

LP Building Products

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Agrément Certificate
09/4660
Product Sheet 1

LP SOLIDSTART I-JOISTS

LP SOLIDSTART LPI 20 AND 32 SERIES AND LPI 26, 30, 36 AND 56 SERIES JOISTS

PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This Certificate relates to LP SolidStart 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.

AGRÉMENT CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



KEY FACTORS ASSESSED

Structural performance — the joists will have adequate strength and stiffness provided they are designed in accordance with the recommendations given in this Certificate (see section 5).

Behaviour in relation to moisture — the joists will not be adversely affected by moisture under the internal conditions of service class 1 or 2 environments as defined in BS 5268-2 : 2002 (see section 6).

Behaviour in relation to fire — the joists are combustibile and have a Class 3 surface spread of flame classification when tested in accordance with BS 476-7 : 1997. The flanges and webs are classified as D-s2,d0 in accordance with EN 13501-1 : 2007 (see section 7).

Durability — the joists will have adequate durability for use in internal conditions of service class 1 or 2 environments (see section 9).

The BBA has awarded this Agrément Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Brian Chamberlain
Head of Approvals — Engineering

Greg Cooper
Chief Executive

Date of First issue: 26 May 2009

Originally certificated on 23 February 2000

The BBA is a UKAS accredited certification body — Number 1113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations:



The Building Regulations 2000 (as amended) (England and Wales)

Requirement:	A1	Loading
Comment:		The joists have adequate strength and stiffness. See sections 5.1 to 5.21 of this Certificate. The joists have been assessed as untreated and, therefore, are restricted under this Requirement. See section 9.4 of this Certificate.
Requirement:	B2	Internal fire spread (linings)
Comment:		The joists have been assessed as having a Class 3 surface in accordance with BS 476-7 : 1997, and are classified as D-s2,d0 in accordance with EN 13501-1 : 2007. In common with other timber products, the joists are combustible. See sections 7.1 and 7.2 of this Certificate.
Requirement:	Regulation 7	Materials and workmanship
Comment:		The joists can contribute to a construction satisfying this Regulation. See sections 9.1 to 9.3 and the <i>Installation</i> part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Fitness and durability of materials and workmanship
Comment:		The joists can contribute to a construction satisfying this Regulation. See sections 8, 9.1 to 9.3 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards – construction
Standard:	1.1(a)(b)	Structure
Comment:		The joists will have sufficient strength and stiffness when designed with reference to clauses 1.1.1 ⁽¹⁾⁽²⁾ of this Standard, and in accordance with sections 5.1 to 5.21 of this Certificate.
Standard:	2.1	Compartmentation
Standard:	2.2	Separation
Standard:	2.3	Structural protection
Standard:	2.6	Spread to neighbouring buildings
Standard:	2.9	Escape
Comment:		The joists have been assessed as having a Class 3 surface in accordance with BS 476-7 : 1997, and are classified as D-s2,d0 in accordance with EN 13501-1 : 2007. In common with other timber products the joists are of a combustible material. There they are classified as ‘high risk’ in relation to fire, and their use will be restricted under clauses 2.1.12 ⁽²⁾ , 2.2.4 ⁽²⁾ , 2.2.5 ⁽²⁾ , 2.2.7 ⁽¹⁾ , 2.2.8 ⁽¹⁾ , 2.3.2 ⁽¹⁾⁽²⁾ , 2.3.3 ⁽¹⁾⁽²⁾ , 2.6.5 ⁽¹⁾ , 2.6.6 ⁽¹⁾⁽²⁾ , 2.6.7 ⁽²⁾ , 2.9.24 ⁽¹⁾ , 2.9.25 ⁽¹⁾ , 2.9.29 ⁽²⁾ , 2.9.30 ⁽²⁾ , 2.A.1 ⁽¹⁾ , 2.A.2 ⁽¹⁾ and 2.B.1 ⁽²⁾ respectively. See sections 7.1 and 7.2 of this Certificate. (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2000 (as amended)

Regulation:	B2	Fitness of materials and workmanship
Comment:		The joists are acceptable. See sections 9.1 to 9.3 and the <i>Installation</i> part of this Certificate.
Regulation:	B3(2)	Suitability of certain materials
Comment:		The joists are acceptable. See section 8 of this Certificate.
Regulation:	D1	Stability
Comment:		The joists have adequate strength and stiffness. See sections 5.1 to 5.21 of this Certificate.
Regulation:	E3	Internal fire spread – Linings
Comment:		The joists have been assessed as having a Class 3 surface in accordance with BS 476-7 : 1997, and are classified as D-s2,d0 in accordance with EN 13501-1 : 2007. In common with other timber products, the joists are combustible. See sections 7.1 and 7.2 of this Certificate.

Construction (Design and Management) Regulations 2007

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See section:	1 <i>Description</i> (1.1, Table 1), 4 <i>Practicability of installation</i> (4.1), 10 <i>General</i> (10.2 and 10.4) and 11 <i>Procedure</i> (11.1 and 11.2).
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Non-regulatory Information

NHBC Standards 2008

NHBC accepts the use of LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists, when installed and used in accordance with this Certificate, in relation to *NHBC Standards* Chapters 5.2 *Suspended ground floors*, 6.2 *External timber framed walls*, 6.3 *Internal walls*, 6.4 *Timber and concrete upper floors*, 7.1 *Flat roofs and balconies* and 7.2 *Pitched roofs*. The joists have been assessed as untreated and, therefore, are restricted under these requirements.

Zurich Building Guarantee Technical Manual 2007

In the opinion of the BBA, LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists, when installed and used in accordance with this Certificate, satisfies the requirements of the *Zurich Building Guarantee Technical Manual*, Section 4 *Superstructure*, Sub-section – *External walls – timber frame, Upper Floors, Flat roofs*. The joists have been assessed as untreated and, therefore, are restricted under this requirement.

General

This Certificate relates to LP SolidStart 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.

The LPI 20 and 32 Series Joists comprise solid timber flanges and oriented strand board (OSB) webs.

The LPI 26, 30, 36 and 56 Series Joists comprise laminated veneer lumber (LVL) flanges and OSB webs.

Louisiana-Pacific and LP are registered trademarks and SolidStart and LPI are trademarks of the Louisiana-Pacific Corporation.

Technical Specification

1 Description

1.1 LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists are of composite construction with solid timber or LVL flanges and OSB webs (see Figure 1). The joists are available in the flange sizes and overall depths given in Table 1. Joist lengths may be limited by handling or transportation but may be up to 21.9 m. The tolerances (mm) on member sizes are:

overall joist length	-0.0 +25.4 to -0.0 +101.6 depending on length
overall joist height	±1.6
flange thickness	±1.6
flange width	±1.6.

Figure 1 Section

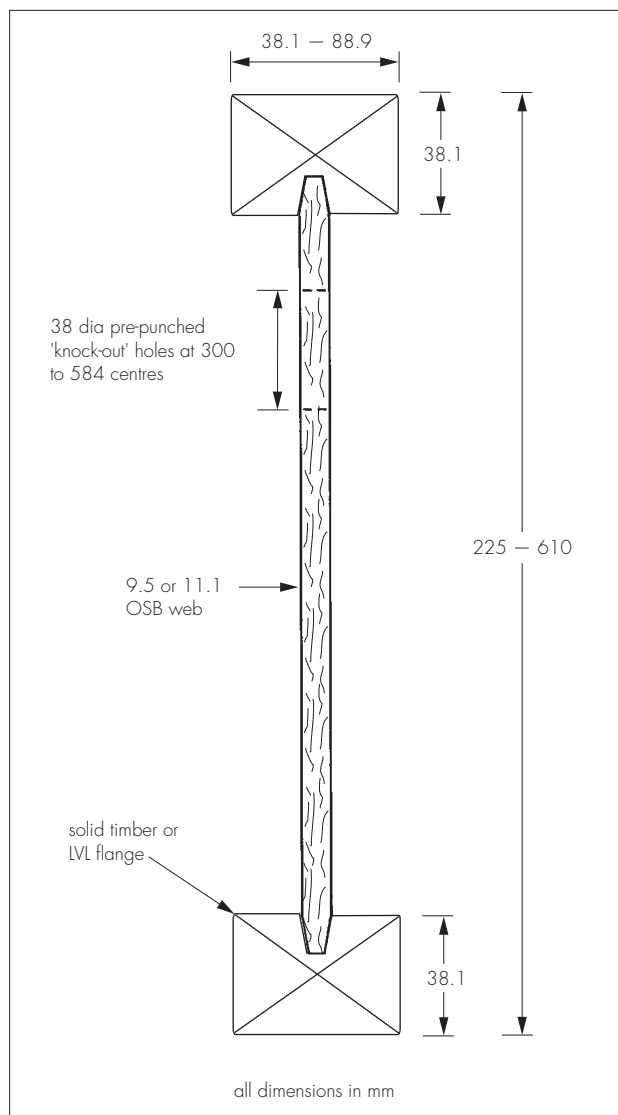


Table 1 Types, sizes and weights

Joist series	Flange size (mm)	Joist depth (mm)	Web thickness (mm)	Joist weight (kgm^{-1})
LPI 20	38.1 x 63.5	225	9.5	3.8
		241		3.9
		302		4.2
		356		4.5
LPI 32	38.1 x 63.5	241	9.5	3.9
		302		4.2
		356		4.5
		406		4.9
LPI 26	38.1 x 38.1	241	9.5	3.2
	302	3.6		
LPI 30	38.1 x 44.5	241	9.5	3.5
		302		3.9
		356		4.2
		406		4.6
LPI 36	38.1 x 57.2	241	9.5	4.3
		302		4.6
		356		5.0
		406		5.4
		457		5.7
		508		6.1
		559		6.5
610	6.9			
LPI 56	38.1 x 88.9	241	11.1	6.4
		302		6.7
		356		7.1
		406		7.4
		457		7.8
		508		8.2
		559		8.6
		610		8.9

1.2 The flanges are solid timber of species group spruce-pine-fir. The material is machine stress rated (MSR) grade 1650f-1.5E for the LPI 20 series and 2100f-1.8E for the LPI 32 series but for the LPI 26, 30, 36 and 56 series, the flanges are of LVL comprising laminated veneers bonded together, laid with the grain running parallel. The veneers are oriented perpendicular to the web.

1.3 The OSB web is 9.5 mm or 11.1 mm thick and is placed in the beams in at least 1220 mm long sections. The OSB sections have either tongue-and-groove or v-joints to form a continuous web.

1.4 The web-to-flange connection is made by gluing the web into a groove in the centre of the wide face of the flange. Phenol-resorcinol (PRF) or melamine-resorcinol (MRF) exterior-type adhesive is used in all joints.

1.5 The components are machine-assembled in one pass.

1.6 Quality control includes checks on flange and web materials, before and after preparation, for quality and dimensional accuracy. Process control includes checks on glue spread, fit of component parts and curing temperature. Regular tests are made for tightness of web-flange connections and strength of completed joists.

2 Delivery and site storage

2.1 Delivery and site storage of LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists must be carried out in accordance with the Certificate holder's instructions and the requirements of this Certificate.

2.2 During transportation the joists must be protected from adverse weather.

2.3 On site, in accordance with normal good practice for timber products, the joists should be stored clear of the ground and stacked vertically. Precautions should be taken to minimise changes in moisture content due to the weather. Full cover should be provided but permit free passage of air.

2.4 The joists bear the BBA identification mark incorporating the number of this Certificate.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists.

Design Considerations

3 General

3.1 LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists are satisfactory for use as structural members, for example as floor or roof joists, beams, rafters, wall studs or ceiling ties, provided the conditions described in section 5 are met.

3.2 The sound reduction properties of floors incorporating joist units are not covered by this Certificate. Where particular sound insulation properties are required, appropriate testing or assessment, relating to the structure, should be obtained.

4 Practicability of installation

4.1 The product is designed to be installed by a competent general builder, or a contractor, experienced with this type of product.


4.2 The joists are lighter than solid timber beams of equivalent structural properties and, therefore, are more easily handled. Normal precautions should be taken when handling, lifting and installing the joists.

4.3 The joists are easily cut to length and fixed using conventional woodworking tools.

4.4 The flanges are nailable for the fixing of flooring and ceiling materials.

4.5 Care should be taken to avoid damage to the flanges and to the webs.

5 Structural performance

 5.1 The joists will have adequate strength and stiffness provided they are designed in accordance with the recommendations given in BS 5268-2 : 2002 and the Certificate holder's literature using the design data given in this section.

5.2 Design and detailing of the joists should be carried out by a suitably experienced person in accordance with the Certificate holder's instructions and the requirements of this Certificate.

5.3 The properties of the joists given in Tables 2 and 3 apply only in the internal conditions of a service class 1 or 2 environment as defined in BS 5268-2 : 2002.

Table 2 Long-term end and intermediate reaction (service classes 1 and 2)

Joist series	Joist depth (mm)	End reaction (kN) 45 mm bearing length		End reaction (kN) 63.5 mm bearing length		Intermediate reaction (kN) 89 mm bearing length	
		Web stiffeners		Web stiffeners		Web stiffeners	
		NO	YES	NO	YES	NO	YES
LPI 20	225	3.88	3.88	—	—	7.76	7.76
	240	4.02	4.40	—	—	8.10	8.42
	302	4.24	4.96	—	—	10.00	10.00
	356	4.37	5.08	—	—	10.00	10.72
LPI 32	241	4.16	4.40	—	—	8.10	8.42
	302	4.25	4.97	—	—	10.00	10.00
	356	4.37	5.09	—	—	10.00	10.72
	406	4.39	5.11	—	—	10.00	10.72
LPI 26	241	4.20	4.20	—	—	8.80	8.80
	302	4.20	4.20	—	—	9.00	9.00
LPI 30	241	4.54	4.54	—	—	9.30	9.80
	302	4.54	5.12	—	—	9.30	10.02
	356	4.54	5.12	—	—	9.30	10.26
	406	4.54	5.12	—	—	9.30	10.26
LPI 36	302	5.34	5.90	—	—	11.80	11.80
	356	5.34	6.40	—	—	11.80	13.00
	406	5.34	6.72	—	—	11.80	13.24
LPI 36	457	—	—	5.34	7.02	11.80	13.48
	508	—	—	5.34	7.26	11.80	13.60
	559	—	—	5.34	7.50	11.80	13.60
	610	—	—	5.34	7.74	11.80	13.60
LPI 56	302	6.23	7.19	—	—	14.00	14.80
	356	6.23	7.43	—	—	16.90	17.00
	406	6.23	7.67	—	—	16.90	17.79
LPI 56	457	—	—	6.50	8.18	16.90	18.58
	508	—	—	6.50	8.42	16.90	18.82
	559	—	—	6.50	8.66	16.90	19.06
	610	—	—	6.50	8.90	16.90	19.30

Table 3a Long-term resistance moments and shear resistances⁽¹⁾ — service class 1

Joist series	Joist depth (mm)	Bending moment capacity		Shear resistance (both loadsharing and non-loadsharing) (kN)	Flexural rigidity (EI) (Nmm ² × 10 ⁹)	Shear rigidity (GA) web (N × 10 ⁶)
		Non-loadsharing situations (kNm)	Loadsharing situations (kNm)			
LPI 20	225	3.12	3.34	3.88	452	2.34
	241	3.42	3.66	4.4	534	2.56
	302	4.58	4.90	5.4	911	3.39
	356	5.62	6.01	5.5	1336	4.12
LPI 32	241	4.38	4.69	4.4	631	2.56
	302	5.87	6.28	5.4	1060	3.39
	356	7.20	7.70	6.0	1533	4.12
	406	8.43	9.02	6.7	2048	4.79
LPI 26	241	3.78	3.93	4.4	465	1.89
	302	4.84	5.03	4.7	793	2.48
LPI 30	241	4.47	4.64	4.9	545	1.89
	302	5.90	6.14	6.34	928	2.48
	356	7.23	7.52	6.6	1360	2.99
	406	8.47	8.81	6.6	1840	3.48
LPI 36	241	5.84	6.07	5.2	704	1.89
	302	7.72	8.03	5.9	1200	2.48
	356	9.47	9.85	6.6	1750	2.99
	406	11.09	11.53	8.4	2360	3.48
	457	12.75	13.26	8.4	3080	3.97
	508	14.41	14.99	8.4	3910	4.46
	559	16.08	16.72	10.0	4850	4.95
	610	17.74	18.45	10.2	5890	5.44
LPI 56	241	9.20	9.57	5.8	1100	1.89
	302	12.19	12.67	7.4	1850	2.48
	356	14.95	15.54	8.8	2701	3.00
	406	17.51	18.21	10.1	3630	3.48
	457	20.14	20.95	11.7	4730	3.97
	508	22.77	23.68	13.3	5990	4.46
	559	25.41	26.42	14.2	7400	4.95
	610	28.04	29.17	15.2	8970	5.44

(1) Lateral restraint to joist at 400 mm maximum centres.

Table 3b Long-term resistance moments and shear resistances⁽¹⁾ — service class 2

Joist series	Joist depth (mm)	Bending moment capacity		Shear resistance (both loadsharing and non-loadsharing) (kN)	Flexural rigidity (EI) (Nmm ² x 10 ⁹)	Shear rigidity (GA) web (N x 10 ⁶)
		Non-loadsharing situations (kNm)	Loadsharing situations (kNm)			
LPI 20	225	2.81	3.01	3.88	439	1.38
	241	3.08	3.29	4.4	516	1.50
	302	4.12	4.41	5.4	881	1.99
	356	5.06	5.41	5.5	1296	2.42
LPI 32	241	3.94	4.22	4.4	631	1.50
	302	5.28	5.65	5.4	1060	1.99
	356	6.48	6.93	6.0	1533	2.42
	406	7.59	8.12	6.7	2048	2.82
LPI 26	241	3.59	3.73	4.4	442	1.56
	302	4.74	4.93	4.7	754	2.05
LPI 30	241	4.25	4.42	4.9	521	1.56
	302	5.61	5.84	6.34	888	2.05
	356	6.87	7.15	6.6	1300	2.48
	406	8.05	5.37	6.6	1760	2.88
LPI 36	241	5.55	5.77	5.2	670	1.56
	302	7.34	7.63	5.9	1140	2.05
	356	9.00	9.36	6.6	1660	2.48
	406	10.54	10.96	8.4	2240	2.88
	457	12.12	12.60	8.4	2930	3.28
	508	13.70	14.25	8.4	3720	3.69
	559	15.28	15.89	10.0	4610	4.09
LPI 56	610	16.87	17.54	10.2	5600	4.50
	241	8.75	9.10	5.8	1040	1.56
	302	11.58	12.05	7.4	1760	2.04
	356	14.21	14.78	8.8	2570	2.47
	406	16.65	17.31	10.1	3450	2.86
	457	19.14	19.91	11.7	4500	3.27
	508	21.64	22.51	13.3	5690	3.67
	559	24.15	25.12	14.2	7030	4.07
	610	26.66	27.72	15.2	8530	4.48

(1) Lateral restraint to joist at 400 mm maximum centres.

5.4 The structural performance of the joists relies upon adequate lateral restraint to the compression flanges. To achieve this on each joist type such restraint should be applied at maximum centres of 400 mm. Lateral restraint is readily achieved for simply-supported beams where battens, boarding or similar provide restraint to the top flange at satisfactorily close intervals. However, in certain conditions additional lateral restraint is required; for example the lower flange can be in compression and, therefore, may not have boarding to act as lateral restraint. Continuous beams and members subject to wind uplift both fall into this category and may require the addition of diagonal braces or similar to provide the necessary restraint.

5.5 I-joists are typically installed at a moisture content between 14% and 18% for solid timber flanges and 10% for LVL flanges. This Certificate relates to maximum flange moisture content of between 14% and 18% for solid timber flanges and between 10% and 14% for LVL flanges. For internal uses up to service class 2, there will be little variation in moisture content. Where the designer considers there to be a risk of fluctuating moisture content beyond normal service class 1 or 2 conditions, the effect of creep deflection is to be included. For I-joists, a creep effect of twice the initial deflection is suggested. The Certificate holder should be consulted in these situations.

5.6 Compared to solid timber joists, the strength and stiffness of the joists in the minor axis is considerably less than in the major axis. As such, care must be taken to ensure that adequate bracing/diaphragm action is provided to resist horizontal loads acting on the structural element.

Flexural members

5.7 Long-term bending moment capacity and shear resistances are given in Table 3. Bending moment capacity and shear resistances for different durations of loading can be evaluated by multiplying the values in the table by the appropriate value of the K_3 modification factor given in BS 5268-2 : 2002.

5.8 The values tabulated for load-sharing systems relate to a modification factor K_8 , of 1.07 for the LPI 20 and 32 Series Joists and a modification factor K_8 , of 1.04 for the LPI 26, 30, 36 and 56 Series Joists, as defined in BS 5268-2 : 2002 where four or more joists of the same cross-section are spaced a maximum of 610 mm centre to centre, and have adequate provision for the distribution of loads by such features as purlins, binders, boarding, battens.

5.9 The values tabulated for domestic floor application have been derived by multiplying basic strength values by the factor $K_{dom} = 1.12^{(1)}$. These values should not be modified further by the load duration factor K_3 .

(1) K_{dom} is only applicable to single-occupancy dwellings.

5.10 The flexural rigidities and shear rigidities, required for the purpose of evaluating deflections, are given in Table 3 for use in accordance with BS 5268-2 : 2002. The maximum deflection of a uniformly loaded I-joist is given by:

$$y = \frac{5wL^4}{384EI} + \frac{wL^2}{8G_wA_w}$$

where

w = uniform load per unit length
 L = effective span
 EI = flexural rigidity
 G_wA_w = web shear rigidity.

5.11 Lightweight I-joist floors may require higher deflection control than those of solid timber (as recommended in BS 5268-2 : 2002) to avoid undue vibration. Generally, the deflection criterion of 0.003 times the span will not impair the strength of the structure nor lead to unsightly damage to the finishes. The Certificate holder's literature should be consulted regarding recommended deflection control limits. Consideration of the deflection criterion should be agreed between interested parties at the design stage.

5.12 The lower flanges of the joists are able to support small loads, for example those associated with normal domestic services and ceilings. The recommended loads relate to the full joist loaded through the top flange.

5.13 The minimum bearing lengths for all types of I-joist, irrespective of whether web stiffeners are present, are from 38 mm to 45 mm for end supports and 89 mm for intermediate supports.

5.14 Details of long-term end and intermediate reactions for joists with and without web stiffeners are given in Table 2.

5.15 Details for web stiffeners are given in Table 4 and Figure 2.

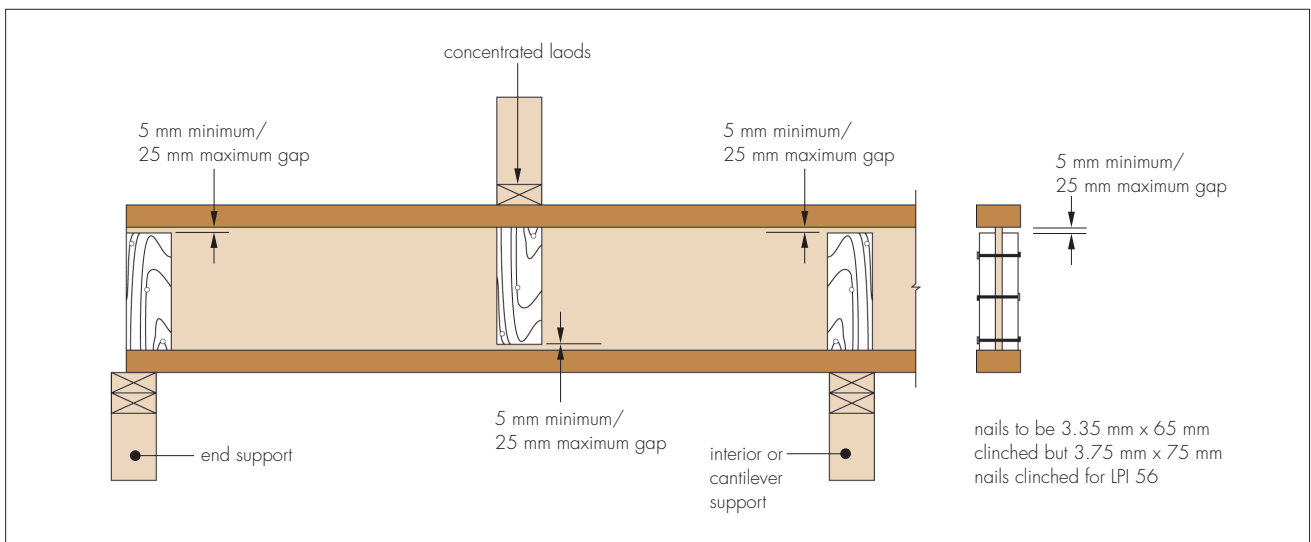
Table 4 Web stiffener specification

Joist depth (mm)	Joist series	Total number of nails	Max stiffener height (mm)	Min stiffener thickness (mm)	Min width ⁽¹⁾ (mm)
225	LPI 20	3	145	22	89
241	LPI 20 and 32	3	161	22	89
302	LPI 20 and 32	3	222	22	89
356	LPI 20 and 32	3	276	22	89
406	LPI 20 and 32	3	327	22	89
241	LPI 26	3	161	12 ⁽²⁾	89
	LPI 30	3	161	18 ⁽²⁾	89
	LPI 36	3	161	22	89
	LPI 56	3	161	38	89
302	LPI 26	3	222	12 ⁽²⁾	89
	LPI 30	3	222	18 ⁽²⁾	89
	LPI 36	4	222	22 ⁽²⁾	89
	LPI 56	4	222	38	89
356	LPI 30	4	276	18 ⁽²⁾	89
	LPI 36	5	276	22 ⁽²⁾	89
	LPI 56	5	276	38	89
406	LPI 30	4	327	18 ⁽²⁾	89
	LPI 36	6	327	22 ⁽²⁾	89
	LPI 56	6	327	38	89 ⁽¹⁾

(1) When not clinched, approximately half the total number of nails is used per side of the I-joists.

(2) Available in OSB.

Figure 1 Web stiffener details



Compression load only

5.16 When using L-joists as a strut, the flange section only is to be considered and the compression stress value is to be used and modified according to the relevant lateral restraint points and guidance given in BS 5268-2 : 2002. The values of admissible long-term compression grade stress parallel to the joist span that should be taken are given in Table 5.

Table 5 Long-term grade stress

Joist series	Admissible long-term grade stress parallel to joist span (Nmm ⁻²)	
	Service class 1	Service class 2
LPI 20 and 32	10.1	9.0
LPI 26, 30, 36 and 56	24.3	21.8

Tension load only

5.17 When using L-joists as a tie, the flange section only is to be considered and the tension stress value is to be used and modified according to the guidance given in BS 5268-2 : 2002. The admissible long-term tension grade stress parallel to the joist span should be taken as:

LPI 20 and 32 Series Joists

$$\sigma_{f, adm', \parallel} = \sigma_{f, grade, \parallel} \times K_3 \times \frac{(2440)^{0.125}}{L}$$

where

$$\sigma_{f, grade, \parallel} = 6.5 \text{ Nmm}^{-2} \text{ for service class 1}$$

$$= 8.3 \text{ Nmm}^{-2} \text{ for service class 2}$$

L = length (m) with a minimum value of 2440 mm.

LPI 26, 30, 36 and 56 Series Joists

$$\sigma_{f, adm', \parallel} = \sigma_{f, grade, \parallel} \times K_3 \times \frac{K_L}{L}$$

where

$$\sigma_{f, grade, \parallel} = 18.2 \text{ Nmm}^{-2} \text{ for service class 1 and 2}$$

$$K_L = \left(\frac{0.99}{L}\right)^{0.071}$$

L = length (m) with a minimum value of 990 mm

Above 5 m: $K_L = 0.89$

Combined axial and bending loads

5.18 L-joists subjected to a small component of axial load in addition to an applied moment must be designed such that each flange satisfies the appropriate interaction formula given in BS 5268-2 : 2002.

OSB webs

5.19 Details for web stiffeners are given in Table 4 and Figure 2.

5.20 The OSB webs incorporate partially punched 'knock-outs' of 38 mm diameter at 300 to 584 mm centres, to facilitate installation of services within floor or roof depths.

5.21 Holes in the web greater than the provided 'knock-outs' will reduce the shear capacity of the joists. The Certificate holder's literature should be consulted for guidance on the size of hole permitted and the reduction in shear capacity.

6 Behaviour in relation to moisture

6.1 The joists will not be adversely affected by moisture under the internal conditions of service class 1 or 2 environments as defined in BS 5268-2 : 2002.

6.2 The joists are for use in a service class 1 or 2 environment⁽¹⁾. Tests indicate that the equilibrium moisture content of the LVL and OSB in a given environment is lower than that of solid timber. In these environments, where the moisture content of solid timber does not exceed 18% the moisture content of the LVL or OSB will not exceed 14%. The LVL or OSB will attain an average moisture content of 10% in service class 1 conditions.

(1) As defined in BS 5268-2 : 2002.

6.3 To ensure that these moisture conditions in a service class 1 or 2 environment are maintained:

- flat roof decks must be constructed in accordance with BS 6229 : 2003, BS 8217 : 1994 and, where appropriate, *NHBC Standards*, Chapter 7.1, or the *Zurich Building Guarantees Technical Standards*, Section 5, clause 5.9.3.19
- roof coverings should be the subject of a relevant Agrément Certificate and must be installed and maintained in accordance with that Certificate, the manufacturer's instructions, and the relevant clauses of BS 8000-4 : 1989 and BS 8217 : 1994
- in suspended ground floors, careful attention must be given to the adequate provision of solum treatment, underfloor space and ventilation. Guidance on design is given in CP 102 : 1973 and *Zurich Building Guarantees Technical Standards*, Section 3, clause 3.9.1.

6.4 Where a building construction is likely to be sensitive to the relative movement of members, it is recommended, in accordance with BS 5268-2 : 2002 that the members should:

- be checked for moisture content at the time of the installation; the determination of moisture content by a calibrated moisture meter will be sufficiently accurate for this purpose
- have a moisture content at the time of installation close to the moisture content they will attain in service.

6.5 I-joists will not shrink in the same manner as solid timber, therefore, care is needed to avoid problems of differential movement when using different materials.

7 Behaviour in relation to fire



7.1 The joists have a Class 3 surface spread of flame classification when tested in accordance with BS 476-7 : 1997. The flanges and webs are classified as D-s2,d0 in accordance with EN 13501-1 : 2007 by reference to EC Decision 2003/43/EC.

7.2 In common with other timber products, the joists are combustible.

7.3 The fire resistance properties of a structure are dependent on the design of the construction incorporating the joists. Where fire resistance is a requirement, an appropriate assessment or test must be carried out by a UKAS (United Kingdom Accreditation Service) approved fire testing laboratory.

8 Maintenance



The product does not require routine maintenance. Damaged I-joists should be repaired as soon as possible, following the manufacturer's instructions and observing all applicable health and safety regulations.

9 Durability



9.1 The joists will have a durability comparable to that of board products of similar timber species incorporating phenol-formaldehyde adhesives (see BS EN 350-2 : 1994). Thus, in a service class 1 or 2 environment, the joists may be taken to have a service life in excess of 60 years, provided there is no mechanical damage or insect attack.

9.2 Details on maintaining the moisture conditions in a service 1 or 2 environment are described in section 6.3.

9.3 The joists are classified as not durable in accordance with BS EN 460 : 1994.



9.4 The joists have been assessed as untreated, therefore, their use is restricted in roof spaces in the geographical areas specified in Approved Document A to the England and Wales Building Regulations (A1/2, clause 2B2) in relation to information on the House Longhorn beetle (*Hylotrupes bajulus* L).

10 General

10.1 The flanges must not be drilled, notched or otherwise altered on site.

10.2 LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists should be handled and installed in a similar manner to solid timber beams. However, the strength and stiffness of joists about their minor axis is less than that of corresponding solid timber sections. Therefore, care must be exercised to ensure that joists are not damaged during handling due to bending about their minor axis. In addition they must be adequately braced during installation to avoid instability. In accordance with normal good practice for timber they should be protected from wetting during installation.

10.3 The joists can withstand normal site handling and usage but if any are significantly damaged they must not be used.

10.4 In common with similar timber products, when using power tools to cut the joists it is recommended that eye protection and a dust mask are used.

11 Procedure

11.1 Installation must be in accordance with the Certificate holder's installation information.

11.2 Temporary bracing should be provided to keep the joists in a straight and plumb position during installation.

11.3 Rigid service pipes can be incorporated within the floor or roof void by passing through the perforated knockout holes in the joists or by passing through site-drilled holes in accordance with the Certificate holder's literature.

11.4 Any service holes cut in the web are to be in accordance with the Certificate holder's instructions.

Technical Investigations

12 Investigations

The following investigations made for the previous Certificates 00/3670 and 04/4086 for this product, were used as the basis for this assessment:

- results of tests on LP SolidStart LPI 20 and 32 Series and LPI 26, 30, 36 and 56 Series Joists over shear critical spans were used to establish their design shear strength and maximum reaction capacities
- results of tests on the joists over moment critical spans were examined to confirm theoretical predictions of bending strength
- the measured deflections from bending tests were used to confirm theoretical deflection predictions
- existing data relating to the durability of timber and adhesives in the specified environments were examined
- assessments, from existing data, were also made of the practicability of installation
- the manufacturing processes for beams were examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

Bibliography

BS 476-7 : 1997 *Fire tests on building materials and structures — Method of test to determine the classification of the surface spread of flame of products*

BS 5268-2 : 2002 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*

BS 6229 : 2003 *Flat roofs with continuously supported coverings — Code of practice*

BS 8000-4 : 1989 *Workmanship on building sites — Code of practice for waterproofing*

BS 8217 : 1994 *Code of practice for built-up felt roofing*

BS EN 350-2 : 1994 *Durability of wood and wood-based products — Natural durability of solid wood — Guide to natural durability and treatability of selected wood species of importance in Europe*

BS EN 460 : 1994 *Durability of wood and wood-based products — Natural durability of solid wood — Guide to the durability requirements for wood to be used in hazard classes*

CP 102 : 1973 *Code of practice for protection of buildings against water from the ground*

EN 13501-1 : 2007 *Fire classification of construction products and building elements — Classification using test data from reaction to fire tests*

13 Conditions

13.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is granted only to the company, firm or person named on the front page — no other company, firm or person may hold or claim any entitlement to this Certificate
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English law.

13.2 Publications and documents referred to in this Certificate are those that the BBA deems to be relevant at the date of issue or re-issue of this Certificate and include any: Act of Parliament; Statutory Instrument; Directive; Regulation; British, European or International Standard; Code of Practice; manufacturers' instructions; or any other publication or document similar or related to the aforementioned.

13.3 This Certificate will remain valid for an unlimited period provided that the product/system and the manufacture and/or fabrication including all related and relevant processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

13.4 In granting this Certificate, the BBA is not responsible for:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- individual installations of the product/system, including the nature, design, methods and workmanship of or related to the installation
- the actual works in which the product/system is installed, used and maintained, including the nature, design, methods and workmanship of such works.

13.5 Any information relating to the manufacture, supply, installation, use and maintenance of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used and maintained. It does not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the manufacture, supply, installation, use and maintenance of this product/system.