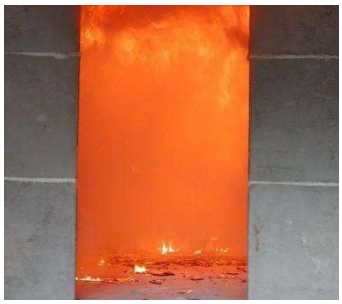

FIRE ASSESSMENT REPORT

FC17299-01-1

FIRE RESISTANCE OF TRAFALGAR FYREWRAP EXTERNAL EXPOSURE DUCT IN ACCORDANCE WITH AS 1530.4:2014

CLIENT

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ASSESSMENT OBJECTIVE

To assess the fire resistance of an external exposure duct protected with Trafalgar FyreWrap® Elite® 1.5 system with variations to construction in accordance with AS 1530.4:2014 and in accordance with AS 4072.1:2005 (Amendment No. 1).

CONCLUSION

It is considered that the Trafalgar Fyrewrap® Elite® 1.5 duct protection system consisting nominal 38 mm thick foil faced blanket protecting a steel duct constructed in accordance with AS 4254.2-2012, if tested in accordance with AS 1530.4:2014 would achieve the following fire resistance:

- 1 layer of nominal 38 mm thick FyreWrap® Elite® 1.5 FRL 180/180/30
- 2 layer of nominal 38 mm thick FyreWrap® Elite® 1.5 FRL 180/180/60
- 3 layer of nominal 38 mm thick FyreWrap® Elite® 1.5 FRL 240/240/120

Subject to the following conditions:

- All joints shall overlap by a minimum of 100 mm and be secured 50 mm from the edge of the blanket and at maximum 200 mm centres.
- The duct suspension system shall be a minimum of 40 mm x 40 mm x 3 mm angle suspended by at least two M10 threaded rods or larger as specified in AS 4254.2-2012 subject to the following:
- The suspension system shall not exceed 10 N/mm² for 120 minutes fire exposure or 6 N/mm² for up to 240 minutes fire exposure.
- The maximum distance between supports shall not exceed 1,700 mm.
- The duct shall be constructed in accordance with AS 4254.2-2012 unless stated otherwise in this assessment.

Additional options/variations are considered not to prejudice the fire resistance of the duct system are as follows:

The duct may be increased in size on the condition the aspect ratio does not exceed 1:4 (height vs width) and constructed in accordance with AS 4254.2-2012 unless stated otherwise in this assessment.

- The duct system may be used with fire rated elements of construction as follows:
- Concrete or masonry walls up to an FRL 240/240/240 or -/240/240.
- Steel or timber stud plasterboard walls up to FRL 120/120/120 or -/120/120.
- 75 mm thick fire rated autoclaved aerated concrete (AAC) walls up to an FRL of -/90/90.
- 78 mm thick Speedpanel walls up to an FRL of -/120/120.
- A fire rated access panel, FWAP, with an internal opening of up to 558 mm x 433 mm up to an FRL of -/180/60.
- Vertical ducts installed in concrete floor slabs.

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LIMITATION

This report is subject to the accuracy and completeness of the information supplied.

BRANZ reserves the right to amend or withdraw this assessment if information becomes available which indicates the stated fire performance may not be achieved.

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TERMS AND CONDITIONS

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The results reported here relate only to the item/s described in this report.

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1. INTRODUCTION

This report gives BRANZ's assessment on the fire resistance of an external exposure steel duct protected with a Trafalgar Fyrewrap® Elite® 1.5 system with variations to construction in accordance with AS 1530.4:2014 and in accordance with AS 4072.1:2005 (Amendment No. 1).

The following variations are considered in this assessment:

- FyreWrap® Elite® 1.5 thickness
- Increase in duct size in accordance with AS 4254.2-2012
- Alternative duct collar details
- Fire barrier
- Access panels

2. BACKGROUND

In BRANZ fire resistance test FR11679-001 a steel duct, nominally 1,200 mm x 1,200 mm, was tested protected by Fyrewrap® Elite® 1.5 flexible wrap and tested for external fire exposure.

The duct was protected with two layers of 50 mm Fyrewrap® Elite® 1.5, was tested with a flow rate of 1 m/s and achieved an FRL of 120/60/60 in accordance with AS 1530.4:2014.

Post test it was determined that some of the pins securing the Fyrewrap® Elite® 1.5 had not been properly welded to the steel duct.

In BRANZ fire resistance test FR12334-001 a steel duct was tested as an external exposure duct protected by Fyrewrap® Elite® 1.5 flexible wrap in accordance with AS 1530.4:2014. The duct was nominally 250 mm high x 1,000 mm wide x 0.8 mm thick protected with two layers of 50 mm thick Fyrewrap® Elite® 1.5 flexible wrap. The duct achieved an FRL of 240/240/120.

In Intertek fire resistance test No. 101269631SAT-005 two ducts nominally 1,220 mm x 1,220 mm were tested in a concrete enclosure in accordance with AS 1530.4-2005. Duct A was protected with nominally 50 mm thick FyreWrap® LT and Duct B with nominally 38 mm thick FyreWrap® LT. In accordance with AS 1530.4-2005 Duct A achieved an FRL of 180/180/180 and Duct B an FRL of 180/180/120.

In Exova Warringtonfire fire resistance test No. 3534300.3 a nominal 600 mm x 600 mm steel duct was tested mounted in a steel stud plasterboard wall and tested as an internal exposure duct. The wall consisted of two layers of 16 mm thick CSR Fyrechek plasterboard secured to 54 mm x 0.5 mm steel framing. Where the duct penetrated the wall a 75 mm x 75 mm x 1.5 mm mild steel angle was installed around the duct and secured to the wall and duct. Covering the angle were strips of 100 mm x 60 mm Maxilite board which were secured to the wall. Fyreflex sealant was applied between surfaces. The duct was wrapped with one layer of nominal 40 mm thick x 600 mm wide Fyrewrap® Elite® 1.5 Duct insulation. Each wrap overlapped by approximately 250 mm at the ends and then a minimum of 100 mm between wraps along the length of the duct. In accordance with AS 1530.4:2014 the duct achieved an FRL of 120/120/30.

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In Exova Warringtonfire fire resistance test No. 43330700.1 a vertical internal exposure steel duct nominally 600 mm x 600 mm was tested in a concrete floor slab. The duct was protected with one layer of nominal 40 mm thick Fyrewrap® Elite® 1.5 over the majority of the duct except where the duct support structure was located approximately 1,420 mm above the slab where there were two layers of Fyrewrap® Elite® 1.5. The duct also included a standard duct access panel which was protected by a Trafalgar Fyrewrap access panel (FWAP). The duct was tested in accordance with AS 1530.4:2014 and maintained the Integrity criteria for the 181 minute duration of the test and 57 minutes Insulation.

In Intertek fire evaluation report No. 101029020SAT-005C Rev.1 EEV it was determined that the encapsulated Fyrewrap® Elite® 1.5 blanket is equivalent to the encapsulated FyreWrap® LT blanket. Hereafter in this assessment the duct wrap will be referred to as Fyrewrap® Elite® 1.5.

3. BASIS OF ASSESSMENT

It is assumed the steel ducts shall be installed generally in accordance with AS 4254.2-2012 except where detailed in this report. The Trafalgar Fyrewrap® Elite® 1.5 system shall be as tested except for the variations discussed in this report.

4. DISCUSSION

4.1 AS 1530.4-2005 vs 2014

With respect to duct testing there are some differences between the 2005 and 2014 versions of AS 1530.4 in how the Insulation failure is determined for external exposure ducts. The 2005 version determines Insulation failure to occur on the unexposed face of the duct outside the furnace whereas the 2014 (and 1997) version deem Insulation failure to be determined on the inside of the duct, inside the furnace.

The Intertek fire resistance test No. 101269631SAT-005 was conducted in accordance with the 2005 version of the test standard however it included thermocouples on the inside of the ducts inside the furnace which are reported and comply with the requirements of the 2014 version. Based on reviewing the test data and criteria of AS 1530.4:2014 it is considered had they been tested in accordance with this version they would have achieved the following fire resistance:

Duct A – 50 mm Fyrewrap® Elite® 1.5 (external exposure) FRL 180/180/30

Duct B – 38 mm Fyrewrap® Elite® 1.5 (external exposure) FRL 180/180/30

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4.2 FyreWrap

4.2.1 FyreWrap installation

The Fyrewrap® Elite® 1.5 system consists of a foil encapsulated ceramic fibre blanket nominally 38 mm thick. In the fire resistance tests referenced in Section 2 the Fyrewrap® Elite® 1.5 was secured in place with a combination of steel pins welded/screwed to the ducts and stainless steel bands. Where any joints between the Fyrewrap® Elite® 1.5 occurred foil tape was used. The steel pins were either screw fixed to the duct and insulation washers installed after the Fyrewrap® Elite® 1.5 was installed or cuphead pins welded to the duct. The wrap shall be secured nominally 50 mm from the joint edge and along the joint and body of the duct at maximum 200 mm centres.

In fire resistance test FR11679-001 it was determined that after the fire test a number of the cuphead pins were not securely welded to the duct and pulled away during the test resulting in the less than expected fire performance. Subsequently fire resistance test FR12334-001 was commissioned essentially repeating Duct 1 of FR11679-001. Based on the fire performance of the Intertek fire resistance test No. 101269631SAT-005 where the pins were screw fixed to the duct, and FR11679-001, it is considered either method of pin attachment is acceptable on the condition the discharge welded pins are properly secured to the ducting.

4.2.2 FyreWrap joints/overlaps

The Fyrewrap® Elite® 1.5 blanket is supplied nominally 610 mm wide or 1,220 mm wide and wrapped around the duct with the ends of the blanket either butting up to each other or overlapping by at least 100 mm depending on the specific configuration.

For single layer systems all joints shall overlap by a minimum of 100 mm in all directions (parallel or transverse to the direction of the duct). Where required the wrap can form a butt joint and shall be cut at least 25 mm larger than required, as tested in Intertek fire resistance test No. 101269631SAT-005. A cover strip at least 200 mm wide shall overlap the two blankets along the butt joint. The cover strip shall be secured in pairs of fixings nominally 100 mm apart and at 200 mm centres along the joint. See Figure 1 for examples.

For two layer (see Figure 2) or three layer (see Figure 3) systems the inner layer joints can be overlapped or butt joints. The outer layer joints shall be overlapped by at least 100 mm or include a 200 mm wide cover strip as discussed above.

The fixing (pin or screw) shall be sized to suit the number of layers being secured. See Table 1 for details.

Table 1: Fyrewrap® Elite® 1.5 fixing length

Fyrewrap® Elite® 1.5 Layers	Fixing Length (pin or screw)
1 x 38 mm	25 to 35 mm
2 x 38 mm	50 to 75 mm
3 x 38 mm	75 to 100 mm

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In the fire resistance tests referenced in Section 2 some of the Fyrewrap® Elite® 1.5 blanket was secured with pins/screws and stainless steel bands. Fire resistance test FR12334-001 was tested with two layers of Fyrewrap® Elite® 1.5 around the steel duct and did not include stainless steel bands. Based on this test evidence it is considered the use of stainless steel bands are recommended but optional.

4.2.3 Fyrewrap® Elite® 1.5 FRL 180/180/30

It is proposed to protect the duct with a single layer of nominally 38 mm thick Fyrewrap® Elite® 1.5 secured as discussed in Section 4.2.1.

In the Intertek fire resistance test No. 101269631SAT-005 Duct B was insulated with a single layer of 38 mm thick Fyrewrap® Elite® 1.5 and maintained the Structural Adequacy and Integrity criteria for 180 minutes. After reviewing the test data from that test it is considered that if the duct had been tested in accordance with AS 1530.4:2014 it would achieve Insulation of at least 30 minutes. Therefore it is considered if Duct B as tested in Intertek fire resistance test No. 101269631SAT-005, if tested in accordance with AS 1530.4:2014, would achieve at least an FRL of at least 180/180/30.

4.2.4 Fyrewrap® Elite® 1.5 FRL 180/180/60

It is proposed to protect the duct with two layers of nominally 38 mm thick Fyrewrap® Elite® 1.5 secured as discussed in Section 4.2.1 resulting in an overall thickness of 76 mm.

Using the test data referenced in Section 2 it is possible to interpolate between 50 mm and 100 mm Fyrewrap® Elite® 1.5 blanket. From this the expected Insulation performance of the Fyrewrap® Elite® 1.5 system consisting of two layers of 38 mm Fyrewrap® Elite® 1.5 can be determined as the thickness falls between tested thicknesses. Using a second order polynomial best fit line between data points it is considered the Insulation criteria would be maintained for at least 60 minutes. Therefore it is considered two layers of nominal 38 mm thick Fyrewrap® Elite® 1.5 Elite 1.5 blanket, if tested in accordance with AS 1530.4:2014, would achieve an FRL of at least 180/180/60.

4.2.5 Fyrewrap® Elite® 1.5 FRL 240/240/120

It is proposed to protect the duct with three layers of nominally 38 mm thick Fyrewrap® Elite® 1.5 secured as discussed in Section 4.2.1 resulting in an overall thickness of 114 mm.

In fire resistance test FR12334-001 two layers of 50 mm thick Fyrewrap® Elite® 1.5 maintained the Structural Adequacy and Integrity criteria for 240 minutes without failure and Insulation criteria for 125 minutes. It is generally considered that multiple layers of protection preform better due to joints between layers being off-set and not causing hot spots on the unexposed face compared to a single layer. Further to this it is considered there would be some benefit going from two layers to three layers for the same reason. In addition the overall thickness of the protection system is to be increased by 14 mm (14 %) from that tested. Based on the available test evidence referenced in Section 2 and the overall increase in protection thickness it is considered three layers of nominal 38 mm thick Fyrewrap® Elite® 1.5 blanket, if tested in accordance with AS 1530.4:2014, would achieve an FRL of at least 240/240/120.

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4.3 Duct size

4.3.1 Duct Aspect ratio

In fire resistance test FR12334-001 a duct nominally 250 mm high x 1,000 mm wide was tested with an aspect ratio of 1:4 (height to width). It is considered that ducts with an aspect ratio of between 1:4 to 1:1 would be expected to perform at least as well as tested.

4.3.2 Duct suspension system

In fire resistance test FR12334-001 the duct was tested with a support angle nominally 40 mm x 40 mm x 3 mm thick suspended at each end with an M10 threaded rod. The support angles were positioned 650 mm from the enclosure wall in the furnace resulting in nominally 1,700 mm between the two supports. There were no significant observations relating to the performance of the suspension system for the 241 minute duration of the test. It is therefore considered the minimum suspension system shall be at least 40 mm x 40 mm x 3 mm angle, or equivalent section stiffness, suspended by at least two M10 threaded rods or larger as specified in AS 4254.2-2012 subject to the following:

- The suspension system shall not exceed 10 N/mm² for 120 minutes fire exposure or 6 N/mm² for up to 240 minutes fire exposure.
- The maximum distance between supports shall not exceed 1,700 mm.

4.3.3 Increase in duct size

In fire resistance test FR12334-001 a mild steel duct nominally 250 mm x 1,000 mm x 0.8 mm thick was tested for 241 minutes without any significant observations relating to the steel duct for the duration of the test. The mild steel duct was built following the requirements of AS 4254.2-2012 Table 2.3(C) for 500 Pa pressure class ducting.

In the fire test the maximum temperature measured in the test on the inside of the steel duct was 407°C which was protected by two layers of 50 mm thick Fyrewrap® Elite® 1.5.

After reviewing the test data and Fyrewrap® Elite® 1.5 layer/thickness configurations it is expected that this is the maximum temperature across the different layers and FRL's the steel duct would be expected to reach for an external exposure duct.

It is considered that on the condition the mild steel ducts are of the minimum dimensions discussed in this report or increased as specified in accordance with AS 4254.2-2012 and the Fyrewrap® Elite® 1.5 blanket protection system does not exert any more stress on the steel duct as tested in FR12334-001 the size of the mild steel duct can be increased. For larger ducts than tested the duct design shall be in accordance with AS 4254.2-2012.

As the size of the duct increases the size of the aperture in the element shall also increase as shown in Table 2.

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Table 2: Duct penetration details

Duct Size* (mm)	Annular gap# (mm)	Steel L-angle (mm)	Maxilite board size (width mm x thickness mm)
Up to 600 x 600	10-30	75 x 75 x 1.6	100 x 60
601 x 601 to 1,600 x 1,600	20-40	75 x 75 x 1.6	100 x 60
1,601 x 1,601 to 2,600 x 2,600	40-60	125 x 125 x 2	150 x 60
2,601 x 2,601 to 3,000 x 3,000	60-80	125 x 125 x 2	150 x 60

* Note AS 4254.2-2012 is limited to duct designs up to 3,000 mm maximum dimension. Ducts larger than this shall be designed to maintain the cross-sectional area of the duct at elevated temperatures (450°C) and the suspension system shall not exceed 10 N/mm² for 120 minutes fire exposure or 6 N/mm² for up to 240 minutes fire exposure.

Note Annular gaps larger than listed for the specific duct size may be used on the condition it is matched with the L-angle and Maxilite board size required for the annular gap.

4.4 Duct wall collar details

In fire resistance test FR12334-001 the duct was tested in a masonry wall. Within the depth of the wall the gap between the wall and steel duct was packed with Fyrewrap® Elite® 1.5 blanket with the foil removed followed by Fyreflex sealant nominally 15 mm deep to each side. A mild steel angle nominally 75 mm x 100 mm x 1.6 mm was secured to both sides of the wall and steel duct. A 150 mm high x 60 mm thick strip of Maxilite board was positioned over the angles to all four sides of the duct and secured to the concrete wall on both sides. There were no significant observations relating to the penetration detail for the 241 minute duration of the test. Figure 4 to Figure 7 essentially show a step by step construction of the tested duct wall collar details.

In the Intertek fire resistance test No. 101269631SAT-005 the ducts were tested in a concrete wall with the gap between the wall and steel duct packed with Fyrewrap® Elite® 1.5 and finished with an intumescent sealant. The Fyrewrap® Elite® 1.5 butted up against the concrete wall. It is proposed as an alternative installation detail (See Figure 20) to flare the outer layer of Fyrewrap® Elite® 1.5 blanket to cover the wall by at least 100 mm from the surface of the duct. It is considered this detail would perform at least as well as the detail tested in fire resistance test No. 101269631SAT-005 and therefore would not be expected to prejudice the fire resistance of the duct protection system discussed above.

It is considered the flared penetration detail can be used with other approved elements for up to the FRL of the protection system or element, whichever is the lesser shall apply.

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4.5 Fire rated wall barrier

4.5.1 Plasterboard walls

4.5.1.1 Steel Stud walls

In fire resistance test EWFA 35343400.3 an internal exposure duct was tested in a plasterboard wall and maintained the Integrity and Insulation criteria for the 121 minute duration of the test. In terms of the fire exposure of the penetration system it is considered an internal exposure duct test is more severe than an external exposure duct test. This is due to the duct collar detail and inside of the steel duct being exposed to furnace conditions. For an external exposure duct the steel duct is protected by the protection system inside the furnace which then limits the temperatures through the duct to the unexposed face. Based on the performance of the duct tested in fire resistance test EWFA 35343400.3 it is considered the external duct would not be prejudiced if installed in a fire rated plasterboard wall before at least 120 minutes or the FRL of the wall whichever is the lesser.

See Figure 8 to Figure 11 for a step by step construction of the tested duct wall collar details in plasterboard walls.

4.5.1.2 Timber Stud walls

In fire resistance test EWFA 35343400.3 an internal exposure duct was tested in a steel stud plasterboard wall. The opening in the wall was framed and then the gap between the steel duct and framing filled with Fyrewrap® Elite® 1.5 blanket with the foil removed. Timber framing tends to be more stable and deflect less than an equivalent steel stud wall, however it is combustible. It is proposed that the opening in the wall is framed and then lined with the same thickness of plasterboard as the wall and the duct otherwise installed as tested. It is considered with the timber framing protected by the plasterboard the duct would be expected to perform at least as well as tested in a steel stud wall.

4.5.2 Alternative fire rated walls

Based on the tested performance of the duct collar system in both concrete and plasterboard walls it is considered a duct installed in a minimum 75 mm thick fire rated autoclaved aerated concrete (AAC) wall or a Speedpanel wall would not be prejudiced up to the FRL of the duct protection system or fire rated wall system. Figure 12 to Figure 15 shows the step by step collar construction in AAC walls and Figure 16 to Figure 19 in Speedpanel walls.

4.6 Access panels

It is proposed to include a fire rated access panel – FyreWrap access panel (FWAP) over a standard steel duct access panel. The FWAP consists of a pressed mild steel frame secured to the steel duct (outside the perimeter of the standard duct access panel) with a Maxilite panel screw fixed to the frame. See Figure 21 and Figure 23 for details.

In fire resistance test No. 43330700.1 a FWAP with an internal opening of 433 mm x 301 mm was tested as part of the internal exposure duct and maintained the Integrity criteria for the 181 minute duration of the test and Insulation for 67 minutes. The duct was protected with a single layer of nominal 38 mm thick Fyrewrap® Elite® 1.5 blanket. It is proposed to install the same access panel as tested but for external fire exposure. The frame of the FWAP was

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packed with one layer of nominal 38 mm Fyrewrap® Elite® 1.5 blanket which for an external exposure duct would be expected to achieve an FRL of at least 120/120/30.

The frame design has been revised to accommodate a minimum of two layers of 38 mm Fyrewrap® Elite® 1.5 blanket. For the single layer system an additional 100 mm wide strip would be positioned within the frame. For the double layer system both layers would slot into the frame and where the system consists of three layers the frame depth will be increased to accommodate three layers of the 38 mm Fyrewrap® Elite® 1.5 blanket. See Figure 22 for one and two layer installations and Figure 23 for three layer installations.

Although the exposure conditions are different between the internal exposure vs external exposure duct it is expected the increase in frame depth would reduce the conduction through the frame and therefore would maintain the FRL achieved in fire resistance test No. 43330700.1 of at least -/180/60.

Further to this it is also proposed to increase the size of the access panel up to nominally 558 mm x 433 mm. Based on the performance of the Trafalgar FWAP and Maxilite panels it is considered the fire resistance of the FWAP would be maintained on the condition the fixing centres remain the same as tested.

4.7 Vertical Duct

In fire resistance test No. 43330700.1 an internal exposure duct was tested in a concrete floor slab. See Figure 24 for the tested penetration details. As discussed in Section 4.5.1 it is considered the tested internal exposure penetration detail would be likely be more severe than a similar detail for an external exposure duct. Therefore it is considered the vertical duct penetration details is suitable for an external exposure duct.

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5. CONCLUSION

It is considered that the Trafalgar Fyrewrap® Elite® 1.5 duct protection system consisting nominal 38 mm thick foil faced blanket protecting a steel duct constructed in accordance with AS 4254.2-2012, if tested in accordance with AS 1530.4:2014 would achieve the following fire resistance:

- 1 layer of nominal 38 mm thick Fyrewrap® Elite® 1.5 FRL 180/180/30
- 2 layer of nominal 38 mm thick Fyrewrap® Elite® 1.5 FRL 180/180/60
- 3 layer of nominal 38 mm thick Fyrewrap® Elite® 1.5 FRL 240/240/120

Subject to the following conditions:

- All joints shall overlap by a minimum of 100 mm and be secured 50 mm from the edge of the blanket and at maximum 200 mm centres.
- The duct suspension system shall be a minimum of 40 mm x 40 mm x 3 mm angle suspended by at least two M10 threaded rods or larger as specified in AS 4254.2-2012 subject to the following:
- The suspension system shall not exceed 10 N/mm² for 120 minutes fire exposure or 6 N/mm² for up to 240 minutes fire exposure.
- The maximum distance between supports shall not exceed 1,700 mm.
- The duct shall be constructed in accordance with AS 4254.2-2012 unless stated otherwise in this assessment.

Additional options/variations are considered not to prejudice the fire resistance of the duct system are as follows:

- The duct may be increased in size on the condition the aspect ratio does not exceed 1:4 (height vs width) and constructed in accordance with AS 4254.2-2012 unless stated otherwise in this assessment.
- The duct system may be used with fire rated elements of construction as follows:
- Concrete or masonry walls up to an FRL 240/240/240 or -/240/240.
- Steel or timber stud plasterboard walls up to FRL 120/120/120 or -/120/120.
- 75 mm thick fire rated autoclaved aerated concrete (AAC) walls up to an FRL of -/90/90.
- 78 mm thick Speedpanel walls up to an FRL of -/120/120.
- A fire rated access panel, FWAP, with an internal opening of up to 558 mm x 433 mm up to an FRL of -/180/60.
- Vertical ducts installed in concrete floor slabs.

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Figure 1: Single layer jointing methods

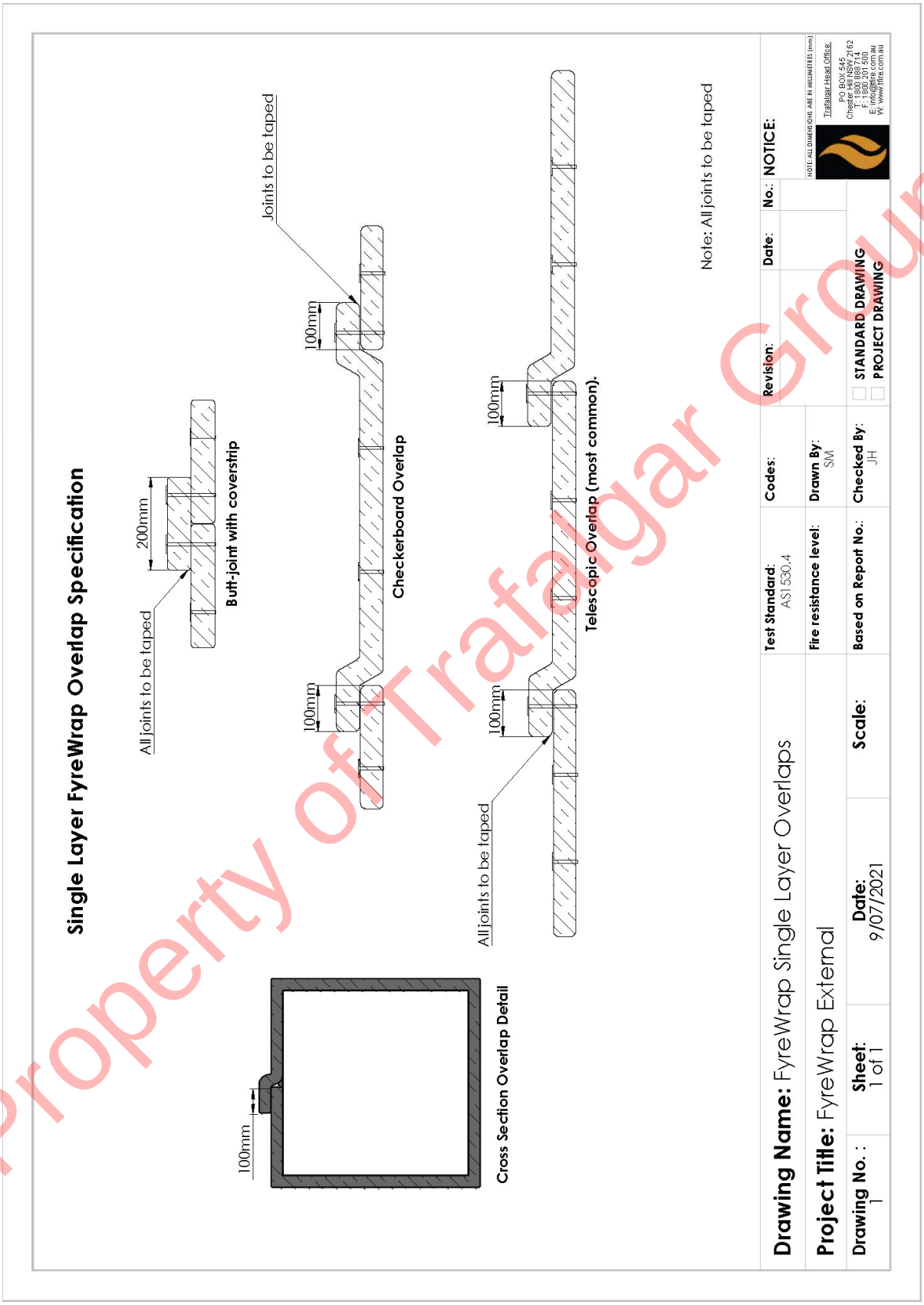

Figure 2: Two layer jointing methods

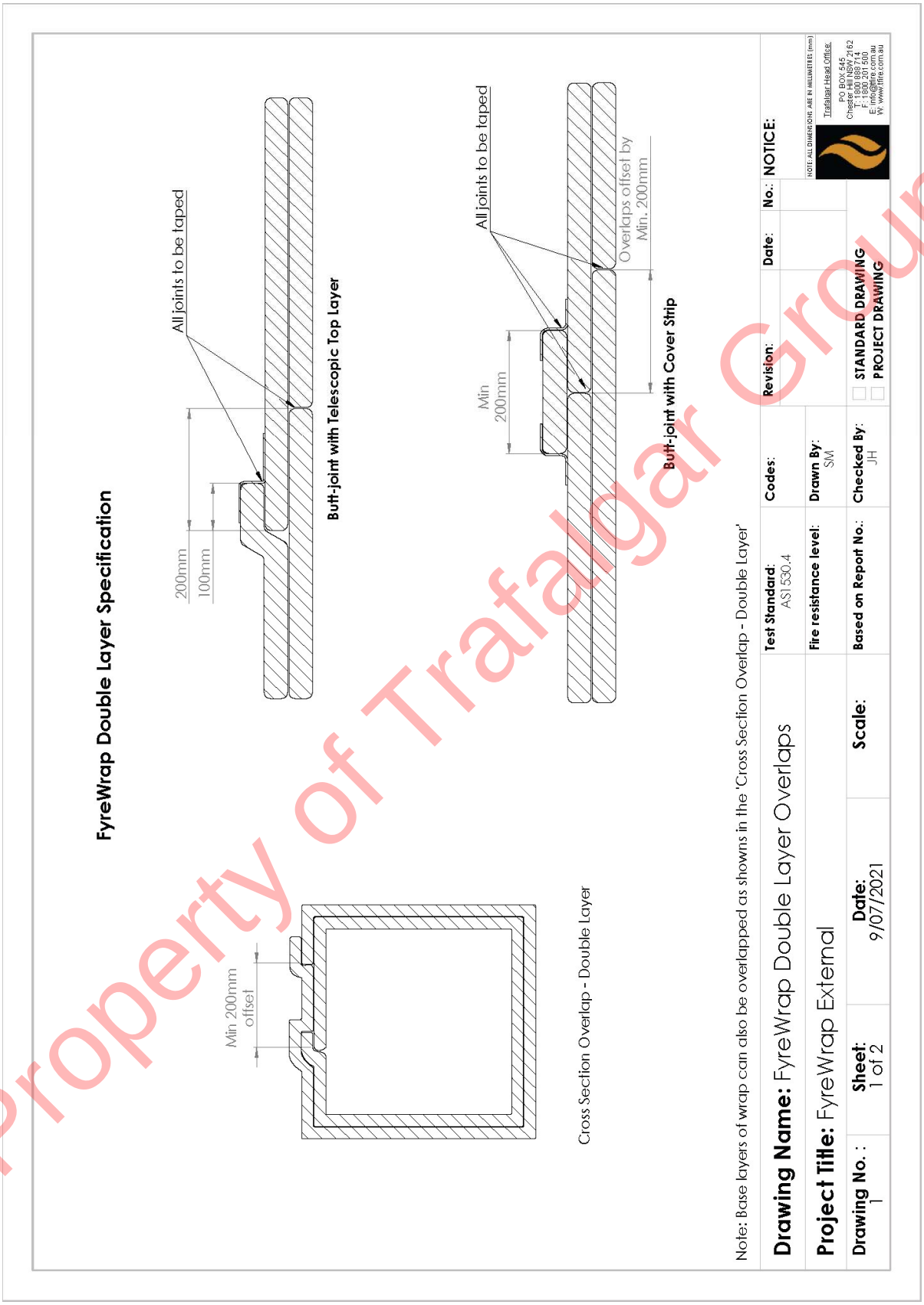

Figure 3: Three layer jointing methods

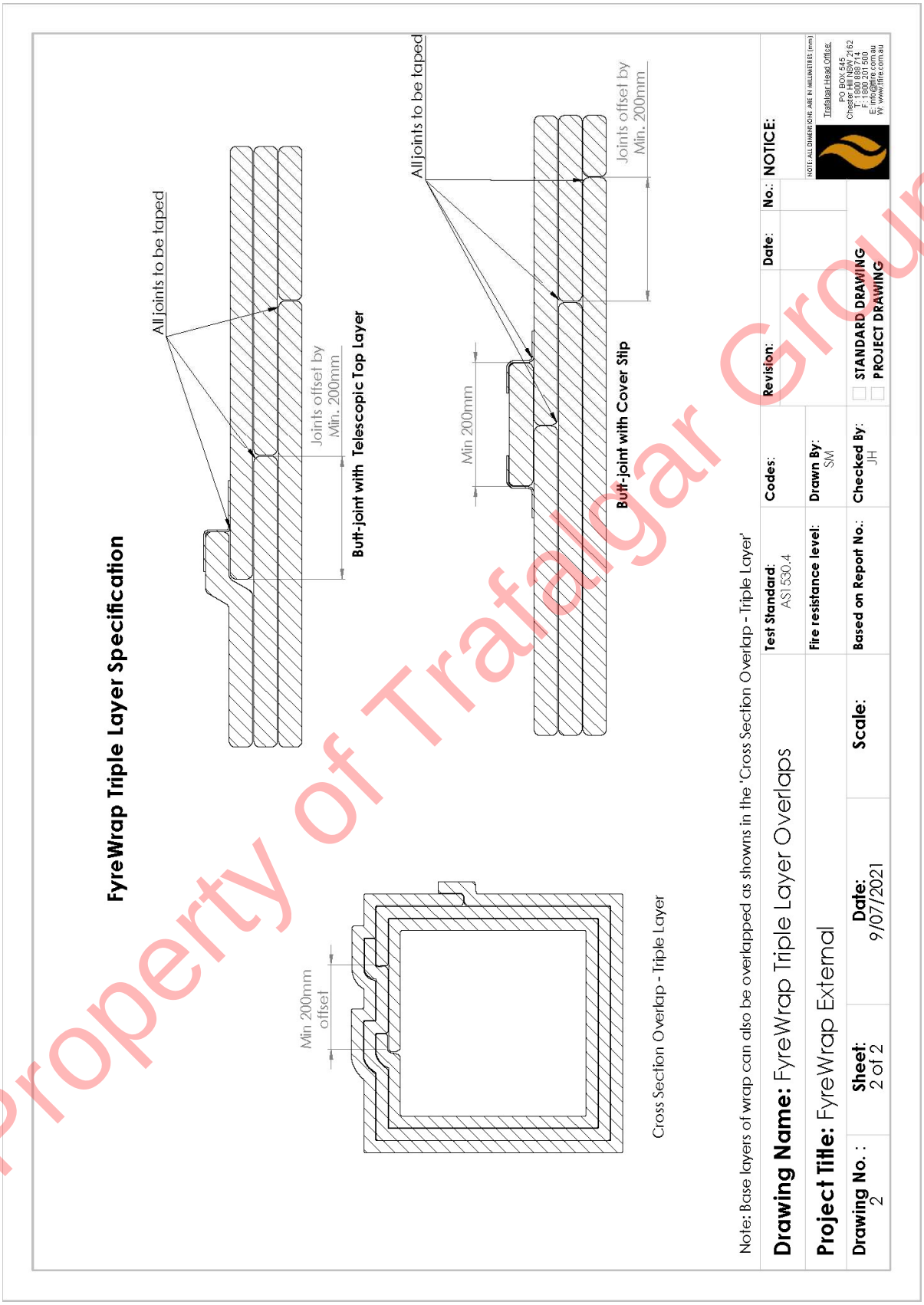

Figure 4:Duct collar – Masonry step 1

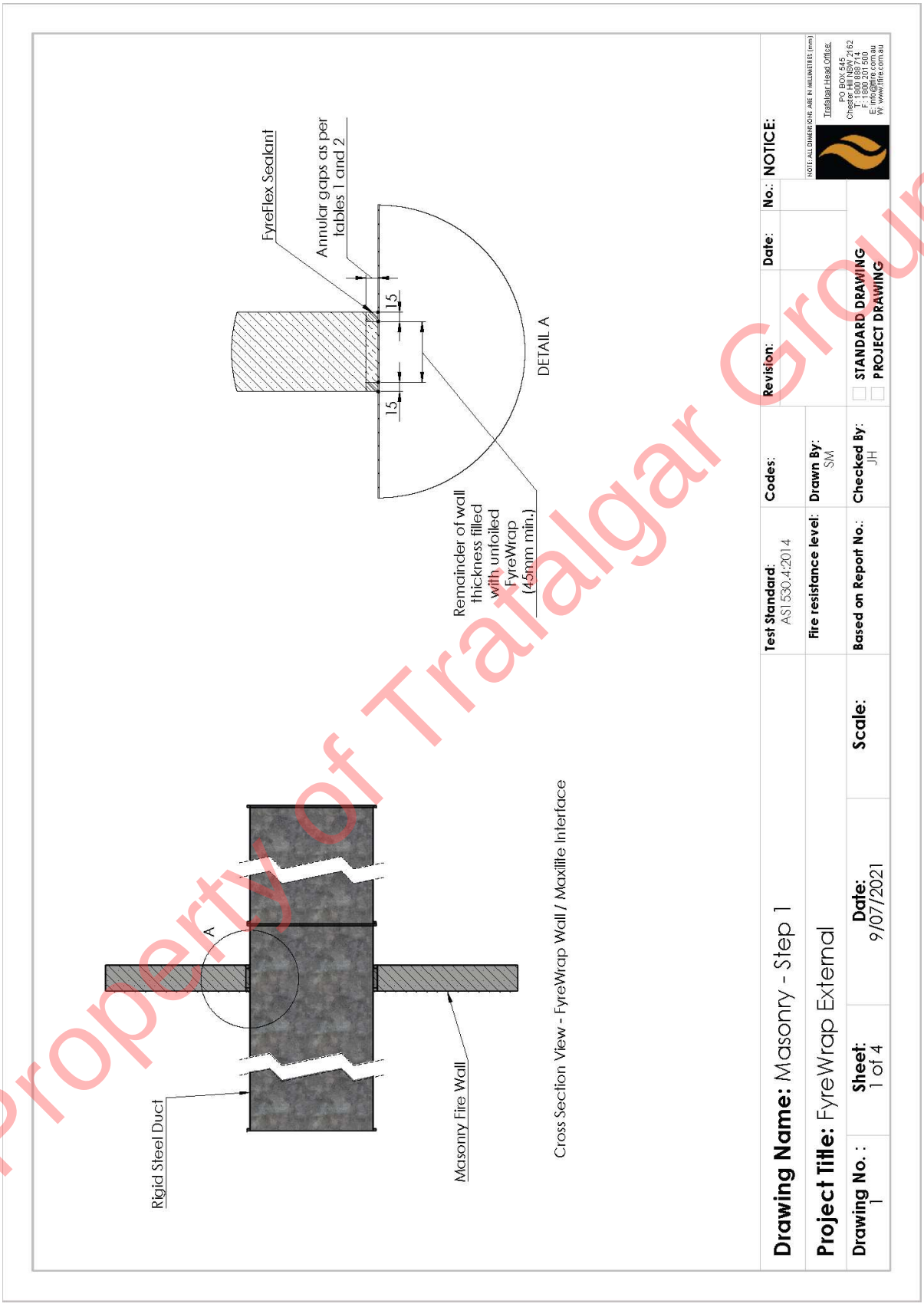

Figure 5: Duct collar – Masonry step 2

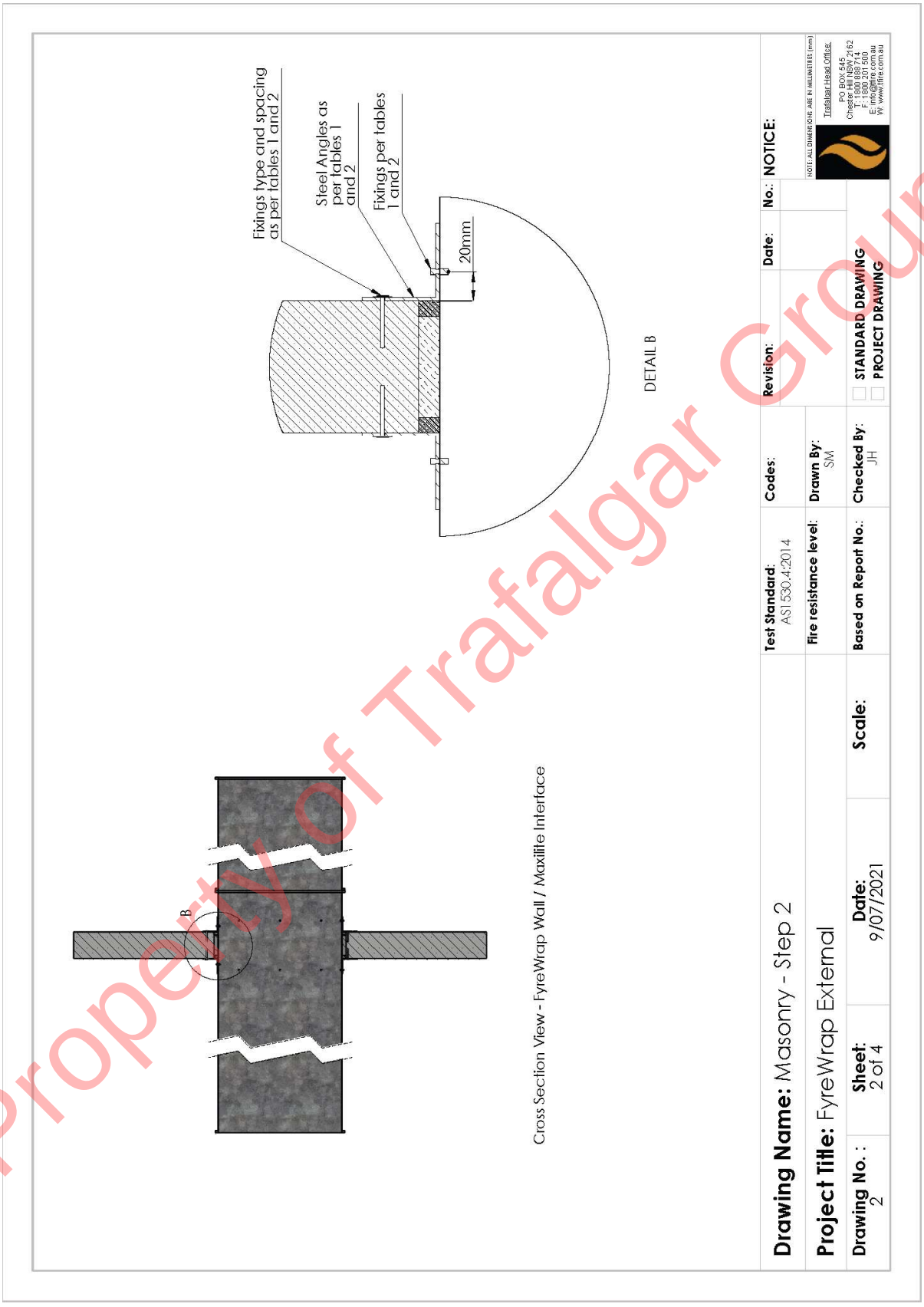

Figure 6: Duct collar – Masonry step 3

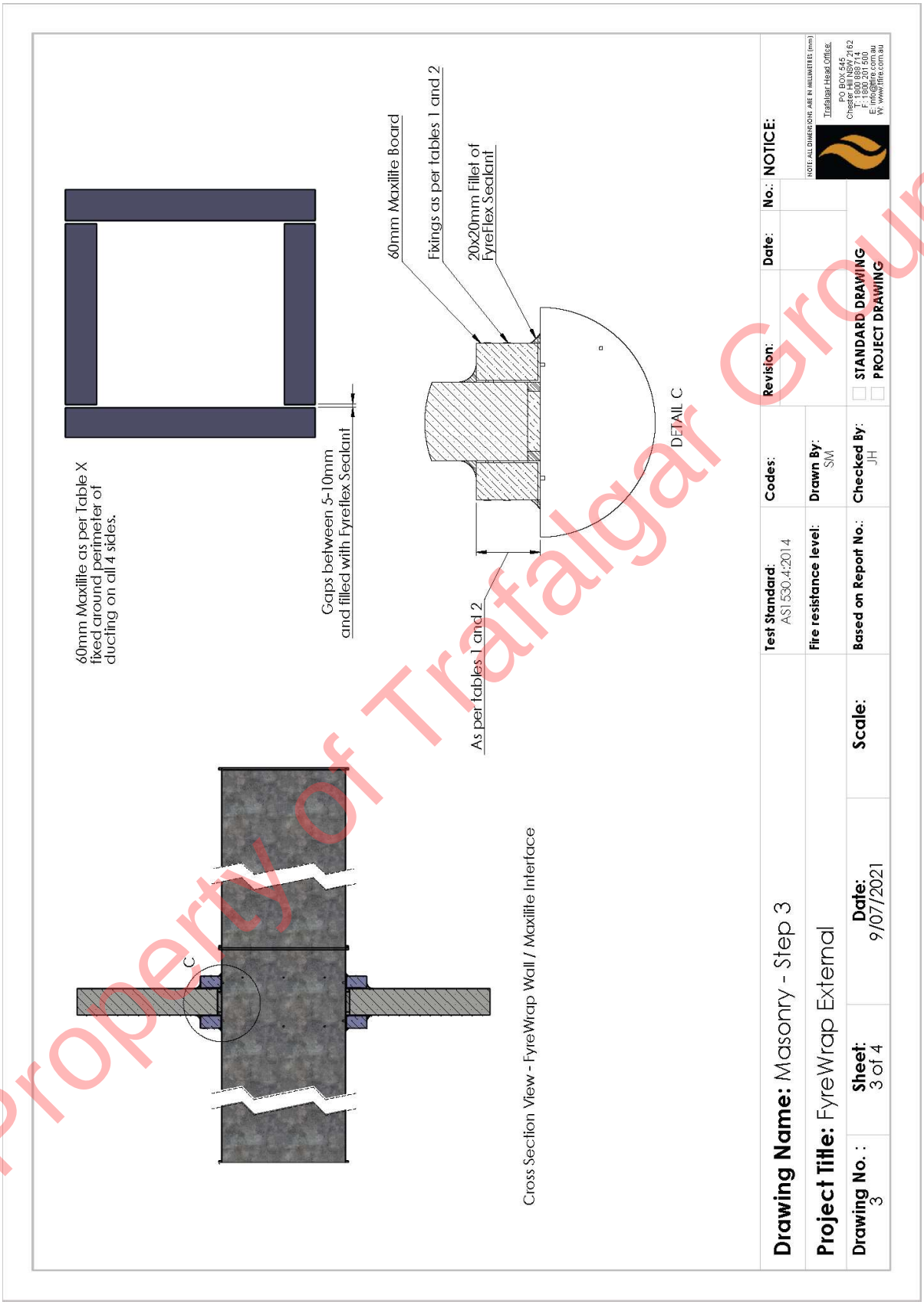

Figure 7: Duct collar – Masonry step 4

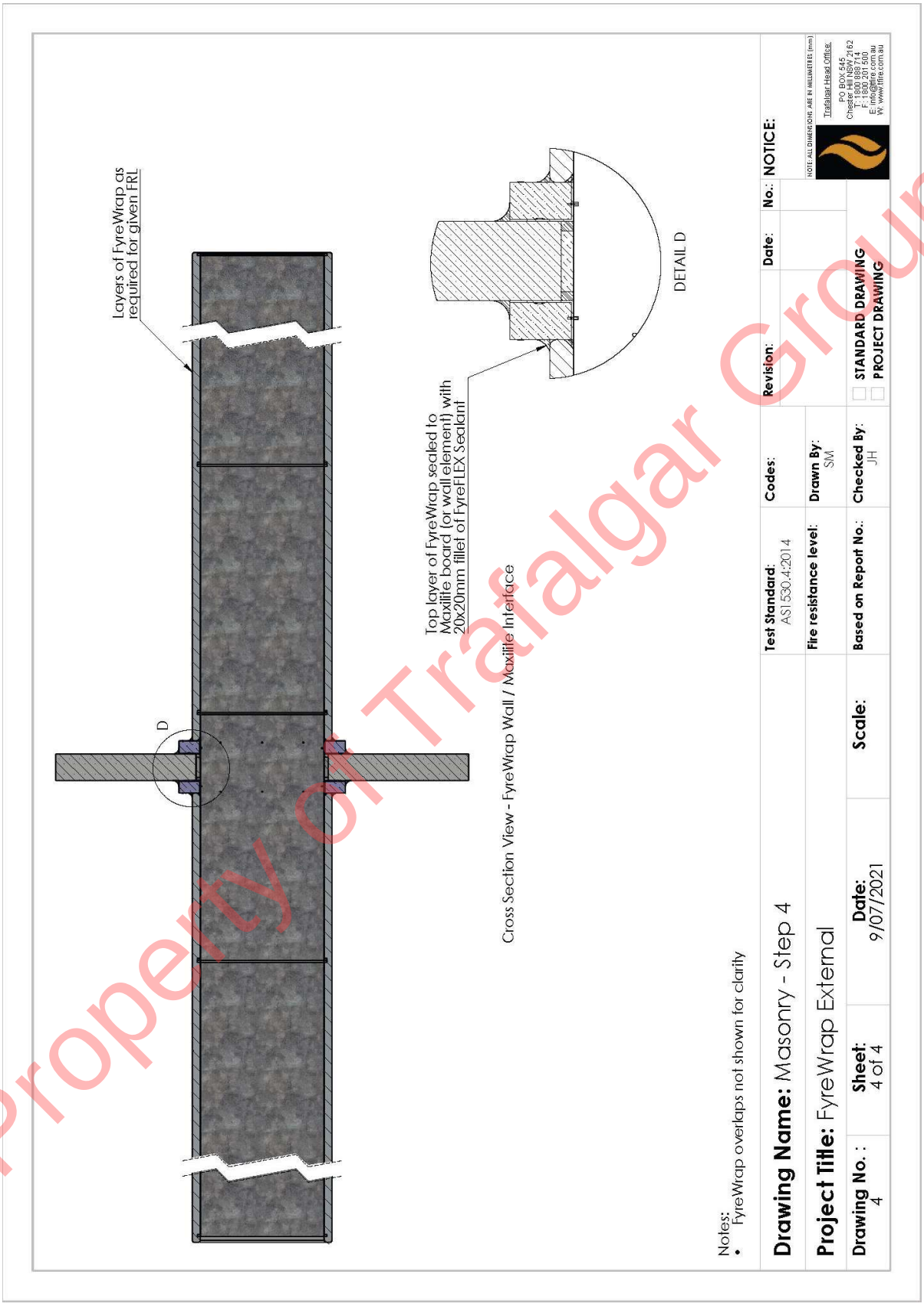

Figure 8: Duct collar – Plasterboard Step 1

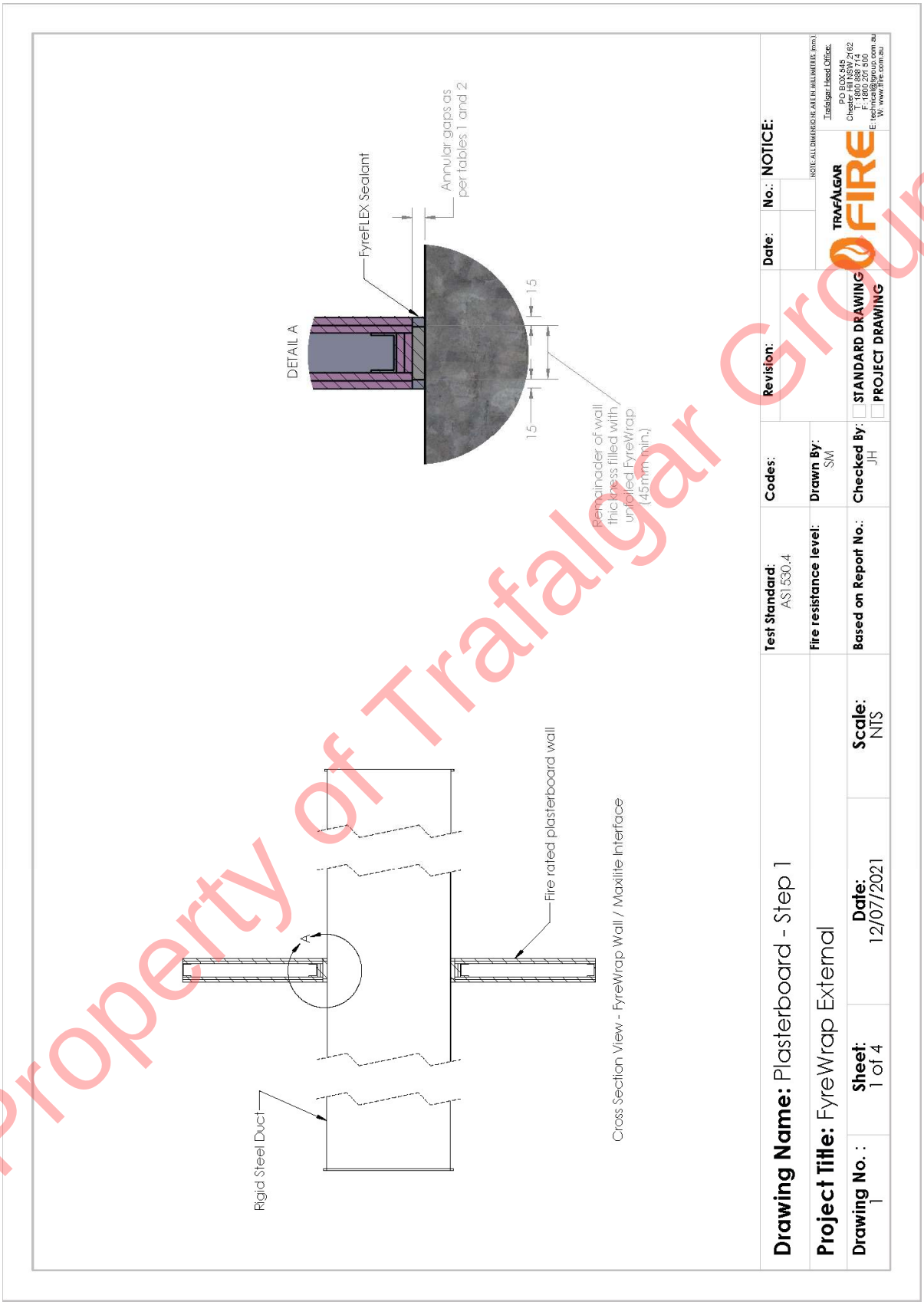

Figure 9: Duct collar – Plasterboard Step 2

Figure 10: Duct collar – Plasterboard Step 3

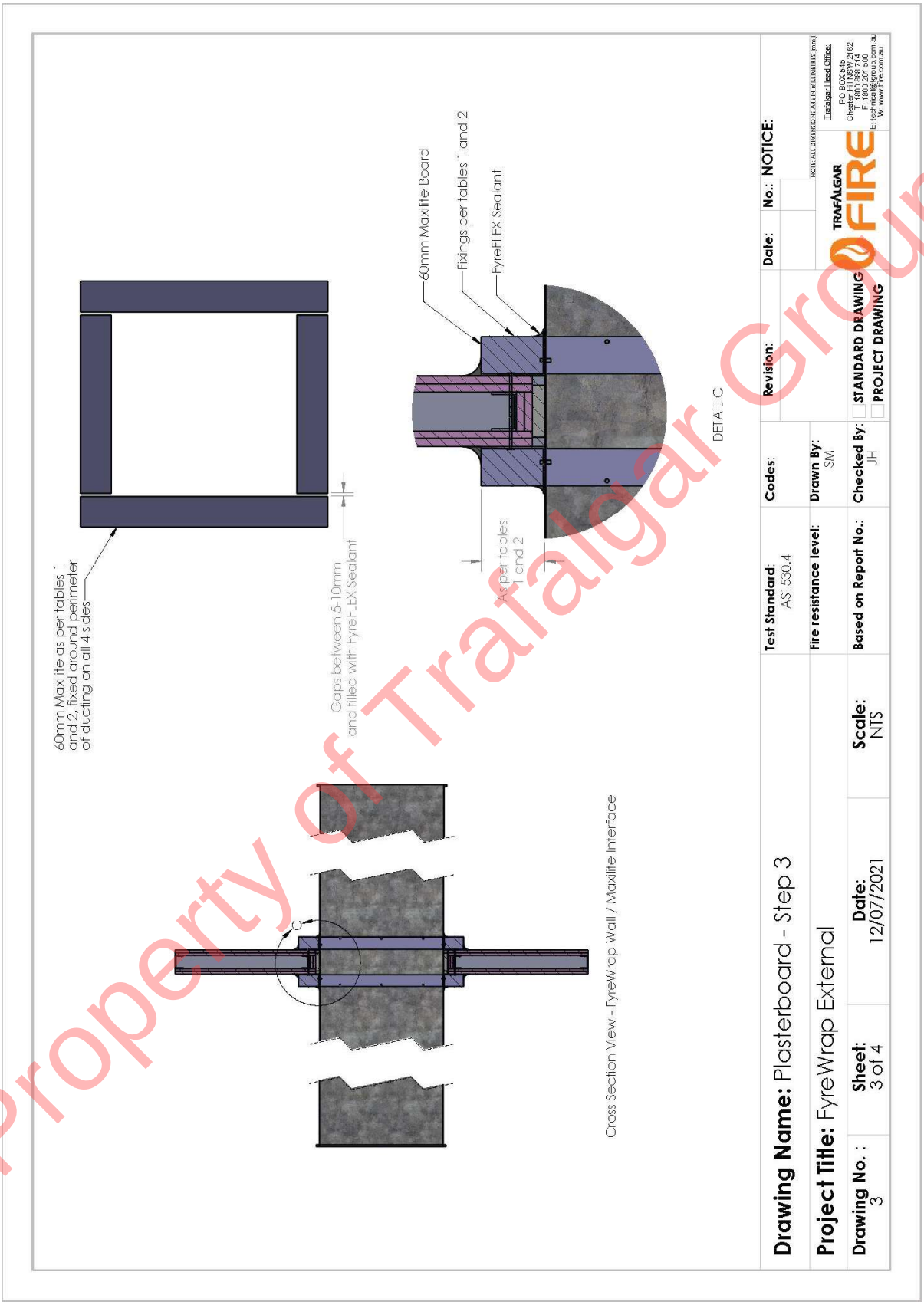

Figure 11: Duct collar – Plasterboard Step 4

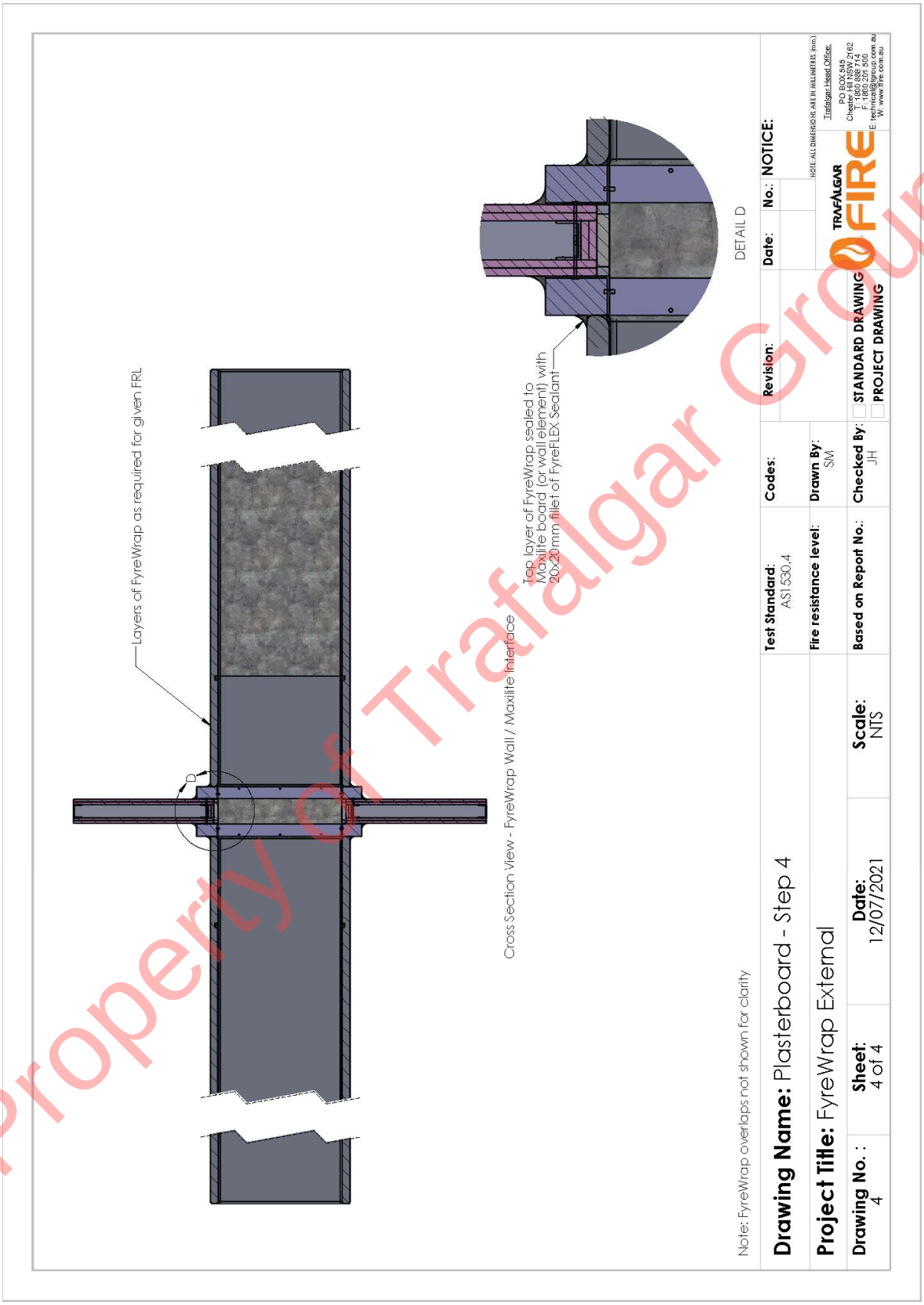

Figure 12: Duct collar – AAC Wall Step 1

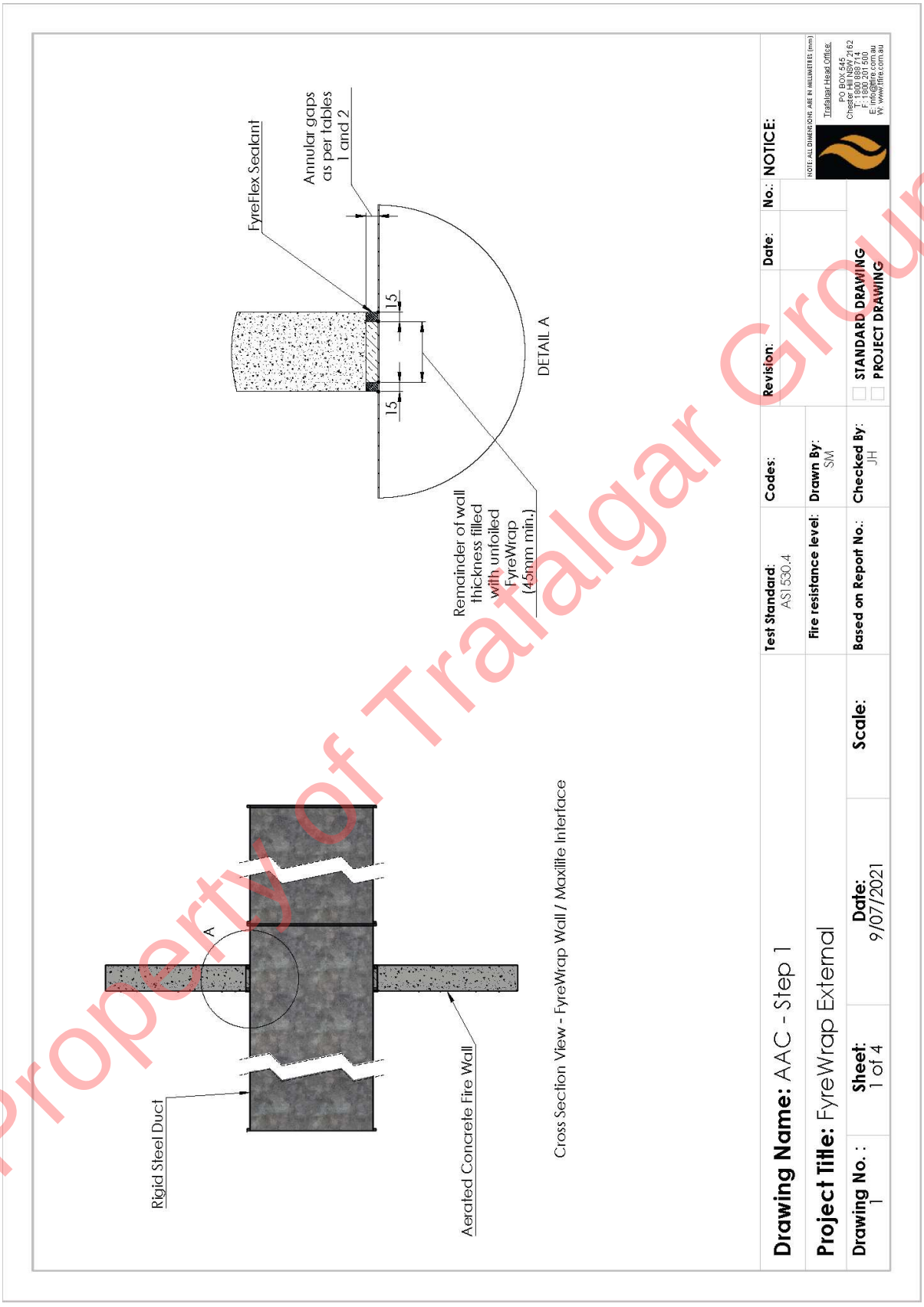

Figure 13: Duct collar – AAC Wall Step 2

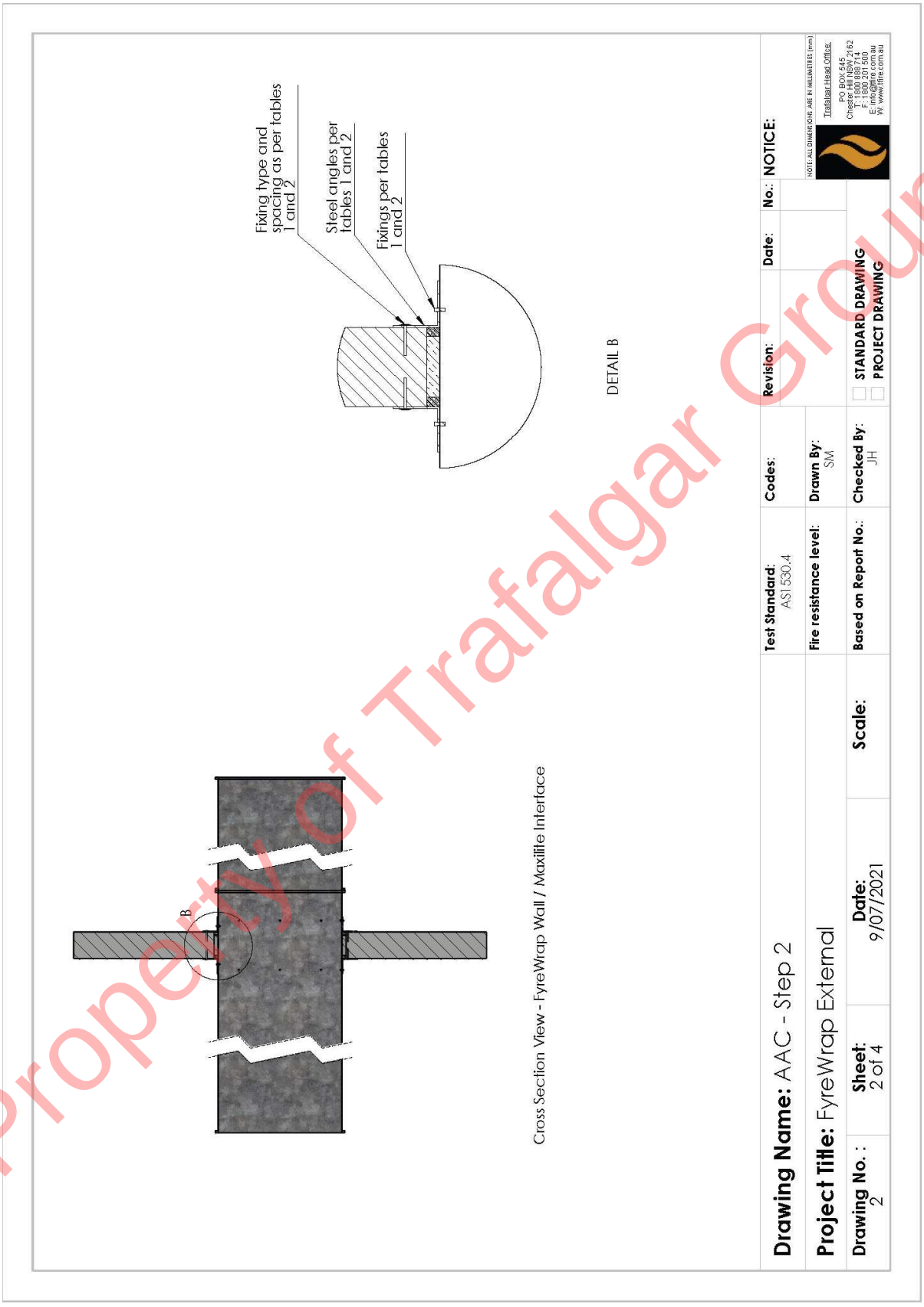

Figure 14: Duct collar – AAC Wall Step 3

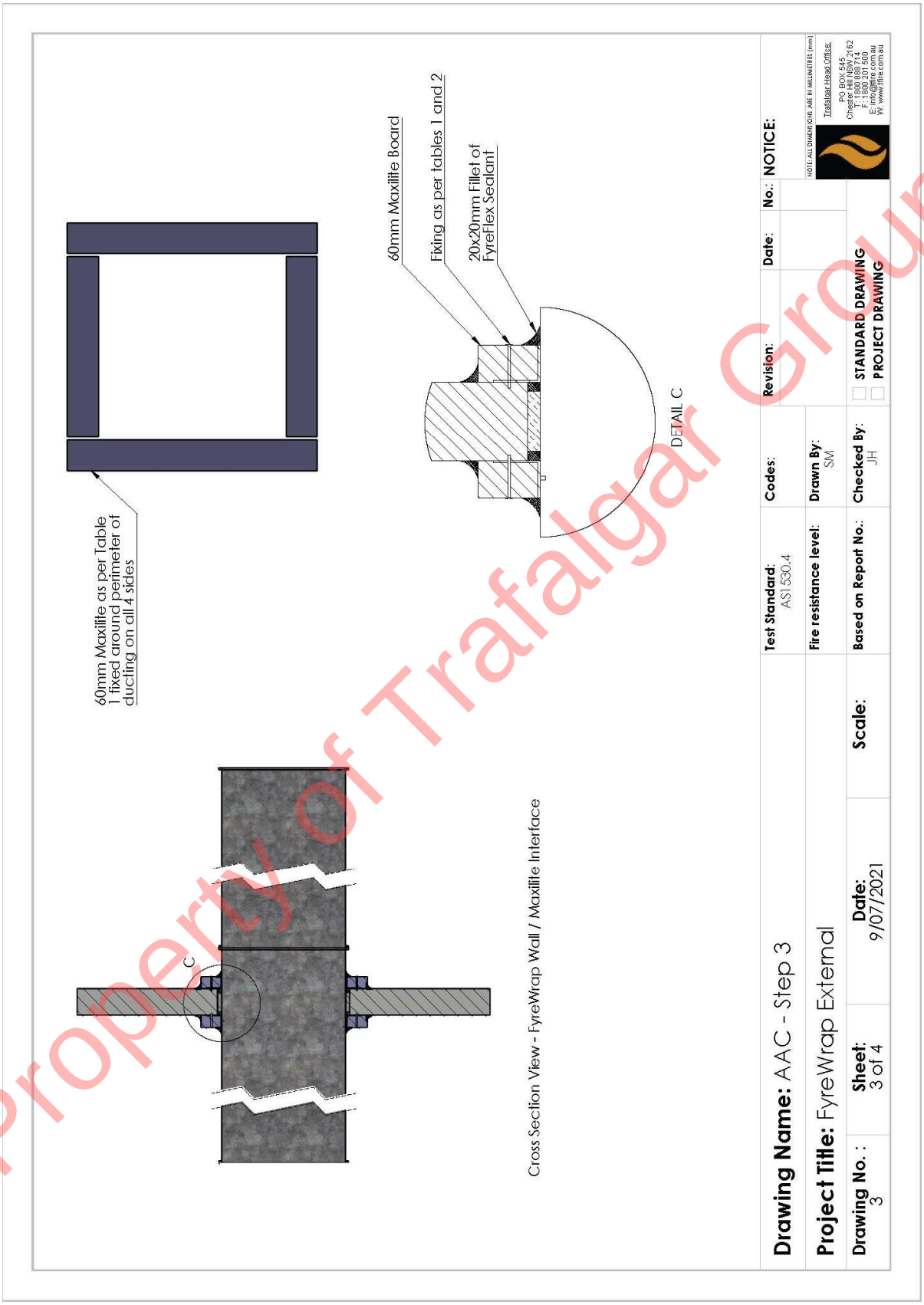

Figure 15: Duct collar – AAC Wall Step 4

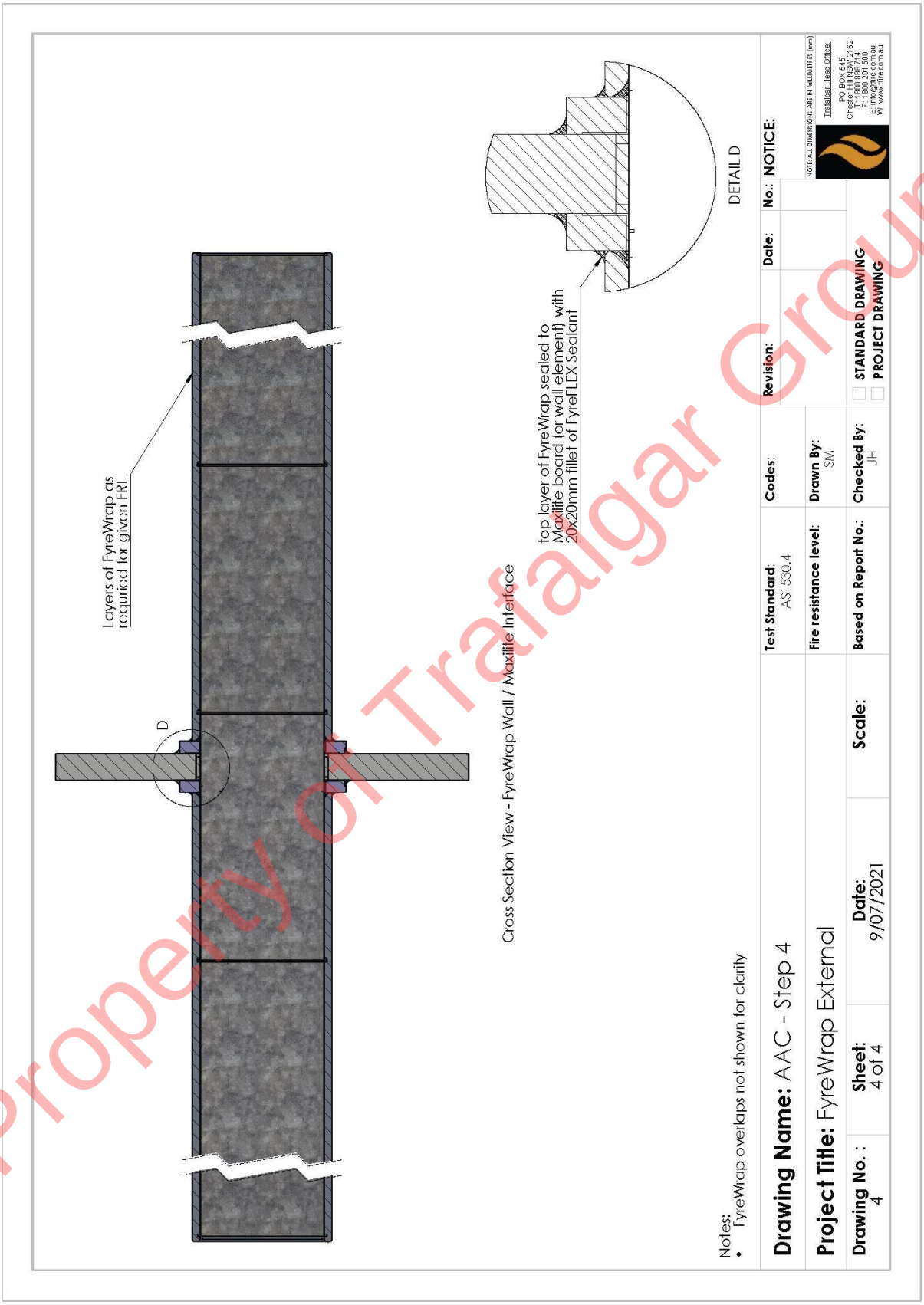

Figure 16: Duct collar – Speedpanel Wall Step 1

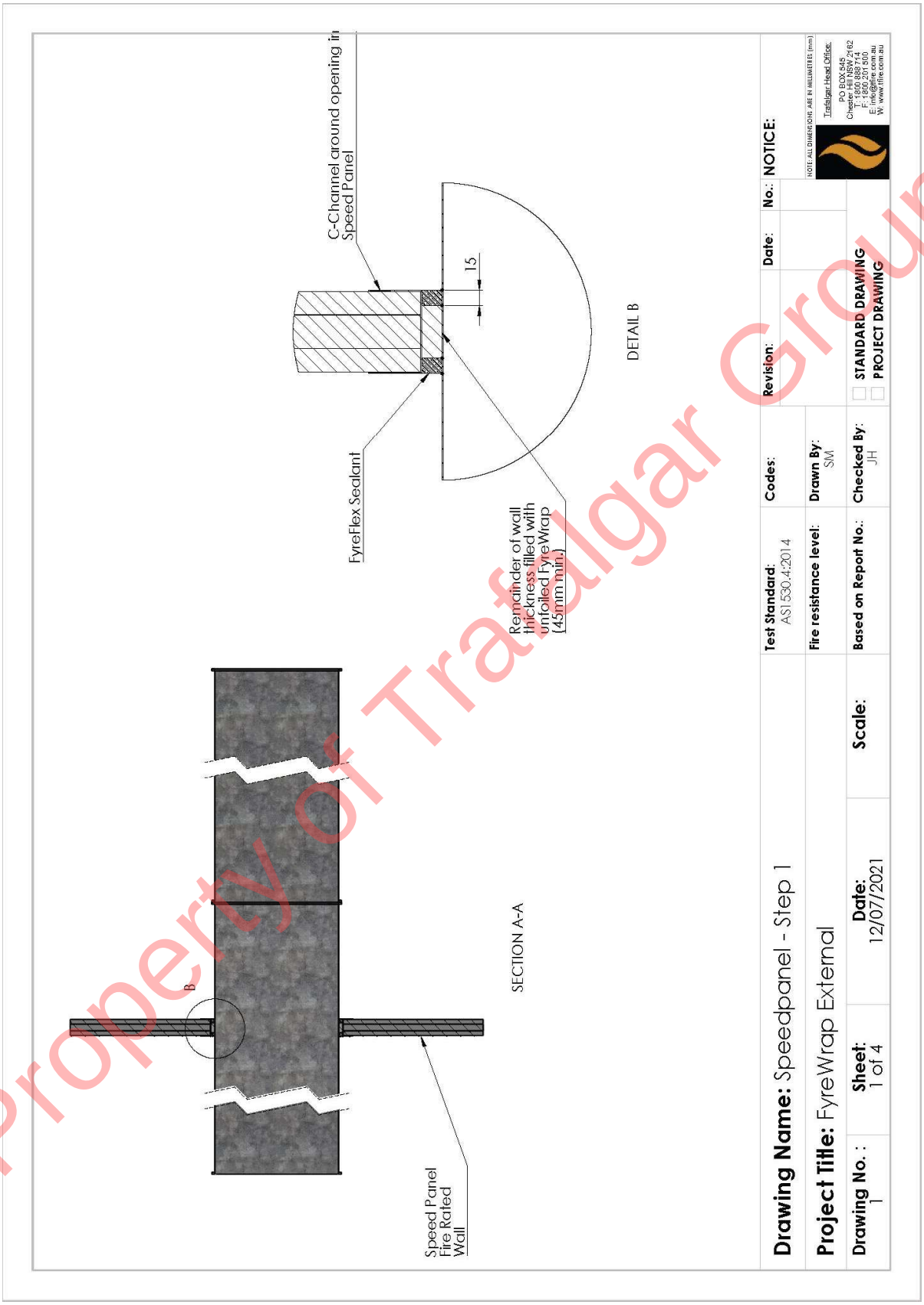

Figure 17: Duct collar – Speedpanel Wall Step 2

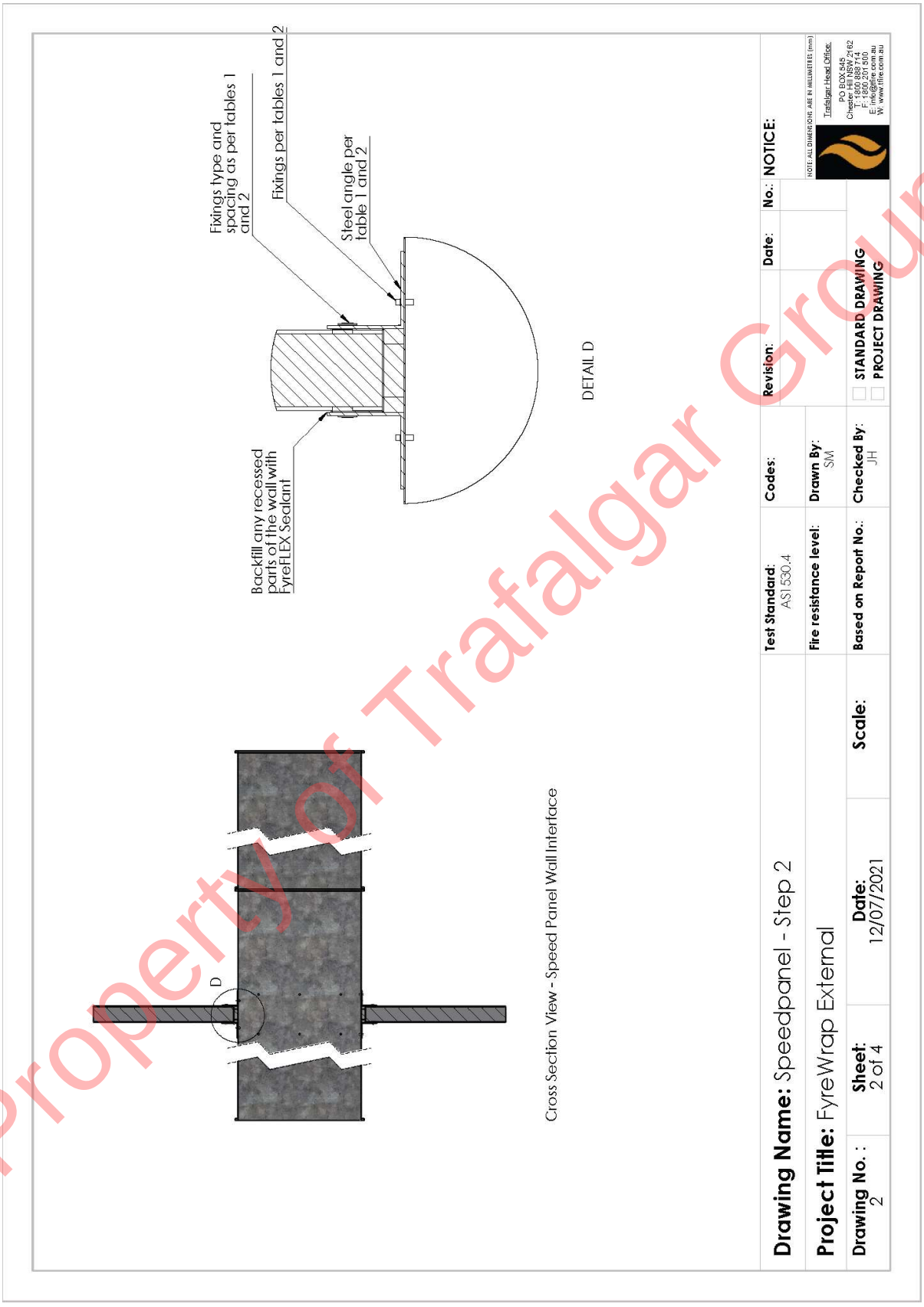

Figure 18: Duct collar – Speedpanel Wall Step 3

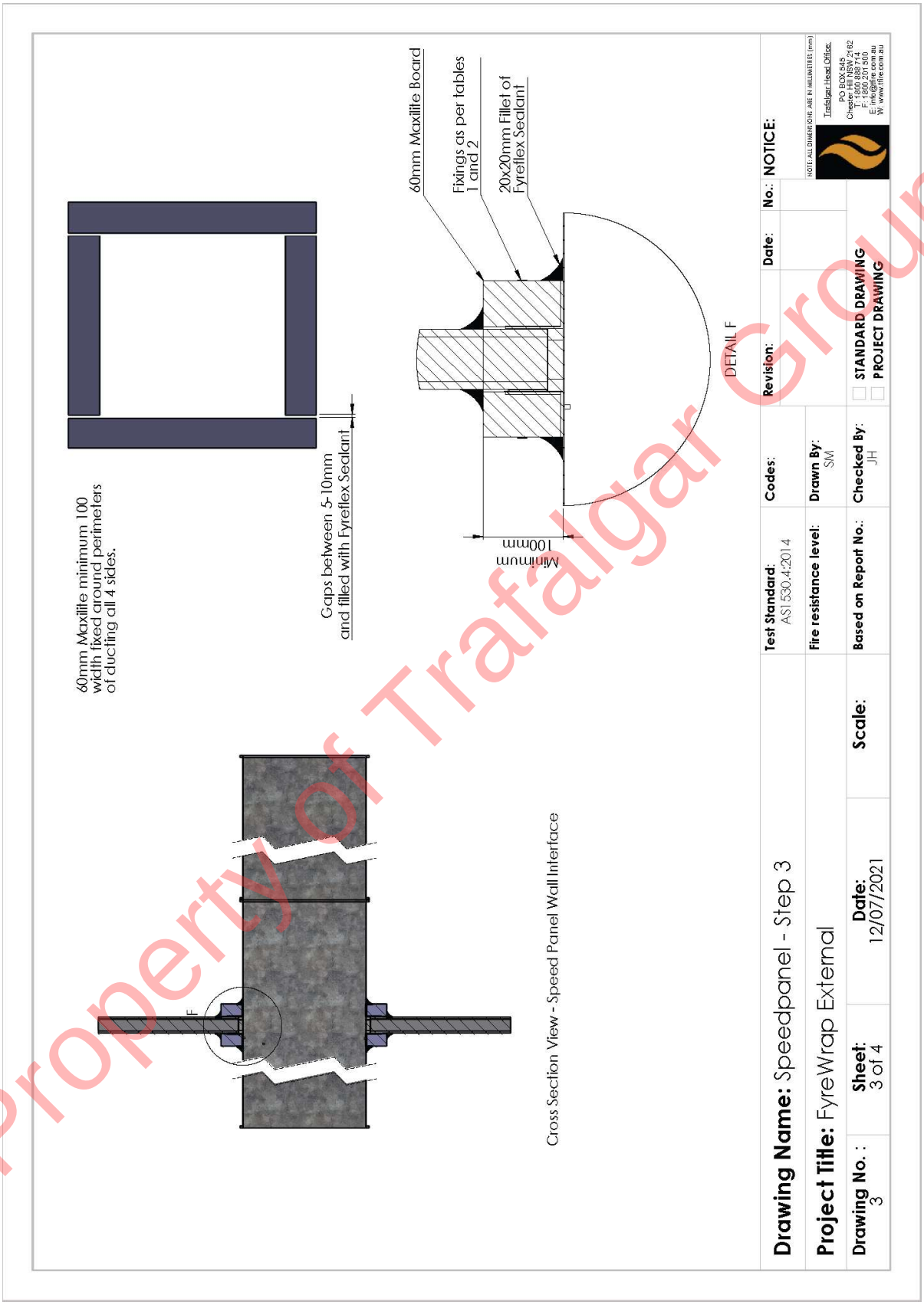

Figure 19: Duct collar – Speedpanel Wall Step 4

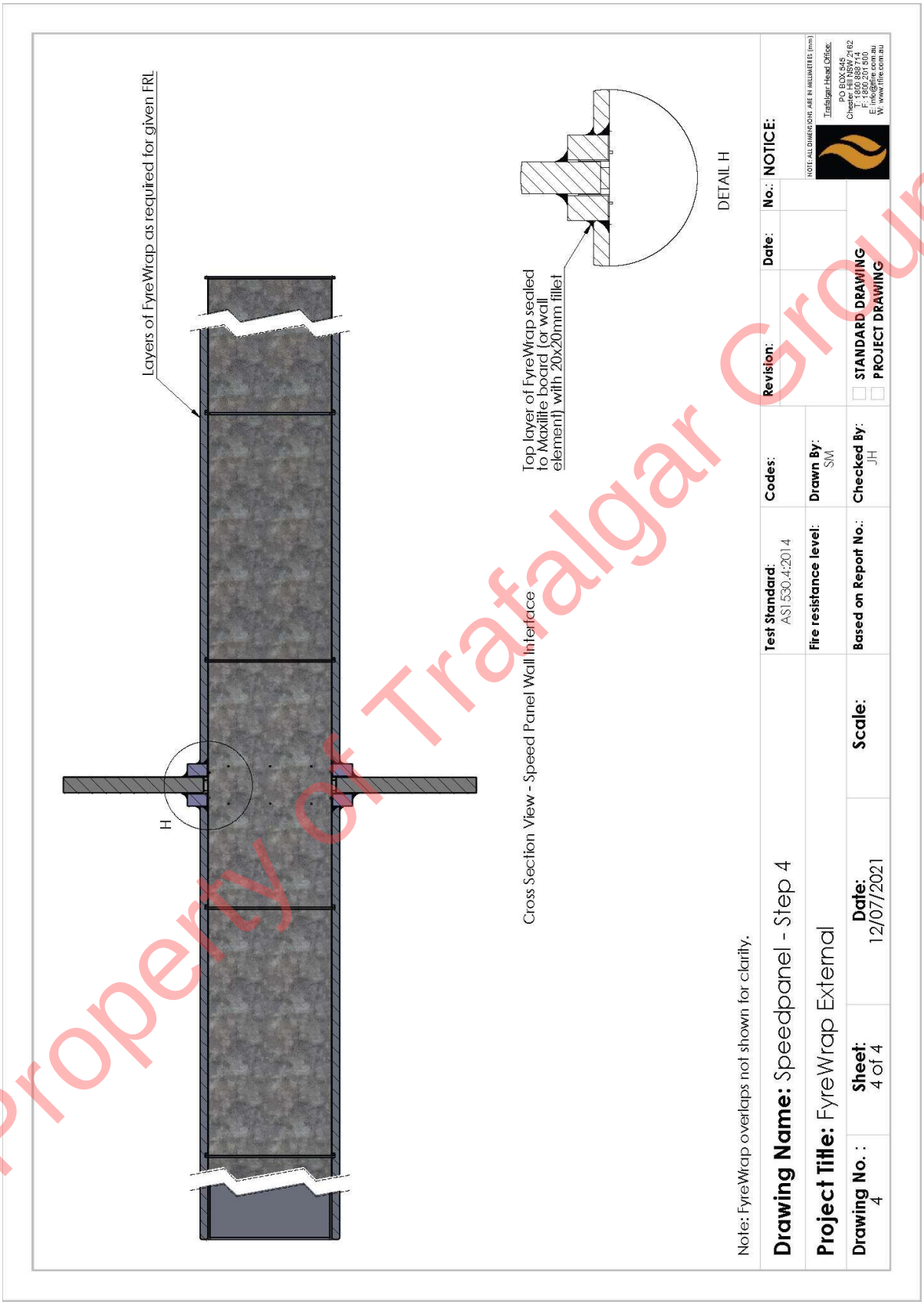

Figure 20: Duct collar – Alternative Installation

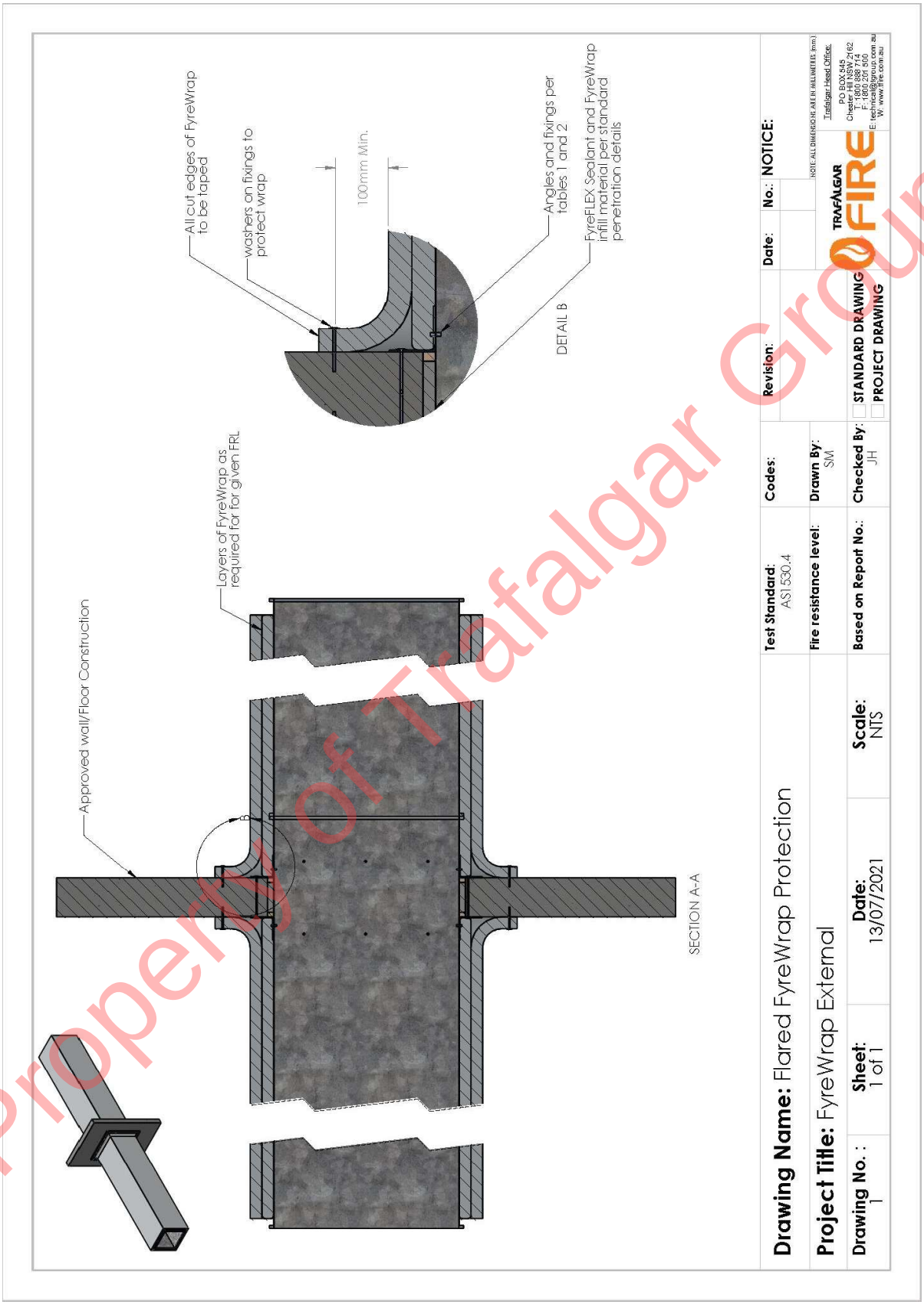

Figure 21: Access Panel Overview

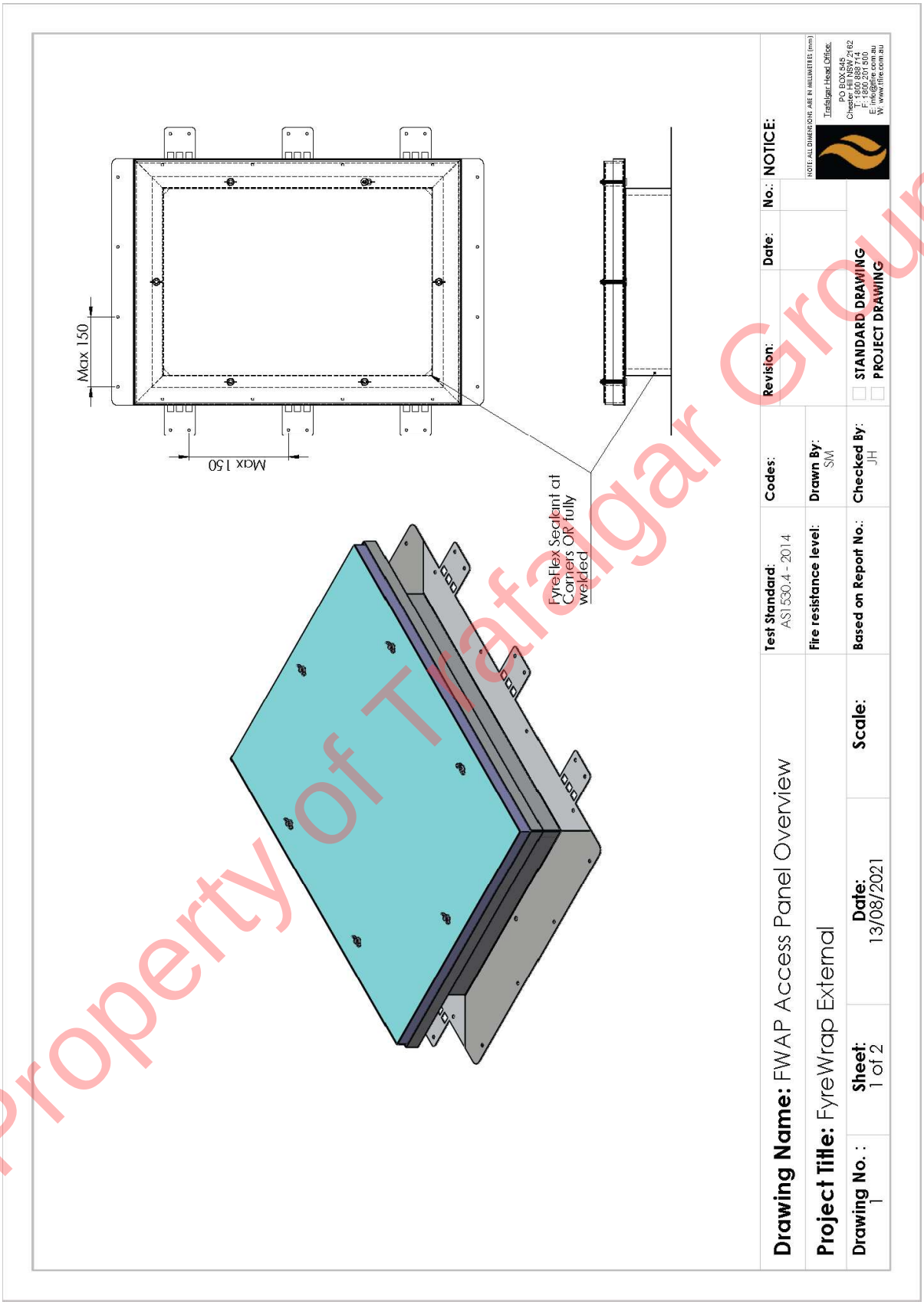

Figure 22: Access Panel Section View 1 (+ strip) and 2 Layer

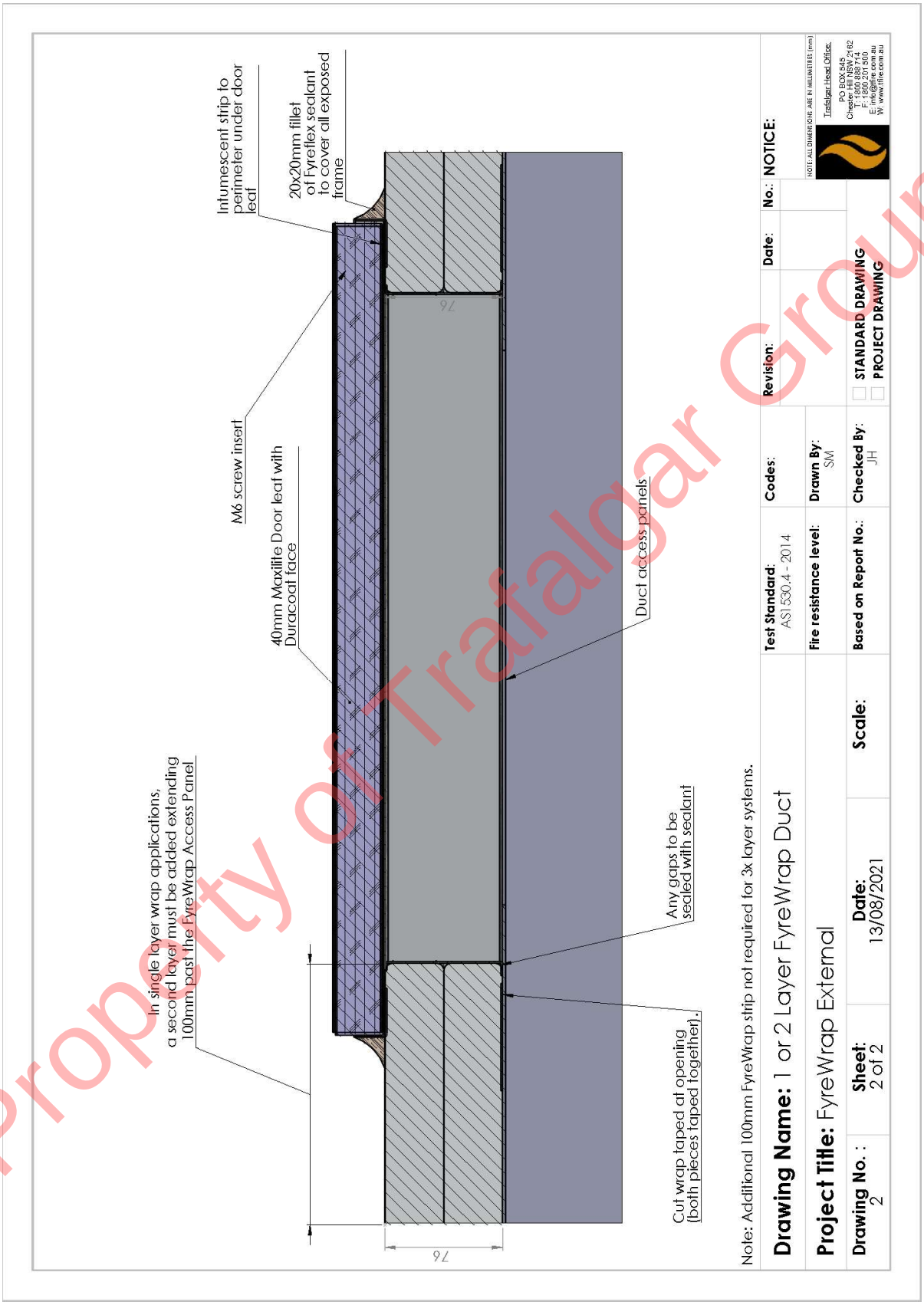

Figure 23: Access Panel Section View 3 Layer

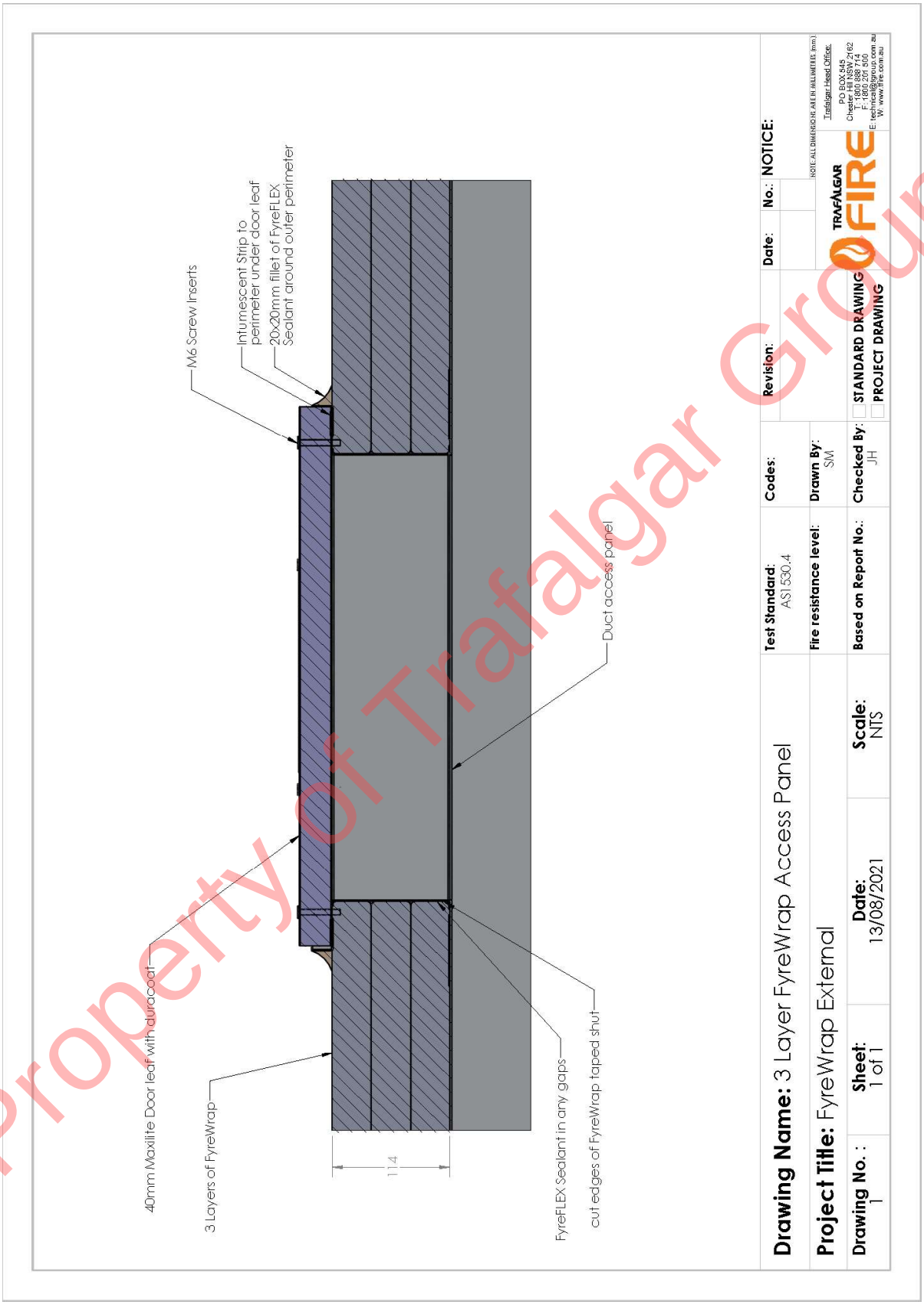

Figure 24: Duct Floor Collar Detail