We believe safety should never be taken for granted

UNICORN
CONTINUOUS FIRE COLLAR

To Whom it may concern,

FCO 3527 pertains to the Trafalgar Unicorn Continuous Fire Collar. This system was launched in early 2024, and is still under development. Trafalgar are committed to continuous improvement, and ongoing fire testing and updates to the systems.

As ongoing fire testing is completed, the report will be updated, and re-uploaded to the Trafalgar Fire Website. These updates will also be communicated via Traflagar's Social Platforms.

As ongoing development continues, inevitably some approvals listed in our technical manual may not have been updated to this report, however the systems listed are fully compliant, and tested to AS1530.4:2014. The specific test report numbers are listed in the technical manual, and can be requested as-needed from the technical team, on technical@tgroup.com.au.

If you have any questions at all about the Unicorn Continuous Fire Collar, please feel free to contact us on 1800 888 714, sales@tgroup.com.au for pricing, or technical@tgroup.com.au for and technical enquiries.

Kind Regards,

Sean McDonald
Lead Systems Engineer
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Fire resistance of Trafalgar Unicorn fire collars when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005

Assessment Report

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Report number: FCO-3527 Revision A

Date: 31/3/2024

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1 Introduction

This report is an assessment of Trafalgar Unicorn fire collars when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

This report is prepared for meeting the requirements of NCC 2019 Volume 1 Schedule 5 clauses 2b) and 2 c) or NCC 2022 Volume 1 Clauses S1C2 (b) and (c) as appropriate for FRL.

This report reviews and confirms the extent to which the reference fire resistance tests listed in section 2 meet the requirements of the standard fire test standards listed in section 4 of the report. The proposed variations to the tested construction presented in section 3 are subject to an analysis in Appendix B and the conclusions are presented in Section 5 of this report.

The field of applicability of the results of this assessment report is presented in Section 6 and subject to the requirements, validity and limitations of Sections 7, 8 and 9.

2 Supporting Data

This assessment report refers to various test reports to support the analysis and conclusions of this report. They are listed below;

Table 1: Reference test data

Report Reference	Test Standard	Outline of Test Specimen
FSP 2287	AS 1530.4 -2014	A fire resistance test on a 96mm thick wall system penetrated by various services protected with various fire stop systems.
FSP 2317	AS 1530.4 -2014	A fire resistance test on a 150mm thick concrete slab penetrated by various services protected with various fire stop systems.
FSP 2342	AS 1530.4 -2014	A fire resistance test on a 150mm thick concrete slab penetrated by various services protected with various fire stop systems.
RTL FT1881.02	AS 1530.4 -2014	A fire resistance test on a 150mm thick concrete slab penetrated by various services protected with various fire stop systems.
FRT 190292.1	AS 1530.4 -2014	A fire resistance test on a 175mm thick concrete slab penetrated by various services protected with various fire stop systems.
FRT 220259	AS 1530.4 -2014	A fire resistance test on a 150mm thick concrete slab penetrated by various services protected with various fire stop systems.

The referenced tests FSP 2287, FSP 2317, FSP 2342 were tested at CSIRO, North Ryde and sponsored by Trafalgar Group Pty Ltd.

The referenced tests FRT 190292.1 and FRT 220259 were tested at Warrington fire, VIC and sponsored by Trafalgar Group Pty Ltd.

The referenced test RTL FT1881.02 was tested at Resolute Testing laboratories, QLD and sponsored by Trafalgar Fire Containment Solutions Pty Ltd.

3 Proposed Minor Variations

3.1 PVC pipes in slabs

The proposed construction shall be Trafalgar Unicorn fire collars tested in Table 1 and as shown in Figure 1 subject to the following variations:

- The inclusion of 50mm and 100mm PVC stack pipes protected with Unicorn collars penetrating min. 150mm and 175mm concrete slabs designed in accordance with AS 3600-2018, with protection as per Table 2.
- All services in slabs to be support at maximum 500mm above slab.
- Separation between adjacent collar bodies shall be at least 40mm as per Figure 2.
- General service installation shall be as per Figures 3 and 4.

Table 2: Concrete slab with Trafalgar Unicorn fire collars protecting PVC stack pipes

Nominal pipe size (mm)	Pipe thickness (mm	Socket/ elbow/ fitting in collar	Annular gap and seal detail (mm)	Unicorn collar length (mm)	Fixings	Tabs on collar	Config. under the slab	Minimum slab thickness (X) (mm)
50	2.7	No	Table 3	250±10	Table 4	2	Straight	150
		Yes					Curved	
100	3	No		375±10		3	Straight	
		Yes					Curved	

Table 3: Gap treatment between the plastic pipe and opening in support construction

Pipe diameter (mm)	Maximum Annular Gap (mm) – to be filled with 10mm FyreFLEX deep sealant on exposed side of slab
50	≤4.5
100	≤4.5

Table 4: Fixing type for each support construction with PVC pipes

Element	Collar Fixing type	
Min. 120mm Concrete slab	Min. M6 x 50mm Dynabolt	
	Min. M6 x 50mm Steel knock in anchor	

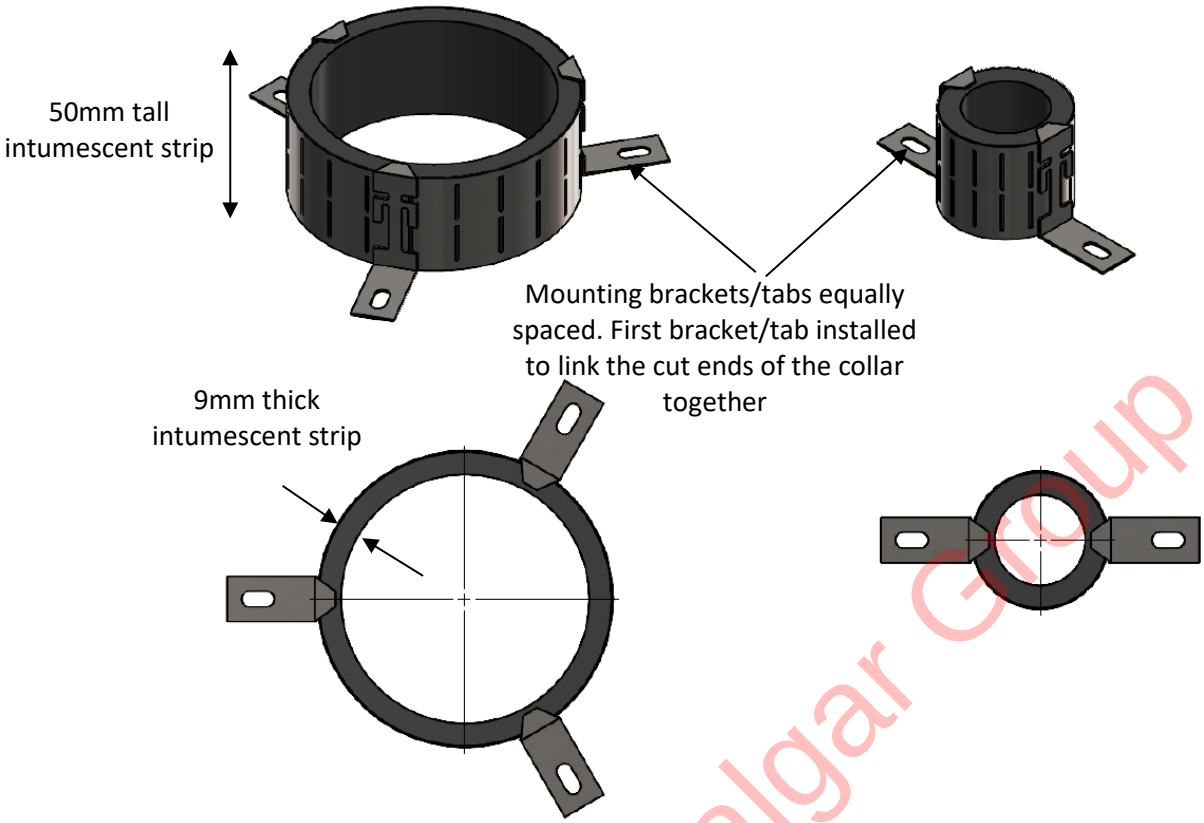


Figure 1: Single Unicorn collar

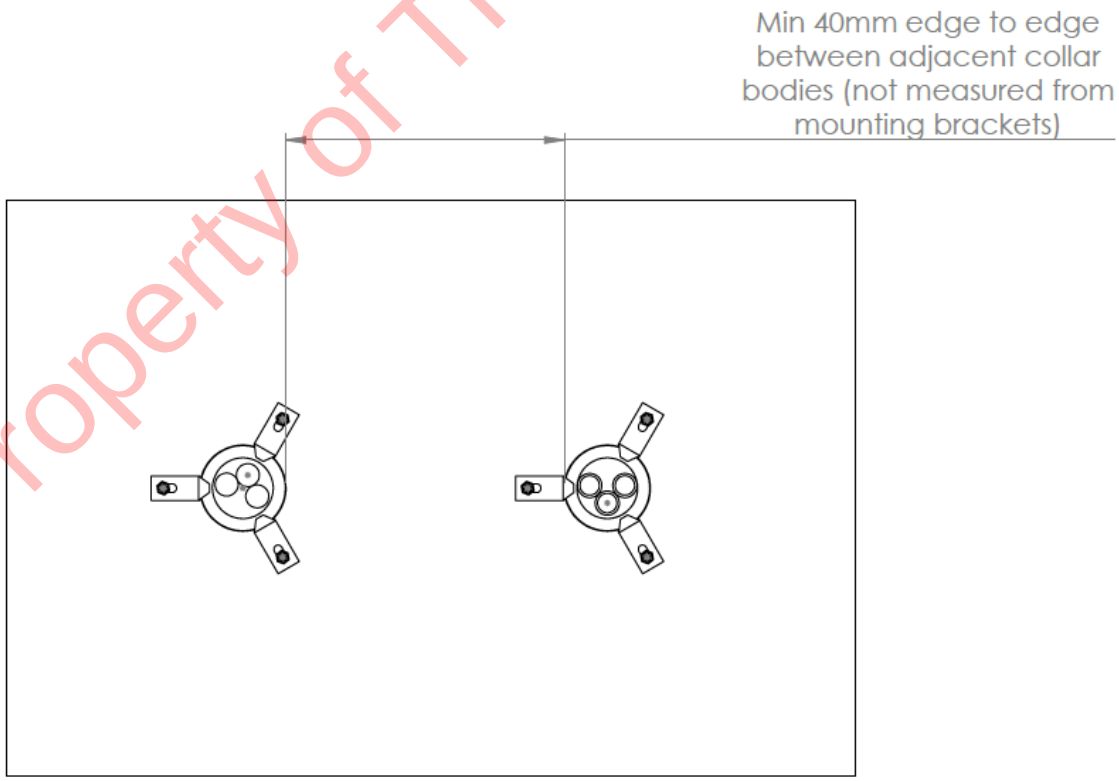


Figure 2: Separation between Unicorn collars

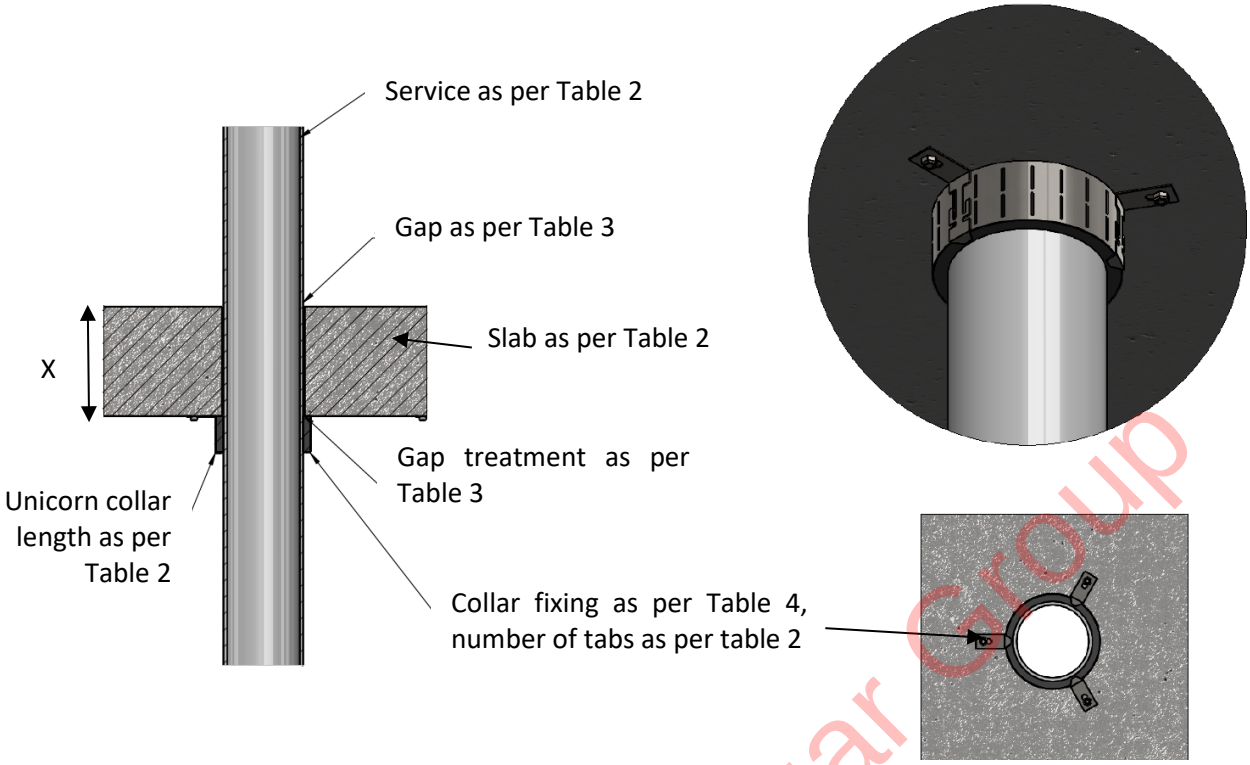


Figure 3: PVC pipes penetrating slabs – no socket within collar body

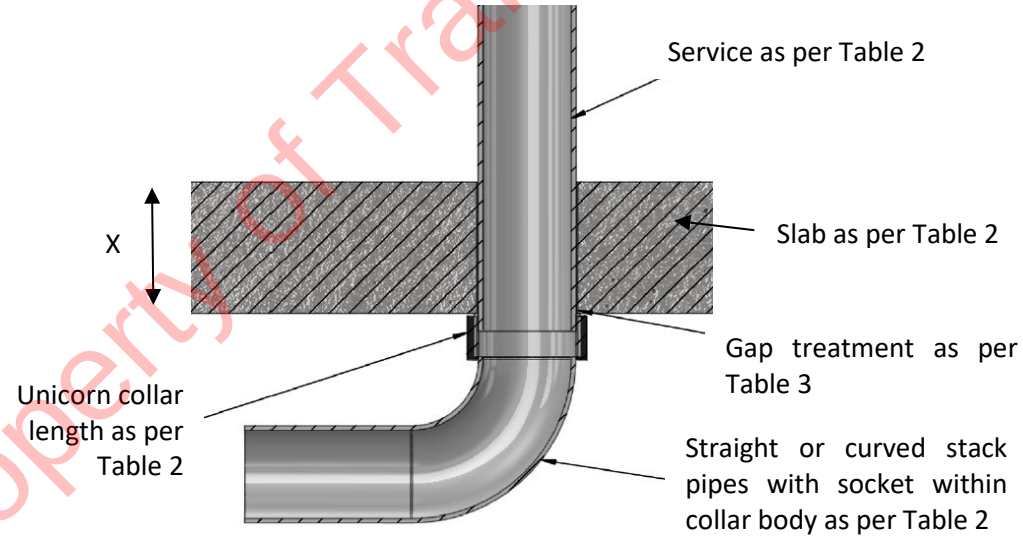


Figure 4: PVC pipes penetrating slabs – with socket within collar body

3.2 PVC conduits and cables in slabs

The proposed construction shall be Trafalgar Unicorn fire collars tested in Table 1 and as shown in Figure 1 subject to the following variations:

- Inclusion of PVC conduits empty and filled protected with Unicorn collars penetrating a minimum 150mm thick concrete slab designed in accordance with AS 3600-2018, with protection as per Table 5.
- Inclusion of various electrical services protected with Unicorn collars penetrating a minimum 150mm thick concrete slab designed in accordance with AS 3600-2018, with protection as per Table 6.
- All services in slabs to be support at maximum 500mm above slab
- The proposed TWrap (25mm thick aluminium faced TWrap fire blanket with a density of 128 kg/m^3) is required to have a minimum of 50mm overlap at any wrap joint and have steel cable ties at maximum 150mm centres as per Figure 11.
- Separation between adjacent collar bodies shall be at least 40mm as per Figure 2.
- General service installation shall be as per Figures 5 - 9

Table 5: Concrete slab with Trafalgar Unicorn fire collars protecting PVC conduits with or without small cable

<table>
<tr><th>Service type</th><th>Number of services</th><th>Max. annular gap between service and slab (mm)</th><th>Seal detail</th><th>Unicorn collar length (mm)</th><th>Fixings</th><th>Tabs on collar</th><th>Minimum slab thickness (X) (mm)</th></tr>
<tr><td>Up to 25mm PVC rigid conduit (empty)</td><td rowspan="2">Up to 10</td><td rowspan="4">≤ 10</td><td rowspan="4">Table 7</td><td rowspan="2">240 – 385</td><td rowspan="4">Table 4</td><td rowspan="2">3</td><td rowspan="4">150</td></tr>
<tr><td>Up to 25mm PVC rigid conduit (optionally filled containing a single small cable from Table 6)</td></tr>
<tr><td>Up to 25mm PVC rigid conduit (empty)</td><td rowspan="2">1</td><td rowspan="2">240±10</td><td rowspan="2">2</td></tr>
<tr><td>Up to 25mm PVC rigid conduit (optionally filled containing a single small cable from Table 6)</td></tr>
</table>

Table 6: Cables with Twrap penetrating a Concrete slab protected with Trafalgar Unicorn fire collars

Service detail	Number of cables	Max. annular gap between service and slab (mm)	Max. dia. of hole in slab (mm)	Seal detail	TWrap on unexposed side of slab as per Figure 11 (mm)	Unicorn collar length (mm)	Fixings	Tabs on collar	Minimum slab thickness (X) (mm)
Small cables		≤ 10	≤ 100	Table 7	450	375±10	Table 4	3	Min. 150mm
$6mm^2$ Power cables	Up to 11								
6.1mm OD CAT6 communication cables	Up to 30								
nom. 4.5mm OD 6 core Fibre optic cable as tested in FRT 220259 Specimen A5	Up to 5								
12mm OD NBN cables as tested in FRT 190292 Specimen I4	1								
Large cables									
$16mm^2$ Power cables	Up to 8								
17.5mm OD CAT3, 50 pair communication cables (UTPL350HF)	Up to 30								
Mixed services									
Any combination of above cables	Up to max. number of cables allowed for each type of cable								

Table 7: Gap treatment between conduits, small and large cables penetrating slab

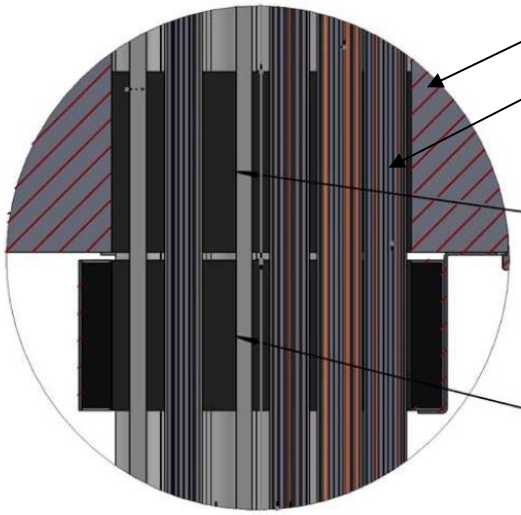
Seal detail


Table 8: Cables without Twrap penetrating a Concrete slab protected with Trafalgar Unicorn fire collars

Service type	Service detail	Number of cables	Gap around Service (mm)	Max. dia. of hole in slab (mm)	Seal detail	TWrap on unexposed side of slab (mm)	Unicorn collar length (mm)	Fixings	Tabs on collar	Minimum slab thickness (X) (mm)
Small cables	6mm² Power cables	Up to 11	≤ 10	≤ 100	Table 7	0	375±10	Table 4	3	Min. 150mm
	6.1mm OD CAT6 communication cables	Up to 30								
	nom. 4.5mm OD 6 core Fibre optic cable as tested in FRT 220259 Specimen A5	Up to 5								
	12mm OD NBN cables as tested in FRT 190292 Specimen I4	1								
Large cables	16mm² Power cables	Up to 8								
	17.5mm OD CAT3, 50 pair communication cables (UTPL350HF)	Up to 30								
Mix services	Any combination of above cables	Up to max. number of cables allowed for each type of cable								

Table 9: Cables and conduits penetrating a Concrete slab protected with Trafalgar Unicorn fire collars

Service type	Service detail	Number of cables	Gap around Service (mm)	Max. dia. of hole in slab (mm)	Seal detail	TWrap on unexposed side of slab (mm)	Unicorn collar length (mm)	Fixings	Tabs on collar	Minimum slab thickness (X) (mm)
Mix services	Any combination of conduits in Table 5 and any cables in Table 6	Up to max. # allowed for each type of cable or conduits	≤ 10	≤ 100	Table 7	450	375±10	Table 4	3	Min. 150mm
	Any combination of conduits in Table 5 and power cables in Table 8					0				
	Any combination of conduits in Table 5 and communication cables in Table 8									
	Any combination of conduits in Table 5 and any cables in Table 8									

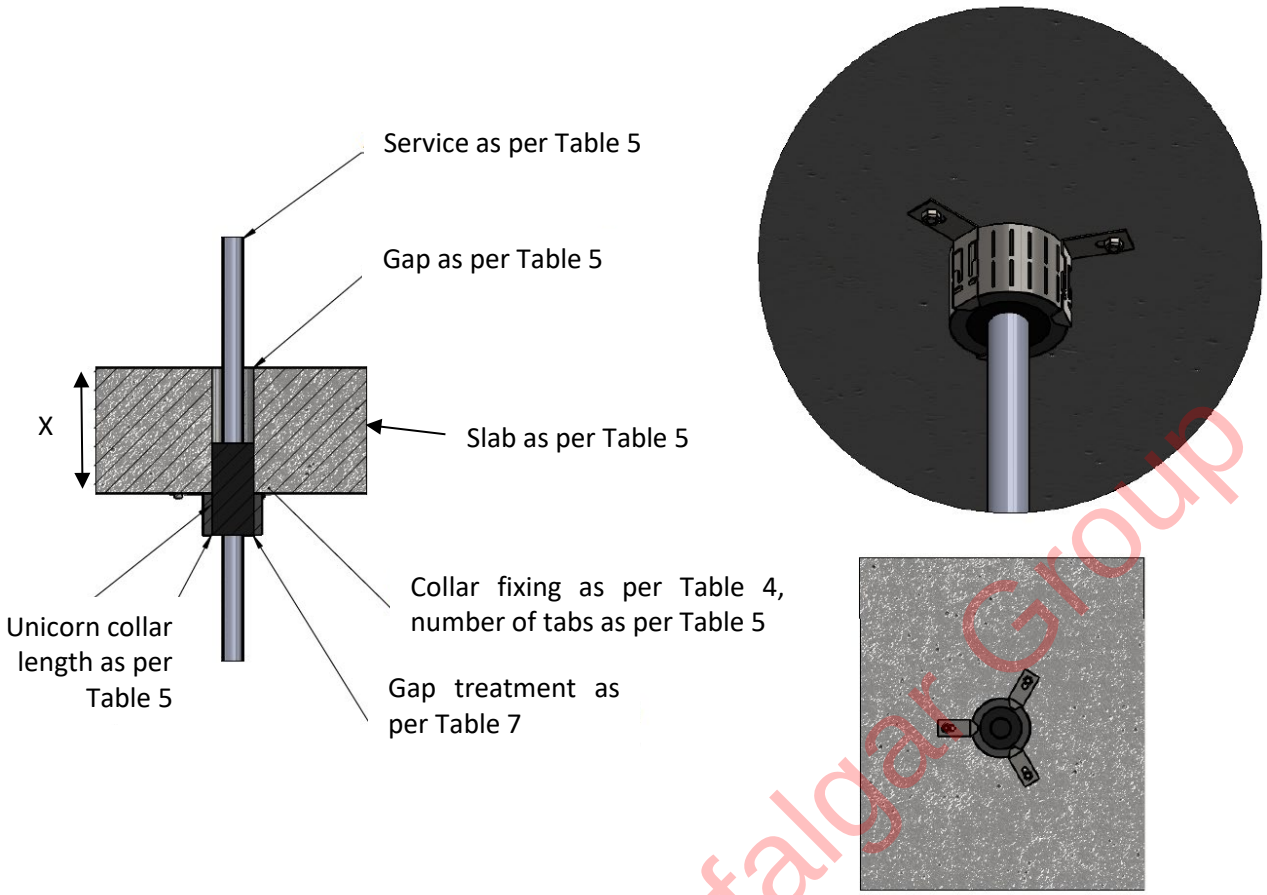


Figure 5: A single PVC conduit penetrating a slab

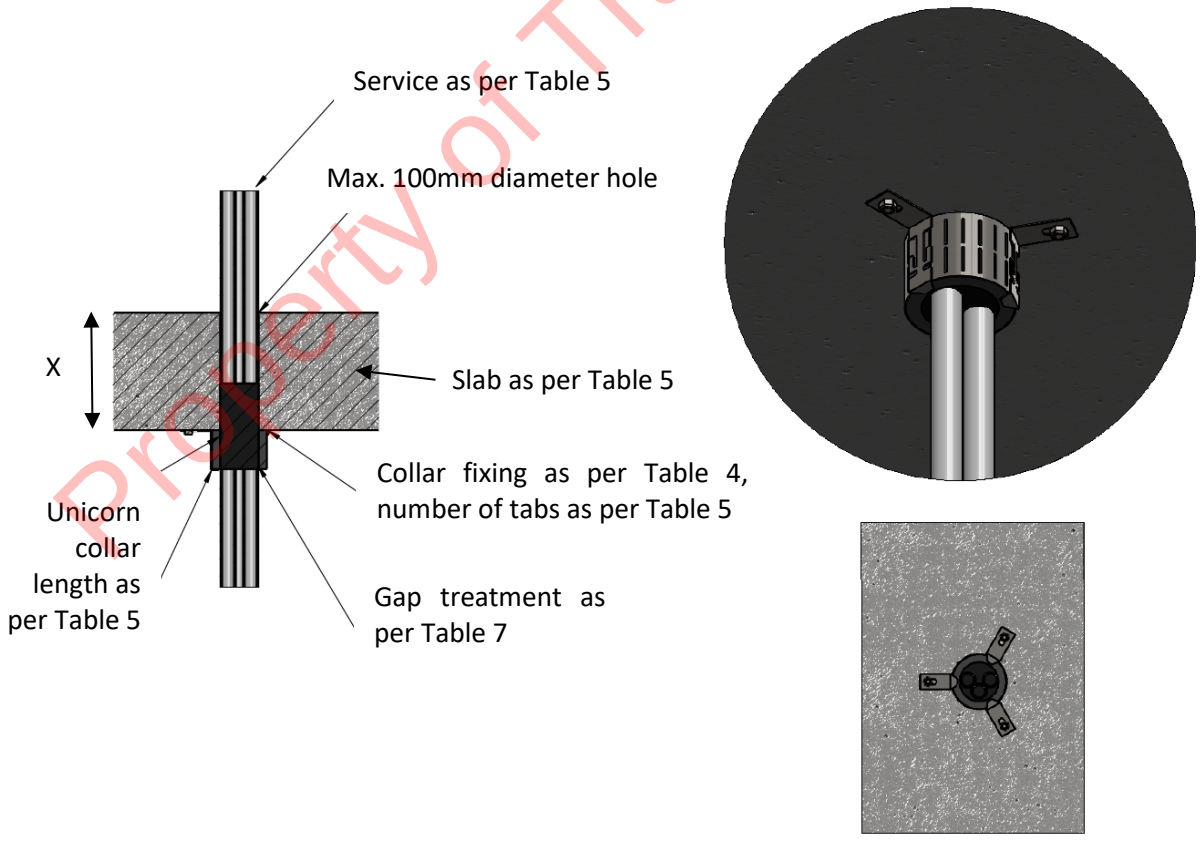


Figure 6: Multiple PVC conduit penetrating a slab

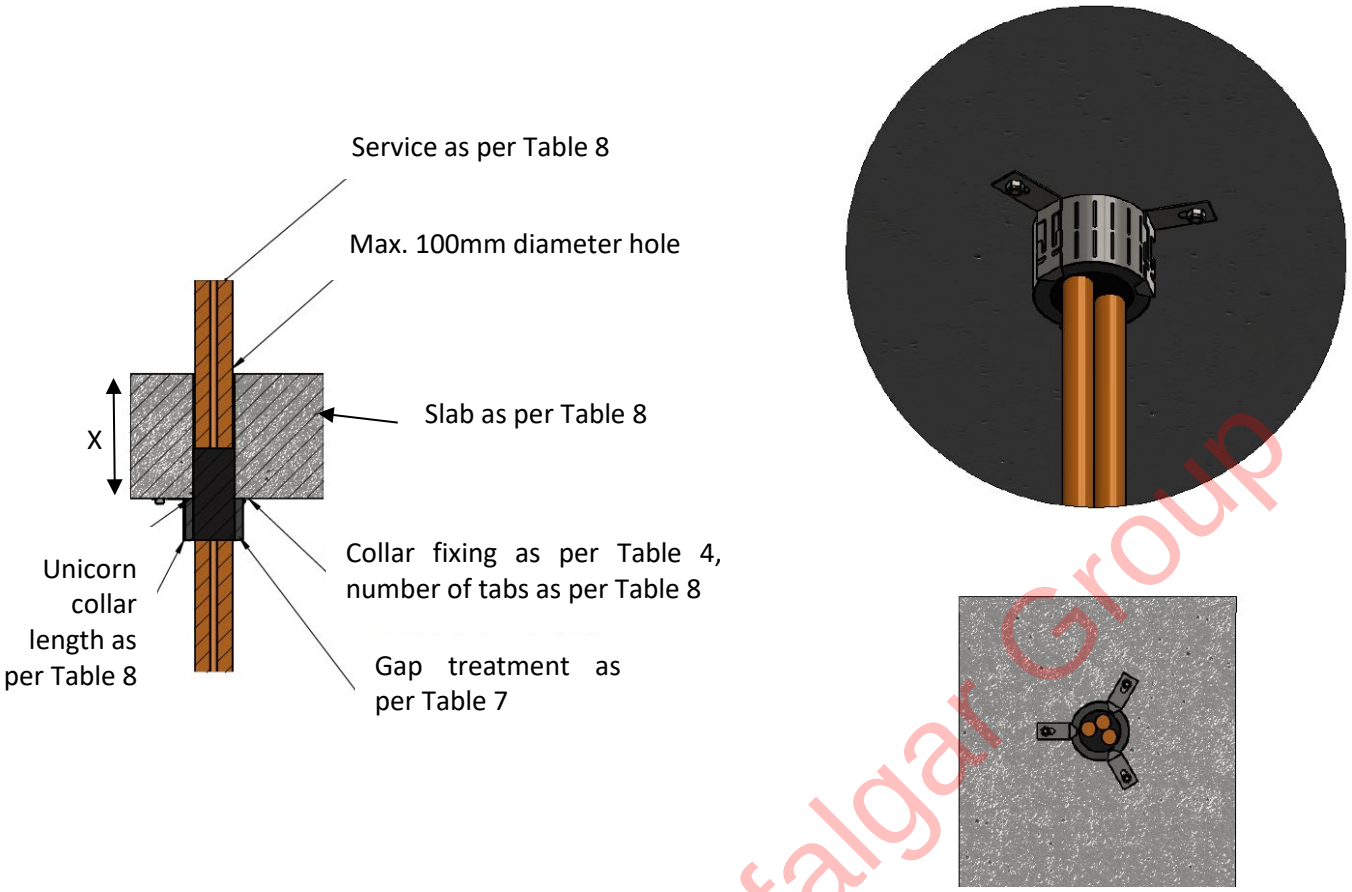


Figure 7: Cables penetrating slabs without TWrap

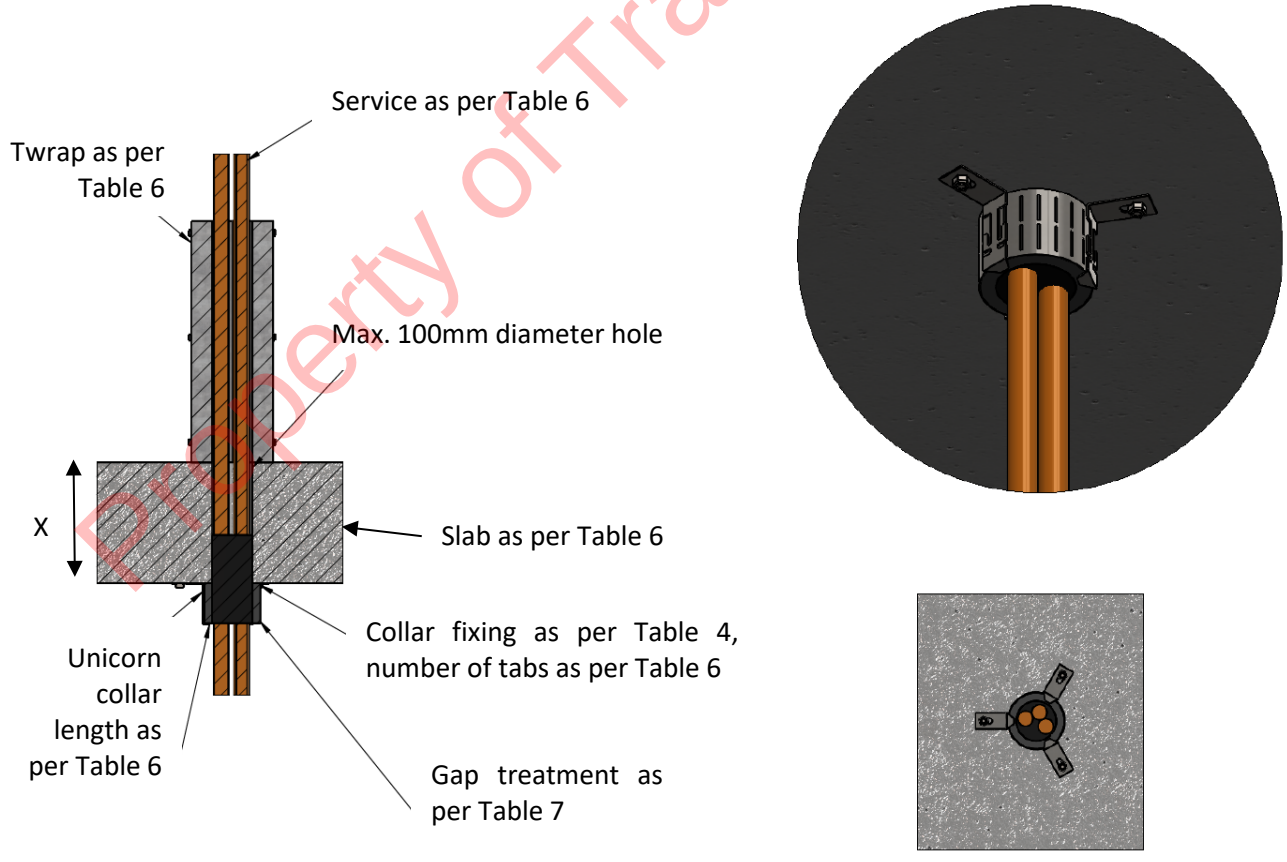


Figure 8: Cables penetrating a slab with TWrap

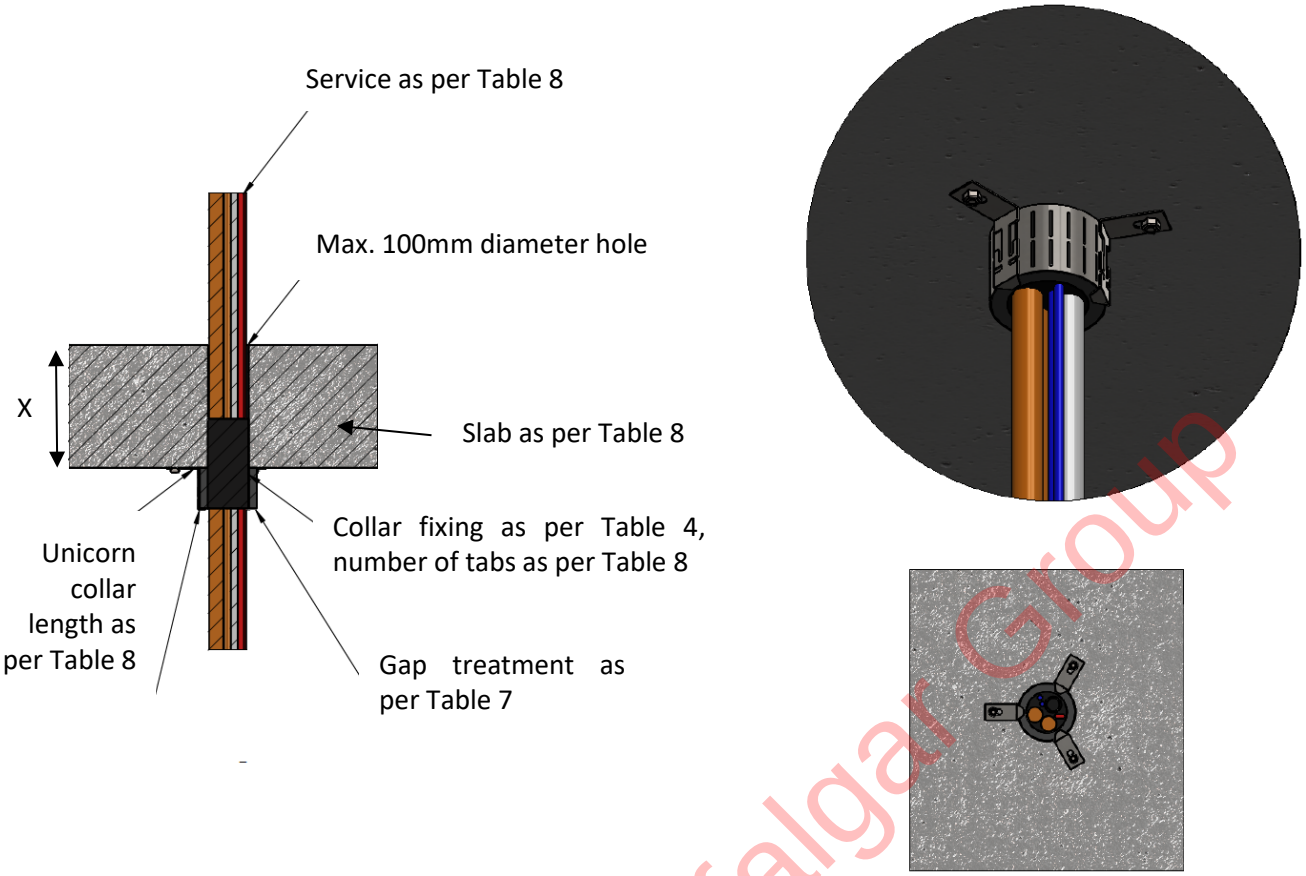


Figure 9: Mixed cables penetrating a slab without TWrap

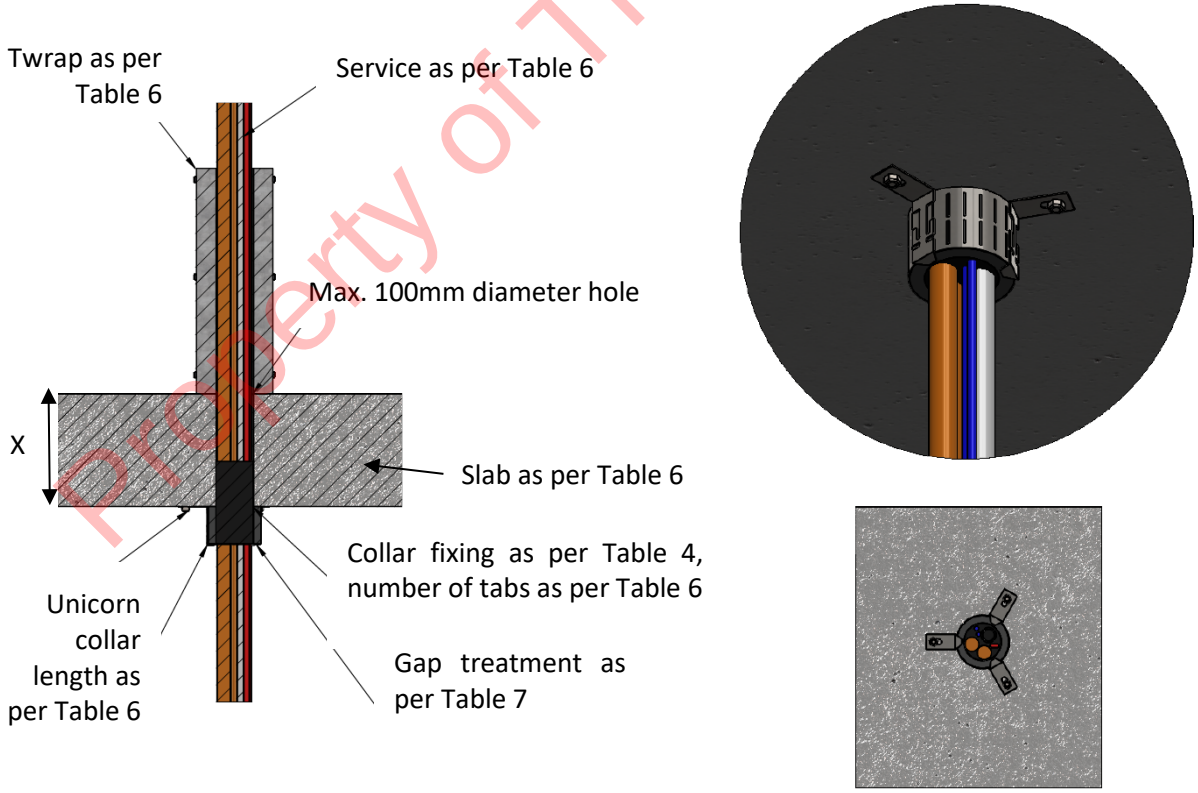


Figure 10: Mix type of cables penetrating slabs without TWrap

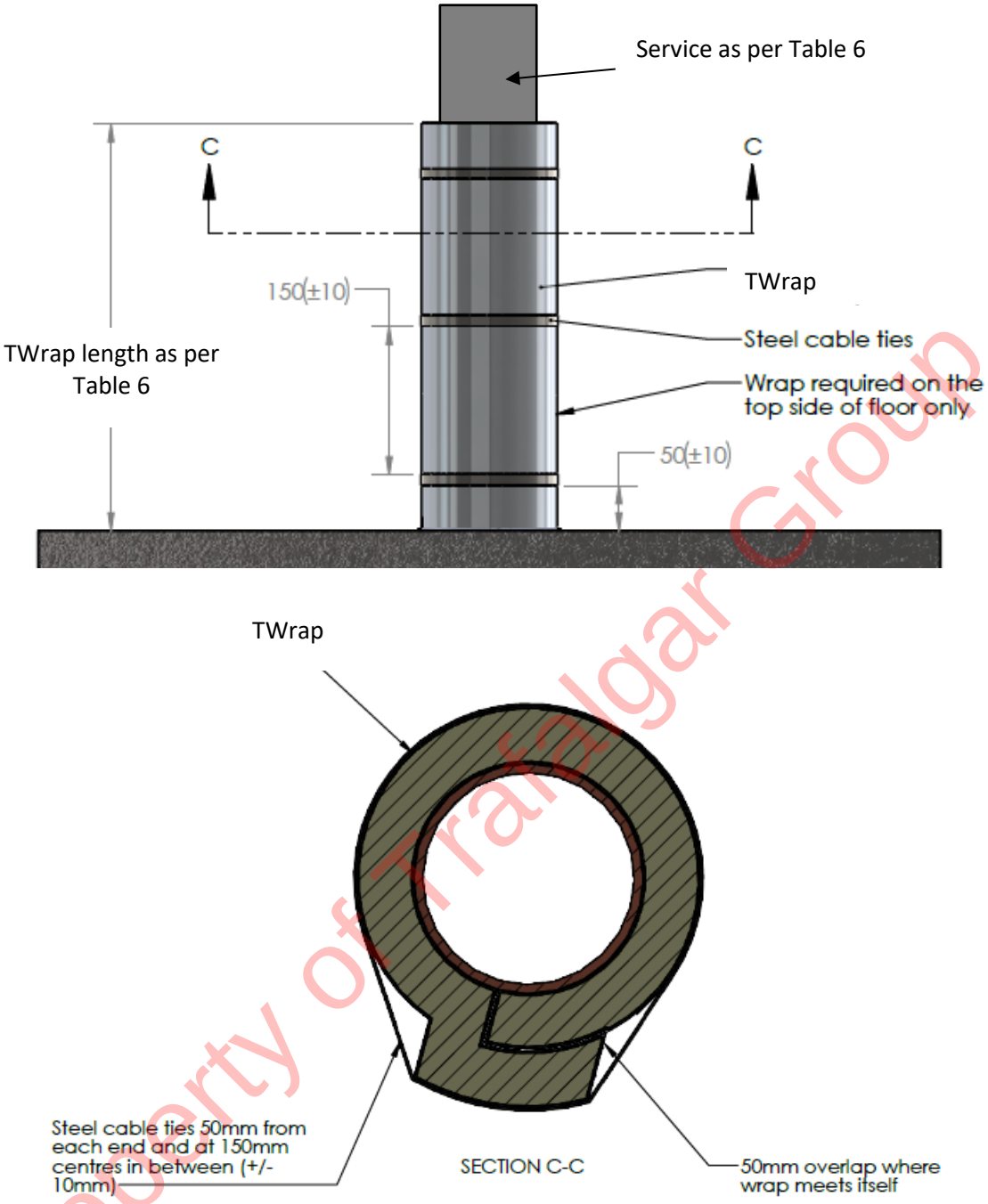


Figure 11: TWrap overlap and cable ties details

4 Referenced Standards

AS 1530.4-2014	Methods for fire tests on building materials, components and structures Part 4: Fire resistance tests of elements of building construction, Section 10 as appropriate for service penetrations.
AS 4072.1-2005	Components for the protection of openings in fire-resistant separating elements Part 1: Service penetrations and control joints. Section 4 as appropriate for preparation of opinions/assessments.

5 Conclusion

On the basis of the analysis presented in this report, it is the opinion of this Accredited Testing Laboratory that the tested prototypes described in Section 2 when varied as described in Section 3 will achieve the Fire Resistance stated below when submitted to a standard fire test in accordance with the test methods referenced in Section 4 and subject to the requirements of section 7, the validity of section 8 and limitation of section 9.

Table 10: PVC stack pipes in slabs

Nominal pipe size (mm)	Socket/ elbow/ fitting in collar	Construction detail	FRL	
			Min. 150mm thick concrete slab	Min. 175mm thick concrete slab
50	N	Tables 2, 3, 4 Figure 1, 2, 3, 4	-/180/180	-/240/240
	Y		-/120/120	-/120/120
100	N		-/180/180	-/240/240
	Y		-/120/120	-/120/120

Table 11: PVC conduits penetrating slab

Service type	Number of services	Minimum slab thickness (X) (mm)	Construction detail	FRL
25mm PVC rigid conduit (empty)	Up to 10	150	Tables 5, 7, 4 Figure 1, 2, 5, 6	-/120/120
25mm PVC rigid conduit (optionally filled with a single small cable from Table 6)				
Up to 25mm PVC rigid conduit (empty)	1			
Up to 25mm PVC rigid conduit (optionally filled with a single small cable from Table 6)				

Table 12: Electrical services in penetrating slab with TWrap

Service type	Service detail	Minimum slab thickness (X) (mm)	Construction detail	FRL
Small cables	6mm^2 Power cables	150	Tables 6, 7, 4 Figure 1, 2, 8, 10, 11	-/120/120
	6.1mm OD CAT6 communication cables			
	nom. 4.5mm OD 6 core fibre optical cable as tested in FRT 220259 Specimen A5			
	12mm OD NBN cables as tested in FRT 190292 Specimen I4			
Large cables	16mm^2 Power cables			
	17.5mm OD CAT3, 50 pair communication cables (UTPL350HF)			
Mix services	Any combination of above cables			

Table 13: Electrical services in penetrating slab without TWrap

Service type	Service detail	Minimum slab thickness (X) (mm)	Construction detail	FRL
Small cables	6mm^2 Power cables	150	Tables 6, 7, 4 Figure 1, 2, 7, 9	-/120/-
	6.1mm OD CAT6 communication cables			-/120/60
	nom. 4.5mm OD 6 core fibre optical cable as tested in FRT 220259 Specimen A5			-/120/120
	12mm OD NBN cables as tested in FRT 190292 Specimen I4			-/120/120
Large cables	16mm^2 Power cables			-/120/-
	17.5mm OD CAT3, 50 pair communication cables (UTPL350HF)			-/120/60
Mix services	Any combination of above cables			-/120/-

Table 14: Mix services penetrating slab with Twrap

Service type	Service detail	Minimum slab thickness (X) (mm)	Construction detail	FRL
Mix services	Any combination of conduits in Table 5 as well as any cables in Table 6	150	Tables 5, 6, 7, 4 Figure 1, 2, 5, 6, 8, 10, 11	-/120/120

Table 15: Mix services penetrating slab without Twap

Service type	Service detail	Minimum slab thickness (X) (mm)	Construction detail	FRL
Mix services	Any combination of conduits in Table 5 as well as **power cables** in Table 8	150	Tables 5, 7, 8, 4 Figure 1, 2, 5, 6, 7, 9	-/120/-
	Any combination of conduits in Table 5 as well as **communication cables** in Table 8			-/120/60
	Any combination of conduits in Table 5 as well as **any cables** in Table 8			-/120/-

6 Direct Field of Application of Results

The results of this report are applicable to floors when exposed to fire from below.

7 Requirements

It is required the floor slab be designed, tested or assessed to maintain the required FRL when including the opening of the service penetration.

Any variations concerning size, constructional details, loads, stresses, edge or end conditions that are other than those identified in this report, may invalidate the conclusions drawn in this report.

8 Term of Validity

This assessment report will lapse on 30th November 2028. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

9 Limitations

The conclusions of this assessment report 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.

This assessment report does not provide an endorsement by CSIRO of the actual products supplied to industry. The referenced assessment can therefore only relate to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of construction 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 is reviewed on or, before, the stated expiry date.

The information contained in this assessment 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.

Appendix A Supporting Test Data

A.1. FSP 2287

On 24 May 2022, CSIRO North Ryde conducted a fire test in accordance with AS 1530.4-2014 on a 96mm thick plasterboard wall system penetrated by various services.

The relevant specimens are summarised in Table A1.

A.2. FSP 2317

On 23 October 2022, CSIRO North Ryde conducted a fire test in accordance with AS 1530.4-2014 on a 150mm thick concrete slab penetrated by various services.

The relevant specimens are summarised in Table A1.

A.3. FSP 2342

On 19 January 2023, CSIRO North Ryde conducted a fire test in accordance with AS 1530.4-2014 on a 150mm thick concrete slab penetrated by various services.

The relevant specimens are summarised in Table A1.

A.4. RTL FT1881.02

On 15 May 2023, Resolute Testing laboratories, QLD conducted a fire test in accordance with AS 1530.4-2014 on a 150mm thick concrete slab penetrated by various services.

The relevant specimens are summarised in Table A1.

A.5. FRT 190292.1

On 16 January 2020, Exova Warrington Fire, VIC conducted a fire test in accordance with AS 1530.4-2014 on a 175mm thick concrete slab penetrated by various services.

Only specimens E1 and I4 are discussed in the report. Their construction and performance are summarized below in Table A2.

A.6. FRT 220259

On 16 January 2020, Exova Warrington Fire, VIC conducted a fire test in accordance with AS 1530.4-2014 on a 150mm thick concrete slab penetrated by various services.

Only specimen A5 is discussed in the report. Its construction and performance are summarized below in Table A2.

A.7. Summary of test data

Table A1: Summary of test data for Unicorn collars

Report	Service	Gap (mm)	Sealant	Collar length (mm)	Barrier	Tabs on collar	Result
FSP 2317 (1)	50mm PVC x 2.7mm	0-9	10mm deep Fyreflex sealant Exposed side	250±10mm	150mm thick Concrete Slab	2	-/2411NF /241NF
FSP 2342 (9)	100mm PVC x 3mm	2		430±10mm	150mm thick Concrete Slab	3	-/2411NF /241NF
FSP 2342 (8)	100mm PVC with socket x 3mm	2		430±10mm	150mm thick Concrete Slab	3	-/127/125 (pipe)
RTL FT1881. 02 (H)	Single 25mm PVC rigid conduit(empty)	100mm hole	60mm deep FyrePEX HP sealant fire side, and FyrePEX HP fully fill gap between cable in collar	375±10mm	150mm thick Concrete Slab	3	-/125NF/ 125NF
RTL FT1881. 02 (C)	Bundle of conduits 10 x 25mm conduit, 5 flexi and 5 rigid, filled with CAT 6, Power cable or empty	100mm hole	60mm deep FyrePEX HP sealant fire side, and FyrePEX HP fully fill gap between cable in collar	375±10mm	150mm thick Concrete Slab	3	-/125NF/ 125NF
RTL FT1881. 02 (B)	Power cables - 3 x 6mm2 and 8 x 16mm2 (800mm non fire side)	100mm hole	60mm deep FyrePEX HP sealant fire side, and FyrePEX HP fully fill gap between cable in collar	375±10mm	150mm thick Concrete Slab	3	-/125NF/ 63 (cable)
RTL FT1881. 02 (F)	Comms cables(30 x CAT3, 50 pair comms cable (800mm non fire side)	100mm hole	60mm deep FyrePEX HP sealant fire side, and FyrePEX HP fully fill gap between cable in collar	375±10mm	150mm thick Concrete Slab	3	-/125NF/ 95 (cable)
FSP 2287 (1)	100mm PVC	0	20mm fillet Fyreflex sealant each side	430mm	96mm thick Shaftliner Wall	4	-/121NF/ 106 (collar)

Table A2: Summary of test report for other types of protections

Report	Service	Support construction	Protection	Result
FRT 190292 (E1)	Appendix D power	60mm thick Maxilite Board in opening in 175mm slab	450mm TWrap and 50mm fillet and 60mm deep sealant in Maxilite board	-/241NF/154 (6mm and 16mm cables max. 84oC rise at 120 min.)
FRT 190292 (I4)	20 x CAT 16 cables with 1 NBN cable	250mm deep Fire pillows in opening in 175mm slab	30mm fillet of Trafalgar FyreFLEX sealant on the non-fire side	-/120NF/120NF
FRT 220259 (A5)	5 Fibre optic cables	60mm thick single coated Fyrebatt in opening in 150mm slab	60mm depth of Trafalgar FyrePEX HP sealant between Fyrebatt and cables, and 30mm fillet of Trafalgar FyrePEX HP was applied on the non-fire side	-/209/96(on Fyrebatt, 168 on cable)

Appendix B Analysis of Minor Variations

B.1 PVC pipes in slabs

The proposed construction shall be Trafalgar Unicorn fire collars tested in Table 1 and as shown in Figure 1 subject to the following variations:

- The inclusion of 50mm and 100mm PVC stack pipes protected with Unicorn collars penetrating min. 150mm and 175mm concrete slabs designed in accordance with AS 3600-2018, with protection as per Table 2.
- All services in slabs to be support at maximum 500mm above slab.
- Separation between adjacent collar bodies shall be at least 40mm as per Figure 2.
- General service installation shall be as per Figures 3 and 4.

Table B1: Summary of test data for PVC pipes in slabs

Report	Service	Gap (mm)	Sealant	Collar length (mm)	Barrier	Tabs on collar	Result
FSP 2317 (1)	50mm PVC x 2.7mm	0-9	10mm deep Exposed side	250±10mm	150mm thick Concrete Slab	2	-/2411NF /241NF
FSP 2342 (9)	100mm PVC x 3mm	2		430±10mm		3	-/2411NF /241NF
FSP 2342 (8)	100mm PVC with socket x 3mm	2		430±10mm		3	-/127/125 (pipe)

It is required that the 150mm and 175mm thick concrete slabs be designed in accordance with AS 3600-2018.

The proposed construction comprises a Unicorn collar protecting 50mm PVC, 100mm PVC (SC) stack pipes penetrating through 150mm and 175mm thick slabs with and without socket in the fire collar.

With reference to test data summarised in Table B1, various sizes and thicknesses of plastic pipes made from AUS PVC, Sandwich Core PVC, penetrated 150mm thick concrete slabs and were protected with Unicorn collar.

The proposed construction comprises a 50mm PVC pipe installed with socket in the Unicorn collar when penetrating a 150mm thick slab.

It is observed that the 100mm PVC-SC pipe specimen without socket in the fire collars was able to maintain integrity and insulation for up to 240 minutes without failure while the same pipe with socket in the fire collars only maintained integrity and insulation for up to 120 minutes.

It is observed that the 50mm PVC pipe specimen without socket in the fire collars was able to maintain integrity and insulation for up to 240 minutes without failure. Therefore, it is reasonable to also expect a 50mm PVC pipe with socket in the Unicorn collar would also be able to maintain integrity and insulation for up to 120 minutes.

The proposed construction also comprises the 150mm PVC(SC) specimen from installed in 150mm thick slab to 175mm.

It is expected that with the increase in slab thickness, the thermal mass of the system will be increased resulting in a greater heat sink effect and thus leading to a lesser increase in pipe temperature throughout the test. It is therefore expected that the pipes installed in a 150mm and 175mm thick slab will be able to maintain insulation for up to a maximum of 180 and 240 minutes respectively.

Confidence in the ability of the concrete slab to perform for the required FRL is offered by reference to AS 3600-2018 clause 5.5, where the required floor thicknesses by that standard are the same as those proposed for the given FRL.

The proposed gap of 4.5mm is within the range of gap tested in the specimens listed in Table B1, and therefore is expected to not detrimentally affect the performance of the specimen for up to 120, 180 and 240 minutes based on design.

Based on the above, it can be expected the proposed construction will be able to maintain integrity and insulation for up to 120, 180 and 240 minutes based on the design if tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

B.2 PVC conduits and cables in slabs

The proposed construction shall be Trafalgar Unicorn fire collars tested in Table 1 and as shown in Figure 1 subject to the following variations:

- Inclusion of PVC conduits empty and filled protected with Unicorn collars penetrating a minimum 150mm thick concrete slab designed in accordance with AS 3600-2018, with protection as per Table 5.
- Inclusion of various electrical services protected with Unicorn collars penetrating a minimum 150mm thick concrete slab designed in accordance with AS 3600-2018, with protection as per Table 6.
- All services in slabs to be support at maximum 500mm above slab
- The proposed TWrap (25mm thick aluminium faced TWrap fire blanket with a density of 128 kg/m^3) is required to have a minimum of 50mm overlap at any wrap joint and have steel cable ties at maximum 150mm centres as per Figure 11.
- Separation between adjacent collar bodies shall be at least 40mm as per Figure 2.
- General service installation shall be as per Figures 5 - 9

Table B2: Summary of test data for PVC conduits and cables in 150mm slabs

Report	Service	Gap (mm)	FyrePEX HP	Collar length (mm)	Tabs on collar	Result
RTL FT1881. 02 (H)	Single 25mm PVC rigid conduit(empty)	100mm hole	60mm deep FyrePEX HP sealant fire side, and FyrePEX HP sealant fully fill gap between cable in collar	160±10mm	3	-/125NF/ 125NF
RTL FT1881.02 (C)	Bundle of conduits 10 x 25mm conduit, 5 flexi and 5 rigid, filled with CAT 6, Power cable or empty	100mm hole		375±10mm	3	-/125NF/ 125NF
RTL FT1881.02 (B)	Power cables - 3 x 6mm2 and 8 x 16mm2 (cables 800mm long on the non-fire side)	100mm hole		375±10mm	3	-/125NF/ 63 (cable)
RTL FT1881.02 (F)	Comms cables(30 x CAT3, 50 pair comms cable (cables 800mm long on the non-fire side)	100mm hole		375±10mm	3	-/125NF/ 95 (cable)

Power cables without TWrap

The proposed construction comprises up to 11 x 6mm^2 power cables or up to 8 x 16mm^2 Power cables installed in a min. 150mm thick slab and protected on the fire side with 375±10mm Unicorn collar, with 60mm deep FyrePEX HP sealant on the fire side of the slab, and FyrePEX HP fully fill gap between cable in collar.

With reference to RTL FT1881. 02 specimen H, a single PVC conduit penetrated a 100mm hole and protected on the fire side with 375±10mm Unicorn collar, with 60mm deep FyrePEX HP sealant on the fire side of the slab, and FyrePEX HP sealant fully fill gap between cable in collar. The specimen did not fail integrity or insulation for up to 120 minutes.

The significance of this test demonstrated the ability for a 100mm hole filled on fire side with 60mm deep FyrePEX HP sealant and covered with a 375±10mm Unicorn collar that's fully filled with FyrePEX HP sealant, and only having a small area of the penetration filled with a PVC conduit, the FyrePEX HP sealant configuration was able to prevent integrity failure for up to 120 minute.

Therefore, is it expected that a single cable, which comprise of plastic and metal components, when protected in the same manner, will not result in an integrity failure at the slab opening for up to 120 minutes.

With reference to RTL FT1881.02 specimen B, the bundle of 3 x 6mm2 and 8 x 16mm2 power cables were tested with 800mm length of cables on the non-fire side, which is 300mm greater than that prescribed by AS 1530.4 – 2014. This will result in a greater surface area for radiation of heat away from specimen, thus making the specimen cooler than if it has been tested in accordance with AS 1530.4 – 2014. Therefore, it is expected that when the specimen is installed with only 800mm length of cables on the non-fire side, the cables will be hotter and thus failing insulation before 60 minutes.

The proposed 11 x 6mm^2 power cables have less copper conductor than the tested cable bundles, and therefore is not expected to be hotter than the tested specimen. However, it also has more cable sheathing material that may present as a flaming risk. However, it is expected that the extra space in the aperture provided by the small cables will be filled with the FyrePEX HP sealant which will intumescence and act to prevent close any gaps formed from melted cable sheath.

Based on the above, it can be expected the proposed construction will be able to maintain integrity for up to 120 minutes if tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

CAT 6 and CAT 3 cables without TWrap

The proposed construction comprises up to 11 x 6mm^2 power cable or up to 8 x 16mm^2 Power cables installed in a min. 150mm thick slab and protected on the fire side with 375±10mm Unicorn collar, with 60mm deep FyrePEX HP sealant on the fire side of the slab, and FyrePEX HP fully fill gap between cable in collar.

With reference to RTL FT1881. 02 specimen H, a single PVC conduit penetrated a 100mm hole and protected on the fire side with 375±10mm Unicorn collar, with 60mm deep FyrePEX HP sealant on the fire side of the slab, and FyrePEX HP sealant fully fill gap between cable in collar. The specimen did not fail integrity or insulation for up to 120 minutes.

The significance of this test demonstrated the ability for a 100mm hole filled on fire side with 60mm deep FyrePEX HP sealant and covered with a 375±10mm Unicorn collar that's fully filled with FyrePEX HP sealant, and only having a small area of the penetration filled with a PVC conduit, the FyrePEX HP sealant configuration was able to prevent integrity failure for up to 120 minute.

Therefore, is it expected that a single cable, which comprise of plastic and metal components, when protected in the same manner, will not result in an integrity failure at the slab opening for up to 120 minutes.

With reference to RTL FT1881.02 specimen F, a bundle of 30 x CAT3 with 50 pairs were tested with 800mm length of cables on the non-fire side, which is 300mm greater than that prescribed by AS 1530.4 – 2014. This will result in a greater surface area for radiation of heat away from specimen, thus making the specimen cooler than if it has been tested in accordance with AS 1530.4 – 2014. Therefore, it is expected that when the specimen is installed with only 800mm length of cables on the non-fire side, the cables will be hotter and thus failing insulation faster.

With a large margin on insulation, it is expected that the cables in RTL FT1881.02 specimen F will be able to maintain insulation for up to 60 minutes.

The proposed inclusion of up to 30 x 6.1mm OD CAT 6 cables penetrating a 150mm slab and protected in the same manner as that tested in RTL FT1881. 02 specimen H.

By inspection, the individual copper conductor size in CAT 6 cables is slightly larger than that in a CAT3 cable. However, the total number of conductors in a single CAT 6 cable is much less than a CAT3 cable. On balance, it is expected that the proposed construction would perform in a similar manner as the tested specimen in specimen F.

Based on the above, it can be expected the proposed construction will be able to maintain integrity for up to 120 minutes and insulation for up to 60 minutes if tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

NBN cable without TWrap

The proposed construction comprises a 12mm OD NBN cable installed in a min. 150mm thick slab and protected on the fire side with 375±10mm Unicorn collar, with 60mm deep FyrePEX HP sealant on the fire side of the slab, and FyrePEX HP fully fill gap between cable in collar.

With reference to FRT 190292 specimen I4, a bundle of cables comprised 20 x CAT 16 cables with 1 NBN cable penetrated a bundle of 250mm deep fire pillow and was protected on the top side with 30mm fillet of Fyreflex sealant. The specimen was able to maintain integrity and insulation for at least 120 minutes.

The proposed construction comprise replacing the 250mm fire pillow with 150mm thick slab and replacing the top side 30mm fillet of Fyreflex sealant with 60mm deep FyrePEX HP sealant on the fire side of the slab, and FyrePEX HP fully fill gap between cable in Unicorn collar.

Although the conduction path is reduced by 130mm when considering the difference in thickness between the fire pillow and fillet of sealant compared to a 150mm slab, the greater heat sink effect of the concrete slab compared to that of the fire pillow will act to absorb heat from the cable, and so allow the non-fire side to be of similar or low temperature than that test. Confidence in the unexposed side cable temperature able to maintain insulation at 120 minutes with the reduction in conduction path can be found in the NBN cable reached only a temperature rise of 62K at 120 minutes. The HP sealant will also expand and act to close off gaps through the slab and act in a similar manner as the Fyreflex sealant.

Based on the above, it can be expected the proposed construction will be able to maintain integrity for up to 120 minutes and insulation for up to 120 minutes if tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

Fibre optic cables without TWrap

The proposed construction comprises up to 5 x 4.5mm Fibre optic cables installed in a min. 150mm thick slab and protected on the fire side with 375±10mm Unicorn collar, with 60mm deep FyrePEX HP sealant on the fire side of the slab, and FyrePEX HP fully fill gap between cable in collar.

With reference to FRT 220259 specimen A5, a bundle 5 Fibre optic cables penetrated 60mm thick Fyrebatt element. 60mm depth of Trafalgar FyrePEX HP sealant fill the gap between Fyrebatt and cables, and 30mm fillet of Trafalgar FyrePEX HP was applied on the non-fire side The specimen was able to maintain integrity and insulation for at least 120 minutes.

The proposed construction comprise replacing the 60mm Fyrebatt with 150mm thick slab and replacing the top side 30mm fillet of FyrePEX HP sealant on the non-fire side of the slab with a full collar of FyrePEX HP on the fire side.

The proposed construction would result in an increase in conduction path of the cables and a greater heat sink effect of the concrete slab compared to that of the Fyrebatt, which will act to absorb heat

from the cables. The HP sealant on the fire side will also expand and act to close off gaps in a similar manner as the HP sealant on the non-fire side.

Based on the above, it can be expected the proposed construction will be able to maintain integrity for up to 120 minutes and insulation for up to 120 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

Mix cable services without TWrap

The proposed construction comprise a combination of various cables discussed above, in a 100mm hole protected in a same manner as that tested in RTL FT1881.02 Specimen B.

It is expected the worse performing cable would dictate the insulation performance of the bundles. Based on the above, it is expected proposed construction will be able to maintain integrity for up to 120 minutes based on design when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

Fibre optic cables, NBN cable, Power cables, CAT 6 and CAT 3 cables with TWrap

The proposed constructions are similar to the cable constructions described above except the cables are wrapped with 450mm of TWrap on the unexposed side of the slab.

With reference to FRT 190292 specimen E, a set of Appendix D cables penetrated a 60mm thick element and was protected on the top side with 450mm of TWrap. The specimen was able to maintain insulation for at least 120 minutes.

The significance of this test specimen demonstrated that 450mm length of Twap is sufficient to allow large cables with large amount of copper content to maintain insulation for up to 120 minutes.

The proposed Power cables, CAT 6 and CAT 3 cable bundles all have similar or less copper content compared to the cables tested in FRT 190292 specimen E, and therefore is expected to also be able to maintain insulation for up to 120 minutes when protected with 450mm length of TWrap.

Based on the above, it is expected the proposed construction will be able to maintain integrity for up to 120 minutes and insulation for up to 120 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

Mix cable services with TWrap

The proposed construction comprise a combination of various cables discussed above, in a 100mm hole protected in a same manner as that tested in RTL FT1881.02 Specimen B and wrapped on the unexposed side with 450mm of TWrap.

It is expected the worse performing cable would dictate the insulation performance of the bundles. Given the large margin in insulation, it is expected proposed construction will be able to maintain integrity and insulation for up to 120 minutes based on design when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

Conduits with single small cable

The proposed construction comprises up to 10 PVC conduits each optionally containing a single 6mm^2 power cable or CAT 6 cable protected in a same manner as that tested in RTL FT1881.02 Specimen C.

With reference to RTL FT1881.02 specimen C, a bundle of 5 x 25mm flexi PVC conduit and 5 x 25mm rigid PVC conduit penetrated a 100mm hole in a 150mm slab. Some conduits were filled with CAT 6 cable and some conduits were filled with 6mm^2 power cable, while the rest remained empty. 60mm deep FyrePEX HP sealant filled the gap between the slab and the services on the fire side, and FyrePEX HP fully fill gap between cable in collar. The specimen was able to maintain integrity and insulation for up to 120 minutes.

With reference to RTL FT1881.02 specimen H, an empty 25mm rigid PVC conduit penetrated a 100mm hole in a 150mm slab. 60mm deep FyrePEX HP sealant filled the gap between the slab and the services

on the fire side, and FyrePEX HP fully fill gap between cable in collar. The specimen was able to maintain integrity and insulation for up to 120 minutes.

The significance of the two refence tests demonstrated that up to 10PVC conduits can be protected in this manner, and the presence of the conduit is sufficient to allow the proposed single small cable to maintain insulation for up to 120 minutes.

Based on the above, it can be expected the proposed construction will be able to maintain integrity for up to 120 minutes and insulation for up to 120 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

Mix conduit and cable services without TWrap

The proposed construction comprise a combination of various cables discussed above with the conduits discussed above, in a 100mm hole protected in a same manner as that tested in RTL FT1881.02 Specimen B.

It is expected the worse performing cable would dictate the insulation performance of the bundles. Based on the above, it is expected proposed construction will be able to maintain integrity for up to 120 minutes based on design when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

Mix conduit and cable services with TWrap

The proposed construction comprise a combination of various cables with the conduits discussed above, in a 100mm hole protected in a same manner as that tested in RTL FT1881.02 Specimen B and wrapped on the unexposed side with 450mm of TWrap.

It is expected the worse performing cable would dictate the insulation performance of the bundles. Given the large margin in insulation, it is expected proposed construction will be able to maintain integrity and insulation for up to 120 minutes based on design when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

B.3 Separation between collars

It is proposed that services are separated by at least 40mm and located within the support construction by at least 40mm. AS 4072. 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 AS 4072. 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".

In light of the above, it is considered that AS 4072.1-2005, clause 4.9.3 applies to services that achieve the required insulation performance for the required integrity period and are separated by at least 40mm.

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