



## Regulatory information report

The fire resistance performance of service penetrations through TBA Firefly™ Intubatt systems in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005

Sponsor: TBA Firefly™ division of TBA Textiles P/L

Report number: FAS190235 Revision: RIR1.20

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## Quality management

Version		Date	Information about the report			
Version	Date	Reason for issue	Report details			Authorised by
			Prepared by	Reviewed by	Authorised by	
Name	Kevin Feng	Omar Saad	Omar Saad	Omar Saad	Omar Saad	Omar Saad
RIR1.0	Issue: 22/09/2020	Reason for issue	Issue of interim report.			Omar Saad
RIR1.1	Issue: 18/09/2020		Revised to incorporate comments from TBA Firefly and include additional services in horizontal and vertical substrates.			
RIR1.2	Issue: 22/12/2020	Reason for issue	Updated to address comments from TBA Firefly and to the latest Warringtonfire template. Report issued to TBA Firefly™ for review and comments.			Omar Saad
RIR1.3	Issue: 14/05/2021		Report updated to include the IPD busways with aluminium and copper conducts. Report issued to TBA Firefly for review and comments.			
RIR1.4	Issue: 3/08/2021	Reason for issue	Amendments to Table 1 (IDs V1, V2, V5, V6 and V9) and Table 6 (IDs H1, H2, H5, H6 and H9)			Omar Saad
RIR1.5	Issue: 11/08/2021		Reason for issue	Report updated to fix typographical errors.		
RIR1.6	Issue: 17/09/2021	Reason for issue	Report updated to incorporate additional test data for VASS HFA6300 busway and revised wrap length for VASS HFA series busways.			Mahmoud Akl
RIR1.6	Issue: 17/09/2021		Reason for issue	Report updated to incorporate additional test data for VASS HFA6300 busway and revised wrap length for VASS HFA series busways.		
RIR1.7	Issue: 21/09/2021	Reason for issue	Report updated to correct the tested busway to be VASS HFA7000 and the wrap lengths for VASS HFA series busways.			Omar Saad

Version		Date	Information about the report			
Reason for issue	Prepared by	Reviewed by	Authorised by			
			Name	Namrata Moharana	Yomal Dias	Omar Saad
RIR1.8	Issue: 16/02/2022	Reason for issue	Amendments to Table 1 (added IDs V86 to V102) and Table 6 (added IDs H68 to H84)			
RIR1.9	Issue: 28/07/2022		Typographical amendments			
RIR1.11	Issue: 16/08/2022	Reason for issue	Amendments to Table 1 (IDs V62 and V64) and Table 3c, Table 3d, Table 8c and Table 8d.			
RIR1.12	Issue: 27/09/2022		Amendments to Table 1 (IDs V11 and V23) and Table 6 (IDs H11, H12 and H85 to H87).			
RIR1.13	Issue: 12/10/2022	Reason for issue	Typographical amendments.			
RIR1.14	Issue: 8/12/2022		Typographical amendments.			
RIR1.15	Issue: 8/12/2022	Reason for issue	Report updated to include close to egde details..			
RIR1.16	Issue: 16/12/2022		Report updated to include close to egde details..			
RIR1.18	Issue: 25/05/2023	Reason for issue	Report revised in response to comments received from TBA on 08/05/2023,			
RIR1.19	Issue: 19/07/2023		Report revised in response to comments received from TBA on 05/06/2023 for Figure 151, V119 and H119			
RIR1.20	Issue: 17/08/2023	Reason for issue	<ul style="list-style-type: none"> <li>• Fixed duplication of services H1-H87</li> <li>• Fixed FRL of H124</li> <li>• Updated H11, H12, V11, V12 with additional wording</li> <li>• V39 typo amendmed</li> <li>• H88 to H109 – left blank for future use</li> </ul>			

Version		Date	Information about the report		
	Expiry: 30/09/2025	Name	Prepared by	Reviewed by	Authorised by
		Signature	Namrata Moharana 	Omar Saad 	Omar Sadd 
Report version RIR1.10, RIR1.14 and RIR1.17 were skipped to match the version of the assessment report number.					

TBA Firefly

## Executive summary

This report contains the minimum information sufficient for regulatory compliance and refers to the referenced assessment report FAS190235 R1.20. Summaries of the test data on which the referenced assessment is based are provided in the appendices which are only available in the full report.

The referenced assessment report documents the findings of the assessment undertaken to determine the fire resistance level (FRL) of service penetrations through TBA Firefly™ Intubatt systems fitted to vertical and horizontal substrates in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

The products assessed in the referenced assessment report include the following:

- TBA Firefly™ Intubatt: 50 mm thick high-density basalt rock fibre batt (180 kg/m<sup>3</sup> Fire Batt) factory coated on both faces to a precise thickness with a white durable fire resistant mastic.
- TBA Firefly™ Intumastic: Water-based fire resisting acrylic sealant.
- TBA Firefly™ Intumastic HP: High pressure exerting Intumescent mastic.
- TBA Firefly™ Penowrap®: High temperature high density 12 mm thick wrap with an aluminium foil facing to one side.
- TBA Firefly™ Insulated Penowrap® System: A two component system consisting of (1<sup>st</sup> layer) 25 mm thick high temperature high density Fortaglas. (2<sup>nd</sup> layer) Phoenix RS 440 g woven Fortaglas cloth with a silicone coating.
- TBA Firefly™ Intustrap: High pressure intumescent wrap, which comes in a 25 m long coil. (4 mm thick graphite × 60 mm wide).
- TBA Firefly™ FRF Fire Collars: Used to fire stop a variety of services which penetrate different Fire-Resistant Substrates. These retro-fit fire collars are made from a steel outer shell containing high pressure exerting graphite intumescent strips.

The referenced assessment report is based upon TBA Firefly™ Systems which were tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005. This report meets compliance with Specification A2.3 Section 2 (c) of NCC2016 Amendment 1 (Including Prior Versions) & Schedule 5 Section 2 (c) of NCC2019 (Including Amendment 1) for determination of an FRL.

The purpose of the referenced assessment report is to be used in conjunction with other tests and assessments of TBA Firefly™ Intubatt barriers only.

The analysis in the referenced assessment report found that the proposed variations are expected to achieve fire resistance performance as shown in Table 1 to Table 8e in accordance with AS 1530.4:2014. Services summarised in Table 1 to Table 8e shall be spaced at a minimum 40 mm from each other in vertical and horizontal substrates.

Services summarised in Table 1 to Table 8e may be positioned close to the interface between TBA Firefly™ Intubatt (main firestop) and the aperture of the wall or floor (the primary fire separating element), where:

- The TBA Firefly™ Intubatt is in an aperture fit for primary fire separating elements in the assessment FAS190234 report RIR1.7 dated 28 July 2022 or other subsequent revisions of the report.
- Services maintain the minimum annular gaps described in 'local fire protection' in the tables and additional figures where listed in this report.
- The separating element is at least the same thickness as the total thickness of the TBA Firefly™ Intubatt layers.
- Services protected with TBA Firefly™ FRF Series Collars are excluded from this concession.

**Table 1 Fire resistance of various services penetrating in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt® fitted to vertical substrates**

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V1	Standard config. PVC insulated D1 Power Cables with or without cable tray  (See Table 20 Item 9)  <b>Note:</b> This service may be installed close to edge of the aperture provided that a 50 mm fillet of TBA Firefly™ Intumastic is provided at the base of the service on both sides and length of the TBA Firefly™ Penowrap® is increased to 600 mm on both sides of the Intubatt.	Protected with 1 layer of 12 mm TBA Firefly™ Penowrap® or 25 mm TBA Firefly™ Insulated Penowrap® for 300 mm each side of the TBA Firefly™ Intubatt seal. Plus 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and Penowrap® with or without packing to the annular gap between the TBA Firefly™ Penowrap® and the service.	TBA Firefly™ Intumastic	(1a or 1b), 2, 3 and 151	-/120/120
V2	Standard config. PVC insulated D2 Communication Cables with or without cable tray  (See Table 20 Item 9)  <b>Note:</b> This service may be installed close to edge of the aperture provided that a 50 mm fillet of TBA Firefly™ Intumastic is provided at the base of the service on both sides.		TBA Firefly™ Intumastic		-/120/120
V3	Standard config. PVC insulated D1 Power Cables with or without cable tray  (See Table 20 Item 9)	Cables protected with 25 mm TBA Firefly™ Insulated Penowrap® for 500mm each side of the TBA Firefly™ Intubatt seal. Plus 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and Penowrap®	TBA Firefly™ Intumastic	(1a or 1b), 2, 3, and 151	-/240/180
V4	Standard config. PVC insulated D2 Communication Cables with or without cable tray  (See Table 20 Item 9)		TBA Firefly™ Intumastic		
V5	Standard config. PVC insulated D1 Power Cables with or without cable tray – Close to edge  (See Table 20 Item 9)	Protected with 1 layer 12 mm TBA Firefly™ Penowrap® or 25 mm TBA Firefly™ Insulated Penowrap® for 300mm each side of the TBA Firefly™ Intubatt seal. Plus 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and Penowrap® with or without packing to the annular gap between the TBA Firefly™ Penowrap® and the service.	TBA Firefly™ Intumastic	(1a or 1b), 2, 8 and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V6	Standard config. PVC insulated D2 Communication Cables with or without cable tray – Close to edge  (See Table 20 Item 9)	Protected with 1 layer 12 mm TBA Firefly™ Penowrap® or 25 mm TBA Firefly™ Insulated Penowrap® for 300 mm each side of the TBA Firefly™ Intubatt seal. Plus 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and Penowrap® with or without packing to the annular gap between the TBA Firefly™ Penowrap® and the service.	TBA Firefly™ Intumastic	(1a or 1b), 2, 8 and 151	-/120/120
V7	Standard config. PVC insulated D1 Power Cables with or without cable tray – Close to edge  (See Table 20 Item 9)	Cables protected with 25 mm TBA Firefly™ Insulated Penowrap® for 500 mm each side of the TBA Firefly™ Intubatt seal. Plus 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and Penowrap®.	TBA Firefly™ Intumastic	(1a or 1b), 2, 8 and 151	-/240/180
V8	Standard config. PVC insulated D2 Communication Cables with or without cable tray – Close to edge  (See Table 20 Item 9)	TBA Firefly™ Intumastic			
V9	Bundle of up to 4 × 28mm Coaxial cables	Protected with 1 layer of 12mm TBA Firefly™ Penowrap® or 25 mm TBA Firefly™ Insulated Penowrap® for 300 mm each side of the TBA Firefly™ Intubatt seal. Plus 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and Penowrap® with or without packing to the annular gap between the TBA Firefly™ Penowrap® and the service.	TBA Firefly™ Intumastic	(1a or 1b), 2, 3 and 151	-/120/120
V10	Bundle of up to 4 × 28mm Coaxial cables	Cables protected with 25mm TBA Firefly™ Insulated Penowrap® for 500mm each side butted up to the face of the TBA Firefly™ Intubatt seal. Plus 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and Penowrap®.	TBA Firefly™ Intumastic	(1a or 1b), 2, 3 and 151	-/240/180
V11	Standard config. copper D1 cables with or without cable tray  (See Table 20 Item 9)	Cables protected with one layer of 12 mm TBA Firefly™ Penowrap® FOR 300 mm on both sides of the Intubatt with TBA Firefly™ Intumastic HP	TBA Firefly™ Intumastic HP	(1a or 1b), 2, and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	<b>Note:</b> This service may be installed close to edge of the aperture provided that the length of the TBA Firefly™ Penowrap® is increased to 600 mm on both sides of the Intubatt.	applied to full depth of the aperture (nominally 10 mm annular gap between Intubatt and cables) and an additional 50 mm fillet of TBA Firefly™ Intumastic acrylic sealant applied to services at both sides of the Intubatt.			
V12	<p>Aluminium cables only or a combination of aluminium and copper cables – with or without cable tray with an equivalent config. resembling standard D1 configuration cable – (See Table 20 Item 20)</p> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• Any ratio of copper and aluminium cable is acceptable.</li> <li>• This service may be installed close to edge of the aperture provided that the length of the TBA Firefly™ Penowrap® is increased to 600 mm on both sides of the Intubatt.</li> </ul>	Cables protected with one layer of 12 mm TBA Firefly™ Penowrap® for 300 mm on both sides of the Intubatt with TBA Firefly™ Intumastic HP applied to full depth of the aperture (nominally 10 mm annular gap between Intubatt and cables) and an additional 50 mm fillet of TBA Firefly™ Intumastic acrylic sealant applied to services at both sides of the Intubatt.	TBA Firefly™ Intumastic HP	(1a or 1b), 2, and 151	-/120/120
V13	<p>Core Hole of up to 75mm with a max' annular gap of 5mm. Filled with an assorted Power Cable Bundle of up to:</p> <p>One (1) 17mm outside diameter 4 core armoured power cable</p> <p>Four (4) 8mm outside diameter 3 core power flex and one (1) 8mm outside diameter earth cable tied in a bundle</p> <p>One (1) 9mm outside diameter neutral cable, one (1) 4mm outside diameter neutral cable and one (1) 4mm outside diameter earth cable</p> <p>Twelve (12) 3.5mm outside diameter data cables tied in a bundle</p>	None	TBA Firefly™ Intumastic filled to the full depth of the TBA Firefly™ Intubatt with a 50 mm fillet of TBA Firefly™ Intumastic to either side	1a or 1b, 2 and 151	-/120/120
V14	Bundle of up to 7 × RG6 Coaxial Cables	None	Core hole of up to 32mm TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 10mm) filled to the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 15 and 151	-/180/180

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V15	Bundle of up to 14 × CAT5e Data Cables	None	Core hole of up to 32mm TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 10mm) filled to the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 25 and 151	-/240/240
V16	Bundle of up to 10 × CAT6 Data Cables	None	Core hole of up to 32mm TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 10mm) filled to the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 29 and 151	-/180/180
V17	Max 50mm Core hole filled with a Mixed Cable and Lagged Copper Pipe Bundle of up to:  Copper Pipe: Ø12.6mm (OD) × 1.63mm copper pipe continuously wrapped with 12.5mm thick Nitrile Rubber insulation.  Red fire alarm cables: Up to 2 Fire Alarm signal wire (1.5mm <sup>2</sup> Straight Twin Flat Olex CACP05A1002WVAB2C)  Communication cables: Cat6 Cable	None	All gaps in the core hole to be filled with TBA Firefly™ Intumastic. Then finished with a TBA Firefly™ FRF 40 Fire Collar to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18, (19 or 109) and 151	-/120/120
V18	Insulated Twin Air-con copper pipe:  Ø9.44mm (OD) × 1.24mm copper pipe continuously wrapped with 10mm thick Nitrile Rubber Insulation. Ø6.45mm (OD) × 1.14mm copper pipe continuously wrapped with 12.2mm thick Nitrile Rubber Insulation.	None	TBA Firefly™ FRF 50 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 23, (19 or 109) and 151	-/120/120
V19	One 10mm wide × 5mm thick Twin and Earth Cable	None	TBA Firefly™ Intumastic + 60mm fillet to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 27 and 151	-/120/120
V20	One Ø8mm Firefix FP200 Gold cable	None	TBA Firefly™ Intumastic + 60mm fillet to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 27 and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V21	Up to Six 13mm wide × 5mm thick Twin and Earth cable	None	Annular gap not to exceed 5mm and to be filled with TBA Firefly™ Intumastic + 60mm fillet to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 27 and 151	-/120/120
V22	Up to three Ø8mm Firefix FP200 cable	None	Annular gap not to exceed 5mm and to be filled with TBA Firefly™ Intumastic + 60mm fillet to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 27 and 151	-/120/120
V23	One Ø7mm AV co-axial cable	None	TBA Firefly™ Intumastic + 60mm fillet to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 27 and 151	-/120/120
V24	One Ø21mm non-sheathed cable	None	TBA Firefly™ Intumastic + 70mm x 100mm fillet to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 28 and 151	-/120/120
V25	Up to twelve 13mm wide × 5mm thick Twin and Earth cable	None	Annular gap not to exceed 5mm and to be filled with TBA Firefly™ Intumastic + 60mm fillet to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 27 and 151	-/120/120
V26	Brass Pipes Ø32-65mm × 0.91mm (min) Ø80-100mm × 1.22mm (min)	None	TBA Firefly™ Intumastic	(1a or 1b), 2 & 3	-/240/-
		Single pipe protected with 1-off layer of TBA Firefly™ 12mm Penowrap® for 600mm each side fixed to pipe with 4 stainless steel cable ties	TBA Firefly™ Intumastic		-/240/120
V27	Copper and Ferrous (Steel and Iron) Pipes Ø8-32mm × 0.91mm (min) Ø32-65mm × 0.91mm (min) Ø65-100mm × 1.22mm (min)	None	TBA Firefly™ Intumastic	(1a or 1b), 2 & 3 and 151	-/240/-
		Single pipe protected with 1-off layer of TBA Firefly™ 12mm Penowrap® for 600mm each side fixed to pipe with 4 stainless steel cable ties	TBA Firefly™ Intumastic		-/240/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	Ø125 x 1.42mm (min) Ø150 x 1.63mm (min)				
V28	V28A:  Foil Coated PIR Foam Lagged Copper and Steel Pipes 8mm up to 32mm OD. The PIR Insulation wall thickness minimum 19mm up to maximum 50mm. Maximum Core hole size 148mm	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.  With a 50mm fillet of TBA Firefly™ Intumastic to 1 side only of the TBA Firefly™ Intubatt seal.	(1a or 1b), 2, 4 & 5 and 151	-/120/120
	V28B:  Nitrile Rubber Lagged Copper and Steel Pipes 8mm up to 32mm OD. The Nitrile Rubber Insulation wall thickness minimum 19mm up to maximum 38mm. Maximum Core hole size 124mm	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.  With a 50mm fillet of TBA Firefly™ Intumastic to 1 side only of the TBA Firefly™ Intubatt seal.	(1a or 1b), 2, 4 and 151	-/90/90
	V28C:  Foil Coated Glasswool Lagged Copper and Steel Pipes 8mm up to 32mm OD. The glasswool wall thickness minimum 19mm up to maximum 50mm. Maximum Core hole size 148mm	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.  With a 50mm fillet of TBA Firefly™ Intumastic to 1 side only of the TBA Firefly™ Intubatt seal.	(1a or 1b), 2, 4 & 5 and 151	-/120/120
	V28D:  Foil Coated rockwool Lagged Copper and Steel Pipes 8mm up to 32mm OD. The rockwool wall thickness minimum 20mm up to maximum 50mm. Maximum Core hole size 148mm	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.  With a 50mm fillet of TBA Firefly™ Intumastic to 1	(1a or 1b), 2, 4, 5 and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
			side only of the TBA Firefly™ Intubatt seal.		
V29	Foil Coated rockwool Lagged Copper and Steel Pipes 8mm up to 200mm OD. The rockwool wall thickness minimum 38mm up to maximum 50mm. Maximum Core hole size 324mm	None	Service wrapped with 3 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.	(1a or 1b), 2, 24 and 151	-/120/120
V30	Lagged copper pipe up to 22mm OD with a min' wall thickness of 0.91mm. Insulated with 40mm foil coated mineral fibre.	None	TBA Firefly™ Intumastic	(1a or 1b), 2, and 151	-/120/120
V31	Lagged copper pipe up to 22mm OD with a min' wall thickness of 0.91mm. Insulated with 30mm foil coated PIR	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 20mm) to the full depth of the TBA Firefly™ Intubatt seal	(1a or 1b), 2 and 151	-/120/120
V32	Up to Ø40mm x 3.2mm uPVC Pipe	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.	(1a or 1b), 2, 10 and 151	-/240/240
V33	40mm OD uPVC Pipe with a max' wall thickness of 2.17mm	None	TBA Firefly™ FRF 40 collar & TBA Firefly™ Intumastic To both sides of the TBA Firefly™ Intubatt Seal	(1a or 1b), 2, 18, (19 or 109) and 151	-/120/120
V34	50mm OD uPVC Pipe with a max' wall thickness of 2.33mm	None	TBA Firefly™ FRF 50 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18, (19 or 109) and 151	-/120/120
V35	65mm OD uPVC Pipe with a max' wall thickness of 3.17mm	None	TBA Firefly™ FRF 65 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18 (19 or 109) and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V36	85mm OD uPVC Pipe with a max' wall thickness of 3.05mm	None	TBA Firefly™ FRF 80 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18 (19 or 109) and 151	-/120/120
V37	100mm OD uPVC Pipe with a max' wall thickness of 3.5mm	None	TBA Firefly™ FRF 100 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18 (19 or 109)	-/120/120
V38	Ø150mm × 4.11mm uPVC Pipe	None	TBA Firefly™ FRF 150 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 18 (19 or 109) and 151	-/120/120
V39	Ø40 mm × 3.2 mm HDPE Pipe	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.	(1a or 1b), 2, 10 and 151	-/240/120
V40	Ø40mm × 3.98mm HDPE Pipe	None	TBA Firefly™ FRF 40 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18, (19 or 109) and 151	-/120/120
V41	Ø50mm × 2.33mm HDPE Pipe	None	TBA Firefly™ FRF 50 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18, (19 or 109) and 151	-/120/120
V42	Ø65mm × 3.17mm HDPE Pipe	None	TBA Firefly™ FRF 65 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18, (19 or 109) and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V43	Ø80mm × 3.05mm HDPE Pipe	None	TBA Firefly™ FRF 80 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 18, (19 or 109) and 151	-/120/120
V44	Ø110mm × 4.58mm HDPE Pipe	None	TBA Firefly™ FRF 100 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 18, (19 or 109)	-/120/120
V45	Insulated Beer Lines with up to 16-off Ø8mm (OD) × 1.5mm thick Saint-Gobain Cobraflex pipes Continuously wrapped with 25mm thick Nitrile Rubber Insulation	None	TBA Firefly™ FRF 100 collar & TBA Firefly™ Intumastic to both sides of the TBA Firefly™ Intubatt seal	(1a or 1b), 2, 22 & 18, (19 or 109) and 151	-/120/120
V46	Lorient LVH44 or Kilargo IFD44 Intumescent fire damper installed in TBA Firefly™ Intubatt® <ul style="list-style-type: none"> <li>• Up to 200 mm × 200 mm damper friction fitted and glued into the aperture using TBA Firefly™ Intumastic</li> <li>• Up to 450 mm × 450 mm damper mechanically secured into the aperture:                             <ul style="list-style-type: none"> <li>– Predrill the centre of the damper with a 5 mm drill bit 50 mm from each corner.</li> <li>– Secure with 75 mm long TBA Firefly™ Pigtail Screws.</li> <li>– 8 × fixings per damper</li> <li>– Seal the gaps with TBA Firefly™ Intumastic</li> </ul> </li> </ul>	None	TBA Firefly™ Intumastic	(1a or 1b), 2, 26a & 26b and 151	-/120/-
V46a	Lorient LVH44 or Kilargo IFD44 Intumescent fire damper installed in TBA Firefly™ Intubatt® <ul style="list-style-type: none"> <li>• Up to 200 mm × 200 mm damper friction fitted and glued into the aperture using TBA Firefly™ Intumastic</li> <li>• Up to 450 mm × 450 mm damper mechanically secured into the aperture:</li> </ul>	None	TBA Firefly™ Intumastic	(1a or 1b), 2, 26b & 26c and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	<ul style="list-style-type: none"> <li>- Predrill the centre of the damper with a 5 mm drill bit 50 mm from each corner.</li> <li>- Secure with 75 mm long TBA Firefly™ Pigtail Screws.</li> <li>- 8 x fixings per damper</li> <li>Seal the gaps with TBA Firefly™ Intumastic.</li> <li>For all Lorient LVH44 or Kilargo IFD44 up to 450 mm x 450 mm:             <ul style="list-style-type: none"> <li>- Wire mesh was installed on both sides, central to the service: 530mm wide x 530mm high x 75mm deep x 1.1mm thick.</li> <li>- The mesh is to be 24mm x 12mm grid pattern with a 50mm high flap on either side that is used to anchor the mesh to the batt, using pigtail screws at minimum 90mm embedment</li> </ul> </li> </ul>				
V47	Max. 2.4m x 2.4m Bullock 4900 series dampers	None	TBA Firefly™ Intumastic	2, 16, 17 and 151	-/120/-
V48	200mm wide x 114mm high (uncompressed) x100mm deep Intuspan	None	None	1a, 2, 11, 12 and 151	-/120/120
V49	Bundle of up to 12 x TPS Electrical Cables or 1.5mm <sup>2</sup> Red Fire Alarm Cables. (May be mixed)	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 69 and 151	-/180/120
V50	Polyolefin (PE) Lagged Copper Pipe 8mm to 25mm OD. PE Insulation to have a minimum wall thickness of 19mm to a maximum of 25mm thick	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 70 and 151	-/120/60
V51	CPVC Fire Sprinkler Pipe up to 33.4mm OD with a maximum wall thickness of 4.1mm. Pipe to be wrapped locally with grease proof paper prior to installation of the Intustrap	None	TBA Firefly™ Intustrap.	(1a or 1b), 2, 71 and 151	-/180/180
V52	CPVC Fire Sprinkler Pipe up to 48mm OD with a maximum wall thickness of 4.1mm. Pipe to be	None	TBA Firefly™ Intustrap.	(1a or 1b), 2, 71 and 151	-/180/180

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	wrapped locally with grease proof paper prior to installation of the Intustrap				
V53	CPVC Fire Sprinkler Pipe up to 33.4mm OD with a maximum wall thickness of 4.1mm. Pipe to be wrapped locally with grease proof paper prior to installation of the sealant	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt.	(1a or 1b), 2, 72 and 151	-/180/180
V54	CPVC Fire Sprinkler Pipe up to 48mm OD with a maximum wall thickness of 4.1mm. Pipe to be wrapped locally with grease proof paper prior to installation of the sealant	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt.	(1a or 1b), 2, 72 and 151	-/120/120
V55	Up to 16mm OD PEX-AL Gas Pipe with a max' Wall thickness of 4.1mm	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt.	(1a or 1b), 2, 72 and 151	-/180/180
V57	Up to 16mm OD PEX Pipe with a max' Wall thickness of 4.1mm	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt.	(1a or 1b), 2, 72 and 151	-/180/180
V58	Aircon Pair Coil Bundle of 1 × 9.4mm Copper lagged in 10mm thick nitrile rubber + 1 × 6.45 Copper lagged in 12.1mm nitrile rubber with or without 18mm PE drain hose + 2 × TPS Power cables.	None	Bundle sealed with TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 73 and 151	-/180/90
V59	Aircon Pair Coil Bundle of 1 × 9.4mm Copper lagged in 10mm thick nitrile rubber + 1 × 6.45 Copper lagged in 12.1mm nitrile rubber with or without 18mm PE drain hose + 2 × TPS Power cables	None	Bundle sealed with TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt plus 50mm fillet each side	(1a or 1b), 2, 74 and 151	-/180/120
V60	uPVC Pipe or Flexi Conduit up to 33.7 mm OD with a max' wall thickness of 1.7 mm and within the conduit	None	TBA Firefly™ Intumastic HP in the annular gap	(1a or 1b), 2, 75 and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	or pipe up to 8 × 2.5 mm <sup>2</sup> (max core size) 2C+E TPS Cables		(min 10mm max 30mm) to depth of 32mm on both sides		
V61	Up to 9 x 13mm copper pipes with 9mm Nitrile Rubber lagging + 20 × TPS cables + With or without 16mm Flexidrain pipe with or without cable tray	1 layer of TBA Firefly™ 12mm Penowrap® 300mm each side 3x stainless steel cable ties	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 76 and 151	-/120/120
V62	Steel Universal Beams (see item 120)	1 layer of TBA Firefly™ 12 mm Penowrap®, to both sides of the TBA Firefly Intubatt® seal. Secured using stainless steel cable ties, nominal 50 mm from each end, then at nominally 100 mm centres for a distance of:	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 77, 87 and 153	-/120/120
	150 UB 14	300 mm			
	150 UB 18	300 mm			
	180 UB 16	300 mm			
	180 UB 18	300 mm			
	200 UB 18	300 mm			
	200 UB 22	300 mm			
	250 UB 25	300 mm			
	200 UB 29	300 mm			
	250 UB 31	300 mm			
	250 UB 37	300 mm			
	310 UB 32	300 mm			
	310 UB 40	300 mm			
	310 UB 46	300 mm			
	360 UB 44	300 mm			

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	360 UB 50	300 mm			
	360 UB 56	300 mm			
	410 UB 53	300 mm			
	410 UB 59	300 mm			
	460 UB 67	300 mm			
	460 UB 74	300 mm			
	460 UB 82	300 mm			
	530 UB 82	300 mm			
	530 UB 92	300 mm			
	610 UB 101	300 mm			
	610 UB 113	300 mm			
	610 UB 125	300 mm			
	150 UB 14	300 mm	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 77, 87 and 153	-/180/180
	150 UB 18	300 mm			
	180 UB 16	300 mm			
	180 UB 18	300 mm			
	200 UB 18	300 mm			
	200 UB 22	300 mm			
	250 UB 25	300 mm			
	200 UB 29	300 mm			
	250 UB 31	300 mm			
	250 UB 37	300 mm			
	310 UB 32	300 mm			
	310 UB 40	300 mm			

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	310 UB 46	300 mm			
	360 UB 44	300 mm			
	360 UB 50	300 mm			
	360 UB 56	300 mm			
	410 UB 53	300 mm			
	410 UB 59	300 mm			
	460 UB 67	300 mm			
	460 UB 74	300 mm			
	460 UB 82	300 mm			
	530 UB 82	300 mm			
	530 UB 92	300 mm			
	610 UB 101	300 mm			
	610 UB 113	300 mm			
	610 UB 125	300 mm			
V63	Minimum 200mm x 45mm Timber Joist	1 layer of TBA Firefly™ 12mm Penowrap® 300mm each side 3x stainless steel cable ties	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 77, 87 and 151	-/120/120
V64	Steel C Purlin or Steel Z Purlin (see item 119)	1 layer of TBA Firefly™ 12 mm Penowrap®, to both sides of the TBA Firefly™ Intubatt® seal. Secured using stainless steel cable ties. Nominal 50 mm from each end then at nominal 100 mm centres. For a distance of:	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 77, 87 and 152	-/120/120
	100 10	600 mm			
	100 12	450 mm			
	100 15	400 mm			
	100 19	450 mm			

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	150 12	400 mm			
	150 15	300 mm			
	150 19	300 mm			
	150 24	300 mm			
	200 15	300 mm			
	200 19	300 mm			
	200 24	300 mm			
	250 19	300 mm			
	250 24	300 mm			
	300 24	300 mm			
	300 30	300 mm			
	350 24	300 mm			
	350 30	300 mm			
	400 24	300 mm			
	400 30	300 mm			
	100 10	750 mm	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 77, 87 and 152	-/180/180
	100 12	600 mm			
	100 15	450 mm			
	100 19	400 mm			
	150 12	450 mm			
	150 15	400 mm			
	150 19	300 mm			
	150 24	450 mm			
	200 15	300 mm			

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	200 19	300 mm			
	200 24	300 mm			
	250 19	300 mm			
	250 24	300 mm			
	300 24	300 mm			
	300 30	300 mm			
	350 24	300 mm			
	350 30	300 mm			
	400 24	300 mm			
	400 30	300 mm			
V65	Steel Pipes up to Ø40mm OD (Min' wall thickness 0.91mm) or up to 12mm OD threaded rod	1 layer of TBA Firefly™ 12mm Penowrap® 300mm each side 3x stainless steel cable ties	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 78 and 151	-/120/120
V66	Steel pipe 41mm OD up to 300mm OD (Min' wall thickness: 41mm OD to 65mm OD 0.91mm, 66mm OD to 100mm OD 1.22mm, 101mm OD to 125mm OD 1.42mm, 126mm OD to 300mm OD 1.63mm)	1 layer of TBA Firefly™ 12mm Penowrap® 350mm each side 4x stainless steel cable ties	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 79 and 151	-/90/90
V67	Steel pipe 41mm OD up to 300mm OD (Min' wall thickness: 41mm OD to 65mm OD 0.91mm, 66mm OD to 100mm OD 1.22mm, 101mm OD to 125mm OD 1.42mm, 126mm OD to 300mm OD 1.63mm)	1 layer of TBA Firefly™ 12mm Penowrap® 500mm each side 5x stainless steel cable ties	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 80 and 151	-/120/120
V68	Up to Ø43mm OD PEX AL Pipe (Max' wall thickness 6mm)	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 72 and 151	-/120/120
V69	Up to Ø43mm OD PEX Pipe (Max' wall thickness 6mm)	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 72 and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V70	Bundle of 2 or 3 uPVC Pipes or Flexi conduits up to 27mm OD with a max' wall thickness of 2.4mm within a single up to 70mm core hole in 2 layers of TBA Firefly™ Intubatt, each conduit filled with up to 10 x Cat 6 Cables, 14 x Cat 5e cables and 7 x RG6 Coaxial Cables	None	TBA Firefly™ Intumastic HP in the annular gap (10mm- 30mm) to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2, 99 and 151	-/240/120
V71	Single uPVC Pipe or Flexi Conduit up to 27mm OD with a max' wall thickness of 2.4mm filled with up to 10 x Cat 6 NBN Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm-max 30mm) to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2 and 151	-/120/120
V72	Single uPVC Pipe or Flexi Conduit up to 27mm OD with a max' wall thickness of 2.4mm filled with up to 14 x Cat 5e NBN Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm-max 30mm) to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2 and 151	-/120/120
V73	Single uPVC Pipe or Flexi Conduit up to 27mm OD with a max' wall thickness of 2.4mm filled with up to 7 x RG6 Coaxial NBN Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm-max 30mm) to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2 and 151	-/120/120
V74	30mm x 70mm Timber up to 44mm x 199mm	Protected with 1 layer of TBA Firefly™ 12mm thick Penowrap® 300mm to either side	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(1a or 1b), 2 and 151	-/120/120
V75	Up to Ø25mm uPVC Pipe max' wall thickness 1.7mm with 9mm nitrile rubber lagging	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm-max 30mm) to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2 and 151	-/120/120
V76	Single uPVC Pipe or Flexi Conduit up to 50mm OD with a max' wall thickness of 2.4mm with up to 20 x Cat 5e NBN Cables + up to 26 x Cat 6 NBN Cables + up to 9 x RG6 Coaxial NBN Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 10mm-max 30mm) to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2 and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V77	8mm UP TO 48.6mm OD STEEL PIPE (Min' wall thickness 0.91mm)	1 Layer of TBA Firefly™ 12mm thick Penowrap® wrapped for a distance of 300mm fixed using stainless steel cable ties 50mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to both sides of seal	TBA Firefly™ Intumastic to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 111 and 151	-/90/90
V78	41mm OD up to 90mm OD STEEL PIPE (Min' wall thickness 41mm OD to 65mm OD 0.91mm, 66mm OD to 90mm OD 1.22mm)	1 Layer of TBA Firefly™ 12mm thick Penowrap® wrapped for a distance of 300mm fixed using stainless steel cable ties 50mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to both sides of seal	TBA Firefly™ Intumastic to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 112 and 151	-/120/120
V79	Bundle of up to 2 × 35mm OD copper pipes lagged in 25mm thick nitrile rubber insulation and 2 × 29mm OD copper pipes lagged in 19mm thick nitrile rubber insulation and 2 × 19mm OD copper pipes lagged in 19mm thick nitrile rubber insulation.	1 Layer of TBA Firefly™ 12mm thick Penowrap® wrapped for a distance of 300mm fixed using stainless steel cable ties 50mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to both sides of seal	TBA Firefly™ Intumastic HP in the annular gap between the nitrile rubber and the TBA Firefly™ Intubatt (min 10mm max 40mm) Filled to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 113 and 151	-/120/120
V80	Bundle of up to 2 × 29mm OD copper pipes lagged in 19mm thick nitrile rubber insulation and 1 × 29mm OD copper pipe lagged in 25mm thick nitrile rubber insulation and 1 × 22mm OD copper pipe lagged in 19mm thick nitrile rubber insulation and 1 × 19mm OD copper pipe lagged in 19mm thick nitrile rubber insulation and 1 × 16mm OD copper pipe lagged in 19mm thick nitrile rubber insulation.	1 Layer of TBA Firefly™ 12mm thick Penowrap® wrapped for a distance of 300mm fixed using stainless steel cable ties 50mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to both sides of seal	TBA Firefly™ Intumastic HP in the annular gap between the nitrile rubber and the TBA Firefly™ Intubatt (min 10mm max 40mm) Filled to the full depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 114 and 151	-/120/120
V81	Bundle of 2 or 3 uPVC Pipes or Flexi conduits up to 32mm OD with a max' wall thickness of 2.4mm each pipe containing up to 9 × RG6 Cables or up to 21 × Cat5e Cables or up to 14 × Cat 6 Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 20mm) filled the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 30 and 151	-/180/180

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V82	Single uPVC Pipe or flexi conduit up to 32mm OD with a maximum wall thickness of 2.4mm containing up to 9 x RG6 Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 20mm) filled the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 123 and 151	-/180/180
V83	Single uPVC Pipe or flexi conduit up to 32mm OD with a maximum wall thickness of 2.4mm containing up to 21 x CAT5e Data Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 20mm) filled the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 124 and 151	-/180/180
V84	Single uPVC Pipe or flexi conduit up to 32mm OD with a maximum wall thickness of 2.4mm containing up to 14 x CAT6 Data Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 20mm) filled the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2, 125 and 151	-/180/180
V85	Bundle of up to 7 x Heliax Foam Dielectric $\frac{1}{4}$ " up to 7/8" (Max' 28.2mm OD) Coaxiable Cables	TBA Firefly™ Penowrap® for a distance of 300mm. Fixed using 3 x stainless steel cable ties, 50mm from either end and 1 in the centre. Wrap to both sides of seal	TBA Firefly™ Intumastic HP in the annular gap (min 5mm max 25mm) filled the depth of the TBA Firefly™ Intubatt	(1a or 1b), 2 126 and 151	-/120/120
V86	ICS-Hexatronic Microduct 1 x 10/8 + 24 x 5/3.5 ID (Item 92) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD), TOL4019038/96AH (5.1 mm OD), TOL4019038/288AH (7.95 mm OD), TOL4019038/288C (7.95 mm OD), TOL4019017/96A (6.7 mm OD), TOL4079028/12 (5.7 mm OD), TOL4079029/24 (6.7 mm OD)	None	Maximum 71 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/240/240
V87	ICS-Hexatronic Microduct 1 x 12/10 ID Standard Grade (Item 93) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, TOL4079030/12 (8.3 mm OD), TOL4079031/24 (9 mm OD), TOL4079033/24 (9 mm OD), TOL4079034/24 (9 mm OD)	None	Maximum 54 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the	(1a or 1b), 2 and 151	-/240/240

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V88	ICS-Hexatronic Microduct 19 × 5/3.5 ID (Item 94) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	full depth of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/240/240
V89	ICS-Hexatronic Microduct 12 × 5/3.5 ID Hi-grade (Item 95) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 67 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/240/240
V90	ICS-Hexatronic Microduct 7 × 5/3.5 ID Hi grade (Item 96) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 57 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/240/240
V91	ICS-Hexatronic Microduct 4 × 5/3.5 ID Hi grade (Item 97) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 54 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/240/240
V92	ICS-Hexatronic Microduct 4 × 12/10 ID Hi Grade (Item 98) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3mm OD 12F Cables, TOL4079030/12 (8.3 mm OD), TOL4079031/24 (9 mm	None	Maximum 77 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm	(1a or 1b), 2 and 151	-/240/240

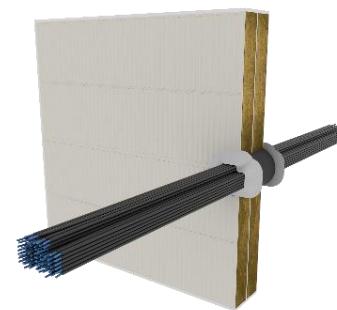
ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
	OD), TOL4079033/24 (9 mm OD), TOL4079034/24 (9 mm OD)		max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®		
V93	ICS-Hexatronic Microduct Bundle of up to 10: 1 × 5/3.5 ID (Item 99) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 60 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/240/240
V94	160 mm OD HDPE Pipe with a maximum wall thickness of 7mm.	None	Nominal 170 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF150 Fire Collar (Item 47) Secured using 6 × 90mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/120/120
V95	125 mm OD HDPE Pipe with a maximum wall thickness of 7 mm.	None	Nominal 135 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF150 Fire Collar (Item 47) Secured using 6 × 90mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/120/120

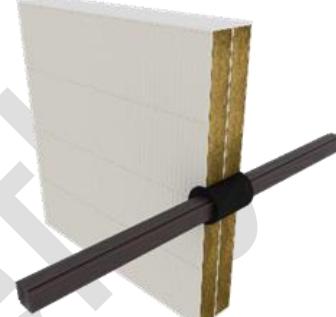
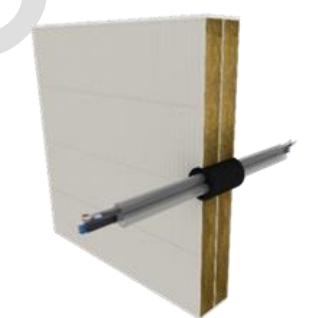
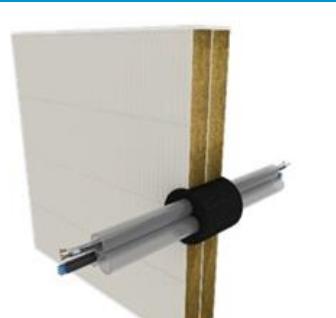
ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V96	110 mm OD HDPE Pipe with a maximum wall thickness of 7mm.	None	Nominal 120 mm Core Hole. Apply a nominal 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF100 Fire Collar (Item 47) Secured using 5 × 90 mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/120/120
V97	90 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 100 mm Core Hole. Apply a nominal 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF80 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2, and 151	-/120/120

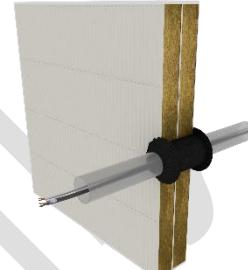
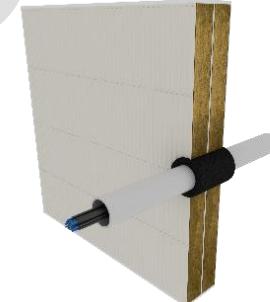
ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V98	75 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 85 mm Core Hole. Apply a nominal 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF80 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/120/120
V99	63 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 75mm Core Hole. Apply a nominal 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF65 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/120/120
V100	56 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 65 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF50 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/120/120

ID	Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
V101	50 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 60 mm Core Hole. Apply a nominal 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF50 Fire Collar (Item 47) Secured using 3 × 90mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/120/120
V102	40 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 50 mm Core Hole. Apply a nominal 6mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF40 Fire Collar (Item 47) Secured using 3 × 90mm long Pigtail Screws. Treat both sides of the TBA Firefly™ Intubatt®	(1a or 1b), 2 and 151	-/180/180

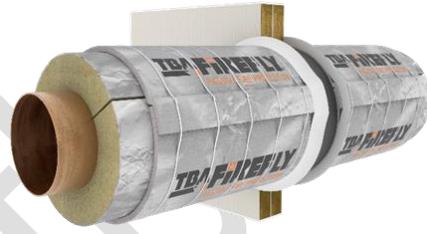
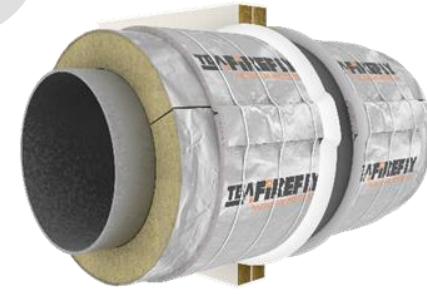
ID	Service	Protection	Local Protection	Refer figure	FRL
For ID's V110 to V132, refer also to Figure 1a or Figure 1b (Intubatt Configuration), Figure 2 (Spacing of Services & Distance from Primary Aperture) Figure 151 (Service Support)					
Note: Dimensions described in Protection and Local Protection columns are nominal only. Penowrap™ outer layer to overlap itself by 50 mm and sealed with TBA Foil Tape					

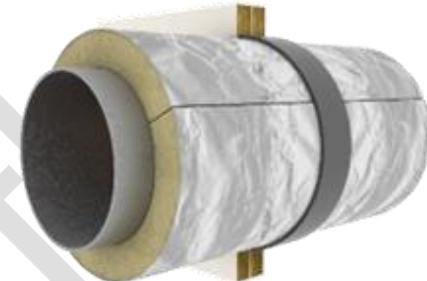
ID	Service	Protection	Local Protection	Refer figure	FRL
V110(a)	Up to 30 × Cat5 + 30 × Cat6 + 30 × RG6 + 30 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is installed in the annular gap (nom. 10 mm in an up to Ø110 mm core hole within the TBA Firefly™ Intubatt), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/120/120
V110(b)	Up to 30 × Cat5 + 30 × Cat6 + 30 × RG6 + 30 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is installed in the annular gap (nom. 10 mm in an up to Ø110 mm core hole within the TBA Firefly™ Intubatt, between the services and the TBA Firefly Intubatt, full depth, finished flush each side.  Apply a 25 × 25 mm fillet of Intumastic Sealant (Item 6) or Intumastic HP sealant (Item 74) between the Intubatt and the service on both sides of the wall .		-/180/180
V111	Up to: 110 × Fibre optic cables (max Ø 4.3 mm OD each) as a bundle in nom. 75mm Ø Hole within the TBA Firefly™ Intubatt	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.  Apply a 25 × 25 mm fillet of Intumastic Sealant (Item 6) or Intumastic HP sealant between the Intubatt and the service on both sides of the wall .		-/240/240

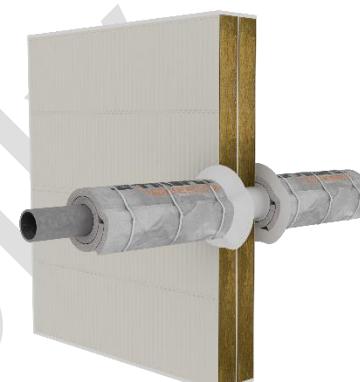
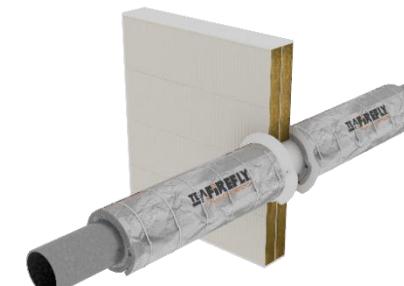
ID	Service	Protection	Local Protection	Refer figure	FRL
V112	Up to 56 × 4 mm & up to 38 × 6 mm Vesda microducts	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/180/180
V113	1,2 or 3 × Ø 20 mm OD clear round plastic military conduits with any of: (1) [empty], (2) 1 × Cat5, 1 × Cat6, 1 × RG6, (3) 7 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/180/180
V114	1,2 or 3 × Ø 32 mm OD clear round plastic military conduits with any of the following in each conduit: (1) [empty], (2) 1 × Cat5, 1 × Cat6, 1 × RG6, (3) 7 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/180/180

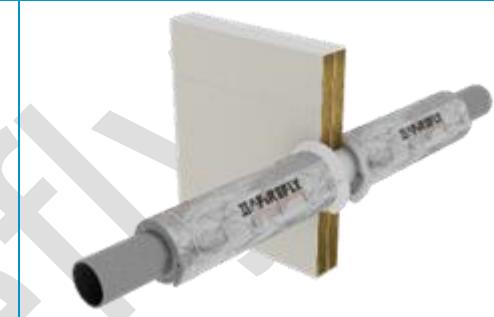
ID	Service	Protection	Local Protection	Refer figure	FRL
V115	1 × Ø 50 mm OD (maximum) clear round plastic military conduits with: (1) [empty] or (2) 1 × Cat5, 1 × Cat6, 1 × RG6 or (3) up to 7 × Optic fibre cables or (4) any combination of the above	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.  A 25 × 25 mm fillet of Intumastic Sealant (Item 6) is applied between the Intubatt and the service on both sides.		-/180/180
V116	Ø 50 mm OD (maximum) uPVC Conduit, Maximum wall thickness 3.0 mm , filled with 2F 9/125 Fibre Optic Cables (4.5 mm OD)	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/240/240
V117	Standard configuration Copper D1 cables, with or without cable tray.  Note : This service can be installed In wall constructions against Floors or ceilings ( see Table 20, Item 9 for 3 sided Penowrap™ installation and cable sizes/cable bundle dimensions)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) wrapped for a distance of 500 mm followed by a 2nd layer of 150 mm on both sides of the Intubatt. The wrap is fixed using stainless steel cable ties 50 mm from ends of the Penowrap™ and also at nom. 100 mm centres.  The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a using a 25 × 25 mm fillet of TBA Firefly™	TBA Firefly™ Intumastic (item 6) is applied to the cut edges of the Intubatt, full depth of the Intubatt . Intumastic HP (Item 74) is applied within the 5-10 mm annular gap, full depth of the Intubatt .		-/240/240

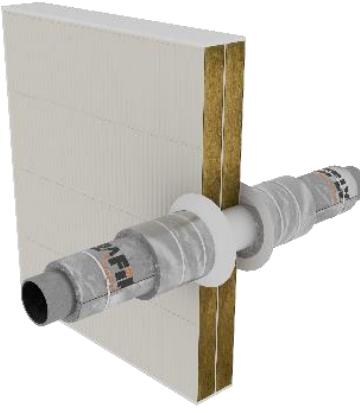
ID	Service	Protection	Local Protection	Refer figure	FRL
		Intumastic sealant (Item 6) or Intumastic HP sealant (Item 74)			
V118	Standard configuration Copper D2 cables, with or without cable tray.  Note : This service can be installed In wall constructions against Floors or ceilings ( see Table 20, Item 9 for 3 sided Penowrap™ installation and cable sizes/cable bundle dimensions)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (item 11) wrapped for a distance of 500 mm followed by a 2nd layer of 150 mm on both sides of the Intubatt . The wrap is fixed using stainless steel cable ties 50 mm from ends of the Penowrap™, and also at nom. 100 mm centres. The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a using a 25 x 25 mm fillet of TBA Firefly™ Intumastic sealant ( Item 6) or Intumastic HP sealant (Item 74)	TBA Firefly™ Intumastic (item 6) is applied to the cut edges of the Intubatt, full depth of the Intubatt . Intumastic HP (Item 74) is applied within the 5-10 mm annular gap , full depth of the Intubatt .		-/240/240
V119	150 mm OD Lorient or Kilargo damper LVH44C with DuraVent flexible ducting	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) is wrapped for a distance of 300 mm on the damper casing (both sides) and fixed using stainless steel cable ties 50 mm from either end and one in the middle.	TBA Firefly™ Intumastic sealant (Item 6) is applied to the full depth of the Intubatt. And finish flush on the surface on both sides of the Intubatt. Apply a 6 mm bead of TBA Firefly Intumastic (Item 6) on both sides between the Intubatt and the service.		-/180/180

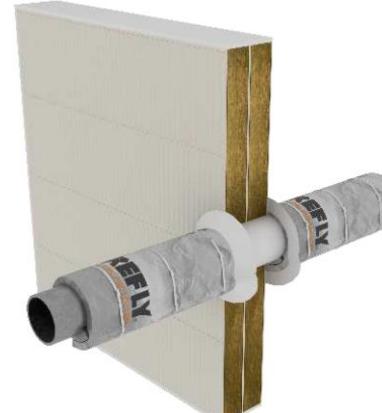
ID	Service	Protection	Local Protection	Refer figure	FRL
V120	Up to 200 mm copper pipe with minimum Wall Thickness 3 mm and 75 mm thick stone wool foil faced continuous lagging.	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) is wrapped for a distance of 500 mm on both sides of the wall & fixed using stainless steel cable ties nom.50 mm from either end & nom. 100 mm centres. Sealed to the face of the TBA Firefly™ Intubatt with a 25 × 25 mm fillet of TBA Firefly™ Intumastic sealant on both sides.	2 Layers of TBA Firefly™ Intustrap (40 mm wide × 2 mm) is wrapped around the service on both sides, flush with the Intubatt. A bead of fire TBA Firefly™ Intumastic (Item 6) is applied around the perimeter of the service, between the service and Intubatt – both sides.		-/180/180
V121(a)	Up to 350 mm Ø OD steel pipe with 75 mm rockwool lagging (continuous)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) wrapped for 300 mm each side & fixed using stainless steel cable ties nom.50 mm from either end & nom. 100 mm centres. The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a 25 × 25 mm fillet of TBA Firefly™ Intumastic sealant on both sides (Item 6)	TBA Firefly™ Intumastic sealant is applied to the full depth of the Intubatt. Double layer strips of 40 × 2 mm TBA Firefly™ Intustrap (item 64), are applied onto both sides of the service, flush with both sides of the Intubatt. TBA Firefly™ Intumastic HP (item 74) is applied to any gaps between the Intustrap and the Intubatt.		-/240/240
V121(b)	Up to 350 mm Ø OD steel pipe with 75 mm rockwool lagging (continuous)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) wrapped for 300 mm each side & fixed using stainless steel cable ties nom. 50 mm from either end & nom. 100 mm centres. The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a 6 mm bead of TBA Firefly™ Intumastic sealant (Item 6)	TBA Firefly™ Intumastic sealant is applied to the full depth of the Intubatt. Double layer strips of 40 × 2 mm TBA Firefly™ Intustrap (Item 64), are applied onto both sides of the service, flush with both sides of the Intubatt. TBA Firefly™ Intumastic HP (Item 74) is applied to any gaps between the Intustrap and the Intubatt.		-/180/180

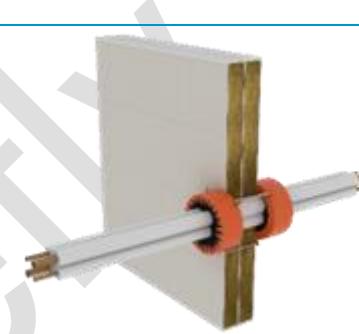
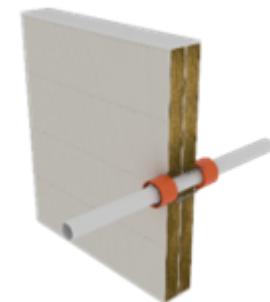
ID	Service	Protection	Local Protection	Refer figure	FRL
V1211	Up to 350 mm Ø OD steel pipe with 75 mm rockwool lagging (continuous)	None	TBA Firefly Intumastic brush Grade is applied to the Intubatt annular gap, full depth of the Intubatt. Double layer strips of 40 × 2 mm TBA Firefly Intustrap (item 64), (4 mm of intumescent) are applied onto both sides of the service, flush with both sides of the Intubatt. TBA Firefly Intumastic HP (item 74) is applied to any gaps between the Intustrap and the Intubatt.		-/120/120
V122	Blank for future use				
V123(a)	Up to Ø 50.8 mm OD Copper pipe, (min wall thickness 1.2 mm)	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (item 11) is wrapped around the service for a distance of 300 –m - both sides of the Intubatt. Fixed using stainless steel cable ties 50 mm from either end and 1 in the centre. Sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service Is installed into the Intubatt maintaining < 5 mm gap, and sealed with TBA Firefly™ Intumastic acrylic sealant (Item 6) , full depth of the Intubatt .		-/180/180
V123(b)	Up to Ø 50.8 mm OD Copper pipe, (min wall thickness 1.2 mm)	1 Layer of TBA Firefly™ 12 mm thick Penowrap® (Item 11) wrapped around the service for a distance of 300 mm followed b\y a 2nd layer of 150 mm both sides of the Intubatt. The wrap is fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap and sealed with TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt.		-/120/120

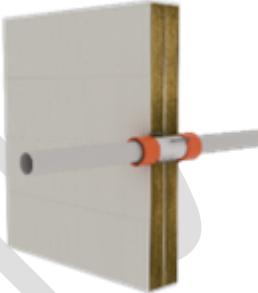
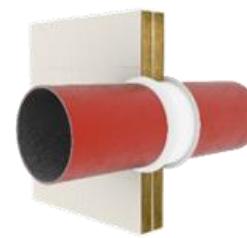
ID	Service	Protection	Local Protection	Refer figure	FRL
V124(a)	Up to Ø 48 mm OD steel pipe, (minimum wall thickness 3.4 mm)	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (Item 11) is wrapped around the service for a distance of 300 mm on both sides of the Intubatt, and fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and then sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt, sealing the service and Intubatt.		-/120/120
V124(b)	Up to 48 mm OD steel pipe, minimum wall thickness 3.4 mm	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (Item 11) is wrapped around the service for a distance of 300 mm on both sides of the Intubatt, and fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and then sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is Installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt , sealing the service and Intubatt.		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
V125(a)	Up to NB100 Steel pipe (114 mm Ø OD), minimum wall thickness 4.5 mm	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (Item 11) is wrapped around the service for a distance of 600 mm on both sides of the Intubatt, and fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and then sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt, sealing the service and Intubatt.		-/180/180
V125(b)	Up to NB100 Steel pipe (114 mm Ø OD), minimum wall thickness 4.5 mm	1 Layer of TBA Firefly™ 12 mm thick Penowrap® (item 11) wrapped for a distance of 600 mm, followed by a 2nd layer 300 mm both sides of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end, and 4 in the centre spaced nom 100 mm. Sealed to the face of the TBA FireflyTM Intubatt with TBA FireflyTM Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6) , full depth of the Intubatt , sealing the service and Intubatt.		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
V126(a)	Up to 76 mm OD steel pipe, minimum wall thickness 4.3 mm	Two layers of 12 mm thick TBA Firefly™ Penowrap® (Item 11) wrapped around the service for a distance of 300 mm – both sides of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end and 4 in the centre spaced nominal 100 mm sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using 25 mm × 25 mm fillet.	TBA Firefly Intumastic Acrylic Sealant (Item 6) is applied between the service and the Intubatt (maximum 5 mm annular gap), full depth of the Intubatt .		-/240/240
V126(b)	Up to 76 mm OD steel pipe, minimum wall thickness 4.3 mm	One layer of 12 mm thick TBA Firefly™ Penowrap® (item 11) wrapped around the service for a distance of 300 mm followed by a second layer of 150 mm on both sides of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end and 4 in the centre spaced nominal 100 mm sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using 25 mm × 25 mm fillet.	TBA Firefly Intumastic Acrylic Sealant ( Item 6) is applied between the service and the Intubatt (maximum 5 mm annular gap), full depth of the Intubatt .		-/180/180

ID	Service	Protection	Local Protection	Refer figure	FRL
V126(c)	Up to 76 mm OD steel pipe, minimum wall thickness 4.3 mm	One layer of 12 mm thick TBA Firefly™ Penowrap® (Item 11) wrapped around the service for a distance of 300 mm – both sides of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end and 4 in the centre spaced nominal 100 mm sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using 25 mm × 25 mm fillet.	TBA Firefly Intumastic Acrylic Sealant ( Item 6) is applied between the service and the Intubatt ( maximum 5 mm annular gap ) , full depth of the Intubatt .		-/120/120
V127	1 × (up to) 3/8" + 5/8" FR pair coil (15.8mm +9.6mm) copper pipes with maximum 19 mm nitrile insulation + 2 × 6 mm² 3C+E cables + 1 × Ø 18 mm Condensate hose	None	TBA Firefly™ Intumastic HP sealant - (Item 6) is installed in the annular gap (nom. 10 mm) between the services and the TBA Firefly Intubatt to the full depth of the Intubatt.		-/120/120
V128(a)	2 × each (up to) 3/8" & 5/8" pair coil (15.8mm +9.6mm) copper pipes with maximum 10 mm CLPE lagging	None	TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt. TBA Firefly™ FRF-100 Fire Collars (FRF 100 Item 47) is installed around the service on both sides of the Intubatt and secured in place using 90 mm pigtail screws (Item 8). TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
V128(b)	2 × each (up to) 3/8" & 5/8" pair coil (15.8mm +9.6mm) copper pipes with maximum 10 mm CLPE lagging	None	<p>service to the full depth of the fire collars.</p> <p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-100 Fire Collars (FRF 100 Item 47) is installed around the service on both sides of the Intubatt and secured in place using M5 threaded rod and nuts through the Intubatt, joining both collars.</p> <p>TBA Firefly Intumastic HP sealant (item 74) is then installed around service to the full depth of the fire collars.</p>		-/180/180
V129(a)	Nom. 40 mm (up to Ø42.9 OD mm) uPVC pipe, maximum wall thickness up to 2.2 mm	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-40 Fire Collars (FRF 40 Item 47) is installed around the service on both sides of the Intubatt and secured in place using 90 mm pigtail screws (Item 8).</p> <p>TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around service to the full depth of the fire collars.</p>		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
V130(a)	Nom. 40 mm (up to 48.3 mm Ø OD) uPVC Pressure Pipe PVC Class 12, wall thickness up to 2.7 mm	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-40 Fire Collars (FRF 40 Item 47) is installed around the service on both sides of the Intubatt and secured in place using 90 mm pigtail screws (Item 8).</p> <p>TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around service to the full depth of the fire collars.</p>		-/120/120
V131(a)	40 mm (40 mm Ø OD) acoustic plastic pipe, wall thickness up to 2.5 mm	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-40 Fire Collars (FRF 40 Item 47) is installed around the service on both sides of the Intubatt and secured in place using 90 mm pigtail screws (Item 8).</p> <p>TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around service to the full depth of the fire collars.</p>		-/180/180
V132	Ø 250 mm (nom.) steel sprinkler pipe, wall thickness, minimum 6 mm.	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>A 20 mm × 20 mm fillet of TBA Firefly™ Intumastic sealant (item 6) is applied to both sides of the Intubatt, between the service and the Intubatt.</p>		-/240/-

**Table 2 Fire resistance of VASS Busway Systems without Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to vertical substrates**

Busway Type	Additional Protection	FRL of Service
HFC800	HFA800	
HFC1000	HFA1000	
HFC1250	HFA1250	
HFC1600	HFA1600	
HFC2000	HFA2000	
HFC2300	HFA2300	
HFC2500	HFA2500	
HFC3150	HFA3150	
HFC3200	HFA3200	
HFC3600	HFA3600	
HFC3780	HFA3780	
HFC4000	HFA4000	
HFC5600	HFA6300	
HFC7000	HFA7000	

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 3 Fire resistance of VASS busway system with 1 layer of 12mm TBA Firefly™ Penowrap® or 25mm Firefly™ Insulated Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to vertical substrates**

Amperage	Outer Dimensions of the Busway (mm)	VASS Steel Encased Busway with Aluminium Conductors			
		Length of TBA Firefly™ Penowrap® to both sides of the TBA Firefly™ Intubatt® & FRL's achieved (mm)		See Fig. 143 (1a or 1b) See Fig. 144 (1a or 1b)	
		FRL -/90/90	FRL -/120/120	FRL -/180/180	FRL -/240/240
HFA800	150 x 145	300	300	350*	450*
HFA1000	150 x 165	300	300	350*	450*
HFA1250	150 x 190	300	300	350*	450*
HFA1600	150 x 245	300	300	400*	450*
HFA2000	150 x 337	300	300	400*	500*
HFA2300	150 x 407	300	300	400*	500*
HFA2500	150 x 407	300	300	400*	500*
HFA3150	150 x 589	300	300	450*	500*
HFA3200	150 x 589	300	300	450*	500*
HFA3600	150 x 589	300	300	450*	500*
HFA3780	150 x 589	300	300	450*	500*
HFA4000	150 x 771	300	300	450*	550*
HFA6300	150 x 851	300	300	500*	550*
HFA7000	150 x 931	300	300	500*	550*

\*Plus a 50mm fillet of TBA Firefly™ Intumastic around the base of the TBA Firefly™ Penowrap® both sides.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

#### VASS Steel Encased Busway with Copper Conductors

Amperage	Outer Dimensions of the Busway (mm)	Length of TBA Firefly™ Penowrap® to both sides of the TBA Firefly™ Intubatt® & FRL's achieved (mm) See Fig. 147 (1a or 1b)				See Fig. 148 (1a or 1b)
		FRL -/90/90	FRL -/120/120	FRL -/180/180	FRL -/240/240	
HFC800	150 x 120	300	300	350	450*	
HFC1000	150 x 128	300	300	350	450*	
HFC1250	150 x 145	300	300	400	450*	
HFC1600	150 x 190	300	300	400	500*	
HFC2000	150 x 245	300	300	450	500*	
HFC2300	150 x 265	300	300	500	550*	
HFC2500	150 x 265	300	300	500	550*	
HFC3150	150 x 367	300	350	500	550*	
HFC3200	150 x 360	300	350	500	550*	
HFC3600	150 x 360	300	350	500	550*	
HFC3780	150 x 360	300	350	500	550*	
HFC4000	150 x 447	300	450	500	600*	
HFC5600	150 x 589	450	600	650	750*	
HFC7000	150 x 709	550	700	750	900*	

\*Plus a 50mm fillet of TBA Firefly™ Intumastic around the base of the TBA Firefly™ Penowrap® both sides.

Note: Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 3a Fire resistance of ABB IP55 ALUMINIUM ENCASED SANDWICH BUSDUCT- ALUMINIUM AND COPPER conductor busduct systems with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to vertical substrates**

Busduct Type	ABB IP55 – ALUMINIUM ENCASED SAND-ICH BUSDUCT - ALUMINIUM CONDUCTORS			Figures: 91a, 91b (1a or 1b)	
	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/60	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/90	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120		
LV-S SB 060 A 03					
LV-S SB 060 A 04					
LV-S SB 060 A 06					
LV-S SB 080 A					
LV-S SB 100 A					
LV-S SB 120 A					
LV-S SB 160 A					
LV-S SB 200 A					
LV-S SB 240 A					
LV-S DB 160 A					
LV-S DB 200 A					
LV-S DB 240 A					

300mm                    300mm                    300mm

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

	<b>ABB IP55 – ALUMINIUM ENCASED SAND-ICH BUSDUCT - ALUMINIUM CONDUCTORS</b>	<b>Figures: 91a, 91b (1a or 1b)</b>	
	<b>ABB IP55 – ALUMINIUM ENCASED SAND-ICH BUSDUCT - COPPER CONDUCTORS</b>	<b>Figures: 92a, 92b (1a or 1b)</b>	
Busduct Type	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/60 (mm)	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/90 (mm)	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120 (mm)
LV-S SB 060 C 03	300	300	400
LV-S SB 060 C 04	300	300	400
LV-S SB 060 C 06	300	300	400
LV-S SB 080 C	300	300	400
LV-S SB 100 C	300	300	400
LV-S SB 120 C	300	300	400
LV-S SB 160 C	300	300	450
LV-S SB 200 C	300	300	450
LV-S SB 240 C	300	300	450
LV-S DB 160 C	300	300	500
LV-S DB 200 C	300	350	500
LV-S DB 240 C	300	350	500

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 3b Fire resistance of ABB CAST RESIN IP68 ALUMINIUM AND COPPER conductor busduct systems with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to vertical substrates**

<b>ABB CAS- RESIN IP68 - BU-DUCT SYSTEM - ALUMINIUM CONDUCTORS</b>					<b>Figures :93a, 93b (1a or 1b)</b>
<b>BUSDUCT TYPE SC-R</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/60 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/90 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/120 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/180 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/240 (mm)</b>
SB 060 A 03	300	300	300	300	300
SB 060 A 04	300	300	300	300	300
SB 060 A 06	300	300	300	300	300
SB 080 A	300	300	300	300	300
SB 100 A	300	300	300	300	300
SB 120 A	300	300	300	300	300
DB 080 A	300	300	300	300	300
DB 100 A	300	300	300	300	300
DB 120 A	300	300	300	300	300
QB 080 A	300	300	300	300	300
QB 100 A	300	300	300	300	300
QB 120 A	300	300	300	300	300

<b>ABB CAS- RESIN IP68 - BU-DUCT SYSTEM - COPPER CONDUCTORS</b>					<b>Figures :94a , 94b (1a or 1b)</b>
<b>BUSDUCT TYPE SC-R</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/60 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/90 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/120 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/180 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/240 (mm)</b>
SB 060 K 03	300	300	300	*300	*400
SB 060 K 04	300	300	300	*300	*400
SB 060 K 06	300	300	300	*300	*400
SB 080 K	300	300	300	*300	*400
SB 100 K	300	300	300	*300	*400
SB 120 K	300	300	300	*300	*400
DB 080 K	300	300	300	*300	*400
DB 100 K	300	300	300	*300	*400
DB 120 K	300	300	300	*300	*400
QB 080 K	300	300	300	*300	*400
QB 100 K	300	300	300	*300	*450
QB 120 K	300	300	300	*300	*500

\* Extra 75mm wide Intubatt TBA Firefly™ Intubatt strips are proposed to be glued using Intumastic sealant and fixed with 75mm pigtail screws to one side of the TBA Firefly™ Intubatt barrier in the vicinity of the penetration.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 3c Fire resistance of EAE IP55 ALUMINIUM ENCASED SANDWICH BUSDUCT-ALUMINIUM AND COPPER conductor busduct systems with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to vertical substrates**

See figures 101a and 101b (1a or 1b)			See figures 102a and 102b (1a or 1b)		
EAE IP55 – ALUMINIUM ENCASED SAND-ICH BUSDUCT - ALUMINIUM CONDUCTORS	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120 (mm)	EAE IP55 – ALUMINIUM ENCASED SAND-ICH BUSDUCT - COPPER CONDUCTORS	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120 (mm)		
KX-A-04	-	300	KX-C-05	-	300
KX-A-05	-	300	KX-C-06	KX-II -C-06	300
KX-A-06	KX-II -A-06	300	KX-C-08	KX-II -C-08	300
KX-A-08	KX-II -A-08	300	KX-C-10	KX-II -C-10	300
KX-A-10	KX-II -A-10	300	KX-C-12	KX-II -C-12	300
KX-A-12	KX-II -A-12	320	KX-C-14	KX-II -C-14	300
KX-A-14	-	320	KX-C-17	KX-II -C-16	300
KX-A-17	KX-II -A-17	330	KX-C-23	KX-II -C-20	300
KX-A-20	KX-II -A-20	340	-	KX-II -C-21	300
KX-A-27	KX-II -A-27	360	KX-C-25	KX-II -C-24	300
-	KX-II -A-21	360	KX-C-22	KX-II -C-25	300
KX-A-25	KX-II -A-25	350	KX-C-27	KX-II -C-28	300
KX-A-32	KX-II -A-32	380	-	KX-II -C-30	320
KX-A-33	KX-II -A-33	390	KX-C-32	KX-II -C-32	320
KX-A-40	KX-II -A-40	420	KX-C-36	KX-II -C-36	340
KX-A-51	KX-II -A-51	480	KX-C-40	KX-II -C-40	360
-	KX-II -A-63	600	KX-C-50	KX-II -C-50	440
			KX-C-63	KX-II -C-63	600

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 3d Fire resistance of EAE IP55 ALUMINIUM ENCASED SANDWICH BUSDUCT-ALUMINIUM AND COPPER conductor busduct systems with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to vertical substrates**

Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides)					
See figures 105a and 105b (1a or 1b)			See figures 106a and 106b (1a or 1b)		
EAE IP55 – ALUMINIUM ENCASED SAND-ICH BUSDUCT - ALUMINIUM CONDUCTORS	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/240 (mm)	EAE IP55 – ALUMINIUM ENCASED SAND-ICH BUSDUCT - COPPER CONDUCTORS	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/240 (mm)		
KX-A-04	KX-II -A-06	300	KX-C-05	KX-II -C-06	*300
KX-A-05	KX-II -A-08	300	KX-C-06	KX-II -C-08	*300

<b>Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides)</b>					
KX-A-06	KX-II -A-10	300	KX-C-08	KX-II -C-10	*300
KX-A-08	KX-II -A-12	300	KX-C-10	KX-II -C-12	*300
KX-A-10	KX-II -A-17	300	KX-C-12	KX-II -C-14	*300
KX-A-12	KX-II -A-20	300	KX-C-14	KX-II -C-16	*300
-	KX-II -A-27	300	KX-C-17	KX-II -C-20	*300
KX-A-14	KX-II -A-21	300	-	KX-II -C-21	*300
KX-A-17	KX-II -A-25	300	-	KX-II -C-25	*300
KX-A-20	KX-II -A-32	300	KX-C-23	KX-II -C-24	*300
KX-A-27	KX-II -A-33	300	KX-C-25	-	*300
KX-A-25	KX-II -A-40	300	KX-C-22	-	*300
KX-A-32	KX-II -A-51	300	KX-C-27	KX-II -C-28	*300
KX-A-33	KX-II -A-63	300	-	KX-II -C-30	*300
KX-A-40	-	300	KX-C-32	KX-II -C-32	*300
KX-A-51	-	300	KX-C-36	KX-II -C-36	*300
			KX-C-40	KX-II -C-40	*300
			KX-C-50	KX-II -C-50	*300
			KX-C-63	KX-II -C-63	*300

\*Additional 25mm sealant fillet (TBA Intumastic) to be applied at the interface between TBA Firefly™ Intubatt and Penowrap®

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 3e Fire resistance of IPD Powerduct Aluminium Encased Busway with Aluminium or Copper Conductor Busway Systems protected with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of TBA Firefly™ Intubatt fitted to vertical substrates**

Amperage	Outer dimensions of the busway	I'D 'Powerduct' Aluminium Encased Busway with Aluminium Conductors			
		Length of TBA Firefly™ Penowrap® to each side of the TBA Firefly™ Intubatt (mm) & FRL's achieved			
		See Figure 135	See Figure 136		
		FRL -/90/90	FRL -/120/120	FRL -/180/180	FRL -/240/240
PDA400	115 mm x 109 mm	300	300	300*	350*
PDA600	115 mm x 109 mm	300	300	300*	350*
PDA800	115 mm x 124 mm	300	300	300*	350*
PDA1000	115 mm x 139 mm	300	300	300*	350*
PDA1200	115 mm x 169 mm	300	300	350*	400*
PDA1350	115 mm x 194 mm	300	300	350*	400*
PDA1600	115 mm x 214 mm	300	300	350*	400*
PDA2000	115 mm x 269 mm	300	300	350*	450*
PDA2500	115 mm x 325 mm	300	300	400*	500*
PDA3200	115 mm x 405 mm	300	350	400*	500*
PDA4000	115 mm x 475 mm	300	350	400*	500*

**I'D 'Powerduct' Aluminium Encased Busway with Aluminium Conductors**

PDA5000	115 mm × 681 mm	300	400	450*	550*
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\*Additional 50mm fillet of TBA Firefly™ Intumastic around the base of the TBA Firefly™ Penowrap® is required.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**I'D 'Powerduct' Aluminium Encased Busway with Copper Conductors**

Amperage	Outer dimensions of the busway	Length of TBA Firefly™ Penowrap® to each side of the TBA Firefly™ Intubatt (mm) & FRL's achieved
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See Figure 137

See Figure 138

FRL -/90/90	FRL -/120/120	FRL -/180/180	FRL -/240/240
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PDC400	115 mm × 89 mm	300	300	300*	350*
PDC600	115 mm × 99 mm	300	300	350*	400*
PDC800	115 mm × 114 mm	300	300	350*	400*
PDC1000	115 mm × 129 mm	300	300	350*	400*
PDC1200	115 mm × 144 mm	300	300	400*	450*
PDC1350	115 mm × 159 mm	300	300	400*	450*
PDC1600	115 mm × 179 mm	300	300	400*	450*
PDC2000	115 mm × 219 mm	300	300	400*	450*
PDC2500	115 mm × 254 mm	300	350	400*	500*
PDC3200	115 mm × 295 mm	300	350	450*	550*
PDC4000	115 mm × 375 mm	300	400	500*	600*
PDC5000	115 mm × 475 mm	300	450	550*	650*
PDC6300	115 mm × 681 mm	300	500	650*	750*

\* Additional 50mm fillet of TBA Firefly™ Intumastic around the base of the TBA Firefly™ Penowrap® is required.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 4 Fire resistance of various services in 1 layer of 50mm thick YBA Firefly™ Intubatt fitted to vertical substrates**

Service	Service Wrap	Local Protection	Refer Figure	FRL of Service
200mm wide x 114mm high (uncompressed) x100mm deep Intuspan	None	None	31 & 32	-/120/120

**Table 5 Fire Resistance of various services in plasterboard walls**

Penetrating element	Structural Support	Protection	Local Protection	Refer Figure	FRL of Service
Z-Purlin or I-Beam support inside wall cavity	The penetrating element shall be vertically supported within the wall by a column or beam arrangement	25mm TBA Firefly™ Insulated Penowrap®, 500mm long each side of the wall	TBA Firefly™ Intumastic	33	-/120/120
Z-Purlin or I-Beam support outside wall cavity	The penetrating element shall be vertically supported by a column or beam arrangement adjacent to the wall on each side. It is not required these elements be protected from fire.	25mm TBA Firefly™ Insulated Penowrap®, 500mm long each side of the wall	TBA Firefly™ Intumastic	34	-/120/120

**Table 6 Fire resistance of various services in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to horizontal substrates**

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
H1	Standard config. of D1 PVC insulated Power Cables with or without Cable tray  <b>Note:</b> This service may be installed close to edge of the aperture provided that TBA Firefly™ Penowrap® is installed for 600 mm on the topside only and a 50 mm fillet of TBA Firefly™ Intumastic is provided at the base of the service on the topside.	1 layer of 12 mm TBA Firefly™ Penowrap® or 25 mm TBA Firefly™ Insulated Penowrap® for 300 mm each side butted up to the face of the TBA Firefly™ Intubatt or 600 mm on topside only with or without packing to the annular gap between the TBA Firefly™ Penowrap® and the service	TBA Firefly™ Intumastic	(13a or 13b) 35, 38, 39, 40, 41, 42, 43, 44, 45, 46, 59 and 151	-/120/120
H2	Standard config. of D2 PVC insulated Communication Cables with or without tray  <b>Note:</b> This service may be installed close to edge of the aperture provided that a 50 mm fillet of TBA Firefly™ Intumastic is provided at the base of the service on the topside.				

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
H3	Standard config. PVC insulated D1 Power Cables with or without cable tray  (See Table 20 Item 9)	25 mm TBA Firefly™ Insulated Penowrap® of 500 mm each side of the barrier or 1000 mm on topside of the barrier	TBA Firefly™ Intumastic	(13a or 13b) 35, 38, 39, 40, 41, 42, 59 and 151	- /180/180
H4	Standard config. PVC insulated D2 Communication Cables with or without cable tray  (See Table 20 Item 9)				
H5	Standard config. PVC insulated D1 Power Cables with or without cable tray – close to edge  (See Table 20 Item 9)	1 layer of 12 mm TBA Firefly™ Penowrap® or 25 mm TBA Firefly™ Insulated Penowrap® for 300 mm each side butted up to the face of the TBA Firefly™ Intubatt or 600 mm on topside only with or without packing to the annular gap between the TBA Firefly™ Penowrap® and the service	TBA Firefly™ Intumastic	(13a or 13b) 35, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 59 and 151	-120/120
H6	Standard config. PVC insulated D2 Communication Cables with or without cable tray – close to edge  (See Table 20 Item 9)				
H7	Standard config. PVC insulated D1 Power Cables with or without cable tray – close to edge  (See Table 20 Item 9)	25 mm TBA Firefly™ Insulated Penowrap® of 500 mm each side of the TBA Firefly™ Intubatt or 1000 mm on topside of the barrier	TBA Firefly™ Intumastic	(13a or 13b) 35, 47, 48, 52, 53, 59 and 151	- /180/180
H8	Standard config. PVC insulated D2 Communication Cables with or without cable tray – close to edge  (See Table 20 Item 9)				
H9	Bundle of up to 4 × 28 mm Coaxial cables	1 layer of 12 mm TBA Firefly™ Penowrap® or 25 mm TBA Firefly™ Insulated Penowrap® for 300 mm each side butted up to the face of the TBA Firefly™ Intubatt or 600 mm on topside only with or without packing to the annular gap between the TBA Firefly™ Penowrap® and the service	TBA Firefly™ Intumastic	(13a or 13b) 35, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57 59 and 151	- /120/120
H10	Bundle of up to 4 × 28 mm Coaxial cables	25 mm TBA Firefly™ Insulated Penowrap® of 500 mm each side of the TBA Firefly™ Intubatt or 1000 mm on topside of the barrier	TBA Firefly™ Intumastic	(13a or 13b) 35, 38, 39, 40, 41, 42, 47, 48, 52, 53 , 59 and 151	- /180/180
H11	Standard config. copper D1 cables with or without cable tray  (See Table 20 Item 9)	1 layer of 12 mm TBA Firefly™ Penowrap® for 300 mm on the top unexposed side only with TBA Firefly™ Intumastic HP applied to full depth of the aperture (nominally 10 mm	TBA Firefly™ Intumastic HP	(13a or 13b), 59 and 151	- /120/120

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
	<p><b>Note:</b> This service may be installed close to edge of the aperture provided the length of the TBA Firefly™ Penowrap® is increased to 600 mm on the unexposed side of the Intubatt.</p>	annular gap between Intubatt and cables) and an additional 50 mm fillet of TBA Firefly™ Intumastic acrylic sealant applied at the services on the top unexposed side of the Intubatt.			
H12	<p>Aluminium cables only or a combination of aluminium and copper cables - with or without cable tray with an equivalent config. resembling standard D1 configuration cable (See Table 20 Item 20)</p> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• Any ratio of copper and aluminium cable is acceptable.</li> <li>• This service may be installed close to edge of the aperture provided that the length of the TBA Firefly™ Penowrap® is increased to 600 mm on the unexposed side of the Intubatt.</li> </ul>	1 layer of 12 mm TBA Firefly™ Penowrap® for 300 mm on the top unexposed side only with TBA Firefly™ Intumastic HP applied to full depth of the aperture (nominally 10 mm annular gap between Intubatt and cables) and an additional 50 mm fillet of TBA Firefly™ Intumastic acrylic sealant applied at the services on the top unexposed side of the Intubatt.	TBA Firefly™ Intumastic HP	(13a or 13b), 59 and 151	- /120/120
H13	2-off Ø23 mm cable type G (from standard cable configuration in BSEN 1366-3: 2009) and a three core 'twin and earth' cable, combined diameter nominally 8.5 mm.	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to the full depth of the TBA Firefly™ Intubatt Seal	13a or 13b, 59 and 151	- /120/120
H13a	2-off Ø23 mm cable type G (from standard cable configuration in BSEN 1366-3: 2009) and a three core 'twin and earth' cable, combined diameter nominally 8.5 mm. The cables are fitted through a Ø50 × 2 mm PVC pipe section, flush to both faces of the TBA Firefly™ Intubatt Seal.	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to the full depth of the TBA Firefly™ Intubatt Seal	13a or 13b, 59 and 151	- /120/120
H14	6-off three core 'twin and earth' cables, each with a combined diameter nominally 8.5 mm. The cables are fitted through a Ø50 × 2 mm PVC pipe section, flush to both faces of the TBA Firefly™ Intubatt Seal.	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to the full depth of the TBA Firefly™ Intubatt Seal	(13a or 13b) 63, 59 and 151	- /120/120
H14a	6-off three core 'twin and earth' cables, each with a combined diameter nominally 8.5 mm.	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to the full depth of the TBA Firefly™ Intubatt Seal	(13a or 13b) 63, 59 and 151	- /120/120

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
H15	Brass Pipes Ø32-65 mm x 0.91 mm (min) Ø80-100 mm x 1.22 mm (min)	None	mm) to the full depth of the TBA Firefly™ Intubatt Seal	(13a or 13b) 59, 60a, and 151	-/180/- - /180/120
		Single pipe protected with 1 layer of TBA Firefly™ 12 mm Penowrap® for 600 mm each side fixed to pipe with 4 stainless steel cable ties	TBA Firefly™ Intumastic		
H16	Copper and Ferrous (Steel and Iron) Pipes Ø8-32 mm x 0.91 mm (min) Ø32-65 mm x 0.91 mm (min) Ø65-100 mm x 1.22 mm (min) Ø125x 1.42 mm (min) Ø150x 1.63 mm (min) Ø210 mm x 1.85 mm (min)	None	TBA Firefly™ Intumastic	(13a or 13b) 59, 60a, and 151	-/180/- - /180/120
		Single pipe protected with TBA Firefly™ 12 mm Penowrap® for 600 mm each side fixed with 4 stainless steel cable ties.	TBA Firefly™ Intumastic		
		Single pipe protected with TBA Firefly™ 12 mm Penowrap® for 1200 mm on topside only fixed with 8 stainless steel cable ties.	TBA Firefly™ Intumastic	(13a or 13b) 60b, 59 and 151	- /180/120
H17	Foil Coated rockwool Lagged Copper and Steel Pipes 8 mm up to 200 mm OD. The rockwool wall thickness minimum 38 mm up to maximum 75 mm. Maximum Core hole size 324 mm	None	Service wrapped with 3 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.	(13a or 13b) 24, 59 and 151	- /120/120
H18	H18A: Foil Coated PIR Foam Lagged Copper and Steel Pipes 8 mm up to 32 mm OD. The PIR Insulation wall thickness minimum 19 mm up to maximum 50 mm. Maximum Core hole size 148 mm	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt. With a 50 mm fillet of TBA Firefly™ Intumastic to Topside only.	(13a or 13b) 59, 61, and 151	-/120/120 - /120/120
	H18B: Nitrile Rubber Lagged Copper and Steel Pipes 8 mm up to 32 mm OD. The Nitrile Rubber Insulation wall thickness minimum 19 mm up to maximum 38 mm. Maximum Core hole size 124 mm	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.		
	H18C: Foil Coated Glasswool Lagged Copper and Steel Pipes 8 mm up to 32 mm OD. The glasswool wall	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.		-/90/90

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
	thickness minimum 19 mm up to maximum 50 mm. Maximum Core hole size 148 mm				
	H18D:  Foil Coated rockwool Lagged Copper and Steel Pipes 8 mm up to 32 mm OD. The rockwool wall thickness minimum 20 mm up to maximum 50 mm. Maximum Core hole size 148 mm	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt. With a 50 mm fillet of TBA Firefly™ Intumastic to 1 side only.		- /120/120
H19	12 mm Threaded Rod	None	TBA Firefly™ Intumastic	(13a or 13b) 68, 59 and 151	-/120/-
H20	Left blank for future use.				
H21	40 mm OD uPVC Pipe with a max' wall thickness of 1.8 mm	None	TBA Firefly™ FRF Collar 40-100 Single Fit & TBA Firefly™ Intumastic	(13a or 13b) (19 or 110), 64, 65, 59 and 151	- /120/120
H22	50 mm OD uPVC Pipe with a max' wall thickness of 2.2 mm				
H23	70 mm OD uPVC Pipe with a max' wall thickness of 2.9 mm				
H24	90 mm OD uPVC Pipe with a max' wall thickness of 3.6 mm				
H25	100 mm OD uPVC Pipe with a max' wall thickness of 3.6 mm				
H26	150 mm OD uPVC Pipe with a max' wall thickness of 5 mm	None	TBA Firefly™ FRF 150 Collar & TBA Firefly™ Intumastic	(13a or 13b) (19 or 110), 64, 65, 59 and 151	- /120/120
H27	Up to Ø40 mm × 3.2 mm HDPE Pipe	None	Service wrapped with 2 x layers of TBA Firefly™ Intustrap where it passes through each layer of TBA Firefly™ Intubatt.	(13a or 13b) 59, 60a, and 51	- /180/180
H28	Ø160 mm ×6.2 mm HDPE Pipe	None	TBA Firefly™ FRF 150 Fire Collar & TBA Firefly™ Intumastic	(13a or 13b) (19 or 110), 64, 65, 59 and 151	- /120/120

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
H29	Ø56 mm × 3.3 mm HDPE Pipe	None	TBA Firefly™ FRF 32-50 Multi-fit Collar & TBA Firefly™ Intumastic	(13a or 13b) (19 or 110), 64, 65, 59 and 151	- /120/120
H30	Bundle of up to 12 x TPS Electrical Cables or 1.5 mm <sup>2</sup> Red Fire Alarm Cables. (May be mixed)	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt.	(13a or 13b) 6, 7, 9, 36, 37, 59 and 151	- /180/120
H31	Polyolefin (PE) Lagged Copper Pipe 8 mm to 25 mm OD. PE Insulation to have a minimum wall thickness of 19 mm to a maximum of 25 mm thick	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt	(13a or 13b) 29, 59 and 151	-/120/60
H32	CPVC Fire Sprinkler Pipe up to 33.4 mm OD with a maximum wall thickness of 4.1 mm. Pipe to be wrapped locally with grease proof paper prior to installation of the Intustrap	None	TBA Firefly™ Intustrap.	(13a or 13b) 81, 59 and 151	- /180/180
H33	CPVC Fire Sprinkler Pipe up to 48 mm OD with a maximum wall thickness of 4.1 mm. Pipe to be wrapped locally with grease proof paper prior to installation of the Intustrap	None	TBA Firefly™ Intustrap.	(13a or 13b) 81, 59 and 151	- /180/180
H34	CPVC Fire Sprinkler Pipe up to 33.4 mm OD with a maximum wall thickness of 4.1 mm. Pipe to be wrapped locally with grease proof paper prior to installation of the sealant	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt.	(13a or 13b) 82, 59 and 151	- /180/180
H35	CPVC Fire Sprinkler Pipe up to 48 mm OD with a maximum wall thickness of 4.1 mm. Pipe to be wrapped locally with grease proof paper prior to installation of the sealant	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt.	(13a or 13b) 82, 59 and 151	- /120/120
H36	Up to 16 mm OD PEX-AL Gas Pipe with a max' Wall thickness of 4.1 mm	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt.	(13a or 13b) 82, 59 and 151	- /180/180
H38	Up to 16 mm OD PEX Pipe with a max' Wall thickness of 4.1 mm	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30	(13a or 13b) 82, 59 and 151	- /180/180

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
			mm) to full depth of TBA Firefly™ Intubatt.		
H39	Aircon Pair Coil Bundle of 1 x 9.4 mm Copper pipe lagged in 10 mm thick nitrile rubber + 1 x 6.45 Copper pipe lagged in 12.1 mm nitrile rubber with or without 18 mm PE drain hose + 2 x TPS Power cables.	None	Bundle sealed with TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt	(13a or 13b) 83, 59 and 151	-/180/90
H40	Aircon Pair Coil Bundle of 1 x 9.4 mm Copper pipe lagged in 10 mm thick nitrile rubber + 1x6.45 Copper pipe lagged in 12.1 mm nitrile rubber with or without 18 mm PE drain hose + 2 xTPS Power cables.	None	Bundle sealed with TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt plus 50 mm fillet each side	(13a or 13b) 84, 59 and 151	- /180/120
H41	uPVC Pipe or Flexi Conduit up to 33.7 mm OD with a max' wall thickness of 1.7 mm and within the conduit or pipe up to 8 x 2.5 mm <sup>2</sup> (max' core size) 2C+E TPS Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to depth of 32 mm on both sides	(13a or 13b) 85, 59 and 151	- /120/120
H42	Up to 9 x 13 mm copper pipes with 9 mm Nitrile Rubber lagging + 20 x TPS cables + with or without 16 mm Flexidrain pipe with or without cable tray	TBA Firefly™ 12 mm Penowrap® 300 mm each side or 600 mm top side only	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 40 mm) to full depth of TBA Firefly™ Intubatt	(13a or 13b) 86, 59 and 151	- /120/120
H43	150 UB up to 200 UB Steel Beam	TBA Firefly™ 12 mm Penowrap® 300 mm each side or 600 mm top side only	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(13a or 13b) 77, 87, 59 and 151	- /180/180
H44	Minimum 200 mm x 45 mm MPG10 Timber Joist	TBA Firefly™ 12 mm Penowrap® 300 mm each side or 600 mm top side only	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(13a or 13b) 77, 87, 59 and 151	- /120/120
H45	Steel C Purlin or Steel Z Purlin	TBA Firefly™ 12 mm Penowrap® 300 mm each side or 600 mm top side only	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(13a or 13b) 77, 87, 59 and 151	- /180/180
H46	Steel Pipes up to Ø40 mm OD (Min' wall thickness 0.91 mm) or up to 12 mm OD threaded rod	1 layer of TBA Firefly™ 12 mm Penowrap® 300 mm each side 3x stainless steel cable ties or 600 mm top side only with 6x stainless steel cable ties	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(13a or 13b) 88, 59 and 151	- /120/120
H47	Steel pipe 41 mm OD up to 300 mm OD (Min' wall thickness: 41 mm OD to 65 mm OD 0.91 mm, 66 mm OD to 100 mm OD 1.22 mm, 101 mm OD to	1 layer of TBA Firefly™ 12 mm Penowrap® 300 mm each side 3x stainless steel cable ties or 600 mm top side only with 7x stainless steel cable ties	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(13a or 13b) 89, 59 and 151	-/90/90

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
	125 mm OD 1.42 mm, 126 mm OD to 300 mm OD 1.63 mm)				
H48	Steel pipe 41 mm OD up to 300 mm OD (Min' wall thickness: 41 mm OD to 65 mm OD 0.91 mm, 66 mm OD to 100 mm OD 1.22 mm, 101 mm OD to 125 mm OD 1.42 mm, 126 mm OD to 300 mm OD 1.63 mm)	1 layer of TBA Firefly™ 12 mm Penowrap® 500 mm each side 5x stainless steel cable ties or 1000 mm top side only with 10x stainless steel cable ties	TBA Firefly™ Intumastic to full depth of TBA Firefly™ Intubatt	(13a or 13b) 90, 59 and 151	- /120/120
H49	Up to Ø43 mm OD PEX AL Pipe (Max' wall thickness 6 mm)	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt	(13a or 13b) 82, 59 and 151	- /120/120
H50	Up to Ø43 mm OD PEX Pipe (Max' wall thickness 6 mm)	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt	(13a or 13b) 82, 59 and 151	- /120/120
H51	Bundle of up to 3 uPVC Pipes or Flexi conduits up to 27 mm OD with a max' wall thickness of 2.4 mm within a single up to 70 mm core hole in 2 layers of TBA Firefly™ Intubatt, each conduit filled with up to 10 x Cat 6 Cables, 14 x Cat 5e cables and 7 x RG6 Coaxial Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt	(13a or 13b) 100, 59 and 151	- /240/120
H52	8 mm up to 48.6 mm OD steel pipe (Min' wall thickness 0.91 mm)	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 300 mm fixed using stainless steel cable ties 50 mm from either end and 1 in the centre. Glued to the face of the Intubatt with TBA Firefly™ Intumastic sealant with a 10 mm fillet of TBA Firefly™ Intumastic around the base of the wrap. Wrap to Topside Only	TBA Firefly™ Intumastic to the full depth of the TBA Firefly™ Intubatt	(13a or 13b), 115, 59 and 151	-/90/90
H53	8 mm up to 48.6 mm OD steel pipe (Min' wall thickness 0.91 mm)	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 300 mm fixed using stainless steel cable ties 50 mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to Topside Only	TBA Firefly™ Intumastic to the full depth of the TBA Firefly™ Intubatt	(13a or 13b), 116, 59 and 151	-/60/60

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
H54	48.7 mm up to 115 mm OD steel pipe (Min' wall thickness 41 mm OD to 65 mm OD 0.91 mm, 66 mm OD to 100 mm OD 1.22 mm, 101 mm OD to 115 mm OD 1.42 mm)	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 500 mm fixed using stainless steel cable ties 50 mm from either end and then at 100 mm centres. A second layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 150 mm from the face of the TBA Firefly™ Intubatt fixed using 2 x stainless steel cable ties. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to Topside Only	TBA Firefly™ Intumastic to the full depth of the TBA Firefly™ Intubatt	(13a or 13b) 117, 59 and 151	-/90/90
H55	48.7 mm up to 115 mm OD steel pipe (Min' wall thickness 41 mm OD to 65 mm OD 0.91 mm, 66 mm OD to 100 mm OD 1.22 mm, 101 mm OD to 115 mm OD 1.42 mm)	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 500 mm fixed using stainless steel cable ties 50 mm from either end and then at 100 mm centres. A second layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 100 mm from the face of the TBA Firefly™ Intubatt fixed using 2 x stainless steel cable ties. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to Topside Only	TBA Firefly™ Intumastic to the full depth of the TBA Firefly™ Intubatt	(13a or 13b) 118, 59 and 151	-/60/60
H56	<b>Bundle of up to 6 x Nitrile Rubber Lagged Copper Pipes consisting of:</b> 2 x 35 mm OD copper pipes lagged in 25 mm thick nitrile rubber insulation and 2 x 29 mm OD copper pipes lagged in 19 mm thick nitrile rubber insulation and 2 x 19 mm OD copper pipes lagged in 19 mm thick nitrile rubber insulation. Spacing between the lagged pipes in the bundle between 0 mm to 39 mm	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 300 mm fixed using stainless steel cable ties 50 mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. With an additional 25 mm fillet of TBA Firefly™ Intumastic where the Penowrap® joins the batt. Wrap to Topside Only.	TBA Firefly™ Intumastic HP in the annular gap between the nitrile rubber and the TBA Firefly™ Intubatt (min 10 mm max 40 mm) Filled to the full depth of the TBA Firefly™ Intubatt	(13a or 13b), 119, 59 and 151	-/120/120
H57	<b>Bundle of up to 6 x Nitrile Rubber Lagged Copper Pipes consisting of:</b> 2 x 35 mm OD copper pipes lagged in 25 mm thick nitrile rubber insulation and 2 x 29 mm OD copper pipes lagged	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 300 mm fixed using stainless steel cable ties 50 mm from either end and 1 in the centre.	TBA Firefly™ Intumastic HP in the annular gap between the nitrile rubber and the TBA Firefly™ Intubatt (min 10 mm max 40 mm)	(13a or 13b), 120, 59 and 151	-/90/90

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
	in 19 mm thick nitrile rubber insulation and 2 x 19 mm OD copper pipes lagged in 19 mm thick nitrile rubber insulation. Spacing between the lagged pipes in the bundle between 0 mm to 39 mm	Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to Topside Only.	Filled to the full depth of the TBA Firefly™ Intubatt		
H58	<b>Bundle of up to 6 x Nitrile Rubber Lagged Copper Pipes consisting of:</b> 2 x 29 mm OD copper pipes lagged in 19 mm thick nitrile rubber insulation and 1 x 29 mm OD copper pipe lagged in 25 mm thick nitrile rubber insulation and 1 x 22 mm OD copper pipe lagged in 19 mm thick nitrile rubber insulation and 1 x 19 mm OD copper pipe lagged in 19 mm thick nitrile rubber insulation and 1 x 16 mm OD copper pipe lagged in 19 mm thick nitrile rubber insulation. Spacing between the lagged pipes in the bundle between 0 mm to 39 mm	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 300 mm fixed using stainless steel cable ties 50 mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to Topside Only.	TBA Firefly™ Intumastic HP in the annular gap between the nitrile rubber and the TBA Firefly™ Intubatt (min 10 mm max 40 mm) Filled to the full depth of the TBA Firefly™ Intubatt	(13a or 13b), 121, 59 and 151	-/90/90
H59	Bundle of up to 6 x Nitrile Rubber Lagged Copper Pipes consisting of: 2 x 29 mm OD copper pipes lagged in 19 mm thick nitrile rubber insulation and 1 x 29 mm OD copper pipe lagged in 25 mm thick nitrile rubber insulation and 1 x 22 mm OD copper pipe lagged in 19 mm thick nitrile rubber insulation and 1 x 19 mm OD copper pipe lagged in 19 mm thick nitrile rubber insulation and 1 x 16 mm OD copper pipe lagged in 19 mm thick nitrile rubber insulation. Spacing between the lagged pipes in the bundle between 0 mm to 39 mm	1 Layer of TBA Firefly™ 12 mm thick Penowrap® wrapped for a distance of 350 mm fixed using stainless steel cable ties 50 mm from either end and 1 in the centre. Glued to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant. Wrap to Topside Only.	TBA Firefly™ Intumastic HP in the annular gap between the nitrile rubber and the TBA Firefly™ Intubatt (min 10 mm max 40 mm) Filled to the full depth of the TBA Firefly™ Intubatt	(13a or 13b), 122, 59 and 151	-/120/120
H60	Bundle of up to 7 x RG6 Coaxial Cables	None	Core hole of up to 32 mm TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 10 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b) 131, 59 and 151	-/180/180
H61	Bundle of up to 14 x CAT5e Data Cables	None	Core hole of up to 32 mm TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 10 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b), 132, 59 and 151	-/240/240

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
H62	Bundle of up to 10 x CAT6 Data Cables	None	Core hole of up to 32 mm TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 10 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b) 133, 59 and 151	- /180/180
H63	2 or 3 uPVC pipes or Flexi Conduits up to 32 mm OD with a maximum wall thickness of 2.4 mm each pipe containing up to 9 x RG6 Cables or up to 21 x Cat5e Cables or up to 14 x Cat 6 Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 20 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b) 127, 59 and 151	- /180/180
H64	Single uPVC Pipe or Flexi Conduits up to 32 mm OD with a maximum wall thickness of 2.4 mm containing up to 9 x RG6 Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 20 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b) 128, 59 and 151	- /180/180
H65	Single uPVC Pipe or Flexi Conduits up to 32 mm OD with a maximum wall thickness of 2.4 mm containing up to 21 x CAT5e Data Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 20 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b) 129, 59 and 151	- /180/180
H66	Single uPVC Pipe or Flexi Conduits up to 32 mm OD with a maximum wall thickness of 2.4 mm containing up to 14 x CAT6 Data Cables	None	TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 20 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b) 130, 59 and 151	- /180/180
H67	Bundle of up to 7 x Heliax Foam Dielectric 1/4" up to 7/8" (Max' 28.2 mm OD) Coaxiable Cables	TBA Firefly™ Penowrap® for a distance of 300 mm. Fixed using 3 x stainless steel cable ties, 50 mm from either end and 1 in the centre. Wrap to Topside of Seal only	TBA Firefly™ Intumastic HP in the annular gap (min 5 mm max 25 mm) filled the depth of the TBA Firefly™ Intubatt	(13a or 13b) 134, 59 and 151	- /120/120
H68	ICS-Hexatronic Microuduct 1 x 10/8 + 24 x 5/3.5 ID (Item 92) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD), TOL4019038/96AH	None	Maximum 71 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /240/240

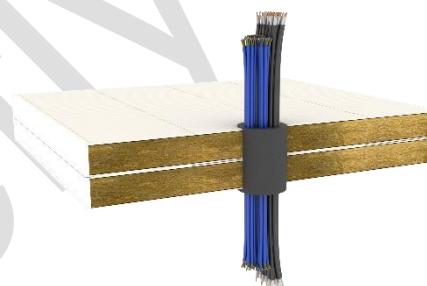
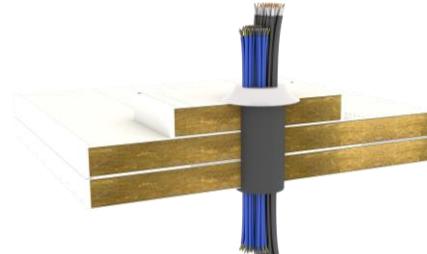
ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
	(5.1 mm OD), TOL4019038/288AH (7.95 mm OD), TOL4019038/288C (7.95 mm OD), TOL4019017/96A (6.7 mm OD), TOL4079028/12 (5.7 mm OD), TOL4079029/24 (6.7 mm OD)				
H69	ICS-Hexatronic Microduct 1 × 12/10 ID Standard Grade (Item 93) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, TOL4079030/12 (8.3 mm OD), TOL4079031/24 (9 mm OD), TOL4079033/24 (9 mm OD), TOL4079034/24 (9 mm OD)	None	Maximum 54 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /240/240
H70	ICS-Hexatronic Microduct 19 × 5/3.5 ID (Item 94) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 67 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /240/240
H71	ICS-Hexatronic Microduct 12 × 5/3.5 ID Hi-grade (Item 95) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 63 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /240/240
H72	ICS-Hexatronic Microduct 7 × 5/3.5 ID Hi grade (Item 96) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD),	None	Maximum 57 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /240/240

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
	KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)				
H73	ICS-Hexatronic Microduct 4 × 5/3.5 ID Hi grade (Item 97) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 54 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /240/240
H74	ICS-Hexatronic Microduct 4 × 12/10 ID Hi Grade (Item 98) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, TOL4079030/12 (8.3 mm OD), TOL4079031/24 (9 mm OD), TOL4079033/24 (9 mm OD), TOL4079034/24 (9 mm OD)	None	Maximum 77 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /240/240
H75	ICS-Hexatronic Microduct Bundle of up to 10: 1 × 5/3.5 ID (Item 99) Empty or may contain any of these ICS-Hexatronic fibre optic cables. 1.3 mm OD 12F Cables, KRPM258022 (1.02 mm OD), KRPM258019 (1.1 mm OD), KRPM258044 (1.65 mm OD), KRPM258041 (1.25 mm OD), KRPM258023 (1.65 mm OD), KRPM258030 (1.65 mm OD), TOL4019070/24 (2.4 mm OD), TOL4019050/12C (2.1 mm OD)	None	Maximum 60 mm Core Hole. TBA Firefly™ Intumastic HP in the annular gap (min' 10 mm max' 20 mm) filled to the full depth of the TBA Firefly™ Intubatt®	(13a or 13b), 56 and 151	- /240/240
H76	160 mm OD HDPE Pipe with a maximum wall thickness of 7 mm.	None	Nominal 170 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF150 Fire Collar (Item 47) Secured using 6 × 90 mm long	(13a or 13b), 59 and 151	- /120/120

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
			Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®		
H77	125 mm OD HDPE Pipe with a maximum wall thickness of 7 mm.	None	Nominal 135 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF150 Fire Collar (Item 47) Secured using 6 × 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /120/120
H78	110 mm OD HDPE Pipe with a maximum wall thickness of 7 mm.	None	Nominal 120 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF100 Fire Collar (Item 47) Secured using 5 × 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®	(13a or 13b) 59 and 151	- /120/120
H79	90 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 100 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF80 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /120/120
H80	75 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 85 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA	(13a or 13b), 59 and 151	- /120/120

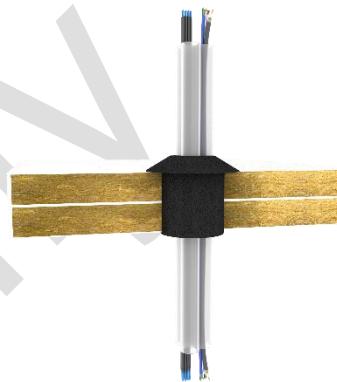
ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
			Firefly™ FRF80 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®		
H81	63 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 75 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF65 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /120/120
H82	56 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 65 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF50 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /120/120
H83	50 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 60 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF50 Fire Collar (Item 47) Secured using 3 × 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®	(13a or 13b), 59 and 151	- /120/120
H84	40 mm OD HDPE Pipe with a maximum wall thickness of 4.7 mm.	None	Nominal 50 mm Core Hole. Apply a nominal 6 mm bead of TBA Firefly™ Intumastic between the	(13a or 13b), 59 and 151	- /180/180

ID	Service	Protection	Local Protection	Refer Figure	FRL of Service
			TBA Firefly™ Intubatt® and service. Then install a TBA Firefly™ FRF40 Fire Collar (Item 47) Secured using 3 x 90 mm long Pigtail Screws. Fixed to the underside only of the TBA Firefly™ Intubatt®		
H85	Up to 8 mm threaded rod	Apply a 50 mm fillet of TBA Firefly™ Intumastic at the base of the threaded rod on the top side.	Core hole size drilled as per the diameter of the threaded rod and then friction fit the threaded rod.	(13a or 13b), 59 and 151	- /240/240
H86	Up to 20 mm threaded rod	Apply a nominal 10 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and threaded rod on the top side. Wrap with 12 mm thick TBA Firefly™ Penowrap® on top side for a height of 100 mm and finish with a 50 mm fillet of TBA Firefly™ Intumastic applied at the base of the service on the top side.	Core hole size drilled as per the diameter of the threaded rod and then friction fit the threaded rod.	(13a or 13b), 59 and 151	- /240/180
H87	Up to 42 mm threaded rod	Apply a nominal 10 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and threaded rod on the top side. Wrap with 12 mm thick TBA Firefly™ Penowrap® on top side for a height of 200 mm and finish with a 50 mm fillet of TBA Firefly™ Intumastic applied at the base of the service on the top side.	Core hole size drilled as per the diameter of the threaded rod and then friction fit the threaded rod.	(13a or 13b), 59 and 151	- /240/120
		Apply a nominal 10 mm bead of TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt® and threaded rod on the top side. Wrap with 12 mm thick TBA Firefly™ Penowrap® on the top side for a height of 300 mm and finish with a 50 mm fillet of TBA Firefly™ Intumastic applied at the base of the service on the top side.			
H88-H109	Left blank for future use				

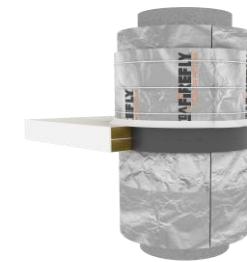
ID	Service	Protection	Local Protection	Refer figure	FRL
For ID's H110 to H132, refer also to Figure 1a or Figure 1b (Intubatt Configuration), Figure 2 (Spacing of Services & Distance from Primary Aperture) Figure 151 (Service Support)					
Note: Dimensions described in Protection and Local Protection columns are nominal only. Penowrap™ outer layer to overlap itself by 50 mm and sealed with TBA Foil Tape					
H110(a)	Up to 30 × Cat5 + 30 × Cat6 + 30 × RG6 + 30 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is installed in the annular gap (nom. 10 mm in an up to Ø110 mm core hole within the TBA Firefly™ Intubatt), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/120/120
H110(b)	Up to 30 × Cat5 + 30 × Cat6 + 30 × RG6 + 30 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is installed in the annular gap (nom. 10 mm, in an up to Ø110 mm core hole within the TBA Firefly™ Intubatt), between the services and the TBA Firefly Intubatt, full depth, finished flush each side. An additional batt mattress is then added on top of the existing two Intubatts, extending 100 mm from the edge of the services.  Install 4 × 150 mm pigtail screw (item 8) from the topside through the Intubatt, 10 mm from the service and evenly spaced around the service.  Apply a 25 × 25 mm fillet of Intumastic Sealant (Item 6) or Intumastic HP sealant (Item 74) between the Intubatt and the service on the top side only.		-/180/180

ID	Service	Protection	Local Protection	Refer figure	FRL
H111	Up to: 110 × Fibre optic cables (max Ø 4.3 mm OD each) as a bundle in nom. 75mm Ø Hole within the TBA Firefly™ Intubatt	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side. Apply a 25 × 25 mm fillet of Intumastic Sealant (Item 6) or Intumastic HP sealant (Item 74) between the Intubatt and the service on the top side only.		-/240/240
H112	Up to 56 × 4 mm & up to 38 × 6 mm Vesda microducts	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/180/180

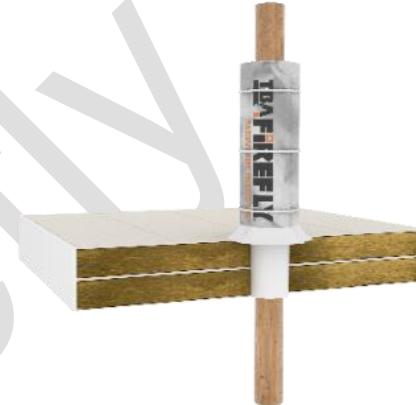
ID	Service	Protection	Local Protection	Refer figure	FRL
H113	1,2 or 3 × Ø 20 mm OD clear round plastic military conduits with any of: (1) [empty], (2) 1 × Cat5, 1 × Cat6, 1 × RG6, (3) 7 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/180/180
H114	1,2 or 3 × Ø 32 mm OD clear round plastic military conduits with any of the following in each conduit: (1) [empty], (2) 1 × Cat5, 1 × Cat6, 1 × RG6, (3) 7 × Optic fibre cables	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/180/180

ID	Service	Protection	Local Protection	Refer figure	FRL
H115	1 × Ø 50 mm OD (maximum) clear round plastic military conduits with: (1) [empty] or (2) 1 × Cat5, 1 × Cat6, 1 × RG6 or (3) up to 7 × Optic fibre cables or (4) any combination of the above	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.  A 25 × 25 mm fillet of Intumastic Sealant (Item 6) is applied between the Intubatt and the service on the top side.		-/180/180
H116	Ø 50 mm OD (maximum) uPVC Conduit, Maximum wall thickness 3.0 mm, filled with 2F 9/125 Fibre Optic Cables (4.5 mm OD)	None	TBA Firefly™ Intumastic HP sealant (Item 74) is applied in the annular gap (nom. 10 mm), between the services and the TBA Firefly Intubatt, full depth, finished flush each side.		-/240/240

ID	Service	Protection	Local Protection	Refer figure	FRL
H117	Standard configuration Copper D1 cables, with or without cable tray.  Note : This service can be installed In wall constructions against Floors or ceilings ( see Table 20, Item 9 for 3 sided Penowrap™ installation and cable sizes/cable bundle dimensions)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) wrapped for a distance of 500 mm followed by a 2nd layer of 150 mm on the top side of the Intubatt. The wrap is fixed using stainless steel cable ties 50 mm from end of the Penowrap™ and also at nom. 100 mm centres.  The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a using a 25 × 25 mm fillet of TBA Firefly™ Intumastic sealant (Item 6) or Intumastic HP sealant (Item 74)	TBA Firefly™ Intumastic (item 6) is applied to the cut edges of the Intubatt, full depth of the Intubatt . Intumastic HP (Item 74) is applied within the 5-10 mm annular gap, full depth of the Intubatt.		-/240/240
H118	Standard configuration Copper D2 cables, with or without cable tray.  Note : This service can be installed In wall constructions against Floors or ceilings ( see Table 20, Item 9 for 3 sided Penowrap™ installation and cable sizes/cable bundle dimensions)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (item 11) wrapped for a distance of 500 mm followed by a 2nd layer of 150 mm on the top side of the Intubatt . The wrap is fixed using stainless steel cable ties 50 mm from ends of the Penowrap™, and also at nom. 100 mm centres. The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a using a 25 × 25 mm fillet of TBA Firefly™ Intumastic sealant ( Item 6) or Intumastic HP sealant (Item 74)	TBA Firefly™ Intumastic (item 6) is applied to the cut edges of the Intubatt, full depth of the Intubatt . Intumastic HP (Item 74) is applied within the 5-10 mm annular gap, full depth of the Intubatt .		-/240/240

ID	Service	Protection	Local Protection	Refer figure	FRL
H119	150 mm OD Lorient or Kilargo damper LVH44C with DuraVent flexible ducting	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) is wrapped for a distance of 300 mm on the damper casing (top side only) and fixed using stainless steel cable ties 50 mm from either end and one in the middle.	TBA Firefly™ Intumastic sealant (Item 6) is applied to the full depth of the Intubatt. and finish flush on the surface on both sides of the Intubatt. Apply a 6 mm bead of TBA Firefly Intumastic (Item 6) on the top side between the Intubatt and the service.		-/180/180
H120	Up to 200 mm copper pipe with minimum Wall Thickness 3 mm and 75 mm thick stone wool foil faced continuous lagging.	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) is wrapped for a distance of 500 mm on the top side & fixed using stainless steel cable ties nom.50 mm from either end & nom. 100 mm centres. Sealed to the face of the TBA Firefly™ Intubatt with a 25 x 25 mm fillet of TBA Firefly™ Intumastic sealant on the top side.	2 Layers of TBA Firefly™ Intustrap (40 mm wide x 2 mm) is wrapped around the service on both sides, flush with the Intubatt. A bead of fire TBA Firefly™ Intumastic (Item 6) is applied around the perimeter of the service, between the service and Intubatt – both sides.		-/180/180
H121(a)	Up to 350 mm Ø OD steel pipe with 75 mm rockwool lagging (continuous)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) wrapped for 300 mm top side & fixed using stainless steel cable ties nom.50 mm from either end & nom. 100 mm centres. The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a 25 x 25 mm fillet of TBA Firefly™ Intumastic sealant on the top side (Item 6).	TBA Firefly™ Intumastic sealant is applied to the full depth of the Intubatt. Double layer strips of 40 x 2 mm TBA Firefly™ Intustrap (item 64), are applied onto both sides of the service, flush with both sides of the Intubatt. TBA Firefly™ Intumastic HP (Item 74) is applied to any gaps between the Intustrap and the Intubatt.		-/240/240

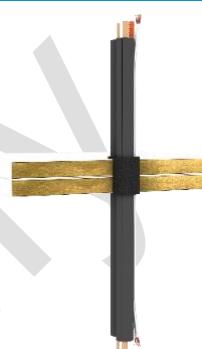
ID	Service	Protection	Local Protection	Refer figure	FRL
H121(b)	Up to 350 mm Ø OD steel pipe with 75 mm rockwool lagging (continuous)	1 Layer of TBA Firefly™ 12 mm thick Penowrap™ (Item 11) wrapped for 300 mm on the top side & fixed using stainless steel cable ties nom. 50 mm from either end & nom. 100 mm centres. The Penowrap™ is sealed to the face of the TBA Firefly™ Intubatt with a 6 mm bead of TBA Firefly™ Intumastic sealant (Item 6)	TBA Firefly™ Intumastic sealant is applied to the full depth of the Intubatt. Double layer strips of 40 × 2 mm TBA Firefly™ Intustrap (Item 64), are applied onto both sides of the service, flush with both sides of the Intubatt. TBA Firefly™ Intumastic HP (Item 74) is applied to any gaps between the Intustrap and the Intubatt.		-/180/180
H121(c)	Up to 350 mm Ø OD steel pipe with 75 mm rockwool lagging (continuous)	None	TBA Firefly Intumastic brush Grade is applied to the Intubatt annular gap, full depth of the Intubatt. Double layer strips of 40 × 2 mm TBA Firefly Intustrap (item 64), (4 mm of intumescent) are applied onto both sides of the service, flush with both sides of the Intubatt. TBA Firefly Intumastic HP (item 74) is applied to any gaps between the Intustrap and the Intubatt.		-/120/120
H122	Blank for future use				

ID	Service	Protection	Local Protection	Refer figure	FRL
H123(a)	Up to Ø 50.8 mm OD Copper pipe, (min wall thickness 1.2 mm)	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (item 11) is wrapped around the service for a distance of 300 mm – top side of the Intubatt. Fixed using stainless steel cable ties 50 mm from either end and 1 in the centre. Sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt .	The service is installed into the Intubatt maintaining < 5 mm gap, and sealed with TBA Firefly™ Intumastic acrylic sealant (Item 6) , full depth of the Intubatt .		-/180/180
H123(b)	Up to Ø 50.8 mm OD Copper pipe, (min wall thickness 1.2 mm)	1 Layer of TBA Firefly™ 12 mm thick Penowrap® (item 11) wrapped around the service for a distance of 300 mm followed by a 2nd layer of 150 mm on the top side of the Intubatt. The wrap is fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap and sealed with TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt.		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
H124(a)	Up to Ø 48 mm OD steel pipe, (minimum wall thickness 3.4 mm)	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (Item 11), 1 layer is wrapped around the service for a distance of 300 mm, 1 layer wrapped around for a distance of 150 mm on the top side of the Intubatt, and fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and then sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt, sealing the service and Intubatt.		-/120/120
H124(b)	Up to 48 mm OD steel pipe, minimum wall thickness 3.4 mm	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (Item 11) is wrapped around the service for a distance of 300 mm on the top side of the Intubatt, and fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and then sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt, sealing the service and Intubatt.		-/180/180
H125(a)	Up to NB100 Steel pipe (114 mm Ø OD), minimum wall thickness 4.5 mm	2 Layers of TBA Firefly™ 12 mm thick Penowrap® (Item 11) is wrapped around the service for a distance of 600 mm on the top side of the Intubatt, and fixed using stainless steel cable ties 50 mm from either end and 1 in the centre, and then sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6), full depth of the Intubatt, sealing the service and Intubatt.		-/180/180

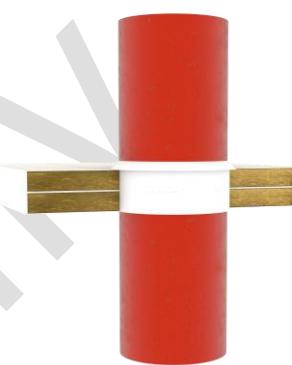
ID	Service	Protection	Local Protection	Refer figure	FRL
H125(b)	Up to 114.9 mm OD steel pipe, minimum wall thickness 4.5 mm	1 Layer of TBA Firefly™ 12 mm thick Penowrap® (item 11) wrapped for a distance of 600 mm, followed by a 2nd layer 300 mm top side of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end, and 4 in the centre spaced nom 100 mm. Sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using a 25 × 25 mm fillet.	The service is installed into the Intubatt maintaining < 5 mm gap, and TBA Firefly™ Intumastic acrylic sealant (Item 6) , full depth of the Intubatt, sealing the service and Intubatt.		-/120/120
H126(a)	Up to 76 mm OD steel pipe, minimum wall thickness 4.3 mm	Two layers of 12 mm thick TBA Firefly™ Penowrap® (Item 11) wrapped around the service for a distance of 300 mm – on top side of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end and 4 in the centre spaced nominal 100 mm sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using 25 mm × 25 mm fillet.	TBA Firefly Intumastic Acrylic Sealant (Item 6) is applied between the service and the Intubatt (maximum 5 mm annular gap), full depth of the Intubatt .		-/240/240

ID	Service	Protection	Local Protection	Refer figure	FRL
H126(b)	Up to 76 mm OD steel pipe, minimum wall thickness 4.3 mm	One layer of 12 mm thick TBA Firefly™ Penowrap® (item 11) wrapped around the service for a distance of 300 mm followed by a second layer of 150 mm on top side of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end and 4 in the centre spaced nominal 100 mm sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using 25 mm × 25 mm fillet.	TBA Firefly Intumastic Acrylic Sealant ( Item 6) is applied between the service and the Intubatt (maximum 5 mm annular gap), full depth of the Intubatt .		-/180/180
H126(c)	Up to 76 mm OD steel pipe, minimum wall thickness 4.3 mm	One layer of 12 mm thick TBA Firefly™ Penowrap® (item 11) wrapped around the service for a distance of 300 mm – top side of the Intubatt. The wrap is then fixed using stainless steel cable ties 50 mm from either end and 4 in the centre spaced nominal 100 mm sealed to the face of the TBA Firefly™ Intubatt with TBA Firefly™ Intumastic sealant, using 25 mm × 25 mm fillet.	TBA Firefly Intumastic Acrylic Sealant (Item 6) is applied between the service and the Intubatt ( maximum 5 mm annular gap ), full depth of the Intubatt .		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
H127	1 × (up to) 3/8" + 5/8" FR pair coil (15.8 mm +9.6 mm) copper pipes with maximum 19 mm nitrile insulation + 2 × 6 mm <sup>2</sup> 3C+E cables + 1 × Ø 18 mm Condensate hose	None	TBA Firefly™ Intumastic HP sealant - (Item 6) is installed in the annular gap (nom. 10 mm) between the services and the TBA Firefly Intubatt to the full depth of the Intubatt.		-/120/120
H128(a)	2 × each (up to) 3/8" & 5/8" pair coil (15.8 mm +9.6 mm) copper pipes with maximum 10 mm CLPE lagging	None	TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.  TBA Firefly™ FRF-100 Fire Collars (FRF 100 Item 47) is installed around the service on bottom side of the Intubatt and secured in place using 90 mm pigtail screws (Item 8).  TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around service to the full depth of the fire collar.		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
H128(b)	2 × each (up to) 3/8" & 5/8" pair coil (15.8 mm +9.6 mm) copper pipes with maximum 10 mm CLPE lagging	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-100 Fire Collars (FRF 100 Item 47) is installed around the service on bottom side of the Intubatt and secured in place using M5 threaded rod and nuts and washers through the Intubatt, joining both collars.</p> <p>TBA Firefly Intumastic HP sealant (item 74) is then installed around service to the full depth of the fire collar.</p>		-/180/180
H129(a)	Nom. 40 mm (up to Ø42.9 OD mm) uPVC pipe, maximum wall thickness up to 2.2 mm	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-40 Fire Collars (FRF 40 Item 47) is installed around the service on bottom side of the Intubatt and secured in place using 90 mm pigtail screws (Item 8).</p> <p>TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around service to the full depth of the fire collar.</p>		-/120/120

ID	Service	Protection	Local Protection	Refer figure	FRL
H130(a)	Nom. 40 mm (up to 48.3 mm Ø OD) uPVC Pressure Pipe PVC Class 12, wall thickness up to 2.7 mm	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-40 Fire Collars (FRF 40 Item 47) is installed around the service on bottom side of the Intubatt and secured in place using 90 mm pigtail screws (Item 8).</p> <p>TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around service to the full depth of the fire collars.</p>		-/120/120
H131(a)	40 mm (40 mm Ø OD) acoustic plastic pipe, wall thickness up to 2.5 mm	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>TBA Firefly™ FRF-40 Fire Collars (FRF 40 Item 47) is installed around the service on bottom sides of the Intubatt and secured in place using 90 mm pigtail screws (Item 8).</p> <p>TBA Firefly™ Intumastic HP sealant (Item 74) is then installed around service to the full depth of the fire collars .</p>		-/180/180

ID	Service	Protection	Local Protection	Refer figure	FRL
H132	Ø 250 mm (nom.) steel sprinkler pipe, wall thickness, minimum 6 mm.	None	<p>TBA Firefly™ Intumastic sealant (item 6) is applied to the full depth of the Intubatt, sealing the service to the Intubatt.</p> <p>A 20 mm × 20 mm fillet of TBA Firefly™ Intumastic sealant (item 6) is applied in top side of the Intubatt, between the service and the Intubatt.</p>		-/240/-

**Table 7 Fire resistance of VASS busway system without Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to horizontal substrates**

Busway Type		Additional Protection	FRL of Service
HFC800	HFA800	A 20mm fillet of TBA Firefly™ Intumastic brush grade sealant applied around busway casing on each side of TBA Firefly™ Intubatt seal	-/240/-
HFC1000	HFA1000		
HFC1250	HFA1250		
HFC1600	HFA1600		
HFC2000	HFA2000		
HFC2300	HFA2300		
HFC2500	HFA2500		
HFC3150	HFA3150		
HFC3200	HFA3200		
HFC3600	HFA3600		
HFC3780	HFA3780		
HFC4000	HFA4000		
HFC5600	HFA6300		
HFC7000	HFA7000		

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 8 Fire resistance of VASS busway system with 1 layer of 12mm TBA Firefly™ Penowrap® or 25mm Firefly™ Insulated Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to horizontal substrates**

Amperage	Outer Dimensions of the Busway (mm)	VASS Steel Encased Busway with Aluminium Conductors			
		Length of TBA Firefly™ Penowrap® to both sides of the TBA Firefly™ Intubatt® & FRL's achieved (mm)			
		See Fig. 145 (1a or 1b) FRL -/90/90	See Fig. 146 (1a or 1b) FRL -/120/120	See Fig. 146 (1a or 1b) FRL -/180/180	See Fig. 146 (1a or 1b) FRL -/240/240
HFA800	150 × 145	300	300	350*	450*
HFA1000	150 × 165	300	300	350*	450*
HFA1250	150 × 190	300	300	350*	450*
HFA1600	150 × 245	300	300	400*	450*
HFA2000	150 × 337	300	300	400*	500*
HFA2300	150 × 407	300	300	400*	500*
HFA2500	150 × 407	300	300	400*	500*
HFA3150	150 × 589	300	300	450*	500*
HFA3200	150 × 589	300	300	450*	500*
HFA3600	150 × 589	300	300	450*	500*
HFA3780	150 × 589	300	300	450*	500*
HFA4000	150 × 771	300	300	450*	550*
HFA6300	150 × 851	300	300	500*	550*
HFA7000	150 × 931	300	300	500*	550*

\*Plus a 50 mm fillet of TBA Firefly™ Intumastic around the base of the TBA Firefly™ Penowrap® both sides.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

VASS Steel Encased Busway with Copper Conductors					
Amperage	Outer Dimensions of the Busway (mm)	Length of TBA Firefly™ Penowrap® to both sides of the TBA Firefly™ Intubatt® & FRL's achieved (mm)			
		See Fig. 149 (13a or 13b)		See Fig. 150 (13a or 13b)	
		FRL -/90/90	FRL -/120/120	FRL -/180/180	FRL -/240/240
HFC800	150 × 120	300	300	350	450*
HFC1000	150 × 128	300	300	350	450*
HFC1250	150 × 145	300	300	400	450*
HFC1600	150 × 190	300	300	400	500*
HFC2000	150 × 245	300	300	450	500*
HFC2300	150 × 265	300	300	500	550*
HFC2500	150 × 265	300	300	500	550*
HFC3150	150 × 367	300	350	500	550*
HFC3200	150 × 360	300	350	500	550*
HFC3600	150 × 360	300	350	500	550*
HFC3780	150 × 360	300	350	500	550*
HFC4000	150 × 447	300	450	500	600*
HFC5600	150 × 589	450	600	650	750*
HFC7000	150 × 709	550	700	750	900*

\*Plus a 50 mm fillet of TBA Firefly™ Intumastic around the base of the TBA Firefly™ Penowrap® both sides.

Note: Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 8a Fire resistance of ABB IP55 ALUMINIUM ENCASED BUSDUCT- ALUMINIUM AND COPPER conductor systems with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to horizontal substrates**

ABB IP55 – SANDWICH TYPE BUSDUCT - ALUMINIUM CONDUCTORS		Figures: 95a, 95b (13a or 13b)	
Busduct Type	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/60	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/90	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120
LV-S SB 060 A 03			
LV-S SB 060 A 04			
LV-S SB 060 A 06			
LV-S SB 080 A			
LV-S SB 100 A			
LV-S SB 120 A			
LV-S SB 160 A			
LV-S SB 200 A			
LV-S SB 240 A			
LV-S DB 160 A			
LV-S DB 200 A			
LV-S DB 240 A			

Note: Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

<b>ABB IP55 – SANDWICH BUSDUCT - COPPER CONDUCTORS</b>				<b>Figures: 96a, 96b (13a or 13b)</b>
<b>Busduct Type</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/60 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/90 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120 (mm)</b>	
LV-S SB 060 C 03	300	300	400	
LV-S SB 060 C 04	300	300	400	
LV-S SB 060 C 06	300	300	400	
LV-S SB 080 C	300	300	400	
LV-S SB 100 C	300	300	400	
LV-S SB 120 C	300	300	400	
LV-S SB 160 C	300	300	450	
LV-S SB 200 C	300	300	450	
LV-S SB 240 C	300	300	450	
LV-S DB 160 C	300	300	500	
LV-S DB 200 C	300	350	500	
LV-S DB 240 C	300	350	500	

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 8b Fire resistance of ABB CAST RESIN IP68 ALUMINIUM AND COPPER conductor busduct systems with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to horizontal substrates**

<b>ABB CAST RESIN IP68 - BUSDUCT SYSTEM - ALUMINIUM CONDUCTORS</b>				<b>Figures: 97a, 97b (13a or 13b)</b>	
<b>BUSDuct TYPE SC-R</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/60 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/90 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/120 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/180 (mm)</b>	<b>LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/240 (mm)</b>
SB 060 A 03	300	300	300	300	300
SB 060 A 04	300	300	300	300	300
SB 060 A 06	300	300	300	300	300
SB 080 A	300	300	300	300	300
SB 100 A	300	300	300	300	300
SB 120 A	300	300	300	300	300
DB 080 A	300	300	300	300	300
DB 100 A	300	300	300	300	300
DB 120 A	300	300	300	300	300
QB 080 A	300	300	300	300	300
QB 100 A	300	300	300	300	300
QB 120 A	300	300	300	300	300

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

<b>ABB CAST RESIN IP68 - BUSDUCT SYSTEM - COPPER CONDUCTORS</b>	<b>Figures: 98a, 98b (13a or 13b)</b>
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BUSDuct Type SC-R	Length of TBA Firefly Penowrap to each side FRL -/240/60 (mm)	Length of TBA Firefly Penowrap to each side FRL -/240/90 (mm)	Length of TBA Firefly Penowrap to each side FRL -/240/120 (mm)	Length of TBA Firefly Penowrap to each side FRL -/240/180 (mm)	Length of TBA Firefly Penowrap to each side FRL -/240/240 (mm)
SB 060 K 03	300	300	300	*300	*400
SB 060 K 04	300	300	300	*300	*400
SB 060 K 06	300	300	300	*300	*400
SB 080 K	300	300	300	*300	*400
SB 100 K	300	300	300	*300	*400
SB 120 K	300	300	300	*300	*400
DB 080 K	300	300	300	*300	*400
DB 100 K	300	300	300	*300	*400
DB 120 K	300	300	300	*300	*400
QB 080 K	300	300	300	*300	*400
QB 100 K	300	300	300	*300	*450
QB 120 K	300	300	300	*300	*500

\* Extra 75 mm wide Intubatt TBA Firefly™ Intubatt strips are proposed to be glued using Intumastic sealant and fixed with 75 mm pigtail screws to one side of the TBA Firefly™ Intubatt barrier in the vicinity of the penetration.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 8c Fire resistance of EAE IP55 ALUMINIUM ENCASED SANDWICH BUSDUCT-ALUMINIUM AND COPPER conductor busduct systems with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt fitted to horizontal substrates**

See figures 103a and 103b (13a or 13b)		See figures 104a and 104b (13a or 13b)			
EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120 (mm)	EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS	LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/120/120 (mm)		
KX-A-04	-	300	KX-C-05	-	300
KX-A-05	-	300	KX-C-06	KX-II -C-06	300
KX-A-06	KX-II -A-06	300	KX-C-08	KX-II -C-08	300
KX-A-08	KX-II -A-08	300	KX-C-10	KX-II -C-10	300
KX-A-10	KX-II -A-10	300	KX-C-12	KX-II -C-12	300
KX-A-12	KX-II -A-12	320	KX-C-14	KX-II -C-14	300
KX-A-14	-	320	KX-C-17	KX-II -C-16	300
KX-A-17	KX-II -A-17	330	KX-C-23	KX-II -C-20	300
KX-A-20	KX-II -A-20	340	-	KX-II -C-21	300
KX-A-27	KX-II -A-27	360	KX-C-25	KX-II -C-24	300
-	KX-II -A-21	360	KX-C-22	KX-II -C-25	300
KX-A-25	KX-II -A-25	350	KX-C-27	KX-II -C-28	300
KX-A-32	KX-II -A-32	380	-	KX-II -C-30	320

See figures 103a and 103b (13a or 13b)			See figures 104a and 104b (13a or 13b)		
KX-A-33	KX-II -A-33	390	KX-C-32	KX-II -C-32	320
KX-A-40	KX-II -A-40	420	KX-C-36	KX-II -C-36	340
KX-A-51	KX-II -A-51	480	KX-C-40	KX-II -C-40	360
-	KX-II -A-63	600	KX-C-50	KX-II -C-50	440
			KX-C-63	KX-II -C-63	600

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 8d Fire resistance of EAE IP55 ALUMINIUM ENCASED SANDWICH BUSDUCT-  
ALUMINIUM AND COPPER conductor busduct systems with 1 layer of 12mm thick  
TBA Firefly™ Penowrap® in 2 or 3 layers of 50mm thick TBA Firefly™ Intubatt  
fitted to horizontal substrates**

Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides)							
See figures 107a and 107b (13a or 13b)		LENGTH OF TBA FIREFLY PENOWRAP TO EACH SIDE FRL -/240/240 (mm)		See figures 108a and 108b (13a or 13b)			
EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS		KX-A-04	KX-II -A-06	300	KX-C-05	KX-II -C-06	*300
		KX-A-05	KX-II -A-08	300	KX-C-06	KX-II -C-08	*300
		KX-A-06	KX-II -A-10	300	KX-C-08	KX-II -C-10	*300
		KX-A-08	KX-II -A-12	300	KX-C-10	KX-II -C-12	*300
		KX-A-10	KX-II -A-17	300	KX-C-12	KX-II -C-14	*300
		KX-A-12	KX-II -A-20	300	KX-C-14	KX-II -C-16	*300
		-	KX-II -A-27	300	KX-C-17	KX-II -C-20	*300
		KX-A-14	KX-II -A-21	300	-	KX-II -C-21	*300
		KX-A-17	KX-II -A-25	300	-	KX-II -C-25	*300
		KX-A-20	KX-II -A-32	300	KX-C-23	KX-II -C-24	*300
		KX-A-27	KX-II -A-33	300	KX-C-25	-	*300
		KX-A-25	KX-II -A-40	300	KX-C-22	-	*300
		KX-A-32	KX-II -A-51	300	KX-C-27	KX-II -C-28	*300
		KX-A-33	KX-II -A-63	300	-	KX-II -C-30	*300
		KX-A-40	-	300	KX-C-32	KX-II -C-32	*300
		KX-A-51	-	300	KX-C-36	KX-II -C-36	*300
					KX-C-40	KX-II -C-40	*300
					KX-C-50	KX-II -C-50	*300
					KX-C-63	KX-II -C-63	*300

\*Additional 25mm sealant fillet of TBA Firefly™ Intumastic acrylic sealant to be applied at the interface between TBA Firefly™ Intubatt and Penowrap®

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

**Table 8e Fire Resistance of IPD Powerduct Aluminium Encased Busway with Aluminium or Copper Conductor Busway Systems protected with 1 layer of 12mm thick TBA Firefly™ Penowrap® in 2 or 3 layers of TBA Firefly™ Intubatt fitted to horizontal substrates.**

<b>IPD 'Powerduct' Aluminium Encased Busway with Aluminium Conductors</b>					
<b>Amperage</b>	<b>Outer dimensions of the busway</b>	<b>Length of TBA Firefly™ Penowrap® to each side of the TBA Firefly™ Intubatt (mm) &amp; FRL's achieved</b>			
		<b>See Figure 139</b>		<b>See Figure 140</b>	
		<b>FRL -/90/90</b>	<b>FRL -/120/120</b>	<b>FRL -/180/180</b>	<b>FRL -/240/240</b>
PDA400	115 mm x 109 mm	300	300	300*	350*
PDA600	115 mm x 109 mm	300	300	300*	350*
PDA800	115 mm x 124 mm	300	300	300*	350*
PDA1000	115 mm x 139 mm	300	300	300*	350*
PDA1200	115 mm x 169 mm	300	300	350*	400*
PDA1350	115 mm x 194 mm	300	300	350*	400*
PDA1600	115 mm x 214 mm	300	300	350*	400*
PDA2000	115 mm x 269 mm	300	300	350*	450*
PDA2500	115 mm x 325 mm	300	300	400*	500*
PDA3200	115 mm x 405 mm	300	350	400*	500*
PDA4000	115 mm x 475 mm	300	350	400*	500*
PDA5000	115 mm x 681 mm	300	400	450*	550*

\* Additional 50mm fillet of TBA Firefly™ Intumastic acrylic sealant around the base of the TBA Firefly™ Penowrap® is required.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

<b>IPD 'Powerduct' Aluminium Encased Busway with Copper Conductors</b>					
<b>Amperage</b>	<b>Outer dimensions of the busway</b>	<b>Length of TBA Firefly™ Penowrap® to each side of the TBA Firefly™ Intubatt (mm) &amp; FRL's achieved</b>			
		<b>See Figure 141</b>		<b>See Figure 142</b>	
		<b>FRL -/90/90</b>	<b>FRL -/120/120</b>	<b>FRL -/180/180</b>	<b>FRL -/240/240</b>
PDC400	115 mm x 89 mm	300 mm	300	300*	350*
PDC600	115 mm x 99 mm	300 mm	300	350*	400*
PDC800	115 mm x 114 mm	300 mm	300	350*	400*
PDC1000	115 mm x 129 mm	300 mm	300	350*	400*
PDC1200	115 mm x 144 mm	300 mm	300	400*	450*
PDC1350	115 mm x 159 mm	300 mm	300	400*	450*
PDC1600	115 mm x 179 mm	300 mm	300	400*	450*
PDC2000	115 mm x 219 mm	300 mm	300	400*	450*
PDC2500	115 mm x 254 mm	300 mm	350	400*	500*
PDC3200	115 mm x 295 mm	300 mm	350	450*	550*
PDC4000	115 mm x 375 mm	300 mm	400	500*	600*
PDC5000	115 mm x 475 mm	300 mm	450	550*	650*
PDC6300	115 mm x 681 mm	300 mm	500	650*	750*

**IPD 'Powerduct' Aluminium Encased Busway with Aluminium Conductors**

\* Additional 50mm fillet of TBA Firefly™ Intumastic acrylic sealant around the base of the TBA Firefly™ Penowrap® is required.

**Note:** Refer to Figure 2 for minimum spacing requirement and Figure 151 for supports and hangers.

TBA Firefly

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TBA Firefly

## 1. Introduction

This report contains the minimum information sufficient for regulatory compliance and refers to the referenced assessment report FAS190235 R1.20. Summaries of the test data on which this assessment is based are provided in the appendices which are only available in the full report.

The referenced assessment report documents the findings of the assessment undertaken to determine the fire resistance level (FRL) of service penetrations through TBA Firefly™ Intubatt systems fitted to vertical and horizontal substrates in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

The products assessed in the referenced assessment report include the following:

- TBA Firefly™ Intubatt: 50 mm thick high-density basalt rock fibre batt (180 kg/m<sup>3</sup> Fire Batt) factory coated on both faces to a precise thickness with a white durable fire resistant mastic.
- TBA Firefly™ Intumastic: Water-based fire resisting acrylic sealant.
- TBA Firefly™ Intumastic HP: High pressure exerting Intumescent mastic.
- TBA Firefly™ Penowrap®: High temperature high density 12 mm thick wrap with an aluminium foil facing to one side.
- TBA Firefly™ Insulated Penowrap® System: A two component system consisting of (1<sup>st</sup> layer) 25 mm thick high temperature high density Fortaglas. (2<sup>nd</sup> layer) Phoenix RS 440 g woven Fortaglas cloth with a silicone coating.
- TBA Firefly™ Intustrap: High pressure intumescent wrap, which comes in a 25 m long coil. (4 mm thick graphite × 60 mm wide).
- TBA Firefly™ FRF Fire Collars: Used to fire stop a variety of services which penetrate different Fire-Resistant Substrates. These retro-fit fire collars are made from a steel outer shell containing high pressure exerting graphite intumescent strips.

The referenced assessment report is based upon TBA Firefly™ Systems which were tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1-2005. This report meets compliance with Specification A2.3 Section 2 (c) of NCC2016 Amendment 1 (Including Prior Versions) & Schedule 5 Section 2 (c) of NCC2019 (Including Amendment 1) for determination of an FRL.

The purpose of the referenced assessment report is to be used in conjunction with other tests and assessments of TBA Firefly™ Intubatt barriers only.

The analysis in the referenced assessment report found that the proposed variations are expected to achieve fire resistance performance as shown in Table 1 to Table 8e in accordance with AS 1530.4:2014.

The sponsor details are included in Table 9.

**Table 9      Sponsor details**

Sponsor	Address
TBA Firefly™ division of TBA Textiles P/L	44 Gindurra Road Somersby, NSW 2250 Australia

## 2. Framework for the assessment

### 2.1 Assessment approach

An assessment is an opinion about the expected performance of a component or element of structure if it was subject to a standard fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. We have therefore followed the 'Guide to undertaking technical assessments of

the fire performance of construction products based on fire test evidence<sup>1</sup> prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2019<sup>1</sup>.

This guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction which has already been tested
- The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

The referenced assessment uses established empirical methods and our experience of fire testing similar products to extend the scope of application by determining the limits for the design based on the tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance if the elements were to be tested in accordance with AS 1530.4:2014.

The referenced assessment has been written using appropriate test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been deemed appropriate to support the manufacturer's stated design.

## 2.2 Compliance with the National Construction Code

The referenced assessment report has been prepared to meet the evidence of suitability requirements of the National Construction Code Volumes One and Two – Building Code of Australia (NCC) 2019 Amendment 1<sup>2</sup> under A.5.2.(1) (d) and schedule 5 for determination of an FRL and 2016 under specification A2.3, including amendments.

The referenced assessment has been written in accordance with the general principles outlined in EN 15725:2010<sup>3</sup> for extended application reports on the fire performance of construction products and building elements. It also references test evidence for meeting a performance requirement or deemed to satisfy (DTS) provisions of the NCC under A5.4 for fire resistance levels as applicable to the assessed systems.

The referenced assessment report may also be used to demonstrate compliance with the requirements for evidence of suitability under NCC 2016 including Amendments<sup>4</sup>.

## 2.3 Declaration

The 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal on 6 April 2021, TBA Firefly™ division of TBA Textiles P/L confirmed that:

- To their knowledge the component or element of structure, which is the subject of the referenced assessment, has not been subjected to a fire test to the standard against which the referenced assessment is being made.
- They agree to withdraw the referenced assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which the referenced assessment is being made and the results are not in agreement with the referenced assessment.

<sup>1</sup> Passive Fire Protection Forum (PFPF) 2019, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

<sup>2</sup> National Construction Code Volume One – Building Code of Australia 2019 Amendment 1, Australian Building Codes Board, Australia.

<sup>3</sup> European Committee for Standardization, EN 15725:2010: Extended application reports on the fire performance of construction products and building elements, European Committee for Standardization, Brussels, Belgium.

<sup>4</sup> National Construction Code Volumes One and Two - Building Code of Australia 2016 including Amendments, Australian Building Codes Board, Australia

- They are not aware of any information that could adversely affect the conclusions of the referenced assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.

### 3. Limitations of the referenced assessment

- The scope of the referenced assessment report is limited to an assessment of the variations to the tested systems described in section 4.3.
- The referenced assessment report details the methods of construction, test conditions and assessed results that are expected in accordance with AS 1530.4:2014.
- We confirm that any changes which subject of this assessment have not been to our knowledge been tested to the standards against which this assessment has been made.
- The results of referenced assessment report are applicable to TBA Firefly™ Intubatt barriers in vertical substrates exposed to fire from either side in horizontal substrates exposed to fire from below.
- The purpose of the referenced assessment report is to be used in conjunction with other tests and assessments of TBA Firefly™ Intubatt barriers only.
- The supporting vertical and horizontal substrate construction shall be capable of providing effective support of the proposed construction for the required fire resistance period (FRL):
  - The Speedpanel wall shall be constructed as appropriate for a non-load bearing service aperture. The wall shall otherwise be tested or assessed for an FRL of -/120/120.
  - The Kingflor profile floor structural design shall be tested or assessed to include floor penetrations without compromising structural adequacy.
- The referenced assessment report is only valid for the assessed systems and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of the referenced assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL).
- The referenced assessment report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.
- The referenced assessment report is based on the proposed systems being constructed under comprehensive quality control practices and following appropriate industry regulations and Australian Standards on quality of materials, design of structures, guidance on workmanship and the expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.

### 4. Description of the specimen and variations

#### 4.1 System description

A range of service penetrations through various supporting construction in vertical and horizontal substrates have been tested in accordance with various revisions of AS 1530.4. Refer to Appendix A in the referenced assessment report for a full summary of the referenced test data.

#### 4.2 Referenced test data

The assessment of the variation to the tested system and the determination of the expected performance is based on the results of the fire tests documented in the reports summarised in Table 10. Further details of the tested system are included in referenced assessment report.

**Table 10 Referenced test data**

Report number	Test sponsor	Test date	Testing authority
EWFA 2600700.2	TBA Textiles	26 September 2011	Warringtonfire Australia
EWFA 2600701.2	TBA Textiles	27 September 2011	Warringtonfire Australia
EWFA 2600703.2	TBA Textiles	4 October 2011	Warringtonfire Australia
EWFA 2517300.2	Speedpanel (VIC) Pty. Ltd.	27 October 2011	Warringtonfire Australia
EWFA 2683500	Warringtonfire Australia	11 January 2012	Warringtonfire Australia
FSV 1523	Lend Lease Project Management & Construction (Aus) Pty Ltd	22 December 2011	CSIRO
FSV 0094	Jackson International Pty Ltd	17 August 1990	National Building Technology Centre
FP 2966	Pyropanel Technologies Pty Ltd	6 March 2011	BRANZ
FP 2081	Pyropanel Technologies Pty Ltd	24 March 1995	BRANZ
FP 2016	Pyropanel Technologies Pty Ltd	1 February 1995	BRANZ
FSP 1665	Vass Electrical Industries Pty Ltd	20 November 2014	CSIRO
EWFA 31139300.1	Pyropanel Technologies Pty Ltd	30 September 2014	Warringtonfire Australia
EWFA 31846500.1	Lend Lease Construction (Abigroup)	21 October 2014	Warringtonfire Australia
F91675B	Lorient Polyproducts	5 June 1997	Warringtonfire Australia
EWFA 49455300.2	TBA Textiles Pty Ltd	2 May 2017	Warringtonfire Australia
EWFA 49455400.2	TBA Textiles Pty Ltd	3 May 2017	Warringtonfire Australia
EWFA 49455500.2	TBA Textiles Pty Ltd	4 May 2017	Warringtonfire Australia
EWFA 29980300	TBA Textiles Pty Ltd	3 September 2014	Warringtonfire Australia
EWFA 42205100	TBA Textiles Pty Ltd	17 May 2016	Warringtonfire Australia
EWFA 39348100	TBA Textiles Pty Ltd	18 December 2015	Warringtonfire Australia
EWFA 39348101	TBA Textiles Pty Ltd	27 January 2016	Warringtonfire Australia
EWFA 40453300	TBA Textiles Pty Ltd	30 March 2016	Warringtonfire Australia
EWFA 54077900.1	TBA Textiles Pty Ltd	1 March 2018	Warringtonfire Australia
EWFA 54078000.1	TBA Textiles Pty Ltd	2 March 2018	Warringtonfire Australia
EWFA 54078100.1	TBA Textiles Pty Ltd	14 May 2018	Warringtonfire Australia
EWFA 51307700.2	TBA Textiles Pty Ltd	25 August 2017	Warringtonfire Australia
EWFA 48623700.3	Lorient Pty Ltd	18 July 2017	Warringtonfire Australia
FRT200124.1	TBA Textiles Pty Ltd	29 May 2020	Warringtonfire Australia
FRT200417 R1.1	TBA Textiles Pty Ltd	25 January 2021	Warringtonfire Australia
FRT200418 R1.0	TBA Textiles Pty Ltd	21 January 2021	Warringtonfire Australia
FRT210125 R1.0	TBA Textiles Pty Ltd	14 July 2021	Warringtonfire Australia
FRT210320 R1.0	TBA Textiles Pty Ltd	30 September 2021	Warringtonfire Australia
FRT220029 R1.0	TBA Textiles Pty Ltd	29 April 2022	Warringtonfire Australia
FRT210321 R1.1	TBA Textiles Pty Ltd	10 December 2021	Warringtonfire Australia
FRT220031 R1.0	TBA Textiles Pty Ltd	29 September 2022	Warringtonfire Australia

Report number	Test sponsor	Test date	Testing authority
FRT220050 R2.0	TBA Textiles Pty Ltd	20 September 2022	Warringtonfire Australia
FRT220051 R1.0	TBA Textiles Pty Ltd	4 August 2022	Warringtonfire Australia

## 4.3 Variations to the tested systems

The variations to the tested systems – together with the referenced standard fire tests – are described in the following sections.

### 4.3.1 Penetrations through TBA Firefly™ Intubatt barriers in vertical substrates

The proposed construction of TBA Firefly™ Intubatt penetration seal systems is as tested in EWFA 2600700.1, 2600703.1, 2600701.1, 29980300, 39348100, 54077900.1, 54078000.1, 54078100.1, 48623700.3, 51307700.2, 40453300.1, FRT200124.1 and FRT220029 R1.0 for vertical and horizontal substrate constructions and subject to following variations. Services may be spaced at a minimum 40mm from each other. Inclusion of service penetrations described below in vertical substrates.

#### Cables:

- Bundle of up to 4 x 28mm Coaxial cables; sealed full depth of batt with TBA Firefly™ Intumastic and protected with TBA Firefly™ Insulated Penowrap® for up to 500mm each side butted up to the face of the TBA Firefly™ Intubatt.
- 11mm diameter plastic cables tied in pair (or three); black coloured PVC sheath, wire reinforced containing two copper cores of seven strands each in a PVC sheath.
- AS 1530.4:2014 Appendix D1– Power cables, both with or without cable trays; sealed full depth of Intubatt with TBA Firefly™ Intumastic protected with one layer of TBA Firefly™ 12mm Penowrap® or TBA Firefly™ Insulated 25mm Penowrap® wrapped out 300mm to each side butted up to the face of the Intubatt.
- AS 1530.4:2014 Appendix D2- Communication cables, both with or without cable trays; sealed full depth of batt with TBA Firefly™ Intumastic protected with 1 layer of TBA Firefly™ 12mm Penowrap® or TBA Firefly™ Insulated Penowrap® wrapped out 300mm to each side butted up to the face of the Intubatt.
- Bundle of up to 12 TPS and/or Red fire alarm cables protected with TBA Firefly™ Intumastic HP
- 3 x 27mm OD PVC conduits within a single 70mm core hole penetrating 2 layers of TBA Firefly™ Intubatt, protected with TBA Firefly™ Intumastic HP in the annular gap (min 10mm max 30mm) to full depth of Intubatt. The 3 Conduits are filled with 10 x Cat 6 cables, 14 x Cat 5e cables and 7 x RG6 Coaxial Cables.
- Bundle of up to 7 x RG6 Coaxial Cables, up to 14 x CAT5e Data Cables or up to 10 x CAT6 Data Cables within a core hole of 32 mm penetrating 2 layers of TBA Firefly™ Intubatt, protected with TBA Firefly™ Intumastic HP in the annular gap (min 5 max 10 mm) to full depth of Intubatt.
- 1, 2 or 3 uPVC pipes up to 32 mm OD with a maximum wall thickness of 2.4mm each pipe containing up to 9 x RG6 Cables or up to 21 x Cat5e Cables or up to 14 x Cat 6 Cables. The single or bundle of uPVC pipes are within a core hole of up to 70 mm penetrating 2 layers of TBA Firefly™ Intubatt, protected with TBA Firefly™ Intumastic HP in the annular gap (min 5 max 20mm) to full depth of Intubatt.
- Bundle of up to 7 x Heliax Foam Dielectric 1/4" up to 7/8" (Max' 28.2mm OD) Coaxiable Cables. TBA Firefly™ Penowrap® for a distance of 300mm are applied on both sides of the seal. The Penowrap® is fixed using 3 x stainless steel cable ties, 50mm from either end and one in the centre. The bundle of cables is penetrating 2 layers of TBA Firefly™ Intubatt, protected with TBA Firefly™ Intumastic HP in the annular gap (min 5 max 25mm) to full depth of Intubatt.
- Aluminium power and communication cable with or without cable trays in an arrangement which is equivalent to AS 1530.4:2014 standard cable configuration with the exception that

aluminium cables are used instead of copper cables are used. To be sealed for the full depth of Intubatt with TBA Firefly™ Intumastic-HP protected with one layer of TBA Firefly™ 12 mm Penowrap® wrapped out 300 mm to services on both sides of the Intubatt.

### Metal Pipes

- Brass, copper, or ferrous pipes having wall thickness greater than or equal to that listed in AS 1530.4:2014, Table 10.11.3.1 without insulation.
- Brass, copper, or ferrous pipes having wall thickness greater than or equal to that listed in AS 1530.4:2014, Table 10.11.3.1 and protected with TBA Firefly™ Insulated Penowrap® for 600mm each side of TBA Firefly™ Intubatt barrier fixed to pipe with 4 stainless steel cable ties.
- 8mm to 32mm copper or steel pipes with insulation 50mm of PIR Foam, Nitrile Rubber and Antiblaze 990 protected with extra 50mm x 50mm TBA Firefly™ Intumastic Brush Grade sealant fillet on one side.
- 8mm to 32mm copper or steel pipes with insulation, 50mm of Rockwool protected with extra 50mm x 50mm TBA Firefly™ Intumastic Brush Grade sealant fillet on one side.
- 8mm-200mm copper pipes with 50mm Bradford Fibertex 650 insulation wrapping as per Specimen A in EWFA 31846500.1
- 8mm-200mm copper pipe with 50mm Bradford Fibertex 650 insulation wrapping as per Specimen B in EWFA 31846500.1.
- 25mm copper pipe protected with Thermotec lagging (with aluminium foil) wrapped to full length and TBA Firefly™ Intumastic HP to full depth of Intubatt
- 33.4mm and 48mm CPVC Fire Sprinkler Pipe protected with TBA Firefly™ Intustrap.
- 33.4mm and 48mm CPVC Fire Sprinkler Pipe protected with TBA Firefly™ Intumastic HP.

### Plastic pipes

- Ø40mm × 3.2mm thick HDPE pipe with Intustrap strips.
- Ø40mm × 3.2mm thick uPVC pipe with Intustrap strips.
- Ø40mm, Ø50mm, Ø65mm, Ø80mm, Ø100mm, Ø110mm, Ø125mm and Ø150mm PVC pipes with Firefly™ FRF collars.
- Ø40mm, Ø50mm, Ø65mm, Ø80mm and Ø100mm HDPE pipes with Firefly™ FRF collars.
- Sixteen Ø8mm × 1.5mm Saint-Gobain Cobraflex 35 pipes bundle with Nitrile Rubber lagging as tested in EWFA 31139300.1.
- Ø12.6mm (OD) Copper pipe with Nitrile Rubber lagging, Red fire alarm cable, and communication cable bundle as tested in EWFA 31139300.1.
- Twin air-con copper pipe with Nitrile Rubber lagging as tested in EWFA 31139300.1
- 16mm and 25mm Gas PEX AL pipe protected with TBA Firefly™ Intumastic HP to full depth of Intubatt.
- 16mm water PEX pipe protected with TBA Firefly™ Intumastic HP to full depth of Intubatt.
- Ø100mm uPVC Pipe protected with RF SL Collar and Intumastic as tested in EWFA 51307700.2.
- Ø25mm uPVC Pipe with 9mm Nitrile Rubber Lagging protected with Intumastic HP as tested in EWFA 51307700.2.

### Combination pipe/cable

- Insulated Twin Air-con copper pipes + PE Drain Hose + Twin Earth Cables. Copper pipes each wrapped with Nitrile Rubber insulation for full length of pipe. Bundle sealed with TBA Firefly™ Intumastic HP to full depth of Intubatt.
- 25mm PVC conduit filled with 8 x TPS cables sealed with TBA Firefly™ Intumastic HP to depth of 32mm on both sides.

- 9 x 13mm copper pipes with 9mm Nitrile Rubber lagging + 20 x TPS cables + 16mm Flexidrain pipe with cable tray sealed with TBA Firefly™ Intumastic HP to full depth of Intubatt and protected with 1 layer of 12mm TBA Firefly™ Penowrap® 300mm each side.
- Ø50mm uPVC conduit with 20 × CAT 5e, 26 × CAT 6, and 9 × RG6 cables protected with Intumastic HP as tested in EWFA 51307700.2.

### Intuspan gap seal

- 200mm wide × 114mm high (uncompressed) × 100mm deep Intuspan used to fill aperture 200mm wide × 100 high.

### Dampers

- Bullock Model 4900 series damper modules of aggregate size 2400mm wide × 2400mm high.
- Lorient LVH44 and Kilargo Intumescent fire damper of size 450mm wide × 450mm high.

### Air transfer grille

- Lorient LVH44 and Kilargo Intumescent fire damper with steel mesh up to 450mm wide × 450mm high as tested in EWFA 48623700.3

### Busways

When designing busway supports (designed by others), for the supporting to be able to sustain the load of the busways, the following considerations must be taken in the design process :

- Not exceeding the maximum capacity of steel uni strut members at ambient and elevated temperature levels.
- Maintaining safe deflection levels and make sure that the load is not transferred to the fire sealing system.
- Support is sized in suitable way to accommodate total mass or load for the number of busways that are being supported.
- Increase number of fixings and fixing sizes as appropriate for increased load.

Penetrations through 2 layers of 50mm thick TBA Firefly™ Intubatt seal for the following busway products.

VASS busway system listed as below in Table 11.

**Table 11 VASS busway system**

Ampere Rating	Copper Busways	Aluminium Busways
800	HFC800	HFA800
1000	HFC1000	HFA1000
1250	HFC1250	HFA1250
1600	HFC1600	HFA1600
2000	HFC2000	HFA2000
2500	HFC2500	HFA2500
3150	HFC3150	HFA3150
3200	HFC3200	HFA3200
3600	HFC3600	HFA3600
3780	HFC3780	HFA3780
4000	HFC4000	HFA4000
5600	HFC5600	HFA6300
7000	HFC7000	HFA7000

The proposed protections of the busways are:

- The busway systems without insulated Penowrap® each side and protected with 200mm long Intuspan within the two layers of 50mm thick TBA Firefly™ Intubatt seal. A 20mm fillet of TBA

Firefly™ Intumastic sealant is applied around busway casing each side of TBA Firefly™ Intubatt seal.

- The busway system shall be optionally wrapped with 12mm TBA Firefly™ Penowrap® on each side penetrating through two layers of 50mm thick Intubatt seal.
- Extra 50mm TBA Firefly™ Intubatt coverage strip or 50mm x 50mm TBA Firefly™ Intumastic sealant fillet shall be optionally fixed on one side of the sealing system.

### ABB busducts

The busduct system listed as below in Table 12.

**Table 12 ABB busducts**

ABB IP55 – ALUMINIUM ENCASED SANDWICH BUSDuct - ALUMINIUM CONDUCTORS	ABB IP55 – ALUMINIUM ENCASED SANDWICH BUSDuct - COPPER CONDUCTORS	ABB CAST RESIN IP68 - BUSDUCT SYSTEM - ALUMINIUM CONDUCTORS	ABB CAST RESIN IP68 - BUSDUCT SYSTEM - COPPER CONDUCTORS
Busduct Type:	Busduct Type:	Busduct type, SC-R:	Busduct type, SC-R:
LV-S SB 060 A 03	LV-S SB 060 C 03	SB 060 A 03	SB 060 K 03
LV-S SB 060 A 04	LV-S SB 060 C 04	SB 060 A 04	SB 060 K 04
LV-S SB 060 A 06	LV-S SB 060 C 06	SB 060 A 06	SB 060 K 06
LV-S SB 080 A	LV-S SB 080 C	SB 080 A	SB 080 K
LV-S SB 100 A	LV-S SB 100 C	SB 100 A	SB 100 K
LV-S SB 120 A	LV-S SB 120 C	SB 120 A	SB 120 K
LV-S SB 160 A	LV-S SB 160 C	DB 080 A	DB 080 K
LV-S SB 200 A	LV-S SB 200 C	DB 100 A	DB 100 K
LV-S SB 240 A	LV-S SB 240 C	DB 120 A	DB 120 K
LV-S DB 160 A	LV-S DB 160 C	QB 080 A	QB 080 K
LV-S DB 200 A	LV-S DB 200 C	QB 100 A	QB 100 K
LV-S DB 240 A	LV-S DB 240 C	QB 120 A	QB 120 K

The proposed protections of the ABB busduct are:

- The busduct systems penetrate the fire rated separating element through the TBA Firefly™ Intubatt in the aperture.
- The busduct systems will be protected with a single layer of Penowrap® wrap around the busduct on the exposed and unexposed side. The wrap extends away from the TBA Firefly™ Intubatt.
- Sandwich type busducts:
  - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and unexposed sides of the Intubatt. The wrap is secured to the busduct with stainless steel cable ties at 20mm from the batt then 100mm centres.
  - Three layers of wrap to be inserted into the modules profile cavity.
  - Three layers of wrap to be inserted into the cavity between the modules.
  - 10mm fillet of TBA Intumastic sealant on the interface between the Intubatt and the Penowrap®.
  - 10mm fillet of TBA Intumastic HP sealant along the outer interface between the Intubatt and the busduct
  - 30mm fillet of TBA Intumastic HP sealant along the inner interface between the Intubatt and the sandwich type busduct.

- Extra 75mm wide Intubatt strips are proposed to be glued using TBA Intumastic sealant and fixed with 75mm pigtail screws to one side of the TBA Firefly™ Intubatt barrier in the vicinity of the penetration.
- Cast resin type busducts:
  - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and unexposed sides of the Intubatt. The wrap is secured to the busduct with stainless steel cable ties 20mm from the batt then 100mm centres.
  - 10mm fillet of TBA Intumastic sealant around the perimeter of the cast resin type busduct.

## EAE Busducts

The EAE busduct systems are listed in Table 13.

**Table 13 EAE busduct systems**

(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))											
EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS	EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS	EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS	EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS	KX-A-04	KX-II -A-06	KX-C-05	KX-II -C-06	KX-A-04	KX-II -A-06	KX-C-05	KX-II -C-06
KX-A-05	KX-II -A-08	KX-C-06	KX-II -C-08	KX-A-05	KX-II -A-08	KX-C-06	KX-II -C-08	KX-A-05	KX-II -A-08	KX-C-06	KX-II -C-08
KX-A-06	KX-II -A-10	KX-C-08	KX-II -C-10	KX-A-06	KX-II -A-10	KX-C-08	KX-II -C-10	KX-A-08	KX-II -A-12	KX-C-10	KX-II -C-12
KX-A-10	KX-II -A-17	KX-C-12	KX-II -C-14	KX-A-10	KX-II -A-17	KX-C-12	KX-II -C-14	KX-A-12	KX-II -A-20	KX-C-14	KX-II -C-16
KX-A-12	KX-II -A-20	KX-C-14	KX-II -C-16	KX-A-12	KX-II -A-20	KX-C-14	KX-II -C-16	KX-A-14	KX-II -A-27	KX-C-17	KX-II -C-20
KX-A-17	KX-II -A-21	KX-C-23	KX-II -C-21	KX-A-17	KX-II -A-21	KX-C-23	KX-II -C-21	KX-A-20	KX-II -A-25	KX-C-25	KX-II -C-24
KX-A-20	KX-II -A-25	KX-C-25	KX-II -C-24	KX-A-20	KX-II -A-25	KX-C-25	KX-II -C-24	KX-A-27	KX-II -A-32	KX-C-22	KX-II -C-25
KX-A-25	KX-II -A-33	KX-C-27	KX-II -C-28	KX-A-25	KX-II -A-33	KX-C-27	KX-II -C-28	KX-A-32	KX-II -A-40	KX-C-32	KX-II -C-30
KX-A-33	KX-II -A-51	KX-C-36	KX-II -C-32	KX-A-33	KX-II -A-51	KX-C-36	KX-II -C-32	KX-A-40	KX-II -A-63	KX-C-40	KX-II -C-36
KX-A-40	KX-II -A-63	KX-C-40	KX-II -C-36	KX-A-40	KX-II -A-63	KX-C-40	KX-II -C-36	KX-A-51	KX-C-43	KX-II -C-40	
		KX-C-43	KX-II -C-40	KX-A-50		KX-C-43	KX-II -C-40	KX-C-50	KX-C-50	KX-II -C-50	
		KX-C-50	KX-II -C-50			KX-C-50	KX-II -C-50				
		KX-C-63	KX-II -C-63			KX-C-63	KX-II -C-63				

The protections of the busducts are:

- The busduct systems penetrate the fire rated separating element through the TBA Firefly™ Intubatt in the aperture.
- The busduct systems will be protected with a single layer of Penowrap® wrap around the busduct on the exposed and unexposed side. The wrap extends away from the TBA Firefly™ Intubatt.
- Sandwich type busducts:
  - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and

- unexposed sides of the Intubatt. The wrap is secured to the busduct with stainless steel cable ties at 50mm from the batt then 100mm centres.
- Four layers of wrap to be inserted into the modules profile cavity.
  - Four layers of wrap to be inserted into the cavity between the modules.
  - TBA Intumastic Sealant to be used in the joints between the Intubatts, the interface between the separating element and Intubatts and interface between the Intubatt and busway.
  - TBA Intumastic Sealant applied along the outer interface between the Intubatt and the busduct.
- Sandwich type busducts (Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides)):
    - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and unexposed sides of the Intubatt. The wrap is secured to the busduct with stainless steel cable ties at 50mm from the batt then 100mm centres.
    - TBA Intumastic Sealant to be used in the joints between the Intubatts, the interface between the separating element and Intubatts and interface between the Intubatt and busway.
    - TBA Intumastic Sealant applied along the outer interface between the Intubatt and the busduct

## IPD busways

The IPD busway systems are listed in Table 14.

**Table 14 IPD busway systems**

IPD Powerduct Aluminium Encased Busway with Aluminium Conductors		IPD Powerduct Aluminium Encased Busway with Copper Conductors	
Amperage	Outer dimensions of the busway	Amperage	Outer dimensions of the busway
PDA400	115 mm × 109 mm	PDC400	115 mm × 89 mm
PDA600	115 mm × 109 mm	PDC600	115 mm × 99 mm
PDA800	115 mm × 124 mm	PDC800	115 mm × 114 mm
PDA1000	115 mm × 139 mm	PDC1000	115 mm × 129 mm
PDA1200	115 mm × 169 mm	PDC1200	115 mm × 144 mm
PDA1350	115 mm × 194 mm	PDC1350	115 mm × 159 mm
PDA1600	115 mm × 214 mm	PDC1600	115 mm × 179 mm
PDA2000	115 mm × 269 mm	PDC2000	115 mm × 219 mm
PDA2500	115 mm × 325 mm	PDC2500	115 mm × 254 mm
PDA3200	115 mm × 405 mm	PDC3200	115 mm × 295 mm
PDA4000	115 mm × 475 mm	PDC4000	115 mm × 375 mm
PDA5000	115 mm × 681 mm	PDC5000	115 mm × 475 mm
		PDC6300	115 mm × 681 mm

The protections of the busways are:

- The busduct systems penetrate the fire rated separating element through the TBA Firefly™ Intubatt in the aperture.
- The busduct systems must be protected with a single layer of Penowrap® wrap around the busduct on the exposed and unexposed side. The wrap extends away from the TBA Firefly™ Intubatt.

- Additional 50 mm fillet of TBA Firefly™ Intumastic acrylic sealant around the base of the TBA Firefly™ Penowrap® for the protection which is required to achieve an FRL of -/180/180.

### Structural Members

- Steel I Beam wrapped with 1 layer of 300mm long 12mm TBA Firefly™ Penowrap® on both sides
- Timber Joist wrapped with 1 layer of 300mm long 12mm TBA Firefly™ Penowrap® on both sides
- Steel C purlin wrapped with 1 layer of 300mm long 12mm TBA Firefly™ Penowrap® on both sides

### 4.3.2 Penetrations in plasterboard walls (C or Z-purlin)

C or Z-purlin passing through plasterboard lined wall construction and wrapped with 500mm long TBA Firefly™ Insulated Penowrap® each side of wall. The annular gap between purlin and wall lining shall be sealed with TBA Firefly™ Intumastic Brush Grade.

### 4.3.3 Penetrations through TBA Firefly™ Intubatt barriers in horizontal substrates

The service penetrations in horizontal substrates are described in the section.

#### Cable Specimens

- AS 1530.4:2014 Appendix D1 – Power cables and Appendix D2- Communication cables, both with or without cable trays; shall be protected with TBA Firefly™ Insulated Penowrap® for up to 500mm each side or up to 1000mm on topside and butted up to the face of the TBA Firefly™ Intubatt. The TBA Firefly™ Insulated Penowrap® may be installed against the adjacent vertical substrates with hoop iron strap at 100mm centres. The details of the systems are summarised in
- Bundle of up to 4 x 28mm Coaxial cables; sealed full depth of batt with TBA Firefly™ Intumastic and protected with TBA Firefly™ Insulated Penowrap® for up to 500mm each side or up to 1000mm on top side and butted up to the face of the TBA Firefly™ Intubatt.
- 11 mm diameter plastic cables tied in pair (or three); black coloured PVC sheath, wire reinforced containing two copper cores of seven strands each in a PVC sheath.
- Aluminium power and communication cable with or without cable trays in an arrangement which is equivalent to AS 1530.4:2014 standard cable configuration with the exception that aluminium cables are used instead of copper cables are used. To be sealed for full depth of Intubatt with TBA Firefly™ Intumastic-HP protected with one layer of TBA Firefly™ 12 mm Penowrap® wrapped out 300 mm to services on the top unexposed side of the Intubatt only.
- AS 1530.4:2014 Appendix D1 – Power cables without cable trays protected with one layer of TBA Firefly™ 12 mm Penowrap® wrapped out 300 mm to the top unexposed side of the Intubatt only.

**Table 15 Cable systems in horizontal substrates**

System Figure	Top Wrap length	Bottom Wrap length	Intubatt build-up depth
Figure 38, Figure 40, Figure 47 and Figure 52	300mm for 120 mins insulation	300mm for 120 mins insulation	No Build-up
	500mm for 180 mins insulation	500mm for 180 mins insulation	
Figure 39, Figure 41, Figure 48 and Figure 53	600mm for 120 mins insulation	No Wrap	No Build-up
	1000mm for 180 mins insulation		
Figure 43, Figure 49 and Figure 54	No Wrap	300mm	300mm

System Figure	Top Wrap length	Bottom Wrap length	Intubatt build-up depth
Figure 44, Figure 50 and Figure 55	300mm	No Wrap	300mm
Figure 45, Figure 51 and Figure 56	No Wrap	No Wrap	600mm

### Metal pipe specimens

- Brass, copper, or ferrous pipes having wall thickness greater than or equal to that listed in AS 1530.4:2014, Table 10.12.3.1 without insulation.
- Brass, copper, or ferrous pipes having wall thickness greater than or equal to that listed in AS 1530.4:2014, Table 10.12.3.1 and protected with 1 layer of 12mm TBA Firefly™ Penowrap® for 600mm to either side with 4x stainless steel cable ties or 1200mm to top side only with 8x stainless steel cable ties.
- 8mm to 32mm copper or steel pipes with insulation 500mm of PIR Foam, Nitrile Rubber , Antibleaze 990 or Rockwool protected with extra 50mm x 50mm TBA Firefly™ Intumastic Brush Grade sealant fillet on the topside of the floor slab.
- 8mm to 210mm copper or steel pipes protected with 38mm Fibretex 450 for 1200mm on the topside of TBA Firefly™ Intubatt barrier fixed to pipe with 8 steel pipe clamps. Additional 50mm x 50mm TBA Firefly™ Intumastic sealant fillet shall be fixed on one side of the sealing system.
- 8mm-200mm copper pipes with 50mm Bradford Fibertex 650 insulation wrapping wrapped in full length of the pipes.

### Plastic pipe specimens

- 40mm x 3.2mm thick, HDPE pipe with Intustrap strips.
- Ø56mm HDPE pipe with TBA Firefly™ FRF 32-50 Multi-fit collar.
- Ø40mm, Ø50mm, Ø65mm, Ø80mm, Ø100mm and Ø150mm PVC pipes with TBA Firefly™ FRF collars. PVC pipes with TBA Firefly™ FRF collars can optionally be installed in Kingflor profile floor slab and the slab void shall be sealed with Intubatt strips as shown in Figure 40.

### Busways

Penetrations through 2 layers of 50mm thick TBA Firefly™ Intubatt seal for the following busway products.

The busway systems are listed as below in Table 16.

**Table 16 Busways in horizontal substrates**

Ampere Rating	Copper	Aluminium
800	HFC800	HFA800
1000	HFC1000	HFA1000
1250	HFC1250	HFA1250
1600	HFC1600	HFA1600
2000	HFC2000	HFA2000
2500	HFC2500	HFA2500
3150	HFC3150	HFA3150
3200	HFC3200	HFA3200
3600	HFC3600	HFA3600
3780	HFC3780	HFA3780
4000	HFC4000	HFA4000
5600	HFC5600	HFA6300
7000	HFC7000	HFA7000

- The busway systems without insulated Penowrap® each side and protected with 200mm long Intuspan within the two layers of 50mm thick Intubatt seal. A 20mm fillet of TBA Firefly™ Intumastic sealant is applied around busway casing each side of TBA Firefly™ Intubatt seal.
- The busway system shall be optionally wrapped with TBA insulated Penowrap® on each side penetrating through two layers of 50mm thick TBA Firefly™ Intubatt seal.
- Extra 50mm TBA Firefly™ Intubatt coverage strip or 50mm x 50mm TBA Firefly™ Intumastic sealant fillet shall be optionally fixed on one side of the sealing system.

### ABB busducts

The ABB busduct systems are listed below in Table 17.

**Table 17 ABB busduct systems in horizontal substrates**

ABB IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS	ABB IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS	ABB CAST RESIN IP68 - BUSDUCT SYSTEM - ALUMINIUM CONDUCTORS	ABB CAST RESIN IP68 - BUSDUCT SYSTEM - COPPER CONDUCTORS
Busduct Type:	Busduct Type:	Busduct type, SC-R:	Busduct type, SC-R:
LV-S SB 060 A 03	LV-S SB 060 C 03	SB 060 A 03	SB 060 K 03
LV-S SB 060 A 04	LV-S SB 060 C 04	SB 060 A 04	SB 060 K 04
LV-S SB 060 A 06	LV-S SB 060 C 06	SB 060 A 06	SB 060 K 06
LV-S SB 080 A	LV-S SB 080 C	SB 080 A	SB 080 K
LV-S SB 100 A	LV-S SB 100 C	SB 100 A	SB 100 K
LV-S SB 120 A	LV-S SB 120 C	SB 120 A	SB 120 K
LV-S SB 160 A	LV-S SB 160 C	DB 080 A	DB 080 K
LV-S SB 200 A	LV-S SB 200 C	DB 100 A	DB 100 K
LV-S SB 240 A	LV-S SB 240 C	DB 120 A	DB 120 K
LV-S DB 160 A	LV-S DB 160 C	QB 080 A	QB 080 K
LV-S DB 200 A	LV-S DB 200 C	QB 100 A	QB 100 K
LV-S DB 240 A	LV-S DB 240 C	QB 120 A	QB 120 K

- The busduct systems penetrate the fire rated separating element through the TBA Firefly™ Intubatt in the aperture.
- The busduct systems will be protected with a single layer of Penowrap® wrap around the busduct on the exposed and unexposed side. The wrap extends away from the TBA Firefly™ Intubatt.
- Sandwich type busducts:
  - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and unexposed sides of the TBA Firefly™ Intubatt. The wrap is secured to the busduct with stainless steel cable ties at 20mm from the batt then 100mm centres.
  - Three layers of wrap to be inserted into the modules profile cavity.
  - Three layers of wrap to be inserted into the cavity between the modules.
  - 10mm fillet of TBA Intumastic sealant on the interface between the Intubatt and the Penowrap®.
  - 10mm fillet of TBA Intumastic HP sealant along the outer interface between the Intubatt and the busduct
  - 30mm fillet of TBA Intumastic HP sealant along the inner interface between the Intubatt and the sandwich type busduct.

- Extra 75mm wide Intubatt strips are proposed to be glued using TBA Intumastic sealant and fixed with 75mm pigtail screws to one side of the TBA Firefly™ Intubatt barrier in the vicinity of the penetration.
- Cast resin type busducts:
  - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and unexposed sides of the Intubatt. The wrap is secured to the busduct with stainless steel cable ties 20mm from the batt then 100mm centres.
  - 10mm fillet of TBA Intumastic sealant around the perimeter of the cast resin type busduct.

### EAE busducts

The EAE busduct systems are listed below in Table 18.

**Table 18 EAE busduct systems in horizontal substrates**

(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))											
EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS	EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS	EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS	EAE IP55 – ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS	KX-A-04	KX-II -A-06	KX-C-05	KX-II -C-06	KX-A-04	KX-II -A-06	KX-C-05	KX-II -C-06
KX-A-05	KX-II -A-08	KX-C-06	KX-II -C-08	KX-A-05	KX-II -A-08	KX-C-06	KX-II -C-08	KX-A-05	KX-II -A-08	KX-C-06	KX-II -C-08
KX-A-06	KX-II -A-10	KX-C-08	KX-II -C-10	KX-A-06	KX-II -A-10	KX-C-08	KX-II -C-10	KX-A-08	KX-II -A-12	KX-C-10	KX-II -C-12
KX-A-10	KX-II -A-17	KX-C-12	KX-II -C-14	KX-A-10	KX-II -A-17	KX-C-12	KX-II -C-14	KX-A-12	KX-II -A-20	KX-C-14	KX-II -C-16
KX-A-12	KX-II -A-20	KX-C-14	KX-II -C-16	KX-A-12	KX-II -A-20	KX-C-14	KX-II -C-16	KX-A-14	KX-II -A-27	KX-C-17	KX-II -C-20
KX-A-17	KX-II -A-21	KX-C-23	KX-II -C-21	KX-A-17	KX-II -A-21	KX-C-23	KX-II -C-21	KX-A-20	KX-II -A-25	KX-C-25	KX-II -C-24
KX-A-20	KX-II -A-25	KX-C-25	KX-II -C-24	KX-A-20	KX-II -A-25	KX-C-25	KX-II -C-24	KX-A-27	KX-II -A-32	KX-C-22	KX-II -C-25
KX-A-25	KX-II -A-33	KX-C-27	KX-II -C-28	KX-A-25	KX-II -A-33	KX-C-27	KX-II -C-28	KX-A-32	KX-II -A-40	KX-C-32	KX-II -C-30
KX-A-33	KX-II -A-51	KX-C-36	KX-II -C-32	KX-A-33	KX-II -A-51	KX-C-36	KX-II -C-32	KX-A-40	KX-II -A-63	KX-C-40	KX-II -C-36
KX-A-40	KX-II -A-63	KX-C-40	KX-II -C-36	KX-A-40	KX-II -A-63	KX-C-40	KX-II -C-36	KX-A-51	KX-C-43	KX-II -C-40	
		KX-C-43	KX-II -C-40	KX-A-50		KX-C-43	KX-II -C-40	KX-C-50	KX-C-50	KX-II -C-50	
		KX-C-50	KX-II -C-50			KX-C-50	KX-II -C-50				
		KX-C-63	KX-II -C-63			KX-C-63	KX-II -C-63				
		KX-C-63				KX-C-63					

- The busduct systems penetrate the concrete separating element through the TBA Firefly™ Intubatt in the aperture.
- The busduct systems will be protected with a single layer of Penowrap® wrap around the busduct on the exposed and unexposed side. The wrap extends away from the TBA Firefly™ Intubatt.
- Sandwich type busducts:
  - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and

- unexposed sides of the TBA Firefly™ Intubatt. The wrap is secured to the busduct with stainless steel cable ties at 50mm from the batt then 100mm centres.
- Four layers of wrap to be inserted into the modules profile cavity.
  - Four layers of wrap to be inserted into the cavity between the modules.
  - TBA Intumastic Sealant to be used in the joints between the Intubatts, the interface between the separating element and Intubatts and interface between the Intubatt and busway.
  - TBA Intumastic Sealant applied along the outer interface between the Intubatt and the busduct.
  - Sandwich type busducts (Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides)):
    - Protected with a single layer of TBA Firefly™ insulated Penowrap® wrapped around the busduct with a 100mm overlap. The wrap extends from the exposed and unexposed sides of the Intubatt. The wrap is secured to the busduct with stainless steel cable ties at 50mm from the batt then 100mm centres.
    - TBA Intumastic Sealant to be used in the joints between the Intubatts, the interface between the separating element and Intubatts and interface between the Intubatt and busway.
    - TBA Intumastic Sealant applied along the outer interface between the Intubatt and the busduct

## IPD busways

The IPD busway systems are listed in Table 19.

**Table 19 IPD busway systems in horizontal substrates**

IPD Powerduct Aluminium Encased Busway with Aluminium Conductors	Outer dimensions of the busway	IPD Powerduct Aluminium Encased Busway with Copper Conductors	Outer dimensions of the busway
Amperage	Outer dimensions of the busway	Amperage	Outer dimensions of the busway
PDA400	115 mm x 109 mm	PDC400	115 mm x 89 mm
PDA600	115 mm x 109 mm	PDC600	115 mm x 99 mm
PDA800	115 mm x 124 mm	PDC800	115 mm x 114 mm
PDA1000	115 mm x 139 mm	PDC1000	115 mm x 129 mm
PDA1200	115 mm x 169 mm	PDC1200	115 mm x 144 mm
PDA1350	115 mm x 194 mm	PDC1350	115 mm x 159 mm
PDA1600	115 mm x 214 mm	PDC1600	115 mm x 179 mm
PDA2000	115 mm x 269 mm	PDC2000	115 mm x 219 mm
PDA2500	115 mm x 325 mm	PDC2500	115 mm x 254 mm
PDA3200	115 mm x 405 mm	PDC3200	115 mm x 295 mm
PDA4000	115 mm x 475 mm	PDC4000	115 mm x 375 mm
PDA5000	115 mm x 681 mm	PDC5000	115 mm x 475 mm
		PDC6300	115 mm x 681 mm

The protections of the busways are:

- The busduct systems penetrate the fire rated separating element through the TBA Firefly™ Intubatt in the aperture.
- The busduct systems must be protected with a single layer of Penowrap® wrap around the busduct on the exposed and unexposed side. The wrap extends away from the TBA Firefly™ Intubatt.

- Additional 50 mm fillet of TBA Firefly™ Intumastic around the base of the TBA Firefly™ Penowrap® for the protection which is required to achieve an FRL of -/180/180.

A detailed description of the proposed construction presented in section 4.5.

## 4.4 Purpose of the test

AS 1530.4:2014 sets out the methods for conducting fire tests on building materials, components and structures. Specifically, section 2 of this standard contains the general requirements for these tests. Section 10 sets out the procedure for determining the fire resistance of elements of construction penetrated by services such as electrical services and conduits.

AS 4072.1:2005 (R2016) sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems.

## 4.5 Schedule of components

Table 20 outlines the schedule of components for the assessed systems subjected to a fire test. Figure 1 to Figure 153 show the assessed systems.

**Table 20 Schedule of components of assessed systems**

		Description
1.	Name	TBA Firefly™ Zip Ties
	Material	Stainless Steel
	Specification	Standard sizes: 8 mm wide x 500 mm long & 8 mm wide x 1100 mm long & 5 mm wide x 300 mm long (Joined together to make longer lengths as required for the specific application)
2.	Name	Steel Pipe
	Size	Steel Pipe 8 mm OD up to 48.6 mm OD with a minimum wall thickness of 0.91 mm
3.	Name	Steel Pipe
	Size	41 mm OD up to 90 mm OD with a minimum wall thickness of 0.91 mm
4.	Name	Steel Pipe
	Material	48.7 mm OD up to 115 mm OD with a minimum wall thickness of 0.91 mm
5.	Name	TBA Firefly™ Intubatt
	Material	Basalt rock fibre with nominal density of 180kg/m <sup>3</sup> , coated on both sides with TBA Firefly™ Intumastic to a thickness of 1.0 mm
	Size	Nominal 1200 mm long x 600 mm wide x 50 mm thick
	Installation	<i>Double Layer or triple Layer</i> Double or triple layer Batts shall be installed at the size and with the perimeter details as tested or assessed as a blank penetration seal for the required FRL <i>Bulkhead</i> Bulkheads made from batts shall be installed at the size and with the perimeter details as tested or assessed as a blank penetration seal for the required FRL
6.	Name	Sealant
	Material	TBA Firefly™ Intumastic-Brush Grade – Sausage or Tube / TBA Intumastic sealant
	Installation	Applied to all cut edges of TBA Firefly™ Intubatt with a minimum thickness of 1 mm; Applied between TBA Firefly™ Intubatt strip and support construction with a minimum thickness of 10 mm and Applied as sealant fillet with a minimum depth of 35 mm Fill the gaps between TBA Firefly™ Intubatt and service penetrations. A 20 mm fillet of sealant is applied around busway casing without insulation wrap each side of TBA Firefly™ Intubatt. A 50 mm fillet of sealant is applied around busway casing with insulation wrap on one side of TBA Firefly™ Intubatt seal.

No.	Description	
7.	Name	<b>TBA Firefly™ Intubatt Strip</b>
	Material	TBA Firefly™ Intubatt with nominal density of 180kg/m <sup>3</sup> , coated on both sides with TBA Firefly™ Intumastic to a thickness of 1.0 mm
	Size	50 mm
	Installation	<p>Addition strip of TBA Firefly™ Intubatt fixed to TBA Firefly™ Intubatt layer with 90 mm long pigtail screws.</p> <p>All cut edges (include joints within each layers, perimeter interface with wall system) to be coated with TBA Firefly™ Intumastic</p>
8.	Name	<b>TBA Firefly™ Pigtail Screws</b>
	Installation	Used to fix additional TBA Firefly™ Intubatt layers/strips to base TBA Firefly™ Intubatt. (75 mm up to 90 mm long).
9.	Name	<b>Power and Communication Cables with or without Cable tray</b>
	Material	PVC insulated Power cables as AS 1530.4:2014, Appendix D1 cables with or without cable tray wrapped with TBA Firefly™ Penowrap® or, PVC insulated Communication cables as Appendix D2 cables with or without cable tray wrapped with TBA Firefly™ Penowrap®
	Size	AS 1530.4:2014, Appendix D1 and D2 Cables with or without cable trays treated with TBA Firefly™ Penowrap®. When tested, the full integrity and insulation was achieved on the standard configuration of Appendix D1 & D2 Cables. Therefore, in accordance with AS 4072.1:2005 Section 4.5.1. the FRL's determined within Table 1 to Table 8 of this report are applicable to all PVC-insulated and sheathed power and communications cables with copper conductors and no limitations are required to be specified with regards to cable sizes or Cable Bundle dimensions.
	Installation	<p><i>In Wall Constructions and Floor Constructions not Against Wall:</i></p> <p>Installed in the aperture and sealed to the barrier with TBA Firefly™ Intumastic sealant. Fill the gaps between the cables to the full depth of the TBA Firefly™ Intubatt seal with TBA Firefly™ Intumastic.</p> <p>Service to be wrapped with 12 mm TBA Firefly™ Penowrap® for 300 mm either side of the Intubatt or 300 mm on the unexposed side only with a 50 mm fillet of TBA Firefly™ Intumastic or 600 mm top side only for horizontal applications as determined within Table 1 to Table 8.</p> <p>The services to be wrapped with 25 mm thick TBA Firefly™ Insulated Penowrap® and butted up to the face of the barrier, up to 500 mm on both sides of the TBA Firefly™ Intubatt. The insulation to be clad with a 440g woven cloth (Phoenix RS) and to be supported at distances of nominally 100 mm and 400 mm from the face of the wall or floor on both sides as shown in Figure 2, 3, 5, 6, 36-46.</p> <p><i>In Floor Constructions Against Wall:</i></p> <p>Installed in the aperture in the concrete floor that adjacent to masonry or concrete wall (Item 1) and sealed to the barrier with TBA Firefly™ Intumastic sealant. Fire grade sealant shall be filled in gaps between cables.</p> <p>The services to be wrapped with 25 mm thick TBA Firefly™ Insulated Penowrap® and butted up to the face of the barrier, up to 500 mm on both sides of the TBA Firefly™ Intubatt or up to 1000 mm on topside of the TBA Firefly™ Intubatt. The insulation to be clad with a 440g woven cloth (Phoenix RS)</p> <p>The insulation is installed against the adjacent wall and fixed to the wall with two M6 steel hoop iron knocking at 100 mm centres by using 25 mm needle point and phoenix RS as shown in Figure 47-57.</p> <p><i>In Wall Constructions Against Floor or Ceiling</i></p> <p>Installed in the aperture in the walls (item 1, 2 or 3) adjacent to concrete floor (Item 4) and sealed to the barrier with TBA Firefly™ Intumastic sealant. Fire grade sealant shall be filled in gaps between cables.</p>

No.	Description				
	<p>The services to be wrapped with 25 mm thick TBA Firefly™ Insulated Penowrap® and butted up to the face of the barrier, up to 500 mm on both sides of the TBA Firefly™ Intubatt. The insulation to be clad with a 440g woven cloth (Phoenix RS)</p> <p>The insulation is installed against the adjacent floor and fixed to the floor with two M6 steel hoop iron knocking at 100 mm centres by using 25 mm needle felt and phoenix RS as shown in Figure 8.</p>				
10.	Name	<b>Metal Pipes</b>			
	Material	Copper, Brass or Ferrous pipes			
	Size	<b>Pipe Material</b>		<b>Max Pipe OD. (mm)</b>	<b>Min Wall Thickness ( mm)</b>
		Copper, Brass or Ferrous pipes		32-65	0.91
				80-100	1.22
		Copper or Ferrous pipes		125	1.42
				150	1.63
11.	Installation	Installed in the aperture and sealed with TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt and the pipe service to the full depth of the TBA Firefly™ Intubatt with a minimum thickness of approx.1 mm.			
	Support of Service	The pipe to be supported with metal pipe bracket at approx. 300 mm and 500 mm.			
12.	Name	<b>TBA Firefly™ 12 mm Penowrap®</b>			
	Material	High temperature wrap			
	Size	300 mm wide × 10 m long × 12 mm thick			
	Installation A	<b>Body of wall Detail: 4-Sided Wrap.</b> To be wrapped out from the substrate for the specified length to meet the required FRL. Secured with Stainless Steel Zip Ties spaced at maximum 100 mm apart and at a nominal 50 mm from both ends or 2 × cable ties spaced at 25 mm from both ends of a 100 mm long wrap. Concise details are determined within the specific ID No's within this report for the specific application. The Cable/Zip tie spacing dimensions detailed above and throughout this report are nominal distances.			
	Installation B	<b>Close to edge Detail: 3-Sided Wrap.</b> To be wrapped out from the substrate for the specified length to meet the required FRL. Secured with minimum 25 mm × 25 mm × 0.5 mm thick galvanised steel angle or minimum 25 mm × 0.6 mm thick galvanised steel strap. Mechanical fixings to be spaced at maximum 100 mm apart and at a nominal 50 mm from both ends. The fixing spacing dimensions detailed above and throughout this report are nominal distances.			
	Name	<b>8 mm - 32 mm Copper Pipe</b>			
13.	Material	Copper pipe			
	Size	Pipe outside diameter from 8 mm to 32 mm × minimum 0.91 mm pipe wall thickness			
	Installation	Installed in the aperture and sealed with TBA Firefly™ Intumastic between the TBA Firefly™ Intubatt aperture and the pipe service to the full depth of the TBA Firefly™ Intubatt with a minimum thickness of approx.1 mm and sealed with a 10 mm sealant fillet on each side.			
	Support of Service	The pipe is supported on the unexposed side with metal pipe bracket at approx. 300 mm and 500 mm.			
	Name	<b>Pipe Insulation 1</b>			
	Product	Foil faced PIR Foam Pipe Lagging			
	Material	PIR Foam			
	Size	50 mm thick wall			
	Installation	Insulating the pipe through the TBA Firefly™ Intubatt barrier, extending 500 mm from the TBA Firefly™ Intubatt barrier on both sides of the system.			

No.	Description	
14.	Name	<b>Pipe Insulation 2</b>
	Product	Nitrile Rubber
	Material	Closed cell- Foamed nitrile rubber
	Size	38 mm thick wall
	Installation	Insulating the pipe through the TBA Firefly™ Intubatt barrier, extending 500 mm from the TBA Firefly™ Intubatt barrier on both sides of the system.
15.	Name	<b>Pipe Insulation 3</b>
	Product	Foil faced Glasswool Pipe Lagging
	Material	Glass Fibre
	Size	50 mm thick wall
	Installation	Insulating the pipe through the TBA Firefly™ Intubatt barrier, extending 500 mm from the TBA Firefly™ Intubatt barrier on both sides of the system.
16.	Name	<b>Pipe Insulation 4</b>
	Material	Rockwool
	Size	50 mm thick wall
	Density	99.5kg/m <sup>3</sup>
	Installation	Insulating the pipe through the TBA Firefly™ Intubatt barrier, extending 500 mm from the TBA Firefly™ Intubatt barrier on both sides of the system.
17.	Name	<b>TBA Firefly™ Intustrap</b>
	Size	60 mm wide × 4 mm thick
	Installation	2 layers of 2-off strips installed around pipes between the TBA Firefly™ Intubatt aperture and pipe, protruding 10 mm on either side of the TBA Firefly™ Intubatt barrier.
18.	Name	<b>40 mm HDPE pipe</b>
	Size	Outside Diameter (OD) 40 mm × 3.2 mm pipe
	Installation	Protruded nominally 530 mm on the exposed side and 2000 mm on the unexposed side, the resulting gap is sealed with 2 layers of 2-off strips of TBA Firefly™ Intustrap (Item 17) around the pipe between Intubatt and pipe, protruding 10 mm on either side of the barrier
	Support	Supported with metal pipe brackets at approx. 500 mm and 1500 mm from the unexposed side.
19.	Name	<b>40 mm uPVC pipe</b>
	Size	Outside Diameter (OD) 42.9 mm × 3.2 mm pipe
	Installation	Protruded nominally 530 mm on the exposed side and 2000 mm on the unexposed side, the resulting gap is sealed with 2 layers of 2-off strips of TBA Firefly™ Intustrap (Item 17) around the pipe between Intubatt and pipe, protruding 10 mm on either side of the barrier
	Support	Supported with metal pipe brackets at approx. 500 mm and 1500 mm from the unexposed side.
20.	Name	Aluminium power and communication cables with or without cable tray
	Specification	AS 1530.2:2014 D1 cables with or without cable tray with the exception that aluminium cables may be used instead of copper cables in accordance with AS 4072.1:2005 section 4.5.2. The FRL determined within Table 1 to Table 8 of this report are applicable to all PVC and XLPE insulated and PVC sheathed power and communication cables with aluminum conductors and no limitations are required to be specified with regards to cable sizes or cables bundle dimensions.
	Installation	Installed in the aperture and sealed to the barrier with TBA Firefly™ Intumastic HP sealant. Fill the gaps between the cables to the full depth of the TBA Firefly™ Intubatt seal with TBA Firefly™ Intumastic HP sealant.

No.	Description	
		Service to be wrapped with 12 mm TBA Firefly™ Penowrap® for 300 mm and a 50 mm fillet of TBA Firefly™ Intumastic acrylic sealant on services at both sides of the wall in vertical applications and on the top unexposed side only of the horizontal applications as determined in Table 1 to Table 8.
21.	Name	Left blank for future use
	Specification	Left blank for future use
	Installation	Left blank for future use
22.	Name	<b>Steel Angle</b>
	Material	Minimum of 50 x 50 x 1.5 mm steel angle
	Installation	<p><i>Vertical Barriers</i>            Vertical angles fixed to head and base angles with M6 Steel Knockins.            Head and base angles fixed to support construction with masonry anchors at maximum 300 mm centres.</p> <p><i>Bulkheads</i>            Angles fixed to wall and each other with sufficient fixing to support the loads supported. Angle fixed to support structure with mechanical, metal fixings such as M6 Steel knockins, expanding anchors and etc.</p>
23.	Name	<b>Coaxial Cable Bundle</b>
	Specification	Bundle of up to 4 x 28 mm Coaxial cables
	Installation	<p><i>In Wall Constructions:</i>            Sealed full depth of batt with TBA Firefly™ Intumastic and protected with 25 mm thick TBA Firefly™ Insulated Penowrap® for up to 500 mm each side butted up to the face of the TBA Firefly™ Intubatt. The insulation to be clad with a 440g woven cloth (Phoenix RS)</p> <p><i>In Floor Constructions:</i>            Sealed full depth of batt with TBA Firefly™ Intumastic and protected with 25 mm thick TBA Firefly™ Insulated Penowrap® for up to 500 mm on each side or up to 1000 mm on topside of TBA Firefly™ Intubatt and butted up to the face of the TBA Firefly™ Intubatt. The insulation to be clad with a 440g woven cloth (Phoenix RS)</p>
24.	Name	<b>Intuspan</b>
	Specification	Layers of graphite-based intumescent and combustion-modified foam.
	Size	200 mm wide x 114 mm high (uncompressed) x 100 mm deep Intuspan used to fill aperture 200 mm wide x 100 high.
25.	Name	<b>Copper Pipe</b>
	Size	22 mm maximum diameter
	Specification	Wrapped with Paroc Wrap-40 mm foil-clad mineral fibre wrapping, butted up to face of the batts and sealed with TBA Firefly™ Intumastic or Wrapped with 30 mm thick foil faced PIR wrapping. Protected with TBA Firefly™ Intumastic HP 25 mm wide x 25 mm thick on both faces backed with TBA Firefly™ mineral fibre (64kg/m3) 50 mm wide x 25 mm thick.
	Installation	Through two TBA Firefly™ Intubatt panels separated by 120 mm or Through two TBA Firefly™ Intubatt panels friction fitted to aperture
26.	Name	<b>Vertical Support Element</b>
	Specification	As determined by Table 3 of TBA Firefly™ Intubatt Seal Report FAS190234 RIR
27.	Name	<b>Small Electrical Cables</b>
	Specification	One (1) 17 mm outside diameter 4 core armoured power cable

No.	Description	
		Four (4) 8 mm outside diameter 3 core power flex and one (1) 8 mm outside diameter earth cable tied in a bundle  One (1) 9 mm outside diameter neutral cable, one (1) 4 mm outside diameter neutral cable and one (1) 4 mm outside diameter earth cable  Twelve (12) 3.5 mm outside diameter data cables tied in a bundle
28.	Name	<b>Horizontal Support Element</b>
	Specification	As determined by Table 4 of TBA Firefly™ Intubatt Seal Report FAS190234 RIR
29.	Name	<b>u PVC Pipe</b>
	Specification	32 mm OD with a wall thickness of 2.4 mm used as an electrical conduit AS/NZS 2053.
30.	Name	<b>Small Electrical Cables</b>
	Specification	"Medium" configuration for small cable penetration seals as described in EN1366.3-2009
	Installation	Supported at 150 mm and 450 mm from the support construction
31.	Name	<b>RG6 Coaxial Cable</b>
	Description	Q 75 OHM Coaxial cable (Omega)
	Specification	7.3 mm OD
32.	Name	<b>CAT 5e Data Cable</b>
	Description	Actassi CAT5e UTP cable 204P5IPV (Clipsal )
	Size	5 mm OD
33.	Name	<b>CAT 6 Data Cable</b>
	Description	4 Pair UTP PVC communication cableCAT6 cable ( Ezydata )
	Specification	5.4 mm OD
34.	Name	<b>Framed Floor System</b>
	Specification	Steel or timber framed floor system lined with sufficient plasterboard to achieve the FRL required for the particular application.
	Installation	The plasterboard shall be directly fixed to structural framing so that the bulkhead fixings can be attached to structure.
35.	Name	<b>Corner Flashing</b>
	Specification	75 mm x 75 mm x 0.75 mm galvanised mild steel angle
	Installation	Fixed over batt corner joint to angle framing behind at 200 mm centres. Refer to item 5.
36.	Name	<b>Batt screw fixing</b>
	Specification	Minimum 75 mm x 8g plasterboard scree with a minimum of 25 mm penny washer fitted to head.
	Installation	Fixing batt to angle framing, refer to item 5.
37.	Name	<b>Heliax Coaxial Cable</b>
	Specification	Foam Dielectric ¼" up to 7/8" (Maximum Cable OD 28.2 mm)
38.	Name	Left blank for future use.
	Specification	
	Installation	
39.	Name	<b>Electrical Cables</b>

No.	Description						
	<b>Specification</b>	Two cable type G (from standard cable configuration in BSEN1366-3:2009) and a three core 'twin and earth' cable, combined diameter nominally 8.5 mm. The cables are fitted through a Ø50 mm × 2 mm wall thickness PVC pipe section, flush to both faces of the floor slab.					
	<b>Installation</b>	30 mm thick TBA Firefly™ Intumastic HP applied flush to the exposed face up to 30 mm thick Earthwool mineral fibre backing in the void between the cables and pipe section. Drawings refer to referenced test report,					
40.	<b>Name</b>	<b>Electrical Cables</b>					
	<b>Specification</b>	Six three-core 'twin and earth' cables, each with a combined diameter nominally 8.5 mm. The cables are fitted through a Ø50 mm × 2 mm wall thickness PVC pipe section, flush to both faces of the floor slab.					
	<b>Installation</b>	30 mm thick TBA Firefly™ Intumastic HP is applied flush to the exposed face up to 30 mm thick Earthwool mineral fibre backing in the void between the cables and pipe section. Drawings refer to referenced test report.					
41.	<b>Name</b>	Left blank for future use.					
	<b>Specification</b>						
	<b>Installation</b>						
42.	<b>Name</b>	<b>Bullock Fire Dampers</b>					
	<b>Size</b>	<table border="1"> <thead> <tr> <th>Model</th> <th>Max. Size (m)</th> <th>Max. Gap (mm)</th> </tr> </thead> <tbody> <tr> <td>4900</td> <td>2.4 × 2.4</td> <td>25 mm</td> </tr> </tbody> </table>	Model	Max. Size (m)	Max. Gap (mm)	4900	2.4 × 2.4
Model	Max. Size (m)	Max. Gap (mm)					
4900	2.4 × 2.4	25 mm					
	It is required that the damper be otherwise tested in accordance with AS 1530.4 and achieve an integrity performance of -/120/- at the given size.						
<b>Installation</b>	Damper installed in the TBA Firefly™ Intubatt with nominal gap sizes along all edges.						
43.	<b>Name</b>	<b>Flange Angle</b>					
	<b>Size</b>	25 mm × 25 mm galvanised steel angles for up to 800 mm wide × 400 mm dampers					
	<b>Installation</b>	Angles (both sides of wall) bolted to the damper body on each side of the perimeter. A bead of TBA Firefly™ Intumastic applied to the TBA Firefly™ Intubatt surface prior to the angle installation.					
44.	<b>Name</b>	<b>Metal Expansion Seal</b>					
	<b>Size</b>	12 mm seal size for up to 800 mm × 400 mm dampers					
	<b>Installation</b>	The expansion seals installed along top, bottom and vertical edges of the damper between TBA Firefly™ Intubatt seal and damper body.					
45.	<b>Name</b>	<b>Ezystrut</b>					
	<b>Size</b>	41 mm × 41 mm					
	<b>Installation</b>	Mechanically fixed to the inside of the aperture by using 40 mm long M6 steel Z-fix.					
46.	<b>Name</b>	<b>Steel Strip</b>					
	<b>Size</b>	0.5 mm thick × 50 mm × 50 mm					
	<b>Installation</b>	Sandwiched and Installed between the two layers of 50 mm thick TBA Firefly™ Intubatt.					
47.	<b>Name</b>	<b>TBA Firefly™ FRF Fire Collar</b>					
	<b>Product</b>	TBA Firefly™ FRF collar					

No.	Description		
	Product	Dimensions	Fixing
	FRF 40	Nominal size: 50 mm H x 45 mm ID x 70 mm OD with 3 layers of 3 mm thick graphite strips and 3 fixing lugs. Orange painted outer mild steel shell with QR Code, Identifier label.	The collar to be fixed to fitted around the pipe on the exposed side and fixed through the TBA Firefly™ Intubatt into the steel strips (item 46) with 8g x 75 mm long screws or directly to the TBA Firefly™ Intubatt with 90 mm long Pigtail screws.
	FRF 50	Nominal size: 50 mm H x 65 mm ID x 85 mm OD with 3 layers of 3 mm thick graphite strips and 3 fixing lugs. Orange painted outer mild steel shell with QR Code, Identifier label.	
	FRF 65	Nominal size: 50 mm H x 75 mm ID x 105 mm OD with 4 layers of 3 mm thick graphite strips and 3 fixing lugs. Orange painted outer mild steel shell with QR Code, Identifier label.	
	FRF 80	Nominal size: 55 mm H x 95 mm ID x 120 mm OD with 4 layers of 3 mm thick graphite strips and 3 fixing lugs. Orange painted outer mild steel shell with QR Code, Identifier label.	
	FRF 100	Nominal size: 60 mm H x 115 mm ID x 150 mm OD with 5 layers of 3 mm thick graphite strips and 4 fixing lugs. Orange painted outer mild steel shell with QR Code, Identifier label.	
	FRF 150	Nominal size: 60 mm H x 165 mm ID x 200 mm OD with 6 layers of 3 mm thick graphite strips and 6 fixing lugs. Orange painted outer mild steel shell with QR Code, Identifier label.	
	FRF 160	NA	

No.	Description					
48.	Name	Plastic Pipe				
	Size	Pipe Material	Nominal Diameter (mm)	Nominal Pipe Wall Thickness (mm)		
48.		PVC	40	1.8-2.17		
			50	2.2-2.33		
			65	3.17		
			80	3.05		
			100	3.5-3.6		
			150	4.11		
48.		HDPE	40	3.98		
			50	2.33		
			56	3.3		
			65	3.17		
			80	3.05		
			110	4.58		
			160	6.2		
			Installation			
49.	Name	<b>Pattress Fitted Batt Fixing</b>				
	Product	Minimum 8g × 75 mm screws				
	Installation	Used to fix the overlapped TBA Firefly™ Intubatt to surrounding floor constructions on all edges at max. 300 mm centres with minimum 20 mm embedment of fixing. Pattress fixed using just screws "or masonry anchors" to floor				
50.	Name	<b>Steel Cable Tray</b>				
	Installation	Used to support the boxout bulkhead TBA Firefly™ Intubatt				
51.	Name	<b>Plasterboard Strip Protection</b>				
	Product	Min. 100 mm wide × 16 mm thick fire grade plasterboard strip				
	Installation	The plasterboard strip shall be fixed to Speedpanel and TBA Firefly™ Intubatt by using 6g × 40 mm Bugle head, Fine Thread, Self-drilling screws in two rows and staggered at 200 mm centres.				
52.	Name	<b>Primary Steel Beam</b>				
	Specification	Spray protected steel beam as a barrier that maintained an FRL of 120/120/120				
	Installation	Used to support the linear gap seal of single layer of 50 mm thick TBA Firefly™ Intubatt				
53.	Name	<b>Secondary Steel Beam</b>				
	Specification	Spray protected to maintain an FRL of 120/120/120 as it passes through the wall				
	Installation	Installed between primary steel beam and concrete floor at maximum 4000 mm centres through the wall.				
54.	Name	<b>Spray Protection</b>				
	Installation	Sprayed all over the beams and the connection between beams and TBA Firefly™ Intubatt.				

No.	Description						
55.	Name	Electrobar H-Series Busway					
	Size	Ampere Rating	Busbar/Phase ( mm)	H ( mm)	Weight (kg/m)	Order Code	
		800	ONE- 6.3 × 55	120	28	HFC800	
		1000	ONE- 6.3 × 63	128	30	HFC1000	
		1250	ONE- 6.3 × 80	145	34	HFC1250	
		1600	ONE- 6.3 × 125	190	46	HFC1600	
		2000	ONE- 6.3 × 180	245	61	HFC2000	
		2500	ONE- 6.3 × 200	265	66	HFC2500	
		3150	TWO- 6.3 × 140	367	89	HFC3150	
		3200	TWO- 6.3 × 140	360	73	HFC3200	
		3600	TWO- 6.3 × 140	360	73	HFC3600	
		3780	TWO- 6.3 × 140	360	73	HFC3780	
		4000	TWO- 6.3 × 180	447	109	HFC4000	
		5600	THREE- 6.3 × 160	589	132	HFC5600	
		7000	THREE- 6.3 × 200	709	162	HFC7000	
	Installation	Busway is supported at each level.					
56.		Left blank for future use					
57.	Name	Saint-Gobain Cobraflex 35 Pipes with Nitrile Rubber Lagging as per EWFA 31139300.1 Spec 17 (otherwise known as Beer Python)					
	Material	16-off Ø8 mm (OD) x 1.5 mm thick Saint-Gobain Cobraflex pipes continuously wrapped with 25 mm thick Nitrile Rubber Insulation.					
	Installation	TBA Firefly™ FRF 100 Fire collars are installed each side of the TBA Firefly™ Intubatt seal and fixed to the TBA Firefly™ Intubatt with 4 x 90 mm long Pigtail Screws. TBA Firefly™ Intumastic sealant is applied at the collar-wall interface and fillet finished (5-10 mm) on each side of TBA Firefly™ Intubatt seal.					
58.	Name	Cable and Copper Pipe Bundle as per EWFA 31139300.1 Spec 20					
	Material	Copper Pipe: Ø12.6 mm (OD) x 1.63 mm copper pipe continuously wrapped with 12.5 mm thick Nitrile Rubber insulation. Red fire alarm cables: 2 Fire Alarm signal wire (1.5 mm <sup>2</sup> Straight Twin Flat Olex CACP05A1002WVAB2C) Communication cables: Cat6 Cable					
	Installation	TBA Firefly™ FRF 40 Fire collars are installed each side of TBA Firefly™ Intubatt seal and to one-another through the wall with hex bolts and nuts. TBA Firefly™ Intumastic sealant is applied at collar-wall interface and fillet finished (5-10 mm) on each side of TBA Firefly™ Intubatt seal.					
59.	Name	Insulated Twin Air-con Copper pipe bundle					
	Material	Ø9.44 mm (OD) x 1.24 mm copper pipe continuously wrapped with 10 mm thick Nitrile Rubber Insulation.					

No.	Description	
		Ø6.45 mm (OD) x 1.14 mm copper pipe continuously wrapped with 12.2 mm thick Nitrile Rubber Insulation.
	<b>Installation</b>	TBA Firefly™ FRF 50 Fire collars are installed each side of the TBA Firefly™ Intubatt seal and fixed to seal with 3-off plasterboard screws. Firefly™ Intumastic sealant is applied at the interface of service and wall aperture and fillet finished (5-10 mm) and sealant is also applied at collar-wall interface and fillet finished (5-10 mm) on each side of TBA Firefly™ Intubatt seal.
60.	<b>Name</b>	<b>Vass Busway Insulation Protection</b>
	<b>Material</b>	25 mm thick TBA Firefly™ Insulated Penowrap® or 12 mm thick TBA Firefly™ Penowrap®
	<b>Installation</b>	Butted up to the face of the TBA Firefly™ Intubatt each side and glued to the seal using TBA Firefly™ Brush Grade Intumastic
61.	<b>Name</b>	Left blank for future use
	<b>Specification</b>	
	<b>Installation</b>	
62.	<b>Name</b>	<b>8 mm to 200 mm Copper and Steel Pipe</b>
	<b>Specification</b>	Outer Diameter (OD) 8 mm to 200 mm
	<b>Installation</b>	As per 31846500.1 specimen A and B through TBA Firefly™ Intubatt seals in walls and floors
63.	<b>Name</b>	<b>Foil Faced Basalt Rock Fibre Lagging</b>
	<b>Specification</b>	Outside Diameter (OD) 300 mm x 50 mm thick 3.96kg/m
	<b>Installation</b>	The pipe insulation wrapped around the pipe in full length and the opening closed with Aluminium metal tape.
64.	<b>Name</b>	<b>TBA Firefly™ Intustrap</b>
	<b>Specification</b>	62.6 mm wide x 4.48 mm thick 1300kg/m3
	<b>Installation</b>	3-off layers of TBA Firefly™ Intustrap wrapped around the pipe over Fibertex lagging and held in place with electrical tape. Two wraps of Intustrap used side-by-side. The interface between the Intustrap and the TBA Firefly™ Intubatt sealed with TBA Firefly™ Intumastic.
65.	<b>Name</b>	Fibre optic cables
	<b>Specification</b>	FIBRE 2F OM1 62.5/125 4.3mm LSZH IOR MSS-CAB-IOR-02-MM (MSS )
66.	<b>Name</b>	<b>Electrical Cables</b>
	<b>Specification</b>	One 10 mm wide x 5 mm thick Twin and Earth Cable One Ø8 mm Firefix FP200 Gold cable Six 13 mm wide x 5 mm thick Twin and Earth cable Three Ø8 mm Firefix FP200 cable One Ø7 mm AV co-axial cable Twelve 13 mm wide x 5 mm thick Twin and Earth cable
	<b>Installation</b>	In 2 layers of 50 mm TBA Firefly™ Intubatt. TBA Firefly™ Intumastic sealant 60 mm x 60 mm cone on both faces and through aperture
67.	<b>Name</b>	<b>Electrical Cables</b>
	<b>Specification</b>	One Ø21 mm non-sheathed cable (BSEN 1366-3:2009 specification cable type G2),
	<b>Installation</b>	In 2 layers of 50 mm TBA Firefly™ Intubatt. TBA Firefly™ Intumastic sealant 70 mm x 70 mm cone on both faces and through aperture

No.	Description	
68.	Name	Z-Purlin
	Specification	100 mm up to 270 mm × 1.6 mm to 2.4 mm BMT
	Installation	The penetrating element shall be vertically supported within the wall by a column or beam arrangement or vertically supported by a column or beam arrangement adjacent to the wall on each side. TBA Firefly™ Intumastic Brush Grade is applied between purlin and wall linings.
69.	Name	<b>TBA Firefly™ Intubatt Build-up</b>
	Specification	Layers of 50 mm TBA Firefly™ Intubatt to give total depth of 300 mm, fixed together with pigtail screws. Cut to size to be close fitting to pipe and give minimum 100 mm thick coverage over pipe. Cut edges and junctions at perimeter of pipe sealed with TBA Firefly™ Intumastic sealant.
	Installation	Fixed to underside of TBA Firefly™ Intubatt seal with Ø5 mm threaded rod and 50 mm washers on exposed and unexposed sides.
70.	Name	<b>Lorient LVH 44 or Kilargo damper</b>
	Size	Up to 450 mm × 450 mm
	Installation	Lorient LVH44 Intumescent fire damper installed in TBA Firefly™ Intubatt® as per below: <ul style="list-style-type: none"> <li>Up to 200 mm × 200 mm damper friction fitted and glued into the aperture using TBA Firefly™ Intumastic</li> <li>Up to 450 mm × 450 mm damper mechanically secured into the aperture: <ul style="list-style-type: none"> <li>Predrill the centre of the damper with a 5 mm drill bit 50 mm from each corner.</li> <li>Secure with 75 mm long TBA Firefly™ Pigtail Screws.</li> <li>8 × fixings per damper</li> <li>Seals the gaps with TBA Firefly™ Intumastic</li> </ul> </li> </ul>
71.	Name	<b>Threaded Rod or Steel Pipe</b>
	Specification	12 mm diameter
	Installation	Fixed to timber joist with angle bracket. Through 2 layers of horizontal TBA Firefly™ Intubatt. TBA Firefly™ Intumastic applied to full depth of batt.
72.	Name	<b>Z-Purlin Insulation Protection</b>
	Specification	25 mm thick TBA Firefly™ Insulated Penowrap®
	Installation	Wrapped around the penetrating service and butted up to the TBA Firefly™ Intubatt extending 500 mm on both sides.
73.	Name	<b>8 mm to 210 mm Copper and Steel Pipe</b>
	Specification	Outer Diameter (OD) 8 mm to 210 mm × 1.85 mm thick pipe
	Installation	Installed in the aperture and sealed with TBA Firefly™ Sealant between the TBA Firefly™ Intubatt and the pipe service to the full depth of the TBA Firefly™ Intubatt with a minimum thickness of approx.1 mm. 38 mm thick Bradford Fibretex 450 Rockwool wrapped around metal pipes for a length of 1200 mm on topside of TBA Firefly™ Intubatt barrier and tied with 8 steel pipe clamps. Additional 50 mm × 50 mm TBA Firefly™ Intumastic sealant fillet applied around penetration on one side of the seal.
74.	Name	<b>TBA Firefly™ Intumastic HP.</b>
	Specification	High pressure exerting intumescent sealant.
	Installation	Applied into the annular gap between TBA Firefly™ Intubatt and service penetration, see specific requirements within Table 1 to Table 8.

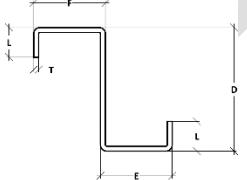
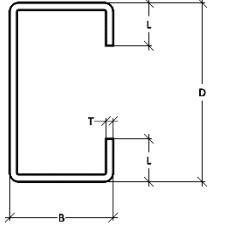
No.	Description	
		A 20 mm fillet of TBA Firefly™ Intumastic HP sealant is adhered at the junction of the TBA Firefly™ Intubatt and the web of the ABB IP55 Aluminium encased sandwich Busduct. Prior to the 3 layers of TBA Firefly™ Penowrap® being packed into the web.
75.	Name	<b>Masonry Screws or Anchors</b>
	Specification	M5 x 75 mm long
	Installation	Fixed at max 100 mm apart and 50 mm in from either end
76.	Name	<b>Clamping angle</b>
	Specification	Galvanised Steel Angle minimum 25 mm x 25 mm x 0.7 mm thick
	Installation	Used to clamp the TBA Firefly™ Penowrap® around the substrate when a 3 sided application is required. Mechanical fixings to be spaced at 100 mm apart for the full length of Penowrap® and 50 mm from either end.
77.	Name	<b>Fixing Screws</b>
	Specification	32 mm x 6g steel drywall screws
	Installation	Fixed at max 100 mm apart and 50 mm in from either end
78.	Name	<b>Fixing Screws self-tapping</b>
	Specification	32 mm x 6g steel
	Installation	Fixed at max 100 mm apart and 50 mm in from either end
79.	Name	<b>ABB IP-55 Aluminium encased Sandwich Type Busduct- Aluminium conductor</b>
	Specification	Conductor: Aluminium Conductor insulation: Halogen free polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt
80.	Name	<b>ABB IP-55 Aluminium encased Sandwich Type Busduct- Copper conductor</b>
	Specification	Conductor: Copper Conductor insulation: Halogen free polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt.
81.	Name	<b>ABB IP-68 Cast Resin Type Busduct – Aluminium conductor</b>
	Specification	Conductor: Aluminium Insulation: Cast Resin
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt
82.	Name	<b>ABB IP-68 Cast Resin Type Busduct – Copper conductor</b>
	Specification	Conductor: Copper Insulation: Cast Resin
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt
83.	Name	<b>3 x 27 mm OD PVC conduits within a single 70 mm core hole, in 2 layers of TBA Firefly™ Intubatt</b>
	Specification	Each conduit filled with up to 10 x Cat 6 Cables, 14 x Cat 5e cables and 7 x RG6 Coaxial Cables.
	Installation	TBA Firefly™ Intumastic HP sealant (item 74) in the annular gap (min 10 mm max 30 mm) to full depth of TBA Firefly™ Intubatt

No.	Description	
84.	Name	<b>EAE IP-55 Aluminium encased Sandwich Type Busduct- Aluminium conductor</b>
	Specification	Conductor: Aluminium Conductor insulation: Halogen free polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt
85.	Name	<b>EAE IP-55 Aluminium encased Sandwich Type Busduct- Copper conductor</b>
	Specification	Conductor: Aluminium Conductor insulation: Halogen free polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt
86.	Name	<b>EAE IP-55 Aluminium encased Sandwich Type Busduct- Aluminium conductor (Promatect® 200 fully enclosed busbars (1 Layer of 25 mm to all four sides))</b>
	Specification	Conductor: Aluminium Conductor insulation: Halogen free polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt
87.	Name	<b>EAE IP-55 Aluminium encased Sandwich Type Busduct- Copper conductor (Promatect® 200 fully enclosed busbars (1 Layer of 25 mm to all four sides))</b>
	Specification	Conductor: Aluminium Conductor insulation: Halogen free polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 layers of TBA Firefly™ Intubatt
88.	Name	<b>90 mm long TBA Firefly™ Pigtail Screws</b>
	Specification	Used to fix the TBA Firefly™ FRF Fire Collars directly to the TBA Firefly™ Intubatt Seals. Both sides of the seal require a Fire Collar
	Installation	Screwed directly into the 2 layers of TBA Firefly™ Intubatt
89.	Name	<b>IPD Powerduct Aluminium encased Sandwich Type Busduct-Copper Conductors</b>
	Specification	Conductor: Copper Conductor Insulation: Halogen Free Polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 or 3 layers of TBA Firefly™ Intubatt
90.	Name	<b>IPD Powerduct Aluminium encased Sandwich Type Busduct-Aluminium Conductors</b>
	Specification	Conductor: Aluminium Conductor Insulation: Halogen Free Polyester Enclosure: Aluminium alloy
	Installation	Penetrating through 2 or 3 layers of TBA Firefly™ Intubatt®
91.	Name	<b>VASS HFA Series – Steel Encased Sandwich Busway with Aluminium Conductors</b>
	Specification	Conductor: Aluminium Conductor Insulation: Halogen Free Polyester Enclosure: Steel
	Installation	Penetrating through 2 or 3 layers of TBA Firefly™ Intubatt®
92.	Item name	<b>Microduct 1 x 10/8 + 24 x 5/3.5 ID</b>

No.	Description	
93.	Product name	24 × 5/3.5 mm Hexatronic A35 20043018 MPB30207/24
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	31 mm OD × 1.1 mm WT
	Number of conduits & dimensions	1 × (10 mm OD × 1 mm WT) 24 × (5 mm OD × 0.75 mm WT)
	Material	Halogen Free Low Smoke Polymer
93.	Item name	<b>Microduct 1 × 12/10 ID Standard Grade</b>
	Product name	1 × 12/10 mm Hexatronic A35 20110922 MPB30273/1
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	13.1 mm OD 1.8 mm (overall thickness) 1 mm (inner thickness) 0.8 mm (outer thickness)
	Material	Halogen Free Low Smoke Polymer
	Item name	<b>Microduct 19 × 5/3.5 ID</b>
94.	Product name	19 × 5/3.5 mm Hexatronic A35 19082018 MPB30206/19
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	26.6 mm OD × 1.2 mm WT
	Number of conduits & dimensions	19 × (5 mm OD × 0.75 mm WT)
	Material	Halogen Free Low Smoke Polymer
	Item name	<b>Microduct 12 × 5/3.5 ID Hi-grade</b>
95.	Product name	12 × 5/3.5 mm Hexatronic A35 20131913 MPB30205/12
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	Rectangular 22.3 mm × 21.2 × 1.4 mm WT
	Number of conduits & dimensions	12 (5 mm OD × 0.75 WT)
	Material	Halogen Free Low Smoke Polymer
	Item name	<b>Microduct 7 × 5/3.5 ID Hi grade</b>
96.	Product name	7 × 5/3.5 mm Hexatronic A35 21050715 MPB30204/7
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	Rectangular 16.7 mm × 17.1 mm × 1 mm WT
	Number of conduits & dimensions	7 (5 mm OD × 0.75 mm WT)
	Material	Halogen Free Low Smoke Polymer
	Item name	<b>Microduct 4 × 5/3.5 ID Hi grade</b>
97.	Product name	4 × 5/3.5 mm Hexatronic A35 20111801 MPB30273/4

No.	Description	
98.	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	Rectangular 13.4 mm × 13.7 mm × 1.3 mm WT
	Number of conduits & dimensions	4 (5 mm OD × 0.75 mm WT)
	Material	Halogen Free Low Smoke Polymer
98.	Item name	<b>Microduct 4 × 12/10 ID Hi Grade</b>
	Product name	4 × 12/10 mm Hexatronic D18 171207 MPB302734
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	Rectangular 36.5 mm × 36.1 mm × 1.2 mm WT
	Number of conduits & dimensions	4 (12 mm OD × 1 mm WT)
	Material	Halogen Free Low Smoke Polymer
99.	Item name	<b>Microduct 1 × 5/3.5 ID</b>
	Product name	1 × 5/3.5 mm Hexatronic A35 21021710 MPB30201/1
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Sheath size	7.5 mm OD
		2 mm (overall thickness)
		0.55 mm (inner thickness)
		1.45 mm (outer thickness)
	Material	Halogen Free Low Smoke Polymer
100.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic 20032810 0.657A2 12F (1.38 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
101.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic ABF 4 G657A2 TIA598 KRPM258022 (1.02 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
102.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic ABF 2 G657A2 TIA598 KRPM258019 (1.1 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
103.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic ABF 12 G657A2 TIA598 KRPM258044 (1.65 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
104.	Item name	<b>Optical Fibre Cables</b>

No.	Description	
105.	Product name	Hexatronic ABF 6 G657A2 TIA598 KRPM258041 (1.25 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
106.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic ABF 12 MM 50 OM3 KRPM258023 (1.65 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
107.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic GPL 24/T24 G657A1 TOL4019070/24 (2.4 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
108.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic GAL-K-DHR 12/A12 G657A1 TIA598 TOL4019050/12C (2.1 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
109.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic GNHL 96/T12 G657A1 200 um S12 TOL4019038/96AH (5.1 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
110.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic GNHL 288/T12 G657A1 200 um S12 TOL4019038/288AH (7.95 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
111.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic GNHL 288/T12 G657A1 200 um TIA598 TOL4019038/288C (7.95 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
112.	Item name	<b>Optical Fibre Cables</b>
	Product name	Hexatronic GNHLDV 96 G652D (8 x 12f) TOL4019017/96A (6.7 mm OD)
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>
	Material	Halogen Free Low Smoke Fibre
113.	Item name	<b>Optical Fibre Cables</b>

No.	Description																																																																																																																												
114.	Product name	Hexatronic Micro Hybrid 12 G657A1 + 4 × 0.75 mm <sup>2</sup> Cu, CPR Dca, Green TOL4079030/12 (8.3 mm OD)																																																																																																																											
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>																																																																																																																											
	Material	Halogen Free Low Smoke Fibre																																																																																																																											
115.	Item name	<b>Optical Fibre Cables</b>																																																																																																																											
	Product name	Hexatronic Micro Hybrid 24 G657A1 + 4 × 1.5 mm <sup>2</sup> Cu, CPR Dca, TOL4079031/24 (9 mm OD)																																																																																																																											
	Supplier	<b>Innovate Connect Solutions PTY LTD – in collaboration with HEXATRONIC</b>																																																																																																																											
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116.	Item name	<b>Optical Fibre Cables</b>																																																																																																																											
	Product name	Hexatronic Micro Hybrid 12 G657A1 + 4×0.75 mm <sup>2</sup> Cu TOL4079028/12 (5.7 mm OD)																																																																																																																											
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117.	Item name	<b>Optical Fibre Cables</b>																																																																																																																											
	Product name	Hexatronic Micro Hybrid 24 G657A1 + 4×1.5 mm <sup>2</sup> Cu TOL4079029/24 (6.7 mm OD)																																																																																																																											
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118.	Item name	<b>Optical Fibre Cables</b>																																																																																																																											
	Product name	Hexatronic Micro Hybrid 24 G657A1 + 8×1.5 mm <sup>2</sup> TOL4079034/24 (9 mm OD)																																																																																																																											
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119.	Item name	Steel C & Z purlin																																																																																																																											
	Specification	Size and Mass Table																																																																																																																											
 		<table border="1"> <thead> <tr> <th>Section</th> <th>Thickness (T) (mm)</th> <th>Height (D) mm</th> <th colspan="2">Z purlin</th> <th colspan="3">C purlin</th> <th>Mass (kg/m)</th> </tr> <tr> <th></th> <th></th> <th></th> <th>E (mm)</th> <th>F (mm)</th> <th>L (mm)</th> <th>B (mm)</th> <th>L (mm)</th> </tr> </thead> <tbody> <tr> <td>100 10</td> <td>1.0</td> <td>102</td> <td>53</td> <td>49</td> <td>12.5</td> <td>51</td> <td>12.5</td> <td>1.74</td> </tr> <tr> <td>100 12</td> <td>1.2</td> <td>102</td> <td>53</td> <td>49</td> <td>13.0</td> <td>51</td> <td>12.5</td> <td>2.07</td> </tr> <tr> <td>100 15</td> <td>1.5</td> <td>102</td> <td>53</td> <td>49</td> <td>13.5</td> <td>51</td> <td>13.5</td> <td>2.57</td> </tr> <tr> <td>100 19</td> <td>1.9</td> <td>102</td> <td>53</td> <td>48</td> <td>14.5</td> <td>51</td> <td>14.5</td> <td>3.25</td> </tr> <tr> <td>150 12</td> <td>1.2</td> <td>152</td> <td>65</td> <td>61</td> <td>15.5</td> <td>64</td> <td>14.5</td> <td>2.82</td> </tr> <tr> <td>150 15</td> <td>1.5</td> <td>152</td> <td>65</td> <td>61</td> <td>16.5</td> <td>64</td> <td>15.5</td> <td>3.53</td> </tr> <tr> <td>150 19</td> <td>1.9</td> <td>152</td> <td>65</td> <td>61</td> <td>17.5</td> <td>64</td> <td>16.5</td> <td>4.46</td> </tr> <tr> <td>150 24</td> <td>2.4</td> <td>152</td> <td>66</td> <td>60</td> <td>19.5</td> <td>64</td> <td>18.5</td> <td>5.62</td> </tr> <tr> <td>200 15</td> <td>1.5</td> <td>203</td> <td>79</td> <td>74</td> <td>18.0</td> <td>76</td> <td>15.5</td> <td>4.44</td> </tr> <tr> <td>200 19</td> <td>1.9</td> <td>203</td> <td>79</td> <td>74</td> <td>18.5</td> <td>76</td> <td>19.0</td> <td>5.68</td> </tr> <tr> <td>200 24</td> <td>2.4</td> <td>203</td> <td>79</td> <td>73</td> <td>21.5</td> <td>76</td> <td>21.0</td> <td>7.15</td> </tr> </tbody> </table>								Section	Thickness (T) (mm)	Height (D) mm	Z purlin		C purlin			Mass (kg/m)				E (mm)	F (mm)	L (mm)	B (mm)	L (mm)	100 10	1.0	102	53	49	12.5	51	12.5	1.74	100 12	1.2	102	53	49	13.0	51	12.5	2.07	100 15	1.5	102	53	49	13.5	51	13.5	2.57	100 19	1.9	102	53	48	14.5	51	14.5	3.25	150 12	1.2	152	65	61	15.5	64	14.5	2.82	150 15	1.5	152	65	61	16.5	64	15.5	3.53	150 19	1.9	152	65	61	17.5	64	16.5	4.46	150 24	2.4	152	66	60	19.5	64	18.5	5.62	200 15	1.5	203	79	74	18.0	76	15.5	4.44	200 19	1.9	203	79	74	18.5	76	19.0	5.68	200 24	2.4	203	79	73	21.5	76	21.0	7.15
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120.	Item name	Universal Steel Beam	250 19	1.9	254	79	74	18.0	76	18.5	6.43																																																																																																																																																																	
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		300 24	2.4	300	100	93	27.0	96	27.5	10.01																																																																																																																																																																		
		300 30	3.0	300	100	93	31.0	96	31.5	12.60																																																																																																																																																																		
		350 24	2.4	350	129	121	30.0	125	30.0	12.13																																																																																																																																																																		
		350 30	3.0	350	129	121	30.0	125	30.0	15.09																																																																																																																																																																		
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121.	Name	Threaded Rods																																																																																																																																																																										
	Specification	Up to 42 mm diameter																																																																																																																																																																										
	Material	Gr4.6 Mild-Steel Galvanised Metric Coarse																																																																																																																																																																										
	Installation	Installed through two layers of horizontal TBA Firefly™ Intubatt. Core hole size drilled through both layers of TBA Firefly™ Intubatt as per the diameter of the threaded rod and then friction fit the threaded rod through the core hole.																																																																																																																																																																										

No.	Description	
122.	Name	Optical fibre cables
	Specification	(MSS Fibre 2F OM1 62.5/125 4.3MM LSZH IOR MSS-CAB-IOR-02-MM E1508 0023 06/21 1515M) Material: Plastic Outer diameter: Ø4.5 mm
123.	Name	Vesda Microduct
	Specification	Product name: DriscoPlex 2600 INSTUBE 4 3652 R12275 XTRALIS ASPIRATED SMOKE Detector Sampling tube for fire detection system Manufacturer: Vesda Material: Polyethylene Outer diameter: 4 mm Wall thickness: 0.8 mm
124.	Name	1,2 or 3 × Ø 20 mm OD clear round plastic military conduits with any of: (1) [empty], (2) 1 × Cat5, 1 × Cat6, 1 × RG6, (3) 7 × Optic fibre cables
	Specification	Item: Ø20 mm transparent rigid uPVC conduit (Aussie Duct, code CR20MDCL) with :  Item: CAT5e cable Actassi CAT5e UTP cable 204P5IPV (Clipsal) Outer Diameter : 4.7 mm Item : CAT6 4 Pair UTP PVC communication cableCAT6 cable ( Ezydata ) Outer diameter: 5.4 mm Item: RG 60-Q 75 OHM Coaxial cable (Omega) Outer diameter: 7.3 mm Item : FIBRE 2F OM1 62.5/125 4.3mm LSZH IOR MSS-CAB-IOR-02-MM ( MSS ) Outer diameter : 4.3 mm
125.	Name	1,2 or 3 × Ø 32 mm OD clear round plastic military conduits with any of the following in each conduit: (1) [empty], (2) 1 × Cat5, 1 × Cat6, 1 × RG6, (3) 7 × Optic fibre cables
	Specification	Item: Ø32 mm transparent rigid uPVC conduit (Aussie Duct, code CR32MDCL) with :  Item: CAT5e cable Actassi CAT5e UTP cable 204P5IPV (Clipsal) Outer Diameter : 4.7 mm Item: CAT6 4 Pair UTP PVC communication cableCAT6 cable ( Ezydata ) Outer diameter: 5.4 mm Item: RG 60-Q 75 OHM Coaxial cable (Omega ) Outer diameter: 7.3 mm Item: FIBRE 2F OM1 62.5/125 4.3mm LSZH IOR MSS-CAB-IOR-02-MM ( MSS ) Outer diameter: 4.3 mm
126.	Name	1 × Ø 50 mm OD (maximum) clear round plastic military conduits with: (1) [empty] or (2) 1 × Cat5, 1 × Cat6, 1 × RG6 or (3) up to 7 × Optic fibre cables or (4) any combination of the above

No.		Description
	Specification	Item: Ø50 mm transparent rigid uPVC conduit (Aussie Duct, code CR50MDCL) with :  Item: CAT5e cable Actassi CAT5e UTP cable 204P5IPV (Clipsal) Outer Diameter :4.7 mm Item: CAT6 4 Pair UTP PVC communication cableCAT6 cable ( Ezydata ) Outer diameter: 5.4 mm Item: RG 60-Q 75 OHM Coaxial cable (Omega ) Outer diameter: 7.3 mm Item: FIBRE 2F OM1 62.5/125 4.3mm LSZH IOR MSS-CAB-IOR-02-MM ( MSS ) Outer diameter: 4.3 mm
127.	Name	50 mm (maximum) uPVC Conduit, Maximum wall thickness 3.0 mm, filled with 2F 9/125 Fibre Optic Cables (4.5 mm OD)
	Specification	Item :50 mm uPVC conduit (Aussie Duct, BEP PVC UPVC Electrical AS/NZS 2053 50 mm MD – T 060)) Material: uPVC Outer diameter: 50.0 mm Wall thickness: 3.0 mm Item: Optical fibre cables (MSS Fibre 2F OM1 62.5/125 4.3MM LSZH IOR MSS-CAB-IOR-02-MM E1508 0023 06/21 1515M) Material: Plastic Outer diameter 4.5 mm
128.	Name	Up to 200 mm copper Pipe (type B) , Minimum Wall Thickness 3 mm with 75mm thick stone wool faced lagging (continuous)
	Specification	Item name: DN200 type B copper pipe with 75 mm thick foil faced mineral wool lagging. Product name: Kembla DN200 type B copper tube Material: Copper Outer diameter: 203.2 mm Wall thickness: 3.02 mm
129.	Name	Up to 350 mm Ø OD steel pipe with 75 mm rockwool lagging (continuous)
	Specification	Item: 350 NB ERW steel pipe Material: Black steel Outer diameter: 355.6 mm Wall thickness: 6.4 mm Item: Mineral wool lagging Outer Diameter: 505 mm, Including aluminium foil outer Wall thickness :75 mm Density :109 kg/m³
130.	Name	DN25 type B copper pipe (25 mm Copper)
	Specification	Item name: Kembla DN25 type B copper tube Material: Copper Outer diameter: 25.4 mm Wall thickness: 1.22 mm
131.	Name	Up to 50 mm copper pipe (Type B)
	Specification	Item name : DN50 type B copper pipe Product name: Kembla DN50 type B copper tube Material: Copper Outer diameter: 50.8 mm Wall thickness: 1.22 mm

No.	Description	
132.	Name	Up to 40 mm Ø OD Galvanised steel pipe, minimum wall thickness 3.4 mm
	Specification	Item name :40 mm galvanised steel pipe Manufacturer: MISO Material: Galvanised steel Outer diameter: 48.2 mm Wall thickness :3.4 mm
133.	Name	Up to 100 mm Ø OD Galvanised steel pipe, minimum wall thickness 4.5 mm
	Specification	Item name: 100 mm galvanised steel pipe Manufacturer: MISO Material: Galvanised steel Outer diameter: 114 mm Wall thickness: 4.5 mm
134.	Name	Up to 65 mm Galvanised steel pipe (min wall thickness 4.3 mm)
	Specification	NB 65 MD galvanised steel pipe (AS 1074 65NB Medium Length 6.50 MTR) Material: Galvanised steel pipe Outer diameter :75.9 mm Wall thickness: 3.8 mm
135.	Name	1 × 3/8 + 5/8 FR pair coil with 19 mm insulation + 2 × 6 mm <sup>2</sup> 3C+E cables + 1 × Ø 18 mm Condensate hose
	Specification	Manufacturer: Ardent Material: Copper pair coil with nitrile rubber insulation Outer diameter: 15.92 mm + 9.52 mm Wall thickness: 1.02 mm + 0.81 mm Insulation thickness: 19 mm  Manufacturer: Advance cables Product name: Advance Cables 2017 V90 Electric Cable 450/750 V 6 mm <sup>2</sup> 3C+E Outer diameter:13.7 mm  Manufacturer: Dura Flex Condensate Drain hose Material: PVC Outer diameter: 19.2 mm Wall Thickness: 1.1 mm
136.	Name	2 × 3/8 - 5/8 (15.8 mm copper pipe + 10 mm CLPE lagging and 9.6 mm copper pipe + 10 mm CLPE lagging)
	Specification	Item: 3/8 + 5/8 FR pair coil with 12.5 mm CLPE insulation Material: Copper pair coil with CLPE foam insulation Outer diameter 15.88 mm & 9.52 mm Wall thickness: 1.02 mm & 0.81 mm Insulation thickness :10 mm
137.	Name	40 mm uPVC Pipe, wall thickness up to 2.2 mm
	Specification	Manufacturer: Vinidex Product name: BEP PVC DWV 40 PVC-U SN 4 Material: uPVC Outer diameter :42.9 mm Wall thickness: 2.2 mm
138.	Name	40 mm uPVC Pressure Pipe PVC Class 12, wall thickness up to 2.7 mm

No.		Description
	Specification	Manufacturer: Pipemakers Product name: BEP S1 uPVC 40 PN12 pipe Material: uPVC Outer diameter: 48.3 mm Wall thickness: 2.7 mm
139.	Name	40 mm acoustic plastic pipe, wall thickness up to 2.5 mm.
	Specification	Item name: 40 mm Acoustic pipe Product name: Rehau Raupiano Plus -10°C BD DN 40 × 1.8 >PP-MD< DIN410Z-BZ,AS/NZS 7671 Manufacturer: Rehau Material: PP-MD Outer diameter:40 mm Wall thickness:2.5 mm
140.	Name	Ø 250 mm (nom.) steel sprinkler pipe, wall thickness, minimum 6 mm
	Specification	NB 250 MD galvanised steel pipe (AS 1074 250NB) Material: Galvanised steel pipe Outer diameter: 250mm Wall thickness: Nom. 6 mm

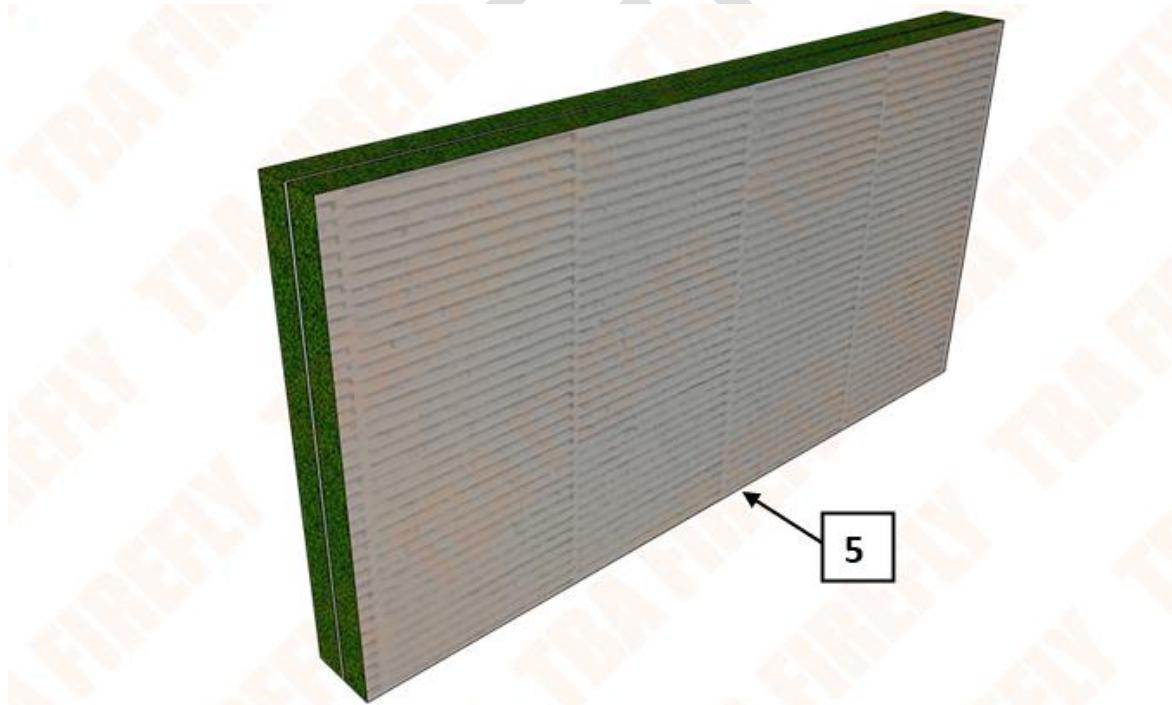


Figure 1a TBA Firefly™ Intubatt (Vertical orientation) 2 Layers of 50mm thick back to back

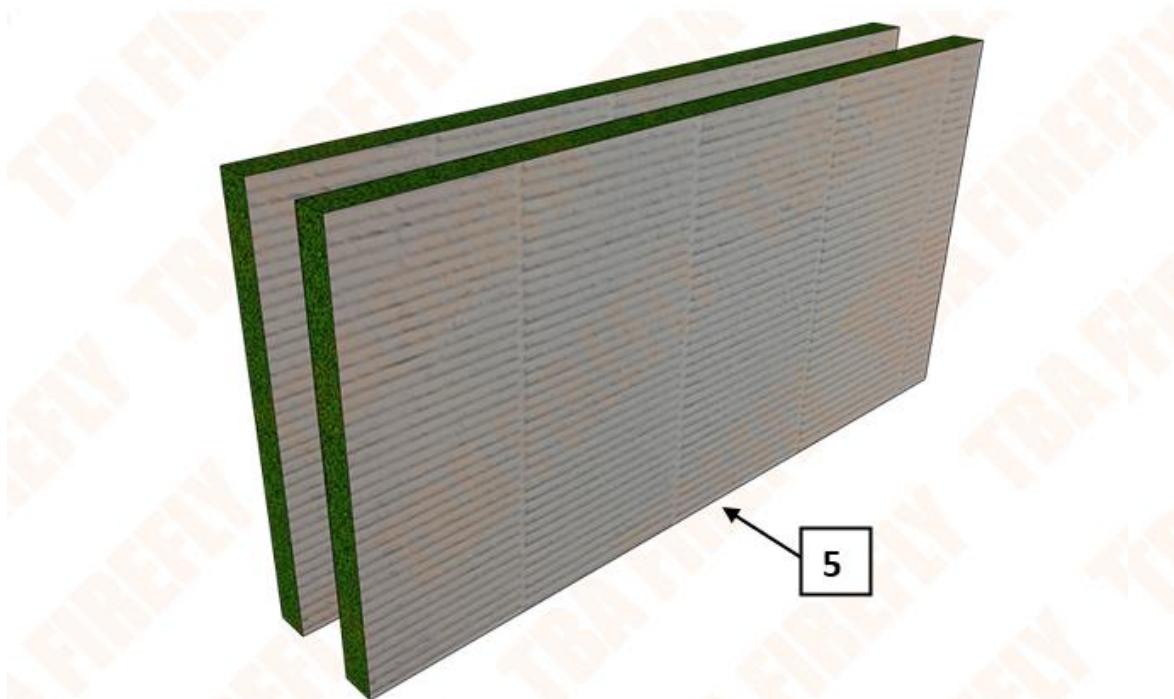


Figure 1b TBA Firefly™ Intubatt (Vertical orientation) 2 Layers of 50mm thick with an air gap

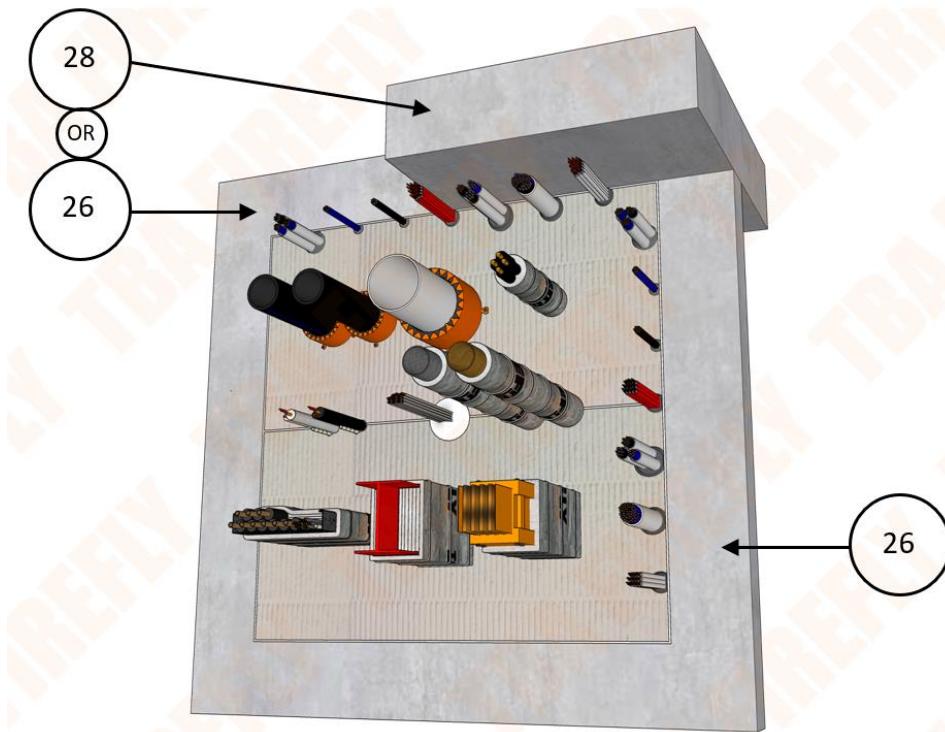


Figure 2 TBA Firefly™ Intubatt® fitted to apertures in Vertical Substrates. All Individual Services or Service Bundles must be spaced at a minimum of 40 mm from each other. (A) Un-letterboxed CLT and Un-letterboxed Lightweight construction a minimum 40 mm spacing is also required between the service to the substrate. (B) This close to edge requirement is not applicable to any other Vertical substrates contained within FAS190234 RIR Table 3. However, the specified annular gap required for fire stopping the service must be maintained.

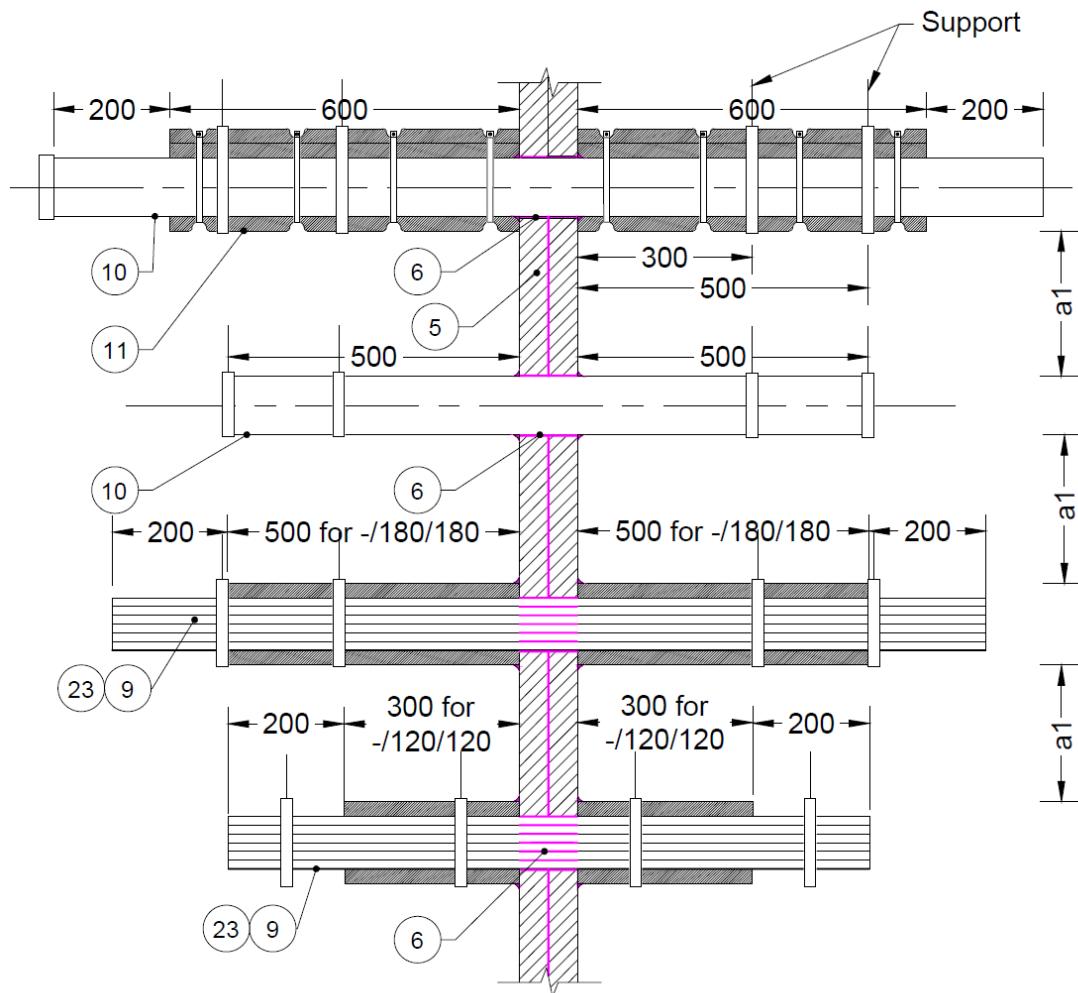


Figure 3 Section View of Penetrations in TBA Firefly™ Intubatt in Vertical Substrates (F-F)

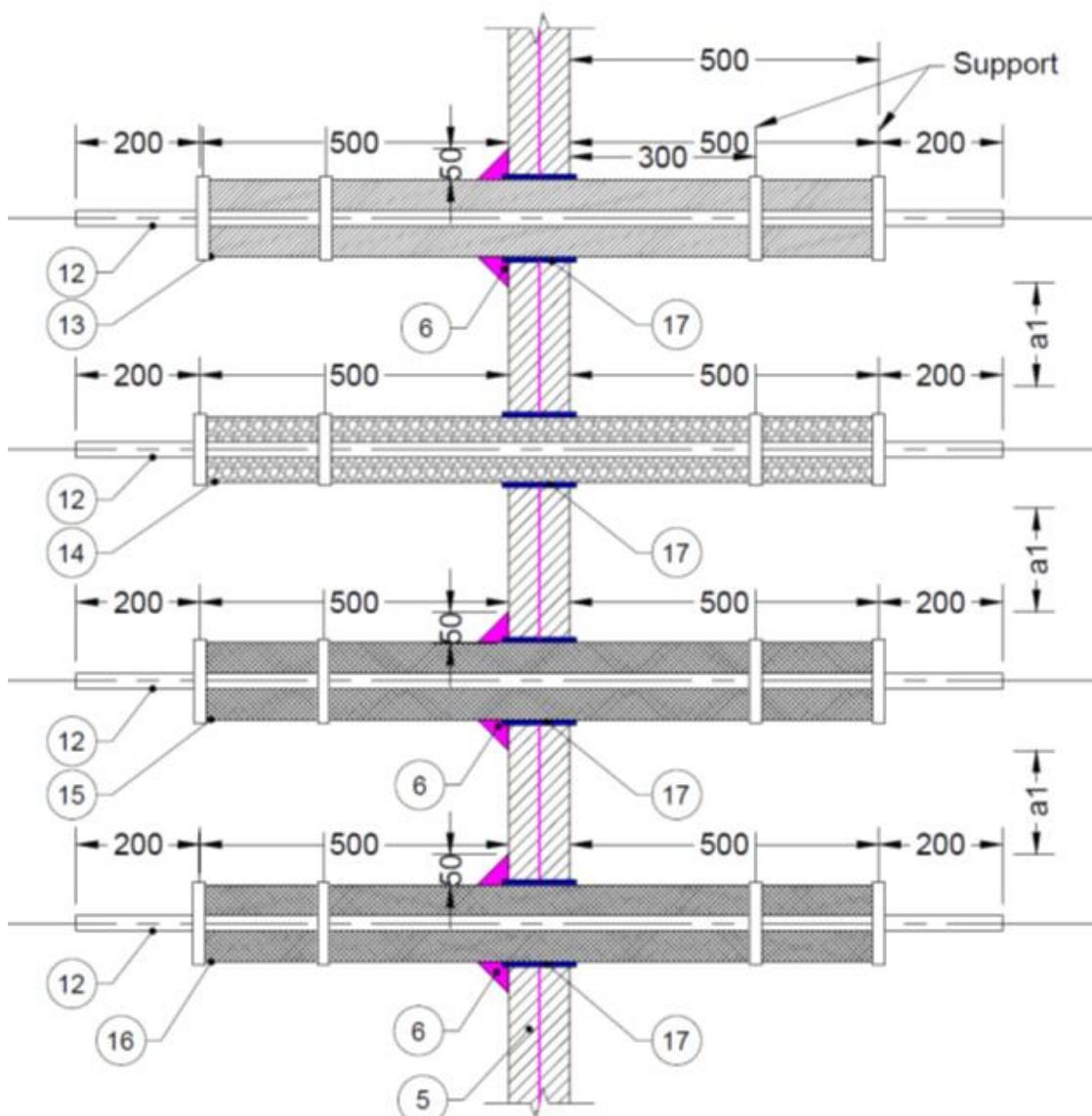
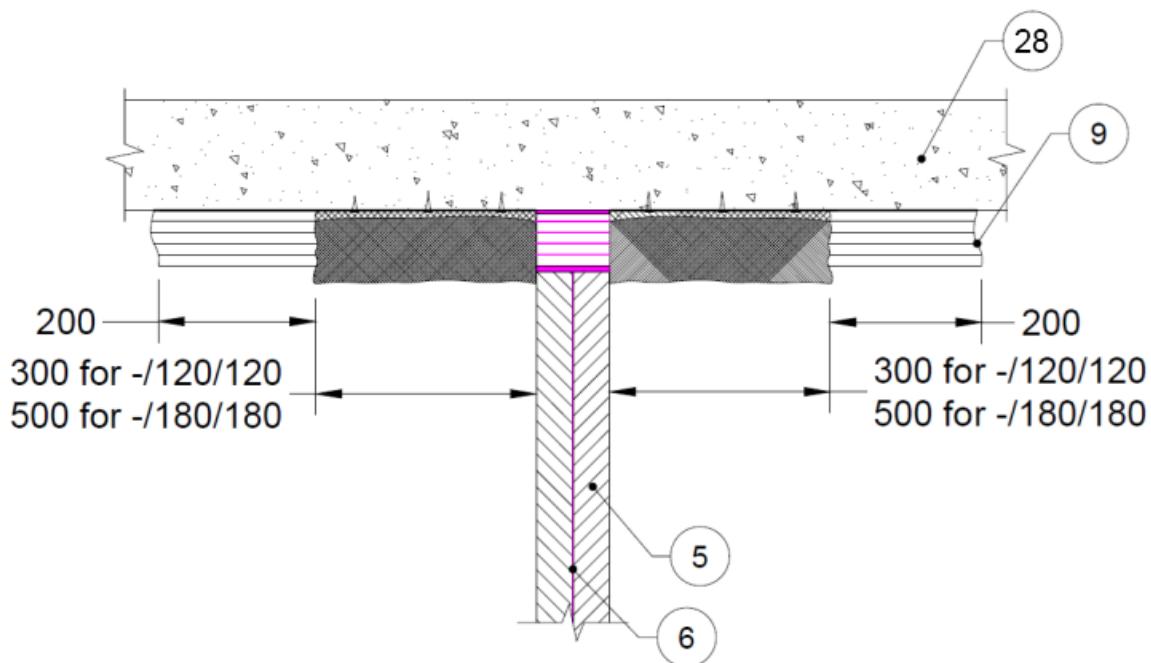


Figure 4 Section View of Penetrations in TBA Firefly™ Intubatt in Vertical Substrates (G-G)

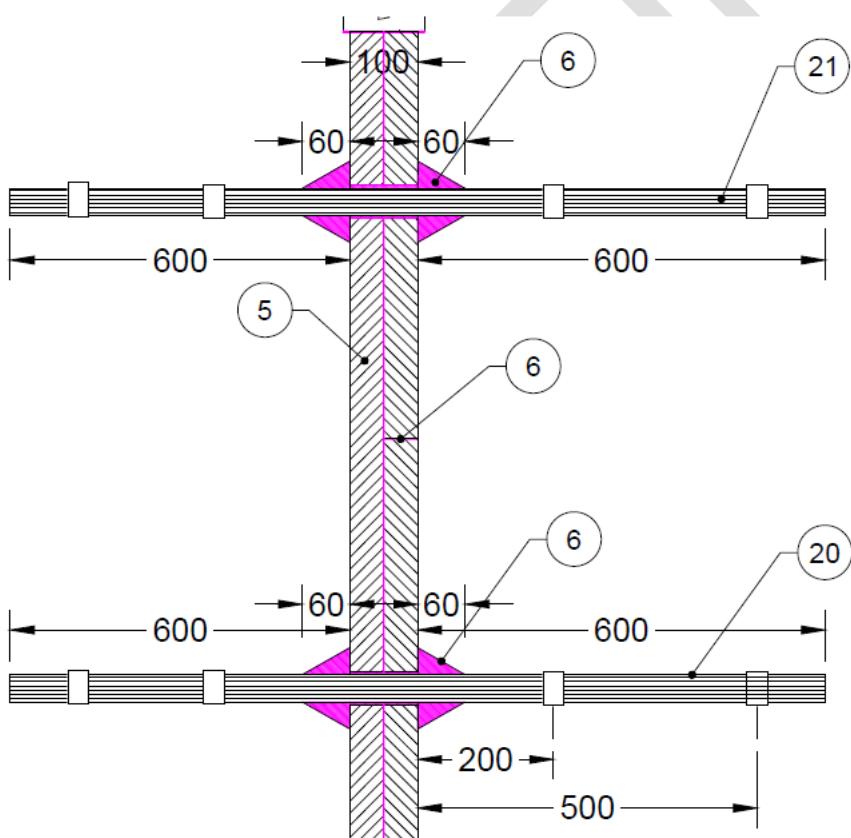
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Figure 6 Left blank for future use

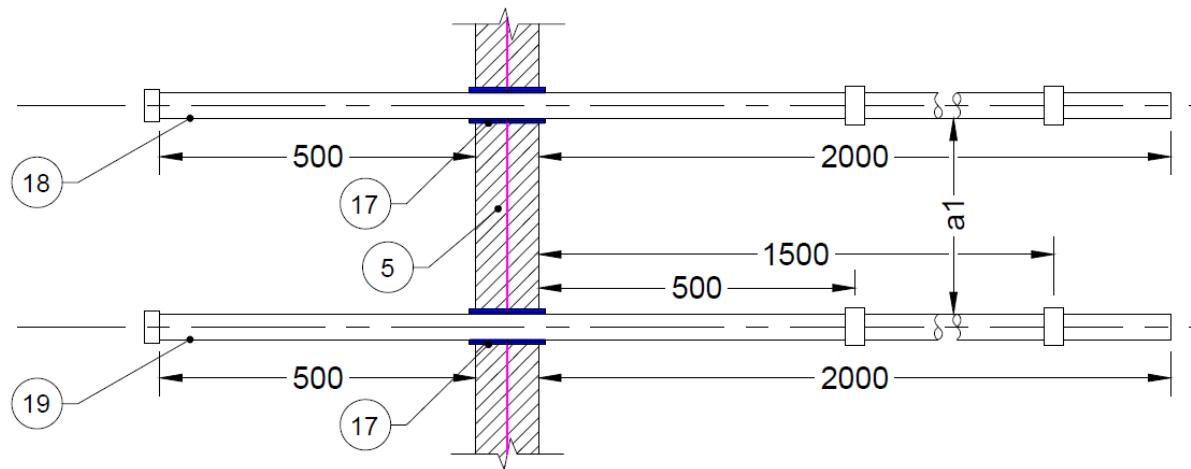
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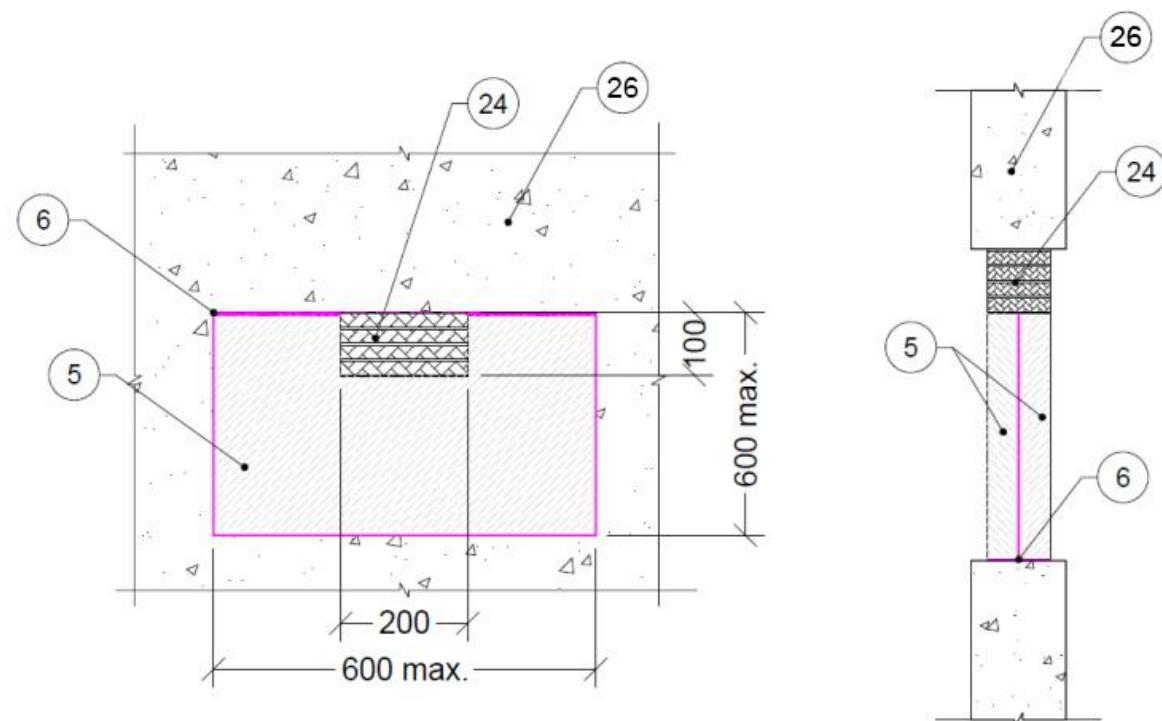
**Figure 8 Section View of D1 & D2 Cables with Cable Trays Installed against Floor Construction in Vertical Substrates**



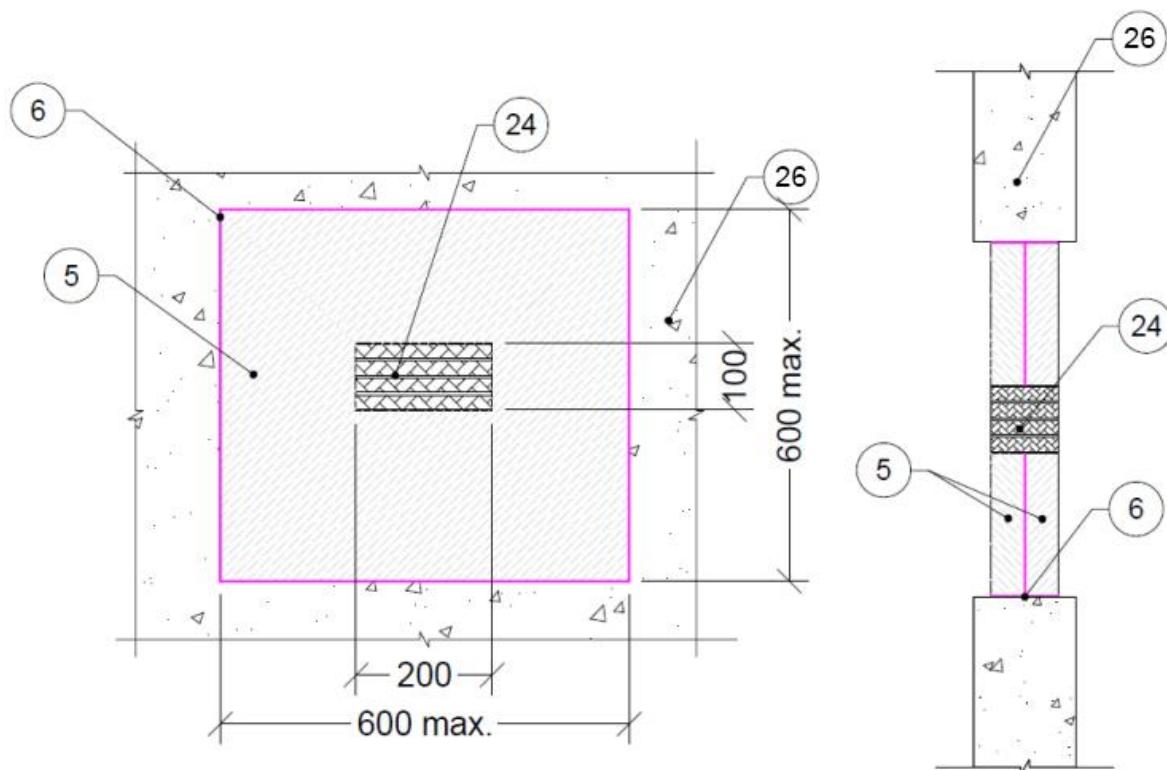
**Figure 9 Section View of Optic Fibre Cables in TBA Firefly™ Intubatt in Vertical Substrates**



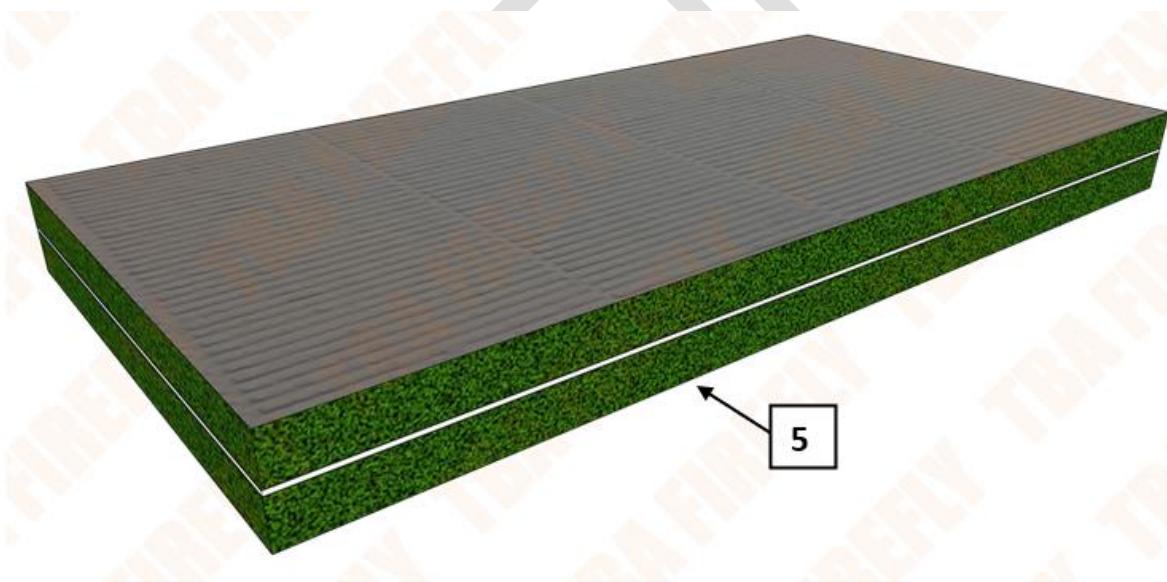
**Figure 10 Section View of Penetrations in TBA Firefly™ Intubatt in Vertical Substrates (F-F)**



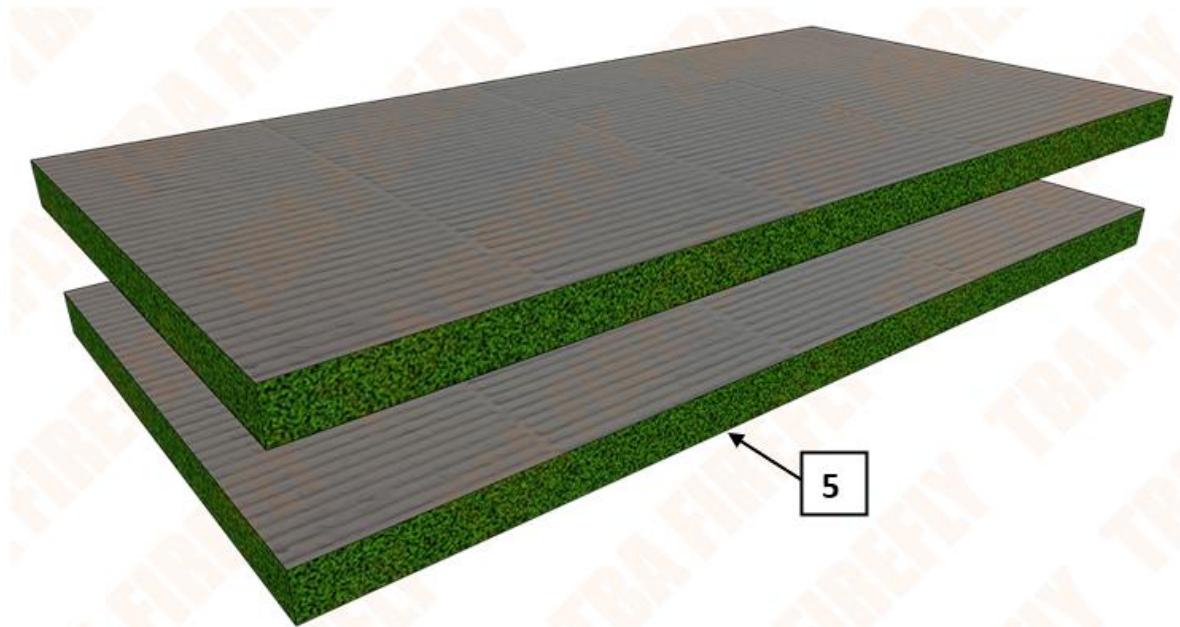
**Figure 11 Intuspan 'Peep-Hole' Configuration in Double Layer TBA Firefly™ Intubatt in Vertical Substrates**



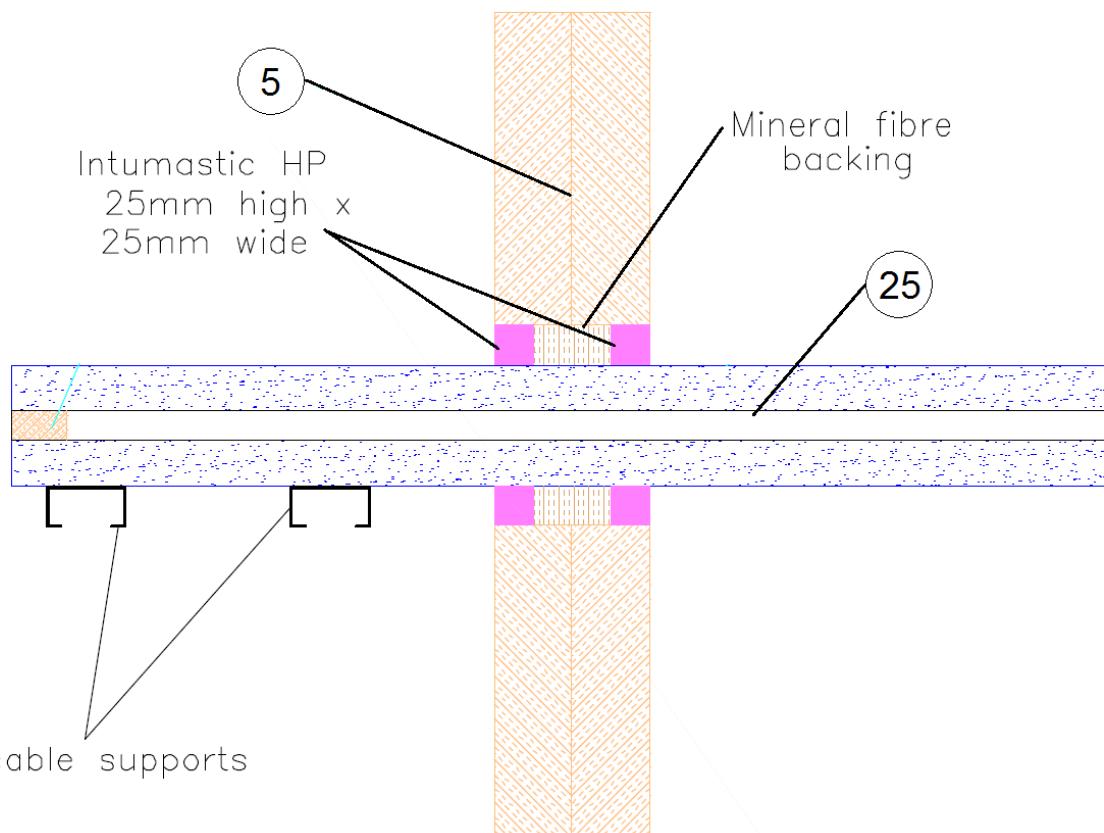
**Figure 12** Intuspan Protecting Aperture in Double Layer TBA Firefly™ Intubatt in Vertical Substrates



**Figure 13a** TBA Firefly™ Intubatt (Vertical orientation) 2 Layers of 50mm thick back to back



**Figure 13b TBA Firefly™ Intubatt (Horizontal orientation) 2 Layers of 50mm thick with an air gap**



**Figure 14 Section View of 25mm Copper Pipes Installed in Vertical Substrates**

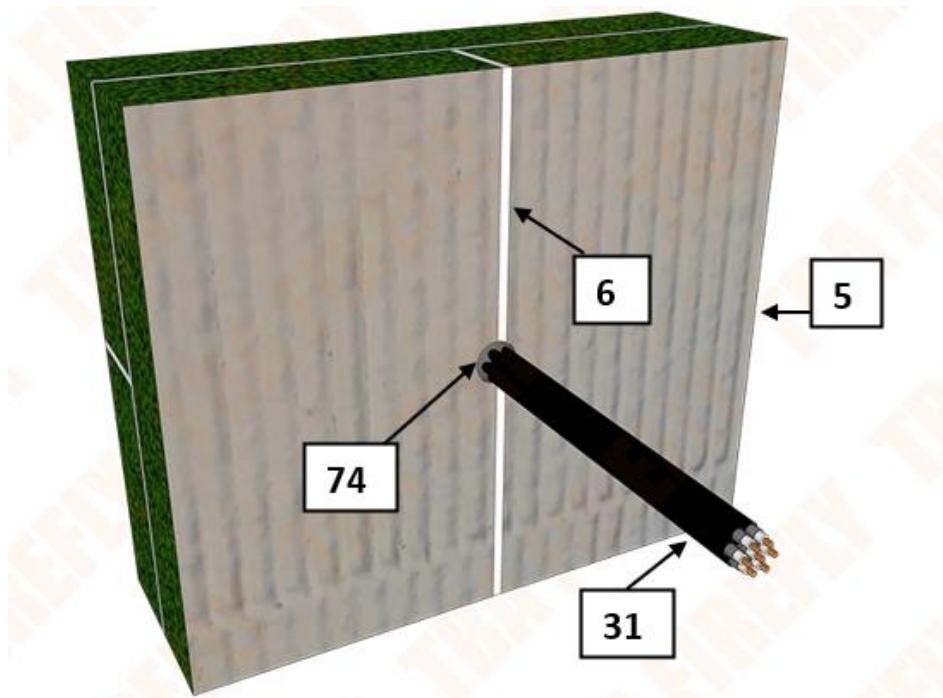


Figure 15 Bundle of up to 7 x RG6 Coaxial Cables

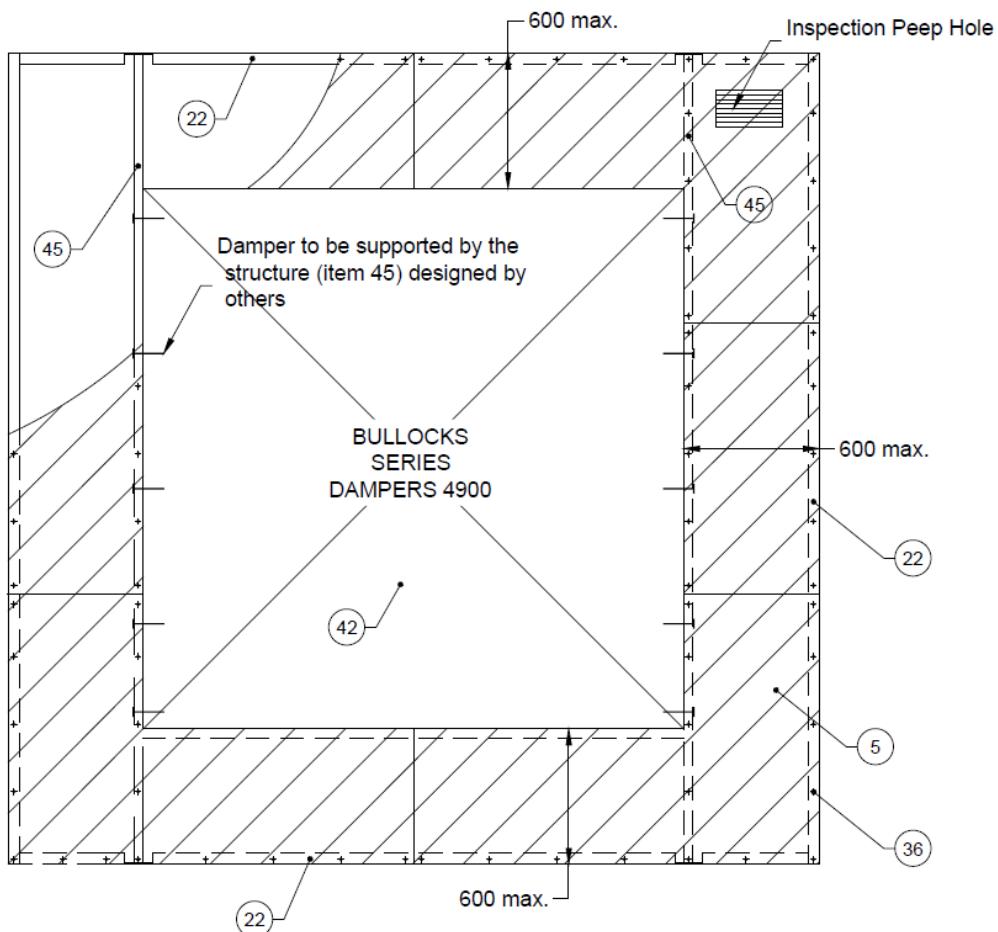
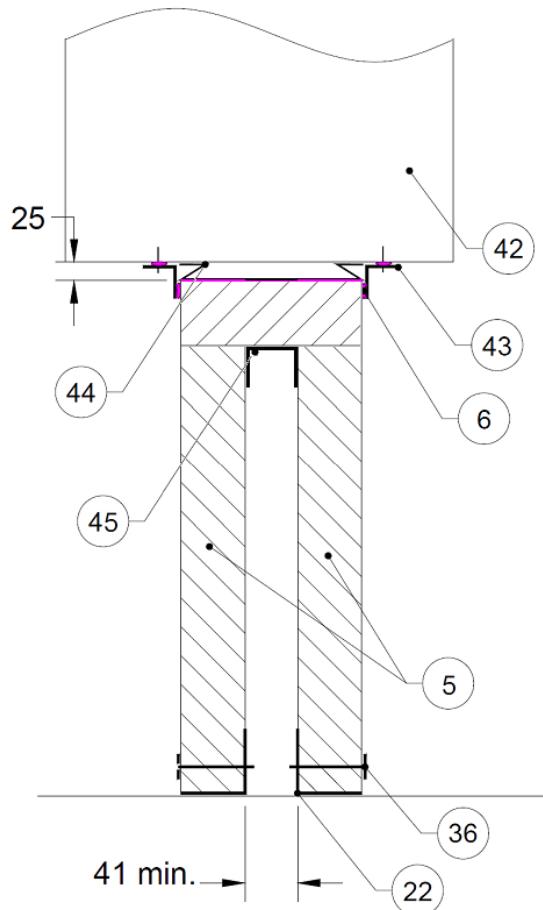
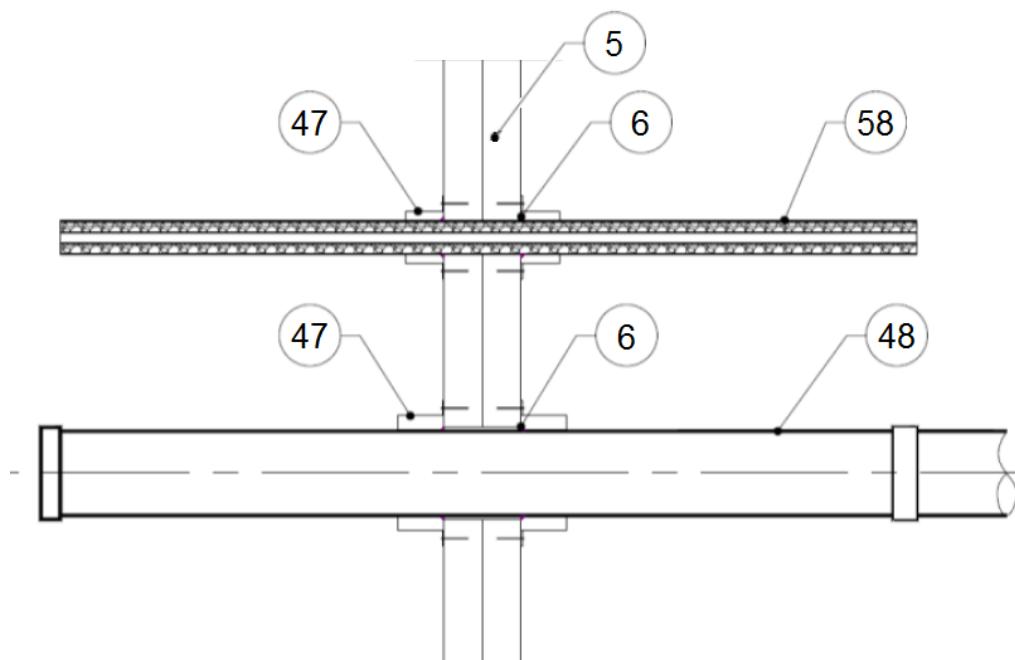


Figure 16 Plan View of Bullock Damper in TBA Firefly™ Intubatt in Vertical Substrates



**Figure 17** Section View of Bullock Damper in TBA Firefly™ Intubatt in Vertical Substrates



**Figure 18** uPVC and HDPE pipes, Cables and Copper pipes through TBA Firefly™ Intubatt in Vertical Substrates

Figure 19 Left blank for future use

Figure 20a Left blank for future use

Figure 20b Left blank for future use

Figure 20c Left blank for future use

Figure 21 Left blank for future use

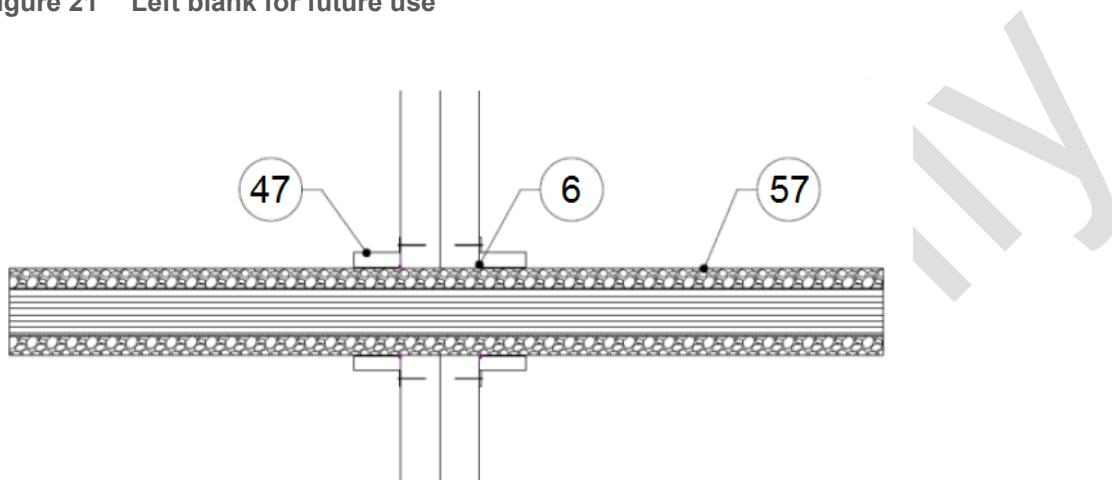


Figure 22 Multiple Plastic Tubing through TBA Firefly™ Intubatt in Vertical Substrates

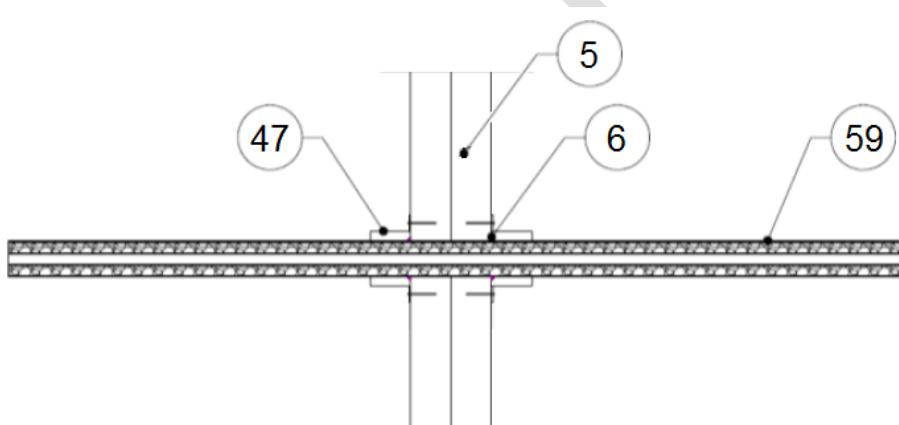


Figure 23 Insulated Twin Air-con Copper Pipe through TBA Firefly™ Intubatt in Vertical Substrates

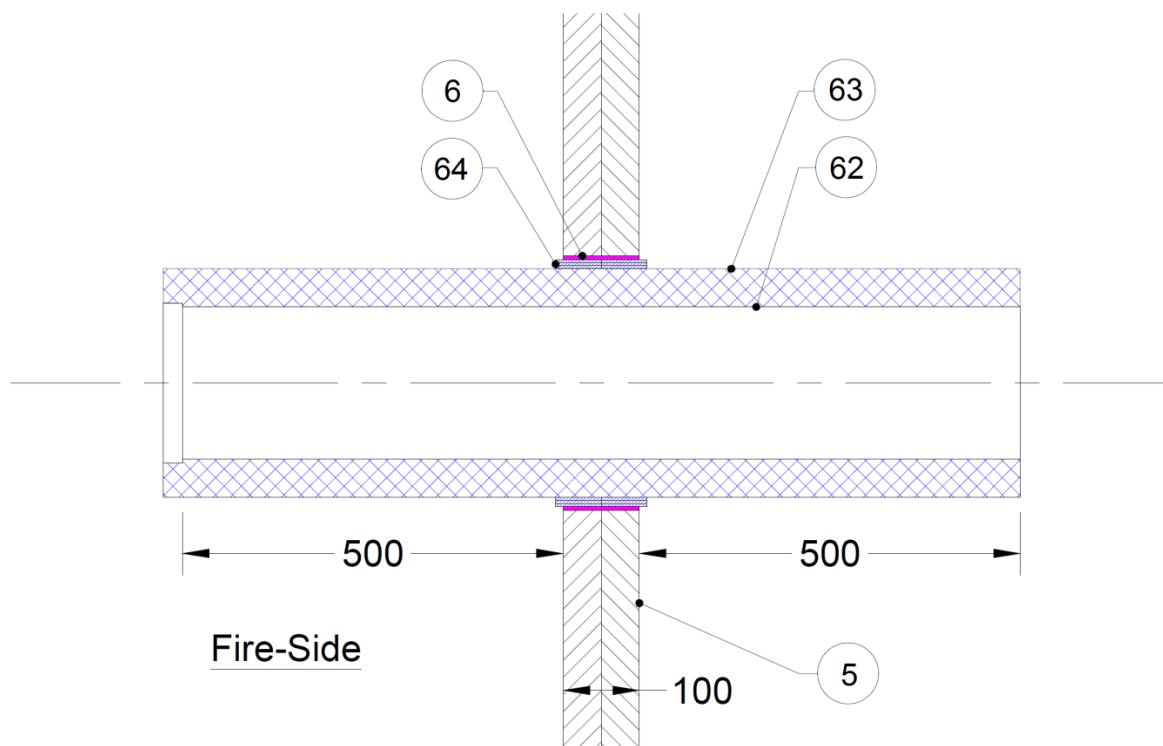


Figure 24 Continuously Insulated Pipes

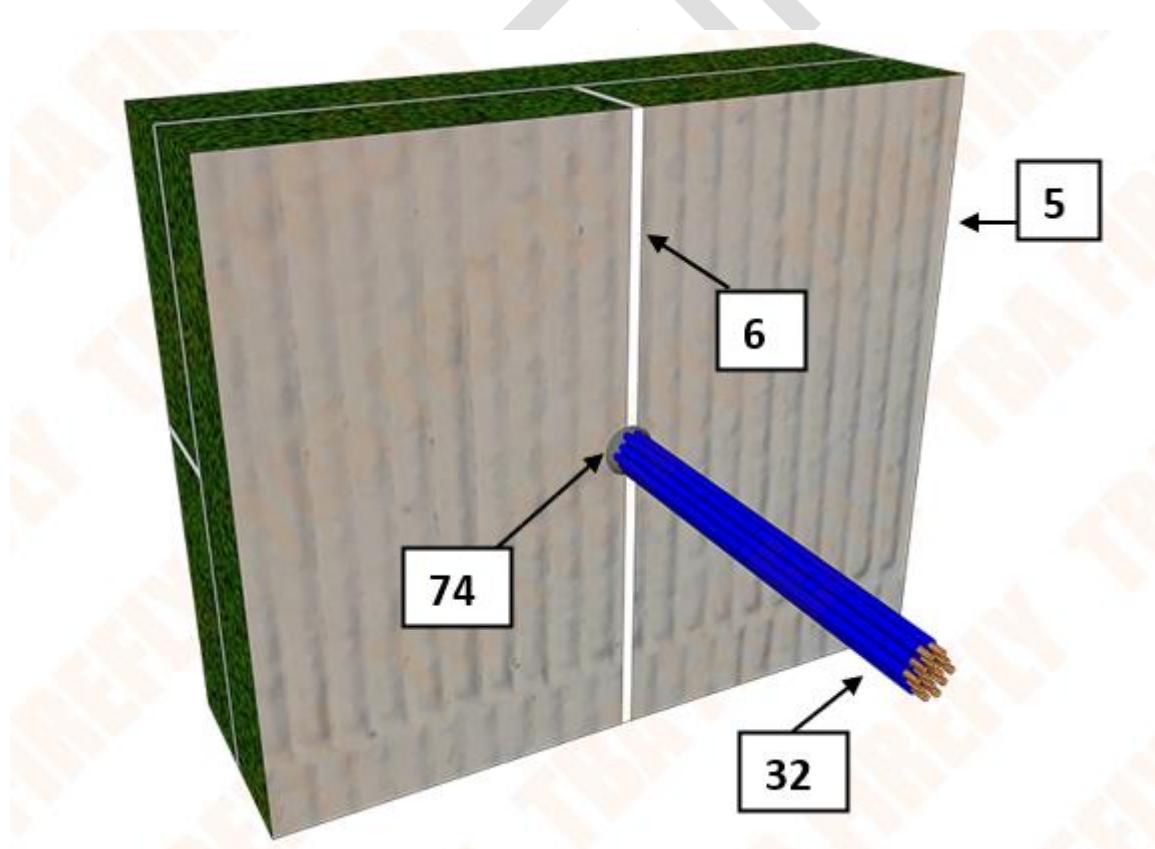


Figure 25 Bundle of up to 14 CAT5e Data Cables

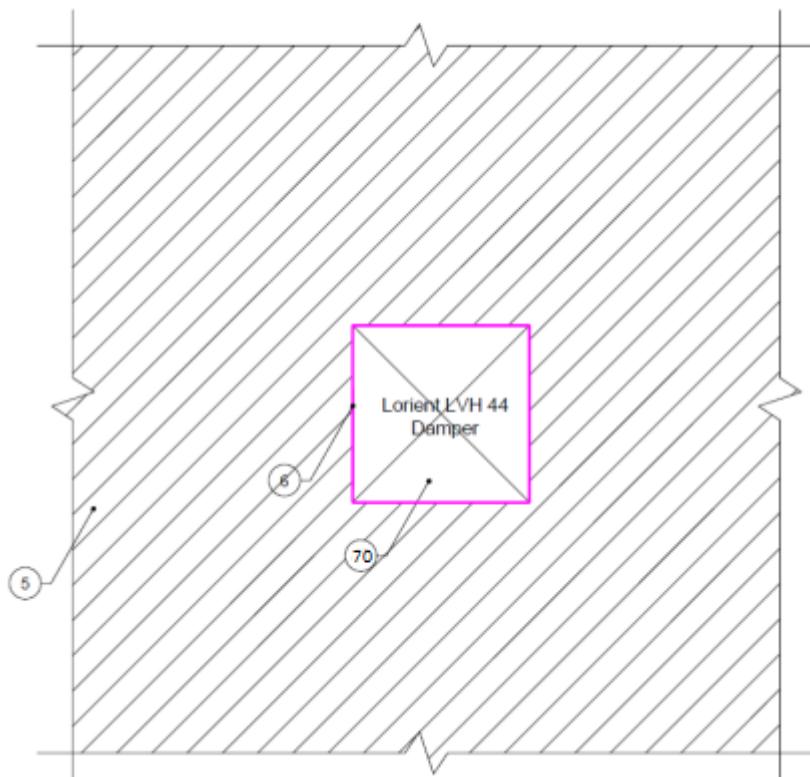


Figure 26a Plan View of Lorient LVH44 or Kilargo damper in TBA Firefly™ Intubatt in Vertical Substrates

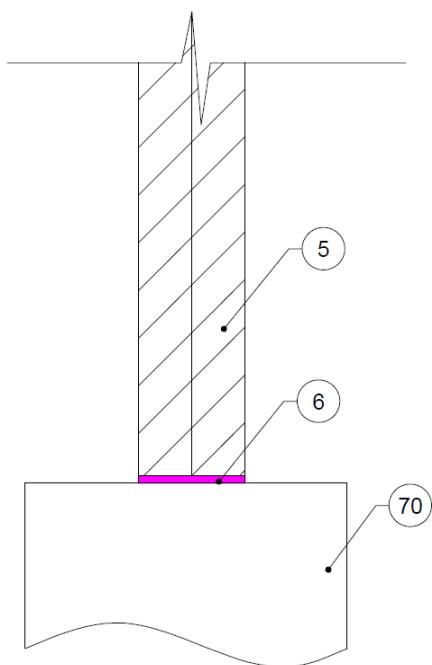


Figure 26b Section View of Lorient LVH44 or Kilargo damper in TBA Firefly™ Intubatt in Vertical Substrates

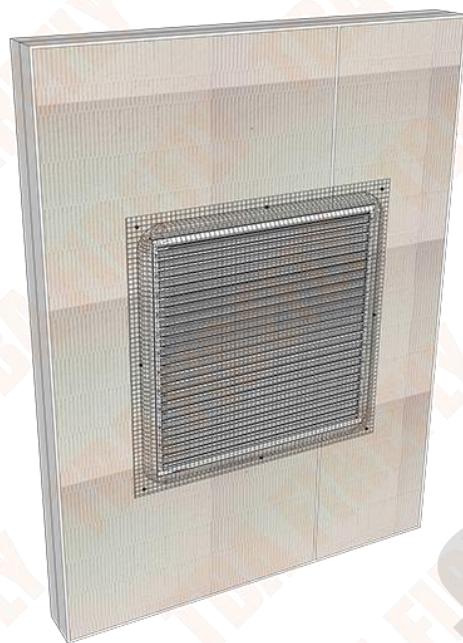


Figure 26c Lorient LVH44 or Kilargo IFD44 intumescent dampers with Steel Mesh Covers: TBA Firefly™ Intubatt in Vertical Substrates

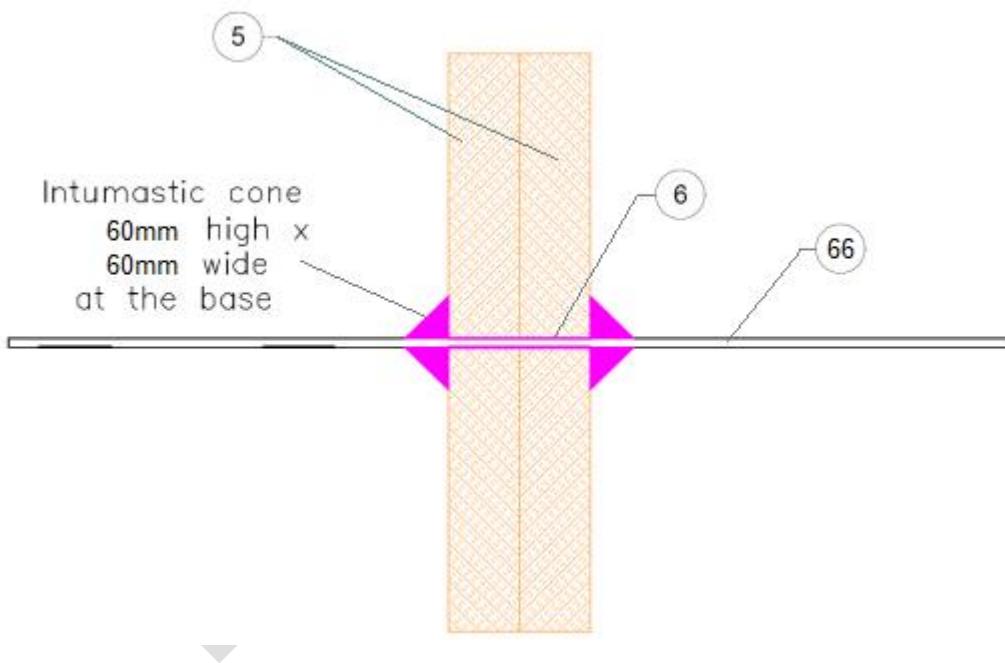


Figure 27 Cables in Vertical Substrates

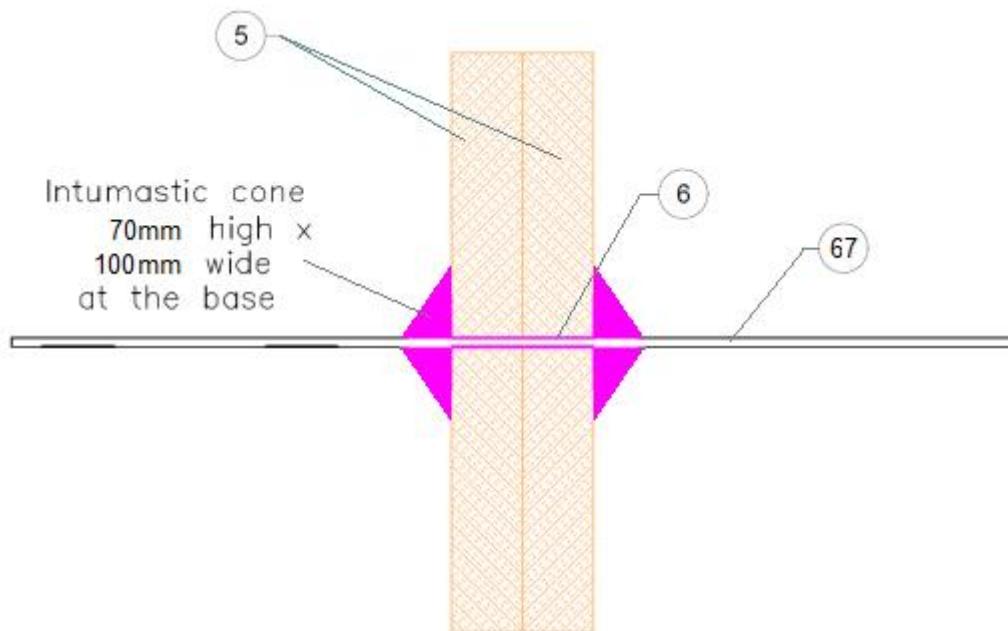


Figure 28 One Ø21mm non-sheathed cable in Vertical Substrates

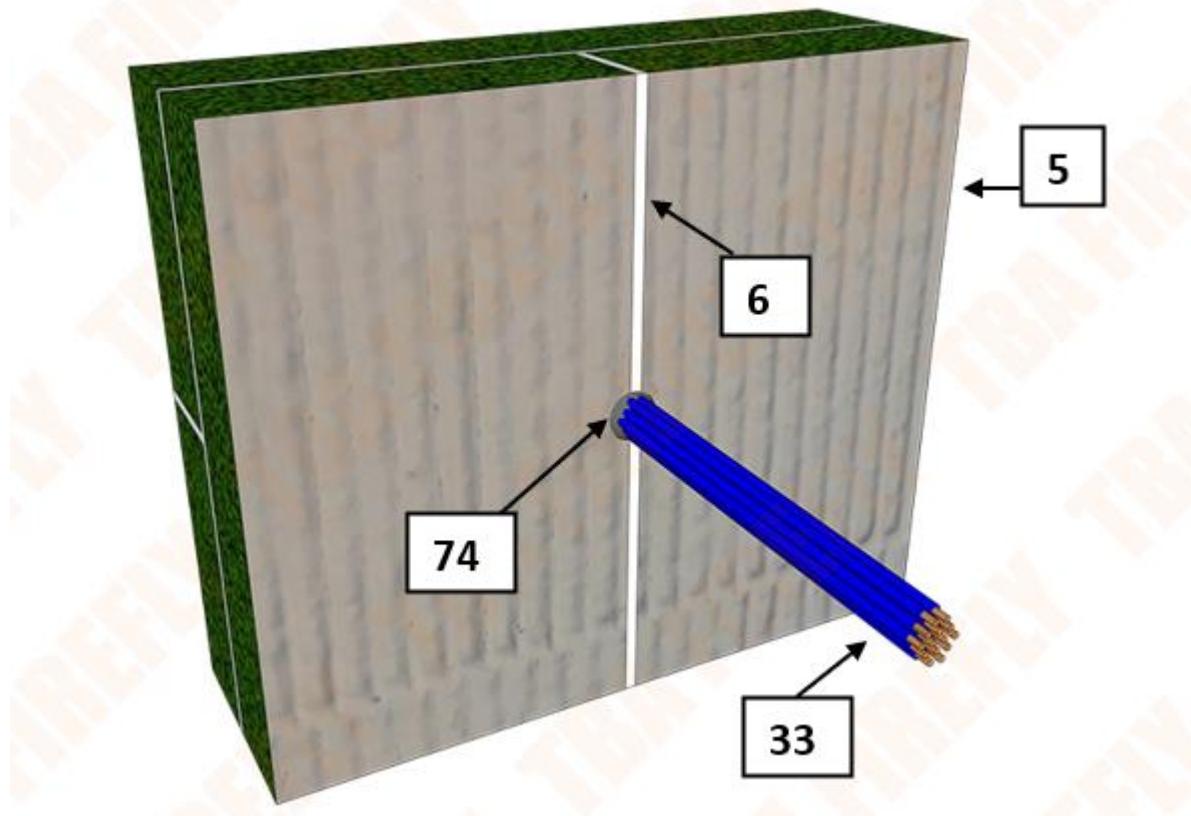


Figure 29 Bundle of up to 10 x CAT6 Data Cables

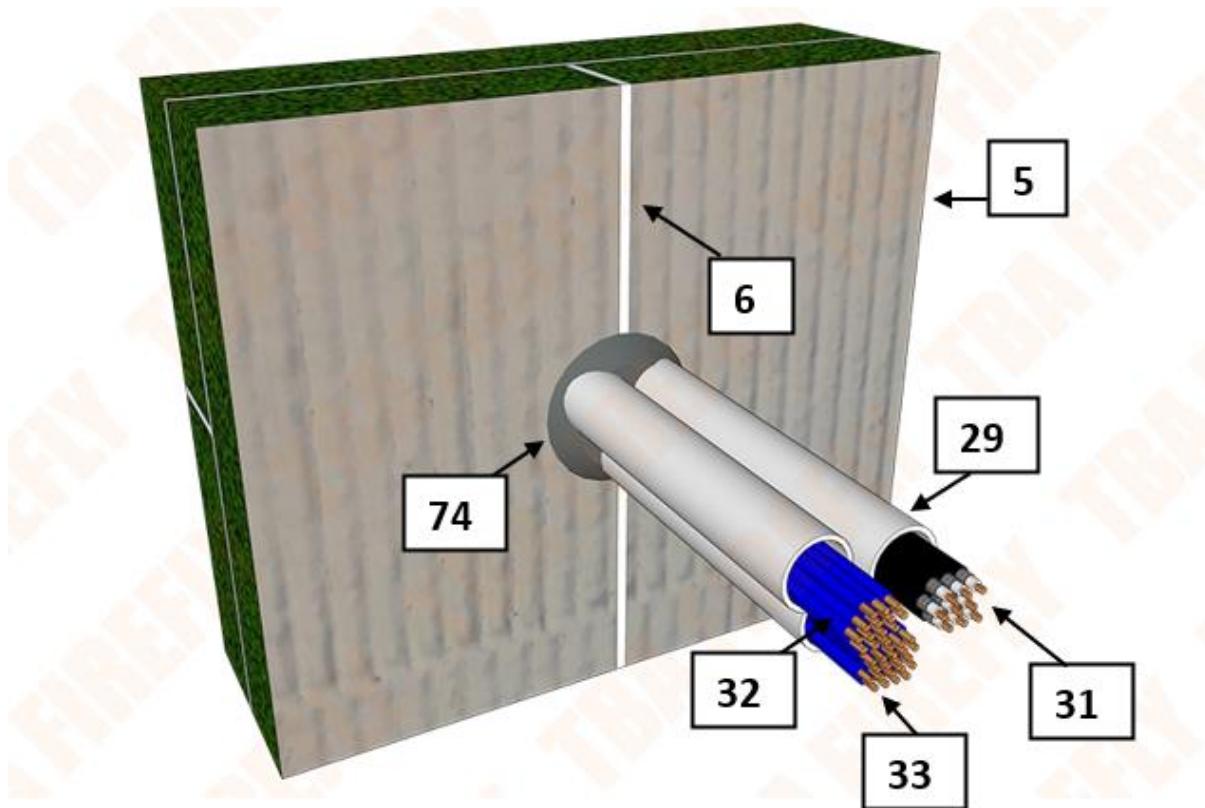


Figure 30 Bundle of 2 or 3 x uPVC Pipes up to 32mm OD with various data cables

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Figure 32 Left blank for future use.

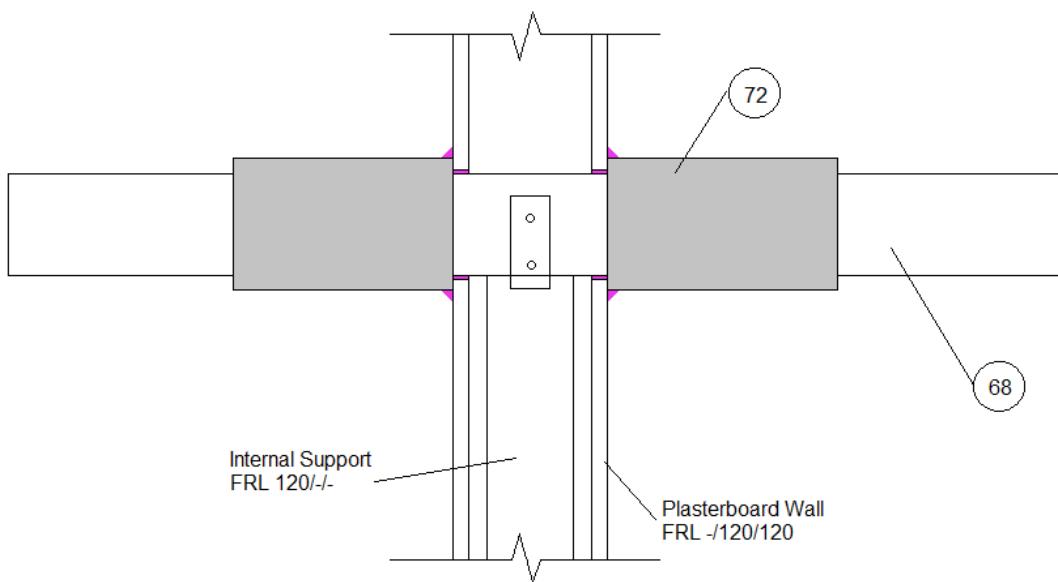


Figure 33 Insulated C or Z-purlin/I-beam through Plasterboard Wall Construction- Case A

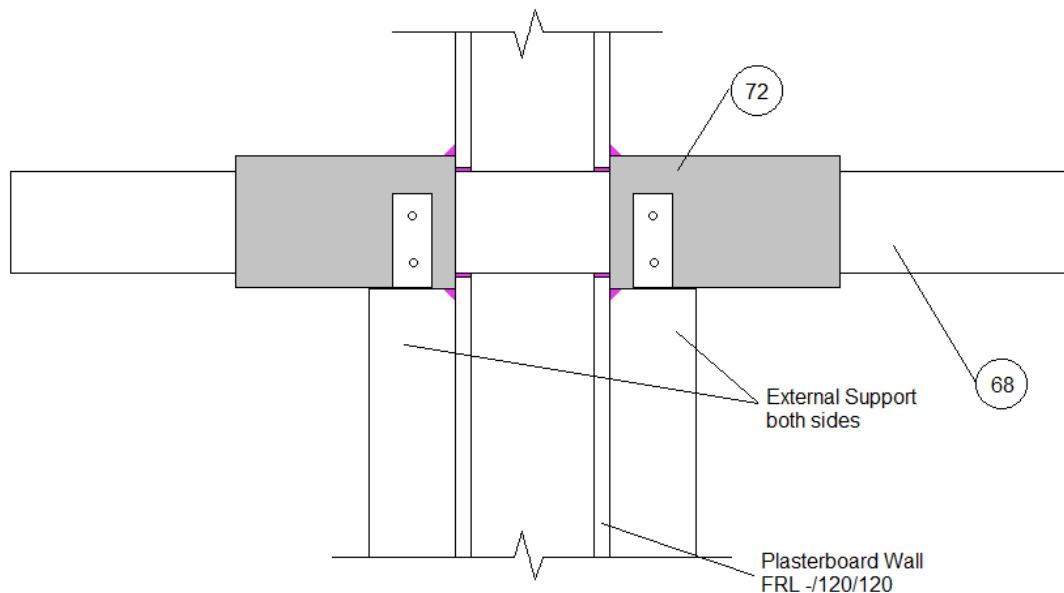


Figure 34 Insulated C or Z-purlin/I-beam through Plasterboard Wall Construction- Case B

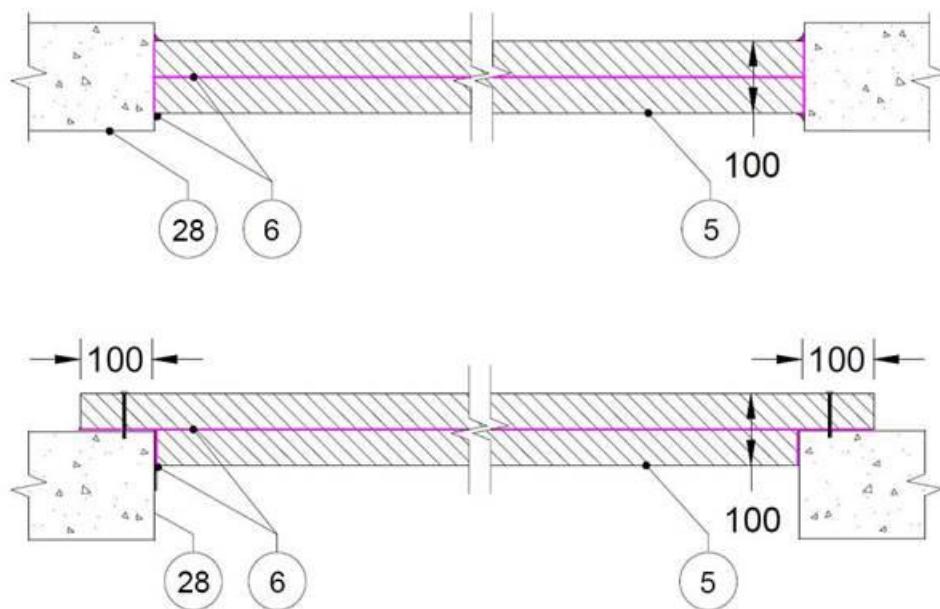


Figure 35 Support Floor Construction Options for Service Penetrations

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Figure 37 Left blank for future use

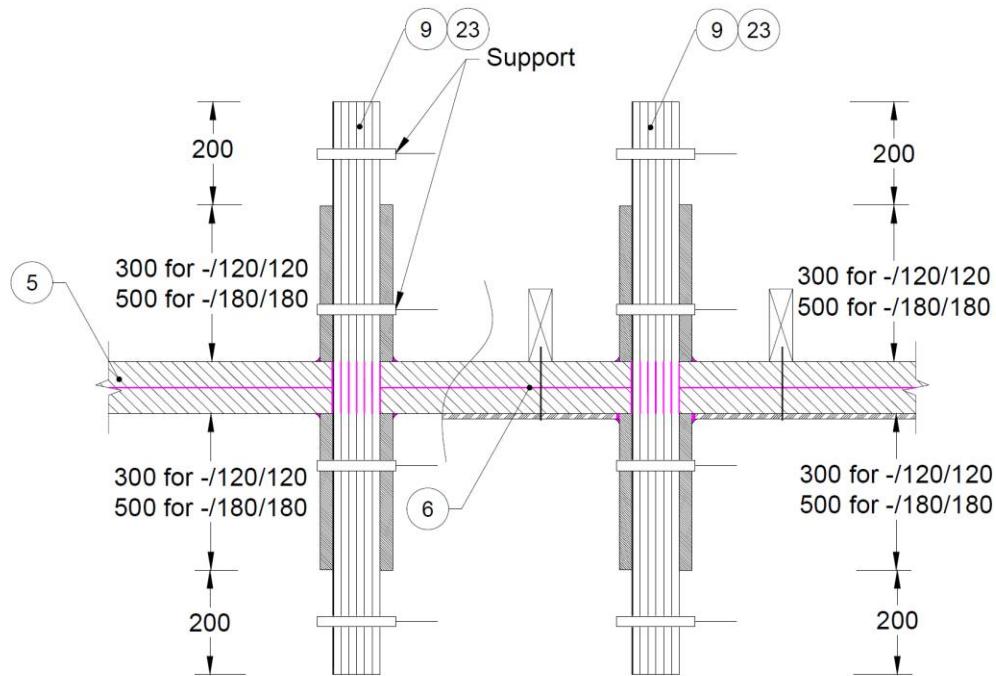


Figure 38 Section View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction in Horizontal Substrates - Wrapping each side

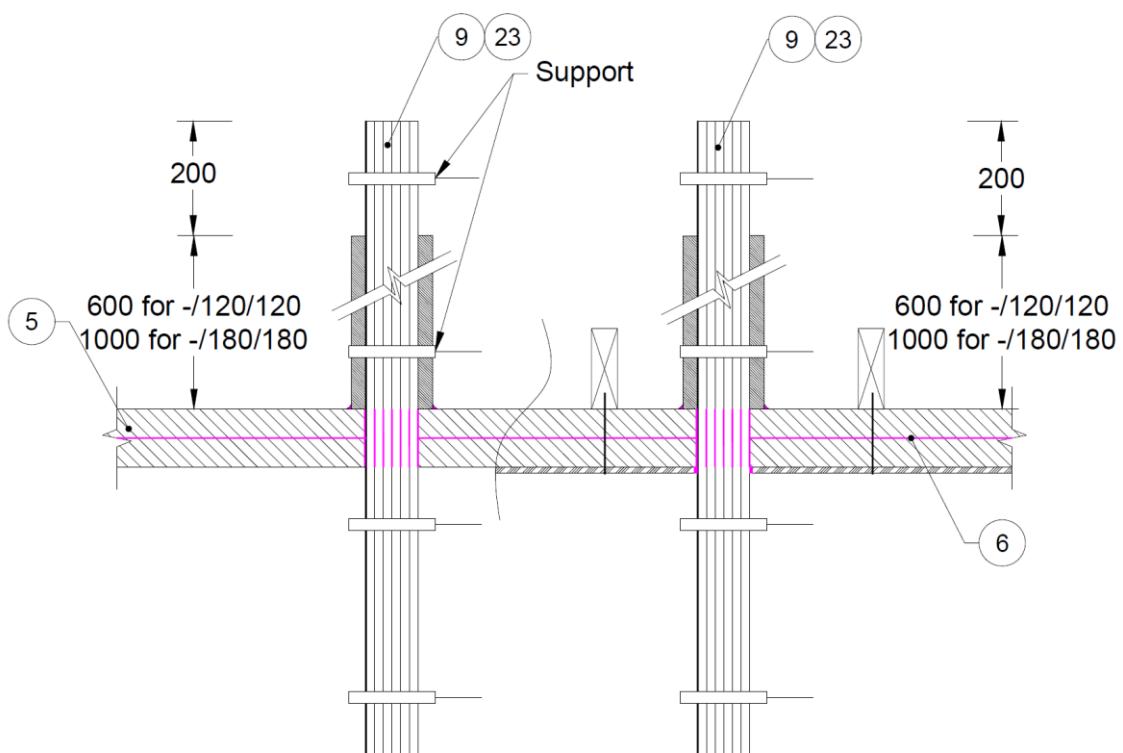
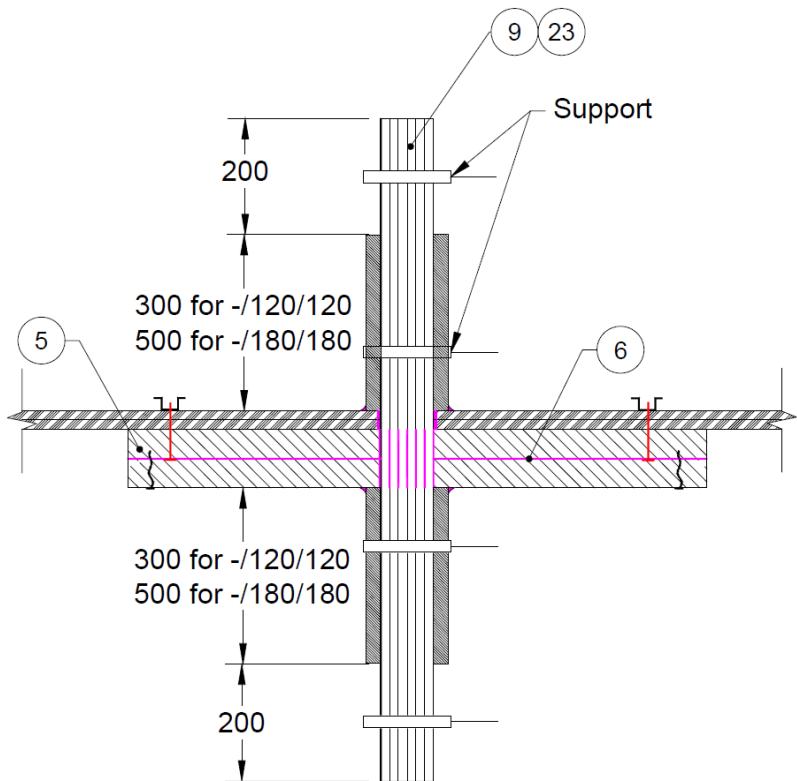
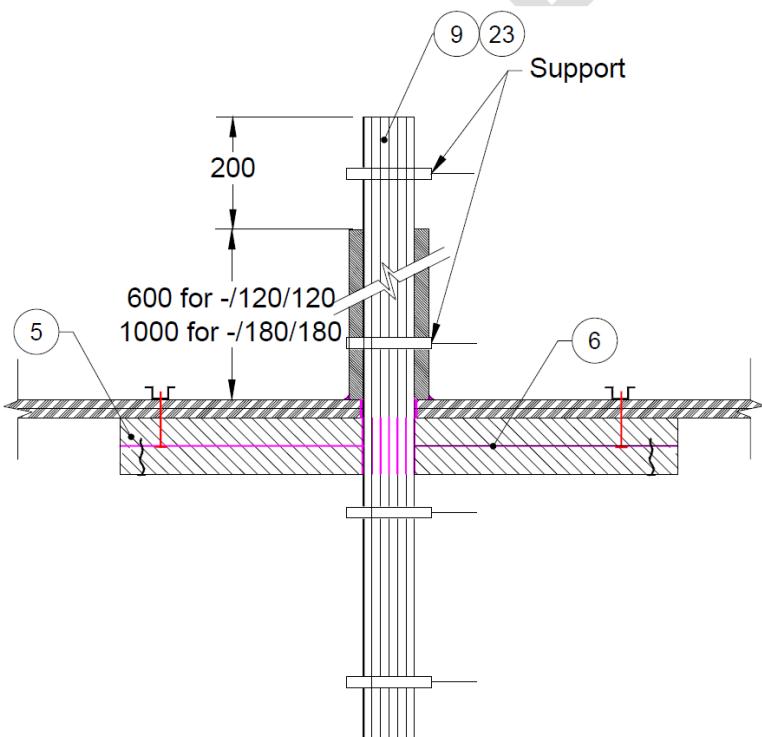


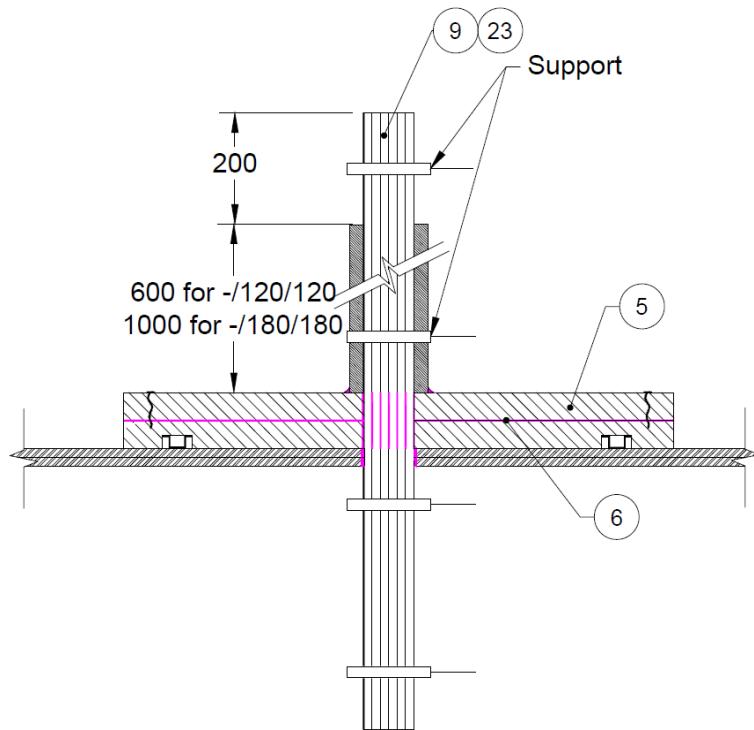
Figure 39 Section View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction in Horizontal Substrates - Wrapping topside only



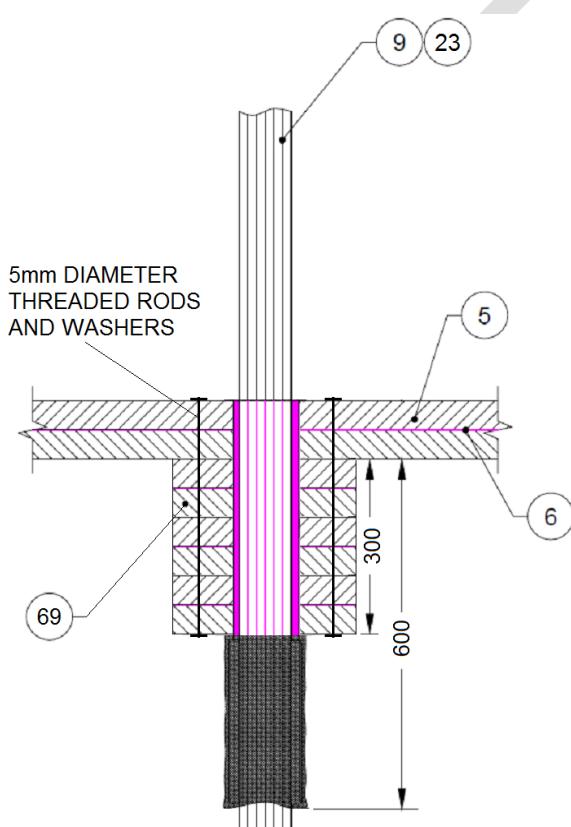
**Figure 40** Section View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction in Horizontal Substrates - Wrapping each side



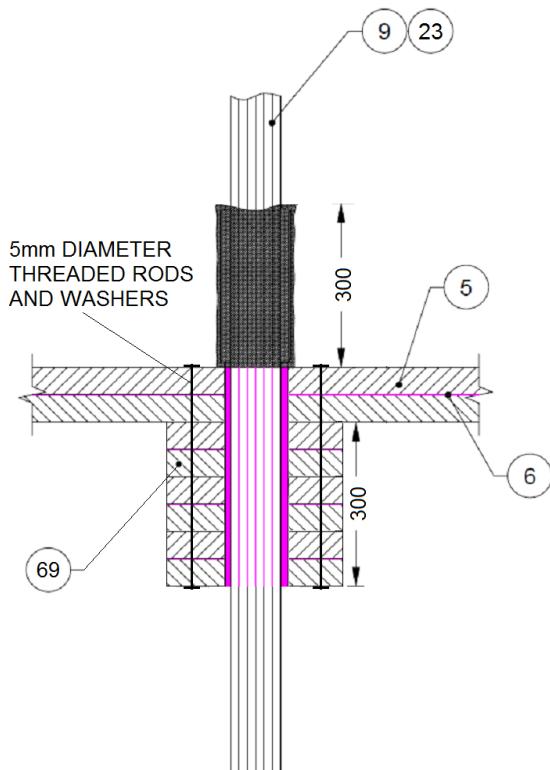
**Figure 41** Section View of D1 and D2 Cables with Cable Trays in TBA Firefly™ Intubatt not Against Wall Construction in Horizontal Substrates - Wrapping top side



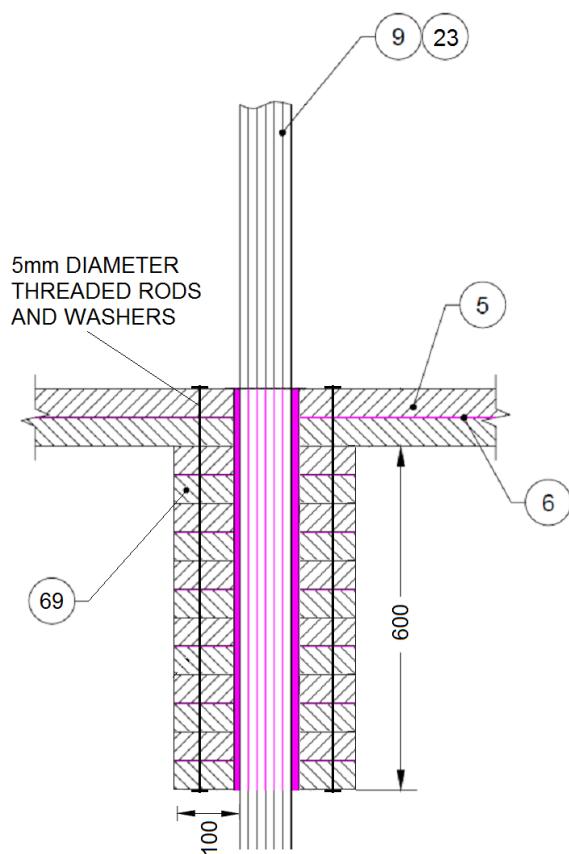
**Figure 42 Section View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction in Horizontal Substrates - Wrapping top side**



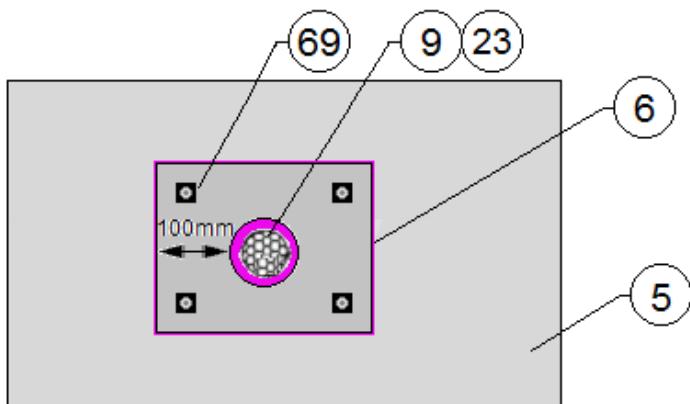
**Figure 43 Section View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction in Horizontal Substrates – Wrapping on Bottom Side**



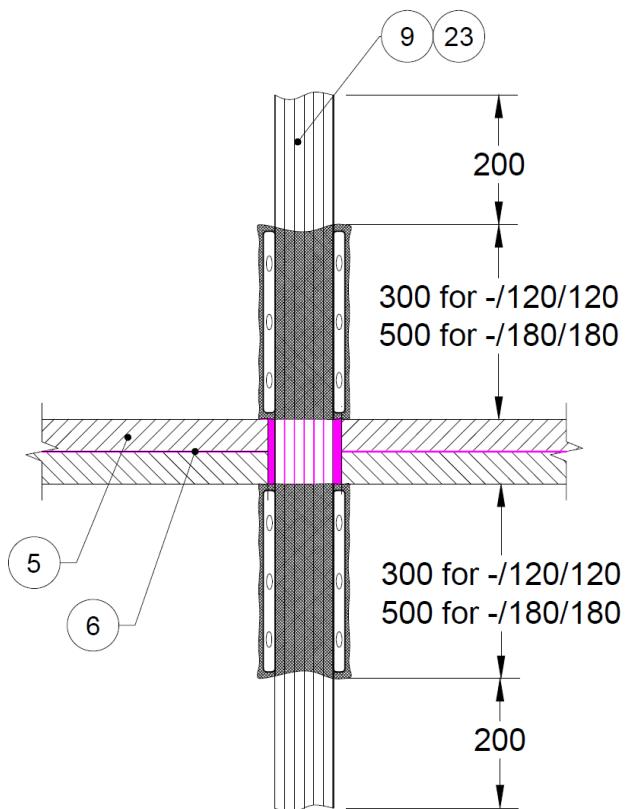
**Figure 44** Section View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction in Horizontal Substrates – Wrapping on Topside



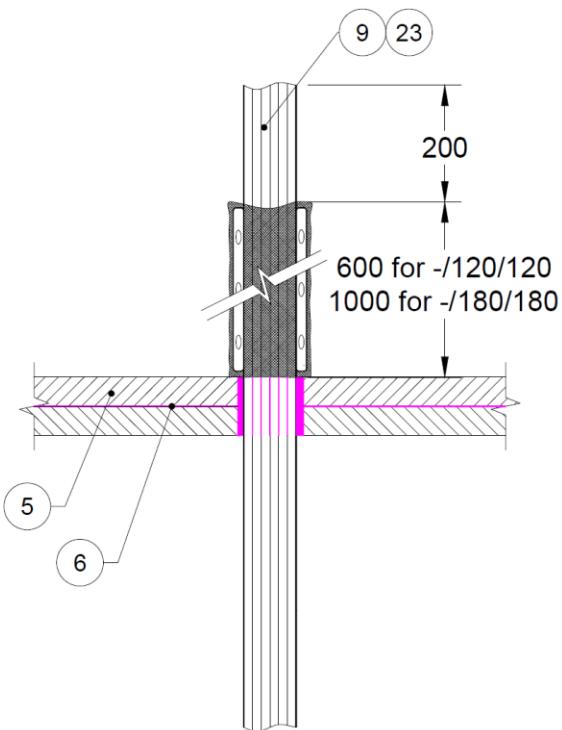
**Figure 45** Section View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction in Horizontal Substrates



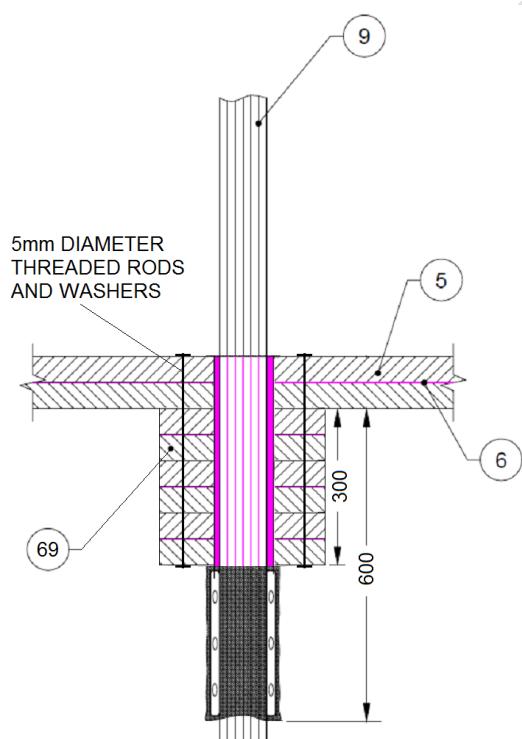
**Figure 46 Plan View of D1 and D2 Cables with/without Cable Trays in TBA Firefly™ Intubatt not against Wall Construction**



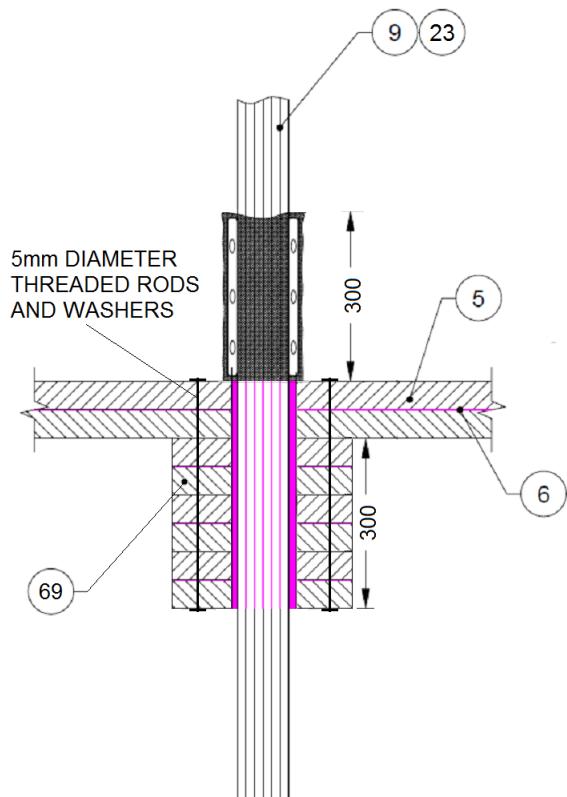
**Figure 47 Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates – Wrapping each side**



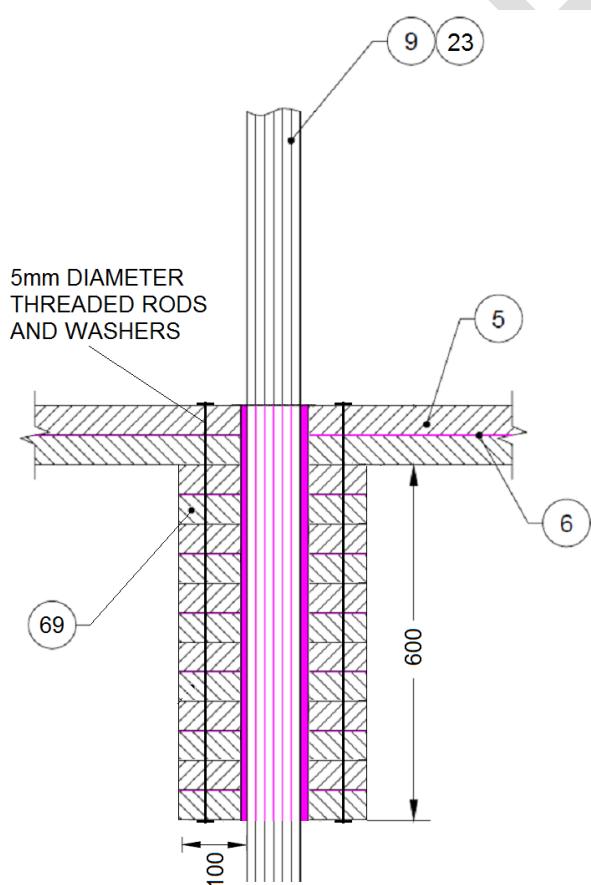
**Figure 48** Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates – Wrapping top side



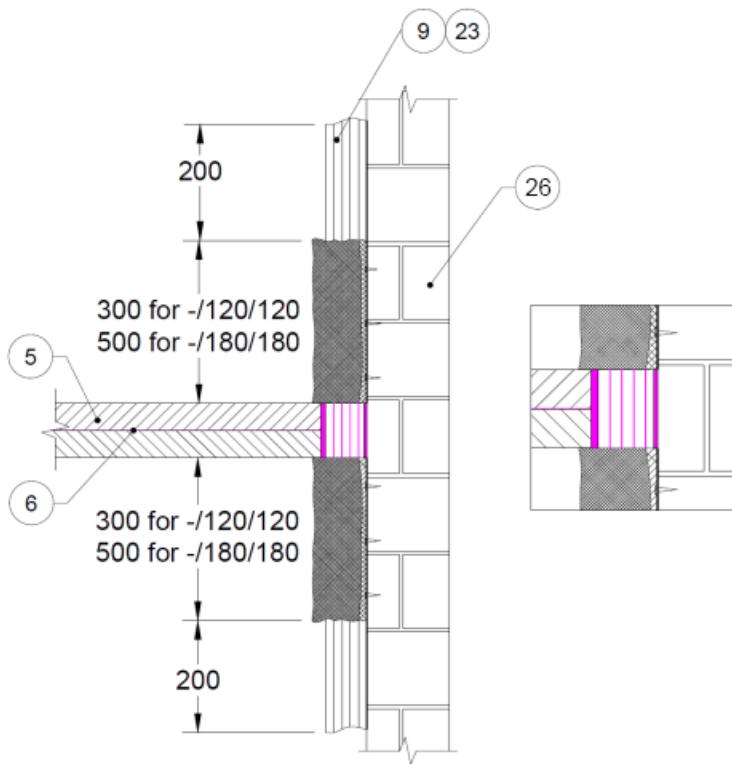
**Figure 49** Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates – Wrapping bottom side



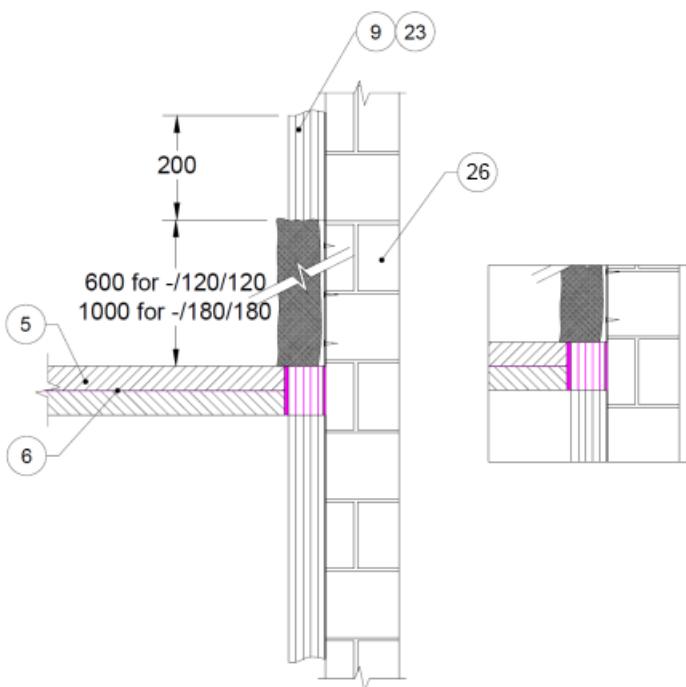
**Figure 50 Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates – Wrapping on Topside**



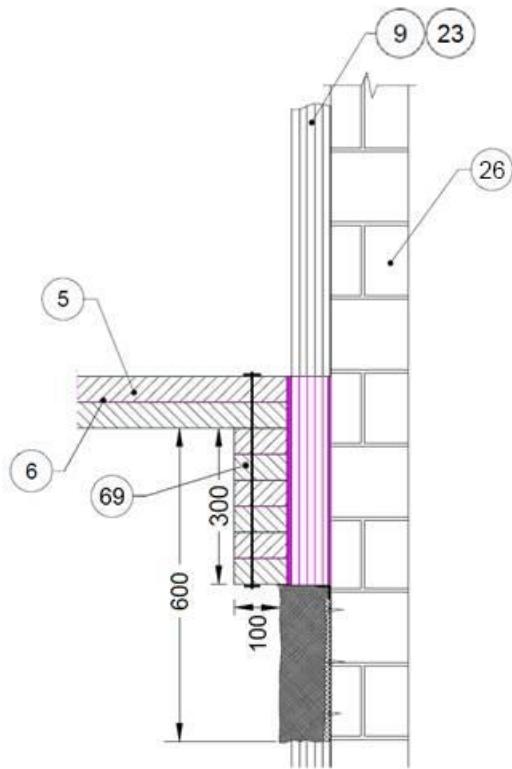
**Figure 51 Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates**



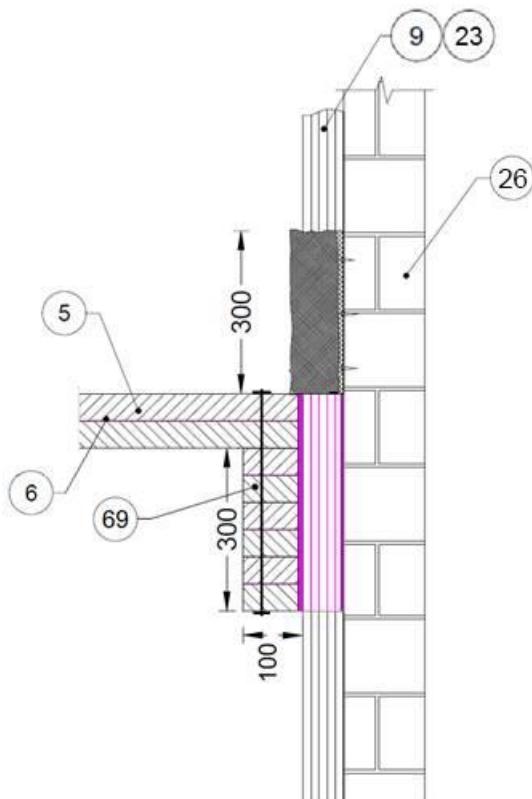
**Figure 52 Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates – Wrapping each side**



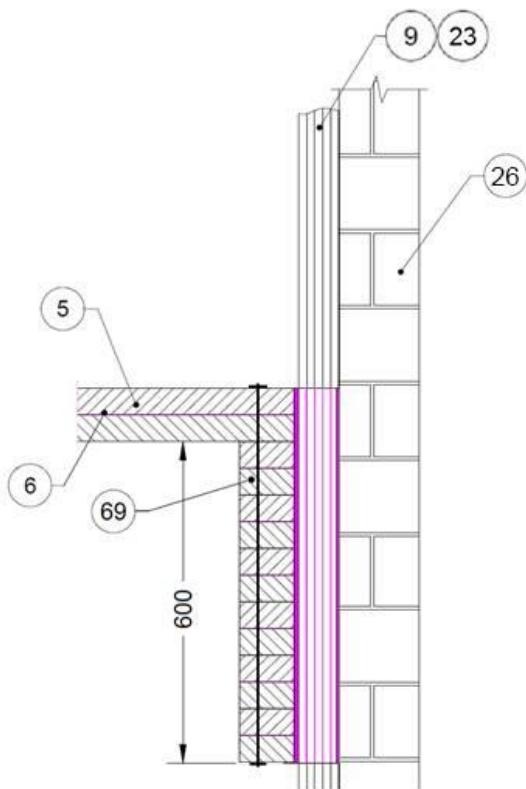
**Figure 53 Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates – Wrapping Topside Only**



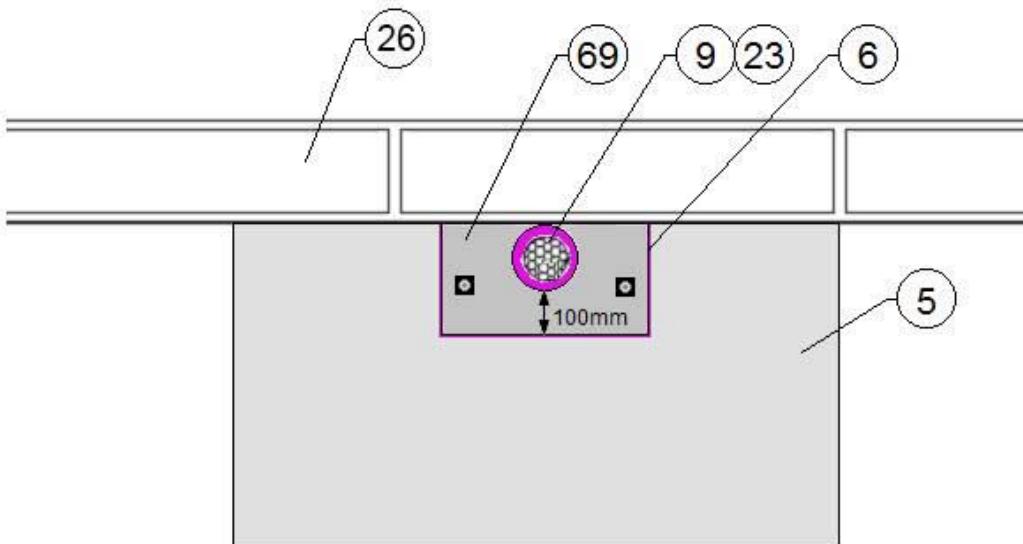
**Figure 54 Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates – Wrapping bottom side**



**Figure 55 Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates**



**Figure 56** Section View of D1 & D2 Cables with/without Cable Trays Installed against Wall Construction in Horizontal Substrates



**Figure 57** Plan View of D1 & D2 Cables with Cable Trays Installed against Wall Construction in Horizontal substrates

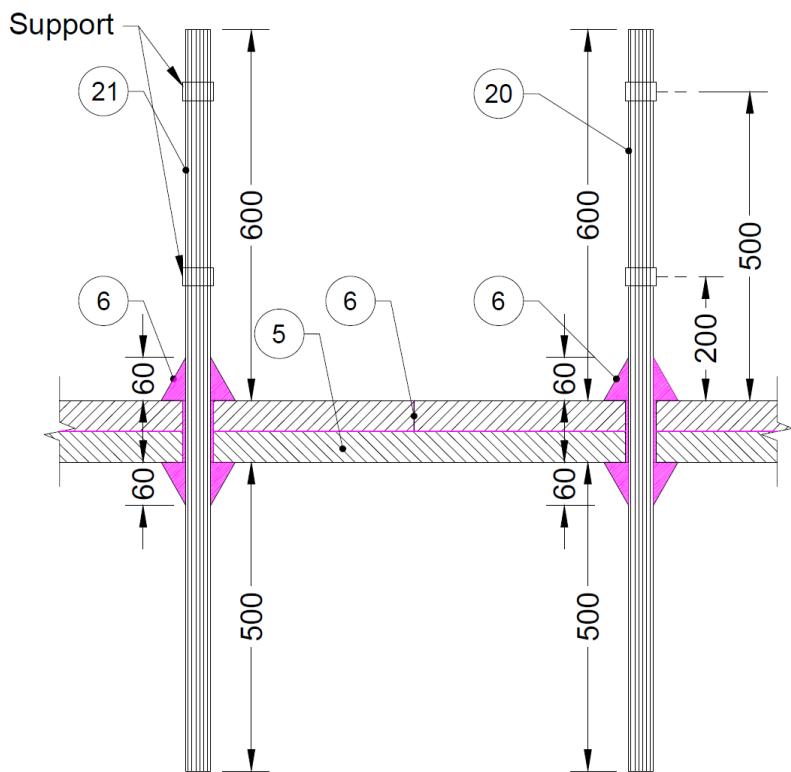
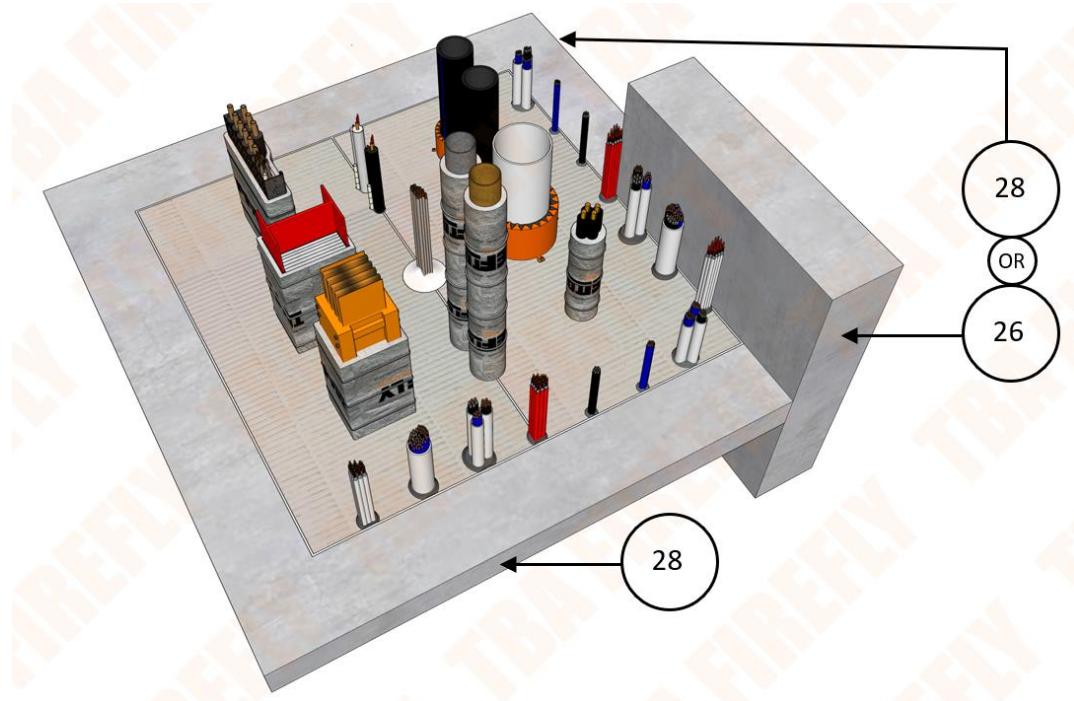
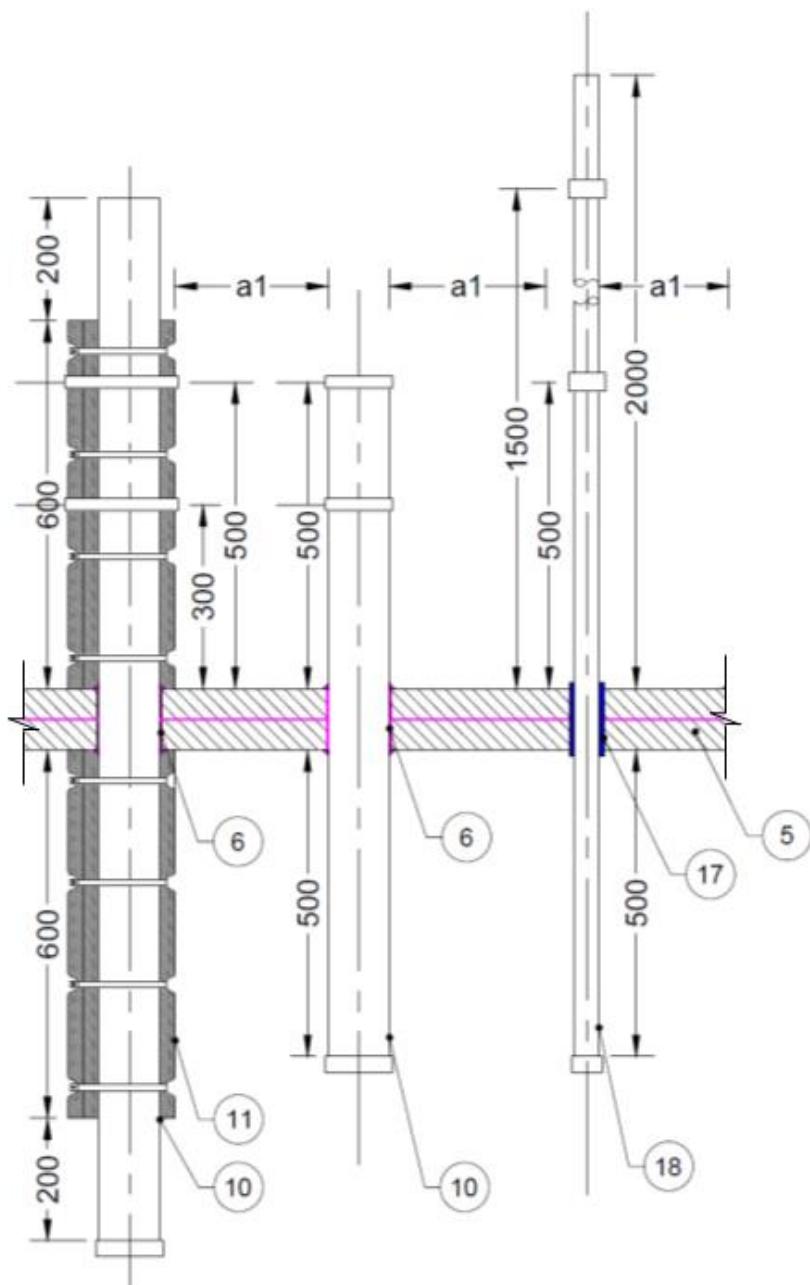


Figure 58 Section View of Optic Fibre Cables in TBA Firefly™ Intubatt in Horizontal Substrates



**Figure 59** TBA Firefly™ Intubatt® fitted to apertures in Horizontal Substrates. All Individual Services or Service Bundles must be spaced at a minimum of 40 mm from each other. (A) Un-letterboxed CLT and Un-letterboxed Lightweight construction a minimum 40mm spacing is also required between the service to the substrate. (B) This close to edge requirement is not applicable to any other Horizontal substrates contained within FAS190234 RIR Table 4. However, the specified annular gap required for fire stopping the service must be maintained.



**Figure 60a Section View of Penetrations in TBA Firefly™ Intubatt in Horizontal Substrates**

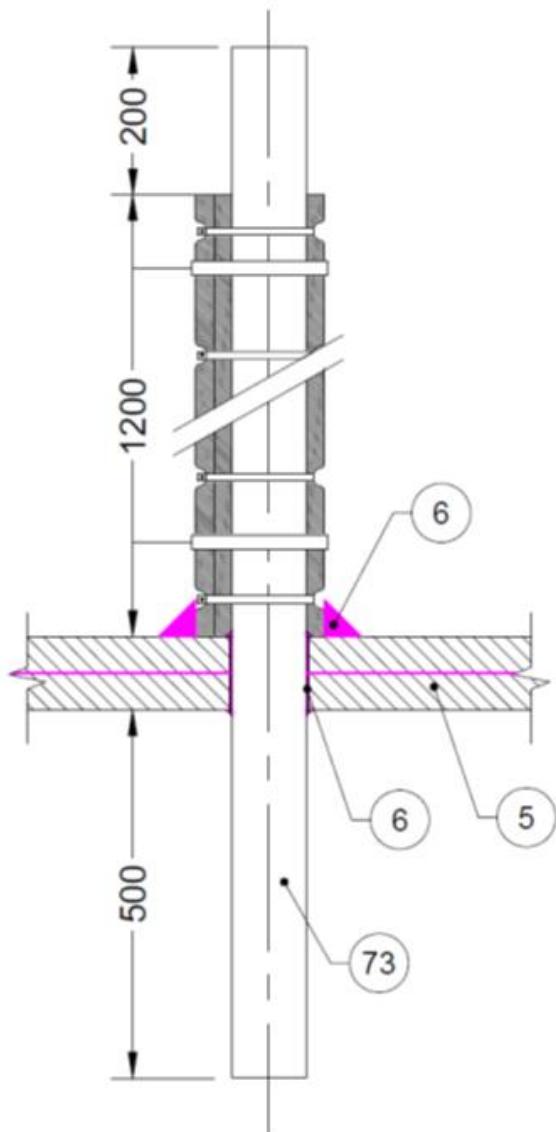


Figure 60b Section View of Penetrations in TBA Firefly™ Intubatt in Horizontal Substrates

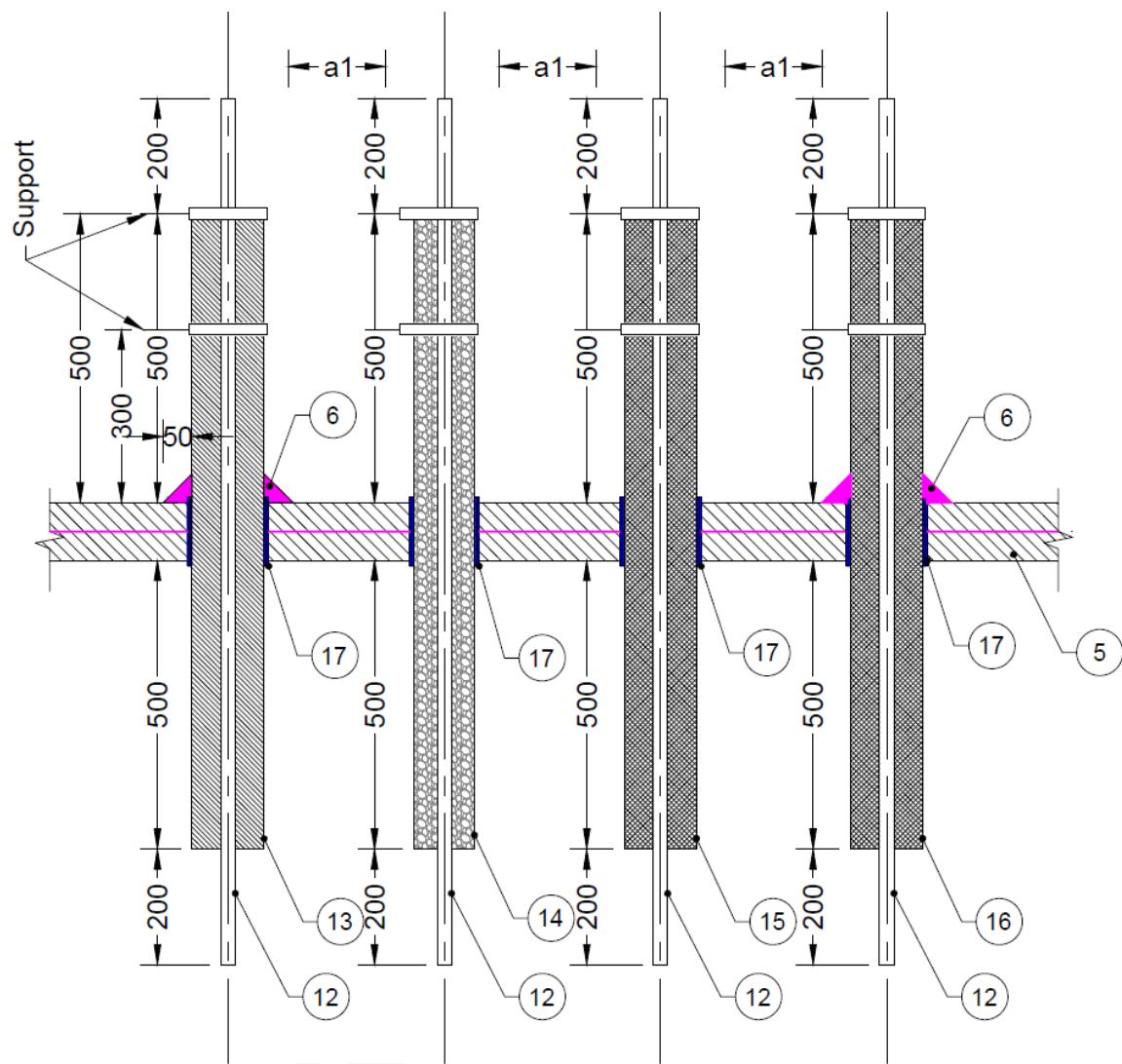


Figure 61 Section View of Penetrations in TBA Firefly™ Intubatt in Horizontal Substrates

Figure 62 Left blank for future use

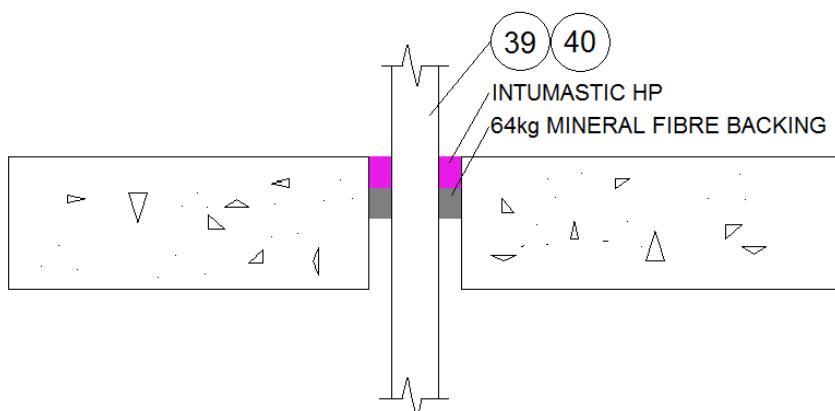


Figure 63 Small electrical cables

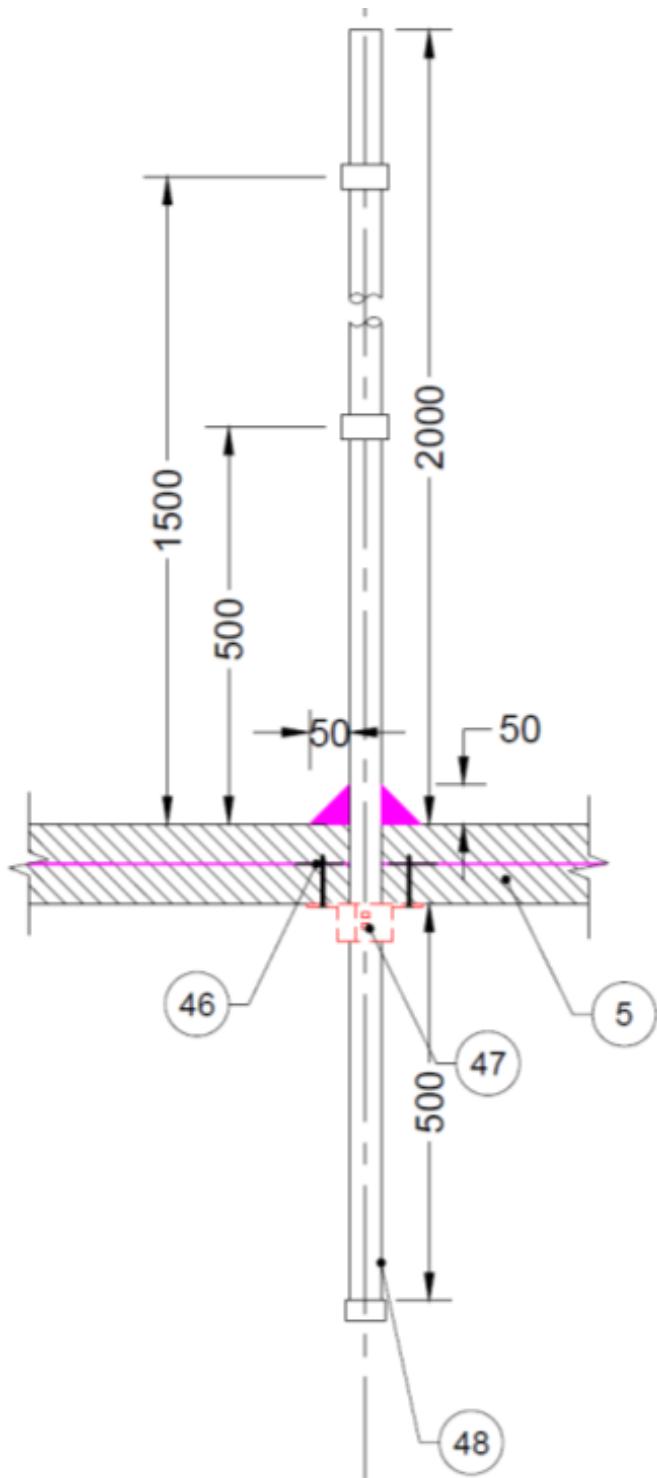
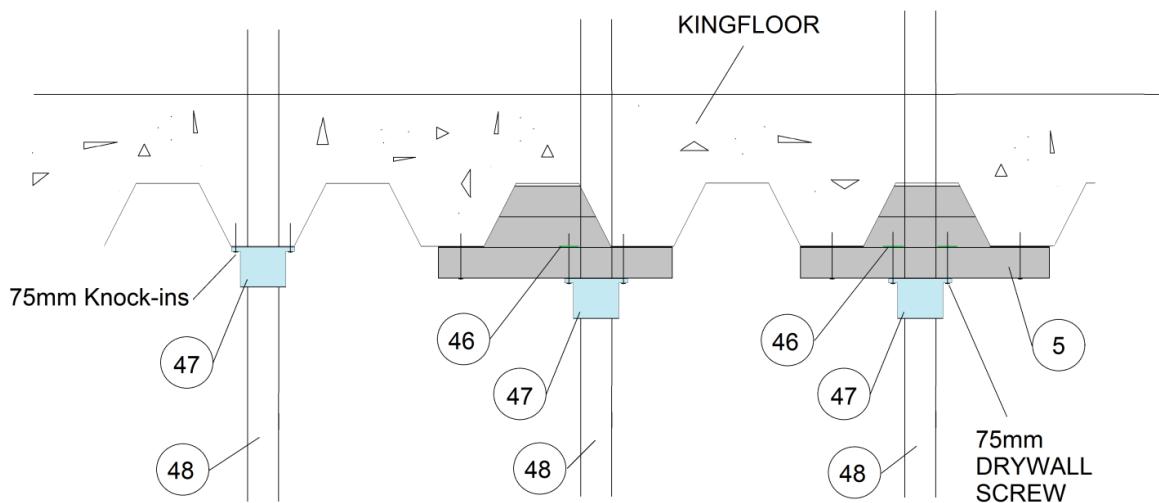


Figure 64 Section View of fire collars TBA Firefly™ Intubatt



**Figure 65 PVC and HDPE pipes protected by TBA Firefly™ FRF collars through floor with Kingfloor profile**

**Figure 66 Left blank for future use**

**Figure 67a Left blank for future use**

**Figure 67b Left blank for future use**

**Figure 67c Left blank for future use**

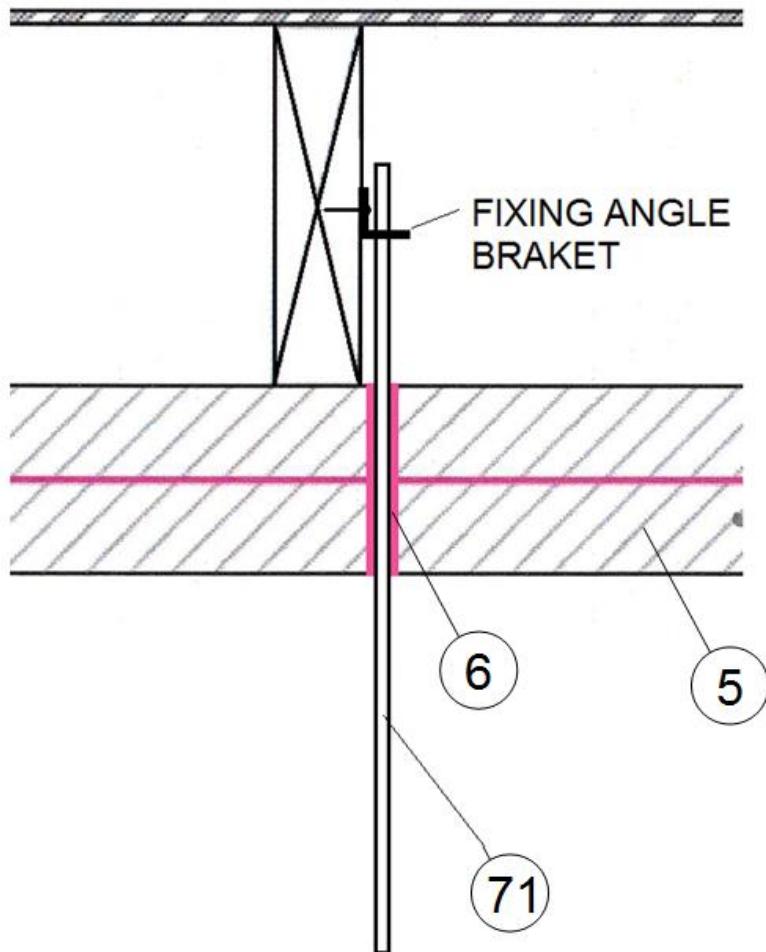


Figure 68 Threaded rod or steel pipe

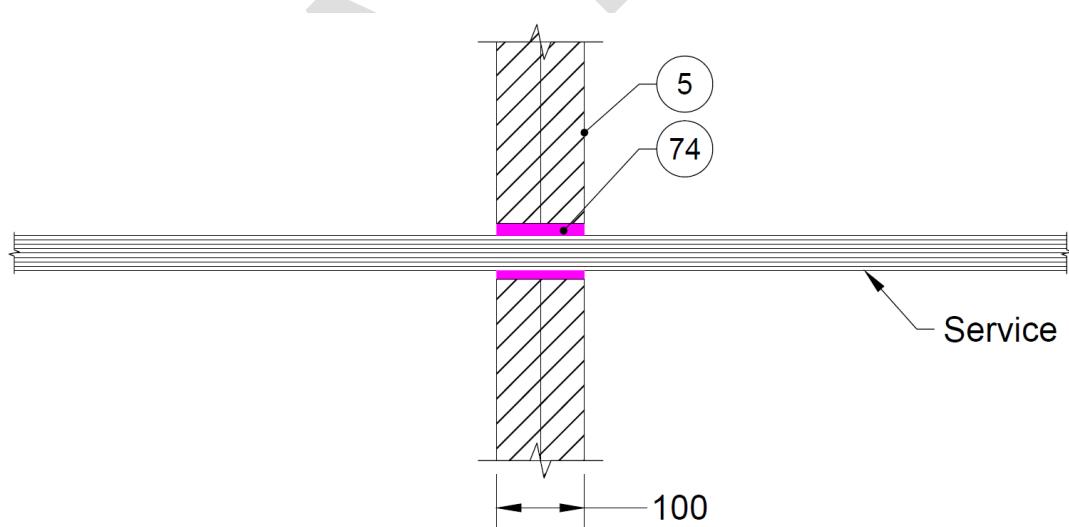
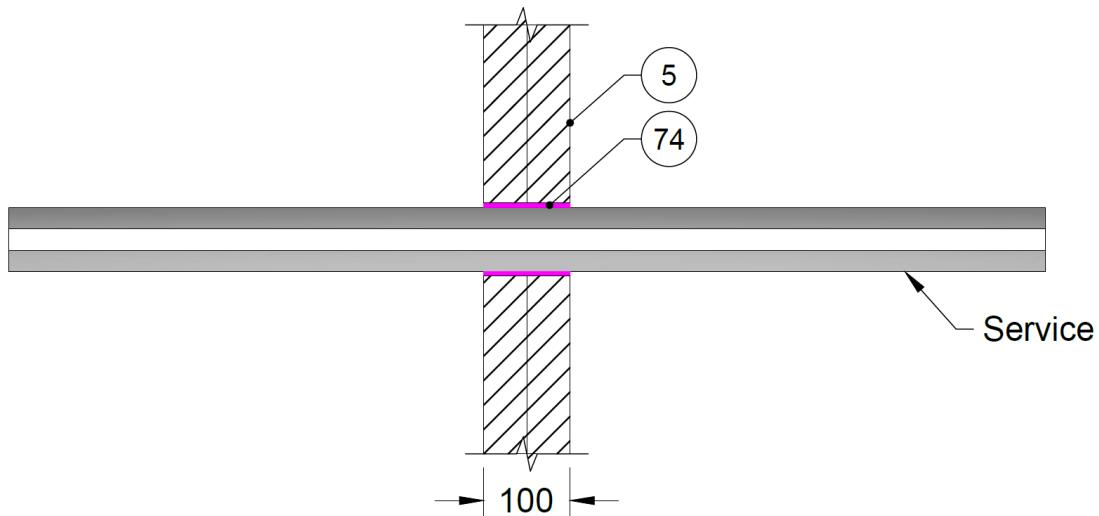
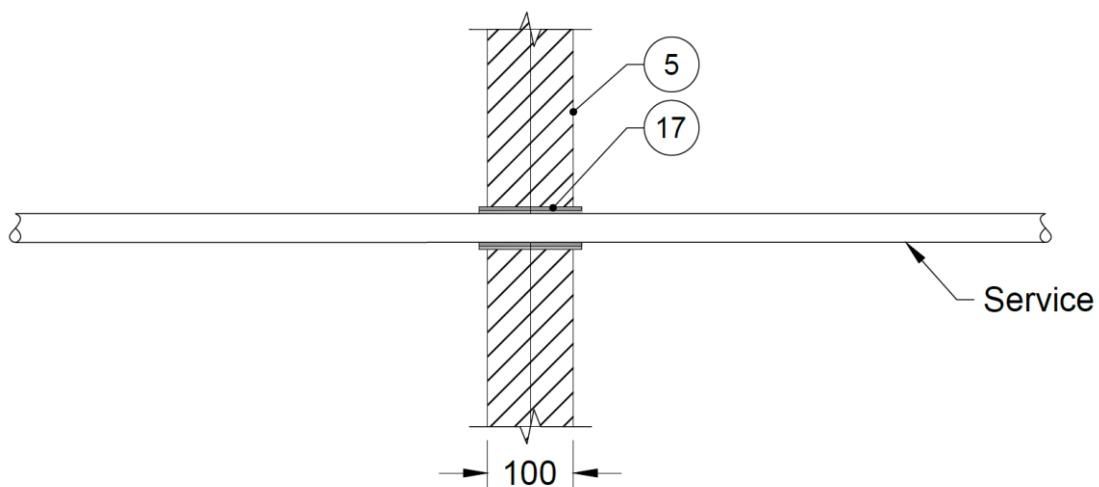


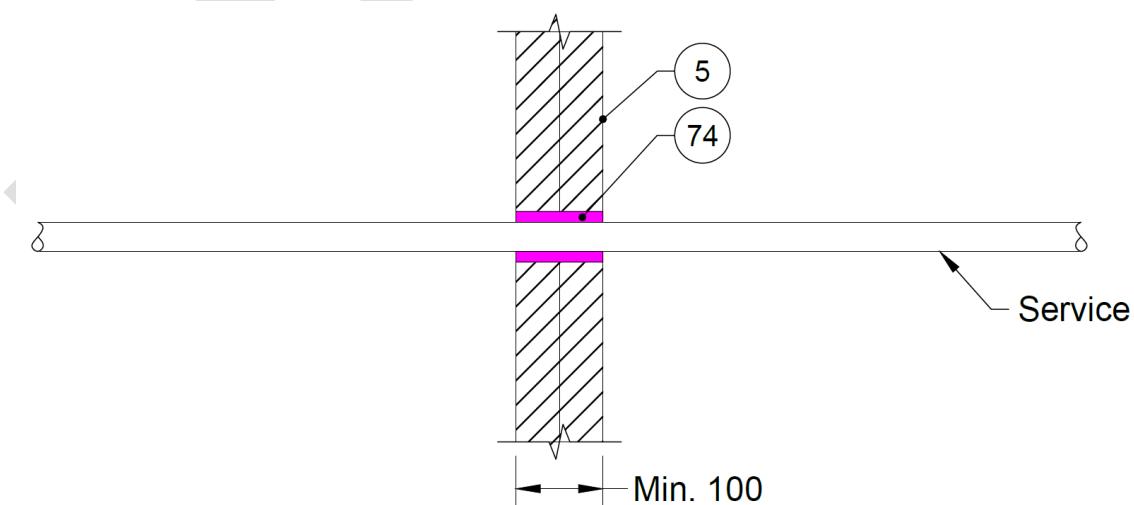
Figure 69 Section View of Cables Installed in Vertical Substrates



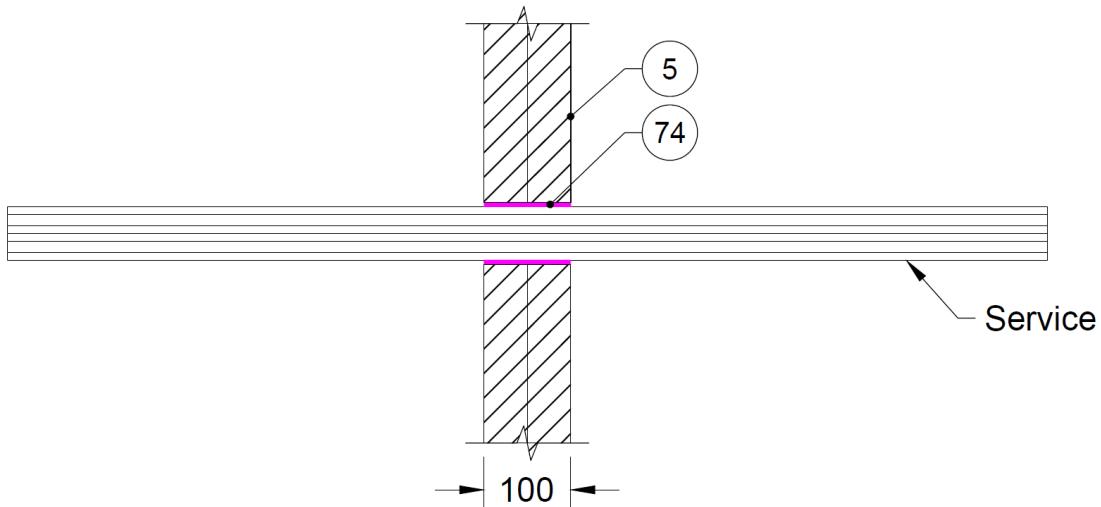
**Figure 70** Section View of lagged copper Pipe Installed in Vertical Substrates



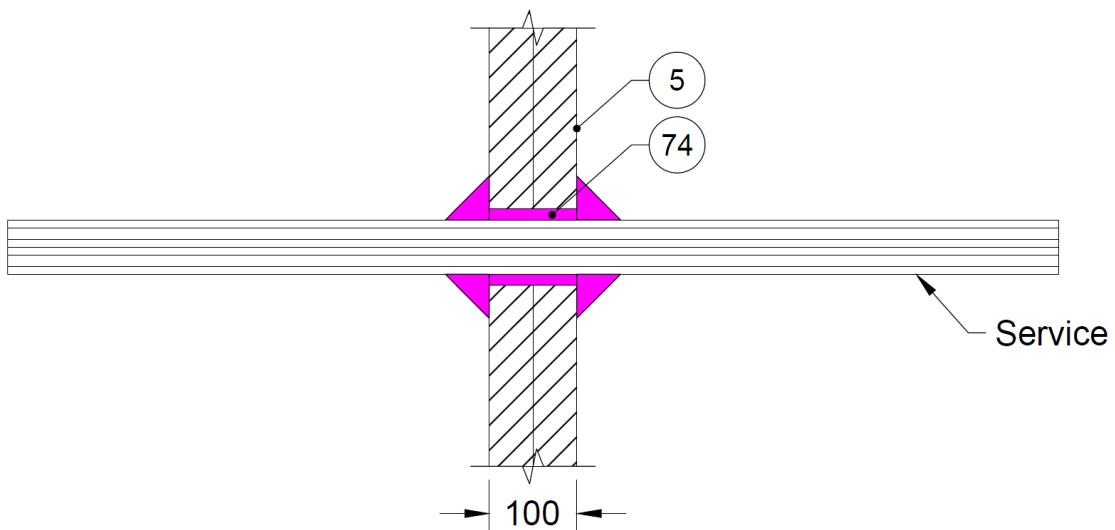
**Figure 71** Section View of Pipes Installed in Vertical Substrates



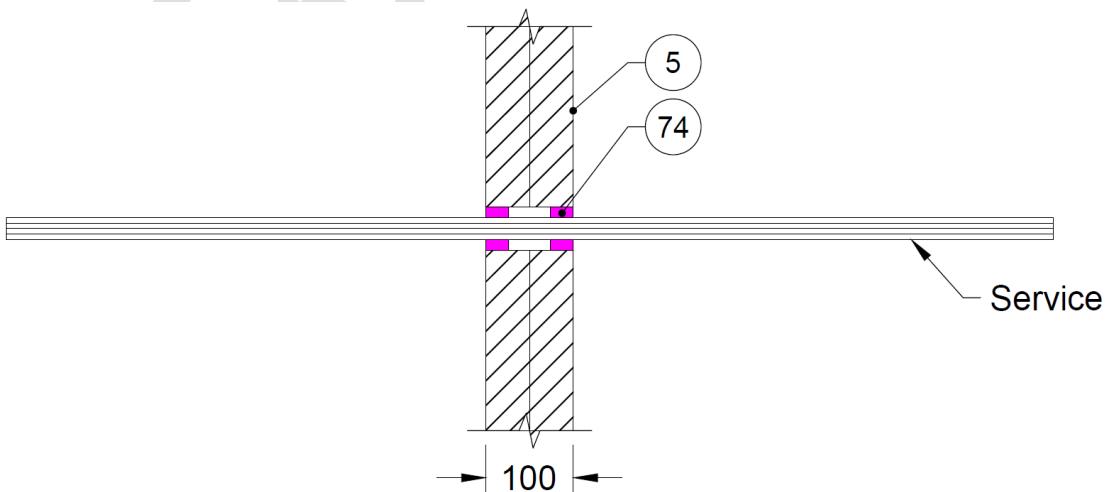
**Figure 72** Section View of Pipes Installed in Vertical Substrates



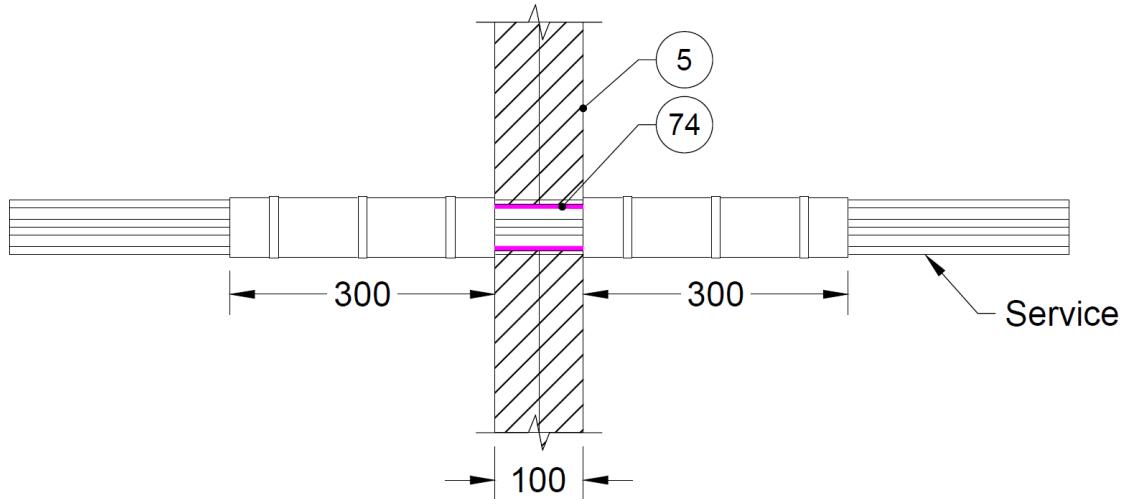
**Figure 73 Section View of Pair coil, drain hose and cables Installed in Vertical Substrates**



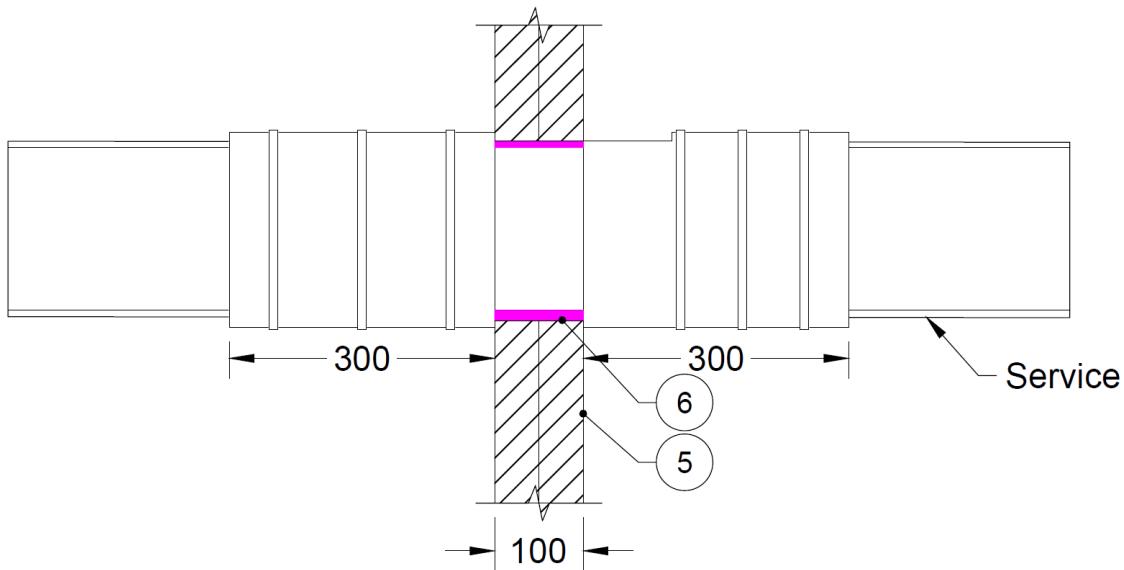
**Figure 74 Section View of Pair coil, drain hose and cables Installed in Vertical Substrates**



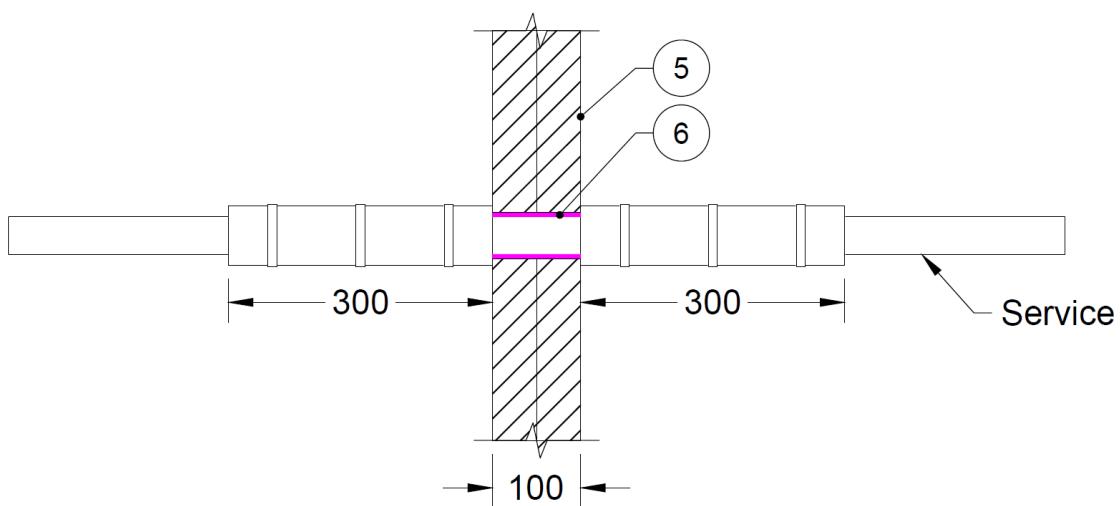
**Figure 75 Section View of Pipe conduit with cables Installed in Vertical Substrates**



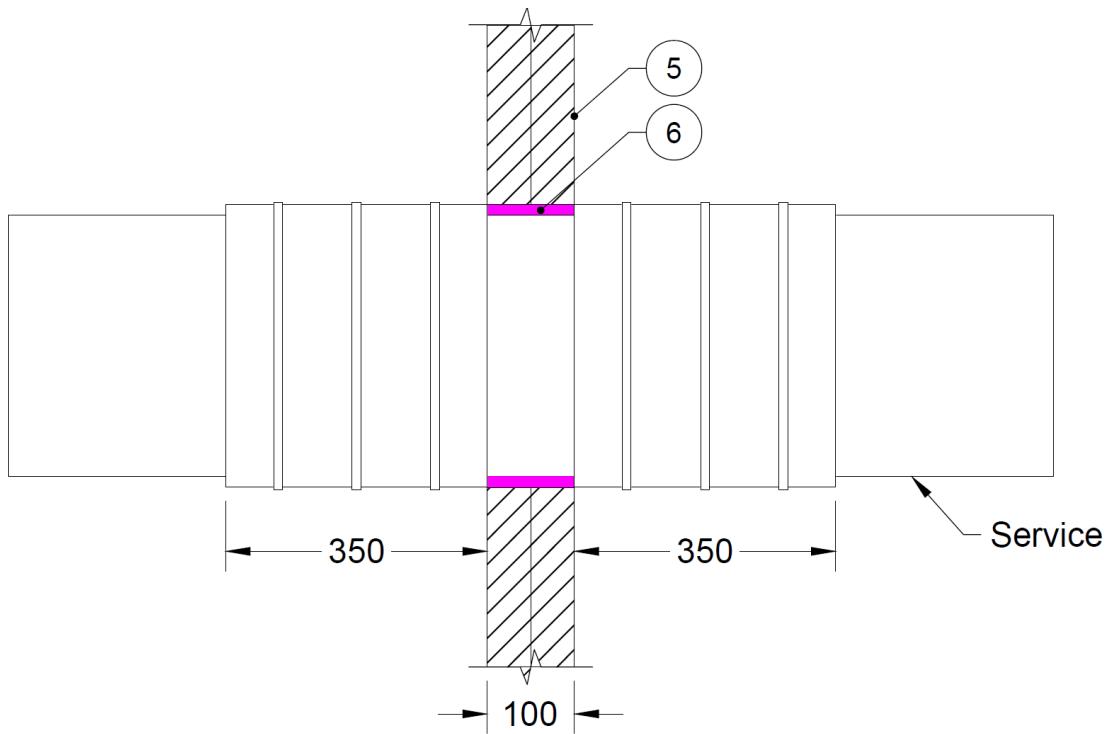
**Figure 76 Section View of Cables and Pipes Installed in Vertical Substrates**



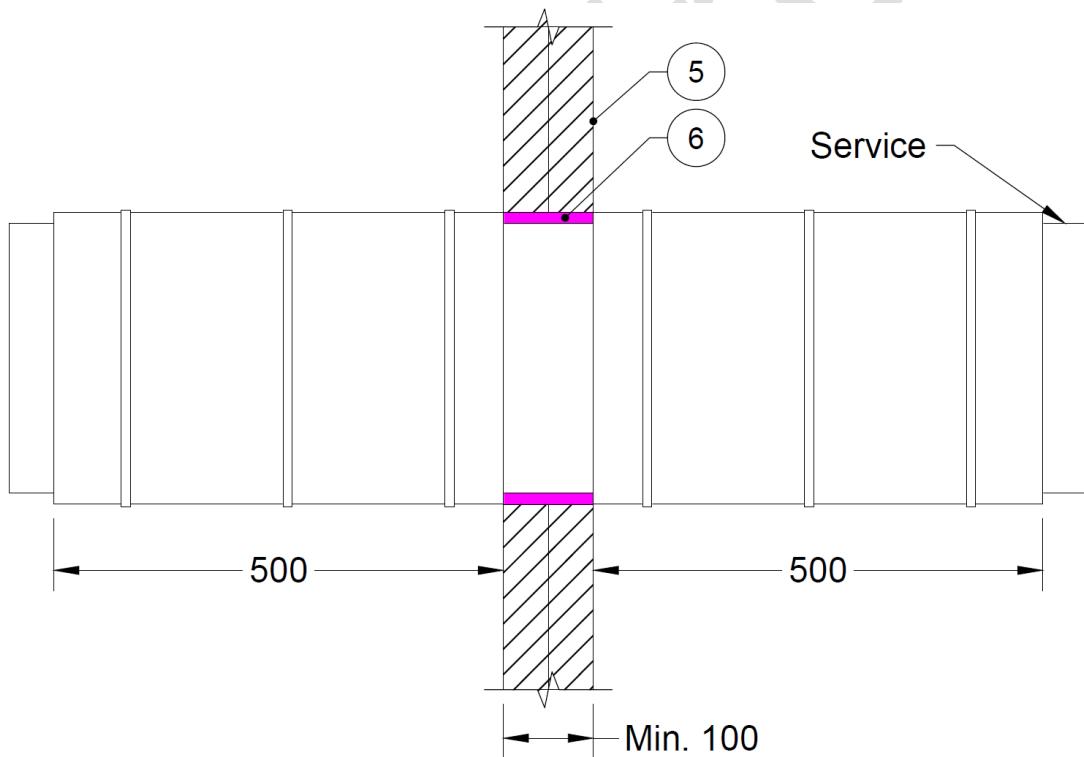
**Figure 77 Section View of beams (Steel I beam, Timber Joist and Steel C purlin) Installed in Vertical or Horizontal Substrates**



**Figure 78 Section View of Steel Pipes (up to Ø41mm) Installed in Vertical Substrates**



**Figure 79 Section View of Steel Pipes (Ø41-Ø300mm) Installed in Vertical Substrates**



**Figure 80 Section View of Steel Pipes (Ø41-Ø300mm) Installed in Vertical Substrates**

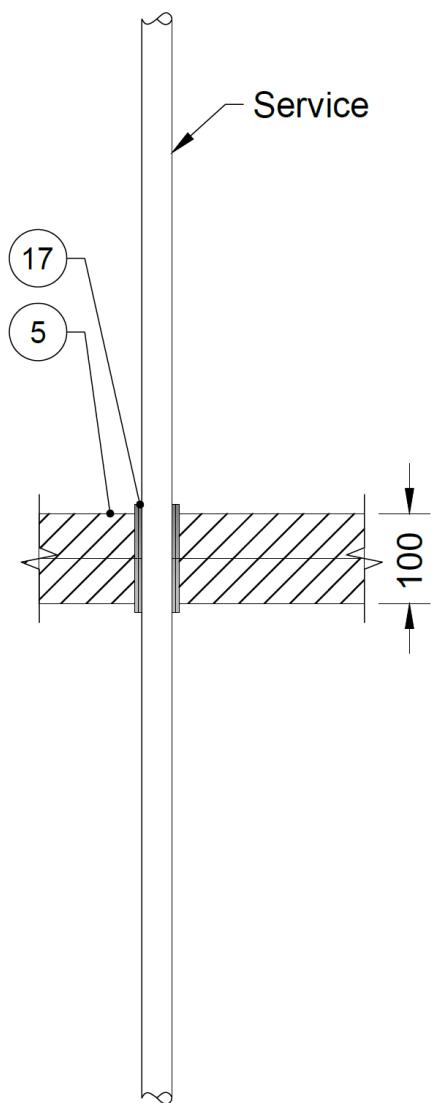


Figure 81 Section View of Pipes Installed in Horizontal Substrates

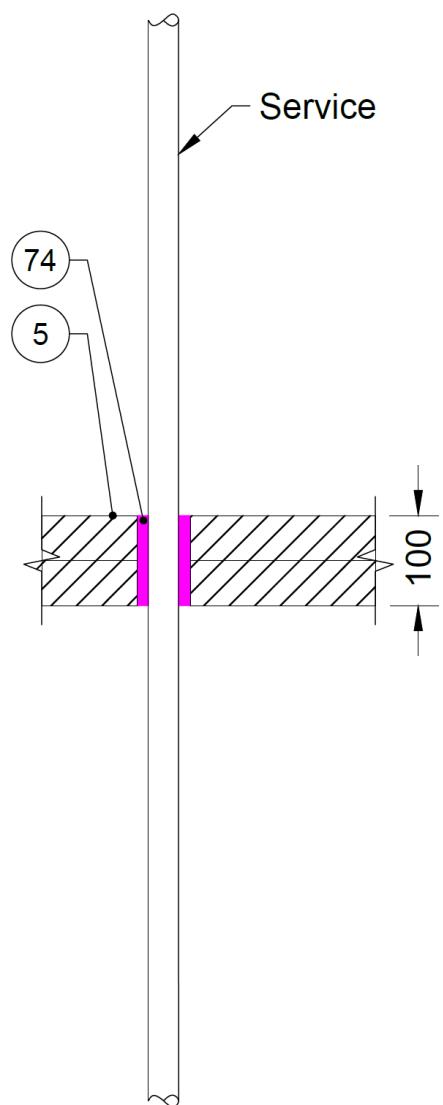


Figure 82 Section View of Pipes Installed in Horizontal Substrates

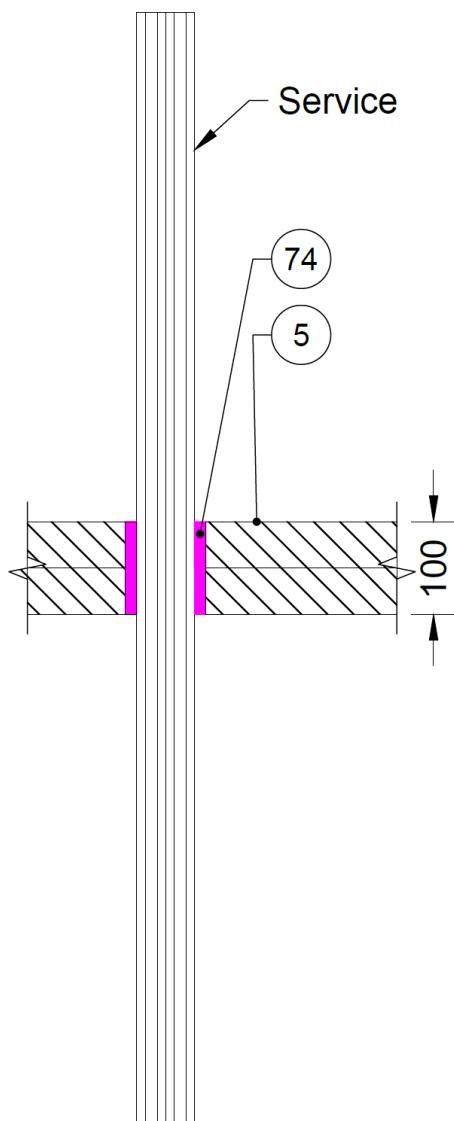


Figure 83 Section View of Pair coil, drain hose and cables Installed in Horizontal Substrates

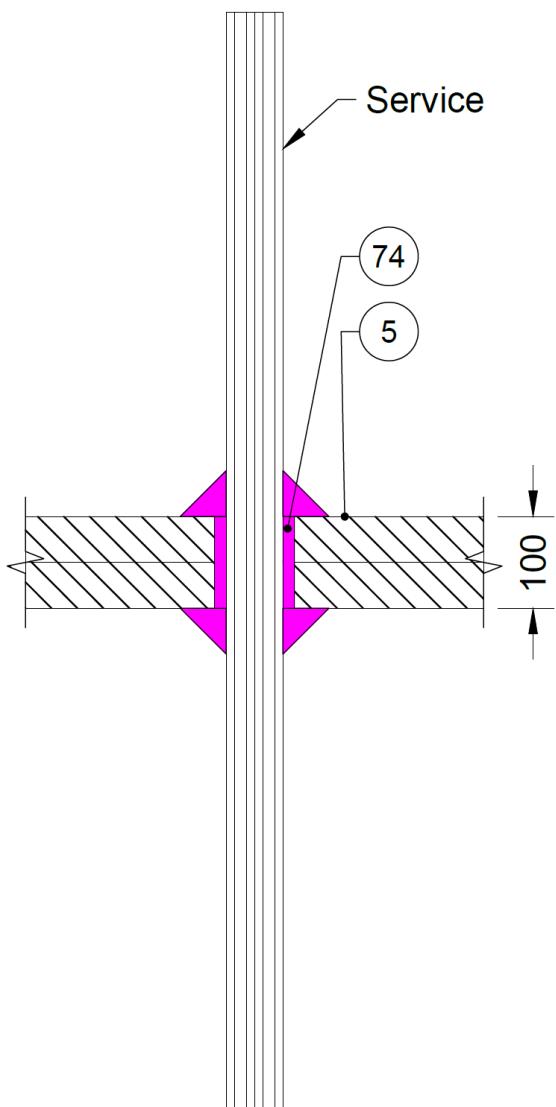


Figure 84 Section View of Pair coil, drain hose and cables Installed in Horizontal Substrates

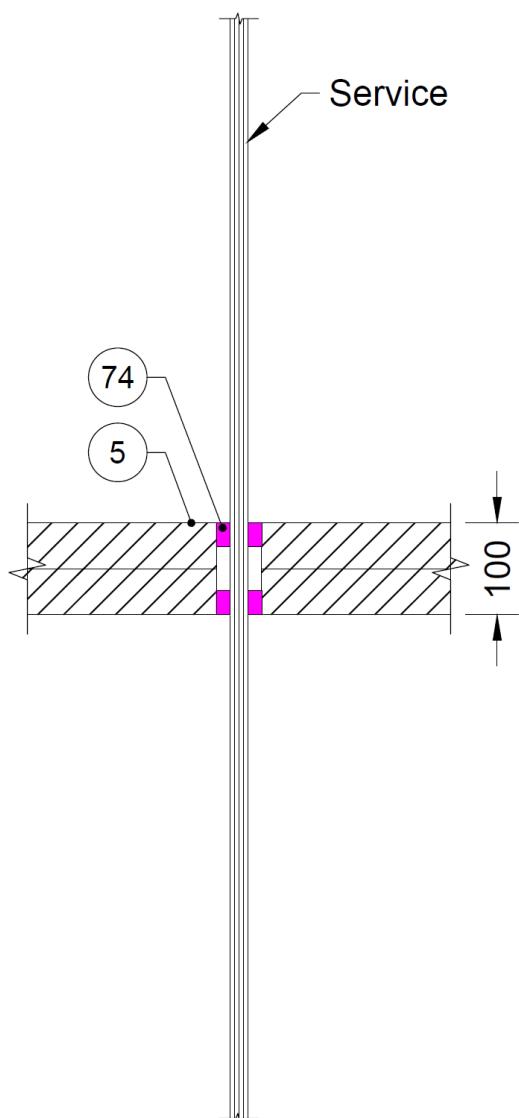


Figure 85 Section View of Pipe conduit with cables Installed in Horizontal Substrates

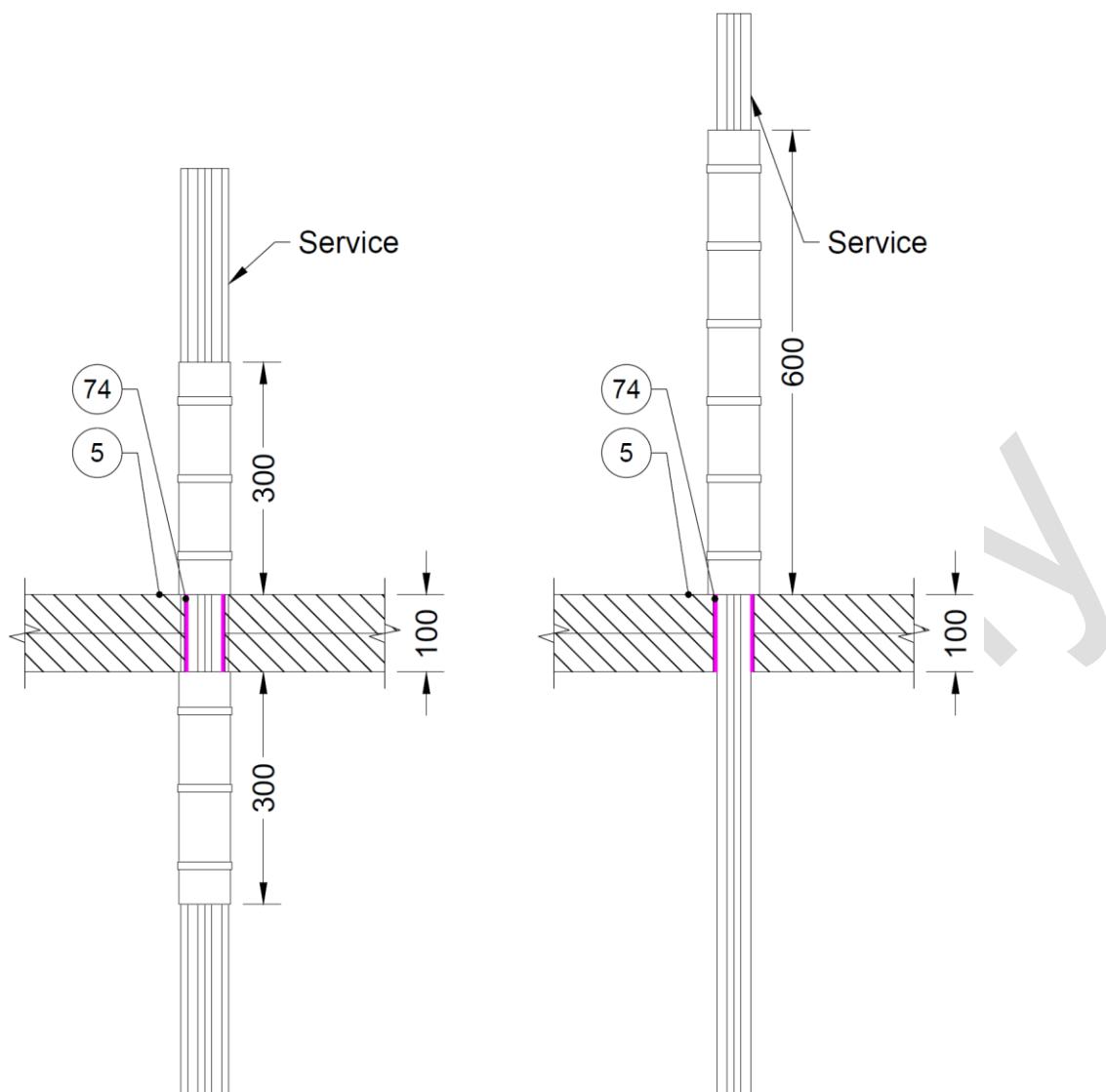
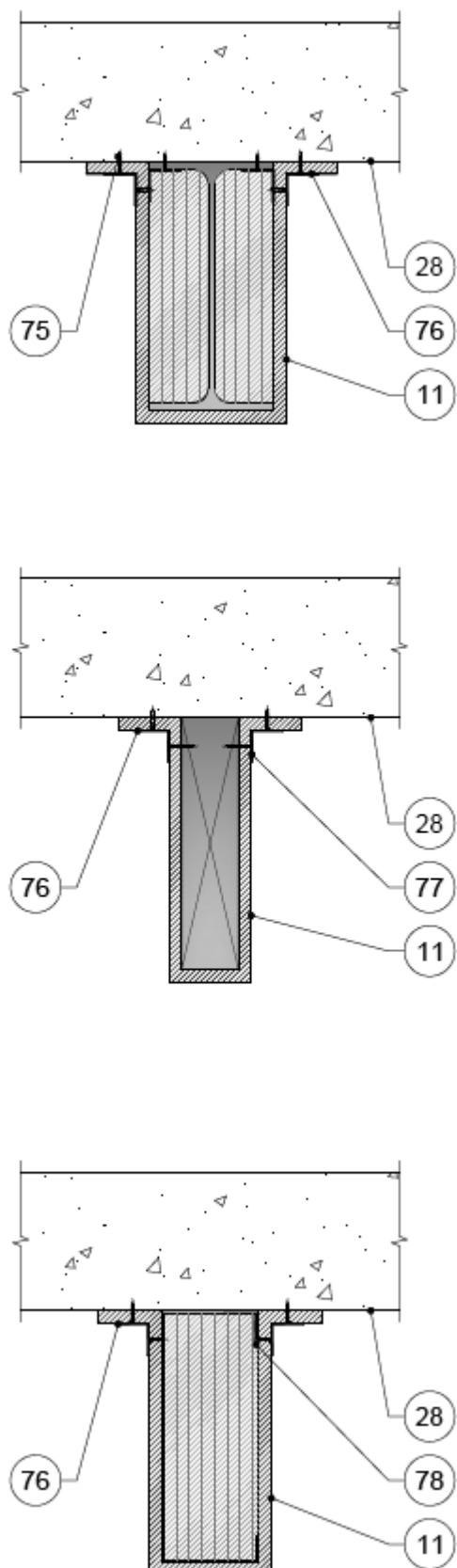


Figure 86 Section View of Cables and Pipes Installed in Horizontal Substrates



**Figure 87 Section View of beams (Steel I beam, Timber Joist and Steel C purlin) Installed in Vertical or Horizontal Substrates**

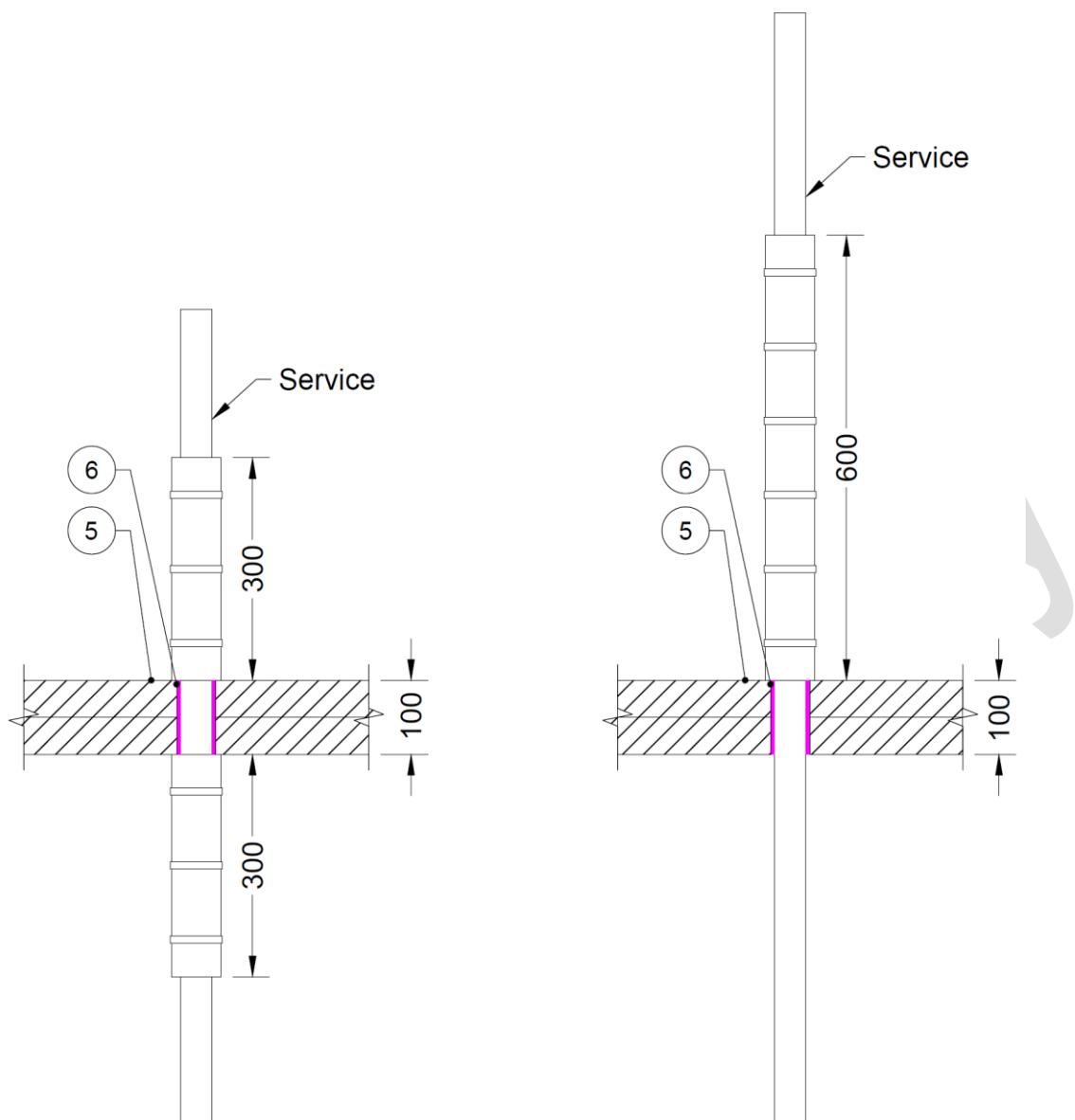


Figure 88 Section View of Steel Pipes (up to Ø41mm) Installed in Horizontal Substrates

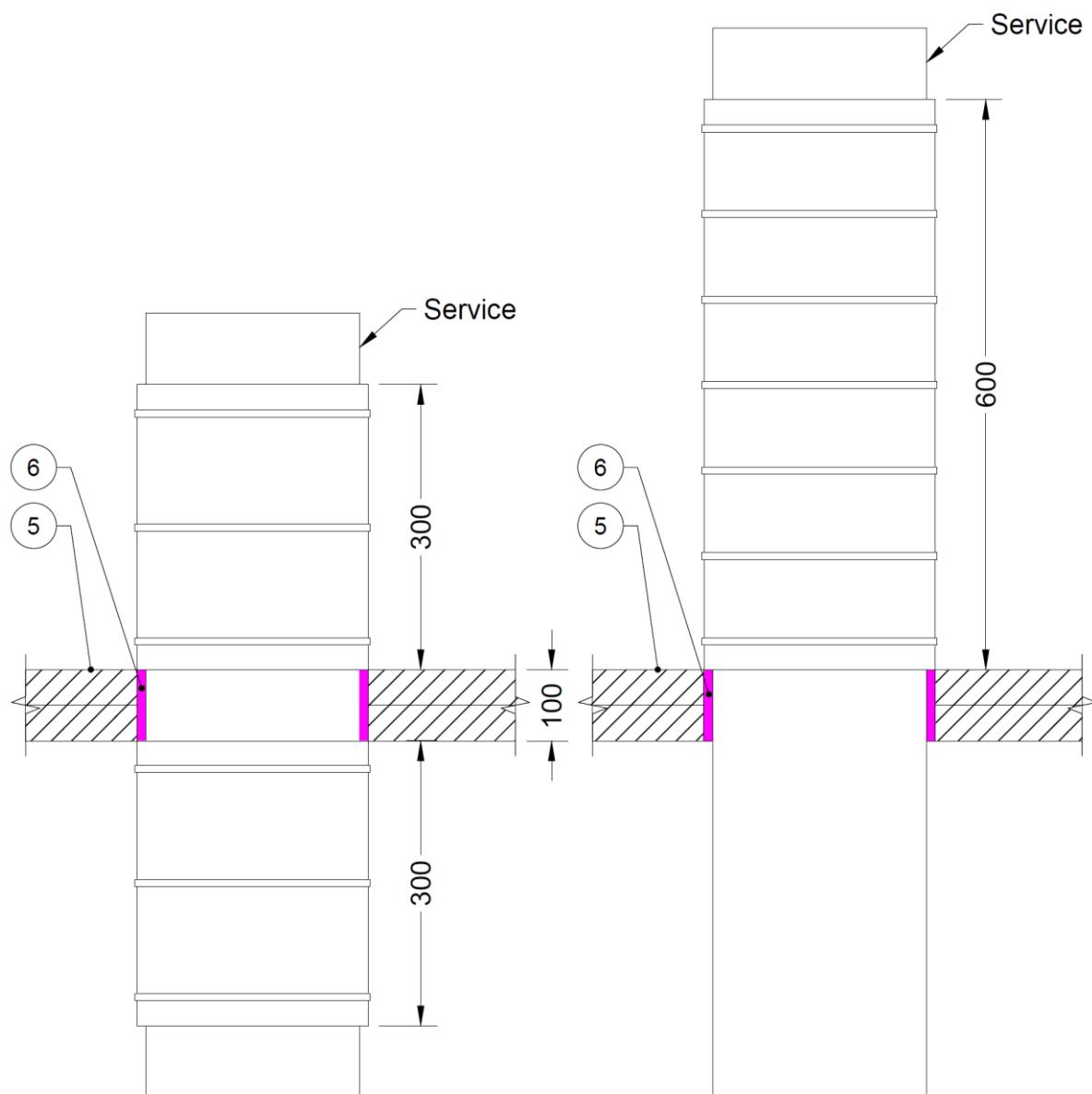


Figure 89 Section View of Steel Pipes ( $\varnothing 41$ - $\varnothing 300$ mm) Installed in Horizontal Substrates

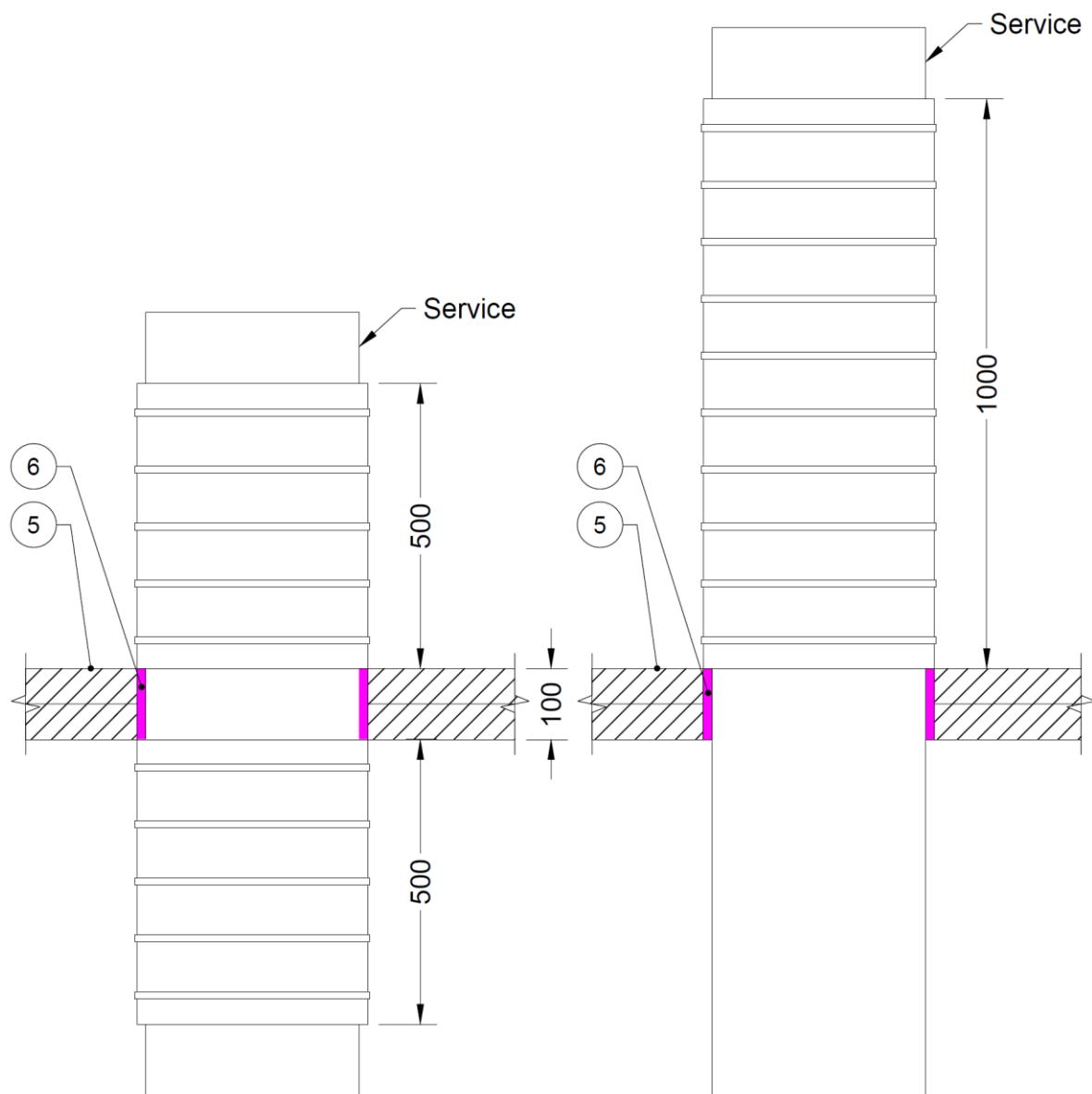
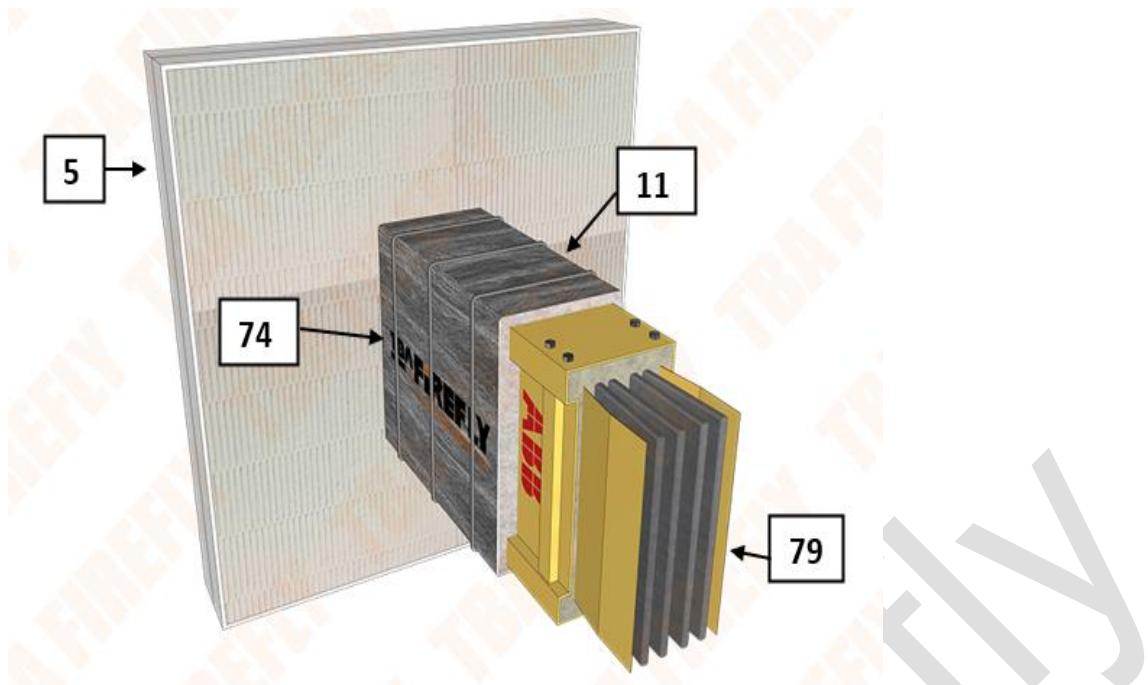


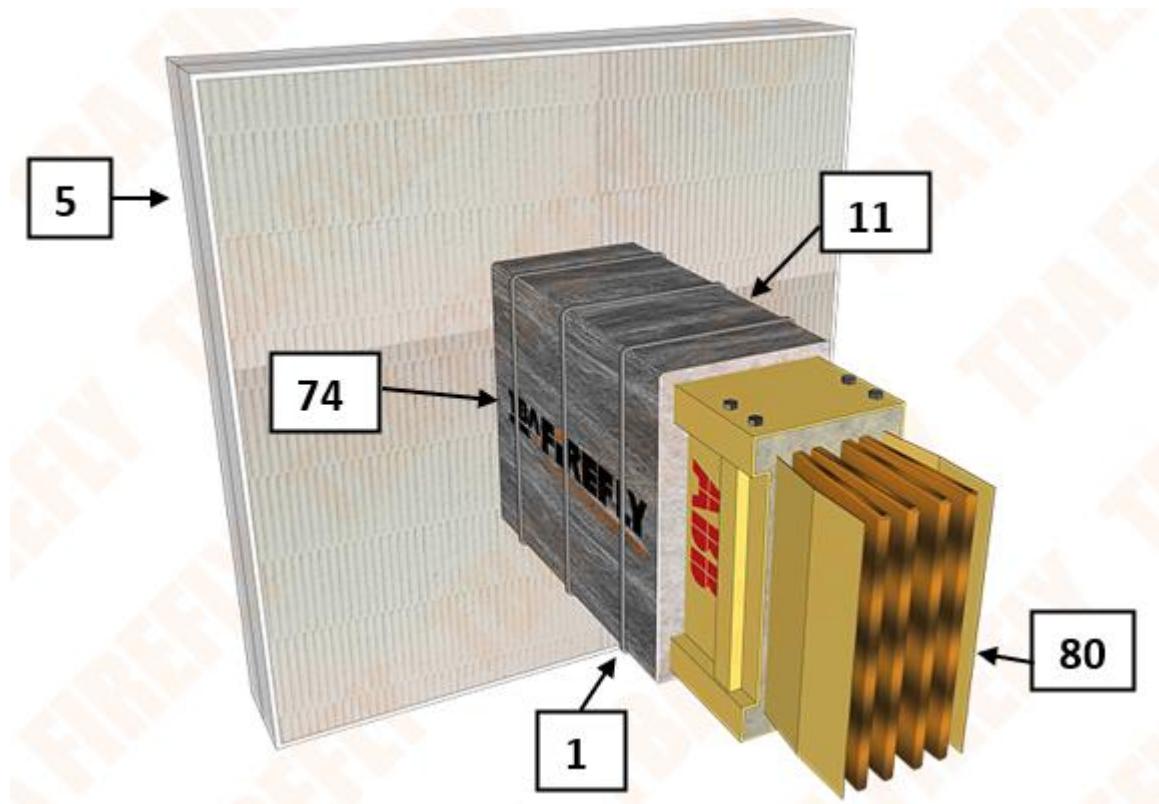
Figure 90 Section View of Steel Pipes ( $\varnothing 41$ - $\varnothing 300$ mm) Installed in Horizontal Substrates



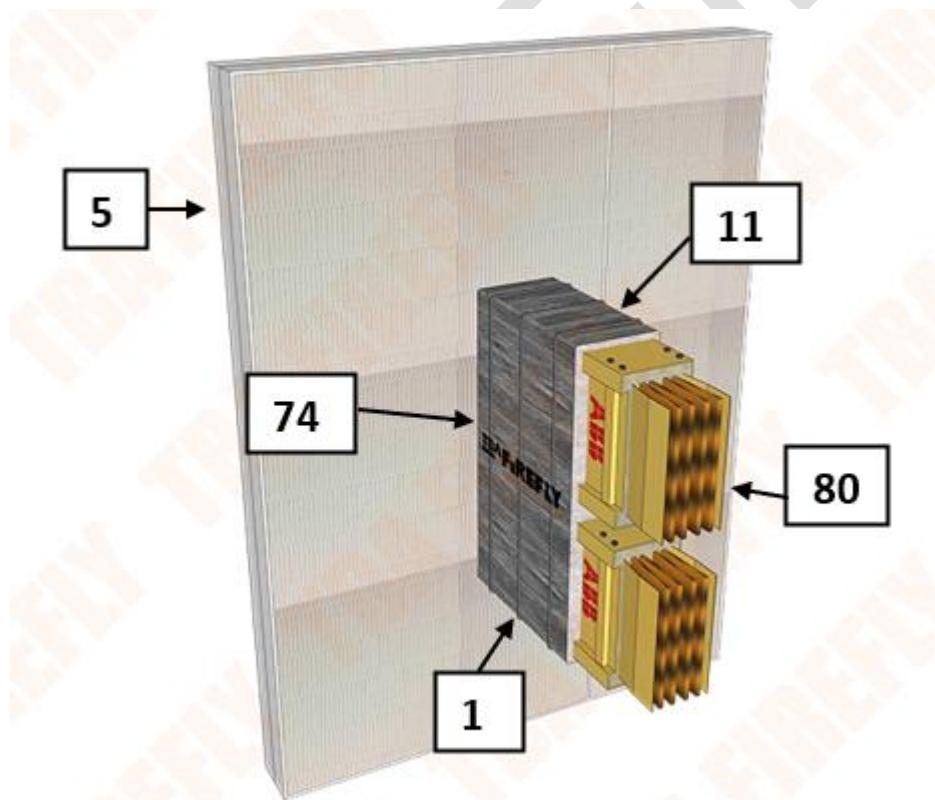
**Figure 91a ABB ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation**



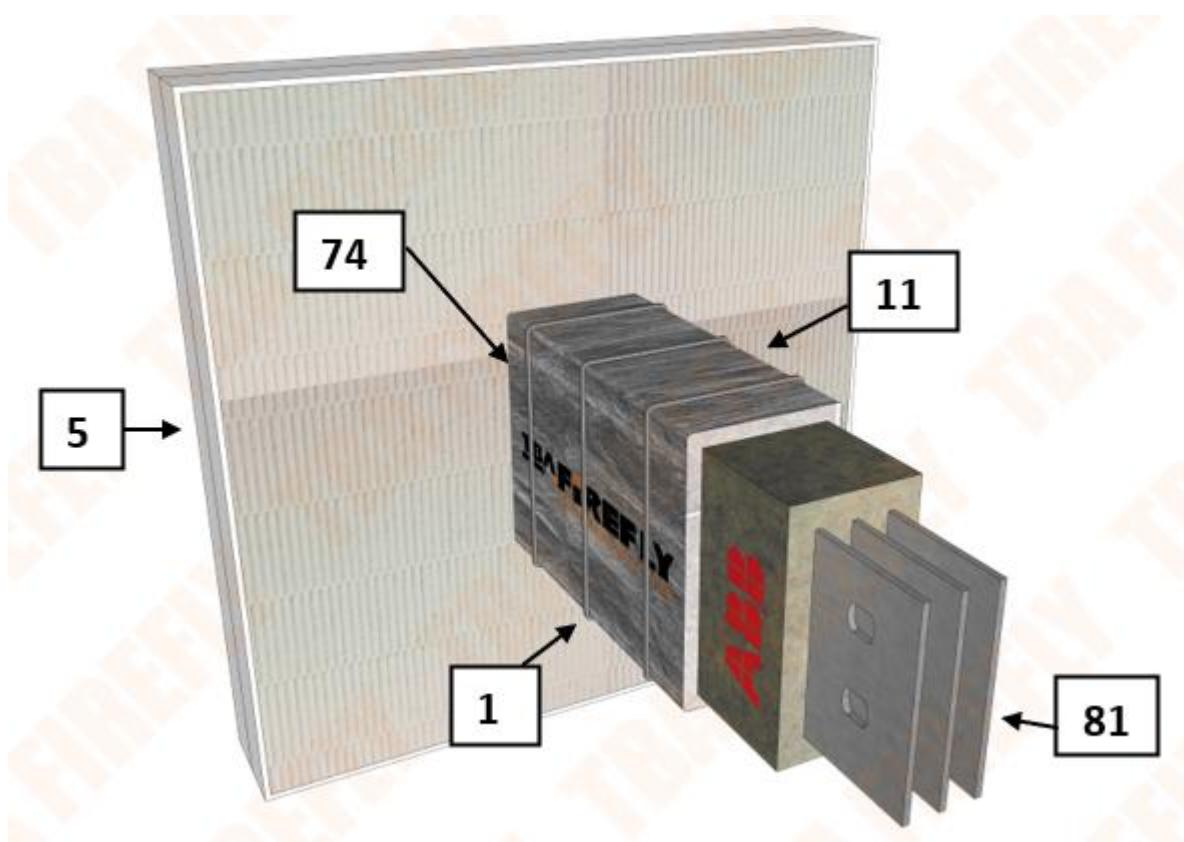
**Figure 91b ABB ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation**



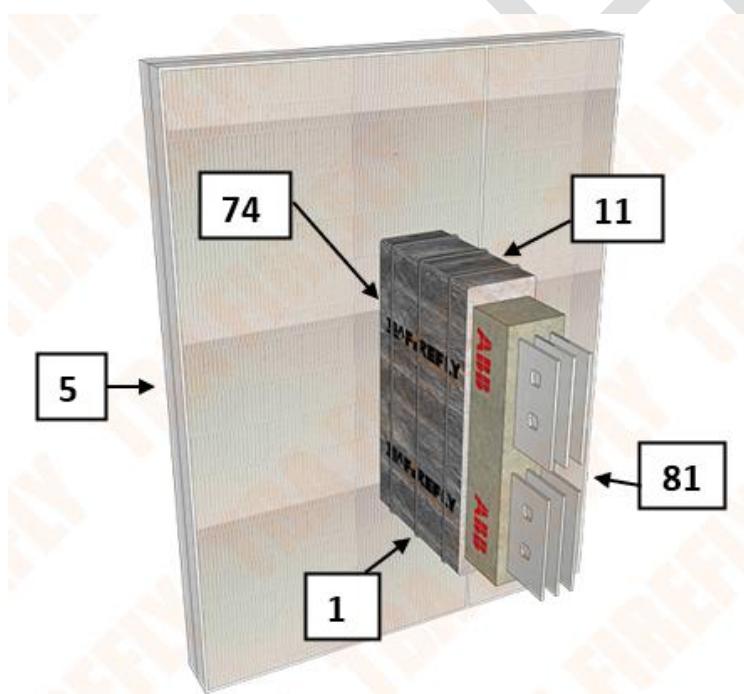
**Figure 92a ABB ALUMINIUM ENCASED SANDWICH BUSDUCT – COPPER CONDUCTORS**  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



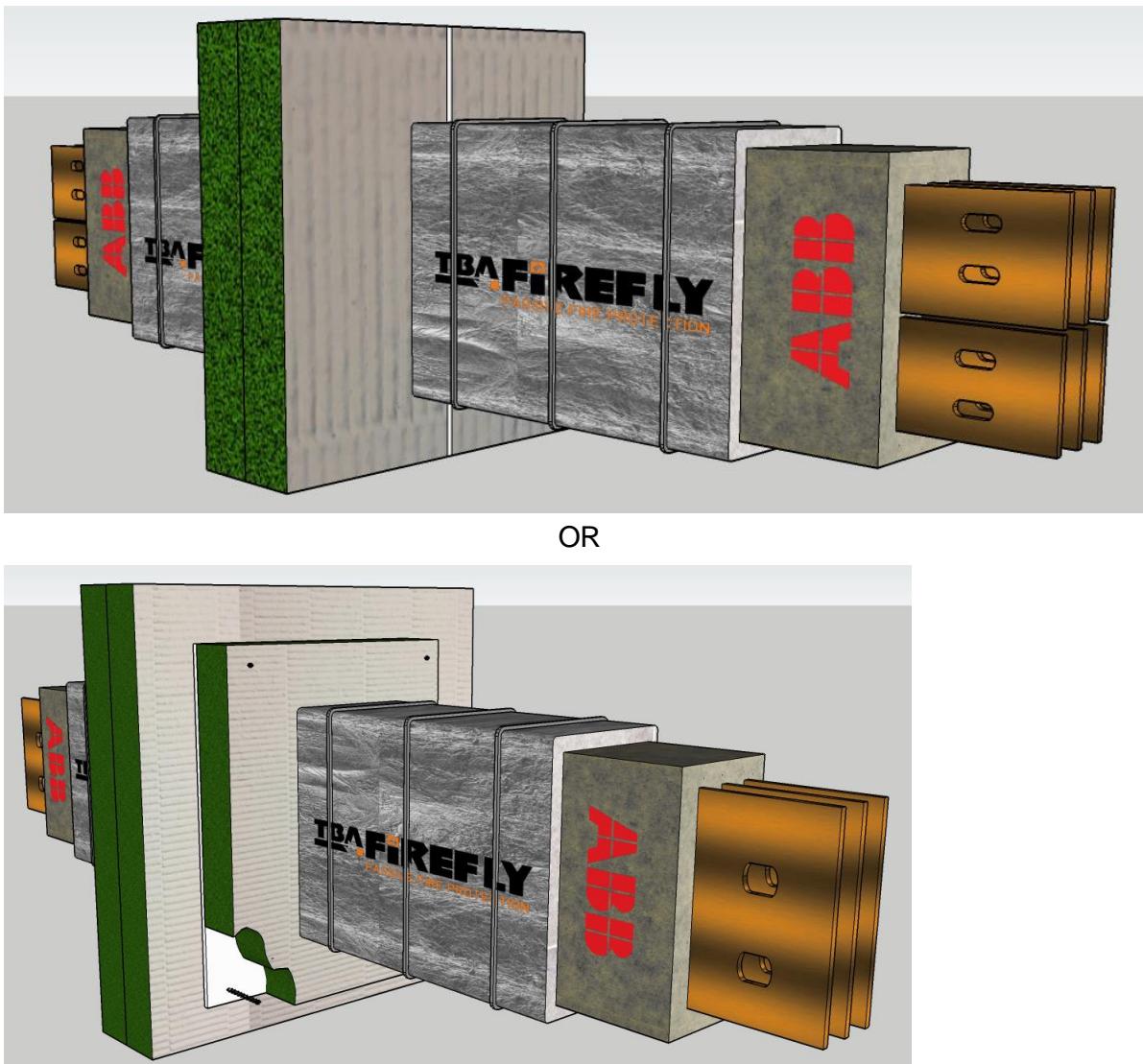
**Figure 92b ABB ALUMINIUM ENCASED SANDWICH BUSDUCT – COPPER CONDUCTORS**  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



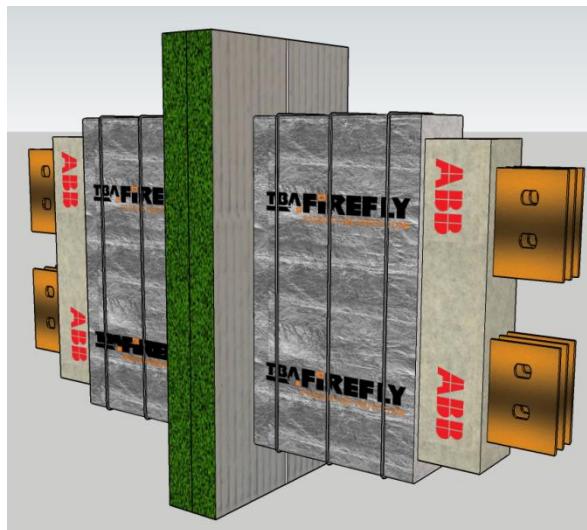
**Figure 93a** ABB CAST RESIN - BUSDUCT SYSTEM - ALUMINIUM CONDUCTORS Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



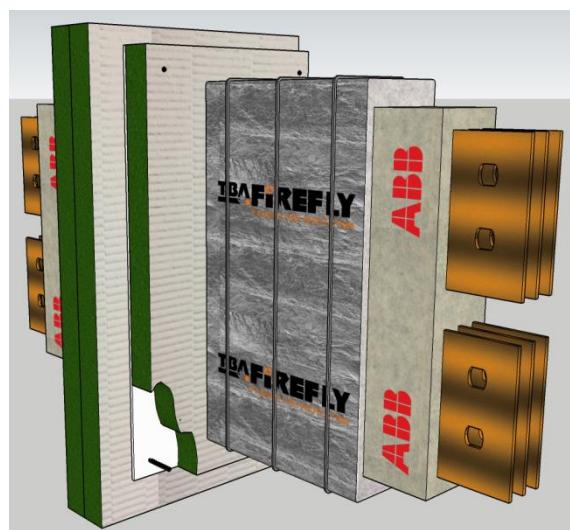
**Figure 93b** ABB CAST RESIN - BUSDUCT SYSTEM - ALUMINIUM CONDUCTORS Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



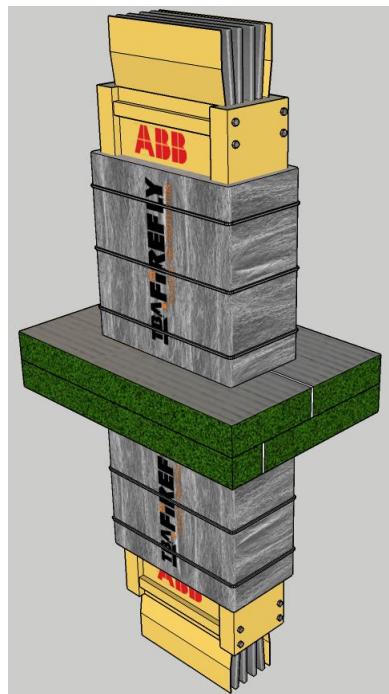
**Figure 94a ABB CAST RESIN - BUSDUCT SYSTEM - COPPER CONDUCTORS** Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation. For FRL-/240/180 and -/240/240 an additional pattrass of TBA Firefly™ Intubatt is required locally around the service



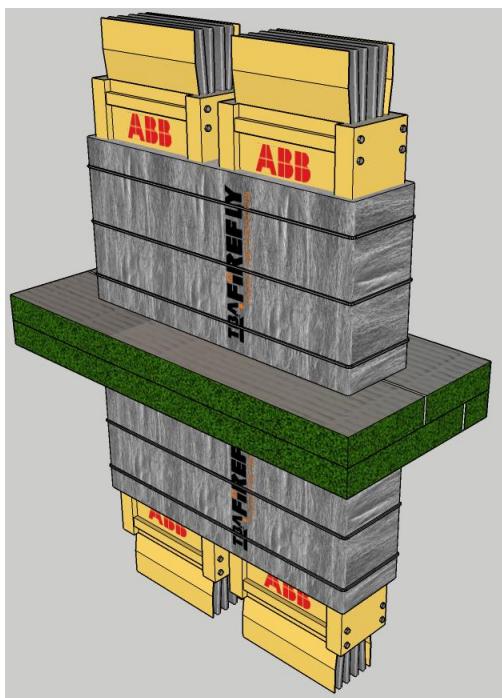
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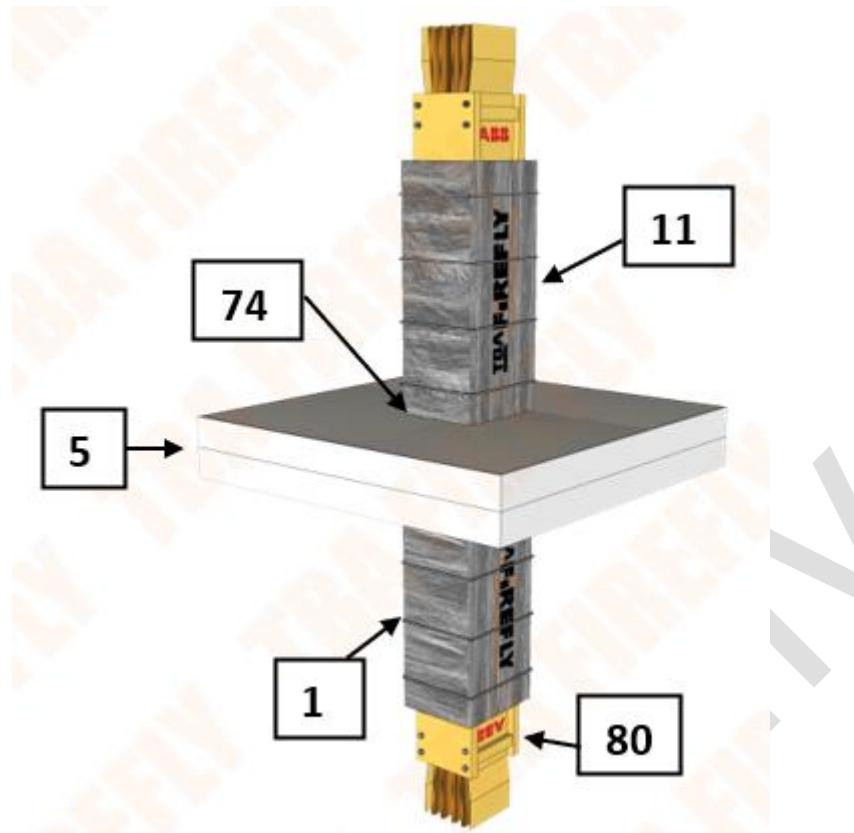
**Figure 94b ABB CAST RESIN - BUSDUCT SYSTEM - COPPER CONDUCTORS** Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation. For FRL-/240/180 and -/240/240 an additional pattress of TBA Firefly™ Intubatt is required locally around the service



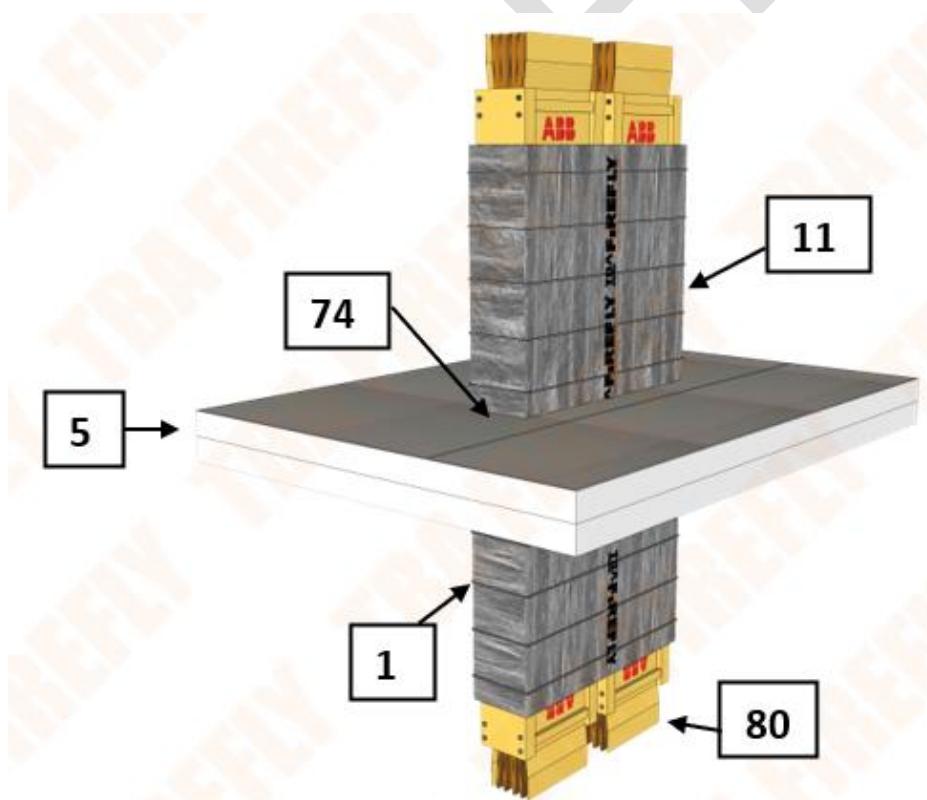
**Figure 95a ABB ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Vertical Orientation**



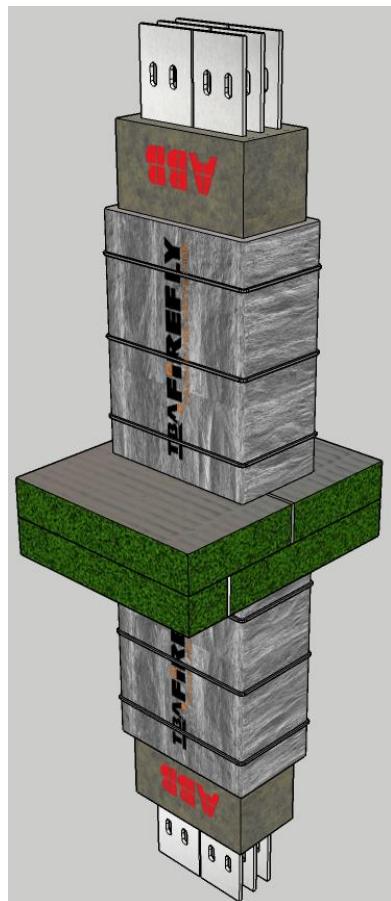
**Figure 95b ABB ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation**



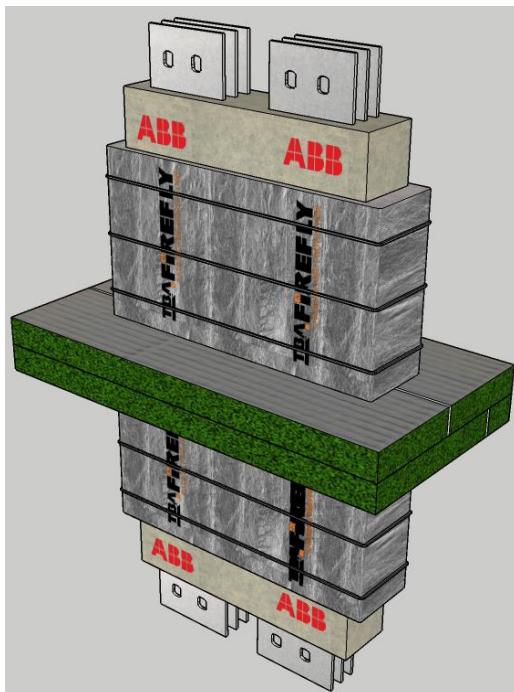
**Figure 96a ABB ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation**



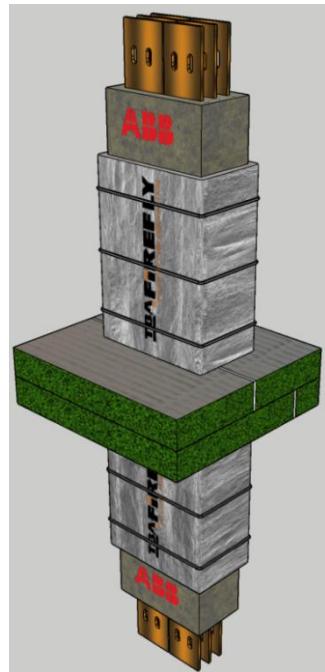
**Figure 96b ABB ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Vertical Orientation**



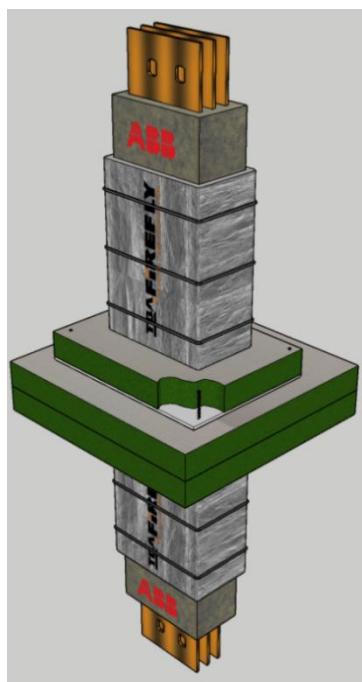
**Figure 97a ABB CAST RESIN - BUSDUCT SYSTEM - ALUMINIUM CONDUCTORS Installed through TBA Firefly™ Intubatt in a Vertical Orientation**



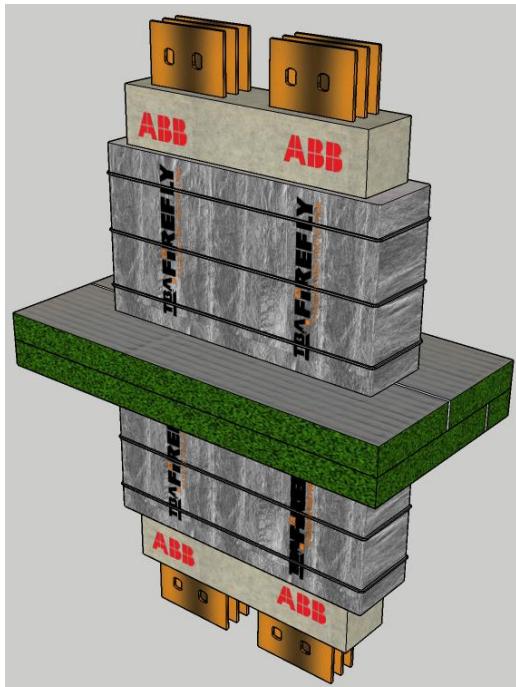
**Figure 97b ABB CAST RESIN - BUSDUCT SYSTEM - ALUMINIUM CONDUCTORS Installed through TBA Firefly™ Intubatt in a Horizontal Orientation**



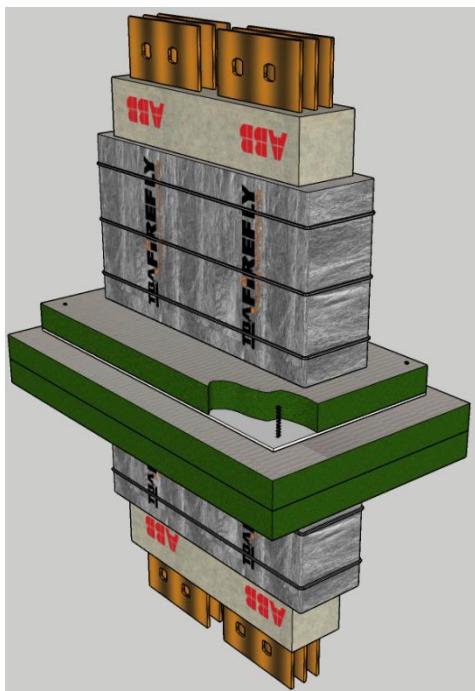
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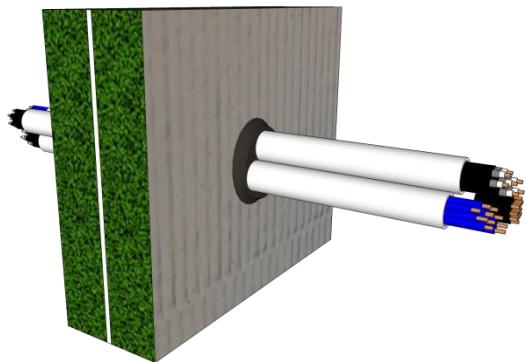
**Figure 98a ABB CAST RESIN - BUSDUCT SYSTEM - COPPER CONDUCTORS Installed through 2 layers of TBA Firefly™ Intubatt in a Horizontal Orientation. For FRL-/240/180 and-/240/240 an additional pattress of Intubatt is required locally around the service**



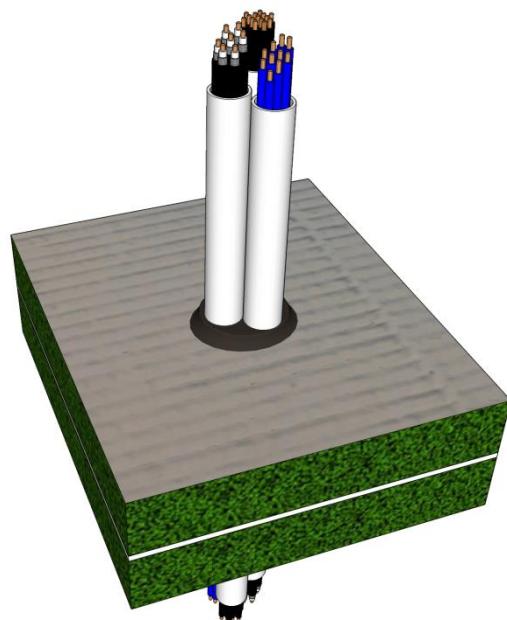
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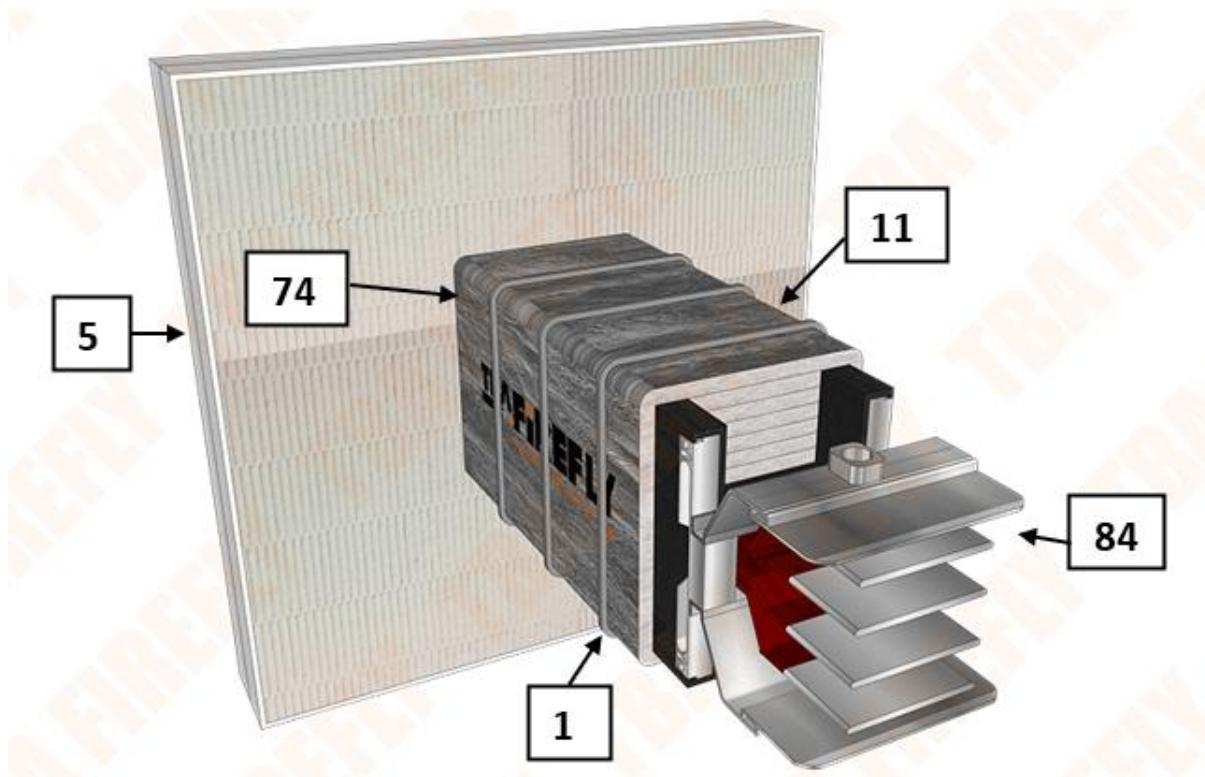
**Figure 98b ABB CAST RESIN - BUSDUCT SYSTEM - COPPER CONDUCTORS** Installed through 2 layers of TBA Firefly™ Intubatt in a Horizontal Orientation. For FRL-/240/180 and -/240/240 an additional pattress of Intubatt is required locally around the service



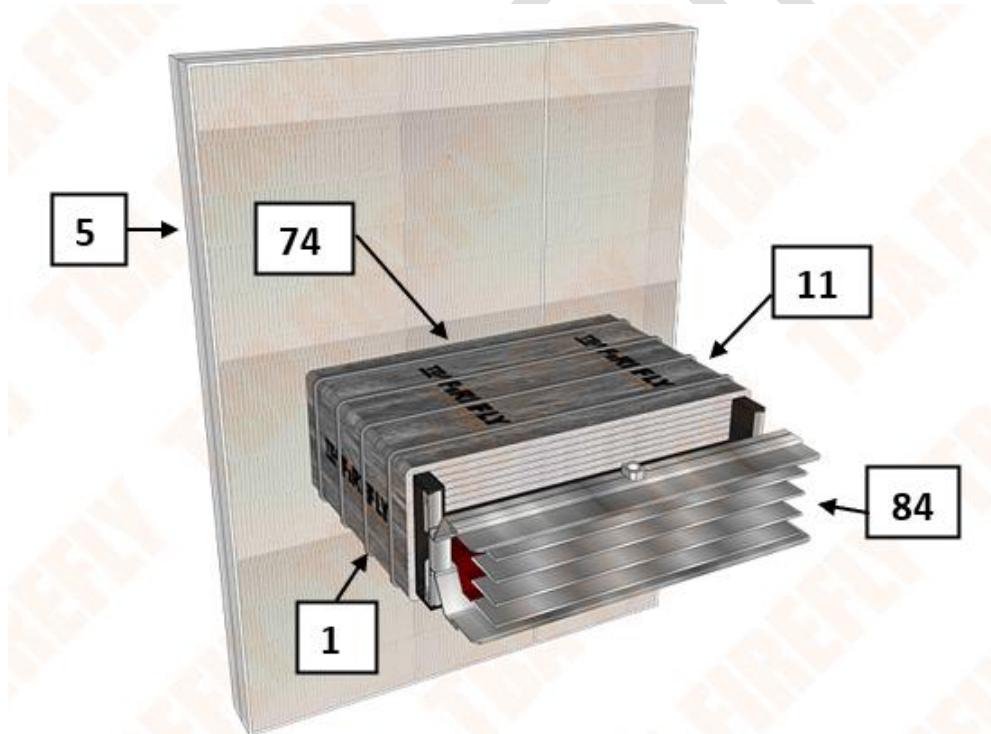
**Figure 99** 3 x 27mm OD conduits within a single 70mm (max ID) core hole, Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



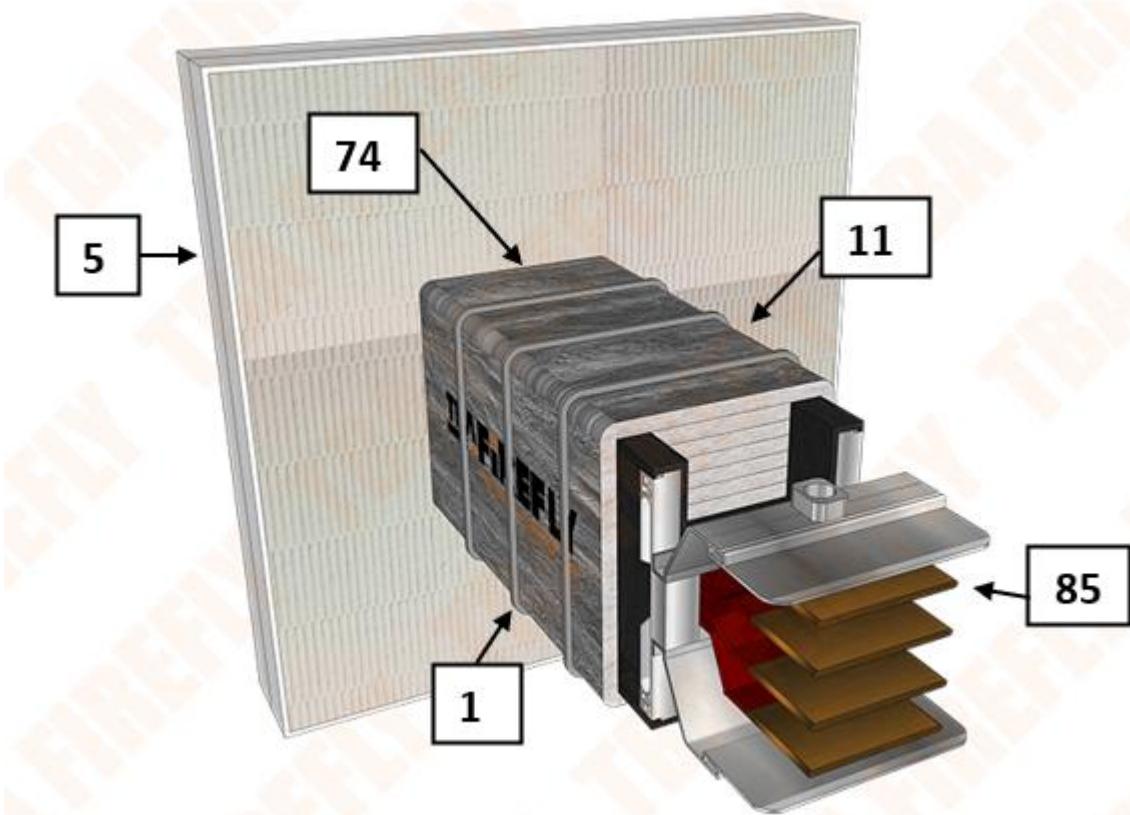
**Figure 100** 3 x 27mm OD conduits within a single 70mm (max ID) core hole, Installed through 2 layers of TBA Firefly™ Intubatt in a Horizontal Orientation



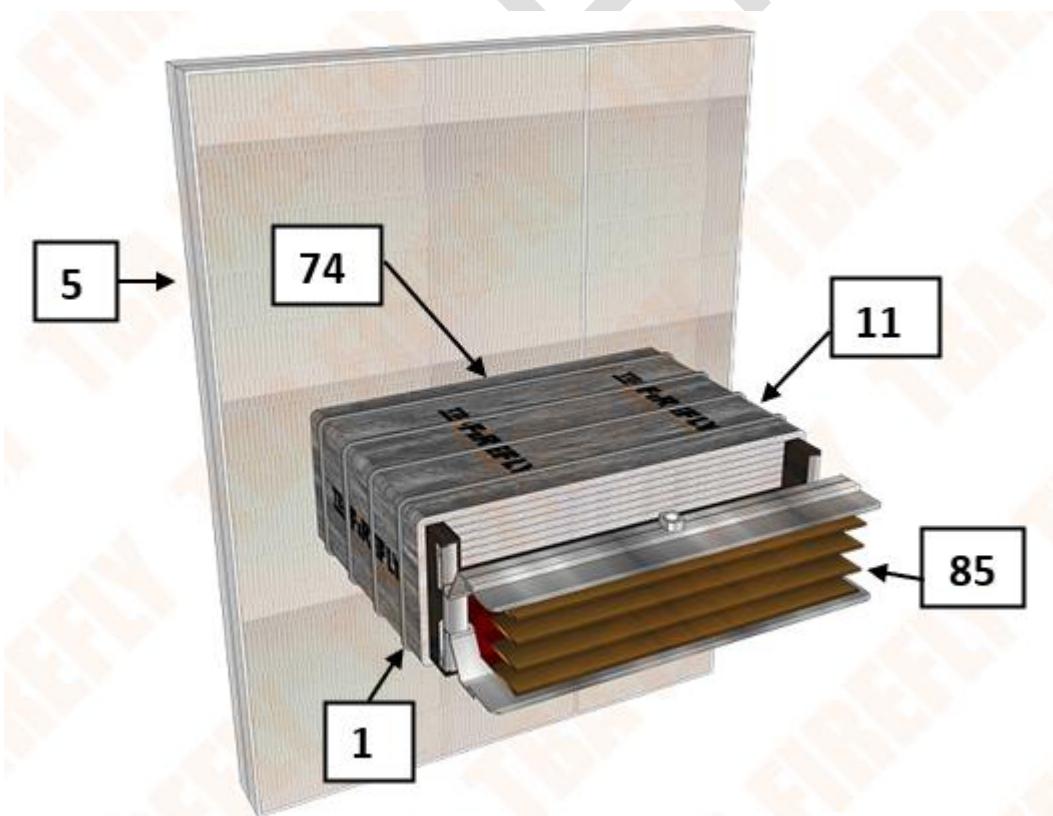
**Figure 101a EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS**  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



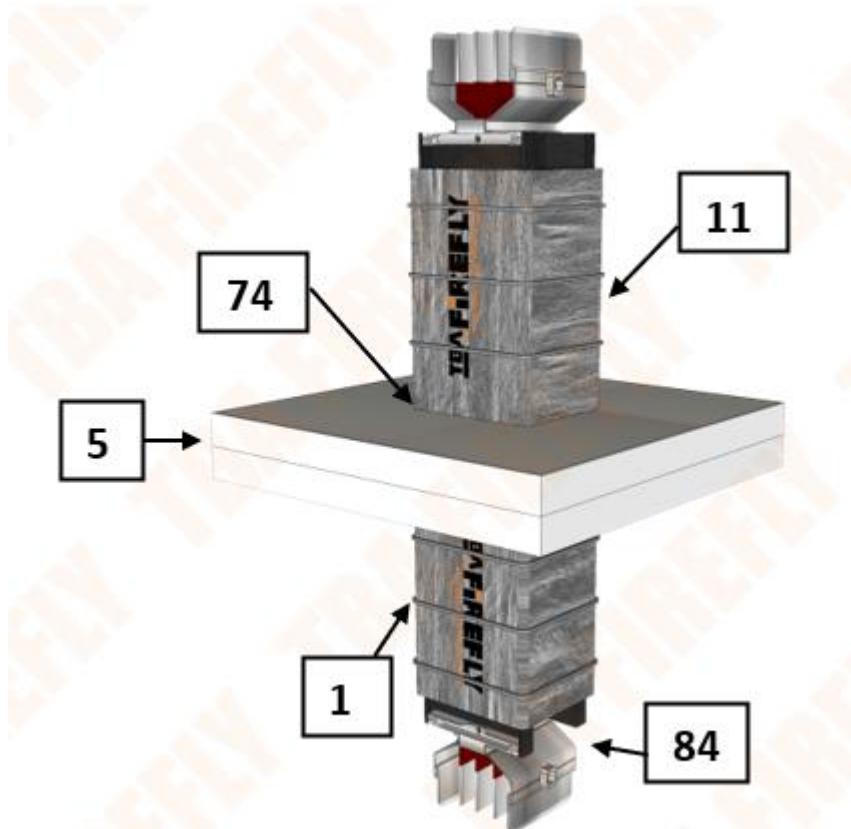
**Figure 101b EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS**  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



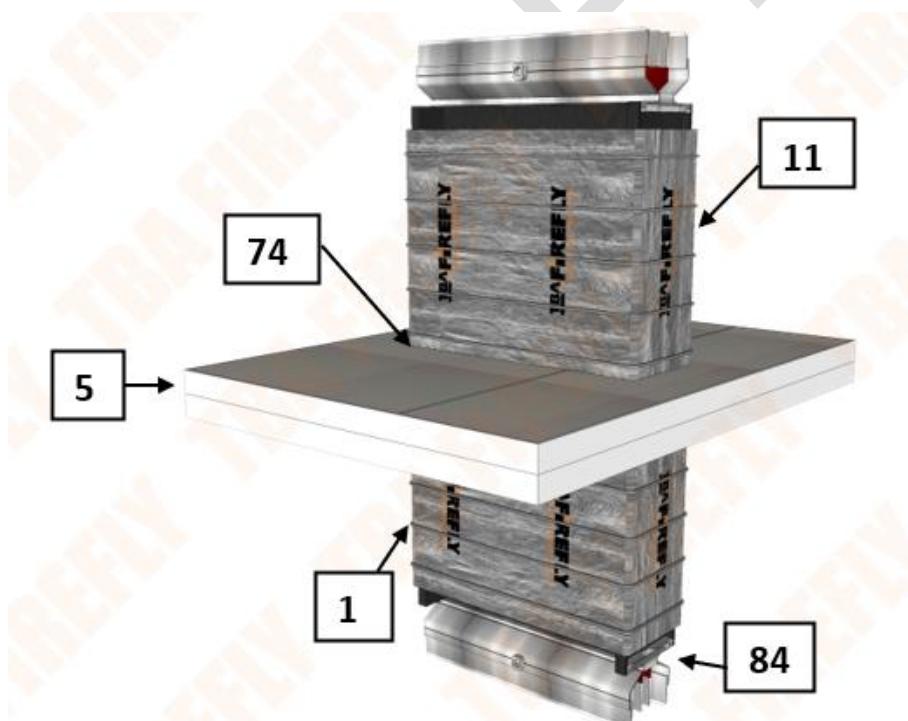
**Figure 102a EAE ALUMINIUM ENCASED SANDWICH BUSDUCT – COPPER CONDUCTORS**  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



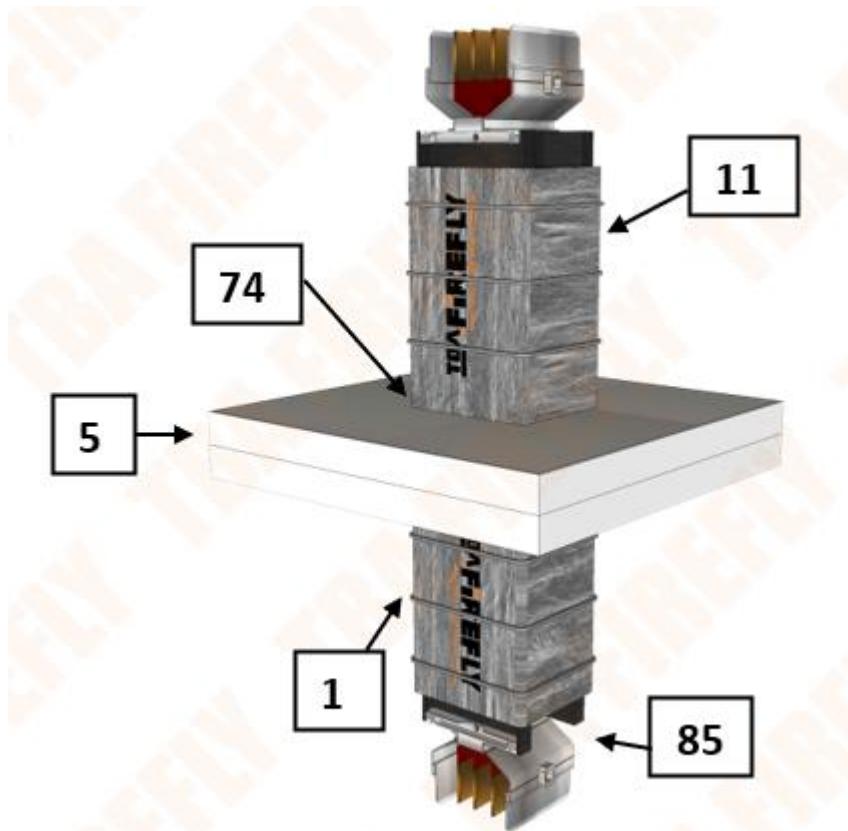
**Figure 102b EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS**  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



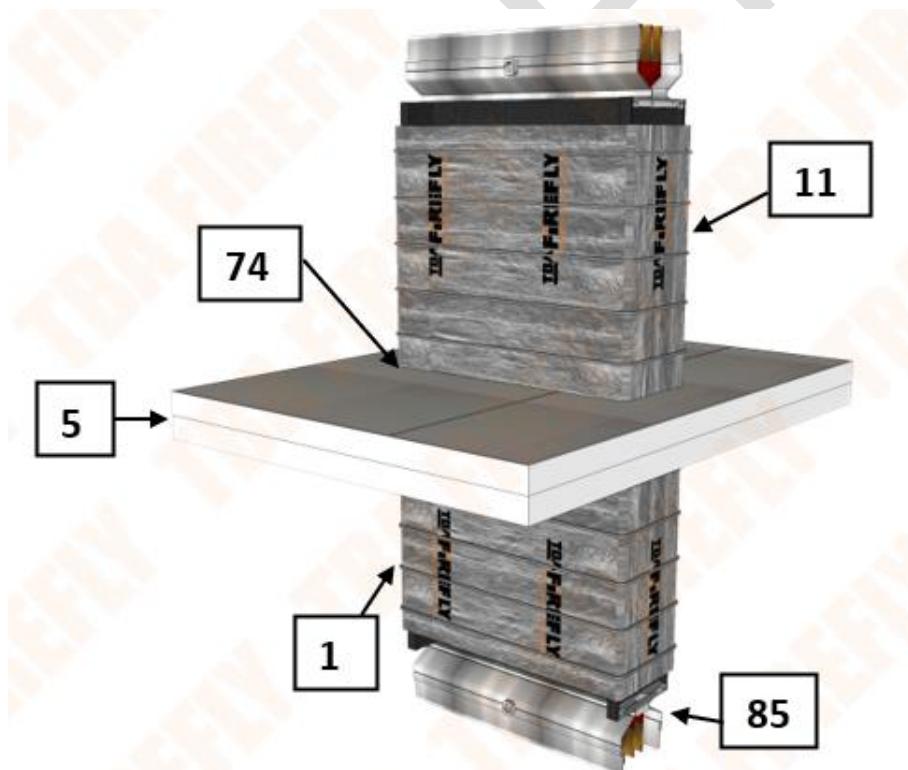
**Figure 103a** EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation



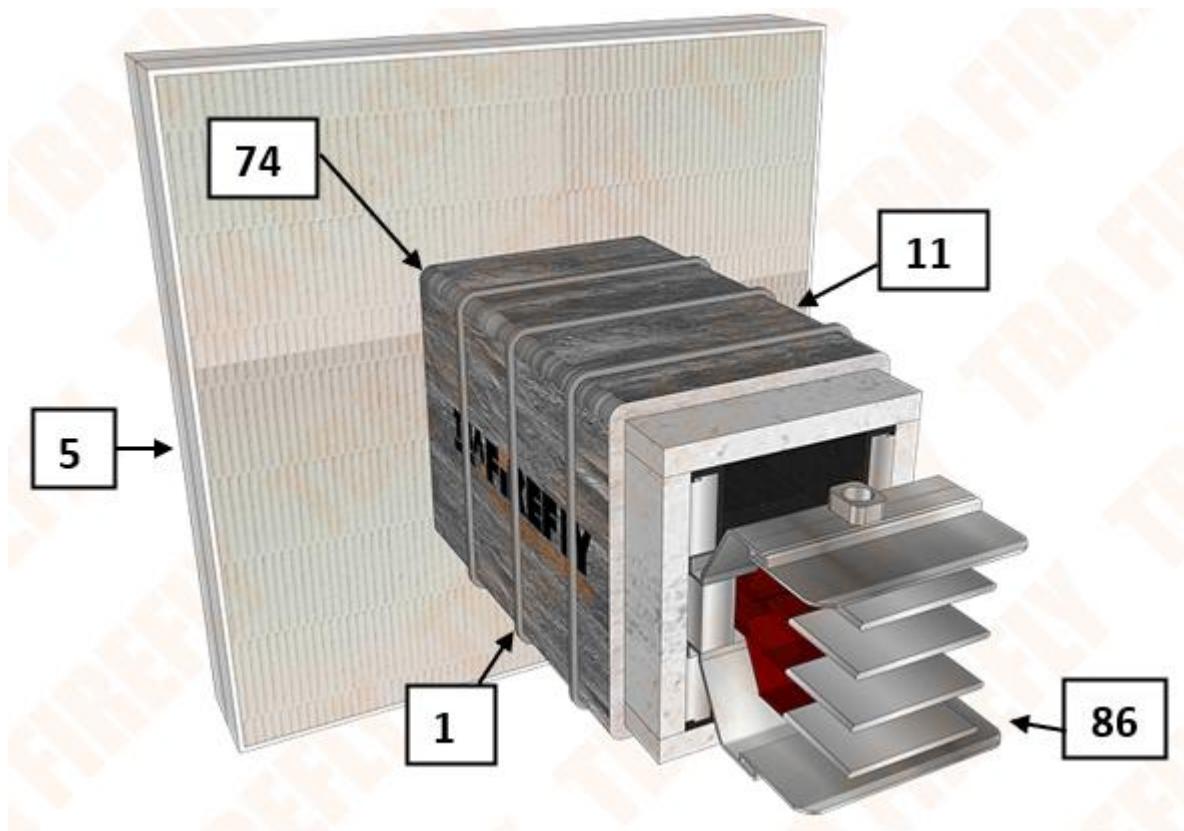
**Figure 103b** EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Vertical Orientation



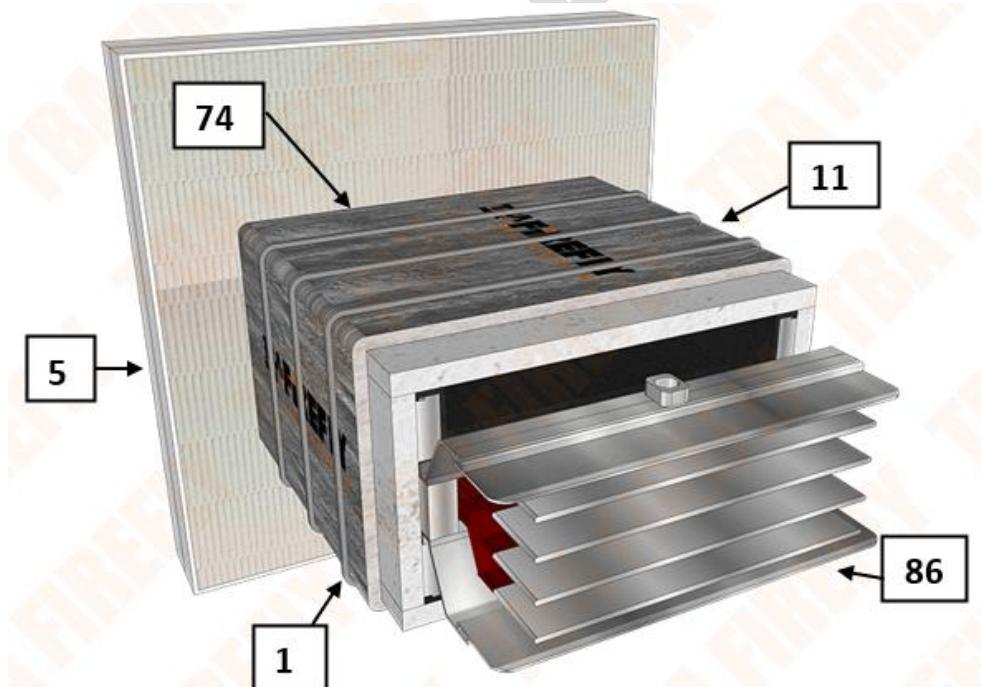
**Figure 104a** EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation



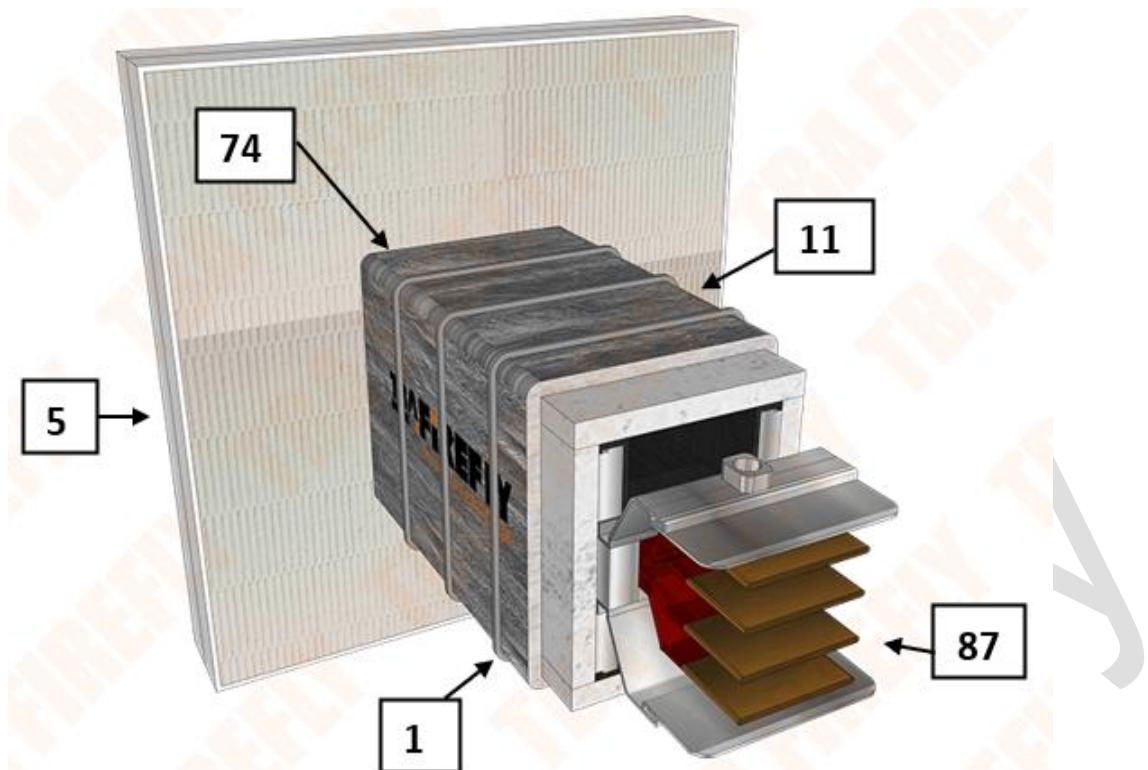
**Figure 104b** EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS  
Installed through TBA Firefly™ Intubatt in a Vertical Orientation



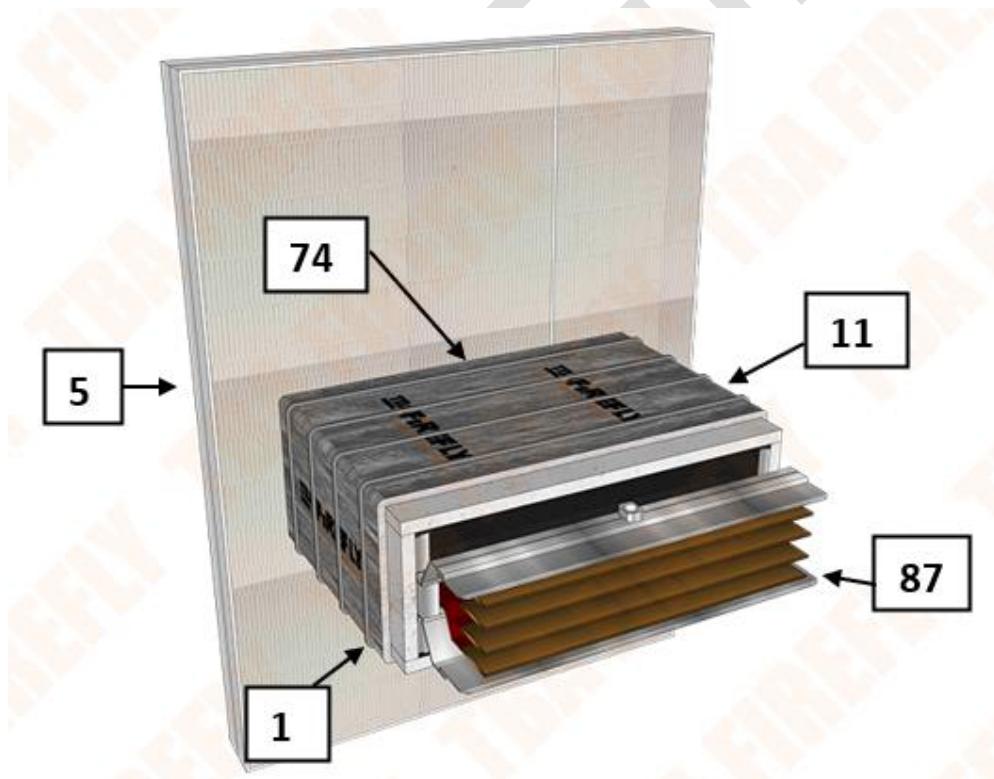
**Figure 105a** EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



**Figure 105b** AE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



**Figure 106a EAE ALUMINIUM ENCASED SANDWICH BUSDUCT – COPPER CONDUCTORS**  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



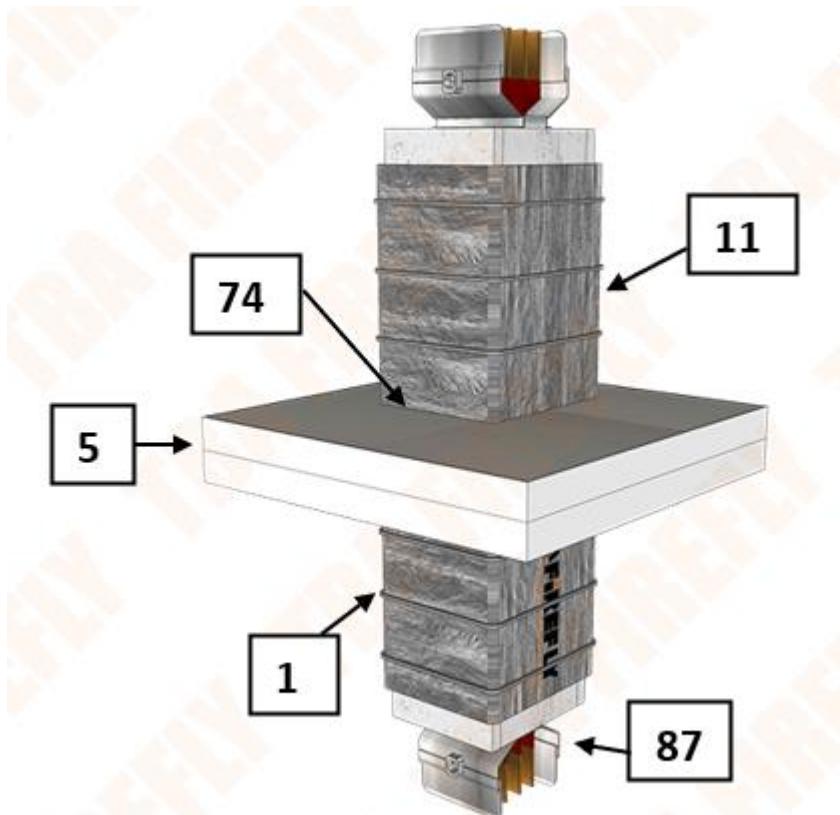
**Figure 106b EAE ALUMINIUM ENCASED SANDWICH BUSDUCT – COPPER CONDUCTORS**  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through 2 layers of TBA Firefly™ Intubatt in a Vertical Orientation



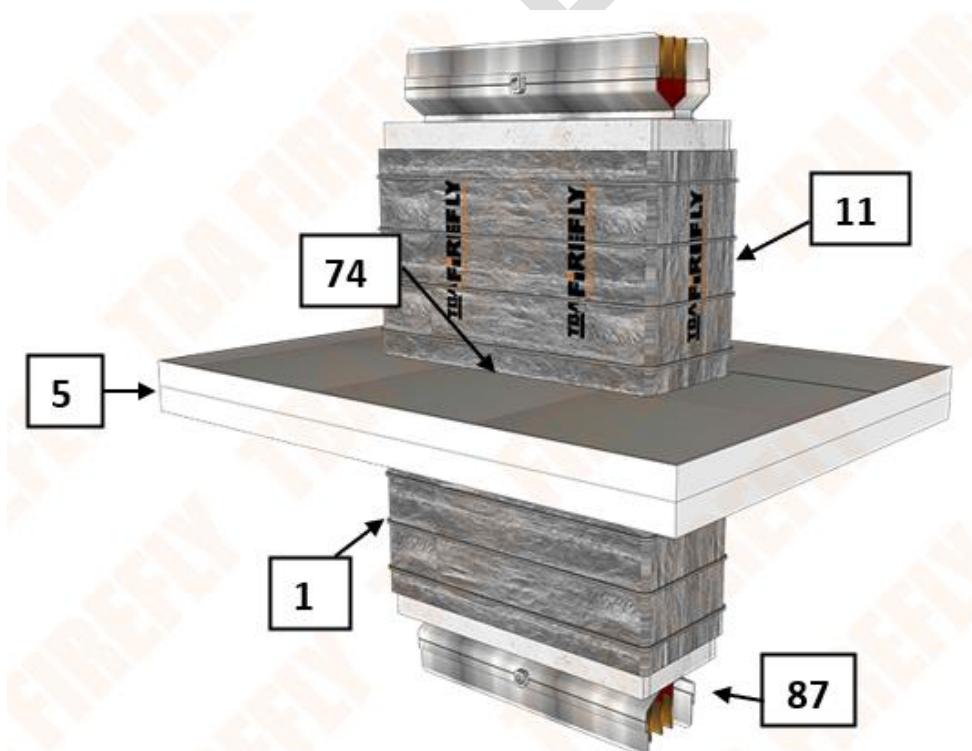
**Figure 107a EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS**  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation



**Figure 107b EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - ALUMINIUM CONDUCTORS**  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation



**Figure 108a** EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation



**Figure 108b** EAE ALUMINIUM ENCASED SANDWICH BUSDUCT - COPPER CONDUCTORS  
(Promatect® 200 fully enclosed busbars (1 Layer of 25mm to all four sides))  
Installed through TBA Firefly™ Intubatt in a Horizontal Orientation

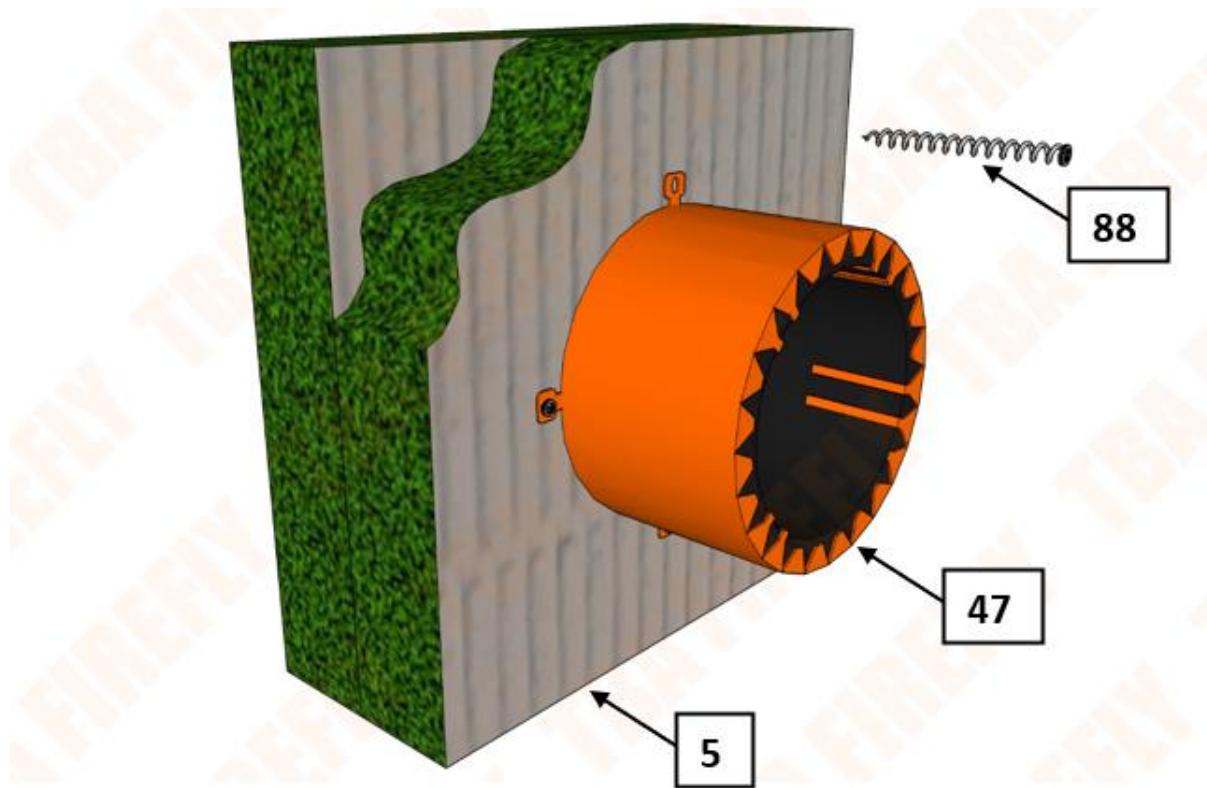


Figure 109 TBA Firefly™ FRF Fire Collar to both sides of the Double TBA Firefly™ Intubatt Seal. Fixing Detail using Pigtail Screws

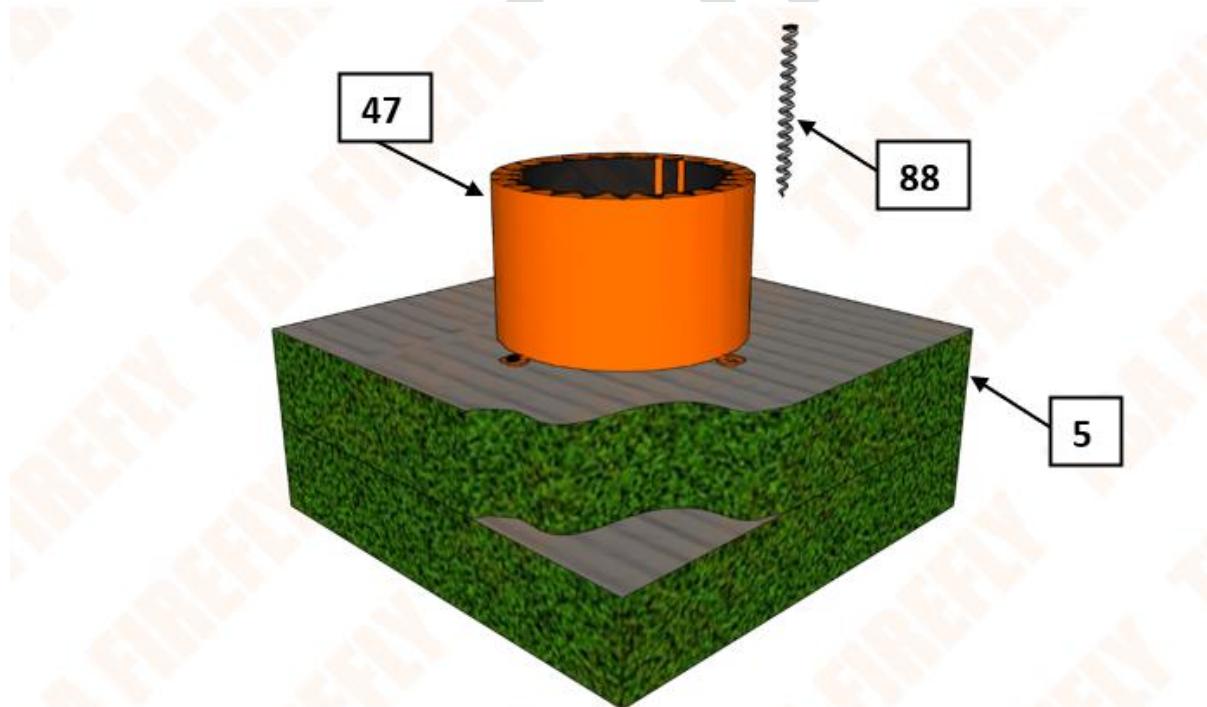


Figure 110 TBA Firefly™ FRF Fire Collar to both sides of the Double TBA Firefly™ Intubatt Seal. Fixing Detail using Pigtail Screws

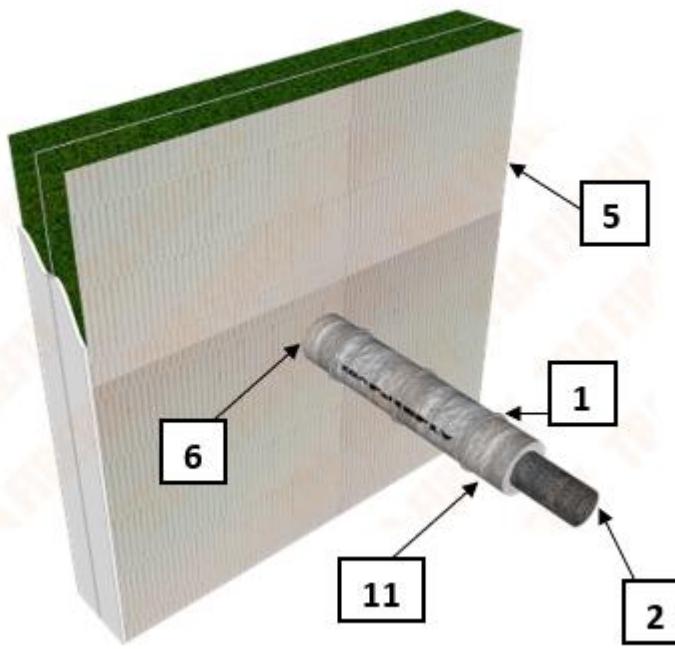


Figure 111 8mm up to 48.6mm OD Steel Pipe through vertical double TBA Firefly™ Intubatt Seal

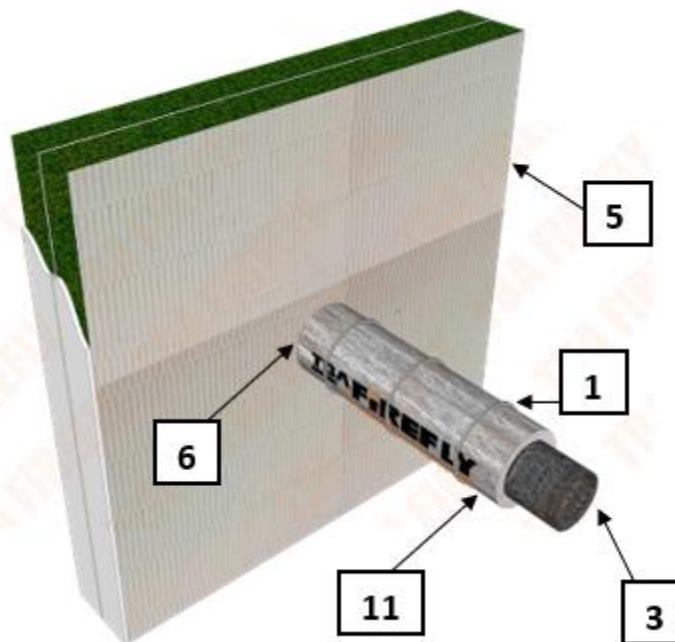


Figure 112 48.7mm up to 90mm OD Steel Pipe through vertical double TBA Firefly™ Intubatt

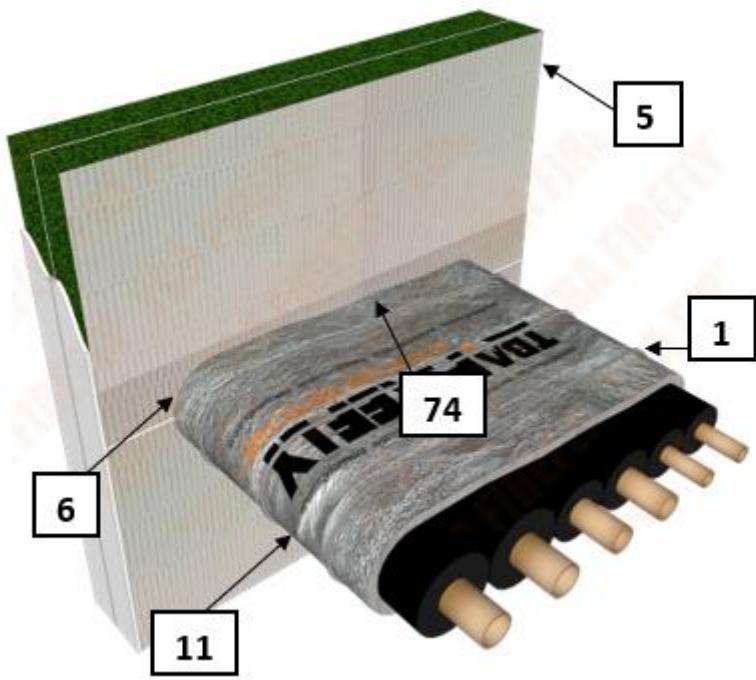


Figure 113 Bundle of Nitrile Rubber lagged Copper pipes (As specified within ID V79) through vertical double TBA Firefly™ Intubatt Seal

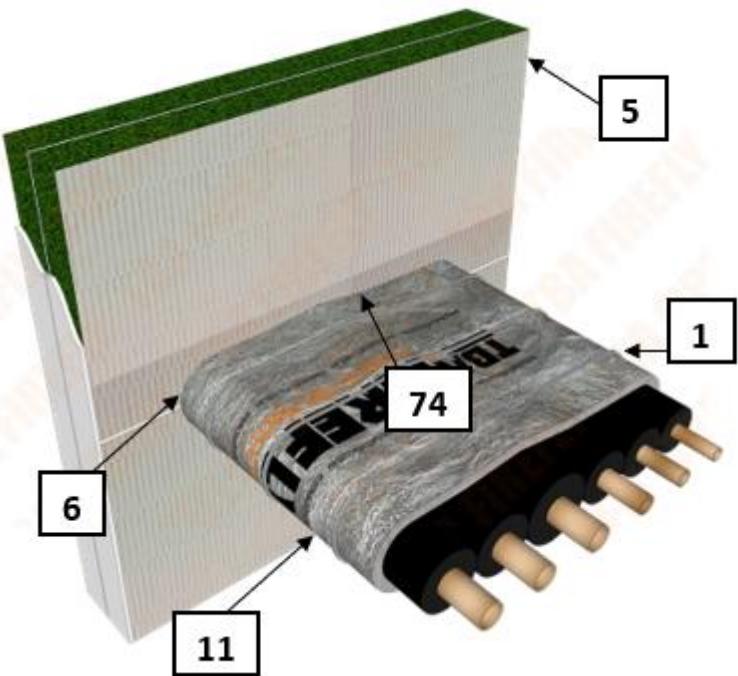


Figure 114 Bundle of Nitrile Rubber lagged Copper pipes (As specified within ID V80) through vertical double TBA Firefly™ Intubatt Seal

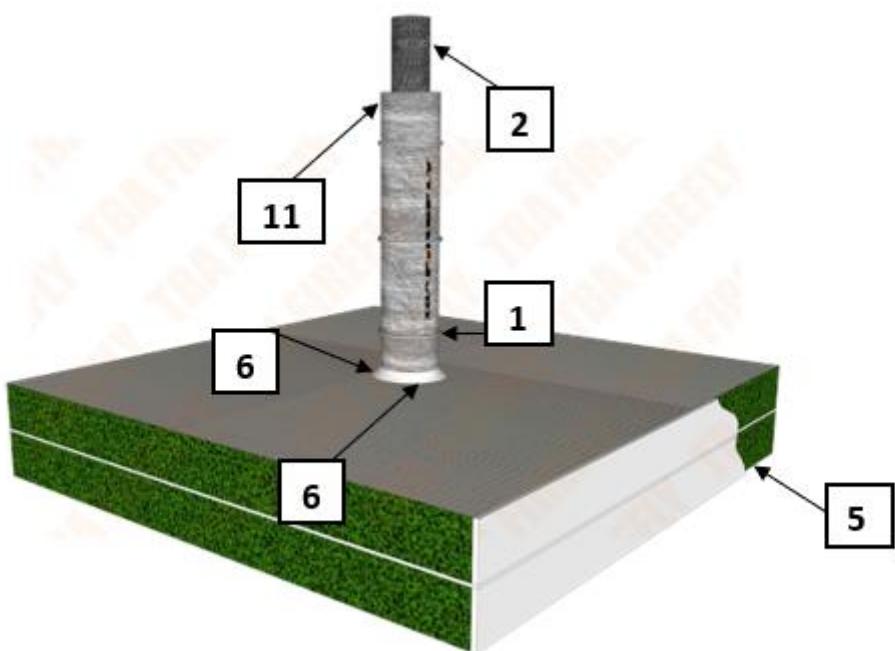


Figure 115 8mm up to 48.6mm OD Steel Pipe through horizontal double TBA Firefly™ Intubatt Seal

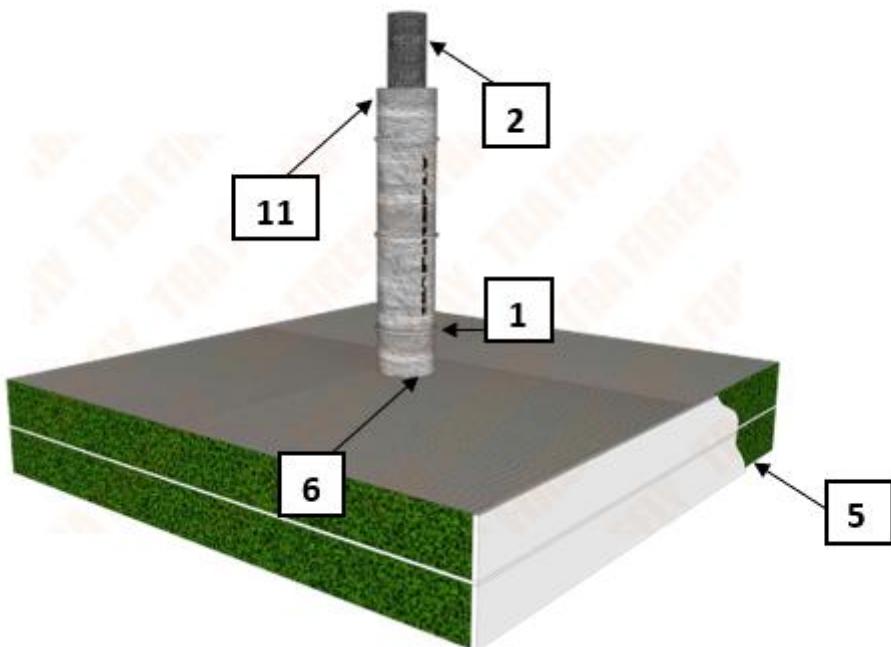


Figure 116 8mm up to 48.6mm OD Steel Pipe through horizontal double TBA Firefly™ Intubatt Seal

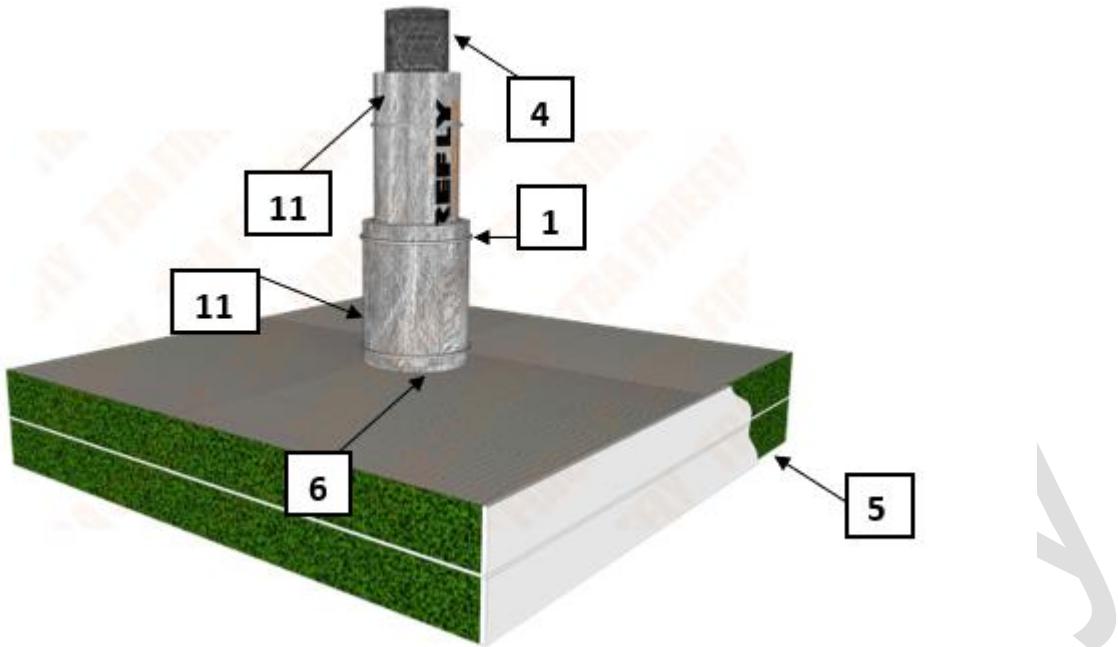


Figure 117 48.7mm up to 115mm OD Steel Pipe through horizontal double TBA Firefly™ Intubatt Seal

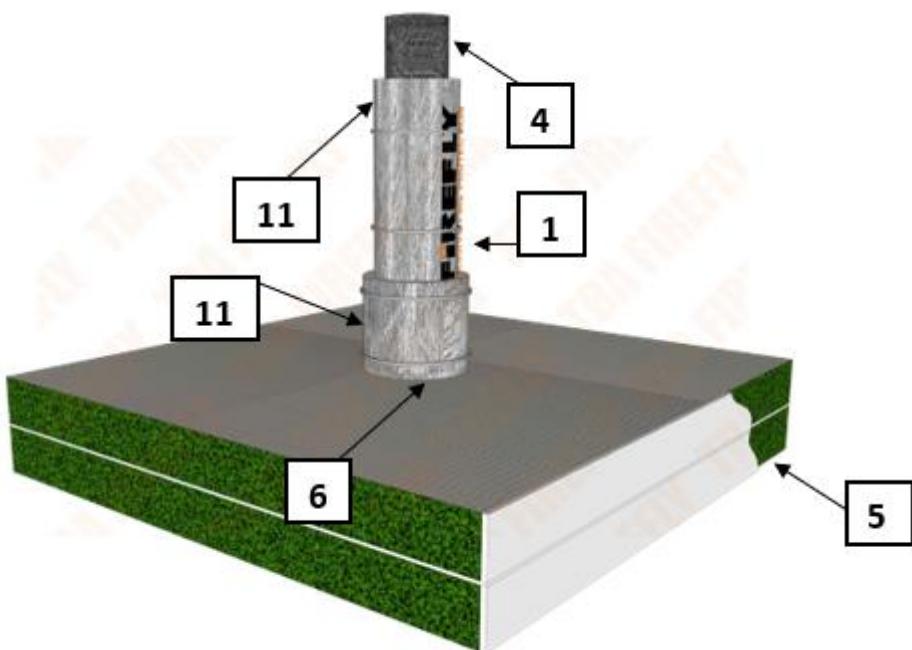


Figure 118 48.7mm up to 115mm OD Steel Pipe through horizontal double TBA Firefly™ Intubatt Seal

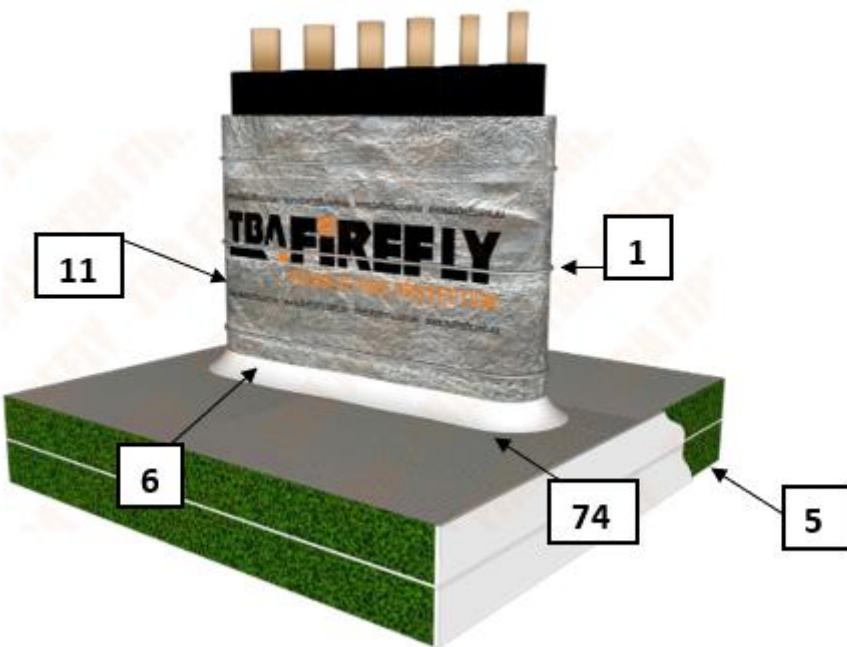


Figure 119 Bundle of Nitrile Rubber lagged Copper pipes (As specified within ID H56)

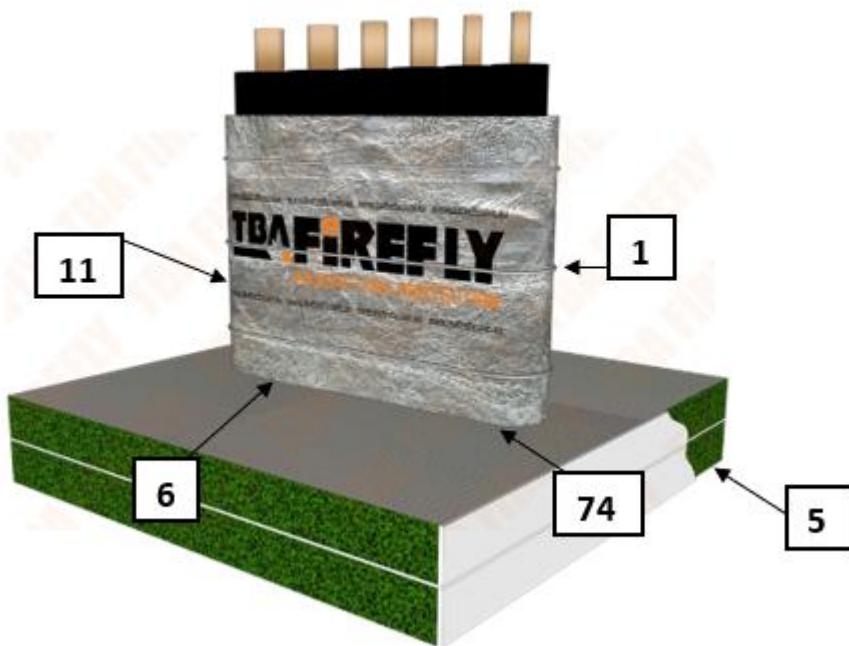


Figure 120 Bundle of Nitrile Rubber lagged Copper pipes (As specified within ID H57)

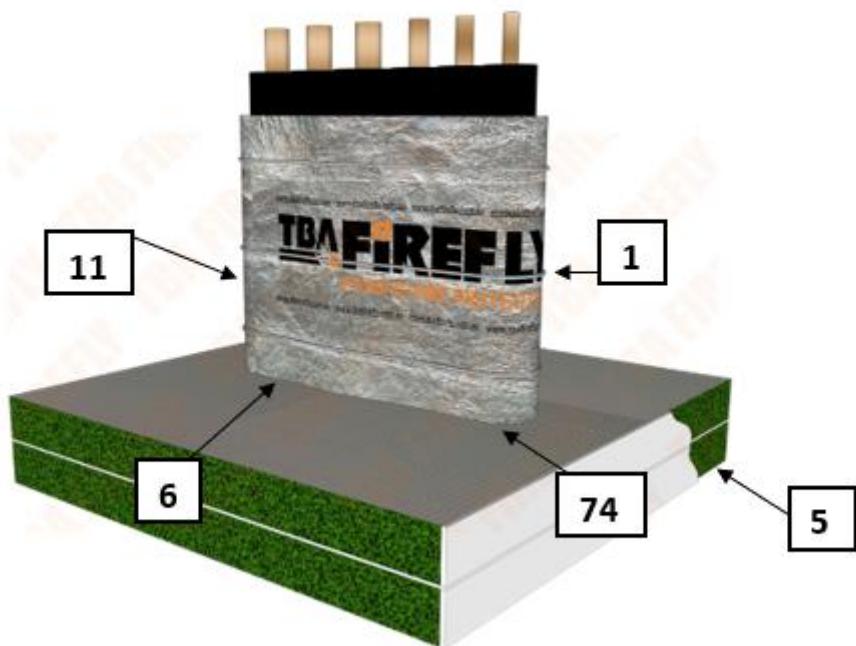


Figure 121 Bundle of Nitrile Rubber lagged Copper pipes (As specified within ID H58)

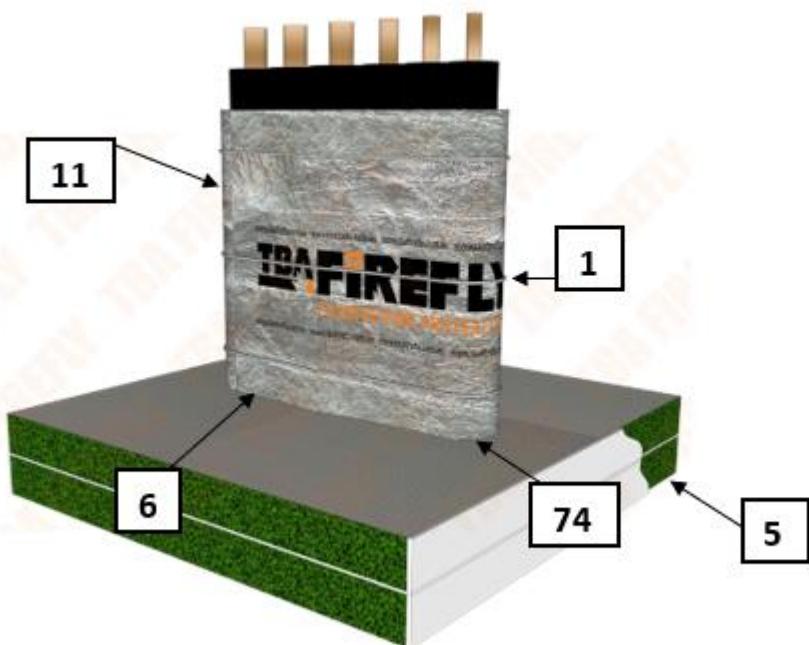


Figure 122 Bundle of Nitrile Rubber lagged Copper pipes (As specified within ID H59)

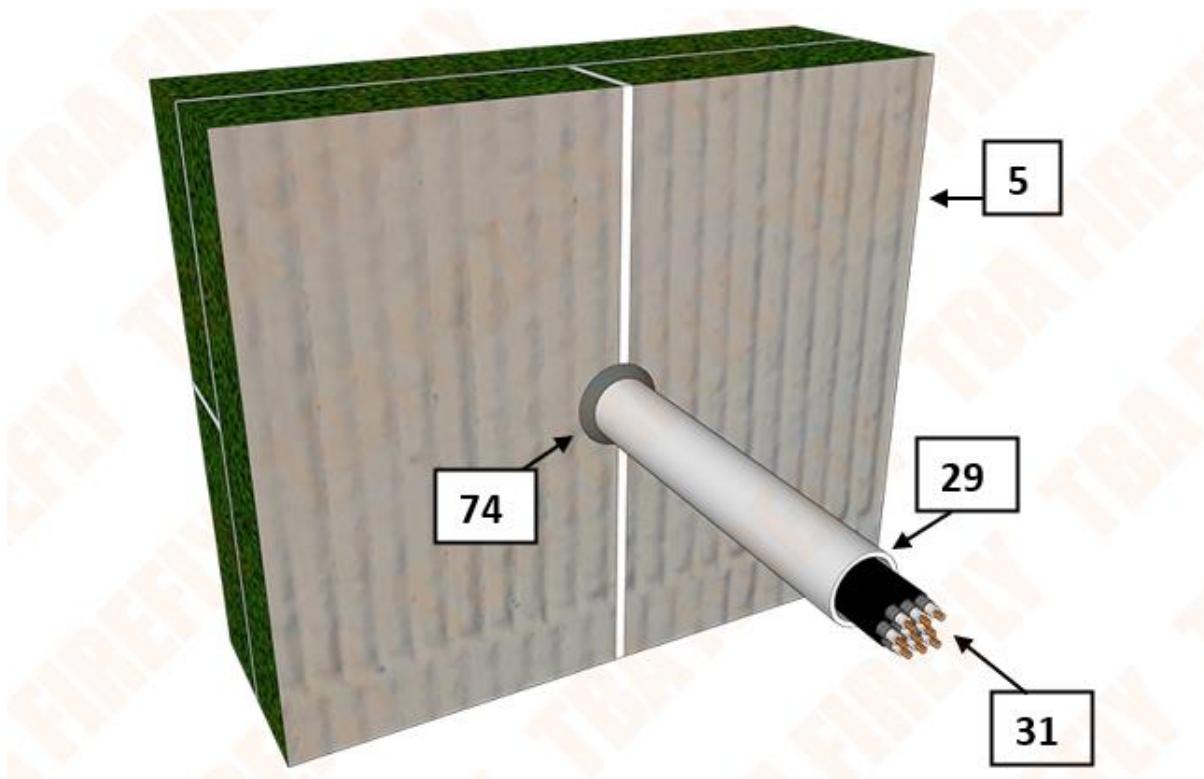


Figure 123 Single uPVC Pipe up to 32mm OD with up to 9 x RG6 Coaxial Cables

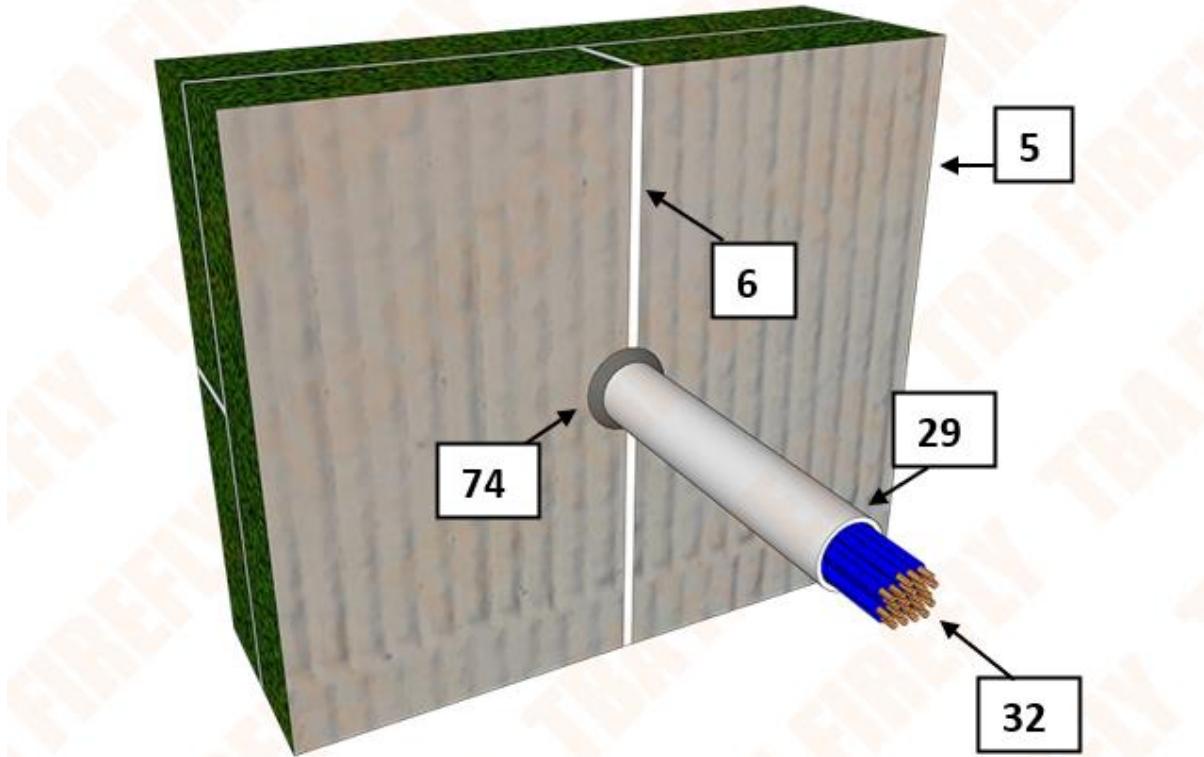


Figure 124 Single uPVC Pipe up to 32mm OD with up to 21 x CAT5e Data Cables

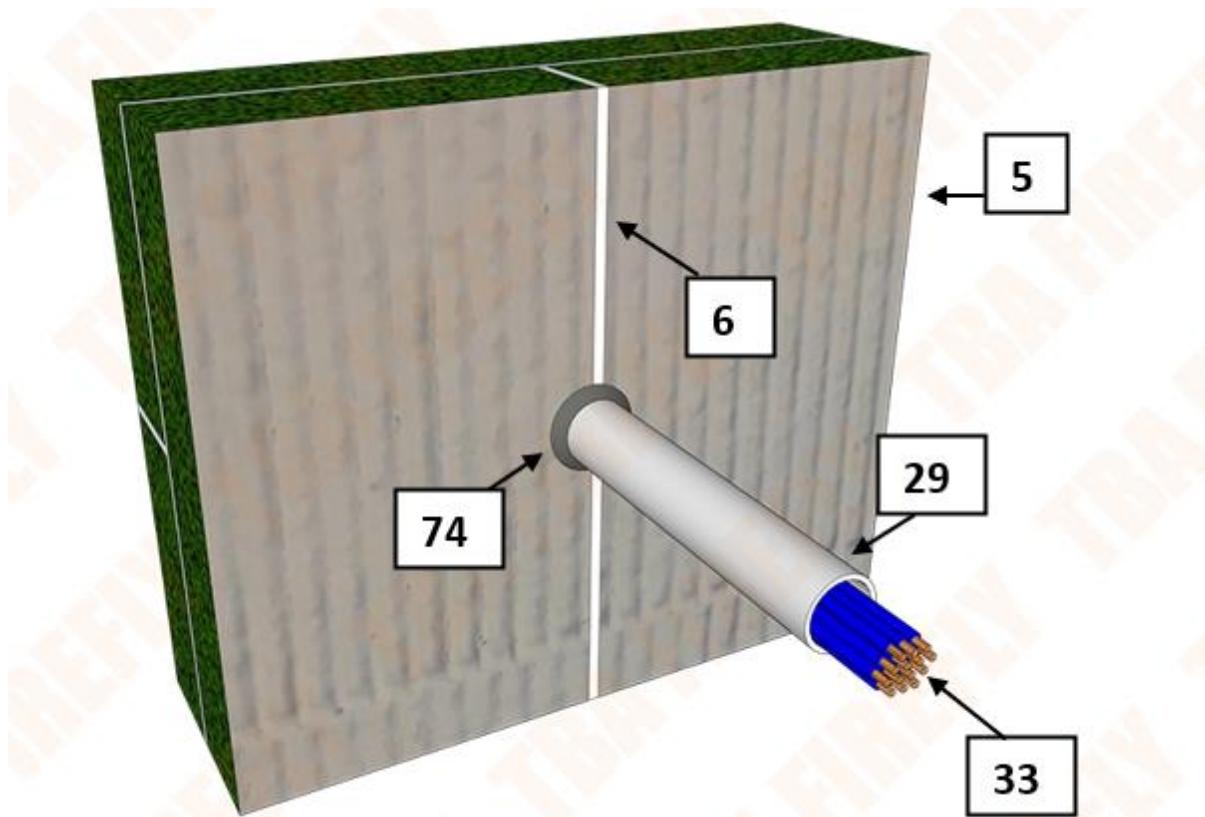


Figure 125 Single uPVC Pipe up to 32mm OD with up to 14 x CAT6 Data Cables

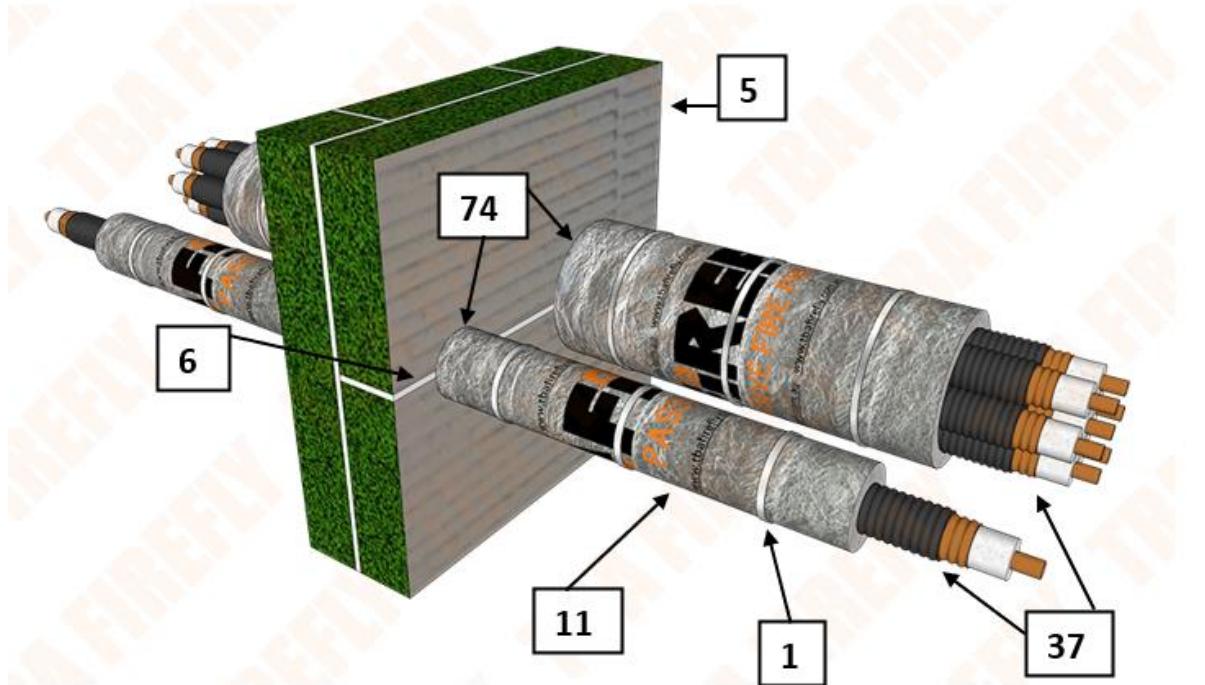


Figure 126 Bundle of up to 7 x Heliax Foam Dielectric Coaxial Cables

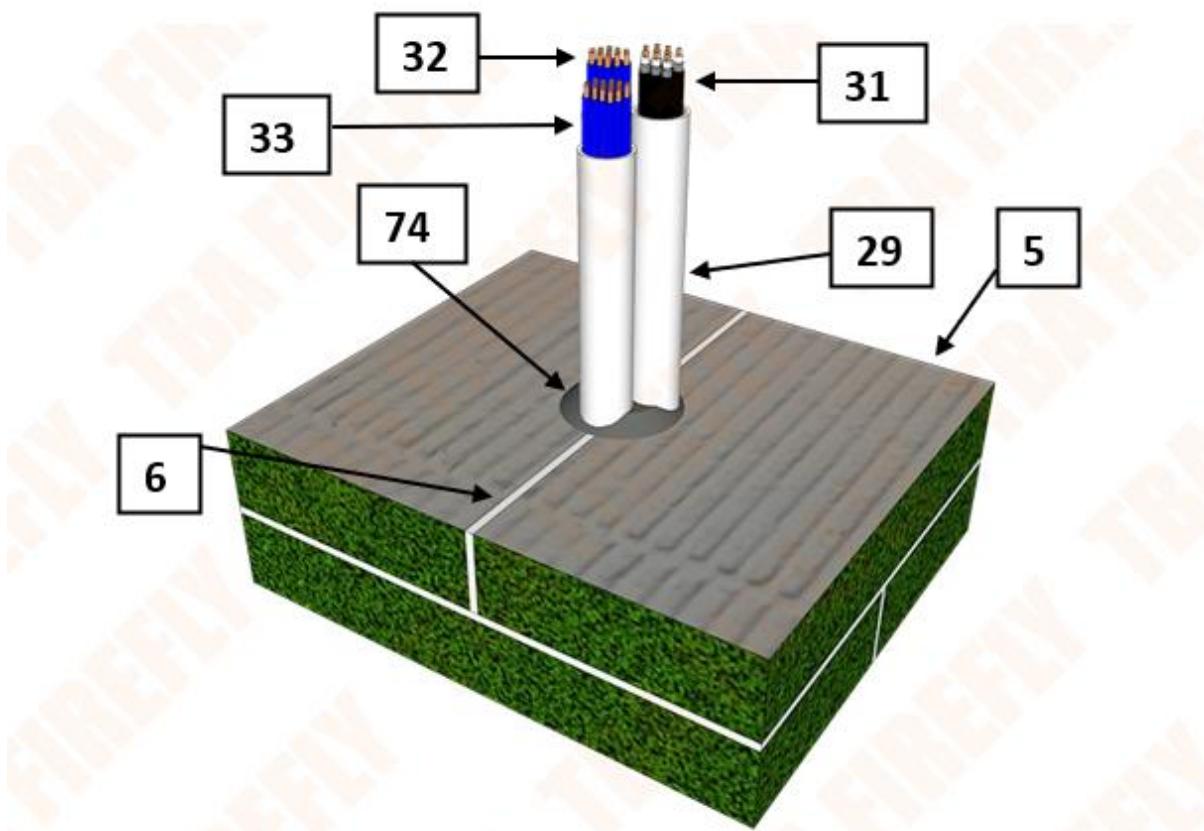


Figure 127 Bundle of 2 or 3 x uPVC Pipes up to 32mm OD with various data cables

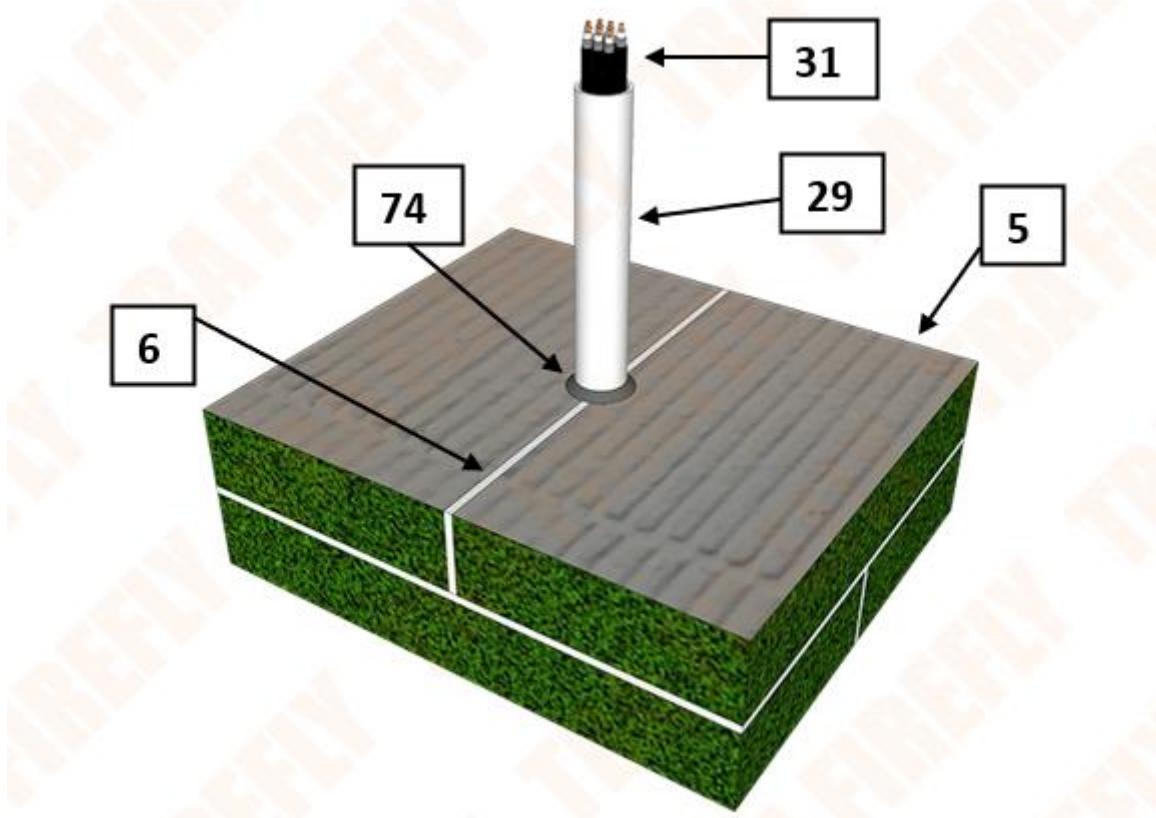


Figure 128 Single uPVC Pipe up to 32mm OD with up to 9 x RG6 Coaxial Cables

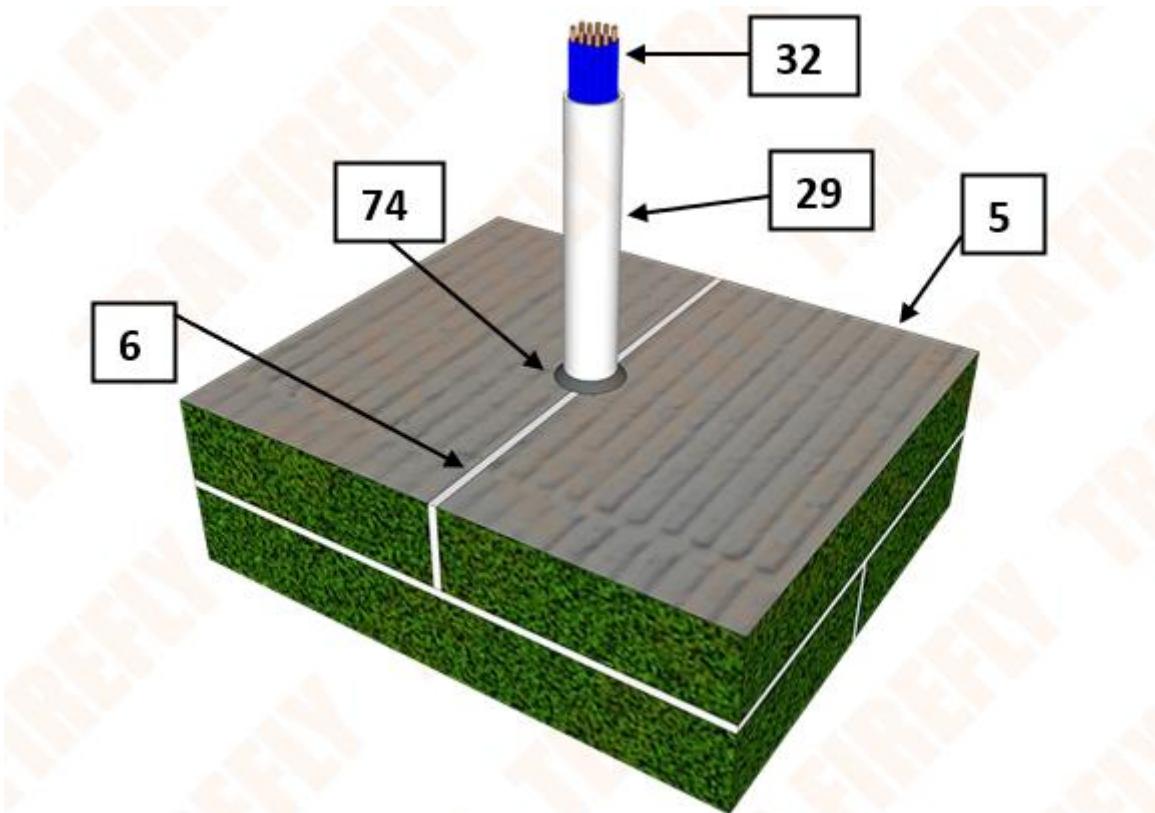


Figure 129 Single uPVC Pipe up to 32mm OD with up to 21 x CAT5e Data Cables

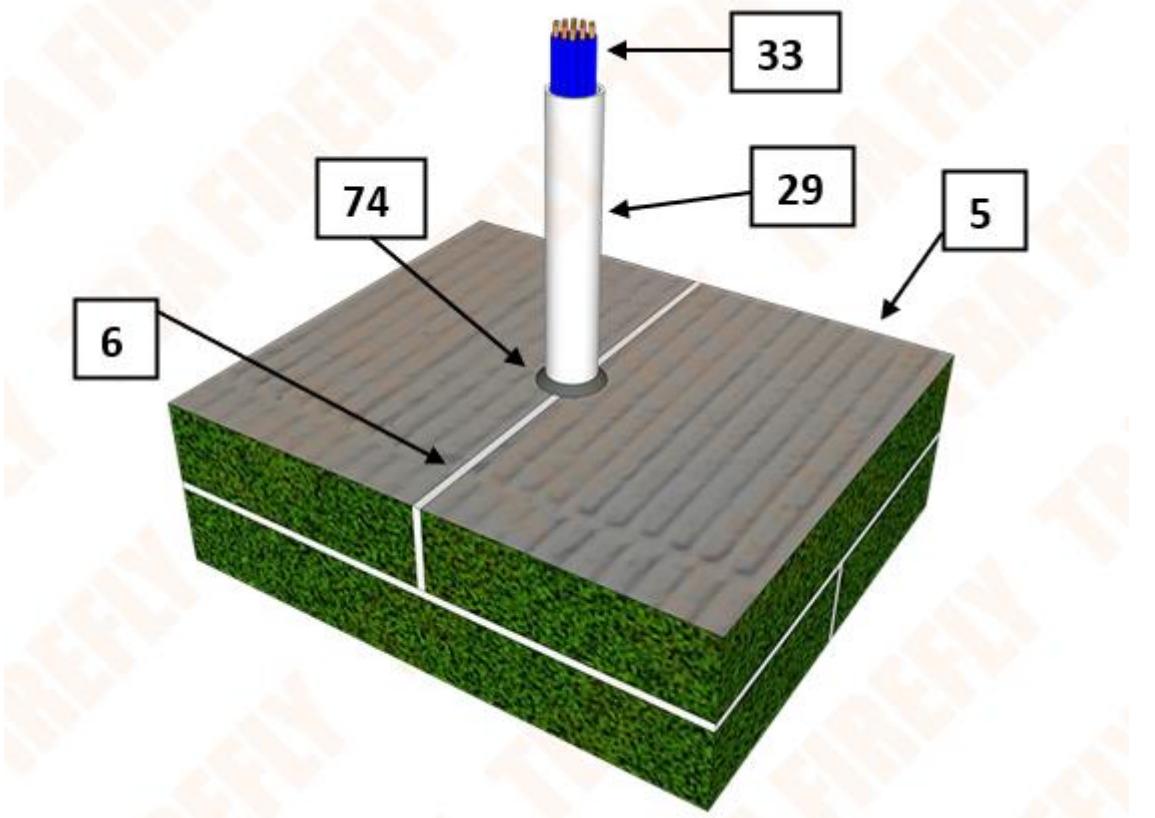


Figure 130 Single uPVC Pipe up to 32mm OD with up to 14 x CAT6 Data Cables

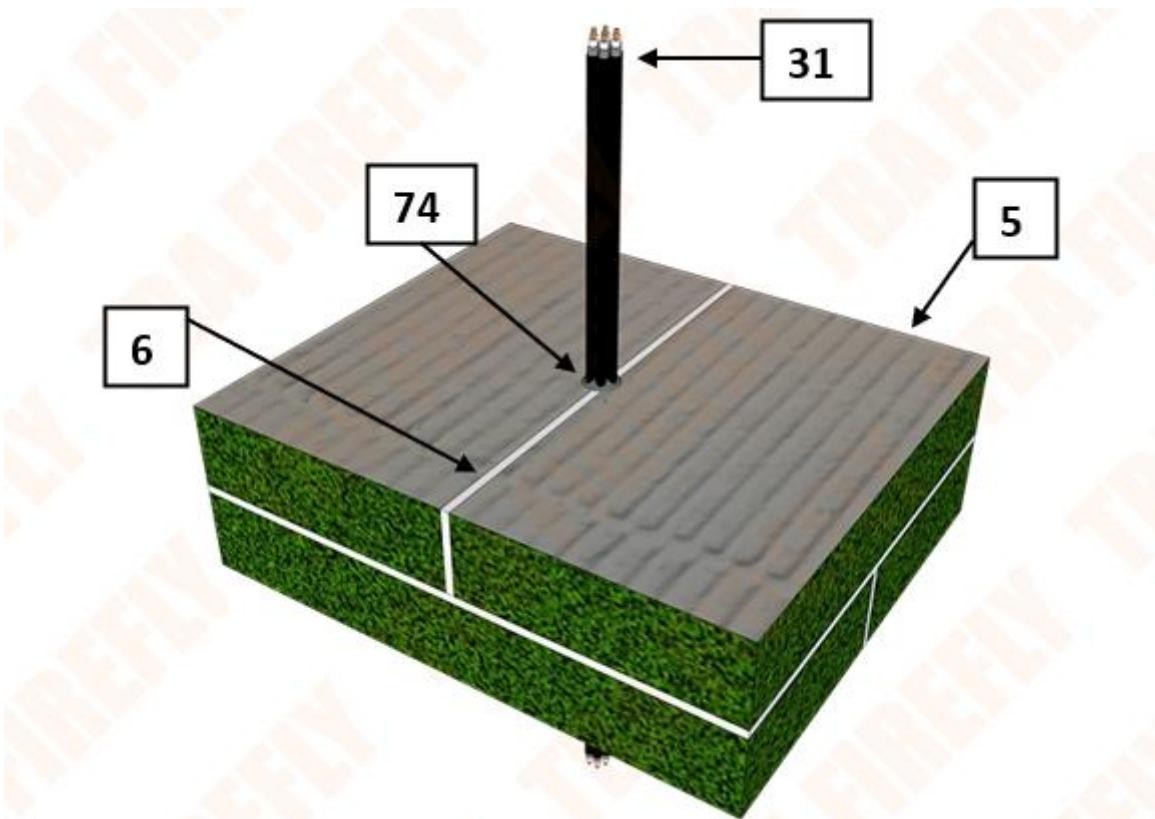


Figure 131 Bundle of up to 7 x RG6 Coaxial Cables

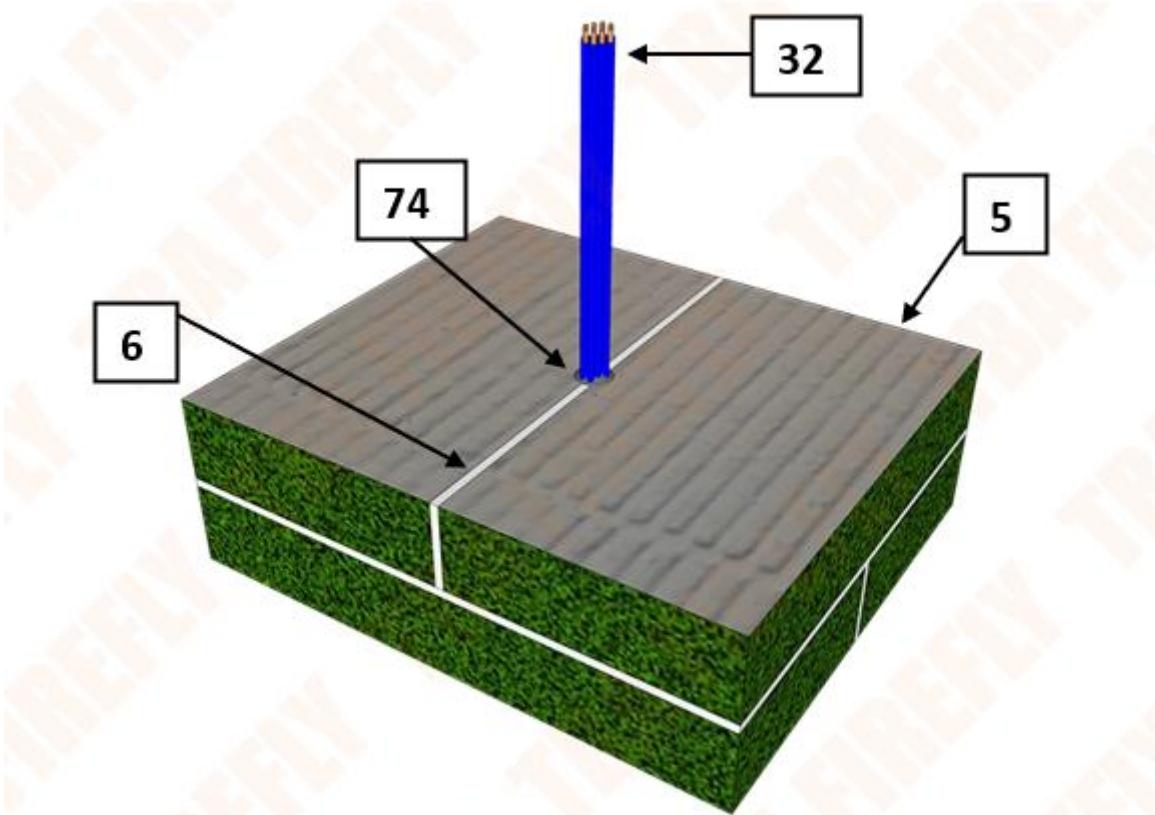


Figure 132 Bundle of up to 14 x Cat5e Data Cables

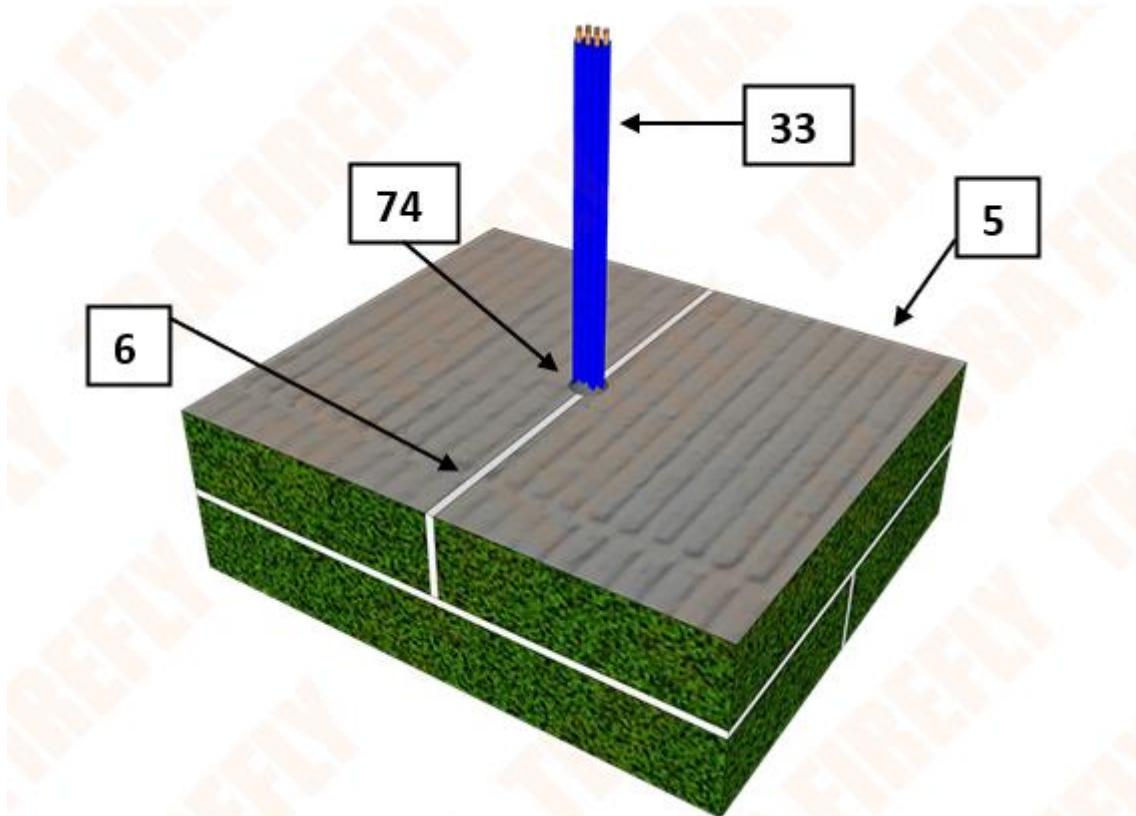


Figure 133 Bundle of up to 10 x CAT6 Data Cables

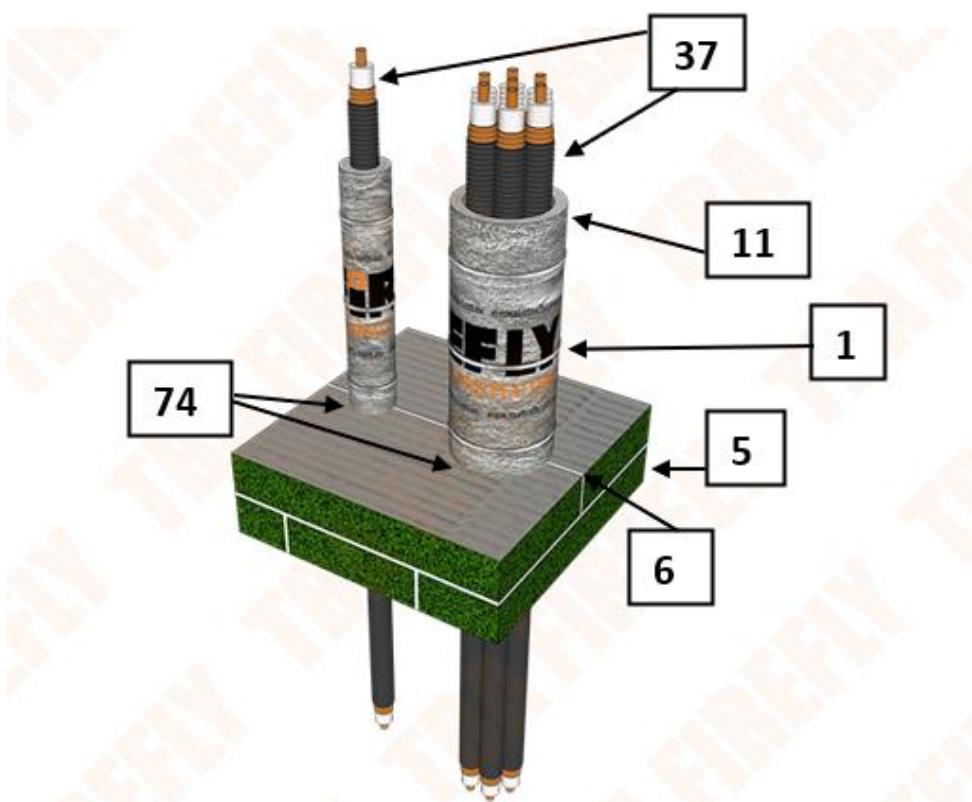
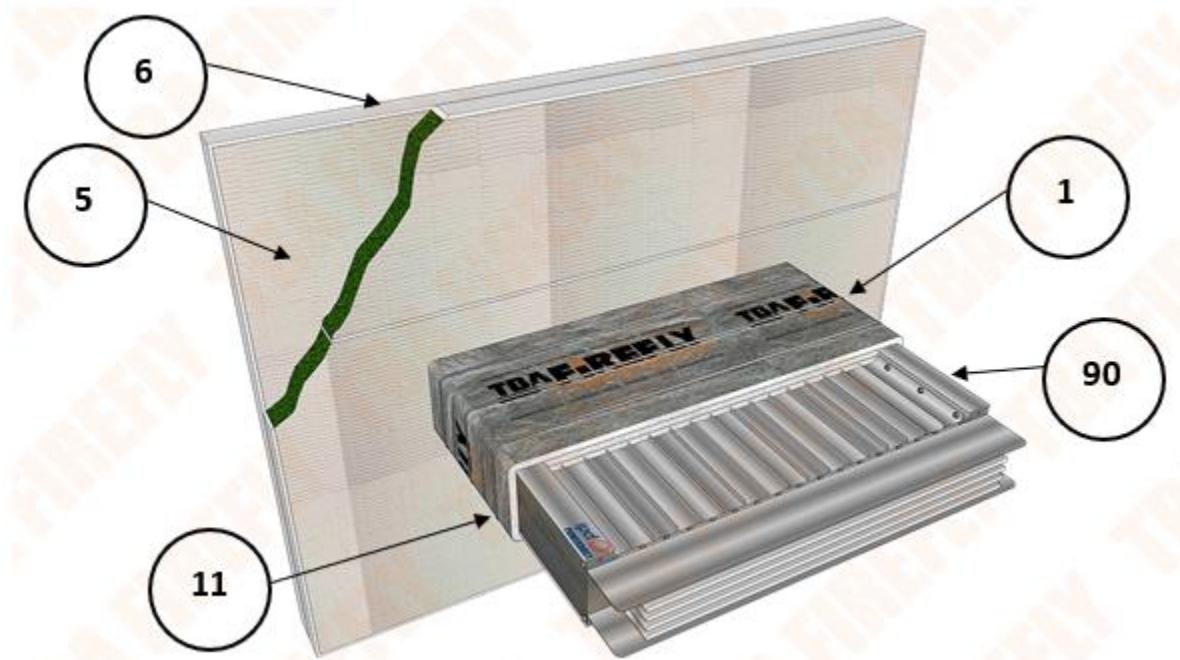
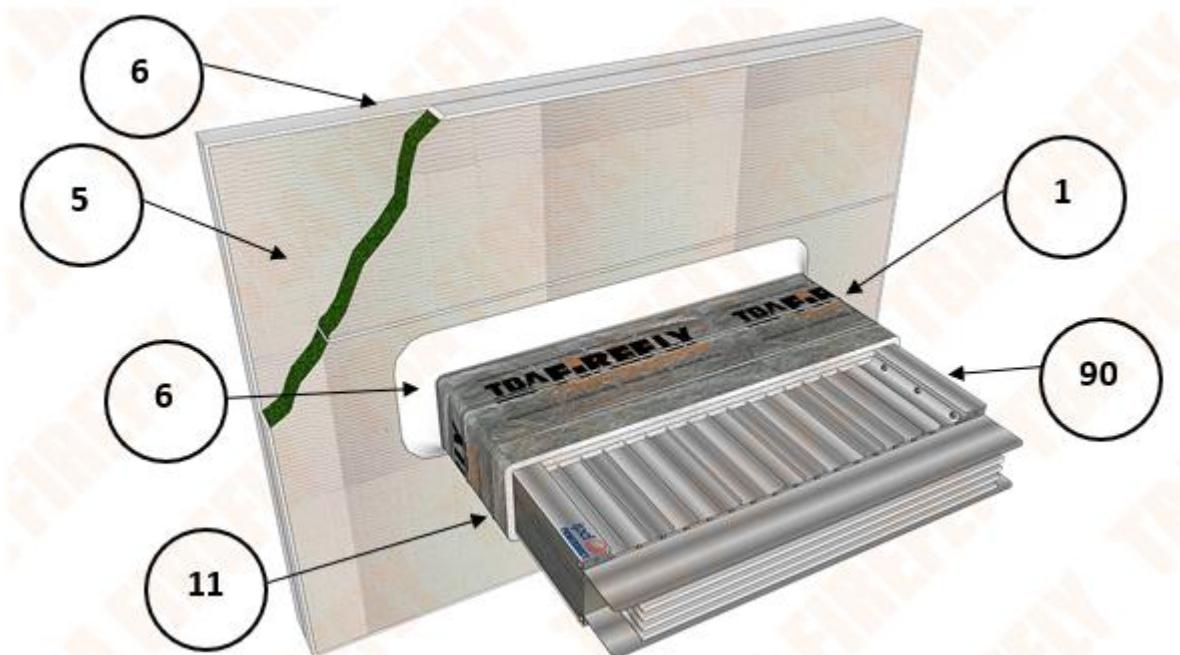


Figure 134 Bundle of up to 7 x Heliax Foam Dielectric Coaxial Cables



**Figure 135** IPD Powerduct (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Vertical substrates. Wrap to both sides of the TBA Firefly™ Intubatt, length of wrap for up to FRL-120/120 determined by Table 3e



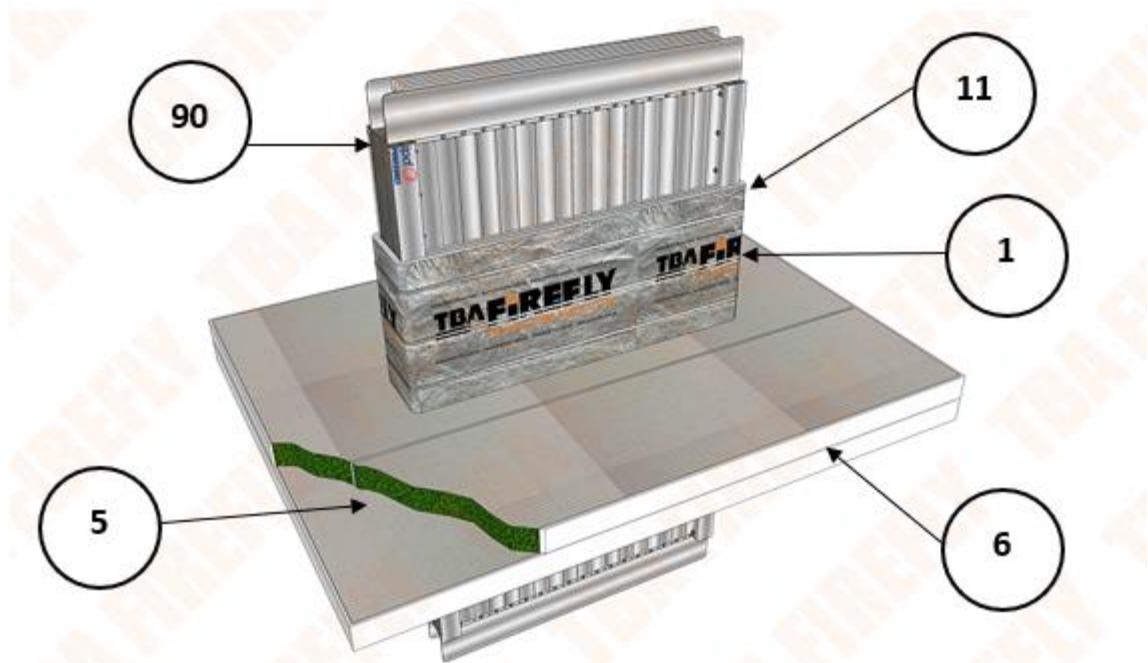
**Figure 136** IPD Powerduct (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Vertical substrates finished with a 50mm fillet of TBA Firefly™ Intumastic. Wrap and fillet to both sides of the TBA Firefly™ Intubatt, length of wrap for FRL-/240/240 determined by Table 3e



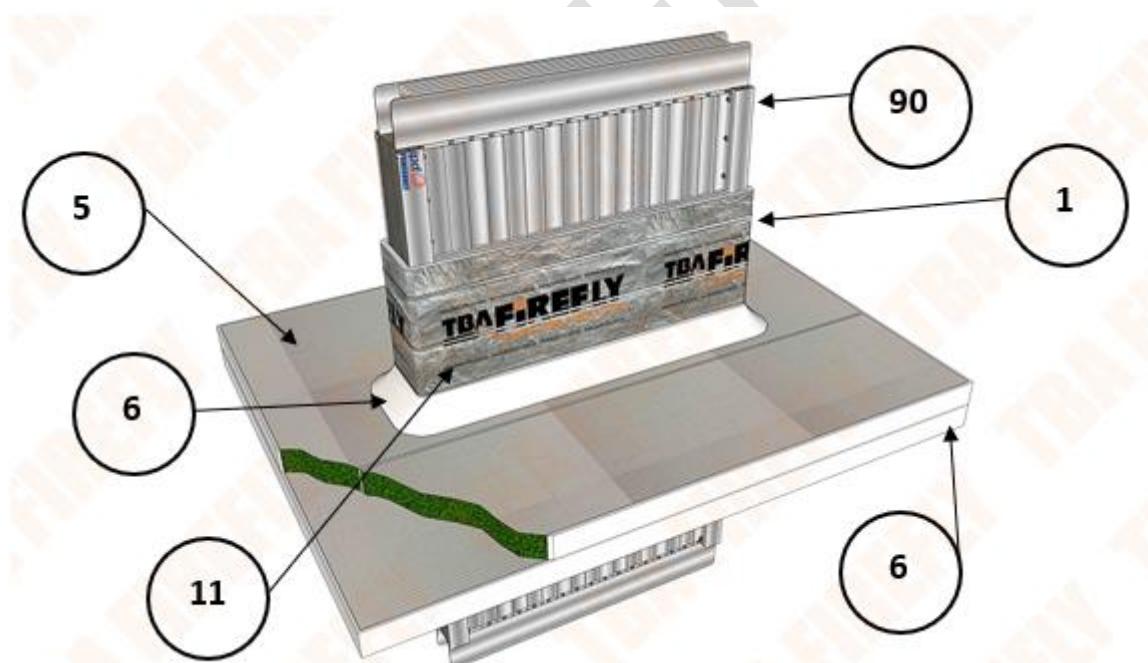
**Figure 137** IPD Powerduct (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Vertical substrates. Wrap to both sides of the TBA Firefly™ Intubatt, length of wrap for up to FRL-/120/120 determined by Table 3e



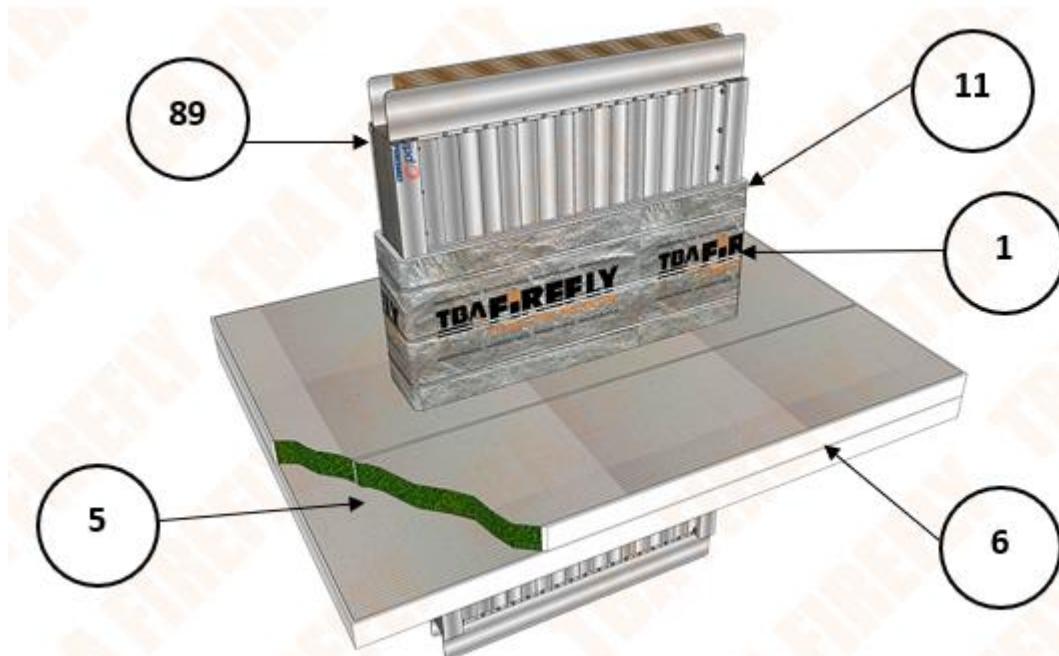
**Figure 138** IPD Powerduct (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Vertical substrates finished with a 50mm fillet of TBA Firefly™ Intumastic. Wrap and fillet to both sides of the TBA Firefly™ Intubatt, length of wrap for FRL-/240/240 determined by Table 3e



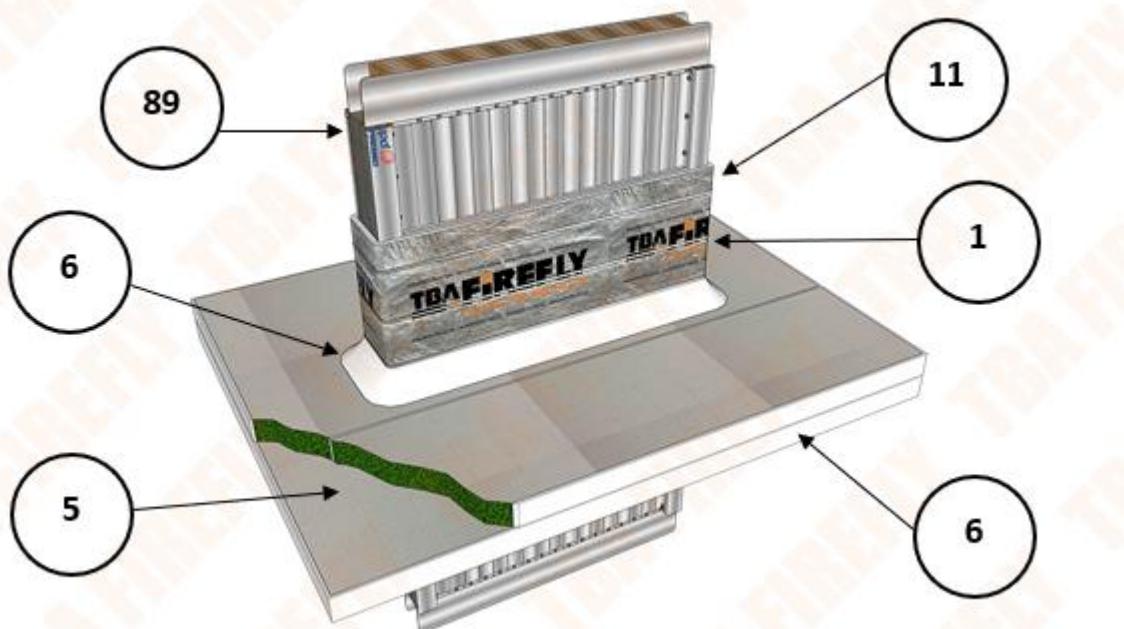
**Figure 139** IPD Powerduct (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt, length of wrap for up to FRL-120/120 determined by Table 8e



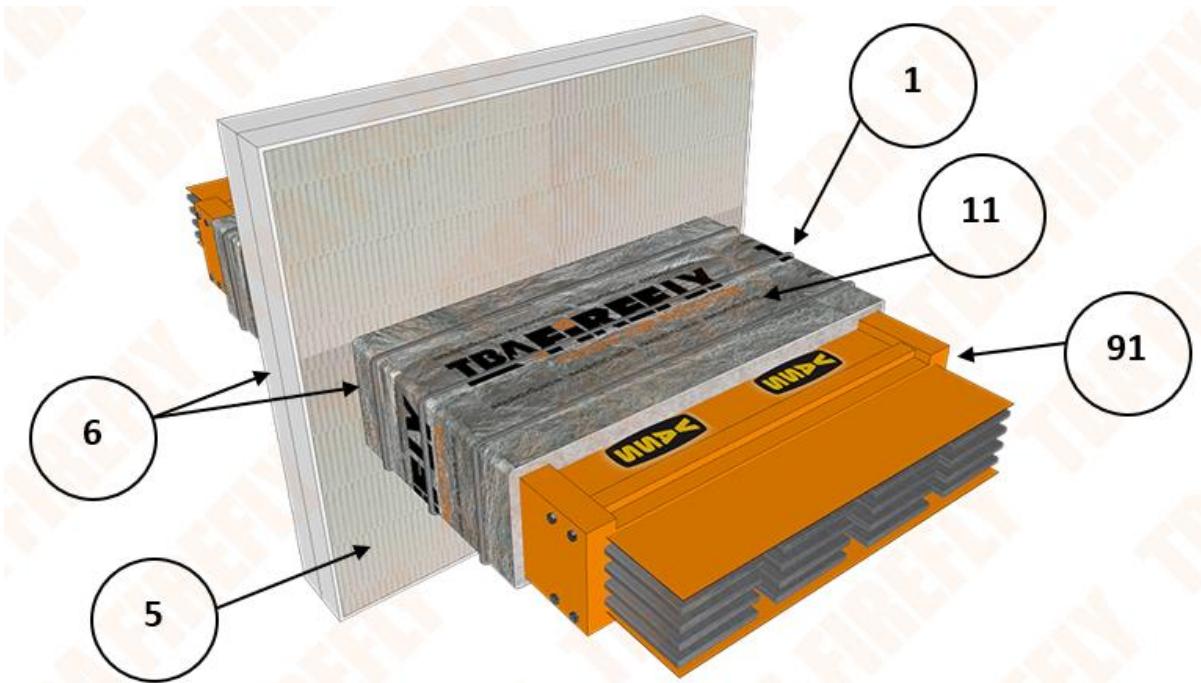
**Figure 140** IPD Powerduct (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt, length of wrap for up to FRL-240/240 determined by Table 8e



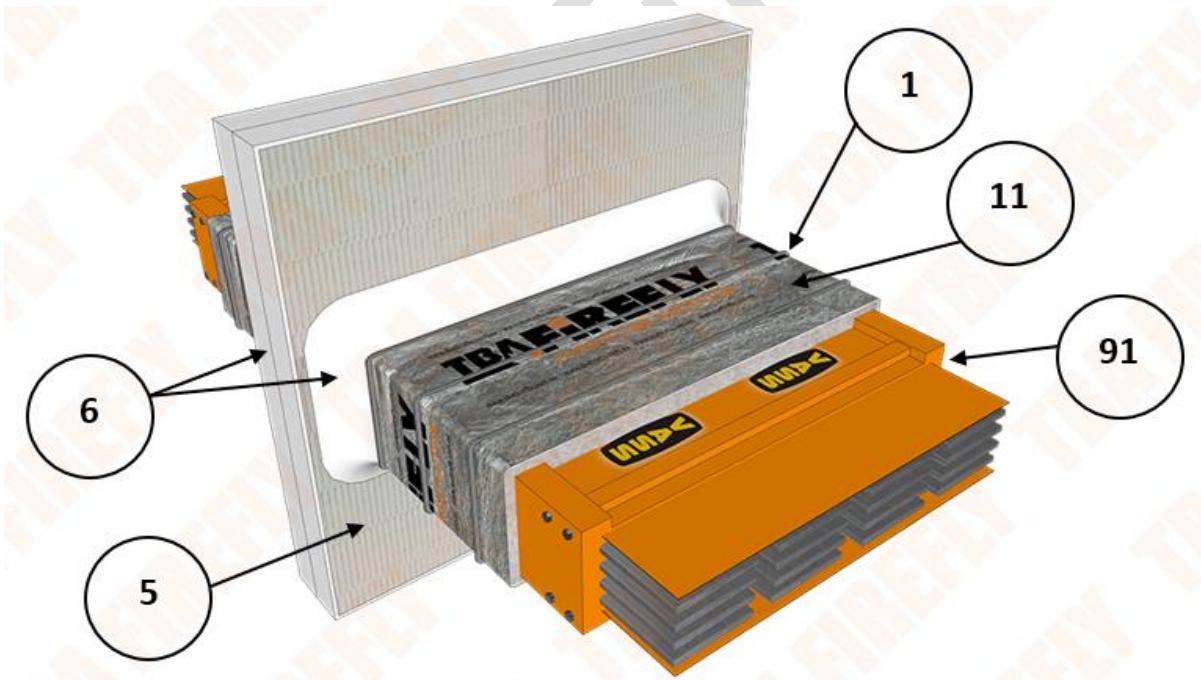
**Figure 141** IPD Powerduct (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt, length of wrap for up to FRL-/120/120 determined by Table 8



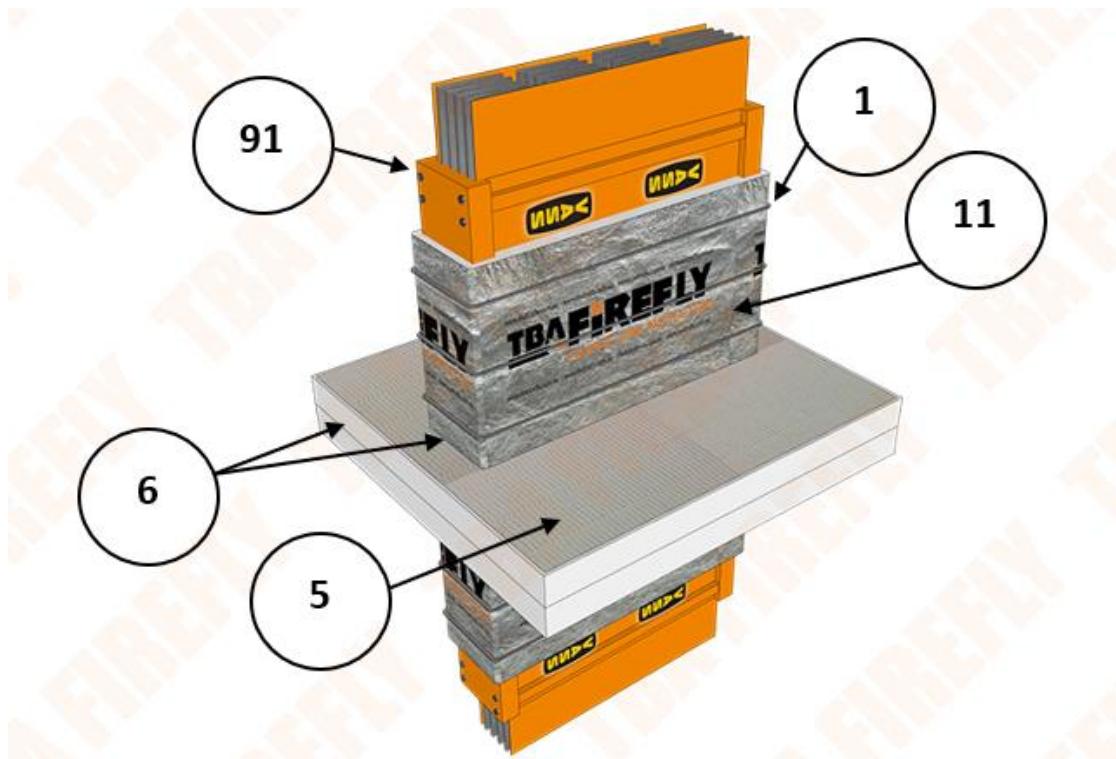
**Figure 142** IPD Powerduct (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt, length of wrap for up to FRL-/240/240 determined by Table 8



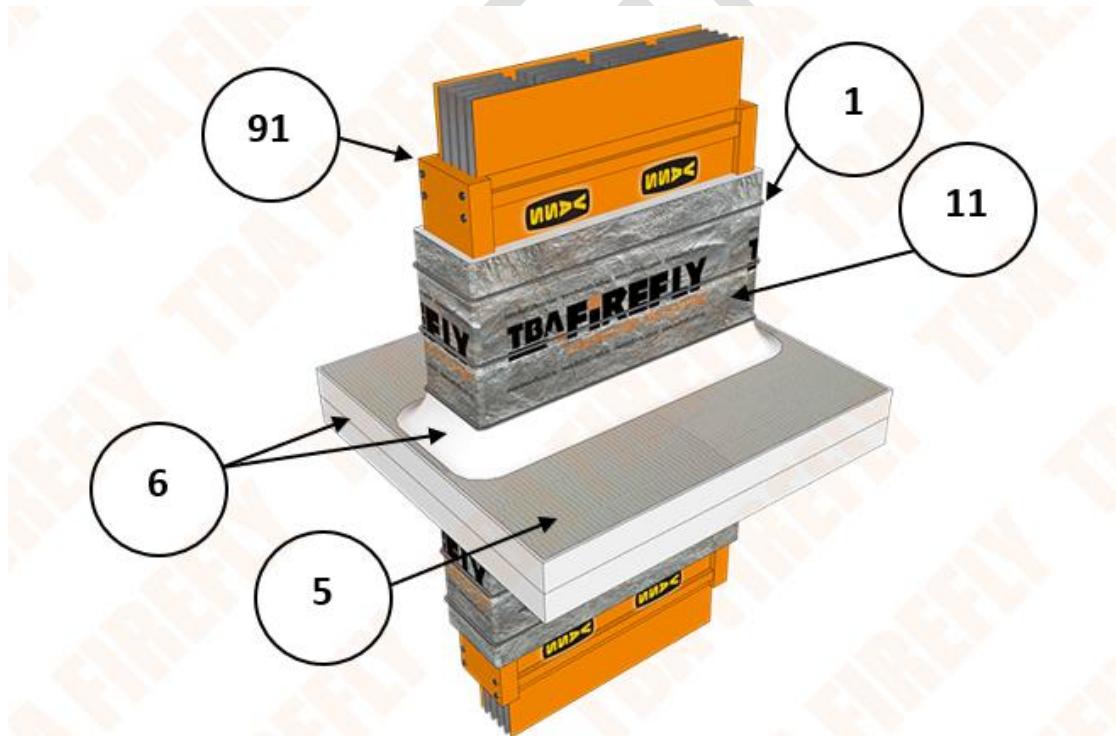
**Figure 143** VASS HFA Series Busway (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Vertical substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL-/120/120 determined by Table 3



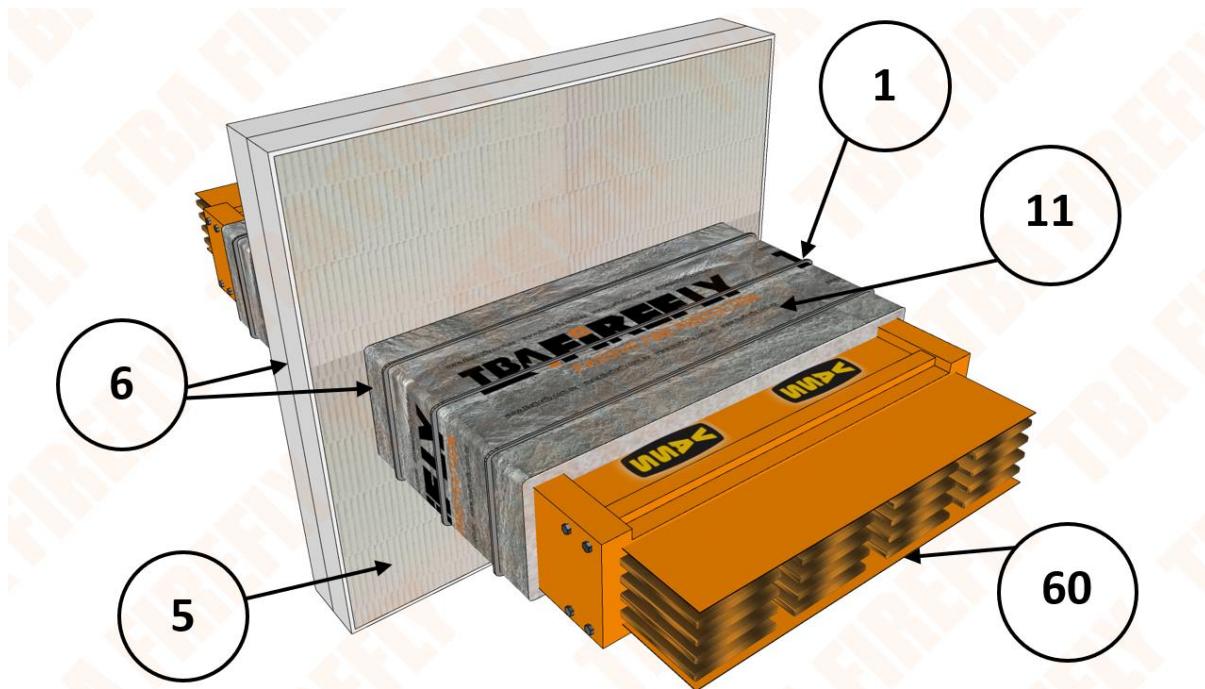
**Figure 144** VASS HFA Series Busway (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Vertical substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL-/240/240 determined by Table 3



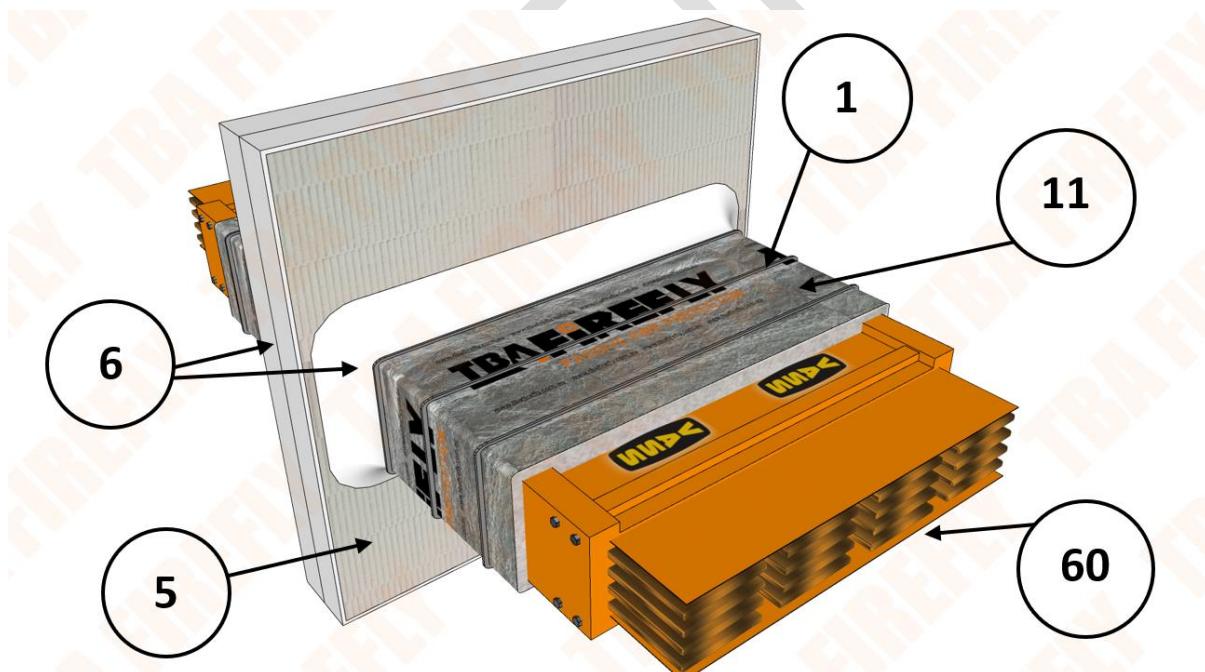
**Figure 145** VASS HFA Series Busway (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL-/120/120 determined by Table 8



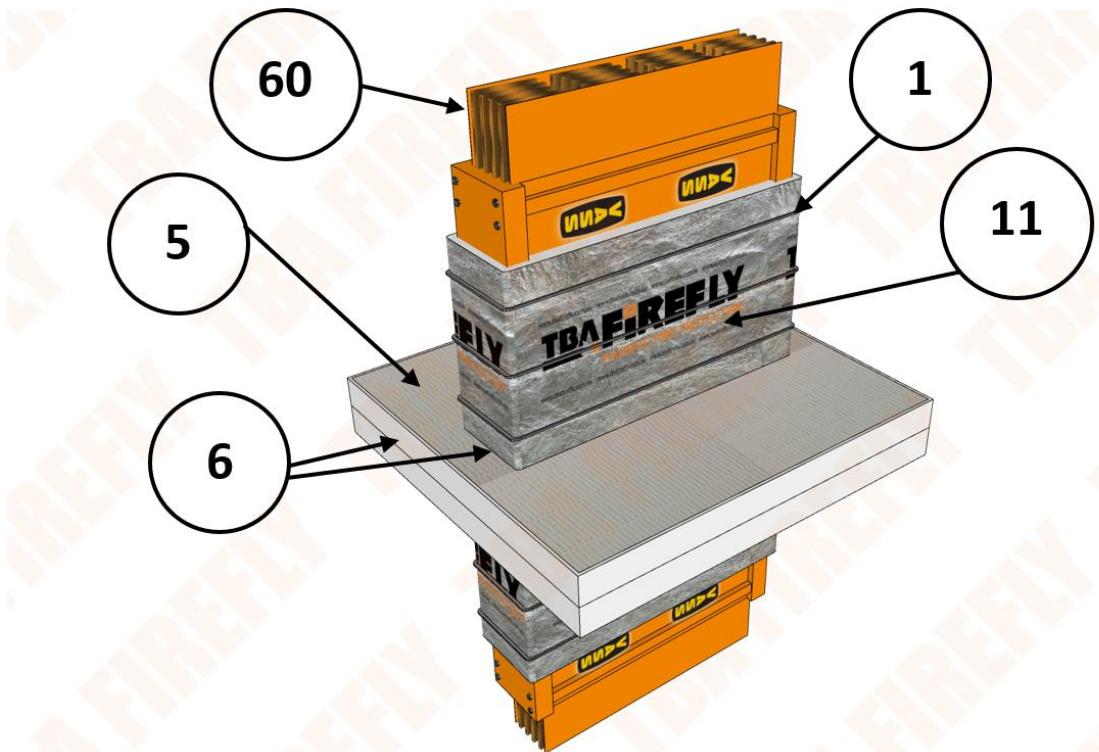
**Figure 146** VASS HFA Series Busway (with Aluminium Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL-/240/240 determined by Table 8



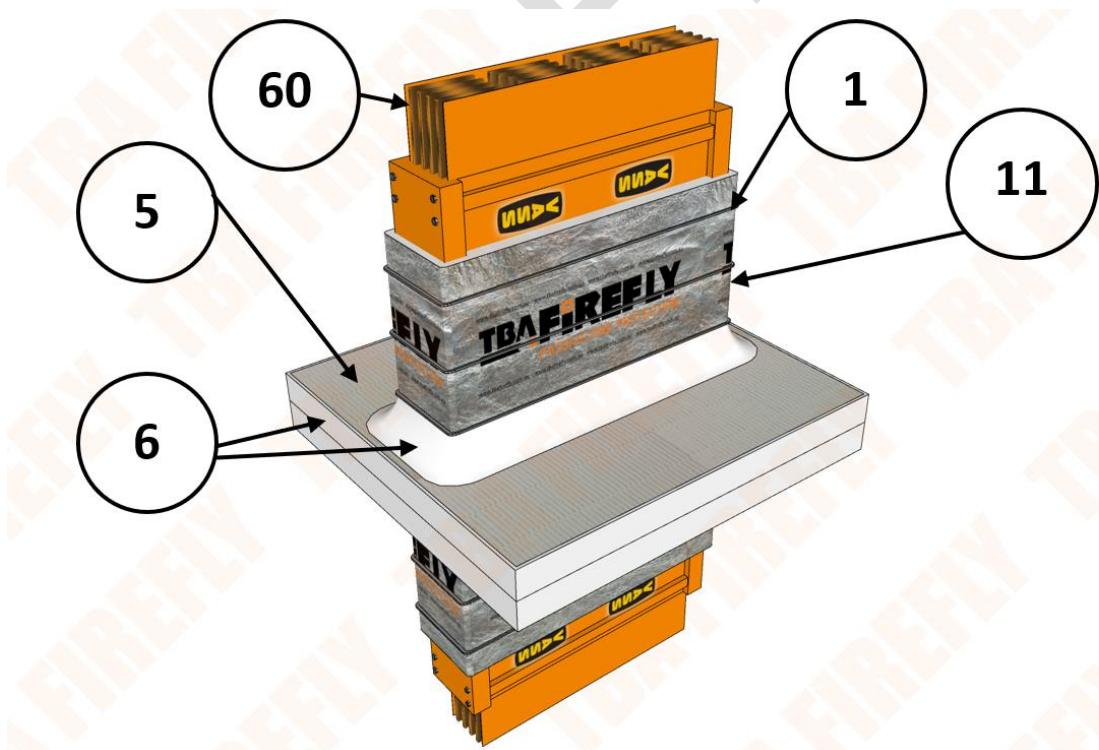
**Figure 147** VASS HFC Series Busway (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Vertical substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL -/180/180 determined by Table 3



**Figure 148** VASS HFC Series Busway (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Vertical substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL -/240/240 determined by Table 3



**Figure 149** VASS HFC Series Busway (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL-/180/180 determined by Table 8



**Figure 150** VASS HFC Series Busway (with Copper Conductors) protected with TBA Firefly™ Penowrap® through 2 or 3 layers of TBA Firefly™ Intubatt® in Horizontal substrates. Wrap to both sides of the TBA Firefly™ Intubatt®, length of wrap up to FRL -/240/240 determined by Table 8

**Service penetration support**

All service penetrations must be supported on both sides of the seal. The supports must be designed to accommodate the required load of the service penetration under normal conditions. Please note that the graphic provided below is for illustrative purposes only.

In this report, all service penetrations, including those that require wrapping with TBA Firefly™ Penowrap®, were tested with supports on the non-fire side only for both vertical and horizontal separating elements. According to AS 1530.4:2014, penetrations are not supported within the furnace. However, for vertical separating elements, it is necessary to have static load support on both sides during onsite installation.

If the onsite application involves supports within the area covered by TBA Firefly™ Penowrap® (Item 11), it is important to ensure that the wrap is cut neatly (maximum cut out is 5 mm and filled with TBE Firefly™ intumastic sealant) around the support. In such cases, the support does not require additional insulation protection. Please note that AS 1530.4:2014 does not provide specific requirements for the attachment of thermocouples in the test procedure for this particular support element or component. However, the test results and assessments are considered compliant with the test standard.

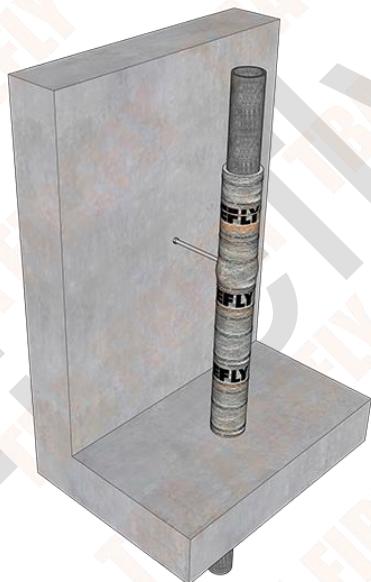


Figure 151 Summary of requirements for service penetration support

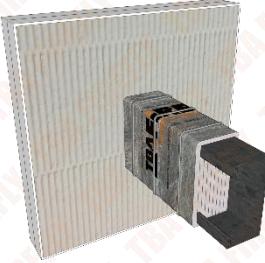
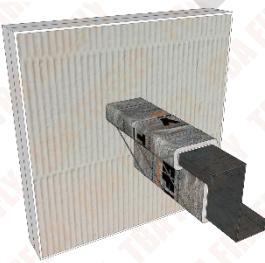
Summary of protection for C and Z purlins			
<b>Steel C Purlin with packing to the web:</b> TBA Firefly™ Penowrap® (Item 11) secured with stainless steel cable ties or steel angles / flat strap			
Body of the TBA Firefly™ Intubatt®		Close to Edge of the TBA Firefly™ Intubatt®	
			
<b>Steel C Purlin without packing to the web:</b> The TBA Firefly™ Penowrap® (Item 11) is glued directly to the profile of the purlin using TBA Firefly™ Intumastic Brush Grade in addition to securing it with stainless steel cable ties or steel angles / flat strap			
Body of the TBA Firefly™ Intubatt®		Close to Edge of the TBA Firefly™ Intubatt®	
			
<b>Steel Z Purlin with packing to the web:</b> TBA Firefly™ Penowrap® (Item 11) secured with stainless steel cable ties or steel angles / flat strap			
Body of the TBA Firefly™ Intubatt®		Close to Edge of the TBA Firefly™ Intubatt®	
			
<b>Steel Z Purlin without packing to the web:</b> The TBA Firefly™ Penowrap® (Item 11) is glued directly to the profile of the purlin using TBA Firefly™ Intumastic Brush Grade in addition to securing it with stainless steel cable ties or steel angles / flat strap.			
Body of the TBA Firefly™ Intubatt®		Close to Edge of the TBA Firefly™ Intubatt®	
			

Figure 152 Summary of protection for C and Z purlins

**Summary of protection for C and Z purlins**

**Steel Universal Beam with packing to the web:** TBA Firefly™ Penowrap® (Item 11) secured with stainless steel cable ties or steel angles / flat strap

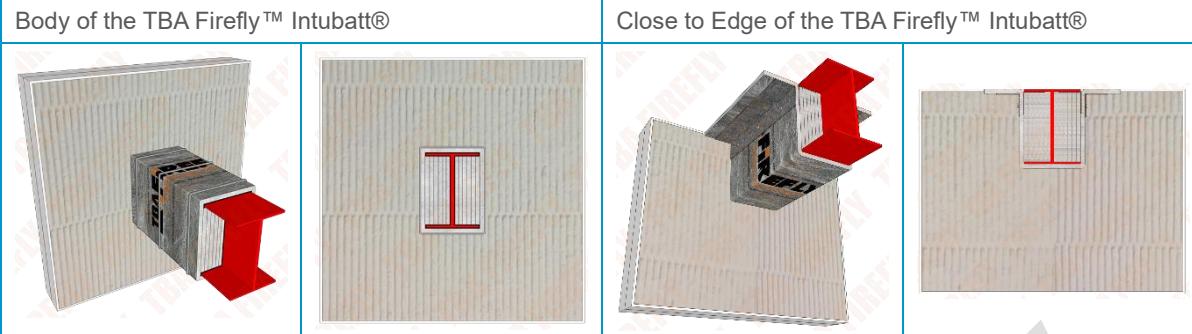


Figure 153 Summary of protection for steel universal beams

## 5. Conclusion

On the basis of the discussion presented in the referenced assessment report, it is the opinion of this testing authority that if the tested prototypes described in section 4.1 had been varied as in section 4.3, they will achieve the fire resistance performances summarised in Table 1 to Table 8e in accordance with the test method referenced in section 4.4 and subject to the requirements of sections 2, 3 and 6.

## 6. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of the referenced assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

Due to the nature of fire 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 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 subject to constant review and improvement. It is therefore recommended that this report be reviewed on, or before, the stated expiry date.

This assessment represents our opinion about the performance expected to be demonstrated on a test in accordance with AS 1530.4:2014, based on the evidence referred to in this report.

TBA FIRE TESTED