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Fire assessment report

Trafalgar FyreDAMPER ceiling box

Sponsor: Trafalgar Group

Report number: FAS210294 Revision: R2.1

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Quality management

Version	Date	Information about the report			
R1.0	Issue: 3/11/2021	Reason for issue	Report issued to Trafalgar Group for review and comment.		
			Prepared by	**Reviewed by**	**Authorised by**
		Name	Mahmoud Akl	Imran Ahamed	Omar Saad
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			Prepared by	**Reviewed by**	**Authorised by**
	Expiry: 30/11/2026	**Name**	Ananya Thomas	Omar Saad	Omar Saad
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			Prepared by	**Reviewed by**	**Authorised by**
	Expiry: 30/11/2026	**Name**	Ananya Thomas	Omar Saad	Omar Saad
		Signature			

Executive summary

This report documents the findings of the assessment undertaken to determine the expected fire resistance level and resistance to incipient spread of fire of Trafalgar FyreDAMPER ceiling box CM2 and CM4 installed in ceiling systems in accordance with AS 1530.4:2014.

The analysis in sections 5 to 7 of this report found that the proposed systems, together with the described variations, are expected to achieve the FRL and RISF values as shown in Table 1 and Table 2, in accordance with AS 1530.4:2014. The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 3 and 8 of this report. The results of this report are valid until 30 November 2026.

Table 1 Variations and assessment outcome Trafalgar CM2 FyreDAMPER System

Item	Variations	FRL
Trafalgar CM2 FyreDAMPER box	• Option of including a single or double 300 mm × 300 mm damper cells to fit the maximum aperture size of 540 mm × 240 mm. • Option of including a single or double 600 mm × 600 mm damper cell to fit maximum aperture size of 1200 mm × 600 mm. • Vary the height of the Trafalgar CM2 FyreDAMPER box to be either less than the as tested 150 mm clearance or to be up to 600 mm high while keeping the height from the top of the damper cell to the mesh at 50 mm. • Internal dimensions can be varied to be equal to and/or greater than ceiling opening. • The fixing configuration of the FyreDAMPER boxes can be varied to include: – The four walls of the damper box are directly fixed to the ceiling steel supports. – In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board up to all four sides. • Include 2 × TPS cables or a combination of 2 × TPS and up to 3 × CAT6 cables through the side wall of the damper box, provided that face has incorporated atleast 2 × 40 mm Maxilite boards. • Installing Trafalgar CM2 FyreDAMPER ceiling box in a two layered ceiling system. • The suspended ceiling framing can be varied to minimum 70 mm × 35 mm timber battens, provided that the ceiling aperture must be lined with one layer of 16 mm fire rated plasterboard	FRL: -/120/120 RISF: 60 minutes
Separating element	• The proposed construction is similar to the construction tested in TR-F49.01 with variation in the main separating element. The proposed ceiling system consists of two layers of 16 mm thick plasterboards installed as tested in FSH0597. • Variation to extend the above variations when the Trafalgar CM2 FyreDAMPER box damper is installed in: – -/120/120 plasterboard ceiling + 60 RISF – -/90/90 plasterboard ceiling + 60 RISF – -/60/60 plasterboard + 60 RISF – -/30/30 plasterboard + 30 RISF	• FRL: -/60/60 RISF: 60 minutes • The separating element must have an established FRL and RISF equal to or greater than the assessed FRL of the system.

Table 2 Variations and assessment outcome Trafalgar CM4 FyreDAMPER System

Item	Variations	FRL
Trafalgar CM4 FyreDAMPER box	• Assess the FRL and RISF of Trafalgar CM4 FyreDAMPER ceiling box when installed in a two layered ceiling system. • Option of including damper cell size up to 300 mm circular or square-based on established performance of Lorient damper in Trafalgar CM4 FyreDAMPER test specimen. • Internal dimensions can be varied to be equal to and/or greater than ceiling opening. • The fixing configuration of the FyreDAMPER boxes can be varied to include: – The four walls of the damper box are directly fixed to the ceiling steel supports. – In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board up to all four sides. • Positioning up to two spigots in either face of the damper assembly, provided the penetrated face is modified to include 2 × 40 mm Maxilite boards and be separated by 50 mm if two spigots are installed. • Include 2 × TPS power cables or a combination of 2×TPS cables and up to 3 × CAT6 through the side wall of the Trafalgar CM4 FyreDAMPER, provided that face has incorporated atleast 2 × 40 mm Maxilite boards. • The suspended ceiling framing can be varied to minimum 70 mm × 35 mm timber battens, provided that the ceiling aperture must be lined with one layer of 16 mm fire rated plasterboard	FRL:-/120/120 RISF: 60 minutes
Separating element	• The proposed construction is similar to the construction tested in TR-F49.01 with variation in the main separating element. The proposed ceiling system consists of two layers of 16 mm thick plasterboards installed as tested in FSH0597. • Variation to extend the above variations when the Trafalgar FyreDAMPER CM4 damper is installed in: – -/120/120 plasterboard ceiling + 60 RISF – -/90/90 plasterboard ceiling + 60 RISF – -/60/60 plasterboard + 60 RISF – -/30/30 plasterboard + 30 RISF	• FRL:-/60/60 RISF: 60 minutes • The separating element must have an established FRL and RISF equal to or greater than the assessed FRL of the system.

Contents

1. Introduction

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) and resistance to incipient spread of fire (RISF) of Trafalgar FyreDAMPER ceiling box CM2 and CM4 – in accordance with AS 1530.4:2014[1].

This report may be used as evidence of suitability in accordance with the requirements of the relevant National Construction Code (NCC) to support the use of the material, product, form of construction or design as given within the scope of this assessment report. It also references test evidence for meeting deemed to satisfy (DTS) provisions of the NCC as applicable to the assessed systems.

This assessment was carried out at the request of Trafalgar Group. The sponsor details are included in Table 3.

Table 3 Sponsor details

Sponsor	Address
Trafalgar Group	26a Ferndell Street South Granville NSW 2142

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 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' prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2019[2].

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.

This assessment has been written in accordance with the general principles outlined in EN 15725:2010[3] for extended application reports on the fire performance of construction products and building elements.

This 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.

1 Standards Australia, 2014, Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests for elements of construction, AS 1530.4:2014, Standards Australia, NSW.
2 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.
3 European Committee for Standardization, 2010, Extended application reports on the fire performance of construction products and building elements, EN 15725:2010, European Committee for Standardization, Brussels, Belgium

This 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

This assessment report has been prepared to meet the evidence of suitability requirements of the NCC 2022, under A5G3 (1) (d)[4]. It references test evidence for meeting DTS provisions of the NCC under A5G5 for fire resistance level that apply to the assessed systems based on Specifications 1 and 2 for fire resistance for building elements.

This assessment report may also be used to demonstrate compliance with the requirements for evidence of suitability under the relevant sections of previous versions of the NCC.

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 14 September 2021 and 13 January 2023, Trafalgar Group confirmed that:

- To their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this 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 this assessment is being made and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.

3. Limitations and requirements of this assessment

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.3.
- This report details the methods of construction, test conditions and assessed results that are expected in accordance with AS 1530.4:2014.
- This assessment is applicable to ceiling systems exposed to fire from below in accordance with the requirements of AS 1530.4:2014 where horizontal elements must be exposed to heat from the underside only.
- It is understood that the proposed Trafalgar CM2 and CM4 FyreDAMPER boxes function as air transfer grille systems that are mainly used in bathrooms and return air grilles. Therefore, it is considered that the proposed boxes will never be used in Heating and Ventilation and Cooling (HVAC) systems or connected to ducts; hence, testing to section 11 of AS 1530.4:2014 is not required.
- For ceiling systems with secondary framing consisting of timber battens – for 120 minutes of integrity and insulation and 60 minutes of RISF – the minimum size of the battens must be 70 mm × 35 mm and the total length of the plasterboard screws fixing the plasterboard layers to the timber battens must be minimum 80 mm. This screw length must be used for an area extending minimum 200 mm from the aperture in all directions. The aperture around the Trafalgar CM2 and CM4 FyreDAMPER box must be capped with one layer of fire-rated plasterboard according to the ceiling specifications.

[4] National Construction Code Volumes One and Two - Building Code of Australia 2022, Australian Building Codes Board, Australia.

- This 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 this assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL).
- The documentation that forms the basis for this report is listed in Appendix A.
- This 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.
- This assessment 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

The Trafalgar CM2 FyreDAMPER box is a 240 mm high box constructed of two layers of 30 mm thick Maxilite blue board. The internal dimensions of the box were 545 mm × 245 mm. The box does not have a closed top, but rather a steel mesh covering the opening. All outer edges of the box are protected with 75 mm × 75 mm × 0.5 mm steel angles, and additional angles, 50 mm × 50 mm × 0.5 mm, on the top edge are used to sandwich the steel mesh down to the top of the Maxilite walls. The internal layer of 30 mm Maxilite is finished short of the top of the box by 90 mm. Resting on the top of this internal layer of Maxilite are two 300 mm × 300 mm damper cells. FyreFLEX sealant is applied between the two cells and in a fillet of 5 × 5 mm around the interface to the damper box walls on both the top and bottom sides of the cells. The cells are fixed to the damper box from the outside, through the Maxilite walls directly into the side of the cell with 2 × 8g × 50 mm fixings along the short side. The damper cells themselves were Lorient LVH44, 300 mm × 300 mm × 40 mm thick and leaving a 50 mm air gap between the top of the cell and the steel mesh.

The tested assembly of RTL FT1553.01 consisted of various services penetrating through a 120-minute fire rated RISF ceiling system with a cavity depth of 550 mm between the non-fire side of the plasterboard and the underside of the floor sheeting. The floor/ceiling system is constructed with three layers of 16 mm plasterboard. All sheets of the plasterboard were suspended by Rondo P129 furring channel and 25 mm top cross rails from 125 mm thick hardwood floor joists evenly spaced and lined with 19 mm yellow tongue flooring on the top. The floor/ceiling system measured a 1600 mm × 1600 mm with a 550 mm depth. Joints in the plasterboard were staggered, and the last layer was sealed with one layer of Gyprock multi-purpose joint compound and a layer of Gyprock paper tape. This floor-ceiling system had an established FRL of -/120/120 + RISF 60 minutes.

Specimen C of this tested assembly was a Trafalgar CM2, which was a 240 mm high box constructed of two layers of 30 mm thick Maxilite board. The Trafalgar CM2 was placed on the top side of the plasterboard and bed down with FyreFLEX Sealant. From the underside, 10g × 100 mm fixings were installed through the plasterboard into the side walls of the CM2, one at each corner and one at midspan in each direction. 10g × 100 mm fixings were installed from the internal wall of the CM2 through the side wall and into the steel ceiling framing surrounding the box at 150 mm centres. FyreFLEX sealant was installed at the interface between the sidewall and the plasterboard from the underside only. One side of the CM2 running parallel with the cross rails, had a small gap from the side wall to the cross rail this gap was packed out locally at each fixing point with 40 mm Maxilite, approximately 150 mm in length.

The tested assembly of TR-F49.01 consisted of various services penetrating through a ceiling system. The floor/ceiling system consisted of 125 mm thick hardwood floor joists evenly spaced and lined with 19 mm yellow tongue flooring on top. Hanging from the floor joists was a plasterboard floor system that consisted of three layers of 16 mm Knauf Fireshield fixed to a frame of furring channels at maximum 450 mm centres. The 16 mm Knauf Fireshield plasterboard sheets had offset joints of 400 mm on each layer.

The first layer of plasterboard was fixed to the wall track around the perimeter at maximum 150 mm centres and the furring channel at maximum 200 mm centres with Type S 6 g × 32 mm NP screws. The next layer of plasterboard was fixed with Type S 6 g × 32 mm NP screws at 150 mm centres around the perimeter and 200 mm centres on each furring channel. The third layer of plasterboard was fixed with 10 g × 38 mm, course thread bugle head laminating screws at 150 mm centres around the perimeter and 200 mm centres through the centre of the ceiling.

Specimen D was a Trafalgar CM4 FyreDAMPER ceiling box a 100 mm diameter installed in a 250 mm × 250 mm aperture through the plasterboard. The FyreDAMPER assembly was secured into the top cross rail using 2 × 8g plasterboard screws on each side at nominal 250 mm centres. Additionally, the FyreDAMPER assembly was secured into the furring channel on the perpendicular edge using 2 × 8g plasterboard screws on each side at nominal 250 mm centres. The Trafalgar CM4 FyreDAMPER box is a box constructed of one layer of 40 mm thick Maxilite board. At the face where the damper/ spigot was installed a second layer of 40 mm thick Maxilite board was added to make a total thickness of 80mm. All corners are protected with are protected with 75 mm × 75 mm × 0.5 mm steel angles.

4.2 Referenced test data

The assessment of the variation to the tested system and the determination of the expected performance are based on the results of the fire tests documented in the reports summarised in Table 4. Authorisation was received from USG Boral to reference test report FSH0597. Further details of the tested system are included in Appendix A.

Table 4 Referenced test data

Report number	Test sponsor	Test date	Testing authority
FSH0597	Boral Plasterboard	25 June 1998	CSIRO
EWFA 51894700.1	Trafalgar Fire Containment Solutions Pty Ltd	13 April 2018	Warringtonfire
RTL TR-F47.01	Trafalgar Fire Containment Solutions Pty Ltd	9 April 2020	Resolute Testing Laboratories
TR-F49.01	Trafalgar Fire Containment Solutions Pty Ltd	5 March 2021	Resolute Testing Laboratories
FT1533.01	Trafalgar Fire Containment Solutions Pty Ltd	23 September 2022	Resolute Testing Laboratories

4.3 Variations to the tested systems

An identical system has not been subject to a standard fire test. We have therefore assessed the product using baseline test information for similar products. The variations to the tested systems – together with the referenced standard fire tests – are described in Table 5. Figure 1 to Figure 3 show the assessed systems.

Table 5 Variations to tested systems

Item	Reference test	Description	Variations
Trafalgar CM2 FyreDAMPER box	RTL FT1553.01 RTL TR-F47.01 EWFA 51894700.1	The tested assembly of RTL FT1553.01 consisted of Trafalgar CM2 FyreDAMPER system installed in a three-layered ceiling system. The specimen achieved an FRL of -/120/120 and a RISF rating of 66 minutes	• Option of including a single or double 300 mm × 300 mm damper cells to fit the maximum aperture size of 540 mm × 240 mm. • Option of including a single or double 600 mm × 600 mm damper cell to fit maximum aperture size of 1200 mm × 600 mm. • Vary the height of the Trafalgar CM2 FyreDAMPER box to be either less than the as tested 150 mm clearance or to be up to 600 mm high while keeping the height from the top of the damper cell to the mesh at 50 mm. • Internal dimensions to be equal to and greater than ceiling opening. • The fixing configuration of the FyreDAMPER boxes can be varied to include: – The four walls of the damper box are directly fixed to the ceiling steel supports. – In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board on all four sides. • Include 2 ×TPS cables or a combination of 2 ×TPS and up to 3 × CAT6 cables through the side wall of the damper box. • Installing Trafalgar CM2 FyreDAMPER ceiling box in a two layered ceiling system.
			The suspended ceiling framing can be varied to minimum 70 mm × 35 mm timber battens provided that the celling aperture must be lined with one layer of 16 mm fire rated plasterboard for an FRL of -/120/120 and RISF 60minutes

Item	Reference test	Description	Variations
Trafalgar CM4 FyreDAMPER box	TR-F49.01 RTL FT1553.01 RTL TR-F47.01 EWFA 51894700.1	The tested assembly consisted of Trafalgar CM4 FyreDAMPER installed in a three-layered ceiling system. The specimen achieved an FRL of -/120/120 and a RISF rating of 51 minutes.	• Trafalgar CM4 FyreDAMPER sizes up to 300 mm in diameter (circular) or 300 mm × 300 mm square configurations. • Maximum aperture size to be 1200 × 600 mm. • Positioning up to two spigots in either face of the damper assembly, provided the penetrated face is modified to include 2 × 40 mm Maxilite boards and be separated by 50 mm if two spigots are installed. • Internal dimensions to be equal to or greater than ceiling opening. • The fixing configuration of the FyreDAMPER boxes can be varied to include: – The four walls of the damper box are directly fixed to the ceiling steel supports. – In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board on all four sides. • Include 2 TPS cables or a combination of 2 × TPS cables and up to 3 × CAT6 fire cable penetrations for 60- and 120-minute ceilings. • Installing Trafalgar CM4 FyreDAMPER ceiling box in a two layered ceiling system.
			The suspended ceiling framing can be varied to minimum 70 mm × 35 mm timber battens provided that the celling aperture must be lined with one layer of 16 mm fire rated plasterboard for an FRL of -/120/120 and RISF of 60 minutes.
Separating element	FSH0597 TR-F49.01 RTL FT1553.01	The tested assembly consisted of a two layered ceiling system that consisted of a layer of 13 mm thick fire rated plasterboard and a second layer of 13 mm and 16 mm thick plasterboards fixed to the upper layer and into the furring channels. The whole ceiling system was suspended from a timber floor frame.	• The proposed construction is similar to the construction tested in TR-F49.01 and RTL FT1553.01 with variation in the main separating element. The proposed ceiling system consists of two layers of 16 mm thick plasterboards installed as tested in FSH0597. • Variation to extend the above variations when the Trafalgar CM2 & CM4 FyreDAMPER boxes are installed in: – -/120/120 plasterboard ceiling + 60 RISF – -/90/90 plasterboard ceiling + 60 RISF – -/60/60 plasterboard + 60 RISF – -/30/30 plasterboard + 30 RISF

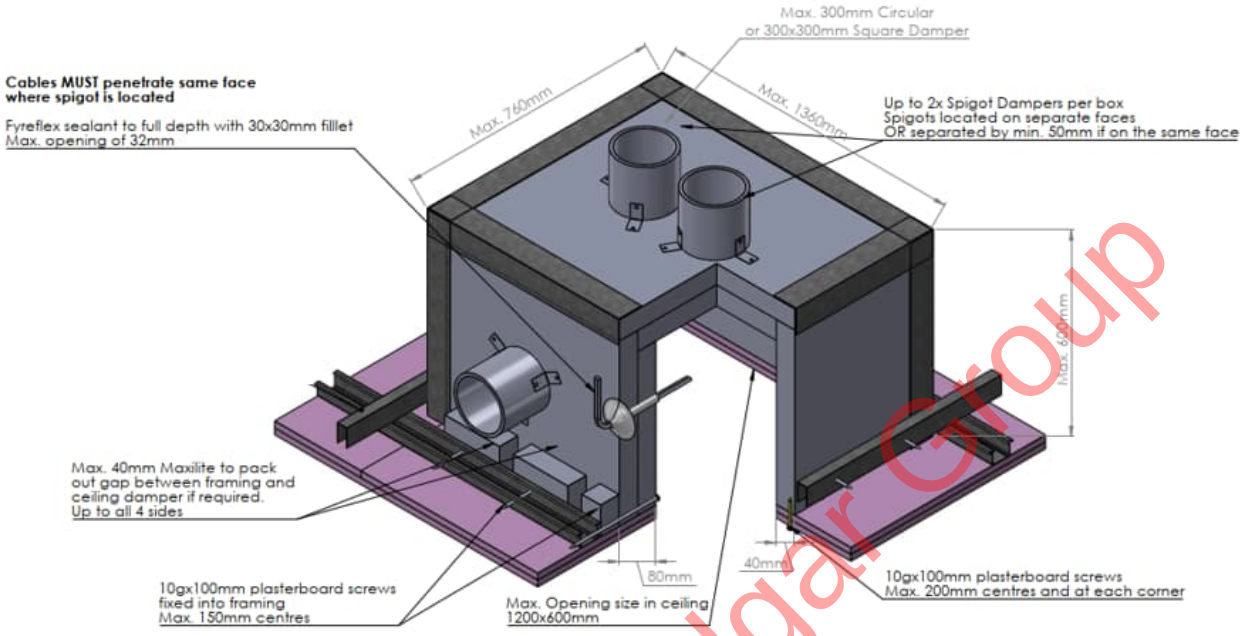

Figure 1 Assessed Trafalgar CM4 FyreDAMPER system

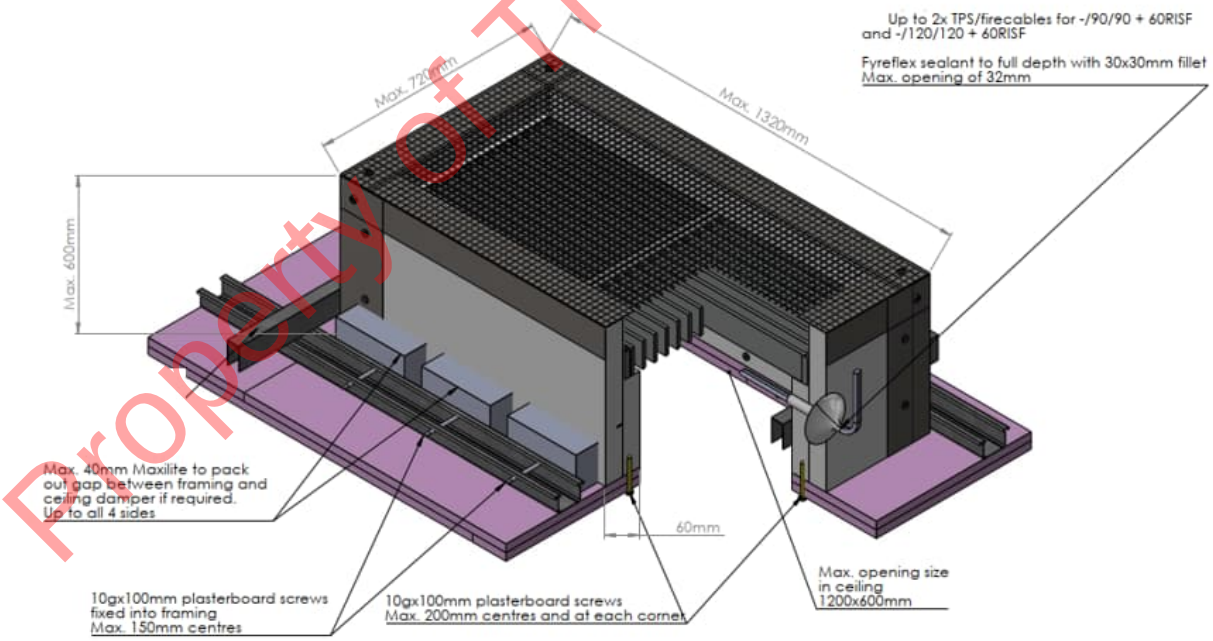

Figure 2 Assessed Trafalgar CM2 FyreDamper Systems

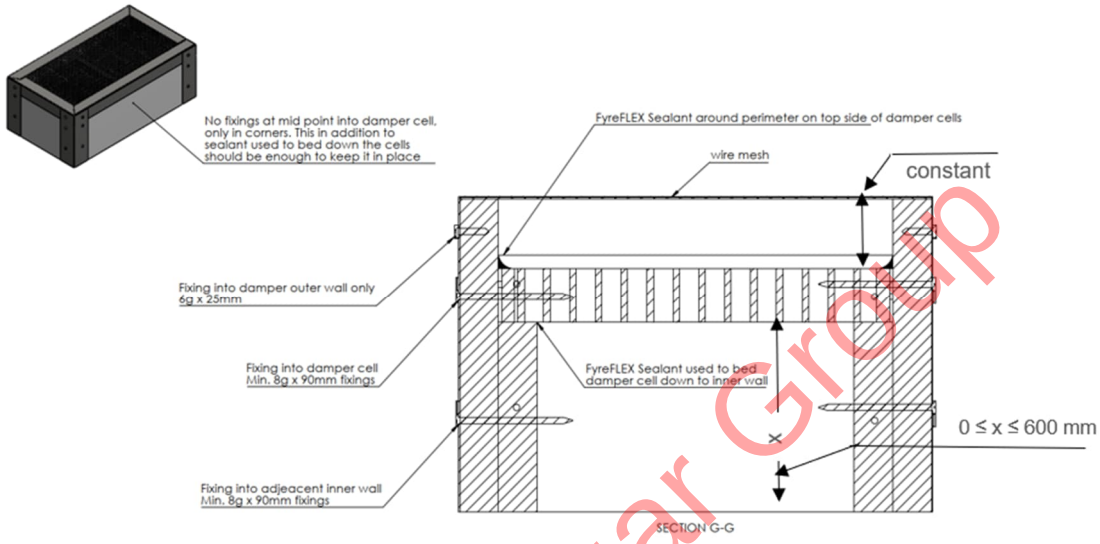

Figure 3 Installation details of Trafalgar CM2 FyreDamper System

5. Assessment 1 – Relevance of AS 1530.4:1997 test data with respect to AS 1530.4:2014

5.1 Description of variation

The fire resistance test FSH0597 was conducted in accordance with AS 1530.4:1997[5] which differs from AS 1530.4:2014. The effect these differences have on the fire resistance performance of the referenced test specimens is discussed below.

5.2 Methodology

The method of assessment used is summarised in Table 6.

Table 6 Method of assessment

Assessment method	
Level of complexity	Simple assessment
Type of assessment	Qualitative and comparative

5.3 Assessment

5.3.1 Discussion

Furnace temperature

The main difference between the heating curve specified in AS 1530.4:2014 and AS 1530.4:1997 is the definition of the ambient temperature conditions. In AS 1530.4:1997. The actual ambient temperature at the start of the test must be used, whereas in AS 1530.4:2014, a constant value of 20°C is used. In FSH0597, an ambient temperature of 19°C was measured at the commencement of the test, so the temperature of the furnace should not be different between the two standards.

AS 1530.4:2014 specifies furnace temperature to follow the following trend:

$T_{AS\,153.04-2014} = 345log_{10}(8 + 1) + 20$

AS 1530.4:1997 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4:1997} = 345log_{10}(8t + 1) + T_{0,}\ 10°C \leq T_0 \leq 40°C$$

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and AS 1530.4:1997 are not appreciably different.

Furnace pressure

The furnace pressure conditions for single and multiple penetration sealing systems in both standards are not appreciably different.

The parameters outlining the accuracy of control of the furnace pressure also in both standards are not appreciably different.

Performance criteria

AS 1530.4:2014 specifies the following performance criteria:

- structural adequacy (not relevant)
- integrity
- insulation

[5] Standards Australia, 1997, Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests of elements of building construction, AS 1530.4:1997, Standards Australia, NSW.

- resistance to incipient spread of fire (RISF)

Integrity

AS 1530.4:1997 deems integrity failure to occur upon collapse, the development of cracks, fissures, or other openings through which flames or hot gases can pass. There is no requirement for a cotton pad test. However, there were no observations made for the specimen relevant to this assessment in FSH0597 which are considered likely to have warranted the application of a cotton pad.

Insulation

The positions of thermocouples and failure criteria for insulation in both standards are not appreciably different. They are defined as:

- The average temperature on the unexposed face exceeds the initial temperature by more than 140 K or
- The temperature at any location on the unexposed face exceeds the initial temperature by more than 180 K.

The location of the unexposed side thermocouples is also not appreciably different between the two standards.

Resistance to incipient spread of fire (RISF)

AS 1530.4:1997 states that failure in relation to RISF will occur when the average temperature rise measured by the RISF thermocouples placed within the cavity of the ceiling exceeds 180ºC.

However, AS 1530.4:2014 states that failure in relation to RISF will occur when the maximum temperature of the RISF thermocouples exceeds 250ºC. Therefore, AS 1530.4:1997 can be considered more onerous as the time taken to reach 180ºC will be lower than the time taken to reach 250ºC.

AS 1530.4:2014 also defines location of RISF thermocouples when ceiling or floor attachments are present which are not specified in AS 1530.4:1997. However, this is not relevant to FSH0597 which did not contain any fixtures.

5.3.2 Application of the test data to AS 1530.4:2014

Based on the above discussion and in the absence of any foreseeable integrity and insulation risk, it is concluded that the results relating to the integrity and insulation performance of the specimens – tested in FSH0597– can be used to assess the integrity and insulation performance in accordance with AS 1530.4:2014.

6. Assessment 2 – Trafalgar CM2 FyreDAMPER box system

6.1 Description of variation

The proposed construction must be similar to Trafalgar CM2 FyreDAMPER tested in RTL FT1553.01, subject to the following variations listed below and shown in Figure 1 and Figure 2.

- Option of including a single or double 300 mm × 300 mm damper cells to fit the maximum aperture size of 540 mm × 240 mm.
- Option of including a single or double 600 mm × 600 mm damper cell to fit maximum aperture size of 1200 mm × 600 mm.
- Vary the height of the Trafalgar CM2 FyreDAMPER box to be either less than the as tested 150 mm clearance or to be up to 600 mm high while keeping the height from the top of the damper cell to the mesh at 50 mm.
- Internal dimensions can be varied to be equal to and/or greater than ceiling opening.
- The fixing configuration of the Trafalgar CM2 FyreDAMPER box can be varied to include:
  - The four walls of the damper box are directly fixed to the ceiling steel supports.
  - In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board up to all four sides.
- Include 2 × TPS power cables or a combination of 2×TPS cables and up to 3× CAT6 through the side wall of the Trafalgar CM2 FyreDAMPER, provided that face has incorporated atleast 2 × 40 mm Maxilite boards.
- Installing Trafalgar CM2 FyreDAMPER ceiling box in timber framed ceiling system.
- Installing Trafalgar CM2 FyreDAMPER ceiling box in a two layered ceiling system.

6.2 Methodology

The method of assessment used is summarised in Table 7.

Table 7 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Qualitative and comparative

6.3 Assessment

6.3.1 General

The test specimen consisted of a 120-minute fire rated RISF floor-ceiling system measuring 1600 mm × 1600 mm with a cavity depth of 550 mm. The floor-ceiling system was separated into three individual cavities, one of which incorporated the Trafalgar CM2 FyreDAMPER damper system. The internal dimensions of the box were 600 mm × 300 mm with an external dimension of 680 mm × 380 mm. The top of the box is a steel mesh covering the opening. The outer edges of the box are protected with 75 mm × 75 mm × 0.5 mm steel angles and additional angles 50 mm × 50 mm × 0.5 mm, on the top edge used to sandwich the steel mesh down to the top of the Maxilite walls. The internal layer of 30 mm Maxilite was finished short of the top of the box by 90 mm. Resting on the top of this internal layer are two 300 mm × 300 mm Lorient LVH 300 mm × 300 mm damper cells, leaving a space of 50 mm between the top of the cell and the steel mesh. FyreFLEX sealant was applied between the two cells and in a fillet 5 × 5 mm around the interface to the damper box walls on both the top and bottom sides of the cells.

It is to be specifically noted that this assessment is based on the assumption that the ceiling system itself has the required FRL and RISF that have been established based on a test or assessment in accordance with AS 1530.4:2014.

6.3.2 Consideration of including single or double damper cell

It is proposed to assess the inclusion of single or double damper cells that fit an aperture size up to 540 mm × 240 mm.

In the tested assembly of RTL FT1553.01, the system included two 300 mm × 300 mm damper cells resting on the Maxilite board. Trafalgar FyreFLEX sealant was applied in between the two cells and in a fillet 5 × 5 mm around the interface to the damper box walls on both the top and bottom sides of the cells. Upon testing the system in accordance with AS 1530.4:2014, observations on the non-fire side showed that the system maintained integrity for 120 minutes without showing any considerable signs of gap formation or flaming around the perimeter of the damper assembly and stayed intact throughout the duration of the test, further review of the test data showed that the temperature recorded by the thermocouples in the cavity stayed well below the insulation failure temperature. It was further noted that upon activation, the intumescent slats of the damper expanded and fused together to create a thermal barrier, which significantly contributed to limiting the spread of fire. Accordingly, the resistance to incipient spread of fire criteria for the system was maintained for 65 minutes.

The damper size in the proposed assembly is to include sizes smaller than the tested assembly of 540 mm × 240 mm. This can be positively assessed as the deflections within the damper would be minimal compared to the deflections in a larger damper system. Hence, including a single or double cell damper that fits a smaller aperture size is expected to perform similarly to the tested assembly in RTL FT1553.0 and is capable of achieving an FRL of -/120/120 and RISF of 60 minutes.

6.3.3 Consideration of including single or double damper cells to fit an aperture up to 1200 mm × 600 mm

It is proposed to assess the possibility of increasing the aperture size to 1200 × 600 mm to suit up to two 600 × 600 mm damper cells instead of the two 300 mm × 300 mm damper cells as tested in RTL FT1553.01.

As discussed above, in the tested assembly of RTL FT1553.01, no signs of integrity failure were noted on the non-fire side of the damper assembly, and the damper system stayed intact throughout the duration of the test without showing any considerable signs of gap formation or flaming around the perimeter of the damper assembly. In this variation, the aperture size is to be increased to 1200 mm × 600 mm to suit up to two 600 × 600 mm damper cells instead of the two 300 mm × 300 mm damper cells as tested in RTL FT1553.01. This variation is not expected to adversely affect the fire resistance behaviour of the system, as the damper system will be positioned inside the ceiling cavity and is independent of the ceiling aperture. Nonetheless, it needs to be analysed if the system itself is capable of holding the weight of the assembly itself. As the outer edges of the damper box are protected with 75 mm × 75 mm × 0.5 mm steel angles, the load of the proposed assembly would be taken up by the ceiling supports on the four sides of the assembly. Furthermore, the proposed system includes an increase in the number of fixings by reducing the fixing spacing to 150 mm, which is expected to reduce the overall stress on the ceiling system.

Hence, it is reasonable to expect the Trafalgar CM2 FyreDAMPER sizes of 1200 mm × 600 mm to achieve an FRL of -/120/120 and RISF of 65 minutes.

6.3.4 Consideration of varying the Trafalgar CM2 FyreDAMPER box height

It is proposed to assess the possibility of varying the height of the Trafalgar CM2 FyreDAMPER box to be either less than the as tested 150 mm clearance or to be up to 600 mm high while keeping the height from the top of the damper cell to the mesh at 50 mm.

In the tested system of FT1553.01, the clearance between the damper cell and the celling lining was 50 mm. The variation of the height is not likely to have an effect on the performance of the system, provided that the height from the top of the damper cell to the mesh is kept constant at 50 mm, as in the tested configuration in FT1553.01. In this test, the intumescent slats of the damper expanded and fused together effectively to create a thermal barrier, thereby limiting the spread of fire, which

maintained an RISF of until 65 minutes. By varying the height of the Trafalgar CM2 FyreDAMPER box and keeping the height from the top of the damper cell constant at 50 mm a similar behaviour is expected in which the intumescent will expand and thereby ensure effective closure of the damper upon activation and maintaining the RISF for 65 minutes; hence, the proposed system can be positively assessed.

6.3.5 Internal dimensions of Trafalgar CM2 FyreDAMPER to be equal to or greater than ceiling opening

As the Trafalgar CM2 FyreDAMPER is intended to be placed on the ceiling opening in such a way that it rests inside the cavity of the ceiling independent of the ceiling aperture, internal dimensions greater than or equal to the ceiling opening are allowed, provided the damper box is fixed to the ceiling steel structure as tested. Therefore, increasing the internal dimensions of CM2 to be equal to or greater than the ceiling opening is not expected to introduce any detrimental impact on the established performance of the Trafalgar CM2 FyreDAMPER box and hence can be positively assessed.

6.3.6 Consideration of fixing Trafalgar CM2 FyreDAMPER directly to steel supports and/or packing Maxilite on up to four sides of the damper box

In the tested assembly in FT1553.01, 3 sides of the damper box were directly fixed to the steel support, while on the 4th side of the damper assembly, when the steel framing did not line up appropriately with the damper box, 40 mm thick Maxilite board was used to pack up the additional spacing.

During the installation of the damper box, if the steel framing lines up appropriately with the sides of the damper box, there is no need to use the Maxilite board as packing, and it is not expected to affect the FRL of the assembly, so it can be positively assessed. Furthermore, during installation, if the sides of the damper box do not line up with the steel framing, 40 mm thick Maxilite board may be used on all four sides of the damper box fill the additional spacing. From the tested system of FT 1553.01, it is clear that the Maxilite board acts as a washer, and no signs of weakness or distortion were observed after the test, hence it does not affect the FRL of the system. Therefore, the consideration of packing Maxilite board on up to four sides of the damper box or directly fixing the Trafalgar CM2 FyreDAMPER box to the steel supports is positively assessed.

6.3.7 Consideration of including small TPS / fire cable penetrations through the side wall of the Trafalgar CM2 FyreDAMPER damper box

It is proposed to include small TPS/ fire cable penetrations through the side wall of the Trafalgar CM2 FyreDAMPER, which includes the 60 mm Maxilite board, for any cabling that may be associated with ceiling fan connections.

In order to assess this variation, a previous test, RTL TR-F47.01, is referenced here. The tested assembly consisted of a 1-hour plasterboard floor-ceiling system that incorporated a 32 mm diameter hole through which 2 × TPS power cables and 3 × CAT6e data cables were passed. This penetration was locally thickened with 60 mm Maxilite board inside the cavity. The Maxilite board was cut into two halves to retrofit around the cable bundles. FyreFLEX sealant was used to seal the gaps between the Maxilite board, and to bed the Maxilite board onto the plasterboard. A 5 mm fillet of FyreFLEX sealant was applied to the perimeter of the Maxilite board. The 32 mm diameter aperture was then filled with FyreFLEX sealant to the full depth of plasterboard and Maxilite board with no fillet applied to the top or underside.

This system achieved an FRL of -/60/60 and RISF of 58 minutes. It was noted that the RISF failure was on the rear of the plasterboard, away from the Maxilite board. From this observation, it is expected that with the application of 30 × 30 mm fillet of FyreFLEX sealant on one side of the Trafalgar CM2 FyreDAMPER, the RISF performance will be enhanced, and the system can easily achieve a RISF of at least 60 minutes.

Hence, for one hour ceiling systems, including 2 × TPS power cables and up to 3 × CAT 6e data cables penetrating through the 80 mm Maxilite incorporated side wall of the Trafalgar CM2 FyreDAMPER damper box with an application of 30 × 30 mm fillet of fyreflex selant on one side will yield a FRL of -/60/60 + 60 RISF.

In another test, EWFA 51894700.1, 2 × TPS power cables were passed through a 30 mm diameter penetration in 60 mm Maxilite board and sealed to the full depth of the element with a 30 × 30 mm fillet of FyreFLEX sealant on the underside of the penetration. This specimen achieved an FRL of -/240/60. This test in turn indicates that the system can easily maintain integrity for at least 120 minutes and an RISF for 60 minutes.

Hence, positively assessing the inclusion of 2×TPS cables or a combination of 2×TPS cables and up to 3 × CAT6 through an 80 mm Maxilite sealed to the full depth of the element with a 30 × 30 mm fillet of FyreFLEX sealant on the underside of the penetration will yield an FRL of -/120/120 and RISF of 60 minutes for 2 hour ceiling systems.

6.3.8 Consideration of installing Trafalgar CM2 FyreDAMPER ceiling box in timber framed ceilings

It is proposed to install the Trafalgar CM2 FyreDAMPER in timber framed ceilings where steel furring channels are to be replaced with timber battens for 30, 60, 90 and 120 minutes rated ceiling systems.

With reference to test RTL FT1553.01, it was noted that when the Trafalgar CM2 FyreDAMPER ceiling box was installed in a steel framed ceiling system, the cavity temperatures remained below 250 ºC for 66 minutes, after which RISF failure occurred, while the ceiling system itself achieved an FRL of -/120/120.

The vulnerability of the fixings between the plasterboard layers and the timber ceiling grid is increased by the loss in effective residual timber cross-section due to charring when exposed to a standard fire. This could result in premature integrity and insulation failure due to plasterboard fall-off. It is considered that the temperature at which the charring of timber begins is 300°C in accordance with BS EN 13381-7:2019[6]. In test RTL FT1553.01 with three layers of 16 mm fire-rated plasterboard, the RISF criteria did not exceed up until 66 minutes, which means that the maximum temperature in the cavity of the ceiling system was maintained below 250 ºC for up to 66 minutes.

For the three-layer ceiling system – provided that the established FRL of the ceiling system is equivalent to or greater than -/120/120 and the RISF is at least 60 minutes as tested or assessed by an accredited testing laboratory – it is not expected that charring of the timber grid would occur for up to 60 minutes due to the presence of the Trafalgar CM2 FyreDAMPER, and so the plasterboard layers will continue to remain in place, showing a similar performance to the specimen in RTL FT1553.01. After 60 minutes, the timber battens will begin to char, which can be detrimental to the plasterboard screw fixings. Therefore, to prevent the dislodgment of the screws for up to 120 minutes so that the plasterboard layers can continue to maintain integrity and insulation of the system, the timber battens must be a minimum of 70 mm × 35 mm and the total plasterboard screw length must be minimum 80 mm to ensure that sufficient embedment will be maintained for 120 minutes. This screw fixing length should be maintained for a minimum of 200 mm in all directions from the aperture. Furthermore, the aperture must be capped with one layer of minimum 13 mm or 16 mm fire-rated plasterboard (to match the ceiling specifications) to delay the charring of timber battens adjacent to the Trafalgar CM2 FyreDAMPER box, which conducts heat into the ceiling cavity, and delay any RISF failure near the interface of the CM2 FyreDAMPER box and the separating element.

For the two-layer systems, reference is made to test FSH0597, which was a suspended ceiling system with no penetrations. The RISF criteria for the 13 mm / 13 mm system was not exceeded up to 55 minutes, and it was maintained for 63 minutes for the 13 mm / 16 mm system. This means that the timber battens around the FyreDAMPER box is not expected to have charred by this time. Therefore, provided that the ceiling system has an established FRL of -/60/60 and an established RISF of minimum 45 minutes for 2 × 13 mm layer systems and 60 minutes for 2 × 16 mm layer systems, it is not expected that FyreDAMPER box will detrimentally affect this performance.

The main structural framing to which the suspended ceiling grid is fixed will be maintained as timber joists. Therefore, if the steel furring channels were substituted with 70 × 35 mm timber battens and the aperture is protected with 16 mm fire rated plasterboard, the battens are expected to be protected for the duration of the fire exposure of the ceiling system, depending on the layers of plasterboard being installed, and the system would achieve an RISF of 60 minutes.

[6] European committee for standardization, 2019, Test methods for determining the contribution to the fire resistance of structural members – Part 7: Applied protection to timber members, EN 13381-7:2019, European committee for standardization, Brussels, Belgium.

6.3.9 Consideration of installing Trafalgar CM2 FyreDAMPER ceiling box in a two layered ceiling system or ceiling systems with different FRLs

Test report FSH0597 details a test conducted on a loadbearing floor / ceiling system consisting of timber floor frame and suspended plasterboard ceiling. The suspended ceiling used two different plasterboard systems. The suspension frame, assembled from Rondo 129 furring channels and Rondo 128 top cross rails, was suspended using suspension brackets nailed into the timber joists. A common upper layer of 13 mm thick fire-rated plasterboard was fixed to the furring channels using 30 mm screws at 200 mm centres in the field and 150 mm centres along the butt joints.

The lower layers of 13 mm or 16 mm thick fire-rated plasterboard were screwed to the upper layer of plasterboard and into the furring channels using 40 mm screws at the same centres as the upper layer. The dimensions of the 13 mm lower layer section were nominally 2600 mm wide × 4540 mm long (13 mm / 13 mm systems) while the 16 mm section was nominally 1040 mm wide × 4540 mm long (13 mm / 16 mm systems). A uniformly distributed load was applied to the ceiling system; however, the structural adequacy is not considered in this assessment.

The entire ceiling system (both the 13 mm / 13 mm system and the 13 mm / 16 mm system) showed no signs of integrity or insulation failure at 63 minutes. The resistance to incipient spread of fire criteria for the 13 mm / 13 mm systems was not exceeded up to 55 minutes, and it was maintained for 63 minutes for the 13 mm / 16 mm systems.

It is proposed to assess the fire resistance performance of Trafalgar FyreDAMPER ceiling box for an FRL of -/60/60 with RISF of 60 minutes when installed in a floor/ceiling system with two layers of 16 mm thick fire rated plasterboards on the exposed side.

If the thickness of the upper layer is further increased by 3 mm so that the thickness of both plasterboard layers is 16 mm, it is likely to be equally or less onerous than the tested 13 mm / 16 mm system. Therefore, based on the results from test report FSH0597, it can be ascertained that a floor / ceiling system with two layers of 16 mm thick fire-rated plasterboard on the exposed side will achieve an FRL of -/60/60 and an RISF of 60 minutes. Moreover, the introduction of the ceiling box to the ceiling system is not expected to introduce a RISF related failure around the aperture for at least 60 minutes.

The proposed construction is similar to the tested Trafalgar FyreDAMPER ceiling box in RTL FT1553.01. Based on the results from test report FSH0597, it is reasonable to consider that if the two layers of 16 mm thick plasterboard stayed in place, the whole system is expected to achieve an FRL of -/60/60 and an RISF of 60 minutes.

It is also proposed to extend the above variations to include the following ceiling systems:

- -/120/120 plasterboard ceiling + 60 RISF
- -/90/90 plasterboard ceiling +60 RISF
- -/60/60 plasterboard + 60 RISF
- -/30/30 plasterboard + 30 RISF

As discussed above, the significance of the Trafalgar CM2 FyreDAMPER ceiling box is that it is installed within the cavity of the ceiling system and is independent from the ceiling aperture. Therefore, it is considered unlikely for an RISF failure to occur on the FyreDAMPER box prior to a failure in the ceiling RISF. Accordingly, it is reasonable to consider that the performance of the Trafalgar CM2 FyreDAMPER ceiling box will be limited by the established FRL and RISF of the proposed ceiling systems. Hence, it can be positively assessed.

6.4 Conclusion

This assessment demonstrates that the proposed variations of the Trafalgar CM2 FyreDAMPER ceiling box are expected to achieve an FRL of -/120/120 and RISF of 60 minutes in accordance with AS 1530.4:2014.

Table 8 Assessed performance of Trafalgar CM2 FyreDAMPER

Item	Variations	FRL
Trafalgar CM2 FyreDAMPER box	• Option of including a single or double 300 mm × 300 mm damper cells to fit the maximum aperture size of 540 mm × 240 mm. • Option of including a single or double 600 mm × 600 mm damper cell to fit maximum aperture size of 1200 mm × 600 mm. • Vary the height of the Trafalgar CM2 FyreDAMPER box to be either less than the as tested 150 mm clearance or to be up to 600 mm high while keeping the height from the top of the damper cell to the mesh constant at 50 mm. • Internal dimensions can be varied to be equal to and/or greater than ceiling opening. • The fixing configuration of the FyreDAMPER boxes can be varied to include: o The four walls of the damper box are directly fixed to the ceiling steel supports. o In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board on all four sides. • Include 2×TPS cables or a combination of 2×TPS and up to 3 × CAT6 cables through the side wall of the damper box, provided that face has incorporated atleast 2 × 40 mm Maxilite boards. • Installing Trafalgar CM2 FyreDAMPER ceiling box in a two layered ceiling system. • The suspended ceiling framing can be varied to minimum 70 mm × 35 mm timber battens provided that the celling aperture must be lined with one layer of 16 mm fire rated plasterboard	FRL: -/120/120 RISF: 60 minutes
Separating element	• The proposed construction is similar to the construction tested in TR-F49.01 with variation in the main separating element. The proposed ceiling system consists of two layers of 16 mm thick plasterboards installed as tested in FSH0597. • Variation to extend the above variations when the CM2 damper is installed in: – -/120/120 plasterboard ceiling +60 RISF – -/90/90 plasterboard ceiling +60 RISF – -/60/60 plasterboard + 60 RISF – -/30/30 plasterboard +30 RISF	• FRL: -/60/60 RISF: 60 minutes • The separating element must have an established FRL and RISF equal to or greater than the assessed FRL of the system.

7. Assessment 3 – Trafalgar CM4 FyreDAMPER box system

7.1 Description of variation

It is proposed to assess the expected fire resistance performance of the Trafalgar CM4 FyreDAMPER ceiling box with the following variations:

- Assess the FRL and RISF of Trafalgar CM4 FyreDAMPER ceiling box when installed in a two layered ceiling system.
- Option of including damper cell size up to 300 mm circular or square-based on established performance of Lorient damper in Trafalgar CM4 FyreDAMPER test specimen.
- Internal dimensions can be varied to be equal to and/or greater than ceiling opening.
- Positioning up to two spigots in either face of the damper assembly, provided the penetrated face is modified to include 2 × 40 mm Maxilite boards and be separated by 50 mm if two spigots are installed.
- The fixing configuration of the Trafalgar CM4 FyreDAMPER box can be varied to include:
  - The four walls of the damper box are directly fixed to the ceiling steel supports.
  - In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board on all four sides.
- Include 2 × TPS power cables or a combination of 2×TPS cables and up to 3 × CAT6 through the side wall of the Trafalgar CM4 FyreDAMPER, provided that face has incorporated atleast 2 × 40 mm Maxilite boards.
- Installing Trafalgar CM4 FyreDAMPER ceiling box in a two layered ceiling system.
- Installing Trafalgar CM4 FyreDAMPER ceiling box in timber framed ceiling system.
- The above-mentioned variations are applicable to Trafalgar CM4 FyreDAMPER dampers installed in the following ceiling systems:
  - -/120/120 plasterboard ceiling + 60 RISF
  - -/90/90 plasterboard ceiling + 60 RISF
  - -/60/60 plasterboard + 60 RISF
  - -/30/30 plasterboard + 30 RISF

7.2 Methodology

The method of assessment used is summarised in Table 9.

Table 9 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Qualitative and comparative

7.3 Assessment

Trafalgar CM4 FyreDAMPER damper box system is constructed from 40 mm thick FyreBOARD Maxilite. When installed with a Spigot, the face accommodating the spigot is thickened with an additional 40 mm resulting in a total thickness of 80 mm. The outer edges of the box are protected with 75 mm × 75 mm × 0.5 mm steel angles.

7.3.1 Consideration of including cell size up to 300 mm circular or square configuration

It is proposed to assess the fire resistance performance of the Trafalgar CM4 FyreDAMPER box for damper sizes up to 300 mm × 300 mm or a circular damper cell with a diameter of 300 mm.

As discussed in section 6.3.2, the tested assembly of RTL FT1553.01 included two Lorient 300 mm × 300 mm damper cells resting on the Maxilite board. When tested in accordance with AS 1530.4:2014, the observations on the non-fire side of the system did not show any considerable signs of gap formation or flaming around the perimeter of the damper assembly, where failure is generally anticipated. Further, the review of the test data showed that the temperature recorded by the thermocouples in the cavity stayed well below the insulation failure temperature. The Lorient LVH44 damper cells in this tested configuration expanded and fused together to create a thermal barrier to flame spread. Accordingly, the resistance to incipient spread of fire criteria for the system was maintained until 65 minutes. This tested evidence shows that including Lorient damper sizes of up to 300 mm in a circular or square configuration will yield an FRL of -/120/120 and RISF of 60 minutes.

7.3.2 Consideration of including an aperture size of 1200 mm × 600 mm

It is proposed to assess the suitability of increasing the aperture size to a maximum of 1200 mm × 600 mm.

As discussed in section 6.3.3, this variation is not expected to adversely affect the fire resistance behaviour of the system as the damper system will be positioned inside the ceiling cavity and will be independent of the ceiling aperture. Nonetheless, it is expected that the load of the proposed assembly will be taken up by the ceiling supports on the four sides of the assembly. Furthermore, by adding suitable fixings with no more than 150 mm spacing, an overall reduction in stress on the system can be achieved.

Hence, it is reasonable to expect the Trafalgar CM4 FyreDAMPER sizes of 1200 mm × 600 mm will achieve an FRL of -/120/120 and RISF of 60 minutes.

7.3.3 Consideration of positioning up to two spigots in either faces of the Trafalgar CM4 FyreDAMPER assembly

It is proposed to assess the inclusion of up to two spigots with a diameter of up to 300 mm or as 300 mm × 300 mm square configuration separated by 50 mm to be positioned in either face of the damper assembly, provided that face is thickened with 2 × 40 mm Maxilite board.

The tested assembly of RTL FR-49.01 consisted of a Trafalgar CM4 FyreDAMPER box, which included a spigot assembly with a diameter of 100 mm and a face thickened with 80 mm Maxilite board. When tested, the specimen achieved an FRL of -/120/120 and a RISF of 51 minutes. The temperatures recorded by thermocouples positioned on the Maxilite board and the spigot indicate that the inclusion of the spigot does not detrimentally affect the performance of the system, provided that the face is thickened with 80 mm Maxilite board. Further, upon reviewing the after-test photos of this test, it was noted that the plasterboard layers on the exposed side peeled off around the aperture area which may have resulted in the temperature increase as recorded by the thermocouples placed on the steel channel in the cavity, which caused the RISF failure. Further, in the tested assembly of RTL FT1553.01, the RISF was noted to be 66 minutes. This test showed that the peeling off of plasterboard sheets can be prevented by proper fixings, and hence the RISF failure before 60 minutes can be prevented.

From the results of these tests, it can be concolded that the inclusion of up to 300 mm diameter spigots on either face of the damper assembly will not detrimentally affect the performance of the damper box, provided that face is thickened with 80 mm Maxilite board and the fixings are properly secured to the plasterboard sheets. This variation can be positively assessed as long as the face that incorporates the spigot is thickened by an 80 mm Maxilite board backing or separated by at least 50 mm.

7.3.4 Consideration of keeping the internal dimensions to be equal to and greater than ceiling opening.

As the Trafalgar CM4 FyreDAMPER is intended to be placed on the ceiling opening in such a way that it rests inside the cavity of the ceiling independent of the ceiling aperture, internal dimensions greater than or equal to the ceiling opening are allowed. Therefore, increasing the internal dimensions of Trafalgar CM4 FyreDAMPER to be equal to or greater than the ceiling opening is not expected to introduce any detrimental impact on the established performance of the product, hence positively assessing this system.

7.3.5 Consideration of fixing Trafalgar CM4 FyreDAMPER Damper box directly to steel supports and/or packing Maxilite on up to four sides of the damper box

In the tested assembly in FT1553.01, 3 sides of the damper box were directly fixed to the steel support, while on the 4th side of the damper assembly, when the steel framing did not line up appropriately with the damper box, 40 mm thick Maxilite board was used to pack up the additional spacing.

During the installation of the damper box, if the steel framing lines up appropriately with the sides of the damper box, there is no need to use the Maxilite board as a packing. Furthermore, during installation, if the sides of the damper box do not line up with the steel framing, 40 mm thick Maxilite board may be used on all four sides of the damper box fill in the additional spacing. From the tested system of FT 1553.01, it is clear that the Maxilite board acts as a washer between the damper box and the steel support. Furthermore, upon the completion of the test it was noted that this assembly did not demonstrate any signs of weakness or distortion and is therefore not expected to affect the FRL of the system. Hence, the consideration of packing Maxilite board on up to four sides of the damper box or directly fixing the Trafalgar CM4 FyreDAMPER box to the steel supports is positively assessed.

7.3.6 Consideration of including TPS / fire cable penetrations through the side wall of the Trafalgar CM4 FyreDAMPER box.

As discussed in Section 6.3.7, the system is positively assessed for the inclusion of 2×TPS cables or a combination of 2×TPS cables and up to 3 × CAT6 through a 80 mm Maxilite sealed to the full depth of the element with a 30 × 30 mm fillet of FyreFLEX sealant on the underside of the penetration, which will yield an FRL of -/120/120 and RISF of 60 minutes for 2 hour ceiling systems.

7.3.7 Consideration of installing Trafalgar CM4 FyreDAMPER box in timber framed ceilings

As discussed in section 6.3.8, the CM4 FyreDAMPER is positively assessed as suitable for installation in timber framed ceiling systems provided that the ceiling system incorporates minimum 70 × 35 mm timber battens and the aperture is protected with 16 mm fire rated plasterboard.

7.3.8 Consideration of installing Trafalgar CM4 FyreDAMPER ceiling box in a two layered ceiling system or ceiling systems with different FRLs

Test report FSH0597 details a test conducted on a loadbearing floor / ceiling system consisting of a timber floor frame and suspended plasterboard ceiling. The suspended ceiling used two different plasterboard systems. The suspension frame, assembled from Rondo 129 furring channels and Rondo 128 top cross rails, was suspended using suspension brackets nailed into the timber joists. A common upper layer of 13 mm thick fire-rated plasterboard was fixed to the furring channels using 30 mm screws at 200 mm centres in the field and 150 mm centres along the butt joints.

The lower layers of 13 mm or 16 mm thick fire-rated plasterboard were screwed to the upper layer of plasterboard and into the furring channels using 40 mm screws at the same centres as the upper layer. The dimensions of the 13 mm lower layer section were nominally 2600 mm wide × 4540 mm long (13 mm / 13 mm systems) while the 16 mm section was nominally 1040 mm wide × 4540 mm long (13 mm / 16 mm systems). A uniformly distributed load was applied to the ceiling system; however, the structural adequacy is not considered in this assessment.

The entire ceiling system (both the 13 mm / 13 mm systems and the 13 mm / 16 mm systems) showed no integrity or insulation failure at 63 minutes. The resistance to incipient spread of fire criteria for the 13 mm / 13 mm systems was not exceeded up to 55 minutes and it was maintained for 63 minutes for the 13 mm / 16 mm systems.

It is proposed to assess the fire resistance performance of Trafalgar FyreDAMPER ceiling box for an FRL of -/60/60 with RISF of 60 minutes when installed in a floor/ceiling system with two layers of 16 mm thick fire rated plasterboards on the exposed side.

If the thickness of the upper layer is further increased by 3 mm so that the thickness of both plasterboard layers is 16 mm, it is likely to be equally or less onerous than the tested 13 mm / 16 mm system. Therefore, based on the results from test report FSH0597, it can be ascertained that a floor / ceiling system with two layers of 16 mm thick fire-rated plasterboard on the exposed side will achieve an FRL of -/60/60 and an RISF of 60 minutes. Moreover, the introduction of the ceiling box to the ceiling system is not expected to introduce a RISF related failure around the aperture for at least 60 minutes.

The proposed construction is similar to the tested Trafalgar FyreDAMPER ceiling box in TR-F49.01. Based on the results from test report FSH0597, it is reasonable to consider that if the two layers of 16 mm thick plasterboard stayed in place, the whole system is expected to achieve an FRL of -/60/60 and an RISF of 60 minutes.

It is also proposed to extend the above variations to include the following ceiling systems:

- -/120/120 plasterboard ceiling + 60 RISF
- -/90/90 plasterboard ceiling + 60 RISF
- -/60/60 plasterboard + 60 RISF
- -/30/30 plasterboard + 30 RISF

As discussed above, the significance of the Trafalgar CM4 FyreDAMPER ceiling box is that it is installed within the cavity of the ceiling system and is independent from the ceiling aperture. Therefore, it is considered unlikely for an RISF failure to occur on the FyreDAMPER box prior to a failure in the ceiling RISF. Accordingly, it is reasonable to consider that the performance of the Trafalgar CM4 FyreDAMPER ceiling box will be limited by the established FRL and RISF of the proposed ceiling systems. Hence, it can be positively assessed.

7.4 Conclusion

This assessment demonstrates that the Trafalgar CM4 FyreDAMPER installed within a ceiling system and incorporating the abovementioned variations is expected to achieve an FRL of -/120/120 and RISF of 60 minutes in accordance with AS 1530.4:2014.

Table 10 Assessed performance of Trafalgar CM4 FyreDAMPER system.

Item	Variations	FRL
Trafalgar CM4 FyreDAMPER box	• Assess the FRL and RISF of Trafalgar CM4 FyreDAMPER ceiling box when installed in a two layered ceiling system. • Option of including damper cell size up to 300 mm circular or square-based on established performance of Lorient damper in CM4 test specimen. • Option of including a single or double 600 mm × 600 mm damper cell to fit maximum aperture size of 1200 mm × 600 mm. • Positioning up to two spigots in either face of the damper assembly, provided the penetrated face is modified to include 2 × 40 mm Maxilite boards and be separated by 50 mm if two spigots are installed. • Internal dimensions can be varied to be equal to and/or greater than ceiling opening. • The fixing configuration of the Trafalgar CM4 FyreDAMPER boxes can be varied to include: – The four walls of the damper box are directly fixed to the ceiling steel supports. – In case of any gaps between the damper box and the ceiling steel supports, the gaps can be packed with up to 40 mm thick Maxilite board up to all four sides. • Include 2 × TPS power cables or a combination of 2×TPS cables and up to 3 × CAT6 through the side wall of the Trafalgar CM4 FyreDAMPER, provided that face has incorporated atleast 2 × 40 mm Maxilite boards. • Installing Trafalgar CM4 FyreDAMPER ceiling box in a two layered ceiling system. • The suspended ceiling framing can be varied to minimum 70 mm × 35 mm timber battens provided that the ceiling aperture must be lined with one layer of 16 mm fire rated plasterboard	FRL:-/120/120 RISF: 60 minutes
Separating element	• The proposed construction is similar to the construction tested in TR-F49.01 with variation in the main separating element. The proposed ceiling system consists of two layers of 16 mm thick plasterboards installed as tested in FSH0597. • Variation to extend the above variations when the Trafalgar FyreDAMPER CM4 damper is installed in: – -/120/120 plasterboard ceiling + 60 RISF – -/90/90 plasterboard ceiling +60 RISF – -/60/60 plasterboard + 60 RISF – -/30/30 plasterboard + 30 RISF	• FRL: -/60/60 RISF: 60 minutes • The separating element must have an established FRL and RISF equal to or greater than the assessed FRL of the system.

8. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of this 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 of the proposed systems expected to be demonstrated on a test in accordance with AS 1530.4:2014, based on the evidence referred to in this report.

This assessment is provided to Trafalgar Group for their own specific purposes. This report may be used as Evidence of Suitability in accordance the requirements of the relevant National Construction Code. Building certifiers and other third parties must determine the suitability of the systems described in this report for a specific installation.

Appendix A Summary of supporting test data

A.1 Test report – TR-F49.01

Table 11 Information about test report

Item	Information about test report
Report sponsor	Trafalgar Fire Containment Solutions Pty Ltd
Test laboratory	Resolute Testing Laboratories, 18-19, 79 Paisley Drive, Lawnton, QLD 4501
Test date	The fire resistance test was done on 5 March 2021.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	None
General description of tested specimen	The tested assembly consisted of various services penetrating through a two-hour ceiling system. The floor/ceiling system started with the floor 125 mm hardwood floor joists evenly spaced and lined with 19 mm yellow tongue flooring on top. Hanging from the floor joists a plasterboard floor system that consisted of a two hour plasterboard floor system with 3 layers of 16 mm Knauf Fireshield. The 16 mm Knauf Fireshield plasterboard sheets had offset joints of 400 mm on each layer. The first layer of plasterboard was fixed to the wall track around the perimeter at maximum 150 mm centres and the furring channel at maximum 200 mm centres with Type S 6 g × 32 mm NP screws. The next layer of plasterboard was fixed with Type S 6 g × 32 mm NP screws at 150 mm centres around the perimeter and 200 mm centres on each furring channel. The third layer of plasterboard was fixed with 10 g × 38 mm course thread bugle head laminating screws at 150 mm centres around the perimeter and 200 mm centres through the centre of the ceiling. Specimen D was a Trafalgar FyreDAMPER ceiling box was a 100 mm diameter installed in a 250 mm × 250 mm aperture through the plasterboard. The FyreDAMPER assembly was secured into the Top Cross Rail using 2 × 8g plasterboard screws on each side at nominal 250 mm centres. Additionally, the FyreDAMPER assembly was secured into the furring channel on the perpendicular edge using 2 ×8g plasterboard screws on each side at nominal 250 mm centres. For further details of the tested specimen, please refer to the actual test report.
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

The test specimen achieved the following results – see Table 12.

Table 12 Results summary for this test report

Specimen	Integrity	Insulation	RISF	FRL
D	No failure at 121 minutes	No failure at 121 minutes	Failure at 51 minutes	-/120/120

A.2 Test report – FSH0597

Table 13 Information about test report

Item	Information about test report
Report sponsor	Boral Plasterboard, 676 Lorimer Street, Port Melbourne VIC
Test laboratory	CSIRO, 14 Julius Avenue, North Ryde, NSW 2113
Test date	The fire resistance test was done on 25 June 1998.
Test standards	The test was done in accordance with AS 1530.4:1997.
Variation to test standards	None
General description of tested specimen	The specimen comprised a timber floor frame lined with chipboard floor sheeting protected by a suspended ceiling that used two different plasterboard systems. The floor section was constructed using 190 × 45 mm F7 seasoned Radiata pine joists placed at 600 mm centres. The top of the frame was lined with 22 mm thick CSR Structaflor and fixed to the frame with nails. The suspended ceiling used two different plasterboard systems. The suspension frame, assembled from Rondo 129 furring channels and Rondo 128 top cross rails, was suspended using suspension brackets nailed into the timber joists. A common upper layer of 13 mm thick fire-rated plasterboard was fixed to the furring channels using 30 mm screws at 200 mm centres in the field and 150 mm centres along the butt joints. The lower layers of 13 mm or 16 mm thick fire-rated plasterboard were screwed to the upper layer of plasterboard and into the furring channels using 40 mm screws at the same centres as the upper layer. The dimensions of the 13 mm lower layer section were nominally 2600 mm wide × 4540 mm long (13 mm / 13 mm system) while the 16 mm section was nominally 1040 mm wide × 4540 mm long (13 mm / 16 mm system). A 1.5 kPa uniformly distributed load was applied onto the ceiling system.
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:1997.

The test specimen achieved the following results – see Table 14.

Table 14 Results summary for this test report

Specimen	Integrity	Insulation	RISF	FRL
Ceiling system with 13 mm / 16 mm plasterboard layers on exposed side	No failure at 63 minutes	No failure at 63 minutes	No failure at 63 minutes	-/60/60

A.3 Test report – RTL FT1553.01

Table 15 Information about test report

Item	Information about test report
Report sponsor	Trafalgar Fire Containment Solutions Pty Ltd
Test laboratory	Resolute Testing Laboratories, 18-19, 79 Paisley Drive, Lawnton, QLD 4501
Test date	The fire resistance test was done on 23 September 2022.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	None
General description of tested specimen	The test specimen consisted of various service penetrations through a 2 hour fire rated RISF ceiling with a cavity depth of 550 mm between the non-fire side of the plasterboard and the underside of the floor sheeting. The floor ceiling system was separated into three individual cavities, one of which incorporated the Trafalgar CM2. Each cavity was separated using Trafalgar FyreBATTs measuring 60 mm thick. The CM2 is placed onto the top side of the plasterboard, bed down with FyreFLEX Sealant. From the underside, 10g × 100 mm fixings are installed through the plasterboard into the side walls of the CM2, one at each corner and one at mid span in each direction. 10g × 100 mm fixings installed from the internal wall of the CM2 through the side wall and into the steel ceiling framing surrounding the box at 150 mm centres. FyreFLEX sealant installed at the interface between the sidewall and the plasterboard from the underside only. One side of the CM2 running parallel with the cross rails, had a small gap from the side wall to the cross rail, this gap was packed out locally at each fixing point with 40 mm Maxilite, approximately 150 mm in length. The supporting construction of a two-hour plasterboard floor-ceiling system constructed with three layers of 16 mm plasterboard. All sheets of plasterboard were suspended by way of Rondo P129 furring channel and 25 mm top cross rails, from 125 mm × 50 mm F17 hardwood at 450 mm centres. 19 mm yellow tongue flooring was installed to the topside of the hardwood, creating a ceiling cavity. The floor/ceiling system measured a 1600 mm × 1600 mm with a 550 mm cavity depth. Joints in the plasterboard were staggered, and the last layer was sealed with one layer of Gyprock multi-purpose joint compound and a layer of Gyprock paper tape. The floor-ceiling system had an established FRL of -/120/120 and RISF 60
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

The test specimen achieved the following results – see Table 16

Table 16 Results summary for this test report

Specimen	Integrity	Insulation	RISF	FRL
Trafalgar CM2	No failure at 121 minutes	No failure at 121 minutes	Failure at 66 minutes	-/120/120

A.4 Test report – RTL TR-F47.01

Table 17 Information about test report

Item	Information about test report
Report sponsor	Trafalgar Fire Containment Solutions Pty Ltd
Test laboratory	Resolute Testing Laboratories, 18-19, 79 Paisley Drive, Lawnton, QLD 4501
Test date	The fire resistance test was done on 9 April 2020.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	None
General description of tested specimen	The test specimen consisted of four service penetrations, out of which one included a FyreFLEX sealant and Maxilite board protecting a cable bundle, installed into a plasterboard floor ceiling system with an overall thickness of 348 mm. A 32 mm diameter hole was cut through plasterboard, and 2 × TPS power cables and 3 × CAT6e data cables were passed through. Cables were supported at 235 mm off the face of the plasterboard cavity, and at 200 mm and 400 mm above the floor sheets. The penetration was locally thickened with 60 mm Maxilite board inside the cavity, the measured 250 mm × 250 mm. FyreFLEX sealant was used to seal the gaps between the Maxilite board, and to bed the Maxilite board onto the plasterboard. The supporting construction of a one-hour plasterboard floor-ceiling system constructed with 13 mm plasterboard layer on the underside and the 16 mm plasterboard layer on the topside. All sheets of plasterboard were suspended by way of Rondo P129 furring channel and 25 mm top cross rails, from 125 mm × 50 mm F17 hardwood at 450 mm centres. 19 mm yellow tongue flooring was installed to the topside of the hardwood creating a ceiling cavity. No butt joints were incorporated in the ceiling, the recessed joint between the 2 layers was offset by 800 mm and finished on the fire side with a single layer of Gyprock paper tape and Gyprock multi-purpose joint compound. A nominal 8 mm gap was left between the plasterboard and the core filled block wall that formed the sides of the test frame. The floor/ceiling system measured a 1600 mm × 1600 mm × 348 mm thick. The floor-ceiling system had an established FRL of -/60/60 and RISF 60
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

The test specimen achieved the following results – see Table 18.

Table 18 Results summary for this test report

Specimen	Integrity	Insulation	RISF	FRL
FyreFLEX sealant and Maxilite board protecting a cable bundle	No failure at 62 minutes	No failure at 62 minutes	Failure at 58 minutes	-/60/60

A.5 Test report – EWFA 51894700.1

Table 19 Information about test report

Item	Information about test report
Report sponsor	Trafalgar Fire Containment Solutions Pty Ltd
Test laboratory	Warringtonfire
Test date	The fire resistance test was done on 13 April 2018.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	None
General description of tested specimen	The test assembly consisted of a nominal 1200 mm long × 1200 mm wide × 180 mm thick concrete floor system. An 800 mm × 375 mm opening was located on the north section of the floor system. A 1000 mm × 575 mm × 60 mm thick Maxilite board was installed on top of the opening. 2 × TPS cables were passed through a penetration of approximately 30 mm in diameter and sealed to the full depth of the element with a 30 ×30 mm fillet of FyreFLEX sealant on the underside of the penetration.
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

The test specimen achieved the following results – see Table 20.

Table 20 Results summary for this test report

Specimen	Integrity	Insulation	FRL
2 × TPS cables	No failure at 240 minutes	Failure at 70 minutes	-/240/60

warringtonfire

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