

<p style="text-align: center;">DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT Housing - Federal Housing Commissioner</p> <p>TO: DIRECTORS, SINGLE FAMILY HOCs DIRECTORS, MULTIFAMILY HUBs</p>	<p>STRUCTURAL ENGINEERING BULLETIN NO. 1091 Rev. 6 (Supersedes issue dated October 26, 2004)</p>				
	<p>ISSUE DATE December 17, 2008</p>				
	<p>REVIEW DATE December 17, 2011</p>				
<p>SUBJECT:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 10%;">1. Item Description</td> <td>LP SolidStart® I-Joist</td> </tr> <tr> <td>2. Name and address of Manufacturer</td> <td>LP Building Products Louisiana-Pacific Corporation 2706 Highway 421 North Wilmington, NC 20401</td> </tr> </table>		1. Item Description	LP SolidStart® I-Joist	2. Name and address of Manufacturer	LP Building Products Louisiana-Pacific Corporation 2706 Highway 421 North Wilmington, NC 20401
1. Item Description	LP SolidStart® I-Joist				
2. Name and address of Manufacturer	LP Building Products Louisiana-Pacific Corporation 2706 Highway 421 North Wilmington, NC 20401				

This Structural Engineering Bulletin (SEB) should be filed with other SEBs and related Bulletins on materials or products as required by prescribed procedures.

The technical description, requirements and limitations expressed herein do not constitute an endorsement or approval by the Department of Housing and Urban Development (HUD) of the subject matter, and any statement or representation, however made, indicating approval or endorsement by HUD is unauthorized and false, and will be considered a violation of the United States Criminal Code, 18 U.S.C. 709.

NOTICE: THIS BULLETIN APPLIES TO DWELLING UNITS BUILT UNDER HUD HOUSING PROGRAMS. NON-HUD-INSURED UNITS MAY OR MAY NOT BE IN CONFORMITY WITH THE REQUIREMENTS OF THE HUD MINIMUM PROPERTY STANDARDS.

Any reproduction of this Bulletin must be in its entirety and any use of all or any part of this Bulletin in sales promotion or advertising is prohibited.

1. General:

This Bulletin sets forth specific requirements under the Technical Suitability of Products Program for determining the eligibility of housing to be constructed under HUD mortgage insurance, or other HUD housing programs.

2. Scope:

This Bulletin applies only to the structural features of this method of construction. Final determination of eligibility is made by the appropriate HUD Field Office. Other factors considered will be valuation, location, architectural planning and appeal, mechanical equipment, thermal characteristics, and market acceptance. Consideration is also necessary to determine whether a specific property will qualify under the specific HUD program, when constructed according to the method outlined in this Bulletin, and where the structure is to be located.

3. Minimum Property Standards (MPS):

Compliance with HUD MPS will be determined by the HUD Field Office or Homeownership Center on the same basis as the submissions involving conventional construction, except for the special features described in this bulletin.

4. Inspection:

Field compliance inspections covering conventional items of construction and any special features covered in this bulletin shall be made in accordance with prescribed procedures.

The appropriate HUD Field Office or Homeownership Center shall furnish a copy of a HUD field inspection report to Headquarters, Office of Manufactured Housing Programs, when there is:

- a. Evidence of non-compliance with any portion of the system of construction described in this bulletin.
- b. Faulty shop fabrication, including significant surface defects.
- c. Damage to shop fabricated items or materials due to improper transportation, storage, handling, or assembly.
- d. Unsatisfactory field workmanship or performance of the product or system.
- e. Any significant degradation or deterioration of the product or evidence of lack of durability or performance.

Periodic plant inspections will be made by HUD Field Office, Homeownership Center, or a HUD designated representative in accordance with their prescribed procedures. Factory inspection reports shall be submitted to HUD Headquarters, upon request.

5. Certification:

The manufacturer named in this bulletin shall furnish the builder with written certification that the product has been manufactured in compliance with the HUD Minimum Property Standards (MPS), except as modified by this bulletin. The builder shall endorse the certification with a statement that the product has been installed in compliance with HUD MPS, except as modified by this bulletin, and that the manufacturer's certification does not relieve the builder, in any way, of responsibility under the terms of the Builder's Warranty required by the National Housing Act, or under any provisions applicable to any other housing program. This certification shall be furnished to the HUD Field Office upon completion of the property.

OUTLINE DESCRIPTION, CATEGORY II CONSTRUCTION

Use:

LP SolidStart® Series Wood I-Joists are used in residential and light commercial construction as floor joists, roof joists, blocking panels and rim joists.

DESCRIPTION:

General:

LP SolidStart® Series I-Joists have structural composite lumber (SCL) flanges and a single web as specified in the Quality Manual that contains the manufacturing standards. The top and bottom flanges are parallel, creating constant-depth joists. Web sections are end-jointed together to form a continuous web. Web end joints shall be of the types specified in the Quality Manual. The web-to-flange connection is a proprietary grooved connection, also conforming to the Quality Manual. The I-Joists are available in various lengths.

The I-Joist series and depths are given in Tables 1 and 2 in Attachment “A”.

MATERIAL SPECIFICATIONS:

Flanges:

The flange material is SCL that meets the requirements noted in the Quality Manual.

Webs:

Web panels for all series, except for the 56 and 550 Series I-Joists, are a minimum of 3/8-inch (9.5 mm) thick. Web panels for the 56 and 550 Series I-Joists are a minimum of 7/16 inch (11.1 mm) thick. All web panels comply with the current U.S. Voluntary Product Standard PS 2-92 and the Quality Manual.

Adhesive:

Adhesives are exterior wet-use types complying with ASTM D 2559 and shall be of the types specified in the Quality Manual.

MANUFACTURING PROCESS FOR LP SolidStart® I-JOIST:

The LP SolidStart® I-Joists are manufactured in a continuous process with the following steps:

1. Web sections are glued and end-jointed to form a continuous web.
2. SCL flange material is grooved for the web joint.
3. While applying a constant uniform flow of glue to the joint, the flanges and web are brought together through a series of vertical and horizontal rollers, which apply continuous pressure to form the I-Joist.

Finished I-Joists are bundled and wrapped with weatherproof material and stored in such a manner as to prevent excessive weathering, glue line breakdown or deterioration of the wood components.

DESIGN AND INSTALLATION:

Allowable Structural Capacity:

Allowable moments, reactions, vertical shear capacity, and I-Joist stiffness (EI) are specified in Tables 1 and 2 in Attachment “A”. Maximum allowable reactions are based on a minimum bearing length of 1 ¾ inches (44 mm), except as noted in Table 2 for simple spans, and 3 ½ inches (89 mm) at intermediate support points for continuous spans.

Web Stiffeners:

The material, size, and attachment of web reinforcement shall be as illustrated and described in Figure 1 and Table 3 in Attachment “A”.

Holes in I-Joist Web:

Size and location of allowable web holes are noted in Tables 5 to 8 in Attachment “A” for LP SolidStart® I-Joists. Web hole equations are noted in Table 4 in Attachment “A” for LP SolidStart® joists. Figure 2 in Attachment “A” shows the web hole drawings for the LP SolidStart® I-Joists. As an analytical approach for the location and size of web holes, the LP design software can be used in lieu of the web hole chart tables or web hole equations noted in this report, provided the web hole calculations are reviewed and approved by a registered design professional. If the registered design professional uses the LP design software for web hole design, the registered design professional shall provide proper reference to the software.

Deflection:

Total I-Joist deflection shall be calculated by using the formula for deflection due to bending and shear as follows:

For example, for uniformly distributed loads,

$$\Delta = \frac{22.5wL^4}{EI} + \frac{wL^2}{K}$$

And for a simple span with a concentrated load at mid-span,

$$\Delta = \frac{36PL^3}{EI} + \frac{2PL}{K}$$

Where:

W = Uniform load (pounds per linear foot).

L = Clear span (feet).

EI = Product of the moment of inertia and modulus of elasticity, as provided in Tables 1 and 2 in Attachment "A" for LP SolidStart® I-Joists.

P = Concentrated load (pounds).

K = Shear deflection factor as provided in Tables 1 and 2 in Attachment "A" for LP SolidStart® I-Joists.

Δ = Deflection (inches).

LOAD TABLES:

Tables showing allowable design values of LP SolidStart® I-Joists for strength, presented for size of I-Joist and deflection limitations are as a function of span. Load tables are available from Louisiana-Pacific Corporation upon request.

MANUFACTURING PLANTS:

Components covered under this Bulletin will be produced in the following plants:

Louisiana-Pacific Corporation
2706 Highway 421 North
Wilmington, NC 28401
Phone: 800-777-9105

Louisiana-Pacific Corporation
11500 Reading & Tyler Road
Red Bluff, CA 96080
Phone: 800-527-1411

Abtibi/LP Larouche
900 Chemin du lac Hippolyte
Larouche, Quebec, Canada G0W 1Z0
Phone: 418-547-2828

The appropriate HUD Field Office or Homeownership Center in whose jurisdiction the manufacturing plants are located, or HUD designated representatives will inspect these plants in accordance with prescribed procedures.

QUALITY CONTROL:

The appropriate HUD field Office or Homeownership Center in whose jurisdiction the manufacturing plants are located, or the State Agency (in Category III states) shall review and approve plants fabrication procedures and quality control program, to ensure compliance with approved plans and specifications.

RECORD OF PROPERTIES:

Upon request, the manufacturer shall provide HUD a list of representative properties in which the component or system described in this bulletin is used. The list shall include the complete address, or description of location, and the approximate date of installation or erection. Failure of the manufacturer to provide HUD with the above information may result in cancellation of this bulletin.

NOTICE OF CHANGES:

The manufacturer shall inform HUD in advance of changes in production facilities, transportation, field erection procedures, design, or materials used in this product. Further, the manufacturer must inform HUD of any revision to corporate structure, change of address or change in name or affiliation of the prime manufacturer. Failure of the manufacturer to notify HUD of any of the above changes may result in cancellation of this bulletin.

EVALUATION:

This SEB shall be valid for a period of three years from the date of initial issuance or most recent renewal or revision, whichever is later. The holder of this bulletin shall apply for renewal or revision 90 days prior to the review date printed on this bulletin. Submittals for renewal or revision shall be sent to:

U. S. Department of Housing and Urban Development
FHA Standards, Office of Manufactured Housing Programs
451 7th Street, SW, Room 9168
Washington, DC 20410-8000

Appropriate User Fee shall be sent to:

U. S. Department of Housing and Urban Development
Miscellaneous Income – Technical Suitability of Products Fees
Bank of America
P. O. Box 198762
Atlanta, GA 30384-8762

The holder of this SEB may apply for revision at any time prior to the review date.
Minor revisions may be in the form of a supplement.

If the Department determines that a proposed renewal or supplement constitutes a revision, the appropriate User Fee for a revision will need to be submitted in accordance with Code of Federal Regulations 24 CFR 200.934, “User Fee System for the Technical Suitability of Products Program,” and current User Fee Schedule.

CANCELLATION:

Failure to apply for a renewal or revision shall constitute a basis for cancellation of the bulletin. HUD will notify the manufacturer that the bulletin may be cancelled when:

1. conditions under which the document was issued have changed so as to affect production of, or to compromise the integrity of the accepted material, product, or system,
2. the manufacturer has changed its organizational form without notifying HUD, or
3. the manufacturer has not complied with responsibilities it assumed as a condition of HUD’s acceptance.

However, before cancellation, HUD will give the manufacturer a written notice of the specific reasons for cancellation, and the opportunity to present views on why the SEB should not be cancelled. No refund of fees will be made on a canceled document.

This bulletin is issued solely for the captioned firm, and is not transferable to any person or successor entity.

ATTACHMENT "A"

Table 1. Allowable Design Values for LP SolidStart® I-Joists

JOIST SERIES	JOIST DEPTH (in.)	MOMENT (lbs-ft)	EI x 10 ⁶ (lbs-in ²)	K x 10 ⁶ (ft-lbs/in)	SHEAR ³ 3.5" MINIMUM BEARING LENGTH (lbs)	END REACTION 1.75" MINIMUM BEARING LENGTH (lbs)		INTERIOR REACTION 3.5" MINIMUM BEARING LENGTH (lbs.)					
						W/O W.S.	W/ W.S.	W/O W.S.	W/ W.S.				
100	9.5	2615	124	0.448	1125	945	NA	1900	NA				
	11.875	3385	216	0.544	1425								
125	9.5	2755	142	0.448	1125								
	11.875	3565	248	0.544	1425								
150	9.5	3040	162	0.448	1125								
	11.875	3930	287	0.544	1425								
200	9.5	2865	142	0.438	1125					1020	NA	2050	2400
	11.875	3840	248	0.549	1425								
	14	4720	371	0.658	1725								
	16	5550	514	0.746	1980								
225	9.5	3025	162	0.438	1125								
	11.875	4050	287	0.549	1425								
	14	4975	431	0.658	1725								
	16	5850	597	0.746	1980								
250	9.5	3575	187	0.438	1125								
	11.875	4630	328	0.549	1425								
	14	5570	495	0.658	1725								
	16	6460	691	0.746	1980								
300	9.5	3795	185	0.423	1225	1200	1225	2350	2700				
	11.875	5075	318	0.570	1425								
	14	6235	474	0.671	1725								
	16	7335	652	0.761	1980								
325	9.5	4340	214	0.423	1225								
	11.875	5620	370	0.570	1425								
	14	6770	550	0.671	1725								
	16	7845	758	0.761	1980								
350	11.875	5620	417	0.570	1425								
	14	6770	627	0.670	1725								
	16	7845	869	0.761	1980								
550	11.875	8625	610	0.569	1940					1400	1840	3400	3850
	14	10385	907	0.665	2150								
	16	12040	1220	0.756	2350								

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 ft-lb = 1.36 N-m, 1 lb = 4.45 N, 1 in²-lb = 0.00287 N-m²

NOTES:

1. The design values are for normal duration of load and are permitted to be adjusted in accordance with the applicable code.
2. Moment capacity shall **not** be increased by any code allowed repetitive member use factor.
3. Shear capacity represents I-joists having web stiffeners, except for depths less than 11-7/8 inches.
4. W/ W.S. is With Web Stiffeners and W/O W.S. is Without Web Stiffeners.
5. The allowable design values shall apply to product installation conditions of use that are dry, well ventilated and covered. Dry conditions are product installation conditions where ambient moisture content is 16% or less.

Table 2. Allowable Design Values for LP SolidStart® I-Joists (Cont'd)

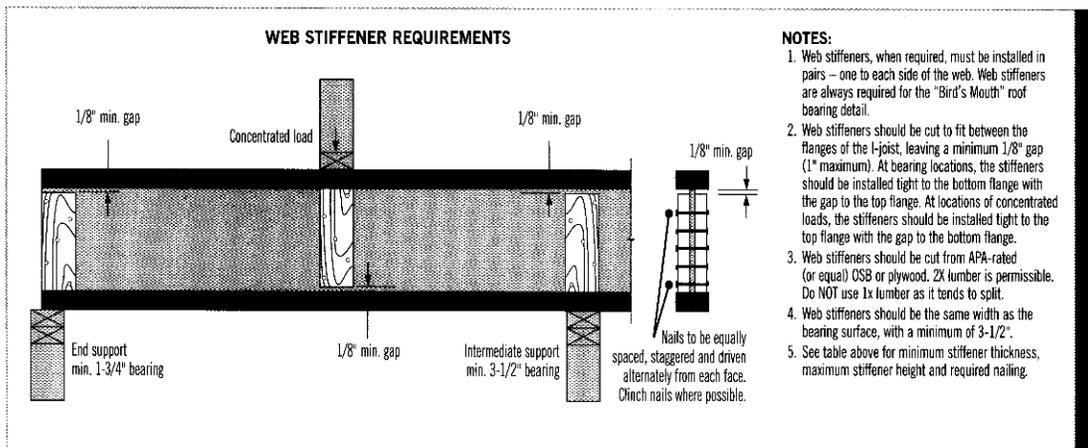
JOIST SERIES	JOIST DEPTH (in)	MOMENT (lbs.-ft)	EI x 10 ⁶ (lbs-in ²)	K x 10 ⁶ (ft.-lbs./in)	SHEAR ³ 3.5" MINIMUM BEARING LENGTH (lbs.)	END REACTION (MINIMUM BEARING LENGTH) (lbs.)		INTERIOR REACTION 3.5" MINIMUM BEARING LENGTH (lbs.)	
						W/O W.S.	W/ W.S.	W/O W.S.	W/ W.S.
26	9.250	3150	160	0.353	960	945 (1.75")	945 (1.75")	2200	2600
	9.500	3250	165	0.368	1125				
	11.875	4205	286	0.447	1425				
30	9.500	3825	199	0.357	1125	1020 (1.75")	1020 (1.75")	2200	2800
	11.875	4950	334	0.451	1425	1020 (1.75")	1150 (1.75")		
	14.000	5960	484	0.541	1725	1020 (1.75")	1150 (1.75")		
	16.000	6910	650	0.613	1980	1020 (1.75")	1150 (1.75")		
36	11.875	6445	429	0.468	1615	1200 (1.75")	1510 (1.75")	2800	3500
	14.000	7755	622	0.550	1830	1200 (1.75")	1510 (1.75")		
	16.000	8995	836	0.625	2020	1200 (1.75")	1510 (1.75")		
	18.000	10135	1082	0.700	2185	1200 (2.50")	1799 (2.50")		
	20.000	11270	1360	0.774	2320	1200 (2.50")	1857 (2.50")		
	22.000	12390	1669	0.850	2435	1200 (2.50")	1906 (2.50")		
56	11.875	10170	668	0.549	1940	1400 (1.75")	1840 (1.75")	3800	4000
	14.000	12250	968	0.641	2241	1400 (1.75")	1840 (1.75")		
	16.000	14205	1301	0.729	2581	1400 (1.75")	1840 (1.75")		
	18.000	16010	1684	0.817	2921	1700 (2.50")	2303 (2.50")	3800	5000
	20.000	17800	2115	0.905	3261	1700 (2.50")	2449 (2.50")		
	22.000	19575	2597	0.993	3601	1700 (2.50")	2595 (2.50")		
	24.000	21340	3127	1.081	3856	1700 (2.50")	2704 (2.50")		

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 ft-lb = 1.36 N-m, 1 lb = 4.45 N, 1 in²-lb = 0.00287 N-m²

NOTES:

1. The design values are for normal duration of load and are permitted to be adjusted in accordance with the applicable code.
2. Moment capacity shall **not** be increased by any code allowed repetitive member use factor.
3. Shear capacity represents I-joists having web stiffeners, except for depths less than 11-7/8 inches.
4. W/ W.S. is with Web Stiffeners and W/O W.S. is Without Web Stiffeners.
5. The allowable design values shall apply to product installation conditions of use that are dry, well ventilated and covered. Dry conditions are product installation conditions where ambient moisture content is 16% or less.

Figure 1. I-Joist Web Stiffener Requirements



- NOTES:**
1. Web stiffeners, when required, must be installed in pairs – one to each side of the web. Web stiffeners are always required for the "Bird's Mouth" roof bearing detail.
 2. Web stiffeners should be cut to fit between the flanges of the I-joist, leaving a minimum 1/8" gap (1" maximum). At bearing locations, the stiffeners should be installed tight to the bottom flange with the gap to the top flange. At locations of concentrated loads, the stiffeners should be installed tight to the top flange with the gap to the bottom flange.
 3. Web stiffeners should be cut from APA-rated (or equal) OSB or plywood, 2x lumber is permissible. Do NOT use 1x lumber as it tends to split.
 4. Web stiffeners should be the same width as the bearing surface, with a minimum of 3-1/2".
 5. See table above for minimum stiffener thickness, maximum stiffener height and required nailing.

- NOTES:**
1. Web Stiffeners, when required, must be installed in pairs – one to each side of the web. Web stiffeners are always required for the "Bird's Mouth" roof bearing detail (Figure 9, Detail 6).
 2. Web stiffeners should be cut to fit between the flanges of the I-joist, leaving a minimum 1/8" gap (1" maximum). At bearing locations, the stiffeners should be installed tight to the bottom flange with the gap to the top flange. At locations of concentrated loads, the stiffeners should be installed tight to the top flange with the gap to the bottom flange.
 3. Web stiffeners should be cut from APA-rated (or equal) OSB or plywood, or from 2x lumber or structural composite lumber.
 4. Web stiffeners should be the same width as the bearing surface, with a minimum of 3-1/2".
 5. See Table 7 for required nailing, maximum stiffener depth and minimum stiffener thickness.
 6. See Tables 1 to 4 for minimum end bearing and interior bearing length.

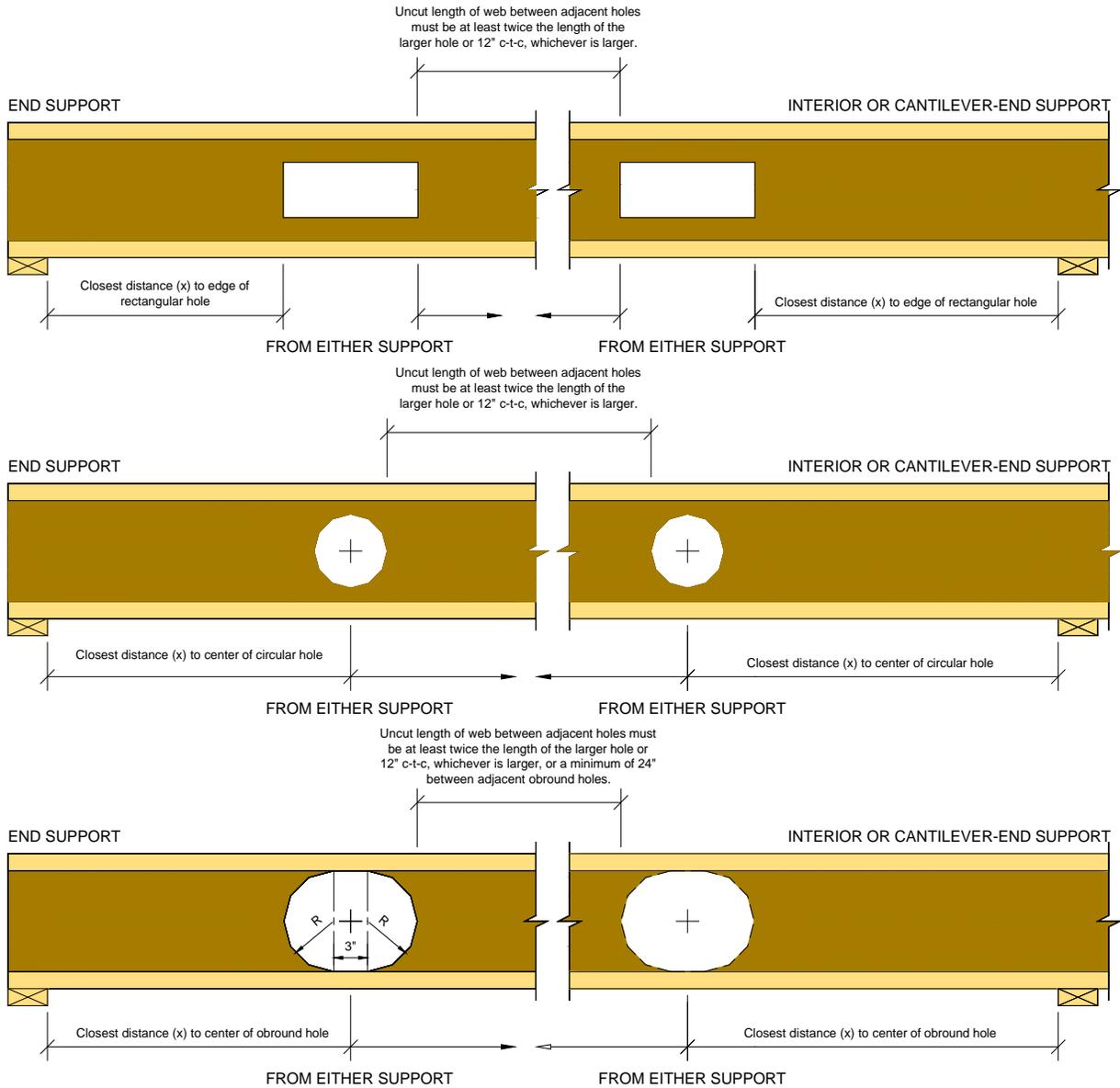
Table 3. I-Joist Web Stiffener Details

JOIST DEPTH	MAXIMUM WEB STIFFENER DEPTH	TOTAL NUMBER OF 8d BOX NAILS							
		LPI Series I-Joist							
(in.)	(in.)	¹ 100-150	² 200-250	² 300-350	^{3,5} 550	¹ 26	² 30	² 36	^{3,4} 56
9 1/4	6 1/8	-	-	-	-	3	-	-	-
9 1/2	6 3/8	3	3	3	-	3	3	-	-
11 1/4	8 1/8	-	-	-	-	3	-	-	-
11 1/2	8 3/8	-	-	-	-	-	-	-	-
11 7/8	8 3/4	3	3	3	3	3	3	4	4
14	10 7/8	-	3	3	3	-	4	5	5
16	12 7/8	-	3	3	3	-	4	6	6
18	14 7/8	-	-	-	-	-	-	7	7
20	16 7/8	-	-	-	-	-	-	8	8
22	18 7/8	-	-	-	-	-	-	9	9
24	20 7/8	-	-	-	-	-	-	10	10

For SI: 1 inch = 25.4 mm

- NOTES:**
1. Web stiffeners shall be a minimum of 15/32" thick.
 2. Web stiffeners shall be a minimum of 23/32" thick.
 3. Web stiffeners shall be a minimum of 1-1/2" thick.
 4. Web stiffeners shall be a minimum of 1-1/8" thick.
 5. For the LPI 550 and LPI 56A Series I-Joists it is required to use 10d box or common nails.
 6. See Figure 1 for I-Joist web stiffener requirements.

Figure 2. Web Hole Drawing for LPI Series I-Joists



For SI: 1 inch = 25.4 mm, 1 ft. = 305 mm.

Table 4. Web Hole Equations for LPI Series I-Joists

General equation form for allowable circular and rectangular holes shear:

$$\text{Allowable Web Hole Shear (lbs)} = C1 * (D - H)/D + C2 * W + C3$$

Where: D = Joist Depth (in)
 H = Hole Height (in)
 W = Hole Width (in)

Equation Constants:

Circular Holes				
Joist Series	C1	C2	C3	Maximum Depth
100	1050	0	38	-
200	885	0	307	-
300	1378	0	105	-
125	1050	0	38	-
225	885	0	307	-
325	1378	0	105	-
150	1050	0	38	-
250	885	0	307	-
350	1378	0	105	-
550	1378	0	105	-
26	1235	0	45	-
30	1041	0	361	-
36	1621	0	124	16"
56	1621	0	124	16"
36	2489	0	88	24"
56	2489	0	88	24"

LPI Joist		C1	C2	C3
Series	Depth			
26 30 36 56	9.5	610	-22.4	282
	11.875	610	-22.4	282
	14	1075	-33.8	413
	16	1075	-33.8	413
	18	1731	-52.0	599
	20	1731	-52.0	599
	22	1731	-52.0	599
	24	1731	-52.0	599
100 125 150 200 225 250 300 325 350 550	9.5	519	-19.0	240
	11.875	519	-19.0	240
	14	914	-28.7	351
	16	914	-28.7	351
	18	1471	-44.2	509
	20	1471	-44.2	509
	22	1471	-44.2	509
	24	1471	-44.2	509

Allowable Web Hole Shear for Obround Holes:

Joist Series	Shear (lbs)	Maximum Depth (in)	Joist Series	Shear (lbs)	Maximum Depth (in)
100	-	-	26	-	-
200	360	-	30	360	-
300	420	-	36	420	16
125	-	-	56	420	16
225	360	-	36	-	24
325	420	-	56	-	24
150	-	-			
250	360	-			
350	420	-			
550	420	-			

For SI: 1 inch = 25.4 mm, 1 lb = 4.45 N

NOTES:

1. The above Obround hole allowable shears apply to all joist depths in a given series and are based on the maximum size hole.
2. Smaller Obround holes are limited to the same value.
3. For LPI 36 and LPI 56A depths greater than 16", the maximum Obround hole for the 16" depth is permitted to be cut using the allowable for that depth.

DESIGN ASSUMPTIONS:

1. The Allowable Web Hole Shear calculated from above is for normal load duration and is permitted to be adjusted for other durations.
2. The critical location for web hole shear is at the center of a circular hole, or to either edge of a rectangular or Obround hole.
3. Obround holes are (up to) full web-depth holes with semi-circular ends defined by three overlapping circular holes spaced up to 1-1/2" apart, center-to-center of holes.
4. The maximum hole depth for circular and rectangular holes is Joist Depth less 4", except the maximum hole depth is 6" for 9-1/2" and 8" for 11-7/8" LPI Series I-joists. The maximum hole width for rectangular holes is 18". Where the Maximum Hole Dimension for rectangular holes exceeds the maximum hole depth, the dimension refers to hole width and the hole depth is assumed to be the maximum for that joist depth.
5. Holes shall not be located any closer than 12 inches or 3 times the length of the hole from the inside face of the closest bearing, without further analysis by a registered design professional.