

# CODE OF STANDARD PRACTICE FOR STEEL JOISTS AND JOIST GIRDERS

Adopted by the Steel Joist Institute April 7, 1931  
Revised to May 18, 2010 - Effective December 31, 2010

## SECTION 1 GENERAL

### 1.1 SCOPE

The practices and customs set forth herein are in accordance with good engineering practice, tend to ensure safety in steel joist and Joist Girder construction, and are standard within the industry. There shall be no conflict between this code and any legal building regulation. This code shall only supplement and amplify such laws. Unless specific provisions to the contrary are made in a contract for the purchase of steel joists or Joist Girders, this code is understood to govern the interpretation of such a contract.

### 1.2 APPLICATION

This Code of Standard Practice is to govern as a standard unless otherwise covered in the architects' and engineers' plans and specifications.

### 1.3 DEFINITIONS

**Add-Load.** A single vertical concentrated load which occurs at any one panel point along the joist chord. This load is in addition to any other gravity loads specified.

**Bend-Check Load.** A vertical concentrated load used to design the joist chord for the additional bending stresses resulting from this load being applied at any location between the joist panel points. This load shall already be accounted for in the specified joist designation load, uniform load, or Add-load and is used only for the additional bending check in the chord and does not contribute to the overall axial forces within the joist. An ideal use of this is for incidental loads which have already been accounted for in the design loading but may induce additional bending stress due to this load occurring at any location along the chord.

**Buyer.** The entity that has agreed to purchase material from the manufacturer and has also agreed to the terms of sale.

**Erector.** The entity that is responsible for the safe and proper erection of the materials in accordance with all applicable codes and regulations.

**Material.** Steel joists, Joist Girders and accessories as provided by the seller.

**Owner.** The entity that is identified as such in the contract documents.

**Placement Plans.** Drawings that are prepared depicting the interpretation of the contract documents requirements for the material to be supplied by the seller. These floor or roof plans are approved by the specifying professional, buyer, or owner for conformance with the design requirements. The seller uses the information contained on these drawings for final material design. A unique piece mark number is typically shown for the individual placement of the steel joists, Joist Girders and accessories along with sections that describe the end bearing conditions and minimum attachment required so that material is placed in the proper location in the field.

**Seller.** A company certified by the Steel Joist Institute engaged in the manufacture and distribution of steel joists, Joist Girders and accessories.

**Specifying Professional.** The licensed professional who is responsible for sealing the building contract documents, which indicates that he or she has performed or supervised the analysis, design and document preparation for the structure and has knowledge of the load-carrying structural system.

**Structural Drawings.** The graphic or pictorial portions of the contract documents showing the design, location and dimensions of the work. These documents generally include plans, elevations, sections, details, connections, all loads, schedules, diagrams and notes.

#### **1.4 DESIGN**

In the absence of ordinances or specifications to the contrary, all designs prepared by the **specifying professional** shall be in accordance with the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.

#### **1.5 RESPONSIBILITY FOR DESIGN AND ERECTION**

When material requirements are specified, the seller shall assume no responsibility other than to furnish the items listed in Section 5.2(a). When material requirements are not specified, the seller shall furnish the items listed in Section 5.2(a) in accordance with Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption, and this code. Pertinent design information shall be provided to the seller as stipulated in Section 6.1. The seller shall identify material by showing size and type. In no case shall the seller assume any responsibility for the erection of the item furnished.

#### **1.6 PERFORMANCE TESTS FOR K-SERIES STEEL JOIST CONSTRUCTION**

When a performance test on a joist is required, the following criteria shall be used:

- a) The performance test load shall be the maximum factored uniformly distributed downward design load for the selected joist.
  - (1) For a **K-Series** joist, this is the TOTAL safe factored uniformly distributed load-carrying capacity tabulated in the Standard LRFD Load Table for the specific joist size and span.
  - (2) For a **K-Series** joist with factored loading conditions other than found in the Standard LRFD Load Table, this is the LRFD Load Combination resulting in the highest uniformly distributed downward factored design load.
  - (3) For a **K-Series** joist with loading conditions other than found in the Standard ASD Load Table, this is the ASD Load Combination resulting in the highest uniformly distributed downward design load multiplied times 1.50.
- b) Joist self-weight and the weight of all test materials shall be included in the calculation of applied performance test loading as appropriate for the joist during testing.

- c) Loading shall be uniformly distributed across the full length of the joist top chord, and the load application shall maintain uniform distribution throughout the test. At any stage during the application of the test loading, the test load shall not be distributed in such a manner as to result in any joist component being subjected to a higher proportion of force than intended by the joist design.
- d) If tested as a panel assembly, the joists shall be tested in pairs with deck, deck attachments, and bridging installed per the approved joist and deck placement plans. All bottom chord horizontal bridging rows shall be terminated by bracing back to the top chord of the adjacent joist or by a lateral restraint system which does not inhibit the vertical deflection of the test joist.
- e) If tested singly, in a load test machine apparatus, the joist chords shall be braced to prevent lateral movement, without inhibiting vertical displacement. The joist top chord shall have lateral braces located at equal spacing of no more than 36 inches (914 mm) on center. The joist bottom chord shall have lateral braces located, at minimum, per the bottom chord bridging locations shown on the approved joist placement plan.
- f) The performance test loading shall be applied at a rate of no greater than 25 plf per minute and shall be sustained for no less than 15 minutes. After the maximum test load has been removed for a minimum of 10 minutes, the remaining vertical displacement at midspan shall not exceed 20% of the vertical midspan deflection sustained under the full performance test load.
- g) All costs associated with such testing shall be borne by the purchaser.
- h) Joists that have been designed and manufactured and have satisfied the above performance test criteria shall be considered to satisfy the intent of the **K-Series** Standard Specification, and shall be considered safe for use in construction. No further proof of strength of individual joist components or connections is required.

## SECTION 2 JOISTS, JOIST GIRDERS, AND ACCESSORIES

### 2.1 STEEL JOISTS AND JOIST GIRDERS

Steel joists and Joist Girders shall carry the designations and meet the requirements of the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.

**K-Series** joists are furnished with parallel chords only and with a standard end bearing depth of 2 1/2 inches (64 mm). Joist bearing seat depths greater than 2 1/2 inches (64 mm) are available when requirements warrant deeper bearing seats. Conditions where a bearing seat depth of more than 2-1/2 inches (64 mm) may be required include:

- Sloped joists;
- Mixing **K-Series** and **LH-Series** products at a common interior support;
- Masonry supports with a steel bearing plate more than 1/2 inch (13 mm) from the face of the wall.

**LH-** and **DLH-Series** joists are furnished either underslung or square ended, with top chords either parallel, pitched one way or pitched two ways.

Underslung types are furnished with minimum end bearing depths as shown in Table 2-1. A standard maximum joist bearing seat width (perpendicular to the joist length) is provided. This width shall be permitted to vary based on the joist design and manufacturer. For sloped joist bearing seats refer to the sloped seat requirements tables in the Accessories and Details section of this catalog.

Because **LH-** and **DLH-**Series joists may have exceptionally large end reactions, it is recommended that the supporting structure be designed to provide a nominal minimum unit bearing pressure of 750 pounds per square inch (5171 kilo Pascals).

It is not recommended that a **DLH-**Series joist that exceeds 72 inches (1829 mm) deep and has a span greater than 80 feet (24384 mm) be used in a bottom bearing configuration.

**TABLE 2-1**

<b>STANDARD END BEARING SEAT DEPTH AND STANDARD MAXIMUM SEAT WIDTH</b>			
<b>JOIST SERIES</b>	<b>SECTION NUMBER*</b>	<b>MINIMUM BEARING DEPTH</b>	<b>MAXIMUM SEAT WIDTH**</b>
K	ALL	2 ½" (64 mm)	6" (152 mm)
LH/DLH	2 – 17	5" (127 mm)	8" (229 mm)
DLH	18 – 20	7 ½" (191 mm)	12" (305 mm)
DLH	21 – 25	7 ½" (191 mm)	13" (330 mm)
*REFER TO LAST DIGIT(S) OF JOIST DESIGNATION			
**THE SEAT WIDTH MAY VARY BASED ON DESIGN			

Joist Girders are furnished either underslung or square ended with top chords either parallel, pitched one way or pitched two ways. Underslung types are furnished with a standard end bearing depth of 7 1/2 inches (191 mm). Joist Girders shall be permitted to have either parallel chords or a top chord pitch of up to 1/2 inch per foot (1:24). The nominal depth of a pitched Joist Girder is taken at the center of the span.

Joist Girder bearing seat widths vary depending on the Joist Girder size and shall be permitted to be up to 13" (330 mm) wide. The supporting structural member shall be made wide enough to accommodate the seat widths.

**2.2 JOIST LOCATION AND SPACING**

The maximum joist spacing shall be in accordance with the requirements of the Standard Specifications Load Tables & Weight Tables of latest adoption.

Where sidewalls, wall beams or tie beams are capable of supporting the floor slab or roof deck, the first adjacent joists may be placed one full space from these members. Joists are provided with camber and may have a significant difference in elevation with respect to the adjacent structure because of this camber. This difference in elevation should be given consideration when locating the first joist adjacent to a side wall, wall beam or tie beam.

Open Web Steel Joists, **K-Series**, should be placed no closer than 6 inches (152 mm) to supporting walls or members. Where partitions occur parallel to joists, there shall be at least one joist provided under each such partition, and more than one such joist shall be provided if necessary to safely support the weight of such partition and the adjacent floor, less the live load, on a strip of floor one foot (305 mm) in width. When partitions occur perpendicular to the joists, they shall be treated as concentrated loads, and joists shall be investigated as indicated in Section 6.1.

### **2.3 SPECIFYING DESIGN LOADS**

Neither the Steel Joist Institute nor the joist manufacturer establishes the loading requirements for which structures are designed.

The specifying professional shall provide the nominal loads and load combinations as stipulated by the applicable code under which the structure is designed and shall provide the design basis (ASD or LRFD).

The specifying professional shall calculate and provide the magnitude and location of ALL JOIST and JOIST GIRDER LOADS. This includes all special loads (drift loads, mechanical units, net uplift, axial loads, moments, structural bracing loads, or other applied loads) which are to be incorporated into the joist or Joist Girder design. For Joist Girders, reactions from supported members shall be clearly denoted as point loads on the Joist Girder. When necessary to clearly convey the information, a Load Diagram or Load Schedule shall be provided.

The specifying professional shall give due consideration to the following loads and load effects:

1. Ponded rain water.
2. Accumulation of snow in the vicinity of obstructions such as penthouses, signs, parapets, adjacent buildings, etc.
3. Wind.
4. Type and magnitude of end moments and/or axial forces at the joist and Joist Girder end supports shall be shown on the structural drawings. For moment resisting joists or Joist Girders framing at or near the top of a column, due consideration shall be given to extend the column length to allow a plate type connection between the top of the joist or Joist Girder top chord and the column.

Avoid transferring joist or Joist Girder end moments and axial forces through the bearing seat connection.

A note shall be provided on the structural drawings stating that all moment resisting joists shall have all dead loads applied to the joist before the bottom chord struts are welded to the supporting connection whenever the moments provided do not include dead load.

The top and bottom chord moment connection details shall be designed by the specifying professional. The joist designer shall furnish the specifying professional with the joist detail information if requested.

The nominal loads, as determined by the specifying professional, shall not be less than that specified in the applicable building codes.

Where concentrated loads occur, the magnitude and location of these concentrated loads shall be shown on the structural drawings when, in the opinion of the specifying professional, they shall require consideration by the joist manufacturer. For nominal concentrated loads, which have been accounted for in the specified uniform design loads, a "strut" to transfer the load to a panel point on the opposite chord shall not be required provided that the sum of the concentrated loads within a chord panel does not exceed 100 pounds and the attachments are concentric to the chord.

#### **(a) Specifying Joist Design Loads**

The Steel Joist Institute Load Tables are based on uniform loading conditions and are valid for use in selecting joist sizes for gravity loads that can be expressed in terms of "pounds per linear foot" (kiloNewtons per meter) of joist.

The specifying professional shall use one of the five options described below that allows:

- The estimator to price the joists.
- The joist manufacturer to design the joists properly.
- The owner to obtain the most economical joists.

**Option 1:** Select a joist designation from the Standard Load Table (or specify a joist type using a uniform load in the designation) which has been determined to be adequate for all design loads. The shear and moment envelope resulting from the selected uniform load shall meet the actual shear and moment requirements. Thus, this option alone may not be adequate if large concentrated loads need to be designed for.

**Option 2:** Select a joist designation from the Standard Load Table (or specify a joist type using a uniform load in the designation) and also provide the load and location of any additional loads on the structural plan with a note “Joist manufacturer shall design joists for additional loads at locations shown.” This option works well for a few added loads per joist with known magnitude and locations.

**Option 3:** For additional point loads with exact locations not known along the joist or for incidental loads, any one, or both, of the following can be specified on the structural plan in addition to option 1 or 2 above:

- a) “**Design for a ( ) lb. concentrated load located at any one panel point along the joist**”. This is referred to as an “Add-Load”.
- b) “**Design for additional bending stresses resulting from a ( ) lb. concentrated load located at any location along ( ) chord**”. This is referred to as a “Bend-Check” and can be specified on top chord, bottom chord, or both top and bottom chords. This can be used when the concentrated load is already accounted for in the joist designation, uniform load, or specified Add-Load yet this specified amount of load shall be permitted to also be located at any location between panel points. The additional bending stresses as a result of this load are then designed for. A Bend-Check load shall not exceed (Add-Load + 400 lbs.) A Bend-Check load can be specified by itself without an Add-Load.
- c) Both (a) and (b) above can be specified with equal concentrated loads for each; or simply denote “**Design joist for a ( ) lb. concentrated load at any location along the ( ) chord.**”

Example uses:

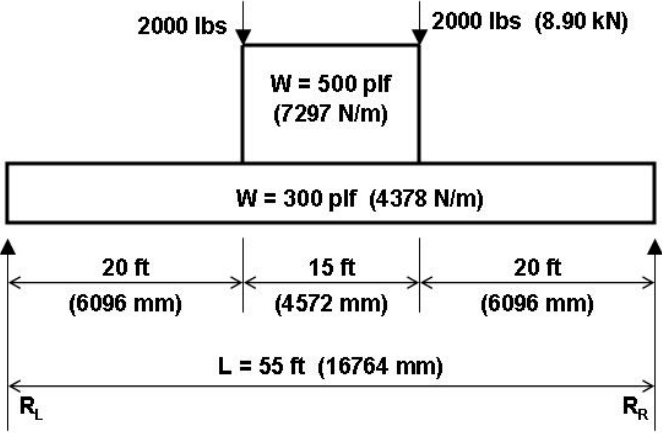
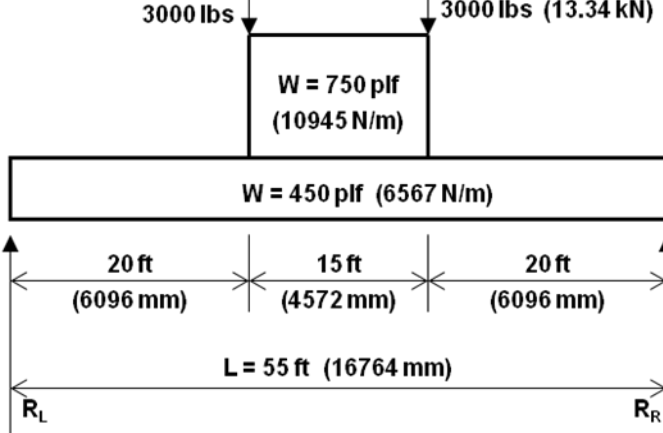
- Specifying professional selects a standard joist capable of carrying a 500 lb. RTU. However, the location and exact frame size is not yet known but the frame load shall result in two- 250 lbs. point loads at least 5'-0" apart. **Specify a 250 lb. Bend-Check**
- Standard joist specified but not selected for 500 lb. RTU load, location not known. **Specify a 500 lb. Add-Load and 250 lb. Bend-check.**
- Standard SJI joist selected to carry collateral load of 3 psf. Specifying professional wants bending from 150 lb. incidental loads to also be designed for. **Specify a 150 lb. Bend-Check.**

**Option 4:** Select a KCS joist using moment and end reaction without specifying added loads or diagrams. This option works well for concentrated loads for which exact locations are not known or for multiple loading.

- a) Determine the maximum moment.
- b) Determine the maximum end reaction (shear).
- c) Select the required KCS joist that provides the required moment and end reaction (shear). Note that the top chord end panel is designed for axial load based on the force in the first tension web, which is based on the specified end reaction. A uniform load of 825 plf (12030 N/m) LRFD or 550 plf (8020 N/m) ASD is used to check end panel bending. If the end panel loading exceeds this, reduce the joist spacing or go to Option 5.
- d) Specify on the structural drawings that an extra web shall be field applied at all concentrated loads not occurring at panel points.



OPTION 4 - ASD EXAMPLE 2:	OPTION 4 - LRFD EXAMPLE 2:
<b>U.S. CUSTOMARY UNITS AND (METRIC UNITS)</b>	<b>U.S. CUSTOMARY UNITS AND (METRIC UNITS)</b>
<p><math>M = 443 \text{ k-in. (50.1 kN-m)}</math></p> <p><math>R_L = 5000 \text{ lbs (22.24 kN)}, R_R = 5340 \text{ lbs (23.75 kN)}</math></p> <p>Select a 22KCS2, <math>M = 488 \text{ k-in. (55.1 kN-m)}</math></p> <p><math>R = 5900 \text{ lbs (26.2 kN)}</math></p> <p>Bridging section no. 6 for <math>L = 30 \text{ ft. (9144 mm)}</math></p> <p>Use 22K6 to determine bridging and stability requirements. Since the maximum uniform load of 430 plf [6275 N/m] (270 plf (3940 N/m) + 160 plf (2335 N/m)) does not exceed the maximum KCS Joist uniform load of 550 plf (8020 N/m) and a standard KCS Joist can be selected from the load table, a load diagram is not required.</p>	<p><math>M = 664 \text{ k-in. (75.03 kN-m)}</math></p> <p><math>R_L = 7500 \text{ lbs (33.36 kN)}, R_R = 8010 \text{ lbs (35.63 kN)}</math></p> <p>Select a 22KCS2, <math>M = 732 \text{ k-in. (82.64 kN-m)}</math></p> <p><math>R = 8850 \text{ lbs (39.3 kN)}</math></p> <p>Bridging section no. 6 for <math>L = 30 \text{ ft. (9144mm)}</math></p> <p>Use 22K6 to determine bridging and stability requirements. Since the maximum <b>factored</b> uniform load of 645 plf (9413 N/m) (405 plf (5911 N/m) + 240 plf (3503 N/m)) does not exceed the maximum KCS Joist uniform load of 825 plf (12030 N/m) and a standard KCS Joist can be selected from the load table, a load diagram is not required.</p>

<b>OPTION 4 - ASD EXAMPLE 3:</b>	<b>OPTION 4 - LRFD EXAMPLE 3:</b>
<b>U.S. CUSTOMARY UNITS AND (METRIC UNITS)</b>	<b>U.S. CUSTOMARY UNITS AND (METRIC UNITS)</b>
	
<p>M = 2910 k-in. (328.8 kN-m)  <math>R_L = R_R = 14000</math> lbs (62.28 kN)                      EXCEEDS CAPACITY OF 30KCS5 (MAXIMUM KCS JOIST) AND EXCEEDS MAXIMUM UNIFORM LOAD OF 550 plf (8027 N/m).  <b>OPTION A:</b> Use double joists each having a minimum moment capacity, <math>M = 1455</math> k-in. (164.4 kN-m) and shear capacity, <math>R = 7000</math> lbs (31.14 kN) and a uniform load of 400 plf (5838 N/m).                      Select two 28KCS5, <math>M = 1704</math> k-in. (192.5 kN-m),  <math>R = 9200</math> lbs (40.9 kN).                      Bridging section no. 12 for <math>L = 55</math> ft. (16764 mm). Use 28K12 to determine bridging and stability requirements.</p> <p><b>OPTION B:</b> Select a LH-Series Joist. See OPTION 5.</p>	<p>M = 4365 k-in. (493.2 kN-m)  <math>R_L = R_R = 21000</math> lbs (93.41 kN)                      EXCEEDS CAPACITY OF 30KCS5 (MAXIMUM KCS JOIST) AND EXCEEDS MAXIMUM <b>FACTORED</b> UNIFORM LOAD OF 825 plf (12040 N/m).  <b>OPTION A:</b> Use double joists each having a minimum moment capacity, <math>M = 2183</math> k-in. (246.65 kN-m) and shear capacity, <math>R = 10500</math> lbs (46.71 kN) and a uniform load of 600 plf (8756 N/m).                      Select two 28KCS5, <math>M = 2556</math> k-in. (288.7 kN-m),  <math>R = 13800</math> lbs (61.3 kN).                      Bridging section no. 12 for <math>L = 55</math> ft. (16764 mm) Use 28K12 to determine bridging and stability requirements.</p> <p><b>OPTION B:</b> Select a LH-Series Joist. See OPTION 5.</p>

**Option 5:** Specify a SPECIAL joist designation when the joist includes more complex loading or for conditions which need consideration of multiple potentially controlling load combinations.

- a) Provide a load diagram and/or enough information on the drawings to clearly define ALL loads.
- b) If the loading criteria are too complex to adequately communicate on the drawings or with a simple load diagram, then the specifying professional shall provide a load schedule along with the appropriate load combinations. Regardless of where the loads are shown, unfactored design loads broken down by load categories shall be provided in order to design the joists correctly with applicable load combinations.

Place the designation (e.g. 28K SP or 28LH SP) with the following note: "Joist manufacturer to design joist to support loads as shown."

<b>OPTION 5 - ASD EXAMPLE:</b>	<b>OPTION 5 - LRFD EXAMPLE:</b>
<b>U.S. CUSTOMARY UNITS AND (METRIC UNITS)</b>	<b>U.S. CUSTOMARY UNITS AND (METRIC UNITS)</b>
<b>Load diagram per ASCE 7 2.4.1(3), D + S</b>	<b>Unfactored Load diagram per ASCE 7 2.3.2(3), 1.2D+1.6S</b>
<p>The diagram shows a 30'-0" (9.14 m) span supported by reactions <math>R_L</math> and <math>R_R</math>. The joist is labeled "32LH SP". The total height is 18" (457 mm). The loads are: a triangular snow load of 160 lb/ft (2.34 kN/m) over an 8'-0" (2.44 m) length; a 500 lbs (2.22 kN) point load at 6'-0" (1.83 m) from the left end; a 300 lbs (1.33 kN) point load at 3'-0" (0.91 m) from the right end; a uniform dead load of 60 lb/ft (0.88 kN/m) over the entire span; and a 7'-0" (2.13 m) section at the right end with a 800 lbs (3.56 kN) point load.</p> <p>Joist manufacturer to design joist to support loads as shown above.</p>	<p>The diagram shows a 30'-0" (9.14 m) span supported by reactions <math>R_L</math> and <math>R_R</math>. The joist is labeled "32LH SP". The total height is 18" (457 mm). The loads are: a triangular snow load of 160 lb/ft SL (2.34 kN/m) over an 8'-0" (2.44 m) length; a 500 lbs DL (2.22 kN) point load at 6'-0" (1.83 m) from the left end; a 300 lbs DL (1.33 kN) point load at 3'-0" (0.91 m) from the right end; a uniform dead load of 60 lb/ft (0.88 kN/m) over the entire span; and a 7'-0" (2.13 m) section at the right end with a 800 lbs DL (3.56 kN) point load.</p> <p>Joist manufacturer to design joist to support <b>unfactored</b> loads as shown above.</p>
<b>PLEASE NOTE THE LOAD COMBINATIONS SHOWN ARE FOR REFERENCE EXAMPLES ONLY.</b>	

**CAUTION FOR OPTIONS 1 thru 5 ABOVE:**

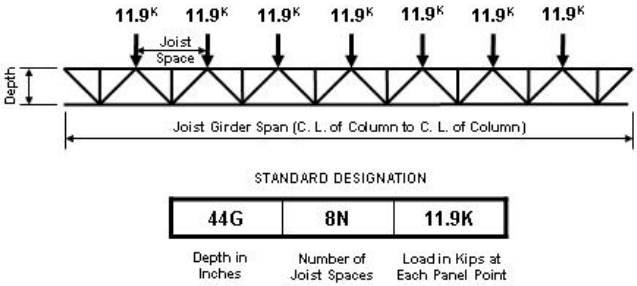
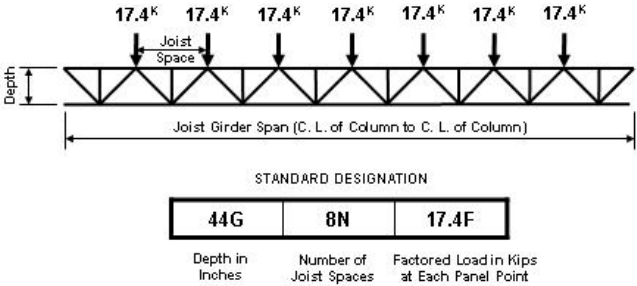
1. If a K-Series joist is being specified, the specifying professional shall compare the equivalent uniform loads derived from the maximum moment and shear to the uniform loads tabulated in the **K-Series Load Table**. An equivalent unfactored uniform load in excess of 550 plf (8020 N/m) or a maximum unfactored end reaction exceeding 9200 lbs. (40.9 kN) indicates that the specifying professional shall use additional joists to reduce the loading or use an **LH-Series** joist and make provisions for 5 inch (127 mm) deep bearing seats.
2. If the joist has not been designed for localized accumulation of loads which results in a point or concentrated load, this load attachment shall be made at top or bottom chord panel points. Therefore, specify on the structural drawings, "Where concentrated loads do not occur at panel points, an extra web shall be field applied from the point of attachment to a panel point on the opposite chord".

**(b) Specifying Joist Girder Design Loads**

The Steel Joist Institute's Design Guide ASD or LRFD Weight Tables for Joist Girders are based on uniformly spaced panel point loading conditions and are valid for use in selecting Joist Girder sizes for gravity conditions that can be expressed in kips (kiloNewtons) per panel point on the Joist Girder. Note that anything other than point loads shall be shown unfactored or in a schedule. For a given Joist Girder span, the specifying professional first determines the number of joist spaces. Then the panel point loads are calculated and a depth is selected. The information provided in the tables gives the Joist Girder weight in pounds per linear foot (kiloNewtons per meter) for various depths and loads.

1. The purpose of the Joist Girder Design Guide Weight Table is to assist the specifying professional in the selection of a roof or floor support system.
2. It is not necessary to use only the depths, spans, or loads shown in the tables.
3. Holes in chord elements present special problems which shall be considered by both the specifying professional and the Joist Girder Manufacturer. The sizes and locations of such holes shall be clearly indicated on the structural drawings.

4. Live load deflection rarely governs because of the relatively small span to depth ratios of Joist Girders. However, it is recommended that a breakdown of the point loads, by load category (i.e. TL/LL), be provided so specified deflection requirements and load combinations can be properly accounted for in design.

<b>Example using <u>Allowable Strength Design (ASD)</u> and U. S. Customary units:</b>	<b>Example using <u>Load and Resistance Factor Design (LRFD)</u> and U. S. Customary units:</b>
	
<p>Given 42'-0" x 50'-0" bay. Joists spaced on 5'-3" centers</p> <p>Live Load = 30 psf</p> <p>Dead Load = 15 psf</p> <p>(includes the approximate Joist Girder weight)</p> <p>Total Load = 45 psf</p> <p>Note: Web configuration may vary from that shown. Contact joist manufacturer if exact layout must be known.</p> <ol style="list-style-type: none"> <li>1. Determine number of actual joist spaces (N). In this example, N = 8.</li> <li>2. Compute total load: Total load = 5.25 x 45 psf = 236.25 plf</li> <li>3. Joist Girder Section: (Interior)             <ol style="list-style-type: none"> <li>a) Compute the factored concentrated load at top chord panel points <math>P = 236.25 \times 50 = 11,813 \text{ lbs} = 11.9 \text{ kips}</math> (use 12K for depth selection).</li> <li>b) Select Joist Girder depth: Refer to the ASD Joist Girder Design Guide Weight Table for the 42'-0" span, 8 panel, 12.0K Joist Girder. The rule of about one inch of depth for each foot of span is a good compromise of limited depth and economy. Therefore, select a depth of 44 inches.</li> <li>c) The Joist Girder shall then be designated 44G8N11.9K.</li> </ol> </li> </ol>	<p>Given 42'-0" x 50'-0" bay. Joists spaced on 5'-3" centers</p> <p>Live Load = 30 psf x 1.6</p> <p>Dead Load = 15 psf x 1.2</p> <p>(includes the approximate Joist Girder weight)</p> <p>Total Load = 66 psf (factored)</p> <p>Note: Web configuration may vary from that shown. Contact joist manufacturer if exact layout must be known.</p> <ol style="list-style-type: none"> <li>1. Determine number of actual joist spaces (N). In this example, N = 8.</li> <li>2. Compute total factored load: Total load = 5.25 x 66 psf = 346.50 plf</li> <li>3. Joist Girder Section: (Interior)             <ol style="list-style-type: none"> <li>a) Compute the factored concentrated load at top chord panel points <math>P = 346.5 \times 50 = 17,325 \text{ lbs} = 17.4 \text{ kips}</math> (use 18K for depth selection).</li> <li>b) Select Joist Girder depth: Refer to the LRFD Joist Girder Design Guide Weight Table for the 42'-0" span, 8 panel, 18.0K Joist Girder. The rule of about one inch of depth for each foot of span is a good compromise of limited depth and economy. Therefore, select a depth of 44 inches.</li> <li>c) The Joist Girder shall then be designated 44G8N17.4F. Note that the letter "F" is included at the end of the designation to clearly indicate that this is a factored load.</li> </ol> </li> </ol>

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<p>d) The ASD Joist Girder Design Guide Weight Table shows the weight for a 44G8N12K as 49 pounds per linear foot. The designer should verify that the weight is not greater than the weight assumed in the Dead Load above.</p> <p>e) Check live load deflection:                  Live load = 30 psf x 50 ft. = 1500 plf                  Approximate Joist Girder moment of inertia = 0.027 NPLd                  = 0.027 x 8 x 11.9 x 42 x 44 = 4750 in.<sup>4</sup>                  Allowable deflection for plastered ceilings                  = L/360 = <math>\frac{42(12)}{360} = 1.40</math> in.  <math display="block">\Delta = 1.15 \left[ \frac{5wL^4}{384EI} \right] = \frac{1.15(5)(1.500/12)[(42)(12)]^4}{384(29000)(4750)}</math>                 = 0.88 in. &lt;1.40 in., Okay</p>	<p>d) The LRFD Joist Girder Design Guide Weight Table shows the weight for a 44G8N18.0F as 49 pounds per linear foot. The designer should verify that the weight is not greater than the weight assumed in the Dead Load above.</p> <p>e) Check live load deflection:                  Live load = 30 psf x 50 ft. = 1500 plf                  Approximate Joist Girder moment of inertia = 0.018 NPLd                  = 0.018 x 8 x 17.4 x 42 x 44 = 4630 in.<sup>4</sup>                  Allowable deflection for plastered ceilings                  = L/360 = <math>\frac{42(12)}{360} = 1.40</math> in.  <math display="block">\Delta = 1.15 \left[ \frac{5wL^4}{384EI} \right] = \frac{1.15(5)(1.500/12)[(42)(12)]^4}{384(29000)(4630)}</math>                 = 0.90 in. &lt;1.40 in., Okay</p>
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**(c) Load Schedule Example**

**LOAD SCHEDULE (All Loads are to be shown as unfactored)**

MARK	DESIGNATION <sup>(1)</sup> ( TL/LL ) Joists: (plf) Girders: (kips)	LOADING <sup>(2)</sup>		W WIND		ADD-LOAD <sup>(6)</sup>	BEND-CHECK <sup>(7)</sup>		REMARKS
		DL <sup>(3)</sup> (plf)	LL <sup>(4)</sup> or L <sub>r</sub> /S/R (plf)	DOWN WARD (plf)	NET <sup>(5)</sup> UPLIFT (plf)	TL/LL (kips)	D TC (kips)	D BC (kips)	
J1	18KSP	120	185		180	1.0/0.6		0.3	Axial Loads Wind Moments Drift Loads, see diagram
J2	24K7SP	85	155						
J3	28LHSP	110	355	95	175	0.5			
G1	36G5N6.5K/3.5K				360				End Moments

- (1) Joist designation loads include all uniform gravity loads. **Provide both Total and Live loads.**
- (2) Loading values are not required if designation loading values are correct for deflection and load combinations.
- (3) When standard SJI designations are used, the design Dead Load is required for load combinations with Wind or Seismic.
- (4) The Floor or Roof Live load, Snow, or Rain load.
- (5) When Net Uplift is specified for simple loading, it shall already take into account possible reduced Dead Loading present in order to create the largest Net uplift load combination. For more complex loading or when the Dead Load varies greatly for use in load combinations below, **Gross** uplift should be specified with the minimum and maximum Dead Loading values clearly defined. If the uplift cannot be assigned in pounds per lineal foot, a diagram can be shown for joist loading using pounds per square foot.
- (6) A concentrated load applied at any panel point on both the top chord and bottom chord.
- (7) Chord members shall be designed for additional bending stresses created by this concentrated Total load.

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MARK	DESIGNATION <sup>(1)</sup> (TL/LL) Joists: (plf) Girders: (kips)	MIN. I (in. <sup>4</sup> )	AXIAL			END MOMENTS								TRANSFER DETAILS @ GRIDS	
			W WIND (kips)	E SEISMIC (kips)	E <sub>m</sub> (kips)	LIVE LOAD CONTINUITY MOMENTS (k-ft.)		LATERAL MOMENTS (k-ft.)							
								W WIND		E		E <sub>m</sub>			
						LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT		
J1 J2 G1	18KSP 24K7SP 36G5N6.5K/3.5K	985	W=18.0	E=21.8											9/S8 @ 4  11/S8 @ B,C

When lateral moments are specified, continuity moments **shall** also be specified. A Load Schedule which shows a complete breakdown of all loads by Load Category may be required.

When special loads as shown in the tables above are specified, the load combinations to be used for joist and Joist Girder design **shall** be provided. Two examples showing how to list load combinations are shown below:

LRFD example- Basic Load Combinations	ASD example - Basic Load Combinations
1. 1.4D	1. D
2. 1.2D + 1.6L + 0.5(L <sub>r</sub> or S or R)	2. D + L
3. 1.2D + 1.6(L <sub>r</sub> or S or R) + (1.0L or 0.8W)	3. D + (L <sub>r</sub> or S or R)
4. 1.2D + 1.6W + 1.0L + 0.5(L <sub>r</sub> or S or R)	4. D + 0.75L + 0.75(L <sub>r</sub> or S or R)
5. 1.2D + 1.0E + 1.0L + 0.2S	5. D + (W or 0.7E)
6. 0.9D + 1.6W	6. D + 0.75(W or 0.7E) + 0.75L + 0.75(L <sub>r</sub> or S or R)
7. 0.9D + 1.0E	7. 0.6D + W
	8. 0.6D + 0.7E
Special Seismic Load Combinations	Special Seismic Load Combinations
8. 1.2D + 1.0L + E <sub>m</sub>	9. D + 0.7E <sub>m</sub>
9. 0.9D + E <sub>m</sub>	10. D + 0.525E <sub>m</sub> + 0.75L + 0.75(L <sub>r</sub> or S or R)
	11. 0.6D + 0.7E <sub>m</sub>

**2.4 SLOPED END BEARINGS**

Where steel joists or Joist Girders are sloped, beveled ends or sloped end bearings may be provided where the slope exceeds 1/4 inch in 12 inches (1:48). When sloped end bearings are required, the seat depths shall be adjusted to maintain the standard height at the shallow end of the sloped bearing. For Open Web Steel Joists, **K-Series**, bearing ends shall be permitted to not be beveled for slopes of 1/4 inch or less in 12 inches (1:48).

**2.5 JOIST AND JOIST GIRDER EXTENSIONS**

Steel joist and Joist Girder extensions shall be in accordance with the requirements of the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.

The magnitude and location of the loads to be supported, deflection requirements, and proper bracing of joist or Joist Girder Top Chord Extensions (S Type), Extended Ends (R Type) or full depth cantilever ends shall be clearly indicated on the structural drawings.

## **2.6 CEILING EXTENSIONS**

Ceiling extensions shall be furnished to support ceilings which are to be attached to the bottom of the joists. They are not furnished for the support of suspended ceilings. The ceiling extension shall be either an extended bottom chord element or a loose unit, whichever is standard with the manufacturer, and shall be of sufficient strength to properly support the ceiling.

## **2.7 BRIDGING AND BRIDGING ANCHORS**

- (a) Bridging standard with the manufacturer and complying with the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption shall be used for bridging all joists furnished by the manufacturer. Positive anchorage shall be provided at the ends of each bridging row at both top and bottom chords.
- (b) For **K-** and **LH-Series** joists horizontal bridging is recommended for spans up to and including 60 feet (18288 mm) except where the Steel Joist Institute Standard Specifications Load Tables & Weight Tables require bolted diagonal bridging for erection stability.

**LH-** and **DLH-Series** joists exceeding 60 feet (18288 mm) in length shall have bolted diagonal bridging for all rows.

Refer to Section 6 in the **K-Series** Standard Specification and Section 105 in the **LH/DLH-Series** Standard Specification for erection stability requirements.

Refer to Appendix B for OSHA steel joist erection stability requirements.

Horizontal bridging shall consist of continuous horizontal steel members designed per the applicable **K-Series** Standard Specification Section 5 or Section 104 in the **LH/DLH-Series** Standard Specification. The material sizes shown in Tables 2.7-1a and 2.7-1b meet the criteria. Alternately, or for "load/load" designation joists, Table 2.7-1c provides the maximum horizontal bridging force,  $P_{br}$ , for various combinations of joist spacing and bridging angle size.

- (c) Diagonal cross bridging consisting of angles or other shapes connected to the top and bottom chords of **K-**, **LH-**, and **DLH-Series** joists shall be used when required by the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.

Diagonal bridging, when used, shall be designed per the applicable **K-Series** Standard Specification Section 5 or Section 104 in the **LH/DLH-Series** Standard Specification.

When the bridging members are connected at their point of intersection, the material sizes listed in Table 2.7-2 and Table 2.7-3 shall meet the above specifications.

For **LH/DLH-Series** joists, where the joist spacing is less than 70 percent of the joist depth, bolted horizontal bridging shall be provided in addition to the diagonal bridging, as shown in Table 2.7-3.

- (d) When bolted diagonal erection bridging is required, the following shall apply:
  - 1. The bridging shall be indicated on the joist placement plan.
  - 2. The joist placement plan shall be the exclusive indicator for the proper placement of this bridging.
  - 3. Shop installed bridging clips, or functional equivalents, shall be provided where the bridging bolts to the steel joist.
  - 4. When two pieces of bridging are attached to the steel joist by a common bolt, the nut that secures the first piece of bridging shall not be removed from the bolt for the attachment of the second piece.
  - 5. Bridging attachments shall not protrude above the top chord of the steel joists.
  - 6. See Table 2.7-4 for bolt sizes that meet the connection requirements of the **K-Series** Standard Specification Section 5 and the **LH/DLH-Series** Standard Specification Section 104.

**TABLE 2.7-1a**

<b>K-SERIES JOISTS</b>							
<b>MAXIMUM JOIST SPACING FOR HORIZONTAL BRIDGING</b>							
JOIST SECTION NUMBER*	Bridging Force P <sub>br</sub>	BRIDGING MATERIAL SIZE**					
		Equal Leg Angles					
		1 x 7/64 (25 x 3 mm) r = 0.20" (5.08 mm)	1-1/4 x 7/64 (32 x 3 mm) r = 0.25" (6.35 mm)	1-1/2 x 7/64 (38 x 3 mm) r = 0.30" (7.62 mm)	1-3/4 x 7/64 (45 x 3 mm) r = 0.35" (8.89 mm)	2 x 1/8 (52 x 3 mm) r = 0.40" (10.16 mm)	2-1/2 x 5/32 (64 x 4 mm) r = 0.50" (12.70 mm)
	lbs (N)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)
<b>1 – 8</b>	340 (1512)	5'- 0" (1524)	6'- 3" (1905)	7'- 6" (2286)	8'- 7" (2616)	10'- 0" (3048)	12'- 6" (3810)
<b>9 – 10</b>	450 (2002)	4'- 4" (1321)	6'- 1" (1854)	7'- 6" (2286)	8'- 7" (2616)	10'- 0" (3048)	12'- 6" (3810)
<b>11 - 12</b>	560 (2491)	3'- 11" (1194)	5'- 6" (1676)	7'- 3" (2210)	8'- 7" (2616)	10'- 0" (3048)	12'- 6" (3810)

\*Refer to last digit(s) of Joist Designation

\*\*Connection to joist shall resist a nominal unfactored 700 pound force (3114 N)

**TABLE 2.7-1b**

<b>LH-SERIES JOISTS</b>							
<b>MAXIMUM JOIST SPACING FOR HORIZONTAL BRIDGING</b>							
SPANS OVER 60 ft. (18.3 m) REQUIRE BOLTED DIAGONAL BRIDGING							
Joist Section Number*	Force P <sub>br</sub> lbs (N)	BRIDGING MATERIAL SIZE**					
		Equal Leg Angles					
		1 x 7/64 (25 x 3 mm) r = 0.20" (5.08 mm)	1-1/4 x 7/64 (32 x 3 mm) r = 0.25" (6.35 mm)	1-1/2 x 7/64 (38 x 3 mm) r = 0.30" (7.62 mm)	1-3/4 x 7/64 (45 x 3 mm) r = 0.35" (8.89 mm)	2 x 1/8 (52 x 3 mm) r = 0.40" (10.16 mm)	2-1/2 x 5/32 (64 x 4 mm) r = 0.50" (12.70 mm)
		ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)
<b>02 - 03</b>	<b>400 (1779)</b>	4'-7" (1397)	6'-3" (1905)	7'-6" (2286)	8'-9" (2667)	10'-0" (3048)	12'-6" (3810)
<b>04 - 05</b>	<b>550 (2447)</b>	3'-11" (1194)	5'-6" (1676)	7'-4" (2235)	8'-9" (2667)	10'-0" (3048)	12'-6" (3810)
<b>06,07,08</b>	<b>750 (3336)</b>		4'-9" (1448)	6'-3" (1905)	7'-11" (2413)	10'-0" (3048)	12'-6" (3810)
<b>09</b>	<b>850 (3781)</b>		4'-5" (1346)	5'-10" (1778)	7'-5" (2261)	9'-9" (2972)	12'-6" (3810)
<b>10</b>	<b>900 (4003)</b>		4'-4" (1321)	5'-8" (1727)	7'-3" (2210)	9'-5" (2870)	12'-6" (3810)
<b>11</b>	<b>950 (4226)</b>		4'-2" (1270)	5'-7" (1702)	7'-0" (2134)	9'-2" (2794)	12'-6" (3810)
<b>12</b>	<b>1100 (4893)</b>		3'-11" (1194)	5'-2" (1575)	6'-8" (2032)	8'-6" (2591)	12'-6" (3810)
<b>13</b>	<b>1200 (5338)</b>		3'-9" (1143)	4'-11" (1499)	6'-3" (1905)	8'-2" (2489)	12'-6" (3810)
<b>14</b>	<b>1300 (5783)</b>			4'-9" (1448)	6'-0" (1829)	7'-10" (2388)	12'-4" (3759)
<b>15</b>	<b>1450 (6450)</b>			4'-6" (1372)	5'-8" (1727)	7'-5" (2261)	11'-8" (3556)
<b>16 – 17</b>	<b>1850 (8229)</b>			4'-0" (1219)	5'-0" (1524)	6'-7" (2007)	10'-4" (3150)
<b>18,19,20</b>	<b>2000 (8896)</b>			3'-10" (1168)	4'-10" (1473)	6'-4" (1930)	9'-11" (3023)
<b>21 – 22</b>	<b>2500 (11120)</b>				4'-4" (1321)	5'-8" (1727)	8'-10" (2692)
<b>23 – 24</b>	<b>3100 (13789)</b>				3'-10" (1168)	5'-1" (1549)	7'-11" (2413)
<b>25</b>	<b>3500 (15569)</b>					4'-9" (1448)	7'-6" (2286)

\* Refer to last two digit(s) of Joist Designation

\*\* Connection to joist shall resist force listed in Table 104.5-1

**TABLE 2.7-1c**

<b>MAXIMUM BRIDGING FORCE (<math>P_{br}</math>) FOR HORIZONTAL BRIDGING (lbs)</b>							
JOIST SPACING (ft.-in.)	<b>BRIDGING ANGLE SIZE (EQUAL LEG ANGLE)</b>						
	1 x 7/64 r = 0.20"	1¼ x 7/64 r = 0.25"	1½ x 7/64 r = 0.30"	1¾ x 7/64 r = 0.35"	2 x 1/8 r = 0.40"	2½ x 5/32 r = 0.50"	3 x 3/16 r = 0.60"
2'-0"	2150	3960	5600				
2'-6"	1370	2730	4410	5910			
3'-0"	950	1890	3290	4850			
3'-6"	700	1390	2420	3840	6180		
4'-0"	530	1060	1850	2960	5030		
4'-6"	420	840	1460	2340	4000		
5'-0"	340	680	1180	1890	3240		
5'-6"	-	560	980	1560	2670		
6'-0"	-	470	820	1310	2250	5490	
6'-6"	-	-	700	1120	1910	4680	
7'-0"	-	-	600	960	1650	4030	
7'-6"	-	-	520	840	1440	3510	
8'-0"	-	-	-	740	1260	3090	
8'-6"	-	-	-	650	1120	2740	5680
9'-0"	-	-	-	-	1000	2440	5060
9'-6"	-	-	-	-	890	2190	4540
10'-0"	-	-	-	-	810	1970	4100
10'-6"	-	-	-	-	-	1790	3720
11'-0"	-	-	-	-	-	1630	3390
11'-6"	-	-	-	-	-	1490	3100
12'-0"	-	-	-	-	-	1370	2850

**TABLE 2.7-2**

<b>K, LH, and DLH SERIES JOISTS MAXIMUM JOIST SPACING FOR DIAGONAL BRIDGING</b>								
<b>JOIST DEPTH</b>	<b>BRIDGING ANGLE SIZE – (EQUAL LEG ANGLE)</b>							
	<b>1 x 7/64</b> (25 x 3 mm) <b>r = 0.20"</b> (5.08 mm)	<b>1-1/4 x 7/64</b> (32 x 3 mm) <b>r = 0.25"</b> (6.35 mm)	<b>1-1/2 x 7/64</b> (38 x 3 mm) <b>r = 0.30"</b> (7.62 mm)	<b>1-3/4 x 7/64</b> (45 x 3 mm) <b>r = 0.35"</b> (8.89 mm)	<b>2 x 1/8</b> (50 x 3 mm) <b>r = 0.40"</b> (10.16 mm)	<b>2 1/2 x 5/32</b> (64x 4 mm) <b>r=0.50"</b> (12.70 mm)	<b>3 x 3/16</b> (76 x 5 mm) <b>r = 0.60"</b> (15.24 mm)	<b>3 1/2 x 1/4</b> (89 x 6 mm) <b>r = 0.70"</b> (17.78 mm)
	<b>in. (mm)</b>	<b>ft.-in. (mm)</b>	<b>ft.-in. (mm)</b>	<b>ft.-in. (mm)</b>	<b>ft.-in. (mm)</b>	<b>ft.-in. (mm)</b>	<b>ft.-in. (mm)</b>	<b>ft.-in. (mm)</b>
12" (305)	6'-7" (2007)	8'-3" (2514)	9'-11" (3022)	11'-7" (3530)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
14" (356)	6'-6" (1981)	8'-3" (2514)	9'-11" (3022)	11'-7" (3530)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
16" (406)	6'-6" (1981)	8'-2" (2489)	9'-10" (2997)	11'-7" (3530)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
18" (457)	6'-6" (1981)	8'-2" (2489)	9'-10" (2997)	11'-6" (3505)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
20" (508)	6'-5" (1955)	8'-2" (2489)	9'-10" (2997)	11'-6" (3505)	13'-2" (4013)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
22" (559)	6'-4" (1930)	8'-1" (2463)	9'-10" (2997)	11'-6" (3505)	13'-2" (4013)	16'-6" (5029)	19'-11" (6070)	23'-3" (7086)
24" (610)	6'-4" (1930)	8'-1" (2463)	9'-9" (2971)	11'-5" (3479)	13'-2" (4013)	16'-6" (5029)	19'-10" (6045)	23'-3" (7086)
26" (660)	6'-3" (1905)	8'-0" (2438)	9'-9" (2971)	11'-5" (3479)	13'-1" (3987)	16'-6" (5029)	19'-10" (6045)	23'-2" (7061)
28" (711)	6'-3" (1905)	8'-0" (2438)	9'-8" (2946)	11'-5" (3479)	13'-1" (3987)	16'-6" (5029)	19'-10" (6045)	23'-2" (7061)
30" (762)	6'-2" (1879)	7'-11" (2413)	9'-8" (2946)	11'-4" (3454)	13'-1" (3987)	16'-5" (5004)	19'-10" (6045)	23'-2" (7061)
32" (813)	6'-1" (1854)	7'-10" (2387)	9'-7" (2921)	11'-4" (3454)	13'-0" (3962)	16'-5" (5004)	19'-9" (6020)	23'-2" (7061)
36" (914)	5'-11" (1803)	7'-9" (2362)	9'-6" (2895)	11'-3" (3429)	12'-11" (3973)	16'-4" (4979)	19'-9" (6020)	23'-1" (7035)
40" (1016)	5'-9" (1753)	7'-7" (2311)	9'-5" (2870)	11'-2" (3403)	12'-10" (3911)	16'-4" (4979)	19'-8" (5994)	23'-1" (7035)
44" (1118)	5'-6" (1676)	7'-5" (2260)	9'-3" (2819)	11'-0" (3352)	12'-9" (3886)	16'-3" (4953)	19'-7" (5969)	23'-0" (7010)
48" (1219)	5'-4" (1626)	7'-3" (2209)	9'-2" (2794)	10'-11" (3327)	12'-8" (3860)	16'-2" (4928)	19'-7" (5969)	22'-11" (6985)
52" (1321)	5'-0" (1524)	7'-1" (2159)	9'-0" (2743)	10'-10" (3302)	12'-7" (3835)	16'-1" (4902)	19'-6" (5943)	22'-11" (6985)
56" (1422)	4'-9" (1448)	6'-10" (2083)	8'-10" (2692)	10'-8" (3251)	12'-5" (3784)	16'-0" (4877)	19'-5" (5918)	22'-10" (6960)
60" (1524)	4'-4" (1321)	6'-8" (2032)	8'-7" (2616)	10'-6" (3200)	12'-4" (3759)	15'-10" (4826)	19'-4" (5893)	22'-9" (6935)
64" (1626)	**	6'-4" (1931)	8'-5" (2565)	10'-4" (3149)	12'-2" (3708)	15'-9" (4801)	19'-3" (5867)	22'-8" (6909)
68" (1727)	**	6'-1" (1854)	8'-2" (2489)	10'-2" (3098)	12'-0" (3657)	15'-8" (4775)	19'-2" (5842)	22'-7" (6884)
72" (1829)	**	5'-9" (1753)	8'-0" (2438)	10'-0" (3048)	11'-10" (3606)	15'-6" (4724)	19'-1" (5816)	22'-6" (6731)
80" (2032)	**	5'-0" (1524)	7'-5" (2260)	9'-6" (2895)	11'-6" (3505)	15'-3" (4648)	18'-10" (5740)	22'-4" (6985)
88" (2235)		**	6'-9" (2058)	9'-0" (2743)	11'-1" (3378)	14'-11" (4546)	18'-7" (5664)	22'-1" (6909)
96" (2438)		**	6'-0" (1829)	8'-5" (2565)	10'-8" (3251)	14'-7" (4445)	18'-4" (5588)	21'-11" (6680)
104" (2642)			**	7'-9" (2362)	10'-1" (3073)	14'-2" (4318)	18'-0" (5486)	21'-8" (6604)
112" (2845)			**	7'-0" (2134)	9'-6" (2895)	13'-9" (4191)	17'-8" (5385)	21'-4" (6503)
120" (3048)				**	8'-9" (2667)	13'-4" (4064)	17'-3" (5258)	21'-1" (6426)

**\*\*INTERPOLATION BELOW THE MINIMUM VALUES SHOWN IS NOT ALLOWED.  
SEE TABLE 2.7-3 FOR MINIMUM JOIST SPACE FOR DIAGONAL ONLY BRIDGING.**

**TABLE 2.7-3**

<b>LH AND DLH SERIES JOISTS HORIZONTAL PLUS DIAGONAL BRIDGING REQUIREMENTS</b>		
<b>JOIST DEPTH</b>	<b>MINIMUM JOIST SPACE FOR DIAGONAL ONLY BRIDGING  (0.70 x DEPTH)*</b>	<b>HORIZONTAL AND DIAGONAL MINIMUM ANGLE SIZE REQUIRED FOR JOIST SPACING &lt; (0.70 X DEPTH) AND JOIST SPANS &gt; 60'-0" (18.3 m)</b>
<b>in. (mm)</b>	<b>ft.-in. (mm)</b>	<b>in. (mm)</b>
52" (1321)	3'- 0" (914)	1" x 1" x 7/64" (25 x 3)
56" (1422)	3'- 3" (990)	1" x 1" x 7/64" (25 x 3)
60" (1524)	3'- 6" (1066)	1" x 1" x 7/64" (25 x 3)
64" (1626)	3'- 8" (1117)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
68" (1727)	3'-11" (1193)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
72" (1829)	4'- 2" (1270)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
80" (2032)	4'- 8" (1422)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
88" (2235)	5'- 1" (1549)	1 1/2" x 1 1/2" x 7/64" (38 x 3)
96" (2438)	5'- 7" (1702)	1 1/2" x 1 1/2" x 7/64" (38 x 3)
104" (2642)	6'- 0" (1829)	1 3/4" x 1 3/4" x 7/64" (44 x 3)
112" (2845)	6'- 6" (1981)	1 3/4" x 1 3/4" x 7/64" (44 x 3)
120" (3048)	7'- 0" (2134)	2" x 2" x 1/8" (51 x 3)

\*NOTE: WHEN THE JOIST SPACING IS LESS THAN 0.70 x JOIST DEPTH,  
BOLTED HORIZONTAL BRIDGING SHALL BE USED IN ADDITION TO DIAGONAL BRIDGING.

**TABLE 2.7-4**

<b>BOLT SIZES WHICH MEET BOLTED BRIDGING CONNECTION REQUIREMENTS</b>		
<b>JOIST SERIES</b>	<b>SECTION NUMBER*</b>	<b>BOLT DIAMETER</b>
K	ALL	3/8" (10 mm) A307
LH/DLH	2 – 12	3/8" (10 mm) A307
LH/DLH	13 – 17	1/2" (13 mm) A307
DLH	18 – 20	5/8" (16 mm) A307
DLH	21 – 22	5/8" (16 mm) A325
DLH	23 – 25	3/4" (19 mm) A325

\*REFER TO LAST DIGIT(S) OF JOIST DESIGNATION  
NOTE: WASHERS SHALL BE USED WITH SLOTTED OR OVERSIZED HOLES. BOLTS SHALL  
BE TIGHTENED TO A MINIMUM SNUG TIGHT CONDITION.

## **2.8 HEADERS**

Headers for Open Web Steel Joists, **K-Series** as outlined and defined in Section 5.2(a) shall be furnished by the seller. Such headers shall be any type standard with the manufacturer. Conditions involving headers shall be investigated and, if necessary, provisions made to provide a safe condition. Headers are not provided for Longspan Steel Joists, **LH-Series**, and Deep Longspan Steel Joists, **DLH-Series**.

## **2.9 BOTTOM CHORD LATERAL BRACING FOR JOIST GIRDERS**

Bottom chord lateral bracing shall be permitted to be furnished to prevent lateral movement of the bottom chord of the Joist Girder and to prevent the ratio of chord length to chord radius of gyration from exceeding that specified in the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption. The lateral bracing shall be that which is standard with the manufacturer, and shall be sufficient to properly brace the bottom chord of the Joist Girder.

# SECTION 3 MATERIALS

## **3.1 STEEL**

The steel used in the manufacture of joists and Joist Girders shall comply with the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.

## **3.2 PAINT**

- (a) Standard Shop Paint - The shop coat of paint, when specified, shall comply with the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.
- (b) Disclaimer - The typical shop applied paint that is used to coat steel joists and Joist Girders is a dip applied, air dried paint. The paint is intended to be an impermanent and provisional coating which shall protect the steel for only a short period of exposure in ordinary atmospheric conditions.

Since most steel joists and Joist Girders are painted using a standard dip coating, the coating shall be permitted to not be uniform and shall be permitted to include drips, runs, and sags. Compatibility of any coating including fire protective coatings applied over the standard shop paint shall be the responsibility of the specifier and/or painting contractor.

The shop applied paint may require field touch-up/repair as a result of, but not limited to, the following:

1. Abrasions from: Bundling, banding, loading and unloading, chains, dunnage during shipping, cables and chains during erection, bridging, installation, and other handling at the jobsite.  
NOTE: Rusting should be expected at any abrasion.
2. Dirt.
3. Diesel smoke.
4. Road salt.
5. Weather conditions during storage.

The joist manufacturer shall not be responsible for the condition of the paint if it is not properly protected after delivery.

## SECTION 4 INSPECTION

Inspections shall be made in accordance with the Steel Joist Institute Standard Specifications Load Tables & Weight Tables Section 5.12 for **K-Series**, Section 104.13 for **LH-** and **DLH-Series**, and Section 1004.10 for Joist Girders.

## SECTION 5 ESTIMATING

### 5.1 PLANS FOR BIDDING

Plans to serve as the basis for bids shall show the character of the work with sufficient clarity to permit making an accurate estimate and shall show the following:

- Designation and location of materials [see Section 5.2(a)], including any special design or configuration requirements.
- Locations and elevations of all steel and concrete supporting members and bearing walls.
- Location and length of joist extended ends.
- Location and size of all openings in floors and roofs.
- Location of all partitions.
- Loads and their locations as defined in Section 6.1.
- Construction and thickness of floor slabs, roof deck, ceilings and partitions.
- Joists or Joist Girders requiring extended bottom chords.
- Paint, if other than manufacturer's standard.

### 5.2 SCOPE OF ESTIMATE

(a) Unless otherwise specified, the following items shall be included in the estimate, and requirements shall be determined as outlined in Section 6.1.

- Steel Joists.
- Joist Girders.
- Joist Substitutes.
- Joist Extended Ends.
- Ceiling Extensions.
- Extended bottom chord used as strut.
- Bridging and bridging anchors.
- Joist Girder bottom chord bracing.
- Headers which are defined as members supported by and carrying Open Web Steel Joists, **K-Series**.
- One shop coat of paint, when specified, shall be in accordance with Section 3.2.

- (b) The following items shall not be included in the estimate but shall be permitted to be quoted and identified by the joist manufacturer as separate items:

Headers for Longspan Steel Joists, **LH-Series**.

Headers for Deep Longspan Steel Joists, **DLH-Series**.

Reinforcement in slabs over joists.

Centering material, decking, and attachments.

Miscellaneous framing between joists for openings at ducts, dumbwaiters, ventilators, skylights, etc.

Loose individual or continuous bearing plates and bolts or anchors for such plates.

Erection bolts for joist and Joist Girder end anchorage.

Horizontal bracing in the plane of the top and bottom chords from joist to joist or joist to structural framing and walls.

Wood nailers.

Moment plates.

Special joist configuration or bridging layouts for ductwork or sprinkler systems.

Shear Studs.

## SECTION 6 PLANS AND SPECIFICATIONS

### 6.1 PLANS FURNISHED BY BUYER

The buyer shall furnish the seller plans and specifications as prepared by the **specifying professional** showing all material requirements and steel joist and/or steel Joist Girder designations, the layout of walls, columns, beams, girders and other supports, as well as floor and roof openings and partitions correctly dimensioned. The elevation of finished floors, roofs, and bearings shall be shown with due consideration taken for the effects of dead load deflections.

#### (a) Loads

The **specifying professional** shall clearly provide all design loads as described in Section 2.3 This includes the live loads to be used, the wind uplift if any, the weights of partitions and the location and amount of any special loads, such as monorails, fans, blowers, tanks, etc.

#### (b) Connections

Minimum End Anchorage for simple span gravity loading shall be in accordance with Steel Joist Institute Standard Specifications; Section 5.6 for **K-Series**, Section 104.4 for **LH-** and **DLH-Series**, and Section 1004.6 for Joist Girders. The end anchorage of a steel joist or Joist Girder is the connection of the joist or Joist Girder bearing seat to the support of the joist or Joist Girder.

The adequacy of the end anchorage connection (bolted or welded) between the joist or Joist Girder bearing seat and the supporting structure is the responsibility of the **specifying professional**. The contract documents shall clearly illustrate the end anchorage connection.

When the end anchorage is welded, it is recommended that the **specifying professional** consider a smaller fillet weld thickness in conjunction with a longer weld length.

The **specifying professional** is responsible for bridging termination connections. The contract documents shall clearly illustrate these termination connections.

The joist manufacturer is responsible for the design of the bearing seats of joists or Joist Girders for the loads designated by the **specifying professional** in the contract documents.

**(c) Special Considerations**

The **specifying professional** shall indicate on the construction documents special considerations including:

- a) Profiles for non-standard joist and Joist Girder configurations (Standard joist and Joist Girder configurations are as indicated in the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption).
- b) Oversized or other non-standard web openings
- c) Extended Ends
- d) Deflection criteria for live and total loads for non-SJI standard joists
- e) Non-SJI standard bridging

**6.2 PLANS FURNISHED BY SELLER**

The seller shall furnish the buyer with steel joist placement plans to show the material as specified on the construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 6.1. Steel placement plans shall include, at a minimum, the following:

- 1. Listing of all applicable loads as stated in Section 6.1 and used in the design of the steel joists and Joist Girders as specified in the construction documents.
- 2. Profiles for non-standard joist and Joist Girder configurations (standard joist and Joist Girder configurations are as indicated in the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption).
- 3. Connection requirements for:
  - a) Joist supports
  - b) Joist Girder supports
  - c) Field splices
  - d) Bridging attachments
- 4. Deflection criteria for live load and total loads for non-SJI standard joists.
- 5. Size, location, and connections for all bridging
- 6. Joist headers

All material shall be identified with its mark which also appears on the bill of material. The shop paint shall be as noted on the joist placement plans. **Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional.**

**6.3 DISCREPANCIES**

The **specifying professional's** bid plans and specifications shall be assumed to be correct in the absence of written notice from the buyer to the contrary. When plans are furnished by the buyer which do not agree with the Architect's bid plans, such detailed plans shall be considered as a written notice of change of plans. However, it shall be the buyer's responsibility to advise the seller of those changes which affect the joists or Joist Girders.

#### **6.4 APPROVAL**

When joist placement plans are furnished by the seller, prints thereof are submitted to the buyer and owner for examination and approval. The seller allows a maximum of fourteen (14) calendar days in their schedule for the return of placement plans noted with the owner's and customer's approval, or approval subject to corrections as noted. The seller makes the corrections, furnishes corrected prints for field use to the owner/customer and is released by the owner/customer to start joist manufacture.

Approval by the owner/customer of the placement plans, sections, notes and joist schedule prepared by the seller indicates that the seller has correctly interpreted the contract requirements, and is released by the owner/customer to start joist manufacture. This approval constitutes the owner's/customer's acceptance of all responsibility for the design adequacy of any detail configuration of joist support conditions shown by the seller as part of the preparation of these placement plans.

Approval does not relieve the seller of the responsibility for accuracy of detail dimensions on the plans, nor the general fit-up of joists to be placed in the field.

#### **6.5 CHANGES**

When any changes in plans are made by the buyer (or the buyer's representative) either prior to or after approval of detailed plans, or when any material is required and was not shown on the plans used as the basis of the bid, the cost of such changes and/or extra material shall be paid by the buyer at a price to be agreed upon between buyer and seller.

#### **6.6 CALCULATIONS**

The seller shall design the steel joists and/or steel Joist Girders in accordance with the current Steel Joist Institute Standard Specifications Load Tables & Weight Tables to support the load requirements of Section 6.1. The **specifying professional** may require submission of the steel joist and Joist Girder calculations as prepared by a registered design professional responsible for the product design. If requested by the **specifying professional**, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under this seal and signature, submittal of the following shall be included:

1. Non-SJI standard bridging details (e.g. for cantilevered conditions, net uplift, etc.)
2. Connection details for:
  - a) Non-SJI standard connections (e.g. flush framed or framed connections)
  - b) Field splices
  - c) Joist headers

## **SECTION 7 HANDLING AND ERECTION\***

The buyer and/or erector shall check all materials on arrival at job site and promptly report to seller any discrepancies and/or damages. The buyer and/or erector shall comply with the requirements of the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption in the handling and erection of material. To comply with these requirements, the Steel Joist Institute's Technical Digest 9, "Handling and Erection of Steel Joists and Joist Girders," shall also be followed.

When joists cannot be delivered as a single piece, they shall be permitted to be delivered in several pieces therefore requiring the pieces to be spliced together in the field. The manufacturer's instructions SHALL be followed to ensure matching pieces are joined, proper bolts are used, and any required bolt tensioning is incorporated.

All joists shall be handled by methods which avoid damage to any part of the joist. For long LH-Series joists, DLH-Series joists, or Joist Girders this may require the use of spreader bars, multiple hoisting cables, or multiple cranes as necessary to safely handle the joist. Hoisting cables shall be attached at panel points and shall be at panel point locations selected to minimize erection stresses.

The current OSHA SAFETY STANDARDS FOR STEEL ERECTION, 29 CFR PART 1926, SUBPART R- STEEL ERECTION, refers to certain joists at or near columns to be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging. **This STANDARD shall not be interpreted that any joist at or near a column line is safe to support an employee without bridging installed.** Many limitations exist that prevent these joists from being designed to safely allow an employee on an un-bridged joist. Because of these limitations these joists shall be erected by incorporating erection methods ensuring joist stability and either:

- 1) Installing bridging or otherwise stabilizing the joist prior to releasing the hoisting cable, or
- 2) Releasing the hoisting cable without having a worker on the joist.

A steel joist or Joist Girder shall not be placed on any support structure unless such structure is stabilized. When steel joists or Joist Girders are landed on a structure, they shall be secured to prevent unintentional displacement prior to installation.

A bridging terminus point shall be established before joist bridging is installed.

Steel joist and Joist Girders shall not be used as anchorage points for a fall arrest system unless written directions to do so is obtained from a "qualified person"<sup>(1)</sup>.

The buyer and/or erector shall check all materials on arrival at job site and promptly report to seller any discrepancies and/or damages. The buyer and/or erector shall comply with the requirements of the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption in the handling and erection of material.

No modification that affects the strength of a steel joist or Joist Girder shall be made without the written approval of the project engineer of record.

The seller shall not be responsible for the condition of paint finish on material if it is not properly protected after delivery.

The seller shall not be responsible for improper fit of material due to inaccurate construction work.

\*For thorough coverage of this topic, refer to SJI Technical Digest 9, "Handling and Erection of Steel Joists and Joist Girders."

<sup>1)</sup> See Federal Register, Department of Labor, Occupational Safety and Health Administration (2001), 29 CFR Part 1926 Safety Standards for Steel Erection; Final Rule, §1926.757 Open Web Steel Joists - January 18, 2001, Washington, D.C. for definition of "qualified person".

SECTION 8  
BUSINESS RELATIONS

**8.1 PRESENTATION OF PROPOSALS**

All proposals for furnishing material shall be made on a Sales Contract Form. After acceptance by the buyer, these proposals shall be approved or executed by a qualified official of the seller. Upon such approval the proposal becomes a contract.

**8.2 ACCEPTANCE OF PROPOSALS**

All proposals are intended for prompt acceptance and are subject to change without notice.

**8.3 BILLING**

Contracts on a lump sum basis are to be billed proportionately as shipments are made.

**8.4 PAYMENT**

Payments shall be made in full on each invoice without retention.

**8.5 ARBITRATION**

All business controversies which cannot be settled by direct negotiations between buyer and seller shall be submitted to arbitration. Both parties shall sign a submission to arbitration and if possible agree upon an arbitrator. If they are unable to agree, each shall appoint an arbitrator and these two shall appoint a third arbitrator. The expenses of the arbitration shall be divided equally between the parties, unless otherwise provided for in the agreements to submit to arbitration. The arbitrators shall pass final judgment upon all questions, both of law and fact, and their findings shall be conclusive.