoke 1-piece retrofit	50	60	60	65
Fyrechoke 1-piece retrofit	65	72	60	73
Fyrechoke 1-piece retrofit	80	85	60	90
Fyrechoke 1-piece retrofit	100	115	60	110
Fyrechoke 1-piece retrofit	130	135	60	116
Fyrechoke 1-piece retrofit	150	170	60	172
Fyrechoke 1-piece retrofit	225	250	132	250

The collars are fitted one to each side of walls or one to the underside of floors. Each collar is sealed with Fyreflex intumescent acrylic sealant in the annular gap between the services and the wall to the depth of any plasterboard lining or to a depth of 10 mm from each side for solid

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walls. The annular gap between the services and the collar is to be filled to the full depth of the collar for mixed service collars. Table 3 gives the approved/alternate details for fixing the collars through the fixing tabs to the wall or floor.

Table 3: Fixing details

Barrier	Fixing details (minimum)
Plasterboard walls	8g x 50 mm steel plasterboard screws
AAC, Speedpanel, Maxilite walls	6g x 25 mm steel plasterboard screws
Masonry and concrete walls/floors	M6 x 50 mm masonry anchors (steel Dynabolt, knock-in, screw thread anchor types)

Figure 1 and Figure 2 shows the construction of the collars and Figure 3 and Figure 4 shows the method of installation in the various walls and floors.

3.3 Integrity

With one exception (the 100 mm PP-R80 pipe Specimen 6 in test FP 4368) the test specimens described in Section 2 above and summarised in Table 1 achieved an Integrity up to at least the integrity of the wall through which they penetrated and at least 120 minutes through a concrete floor slab.

It is therefore considered that the following penetrations sealed with a Fyrechoke collar to both sides of a fire rated wall or to the underside of a concrete floor slab, will achieve an Integrity of that of at least that of the wall or floor through which they penetrate or at least 120 minutes whichever is the lesser.

- uPVC conduits up to 50 mm nominal diameter with or without the inclusion of up to two power cables up to 3C+E 2.5 mm² and up to five CAT 5 or CAT6 data cables.
- Up to three air conditioning bundles consisting of 3/8 and 3/4 inch pair coils or 9 mm and 19 mm OD pair coils with 25 mm thick FR or 19 mm thick non-FR insulation, one TPS cable and two 5 mm OD CAT5 or CAT 6 data cables.
- 25 mm Pex pipe or 25 mm Pex-Al-Pex pipe

Based on the performance of the copper pipes in the air conditioning bundles it is also considered that copper pipes up to 20 mm nominal diameter and insulated with at least 19 mm thick non-FR insulation would also achieve the same Integrity.

Based on the performance of the Pex and Pex-Al-Pex pipes it is considered that pipes smaller than 25 mm nominal diameter will achieve the same integrity.

In BRANZ fire resistance test FP 4368, Specimen 4 demonstrated that a 100 mm PVC pipe inserted into an elbow and enclosed in a size larger 130 mm collar could close the double thickness of pipe and maintain integrity for the 240 minutes duration of the test. It is therefore expected that a 50 mm PVC DWV pipe and collar enclosed in a size larger 65 mm collar would also maintain integrity.

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HDPE pipe up to 100 mm nominal diameter is limited to installation in a concrete floor slab only.

Polypropylene (PP) pipe up to 100 mm nominal diameter is limited to an Integrity of 60 minutes installed in a concrete floor slab only.

3.4 Insulation

With two exceptions (the 100 mm nominal diameter PP-R80 pipe Specimen 6 in test FP 4368 and the air conditioning pair coil bundle with non-FR insulation Specimen 3 in test FSP 1801) the test specimens described in Section 2 above and summarised in Table 1 achieved an Insulation in excess of the insulation of the wall through which they penetrated and at least 120 minutes for the penetrations through a concrete floor slab.

In BRANZ fire resistance test FP 6033 the air conditioning bundles with FR insulation and additional TWrap insulation tested as Specimens 6 and 7 failed insulation at 62 and 71 minutes respectively on the wall, followed by insulation failure at 73 and 88 minutes respectively on the collars. The pair coils did not fail insulation for the 93 minutes duration of the test. In comparison the air conditioning bundle with only the FR insulation tested as Specimen 3 in fire resistance test FSP 1795 achieved 65 minutes Insulation thus demonstrating that the air conditioning pair coils with only FR insulation can achieve an Insulation of at least 60 minutes without the additional TWrap insulation.

It is therefore considered that the following penetrations sealed with a Fyrechoke collar to both sides of a fire rated wall or to the underside of a concrete floor slab, will achieve an Insulation of at least that of the wall or floor through which they penetrate or at least 120 minutes whichever is the lesser.

- uPVC conduits up to 100 mm nominal diameter with or without the inclusion of up to two power cable up to 3C+E 2.5 mm² and up to five CAT 5 or CAT6 data cables.
- Up to three air conditioning bundles consisting of 3/8 and 3/4 inch pair coils or 9 mm and 19 mm OD pair coils with 25 mm thick FR or 19 mm thick non-FR insulation, one TPS cable and two 5 mm OD CAT5 or CAT 6 data cables with additional 300 mm length of 25 mm thick TWrap insulation, installed covering the collar and penetration, each side for Insulation greater than 60 minutes.
- 25 mm Pex pipe or 25 mm Pex-Al-Pex pipe.

Based on the performance of the copper pipes in the air conditioning bundles it is also considered that copper pipes up to 20 mm nominal diameter and insulated with at least 19 mm thick non-FR insulation would also achieve at least 30 minutes Insulation and insulated with 25 mm thick FR would achieve at least 60 minutes Insulation.

In BRANZ Fire Resistance Test FP 6251, the 100 mm diameter uPVC pipe, specimen 6, achieved Insulation of 107 minutes while the smaller pipe achieved at least 120 minutes. The insulation failure occurred on the Maxilite board surrounding the collar and not on the collar or pipe. It is therefore considered that if the penetrated element was thickened by the addition of a further panel of Maxilite, not less than 30 mm thick and 250 mm square screw fixed around the penetration, the system would achieve an Insulation of at least 120 minutes.



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HDPE pipe up to 100 mm nominal diameter is limited to installation in a concrete floor slab only.

Polypropylene (PP) pipe up to 100 mm nominal diameter is limited to an Insulation of 60 minutes installed in a concrete floor slab only.

The air conditioning bundle with non-FR insulation failed insulation after 45 minutes on the copper pipes when the insulation melted away and hence is limited to an Insulation of 30 minutes. However, if the penetration is wrapped with TWrap 25 for a length of 300 mm each side of the wall, as tested in Specimens 6 and 7 in test FP 6033, the Insulation will be increased to at least 120 minutes. It has been stated that Fyrewrap is equivalent to TWrap and hence can be used as a substitute.

In fire resistance test FRT180323 the 100 mm and 25 mm diameter uPVC pipe penetrations passing through a Speedpanel wall failed insulation on the element wall without failure on the pipe or collar. In fire resistance test FRT190298 the 100 mm diameter uPVC pipe passing through the Speedpanel wall which had been increased in thickness by the fixing of a panel of 60 mm thick Maxilite board to the unexposed face did not fail the insulation criteria for the 121 minute duration of the test. It is therefore considered that the range of uPVC pipes up to nominal 100 mm diameter penetrating a Speedpanel wall would achieve Insulation of at least 120 minutes if the wall is thickened with a 60 mm thick Maxilite panel as tested in fire resistance test FRT190298.

3.5 Concrete or masonry walls

Test standard AS 1530.4:2014, Clause 10.12.2(c), states that results obtained from framed wall systems may be applied to the performance of a system in concrete or masonry of greater or equal thickness to that of a tested prototype. Hence the above fire resistance results may be applied to concrete or masonry walls of at least 120 mm thick which has an FRL of at least 120 minutes.

3.6 Concrete floor slabs

As demonstrated in tests FR 3402 and FP 4368 some of the plastic pipes passing through a concrete floor slab of thickness greater than 120 mm thick achieved a fire resistance greater than -/120/120 and these are included in the conclusion.



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4. CONCLUSION

It is considered that the Fyrechoke collars of appropriate size fitted each side of service penetrations passing through walls, or to the underside of penetrations passing through a concrete floor slab as described in Section 3.2 and Figure 1 and Figure 2 and installed as shown in Figure 3 to Figure 6, will achieve the FRLs listed in Table 4, if tested in accordance with AS 1530.4:2014 with reference to AS 4072.1-2005 (including Amendment 1).

Table 4: FRL of Fyrechoke collars and penetrations

Fire barrier	Service (nominal sizes)	FRL
Single layer 13 mm FR plasterboard each face	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/60/30
	uPVC pipes up to 100 mm Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm Copper pipes up to 20 mm with FR insulation uPVC pipes or conduits up to 50 mm # Up to three pair coil A/C bundles with FR insulation	-/60/60
Single layer 16 mm FR plasterboard each face	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/90/30
	Up to three pair coil A/C bundles with FR insulation Copper pipes up to 20 mm with FR insulation	-/90/60
	uPVC pipes up to 100 mm Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm uPVC conduits up to 50 mm # Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap over the collar and penetration	-/90/90
Maxilite 60 mm thick board	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/90/30
	Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap over the collar and penetration. Copper pipes up to 20 mm with FR insulation with 300 mm TWrap over the collar and penetration.	-/90/60
	100 mm uPVC pipes	-/120/90
	uPVC pipes and conduits # up to 80 mm	-/120/120
Maxilite 90 mm thick board	Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap over the collar and penetration	-/120/120
	100 mm uPVC pipes	-/120/120



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Fire barrier	Service (nominal sizes)	FRL
AAC walls (min. 75 mm) e.g. Hebel PowerPanel	Up to three pair coil A/C bundles with non-FR insulation Copper pipes up to 20 mm with non-FR insulation	-/90/30
	Up to three pair coil A/C bundles with FR insulation Copper pipes up to 20 mm with FR insulation	-/90/60
	Up to three pair coil A/C bundles with FR insulation with 300 mm TWrap insulation to each side Copper pipes up to 20 mm with FR insulation with 300 mm TWrap insulation to each side	-/90/90
	Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm	-/90/90
	uPVC pipes up to 100 mm	-/90/90
	uPVC pipes and conduits # up to 50 mm	-/90/90
Double layer 13 mm FR plasterboard each face Speedpanel 78 mm thick wall with 60 mm Maxilite panel Concrete floor slabs minimum 120 mm thick	uPVC pipes up to 100 mm Pex pipes up to 25 mm Pex-Al-Pex pipes up to 25 mm PVC conduits up to 50 mm # Copper pipes up to 20 mm with FR and 300 mm TWrap insulation to each side \$ Up to three pair coil A/C bundles with 300 mm TWrap insulation to each side \$	-/120/120
Concrete floor slabs minimum 150 mm thick	Up to three pair coil A/C bundles with non-FR and FR insulation	-/120/120
Concrete floor slabs minimum 170 mm thick	PP-R80 pipe 100 mm	-/60/60
	PP-R80 pipe up to 50 mm	-/240/240
	uPVC pipe 65 mm & 150 mm	-/180/180
	uPVC pipes up to 100 mm uPVC pipe 50 mm with elbow or socket with 65 mm collar uPVC pipe 100 mm with elbow or socket with 130 mm collar HDPE pipes up to 100 mm	-/240/240

- The conduits may contain any combination of the following up to the maximum that can be accommodated; 2C & E 2.5mm² TPS cable, CAT5/CAT6 data cables, 3C & E PVC sheathed power cables up to 19 mm diameter or fibre optic cables.

\$ - For floor slab applications TWrap is only required to the top side of the slab.

In accordance with Clause 4.9.3 of AS 4072.1-2005 the clearances between multiple penetration systems shall not be less than 40 mm apart.



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Figure 1: Fyrechoke Collar construction sizes up to 40 mm

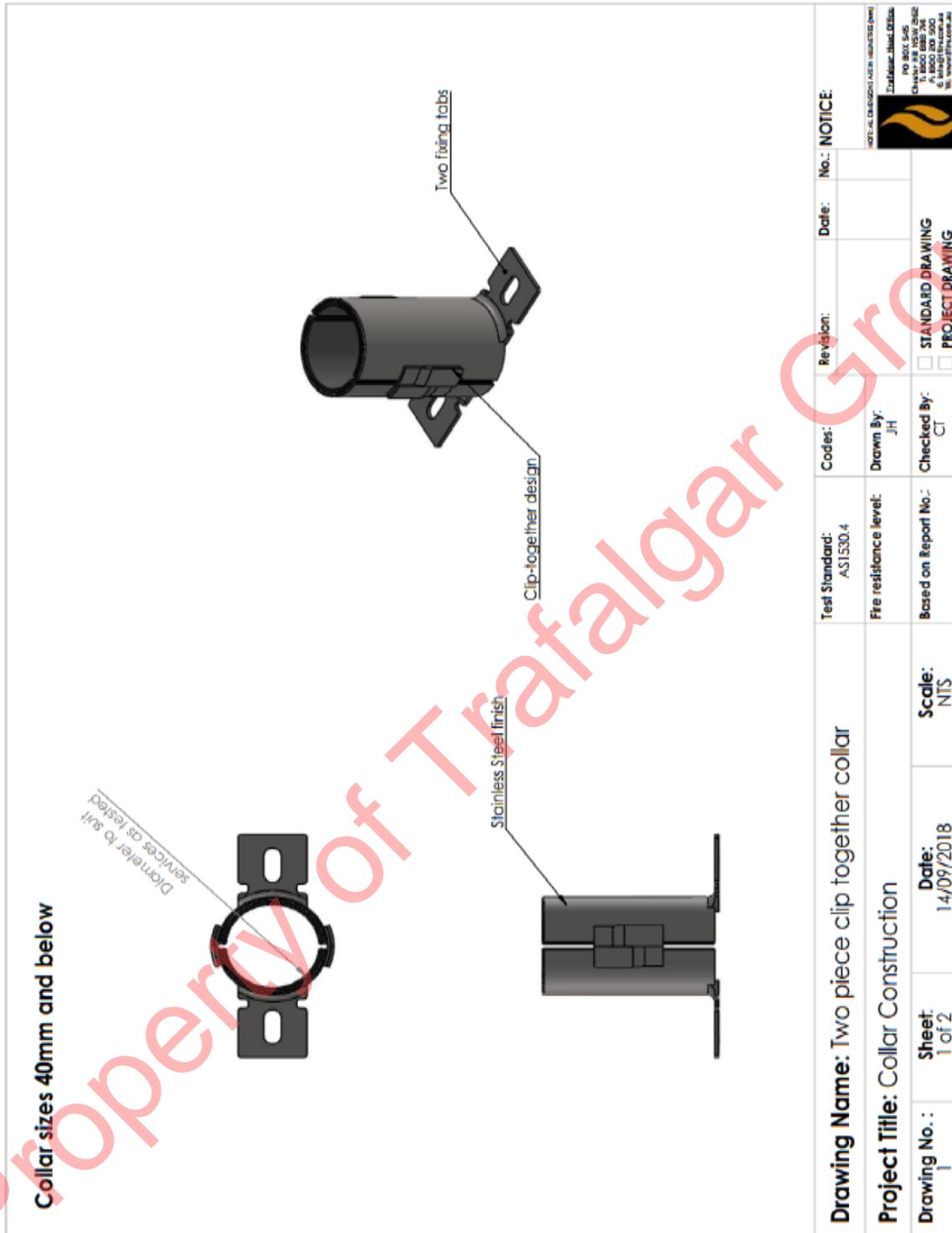


Figure 2: Fyrechoke Collar construction sizes 50 mm and above

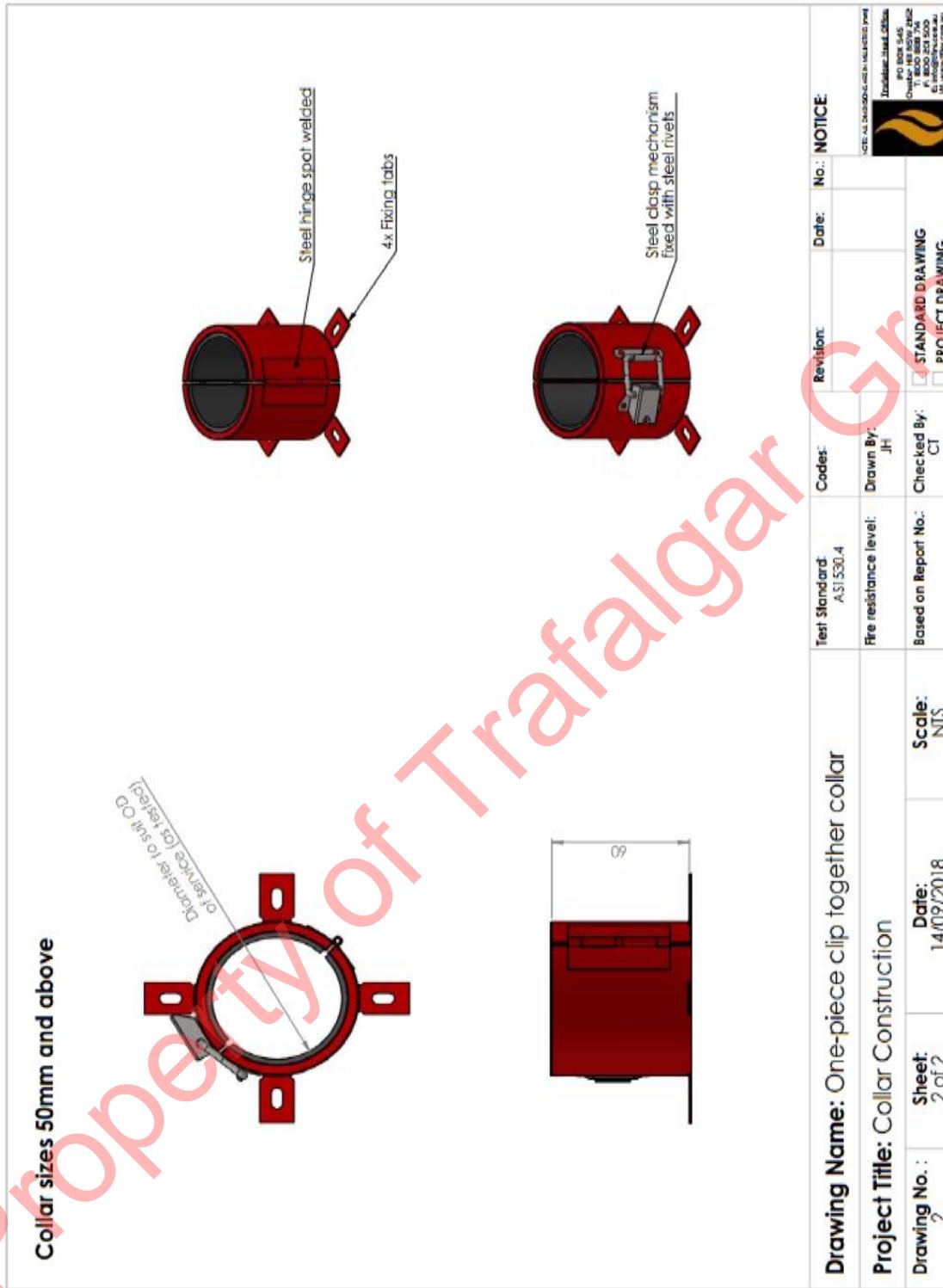
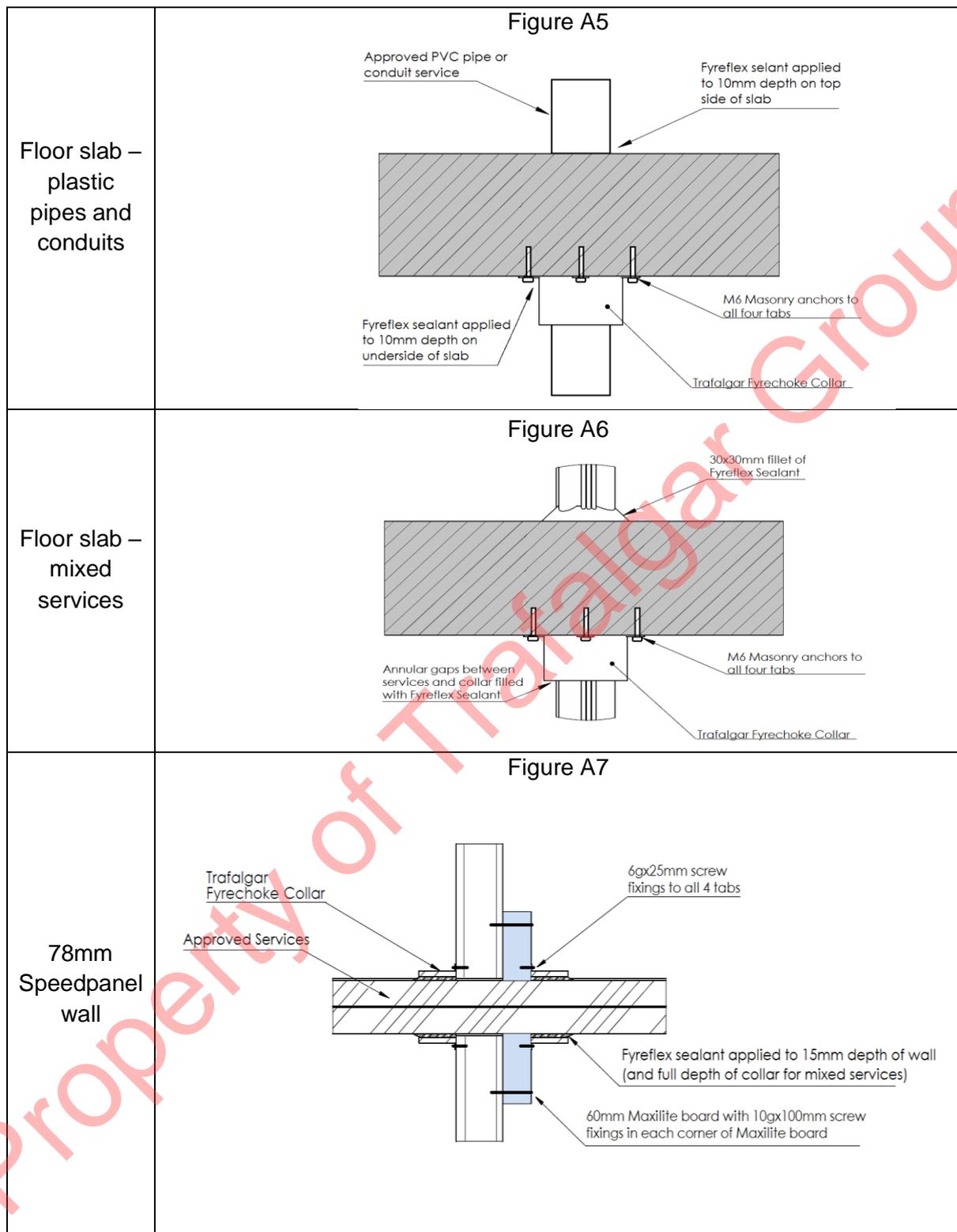


Figure 3: Fyrechoke collars Installation in walls

Detail	Fyrechoke Collar install requirements
Plasterboard walls	<p style="text-align: center;">Figure A1</p>
AAC walls	<p style="text-align: center;">Figure A2</p>
Masonry walls	<p style="text-align: center;">Figure A3</p>

Figure 4: Fyrechoke collars Installation in floors and Speedpanel walls



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Figure 5: Fyrehoke collars Installation with TWrap 25

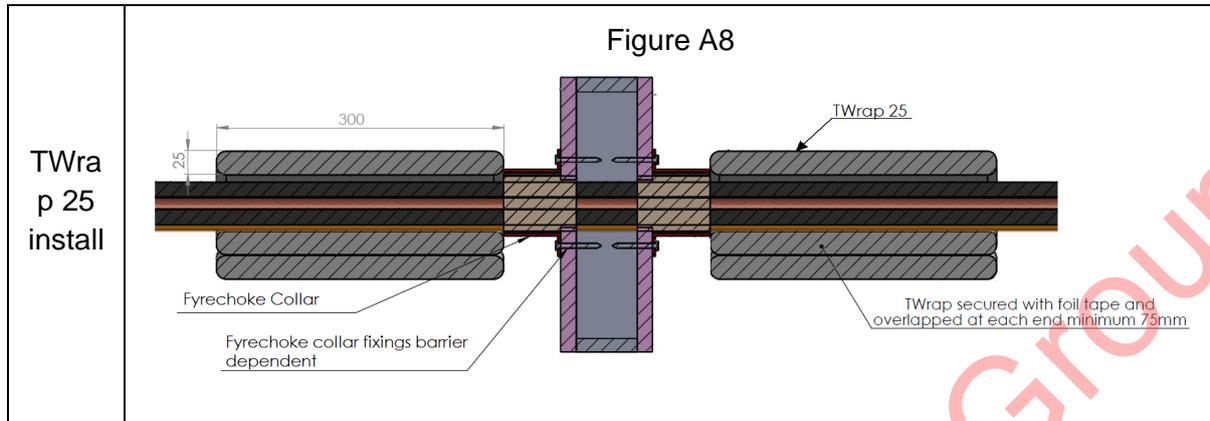


Figure 6: Fyrehoke collars to PVC Conduits cast into a concrete floor

