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IFC ASSESSMENT REPORT PAR/9720/03

Assessment of the Fire Resistance of LP[®] SolidStart[™] Rim Board system installed in Engineered Timber Joist Floors for 30, 60 and 90 minutes fire resistance performance to BS476: Part 21 & 22: 1987 depending upon the application

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ISSUE RECORD

Issue	Date	Recipient	Comments
Original	13/05/09	C4CI Limited	In electronic (pdf) and hard copy format
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Draft	18/06/09	LP [®] Building Products	In electronic (pdf)
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Draft	29/07/11	LP [®] Building Products	In electronic (pdf)
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AMENDMENT RECORD

Date	Paragraph	Amendment

Revision	PAR/9720/01	PAR/9720/02	PAR/9720/03			
Author	RK	RK	RK			
Reviewer	PEJ	PEJ	PEJ			

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FIGURES PAR/9720/03:01 AND 02

1. INTRODUCTION

This report has been produced by International Fire Consultants Ltd (IFC) for our assessment of the fire resistance of LP[®] SolidStart™ Rim Board system and I-Joist blocking systems, to be installed in engineered timber joist floors. IFC have performed the evaluations/analysis, and preparation of the assessment report, on the instruction of LP Building Products.

Fire resisting assemblies are rarely supplied in an identical form to that which was tested. The specification will invariably require the construction to be supplied at a size, at different joist centres, with different linings, spans, etc. which are different from that tested. The result of a fire resistance test can apply to variations in configuration/construction, as long as they do not reduce the performance to one which is below that specified. The influence of those variations is covered by a judgement, sometimes made by the approving authority.

Where the approving authority does not feel technically able to make such judgements, or, does not wish to take responsibility for them, then a third party expert opinion is often sought. Such an opinion is often expressed in the form of an assessment of the performance, which may be supported by numerical/quantifiable methods or may be purely an expert judgement.

When establishing the variations in the construction that can achieve the required fire resistance performance, IFC follow the guidance given in BS.ISO/TR12470: 1998, *"Fire resistance tests - Guidance on the application and extension of results"*.

Where Building Regulations guidance requires that Fire Safety Information is given to the 'Responsible Person' [as defined under the Regulatory Reform (Fire Safety) Order 2005] for a building or project, an Assessment is used to provide essential information upon the design, construction and performance of relevant fire resisting assemblies.

The assessment is based upon the constructional information supplied to us (detailed in Section 2) and upon the fire resistance test evidence for parts of the constructions (detailed in Section 3). A full analysis of the fire resistance performance of these assemblies is presented in Section 4.

This report supersedes reports PAR/9720/01 and PAR/9720/02.

2. PROPOSAL

It is proposed that this Assessment Report shall establish the fire resistance performance of LP[®] SolidStart™ Rim Board system and LP[®] SolidStart™ Rim Board Blocking, to be installed in engineered timber joist floors, if they were to be tested to the integrity, insulation and loadbearing capacity criteria of BS476: Part 21: 1987, *"Methods for determination of the fire resistance of load-bearing elements of construction"*.

The assessed LP[®] SolidStart[™] Rim Board system and LP[®] SolidStart[™] Rim Board Blocking are generally based upon details shown on the drawings and/or schedules, provided by C4CI Limited, copies of which are kept on file by IFC for reference. The construction and details of the assemblies are summarised in Sections 2.1 to 2.4, below, but the documents should be read in conjunction with this report for full interpretation. Anyone using this report should verify that copies of documents in their possession match those copies which are kept on file by IFC. If variations occur between details described herein and those on the relevant documents, the former shall take precedence. Otherwise IFC should be contacted for clarification. Refer to Section 6 for recommendations with respect to audit and verification of the manufactured/installed assemblies.

2.1 LP[®] SolidStart[™] Rim Board system

Rim Boards are used as edge binders and load transfer members for timber floor assemblies, and also serve a purpose as fire separating components.

Two types of LP[®] SolidStart[™] Rim Board system are covered by this assessment:

- i) LP[®] SolidStart[™] Rim Board system fabricated from laminated strand lumber (LSL)
- ii) LP[®] SolidStart[™] Rim Board system LVL Rim Board fabricated from cross banded laminated veneer lumber.

Note: Louisiana-Pacific[®] and LP[®] are registered trademarks and SolidStart[™] and LPI[™] are trademarks of Louisiana-Pacific[®] Corporation. © 2009 Louisiana-Pacific[®] Corporation.

Both these types are manufactured by LP[®] Building Products. These are of reconstituted timber, the LSL is of strands arranged and bonded in a linear orientation, and the LVL which has laminated veneers bonded together. The cross banded designation of the latter refers to two of the veneers which are orientated at 90° to the other to provide an enhanced vertical load capacity.

Both types of LP[®] SolidStart[™] Rim Board system are available in the following thicknesses which are specified to suit the site load conditions:

- 29mm
- 32mm
- 38mm
- 45mm
- 51mm

The height (width) of the LP® SolidStart™ Rim Board system must match the height (depth) of the engineered joists. LP® SolidStart™ Rim Board are nailed across the ends of the joists, or in line with the joist (depending on joist orientation) and in line with the void face of the wall frame assembly.

30 minutes fire resistance performance

A single 29mm thick, LP® SolidStart™ Rim Board is sufficient to satisfy the loadbearing, integrity and insulation criteria for 30 minutes. There is no requirement to install blocking between joists.

60 and 90 minutes fire resistance performance

In addition to the LP® SolidStart™ Rim Board system lining the void, LP® SolidStart™ Rim Board of the same width and thickness is used as blocking between joists, or continuous blocking where 'in line' with joists.

2.2 Web Stiffeners/Backing Blocks

30 minutes fire resistance performance

There is no requirement to install Web Stiffeners or Backing Blocks.

60 and 90 minutes fire resistance performance

Web Stiffeners or Backing Blocks should be installed. The Web Stiffeners or Backing Blocks comprise plywood, sawn timber or OSB packs which have been cut to shape and filled between the joist webs (see Section 2.1). These should be cut or shaped to fit the void profile of the engineering joists, i.e. width: half the joist width less half the web thickness; height: joist depth less 2 x flange thickness less 3mm. Plywood, timber or OSB packers are inserted adjacent to the blocking on each side to fill the void between the end of the blocking and web of the I-Joist. This is nailed to the I-Joist web between the I-Joist flanges.

2.3 Floor Construction

The floor assembly (or cassettes) comprises engineered I-Joists faced on all faces by LP® SolidStart™ Rim Board system. The joists are set at 600mm centres, or less.

The floors are decked with flooring grade tongue and grooved chipboard, OSB or plywood, and lined (underdrawn) by a single layer of one of the following board types where a 30 minute fire resistance performance is required:

- 12.5mm or 15mm fire performance-enhanced plasterboard
- 15mm sound performance-enhanced plasterboard
- 15mm standard wallboard plasterboard

The plasterboard should be orientated as shown in **Figure PAR/9720/03:02**, which also shows a detail of a plaster 'hook-over joint to be used where the lateral joints are not backed by plasterboard or timber noggins.

2.4 Wall Construction

Wall construction is a standard timber frame twin-leaf party wall conforming to robust detail EWT-1 (2 off 38 x 89mm timber studs with 2 layers of plasterboard and enclosing acoustic quilt). At the floor level and in the void within the compartment separation, a vertical fire stop is formed by MRF insulation. See **Figure PAR/9720/03:01** for sectional details.

3. TEST EVIDENCE

The LP® SolidStart™ Rim Board system and I-Joist blocking system installed in engineered timber joist floors have not been tested for fire resistance performance in the form and/or configuration proposed, hence the requirement for this assessment of fire resistance performance.

Applicable fire resistance test evidence does exist for specific elements of the proposed timber construction, and this can be used to form the basis of the technical evaluation.

Test evidence of fire resistance is not available to support the use of LP® SolidStart™ Rim Board system, LP End Blocks or LP Engineered Joists, however BBA Agrément Certificates 09/4634 and 09/4660 have been issued. These are summarised in Section 3.1 to 3.2 below:

3.1 BBA Certificate 09/4660 – Title '*LP® SolidStart™ I-Joist system*'

Scope 'This Certificate relates to LP® SolidStart™ I-Joist system LPI 20 and 32 series and LPI 26, 30, 36 and 56 Series Joists, for use as structural members, for example as floor or roof joists, beams, rafters, wall studs or ceiling ties'.

This certificate addresses the physical and mechanical qualities and production details of the complete series of LPI joists, in particular providing the loading details for the range of joists covered by the certificates.

This certificate does not specifically address the fire resistance properties of the joists, referring only to this being dependent on the design and specification of the materials cladding the joists (see 7.3 of BBA Cert 09/4460). This certificate also quotes the Class 3 surface spread of flame classification (in accordance with BS476: Part 7) or D-S2,d0. As the joists are deemed combustible, for ignitability purposes they can be designated P in accordance with BS476: Part 5: 1979.

3.2 BBA Certificate 09/4634 – Title 'LP® SolidStart™ LVL system'

Scope 'This Certificate relates to LP® SolidStart™ LVL (Laminated Veneer Lumber), a wood based material for use in structural members (e.g. beams, joists, lintels, rafters, ties, struts) or structural framing, and also for the fabrication of built up components such as trusses and panels'.

4. ANALYSIS

Evaluation of the fire resistance of the proposed assemblies for installation in timber framed walls and floor cassettes will address the factors that influence the overall fire resistance performance of timber components under the fire test conditions of BS476: Parts 21 and 22: 1987. These include the following:

- Ceiling lining
- Web stiffeners
- LP® SolidStart™ Rim Board system

All assemblies will be assessed in respect of the integrity and insulation criteria defined in BS476: Part 20: 1987 for a 'compartment to compartment' fire resistance of 30, 60 or 90 minutes.

4.1 Fire Resistance of Ceiling Lining

The overall fire resistance of the LP® SolidStart™ Rim Board system and Web Stiffener/I-Joist blocking systems incorporated into the floor system is dependent on the performance of the floor decking, ceiling lining and wall cladding.

With regard to the floor/ceiling construction, the ceiling forms a membrane with the object of protecting the void between the ceiling and the flooring from excessive heat. If the ceiling, or parts of the ceiling fall away, hot gases penetrate into the floor void and cause ignition of the timber joists. The fire resistance of the joists when fully exposed is typically between 4 and 6 minutes, so they are normally underdrawn by a ceiling lining of plasterboard. In this case, each dwelling should have timber floor systems having a ceiling lining of at least 26 minutes fire resistance.

To provide a minimum fire resistance performance of 30 minutes the plasterboard must, therefore, stay in place for at least 26 minutes. The major plasterboard manufacturers publish tables of fire resistance performance for a large range of configurations using their products, and for 30, 60 and 120 minute periods of fire resistance. Typical linings for a 30 minute period would be a single layer of 12.5mm plasterboard having a fire enhanced performance (e.g. Fireline), a single layer of 15mm plasterboard having a sound enhanced performance (e.g. Soundbloc), or a single layer of 15mm standard wallboard plasterboard. The plasterboard should be orientated so that the long side is perpendicular with the line of the joists to provide optimum stiffening, and the unbacked lateral edge joists must be plugged with a 'hook-over' type plaster seal (see **Figure PAR/9720/03:02**)

Whichever system is used it should have documentation to support its claimed combined loadbearing performance of 30 minutes fire resistance in accordance with BS476: Part 21: 1987, and the gypsum plasterboard must be handled carefully and installed in accordance with the manufacturers instructions.

The decking of the floor will also deteriorate in a fully developed fire (above the floor), although 'burning downwards' is not so rapid or as onerous as upward fire spread. A 22mm thick moisture resisting tongue and groove chipboard is a fairly standard form of decking and would be deemed acceptable, as would 18mm OSB or plywood.

4.2 Web Stiffener (Blocking) Performance

Once the ceiling or decking has burnt through, the fire will penetrate through to the void and the I-Joists will be consumed. The I-Joist web being thin will be consumed, rapid deflection of the joists will occur followed by failure of the floor.

It is important that the fire does not penetrate the void. This function is performed by the Rim Board, Web Stiffener or Backing Block elements. The accepted rate of charring (see BS5268: Part 4: Section 4.1: 1978) for LVL or LSL timber types is stated to be 20mm per 30 minutes (0.67mm per minute).

30 minutes fire resistance performance

For the 30 minutes solution a web stiffener or blocking is not installed. Therefore the LP[®] SolidStart[™] Rim Board will be directly exposed to fire conditions after the fire has penetrated the ceiling void. See section 4.3 for analysis of the Rim Board.

60 and 90 minutes fire resistance performance

An end stop which has a blocking member thickness of 45mm, at least 50% of the material will remain after 60 minutes total fire exposure time. This allows for a certain amount of charring resulting from a raised temperature in the ceiling void prior to the penetration of the fire at 30 minutes or soon after.

Table 1 in Section 5 refers to minimum thickness for blocking thicknesses for 30, 60 and 90 minutes overall fire resistance performance.

4.3 LP® SolidStart™ Rim Board system Performance

The LP® SolidStart™ Rim Board system is also required to provide a barrier to prevent fire penetrating the void in the party wall. (This is a lined compartment requiring 30, 60 or 90 minutes fire resistance).

30 minutes fire resistance performance

Providing the fire resistance of the ceiling lining is at least 26 minutes the LP® SolidStart™ Rim Board will be directly exposed to fire conditions for $30 - 26 = 4$ minutes. The charring depth of a single 29mm thick LP® SolidStart™ Rim Board after a heating time of 4 minutes is $4 \times 0.67\text{mm}/\text{min} = 2.67\text{mm}$. Therefore the remaining thickness of the LP® SolidStart™ Rim Board will be $29 - 2.67 = 26.33\text{mm}$. Hence, more than 90% of the material will remain after 30 minutes total fire exposure time.

60 and 90 minutes fire resistance performance

The LP® SolidStart™ Rim Board system is also required to support the timber frame above the floor line. In this case two Rim Boards, or LP® SolidStart™ Rim Board system plus blocking, should be used. The inner LP® SolidStart™ Rim Board system would then be sacrificial with approximately 75% of the thickness consumed. The remaining LP® SolidStart™ Rim Board system will then still be able to support the loading of the structure above.

Table 1 in Section 5 refers to minimum thicknesses for LP® SolidStart™ Rim Board system for 60 and 90 minutes overall fire resistance performance.

5. CONCLUSIONS

It is the opinion of International Fire Consultants Ltd that, if the proposed LP® SolidStart™ Rim Board system and End Blocks to be installed as perimeter elements in engineered timber joist floors were manufactured and installed in accordance with the requirements of this Assessment Report, and tested for fire resistance, the timber components would satisfy the integrity and insulation criteria given in BS476: Part 20: 1987 when tested either to BS476:Part 21 when part of a loadbearing system or to Part 22 when installed without load, for the overall proposed period of 30, 60 or 90 minutes (compartment to compartment) in accordance with the following table:

	30 min FR	60 min FR	90 min FR	Alternative 90 min
Minimum blocking thickness	-	29mm	45mm	2 x 29mm
Minimum rim board thickness	29*mm	29*mm	32*mm	1 x 29*mm

**Note: The LP[®] SolidStart[™] Rim Board system thickness would need to be increased for buildings requiring a greater loadbearing capability than 1.5kN/m²*

Table 1: Minimum blocking and LP[®] SolidStart[™] Rim Board thicknesses

6. LIMITATIONS

This Assessment Report, which is only valid for LP[®] SolidStart[™] Rim Board system and LP[®] SolidStart[™] Rim Board Blocking installed in engineered timber joist floors, addresses itself solely to the ability of the assemblies described to satisfy the criteria of the fire resistance test. It does not imply any suitability for use with respect to other unspecified criteria.

This document only considers the timber components described herein, and assumes that the surrounding construction will provide no less restraint than the tested assembly, and that it will remain in place and be substantially intact for the full fire resistance period.

Where the constructional information in this report is taken from details provided to International Fire Consultants Ltd (IFC) and/or from fire resistance test reports referenced herein, it is, therefore, limited to the information given in those documents. It is necessarily dependent upon the accuracy and completeness of that information. Where constructional or manufacturing details are not specified, or discussed herein, it should not, therefore, be taken to infer approval of variation in such details from those tested or otherwise approved.

Where the assessed constructions have not been subject to an on-site audit by International Fire Consultants Ltd, it is the responsibility of anyone using this report to confirm that all aspects of the assemblies fully comply with the descriptions and limitations herein.

Any materials specified in this report have been selected and judged primarily on their fire performance. IFC do not claim expertise in areas other than fire safety. Whilst observing all possible care in the specification of solutions, we would draw the reader's attention to the fact that during the construction and procurement process, the materials used should be subjected to more general examination regarding the wider Health and Safety, and CoSHH Regulations.

This Report is provided to the sponsor on the basis that it is a professional independent engineering opinion as to what the fire performance of the construction/system would be should it be tested to the named standard. It is IFC's experience that such an opinion is normally acceptable in support of an application for building approvals, certainly throughout the UK and in many parts of Europe and the rest of the world.

However, unless IFC have been commissioned to liaise with the Authorities that have jurisdiction for the building in question for the purpose of obtaining the necessary approvals, IFC cannot assure that the document will satisfy the requirements of the particular building regulations for any building being constructed.

It is, therefore, the responsibility of the sponsor to establish whether this evidence is appropriate for the application for which it is being supplied and IFC cannot take responsibility for any costs incurred as a result of any rejection of the document for reasons outside of our control. Early submittal of the Report to the Authorities will minimise any risks in this respect.

In compiling this assessment, International Fire Consultants Ltd have used judgmental data from other organisations, the quality or accuracy of which we have no control over. We have not had access to the original data and, therefore, IFC are not in a position to evaluate its technical validity. Should any failure be alleged of the product as a result of the quality of this information, International Fire Consultants Ltd cannot be held responsible.

7. VALIDITY

This assessment has been prepared based on International Fire Consultants Ltd's present knowledge of the products described, the stated testing regime and the submitted test evidence. For this reason anyone using this document after August 2016 should confirm its ongoing validity.

Prepared by:



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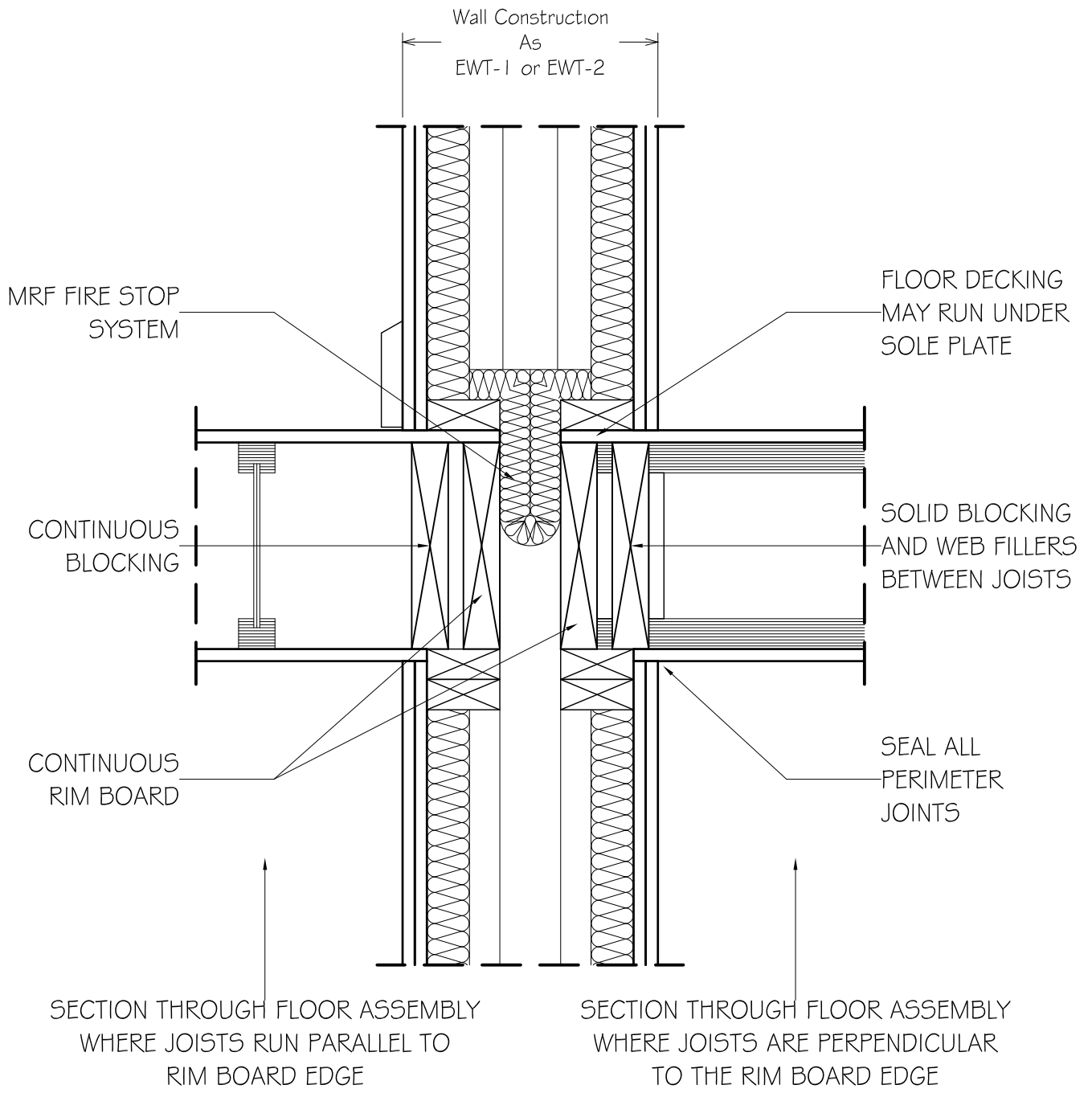


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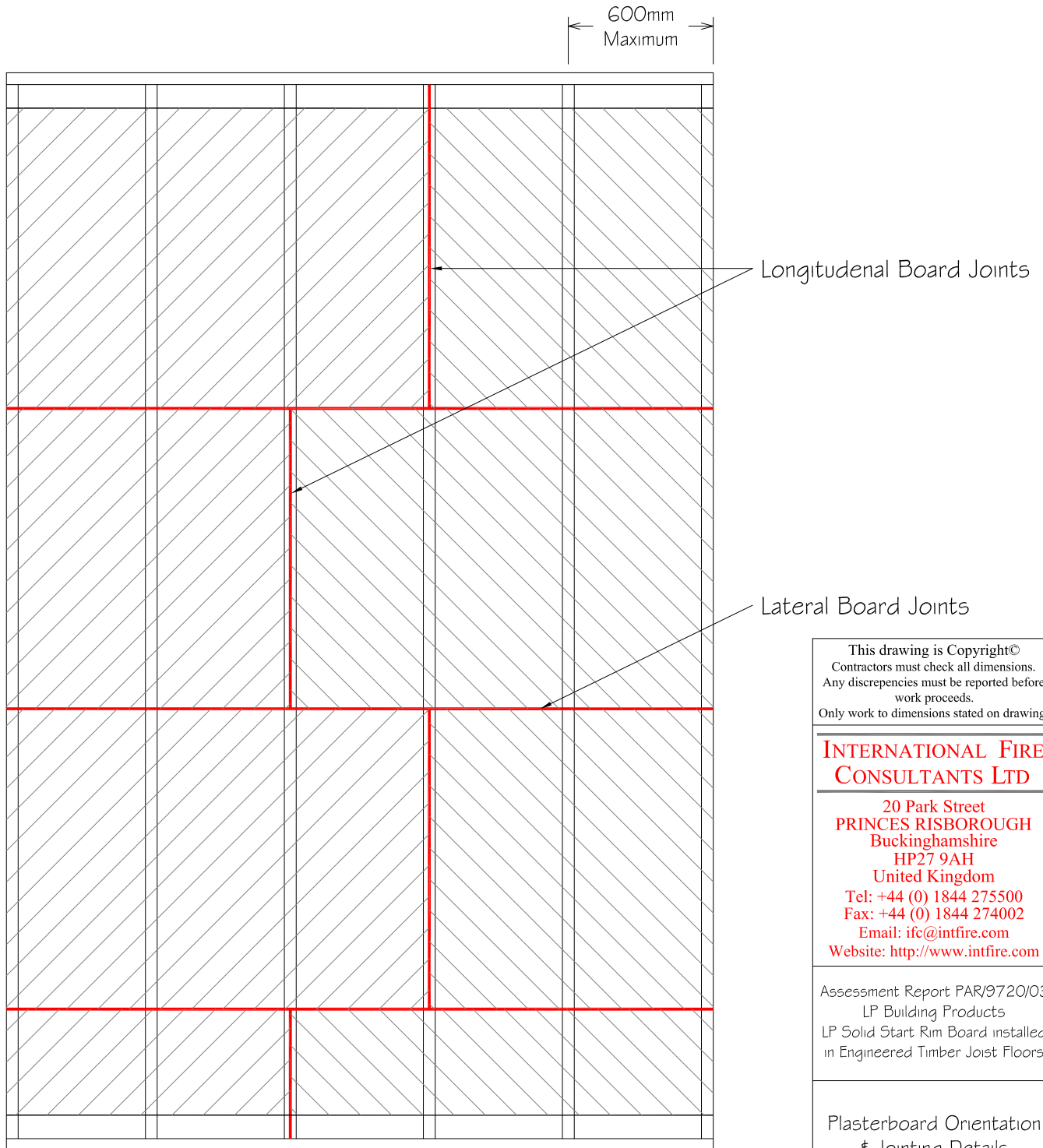
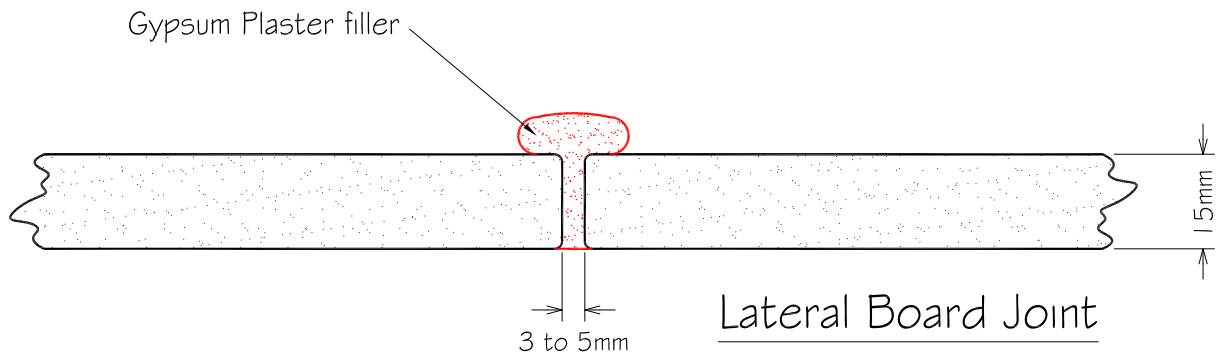
APPENDIX A

Figures PAR/9720/03:01 and 02

*The figures in this Appendix are not included
in the sequential page numbering of this report.*



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<p>Assessment Report PAR/9720/03 LP Building Products LP Solid Start Rim Board installed in Engineered Timber Joist Floors</p>	<p>Arrangement at Intermediate Floor/Party Wall Junction</p>	<p>Job number : 11330 Drawn by : CSP Checked by : RK Not To Scale August 2011 PAR/9720/03:01</p>



Plasterboard Layout

No Board Spanning Less Than Two Bays

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Assessment Report PAR/9720/03
LP Building Products
LP Solid Start Rim Board installed
in Engineered Timber Joist Floors

Plasterboard Orientation
& Jointing Details

Job number : 11330
Drawn by : CSP Checked by : RK
Not To Scale August 2011

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