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Fire assessment report

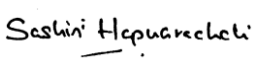
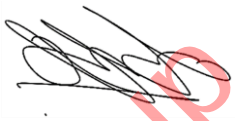
DuoPEX pipes protected with TWrap in accordance with AS 1530.4:2014

Sponsor: Trafalgar Group

Report number: FAS220119 Revision: R1.0

Issued date: 16 June 2022 Expiry date: 30 June 2027

Quality management

Version	Date	Information about the report			
R1.0	Issue: 16 Jun 2022	Reason for issue	Initial issue		
	Expiry: 30 Jun 2027		Prepared by	Reviewed by	Authorised by
		Name	Sashini Sue	Imran Ahamed	Omar Saad
		Signature			

Executive summary

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various DuoPEX pipes penetrating through concrete floors – in accordance with AS 1530.4:2014 and AS 4072.1:2005.

The analysis in section 5 of this report found that the proposed systems, together with the described variations, are expected to achieve an FRL as shown in Table 1, 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 6 of this report. The results of this report are valid until 30 June 2027.

Table 1 Variations and assessment outcome

Service	Referenced drawing	Separating element	Local fire stopping protection	FRL
40 mm DuoPEX pipe	Figure 1	Minimum 150 mm thick concrete floor	Cast-in CWFC-50 collar (backfilled) on the exposed side and 450 mm of TWrap insulation on the unexposed side	-/120/120
50 mm DuoPEX pipe	Figure 2			
63 mm DuoPEX pipe	Figure 3	Minimum 175 mm thick concrete floor	Cast-in CWFC-100 collar (backfilled) on the exposed side and 600 mm of TWrap insulation on the unexposed side	-/120/120

Contents

1. Introduction

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various DuoPEX pipes penetrating through concrete floors – in accordance with AS 1530.4:2014[1] and AS 4072.1:2005[2].

This report can 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 2.

Table 2 Sponsor details

Sponsor	Address
Trafalgar Group	26A Ferndell Street South Granville NSW 2142 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 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 2021[3].

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 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 Standards Australia, 2005, Components for the protection of openings in fire-resistant separating elements: Service penetrations and control joints, AS 4072.1:2005, Standards Australia, NSW.
3 Passive Fire Protection Forum (PFPF), 2021, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

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 2019, including amendments[4] under A5.2 (1) (d).

This assessment has been written in accordance with the general principles outlined in EN 15725:2010[5] 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) provision of the NCC under A5.4 for fire resistance levels, as applicable to the assessed systems.

This assessment report may also be used to demonstrate compliance with the requirements for Evidence of Suitability under NCC 2016, including amendments[6].

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 5 May 2022, 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 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 if the systems were tested in accordance with AS 1530.4:2014.
- This assessment is applicable to floor 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.
- 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) that is accredited to the same nominated standards of this report.
- The documentation that forms the basis for this report is listed in Appendix A and Appendix B.

[4] National Construction Code Volumes One and Two - Building Code of Australia 2019 including Amendments, Australian Building Codes Board, Australia
[5] 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.
[6] National Construction Code Volumes One and Two - Building Code of Australia 2016 including Amendments, Australian Building Codes Board, Australia

- 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 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

In FRT210476 R1.1, 40 mm, 50 mm and 63 mm DuoPEX pipes were tested in a 150 mm thick concrete floor slab in accordance with AS 1530.4:2014. The collars were protected on the exposed side with Cast-in CWFC collars. The 40 mm, 50 mm and 63 mm DuoPEX pipes achieved FRLs of -/240/30, -/240/- and -/240/- respectively. It is proposed to assess the fire performance of the referenced pipes when protected with the TWrap insulation material on the unexposed side.

4.2 Referenced test data

The assessment of the variation to the tested systems and the determination of the expected performance is based on the results of the fire test documented in the report summarised in Table 3. Further details of the tested systems are included in Appendix B.

Table 3 Referenced test data

Report number	Test sponsor	Test date	Testing authority
FRT210467 R1.1	Trafalgar Group	9 February 2022	Warringtonfire

4.3 Variations to the tested systems

An identical system has not been subject to a standard fire test. We have therefore assessed the systems using baseline test information for similar systems. The variations to the tested systems – together with the referenced standard fire tests – are described in Table 4.

Table 4 Variations to tested systems

Item	Reference test	Description	Variations
1.	FRT210467 R1.1	40 mm and 50 mm DuoPEX pipes were tested in a 150 mm thick concrete floor slab with a Cast-in CWFC-50 collar on the exposed side in in accordance with AS 1530.4:2014	It is proposed to assess the performance of the referenced specimens with an additional TWrap insulation on the unexposed side.
2.		A 63 mm DuoPEX pipe was tested in a 150 mm thick concrete floor slab with a Cast-in CWFC -100 collar on the exposed side in accordance with AS 1530.4:2014	It is proposed to assess the performance of the referenced specimen in a 175 mm concrete floor slab with an additional TWrap insulation on the unexposed side.

4.4 Assessment standard

AS 1530.4:2014 sets out procedures and methods for fire tests on building materials, components, structures, and fire-resistance tests for elements of construction. Section 10 discusses the procedures and methods for service penetrations and control joints.

AS 4072.1:2005 sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems around penetrations through separating building elements that are required to have an FRL.

4.5 Schedule of components

Table 5 outlines the schedule of components for the assessed system

Table 5 Schedule of components of assessed systems

Item	Description		
Separating element (SE)			
1.	Item name	Concrete slab	
	Product name	Normal weight concrete	
	Density	2400 kg/m^3	
	Thickness	150 mm or thicker as nominated in Table 7	
Fire collar			
2.	Item name	50 mm cast-in collar	
	Product name	Cast-in CWFC-50 Collar	
	Collar details	Overall size Height Outer shell thickness	132 mm × 132 mm 60 mm 2 mm thick ABS plastic
	Intumescent details	Number of layers Density	1 1200 kg/m^3
3.	Item name	100 mm cast-in collar	
	Product name	Cast-in CWFC-100 Collar	
	Collar details	Outer size Inner diameter Height Outer shell thickness	217 mm × 217 mm 110 mm 117 mm 2 mm thick ABS plastic
	Intumescent details	Number of layers Size Thickness Density	1 60 mm × 60 mm 8 mm 1200 kg/m^3
Wrap			
4.	Item name	Insulation wrap	
	Product name	TWrap	
	Thickness (including silver foil)	25 mm	
	Ceramic mineral fibre wool density	130 kg/m^3	
	Description	Ceramic fibre wool with silver foil	
Services			
5.	Item name	40 mm DuoPEX pipe	
	Material	Multi-layer composite system	

Item	Description		
	Size	Outer diameter	40 mm
		Wall thickness	3.5 mm
6.	Item name	50 mm DuoPEX pipe	
	Material	Multi-layer composite system	
	Size	Outer diameter	50 mm
		Wall thickness	4 mm
7.	Item name	63 mm DuoPEX pipe	
	Material	Multi-layer composite system	
	Size	Outer diameter	63 mm
		Wall thickness	4.5 mm

Figure 1 to Figure 3 show the assessed systems.

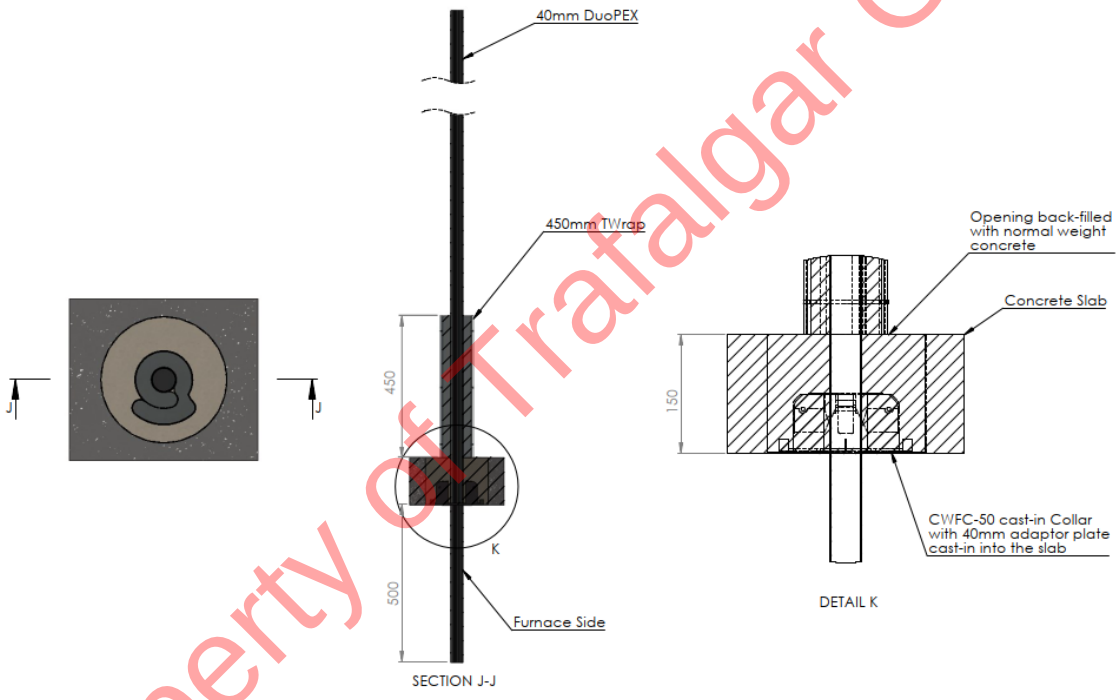


Figure 1 40 mm DuoPEX pipes

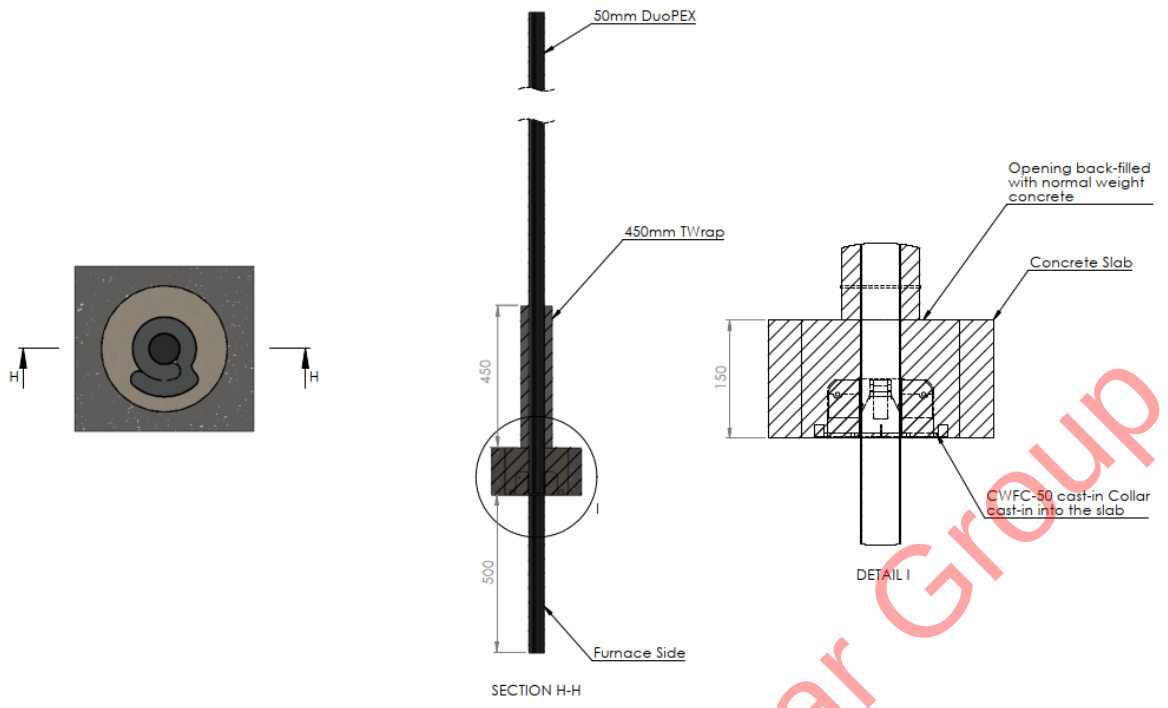


Figure 2 50 mm DuoPEX pipes

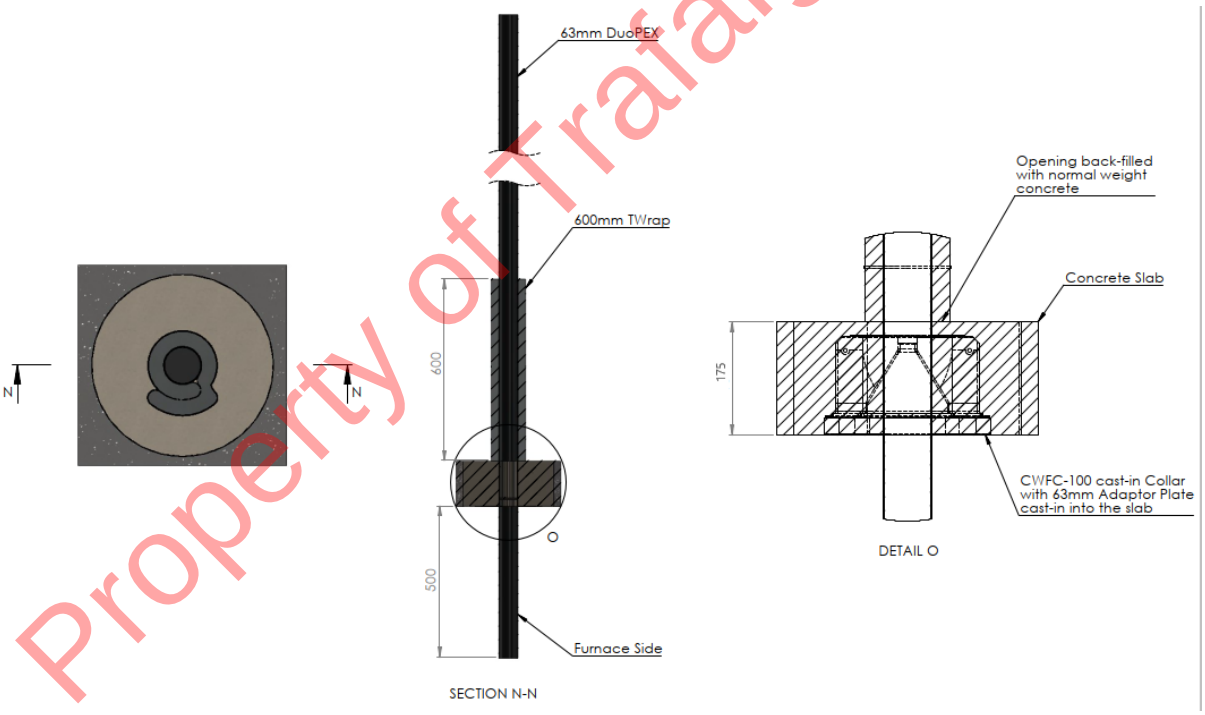


Figure 3 63 mm DuoPEX pipes

5. Assessment

5.1 Description of variation

In FRT210476 R1.1, 40 mm, 50 mm and 63 mm DuoPEX pipes were tested in a 150 mm thick concrete floor slab in accordance with AS 1530.4:2014. The collars were protected on the exposed side with Cast-in CWFC collars. The 40 mm, 50 mm and 63 mm DuoPEX pipes achieved FRLs of -/240/30, -/240/- and -/240/- respectively.

It is proposed to assess the performance of the referenced specimens for an FRL of -/120/120 when protected with a TWrap insulation material as specified in Table 5.

5.2 Methodology

The method of assessment used is summarised in Table 6.

Table 6 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Qualitative

5.3 Assessment

5.3.1 40 mm and 50 mm DuoPEX pipes

It is proposed to assess the performance of 40 mm and 50 mm DuoPEX pipes protected with a Cast-in CWFC-50 collar on the exposed side and TWrap insulation on the unexposed side.

40 mm and 50 mm DuoPEX pipes were tested in FRT210467 R1.1 with a Cast-in CWFC-50 collar on the exposed side in a 150 mm thick concrete floor. The pipes maintained the integrity criteria for 241 minutes without any failure. The pipes did not have protection with any insulation material on the unexposed side, hence they failed the insulation criteria at 36 minutes and 14 minutes, respectively. The temperatures on the unexposed side at 120 minutes were 211 °C and 315 °C for the 40 mm and 50 mm pipes, respectively. It was observed that the thermocouple temperatures at 120 minutes on the separating element on the unexposed side of the 40 mm and 50 mm pipes were 114°C and 146°C, respectively. This shows that the temperatures on the unexposed side of the separating element did not reach an increase in temperature of 180°C for 120 minutes.

The same test, FRT210467 R1.1, consists of a 40 mm copper pipe protected with TWrap insulation to a length of 300 mm on the unexposed side, which was able to maintain the insulation performance for 169 minutes. Copper pipes are expected to perform worse in insulation performance compared to DuoPEX pipes, due to the higher conductivity of copper. Therefore, it can be expected that by protecting the 40 mm and 50 mm DuoPEX pipes with the TWrap insulation material to a length of 450 mm on the unexposed side, the insulation performance of the pipes will be maintained for at least 120 minutes.

Based on the above discussion, when protected with a Cast-in CWFC-50 collar on the exposed side and 450 mm TWrap insulation on the unexposed side, 40 mm and 50 mm DuoPEX pipes are positively assessed for an FRL of -/120/120 in accordance with AS 1530.4:2014.

5.3.2 63 mm DuoPEX pipes

It is proposed to assess the performance of the 63 mm DuoPEX pipes protected with a Cast-in CWFC-100 collar on the exposed side and TWrap insulation on the unexposed side.

In FRT210467 R1.1, a 63 mm DuoPEX pipe protected with a Cast-in CWFC-100 collar on the exposed side was tested in a 150 mm thick concrete floor. The specimen failed the insulation criteria after 14 minutes as the temperature on the thermocouple placed on the specimen 25 mm away from the slab exceeded the initial temperature by more than 180 °C. The maximum temperature of the service on the unexposed side was recorded to be 335 °C at 120 minutes. It was also observed that the temperature of the separating element on the unexposed side reached 233 °C at 120 minutes.

FRT210467 R1.1 consists of an 80 mm copper pipe wrapped with TWrap insulation to a length of 600 mm on the unexposed side. The copper pipe maintained the insulation criteria for 141 minutes. As discussed above, it is expected that copper pipes will have worse insulation performance compared to DuoPEX pipes. Hence, protecting the 63 mm DupPEX pipe with a 600 mm long TWrap insulation on the unexposed side will likely increase its insulation performance to at least 120 minutes. However, as the 150 mm thick concrete floor itself failed the insulation criteria in the 63 mm DuoPEX pipe system, it is required to increase the thickness of the concrete floor to maintain the insulation performance for 120 minutes. The failure in insulation on the concrete slab is expected to be due to the insufficient effective thickness of the concrete slab after the removal of concrete for the installation of the 117 mm deep Cast-in CWFC-100 collar on the exposed side. According to Table 5.5.1 in AS 3600:2018[7], when the effective thickness of a concrete slab is increased by 20 mm, the fire resistance period for insulation is expected to increase by 30 minutes. In FRT210467 R1.1, it was observed that the maximum temperature on the concrete slab was around 192 °C at 90 minutes during the test. Therefore, it is expected that if the thickness of the concrete slab is increased by 25 mm to a total thickness of 175 mm, the insulation performance of the concrete slab will be increased to at least 120 minutes as per the values for the insulation performance in concrete slabs in Table 5.5.1 in AS 3600:2018 as discussed above.

Based on the above discussion, when protected with a Cast-in CWFC-100 collar on the exposed side and TWrap insulation to a length of 600 mm on the unexposed side, 63 mm DuoPEX pipe penetrating a 175 mm thick concrete slab is positively assessed for an FRL of -/120/120 in accordance with AS 1530.4:2014.

5.4 Conclusion

This assessment demonstrates that various DuoPEX pipes protected with Cast-in collars and TWrap insulation are expected to achieve an FRL of -/120/120 as shown in accordance with AS 1530.4:2014 and AS 4072.1:2005.

Table 7 Conclusion

Service	Referenced drawing	Separating element	Local fire stopping protection	FRL
40 mm DuoPEX pipe	Figure 1	Minimum 150 mm thick concrete floor	Cast-in CWFC -50 collar (backfilled) on the exposed side and 450 mm of TWrap insulation on the unexposed side	-/120/120
50 mm DuoPEX pipe	Figure 2			
63 mm DuoPEX pipe	Figure 3	Minimum 175 mm thick concrete floor	Cast-in CWFC -100 collar (backfilled) on the exposed side and 600 mm of TWrap insulation on the unexposed side	-/120/120

[7] Standards Australia, 2018, Concrete structures, AS 3600:2018 (Incorporating Amendment No. 1), Standards Australia, NSW.

6. 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 resistance, but it should be recognised that a single test method will not provide a full assessment of fire resistance 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 test data, information and experience available at the time of preparation. If contradictory evidence becomes available to the assessing authority, the assessment will be unconditionally withdrawn and the report sponsor will be notified in writing. Similarly, the assessment should be re-evaluated, if the assessed construction is subsequently tested since actual test data is deemed to take precedence.

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 with 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 Drawings and additional information

Table 8 Details of drawings

Referenced Figure	Drawing title	Dwg no	Date	Provided by
Figure 1	40 mm DuoPEX	2	10 June 2022	Trafalgar Group
Figure 2	50 mm DuoPEX	1		
Figure 3	63 mm DuoPEX	3		

Appendix B Summary of supporting test data

B.1 Test report – FRT210467 R1.1

Table 9 Information about test report

Item	Information about test report
Report sponsor	Trafalgar Group
Test laboratory	Warringtonfire Australia, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.
Test date	The fire resistance test was done on 9 February 2022.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	The pressure was up to 7 Pa below the limits prescribed in the standard during the 225 – 230 minute period. The pressure and temperature were within the limits for the rest of the test. Due to the nature of the specimen and the fact that no significant events occurred during this time period, this under pressure is unlikely to have invalidated the test result.
General description of tested specimen	The test specimens consist of DuoPEX and copper pipes installed in a 150 mm thick concrete floor protected with various local protection methods. Only results from test specimens A, B, E, G and I are relevant for this assessment.
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 10.

Table 10 Results summary for this test report

Penetration system	Service	Integrity	Insulation
A	40 mm DuoPEX pipe	No failure at 241 minutes	Failure at 36 minutes
B	DN80 copper pipe	No failure at 241 minutes	Failure at 141 minutes
E	50 mm DuoPEX pipe	No failure at 241 minutes	Failure at 14 minutes
G	DN40 copper pipe	No failure at 241 minutes	Failure at 169 minutes
I	63 mm DuoPEX pipe	No failure at 241 minutes	Failure at 14 minutes

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