LSB LiteSteelbeam

# LiteSteel beam Part 4 Structural Design

## Residential Construction Manual For LiteSteel® beam

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## Contents

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## 4.1 General

Span tables are provided for using the LiteSteel beam in a range of structural applications in floors, loadbearing walls and roofs of houses. The basis for the structural design of the LSB structural members and connections for these tables is contained in this part.

## 4.2 Member Design

### 4.2.1 Design Standard

The LSB is a cold-formed steel product so the applicable design standard is AS/NZS 4600 Cold-formed steel structures. All member capacities and connection capacities relevant to the LSB used to develop the span tables and connection details have been calculated in accordance with this standard. Refer to LST (2007a) and LST (2007b) for design capacity tables and connection capacity tables for the LSB.

### 4.2.2 Member Design Capacities

The LSB capacities which have been considered in the development of the span tables are:

- Bending capacity
- Shear capacity
- Bearing capacity at concentrated loads and at supports

The member restraint conditions assumed for each member type are given in the design criteria with the relevant tables.

### 4.2.3 Combined Actions

For two span continuous beams presented in the span tables, the following combinations of actions have been considered at the internal supports:

- Bending and shear
- Bending and bearing

### 4.2.4 Deflection

Deflections have been calculated using the LSB section properties given in Tables 2.1-1 and 2.1-2, and using widely accepted deflection formulae for beams. Refer also to LST (2005a) and Syam (1992).

## 4.3 Connection Design

### 4.3.1 General

Connection details and capacities are presented in Part 9 of this publication. Wherever possible the designer or builder is given a range of options for achieving a connection between members.

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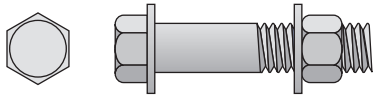
## 4.3.2 Bolted Connections

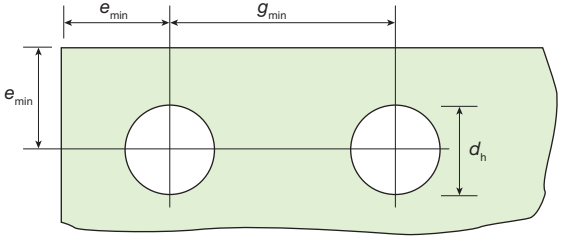
The flat vertical web makes the LSB ideal for simple bolted connections. Part 9 gives several options for bolted connections using metric "commercial" hexagon bolts of property class 4.6 manufactured to AS 1111, associated nuts manufactured to AS 1112, and washers manufactured to AS 1237. To avoid corrosion, particularly during construction, it is recommended that bolts, nuts and washers are hot-dip galvanised. Typical bolt sizes used in this publication are M10, M12 and M16.



LSB bolted connections are designed to Section 5.3 of AS/NZS 4600. Steel connection plates greater than or equal to 3 mm thick are designed to AS 4100. Details of standard hole sizes, minimum edge distances and minimum hole spacing in accordance with AS/NZS 4600 are given in Table 4.1. These apply to the LSB and other brackets and cleats used in the connections.

**Note: All bolts must have a standard washer under both the bolt head and the nut.**

**Table 4.1: Details for Standard Bolt Holes**




| Bolt Size | Diameter of Standard Hole $d_h$ | Minimum Edge Distance $e_{min}$ | Minimum Hole Spacing $g_{min}$ |
|---|---|---|---|
| | mm | mm | mm |
| M10 | 11 | 15 | 30 |
| M12 | 14 | 18 | 36 |
| M16 | 18 | 24 | 48 |

**Note: The hole spacing in the table is the minimum to comply with AS/NZS 4600. The spacing specified must also be sufficient to provide clearance for bolt heads, nuts, washers and the spanner.**

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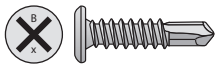
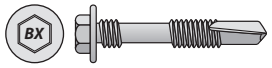
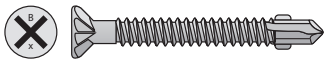
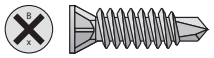
## 4.3.3 Screwed Connections

Self-drilling screws (Tek® screws) used for connection to the LSB must comply with AS 3566.1 for general requirements and mechanical properties, and with AS 3566.2 for corrosion resistance. Generally the screws used for connections have hexagon washer heads, except for flooring for which the screws will have cross-recessed counter-sunk flat heads.

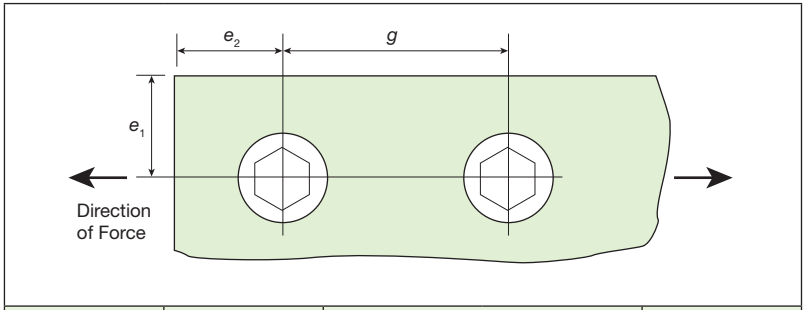
The connection details and capacities given in Part 9 of this publication are based on the following Buildex® screws:

| | Screw | Application |
|---|---|---|
|  | Buildex® Teks® Hexagon Head no Seal | General Structural connection |
|  | Buildex® Teks® Wafer Head | General Structural connection needing low profile head |
|  | Buildex® Super Teks® Series 500 Hex Head no Seal | Structural connections to thick steel or to penetrate both faces of the LSB hollow flange |
|  | Buildex® Wing Teks® Countersunk Ribbed Head | Connecting particle board and timber flooring to LSB floor joists |
|  | Buildex® Fibre Teks® Series 500 Countersunk Ribbed Head | Connecting compressed fibre cement floor sheets to LSB floor joists |

Refer to the Buildex® Product Catalogue and Selection Guide – 2004 for further information on the available screws and their use.

Connection capacities are calculated in accordance with Clause 5.4 of AS/NZS 4600. For shear connections the minimum screw spacing and edge distances required by this standard are $3d_f$ except that the edge distance may be reduced to $1.5d_f$ in the direction perpendicular to the force (where $d_f$ is the nominal diameter of the screw). Minimum screw spacing and edge distances for the screw sizes considered in this publication are given in Table 4.2.

### Table 4.2 Details for Standard Tek Screws




| Screw Size | Nominal Diameter $d_f$ | Minimum Edge Distance | | Minimum Hole Spacing $g$ |
|---|---|---|---|---|
| | | Side $e_1$ | End $e_2$ | |
| | mm | mm | mm | mm |
| No.10 | 4.8 | 7.5 | 15 | 15 |
| No.12 | 5.5 | 8.5 | 17 | 17 |
| No.14 | 6.3 | 9.5 | 19 | 20 |

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### 4.3.4 Blind Riveted Connections

Blind rivets can be used for connecting thin steel sections and brackets to the LSB. However they are not considered in this publication because they are more applicable to factory assembly of steel frames. Other fasteners which do not require holes to be pre-drilled tend to be faster and therefore more appropriate for site work.

The design of blind riveted connections must comply with the relevant provisions of Section 5.5 of AS/NZS 4600.

### 4.3.5 Welded Connections

The LiteSteel beam can be readily welded using appropriate arc welding processes. The design of welded connections must comply with Section 5.2 of AS/NZS 4600.

The following welding consumables are suitable for DuoSteel grade sections:

- Stick electrodes E48XX
- Wire consumables W50X

Refer to LST (2007b) for further guidance on designing welded connections to the LSB.

### 4.3.6 Other Fasteners

Other fasteners may be used for connections to the LSB provided their suitability and capacity in particular connection configurations is verified. Advice should be sought from the fastener manufacturer and/or a structural engineer competent in the design of cold-formed steel structures.

Pneumatically driven nails may be used for nominal connections to LSB members up to 2.0 mm thick. Various brands of nails and nail guns can perform differently. For best results, selected nails and nail guns should be tested for size and penetration prior to construction. Air pressure should be in the range of 100-200 psi.

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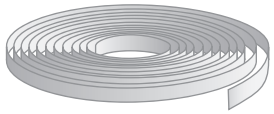
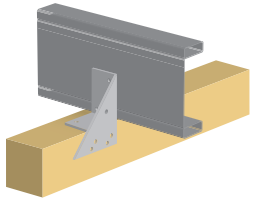
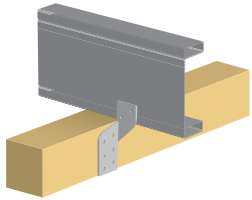
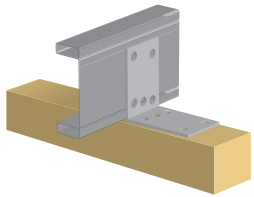
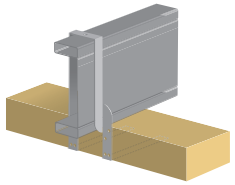
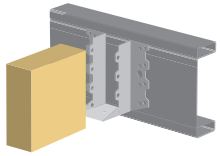
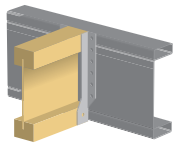
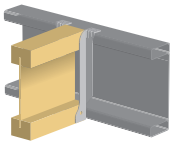
## 4.3.7 Connectors

There are many galvanised steel connectors used for timber framing which can also be used for connections to the LSB. Where possible, connection details are given using readily available connectors and brackets. Examples from the Pryda range of products are shown below.

When using any connectors that have holes pre-punched, it is important to ensure that the edge distances and spacing of fasteners are sufficient in accordance with the requirements of AS/NZS 4600 and with recommendations given on this publication. If the pre-punched holes are not used for fasteners such as self-drilling screws, there must also be sufficient space between the fastener and the unused hole. The connection details provided in Part 9 also make use of standard steel angles, flats and plates.

| Unpunched Strapping | Triple Grips | Unities | Pergola Angles |
|---|---|---|---|
|  |  |  |  |
| G300-Z275, 30 × 0.8 mm thick | G300-Z275, 1.0 mm thick | G300-Z275, 1.0 mm thick | G300-Z275, 1.6 or 2.0 mm thick |
| **Cyclone Straps** | **Joist Hangers** | **I-Joist Hangers (face mounted)** | **I-Joist Hangers (top mounted)** |
|  |  |  |  |
| G300-Z275, 1.0 mm thick | G300-Z275, 1.0 mm thick | G300-Z275, 1.2 mm thick | G300-Z275, 1.2 mm thick |