FAR 3583

Assessment of a Non Load Bearing Continuous Height, Horizontal Orientated Speedpanel Wall Interfaced with a Vertical Speedpanel Wall

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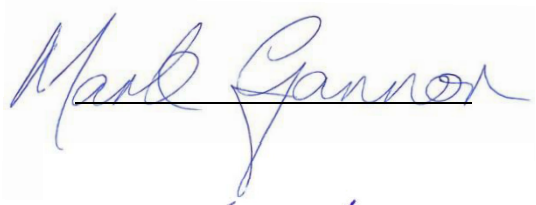

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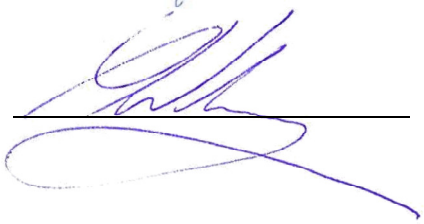

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Assessment of a Non Load Bearing Continuous Height, Horizontal Orientated Speedpanel Wall Interfaced with a Vertical Speedpanel Wall

1. CLIENT

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2. INTRODUCTION

This report gives BRANZ's assessment of the fire resistance of the Speedpanel non-load bearing, pre-cast horizontally aligned wall panels when interfaced between vertically aligned panels that are up to 6,000 mm high. The assessment is limited to horizontal panels with a maximum span of 4,500 mm with an effective continuous height for the abridging horizontal panel walls (internal shaft walls) between the maximum 6,000 mm high vertically aligned Speedpanel walls to the sides. The maximum 6,000 mm high vertical panels are interrupted by a 120 mm wide concrete shaft lintel as designed in Figure 1.

The assessment considers that the assessed design criteria (including the panel-to-panel interfacing) as contained BRANZ assessment reports FAR 3502 and FAR 3454 for the vertically aligned panels for heights up to 4,500 has been followed and as such this assessment report specifically assesses the 4,500 mm long horizontal panels (internal shaft walls) in between the Speedpanel vertically orientated walls.

3. BACKGROUND

3.1 BWA Fire Resistance Test Report 2257600.4

In BWA fire resistance test 2257600.4 the test specimen consisted of a non-loadbearing, Speedwall® panel wall nominally 3,000 mm high by 3,000 mm wide which comprised interlocking panels (tongue and groove), each 285 mm wide x 78 mm thick, of a light weight concrete core with galvanised steel sheathing. Steel C-channels, 54 mm x 83 mm x 54 mm x 1.19 mm thick were fixed to all perimeter edges of the Speedpanel wall.

The perimeter channels were fixed to the specimen concrete frame at the vertical sides but not fixed to the specimen frame top or bottom (i.e. the top and bottom C- track were free edges). The vertical C-channels were fixed to the frame with M8 masonry anchors spaced at 450 mm centres.

The horizontally aligned panels were fixed to the C-Track on the vertical edges at every second panel join at 500 mm centres on the exposed and unexposed face using 35 mm long self tapping screws. Both the top and bottom panels were fixed to the top and bottom C-track at 450 mm centres with 35 mm long self tapping screws.

Additional fixings, using 35 mm long self tapping screws, were located on the first and second horizontal panel joint (from the bottom) at 250 mm and 500 mm centres, respectively.

The channels were sealed to the specimen frame and to the panels at the following locations using Premium Flex Fyreseal acrylic sealant (from the bottom up):

Wall Location	Unexposed Side	Exposed Side
Sides of the Bottom Quarter	No	Yes
Sides of the Second Quarter	Yes	No
Sides of the Top Half	Yes	Yes
Head of the wall	Yes	Yes

Nullifire S707-120 Intumescent paint was applied to the exposed and unexposed inside of the C-track of the upper half and half of the head track on the east side of the specimen wall. No intumescent paint was applied to the west side or lower half of the east side.

A 25 mm clearance gap was provided between the top edge of the panels and the specimen frame, and a 80 mm gap was provided between the specimen frame holder at the bottom. A 10 mm expansion gap was provided at the sides between the panels and side C-track.

The specimen was tested for a duration of 242 minutes in accordance with AS 1530.4-2005 and achieved fire resistance of 128 minutes integrity due to flaming of a cotton pad at a horizontal join in the middle of the upper half of the wall.

After 23 minutes the insulation failure occurred when the temperature recorded on the east side of the bottom quarter channel exceeded the test criterion of 180°C temperature rise (sealant on the exposed side only).

The maximum temperature rise around the perimeter C-track of the wall varied from 23 minutes to 114 minutes failure depended on the application of intumescent paint and/or acrylic sealant.

The temperature rise of the panel exceeded the test criterion of a temperature rise of 180°C above ambient at 15 mm below a horizontal join in the top half of the wall (approximately the mid point of the top half) after 117 minutes

Full details of the construction of the wall and the results achieved are given in BWA fire resistance test report 2257600.4, dated 25 June 2008.

3.2 Branz Fire Resistance Test FR 3754

In BRANZ fire resistance test FR 3754 the test Specimen consisted of a non-load bearing, Speedwall® panel wall nominally 3,000 mm high by 3,000 mm wide which comprised interlocking panels (tongue and groove), of a light weight concrete core with galvanised steel sheathing. Steel angles, 64 mm x 55 mm x 1.15 mm thick were fixed to the top, base and left hand perimeter edges of the wall with bolts. The angles were sealed to the specimen frame and the panels with Bostik Firecaulk fire rated acrylic sealant. The panels were fixed to the angles and to each other with Hilti DB7 6 mm diameter fasteners. Each panel was fixed to the next at 1,000 mm centres on both sides of the vertical joints.

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A 10 mm expansion gap was provided between the top edge of the panels and the specimen frame, and filled with a bead of sealant. A second set of angles was screw fixed to the unexposed face of the panels at the top, base and left hand side with Hilti DB7 fasteners and a bead of sealant was placed between the angles and the panels and specimen frame.

The specimen was tested in accordance with AS 1530.4-1997 and achieved fire resistance of 245 minutes Integrity and 123 minutes Insulation.

Full details of the construction of the wall and the results achieved are given in BRANZ fire resistance test report FR 3754, dated 12 June 2007.

3.3 BRANZ Pilot Fire Resistance Test FP 3904

BRANZ un-reported pilot fire resistance test FP 3904 was carried out on 30 October 2007 at the BRANZ laboratories at Judgeford. The test Specimen consisted of a Speedwall® panel wall nominally 2,200 mm high by 1,000 mm mm wide, identical to that tested in fire resistance test FR 3754, except it included an alternative head detail consisting of a C-channel and Z-flashing strips to each face. The specimen was tested generally in accordance with AS 1530.4-1997, except it was of reduced size. The flashing detail maintained the Integrity criteria for 132 minutes without failure and the Insulation criteria for 130 minutes.

3.4 BRANZ Assessment Report FAR 3107

In BRANZ assessment report FAR 3107 the fire resistance in accordance with AS 1530.4-1997 of the wall tested in BRANZ fire resistance test FR 3754 with the alternative top edge flashing detail tested in FP 3904 was considered to be at least 240 minutes Integrity and 120 minutes Insulation.

3.5 BRANZ Assessment Report FAR 3561

In BRANZ assessment report FAR 3561 the fire resistance in accordance with AS 1530.4-1997 of the wall tested in BRANZ fire resistance test FR 3754 was considered to be at least 120 minutes Integrity and 120 minutes Insulation with:

1) the construction as tested in FR 3754 or alternatively the head detail as tested in pilot fire resistance test FP 3904 as detailed in Figure 1 of Assessment Report FAR 3107; and
2) the construction as tested in FR 3754 or alternatively the bottom and side edge detail consisting of channel sections as tested in FR 3569; and
3) the wall having a maximum height of 4,500 mm; and
4) the screws fixing the panels together at the tongue and groove joints are spaced at 1,500 mm maximum.

3.6 BRANZ Assessment Report FAR 3502

In BRANZ assessment report FAR 3502 the fire resistance in accordance with AS 1530.4-2005 of two walls as tested in BRANZ fire resistance test FR 3754 and spaced 1,000 mm apart with a horizontally aligned Speedpanel wall were considered to be at least 120 minutes Integrity and 120 minutes Insulation. The fixing details of the horizontally aligned intermediate Speedpanel wall is detailed in BRANZ assessment report FAR 3502.

3.7 BRANZ Assessment Report FAR 3454

In BRANZ assessment report FAR 3454 the fire resistance in accordance with AS 1530.4-2005 of a Speedpanel wall in BRANZ fire resistance tests FR 3754 and FR 3569 comprising a 90° junction between another Speedpanel was considered to be at least 120 minutes Integrity and 120 minutes Insulation. The perimeter track detail was required to be the same as that in BWA 2257600 or FR 3569. The fixing details of the Speedpanel 90° angle interfacing is detailed in BRANZ assessment report FAR 3454.

3.8 BRANZ Structural Fire Analysis FAR 3639

In BRANZ assessment report FAR 3639 the overall out-of-plane deflection comprising two components, the sectional thermal gradient and the component due to P-Δ effect were assessed for the vertical and horizontal orientated Speedpanel panels. The assessment report FAR 3639 is valid for panels with a maximum span up to 4,500 mm (aligned horizontally) and panels with a maximum height of 6,000 mm high (aligned vertically). The assessment report also considered the inclusion of an internal panel wall (horizontally aligned) and concluded that the internal wall promoted stiffening within the opposing wall and reduced thermal distortion effects.

The assessment concluded that the proposed Speedpanel configuration(s) as highlighted in Figure 1, when subject to the design constraints discussed in this report, will maintain the required fire resistance rating of 120 minutes integrity and insulation in accordance with AS 1530.4-2005 and AS 1530.4-1997.

4. DISCUSSION

4.1 Test Standard

The fire resistance tests described in section 3.1 and 3.2 were undertaken in accordance with test standard AS 1530.4-2005. The fire resistance tests described in section 3.3, 3.4 and 3.5 were undertaken in accordance with AS 1530.4-1997. The only significant difference between the two versions of the standard with respect to walls is that the 2005 version includes the cotton pad test for determining integrity failure at gaps which develop in the tested specimen.

In test FR 3569 a gap through the specimen was reported after 105 minutes and hot gases could be seen passing out of the joint which was deemed to be an integrity failure. It is therefore considered that if a cotton pad test was applied at this location the specimen would also achieve the same test result if tested in accordance with AS 1530.4-2005.

In test FR 3754 no gaps through the specimen were reported for the 245 minute duration of the test and hence a cotton pad test was not required. It is therefore considered that the specimen would also achieve the same test result if tested in accordance with AS 1530.4-2005.

4.2 Speedpanel Wall Panels

4.2.1 Insulation

It is considered that the relationship between the thickness of the galvanised steel panel sheath, the location of screw fixings and the curvature of the wall greatly influence the walls performance in terms of integrity. This is also true for the effect on

insulation of a wall system. The supporting test evidence reports highlight that the specimens were tested with the minimum number of screw fixings and where the integrity failures occurred in these specimens it mainly occurred due to the panel join opening up which in turn effected the insulation performance of the test specimen.

In the horizontally aligned panel wall tested in fire resistance test BWA 2257600, the thickness of the galvanised steel sheathing of the panels was measured to be 0.22 mm and only every second panel was screw fixed to the vertical track (500 mm centres). No screws were inserted in the "Interlocking" join of the panels except the bottom two panels with screw centres every 250 mm and 500 mm in the first and second panel, respectively.

The wall panel in fire resistance test BWA 2257600 failed the maximum insulation criteria of 180 K rise at a given point located on the second panel down from the head centrally within 15 mm near a panel join after 117 minutes. The panel join above this began to open after 119 minutes.

It is considered that inserting additional screw fixings (as highlighted in Table 1) at each panel join would maintain the insulation of the horizontally aligned wall panels for at least 120 minutes by preventing the joints opening up between panels and reducing heat transfer through the join.

For vertically aligned panels, BRANZ assessment report FAR 3561 is based on the fire resistance tests FR 3754 and FP 3904 for vertically aligned Speedpanel walls and considers walls up to a height of 4,500 mm and achieving at least 120 minutes Integrity and Insulation fire resistance performance. BRANZ structural fire analysis FAR 3639 and BRANZ fire resistance assessment report FAR 3525 considers walls above 4,500 mm and up to 6,000 mm high.

See Table 2 in section 4.3 for the summary of the minimum perimeter channel/track design criteria to provide 120 minutes Insulation.

Table 1

Maximum Wall Width (mm) NOTE 1 **X**	Maximum Wall Height between floor levels (mm) NOTE 1 **Y**	Minimum Panel Galv. Steel Sheath Thickness (mm)	Maximum Fixing Centres at the Panel Interlock Join NOTE 2 (mm)
Horizontal Orientated Speedpanel Walls			
4,500	Unlimited	0.44	1,500
Vertically Orientated Speedpanel Walls (Side Walls Between Floors)			
Unlimited	4,500	0.44	1,500
Unlimited	6,000	0.44	750

NOTE 1 Subject to similar design of Figure 1 where the horizontal panels are interfaced with vertical panels of the same construction. See Figure 1 for the location of the X and Y components

NOTE 2 Located at each interlocking panel junction.

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Table 1 also includes the maximum fixing centres at the panel interlock join which is based on section 4.2.2

4.2.2 Integrity

4.2.2.1 Horizontally Aligned Panels

The vertical movement of the panels in fire resistance test BWA 2257600 was limited to approximately 10 mm downwards movement for the 242 minute duration of the test indicating that the panels are largely self supporting and did not experience excessive sagging.

The wall failed Integrity after 128 minutes in this test due to the panel join (which had no screw fixings) located between the top panel and second from the top panel opening up and emitting hot gases. The panel joins of the bottom two panels remained closed for the 242 minute duration of the test due to the screw fixings.

Therefore based on fire resistance test BWA 2257600 with the addition of screw fixings at 1,500 mm centres (as highlighted in Table 1) and the increased thickness of the galvanised steel sheath, it is considered that the Speedpanel wall up to 4,500 mm wide would achieve at least 120 minutes fire resistance performance in terms of Integrity.

4.2.2.2 Vertically Aligned Panels

BRANZ assessment report FAR 3561 considered that on the basis of the vertical panel joints as tested in FR 3754 could be fixed together at 1,500 mm centres without prejudice to integrity for 4,500 mm high vertical panels for 245 minutes.

Furthermore, the Integrity performance of the vertically aligned panels in fire resistance test BWA 2286900 demonstrated that a 3,000 x 3,000 mm loaded Speedpanel wall (to simulate a 6,000 mm high wall) did not experience any Integrity failure for at least 120 minutes.

Therefore based on BWA 2286900 and FAR 3561 with the addition of screw fixings as highlighted in Table 1 it is considered that the non-load bearing Speedpanel wall up to 6,000 mm high would achieve at least 120 minutes fire resistance performance in terms of Integrity

See Table 2 in section 4.3 for the summary of the minimum perimeter channel/track design criteria to provide 120 minutes Integrity.

4.2.3 Increase in Speedpanel Panel Height and Width

Based on curvature calculations from the supporting test evidence reports and FAR 3639, the centre of curvature for a 6,000 mm vertical panel wall is determined to have a deflection approximately twice that of a 4,500 mm high wall.

It is therefore considered that for vertical panels above 4,500 mm and up to 6,000 mm high, halving the distances of the screw fixings centres conservatively to 750 mm vertically at the interlocking joins and using a galvanised steel sheathing thickness of at least 0.44 mm will maintain the Integrity performance of the panels for at least 120 minutes

For a horizontally orientated panel the deflection will approximately double when increasing the span from 3,000 mm to 4,500 mm wide, however the introduction of screw fixings located at 1,500 mm centres in the wall for horizontally aligned panels will prevent premature separation occurring between the panel interlocking joins. Thereforeit is considered that increasing the width of the horizontal panels to 4,500 mm

with screw fixings at maximum centres 1,500 mm would not prejudice the Integrity performance of the 0.44 mm thick panel galvanised steel sheathing before at least 120 minutes.

4.3 Perimeter Track Design

The supporting test evidence reports and assessment reports such as FP 3904, FR 3754, FAR 3107 and FAR 3525 or EWFA 22551-01 describe the construction of the different perimeter tracks, configuration, size and fixing details etc. that will provide a minimum Integrity and Insulation performance of at least 120 minutes.

Therefore, the design criteria of the perimeter track for the Speedpanel walls covered by this assessment will provide a fire resistance performance in terms of Integrity and Insulation for Speedpanel walls with vertically orientated panels for heights up to 6,000 mm and horizontally orientated panels up to 4,500 mm wide.

Table 2

Maximum Wall Width (mm) NOTE 1 **X**	Maximum Wall Height between floor levels (mm) NOTE 1 **Y**	Assessment Report Containing the Minimum Perimeter Track Design Details
Horizontal Orientated Speedpanel Walls		
≤ 3,000	Unlimited	FAR 3107, FAR 3561, FP 3904 and FR 3754 NOTE 2
≥ 3,000 ≤ 4,500	Unlimited	FAR 3525 or EWFA 22551-01 NOTE 2
Vertically Orientated Speedpanel Walls		
Unlimited NOTE 3	4,500	FAR 3107, FAR 3561, FP 3904 and FR 3754
Unlimited NOTE 3	6,000	FAR 3525 or EWFA 22551-01

NOTE 1 Subject to similar design of Figure 1 where the horizontal panels are interfaced with vertical panels of the same construction. See Figure 1 for the location of the X and Y components.

NOTE 2 The vertical centre fixing distance of the panels to the side track for panels ≤ 3,000 mm wide is 500 mm (every second panel) and for panels >3,000 mm but ≤4,500 the vertical fixing distance to the side track is 250 mm (every panel).

NOTE 3 Unlimited overall wall width in the Z direction. See Figure 1 for the location of the Z component (Plan View).

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4.4 Panel Junction Detail

Figure 1 highlights the two types of Speedpanel Interface details. The minimum design criteria as described in BRANZ assessment reports FAR 3454, FAR 3502 and FAR 3525 should be incorporated into the interface design. This assessment only covers where the wall is exposed to fire conditions from one side only.

Table 3

Maximum Wall Width (mm) **X**	Maximum Wall Height between floor levels (mm) NOTE **1** **Y**	Assessment Report Containing the Minimum Panel Junction Design Details
Horizontal Orientated Speedpanel Walls		
≤ 3,000	Unlimited	FAR 3454 and FAR 3502
≥ 3,000 ≤ 4,500	Unlimited	FAR 3525 or EWFA 22551-01
Vertically Orientated Speedpanel Walls		
Unlimited **NOTE 2**	4,500	FAR 3454 and FAR 3502
Unlimited **NOTE 2**	6,000	FAR 3525 or EWFA 22551-01

NOTE 1 Subject to similar design of Figure 1 where the horizontal panels are interfaced with vertical panels of the same construction. See Figure 1 for the location of the X and Y components.

NOTE 2 Unlimited overall wall width in the Z direction. See Figure 1 for the location of the Z component (Plan View).

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5. CONCLUSION

It is considered that the Speedpanel non-load bearing, pre-cast, concrete vertical and horizontal panel wall system as highlighted in Figure 1 would achieve a fire resistance, in accordance with AS 1530.4-1997 and AS 1530.4-2005, of at least 120 minutes Integrity and 120 minutes Insulation with the minimum design criteria contained in section 4 and summarised in Table 4 (see page 12).

6. LIMITATION

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

BRANZ reserves the right to amend or withdraw this report should additional information become available regarding the fire performance of the product assessed herein.

This assessment considers:

1. The wall and/or shaft Speedpanel systems discussed within the report are exposed to fire conditions from one face only.
2. All walls in the systems are non-load bearing.
3. The combined load of the “X” walls onto the “Y” vertical wall (as highlighted in Figure 1) should not exceed 180 kg per linear meter. Variations to this limitation will require structural analysis on a project specific basis.
4. Where the perimeter tracks pass through a floor slab, they should be overlapped by at least 350 mm and in all cases should additionally be fixed using a minimum size M8 steel bolt penetrating the floor slab edge, centrally, by at least 50 mm.
5. Subject to the shaft wall lintels and perimeter wall construction being structurally adequate under ambient conditions.

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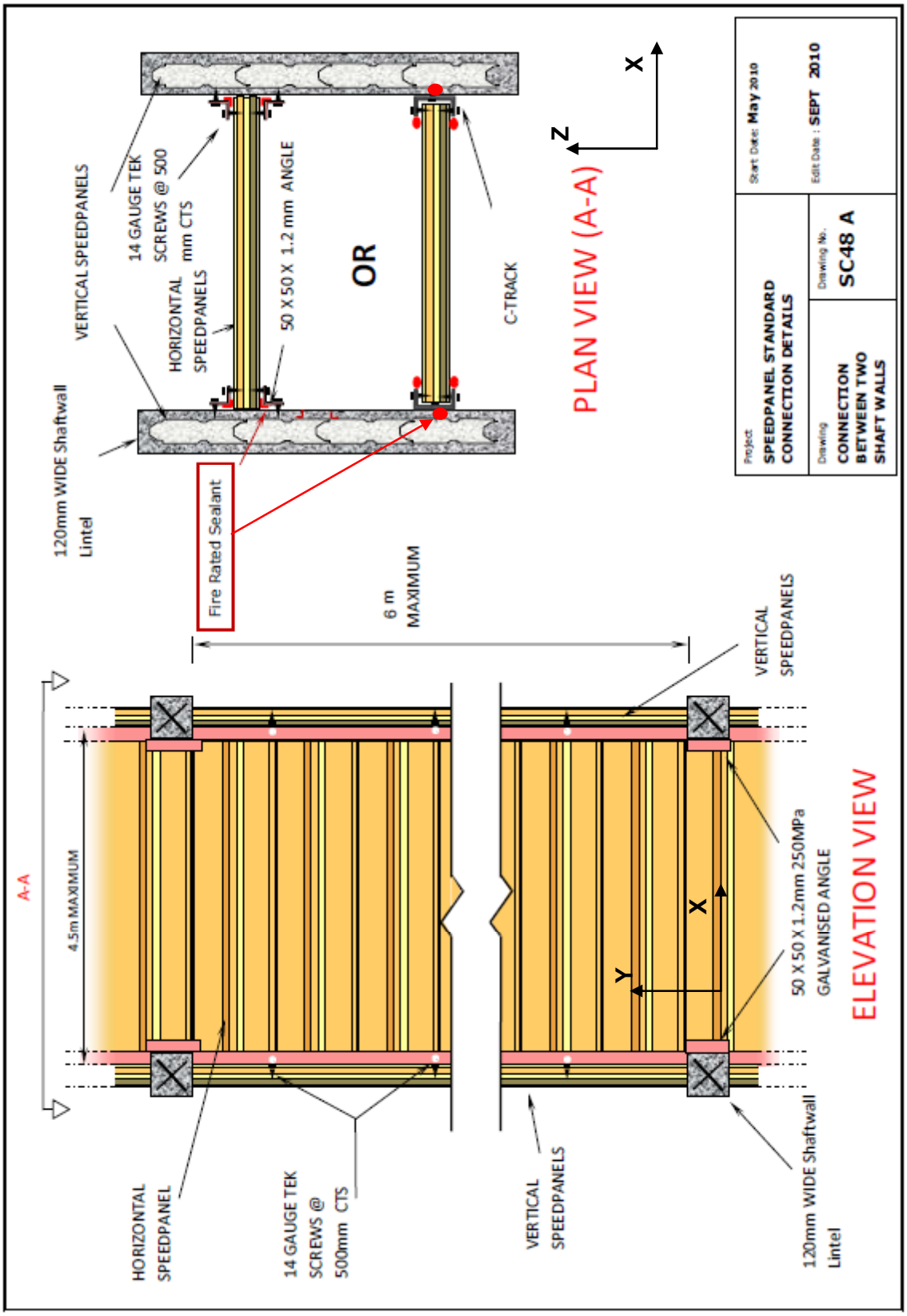
Table 4 –Summary Installation Guide

	Up to 4,500 mm high side vertical panel walls between floor slabs (Y-Direction)	Minimum angle thickness and size for vertical panel orientation (Figure 1 page 13)	Minimum C-track thickness and size for vertical panel orientation (Figure 1 page 13)	Minimum C-track thickness and size for horizontal panel orientation	Above 4,500 mm up to 6,000mm high side vertical panel walls between floor slabs (Y-Direction)	Minimum angle thickness and size for vertical panel orientation (Figure 1 page 13)	Minimum bottom C-track thickness and size for vertical panel orientation (Figure 1 page 13)	Minimum C-track thickness and size for horizontal and head track application for walls in the Y-Direction (Figure 1 page 13)
Maximum width X direction	4,500 mm	50x50mm Bmt 1.2mm 250 Mpa *	55x80 mm internal Clearance Bmt 1.2mm 250 Mpa *	50x50mm Bmt 1.2mm 250 Mpa *	4,500 mm	50x50mm Bmt 1.2mm 250 Mpa *	50 X 80mm internal Clearance Bmt 1.2mm 250 Mpa *	90 X 80mm internal Clearance Bmt 1.2mm 250 Mpa * Shielded Ctrack
Vertical side wall screw fixing distance	1,500 mm				750 mm			
Horizontal shaft wall screw fixing distance (panel to panel)	250 mm centre fixings on the bottom panel **and** 500 mm centre fixings on the second from the bottom panel **and** 1,500 mm centre fixings therafter				250 mm centre fixings on the bottom panel **and** 500 mm centre fixings on the second from the bottom panel **and** 1,500 mm centre fixings therafter			
Minimum panel galv. Steel sheath thickness	0.44 mm				0.44 mm			
Vertical fixing distance side track	Panels ≤ 3,000 mm wide - **500 mm** (every second panel) Panels >3,000 mm but ≤4,500 wide - **250 mm** (every panel)				Panels ≤ 3,000 mm wide - **500 mm** (every second panel) Panels >3,000 mm but ≤4,500 wide - **250 mm** (every panel)			
Assessment report containing the minimum perimeter track design	FAR 3107, FAR 3561, FP 3904 and FR 3754				FAR 3525 and EWFA 22551-01			
Assessment report containing the minimum panel junction design details	FAR 3454 and FAR 3502				FAR 3525 or EWFA 22551-01			

* 250 Mpa indicates that the Angle /C-Track is "Grade-250" mild steel

Figure 1 – Horizontal and Vertical Speedpanel Configuration



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