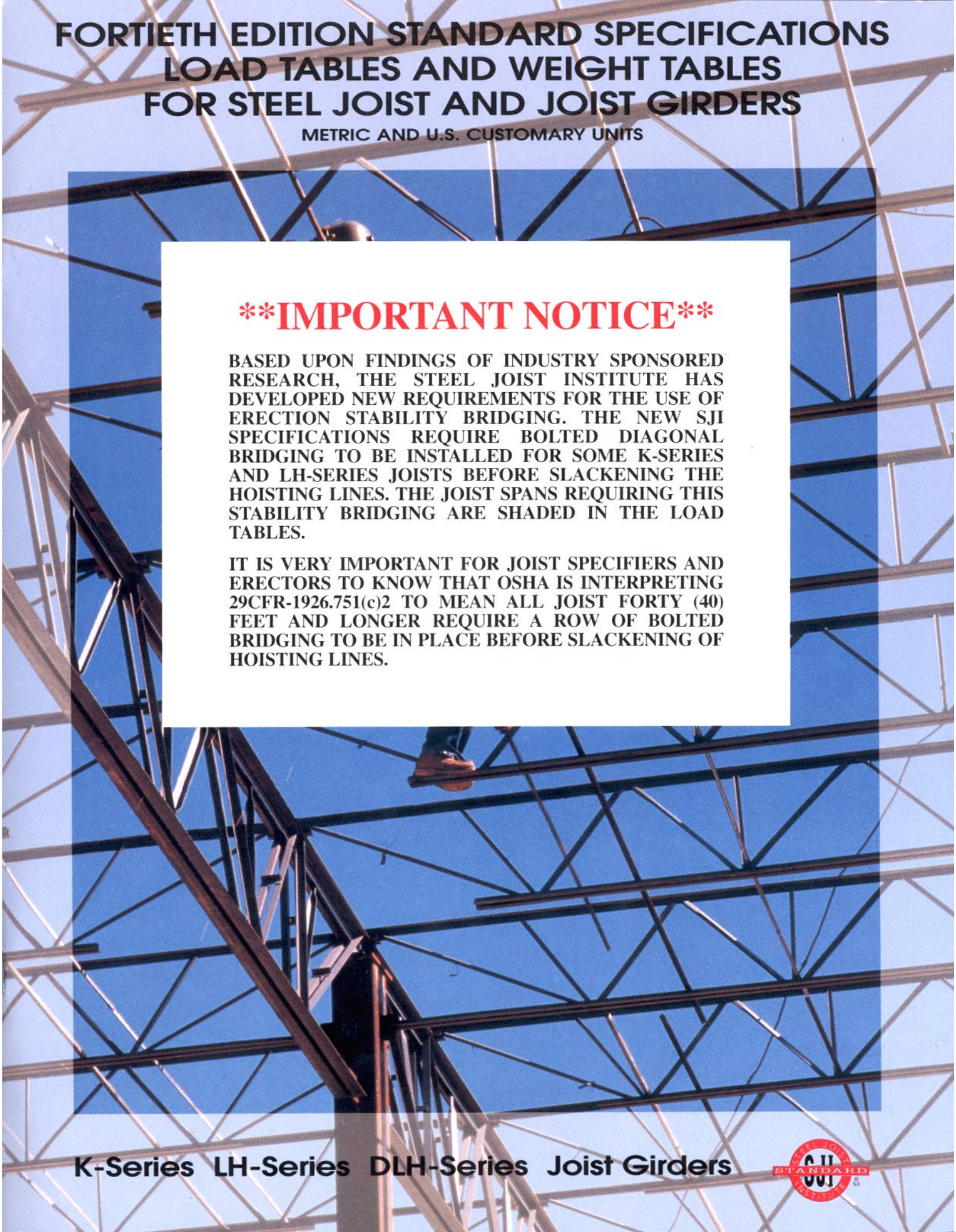
# FORTIETH EDITION STANDARD SPECIFICATIONS LOAD TABLES AND WEIGHT TABLES FOR STEEL JOIST AND JOIST GIRDERS

METRIC AND U.S. CUSTOMARY UNITS



## **IMPORTANT NOTICE**

BASED UPON FINDINGS OF INDUSTRY SPONSORED RESEARCH, THE STEEL JOIST INSTITUTE HAS DEVELOPED NEW REQUIREMENTS FOR THE USE OF ERECTION STABILITY BRIDGING. THE NEW SJI SPECIFICATIONS REQUIRE BOLTED DIAGONAL BRIDGING TO BE INSTALLED FOR SOME K-SERIES AND LH-SERIES JOISTS BEFORE SLACKENING THE HOISTING LINES. THE JOIST SPANS REQUIRING THIS STABILITY BRIDGING ARE SHADED IN THE LOAD TABLES.

IT IS VERY IMPORTANT FOR JOIST SPECIFIERS AND ERECTORS TO KNOW THAT OSHA IS INTERPRETING 29CFR-1926.751(c)2 TO MEAN ALL JOIST FORTY (40) FEET AND LONGER REQUIRE A ROW OF BOLTED BRIDGING TO BE IN PLACE BEFORE SLACKENING OF HOISTING LINES.

K-Series LH-Series DLH-Series Joist Girders

# STEEL JOIST INSTITUTE

## OPEN WEB STEEL JOISTS, K-SERIES
## LONGSPAN STEEL JOISTS, LH-SERIES
## DEEP LONGSPAN STEEL JOISTS, DLH-SERIES
## JOIST GIRDERS, G

The following manufacturers are contributors to the research and technical development of steel joists through the Steel Joist Institute. The current designs of Standard Open Web, Longspan, and Deep Longspan Steel Joists and Joist Girders which have been checked by the Steel Joist Institute and found to conform to its standard specifications and load tables are indicated by colored letters after each company's plant location(s), which has been inspected for those products.

**CANAM DE MEXICO**
Juarez, Mexico K LH DLH G
Monterrey, Mexico K LH DLH G

**CANAM STEEL CORPORATION**
Lafayette, IN K LH DLH G
Jacksonville, FL K LH DLH G
Point of Rocks, MD K LH DLH G
Washington, MO K LH DLH G
Sunnyside, WA K LH DLH G

**CYMIOSA**
Juarez, Mexico K LH DLH G

**DARNELL STEEL PRODUCTS, INC.**
Shelbyville, TN K LH DLH G

**DE LONG'S, INC.**
Jefferson City, MO K LH DLH G

**DELTA JOIST, INC.**
St. Marie, Quebec, Canada K LH DLH G

**EAST COAST STEEL**
Columbia, SC K

**EMYCSA**
Chihuahua, Mexico K LH DLH G

**GOODER-HENRICHSEN CO., INC.**
Chicago Heights, IL K LH DLH G

**JOHN W. HANCOCK, JR., INC.**
Salem, VA K LH DLH G

**NEW COLUMBIA JOIST CO.**
A SUBSIDIARY OF BOURAS INDUSTRIES, INC.
New Columbia, PA K LH DLH G

**NUCOR CORPORATIONS**
**VULCRAFT DIVISIONS**
Ft. Payne, AL K LH DLH G
St. Joe, IN K LH DLH G
Norfolk, NE K LH DLH G
Florence, SC K LH DLH G
Grapeland, TX K LH DLH G
Brigham City, UT K LH DLH G

**QUINCY JOIST COMPANY**
Quincy, FL K LH DLH G

**SMI JOIST COMPANY**
Hope, AR K LH DLH G
Starke, FL K LH DLH G
Fallon, NV K LH DLH G
Cayce, SC K LH DLH G

**SOCAR, INCORPORATED**
Continental, OH K LH DLH G
Florence, SC K LH DLH G

**VALLEY JOIST**
A SUBSIDIARY OF EBSCO INDUSTRIES, INC.
Fort Payne, AL K LH DLH G
Fernley, NV K LH DLH G

The above locations of the SJI member companies' plants are the only locations certified to manufacture those products listed.

For the names of the manufacturers whose joist designs may have been checked subsequent to the publication of this catalogue, or who are not contributors to the research and technical development of steel joists through the Steel Joist Institute, but those designs have been checked by the Institute, write the Managing Director, Steel Joist Institute.

3127 10th AVE. NORTH EXT. • MYRTLE BEACH, S.C. 29577-6760
PHONE: 843-626-1995 • FAX: 843-626-5565
WEB ADDRESS: / www.steeljoist.org
*Managing Director:* / R. Donald Murphy
*Consulting Engineer:* / Dr.Theodore V. Galambos
University of Minnesota

## CONTENTS

## 1994 REVISIONS

| *Page* | *Section* | *Change* |
|---|---|---|
| – | General | Added Metric Nomenclature |
| 3 | History | Added 1994 paragraph |
| 4 | Publications | Revised Pricing. |
| 5 | LRFD | New |
| 6 | Fire-Resistance Ratings | Revised Stress limitations & revised some fire resistance ratings |
| 13 | Top Chord Extensions | Added Metric Load Tables for Type S and Type R extensions. |
| 14 | Section 3.1 | Added ASTM A529 Steel, deleted A441 |
| 20 | Section 5.4(b) | Revised notes in bridging table referencing bolted diagonal (stability) bridging. |
| 20 | Section 5.4(b) | Added metric bridging table. |
| 22 | Section 6 | Revised erection stability requirements |
| 24 | K - Load Table | Shading added to depict erection stability requirements. |
| 28 | KCS Joists | New section with Load Tables |
| 32 | K - Economy Table | Shading added to depict erection stability requirements. |
| 37 | K-Series | Definition of span - metric |
| 38 | K-Series Metric Load Table | New |
| 44 | Section 102.1 | Added ASTM A529 Steel, deleted A441 |
| 50 | Section 104.5(c) | Revised erection stability requirements |
| 51 | Section 104.5(d) | Revised bridging spacing table 104.5.1 |
| 52 | Section 105 | Revised erection stability requirements |
| 54 | LH Load Table | Shading added to depict erection stability requirements. Formula for $I_J$ added to notes preceding the table. |
| 57 | DLH Load Table | Shading added to depict erection stability requirements. Formula for $I_J$ added to notes preceding the table. |
| 59 | LH Metric Load Table | New |
| 63 | DLH Metric Load Table | New |
| 67 | Section 1002. | Added ASTM A529 Steel, deleted A441. |
| 74 | Joist Girder Weight Table | Added heavy black line indicating 7½ inch depth bearing seats. |
| 80 | Joist Girder Metric Design example | New |
| 81 | Joist Girder Metric weight table | New |
| 89 | Section 2.5(b) | Revised erection stability requirements and new tables 2.5.1(a) and 2.5.1(b) added. |
| 89 | Section 2.5(c) | New table 2.5.2 added. |
| 93 | Section 5.5 | Special joist design example using metric units. |

## HISTORY

Formed five years after the first open web steel joist was manufactured, the Institute has worked since 1928 to maintain sound engineering practice throughout our industry. As a non-profit organization of active manufacturers, the Institute cooperates with governmental and business agencies to establish steel joist standards. Continuing research and updating are included in its work.

The first joist in 1923 was a Warren truss type, with top and bottom chords of round bars and a web formed from a single continuous bent bar. Various other types were developed, but problems also followed because each manufacturer had his own design and fabrication standards. Architects, engineers and builders found it difficult to compare rated capacities and to use fully the economies of steel joist construction.

Members of the industry began to organize the Institute, and in 1928 the first standard specifications were adopted, followed in 1929 by the first load table. The joists covered by these early standards were later identified as open web steel joists, **SJ**-Series.

Other landmark adoptions by the Institute include the following:

**1953 –** Introduction of Longspan Steel Joists, L-Series. Specifications and a standard load table, covering spans through 96 feet and depths through 48 inches, were jointly approved with the American Institute of Steel Construction.

**1959 –** Introduction of the S-Series Joists, which replaced the SJ- Series Joists. The allowable tensile stress was increased from 18,000 to 20,000 psi, joist depths were expanded through 24 inches, and spans increased through 48 feet.

**1961 (a)** Introduction of the J-Series Joists, which replaced the S-Series Joists. The allowable tensile stress was increased from 20,000 psi to 22,000 psi, based on the use of steel with a minimum yield strength of 36,000 psi.

**(b)** Introduction of the LA-Series Joists, which replaced the L-Series Joists. The LA-Series Joists allowed a tensile stress of either 20,000 psi or 22,000 psi, depending on the yield strength of the steel.

**(c)** Introduction of the H-Series Joists, whose design was based on steel with a minimum yield strength of 50,000 psi, and an allowable tensile stress of 30,000 psi.

**1962 –** Introduction of the LH-Series Joists, utilizing steel whose minimum yield strength was between 36,000 psi and 50,000 psi.

**1965 –** Development of a single specification for both the J- and H- Series Joists by the Steel Joist Institute and the American Institute of Steel Construction.

**1966 –** Development and introduction by the SJI and AISC of the LJ- Series Joists, which replaced the LA-Series Joists. Also, the development of a single specification for both the LJ- and the LH-Series Joists, with the use of 36,000 psi minimum yield strength steel for the LJ-Series, and 36,000 psi to 50,000 psi minimum yield strength steel for the LH-Series.

**1970 –** Introduction of the DLJ- and DLH-Series Joists to include depths through 72 inches and spans through 144 feet.

**1971 –** Elimination of the number 2 chord sizes and the addition of joist designations 8J3 and 8H3 to the load tables.

**1972 (a)** Adoption by the SJI and AISC of a single specification for the LJ-, LH-, DLJ-, and DLH-Series Joists.

**(b)** Adoption by the SJI and AISC of the expanded specifications and load tables for the Open Web Steel Joists which increased the depths through 30 inches, and the spans through 60 feet, plus adding chord sections 9, 10, & 11.

**1978 (a)** Elimination of the J-, LJ-, and DLJ-Series Joists because of the widespread acceptance of high strength steel joists.

**(b)** Introduction of Joist Girders, complete with specifications and weight tables, in response to the growing need for longer span primary structural members with highly efficient use of steel.

**1986 –** Introduction of the K-Series Joists, which replaced the H-Series Joists. The reasons for developing the K-Series Joists were (1) to achieve greater economies by utilizing the Load Span design concept; (2) To meet the demand for roofs with lighter loads at depths from 18 inches to 30 inches; (3) To offer joists whose load carrying capacities at frequently used spans are those most commonly required; (4) To eliminate the very heavy joists in medium depths for which there was little, if any, demand.

**1994 (a)** Introduced the “KCS” Joists to the K-Series in response to the need for a joist with a constant moment and constant shear. The “KCS” Joist is an alternative joist to be used in special loading conditions.

**(b)** Addition of metric nomenclature for all Joist

and Joist Girder Series in compliance with government and industry standards.

**(c)** Addition of revised stability criteria.

## POLICY

The manufacturers of any standard SJI Products shall be required to submit design data for verification of compliance with Steel Joist Institute Specifications, undergo physical design verification tests (on K-Series only), and undergo periodic in-plant inspections for all products on which they wish to become certified.

SJI Member Companies complying with the above conditions shall be licensed to publish the appropriate copy-righted SJI Specifications and Load Tables.

## MEMBERSHIP

Open to manufacturers who produce, on a continuing basis, joists of the **K-**, **LH/DLH-**Series, and/or **Joist Girders,** conforming to the Institute's Specifications and Load Tables. Membership requirements differ as described below.

### APPLICANTS BASED ON K-SERIES JOISTS

The Institute's Consulting Engineer checks to see that designs conform to the Institute's Specifications and Load Tables. This comprises an examination of: (1) Complete engineering design details and calculations of all **K-**Series joists, bridging and accessories for which standards have been adopted; (2) Data obtained from physical tests of a limited number of joists, conducted by an independent laboratory, to verify conclusions from analysis of the applicant's engineering design details and calculations.

An initial plant inspection and subsequent periodic inspections are required to ensure that the applicant/member possesses the facilities, equipment and personnel required to fabricate properly the **K**-Series Joists.

Joist manufacturers who have previously obtained certification on their **H**-Series Joists are required to obtain certification on their **K**-Series design data. Physical tests are required only if substantive changes are made in either joist configuration or member shapes.

### APPLICANTS BASED ON LH- OR DLH-SERIES JOISTS OR JOIST GIRDERS

Designs are checked by the Consulting Engineer. Periodic in-plant inspections (but no physical tests) are required.

### RESPONSIBILITY FOR PRODUCT QUALITY

The plant inspections are not a guaranty of the quality of any specific joists or Joist Girders; this responsibility lies fully and solely with the individual manufacturer.

### SERVICES TO NONMEMBERS

The Institute's facilities for checking the design of **K-**, **LH-**, and **DLH-**Series Joists or Joist Girders are available on a cost basis.

The Steel Joist Institute does not check joist designs for specific construction projects. Fabrication to Institute Specifications is the responsibility of the individual manufacturer.

## STEEL JOIST INSTITUTE PUBLICATIONS

### PREPAYMENT IS REQUIRED

A. Catalogue of **Standard Specifications, Load Tables, and Weight Tables** for Steel Joists and Joist Girders . . . . . $20.00

B. The following **TECHNICAL DIGESTS** are also available from the Institute:

- #3 Structural Design of Steel Joist Roofs to Resist PONDING LOADS . . . . . $10.00
- #5 VIBRATION of Steel Joist - Concrete Slab Floors . . . . . $12.50
- #6 Structural Design of Steel Joist Roofs to Resist UPLIFT LOADS . . . . . $10.00
- #8 WELDING of Open Web Steel Joists $12.50
- #9 HANDLING AND ERECTION of Steel Joists and Joist Girders . . . . . $12.50

(Set of Digests #3, #5, #6, #8, & #9) $49.75

C. 60-Year Steel Joist Manual . . . . . $59.00

D. Computer Vibration Program . . . . . $125.00

[All prices include handling, plus either U.P.S. or 1st Class postage within the United States and its Possessions]

Add $10.00 shipping charges for International shipments.

Send check or money order (U.S. currency only) payable to:

Steel Joist Institute
3127 10th Ave. North
Myrtle Beach, SC 29577-6760

# LOAD AND RESISTANCE FACTOR DESIGN

## The following method may be used to convert the Steel Joist Institute's Specifications for use in Load and Resistance Factor Design ( LRFD )

Method:

WU = 1.65 Wsji, or  Wsji = WU /1.65

Where, WU = ultimate joist capacity
Wsji = SJI Load Table Load (black figure)

Load tables for LRFD can be obtained directly from the current SJI Load Tables by using the formula:

Wn = Wsji x 0.9 x 1.65

Where, Wn = nominal joist capacity
0.9 = Resistance Factor ( $\phi$ )

"K" Series Example:

Given: WU = 1.2 WD + 1.6 WL
Problem: Select a joist from the current load tables for Wsji $\geq$ Wu/1.65( $\phi$ )

L = 40 ft.
WD = 50 plf
WL = 150 plf
Use Roof Live load deflection $\leq$ L/240

WU = 1.2 x 50 + 1.6 x 150 = 300 plf

Wsji $\geq$ 300/(1.65 x 0.9) = 202 plf

Select 22K6: Wsji @ 40 ft. span = 207 plf > 202 plf. O'K'

Deflection Live Load $\leq$ L/240

WsjiLL = 1.5 x 111 = 166 plf > 150 plf O'K'

The above procedure outlines the specification of a "K" Series Joist to support a uniform gravity load utilizing LRFD. When loads other than uniform gravity loads (such as wind uplift loads, concentrated loads, end moments or non-uniform loads) are a design consideration, the Specifying Professional shall clearly indicate on the structural drawings whether these loads are factored or unfactored. To remain consistent with established LRFD design procedures it is recommended that factored loads be specified.

The above procedure is also applicable to the LH/DLH Series Joists and Joist Girders.

# FIRE-RESISTANCE RATINGS WITH STEEL JOISTS

Hundreds of fire tests on steel joist-supported assemblies have been conducted at nationally recognized testing laboratories in accordance with ASTM Standard E119, ANSI A2.1/UL 263, and NFPA 251. Because of practical loading restrictions and limitations of furnace dimensions, the vast majority of these tests were run using lightweight joists - normally from 8 inches to 14 inches deep. This practice was advantageous in that it established the *minimum* acceptable joists at the shallow and lightweight end of the joist load tables.

The specified minimum size joist as listed in **Underwriters Laboratories (U.L.) Fire Resistance Designs** is the joist which combines the required minimum depth and minimum weight per foot. Joists, of the same series, which meet, or exceed the specified minimums may be used provided the accessories are compatible. The dimension from the bottom chord of joists to the ceiling, whether given or calculated, is a minimum.

**K-Series Joists, LH Series Joists and Joist Girders** specified in floor- or roof-ceiling assemblies, shall be designed and manufactured in accordance with the Steel Joist Institute's Specifications adopted November 4, 1985 revised November 12, 1991.

Many of U.L.'s Fire Rated Assemblies now specifically list **K-Series Joists.** When a **K-Series Joist** is specified in a particular U.L. assembly the **K-Series Joist** shall have its design stress limited only if the assembly specifically limits the design stress of the **K-Series Joist.**

**K-Series Joists** may be substituted for S-, J-, and/or H-Series Joists specified in U.L. floor-, or roof-ceiling designs as follows:

Floor-Ceiling Assemblies:

**K-Series Steel Joists** of equal or greater depth and weight per foot *may be substituted* for any S-, J-, and/or H-Series Joist in any floor-ceiling design, which employs a structural concrete floor and suspended membrane ceiling.

Roof-Ceiling Assemblies:

**K-Series Steel Joists** of equal or greater depth and weight per foot *may be substituted* for any S-, J-, and/or H-Series Joists in any roof-ceiling design with the following restrictions:

a) Minimum Nominal Depth = 10 inches (254mm)
b) Maximum Tensile Stress = 26 KSI (179 MPa)

Any stress limitation specified in a U.L. floor or roof fire rated assembly containing S, J and/or H Series Joists shall remain applicable when a **K-Series Joist** is substituted. Also, certain U.L. assembly designs contain restrictions regarding minimum allowable joist member sizes, areas of steel, and/or bridging material sizes. These restrictions remain applicable when a K-Series Joist is substituted and it is the responsibility of the specifying professional to list all such restrictions on the contract drawings.

The following procedure may be used to substitute the proper **K-Series Joist** for any S-, J-, and/or H-Series Joist listed in a U.L. design assembly.

1. Determine the uniform load per foot the joist is required to support.
2. Select a design from the U.L. "Fire Resistance Directory" that matches the building construction and has the required fire rating.
3. a) Floor Assemblies:
   Adjust the design load per foot calculated in step #1 for any required reduction in stress level by multiplying the load by a factor of 30 ksi (207 MPa) divided by the specified stress level, i.e. [30/24 (207/165), 30/22 (207/152). etc.].

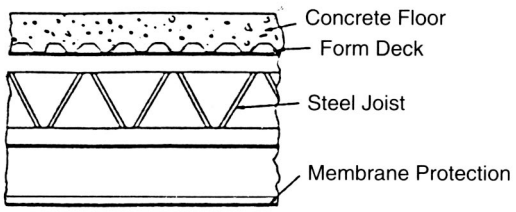
   b) Roof Assemblies:
   Adjust the design load per foot calculated in step #1 by multiplying by the factor of 30/26 (207/179), or a greater factor if the particular assembly design requires a lessor stress level.
4. Enter the K-Series Economy Table and select the proper joist for the calculated load requirement.
5. Insure that the **K-Series Joist** selected has a depth and load table weight per foot equal to, or greater than, the S-, J- and/or H-Series joist listed in the U.L. Design. Joists used in roof assemblies must have a minimum depth of 10 inches (254mm).

So that the proper **K-Series Joist** can be selected for U.L. Designs not presently containing a K-Series designation the weights of various S-, J-, and H-Series Joists used in the U.L. Fire Resistance Designs are listed below:

| Joist Designation | Load Table Weight lbs./ft. | Joist Designation | Load Table Weight lbs./ft. |
|---|---|---|---|
| 8S2 | 4.0 | 14J5 | 7.3 |
| 10S3 | 5.0 | 14J7 | 9.7 |
| 8J2 | 4.2 | 8H2 | 4.2 |
| 10J2 | 4.2 | 8H3 | 5.0 |
| 10J3 | 4.8 | 10H2 | 4.2 |
| 10J4 | 6.0 | 10H3 | 5.0 |
| 12J2 | 4.5 | 10H4 | 6.1 |
| 12J3 | 5.1 | 12H4 | 6.2 |
| 12J4 | 6.0 | 12H5 | 7.1 |
| 12J5 | 7.0 | | |
| 12J6 | 8.1 | | |

# FIRE-RESISTANCE RATINGS WITH STEEL JOISTS

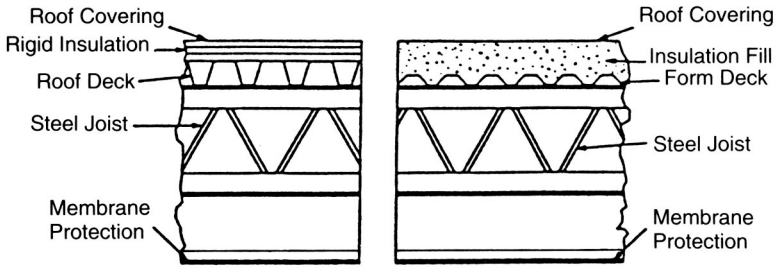
## FLOOR-CEILING ASSEMBLIES WITH MEMBRANE PROTECTION




| Restrained Assembly Rating | Type of Protection System | Concrete | | Minimum Joist Size See Note #3 & #4 | Maximum Joist Spacing See Note #2 | Primary Support Member Min. Depth & Wt. See Note #3 | U.L. Design Number |
|---|---|---|---|---|---|---|---|
| | | Thickness Above Deck | Type | | | | |
| 1 Hr. | Exposed Grid | 2 1/2″ | NW | 10K1 | 72″ | 20g @14.0 plf. Min. Area Top & Bottom Chord 1.12 Sq. Inch | G256 |
| | | 2 1/2″ | NW | 12K1,18LH02 | Unrestricted | — | D216 |
| 1 1/2 Hr. | Exposed Grid | 2 1/2″<br>2″<br>2 1/2″ | NW<br>NW<br>NW | 10K1<br>10K1<br>10K1 | 48″<br>48″<br>48″ | 20G @13.0 plf.<br>20G @13.0 plf.<br>20g @13.0 plf. | G228<br>G229<br>G243 |
| | Gypsum Brd. | 2″ | NW | 12K1 | 48″ | — | G502 |
| | Cementitious | 2 1/2″ | LW<br>NW | 16K6<br>Min. 3/4″ dia. web | Unrestricted | 20G @20.0 plf. | G701 |
| | Sprayed Fiber | 2 1/2″ | LW<br>NW | 16K6<br>Min. 3/4″ dia. web | Unrestricted | 20G @20.0 plf. | G801 |
| 2 Hr. | Concealed Grid | 2 1/4″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G023 |
| | | 2 1/2″ | NW | 8K1,10K1 | 48″ | 20G @13.0 plf. | G031 |
| | | 2 1/2″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G036 |
| | Exposed Grid | 2 1/2″ | NW | 10K1 | 48″ | W6x12 | G213 |
| | | 2 1/2″ | NW | 10K1 | 48″ | W8x31 | G227 |
| | | 2 1/2″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G228 |
| | | 2 1/2″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G243 |
| | | 2 1/2″ | NW | 10K1 | 48″ | — | G256 |
| | | 2 1/2″ | NW | 12K1,18LH02 | Unrestricted | — | D216 |
| | Gypsum Board | 2″ | NW | 10K1 | 48″ | — | G505 |
| | | 2 1/2″ | NW | 10K1 | 48″ | 20G @14.0 plf. Min. Area Top & Bottom Chord 1.12 Sq. inch | G514 |
| | | 2 1/2″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G253 |
| | | 2 1/2″ | LW<br>NW | 10K1 | 48″ | 20G @13.0 plf. | G529 |
| | Cementitious | 2 1/2″ | NW | 12K1 | Unrestricted | 20G @20.0 plf. | D502 |
| | | 2 1/2″ | LW<br>NW | 16K6<br>Min. 3/4″ dia. web | Unrestricted | 20G @20.0 plf. | D701 |
| | Sprayed Fiber | 2 1/2″ | LW<br>NW | 16K6<br>Min. 3/4″ dia. web | Unrestricted | 20G @20.0 plf. | D801 |
| 3 Hr. | Concealed Grid | 3 1/2″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G033 |
| | | 3 1/4″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G036 |
| | Exposed Grid | 3 1/2″ | NW | 10K1 | 48″ | W6x12 | G213 |
| | | 3 1/4″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G229 |
| | | 3 1/2″ | NW | 10K1 | 72″ | 20G @14.0 plf. Min. Area Top & Bottom Chord 1.12 Sq. inch | G256 |
| | | 3 1/2″ | NW | 12K1, 18LH02 | Unrestricted | — | D216 |
| | Gypsum Board | 3″ | NW | 10K1 | 48″ | 20G @13.0 plf. | G523 |
| | | 2 3/4″ | LW, NW | 10K1 | 48″ | 20G @13.0 plf. | G529 |

# FIRE-RESISTANCE RATINGS WITH STEEL JOISTS

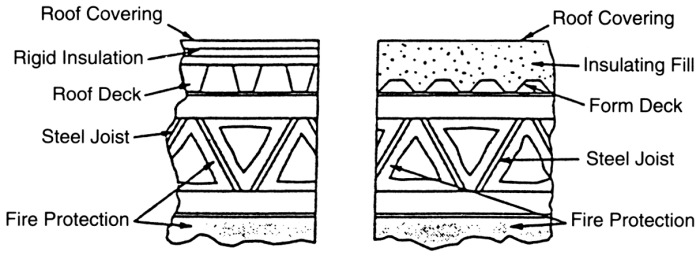
## ROOF-CEILING ASSEMBLIES WITH MEMBRANE PROTECTION




| Restrained Assembly Rating | Type of Protection System | Built Up Roof | | Minimum Joist Size See Note #3 & #4 | Maximum Joist Spacing | Primary Support Member Min. Depth & Wt. See Note #3 | U.L. Design Number |
|---|---|---|---|---|---|---|---|
| | | Type of Insulation | Metal Deck Min. Size | | | | |
| 1 Hr. | Exposed Grid | Rigid Insulation | 26 Ga. | 10K1 | 48″ | 20G @20.00 plf. | P211 |
| | | | 22 Ga.<br>28 Ga. | 12K3<br>12K3 | 72″<br>48″ | 20G @13.0 plf. or W8x18 | P214 |
| | | | 26 Ga.<br>24,22 Ga. | 12K1<br>12K1 | 60″<br>72″ | — | P224 |
| | | | 26,24,22 Ga. | 12K1 | 72″ | 20G @13.0 plf. | P225 |
| | | | 24 Ga. | 12K3 | 48″ | — | P227 |
| | | | 26 Ga. | 12K3 | 72″ | 20G @13.0 plf. | P230 |
| | | | 26 Ga. | 12K5 or 14K4 | 48″ | W6x12 | P250 |
| | | | 22 Ga. | 10K1 | 48″ | W6x12 | P254 |
| | | Insulating Fill | 26,22Ga. | 12K1 | 72″ | 20G @14.0 plf. | P231 |
| | | | 28 Ga. | 10K1 | 72″ | 20G @13.0 plf. | P246 |
| | | | 28,26 Ga. | 12K1 | 72″ | 20G @13.0 plf. | P251 |
| | | | 28 Ga. | 10K1 | 72″ | W8x15 | P255 |
| | | | 28,26 GA. | 12K1 | 72″ | 20g @13.0 plf. | P261 |
| | Gypsum | Insulating Fill | 26 Ga.<br>24 Ga. | 12K3<br>12K3 | 48″<br>60″ | W8x24 | P509 |
| 1 1/2 Hr. | Exposed Grid | Rigid Insulation | 26,24,22GA. | 12K1 | 72″ | 20G @13.0 plf. | P225 |
| | | | 24 Ga. | 12K3 | 48″ | — | P227 |
| | | | 26 Ga. | 12K5, 14K4 | 48″ | W6x12 | P250 |
| | | Insulating Fill | 26,22 Ga. | 12K1 | 72″ | 20G @14.0 plf. | P231 |
| | | | 28,26 Ga. | 12K1 | 72″ | 20G @13.0 plf. | P251 |
| | Metal Lathe | Rigid Insulation | 22 Ga. | 12K5<br>14k3 | 72″ | — | P404 |
| 2 Hr. | Exposed Grid | Insulating Fill | 18,16 Ga. | 12K1 | 72″ | 20G @13.0 plf. | P251 |
| | | Rigid Insulation | 24 Ga. | 10K1 | 72″ | W6x12 | P237 |
| | Metal Lathe | Rigid Insulation | 22 Ga. | 12K5,14K3 | 72″ | — | P404 |
| | Gypsum Board | Rigid Insulation | 22 Ga. | 10K1 | 48″ | — | P514 |
| 3 Hr. | Metal Lathe | Insulating Fill | 28,22 Ga. | 10K1 | 48″ | — | P405 |

# FIRE-RESISTANCE RATINGS WITH STEEL JOISTS

## ROOF-CEILING ASSEMBLIES WITH DIRECT APPLIED PROTECTION




| Restrained Assembly Rating | Type of Protection System | Built Up Roof | | Minimum Joist Size See Note #3 & #4 | Maximum Joist Spacing See Note #5 | Primary Support Member Min. Depth & Wt. | U.L. Design Number |
|---|---|---|---|---|---|---|---|
| | | Type of Insulation | Metal Deck Min. Size | | | | |
| 1 Hr.<br>1 1/2 Hr.<br>2 Hr. | Cementitious | Rigid Insulation | 22 Ga. | 14K4 or LH | Unrestricted | 20G @13.0 plf. | P701 |
| | | | 22 Ga. | 14K4 | Unrestricted | 20G @13.0 plf. | P711 |
| | Sprayed Fiber | Rigid Insulation | 22 Ga | 16K6 | Unrestricted | – | P801 |
| | | | 22 Ga | 10K1 | Unrestricted | 20G @13.0 plf. | P815 |
| | | | 22 Ga. | 12K3 | Unrestricted | – | P816 |
| | | | 22 Ga. | 12K3 | Unrestricted | 20G @13.0 plf. | P817 |
| | | | 22 Ga. | 12K1 | Unrestricted | 20G @13.0 plf. | P818 |
| | Cementitious and Sprayed Fiber | Insulating Fill | 22 Ga. | 14K4 | 96" | 20G @13.0 plf. | P902 |
| | | | 24 Ga. | 12K5, 14K3 | 96" | – | P907 |
| | | | 28 Ga. | 12K5, 14K3 | 96" | – | P920 |
| | | | 24 Ga. | 12K5 | 96" | 20G @13.0 plf. | P921 |
| | | | 24 Ga. | 12K3 | 96" | – | P922 |
| | | | 22 Ga | 12K3 | 96" | 20G @13.0 plf. | P923 |

NOTES:

1. The **UNDERWRITERS LABORATORY FIRE RESISTANCE DIRECTORY** lists hundreds of assemblies and their fire ratings. As a convenience a selected number of assemblies are listed on 3 preceding pages. This listing is intended as a guide only and the *specifying professional* must refer to the U.L. Directory for complete design information.
2. The maximum joist spacing shown for Floor-Ceiling Assemblies may be increased from the spacing listed in the U.L. Directory to a maximum of 48 inches on center, provided the floor slab meets the structural requirements and the spacing of hanger wires supporting the ceiling is not increased.
3. Some U.L. Design Assemblies stipulate minimum size materials for Steel Joist and Joist Girder components, and/or bridging. It is the responsibility of the *specifying professional* to show all special requirements on the Structural Drawings.
4. Some *U.L. Fire Assembly Designs* stipulate an allowable maximum joist design stress level less than the 30 ksi (207MPa) used in the K-Series Joist Specifications.

   It is the *responsibility of the specifying professional* to apply the proper stress level reductions (if required) when selecting Joists and/or Joist Girders.

   To adjust the stress level of K-Series Joists or Joist Girders multiply the design load by the required factor [30/26 (207/179), 30/24 (207/165), 30/22 (207/1520)], and then using this increased load select a Joist or Joist Girder from the load and/or weight tables.
5. Some U.L. Roof-Ceiling Design assemblies using direct applied protection limit the spacing of the joists for certain types and gages of metal decking – refer to the U.L. Directory for this information.