STEEL JOIST INSTITUTE
SJI

K-Series
LH-Series
DLH-Series
Joist Girders

42nd Edition

Standard Specifications

Load Tables and Weight Tables for Steel Joists and Joist Girders

The information presented in this publication has been developed by the Steel Joist Institute and is produced in accordance with recognized engineering principles and is for general information only. The SJI and its committees have made a concerted effort to present accurate, reliable, and useful information on the design of steel joists and Joist Girders. Application of this information should not be used or relied upon for any specific project without competent professional assessment of its accuracy, suitability and applicability by a licensed professional engineer or architect. The publication of the material contained in this catalog is not intended as a representation or warranty on the part of the Steel Joist Institute. Any person making use of this information does so at one's own risk and assumes all liability arising from such use.

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APPENDICES

The following documents contained in this catalog have been approved by the American National Standards Institute (ANSI):

Standard Specifications for Open Web Steel Joists, **K-**Series and Load Tables (SJI-K-1.1)

Standard Specifications for Longspan Steel Joists, **LH-**Series and Deep Longspan Steel Joists, **DLH-**Series and Load Tables (SJI LH/DLH-1.1)

Standard Specifications for Joist Girders (SJI-JG-1.1)

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 their 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 were designed to a maximum 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 and an allowable tensile strength of 22,000 psi to 30,000 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 chord section number 2 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 Open Web Steel Joists with increased depths through 30 inches, and spans through 60 feet, plus adding chord section numbers 9,10, and 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) Introduction of the KCS Joists as a part of the **K-**Series Specification in response to the need for a joist with a constant moment and constant shear. The KCS Joist is an economical alternative joist that may be specified for special loading situations.

(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.

2002

(a) Introduction of Joist Substitutes, **K-**Series.

(b) **K-**Series, **LH-** and **DLH-** Series and Joist Girder Specifications approved as American National Standards (ANSI).

(c) Revisions to **K-**Series Section 6, **LH-** and **DLH-**Series Section 105, and Recommended Code of Standard Practice for conformance to OSHA Steel Erection Standard § 1926.757.

(d) Addition of Standing Seam Roof requirements to the **K-**Series Specification Section 5.8(g) and the **LH-** and **DLH-**Series Specification Section 104.9(g).

(e) Addition of Definition for Parallel Chord Sloped Joists – **K-**Series Section 5.13 and **LH-**Series Section 104.14.

2005

(a) Major revision of **K-**Series, **LH-** and **DLH-**Series and Joist Girder Specifications to allow the design of joists and Joist Girders to be either in accordance with Load and Resistance Factor design (LRFD) or Allowable Strength Design (ASD).

(b) Major revision of **K-**Series and **LH-** and **DLH-**Series Load Tables to be in both LRFD and ASD.

(c) Expansion of Joist Girder Weight Tables to spans through 120 feet.

(d) Code of Standard Practice was renamed.

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 an initial plant inspection and subsequent biennial in-plant inspections for all products for which they wish to be certified.

SJI Member companies complying with the above conditions shall be licensed to publish the appropriate copyrighted SJI Specifications, Load Tables and Weight Tables.

MEMBERSHIP

Open to manufacturers who produce, on a continuing basis, joists of the **K-, LH-,** and **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 biennial inspections are required to ensure that the applicant/member possesses the facilities, equipment and personnel required to properly fabricate the **K-**Series Joists.

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

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

RESPONSIBILITY FOR PRODUCT QUALITY

The plant inspections are not a guarantee 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

Visit the SJI Web Site at <www.steeljoist.org> for a complete listing of SJI publications and a copy of the standard order form. Also, be sure to check the website for upcoming Education Seminars in your area.

A. Catalog of Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders

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

- No. 3 Structural Design of Steel Joist Roofs to Resist Ponding Loads (2006)
- No. 5 Vibration of Steel Joist - Concrete Slab Floors (1988)
- No. 6 Structural Design of Steel Joist Roofs to Resist Uplift Loads (2006)
- No. 8 Welding of Open Web Steel Joists (1983)
- No. 9 Handling and Erection of Steel Joists and Joist Girders (2006)
- No. 10 Design of Fire Resistive Assemblies with Steel Joists (2003)
- No. 11 Design of Joist Girder Frames (1999)

C. 75-Year Steel Joist Manual (1928-2003)

D. Computer Vibration Program

E. SJI Video No. 1 – Introduction to Steel Joists

F. SJI Video No. 2 – The Safe Erection of Steel Joists and Joist Girders (2001)

INTRODUCTION TO K-SERIES

Open Web Steel Joists, **K-**Series, were primarily developed to provide structural support for floors and roofs of buildings. They possess the following advantages and features which have resulted in their wide use and acceptance throughout the United States and other countries.

First and foremost, they are economical. For many types of buildings, no other products or methods for supporting floors and roofs can compete with steel joists. The advantages listed in the following paragraphs all contribute to the overall economy of using Open Web Steel Joists.

K-Series are light in weight – they possess an exceptionally high strength-to-weight ratio in comparison with other building materials. Coupled with their low price per pound, they contribute significantly to lower building costs. An additional economy stemming from their light weight is the fact that the structural materials supporting the joists, such as beams and Joist Girders, columns, and the foundations themselves, can therefore be lighter, thus leading to even greater economies.

Open Web Steel Joists represent unitized construction. Upon arrival at the job site, the joists are ready immediately for proper installation. No forming, pouring, curing, or stripping is required. Furthermore, their light weight makes the erection procedure simple and fast.

K-Series Joists are standardized regarding depths, spans, and load-carrying capacities. There are 64 separate designations in the Load Tables, representing joist depths from 8 inches (203 mm) through 30 inches (762 mm) in 2 inch (51 mm) increments and spans through 60 feet (18,288 mm). Standard **K-**Series Joists have a 2 1/2 inch (64 mm) end bearing depth so that, regardless of the overall joist depths, the tops of the joists lie in the same plane.

The open webs in the joists permit the ready passage and concealment of pipes, ducts and electric conduits within the depth of the floor. In high rise buildings this can result in a reduced overall building height, which translates into considerable cost savings. As soon as the joists are erected and bridged, with ends properly attached, a working platform is available for the immediate follow-up of allied trades; this allows field work to progress rapidly and efficiently.

In combination with other materials, joists can provide fire resistive assemblies for both floors and roofs of buildings for nearly any hourly rating required. Appendix D, Fire Resistance Ratings, provides detailed information on this subject.

There are no restrictions on the types, sizes or heights of buildings in which joists can be used. They can be found in the roof of the neighborhood convenience store as well as in your local Lowe's, Home Depot, discount club, K-Mart, Target or Walmart.

INTRODUCTION TO LH- and DLH-SERIES

Longspan and Deep Longspan Steel Joists are relatively light weight shop-manufactured steel trusses. Longspan Steel Joists are used in the direct support of floor or roof slabs or decks between walls, beams, and main structural members. Deep Longspan Steel Joists are used for the direct support of roof slabs or decks between walls, beams, and main structural members.

The **LH-** and **DLH-**Series have been designed for the purpose of extending the use of joists to spans and loads in excess of those covered by Open Web Steel Joists, **K-**Series.

Longspan Series Joists have been standardized in depths from 18 inches (457 mm) through 48 inches (1219 mm), for clear spans through 96 feet (29,260 mm).

Deep Longspan Series Joists have been standardized in depths from 52 inches (1321 mm) through 72 inches (1829 mm), for clear spans up through 144 feet (43,891 mm).

STANDARD TYPES

Longspan and Deep Longspan Steel Joists can be furnished with either under-slung or square ends, with parallel chords or with single or double pitched top chords to provide sufficient slope for roof drainage. Square end joists are primarily intended for bottom chord bearing.

Sloped parallel-chord joists shall use span as defined by the length along the slope. The joist designation is determined by its nominal depth at the center of the span and by the chord size designation.

The depth of the bearing seat at the ends of underslung **LH-** and **DLH-**Series Longspan Joists has been established at 5 inches (127 mm) for chord section number 2 through 17. A bearing seat depth of 7 1/2 inches (191 mm) has been established for the DLH Series chord section number 18 and 19.

All Longspan and Deep Longspan Steel Joists are fabricated with standardized camber as given in Table 103.6-1.

Parallel Chords, Underslung

Parallel Chords, Square Ends

Top Chord Pitched One Way, Underslung

Top Chord Pitched One Way, Square Ends

Top Chord Pitched Two Ways, Underslung

Top Chord Pitched Two Ways, Square Ends

The illustrations above show Longspan and Deep Longspan Steel Joists with modified WARREN type web systems. However, the web systems may be any type, whichever is standard with the manufacturer furnishing the product.

INTRODUCTION TO JOIST GIRDERS

Joist Girders are open web steel trusses used as primary framing members. They are designed as simple spans supporting equally spaced concentrated loads for a floor or roof system. These concentrated loads are considered to act at the panel points of the Joist Girders. Joist Girders have been designed to allow for a growing need for longer span primary members, coupled with a need for more efficient steel usage.

These members have been standardized in the LRFD and ASD Weight Tables for depths from 20 inches (508 mm) to 120 inches (3048 mm), and spans to 120 feet (36,576 mm). Standardized camber is as shown in Table 1003.6-1 of the Specifications. Joist Girders are furnished with underslung ends and bottom chord extensions. The standard depth at the bearing ends has been established at 7 1/2 inches (191 mm) for all Joist Girders. Joist Girders are usually attached to the columns by bolting with two 3/4 inch diameter (19 mm) A325 bolts. A loose connection of the bottom chord to the column or other support is recommended during erection in order to stabilize the bottom chord laterally and to help brace the Joist Girder against possible overturning. A vertical stabilizer plate shall be provided on each column for the bottom chord of the Joist Girder. The stabilizer plate shall be furnished by other than the joist manufacturer.

"CAUTION": If a rigid connection of the bottom chord is to be made to the column or other support, it shall be made only after the application of the dead loads. The Joist Girder is then no longer simply supported and the system must be investigated for continuous frame action by the specifying professional*. Bearing details of joists on perimeter Joist Girders, or interior Joist Girders with unbalanced loads, should be designed such that the joist reactions pass through the centroid of the Joist Girder.

The Weight Tables list the approximate weight in pounds per linear foot (kilograms per meter) for a Joist Girder supporting the concentrated panel point loads shown. Please note that the weight of the Joist Girder must be included in the panel point load (See Specifications Section 1006 for examples).

For calculating the approximate deflection or checking for ponding, the following formulas in U. S. Customary Units and Metric Units may be used in determining the approximate moment of inertia of a Joist Girder.

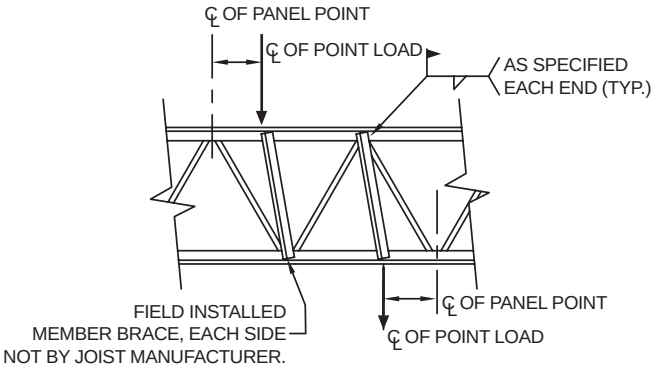
I_{JG} = 0.027 NPLd: where N = number of joist spaces; P = Total panel point load in kips (unfactored); L = Joist Girder length in feet; and d = effective depth of the Joist Girder in inches, or,

I_{JG} = 0.3296 NPLd: where N = number of joist spaces; P = Total panel point load in kiloNewtons (unfactored); L = Joist Girder length in millimeters and d = effective depth of the Joist Girder in millimeters.

The Joist Girder manufacturer should be contacted when a more exact Joist Girder moment of inertia must be known.

* For further reference, refer to Steel Joist Institute Technical Digest Number 11, "Design of Joist-Girder Frames".

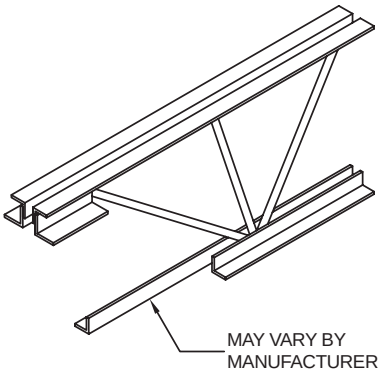
ADDED MEMBERS



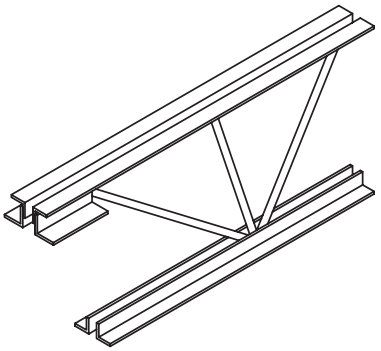
TYPICAL JOIST REINFORCEMENT AT CONCENTRATED LOADS

Standard joists, including KCS-Series, are not designed for localized bending from point loads. Concentrated loads must be applied at joist panel points or field strut members must be utilized as shown.

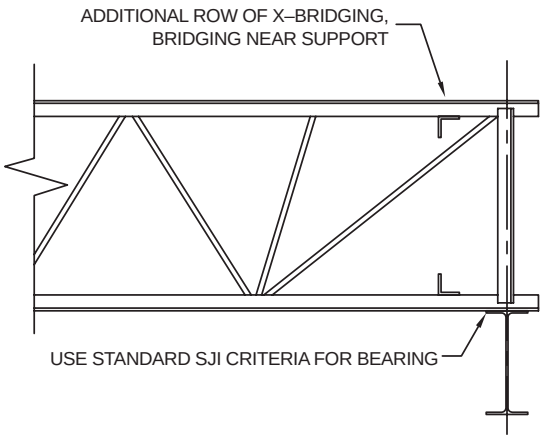
Joist manufacturers can provide a specially designed joist with the capability to take point loads without the added members if this requirement and the exact location and magnitude of the loads are clearly shown on the contract drawings. Also, the manufacturer can consider the worst case for both the shear and bending moment for a traveling load with no specific location. When a traveling load is specified, the contract drawings should indicate whether the load is to be applied at the top or bottom chord, and at any panel point, or at any point with the local bending effects considered.



CEILING EXTENSION



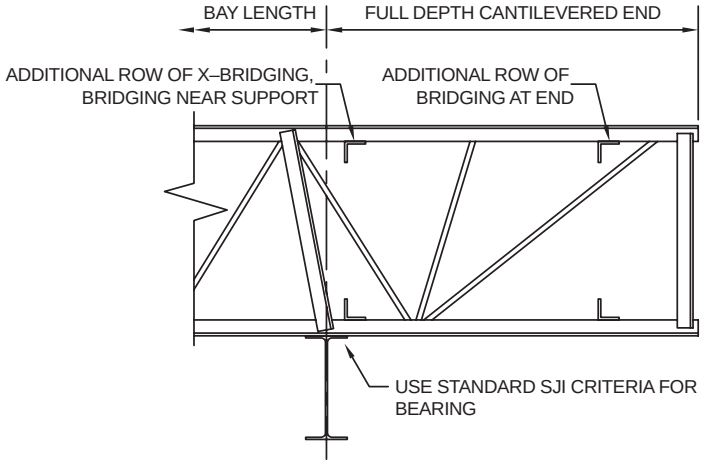
BOTTOM CHORD EXTENSION



SQUARE ENDED, BOTTOM BEARING

Whenever joists are bottom chord bearing, diagonal bridging should be installed from joist to joist at or near the bearing location to provide additional lateral erection stability.

Note: Joist configuration and member sizes may vary.

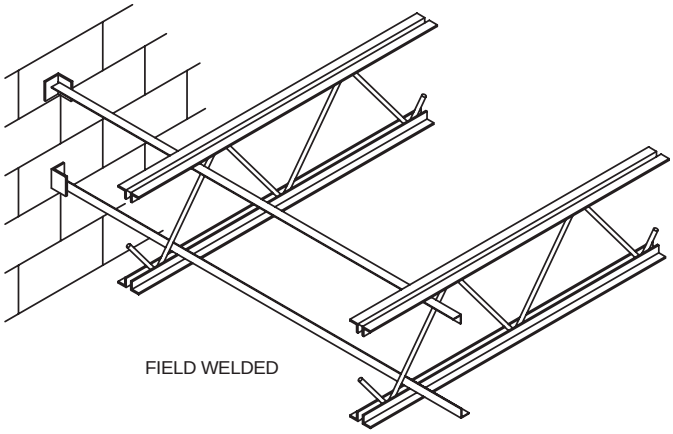


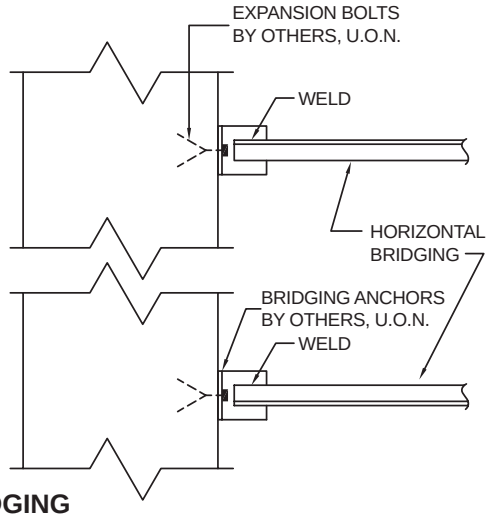
CANTILEVERED, BOTTOM BEARING, SQUARE END

The weight of walls, signage, fascia, etc. supported at the end of a cantilever square end must be shown on the contract drawings to be properly considered in the joist design.

Note: Joist configuration and member sizes may vary.

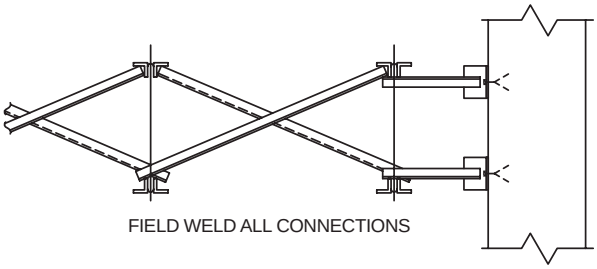
K-SERIES BRIDGING DETAILS





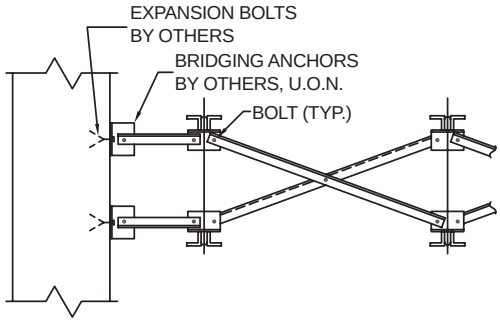
HORIZONTAL BRIDGING
SEE SJI SPECIFICATIONS

NOTE: DO NOT WELD BRIDGING TO JOIST WEB MEMBERS.
DO NOT HANG ANY MECHANICAL, ELECTRICAL, ETC. FROM BRIDGING.



WELDED CROSS BRIDGING
SEE SJI SPECIFICATIONS

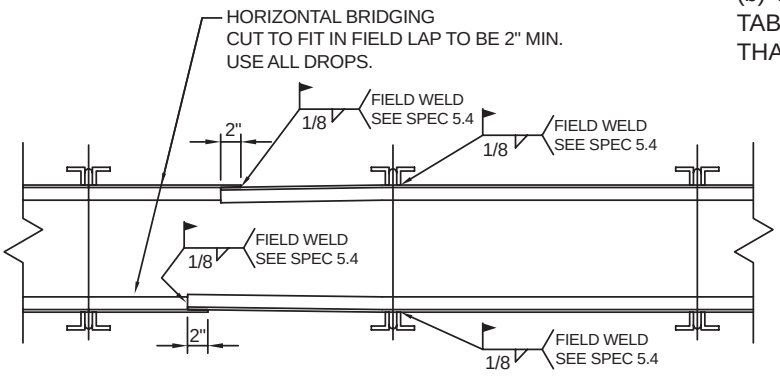
HORIZONTAL BRIDGING SHALL BE USED IN SPACE ADJACENT TO THE WALL TO ALLOW FOR PROPER DEFLECTION OF THE JOIST NEAREST THE WALL.



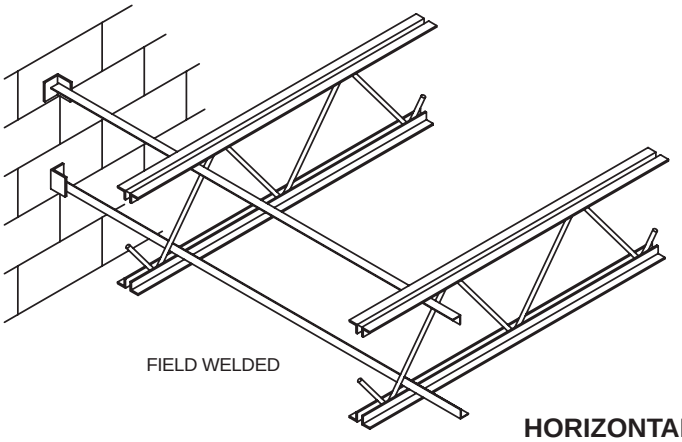
BOLTED CROSS BRIDGING
SEE SJI SPECIFICATIONS

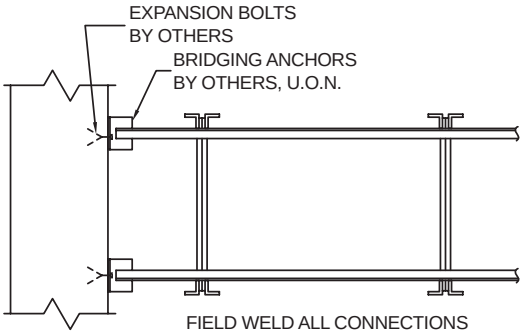
(a) HORIZONTAL BRIDGING UNITS SHALL BE USED IN THE SPACE ADJACENT TO THE WALL TO ALLOW FOR PROPER DEFLECTION OF THE JOIST NEAREST THE WALL.

(b) FOR REQUIRED BOLT SIZE REFER TO BRIDGING TABLE. NOTE: CLIP CONFIGURATION MAY VARY FROM THAT SHOWN.



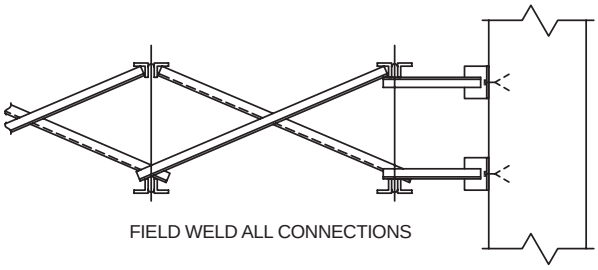
LH- AND DLH-SERIES BRIDGING DETAILS





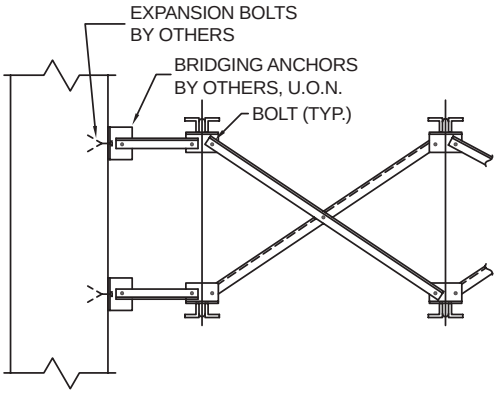
HORIZONTAL BRIDGING
SEE SJI SPECIFICATIONS

NOTE: DO NOT WELD BRIDGING TO WEB MEMBERS. DO NOT HANG ANY MECHANICAL, ELECTRICAL, ETC. FROM BRIDGING.



WELDED CROSS BRIDGING
SEE SJI SPECIFICATIONS

HORIZONTAL BRIDGING SHALL BE USED IN SPACE ADJACENT TO THE WALL TO ALLOW FOR PROPER DEFLECTION OF THE JOIST NEAREST THE WALL.



BOLTED CROSS BRIDGING
SEE SJI SPECIFICATIONS

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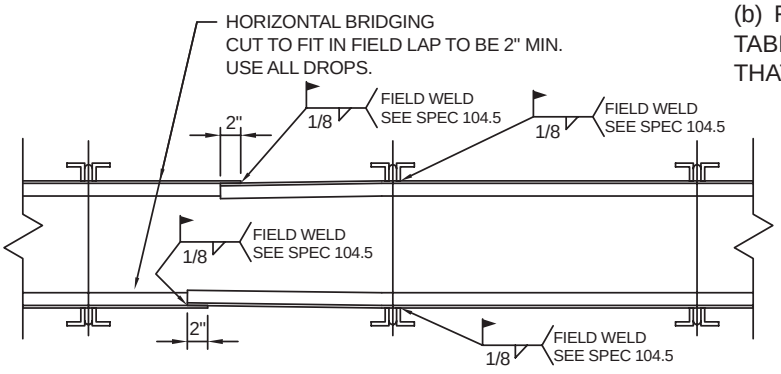
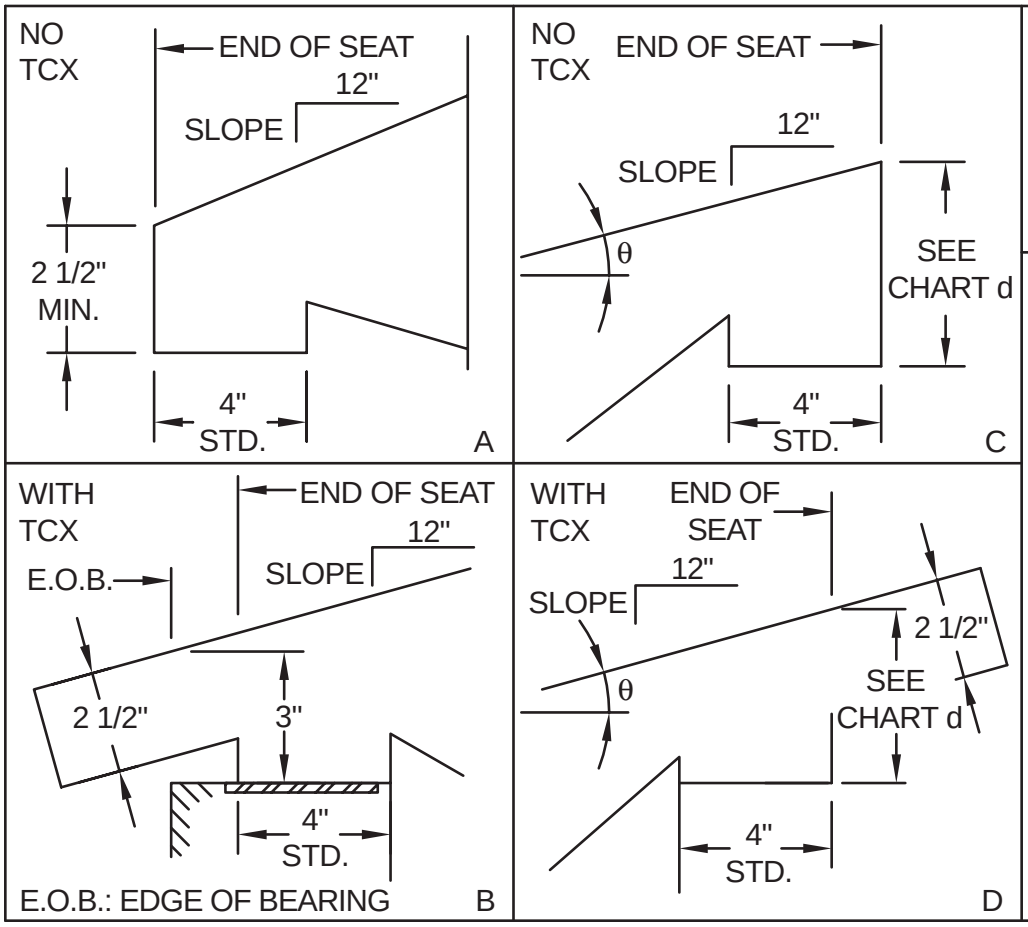
(b) FOR REQUIRED BOLT SIZE REFER TO BRIDGING TABLE. NOTE: CLIP CONFIGURATION MAY VARY FROM THAT SHOWN.



SLOPED SEAT REQUIREMENTS FOR SLOPES 3/8: 12 AND GREATER

K-SERIES OPEN WEB STEEL JOISTS

LOW END HIGH END



SLOPE RATE	HIGH END SEAT DEPTH d (MIN.)
3/8: 12	3"
1/2: 12	3"
1: 12	3 1/2"
1 1/2: 12	3 1/2"
2: 12	4"
2 1/2: 12	4"
3: 12	4"
3 1/2: 12	4 1/2"
4: 12	4 1/2"
4 1/2: 12	4 1/2"
5: 12	5"
6: 12 & OVER	SEE BELOW

NOTES:

(1) Depths shown are the minimums required for manufacturing of sloped bearing seats. Depths may vary depending on actual bearing conditions.

(2) $d = 1/2 + 2.5 / \cos\theta + 4 \tan\theta$

(3) Clearance must be checked at outer edge of support as shown in Detail B. Increase bearing depth as required to permit passage of 2 1/2" deep extension.

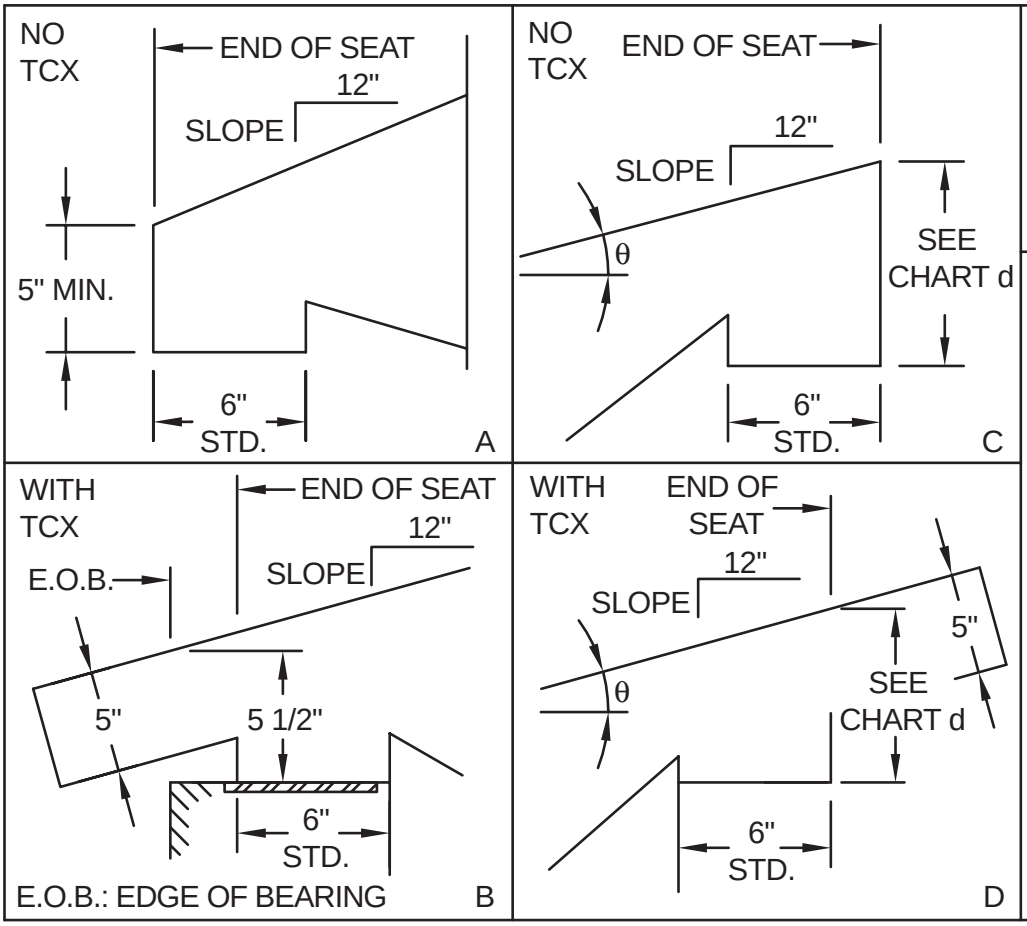
(4) If extension depth greater than 2 1/2" is required (see Details B and D) increase bearing depths accordingly.

(5) If slope is 1/4: 12 or less, sloped seats are not required.

SLOPED SEAT REQUIREMENTS FOR SLOPES 3/8: 12 AND GREATER

LH- AND DLH-SERIES STEEL JOISTS

LOW END HIGH END



SLOPE RATE	HIGH END SEAT DEPTH d (MIN.)
3/8: 12	5 1/2"
1/2: 12	6"
1: 12	6"
1 1/2: 12	6 1/2"
2: 12	6 1/2"
2 1/2: 12	7"
3: 12	7"
3 1/2: 12	7 1/2"
4: 12	8"
4 1/2: 12	8"
5: 12	8 1/2"
6: 12 & OVER	SEE BELOW

Notes:
(1) Depths shown are the minimums required for manufacturing of sloped bearing seats.
(2) $d = 1/2 + 5 / \cos\theta + 6 \tan\theta$
(3) Clearance must checked at outer edge of support as shown in Detail B. Increase bearing depth as required to permit passage of 5" deep extension.
(4) If extension depth greater than 5" is required (see Details B and D) increase bearing depths accordingly.
(5) Add 2 1/2" to seat depth at 18 and 19 chord section numbers. Consult manufacturer for information when TCX's are present.

APPROXIMATE DUCT OPENING SIZES

JOIST DEPTH	ROUND	SQUARE	RECTANGLE
8 INCHES	5 INCHES	4x4 INCHES	3x6 INCHES
10 INCHES	5 INCHES	4x4 INCHES	3x7 INCHES
12 INCHES	7 INCHES	5x5 INCHES	3x8 INCHES
14 INCHES	8 INCHES	6x6 INCHES	5x9 INCHES
16 INCHES	8 INCHES	6x6 INCHES	5x9 INCHES
18 INCHES	9 INCHES	7x7 INCHES	5x9 INCHES
20 INCHES	10 INCHES	8x8 INCHES	6x11 INCHES
22 INCHES	10 INCHES	9x9 INCHES	7x11 INCHES
24 INCHES	12 INCHES	10x10 INCHES	7x13 INCHES
26 INCHES	15 INCHES*	12x12 INCHES*	9x18 INCHES*
28 INCHES	16 INCHES*	13x13 INCHES*	9x18 INCHES*
30 INCHES	17 INCHES*	14x14 INCHES*	10x18 INCHES*

SPECIFYING PROFESSIONAL MUST INDICATE ON STRUCTURAL DRAWINGS SIZE AND LOCATION OF ANY DUCT THAT IS TO PASS THRU JOIST. THIS DOES NOT INCLUDE ANY FIREPROOFING ATTACHED TO JOIST. FOR DEEPER **LH-** AND **DLH-**SERIES JOISTS, CONSULT MANUFACTURER.

* FOR ROD WEB CONFIGURATION THESE WILL BE REDUCED, CONSULT MANUFACTURER.