

Fecha: 2014-06-24 16:31:24 Dep. 2020 DIR.NUEVASCR
Tra. 3 MODELO Eve: 1 REGDEPOSITO
Act. 444 RESPUESTAREQUE Folios: 208

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Anexo 208 Folios

VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1.

SECTOR TECNOLÓGICO: CONSTRUCCIÓN para uso en estructuras aporticadas, en concreto, en acero o en su combinación, mejora el sistema constructivo JOIST.

RESUMEN

La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** es un **ELEMENTO ESTRUCTURAL DE ALMA ABIERTA EN ONDAS DIAGONALES CONTINUAS - CELOSÍA CONTINUA** que consta de un cordón superior armado con 2 ángulos, un cordón inferior armado con 2 ángulos y parte media elaborada en refuerzo redondo doblado sin cortes en ondas en forma de ZIGZAG (Onda en "V") unida a los 2 ángulos que conforman el cordón superior y a los 2 ángulos que conforman el cordón inferior, con puntos de soldadura.

Caracterizada porque la parte media está elaborada en refuerzo en diámetros de 15,87 mm 19,05 mm 22,22 mm 25,40 mm 28,57 mm 31,75 mm 34,93 mm 38,10mm y 50,80 mm, doblado a máquina, en ondas diagonales desplegadas sin cortes en forma continúa; Porque la parte superior de las ondas diagonales sobresalen a los 2 ángulos que conforman el cordón superior; Porque tiene incorporado el conector de cortante; y Porque el refuerzo de los extremos es de mayor diámetro.

La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, resuelve varios problemas técnicos y estructurales, porque la parte media al estar elaborada en refuerzo liso de 15,87 mm hasta 50,80 mm, doblado desplegado en forma continúa sin cortes en ondas diagonales, genera compresión y tracción, aumentando la capacidad de carga y reduciendo el peso muerto de la estructura para menores dimensiones de columnas y vigas, porque por el hecho de que sea doblado en la máquina DOBLADORA DE REFUERZO DE ONDAS DIAGONALES EN FORMA DE ZIG-ZAG "CELOSIA CONTINUA" diseñada por el mismo, con radios de giro o curvaturas, garantiza que no se distorsionen o alteran las propiedades mecánicas del refuerzo utilizado; y porque las ondas sobresalientes cuando se extiende el concreto sobre las viguetas, actúan como Conector de Cortante que trabaja como **VIGUETA T** donde el concreto adhiriéndose al tramo superior (ondas sobresalientes) queda en compresión dejando al tramo inferior trabajando 100% a tracción y porque el refuerzo de los extremos al ser de mayor densidad evita el pandeo.

REINVINDICACIONES

PREAMBULO

LA VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1 es un elemento estructural **DE ALMA ABIERTA EN ONDAS DIAGONALES CONTINUAS - CELOSÍA CONTINUA** que consta de un cordón superior (No. 4 Figura 1) armado con 2 ángulos, un cordón inferior (No. 5 - Figura 1) armado con 2 ángulos y una parte media (No. 6 - Figura 1), elaborada en refuerzo redondo doblado desplegado en forma continua en ondas en forma de ZIGZAG (Onda en "V") (No. 6 - Figuras 1 y 2), unida a los 2 ángulos que conforman el cordón superior y a los 2 ángulos que conforman el cordón inferior, con puntos de soldadura (números 15,16, 17, 18, 19, 20 - Figura 1 y No. 15, Figura 5 y Figura 6).

Caracterizada porque la parte media está elaborada en refuerzo en diámetros de 15,87 mm 19,05 mm 22,22 mm 25,40 mm 28,57 mm 31,75 mm 34,93 mm 38,10mm y 50,80 mm, doblado a máquina en ondas diagonales desplegado sin cortes en forma continúa (No. 6 - Figura 1); porque la parte superior de las ondas diagonales sobresalen (número 21 Figura 1) a los 2 ángulos que conforman el cordón superior (número 4 - Figura 1); porque incorpora en su diseño el Conector de Cortante (número 23 - Figura 8) y porque el refuerzo de los extremos es de mayor diámetro para evitar el pandeo (número 2 izquierdo y número 2 derecho, Figura 1 y Figura 2).

REINVINDICACIONES

REIVINDICACIÓN No. 1.- La VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1 está caracterizada porque la parte media está elaborada en refuerzo en diámetros de 15,87 mm 19,05 mm 22,22 mm 25,40 mm 28,57 mm 31,75 mm 34,93 mm 38,10mm y 50,80 mm, doblado a máquina en ondas diagonales desplegada sin cortes en forma continúa (No. 6 - Figura 1);

REIVINDICACIÓN No. 2.- La VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1 está caracterizada porque la parte superior de las ondas continuas, sobresalen (No. 21 - Figura 1) a los 2 ángulos que conforman el cordón superior (No. 4 - Figura 1);

REIVINDICACIÓN No. 3.- La VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1, está caracterizada porque la onda que sobresale (No. 21- Figura 8) del

Cordón Superior (Número 4 -Figura 8), trabaja estructuralmente como Conector de Cortante (No. 23- Figura 8) para integrar mecánicamente el concreto de la losa (No. 22- Figura 8) con la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**.

- Las ondas del refuerzo que sobresale (No. 21 Figura 1) del Cordón Superior (No. 4 Figura 1) de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** trabaja estructuralmente como Conector de Cortante (No. 23 Figura 1) para integrar mecánicamente el concreto de la losa (No. 22 Figura 8) con la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** (No. 1 Figura 1).

REIVINDICACIÓN No. 4.- La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, está caracterizada porque el refuerzo de las ondas situadas en los extremos es de mayor diámetro (No. 2 a izquierda y No. 2 a derecha - Figura 1 y Figura 2).

- El refuerzo para conformar el ZIGZAG o las diagonales de la celosía a lo largo de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, se definen con diferentes ZONAS como son las ZONA 2 y ZONA 3 (No. 2 a la izquierda y No. 2 a la derecha - Figuras 1 y 2). En la ZONA 2 se ve que el refuerzo es de mayor diámetro al de la ZONA 3 (No. 2 a la izquierda y No. 2 a la derecha y No. 3 - Figuras 1 y 2).
- El cambio de diámetro del refuerzo se produce únicamente en los extremos izquierdo y derecho de las ondas en zig-zag en el punto que muestra la transición de la ZONA 2 a la ZONA 3 (No. 2 izquierdo y No. 2 derecho y número 3 - Figura 2). Tal como aparece mostrado en la figura 2, en la transición de la ZONA 2 a la ZONA 3.

ESTADO DE LA TECNICA O TECNOLOGIA ANTERIOR

El documento D1, a través del cual se divulgó la patente identificada con el número US 2009/0188192, denominada "EL COMPOSITE JOIST FLOOR SYSTEM", publicada el 30 de Julio de 2009, no anticipa el objeto de la solicitud de patente de modelo de utilidad, presentado por mi mandante y no puede tomarse como base para concluir que la patente solicitada por mi mandante carece de novedad, porque no tiene ninguna similitud con la presentada por este.

EL COMPOSITE JOIST FLOOR SYSTEM, no tiene incorporado el conector de cortante que constituye la evolución a gran escala de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** porque esta última, tiene incorporado el conector de cortante y tampoco tiene las otras características del modelo de utilidad de mi mandante que en la parte media está elaborada en refuerzo en diámetros de 15,87 mm 19,05 mm 22,22 mm 25,40 mm 28,57 mm 31,75 mm 34,93 mm 38,10mm y 50,80 mm, doblado a máquina en ondas diagonales desplegado sin cortes en forma continua (No. 6 - Figura 1); porque la parte superior de las ondas diagonales sobresalen (número 21 Figura 1) a los 2 ángulos que conforman el cordón superior (número 4 - Figura 1); porque incorpora en su diseño el Conector de Cortante (número 23 - Figura 8) y porque el refuerzo de los extremos es de mayor diámetro para evitar el pandeo (número 2 izquierdo y número 2 derecho, Figura 1 y Figura 2).

EL COMPOSITE JOIST FLOOR SYSTEM, se basa en el uso de lámina metálica stell - deck, , que se adhiere para que la plancha no se resbale, mediante espigos o conectores de cortante pegados a la estructura, en las depresiones de la lámina. Estos espigos deben ser instalados con poderosos equipos de soldadura, que normalmente no se usan en el país, porque sus requerimientos de energía son altísimos.

Es decir el sistema de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, cuya patente de modelo de utilidad solicitó mi mandante es absolutamente diferente, **NO REQUIERE EL USO DE LAMINA METALICA STELL DECK**, al contrario, para este se utiliza losa maciza en concreto. **NO REQUIERE ESPIGOS O CONECTORES DE CORTANTE**, porque la vigueta tiene incorporado el conector de cortante, constituido por la parte de las ondas que sobresalen al cordón superior. En el modelo de utilidad creado por mi mandante, el refuerzo no va en el cordón inferior, sino en las ondas situadas en los extremos izquierdo y derecho de la vigueta y su sistema no es ni siquiera similar al del documento D1 donde el refuerzo va en una terminación en diagonal, unidos a la cuerda superior

próxima al asiento o vigueta de zapato. En el modelo de utilidad creado por mi mandante, el refuerzo de mayor densidad evita el pandeo, sin requerir estar unido a ninguna cuerda superior.

Los elementos estructurales denominados viguetas en celosía o cerchas se emplea comúnmente pero antes de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, debían fabricarse artesanalmente y solo podían doblarse manualmente con refuerzo de los mas pequeños diámetros 9,52 mm, 12,70 mm y 15,87 mm, empleando ángulos en los tramos horizontales y varilla en diámetros de y 15,87 mm. Antes de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, solo en este rango de diámetros se doblaba el refuerzo en forma manual, lo que resultaba sumamente costoso, por el tiempo que tardaba cada trabajador doblando cada varilla.

Antes de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, con refuerzo en diámetro de 15,87 mm, se armaban elementos utilizando tramos cortados en forma de "V" para las diagonales, que luego debían soldarse angularmente ello hacía vulnerable la estructura por insuficiente capacidad de carga.

El proceso de cortar cada tramo de varilla para conformar la diagonal se hacía artesanalmente por lo que resultaba sumamente costoso, se incrementan las cuantías de soldadura, aumentan los esfuerzos a que son sometidas las soldadura y no hay continuidad del refuerzo. El uso de ángulo en las diagonales también se ha considerado y empleado, pero el proceso de fabricación sigue siendo artesanal y costoso.

Antes de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, las viguetas no tenían integrado el conector de cortante, por ello había que comprar e instalar sobre las mismas, los conectores de cortante tales como el NELSON STUD, CORONA Y ESPIGO, los cuales no se producen en el país, es decir son importados y son muy costosos, además debían ser pegados sobre el Stell Deck, que es una lámina trapezoidal, adhiriéndolos a las viguetas con puntos de soldadura, para lo cual se requerían soldadores calificados en la obra y costosos equipos de soldadura, que solo funcionan con electricidad de mas de 1.000 amperios, lo cual era muy difícil de suministrar porque la luz en las obras es provisional, lo que hacía costoso y dispendioso el sistema.

Antes de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, el refuerzo de las ondas situadas en los extremos, no se hacía con la precaución de utilizar

las viguetas tendían a pandearse, para prevenirlo se hacían mayores y mas columnas lo que implicaba, mayores costos de obra.

PROCEDIMIENTOS DE DISEÑO: Antes de la **DOBLADORA DE REFUERZO EN ONDAS DIAGONALES EN FORMA DE ZIGZAG "CELOSIA CONTINUA"**, no había manera de formar el entramado en refuerzo liso desplegado en forma continua con una figura de ondas diagonales de tipo Zig Zag, cuando se requería utilizar refuerzo liso de los siguientes diámetros 15,87 mm 19,05 mm 22,22 mm 25,40 mm 28,57 mm 31,75 mm 34,93 mm 38,10mm y 50,80 mm. Para elaborar elementos estructurales secundarios que le dieran mayor fuerza y resistencia a la estructura, solo era posible cortar la varilla en las dimensiones deseadas y unir las formando un ángulo mediante un punto de soldadura en su parte superior, que implicaba un alto esfuerzo para el punto de soldadura, lo cual hacía vulnerable la estructura. Además por no poder formar en diagonal el entramado en refuerzo liso, el esfuerzo de la soldadura necesaria para unir el entramado con los ángulos que conforman los cordones superior e inferior, aumentaba en un cincuenta por ciento (50%).

DESCRIPCION DE LA INVENCION

La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, es una vigueta que resuelve varios problemas técnicos porque la parte de las ondas que sobresalen al cordón superior actúan como conectores de cortante, adhiriéndose mecánicamente a la placa y estructurales porque su incorporación como vigueta estructural colabora con la reducción de peso muerto de la estructura, disminuyendo las cargas de cimentación y las dimensiones de los miembros que conforman la parte primaria de la estructura como son Columnas y Vigas. La puede ser empleada en cualquier tipo de estructura, aporticada en concreto, aporticada en acero o la combinación de estas.

Se ensambla en bancos de trabajo que le dan un pre dimensionamiento y se le aplican puntos de soldadura para luego ser soldados según especificaciones por un soldador experto.

La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** se puede fabricar en alturas variables (No. 9 - No.10) y en longitudes variables (No. 15), como se observa en la Fig. 5.

La conformación de los componentes que conforman la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** se definen con un procedimientos de diseño o calculo estructural que debe cumplir las normas y/o especificaciones de diseño que obliga el Código Colombiano de Diseño Sismo Resistente Norma NSR, vigente al momento de diseñarse y/o la norma local del país donde se emplee. Como la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** es un modelo de utilidad nuevo, el diseñador y fabricante deben adelantar diseños y pruebas de su funcionamiento para homologar los procedimientos de diseño y la comprobación de su funcionamiento estructural.

La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** se fabrica empleando materiales 100% Colombianos o de países donde haya fabricación local de ángulos y refuerzo. Contribuye a reducir la importación de elementos estructurales como vigas laminadas en caliente de tipo HEA, IPE y Wide Flange (WF) entre otras.

La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, es un elemento estructural jamás visto ni fabricado según en las dimensiones, alturas y longitudes propuestas.

El refuerzo de las diagonales (6) (7), Fig. 2 de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** corresponde a refuerzos doblados en maquina que logran Radios de Giro apropiados para que el refuerzo no se quiebre y no pierda su capacidad, se emplea refuerzo en diámetros de: 15,87 mm 19,05 mm 22,22 mm 25,40 mm 28,57 mm 31,75 mm 34,93 mm 38,10mm y 50,80 mm.

Como criterios de diseño se emplea: Esfuerzos Admisibles (ASD) y Esfuerzo Ultimo (LRFD), con el criterio de Sección Compuesta que quiere decir que La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** trabaja como una **VIGUETA "T"**. Que la losa de concreto (22), Fig. 8 se integra a La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** mediante las ondas de los refuerzos superiores que sobresalen (21) a los tramos superiores horizontales (Cordón Superior) (4) de tal manera que el concreto se adhiere mecánicamente a la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** con el concreto (22), la parte superior de la losa en concreto (22) y el tramo superior horizontal (Cordón Superior) (4) de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** se encuentran en la zona de compresión y el tramo inferior horizontal (Cordón Inferior) (5) queda trabajando 100% a tracción. Los refuerzos de las ondas en diagonal (6) (7) se encuentran, algunas en compresión y otras en tracción. La curvatura y/o Radio de Gira del refuerzo dado en proceso mecánico a los refuerzos en diámetro: 15,87 mm 19,05 mm 22,22 mm 25,40 mm 28,57 mm 31,75 mm 34,93 mm 38,10mm y 50,80 mm, reducen los esfuerzos de las soldaduras hasta en un 50% y la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** garantiza una capacidad de carga muy por encima de los requerimientos.

Las diagonales de refuerzo de las ondas (6) (7) pueden variar de diámetro de acuerdo con el diseño, sin embargo, las **VIGUETAS ESTRUCTURALES DE ALMA ABIERTA TIPO 1** se diseñan y fabrican con diámetros de refuerzo por ZONAS, ellas son: ZONA 2 y ZONA 3 como lo muestra la Fig. 2, para evitar el pandeo se c las dos (2) o tres (3) primeras ondas de cada extremo llevan refuerzo en un (1) o dos (2) diámetros mayores a las demás. El diámetro mayor de los extremos se da por los esfuerzos de cortante que resulta por el diseño. Las ondas que van en la zona entre las ondas de los extremos se definen por diseño.

En la ZONA 2, el diámetro del refuerzo (No. 7- Figuras 1 y 2) es mayor en razón a los esfuerzos por cortante a es sometida la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** en su etapa de trabajo. En la ZONA 3, el diámetro del refuerzo (No. 6 - Figuras 1 y 2) puede variar a un menor diámetro de aquel en la ZONA 2.

La **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** lleva un refuerzo adicional (No. 8 - Figura 1), en los extremos que es definido por la longitud o distancia que resulte de la última onda (No. 7 - Figura 1) a la viga o punto donde se determina el apoyo o asiento de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** a la viga principal.

DESCRIPCION DE LAS FIGURAS

Para complementar la descripción que se está realizando y con el objeto de ayudar a una mejor comprensión de las características del invento, se acompaña a la presente memoria descriptiva, como parte integrante de la misma, un juego de dibujos en donde con carácter ilustrativo y no limitado, se ha representado lo siguiente:

Figura 1- Muestra una vista longitudinal de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**.

Longitudinalmente la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, se define así:

- Longitud Tramo Horizontal Superior (Cordón Superior) (15)
- ZONA 2
Altura Onda (10), Diagonal Onda (12), Paso Onda (13), Diámetro Refuerzo (7), Angulo Onda (14).
- ZONA 3
Altura Onda (10), Diagonal Onda (12), Paso Onda (13), Diámetro Refuerzo (6), Angulo Onda (14).
- Refuerzo Extremo
Altura Onda (9), Diámetro Refuerzo (8).
- Distancia entre ondas o paso de refuerzo doblado (13)
- Altura de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** (Figura 1), entre:
Altura Total (10)
Altura entre Cordón Superior (4) y Cordón Inferior (5), (9)
Altura Peralte (11)
- Onda sobresaliente de refuerzo (21)

Figura 2- Muestra una vista longitudinal de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, define ZONA 2, ZONA 3, Cordón Superior (4), Cordón Inferior (5), Refuerzo ZONA 2 (7), Refuerzo ZONA 3 (6) y Refuerzo Onda Extremo (control de pandeo) (8).

Figura 3- Muestra una vista en corte de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, define:

- Altura Total (10)
- Altura entre Cordón Superior y Cordón Inferior (9)

- Peralte (11)

Figura 4- Muestra el corte longitudinal de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, define:

- Longitud Onda en Diagonal (12)
- Paso de la Onda (13)
- Angulo de la Onda (14)

Figura 5- Muestra el corte longitudinal de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, define:

- Cordón Superior (4)
- Cordón Inferior (5)
- Altura Total (10)
- Altura entre Cordón Superior y Cordón Inferior (9)
- Longitud del Cordón Superior (15)

Figura 6- Muestra un detalle **DE LA VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1, ZONA 2** y el Refuerzo Onda Extremo (8), definido así:

- ZONA 2, zona de mayor cortante.
- Cordón Superior (4)
- Cordón Inferior (5)
- Refuerzo ZONA 2 (7), define el diámetro y las propiedades mecánicas del acero.
- Soldadura Cordón Superior del refuerzo ZONA 2 (16), define la longitud de desarrollo, espesor del filete y especifica propiedades mecánicas de la soldadura.
- Soldadura Cordón Inferior del refuerzo ZONA 2 (15), define la longitud de desarrollo, espesor del filete y especifica propiedades mecánicas de la soldadura.

Refuerzo Onda Extremo (control de pandeo) (8).

- Soldadura Refuerzo Onda Extremo en el Cordón Superior (18), define la longitud de desarrollo, espesor del filete y especifica propiedades mecánicas de la soldadura.
- Soldadura Refuerzo Onda Extremo en el Cordón Inferior (17), define la longitud de desarrollo, espesor del filete y especifica propiedades mecánicas de la soldadura.

Figura 7- Muestra un detalle de la ZONA 3, **DE LA VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, define:

- ZONA 3, zona media.
- Cordón Superior (4)
- Cordón Inferior (5)
- Refuerzo ZONA 3 (6), define el diámetro y las propiedades mecánicas del acero.
- Soldadura Cordón Superior del refuerzo ZONA 3 (20), define la longitud de desarrollo, espesor del filete y especifica propiedades mecánicas de la soldadura.
- Soldadura Cordón Inferior del refuerzo ZONA 3 (19), define la longitud de desarrollo, espesor del filete y especifica propiedades mecánicas de la soldadura.

Figura 8- Muestra un corte longitudinal y transversal de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** con la losa de concreto (22), define:

- Altura de la parte de la Onda del Refuerzo que sobresale (21) al cordón superior para actuar como Conector de Cortante.
- Espesor de la Altura de la Losa de Concreto (23).
- Cordón Superior (4)

DESCRIPCION DETALLADA DE LA INVENCION

A la vista de estas figuras puede observarse la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** con los diferentes componentes que la conforman.

La longitud superior de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, está definida por la distancia entre las vigas principales que debe cubrir como elemento estructural, el tramo superior horizontal (Cordón Superior) (4) es conformado por dos (2) ángulos en longitud definida (15). Las características de los ángulos del Tramo Horizontal Superior (Cordón Superior) (4) son variables, el diseño define su altura (9) (10).

La longitud inferior de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** esta definida por el paso y/o la separación de las ondas (6) (7) que es definida por una relación entre la altura de onda (10) a la que se le suman 20 centímetros.

La especificación, características o tipos de ángulo (4) que se deben colocar en el tramo longitud horizontal superior (Cordón Superior) (15) de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** es definida por el diseño estructural. El diseño define Altura (9) (10) (11).

La especificación, características o tipos de ángulo que se deben colocar en el tramo longitud horizontal inferior (Cordón Inferior) (5) de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** es definida por el diseño estructural.

La especificación, características o tipos de refuerzo (7), diámetro (7), altura (110) que se deben colocar en la ZONA " dos (2) de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, la define el diseño estructural.

La especificación, características o tipos de refuerzo (6), diámetro (6), que se deben colocar en las demás ondas (6) de la ZONA 3 de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1**, la define el diseño estructural.

La especificación, características o tipos de refuerzo (8), diámetro (8), altura (9) que se deben colocar en los extremos de la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** la define el diseño estructural.

La separación o paso de las ondas (13) las define la relación determinada por cierto numero de veces la altura (10).

La distancia vertical que sobresale el refuerzo (21) de la parte superior del tramo horizontal superior (Cordón Superior) (4) se define en relación a la altura de la losa (23).

El refuerzo (21) que sobresale de la parte superior del tramo horizontal superior (Cordón Superior) (4) se denomina Conector de Cortante y su objetivo es logara una integración mecánica entre la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** y el concreto de la placa (22).

El diámetro y la cantidad de Conectores de Cortante (21) lo define el diseño estructural y define el refuerzo (6) (7) de las ondas de la ZONA 2 y ZONA 3.

Las características y/o especificaciones técnicas de la soldadura (15) (16) (17) (18) (19) (20) que se emplea para unir el refuerzo (6) (7) (8) a los ángulos de los tramos horizontal superior (Cordón Superior) (4) y a los ángulos de los tramos horizontales inferior (Cordón Inferior) (5) la define el diseño estructural.

Las longitudes de desarrollo de la soldadura (16) de las ondas de la ZONA 2 al (Cordón Superior) (4) la define el diseño estructural,

Las longitudes de desarrollo de la soldadura (20) de las ondas de la ZONA 3 en el tramo horizontal superior (Cordón Superior) (4) la define el diseño estructural.

Las longitudes de desarrollo de la soldadura (15) del refuerzo (7) de la ZONA 2 en el tramo horizontal inferior (Cordón Inferior) (5) la define el diseño estructural.

Las longitudes de desarrollo de la soldadura (19) de la ZONA 3 en el tramo horizontal inferior (Cordón Inferior) (5) la define el diseño estructural.

Las longitudes de desarrollo de la soldadura (20) del refuerzo de la onda extremo (8) en el tramo horizontal superior (Cordón Superior) (4) la define el diseño estructural.

Las longitudes de desarrollo de la soldadura (19) del refuerzo de la onda extremo (8) refuerzo con el tramo horizontal inferior (Cordón Inferior) (5) la

Las ondas sobresalientes (Conector de Cortante) (21), sirven de conexión mecánica entre la **VIGUETA ESTRUCTURAL DE ALMA ABIERTA TIPO 1** y el concreto (22) que se coloca en obra para las placas o losas de entrepiso (22).

No se considera hacer más extensa esta descripción para que cualquier experto comprenda el alcance de la invención y las ventajas que de ella se derivan. Los materiales, forma, tamaño y disposición de los elementos que compone la son susceptibles de variación siempre y cuando el concepto general no suponga una alteración de las características del invento.



17

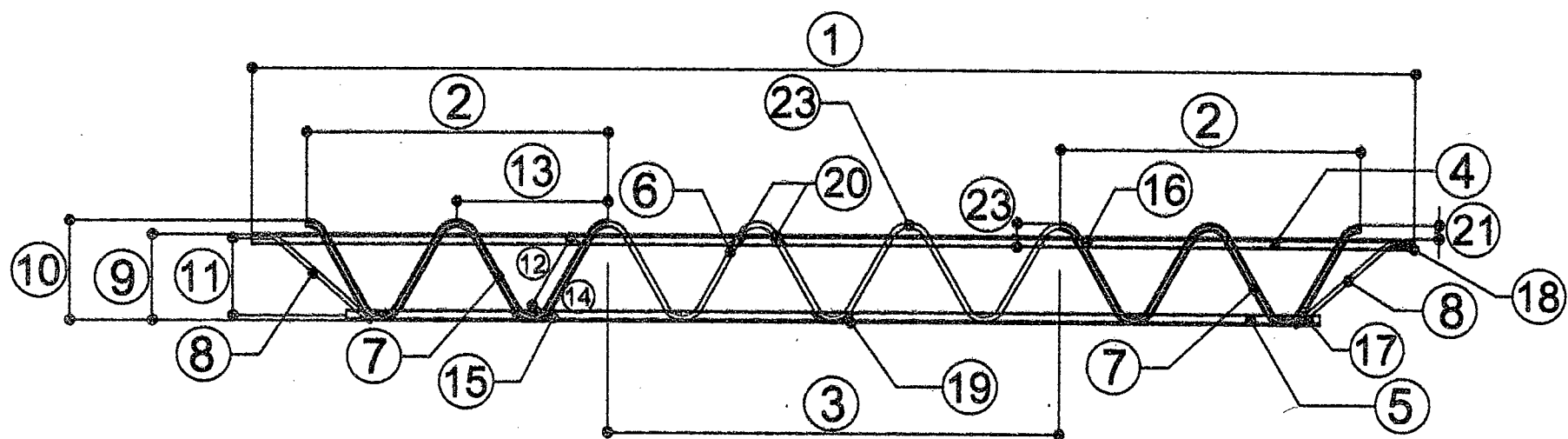
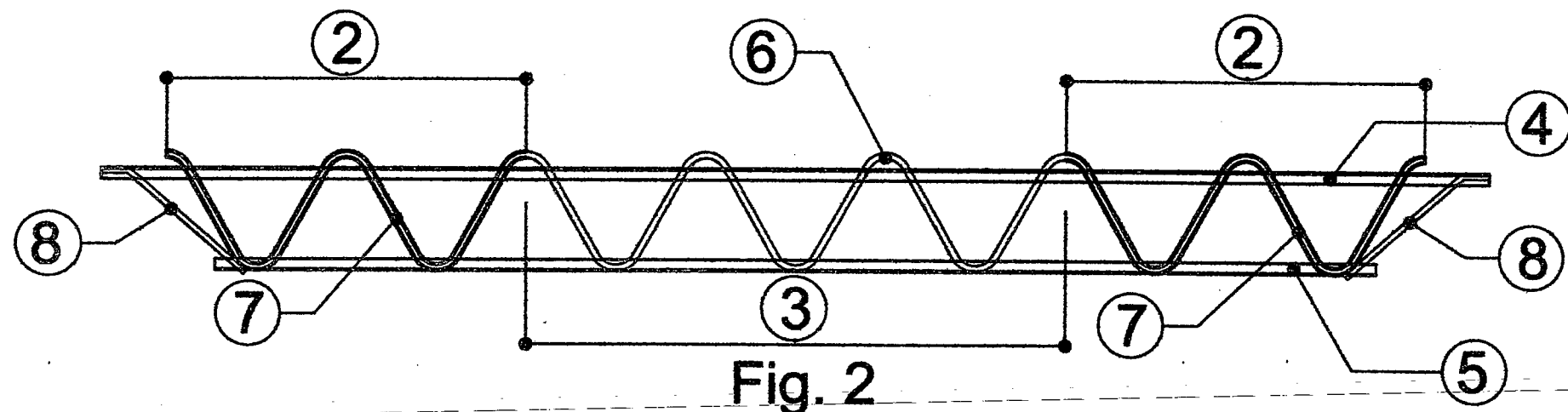


Fig. 1



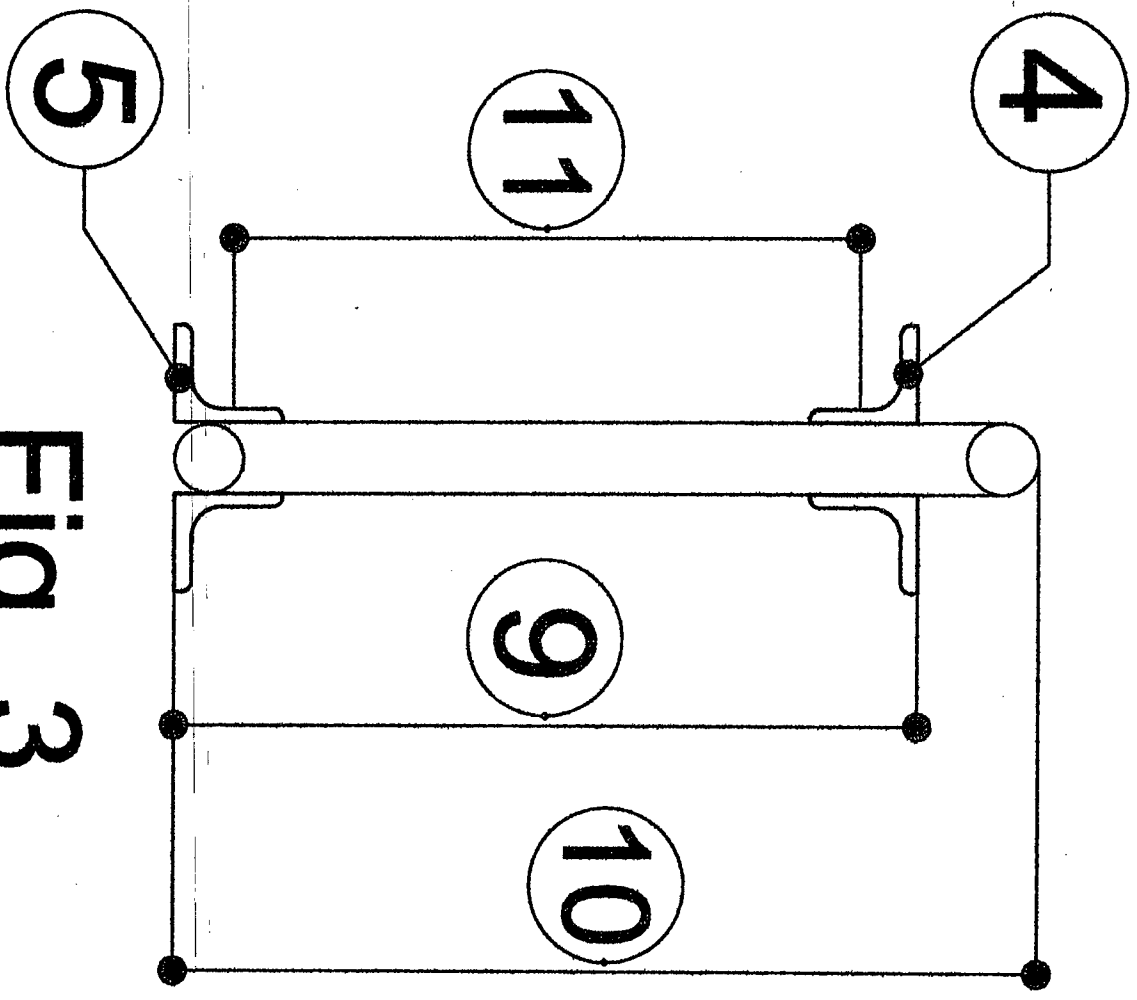


Fig. 3

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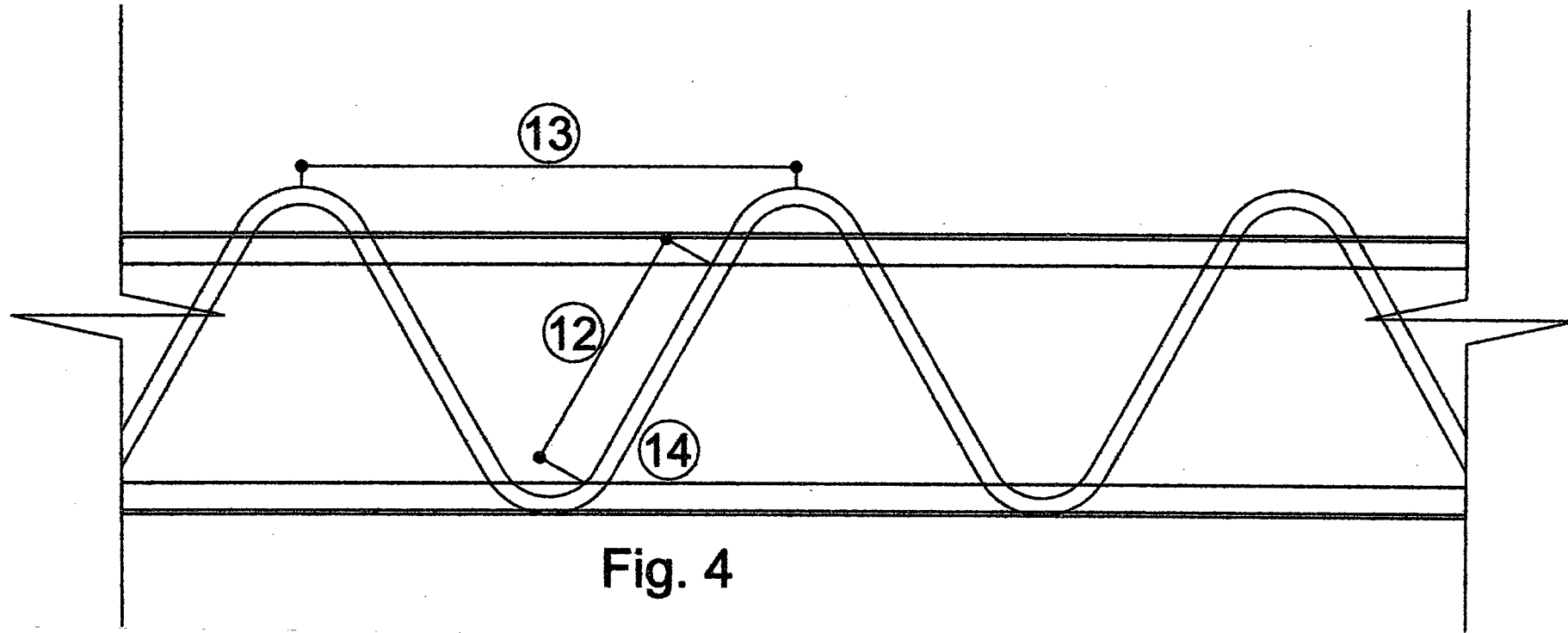


Fig. 4

29

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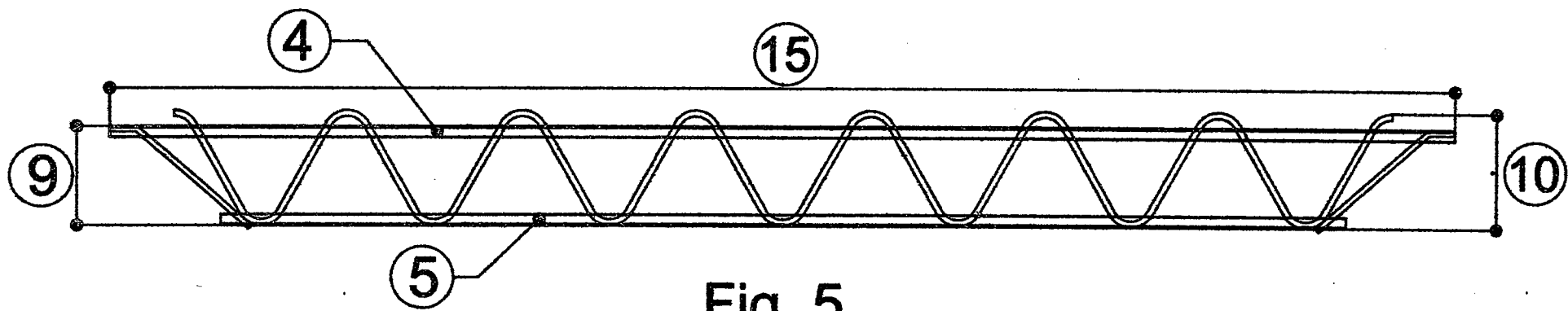


Fig. 5

22

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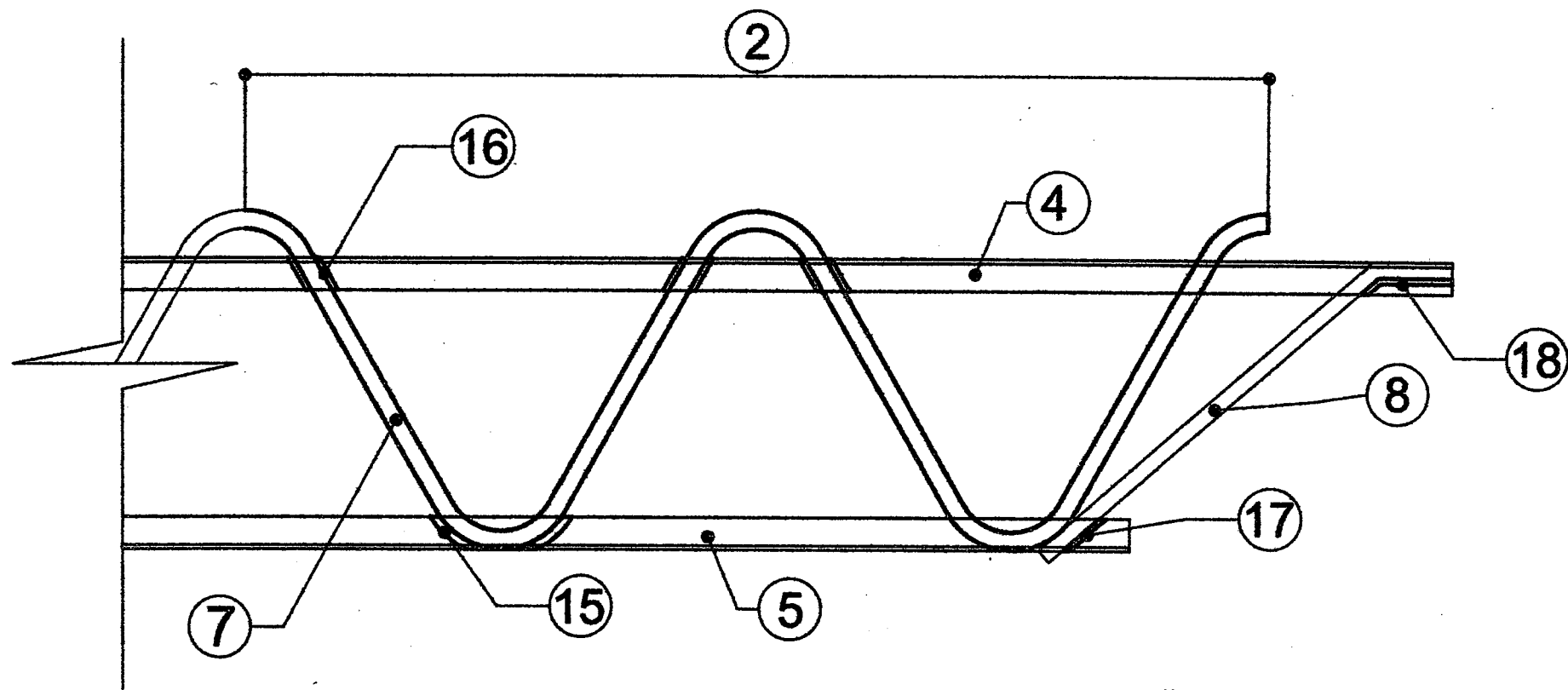


Fig. 6

3

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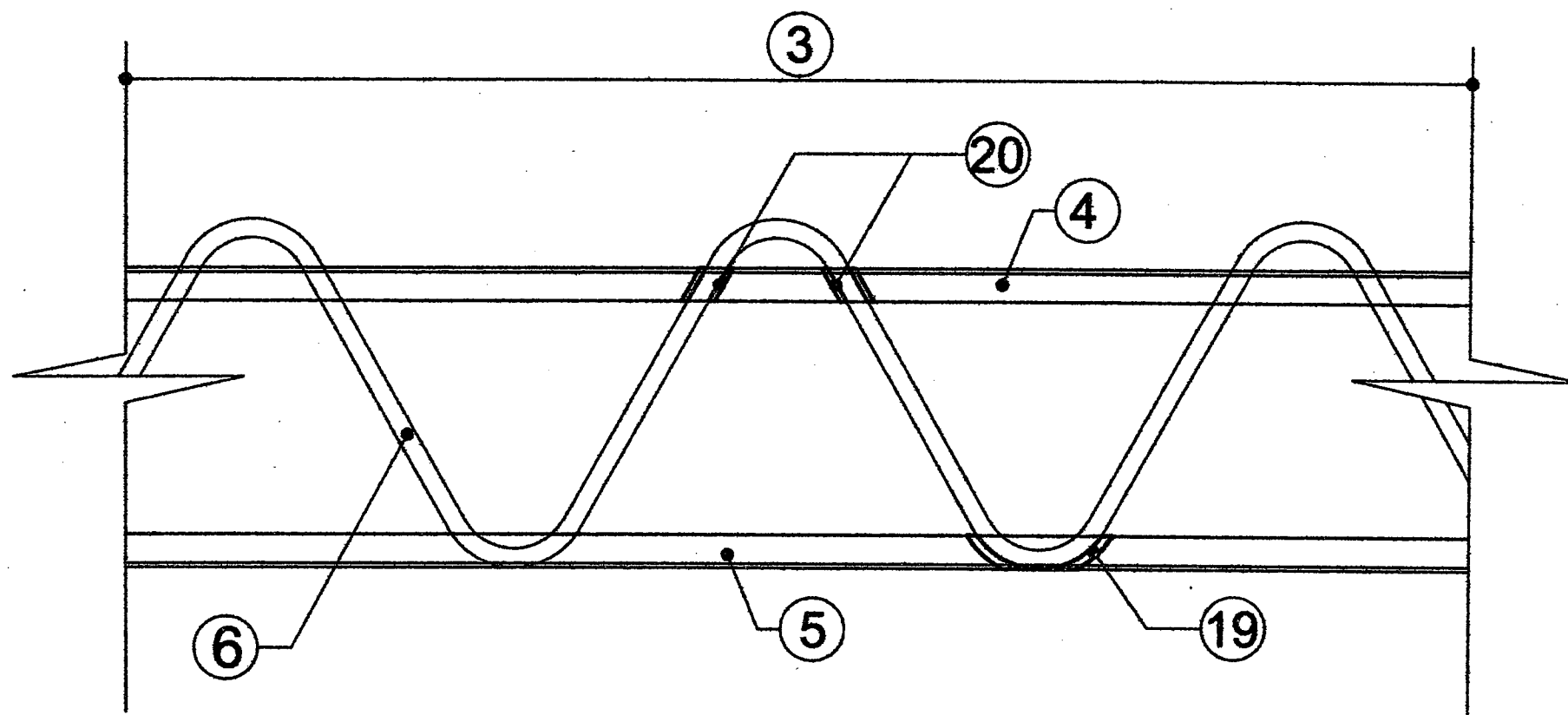


Fig. 7

(24)

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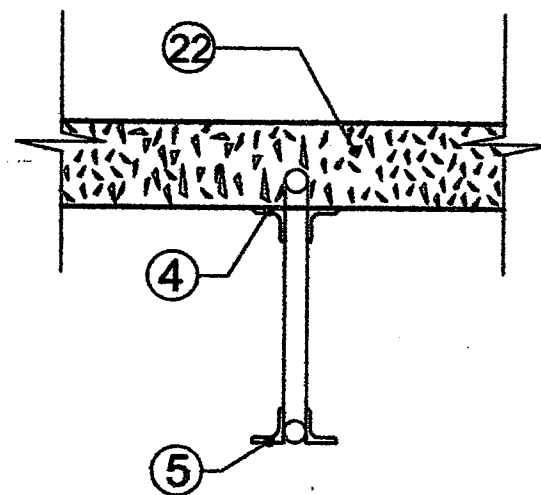
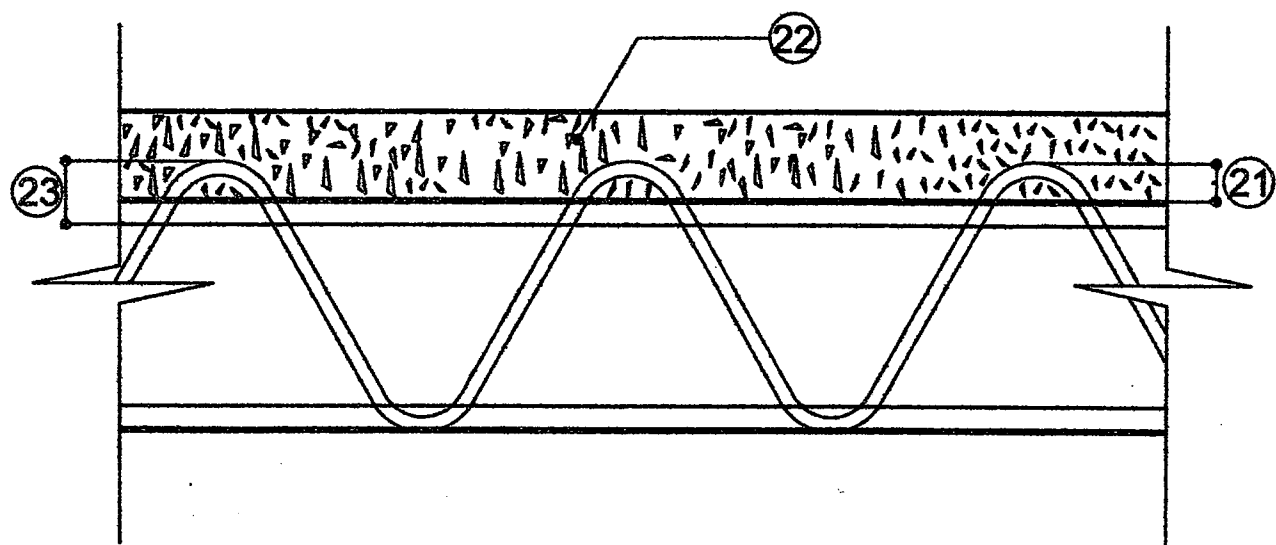


Fig. 8

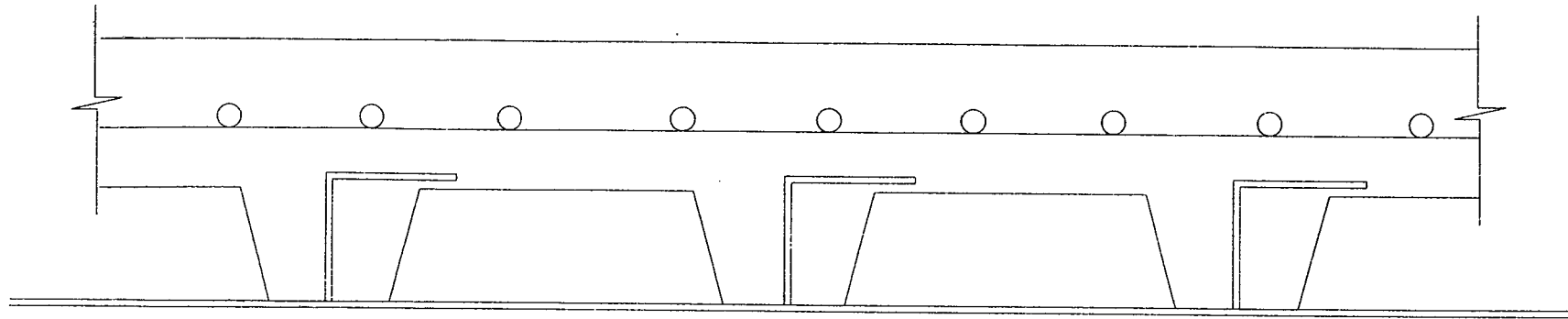
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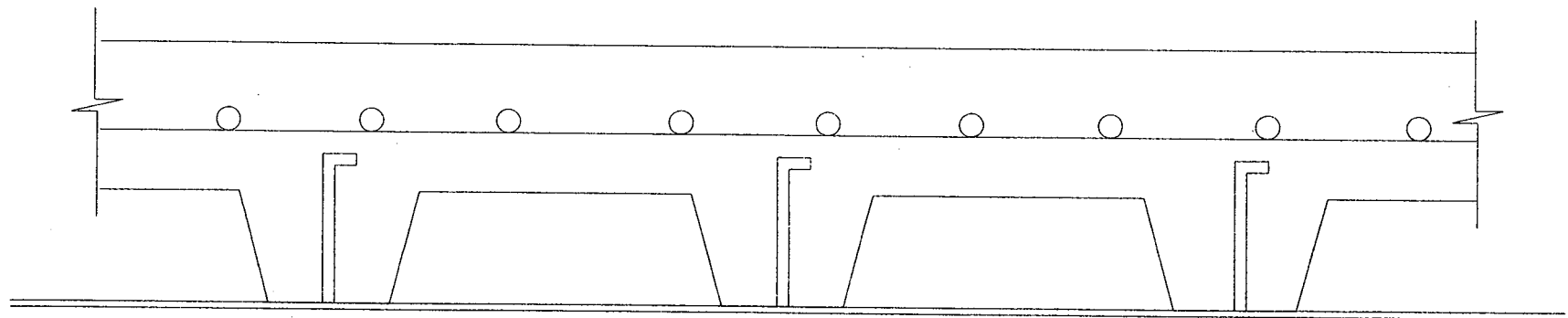
METAL PRODUCTS RESOURCES ASC. SAS

CONECTOR TIPO ANGULO Y REFUERZO EN 1 (ANEXO 1)

26



CONECTOR EN ANGULO



CONECTOR REFUERZO "L"

Fig. 1 (ANEXO 1)



METAL PRODUCTS RESOURCES ASC. S.A.S.

26

27



METAL PRODUCTS RESOURCES ASC. SAS

CONECTOR PERFIL
UPN DESARROLLADO
POR SIDETUR
VENEZUELA
(ANEXO 2)

NUESTROS DISTRIBUIDORES

ESTADO ANZOÁTEGUI		
Anaco (0282)		424.88.24
Ferretería Anaco, C.A.	424.31.68/03.65	
Feymaca		
Barcelona / Pto. La Cruz (0281)		
Acero Gangs, C.A.	276.70.34/01.35	
Ferreconstruya, C.A.	286.2104/09.05	
PRECA Barcelona		
Sec. La Aduana	276.34.02 / 10.50	
PRECA Barcelona		
zona Ind. Los Montones	275.97.55	
PRECA Pto. La Cruz	269.55.50	
Suplimaca Oriente	274.75.92/73.92	
El Tigre (0283)		
Ferretería Celma	235.19.48/07.10	
PRECA El Tigre	235.62.21/63.11	

ESTADO ARAGUA		
Maracay (0243)		
Hierroganga, C.A.	553.79.21/551.80.77	
Materiales		
La Económica, C.A.	271.27.85 / 21.40	
Maveca	245.81.44 / 63.44	
Tschomat, C.A.	271.07.79 / 39.95	
Venemat	553.09.04 / 38.05	
La Victoria (0244)		
Dist. de Hierro El Vigía	321.51.78/42.42	
Migo Victoria	322.58.23 / 38.23	
Turnero (0243)		
Tschomat Metropolitano	269.11.80 / 18.80	

ESTADO BARINAS		
Barinas (0273)		
Ferretería El Llano	546.44.58	
Hierro Cojedes Barinas	533.09.04 / 552.75.51	
Materiales de Construcción		
Los Mangos, C.A.	552.79.84 / 47.05	
Materiales Los Andes		
Barinas	546.45.54 / 58.97	
PRECA Barinas	546.05.78	

ESTADO BOLÍVAR		
Ciudad Bolívar (0285)		
Hierros Ríoúpero	631.33.01 / 11.76	
Pto. Ordaz / San Félix (0286)		
Hierrobeco	994.19.11/20.44	
Hierros San Félix, C.A.	934.35.66/717.04.41	
H. Welle, S.A.	994.05.70 / 19.09	
Maploca	994.19.32 / 33.44	
PRECA Guayana	934.40.35/717.38.61	
Upata (0288)		
Ferro-Materiales Piar	221.26.08	

ESTADO CARABOBO		
Valencia (0241)		
Cerami Hierro La Tejera, C.A.	835.00.32	
Dimo, C.A.	848.65.12	
Ferreconstruya, C.A.	897.87.45/832.41.13	
Ferro Cerámica Valcro	835.07.94	
Ferum	832.00.22	
Gangahierros, C.A.	847.83.78	
Hierro Cojedes Valencia, C.A.	835.51.30/16.87	
Logonca Valencia	871.60.43/52.18	
MAPLOCA	878.68.87	
Motasa Valencia	833.45.71	
PRECA Valencia	832.52.18/48.55	
Suplimaca	617.97.40/11.17	
San Joaquín / Guacara (0245)		
Caproa	571.74.63	
Hierrobeco	552.02.08 / 18	
Mat. Alianza	400.40.21	
Suplimaca	571.05.87/72.38	
Puerto Cabello (0242)		
Ferretería	361.68.63	

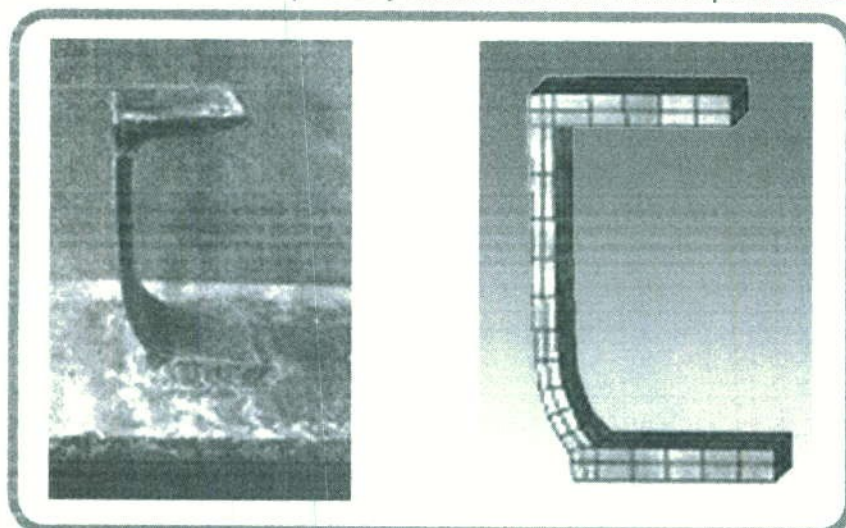
ESTADO COJEDES		
Tinaquillo (0258)		
Hierro Oferta	768.46.56	

DTTO. CAPITAL		
Zona Metropolitana / Litoral Central (0212)		
Acero oferta, C.A.	861.27.34 / 34.06	
Cabipirca	907.14.22 / 14.11	
Comercial Hierrotuven	860.51.11 / 860.35.38	
Comercial Muentes y Otero, C.A.		
- Catla	860.55.14 / 862.24.11	
- El Algodonal	472.77.52 / 443.29.78	
Diprosica	251.23.11 / 251.18.30	
Ferum	241.13.77/243.55.19	
Hierro Acero 2000	532.22.42 / 532.13.66	
Hierro Caracas 2003 C.A.	945.20.39 / 87.75	
Hierro Trébol	332.27.29 / 97.91	
Hierro y Tubo Molisano	631.17.17 / 632.32.22	
Hierrobeco, C.A.	251.66.22 / 11.45	
Maploca, C.A.	239.09.86	
Maxiferre	472.70.46/46.32	
Motasa Caracas	237.28.44/238.36.11	
Purohierro 93, C.A.	352.28.23 / 03.49	
Hierro Litoral	532.30.05	

Perfiles UPL

Resistencia de conectores de corte UP laminados en caliente

Un estudio experimental de perfiles canal o U laminados en caliente embebidos en concreto y su posterior modelo tridimensional en el computador, confirman el comportamiento estructural esperado y las fórmulas normativas para su diseño.



a) Resultado del ensayo

b) Resultado del modelo en el computador

Figura 1 Deformación típica del conector de corte tipo UPN

Uno de los estudios más recientes sobre el proyecto de vigas mixtas acero – concreto fue el realizado por los ingenieros Maleki y Bagheri, de la Universidad de Tecnología Sharif, en Irán, (2007) titulado “Comportamiento de los conectores de corte”. El mismo arrojó interesantes resultados experimentales respecto al comportamiento del UPN 100 que permitieron construir un modelo tridimensional en el computador para evaluar la incidencia de las diferentes variables que se encuentran tanto en las fórmulas normativas de la Canadian Standard Association (CSA) como del American Institute of Steel Construction (AISC), en la cual se basa la Norma Venezolana COVENIN 1618:1998 *Estructuras de Acero para Edificaciones. Método de los Estados Límites*.

Tal como se muestra en la Figura 1, la precisión del modelo matemático con respecto a los resultados experimentales se constata por la reproducción de la deformación del alma del perfil UPN adyacente a su ala soldada a la viga de acero sobre la cual se apoya.

En la Figura 2 se muestra el detalle del ensayo de empujamiento (*push out*) de las 16 probetas, en las que se combinó el largo de 30 y 50 mm del perfil UPN 100, con el tipo y calidad del concreto (concreto simple (C), concreto reforzado con cabillas (CR), concreto reforzado con fibras de polipropileno (FRC), o con fibras de alcohol polivinílico (ECC)).





Las Figuras desde la 4 hasta la 6 muestran como debe detallarse en los planos de proyecto que se utilizan en la construcción, la colocación de los perfiles UPL como conector de corte.

Es importante tomar en cuenta los siguientes aspectos (Figura 4):

- Es necesario colocar la malla de acero de refuerzo en la losa de concreto, para evitar su fisuración debido a la retracción y la fluencia del concreto.
- La continuidad entre las láminas del sofito metálico se consigue colocando la soldadura de unión dentro del agujero de una arandela, a fin de minimizar los daños al galvanizado del sofito.

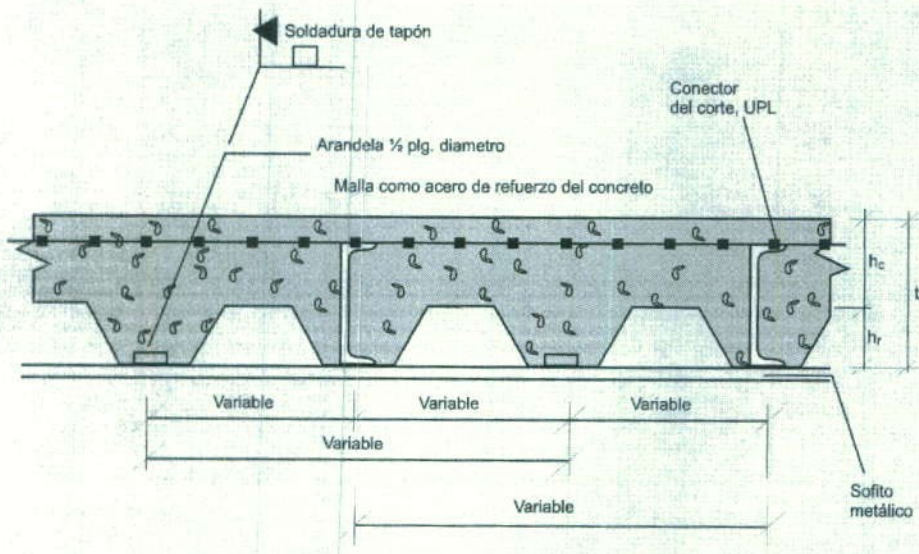


Figura 4 Detalle para la colocación de los conectores de corte UPL

- El conector UPL debe soldarse como se muestra en la Figura 5.
- La dimensión L_c debe respetarse, porque ha sido considerada en el cálculo de la resistencia del conector de corte, y por ende en la determinación del número de conectores (Figura 6).

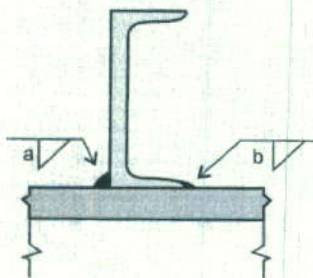


Figura 5 Soldadura del conector de corte UPL (Vista lateral)

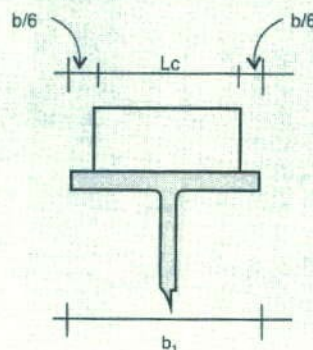


Figura 6 Longitud del conector de corte UPL (Vista frontal)

conector de corte: Plancha, espárragos, o perfiles de acero soldados a otro perfil y embebidos en concreto para transmitir la fuerza cortante producida por el aplastamiento local del concreto en el interfase concreto-acero.

ductilidad: Capacidad de deformación una vez rebasado el límite de proporcionalidad o límite elástico. En ingeniería sismorresistente, la capacidad de los componentes de un sistema estructural de hacer incursiones alternantes en el dominio inelástico de la respuesta sin pérdida apreciable de su capacidad resistente.

espárrago: Conector de corte constituido por una barra corta de acero ensanchada en su extremo superior que se suelda al ala superior de los perfiles y queda embebida en el concreto (*stud*).

L_c : Largo del conector de corte tipo canal que interviene en el cálculo de su resistencia.

retracción: Disminución de volumen que en el tiempo se produce en el concreto, debido principalmente a la pérdida de agua.

ESTADO FALCÓN

Coro (0268)	
Coselmpa Coro, C.A.	277.12.30
Ferremaco, C.A.	253.01.95/251.58.19
Materiales Franco Savino	251.55.98/21.40
Punto Fijo (0269)	
Coselmpa	247.44.64
Ferretería El Áncora	246.57.93
Ferrometalca	245.43.87 / 57.54

ESTADO LARA

Barquisimeto (0251)	
Ferreconstruya, C.A.	266.76.09/72.07
Ferum	237.01.35
Hierro Barquisimeto, C.A.	269.23.80
Hierro Lara C.A.	237.25.12/05.12
Hierroheco, C.A.	237.36.36/69.20
Hierroheca	237.12.84/02.80
PRECA Barquisimeto Vía Quibor	266.62.35
PRECA Cabudare	263.64.71
PRECA Barquisimeto Obelisco	376.05.02

ESTADO MÉRIDA

Mérida (0274)	
Casamia	271.59.66/ 25.33
Materiales Andinos	266.13.63
Mat. de Construcción El Roble	221.25.04
Mat. Los Andes C.A.	266.26.44
El Vigía (0275)	
Dist. de Hierro El Vigía, C.A.	881.22.14/98.12
Materiales Los Andes	881.69.42/26.23

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Charallave / Cúa / Sta. Teresa (0239)	
Crial Muentes y Otero	
Oumare del Tuy	224.13.46/225.78.40
Distribuidora Rogui, C.A.	231.15.01
Hierros Río Tuy, C.A.	246.06.61/04.34
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Hierro Tubos, C.A.	532.08.06
Galvalume 2000	244.10.59
Motasa Guaremas	363.18.22/75.25
Los Teques (0212)	
Distribuidora Multirísticos	321.87.40
Comercializadora J.P.H. C.A.	375.13.79
Río Chico (0234)	
Comercial Sica Mar	342.10.16

ESTADO MONAGAS

Maturín (0291)	
FERVENCA	643.11.55/12.75
PRECA Maturín sector Bella Vista	651.49.14
PRECA Maturín sector Las Piñas	643.12.32

ESTADO NUEVA ESPARTA (0295)

Aceros Materiales C.A.	269.23.44
Catalano Home Center	287.00.37 / 05.50

ESTADO PORTUGUESA

Acariquis (0255)	
Fessica	623.12.84
Guarema (0257)	
Casa del Constructor	251.10.10

ESTADO SUCRE

Carúpano / Cumaná (0293)	
Industrial de Oriente	431.00.25 / 432.22.86
PRECA Cumaná	451.14.14

ESTADO TÁCHIRA

San Cristóbal / Ureña (0276)	
Hierro Gómez	347.16.89
Madeo	343.99.42/99.30

ESTADO TRUJILLO

Valera (0271)	
Ferretería y Materiales Dario	225.31.01/82.63

ESTADO YARACUY

San Felipe (0254)	
Comercial López González, C.A.	
Logonca Marín	234.36.82
Ferretería San Felipe	234.35.08
PRECA Nirgua	572.04.35

ESTADO ZULIA

Maracaibo / Santa Bárbara (0261)	
Ferretería Bicolor	734.55.52/09.95
Ferretería La Principal, C.A.	755.42.80
Ferum	785.32.80/07.42
Iron Wolter & La Guardia	757.78.12/83.55
PRECA Maracaibo	736.20.98
Ciudad Ojeda (0265)	
Comercial Lada, S.R.L.	631.57.61

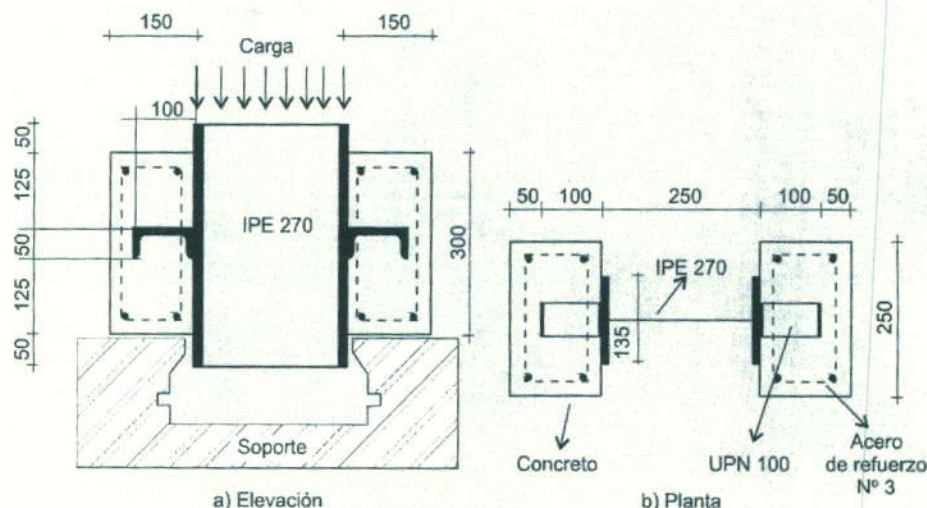


Figura 2 Detalles de las probetas ensayadas, dimensiones en mm

Es importante señalar que además de la resistencia del concreto, en el modelo tridimensional del computador, también se variaron las siguientes dimensiones del perfil para evaluar su incidencia en el comportamiento: el espesor de alma y alas, la altura y la longitud de contacto con el perfil. Asimismo, respecto a las cargas aplicadas en las probetas, en 9 fueron estáticas (monotónicas) y en las otras 7, fueron dinámicas de bajo ciclaje.

Resultados

Los resultados obtenidos permitieron concluir que la altura del perfil UPN no es un parámetro significativo en la fórmula de diseño dada por las Normas CSA, AISC y COVENIN 1618:1998 para obtener la resistencia.

Igualmente, se demostró que el modo de falla del canal como conector de corte fue siempre de comportamiento dúctil, tal como se aprecia en la Figura 3.

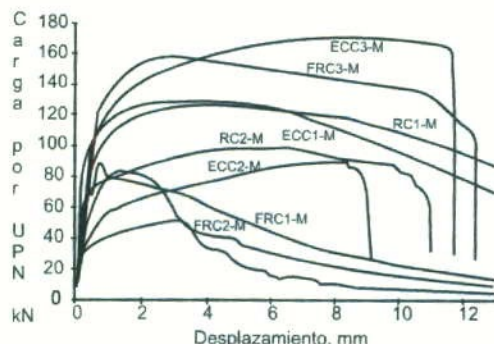


Figura 3 Curvas carga-desplazamiento de las probetas ensayadas estáticamente

Los valores de resistencia del conector obtenidos con la fórmula canadiense están más cerca de los resultados experimentales y analíticos que cuando se emplea la fórmula de la AISC. Es decir, la norma estadounidense, y por tanto la COVENIN, es más conservadora que la canadiense porque exige mayor número de conectores; por ejemplo si la norma canadiense exige 14 conectores, nuestra Norma pedirá 16. Esta comparación es la que justifica que se haya retomado la investigación con ensayos más continuos en el tiempo para mejorar las normas.

Aplicación en Venezuela

El perfil SIDETUR UPL 100 logra cumplir las funciones del perfil canal laminado en caliente estándar europeo UPN 100, porque las dimensiones y calidad de acero son muy similares.

Además de su mayor resistencia con respecto a los conectores importados tipo espárragos, el perfil UPL, como conector de corte, tiene varias ventajas, entre las cuales podemos mencionar:

- Mayor disponibilidad, por ser de fabricación nacional.
- Mayor economía, porque un canal puede reemplazar un mayor número de pernos espárragos.
- Más fácil de usar y más independencia de la configuración geométrica de la lámina de acero (sofite metálico) sobre la cual se



El Centro de Información y Documentación de SIDETUR ofrece, para su consulta, las siguientes obras:

ANSI/AISC 360-05: Specification for Structural Steel Buildings. Articulado y Comentarios, March 9, 2005 / ANSI; AISC. Chicago: AISC, 2005, 460 p.

Behavior of channel shear connectors. Part I: Experimental Study / Shervin Maleki; Saman Bagheri // En: Journal of Constructional Steel Research. - Vol. 64, Dec. 2008, pp. 1333-1340

Behavior of channel shear connectors. Part II: Analytical Study / Shervin Maleki; Saman Bagheri // En: Journal of Constructional Steel Research. Vol. 64, Dec. 2008, pp. 1341-1348

CSA S16-01: Limit States Design of Steel Structures / Canadian Standard Association. Toronto: CSA, 2001. 156 p.

Handbook of Steel Construction / Canadian Institute of Steel Construction. 9 ed. Toronto: CISC, 2006. 1032 p.

New design equations for channel shear connectors in composite beams / Amit Pashan and M.U. Hosain // En: Canadian Journal of Civil Engineering. Vol. 36, Sep. 2009, pp. 1435-1443

Norma Brasileira para Estruturas de Acero. Versión DEZ/2005. Projeto de Revisão da NBR 8800 / ABNT - Associação Brasileira de Normas Técnicas, 291 p.

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Publicaciones más solicitadas en el 2009

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Calendario de Eventos

III Concurso ILAFA

Diseño en Acero para Estudiantes de Arquitectura 2010

Tema: "Centro Urbano". Plaza pública de uso múltiple techada.

Al igual que todos los años, ILAFA procura con este concurso apoyar el desarrollo de la Arquitectura como disciplina fundamental de la construcción del habitar humano, estimular el trabajo en equipo de profesores y alumnos y promover e incentivar el conocimiento del acero como material, la investigación en torno a su enorme potencial, sus tecnologías, y sus múltiples usos y aplicaciones en el área de la construcción y su desarrollo en una

concepción arquitectónica y estructural apropiada.

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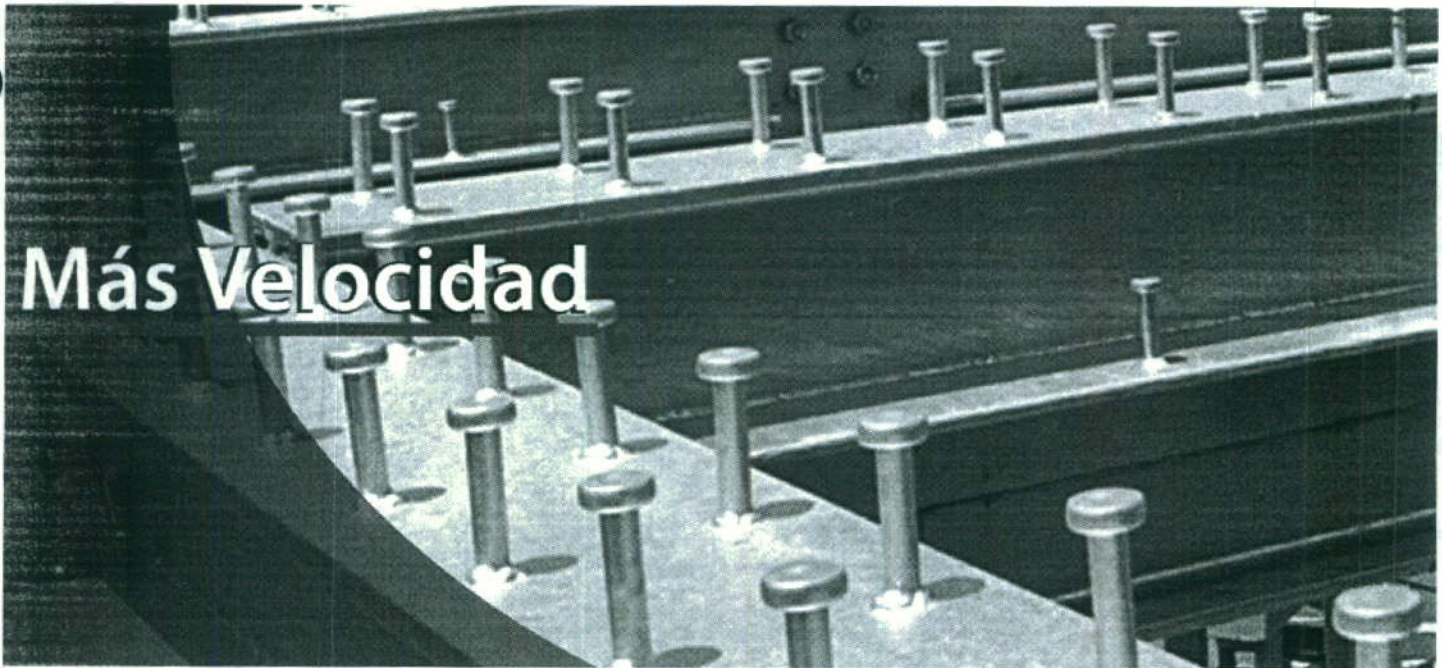
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CONECTORES NELSON STUD (ANEXO 3)



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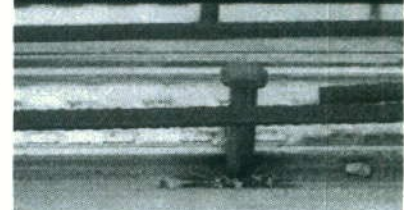
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PriceSmart de Cortante - Nelson Stud - PriceSmart - Santiago de Cali, Colombia.



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ESQUEMA DETALLE APLICACIÓN NELSON STUD

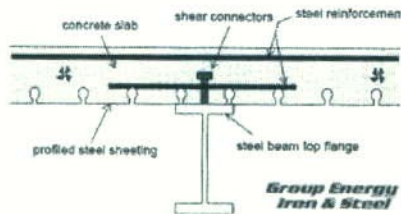
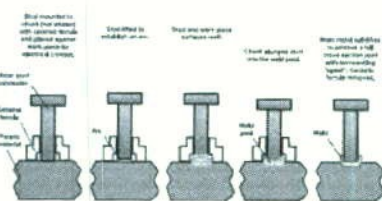
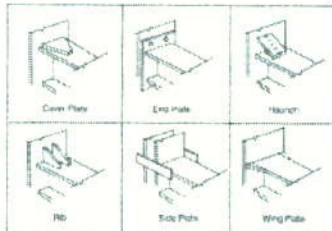
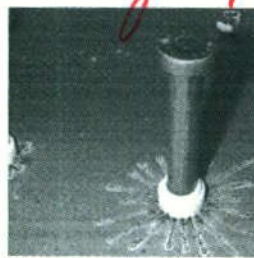
(FIG 4)

Imágenes

Fig. 4.

SafeSearch

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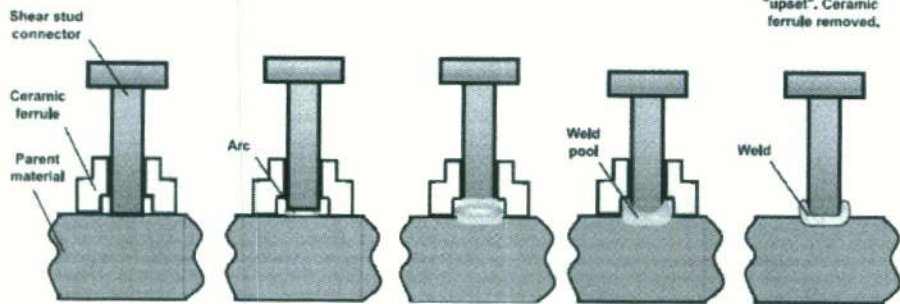
Stud mounted in chuck (not shown) with ceramic ferrule and placed against work piece for electrical contact.

Stud lifted to establish an arc.

Stud and work piece surfaces melt.

Chuck plunges stud into the weld pool.

Weld metal solidifies to achieve a full cross section joint with surrounding "upset". Ceramic ferrule removed.

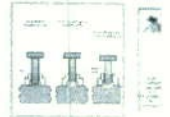


Welding - S

The ferrule is chipped have a regular, bright

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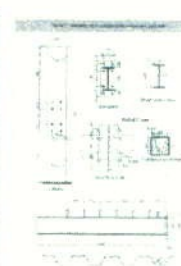
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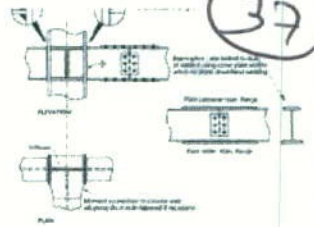
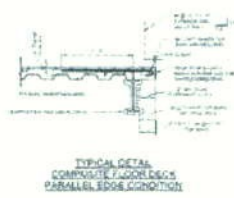
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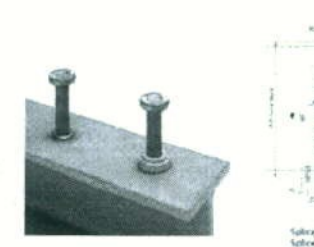
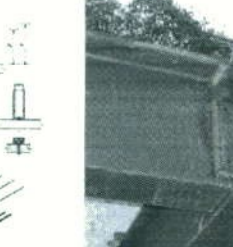
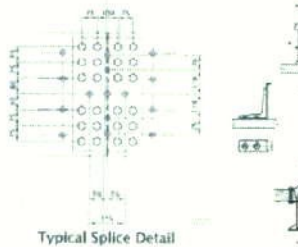
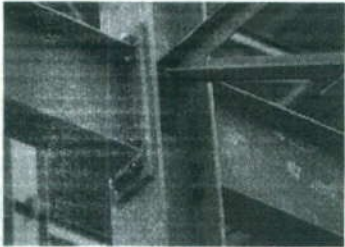
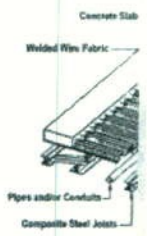
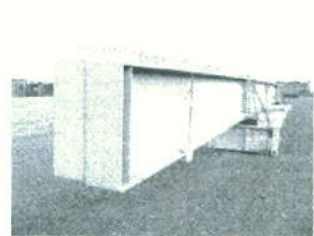
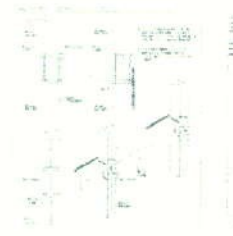
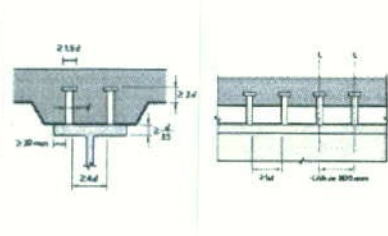
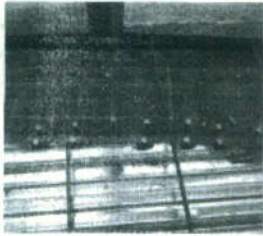
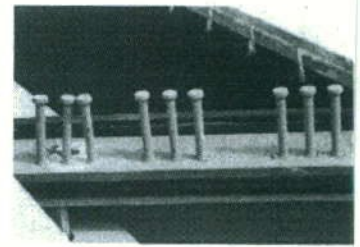
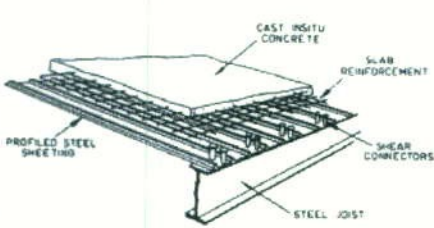
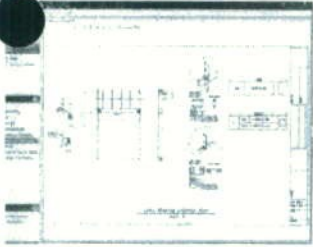
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COMPLEMENTO CONECTORES TIPO NELSON STUD

(FIG 5)



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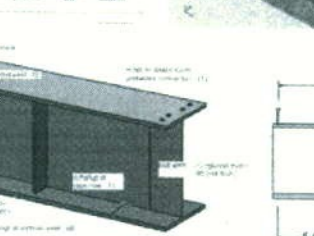
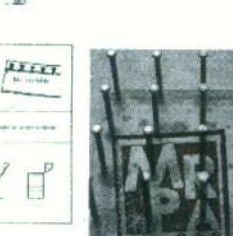
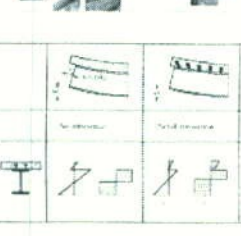
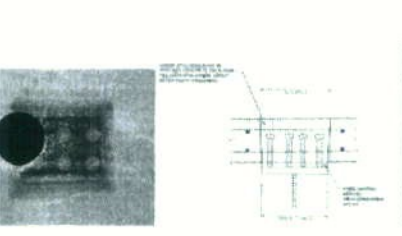
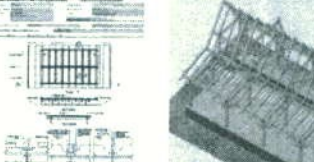
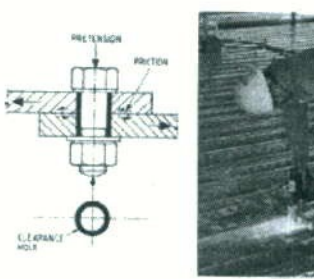
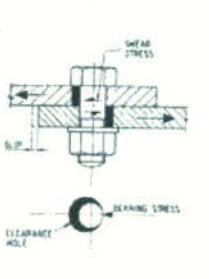
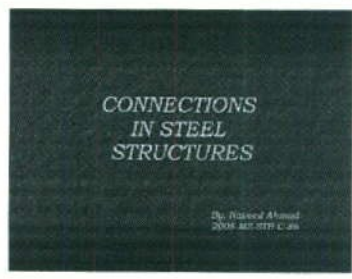
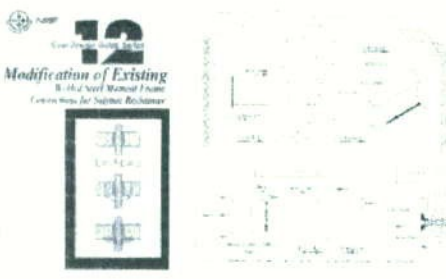
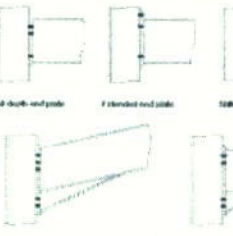
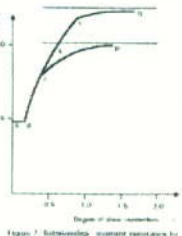
CHAPTER 3 Unstayed Steel Beams
2.2 Shear Capacity of Welded Studs

Discussion

These studs are welded to the top flange of a steel beam to connect the beam to a concrete slab forming a composite action. The composite action is stronger and stiffer than a steel beam of the same size that is not supported by the slab with these studs. The studs help to reduce a wide variety of concrete placed on perimeter and form in a composite action (including of concrete and a composite steel deck).

The shear strength of the studs depends on the diameter and length, the strength and weight of the concrete, and the orientation and pitch of the studs. The AISC Specification Section 12 provides formulas and tables for calculating shear stud capacity, and for reduction factors.

The strength of a stud is first calculated as a solid in the width and of nominal weight capacity and then strength reduction factors are applied for the use of lightweight concrete, and for the pitch and orientation of studs in composite steel decks. The AISC Specification Section 12 provides formulas and tables for calculating shear stud capacity, and for reduction factors.



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Fig. 5



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**CORTES LOGINTUDINAL
UTILIZACION VIGAS TIPO
JOIST PISO METALICO
METALDECK, CONECTORES
TIPO ESPIGO
(NELSON STUD)**

FIG 6

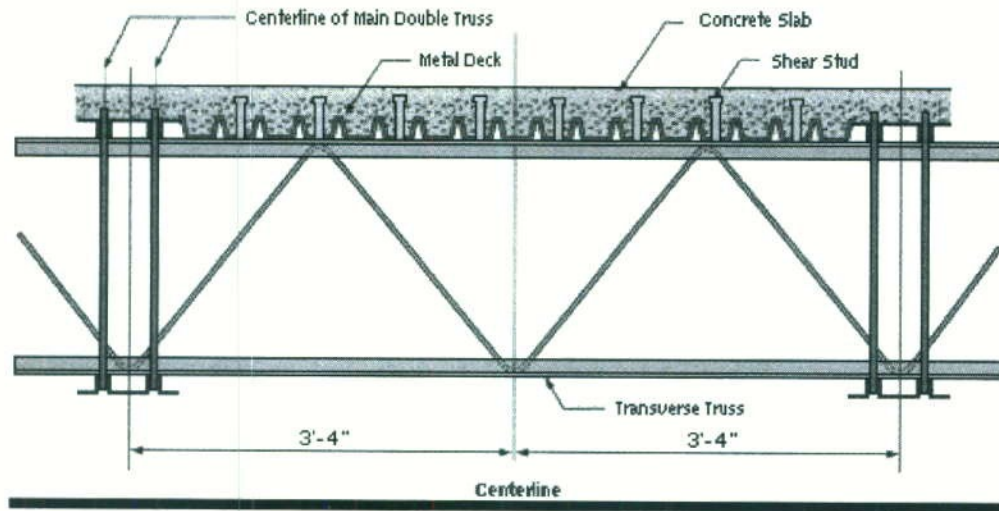


Fig. 6.

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**DETALLE EMPLEO VIGA
METALICA IPE COMO
ELEMENTO ESTRUCTURAL
PRINCIPAL VIGA
SECUNDARIA TIPO JOIST
ENTRE PISO METALICO
(METALDECK CONECTORES DE
CORTANTE TIPO NELSON STUD FIG 7)**

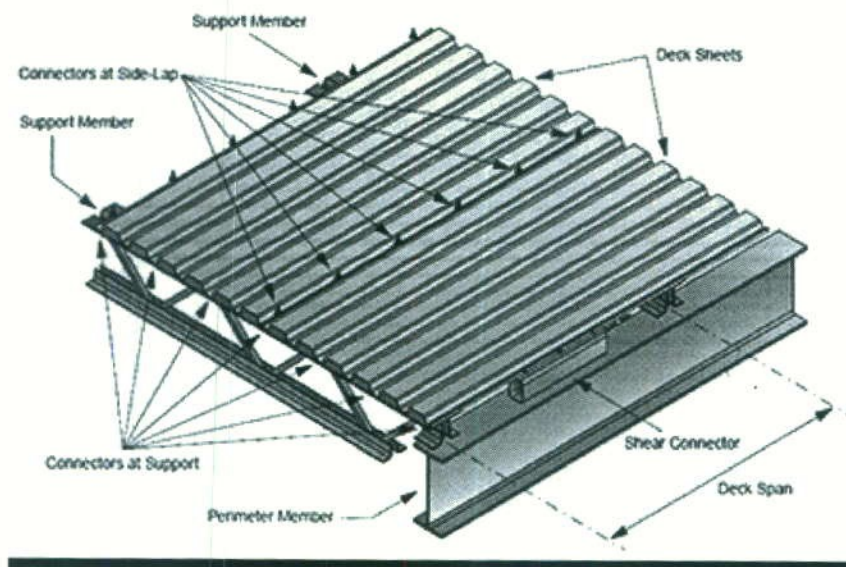
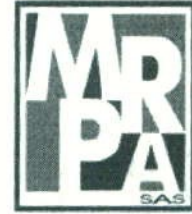


Fig. 7

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PATENTE NUMERO
US 20090188192 A 1
COMPOSITE JOIST
FLOOR SYSTEM
(COPIA)
ANEXO 8

43

ANEXO 8.

Patentes

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Composite joist floor system US 20090188192 A1

RESUMEN

The composite joist floor system includes joists supported by supporting members. Corrugated steel decking is positioned over the joists such that the corrugations are substantially perpendicular to the joists. Self-drilling, self-tapping, stand-off screws are spaced along the length of the joist, aligned with the deck corrugations. These stand-off screws provide the required shear transfer between the joist and concrete slab to form a composite floor system. The placed concrete encapsulates the upper non-threaded shank portions of the stand-off screws and the end of the joists. After the concrete has cured, the resultant system comprised of steel joists, steel decking, stand-off screws, and concrete, act together to form a composite system with greater load carrying capacity and less vertical deflection. The stand-off screws connect the joist upper chords to the concrete slab allowing the joist and concrete slab to act as a unit, by transferring shear between the two joined components.

Número de publicación US20090188192 A1
Tipo de publicación Solicitud
Número de solicitud US 12/019,329
Fecha de publicación 30 Jul 2009
Fecha de presentación 24 Ene 2008
Fecha de prioridad 24 Ene 2008
También publicado como CA2650688A1, 6 más »
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IMÁGENES



DESCRIPCIÓN

FIELD

This invention relates to the field of structural systems for buildings. More particularly, embodiments of the invention relate to improved composite joist floor systems.

BACKGROUND

Large scale, multi-story buildings are typically constructed of steel and concrete. Floors in such buildings may be constructed by spanning wide flange beams or steel joists between structural supports and installing metal decking across the tops of such beams or joists. The decking forms a horizontal surface onto which concrete is placed. Generally, the bottoms of the beams or joists form the framework from which ceilings are hung. The composite construction is typically achieved by using welded shear studs or partial extension of the joist top chord above the form or metal deck into the concrete slab. Flooring system designs must also be mindful of fire safety, acoustics, and vibration considerations.

While joist and deck floor systems have been designed in the past to address one or more of these issues individually, these prior designs are not optimized and integrated with the portions of the support structure of a building to provide an integrated design to address the above mentioned issues in a systematic manner.

BRIEF SUMMARY

RECLAMACIONES

1. A composite joist floor system comprising:

- a first supporting structure;
- a second supporting structure;
- a plurality of joists spaced apart from one another and extending from the first supporting structure to the second supporting structure;
- decking supported by the plurality of joists;
- a plurality of stand-off fasteners for fastening the decking to the plurality of joists, wherein the stand-off fasteners each comprise a lower portion and an upper portion, the lower portion having a greater degree of hardness than that of the upper portion, and wherein, when installed, at least a portion of the upper portion of each stand-off fastener extends significantly above the decking; and
- a cementitious slab supported by the decking and encapsulating the portion of each stand-off fastener extending above the decking.

2. The composite floor system of claim 1, wherein the decking comprises corrugated steel decking, the corrugations of the corrugated steel decking defining a plurality of peaks and valleys, wherein the stand-off fasteners are located in the valleys of the corrugated steel decking, and wherein adjacent stand-off fasteners along a joist are



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Embodiments of the present invention address the above needs and/or achieve other advantages by providing an improved and integrated composite joist floor system. One aspect of the improved composite joist floor system includes joists having ends supported by varying supporting members. Corrugated steel decking is positioned over the joists such that the corrugations are substantially perpendicular to the joists. Self-drilling, self-tapping, stand-off screws are spaced along the length of the joist, aligned with the deck corrugations. These stand-off screws provide the required shear transfer between the joist and concrete slab to form a composite floor system. The placed concrete encapsulates the upper non-threaded shank portions of the self-drilling, self-tapping, stand-off screws and the end of the joists.

After the concrete has cured, the resultant system comprised of steel joists, steel decking, stand-off screws, and concrete, act together to form a composite system with greater load carrying capacity and less vertical deflection than a non-composite floor system. The self-drilling, self-tapping stand-off screws connect the joist upper chords to the concrete slab allowing the joist and concrete slab to act as a unit, by transferring shear between the two joined components. The concrete slab then effectively behaves as the upper chord of the composite system with a much larger load carrying capacity than the joist upper chord alone.

To provide additional continuity, fire protection, and stiffness at joist ends and at slab edge locations, a combination of z-shaped closures and/or pour stops provide forming for the concrete. A z-shaped closure is provided having a vertical face, an upper horizontal flange, and a lower horizontal flange. The upper horizontal flange extends over a portion of the corrugated steel decking and the lower horizontal flange is supported by the steel joist supporting member. The vertical face extends between the upper and lower horizontal flanges and has a cutout so that at least a portion of the joist end passes through the vertical face. At exterior conditions, break formed pour stops are supplied. Concrete is then placed over the corrugated steel decking and into a channel formed at least partially by the z-shaped closure and/or the pour stop.

In one embodiment, the stand-off screw comprises a first threaded portion having first and second ends and a first helical thread. The stand-off screw may also include a stand-off portion extending from the second end of the first threaded portion, the stand-off portion having a first end and a second end. The first end of the stand-off portion is proximate to the second end of the first threaded portion. The stand-off screw may further include a driving section located proximate to the second end of the stand-off portion. The driving section is configured to allow engagement between the stand-off screw and a tool for rotating the stand-off screw so that the first threaded portion of the stand-off screw can be drilled into a support member of the building structure. The stand-off screw may also include a second threaded portion comprising a second helical thread. The second threaded portion is generally located proximate to the second end of the stand-off portion and configured to be used to couple the stand-off screw to an extension member.

In general, the decking of the composite floor system comprises corrugated steel decking where the corrugations of the corrugated steel decking define a plurality of peaks and valleys. In some embodiments, the stand-off fasteners are located in the valleys of the corrugated steel decking, and adjacent stand-off fasteners along a joist are separated by at least one valley that does not have a stand-off fastener located therein on that joist. In other embodiments, at least two adjacent stand-off fasteners are located in the same valley of the corrugated steel decking on that joist.

In some embodiments of the composite floor system, the joist may include a wood member and the lower portion of each stand-off fastener may comprise a wood screw portion having a helical wood screw thread for drilling into the wood member. In some embodiments, the decking has pre-formed holes for installing the stand-off fasteners therethrough.

separated by at least one valley that does not have a stand-off fastener located therein on that joist.

3. The composite floor system of claim 1, wherein the decking comprises corrugated steel decking, the corrugations of the corrugated steel decking defining a plurality of peaks and valleys, and wherein at least two adjacent stand-off fasteners are located in the same valley of the corrugated steel decking on that joist.

4. The composite floor system of claim 1, wherein the joist comprises a wood member and wherein the lower portion of each stand-off fastener comprises a wood screw portion having a helical wood screw thread for drilling into the wood member.

5. The composite floor system of claim 1, wherein the decking has pre-formed holes for installing the stand-off fasteners therethrough.

6. The composite floor system of claim 1, further comprising:

a welded wire fabric located over the decking and encapsulated within the cementitious slab.

7. The composite floor system of claim 1, wherein the decking comprises corrugated steel decking, wherein any 32-inch span of the corrugated steel decking over a joist has between three and nine stand-off fasteners located therein.

8. A composite floor system comprising:

a supporting member;

a joist comprising an upper chord and a lower chord separated by a web, wherein the joist has a shoe coupled to the underside of an end of the upper chord, and wherein the shoe is supported by the top of the supporting member;

a corrugated steel decking supported at least partially by the upper chord of the joist and positioned such that the corrugations are substantially perpendicular to the joist, wherein the corrugations in the corrugated steel decking form a plurality of peaks and valleys, and wherein the corrugated steel decking ends before it extends over the top of the supporting member;

a plurality of self-drilling, self-tapping stand-off fasteners, each stand-off fastener having a lower screw portion and an upper stud portion, wherein the lower screw portion is drilled into a valley in the corrugated steel decking and into the upper chord of the joist located below the corrugated steel decking, and wherein the upper stud portion extends above the corrugated steel decking;

a generally z-shaped closure having a generally vertical face, a generally horizontal upper flange extending from the upper end of the vertical face in a first direction, and a generally horizontal lower flange extending from the lower end of the vertical face in a second different direction;

wherein the vertical face of the z-shaped closure extends from the bottom of the shoe to a location higher than the top of the upper chord, wherein the horizontal upper flange extends over at least one peak in the corrugated steel decking, wherein the horizontal lower flange is supported by the first supporting member, and wherein the z-shaped closure has a cutout such that the z-shaped closure surrounds at least a portion of the end of the upper chord and the shoe, and

a layer of cementitious material at least partially supported by the corrugated steel decking, wherein the cementitious material encapsulates the upper stud portions of the self-drilling, self-tapping stand-off fasteners and at least a portion of the end of the upper chord and the shoe, and wherein the z-shaped

A welded wire fabric may also be located over the decking and encapsulated within the cementitious slab. In some embodiments, any 32-inch span of the corrugated steel decking over a joist has between three and nine stand-off fasteners located therein.

In some embodiments, the supporting member that supports the joist is comprised of a metal stud, a wood stud, a masonry wall, a concrete wall, a metal beam, or a metal truss that extends generally perpendicular to the joist. A self-drilling, self-tapping stand-off fastener may, in accordance with one embodiment of the present invention, be drilled into the end of the joist's upper chord above the supporting member and beyond the end of the corrugated steel decking.

The joist of the composite floor system may comprise an open web which may be comprised of one or more rods having a generally circular cross-section. For example, the web may include a rod bent into a generally zigzag or sinusoidal pattern such that the rod extends from one chord to the other chord and then back again.

In some instances, the composite floor system may include a self-tapping screw drilled through the generally horizontal upper flange of the z-shaped closure into a peak of the corrugated steel decking. The composite floor system may also include a self-tapping screw drilled through the generally horizontal lower flange of the z-shaped closure into the supporting member or a distribution track or other distribution member positioned between the lower flange and the supporting member.

In some embodiments, the joist's upper chord, lower chord, and shoe are each comprised of a pair of angles. For example, the upper chord, lower chord, and shoe may be each made up of a pair of angles spaced apart by rod-shaped members of the web and/or by a rod-shaped end diagonal member.

The composite floor system may further comprise a pour stop having a generally horizontal flange and a generally vertical face. The horizontal flange of the floor stop is generally positioned adjacent to the top of the supporting member and the vertical face generally extends vertically opposite the vertical face of the z-shaped closure. In this way, the pour stop forms at least a portion of the boundary of the cementitious channel formed over the supporting member. In some embodiments, the pour stop further comprises a lip extending from the top of the vertical face diagonally toward the corrugated steel decking, the lip being substantially encapsulated within the cementitious material.

The features, functions, and advantages that have been discussed may be achieved independently in various embodiments of the present invention or may be combined in yet other embodiments, further details of which can be seen with reference to the following description and drawings but are not limited to only these applications shown.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Having thus described embodiments of the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 illustrates a cross-sectional perspective view of a composite joist floor system in accordance with an embodiment of the present invention;

FIGS. 2 a and 2 b illustrate a cross-sectional side views of two composite joist floor systems similar to the floor system illustrated in FIG. 1, in accordance with embodiments of the present invention;

FIG. 3 illustrates at least a portion of the z-shaped closure illustrated in FIGS. 1 and 2 in accordance with an embodiment of the present invention;

FIG. 4 a illustrates a side view of one of the self-drilling, self-tapping stand-off screws illustrated in FIGS. 1 and 2 in accordance with an embodiment of the present invention;

closure forms at least a portion of the boundary of a cementitious channel formed over the supporting member.

9. The composite floor system of claim 8 further comprising a welded wire mesh encapsulated within the cementitious material.

10. The composite floor system of claim 8, wherein at least a portion of the lower screw portion of each self-drilling, self-tapping shear stud has a hardness that is greater than the hardness of the upper stud portion of each self-drilling, self-tapping shear stud.

11. The composite deck system of claim 8, further comprising a self-drilling, self-tapping stand-off fastener drilled into the end of the upper chord above the supporting member beyond the end of the corrugated steel decking.

12. The composite floor system of claim 8, wherein the supporting member comprises a metal stud, a wood stud, a masonry wall, a concrete wall, a metal beam, or a metal truss that extends generally perpendicular to the joist.

13. The composite floor system of claim 8, wherein the web is comprised of one or more rods having a generally circular cross-section.

14. The composite floor system of claim 13, wherein the web includes a rod bent into a generally zigzag or sinusoidal pattern such that the rod extends from one chord to the other chord and then back again.

15. The composite floor system of claim 8 further comprising a self-tapping screw drilled through the generally horizontal upper flange of the z-shaped closure into a peak of the corrugated steel decking.

16. The composite floor system of claim 8 further comprising a self-tapping screw drilled through the generally horizontal lower flange of the z-shaped closure into the supporting member or a distribution plate or other distribution member positioned between the lower flange and the supporting member.

17. The composite floor system of claim 8, wherein the upper chord, the lower chord, and the shoe are each comprised of a pair of angles.

18. The composite floor system of claim 8, wherein the upper chord, the lower chord, and the shoe are comprised of a pair of angles spaced apart by rod-shaped members of the web or by a rod-shaped end diagonal member.

19. The composite floor system of claim 8, wherein the self-drilling, self-tapping stand-off fasteners are spaced apart such that there is at least one valley in the corrugated decking between at least two adjacent stand-off fasteners, said valley not having a self-drilling, self-tapping stand-off fastener drilled therethrough between the two adjacent stand-off fasteners.

20. The composite floor system of claim 8, further comprising a pour stop having a generally horizontal flange and a generally vertical face, the horizontal flange positioned adjacent to the top of the supporting member and the vertical face extending vertically opposite the vertical face of the z-shaped closure such that the pour stop forms at least a portion of the boundary of the cementitious channel formed over the supporting member.

21. The composite floor system of claim 20, wherein the pour stop further comprises a lip extending from the top of the vertical face diagonally toward the corrugated steel decking, the lip being substantially encapsulated within the cementitious material.



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FIG. 4 *b* illustrates a cross-sectional side view of the self-drilling, self-tapping, stand-off screw illustrated in FIG. 4 *a*, in accordance with an embodiment of the present invention;

FIG. 5 illustrates the exemplary standardized patterns of stand-off screw spacings that may be used in accordance with embodiments of the present invention;

FIG. 6 illustrates a cross-sectional perspective view of a composite joist floor system in accordance with an embodiment of the present invention where the member for supporting the end of the joists includes a structural steel beam;

FIG. 7 illustrates a cross-sectional perspective view of a composite joist floor system in accordance with an embodiment of the present invention where the member for supporting the end of the joists includes a masonry wall, such as a wall comprised of concrete masonry units or brick;

FIG. 8 illustrates a cross-sectional perspective view of a composite joist floor system in accordance with an embodiment of the present invention where the supporting member for supporting the end of the joists includes a concrete wall;

FIG. 9 illustrates a cross-sectional perspective view of a composite joist floor system in accordance with an embodiment of the present invention where the supporting member for supporting the end of the joists includes a wood stud;

FIG. 10 illustrates a cross-sectional side view of a composite joist floor system showing how a beam running substantially perpendicular to the joists may support the ends of two joists on opposite sides of the beam in accordance with an embodiment of the present invention;

FIG. 11 illustrates a cross-sectional side view of a composite joist floor system showing how the corrugated steel decking may be supported at its edge by a wall that runs substantially parallel to the joists and generally perpendicular to the corrugations in the decking, in accordance with an embodiment of the present invention;

FIG. 12 *a* illustrates a cross-sectional side view of a composite joist floor system where an exterior wall that is substantially parallel to the joists supports the edges of a corrugated steel decking sheet using a z-shaped closure, in accordance with an embodiment of the present invention;

FIG. 12 *b* illustrates a cross-sectional side view of a composite joist floor system where an interior demising wall that is substantially parallel to the joists supports the edges of two corrugated steel decking sheets using z-shaped closures, in accordance with an embodiment of the present invention;

FIG. 13 illustrates a cross-sectional view of a composite joist floor system where the joist has a flush bearing seat and where the flush bearing seat is supported by a wall running substantially perpendicular to the joist, in accordance with an embodiment of the present invention;

FIG. 14 illustrates another embodiment of a flush bearing seat configuration where two opposing joists are supported by the same steel beam in accordance with an embodiment of the present invention;

FIG. 15 illustrates a flush bearing configuration where the flush bearing seat is configured specifically for a masonry-type support member in accordance with an embodiment of the present invention;

FIGS. 16 *a* and 16 *b* illustrate how the composite floor system may be configured to transfer horizontal diaphragm shear forces from the concrete slab to the primary support structures, such as a cold-formed steel shear-wall, in accordance with an embodiment of the present invention;

FIG. 17 illustrates a side section view of a portion of the floor system at an external wall that is substantially parallel to the floor joists where stand-off screws have been installed into the top of the wall to transfer diaphragm forces, in accordance with an embodiment of the present invention;

FIG. 18 illustrates an interior support wall in which stand-off screws have been installed into the top of the wall to transfer diaphragm forces from the concrete slab to the wall in accordance with an embodiment of the present invention;

FIG. 19 illustrates a composite joist floor system where the joists are made of wood in accordance with an embodiment of the present invention;

FIG. 20 illustrates a side view of the stand-off wood screw illustrated in FIG. 19, in accordance with an embodiment of the present invention;

FIG. 21 illustrates three different exemplary composite joist floor systems comprising three different cold-formed steel floor joists, in accordance with embodiments of the present invention;

FIGS. 22 *a* and 22 *b* illustrate a composite floor system supported by cold-formed wall studs, the floor system having a composite header configuration in accordance with an embodiment of the present invention;

FIG. 23 illustrates an embodiment of the present invention where rebar in the concrete slab is coupled to a stand-off screw



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installed into the top of a supporting wall;

FIG. 24 illustrates a stand-off screw configured to attach to a rebar member or some other extension member at the end of the screw opposite the screw's tip, in accordance with an embodiment of the present invention;

FIG. 25 illustrates a stand-off screw used to attach a joist shoe to the supporting wall in accordance with an embodiment of the present invention;

FIG. 26 illustrates how stand-off screws may be used to attach a z-shaped closure and a pour stop to a wall, while also functioning to couple rebar to the wall and/or to transfer horizontal diaphragm forces from the slab to the wall, in accordance with an embodiment of the present invention;

FIGS. 27 a and 27 b illustrate a composite joist floor system configured to provide for a balcony that extends from the structure parallel to the floor joists in accordance with an embodiment of the present invention;

FIGS. 28 a and 28 b illustrate a composite joist floor system configured to provide for a balcony that extends from the structure perpendicular to the floor joists in accordance with an embodiment of the present invention;

FIG. 29 illustrates an exterior slab edge condition within a composite joist floor system where the concrete floor ends at a joist in accordance with an embodiment of the present invention;

FIG. 30 illustrates a composite joist floor system where the floor system transitions from a deck system, such as that used in a corridor, to a composite joist and deck system in accordance with an embodiment of the present invention;

FIG. 31 illustrates a composite joist floor system having a corridor running perpendicular to the joists and having a mechanical header, in accordance with an embodiment of the present invention; and

FIG. 32 provides a more detailed illustration of the mechanical header illustrated in FIG. 31, in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Embodiments of the present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all, embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

Composite Joist Floor Systems

The composite joist floor systems described herein are generally constructed at the building site and make-up the floors and provide structural support for the ceilings of the building. In general, a plurality of joists are provided and each joist is supported at either end by the building's primary support structures, which may include but are not limited to: beams, joist girders, masonry walls, concrete walls, cold-formed wall studs, and/or wood load bearing wall studs. In this way, the joists span the open areas within the building's main structure to provide support for the floors and/or ceilings. Importantly, the present invention provides a plurality of varying flooring system designs and design methodologies. These various designs and design methodologies use a combination of joist depth, chord size, joist spacing, flexible self-tapping stand-off screw size and spacing, and various corrugated steel deck profiles to create flooring systems that are light in weight, have generally decreased material cost and construction costs, and offer improved strength.

Typical steel joists of the composite joist systems described herein have spans ranging from eight (8) to fifty (50) feet and depths ranging from eight (8) to fifty (50) inches. In addition to variations in the size and spacing of the joist, the number and pattern of the flexible self-drilling, self-tapping stand-off screws, the configuration of the corrugated steel decking, the connections between the flooring system and the support beam, as well as other design elements contribute to lighter weight and added strength of the flooring systems.

Referring to the drawings, FIGS. 1 and 2 illustrate a cross-sectional perspective view and a cross-sectional side view, respectively, of a composite joist floor system 1 in accordance with an embodiment of the present invention. As illustrated in FIGS. 1 and 2, and as described above, the composite joist floor system 1 generally includes at least one joist 10 supported on its ends by a stud or beam, such as a steel wall stud 60. The joist 10, in combination with other joists, walls, or beams (not shown), supports a layer of corrugated steel decking 20. The corrugated steel decking 20 is positioned such that the corrugations run perpendicular to the joist 10. Importantly, a plurality of self-drilling, self-tapping stand-off screws 30 are drilled through the corrugated steel decking 20 into the joist 10. Each self-drilling, self-tapping stand-off screw 30 not only connects the corrugated decking 20 to the joist 10, but also extends some distance above the corrugated decking 20. In this way, when concrete 40 is placed over the corrugated steel decking 20, the self-drilling, self-tapping stand-off screws 30 are encapsulated within the concrete to form a composite joist floor system once the concrete is cured. As will be described in greater detail below, this composite joist floor system allows for structures to be stronger, lighter, and/or more economical. Although the term "concrete" is often used herein when describing embodiments of the present invention, other embodiments



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of the present invention may use other cementitious materials or materials with properties similar to cementitious materials.

As illustrated in FIGS. 1 and 2, in an exemplary embodiment, the joist 10 comprises an upper chord 12 and a lower chord 15. The upper chord 12 and the lower chord 15 are joined together by a web 18 extending therebetween. In the illustrated embodiment, the web 18 has an open web configuration comprised of one or more of rod, angle, or cold-formed "C" shaped members 19 that extend between and are coupled to the upper chord 12 and the lower chord 15. In the illustrated embodiment of the invention, the web 18 is made primarily from a single round solid rod 19 bent into a zigzag or sinusoidal-like pattern having one or more peaks alternating with one more valleys. In such an embodiment, the upper chord 12 is welded (or otherwise coupled) to the peaks in the bent rod 19 and the lower chord 15 is welded (or otherwise coupled) to the valleys in the bent rod 19.

In the illustrated embodiment, the upper and lower chords 12 and 15 are each formed from two metal angles (also sometimes referred to as "angle irons," although the angles described herein need not be iron). FIG. 1 illustrates an embodiment where two angles 16 and 17 are placed on either side of the bent rod 19 and joined to the valleys in the bent rod 19 to form the lower chord 15. Similarly, two angles 13 and 14 are placed on either side of the bent rod 19 and joined to the peaks in the bent rod 19 to form the upper chord 12. So that the composite joist floor system 1 is relatively light in weight, the upper chord 12 and the lower chord 15 typically have relatively thin cross sections.

As further illustrated in FIGS. 1 and 2, the joist 10 includes a rod-shaped "end diagonal" 25 at each end of the joist for transferring forces between the joist 10 and the wall stud 60. The "end diagonal" 25 may also potentially consist of angles or cold-formed "C"-shaped sections for heavier floor loadings. One end of the end diagonal 25 is joined to the lower chord 15 proximate to the first web joint and the other end of the end diagonal 25 is joined to the upper chord 12 proximate to the seat or joist shoe 70. In some embodiments, the lower chord 15 of the joist 10 may include a ceiling extension 90 that extends the lower chord 15 such that the lower chord 15 ends proximate to the supporting wall 60 or beam, as the case may be. Such an extension may be desired so that a ceiling 100 may be hung from the lower chord 15 of the joist.

As described above, corrugated steel decking 20 is positioned over the joist 10 and generally spans two or more adjacent joists. The corrugated steel decking 20 may be painted or galvanized. Standard corrugated steel decking generally comes in the form of sheets having for example, coverage widths of 32, 33, or 36 inches. Besides coming in a variety of widths, standardized corrugated steel decking also comes in many different profiles, depending on the application. The type of corrugated steel decking primarily illustrated herein is 1.0 deep steel decking, although other types of decking may be used depending upon the application. In one embodiment, the steel used in the decking is made from approximately 70% recycled materials and the steel used in the joists is made from approximately 99% recycled materials.

As illustrated in FIGS. 1 and 2, the corrugated steel decking 20 is generally positioned such that the corrugations run at right angles to the joist 10. As described above, self-drilling, self-tapping stand-off screws 30 are drilled through the corrugated decking 20 and the flanges of the upper chord 12. In this way, the self-drilling, self-tapping stand-off screws 30 transfer compressive forces from the joist top chord into the concrete slab 40 of the joist 10. The concrete floor slab 40 is designed with sufficient compressive strength to resist these compressive forces.

In some embodiments, the concrete is strengthened by placing welded wire fabric 45 or other types of rebar over the corrugated steel decking 20. When the concrete 40 is then placed over the welded wire fabric 45 and the corrugated steel decking 20, the welded wire fabric 45 and the upper portion of the self-drilling, self-tapping stand-off screws 30 are encapsulated within the concrete 40. The concrete is then smoothed so as to form a floor of the building. In some embodiments, chairs are used to hold the welded wire fabric 45 in the specified location above the corrugated steel decking 20 as the concrete 40 is placed.

It should be appreciated that the composite joist floor system 1 described above provides many advantages over the traditional non-composite floor systems. In a traditional non-composite floor design, the concrete slab rests on the joist and the concrete slab and the joist act independently to resist the loads on the floor. Specifically, in a non-composite joist floor design, the joist and the concrete share the loads based on the relative stiffness of each component. Since the concrete slab is relatively thin compared to its span (i.e., the length of the joist), the concrete has very low stiffness relative to the joist. As such, in a non-composite joist floor design, the joist must carry substantially the entire load on the floor. In contrast, in the composite joist floor system described above, the concrete slab 40 and the joist 10 act more like a single unit due to the fact that the concrete slab 40 and the joist 10 are coupled together by the stand-off screws 30. In general, the concrete 40 carries compression and the lower chord 15 of the joist 10 carries tension. As such, the design moment is based on the concrete strength, the steel strength, and the shear transfer between the two. The self-drilling, self-tapping stand-off screws 30 function as a shear transfer mechanism. Since the concrete 40 carries much of the compressive stresses that would otherwise have to be carried by the upper chord of the joist in a non-composite joist floor system, a composite joist floor system allows the upper chord 12 to be reduced in size and weight. In this way, the material used in the structure can be reduced to reduce weight and costs. Alternatively, the material that would otherwise have been used in the upper chord 12 can be transitioned to increase the size and strength of the lower chord 15 to achieve significant increases in load capacity without an increase in material. Therefore, in some embodiments of the present invention, the upper chord 12 of the joist 10 is smaller than the lower chord 15 or is formed from of lower strength material compared to the material used to form the lower chord 15.



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Returning to FIGS. 1 and 2, as described above the end of the joist 10 is supported by a beam, wall, stud, or other structural member. In the illustrated example, the end of the joist 10 is supported by a steel wall stud 60. The end of the upper chord 12 has a shoe 70 for transferring forces from the joist 10 to the wall stud 60. In the illustrated embodiment, the shoe 70 is made up of a pair of metal angles welded to the bottoms of the upper chord's angles 13 and 14. Configured as such, the angles 13 and 14 that make up the upper chord 12 and the angles 71 and 72 that make up the joist shoe 70 combine to form an I-beam like bearing connection. The end of the end diagonal 25 is positioned between the shoe angles 71 and 72 and serves as a spacer between the shoe angles. In this regard, the shoe angles 71 and 72 are welded to the end diagonal 25 in addition to being welded to the upper chord angles 13 and 14.

The bottom surface of the joist shoe 70 rests upon the top surface of the wall 60. As illustrated in FIG. 2 a, a distribution member 65 or header and/or a distribution track 62 or plate may be positioned between the top of the wall studs and the bottom of the joist shoe 70 to distribute force along the length of the wall 60. In other embodiments, as illustrated in FIGS. 1 and 2 b, only a distribution plate 62 is used.

As further illustrated in FIGS. 1 and 2, in some embodiments of the composite joist floor system 1, the corrugated steel decking 20 does not extend significantly over the wall stud 60 or other supporting member. In this way, when the concrete 40 is placed over the steel decking 20, the concrete 40 may flow or be placed into the region 41 above the supporting wall 60. The concrete 40 in this region 41 encapsulates the ends of the upper chords 12 of each joist 10 and the ends of each joist shoe 70 and functions to help hold the joist shoes 70 in place at the top of the wall 60. The concrete 40 in the region 41 also forms a concrete beam extending over the wall 60 perpendicular to the joists 10. This concrete beam helps to collect and distribute forces being transferred between the walls and the floor. As illustrated in FIGS. 1 and 2, a z-shaped closure 50 and a pour stop 55 are used to contain the concrete 40 within the region 41 over the upper end of the wall 60. In addition to the structural benefits of a floor system having such a concrete beam, floor systems that allow the concrete 40 to contact the upper end of the wall 60, such as the floor systems illustrated in FIGS. 1 and 2, typically lead to improved fire-safety ratings and improved acoustic attenuation.

In the embodiment illustrated in FIG. 2 a, a pour stop 55 is used to prevent the concrete 40 from flowing beyond the plane of the supporting wall 60 as the concrete 40 is curing. The pour stop 55 has a lower horizontal flange 58 and a vertical face 57. The horizontal flange 58 rests atop the distribution member 65 and may be coupled to the distribution member 65 by, for example, a self-tapping screw 56. The pour stop 55 is positioned such that the vertical face 57 is substantially within the same plane of the backside of the wall 60 so that the vertical face 57 of the pour stop 55 prevents the concrete from flowing beyond this plane. In a preferred embodiment, the pour stop 55 has a lip 59 at the top of the vertical face 57 that curves or is otherwise bent inward and downward toward the joist 10. The lip 59 prevents the vertical face 57 of the pour stop 55 from becoming separated from the concrete slab 40 and, therefore, prevents moisture from entering between the pour stop's vertical face 57 and the concrete 40. In other embodiments, the pour stop 55 may not include the lip 59. In one exemplary embodiment, the height of the pour stop 55 is sized such that a 2.5 to 3-inch deep 3000 pounds per square inch minimum compressive strength cast-in place concrete slab is created over the top of the corrugated steel decking 20.

Opposite the pour stop 55, a z-shaped closure 50 is provided. In combination with the joist 10 and the corrugated steel decking 20, the z-shaped closure 50 functions to contain the concrete 40 within the region 41 above the wall 60. FIG. 3 illustrates a portion of a z-shaped closure 50 in accordance with an embodiment of the present invention. As illustrated in FIG. 3, the z-shaped closure 50 has a generally vertical face 52, a generally horizontal upper flange 53 extending away from the wall 60, and a generally horizontal lower flange 51 extending in a direction opposite from the upper generally horizontal flange 53. In the illustrated embodiment, the vertical face 52 has a cutout 110 at one end. The cutout 110 has the shape of approximately one-half of an I-beam. This cutout 110 is configured to fit around at least one side of the I-beam formed by the combination of the upper chord 12 and the joist shoe 70, as illustrated in FIGS. 1 and 2. As also illustrated in FIGS. 1 and 2, the vertical face 52 of the z-shaped closure extends upwards further than the top of the upper chord 12 so that the generally horizontal upper flange 53 extends above at least one peak in the corrugated steel decking 20. Self-tapping screws 54 a and 54 b, welds, pneumatic pins, or a variety of other fasteners may be used to couple the generally horizontal lower flange 51 to the distribution member 65 and the generally horizontal upper flange 53 to a peak in the corrugated steel decking 20, respectively.

As illustrated in FIG. 3 c, in some embodiments of the invention, the generally horizontal lower flange 51 is configured such that, before the z-shaped closure 50 is installed in the floor system 1, it forms an angle with the generally vertical face 53 that is greater than 90 degrees. For example, the z-shaped closure illustrated in FIG. 3 c forms a 100-degree angle between the generally vertical face 53 and the generally horizontal lower flange 51. When such a z-shaped closure 50 is installed in the floor system 1, the z-shaped closure 50 may be pressed into position such that the angle between the generally vertical face 53 and the generally horizontal lower flange 51 is reduced to an angle closer to 90 degrees. When the z-shaped closure 50 is installed in this manner, the resilient bias of the z-shaped closure 50 will press the horizontal lower flange 51 against the top of the wall 60 and, thereby, create a better seal between the wall 60 and the z-shaped closure 50 than would have otherwise been formed using a z-shaped closure manufactured to have a 90-degree angle between the generally vertical face 53 and the generally horizontal lower flange 51.



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As described above and as illustrated in FIGS. 1 and 2, the composite joist flooring system 1 includes a plurality of self-drilling, self-tapping stand-off screws 30 screwed through at least some of the valleys in the corrugated steel decking 20 and through a horizontal flange of the upper chord 12. As further illustrated, a portion of each self-drilling, self-tapping stand-off screw 30 continues to extend upwards above the corrugated steel decking 20 after the self-drilling, self-tapping stand-off screw 30 is fully installed through the decking 20 and the upper chord 12. The stand-off screw 30 has a lower collar 430 that functions to secure the corrugated steel decking 20 to the upper chord 12. The upper portion of the self-drilling, self-tapping stand-off screw that extends above the steel decking 20 becomes encapsulated within the concrete 40. In this way, the self-drilling, self-tapping stand-off screws 30 connect the joist's upper chord 12 to the concrete slab 40 allowing the joist 10 and concrete slab 40 to act as a unit, by transferring shear between the two joined components. In other words, the stand-off screws 30 cause the concrete slab 40 to function as the upper chord of the composite joist system with a much larger load carrying capacity than the joist's upper chord 12 alone. Specifically, tensile forces in the joist lower chord 15 are transferred to horizontal compressive forces in the concrete slab 40. The high compressive capacity of the concrete efficiently carries this compressive force.

In order for the self-drilling, self-tapping stand-off screws 30 to more uniformly transfer the horizontal shear loads along the length of the composite steel joist, the stand-off screws 30 are designed so that they are at least somewhat ductile. As the shank of the stand-off screws bends, shear load is shared with stand-off screws located more toward the middle of the joist span. However, in addition to being ductile enough to share the shear loads without breaking, the self-drilling, self-tapping stand-off screw 30 must also have sufficient hardness to allow it to drill through the corrugated steel decking 20 and the upper chord 12 of the joist 10. To accommodate both design requirements, the self-drilling, self-tapping stand-off screw 30 is specially heat treated so that the lower screw portion of the stand-off screw 30 has sufficient hardness for drilling while the upper portion remains sufficiently ductile.

FIG. 4 a illustrates a side view of one of the self-drilling, self-tapping stand-off screws 30 illustrated in FIGS. 1 and 2 in accordance with an embodiment of the present invention. Each self-drilling, self-tapping stand-off screw 30 has an elongated shank 417 with an unthreaded shank portion 419 and integral threaded screw portion 418 having helical threads. The unthreaded shank portion 419 generally ranges from about two (2) inches to about four-and-a-half (4.5) inches in length depending on the application and the thickness of the concrete slab 40. The self-drilling, self-tapping stand-off screw 30 has a fluted drill tip 420 projecting from the lower end of the threaded screw portion 418. Located at the end of the stand-off screw 30 opposite the drill tip 420 is a driving head 421 configured to engage a driving tool capable of rotating the stand-off screw 30. An integral flange 426 is located between the threaded and unthreaded portions 418 and 419 of the stand-off screw 30 forming a lower collar 430 that is used to draw down the decking 20 during installation and hold the decking 20 firmly against the joist 10.

FIG. 4 b illustrates a cross-sectional side view of the self-drilling, self-tapping stand-off screw 30 illustrated in FIG. 4 a. The cross hatch pattern in FIG. 4 b represents an area of the stand-off screw that is heat treated to a higher degree of hardness relative to the remainder of the stand-off screw, in accordance with an embodiment of the present invention. As illustrated in FIG. 4 b, a lower portion of the self-drilling, self-tapping stand-off screw 30, including the drill tip 420 and at least some of the threads 428, is heat treated to a degree of hardness that enables the stand-off screw 30 to effectively drill and tap into the steel decking 20 and the joist's steel upper chord 12. In one embodiment, the self-drilling, self-tapping stand-off screws are comprised of stand-off screws described in U.S. Pat. No. 5,605,423 to Michael Janusz, which is incorporated herein by reference.

In one embodiment, the self-drilling, self-tapping stand-off screws are installed in every valley of the corrugated steel decking 20 along the length of the joist 10 as described, for example, in U.S. Pat. No. 5,605,423. However, in a preferred embodiment of the present invention, the self-drilling, self-tapping stand-off screws 30 are only installed as necessary for the particular composite joist floor system and its application. By providing increased spacing between at least some of the stand-off screws 30, such as by installing stand-off screws only in every other valley of the corrugated steel decking 20, the construction times and costs can be significantly reduced. Furthermore, the attachment patterns may be standardized for particular design scenarios in order to simplify installation of the self-drilling, self-tapping stand-off screws 30. For example, FIG. 5 illustrates an exemplary set of screw spacing standards that may be used in embodiments of the present invention.

Specifically, FIGS. 5 a through 5 d illustrate 1.0C-type steel decking having 32-inch wide coverage. FIG. 5 a illustrates 32/3 spacing where each 32-inch width of corrugated steel decking 20 contains three self-drilling, self-tapping stand-off screws 30. FIG. 5 b illustrates 32/4 spacing where each 32-inch width of corrugated steel decking 20 contains four self-drilling, self-tapping stand-off screws 30. FIG. 5 c illustrates 32/5 spacing where each 32-inch width of corrugated steel decking 20 contains five self-drilling, self-tapping stand-off screws 30. FIG. 5 d illustrates 32/6 spacing where each 32-inch width of corrugated steel decking 20 contains six self-drilling, self-tapping stand-off screws 30.

As illustrated in FIG. 1, it is generally preferable to drill adjacent self-drilling, self-tapping stand-off screws through the upper chord 12 on alternating sides of the web 18. For increased floor capacities, the quantity of self-drilling, self-tapping, stand-off screws may be increased as shown from FIG. 5 a through FIG. 5 d.

FIGS. 6-9 illustrate variations of the embodiment of the composite joist floor system described above in FIGS. 1-5. More



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particularly, FIG. 6 illustrates a composite joist floor system **600** in accordance with an embodiment of the present invention where the supporting member for supporting the end of the joist **610** includes a structural steel beam **660**.

FIG. 7 illustrates a composite joist floor system **700** in accordance with an embodiment of the present invention where the supporting member for supporting the end of the joist **710** includes a masonry wall **760**, such as a concrete block or a brick wall. In such an embodiment, the wall **760** may include a concrete-filled channel **765** running through the uppermost blocks or bricks in the wall **760** so that masonry screws may be inserted into the concrete to hold, for example, the pour stop **755** or the joist shoe **770** in place and so that the forces from the concrete floor slab are more evenly distributed throughout the wall **760**. As also illustrated in FIG. 7, the concrete-filled channel **765** may have rebar **762** provided therein for reinforcing the concrete in the channel.

FIG. 8 illustrates a composite joist floor system **800** in accordance with an embodiment of the present invention where the supporting member for supporting the end of the joist **810** includes a concrete wall **860**. FIG. 9 illustrates a composite joist floor system **900** in accordance with an embodiment of the present invention where the supporting member for supporting the end of the joist **910** includes a wood stud **960**. In such an embodiment, two or more wood supporting members **965** may be used to distribute the force from the concrete slab throughout the wall. As illustrated, all of the floor systems shown in FIGS. 6-9 utilize many of the same structures and configurations describe above with reference to FIGS. 1-5.

FIG. 10 illustrates a sectional side view of composite joist floor system **1000** showing how a beam **1065** running substantially perpendicular to the joists may support the ends of two joists **1010 a** and **1010 b** on opposite sides of the beam **1065** in accordance with an embodiment of the present invention. Similar to the joist described above with respect to FIGS. 1 and 2, each joist **1010 a** and **1010 b** illustrated in FIG. 10 may include an upper chord **1012 a** and **1012 b** and a lower chord **1015 a** and **1015 b** separated by an open web formed from one or more rod-like members **1019 a** and **1019 b**. At the end of each joist **1010 a** and **1010 b**, a diagonal end member **1025 a** and **1025 b** extends from the lower chord **1015 a** and **1015 b** proximate the first web connection to the end of the upper chord **1012 a** and **1012 b** proximate the joist shoe **1070 a** and **1070 b**. Shoes **1070 a** and **1070 b** are attached to the ends of the upper chords **1012 a** and **1012 b** to form an I-beam configuration at the end of each joist **1010 a** and **1010 b**. The bottom surface of each shoe **1070 a** and **1070 b** is supported by the top surface of the beam **1065**.

In the illustrated embodiment, the ends of the joists are configured such that they extend less than halfway across the beam **1065**, thereby, creating a gap between the ends of the opposing joists. In the illustrated embodiment, the ends of the opposing joists **1010 a** and **1010 b** are seated on the beam **1065** at approximately the same location along the beams longitudinal axis. In other embodiments, however, the opposing joists **1010 a** and **1010 b** may be staggered along the longitudinal axis of the beam **1065**.

As further illustrated by FIG. 10, each joist **1010 a** and **1010 b** supports corrugated steel decking **1020 a** and **1020 b**. The corrugated steel decking **1020 a** and **1020 b** is positioned such that the corrugations run perpendicular to the joists **1010 a** and **1010 b**. The corrugated steel decking **1020 a** and **1020 b** is also positioned such that the corrugated steel decking **1020 a** and **1020 b** on either side of the beam **1065** ends at or before the beam **1065**. By ending the corrugated steel decking **1020 a** and **1020 b** at or before the beam **1065**, an opening is created above the beam **1065** that exposes the top of the beam, the ends of the upper chords, and the ends of the joist shoes. When concrete is placed over the corrugated steel decking to form the concrete slab, concrete is permitted to flow or is placed into the opening above the beam **1065** to create a concrete distribution/collector beam that extends above the steel beam **1065** and encapsulates the ends of the upper chords and the joist shoes in the concrete **1040**. Z-shaped closures **1050 a** and **1050 b** are positioned on either side of the beam **1065** to form the walls of a channel that the concrete is placed into and, thus, form the walls of the concrete distribution/collector beam.

More specifically, each z-shaped closure has a generally horizontal lower flange **1051 a** and **1051 b** that rests atop the steel beam **1065**. A screw, weld, powder actuated fastener, pneumatic pin, or a variety of other fasteners may be used to couple each horizontal lower flange to the steel beam **1065**. The generally horizontal upper flanges **1053 a** and **1053 b** of the z-shaped closures extend away from the beam **1065** and at least a portion of each horizontal upper flange **1053 a** and **1053 b** rests atop a peak in the corrugated steel decking **1020 a** and **1020 b**. A screw **1058** may be used to couple each horizontal upper flange **1053 a** and **1053 b** to a respective peak in the corrugated steel decking **1020 a** and **1020 b**. Each z-shaped closure **1050 a** and **1050 b** further includes a vertical face **1052 a** and **1052 b** extending between the upper and lower flanges to form the vertical walls of the channel. As described above with respect to FIG. 3, the vertical faces **1052 a** and **1052 b** have cutouts that allow the closures **1050 a** and **1050 b** to fit around the contours of the I-beam created by the ends of the upper chords and the joist seats.

As described above with respect to the FIGS. 1 and 2, self-drilling, self-tapping stand-off screws **1030 a** and **1030 b** are positioned through the corrugated steel decking and the upper chords of the joist in at least some of the valleys of the corrugated steel decking. In some embodiments, self-drilling, self-tapping stand-off screws **1031 a** and **1031 b** are also positioned in the flanges of the upper chords **1012 a** and **1012 b** proximate the ends of the upper chords in the region above the steel beam **1065**.



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FIG. 11 illustrates a sectional side view of a composite joist floor system **1100** showing where the corrugated steel decking **1020** is supported at its edge by a wall **1160** that runs substantially parallel to the joists **1110**. The wall **1160** may be, for example, comprised of a plurality of steel studs. A cold-formed wall track **1162** may be positioned over the ends of the studs and may run along the top of the wall to distribute forces from the composite joist floor to the load bearing wall studs. A self-tapping screw **1161** may be drilled through a valley in the corrugated decking **1020** and into the cold-formed wall track **1162** to couple the edge of the concrete floor slab **1020** to the wall **1160**. In some embodiments, the self-tapping screw **1161** may be a self-tapping, self-drilling stand-off screw, such as the one's described above with respect to FIG. 4.

As further illustrated in FIG. 11, the corrugated steel decking **1020** may, in some embodiments, only extend over a portion of the supporting wall **1160** so that the un-cured concrete **1040** can flow or be placed over the edge of the corrugated steel decking **1020** and onto the top of the cold-formed wall track **1162**. If the floor is to end at the edge of the wall **1160**, a pour stop **1155**, such as the pour stop described above with respect to FIGS. 1 and 2, may be used to contain the un-cured concrete **1040** during concrete placement and curing.

As further illustrated, one or more self-drilling, self-tapping stand-off screws **1131** may be drilled through the cold-formed wall track **1162** in the region over the wall **1160** beyond the edge of the corrugated steel decking **1020**. As will be described in greater detail below, using self-drilling, self-tapping stand-off screws **1131** in this manner at the tops of the walls or other supporting members can provide significant structural advantages. For example, in some embodiments, the cold-formed wall track **1162** is a cold-formed steel section that rests atop a plurality of the cold-formed steel wall studs. The stand-off screws **1131** installed along the top of the wall in the cold-formed steel wall track **1162** transfer forces between the cold-formed steel wall track **1162** and the concrete **1140** allowing the two structures to act more like a single unit. As such, the structure may be significantly stronger and/or material may be reduced in the cold-formed wall track **1162** used in the floor system. Furthermore, as will also be described in greater detail below, stand-off screws **1131** installed at the tops of shear walls may also have significant structural advantages with regard to transferring horizontal diaphragm forces from the floor to the shear wall.

In FIG. 11, the wall **1160** is the proper height to directly support the edge of the corrugated steel decking **1120**. In other embodiments, however, z-shaped closures may be used at the inside edge of the wall to support the corrugated steel decking **1120**. In this way, a larger concrete distribution/collector beam can be created over the top of the wall that can provide various structural advantages and improve the structures fire safety rating. For example, FIG. 12 illustrates a cross-sectional view of a composite joist floor system **1200** where an external masonry wall **1260** that is substantially parallel to the floor joist **1210** supports the edge of the corrugated steel decking **1220** using a z-shaped closures **1250** to support the edge of the corrugated steel decking **1220**, in accordance with an embodiment of the present invention.

More particularly, the z-shaped closure **1250** comprises a generally horizontal lower flange **1251** that is coupled to the top of the wall **1260** by, for example, a masonry screw **1257**. The z-shaped closure **1250** further comprises a generally horizontal upper flange **1253** that abuts and supports the lower side of the edge of the corrugated steel decking **1220**. Self-tapping screws **1258** may be used to couple the valleys in the corrugated steel decking to the upper flanges of the z-shaped closure **1250**. A vertical face **1252** extends between the upper and lower flanges and forms the walls of the concrete beam **1241**.

Since the wall **1260** is an external wall, a pour stop **1255** is used to form the exterior wall of the concrete slab **1240** and beam **1241**. The pour stop **1255** comprises a generally horizontal lower flange **1271** and a generally vertical face **1272**. The generally horizontal lower flange **1260** may be coupled to the top of the wall **1260** by, for example, a masonry screw **1257**. It should be appreciated that the length of the vertical faces of the pour stop **1255** and the z-shaped closure **1250** determine the size of the concrete distribution/collector beam **1241** over the wall **1260** and the distance that this beam **1241** extends below the bottom of the decking **1220**. Therefore, the pour stops **1255** and z-shaped closures **1250** can be varied to change the structural characteristics of the floor system depending on the design requirements. The pour stops **1255** and z-shaped closures **1250** can also be used to alter the noise attenuating and fire containing properties of the structure. Furthermore, when the supporting structure is a masonry wall such as in FIG. 12 a, the height of the pour stop **1255** and z-shaped closure **1250** can be selected so that the height of the resulting concrete beam **1241** matches the masonry course height or some desired multiple thereof.

FIG. 12 b illustrates an interior demising wall **1260 b** that is parallel to the floor joists **1210 a**. Since the demising wall **1260 b** supports corrugated decking **1220 a** and **1220 b** on each side of the wall **1260 b**, two z-shaped closures **1250 a** and **1250 b** are used to support the decking **1220 a** and **1220 b**, respectively, and to create the walls of the channel that forms the concrete distribution/collector beam **1241 b** above the wall **1260 b**. Typically fire caulking is required at the top of a demising wall or some other fire stop must be installed in the corrugations of the metal decking **1220 a** and **1220 b** between the decking and demising wall in order to meet the proper fire safety design requirements. However, the z-shaped closures **1250 a** and **1250 b** may be used to create a concrete beam **1241 b** that is large enough and creates enough of a fire barrier so that additional fire proofing may not be required at the juncture between the floor and the demising wall. This can save significant time and cost during construction of the structure.

Flush Seat Configuration for Composite Joist Floor System

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FIG. 13 illustrates a sectional side view of a composite joist floor system **1300** where the joist **1310** is supported by a wall **1360** running perpendicular to the joist **1310** in accordance with another embodiment of the present invention. The configuration of the joist **1310** and the joist shoe **1370** are generally similar to the joists and joist shoes described above, however, the composite joist floor system **1300** uses a "flush seat" configuration to support the end of the joist **1310**.

Referring to FIG. 13, in the flush seat configuration the top of the upper chord **1312** is secured such that it is substantially flush with the top of the supporting member, such as the supporting wall or, in this case, a distribution member **1365** or header positioned at the top of a supporting wall **1360**. The flush seat configuration includes a generally horizontal plate **1375** that is welded to the top surface of the end of the upper chord **1312**. The horizontal plate **1375** extends beyond the end of the upper chord **1312** so that a portion of the plate **1375** rests upon the top surface of the distribution member **1365**. In the illustrated embodiment, a substantially vertical plate **1377** extends downward from the horizontal plate **1375** at a location on the horizontal plate **1375** just beyond the end of the upper chord **1312**. The vertical plate **1377** extends downward just below the lower surface of the joist shoe **1370**. The joist shoe **1370** is welded to the joist such that it extends slightly (e.g., $\frac{1}{4}$ of an inch) beyond the end of the upper chord **1312**. This slight extension of the joist shoe **1370** allows the vertical plate **1377** to be welded to the horizontal plate **1375** without interfering with the end of the joist's upper chord **1312**. The welding of the vertical plate **1377** to the bottom of the joist shoe **1370** applies the vertical load into the bottom of the joist shoe **1370** and minimizes eccentricity on the joist end.

In the flush seat configuration illustrated in FIG. 13, the corrugated steel decking **1320** extends over the horizontal plate **1375** and ends after it extends approximately half way (or, for example, at least 2.5 inches) across the supporting wall **1360**. As also illustrated, in a preferred embodiment, the self-drilling, self-tapping stand-off screws **1330** installed into the joist's upper chord **1312** proximate to the flush seat configuration are preferably positioned closer to each other than the typical spacing of the self-drilling, self-tapping stand-off screws along the joist **1310**.

FIG. 14 illustrates another embodiment of a flush seat configuration where two opposing joists **1410 a** and **1410 b** are supported by the same steel beam **1460**. In the illustrated composite joist floor system **1400**, the horizontal plates **1475 a** and **1475 b**, the vertical plates **1477 a** and **1477 b**, and the joist shoes **1470 a** and **1470 b** are each configured similar to the corresponding plates and shoes described above with reference to FIG. 13. In FIG. 14, however, the corrugated steel decking **1420** extends from the first joist **1410 a** completely over the beam **1460** to the second joist **1410 b**.

FIG. 15 illustrates a flush shoe configuration **1500** where the flush bearing seat **1574** is configured specifically for a masonry-type support member, such as a block wall, in accordance with an embodiment of the present invention. Specifically, the portion of the horizontal plate **1575** extending beyond the vertical plate **1577** is bent downward. In this way, the horizontal plate **1575** is pre-bent to concentrate the downward force more toward the center of the concrete channel **1565** rather than toward the top inside corner of the top block in the masonry wall **1560**.

Diaphragm Attachment Using Stand-Off Screws

FIGS. 16 a and 16 b illustrate a top view and a side section view, respectively, of a composite floor system **2700** in accordance with an embodiment of the present invention. Specifically, FIGS. 16 a and 16 b illustrate how the composite floor system **2700** may be configured to transfer horizontal diaphragm shear forces **2705** from the concrete slab **2740** to the primary support structures, such as a cold-formed steel shear-wall **2760**, in accordance with an embodiment of the present invention. In addition to transferring horizontal diaphragm loads from the slab to the wall, the techniques described herein also provide for the transfer of other forces between the two structures. For example, the force exerted by wind blowing against the an exterior wall can be transferred from the wall to the concrete slab more efficiently using the systems described herein. The corrugated decking **2720** and the concrete slab **2740** are not shown in FIG. 16 a for clarity.

As illustrated in FIGS. 16 a and 16 b, in addition to the friction between the concrete slab **2740** and the top of the wall **2760**, embodiments of the present invention use two primary techniques for transferring diaphragm shear forces from the concrete slab **2740** to the shear wall **2760**. In some embodiments of the present invention both techniques are used together, while in other embodiments of the present invention one or none of the techniques may be used. In the first technique, the joist shoes **2770** are attached to the top of the wall **2760** by, for example, self-drilling screws **2780** or other fasteners. By securing the ends of the joists **2710** to the top of the wall **2760** and by using the self-drilling stand-off screws **2730** to couple the joist to the concrete slab as described above, the shear forces are transferred from the slab **2740** into the joist **2710** by the stand-off screws **2730** and then from the joist **2710** into the wall **2760** by the self-drilling screw **2780** or other fastener used to attach the joist **2710** to the wall **2760**.

As illustrated in FIG. 16 b, in one embodiment of the floor system, the joist shoes **2770** extend over the supporting wall **2760** beyond the end of the joist's upper chord **2712** so that there is sufficient room for the self-drilling screws to be drilled through the joist shoe **2770** and into the top of the wall **2760** and/or distribution plate **2762**. In some embodiments, self-tapping, self-drilling stand-off screws are used to fasten the joist shoes **2770** to the wall **2760**.

In the second technique for transferring horizontal diaphragm forces from the concrete slab **2740** to the shear wall **2760**, self-drilling stand-off screws **2785**, which may be the same size as or a different size from the stand-off screws **2730** installed in the decking **2720** and joists **2710**, are installed into the top of the wall **2760** (or distribution plate **2762**, member, wall track, or



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header, as the case may be) at design spacing. These stand-off screws **2785** then function to transfer the diaphragm shear forces from the concrete **2740** to the wall **2760**. As described above, in preferred embodiments, the stand-off screws **2785** are heat treated in such a way that the lower portion of the screw has a greater hardness than the upper shank portion of the screw.

FIG. 16 illustrates an exemplary embodiment of the invention where a single row of stand-off screws **2785** are installed into the top of wall **2760**. In other embodiments, more than one row of stand-off screws **2785** may be installed into the top of the wall **2760**. Where more than one row of stand-off screws **2785** are used, the rows may be aligned and have the same screw spacing such that each stand-off screw **2785** is installed next to a corresponding stand-off screw in the other row(s). In other embodiments, the rows may be configured such that they are not aligned and/or have different screw spacings such that the stand-off screws **2785** are staggered relative to the stand-off screws **2785** in the other row(s).

FIG. 17 illustrates a side section view of a portion of the floor system **2700** at an external wall that is substantially parallel to the floor joists **2710**, in accordance with an embodiment of the present invention. As illustrated in FIG. 17, two rows of stand-off screws **2785** are installed into the top of the wall **2760** to transfer horizontal diaphragm forces from the concrete slab **2740** to the external wall **2760**. As described above, although two side-by-side rows of stand-off screws **2785** are illustrated in the FIG. 17, in other embodiments any number of rows may be used and the rows may be staggered relative to each other.

Although FIGS. 16 and 17 illustrate external walls, the stand-off screws can also be used in a similar manner to transfer diaphragm forces from the concrete slab **2740** to interior walls or support beams, as the case may be. In this regard, FIG. 18 illustrates an interior support wall **2761** in which stand-off screws **2785** have been installed into the top of the wall **2761** to transfer diaphragm forces from the concrete slab **2740** to the wall in accordance with an embodiment of the present invention.

Furthermore, although the figures illustrate installation of the stand-off screws **2785** into cold-formed steel wall studs and steel distribution plates or wall tracks, the stand-off screws may be similarly used in support structures made of other materials. For example, stand-off screws may be used at the tops of masonry walls or wood-framed walls. In such embodiments, the stand-off screws are preferably modified such that the stand-off screws have threads and hardnesses that are tailored to meet the requirements of the material being driven into. Exemplary stand-off screws specifically configured for installation into wood or masonry support structures are described in greater detail below.

Composite Wood Joist Floor System

FIG. 19 illustrates a composite joist floor system **2100** where the joists **2110** are made of wood in accordance with an embodiment of the present invention. As illustrated, the wood joists may comprise solid wood beams **2110 b** or wood trusses or I-beams **2110 a**. In the case of wood trusses or I-beams **2110 a**, the chords and the webs (which may be open webs or closed webs) may both be made of wood or, in other embodiments, the chords may be made of wood and the webs may comprise another material such as a metallic material. The wood joists **2110** are covered by a forming material **2120**, which may be wood flooring, light gauge metal decking, or some other material. The stand-off wood screws **2130** are then installed through the flooring **2120** and into the joists **2110**. In one embodiment, the forming material **2120** is pre-punched so that the stand-off wood screws **2130** can be installed therethrough without having to drill through the forming material **2120**. Whether the forming material **2120** is pre-punched or not, the clamping collar **2126** on the stand-off wood screw **2130** draws the flooring **2120** tight against the wooden floor joist. A cementitious floor topping is placed over the forming material **2120** and encapsulates the stand-off shank portion of the stand-off wood screw **2130**. As described above with respect to other embodiments of the present invention, the stand-off screws **2130** result in a stiffer and stronger wooden floor system by causing the cementitious floor topping to effectively function as an upper chord of the wood floor joists.

FIG. 20 illustrates a side view of a stand-off wood screw **2130** illustrated in FIG. 19, in accordance with an embodiment of the present invention. Each stand-off wood screw **2130** has an elongated shank **2217** with an unthreaded shank portion **2219** and integral threaded screw portion **2218** having helical threads. The threaded screw portion **2218** is configured to have a wood screw thread pattern. As illustrated in FIG. 19, the threaded screw portion **2218** may vary in length depending on the size and type of wood joist **2110** used in the flooring system **2130**.

The unthreaded shank portion **2219** may also vary in height depending on the thickness of the cementitious topping **2130** that is planned for the floor system **2130**. For example, the unthreaded shank portion **2219** may typically range from about one (1) inch to about four-and-a-half (4.5) inches in length depending on the application and the thickness of the cementitious material. Located at the end of the stand-off wood screw **2130** opposite the drill tip **2222** is a driving head **2221** configured to engage a driving tool capable of rotating the stand-off wood screw **2130**. In one embodiment, the driving head **2221** comprises a hexagonal head configured to mate with a hexagonal socket. An integral angular flange or clamping collar **2226** is located between the threaded and unthreaded portions **2218** and **2219** of the stand-off screw **2130**. As described above with reference to FIG. 19, this clamping collar **2226** functions to draw the forming material **2120** down against the wood joist **2110**. In one embodiment, a portion of the stand-off wood screw **2130** is unthreaded below the clamping collar **2226** between the clamping collar **2226** and the threaded screw portion **2218**.

The stand-off wood screw is generally relatively ductile so that the screw may bend slightly with movement of the cementitious topping material and not break under the shear loads that the stand-off screw **2130** will likely experience under

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load. Furthermore, the fact that the stand-off screws are at least somewhat ductile allows a stand-off screw **2130** to share the shear loads in cementitious material with neighboring stand-off screws.

In other embodiments of the stand-off wood screw **2130**, however, the screw may have a uniform hardness since the hardness required to drill into the wood floor may be soft enough to prevent the screw from breaking under the shear loads presented by the cementitious flooring layer **2140**.

Stand-off wood screws **2130** of the type illustrated in FIG. 20 are not limited to use with wood joists and may also be used in conjunction with other wood structural members. For example, where wood distribution members or headers are used at the top of a support wall and where the concrete or cementitious material contacts the top of the wall, the stand-off wood screws **2130** can be installed into the wood distribution member or header to form a composite distribution member or header and/or to transfer diaphragm forces from the cementitious material to the wall.

Composite Cold-Formed Steel Joist Floor System

In some embodiments of the present invention, various different types of cold-formed steel floor joists are used in addition to or as an alternative to open web steel joists. For example, FIG. 21 illustrates three different exemplary cold-formed steel floor joists **2310 a**, **2310 b**, and **2310 c**. In each of these examples, self drilling, self-tapping stand-off screws **2330** are installed through the corrugated steel decking **2320** and into the cold formed steel floor joist **2310** and function to pull the decking **2320** against the joists **2310**. The stand-off portion of the screws **2330** are then encapsulated in the concrete slab **2340** providing a composite structure that increases the stiffness and load carrying capacity of the floor.

Cold-Formed Steel Composite Header

In some embodiments of the present invention, one or more headers are used at the tops of supporting walls and/or over, doors, windows, or other openings in the walls. In conventional floor systems designed for heavy loads, the connections between the header and the jambs at either side of the opening are often some of the most expensive connections within the wall system since the load of the floor above the opening must be properly distributed to wall structures on either side of the opening. Embodiments of the present invention provide a floor system that has a composite header design that may reduce the cost of these connections.

FIGS. 22 *a* and 22 *b* illustrate a composite floor system **2400** having a composite header configuration in accordance with and embodiment of the present invention. In the illustrated embodiment, the header **2480** is a cold-formed steel header comprised of a plurality of cold-formed steel sections. Specifically, the header **2480** is comprised of two opposing C-sections **2464** and two opposing tracks **2462**. As illustrated in FIG. 22 *b*, the header **2480** generally spans an opening **2405** in the wall **2460**. The header is generally supported on each end by a jamb **2406**. As described above, z-shaped closures **2450** and pour stops **2455** can be used to define a channel over the top of the wall **2460**. Concrete **2440** can be placed in this channel and cured to form a concrete distribution/collector beam **2441** on the top of the wall **2460** and extending over the header **2480**. As illustrated in FIGS. 22 *a* and 22 *b*, one or more self-drilling, self-tapping stand-off screws **2485** may be installed into the header **2480** prior to the concrete placement. These stand-off screws **2485** may be of the same type and size as the stand-off screws **2430** installed into the upper chords of the joist **2410** or they may be of a different size and/or type as required by the design parameters.

When the concrete **2440** is placed over the wall **2460** and allowed to cure, the upper stand-off portions of the screws **2485** become encapsulated within the concrete beam **2441**. In this way, a composite header is formed and loads in the cold-formed steel header **2480** may be transferred into the concrete beam **2441** and vice versa such that the concrete beam and the cold-formed steel header **2480** function as a single unit. By locking the concrete to the header via composite action, the cold-formed steel header **2480** may be constructed of a lighter gauge material. Conversely, the composite header can safely support increased vertical loads with reduced deflection compared to a normal non-composite header. The composite header may also reduce costly header-to-jamb connections for heavy loads by distributing much of the shear at the ends of the header into the jambs through the concrete. With the composite header, some of the vertical load will be transferred through the concrete slab into the jambs. This contrasts with a normal header where all of the vertical load must be transferred out of the header via direct connections between the header and the jambs. As further illustrated in FIG. 22 *a*, in some embodiments of the invention the self-drilling, self-tapping stand-off screws **2485** also function to attach the z-shaped closure **2450** and the pour stop **2455** to the cold-formed steel header **2480**.

FIG. 22 *a* also illustrates how, in some embodiments, the joist seat or shoe **2470** may be spaced apart from the joist's upper chord **2412** and connected by the end diagonal **2425** and/or other connecting members **2426**. Such a configuration in combination with appropriately sized z-shaped closures **2450** and pour stops **2455** allow for variations in the height of the concrete distribution/collector beam **2441** that is formed above the wall **2460**.

Improved Stand-Off Screw and Composite Floor System for Transferring Forces between the Concrete Slab and the Support Structures

FIG. 23 illustrates a composite floor and wall system **2500** in accordance with another embodiment of the present invention.



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As described above, a concrete floor system may comprises rebar **2545** embedded within the concrete **2440** to reinforce the concrete slab **2540**. In general, the rebar is spaced both perpendicular and parallel to the walls. In some embodiments, the perpendicular and parallel rebar members are welded or otherwise coupled together at their intersections to form a welded wire fabric. These welds may be made before or after positioning the rebar over the corrugated decking **2520** in the floor system. In other embodiments, the rebar may be positioned in other formations in the concrete slab based on the particular design requirements.

FIG. 23 illustrates an embodiment of the present invention where rebar **2545** in the concrete slab **2540** is coupled to a stand-off screw **2585** installed into the top of a supporting wall **2560**. Specifically, FIG. 23 illustrates the top of a masonry wall **2560**. The masonry wall **2560** may comprise a concrete-filled channel **2565** running through the uppermost blocks or bricks in the wall **2560** so that masonry screws may be inserted into the concrete and so that forces from the floor may be more evenly distributed throughout the wall **2560**. As also illustrated in FIG. 23, the concrete-filled channel **2565** may have rebar **2562** provided therein for reinforcing the concrete in the channel **2565**. In general, when standard masonry screws or stand-off screws **2585** having masonry threads are installed into the concrete, the concrete is pre-drilled to provide a hole for the masonry screw or stand-off screw to be threaded into.

As described above, a stand-off screw **2585** may be installed into the top of a supporting wall **2560** and z-closures **2550** and pour stops **2555** may be used to create a concrete distribution/collector beam **2541** at the top of the wall that encapsulates the stand-off end of the stand-off screw **2585**. As also described above, installing the stand-off screws **2585** into the top of the wall in this manner creates composite action between the concrete beam **2541** and the wall **2560** or the header, as the case may be. The stand-off screws **2585** also function to transfer horizontal diaphragm forces from the concrete slab **2540** to the shear wall **2560**. To improve the connection between the floor and the wall and to, thereby, improve the transfer of forces between the floor and the wall and increase the composite action so that the walls and the floors function more like a single unit, embodiments of the present invention couple the end of each rebar member **2545** that intersects with the wall **2560** to the top of a stand-off screw **2585** installed in the top of the wall **2560**. In an exemplary embodiment of the present invention, specially-designed stand-off screws are used that allow the rebar to be more easily coupled to the stand-off end of the screw.

For example, FIGS. 23 and 24 illustrate a stand-off screw **2585** configured to attach to a rebar member or some other extension member at the end of the screw opposite the screw's tip **2587**, in accordance with an embodiment of the present invention. As illustrated in FIG. 24, the stand-off screw **2585** generally comprises a lower threaded portion **2586** and an upper un-threaded shank portion **2588**. In the illustrated embodiment, the lower threaded portion **2586** comprises threads configured for drilling into concrete or other masonry materials. In other embodiments, the lower threaded portion **2586** may be configured for drilling into other materials such as steel or wood. Similar to the stand-off screws described above with respect to FIG. 4, the stand-off screw **2586** may be specially heat treated so that tip and a lower portion of the screw is harder than the upper portion of the screw.

Similar to other stand-off screws described above, the stand-off screw **2585** illustrated in FIGS. 23 and 24 generally has a driving head **2592**, such as a hexagonal head, proximate to the end of the screw opposite the tip **2587** and configured to engage a driving tool capable of rotating the stand-off screw **2592**. However, unlike the other stand-off screws described above, this stand-off screw **2585** has an extension coupling portion **2593** located above the driving head **2592** at the extreme end of the stand-off screw **2592**.

The extension coupling portion **2593** is configured to couple to a rebar member in the floor system or some other member that will effectively extend the length of the stand-off screw **2585**. In the embodiment illustrated in FIGS. 23 and 24, the extension coupling portion **2593** comprises a threaded portion. As illustrated in FIG. 23, a couple nut **2595** having two opposing female connectors may be used to join the end of the stand-off screw **2585** to the end of the rebar member **2545** or other extension. Where the end of the stand-off screw **2585** is threaded, at least one of the female connectors in the couple nut **2595** has corresponding threads so that the couple nut may be screwed on to the end of the stand-off screw **2585**. In one embodiment, the end rebar member **2545** is also threaded and screws into the second female connector of the couple nut **2595**. In other embodiments, the second female connector of the couple nut **2595** is not threaded and is configured to receive and hold the end of the rebar **2545** therein by other means. For example, an adhesive, a fastener, and/or a weld may be used to hold the end of the rebar in the end of the couple nut **2595** at least until the concrete **2540** cures around the connection.

Of course, the stand-off screw **2585** illustrated in FIG. 24 may also be used without connecting it to a rebar member to perform the functions of the stand-off screws described above with respect to other embodiments of the present invention. For example, FIGS. 25 and 26 illustrate embodiments of the present invention in which the stand-off screw **2585** is being used for functions other than or in addition to coupling the wall to a rebar member in the floor.

More particularly, FIG. 25 illustrates a stand-off screw **2585** used to attach a joist shoe **2570** to the supporting wall **2560** in accordance with an embodiment of the present invention. In the illustrated embodiment, the supporting wall **2560** is a masonry wall and the joist shoe **2570** is extended to allow for installation of the stand-off-screw **2585** therethrough. In the illustrated embodiment, where the joist shoe **2570** is metal and the wall is masonry, the stand-off screw **2585** used in this system will generally have threads designed for drilling into masonry and the joist shoe **2570** may be pre-punched or drilled to allow the lower threaded portion of the screw **2585** to pass therethrough. Preferably, if the joist is pre-punched or pre-drilled,



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the pre-punched or pre-drilled hole has a diameter greater than the diameter of the screw's lower threaded portion but less than the diameter of the screw's clamping collar.

FIG. 26 illustrates how the stand-off screws **2585** may also be used to attach a z-shaped closure **2550** and a pour stop **2555** to a wall **2560**, while also functioning to couple rebar **2545** to the wall **2560** and/or to transfer horizontal diaphragm forces from the slab **2540** to the wall **2560**. Where the z-shaped closure **2550** and the pour stop **2555** are metal and the wall **2560** is masonry, the z-shaped closure **2550** and the pour stop **2555** are generally pre-punched to have holes at the required design intervals to allow the threaded portions of the stand-off screws **2585** to pass therethrough.

As described above, extension members other than rebar may also be coupled to the ends of the stand-off screws **2585**. For example, in an embodiment of the present invention where the concrete distribution/collector beam that is to be formed over a supporting wall is particularly large, the stand-off screws **2585** available may be shorter than what would be ideal for coupling the concrete distribution/collector beam to the wall. In such an embodiment, extensions may be added to the end of the stand-off screw **2585**, via a couple nut or via other fastening systems, to increase the length of the stand-off screw **2585** and/or to change the shape of the end of the stand-off screw **2585**.

Therefore, it should be appreciated that the improved stand-off screw **2585** illustrated in FIGS. 23-26 permits the efficient transfer of diaphragm loads from the concrete floor slab into the supporting walls. This may be particularly advantageous for structures having masonry supporting walls. The conventional method of joining a masonry wall to a concrete floor would be to embed rebar into the masonry wall during construction of the wall such that portions of the rebar extend out of the top of the masonry wall. In this conventional method, the reinforcing bars present a trip hazard for any one walking on the top of the wall during construction of the structure. In contrast to the conventional method, the stand-off screws **2585** can be installed just prior to the placing of the concrete floor slab, thereby reducing the tripping potential. Furthermore, the stand-off screw **2585** installation does not require skilled labor and the installation spacing is easily adjusted to match the design diaphragm shear loads.

Balcony Configuration for Composite Joist Floor System

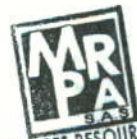
FIGS. 27 *a* and 27 *b* illustrate a composite joist floor system **1600** configured to provide for a balcony **1680** that extends from the structure parallel to the floor joists **1610 a**, **1610 b**, and **1610 c**, in accordance with an embodiment of the present invention. Specifically, FIG. 27 *a* illustrates a cross-sectional front view of the composite joist floor system **1600**, including the backspan **1685** used to support the cantilevered balcony **1680**. FIG. 27 *b* illustrates a cross-sectional side view of the composite joist floor system **1600**. To sufficiently support the balcony **1680**, the composite joist backspan **1685** must generally be thicker than the rest of the composite joist floor. Therefore, in order to maintain a level floor, the corrugated steel decking **1621** must be lowered to accommodate the increased concrete thickness in the backspan **1685**. As such, additional angles **1687** are welded to the sides (e.g., the vertical webs **1611**) of the joists **1610 a-c** to provide seats for the edges of the corrugated steel decking **1621** below the level of the standard corrugated steel decking **1620**. Since joist **1610 b** is a standard joist, the upper chord **1612 b** of the joist **1610 b** is encapsulated in concrete within the backspan **1685**.

To prevent concrete from pouring out of the gaps between the standard corrugated steel decking **1620** and the lowered corrugated steel decking **1621**, a couple of different closures are used. For example, as illustrated in FIG. 27 *a*, z-shaped closures **1650** are positioned such that the horizontal lower flange is coupled to the peaks in the lower corrugated steel decking **1621** and the horizontal upper flange is coupled to the peaks of the standard corrugated steel decking **1620**. Angle-shaped closures **1654** may be used to substantially prevent concrete **1640** from escaping through the corrugations under the lower flanges of the z-shaped closures **1650** and under the lower corrugated steel decking **1621**. As illustrated in FIG. 27 *b*, z-shaped closure **1652** is positioned along the rear of the backspan **1685** such that the horizontal lower flange extends below at least one valley in the lower corrugated steel decking **1621** and the horizontal upper flange extends over at least one peak in the standard corrugated steel decking **1620**.

FIGS. 28 *a* and 28 *b* illustrate a composite joist floor system **1700** configured to provide for a balcony **1780** that extends from the structure perpendicular to the floor joists **1710 a**, **1710 b**, and **1710 c**, in accordance with an embodiment of the present invention. Specifically, FIG. 28 *a* illustrates a cross-sectional side view of the composite joist floor system **1700**, including the backspan **1785** used to support the cantilevered balcony **1780**. FIG. 28 *b* illustrates a cross-sectional front view of the composite joist floor system **1700** and specifically illustrates stepped joist **1710 c**. To sufficiently support the balcony **1780**, the composite joist backspan **1785** must generally be thicker than the rest of the composite joist floor. Therefore, in order to maintain a level floor, the corrugated steel decking **1721** must be lowered relative to the standard corrugated steel decking **1720** to accommodate the increased concrete thickness in the backspan **1785**. As such, an additional angle **1787** is welded to the side (e.g., the web) of the joist **1710 b** to provide a seat for one edge of the corrugated steel decking **1721** below the level of the standard corrugated steel decking **1720**. In some embodiments, where the backspan is under a certain size, the lowered corrugated steel decking **1721** may be supported by the angle **1787** on one side and the wall **1760** or other supporting member on the other. However, in the illustrated embodiment, a joist **1710 c** is required to provide additional support for the backspan **1785** midway between the wall **1760** and the joist **1710 b**.

FIG. 28 *b* illustrates joist **1710 c** in accordance with an embodiment of the present invention. Specifically, joist **1710 c** has a

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step down in its span to support the corrugated steel decking **1721** of the backspan. FIGS. **28 a** and **28 b** also illustrate how z-shaped closures and angle-shaped closures may be used to prevent concrete from pouring out of the gaps between the standard corrugated steel decking **1720** and the lowered corrugated steel decking **1721**. As illustrated in FIG. **28 a**, z-shaped closure **1750** is positioned along the rear of the backspan **1785** such that the horizontal lower flange is coupled to the peaks in the lower corrugated steel decking **1721** and the horizontal upper flange is coupled to the peaks of the standard corrugated steel decking **1720**. Angle-shaped closures **1754** may be used to substantially prevent concrete **1740** from escaping through the corrugations under the lower flange of the z-shaped closure **1750** and under the lower corrugated steel decking **1721**. As illustrated in FIG. **28 b**, z-shaped closures **1752** are positioned on either side of the backspan **1785** such that the horizontal lower flanges each extend below at least one valley in the lower corrugated steel decking **1721** and the horizontal upper flanges each extend over at least one peak in the standard corrugated steel decking **1720**.

FIG. **29** illustrates a composite joist floor system **1800** where the concrete floor ends at a joist **1810** in accordance with an embodiment of the present invention. In such a system, the joist **1810** supports one end of the corrugated steel decking **1820** by a portion of a horizontal flange of the upper chord **1812**. The remainder of the upper chord **1812** supports a bent plate, such as a quarter-inch bent plate, that has a substantially horizontal portion **1856** that extends outward away from the joist **1810** and then bends upward at a right angle to form a substantially vertical portion **1857**. The vertical portion **1857** is used to contain the concrete **1840** when it is placed over the steel decking **1820**. An angle-shaped closure **1854** may be used over the end of the corrugated steel decking **1820** to prevent the placed concrete from escaping through the gaps between the corrugated steel decking **1820** and the upper chord **1812** of the joist **1810**. In one embodiment, one or more head studs **1831** are welded to the vertical portion **1857** and extend inward from the vertical portion **1857** toward the joist **1810** so that they are encapsulated by the concrete **1840**. Preferably, steel reinforcing bars and/or welded wire fabric **1845** is also encapsulated within the concrete **1840** to provide additional reinforcement for the concrete.

Corridors and Mechanical Headers for Supporting Heavy Loads

Many structures require one or more corridors in which HVAC, plumbing, and other large and sometimes heavy loads may be routed. For example, the main pipes and ducts in a structure are often hung from the ceiling of such a corridor. FIG. **30** illustrates a composite joist floor system **1900** where a joist **1910** interacts with a corridor **1980** running perpendicular to the joist **1910** in accordance with an embodiment of the present invention. As can be seen in FIG. **30**, the configuration of the joist and the steel decking, load bearing wall studs, concrete, and closures supported by the joist are similar to those described above with respect to other embodiments of the invention. A supporting wall **1960** or other supporting member will typically be located where the joist **1910** intercepts the corridor **1980**. For example, the end of the joist **1910** may be supported by the wall studs in the manner described above with reference to FIGS. **1** and **2**.

In contrast to the other floor systems described above, the floor spanning the corridor **1980** may not require a joist since the corridor is generally relatively narrow. As such, the corridor **1980** may comprise corrugated steel decking spanning the corridor by extending from the supporting wall **1960** to another supporting wall (not shown) on the other side of the corridor **1980**, the corrugations of the corrugated steel decking **1982** being substantially perpendicular to the walls. Since the concrete **1940** located over the corrugated steel decking **1982** in the corridor is generally thicker than the concrete located over the standard corrugated steel decking **1920** and since heavy loads are often hung from the ceiling in the corridor, the corrugated steel decking **1982** used in the corridor **1980** is typically of a stronger design than the standard corrugated steel decking **1920** used in many other areas of the structure. For example, in one embodiment, the corrugated steel decking over the corridor is a 2-inch deep corrugated steel composite floor decking.

In some instances, the vertical loads generated from hanging pipes, ducts, or other mechanical equipment cannot be safely supported by inserting mechanical anchors through the metal deck into the concrete slab. As such, in some embodiments, mechanical headers are used to provide support for mechanical equipment that cannot be safely hung from the floor spanning the top of the corridor. FIG. **31** illustrates a composite joist floor system **3000** having a corridor **3080** running perpendicular to the joists **3010 a** and **3010 b** and having a mechanical header **3090**, in accordance with an embodiment of the present invention. As illustrated, the mechanical header **3090**, which is generally made of steel, spans the corridor **3080** and is supported at each end by supporting walls or beams **3060 a** and **3060 b**. Typically the mechanical headers span a distance that ranges from 6 to 15 feet. In this way, the mechanical header **3090** provides support points for the heavy mechanical items, such as ducts **3001** and/or pipes **3002**, to hang in the corridor **3080**.

FIG. **32** provides a more detailed illustration of the mechanical header **3080** illustrated in FIG. **31**, in accordance with an exemplary embodiment of the present invention. As illustrated, the mechanical header **3080** may be comprised of a first angle **3081** and a second angle **3082**. The first angle **3081** and the second angle **3082** may be oriented relative to each other so that they combine to approximately form a "U" shape and so that a flange of the first angle **3081** at least partially overlaps a flange of the second angle **3082**. The two overlapping flanges may then be coupled together by, for example, one or more welds, fasteners, adhesives, or other coupling techniques.

A third angle **3085** and a fourth angle **3086** are welded or otherwise coupled to each end of the U-shaped member formed by the combination of the first angle **3081** and the second angle **3082**. As illustrated in FIG. **31**, the third angle **3085** and the fourth angle **3086** rest on top of the supporting walls or beams **3060 a** and **3060 b**, respectively, and function as the seats for

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the mechanical header 3090. In a preferred embodiment of the mechanical header 3090, the third angle 3085 and the fourth angle 3086 on each end of the header 3090 are sufficiently narrow such that the flanges that rest on top of the supporting walls or beams 3060 a and 3060 b fit between the corrugations of the corridor's decking 3020 c. This may make installation of the mechanical header 3090 easier and allows the decking 3020 c to bear uniformly on the top of the supporting wall or beam 3060 a and 3060 b as opposed to being lifted up to travel over the seats of the mechanical header 3090.

Referring again to FIG. 32, in some embodiments of the invention, the mechanical header 3090 has one or more holes 3083 punched or otherwise formed into the bottom flange of the header 3090 to provide anchor points for hanging equipment from the header. In one embodiment, the holes 3083 are pre-punched at a predetermined spacing, such as every six inches, to allow for flexibility in where items can be hung once the mechanical header is installed.

FIG. 31 illustrates how threaded rods 3095 may be inserted through the pre-punched holes 3083 in the header 3090 to suspend various mechanical and/or HVAC equipment, such as ducts 3001 and/or pipes 3002, in the corridor 3080, in accordance with an embodiment of the present invention. In a preferred embodiment, no specialty connectors or clamps are required to hang the ducts. Instead, one merely inserts a threaded rod 3095 through the pre-punched holes 3083 in the bottom flange of the mechanical header 3090 and threads a nut onto the threaded rod 3095 above the bottom flange. A lower support plate 3096 or section having holes punched therethrough may be used to span two threaded rods 3095 to provide support for pipes, ducts, or other equipment. The two threaded rods 3095 are inserted through the holes in the support plate 3096 and nuts are threaded onto the threaded rods 3095 below the support plate 3096. Adjustments in the vertical location of the support plate 3096 can be made by adjusting the length of the threaded rods 3095 and/or the position of the nuts on the threaded rods.

The following U.S. patent applications are filed concurrently with the present application and are hereby incorporated by reference: U.S. patent application Ser. No. _____ to Stuebaker et al. and entitled "Composite Wall and Floor System"; U.S. patent application Ser. No. _____ to Stuebaker et al. and entitled "Flush Joist Seat"; U.S. patent application Ser. No. _____ to Stuebaker et al. and entitled "Mechanical Header"; and U.S. patent application Ser. No. _____ to Stuebaker et al. and entitled "Balcony Structure".

Although embodiments of the present invention described herein are generally described as providing a floor structure for a building, it will be apparent to one of ordinary skill in the art that other embodiments of the present invention can be similarly used to provide a roof or ceiling structure for a building. Likewise, although some embodiments of the present invention are described as providing a balcony structure for a building, other embodiments of the present invention can be similarly used to provide an overhang structure for a building.

Specific embodiments of the invention are described herein. Many modifications and other embodiments of the invention set forth herein will come to mind to one skilled in the art to which the invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

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Patente citante	Fecha de presentación	Fecha de publicación	Solicitante	Título
US8636456 *	13 Mar 2013	28 Ene 2014	Nucor Corporation	Weldless building structures

* Citada por examinador

CLASIFICACIONES

Clasificación de EE.UU.	52/321, 52/798.1, 52/650.3, 411/394
Clasificación internacional	E04B5/17, E04C2/32, F16B35/00, E04G21/14, E04C3/29
Clasificación cooperativa	F16B5/0275, F16B25/103, E04B5/40, F16B25/0031, F16B35/048, F16B25/0094, F16B33/06
Clasificación europea	F16B25/00G5, F16B25/00C4, F16B25/10B, F16B33/06, F16B35/04B4, F16B5/02R

EVENTOS LEGALES

Fecha	Código	Evento	Descripción
11 Abr 2008	AS	Assignment	Owner name: NUCOR CORPORATION, NORTH CAROLINA Free format text: ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:STUEBAKER, GLENN WAYNE;SAMUELSON, DAVID LEE;DAYTON, LIONEL EDWARD;REEL/FRAME:020790/0967;SIGNING DATES FROM 20080328 TO 20080407 Free format text: ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:STUEBAKER, GLENN WAYNE;SAMUELSON, DAVID LEE;DAYTON, LIONEL EDWARD;SIGNING DATES FROM 20080328 TO 20080407;REEL/FRAME:020790/0967



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ESTÁNDAR SPECIFICATIONS FOR OPEN WEB STEEL JOIST

**(ESPECIFICACIONES PARA
ELEMENTOS ESTRUCTURALES DE
ALMA ABIERTA EMITIDO POR EL
STEEL JOIST INSTITUTE)**

(SJI)

DE LOS ESTADOS UNIDOS

STANDARD SPECIFICATIONS

FOR OPEN WEB STEEL JOISTS, K-SERIES

Adopted by the Steel Joist Institute November 4, 1985
Revised to November 10, 2003 - Effective March 01, 2005

SECTION 1. SCOPE

This specification covers the design, manufacture and use of Open Web Steel Joists, **K-Series**. Load and Resistance Factor Design (LRFD) and Allowable Strength Design (ASD) are included in this specification.

SECTION 2. DEFINITION

The term "Open Web Steel Joists **K-Series**," as used herein, refers to open web, parallel chord, load-carrying members suitable for the direct support of floors and roof decks in buildings, utilizing hot-rolled or cold-formed steel, including cold-formed steel whose yield strength* has been attained by cold working. **K-Series** Joists shall be designed in accordance with this specification to support the uniformly distributed loads given in the Standard Load Tables for Open Web Steel Joists, **K-Series**, attached hereto.

The KCS Joist is a **K-Series** Joist which is provided to address the problem faced by specifying professionals when trying to select joists to support uniform plus concentrated loads or other non-uniform loads.

The design of chord sections for **K-Series** Joists shall be based on a yield strength of 50 ksi (345 MPa). The design of web sections for **K-Series** Joists shall be based on a yield strength of either 36 ksi (250 MPa) or 50 ksi (345 MPa). Steel used for **K-Series** Joists chord or web sections shall have a minimum yield strength determined in accordance with one of the procedures specified in Section 3.2, which is equal to the yield strength assumed in the design.

* The term "Yield Strength" as used herein shall designate the yield level of a material as determined by the applicable method outlined in paragraph 13.1 "Yield Point", and in paragraph 13.2 "Yield Strength", of ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*, or as specified in paragraph 3.2 of this specification.

Standard Specifications and Load Tables, Open Web Steel Joists, **K-Series**,

Steel Joist Institute - Copyright, 2005

SECTION 3. MATERIALS

3.1 STEEL

The steel used in the manufacture of chord and web sections shall conform to one of the following ASTM Specifications:

- Carbon Structural Steel, ASTM A36/A36M.
- High-Strength, Low-Alloy Structural Steel, ASTM A242/A242M.
- High-Strength Carbon-Manganese Steel of Structural Quality, ASTM A529/A529M, Grade 50.
- High-Strength Low-Alloy Columbium-Vanadium Structural Steel, ASTM A572/A572M, Grade 42 and 50.
- High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 inches (100 mm) Thick, ASTM A588/A588M.
- Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Corrosion Resistance, ASTM A606.
- Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1008/A1008M
- Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1011/A1011M

or shall be of suitable quality ordered or produced to other than the listed specifications, provided that such material in the state used for final assembly and manufacture is weldable and is proved by tests performed by the producer or manufacturer to have the properties specified in Section 3.2.

3.2 MECHANICAL PROPERTIES

The yield strength used as a basis for the design stresses prescribed in Section 4 shall be either 36 ksi (250 MPa) or 50 ksi (345 MPa). Evidence that the steel furnished meets or exceeds the design yield strength shall, if requested, be provided in the form of an affidavit or by witnessed or certified test reports.

For material used without consideration of increase in yield strength resulting from cold forming, the specimens shall be taken from as-rolled material. In the case of material, the mechanical properties of which conform to the requirements of one of the listed specifications, the test specimens and procedures shall conform to those of such specifications and to ASTM A370.



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The top chord shall be designed for only axial compressive stress when the panel length, ℓ , does not exceed 24 inches (609 mm). When the panel length exceeds 24 inches (609 mm), the top chord shall be designed as a continuous member subject to combined axial and bending stresses and shall be so proportioned that:

For LRFD:

at the panel point:

$$f_{au} + f_{bu} \leq 0.9F_y \quad (4.4-1)$$

at the mid panel: for $\frac{f_{au}}{\phi_c F_{cr}} \geq 0.2$,

$$\frac{f_{au}}{\phi_c F_{cr}} + \frac{8}{9} \left[\frac{C_m f_{bu}}{1 - \left(\frac{f_{au}}{\phi_c F_e} \right)} \right] Q \phi_b F_y \leq 1.0 \quad (4.4-2)$$

for $\frac{f_{au}}{\phi_c F_{cr}} < 0.2$,

$$\left(\frac{f_{au}}{2\phi_c F_{cr}} \right) + \left[\frac{C_m f_{bu}}{1 - \left(\frac{f_{au}}{\phi_c F_e} \right)} \right] Q \phi_b F_y \leq 1.0 \quad (4.4-3)$$

$f_{au} = P_u/A$ = Required compressive stress, ksi (MPa)

P_u = Required axial strength using LRFD load combinations, kips (N)

$f_{bu} = M_u/S$ = Required bending stress at the location under consideration, ksi (MPa)

M_u = Required flexural strength using LRFD load combinations, kip-in. (N-mm)

S = Elastic Section Modulus, in.³ (mm³)

F_{cr} = Nominal axial compressive stress in ksi (MPa) based on ℓ/r as defined in Section 4.2(b),

$C_m = 1 - 0.3 f_{bu}/\phi F_e$ for end panels

$C_m = 1 - 0.4 f_{au}/\phi F_e$ for interior panels

F_y = Specified minimum yield strength, ksi (MPa)

$F_e = \frac{\pi^2 E}{\left(\frac{\ell}{r_x} \right)^2}$, ksi (MPa)

Where ℓ is the panel length, in inches (millimeters), as defined in Section 4.2(b) and r_x is the radius of gyration about the axis of bending.

Q = Form factor defined in Section 4.2(b)

A = Area of the top chord, in.² (mm²)

For ASD:

at the panel point:

$$f_a + f_b \leq 0.6F_y \quad (4.4-4)$$

at the mid panel: for $\frac{f_a}{F_a} \geq 0.2$,

$$\frac{f_a}{F_a} + \frac{8}{9} \left[\frac{C_m f_b}{1 - \left(\frac{1.67 f_a}{F_e} \right)} \right] Q F_b \leq 1.0 \quad (4.4-5)$$

for $\frac{f_a}{F_a} < 0.2$,

$$\left(\frac{f_a}{2F_a} \right) + \left[\frac{C_m f_b}{1 - \left(\frac{1.67 f_a}{F_e} \right)} \right] Q F_b \leq 1.0 \quad (4.4-6)$$

$f_a = P/A$ = Required compressive stress, ksi (MPa)

P = Required axial strength using ASD load combinations, kips (N)

$f_b = M/S$ = Required bending stress at the location under consideration, ksi (MPa)

M = Required flexural strength using ASD load combinations, kip-in. (N-mm)

S = Elastic Section Modulus, in.³ (mm³)

F_a = Allowable axial compressive stress based on ℓ/r as defined in Section 4.2(b), ksi (MPa)

F_b = Allowable bending stress; $0.6F_y$, ksi (MPa)

$C_m = 1 - 0.50 f_a/F_e$ for end panels

$C_m = 1 - 0.67 f_a/F_e$ for interior panels

(b) Web

The vertical shears to be used in the design of the web members shall be determined from full uniform loading, but such vertical shears shall be not less than 25 percent of the end reaction. Due consideration shall be given to the effect of eccentricity. The effect of combined axial compression and bending may be investigated using the provisions of Section 4.4(a), letting $C_m = 0.4$ when bending due to eccentricity produces reversed curvature.

Interior vertical web members used in modified Warren type web systems shall be designed to resist the gravity loads supported by the member plus an additional axial load of 1/2 of 1.0 percent of the top chord axial force.

(c) Extended Ends

The magnitude and location of the loads to be supported, deflection requirements, and proper bracing of extended



top chords or full depth cantilever ends shall be clearly indicated on the structural drawings.

4.5 CONNECTIONS

(a) Methods

Joist connections and splices shall be made by attaching the members to one another by arc or resistance welding or other accredited methods.

(1) Welded Connections

- a) Selected welds shall be inspected visually by the manufacturer. Prior to this inspection, weld slag shall be removed.
- b) Cracks are not acceptable and shall be repaired.
- c) Thorough fusion shall exist between weld and base metal for the required design length of the weld; such fusion shall be verified by visual inspection.
- d) Unfilled weld craters shall not be included in the design length of the weld.
- e) Undercut shall not exceed 1/16 inch (2 millimeters) for welds oriented parallel to the principal stress.
- f) The sum of surface (piping) porosity diameters shall not exceed 1/16 inch (2 millimeters) in any 1 inch (25 millimeters) of design weld length.
- g) Weld spatter that does not interfere with paint coverage is acceptable.

(2) Welding Program

Manufacturers shall have a program for establishing weld procedures and operator qualification, and for weld sampling and testing. (See Technical Digest #8 - Welding of Open Web Steel Joists.)

(3) Weld Inspection by Outside Agencies (See Section 5.12 of these specifications)

The agency shall arrange for visual inspection to determine that welds meet the acceptance standards of Section 4.5(a)(1) above. Ultrasonic, X-Ray, and magnetic particle testing are inappropriate for joists due to the configurations of the components and welds.

(b) Strength

- (1) Joint Connections - Joint connections shall be capable of withstanding forces due to an ultimate load equal to at least 1.35 times the LRFD, or 2.0 times the ASD load shown in the applicable Standard Load Table.
- (2) Shop Splices - Splices may occur at any point in chord or web members. Members containing a butt weld splice shall develop an ultimate tensile force of at least 57 ksi (393 MPa) times the full design area of the chord or web. The term "member" shall be defined as all component parts comprising the chord or web, at the point of the splice.

(c) Eccentricity

Members connected at a joint shall have their centroidal axes meet at a point if practical. Otherwise, due consideration shall be given to the effect of eccentricity. In no case shall eccentricity of any web member at a joint exceed 3/4 of the over-all dimension, measured in the plane of the web, of the largest member connected. The eccentricity of any web member shall be the perpendicular distance from the centroidal axis of that web member to the point on the centroidal axis of the chord which is vertically above or below the intersection of the centroidal axes of the web members forming the joint. Ends of joists shall be proportioned to resist bending produced by eccentricity at the support.

4.6 CAMBER

Joists shall have approximate camber in accordance with the following:

TABLE 4.6-1

Top Chord Length	Approximate Camber
20'-0" (6096 mm)	1/4" (6 mm)
30'-0" (9144 mm)	3/8" (10 mm)
40'-0" (12192 mm)	5/8" (16 mm)
50'-0" (15240 mm)	1" (25 mm)
60'-0" (18288 mm)	1 1/2" (38 mm)

The specifying professional shall give consideration to coordinating joist camber with adjacent framing.

4.7 VERIFICATION OF DESIGN AND MANUFACTURE

(a) Design Calculations

Companies manufacturing K-Series Joists shall submit design data to the Steel Joist Institute (or an independent agency approved by the Steel Joist Institute) for verification of compliance with the SJI Specifications. Design data shall be submitted in detail and in the format specified by the Institute.

(b) Tests of Chord and Web Members

Each manufacturer shall, at the time of design review by the Steel Joist Institute or other independent agency, verify by tests that the design, in accordance with Sections 4.1 through 4.5 of this specification, will provide the theoretical strength of critical members. Such tests shall be evaluated considering the actual yield strength of the members of the test joists.

Material tests for determining mechanical properties of component members shall be conducted.

(c) Tests of Joints and Connections

Each manufacturer shall verify by shear tests on representative joints of typical joists that connections will meet the provision of Section 4.5(b). Chord and web members may be reinforced for such tests.



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(d) In-Plant Inspections

Each manufacturer shall verify their ability to manufacture K-Series Joists through periodic In-Plant Inspections. Inspections shall be performed by an independent agency approved by the Steel Joist Institute. The frequency, manner of inspection, and manner of reporting shall be determined by the Steel Joist Institute. The plant inspections are not a guarantee of the quality of any specific joists; this responsibility lies fully and solely with the individual manufacturer.

**SECTION 5.
APPLICATION**

5.1 USAGE

These specifications shall apply to any type of structure where floors and roofs are to be supported directly by steel joists installed as hereinafter specified. Where joists are used other than on simple spans under uniformly distributed loading as prescribed in Section 4.1, they shall be investigated and modified if necessary to limit the required stresses to those listed in Section 4.2.

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 is then no longer simply supported, and the system must be investigated for continuous frame action by the specifying professional.

The designed detail of a rigid type connection and moment plates shall be shown on the structural drawings by the specifying professional. The moment plates shall be furnished by other than the joist manufacturer.

5.2 SPAN

The span of a joist shall not exceed 24 times its depth.

5.3 END SUPPORTS

(a) Masonry and Concrete

K-Series Joists supported by masonry or concrete are to bear on steel bearing plates and shall be designed as steel bearing. Due consideration of the end reactions and all other vertical or lateral forces shall be taken by the specifying professional in the design of the steel bearing plate and the masonry or concrete. The ends of K-Series Joists shall extend a distance of not less than 4 inches (102 millimeters) over the masonry or concrete support and be anchored to the steel bearing plate. The plate shall be located not more than 1/2 inch (13 millimeters) from the face of the wall and shall be not less than 6 inches (152 millimeters) wide perpendicular to the length of the joist. The plate is to be designed by the specifying professional and shall be furnished by other than the joist manufacturer.

Where it is deemed necessary to bear less than 4 inches (102 millimeters) over the masonry or concrete support, special consideration is to be given to the design of the

steel bearing plate and the masonry or concrete by the specifying professional. The joists must bear a minimum of 2 1/2 inches (64 millimeters) on the steel bearing plate.

(b) Steel

Due consideration of the end reactions and all other vertical and lateral forces shall be taken by the specifying professional in the design of the steel support. The ends of K-Series Joists shall extend a distance of not less than 2 1/2 inches (64 millimeters) over the steel supports.

5.4 BRIDGING

Top and bottom chord bridging is required and shall consist of one or both of the following types.

(a) Horizontal

Horizontal bridging shall consist of continuous horizontal steel members. Attachments to the joist chords shall be made by welding or mechanical means and shall be capable of resisting a nominal (unfactored) horizontal force of not less than 700 pounds (3114 Newtons).

The ratio of unbraced length to least radius of gyration, ℓ/r , of the bridging member shall not exceed 300, where ℓ is the distance in inches (millimeters) between attachments and r is the least radius of gyration of the bridging member.

(b) Diagonal

Diagonal bridging shall consist of cross-bracing with a ℓ/r ratio of not more than 200, where ℓ is the distance in inches (millimeters) between connections and r is the least radius of gyration of the bracing member. Where cross-bracing members are connected at their point of intersection, the ℓ distance shall be taken as the distance in inches (millimeters) between connections at the point of intersection of the bracing members and the connections to the chord of the joists. Connections to the chords of steel joists shall be made by positive mechanical means or by welding.

(c) Quantity and Spacing

The number of rows of top chord bridging shall not be less than as shown in Bridging Tables 5.4-1 and the spacing shall meet the requirements of Section 4.4(a). The number of rows of bottom chord bridging, including bridging required per Section 5.11, shall not be less than the number of top chord rows. Rows of bottom chord bridging are permitted to be spaced independently of rows of top chord bridging. The spacing of rows of bottom chord bridging shall meet the slenderness requirement of Section 4.3 and any specified strength requirements.

(d) Bottom Chord Bearing Joists

Where bottom chord bearing joists are utilized, a row of diagonal bridging shall be provided near the support(s). This bridging shall be installed and anchored before the hoisting cable(s) is released.



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4.2 DESIGN AND ALLOWABLE STRESSES

Design Using Load and Resistance Factor Design (LRFD)

Joists shall have their components so proportioned that the required stresses, f_u , shall not exceed ϕF_n where,

$$\begin{aligned} f_u &= \text{required stress} && \text{ksi (MPa)} \\ F_n &= \text{nominal stress} && \text{ksi (MPa)} \\ \phi &= \text{resistance factor} \\ \phi F_n &= \text{design stress} \end{aligned}$$

Design Using Allowable Strength Design (ASD)

Joists shall have their components so proportioned that the required stresses, f , shall not exceed F_n / Ω where,

$$\begin{aligned} f &= \text{required stress} && \text{ksi (MPa)} \\ F_n &= \text{nominal stress} && \text{ksi (MPa)} \\ \Omega &= \text{safety factor} \\ F_n / \Omega &= \text{allowable stress} \end{aligned}$$

Stresses:

(a) **Tension:** $\phi_t = 0.90$ (LRFD) $\Omega = 1.67$ (ASD)

For Chords: $F_y = 50$ ksi (345 MPa)

For Webs: $F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

$$\text{Design Stress} = 0.9F_y \text{ (LRFD)} \quad (4.2-1)$$

$$\text{Allowable Stress} = 0.6F_y \text{ (ASD)} \quad (4.2-2)$$

(b) **Compression:** $\phi_c = 0.90$ (LRFD) $\Omega_c = 1.67$ (ASD)

For members with $\ell/r \leq 4.71 \sqrt{E/QF_y}$

$$F_{cr} = Q \left[0.658 \left(\frac{QF_y}{F_e} \right) \right] F_y \quad (4.2-3)$$

For members with $\ell/r > 4.71 \sqrt{E/QF_y}$

$$F_{cr} = 0.877F_e \quad (4.2-4)$$

Where F_e = Elastic buckling stress determined in accordance with Equation 4.2-5.

$$F_e = \frac{\pi^2 E}{\left(\frac{\ell}{r} \right)^2} \quad (4.2-5)$$

For hot-rolled sections, "Q" is the full reduction factor for slender compression elements.

$$\text{Design Stress} = 0.9F_{cr} \text{ (LRFD)} \quad (4.2-6)$$

$$\text{Allowable Stress} = 0.6F_{cr} \text{ (ASD)} \quad (4.2-7)$$

In the above equations, ℓ is taken as the distance in inches (millimeters) between panel points for the chord members

and the appropriate length for web members, and r is the corresponding least radius of gyration of the member or any component thereof. E is equal to 29,000 ksi (200,000 MPa).

Use $1.2 \ell/r_x$ for a crimped, first primary compression web member when a moment-resistant weld group is not used for this member; where r_x = member radius of gyration in the plane of the joist.

For cold-formed sections the method of calculating the nominal column strength is given in the AISI, *North American Specification for the Design of Cold-Formed Steel Structural Members*.

(c) **Bending:** $\phi_b = 0.90$ (LRFD) $\Omega_b = 1.67$ (ASD)

Bending calculations are to be based on using the elastic section modulus.

For chords and web members other than solid rounds:

$$F_y = 50 \text{ ksi (345 MPa)}$$

$$\text{Design Stress} = 0.9F_y \text{ (LRFD)} \quad (4.2-8)$$

$$\text{Allowable Stress} = 0.6F_y \text{ (ASD)} \quad (4.2-9)$$

For web members of solid round cross section:

$$F_y = 50 \text{ ksi (345 MPa), or } F_y = 36 \text{ ksi (250 MPa)}$$

$$\text{Design Stress} = 1.45F_y \text{ (LRFD)} \quad (4.2-10)$$

$$\text{Allowable Stress} = 0.95F_y \text{ (ASD)} \quad (4.2-11)$$

For bearing plates:

$$F_y = 50 \text{ ksi (345 MPa), or } F_y = 36 \text{ ksi (250 MPa)}$$

$$\text{Design Stress} = 1.35F_y \text{ (LRFD)} \quad (4.2-12)$$

$$\text{Allowable Stress} = 0.90F_y \text{ (ASD)} \quad (4.2-13)$$

4.3 MAXIMUM SLENDERNESS RATIOS

The slenderness ratio, ℓ/r , where ℓ is as used in Section 4.2 (b) and r is the corresponding least radius of gyration, shall not exceed the following:

Top chord interior panels	90
Top chord end panels	120
Compression members other than top chord	200
Tension members	240

4.4 MEMBERS

(a) Chords

The bottom chord shall be designed as an axially loaded tension member.

The radius of gyration of the top chord about its vertical axis shall not be less than $\ell/145$ where ℓ is the spacing in inches (millimeters) between lines of bridging as specified in Section 5.4(c).

The top chord shall be considered as stayed laterally by the floor slab or roof deck when attachments are in accordance with the requirements of Section 5.8(e) of these specifications.



In the case of material, the mechanical properties of which do not conform to the requirements of one of the listed specifications, the test specimens and procedures shall conform to the applicable requirements of ASTM A370, and the specimens shall exhibit a yield strength equal to or exceeding the design yield strength and an elongation of not less than (a) 20 percent in 2 inches (51 millimeters) for sheet and strip, or (b) 18 percent in 8 inches (203 millimeters) for plates, shapes and bars with adjustments for thickness for plates, shapes and bars as prescribed in ASTM A36/A36M, A242/A242M, A529/A529M, A572/A572M, A588/A588M, whichever specification is applicable on the basis of design yield strength.

The number of tests shall be as prescribed in ASTM A6/A6M for plates, shapes, and bars; and ASTM A606, A1008/A1008M and A1011/A1011M for sheet and strip.

If as-formed strength is utilized, the test reports shall show the results of tests performed on full section specimens in accordance with the provisions of the AISI North American Specifications for the Design of Cold-Formed Steel Structural Members. They shall also indicate compliance with these provisions and with the following additional requirements:

- a) The yield strength calculated from the test data shall equal or exceed the design yield strength.
- b) Where tension tests are made for acceptance and control purposes, the tensile strength shall be at least 6 percent greater than the yield strength of the section.
- c) Where compression tests are used for acceptance and control purposes, the specimen shall withstand a gross shortening of 2 percent of its original length without cracking. The length of the specimen shall be not greater than 20 times the least radius of gyration.
- d) If any test specimen fails to pass the requirements of the subparagraphs (a), (b), or (c) above, as applicable, two retests shall be made of specimens from the same lot. Failure of one of the retest specimens to meet such requirements shall be the cause for rejection of the lot represented by the specimens.

3.3 PAINT

The standard shop paint is intended to protect the steel for only a short period of exposure in ordinary atmospheric conditions and shall be considered an impermanent and provisional coating.

When specified, the standard shop paint shall conform to one of the following:

- a) Steel Structures Painting Council Specification, SSPC No. 15.
- b) Or, shall be a shop paint which meets the minimum performance requirements of the above listed specification.

SECTION 4.

DESIGN AND MANUFACTURE

4.1 METHOD

Joists shall be designed in accordance with these specifications as simply supported, uniformly loaded trusses supporting a floor or roof deck so constructed as to brace the top chord of the joists against lateral buckling. Where any applicable design feature is not specifically covered herein, the design shall be in accordance with the following specifications:

- a) Where the steel used consists of hot-rolled shapes, bars or plates, use the American Institute of Steel Construction, *Specification for Structural Steel Buildings*.
- b) For members that are cold-formed from sheet or strip steel, use the American Iron and Steel Institute, *North American Specification for the Design of Cold-Formed Steel Structural Members*.

Design Basis:

Designs shall be made according to the provisions in this Specification for either Load and Resistance Factor Design (LRFD) or for Allowable Strength Design (ASD).

Load Combinations:

LRFD:

When load combinations are not specified to the joist manufacturer, the required stress shall be computed for the factored loads based on the factors and load combinations as follows:

$$1.4D$$

$$1.2D + 1.6 (L, \text{ or } L_r, \text{ or } S, \text{ or } R)$$

ASD:

When load combinations are not specified to the joist manufacturer, the required stress shall be computed based on the load combinations as follows:

$$D$$

$$D + (L, \text{ or } L_r, \text{ or } S, \text{ or } R)$$

Where:

D = dead load due to the weight of the structural elements and the permanent features of the structure

L = live load due to occupancy and movable equipment

L_r = roof live load

S = snow load

R = load due to initial rainwater or ice exclusive of the ponding contribution

When special loads are specified and the specifying professional does not provide the load combinations, the provisions of ASCE 7, "Minimum Design Loads for Buildings and Other Structures" shall be used for LRFD and ASD load combinations.



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TABLE 5.4-1

NUMBER OF ROWS OF TOP CHORD BRIDGING** Refer to the K-Series Load Table and Specification Section 6 for required bolted diagonal bridging. Distances are Joist Span lengths in feet - See "Definition of Span" preceding Load Table.					
*Section Number	One Row	Two Rows	Three Rows	Four Rows	Five Rows
#1	Up thru 16	Over 16 thru 24	Over 24 thru 28		
#2	Up thru 17	Over 17 thru 25	Over 25 thru 32		
#3	Up thru 18	Over 18 thru 28	Over 28 thru 38	Over 38 thru 40	
#4	Up thru 19	Over 19 thru 28	Over 28 thru 38	Over 38 thru 48	
#5	Up thru 19	Over 19 thru 29	Over 29 thru 39	Over 39 thru 50	Over 50 thru 52
#6	Up thru 19	Over 19 thru 29	Over 29 thru 39	Over 39 thru 51	Over 51 thru 56
#7	Up thru 20	Over 20 thru 33	Over 33 thru 45	Over 45 thru 58	Over 58 thru 60
#8	Up thru 20	Over 20 thru 33	Over 33 thru 45	Over 45 thru 58	Over 58 thru 60
#9	Up thru 20	Over 20 thru 33	Over 33 thru 46	Over 46 thru 59	Over 59 thru 60
#10	Up thru 20	Over 20 thru 37	Over 37 thru 51	Over 51 thru 60	
#11	Up thru 20	Over 20 thru 38	Over 38 thru 53	Over 53 thru 60	
#12	Up thru 20	Over 20 thru 39	Over 39 thru 53	Over 53 thru 60	

* Last digit(s) of joist designation shown in Load Table

** See Section 5.11 for additional bridging required for uplift design.



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5.5 INSTALLATION OF BRIDGING

Bridging shall support the top and bottom chords against lateral movement during the construction period and shall hold the steel joists in the approximate position as shown on the joist placement plans.

The ends of all bridging lines terminating at walls or beams shall be anchored thereto.

5.6 END ANCHORAGE

(a) Masonry and Concrete

Ends of K-Series Joists resting on steel bearing plates on masonry or structural concrete shall be attached thereto with a minimum of two 1/8 inch (3 millimeters) fillet welds 1 inch (25 millimeters) long, or with two 1/2 inch (13 millimeters) ASTM A307 bolts, or the equivalent.

(b) Steel

Ends of K-Series Joists resting on steel supports shall be attached thereto with a minimum of two 1/8 inch (3 millimeters) fillet welds 1 inch (25 millimeters) long, or with two 1/2 inch (13 millimeters) ASTM A307 bolts, or the equivalent. When K-Series Joists are used to provide lateral stability to the supporting member, the final connection shall be made by welding or as designated by the specifying professional.

(c) Uplift

Where uplift forces are a design consideration, roof joists shall be anchored to resist such forces (Refer to Section 5.11 Uplift).

5.7 JOIST SPACING

Joists shall be spaced so that the loading on each joist does not exceed the design load (LRFD or ASD) for the particular joist designation and span as shown in the applicable load tables.

5.8 FLOOR AND ROOF DECKS

(a) Material

Floor and roof decks may consist of cast-in-place or precast concrete or gypsum, formed steel, wood, or other suitable material capable of supporting the required load at the specified joist spacing.

(b) Thickness

Cast-in-place slabs shall be not less than 2 inches (51 millimeters) thick.

(c) Centering

Centering for cast-in-place slabs may be ribbed metal lath, corrugated steel sheets, paper-backed welded wire fabric, removable centering or any other suitable material capable of supporting the slab at the designated joist spacing. Centering shall not cause lateral displacement or damage to the top chord of joists during installation or removal of the centering or placing of the concrete.

(d) Bearing

Slabs or decks shall bear uniformly along the top chords of the joists.

(e) Attachments

The spacing for slab or deck attachments along the joist top chord shall not exceed 36 inches (914 millimeters), and shall be capable of resisting a nominal (unfactored) lateral force of not less than 300 pounds (1335 Newtons), i.e., 100 plf (1.46 kN/m).

(f) Wood Nailers

Where wood nailers are used, such nailers in conjunction with deck or slab shall be attached to the top chords of the joists in conformance with Section 5.8(e).

(g) Joist With Standing Seam Roofing

The stiffness and strength of standing-seam roof clips varies from one manufacturer to another. Therefore, some roof systems cannot be counted on to provide lateral stability to the joists which support the roof. Sufficient stability must be provided to brace the joists laterally under the full design load. The compression chord must resist the chord axial design force in the plane of the joist (i.e., x-x axis buckling) and out of the plane of the joist (i.e., y-y axis buckling). Out-of-plane strength may be achieved by adjusting the bridging spacing and/or increasing the compression chord area, the joist depth, and the y-axis radius of gyration. The effective slenderness ratio in the y-direction equals $0.94 L/r_y$; where L is the bridging spacing in inches (millimeters). The maximum bridging spacing may not exceed that specified in Section 5.4(c).

Horizontal bridging members attached to the compression chords and their anchorage's must be designed for a compressive axial force of $0.0025nP$, where n is the number of joists between end anchors and P is the chord design force in kips (Newtons). The attachment force between the horizontal bridging member and the compression chord is $0.005P$. Horizontal bridging attached to the tension chords shall be proportioned so that the slenderness ratio between attachments does not exceed 300. Diagonal bridging shall be proportioned so that the slenderness ratio between attachments does not exceed 200.



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5.9 DEFLECTION

The deflection due to the design nominal live load shall not exceed the following:

Floors: 1/360 of span.

Roofs: 1/360 of span where a plaster ceiling is attached or suspended.
1/240 of span for all other cases.

The specifying professional shall give consideration to the effects of deflection and vibration* in the selection of joists.

* For further reference, refer to Steel Joist Institute Technical Digest #5, "Vibration of Steel Joist-Concrete Slab Floors" and the Institute's Computer Vibration Program.

5.10 PONDING*

The ponding investigation shall be performed by the specifying professional.

* For further reference, refer to Steel Joist Institute Technical Digest #3, "Structural Design of Steel Joist Roofs to Resist Ponding Loads" and AISC Specifications.

5.11 UPLIFT

Where uplift forces due to wind are a design requirement, these forces must be indicated on the contract drawings in terms of NET uplift in pounds per square foot (Pascals). The contract documents shall indicate if the net uplift is based upon LRFD or ASD. When these forces are specified, they must be considered in the design of joists and/or bridging. A single line of **bottom chord** bridging must be provided near the first bottom chord panel points whenever uplift due to wind forces is a design consideration.*

* For further reference, refer to Steel Joist Institute Technical Digest #6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads".

5.12 INSPECTION

Joists shall be inspected by the manufacturer before shipment to verify compliance of materials and workmanship with the requirements of these specifications. If the purchaser wishes an inspection of the steel joists by someone other than the manufacturer's own inspectors, they may reserve the right to do so in their "Invitation to Bid" or the accompanying "Job Specifications".

Arrangements shall be made with the manufacturer for such inspection of the joists at the manufacturing shop by the purchaser's inspectors at purchaser's expense.

5.13 PARALLEL CHORD SLOPED JOISTS

The span of a parallel chord sloped joist shall be defined by the length along the slope. Minimum depth, load-carrying capacity, and bridging requirements shall be determined by the sloped definition of span. The Standard Load Table capacity shall be the component normal to the joist.

SECTION 6.*

ERECTION STABILITY AND HANDLING

When it is necessary for the erector to climb on the joists, extreme caution must be exercised since unbridged joists may exhibit some degree of instability under the erector's weight.

(a) Stability Requirements

- 1) Before an employee is allowed on the steel joist: BOTH ends of joists at columns (or joists designated as column joists) shall be attached to its supports. For all other joists a minimum of one end shall be attached before the employee is allowed on the joist. The attachment shall be in accordance with Section 5.6 – End Anchorage.

When a bolted seat connection is used for erection purposes, as a minimum, the bolts must be snug tightened. The snug tight condition is defined as the tightness that exists when all plies of a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of an employee using an ordinary spud wrench.

- 2) On steel joists that do not require erection bridging as shown by the unshaded area of the Load Tables, only one employee shall be allowed on the steel joist unless all bridging is installed and anchored.

* For a thorough coverage of this topic, refer to SJ I Technical Digest #9, "Handling and Erection of Steel Joists and Joist Girders".

- 3) Where the span of the steel joist is within the Red shaded area of the Load Table, the following shall apply:

- a) The row of bridging nearest the mid span of the steel joists shall be bolted diagonal erection bridging; and
- b) Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored, unless an alternate method of stabilizing the joist has been provided; and
- c) No more than one employee shall be allowed on these spans until all other bridging is installed and anchored.

- 4) When permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points are required to provide stability.

- 5) In the case of bottom chord bearing joists, the ends of the joist must be restrained laterally per Section 5.4(d).

- 6) After the joist is straightened and plumbed, and all bridging is completely installed and anchored, the ends of the joists shall be fully connected to the supports in accordance with Section 5.6 End Anchorage.



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(b) Landing and Placing Loads

- 1) Except as stated in paragraphs 6(b)(3) and 6(b)(4) of this section, no "construction loads"⁽¹⁾ are allowed on the steel joists until all bridging is installed and anchored, and all joist bearing ends are attached.
- 2) During the construction period, loads placed on the steel joists shall be distributed so as not to exceed the capacity of the steel joists.
- 3) The weight of a bundle of joist bridging shall not exceed a total of 1000 pounds (454 kilograms). The bundle of joist bridging shall be placed on a minimum of 3 steel joists that are secured at one end. The edge of the bridging bundle shall be positioned within 1 foot (0.30 m) of the secured end.

⁽¹⁾ See page 150 for definition of "construction load". A copy of the OSHA Steel Erection Standard §1926.757, Open Web Steel Joists, is included in Appendix E for reference purposes.

- 4) No bundle of deck may be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless the following conditions are met:
 - a) The contractor has first determined from a "qualified person"⁽²⁾ and documented in a site-specific erection plan that the structure or portion of the structure is capable of supporting the load;
 - b) The bundle of decking is placed on a minimum of 3 steel joists;
 - c) The joists supporting the bundle of decking are attached at both ends;
 - d) At least one row of bridging is installed and anchored;
 - e) The total weight of the decking does not exceed 4000 pounds (1816 kilograms); and
 - f) The edge of the decking shall be placed within 1 foot (0.30 meters) of the bearing surface of the joist end.
 - g) The edge of the construction load shall be placed within 1 foot (0.30 meters) of the bearing surface of the joist end.

(c) Field Welding

- 1) All field welding shall be performed in accordance with the contract documents. Field welding shall not damage the joists.
- 2) On cold-formed members whose yield strength has been attained by cold working, and whose as-formed strength is used in the design, the total length of weld at any one point shall not exceed 50 percent of the overall developed width of the cold-formed section.

(d) Handling

Care shall be exercised at all times to avoid damage to the joists and accessories.

(e) Fall Arrest Systems

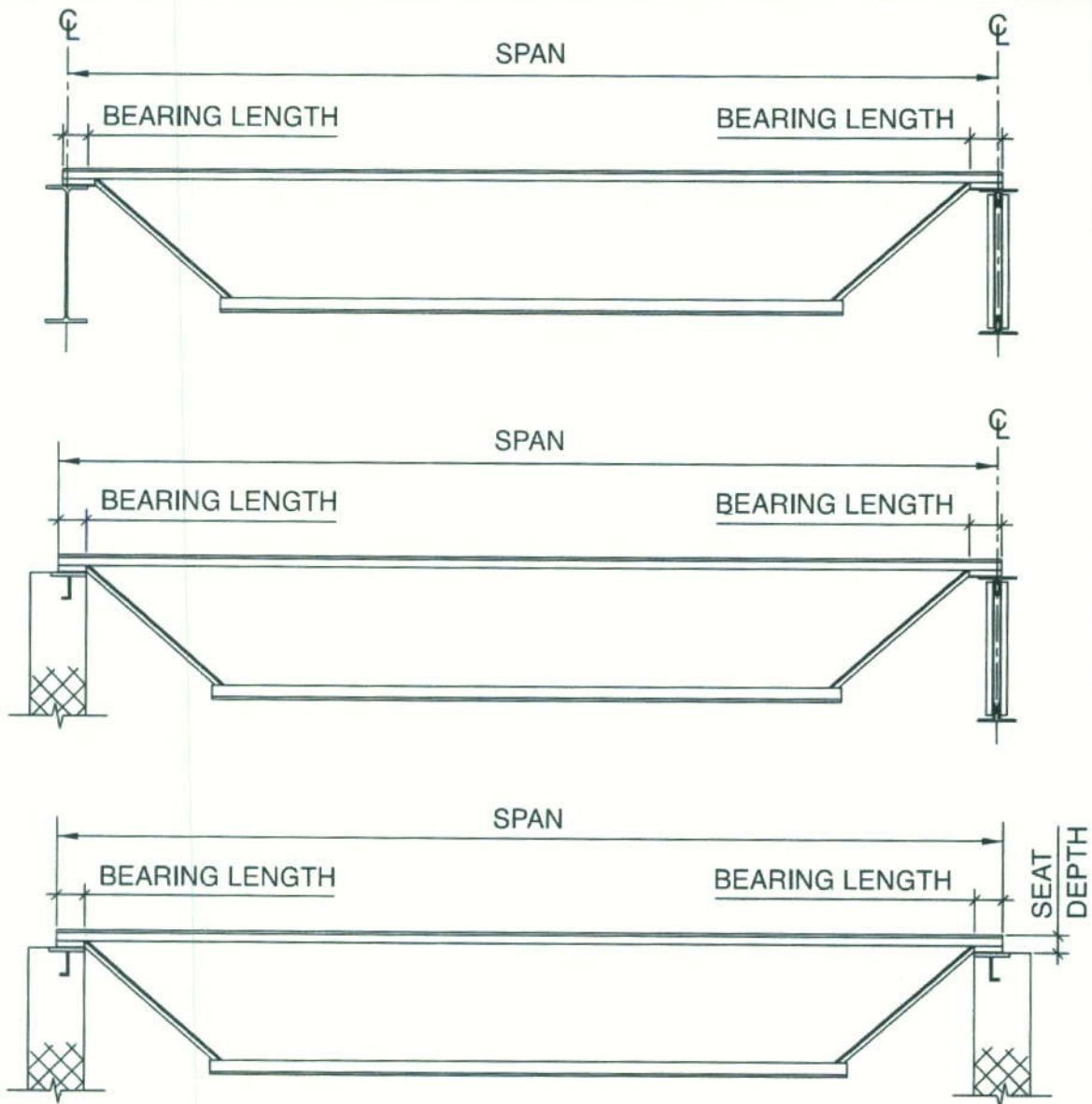
Steel joists shall not be used as anchorage points for a fall arrest system unless written direction to do so is obtained from a "qualified person"⁽²⁾.

⁽²⁾ See page 150 for OSHA definition of "qualified person".



DEFINITION OF SPAN

(U. S. Customary Units)



- NOTES:**
- 1) **DESIGN LENGTH = SPAN - 0.33 FT.**
 - 2) **BEARING LENGTH FOR STEEL SUPPORTS SHALL NOT BE LESS THAN 2 1/2 INCHES; FOR MASONRY AND CONCRETE NOT LESS THAN 4 INCHES.**
 - 3) **PARALLEL CHORD JOISTS INSTALLED TO A SLOPE GREATER THAN 1/2 INCH PER FOOT SHALL USE SPAN DEFINED BY THE LENGTH ALONG THE SLOPE.**



METAL PRODUCTS RESOURCES ASC. S.A.S.

STANDARD LRFD LOAD TABLE

OPEN WEB STEEL JOISTS, K-SERIES

Based on a 50 ksi Maximum Yield Strength
 Adopted by the Steel Joist Institute May 1, 2000
 Revised to November 10, 2003 – Effective March 01, 2005

The black figures in the following table give the TOTAL safe factored uniformly distributed load-carrying capacities, in pounds per linear foot, of LRFD K-Series Steel Joists. The weight of factored DEAD loads, including the joists, must be deducted to determine the factored LIVE load-carrying capacities of the joists. Sloped parallel-chord joists shall use span as defined by the length along the slope.

The figures shown in RED in this load table are the unfactored nominal LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the figures in RED by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

The approximate joist weights per linear foot shown in these tables do not include accessories.

The approximate moment of inertia of the joist, in inches⁴ is;

$$I_j = 26.767(W_{LL})(L^3)(10^{-6}), \text{ where } W_{LL} = \text{RED figure in the Load Table and } L = (\text{Span} - 0.33) \text{ in feet.}$$

For the proper handling of concentrated and/or varying loads, see Section 6.1 in the Code of Standard Practice for Steel Joists and Joist Girders.

Where the joist span exceeds the unshaded area of the Load Table, the row of bridging nearest the mid span shall be diagonal bridging with bolted connections at the chords and intersections.

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STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
 Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	8K1	10K1	12K1	12K3	12K5	14K1	14K3	14K4	14K6	16K2	16K3	16K4	16K5	16K6	16K7	16K9
Depth (in.)	8	10	12	12	12	14	14	14	14	16	16	16	16	16	16	16
Approx. Wt (lbs./ft.)	5.1	5.0	5.0	5.7	7.1	5.2	6.0	6.7	7.7	5.5	6.3	7.0	7.5	8.1	8.6	10.0
Span (ft.)																
8	825 550															
9	825 550															
10	825 480	825 550														
11	798 377	825 542														
12	666 288	825 455	825 550	825 550	825 550											
13	565 225	718 363	825 510	825 510	825 510											
14	486 179	618 289	750 425	825 463	825 463	825 550	825 550	825 550	825 550							
15	421 145	537 234	651 344	814 428	825 434	766 475	825 507	825 507	825 507							
16	369 119	469 192	570 282	714 351	825 396	672 390	825 467	825 467	825 467	825 550	825 550	825 550	825 550	825 550	825 550	825 550
17		415 159	504 234	630 291	825 366	592 324	742 404	825 443	825 443	768 488	825 526	825 526	825 526	825 526	825 526	825 526
18		369 134	448 197	561 245	760 317	528 272	661 339	795 397	825 408	684 409	762 456	825 490	825 490	825 490	825 490	825 490
19		331 113	402 167	502 207	681 269	472 230	592 287	712 336	825 383	612 347	682 386	820 452	825 455	825 455	825 455	825 455
20		298 97	361 142	453 177	613 230	426 197	534 246	642 287	787 347	552 297	615 330	739 386	825 426	825 426	825 426	825 426
21			327 123	409 153	555 198	385 170	483 212	582 248	712 299	499 255	556 285	670 333	754 373	822 405	825 406	825 406
22			298 106	373 132	505 172	351 147	439 184	529 215	648 259	454 222	505 247	609 289	687 323	747 351	825 385	825 385
23			271 93	340 116	462 150	321 128	402 160	483 188	592 226	415 194	462 216	556 252	627 282	682 307	760 339	825 363
24			249 81	312 101	423 132	294 113	367 141	442 165	543 199	381 170	424 189	510 221	576 248	627 269	697 298	825 346
25						270 100	339 124	408 145	501 175	351 150	390 167	469 195	529 219	576 238	642 263	771 311
26						249 88	313 110	376 129	462 156	324 133	360 148	433 173	489 194	532 211	592 233	711 276
27						231 79	289 98	349 115	427 139	300 119	334 132	402 155	453 173	493 188	549 208	658 246
28						214 70	270 88	324 103	397 124	279 106	310 118	373 138	421 155	459 168	510 186	612 220
29										259 95	289 106	348 124	391 139	427 151	475 167	570 198
30										241 86	270 96	324 112	366 126	399 137	444 151	532 178
31										226 78	252 87	304 101	342 114	373 124	415 137	498 161
32										213 71	237 79	285 92	321 103	349 112	388 124	466 147



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STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	18K3	18K4	18K5	18K6	18K7	18K9	18K10	20K3	20K4	20K5	20K6	20K7	20K9	20K10	22K4	22K5	22K6	22K7	22K9	22K10	22K11
Depth (in.)	18	18	18	18	18	18	18	20	20	20	20	20	20	20	22	22	22	22	22	22	22
Approx. Wt. (lbs./ft.)	6.6	7.2	7.7	8.5	9	10.2	11.7	6.7	7.6	8.2	8.9	9.3	10.8	12.2	8	8.8	9.2	9.7	11.3	12.6	13.8
Span (ft.)																					
18	825 550	825 550	825 550	825 550	825 550	825 550	825 550														
19	771 494	825 523	825 523	825 523	825 523	825 523	825 523														
20	694 423	825 490	825 490	825 490	825 490	825 490	825 490	775 517	825 550	825 550	825 550	825 550	825 550	825 550							
21	630 364	759 426	825 460	825 460	825 460	825 460	825 460	702 453	825 520	825 520	825 520	825 520	825 520	825 520							
22	573 316	690 370	777 414	825 438	825 438	825 438	825 438	639 393	771 461	825 490	825 490	825 490	825 490	825 490	825 548	825 548	825 548	825 548	825 548	825 548	825 548
23	523 276	630 323	709 362	774 393	825 418	825 418	825 418	583 344	703 402	793 451	825 468	825 468	825 468	825 468	777 491	825 518	825 518	825 518	825 518	825 518	825 518
24	480 242	577 284	651 318	709 345	789 382	825 396	825 396	535 302	645 353	727 396	792 430	825 448	825 448	825 448	712 431	804 483	825 495	825 495	825 495	825 495	825 495
25	441 214	532 250	600 281	652 305	727 337	825 377	825 377	493 266	594 312	669 350	729 380	811 421	825 426	825 426	657 381	739 427	805 464	825 474	825 474	825 474	825 474
26	408 190	492 222	553 249	603 271	672 299	807 354	825 361	456 236	549 277	618 310	673 337	750 373	825 405	825 405	606 338	682 379	744 411	825 454	825 454	825 454	825 454
27	378 169	454 198	513 222	558 241	622 267	747 315	825 347	421 211	508 247	573 277	624 301	694 333	825 389	825 389	561 301	633 337	688 367	768 406	825 432	825 432	825 432
28	351 151	423 177	477 199	519 216	577 239	694 282	822 331	391 189	472 221	532 248	579 269	645 298	775 353	825 375	522 270	588 302	640 328	712 364	825 413	825 413	825 413
29	327 136	394 159	444 179	483 194	538 215	646 254	766 298	364 170	439 199	495 223	540 242	601 268	723 317	825 359	486 242	547 272	597 295	664 327	798 387	825 399	825 399
30	304 123	367 144	414 161	451 175	502 194	603 229	715 269	340 153	411 179	462 201	504 218	561 242	675 286	799 336	453 219	511 245	556 266	619 295	745 349	825 385	825 385
31	285 111	343 130	387 146	421 158	469 175	564 207	669 243	318 138	384 162	433 182	471 198	525 219	631 259	748 304	424 198	478 222	520 241	580 267	697 316	825 369	825 369
32	267 101	322 118	363 132	396 144	441 159	529 188	627 221	298 126	360 147	406 165	442 179	492 199	592 235	702 276	397 180	448 201	489 219	544 242	654 287	775 337	823 355
33	252 92	303 108	342 121	372 131	414 145	498 171	589 201	280 114	339 134	381 150	415 163	463 181	556 214	660 251	373 164	421 183	459 199	511 221	615 261	729 307	798 334
34	237 84	285 98	321 110	349 120	390 132	468 156	555 184	264 105	318 122	358 137	391 149	435 165	523 195	621 229	352 149	397 167	432 182	481 202	579 239	687 280	774 314
35	223 77	268 90	303 101	330 110	367 121	441 143	523 168	249 96	300 112	339 126	369 137	411 151	493 179	585 210	331 137	373 153	408 167	454 185	546 219	648 257	741 292
36	211 70	253 82	286 92	312 101	348 111	417 132	495 154	235 88	283 103	319 115	348 125	388 139	466 164	553 193	313 126	354 141	385 153	429 169	516 201	612 236	700 269
37								222 81	268 95	303 106	330 115	367 128	441 151	523 178	297 116	334 130	364 141	406 156	487 185	579 217	663 247
38								211 74	255 87	286 98	312 106	348 118	418 139	496 164	280 107	316 119	345 130	384 144	462 170	549 200	628 228
39								199 69	241 81	271 90	297 98	330 109	397 129	471 151	267 98	300 110	327 120	364 133	438 157	520 185	595 211
40								190 64	229 75	258 84	282 91	313 101	376 119	447 140	253 91	285 102	310 111	346 123	417 146	495 171	565 195
41															241 85	271 95	295 103	330 114	396 135	471 159	538 181
42															229 79	259 88	282 96	313 106	378 126	448 148	513 168
43															219 73	247 82	268 89	300 99	360 117	427 138	489 157
44															208 68	235 76	256 83	286 92	343 109	408 128	466 146



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STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	24K4	24K5	24K6	24K7	24K8	24K9	24K10	24K12	26K5	26K6	26K7	26K8	26K9	26K10	26K12
Depth (in.)	24	24	24	24	24	24	24	24	26	26	26	26	26	26	26
Approx. Wt. (lbs./ft.)	8.4	9.3	9.7	10.1	11.5	12.0	13.1	16.0	9.8	10.6	10.9	12.1	12.2	13.8	16.6
Span (ft.)															
24	780 516	825 544	825 544	825 544	825 544	825 544	825 544	825 544							
25	718 456	810 511	825 520	825 520	825 520	825 520	825 520	825 520							
26	663 405	748 453	814 493	825 499	825 499	825 499	825 499	825 499	813 535	825 541	825 541	825 541	825 541	825 541	825 541
27	615 361	693 404	754 439	825 479	825 479	825 479	825 479	825 479	753 477	820 519	825 522	825 522	825 522	825 522	825 522
28	571 323	643 362	700 393	781 436	825 456	825 456	825 456	825 456	699 427	762 464	825 501	825 501	825 501	825 501	825 501
29	531 290	600 325	652 354	727 392	804 429	825 436	825 436	825 436	651 384	709 417	790 463	825 479	825 479	825 479	825 479
30	496 262	559 293	609 319	679 353	750 387	816 419	825 422	825 422	607 346	661 377	738 417	816 457	825 459	825 459	825 459
31	465 237	523 266	570 289	636 320	702 350	765 379	825 410	825 410	568 314	619 341	690 378	763 413	825 444	825 444	825 444
32	435 215	490 241	535 262	595 290	658 318	717 344	823 393	823 393	534 285	580 309	648 343	715 375	778 407	823 431	823 431
33	409 196	462 220	502 239	559 265	619 289	673 313	798 368	798 368	501 259	546 282	609 312	672 342	732 370	798 404	798 404
34	385 179	435 201	472 218	526 242	582 264	634 286	753 337	774 344	472 237	514 257	573 285	633 312	688 338	774 378	774 378
35	363 164	409 184	445 200	496 221	549 242	598 262	709 308	751 324	445 217	484 236	540 261	597 286	649 310	751 356	751 356
36	343 150	387 169	421 183	469 203	519 222	565 241	670 283	730 306	420 199	457 216	510 240	564 263	613 284	729 334	730 334
37	324 138	366 155	399 169	444 187	490 205	534 222	634 260	711 290	397 183	433 199	483 221	534 242	580 262	690 308	711 315
38	307 128	346 143	378 156	421 172	465 189	507 204	601 240	691 275	376 169	411 184	457 204	505 223	550 241	654 284	691 299
39	292 116	328 132	358 144	399 159	441 174	480 189	570 222	673 261	357 156	390 170	433 188	480 206	522 223	619 262	673 283
40	277 109	312 122	340 133	379 148	420 161	456 175	541 206	657 247	340 145	370 157	412 174	456 191	496 207	589 243	657 269
41	264 101	297 114	324 124	361 137	399 150	435 162	516 191	640 235	322 134	352 146	393 162	433 177	472 192	561 225	640 256
42	252 94	283 106	309 115	343 127	379 139	414 151	490 177	625 224	307 125	336 136	373 150	412 164	450 178	534 210	625 244
43	240 88	270 98	294 107	328 118	363 130	394 140	468 165	609 213	294 116	319 126	357 140	394 153	429 166	508 195	610 232
44	229 82	258 92	280 100	313 110	346 121	376 131	447 154	580 199	280 108	306 118	340 131	376 143	409 155	486 182	597 222
45	219 76	246 86	268 93	298 103	330 113	360 122	427 144	555 185	268 101	291 110	325 122	360 133	391 145	465 170	583 212
46	208 71	235 80	256 87	286 97	316 106	345 114	408 135	531 174	256 95	279 103	310 114	343 125	375 135	444 159	570 203
47	199 67	225 75	246 82	274 90	303 99	330 107	391 126	508 163	246 89	267 96	298 107	328 117	358 127	426 149	553 192
48	192 63	216 70	235 77	262 85	291 93	316 101	375 118	487 153	235 83	256 90	285 100	315 110	343 119	408 140	529 180
49									225 78	246 85	274 94	303 103	330 112	391 131	508 169
50									216 73	235 80	262 89	291 97	316 105	375 124	487 159
51									208 69	226 75	252 83	279 91	304 99	361 116	469 150
52									199 65	217 71	243 79	268 86	292 93	346 110	451 142



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STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	28K6	28K7	28K8	28K9	28K10	28K12	30K7	30K8	30K9	30K10	30K11	30K12
Depth (in.)	28	28	28	28	28	28	30	30	30	30	30	30
Approx. Wt. (lbs./ft.)	11.4	11.8	12.7	13.0	14.3	17.1	12.3	13.2	13.4	15.0	16.4	17.6
Span (ft.)												
↓												
28	822 541	825 543	825 543	825 543	825 543	825 543						
29	766 486	825 522	825 522	825 522	825 522	825 522						
30	715 439	796 486	825 500	825 500	825 500	825 500	825 543	825 543	825 543	825 543	825 543	825 543
31	669 397	745 440	825 480	825 480	825 480	825 480	801 508	825 520	825 520	825 520	825 520	825 520
32	627 361	699 400	772 438	823 463	823 463	823 463	751 461	823 500	823 500	823 500	823 500	823 500
33	589 329	657 364	726 399	790 432	798 435	798 435	706 420	780 460	798 468	798 468	798 468	798 468
34	555 300	618 330	684 364	744 395	774 410	774 410	664 384	735 420	774 441	774 441	774 441	774 441
35	523 275	583 305	645 333	702 361	751 389	751 389	627 351	693 384	751 415	751 415	751 415	751 415
36	495 252	550 280	609 306	663 332	730 366	730 366	592 323	654 353	712 383	730 392	730 392	730 392
37	468 232	522 257	576 282	627 305	711 344	711 344	559 297	619 325	673 352	711 374	711 374	711 374
38	444 214	493 237	546 260	594 282	691 325	691 325	531 274	586 300	639 325	691 353	691 353	691 353
39	420 198	469 219	519 240	564 260	670 306	673 308	504 253	556 277	606 300	673 333	673 333	673 333
40	399 183	445 203	492 222	535 241	636 284	657 291	478 234	529 256	576 278	657 315	657 315	657 315
41	379 170	424 189	468 206	510 224	606 263	640 277	454 217	502 238	547 258	640 300	640 300	640 300
42	361 158	403 175	445 192	486 208	576 245	625 264	433 202	480 221	522 240	619 282	625 284	625 284
43	345 147	385 163	426 179	463 194	550 228	610 252	414 188	457 206	498 223	591 263	610 270	610 270
44	330 137	367 152	406 167	442 181	525 212	597 240	394 176	436 192	475 208	564 245	597 258	597 258
45	315 128	351 142	388 156	423 169	501 198	583 229	376 164	417 179	454 195	538 229	583 246	583 246
46	301 120	336 133	372 146	405 158	480 186	570 219	361 153	399 168	435 182	529 214	570 236	570 236
47	288 112	321 125	355 136	387 148	459 174	558 210	345 144	382 157	415 171	493 201	558 226	558 226
48	276 105	309 117	340 128	370 139	441 163	547 201	331 135	366 148	399 160	472 188	543 215	547 216
49	265 99	295 110	327 120	355 130	423 153	535 193	318 127	351 139	382 150	454 177	520 202	535 207
50	255 93	283 103	313 113	342 123	405 144	525 185	304 119	337 130	367 141	436 166	499 190	525 199
51	244 88	273 97	301 106	328 115	390 136	507 175	292 112	324 123	352 133	418 157	480 179	514 192
52	235 83	262 92	289 100	315 109	375 128	487 165	282 106	312 116	339 126	402 148	462 169	504 184
53	226 78	252 87	279 95	304 103	360 121	469 156	271 100	300 109	327 119	387 140	444 159	495 177
54	217 74	243 82	268 89	292 97	348 114	451 147	261 94	288 103	313 112	373 132	427 150	486 170
55	210 70	234 77	259 85	282 92	334 108	435 139	252 89	277 98	303 106	360 125	412 142	468 161
56	202 66	226 73	249 80	271 87	322 102	420 132	243 84	268 92	292 100	346 118	397 135	451 153
57							234 80	259 88	282 95	334 112	384 128	435 145
58							226 76	250 83	271 90	322 106	370 121	420 137
59							219 72	241 79	262 86	312 101	358 115	406 130
60							211 69	234 75	253 81	301 96	346 109	393 124



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STANDARD ASD LOAD TABLE

OPEN WEB STEEL JOISTS, K-SERIES

Based on a 50 ksi Maximum Yield Strength
 Adopted by the Steel Joist Institute November 4, 1985
 Revised to November 10, 2003 - Effective March 01, 2005

The black figures in the following table give the TOTAL safe uniformly distributed load-carrying capacities, in pounds per linear foot, of **ASD K-Series** Steel Joists. The weight of DEAD loads, including the joists, must be deducted to determine the LIVE load-carrying capacities of the joists. Sloped parallel-chord joists shall use span as defined by the length along the slope.

The figures shown in **RED** in this load table are the nominal LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the figures in **RED** by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

The approximate joist weights per linear foot shown in these tables do not include accessories.

The approximate moment of inertia of the joist, in inches⁴ is;

$$I_j = 26.767(W_{LL})(L^3)(10^{-6}), \text{ where } W_{LL} = \text{RED figure in the Load Table and } L = (\text{Span} - 0.33) \text{ in feet.}$$

For the proper handling of concentrated and/or varying loads, see Section 6.1 in the Code of Standard Practice for Steel Joists and Joist Girders.

Where the joist span exceeds the unshaded area of the Load Table, the row of bridging nearest the mid span shall be diagonal bridging with bolted connections at the chords and intersections.

ASD

STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
 Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	8K1	10K1	12K1	12K3	12K5	14K1	14K3	14K4	14K6	16K2	16K3	16K4	16K5	16K6	16K7	16K9
Depth (in.)	8	10	12	12	12	14	14	14	14	16	16	16	16	16	16	16
Approx. Wt (lbs./ft.)	5.1	5.0	5.0	5.7	7.1	5.2	6.0	6.7	7.7	5.5	6.3	7.0	7.5	8.1	8.6	10.0
Span (ft.)																
8	550															
9	550															
10	550	550														
11	532	550														
12	444	550	550	550	550											
13	377	479	550	550	550											
14	324	412	500	550	550	550	550	550	550							
15	281	358	434	543	550	511	550	550	550							
16	246	313	380	476	550	448	550	550	550	550	550	550	550	550	550	550
17		277	336	420	550	395	495	550	550	512	550	550	550	550	550	550
18		246	299	374	507	352	441	530	550	488	526	550	550	550	550	550
19		221	268	335	454	315	395	475	550	456	508	550	550	550	550	550
20		199	241	302	409	284	356	428	525	408	455	547	550	550	550	550
21			218	273	370	257	322	388	475	333	371	447	503	548	550	550
22			199	249	337	234	293	353	432	303	337	406	458	498	550	550
23			181	227	308	214	268	322	395	277	308	371	418	455	507	550
24			166	208	282	196	245	295	362	254	283	340	384	418	465	550
25						180	226	272	334	234	260	313	353	384	428	514
26						166	209	251	308	216	240	289	326	355	395	474
27						154	193	233	285	200	223	268	302	329	366	439
28						143	180	216	265	186	207	249	281	306	340	408
29						70	88	103	124	106	118	138	155	168	186	220
30										173	193	232	261	285	317	380
31										95	106	124	139	151	167	198
32										161	180	216	244	266	296	355
										86	96	112	126	137	151	178
										151	168	203	228	249	277	332
										78	87	101	114	124	137	161
										142	158	190	214	233	259	311
										71	79	92	103	112	124	147



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STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	18K3	18K4	18K5	18K6	18K7	18K9	18K10	20K3	20K4	20K5	20K6	20K7	20K9	20K10	22K4	22K5	22K6	22K7	22K9	22K10	22K11
Depth (in.)	18	18	18	18	18	18	18	20	20	20	20	20	20	20	22	22	22	22	22	22	22
Approx. Wt. (lbs./ft.)	6.6	7.2	7.7	8.5	9	10.2	11.7	6.7	7.6	8.2	8.9	9.3	10.8	12.2	8	8.8	9.2	9.7	11.3	12.6	13.8
Span (ft.)																					
18	550	550	550	550	550	550	550														
19	514	550	550	550	550	550	550														
20	463	550	550	550	550	550	550	517	550	550	550	550	550	550							
21	420	506	550	550	550	550	550	468	550	550	550	550	550	550							
22	382	460	518	550	550	550	550	426	514	550	550	550	550	550	550	550	550	550	550	550	550
23	349	420	473	516	550	550	550	389	469	529	550	550	550	550	518	550	550	550	550	550	550
24	320	385	434	473	526	550	550	357	430	485	528	550	550	550	475	536	550	550	550	550	550
25	294	355	400	435	485	550	550	329	396	446	486	541	550	550	438	493	537	550	550	550	550
26	272	328	369	402	448	538	550	304	366	412	449	500	550	550	404	455	496	550	550	550	550
27	252	303	342	372	415	498	550	281	339	382	416	463	550	550	374	422	459	512	550	550	550
28	234	282	318	346	385	463	548	261	315	355	386	430	517	550	348	392	427	475	550	550	550
29	218	263	296	322	359	431	511	243	293	330	360	401	482	550	324	365	398	443	532	550	550
30	203	245	276	301	335	402	477	227	274	308	336	374	450	533	302	341	371	413	497	550	550
31	190	229	258	281	313	376	446	212	256	289	314	350	421	499	283	319	347	387	465	550	550
32	178	215	242	264	294	353	418	199	240	271	295	328	395	468	265	299	326	363	436	517	549
33	168	202	228	248	276	332	393	187	226	254	277	309	371	440	249	281	306	341	410	486	532
34	158	190	214	233	260	312	370	176	212	239	261	290	349	414	235	265	288	321	386	458	516
35	149	179	202	220	245	294	349	166	200	226	246	274	329	390	221	249	272	303	364	432	494
36	141	169	191	208	232	278	330	157	189	213	232	259	311	369	209	236	257	286	344	408	467
37	131	157	177	192	214	256	304	148	179	202	220	245	294	349	198	223	243	271	325	386	442
38	123	144	161	175	194	229	269	138	162	182	198	219	259	304	198	222	241	267	316	369	424
39	116	134	149	161	179	207	243	131	153	171	187	207	243	283	191	214	235	261	307	357	407
40	110	126	140	151	166	188	218	125	145	161	176	195	229	269	184	204	224	249	293	337	382
41	104	118	130	140	153	171	201	118	134	150	163	181	214	251	174	191	211	230	271	311	351
42	98	110	120	129	140	156	184	112	126	140	153	169	201	235	168	184	201	219	257	297	337
43	92	102	110	118	127	141	168	106	118	130	142	156	186	218	161	176	192	209	245	285	325
44	86	94	101	108	115	126	151	100	111	121	131	144	171	201	154	168	183	199	233	273	313
	80	87	92	98	104	113	134	94	104	113	121	133	159	188	147	160	174	189	221	261	301
	74	80	84	89	94	101	119	88	97	105	112	123	147	174	139	151	165	179	209	247	285
	68	73	76	80	84	90	104	81	89	95	101	109	131	154	125	136	148	160	188	224	260
	62	66	69	72	75	81	93	75	82	87	92	99	118	139	116	125	135	144	170	202	234
	56	59	61	63	65	69	79	68	74	78	82	88	104	122	109	117	125	132	156	184	212
	50	52	54	56	57	60	68	61	65	68	71	75	88	103	98	105	111	117	138	163	188
	44	45	46	47	48	50	56	53	56	58	60	63	74	86	88	93	98	103	121	143	165
	38	38	39	40	40	41	46	45	46	47	48	50	58	67	79	81	84	88	103	121	140
	32	32	32	32	32	32	36	37	37	37	38	39	45	52	63	64	66	69	81	96	111
	26	26	26	26	26	26	29	29	29	29	30	31	35	40	49	50	51	53	62	74	86
	20	20	20	20	20	20	23	23	23	23	23	24	27	31	38	39	40	41	48	57	67
	14	14	14	14	14	14	16	16	16	16	16	17	19	22	27	28	28	29	34	40	47
	8	8	8	8	8	8	9	9	9	9	9	10	11	13	16	16	16	16	19	22	26
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2



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STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	24K4	24K5	24K6	24K7	24K8	24K9	24K10	24K12	26K5	26K6	26K7	26K8	26K9	26K10	26K12
Depth (In.)	24	24	24	24	24	24	24	24	26	26	26	26	26	26	26
Approx. Wt. (lbs./ft.)	8.4	9.3	9.7	10.1	11.5	12.0	13.1	16.0	9.8	10.6	10.9	12.1	12.2	13.8	16.6
Span (ft.)															
↓															
24	520 516	550 544	550 544	550 544	550 544	550 544	550 544	550 544							
25	479 456	540 511	550 520	550 520	550 520	550 520	550 520	550 520							
26	442 405	499 453	543 493	550 499	550 499	550 499	550 499	550 499	542 535	550 541	550 541	550 541	550 541	550 541	550 541
27	410 361	462 404	503 439	550 479	550 479	550 479	550 479	550 479	502 477	547 519	550 522	550 522	550 522	550 522	550 522
28	381 323	429 362	467 393	521 436	550 456	550 456	550 456	550 456	466 427	508 464	550 501	550 501	550 501	550 501	550 501
29	354 290	400 325	435 354	485 392	536 429	550 436	550 436	550 436	434 384	473 417	527 463	550 479	550 479	550 479	550 479
30	331 262	373 293	406 319	453 353	500 387	544 419	550 422	550 422	405 346	441 377	492 417	544 457	550 459	550 459	550 459
31	310 237	349 266	380 289	424 320	468 350	510 379	550 410	550 410	379 314	413 341	460 378	509 413	550 444	550 444	550 444
32	290 215	327 241	357 262	397 290	439 318	478 344	549 393	549 393	356 285	387 309	432 343	477 375	519 407	549 431	549 431
33	273 196	308 220	335 239	373 265	413 289	449 313	532 368	532 368	334 259	364 282	406 312	448 342	488 370	532 404	532 404
34	257 179	290 201	315 218	351 242	388 264	423 286	502 337	516 344	315 237	343 257	382 285	422 312	459 336	516 378	516 378
35	242 164	273 184	297 200	331 221	366 242	399 262	473 308	501 324	297 217	323 236	360 261	398 286	433 310	501 356	501 356
36	229 150	258 169	281 183	313 203	346 222	377 241	447 283	487 306	280 199	305 216	340 240	376 263	409 284	486 334	487 334
37	216 138	244 155	266 169	296 187	327 205	356 222	423 260	474 290	265 183	289 199	322 221	356 242	387 262	460 308	474 315
38	205 128	231 143	252 156	281 172	310 189	338 204	401 240	461 275	251 169	274 184	305 204	337 223	367 241	436 284	461 299
39	195 118	219 132	239 144	266 159	294 174	320 189	380 222	449 261	238 156	260 170	289 188	320 206	348 223	413 262	449 283
40	185 109	208 122	227 133	253 148	280 161	304 175	361 206	438 247	227 145	247 157	275 174	304 191	331 207	393 243	438 269
41	176 101	198 114	216 124	241 137	266 150	290 162	344 191	427 235	215 134	235 146	262 162	289 177	315 192	374 225	427 256
42	168 94	189 106	206 115	229 127	253 139	276 151	327 177	417 224	205 125	224 136	249 150	275 164	300 178	356 210	417 244
43	160 88	180 98	196 107	219 118	242 130	263 140	312 165	406 213	196 116	213 126	238 140	263 153	286 166	339 195	407 232
44	153 82	172 92	187 100	209 110	231 121	251 131	298 154	387 199	187 108	204 118	227 131	251 143	273 155	324 182	398 222
45	146 76	164 86	179 93	199 103	220 113	240 122	285 144	370 185	179 101	194 110	217 122	240 133	261 145	310 170	389 212
46	139 67	157 75	171 82	191 90	211 99	230 107	272 126	354 163	171 89	186 96	207 107	229 117	250 127	296 149	380 192
47	133 67	150 75	164 82	183 90	202 99	220 107	261 126	339 163	164 89	178 96	199 107	219 117	239 127	284 149	369 192
48	128 63	144 70	157 77	175 85	194 93	211 101	250 118	325 153	157 83	171 90	190 100	210 110	229 119	272 140	353 180
49									150 78	164 85	183 94	202 103	220 112	261 131	339 169
50									144 73	157 80	175 89	194 97	211 105	250 124	325 159
51									139 69	151 75	168 83	186 91	203 99	241 116	313 150
52									133 65	145 71	162 79	179 86	195 93	231 110	301 142



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STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	28K6	28K7	28K8	28K9	28K10	28K12	30K7	30K8	30K9	30K10	30K11	30K12
Depth (in.)	28	28	28	28	28	28	30	30	30	30	30	30
Approx. Wt. (lbs./ft.)	11.4	11.8	12.7	13.0	14.3	17.1	12.3	13.2	13.4	15.0	16.4	17.6
Span (ft.)												
28	548 541	550 543	550 543	550 543	550 543	550 543						
29	511 486	550 522	550 522	550 522	550 522	550 522						
30	477 439	531 486	550 500	550 500	550 500	550 500	550 543	550 543	550 543	550 543	550 543	550 543
31	446 397	497 440	550 480	550 480	550 480	550 480	534 508	550 520	550 520	550 520	550 520	550 520
32	418 381	466 400	515 438	549 463	549 463	549 463	501 461	549 500	549 500	549 500	549 500	549 500
33	393 329	438 364	484 399	527 432	532 435	532 435	471 420	520 460	532 468	532 468	532 468	532 468
34	370 300	412 333	456 364	496 395	516 410	516 410	443 384	490 420	516 441	516 441	516 441	516 441
35	349 275	389 305	430 333	468 361	501 389	501 389	418 351	462 384	501 415	501 415	501 415	501 415
36	330 252	367 280	406 306	442 332	487 366	487 366	395 323	436 353	475 383	487 392	487 392	487 392
37	312 232	348 257	384 282	418 305	474 344	474 344	373 297	413 325	449 352	474 374	474 374	474 374
38	296 214	329 237	364 260	396 282	461 325	461 325	354 274	391 300	426 325	461 353	461 353	461 353
39	280 198	313 219	346 240	376 260	447 306	449 308	336 253	371 277	404 300	449 333	449 333	449 333
40	266 183	297 203	328 222	357 241	424 284	438 291	319 234	353 256	384 278	438 315	438 315	438 315
41	253 170	283 189	312 206	340 224	404 263	427 277	303 217	335 238	365 258	427 300	427 300	427 300
42	241 158	269 175	297 192	324 208	384 245	417 264	289 202	320 221	348 240	413 282	417 284	417 284
43	230 147	257 163	284 179	309 194	367 228	407 252	276 188	305 206	332 223	394 263	407 270	407 270
44	220 137	245 152	271 167	295 181	350 212	398 240	263 176	291 192	317 208	376 245	398 258	398 258
45	210 128	234 142	259 156	282 169	334 198	389 229	251 164	278 179	303 195	359 229	389 246	389 246
46	201 120	224 133	248 146	270 158	320 186	380 219	241 153	266 168	290 182	344 214	380 236	380 236
47	192 112	214 125	237 136	258 148	306 174	372 210	230 144	255 157	277 171	329 201	372 226	372 226
48	184 105	206 117	227 128	247 139	294 163	365 201	221 135	244 148	266 160	315 188	362 215	365 216
49	177 99	197 110	218 120	237 130	282 153	357 193	212 127	234 139	255 150	303 177	347 202	357 207
50	170 93	189 103	209 113	228 123	270 144	350 185	203 119	225 130	245 141	291 166	333 190	350 199
51	163 88	182 97	201 106	219 115	260 136	338 175	195 112	216 123	235 133	279 157	320 179	343 192
52	157 83	175 92	193 100	210 109	250 128	325 165	188 106	208 116	226 126	268 148	308 169	336 184
53	151 78	168 87	186 95	203 103	240 121	313 156	181 100	200 109	218 119	258 140	296 159	330 177
54	145 74	162 82	179 89	195 97	232 114	301 147	174 94	192 103	209 112	249 132	285 150	324 170
55	140 70	156 77	173 85	188 92	223 108	290 139	168 89	185 98	202 106	240 125	275 142	312 161
56	135 66	151 73	166 80	181 87	215 102	280 132	162 84	179 92	195 100	231 118	265 135	301 153
57							156 80	173 88	188 95	223 112	256 128	290 145
58							151 76	167 83	181 90	215 106	247 121	280 137
59							146 72	161 79	175 86	208 101	239 115	271 130
60							141 69	156 75	169 81	201 96	231 109	262 124



OPEN WEB STEEL JOISTS, K-SERIES

KCS JOISTS

The KCS Joists:

1. Provide a versatile **K-Series** Joist that can be easily specified to support uniform loads plus concentrated and non-uniform loads.
2. Eliminate many repetitive load diagrams required on contract documents and allow some flexibility of load locations.

KCS joists are designed in accordance with the Standard Specification for **K-Series** Joists.

Standard **K-Series** Joists are designed for simple span uniform loading which results in a parabolic moment diagram for chord forces and a linearly sloped shear diagram for web forces. When non-uniform and/or concentrated loads are encountered the shear and moment diagrams required may be shaped quite differently and may not be covered by the shear and moment design envelopes of a standard **K-Series** Joist.

KCS Joist chords are designed for a flat positive moment envelope. The moment capacity is constant at all interior panels. 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 shear. A uniform load of 825 plf (12030 N/m) LRFD or 550 plf (8020 N/m) ASD is used to check end panel bending.

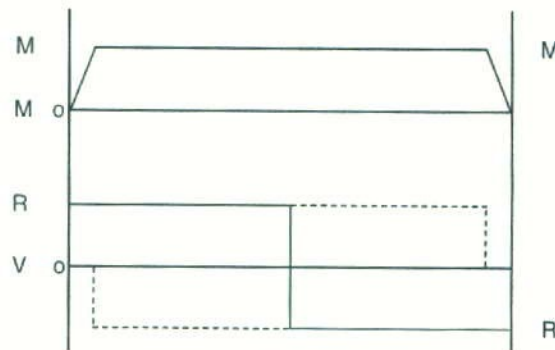
The web forces are determined based on a flat shear envelope. All webs are designed for a vertical shear equal to the specified shear capacity. Furthermore, all webs (except the first tension web which remains in tension under all simple span gravity loads) will be designed for 100% stress reversal.

Both LRFD and ASD KCS Joist load tables list the shear and moment capacity of each joist. The selection of a KCS Joist requires the specifying professional to calculate the maximum moment and shear imposed and select the appropriate KCS Joist. If a KCS Joist cannot be selected from the load table or if any uniform load exceeds 825 plf (12030 N/m) LRFD or 550 plf (8020 N/m) ASD or if the maximum concentrated load exceeds the shear capacity of the joist, use double KCS Joists or select an **LH-Series** Joist. For the **LH-Series** Joist, supply a load diagram. When net uplift loads, end moments or other external horizontal loads are a design consideration; these loads shall be provided to the joist manufacturer by the specifying professional.

As is the case with standard **K-**, **LH-** and **DLH-Series** Joists, chord bending due to concentrated loads must be addressed. In the case of concentrated loads, the specifying professional shall handle them in one of two ways: 1) specify on the structural drawings that an extra web must be field applied at all concentrated loads not occurring at joist panel points, or 2) provide exact locations of all concentrated loads for which the joist manufacturer shall provide necessary reinforcement.

Please reference SJI Technical Digest #9 "Handling and Erection of Steel Joists and Joist Girders" for further information.

NOTE: In the following examples joist selection is based on minimum depth and minimum weight (plf, kg/m). Other selections may be more suitable for specific job conditions.

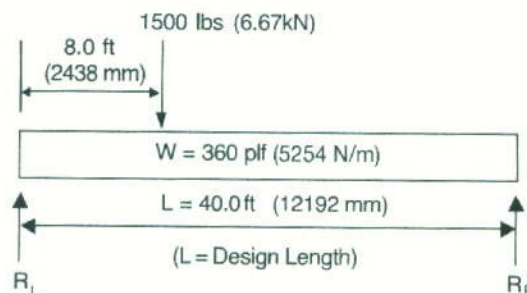


KCS JOIST
SHEAR AND MOMENT ENVELOPES

LRFD EXAMPLES

EXAMPLE 1

LRFD FACTORED LOADS



$$M = 938 \text{ in.-kip (105.9 kN-m)}$$

$$R_L = 8400 \text{ lbs (37.37 kN)}, R_R = 7500 \text{ lbs (33.36 kN)}$$

Select a 22KCS3, $M = 987 \text{ in.-kip (111.5 kN-m)}$

$$R = 9900 \text{ lbs (44.0 kN)}$$

Bridging section no. 9 for $L = 40 \text{ ft. (12192 mm)}$

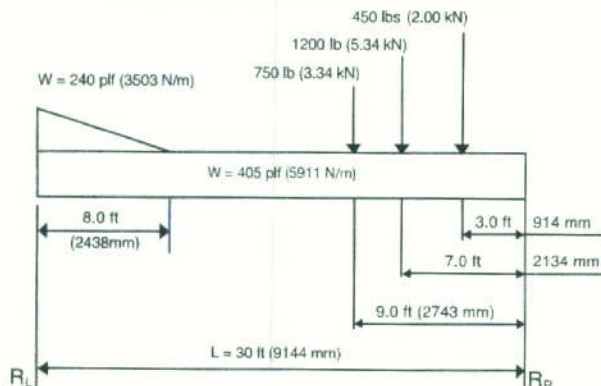
Use 22K9 to determine bridging and stability requirements.

Since a standard KCS Joist can be selected from the load table a load diagram is not required.



EXAMPLE 2

LRFD FACTORED LOADS



$$M = 664 \text{ in.-kip (75.03 kN-m)}$$

$$R_L = 7500 \text{ lbs (33.36 kN)}, R_R = 8010 \text{ lbs (35.63 kN)}$$

Select a 22KCS2, $M = 732 \text{ in.-kip (82.64 kN-m)}$

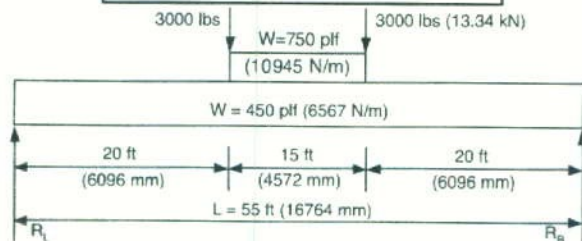
$$R = 8850 \text{ lbs (39.3 kN)}$$

Bridging section no. 6 for $L = 30 \text{ ft. (9144 mm)}$

Use 22K6 to determine bridging and stability requirements. Since the maximum *factored* 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.

EXAMPLE 3

LRFD FACTORED LOADS



$$M = 4365 \text{ in.-kip (493.2 kN-m)}$$

$$R_L = R_R = 21000 \text{ lbs (93.41 kN)}$$

EXCEEDS CAPACITY OF 30KCS5 (MAXIMUM KCS JOIST AND EXCEEDS MAXIMUM *FACTORED* UNIFORM LOAD OF 825 plf (12040 N/m).

OPTION A: Use double joists each having a minimum moment capacity $M = 2183 \text{ in.-kip (246.65 kN-m)}$ and shear capacity $R = 10500 \text{ lbs (46.71 kN)}$ and a uniform load of 600 plf (8756 N/m).

Select two 28KCS5, $M = 2556 \text{ in.-kip (288.7 kN-m)}$, $R = 13800 \text{ lbs (61.3 kN)}$.

Bridging section no. 12 for $L = 55 \text{ ft. (16764 mm)}$ Use 28K12 to determine bridging and stability requirements.

OPTION B: Select an LH-Series Joist. Calculate an equivalent uniform load based on the maximum moment or shear:

$$W_M = \frac{8M}{L^2} = 962 \text{ plf (14.04 kN/m)}$$

$$W_V = \frac{2R}{L} = 764 \text{ plf (11.14 kN/m)}$$

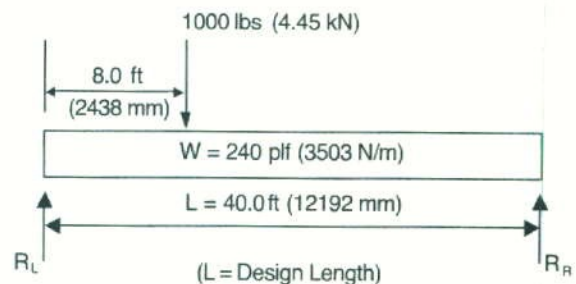
Use 962 plf (14.04 kN/m)

From the LH-Series LRFD Load Table select a 32LH13, $W = 1035 \text{ plf (15.10 kN/m)}$ for a 55 ft. (16764 mm) clear span. Specify a 32LH13SP and present a load diagram on the structural drawings with the following note:

JOIST MANUFACTURER SHALL DESIGN FOR THE LOADING SHOWN IN THE LOAD DIAGRAM.

ASD EXAMPLES

EXAMPLE 1



$$M = 625 \text{ in.-kip (70.6 kN-m)}$$

$$R_L = 5600 \text{ lbs (24.9 kN)}, R_R = 5000 \text{ lbs (22.2 kN)}$$

Select a 22KCS3, $M = 658 \text{ in.-kip (74.3 kN-m)}$

$$R = 6600 \text{ lbs (29.3 kN)}$$

Bridging section no. 9 for $L = 40 \text{ ft. (12192 mm)}$

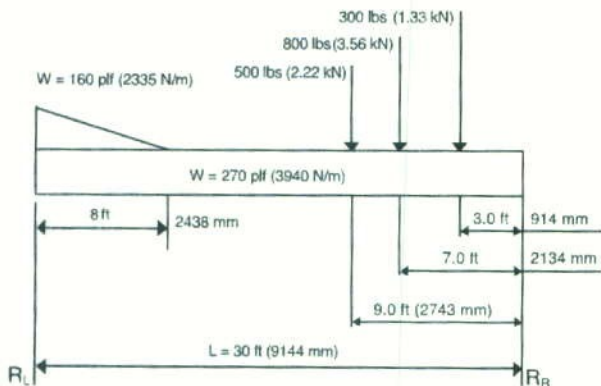
Use 22K9 to determine bridging and stability requirements.

Since a standard KCS Joist can be selected from the load table a load diagram is not required.



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EXAMPLE 2



$$M = 443 \text{ in.-kip (50.1 kN-m)}$$

$$R_L = 5000 \text{ lbs (22.24 kN)}, R_R = 5340 \text{ lbs (23.75 kN)}$$

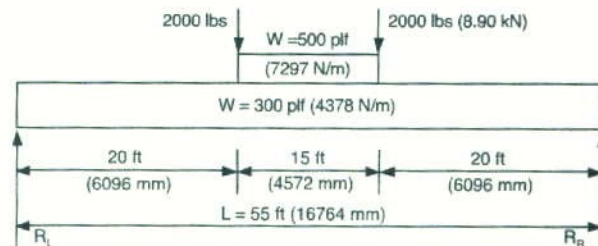
Select a 22KCS2, $M = 488 \text{ in.-kip (55.1 kN-m)}$

$$R = 5900 \text{ lbs (26.2 kN)}$$

Bridging section no. 6 for $L = 30 \text{ ft. (9144 mm)}$

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.

EXAMPLE 3



$$M = 2910 \text{ in.-kip (328.8 kN-m)}$$

$$R_L = R_R = 14000 \text{ lbs (62.28 kN)}$$

EXCEEDS CAPACITY OF 30KCS5 (MAXIMUM KCS JOIST) AND EXCEEDS MAXIMUM UNIFORM LOAD OF 550 plf (8027 N/m).

OPTION A: Use double joists each having a minimum moment capacity $M = 1455 \text{ in.-kip (164.4 kN-m)}$ and shear capacity $R = 7000 \text{ lbs (31.14 kN)}$ and a uniform load of 400 plf (5838 N/m).

Select two 28KCS5, $M = 1704 \text{ in.-kip (192.5 kN-m)}$, $R = 9200 \text{ lbs (40.9 kN)}$

Bridging section no. 12 for $L = 55 \text{ ft. (16764 mm)}$ Use 28K12 to determine bridging and stability requirements.

OPTION B: Select an LH-Series Joist. Calculate an equivalent uniform load based on the maximum moment or shear:

$$W_M = \frac{8M}{L^2} = 641 \text{ plf (9.35 kN/m)}$$

$$W_V = \frac{2R}{L} = 509 \text{ plf (7.43 kN/m)}$$

Use 641 plf (9.35 kN/m)

From the LH-Series ASD Load Table select a 32LH13, $W = 690 \text{ plf (10.06 kN/m)}$ for a 55 ft. (16764 mm) clear span. Specify a 32LH13SP and present a load diagram on the structural drawings with the following note:

JOIST MANUFACTURER SHALL DESIGN FOR THE LOADING SHOWN IN THE LOAD DIAGRAM.



LRFD

STANDARD LOAD TABLE FOR KCS OPEN WEB STEEL JOISTS

Based on a 50 ksi Maximum Yield Strength

JOIST DESIGNATION	DEPTH (inches)	MOMENT CAPACITY (inch-kips)	SHEAR CAPACITY* (lbs)	APPROX. WEIGHT** (lbs/ft)	GROSS MOMENT OF INERTIA (in. ⁴)	BRIDGING TABLE SECTION NUMBER
10KCS1	10	258	3000	6.0	29	1
10KCS2	10	337	3750	7.5	37	1
10KCS3	10	444	4500	10.0	47	1
12KCS1	12	313	3600	6.0	43	3
12KCS2	12	411	4500	8.0	55	5
12KCS3	12	543	5250	10.0	71	5
14KCS1	14	370	4350	6.5	59	4
14KCS2	14	486	5100	8.0	77	6
14KCS3	14	642	5850	10.0	99	6
16KCS2	16	523	6000	8.5	99	6
16KCS3	16	705	7200	10.5	128	9
16KCS4	16	1080	7950	14.5	192	9
16KCS5	16	1401	8700	18.0	245	9
18KCS2	18	592	7050	9.0	127	6
18KCS3	18	798	7800	11.0	164	9
18KCS4	18	1225	8550	15.0	247	10
18KCS5	18	1593	9300	18.5	316	10
20KCS2	20	663	7800	9.5	159	6
20KCS3	20	892	9000	11.5	205	9
20KCS4	20	1371	11850	16.5	308	10
20KCS5	20	1786	12600	20.0	396	10
22KCS2	22	732	8850	10.0	194	6
22KCS3	22	987	9900	12.5	251	9
22KCS4	22	1518	11850	16.5	377	11
22KCS5	22	1978	12900	20.5	485	11
24KCS2	24	801	9450	10.0	232	6
24KCS3	24	1080	10800	12.5	301	9
24KCS4	24	1662	12600	16.5	453	12
24KCS5	24	2172	13350	20.5	584	12
26KCS2	26	870	9900	10.0	274	6
26KCS3	26	1174	11700	12.5	355	9
26KCS4	26	1809	12750	16.5	536	12
26KCS5	26	2364	13800	20.5	691	12
28KCS2	28	939	10350	10.5	320	6
28KCS3	28	1269	12000	12.5	414	9
28KCS4	28	1954	12750	16.5	626	12
28KCS5	28	2556	13800	20.5	808	12
30KCS3	30	1362	12000	13.0	478	9
30KCS4	30	2100	12750	16.5	722	12
30KCS5	30	2749	13800	21.0	934	12

*MAXIMUM UNIFORMLY DISTRIBUTED LOAD CAPACITY IS 825 PLF AND SINGLE CONCENTRATED LOAD CANNOT EXCEED SHEAR CAPACITY

**DOES NOT INCLUDE ACCESSORIES



(85)

ASD

STANDARD LOAD TABLE FOR KCS OPEN WEB STEEL JOISTS
Based on a 50 ksi Maximum Yield Strength

JOIST DESIGNATION	DEPTH (inches)	MOMENT CAPACITY* (inch-kips)	SHEAR CAPACITY* (lbs)	APPROX. WEIGHT** (lbs/ft)	GROSS MOMENT OF INERTIA (in. ⁴)	BRIDGING TABLE SECTION NUMBER
10KCS1	10	172	2000	6.0	29	1
10KCS2	10	225	2500	7.5	37	1
10KCS3	10	296	3000	10.0	47	1
12KCS1	12	209	2400	6.0	43	3
12KCS2	12	274	3000	8.0	55	5
12KCS3	12	362	3500	10.0	71	5
14KCS1	14	247	2900	6.5	59	4
14KCS2	14	324	3400	8.0	77	6
14KCS3	14	428	3900	10.0	99	6
16KCS2	16	349	4000	8.5	99	6
16KCS3	16	470	4800	10.5	128	9
16KCS4	16	720	5300	14.5	192	9
16KCS5	16	934	5800	18.0	245	9
18KCS2	18	395	4700	9.0	127	6
18KCS3	18	532	5200	11.0	164	9
18KCS4	18	817	5700	15.0	247	10
18KCS5	18	1062	6200	18.5	316	10
20KCS2	20	442	5200	9.5	159	6
20KCS3	20	595	6000	11.5	205	9
20KCS4	20	914	7900	16.5	308	10
20KCS5	20	1191	8400	20.0	396	10
22KCS2	22	488	5900	10.0	194	6
22KCS3	22	658	6600	12.5	251	9
22KCS4	22	1012	7900	16.5	377	11
22KCS5	22	1319	8600	20.5	485	11
24KCS2	24	534	6300	10.0	232	6
24KCS3	24	720	7200	12.5	301	9
24KCS4	24	1108	8400	16.5	453	12
24KCS5	24	1448	8900	20.5	584	12
26KCS2	26	580	6600	10.0	274	6
26KCS3	26	783	7800	12.5	355	9
26KCS4	26	1206	8500	16.5	536	12
26KCS5	26	1576	9200	20.5	691	12
28KCS2	28	626	6900	10.5	320	6
28KCS3	28	846	8000	12.5	414	9
28KCS4	28	1303	8500	16.5	626	12
28KCS5	28	1704	9200	20.5	808	12
30KCS3	30	908	8000	13.0	478	9
30KCS4	30	1400	8500	16.5	722	12
30KCS5	30	1833	9200	21.0	934	12

*MAXIMUM UNIFORMLY DISTRIBUTED LOAD CAPACITY IS 550 PLF AND SINGLE CONCENTRATED LOAD CANNOT EXCEED SHEAR CAPACITY

**DOES NOT INCLUDE ACCESSORIES



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NOTES



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ACCESSORIES AND DETAILS

JOIST SUBSTITUTES K SERIES

Joist substitutes are 2.5 inch (64 mm) deep sections intended for use in very short spans (less than 8 feet (2.4 m) where Open Web Steel Joists are impractical. They are commonly specified to span over hallways and short spans in skewed bays.

Joist substitutes are fabricated from material conforming to Steel Joist Institute Specifications. Full lateral support to the compressive flange is provided by attachments to the deck. Caution must be exercised during erection since joist substi-

tutes exhibit some degree of instability. After erection and before loads of any description are placed on the joist substitutes, the ends must be attached to the supports per SJI K-Series specifications and the deck installed and attached to the top flange.

Tables below list uniform loads based on LRFD and ASD methods of design and listed in U.S. Customary units:

LRFD

2.5 Inch K-Series Joist Substitutes			
Based on a Maximum Yield Strength of 50 ksi			
Designation	2.5K1	2.5K2	2.5K3
Span (ft-in)	Pounds per Linear Foot		
4'-0"	825	825	825
5'-0"	825	825	825
	338	465	
6'-0"	561	779	825
	189	260	354
7'-0"	405	563	810
	116	160	218
8'-0"	306	426	612
	76	105	143
9'-0"	—	333	480
	—	73	99
10'-0"	—	267	386
	—	52	71

ASD

2.5 Inch K-Series Joist Substitutes			
Based on a Maximum Yield Strength of 50 ksi			
Designation	2.5K1	2.5K2	2.5K3
Span (ft-in)	Pounds per Linear Foot		
4'-0"	550	550	550
5'-0"	550	550	550
	338	465	
6'-0"	374	519	550
	189	260	354
7'-0"	270	375	540
	116	160	218
8'-0"	204	284	408
	76	105	143
9'-0"	—	222	320
	—	73	99
10'-0"	—	178	257
	—	52	71

The figures shown in red are the uniform live loads which produce an approximate deflection of 1/360 of the span. Live loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the figures in red by 1.5. In no case shall the total load capacity of the joist substitute be exceeded.

ACCESSORIES AND DETAILS

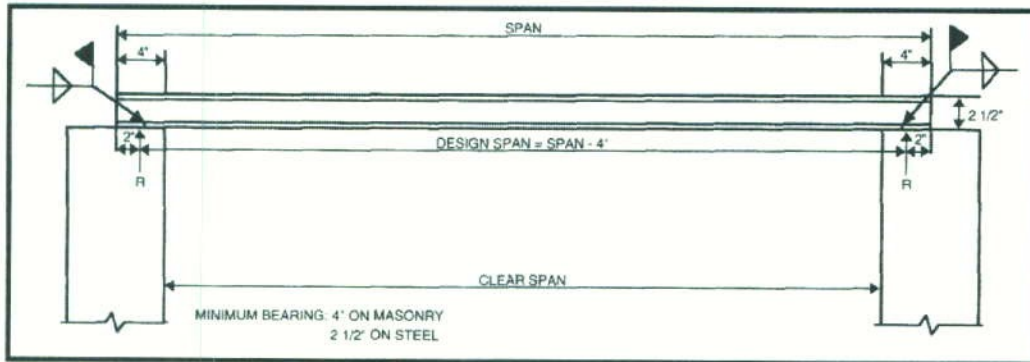


FABRICATION

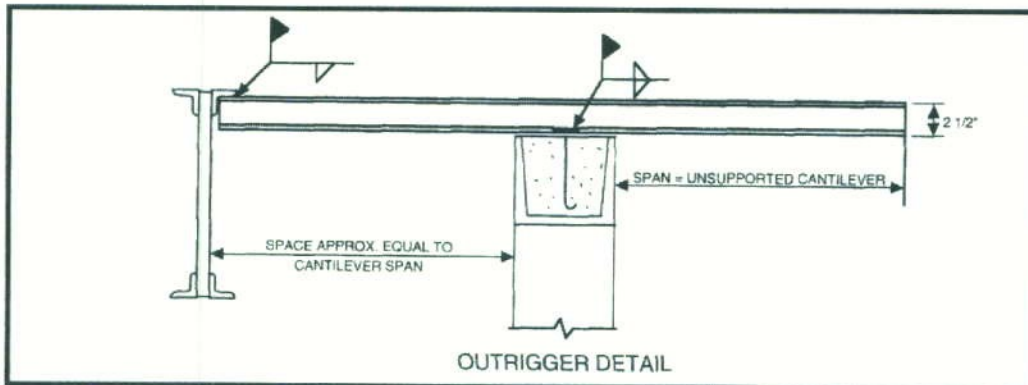
- Depth 2.5 in
- Maximum Length 10 ft
- Minimum Length 3 ft
- Contact your local Vulcraft plant for sloped or pitched seat information.

2.5K SERIES SIMPLE SPAN INFORMATION

2.5K TYPE	2.5K1	2.5K2	2.5K3
S in ³	0.62	0.84	1.2
I in ⁴	0.78	1.1	1.5
WT lbs/ft	3.0	4.2	6.4



NOTE: 2.5K SERIES NOT U.L. APPROVED.



NOTE: 2.5K SERIES NOT U.L. APPROVED.

LRFD

ASD

LOAD TABLE FOR LOOSE OUTRIGGERS

OUTRIGGER TYPE	TOTAL ALLOWABLE LOAD FOR UNSUPPORTED CANTILEVER PLF*									
	SPAN ft-in									
	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"
2.5K1	825	749	519	381	293	231	188	155	—	—
2.5K2	825	825	698	512	392	311	251	207	174	—
2.5K3	825	825	825	740	566	447	362	299	252	215

LOAD TABLE FOR LOOSE OUTRIGGERS

OUTRIGGER TYPE	TOTAL ALLOWABLE LOAD FOR UNSUPPORTED CANTILEVER PLF*									
	SPAN ft-in									
	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"
2.5K1	550	499	346	254	195	154	125	103	—	—
2.5K2	550	550	465	341	261	207	167	138	116	—
2.5K3	550	550	550	493	377	298	241	199	168	143

*Serviceability requirements must be checked by the specifying professional.



ACCESSORIES AND DETAILS

TOP CHORD EXTENSIONS AND EXTENDED ENDS, K-SERIES

Joist extensions are commonly furnished to support a variety of overhang conditions. The two types are pictured below. The first is the TOP CHORD EXTENSION or "S" TYPE, which has only the top chord angles extended. The second is the EXTENDED END or "R" TYPE in which the standard 2 1/2 in. (64 mm) end bearing depth is maintained over the entire length of the extension. The "S" TYPE extension is so designated because of its Simple nature whereas the "R" TYPE involves Reinforcing the top chord angles. The **specifying professional** should be aware that an "S" TYPE is more economical and should be specified whenever possible.

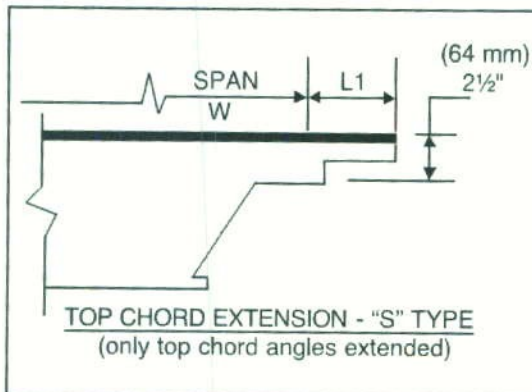
The following load tables for K-Series TOP CHORD EXTENSIONS and EXTENDED ENDS for LRFD and ASD methods of design and listed in U.S. Customary and Metric units, have been developed as an aid to the **specifying professional**. The black number in the tables is the maximum allowable uniform load in pounds per linear foot (kilo-Newton/Meter). The red number is the uniform load which will produce an approximate deflection of $L_1/240$, where L_1 is the length of the extension. The load tables are

applicable for uniform loads only. If there are concentrated loads and/or non-uniform loads, a loading diagram must be provided by the **specifying professional** on the structural drawings. In cases where it is not possible to meet specific job requirements with a 2 1/2 in. (64 mm) deep "R" type extension (refer to "S" and "I" values in the Extended End Load Table), the depth of the extension must be increased to provide greater load-carrying capacity. If the loading diagram for any condition is not shown, the joist manufacturer will design the extension to support the uniform load indicated in the K-Series Joist Load Table for the span of the joist.

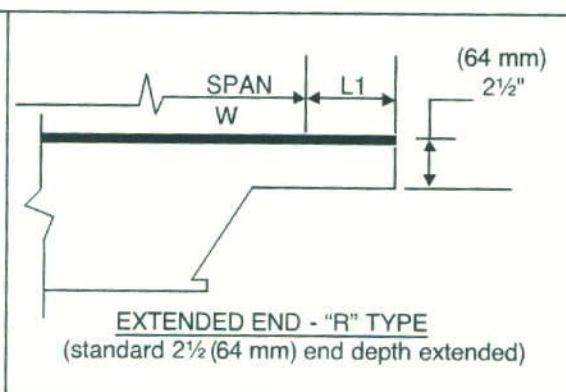
When TOP CHORD EXTENSIONS or EXTENDED ENDS are specified, the allowable deflection and the bracing requirements must be considered by the **specifying professional**.

It should be noted that an "R" TYPE extension must be specified when building details dictate a 2 1/2 in. (64 mm) depth at the end of the extension. In the absence of specific instructions, the joist manufacturer may provide either type.

TOP CHORD EXTENSION



EXTENDED END



W = Uniform Load
L1 = Length of Extension
SPAN = See K-Series Load Table for definition of Span



LRFD

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TOP CHORD EXTENSION LOAD TABLE (S TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)								
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"
S1	0.099	0.088	825 550	544 363	267 127	157 58					
S2	0.127	0.138	825 550	700 422	343 200	202 91					
S3	0.144	0.156	825 550	793 550	388 226	229 104					
S4	0.160	0.172	825 550	825 550	432 249	255 113	168 60				
S5	0.176	0.188	825 550	825 550	474 272	280 124	184 66				
S6	0.192	0.204	825 550	825 550	517 295	306 134	202 72				
S7	0.241	0.306	825 550	825 550	649 443	384 201	253 108	180 64			
S8	0.266	0.332	825 550	825 550	717 481	424 219	280 117	198 70			
S9	0.288	0.358	825 550	825 550	777 519	459 236	303 126	214 75	160 48		
S10	0.380	0.544	825 550	825 550	825 550	606 359	400 192	283 115	211 74	163 50	
S11	0.438	0.622	825 550	825 550	825 550	699 410	460 220	327 131	243 84	189 57	150 41
S12	0.494	0.696	825 550	825 550	825 550	789 459	520 246	369 147	274 94	213 64	169 45

LRFD

TOP CHORD EXTENSION LOAD TABLE (R TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)											
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"
R1	0.895	1.119	825 550	825 550	825 550	825 550	669 396	498 236	385 152	307 103	250 73	208 54	175 41	132 32
R2	0.923	1.157	825 550	825 550	825 550	825 550	690 409	514 244	399 157	318 107	259 76	216 56	181 42	133 33
R3	1.039	1.299	825 550	825 550	825 550	825 550	777 459	579 274	448 176	358 120	292 85	243 63	205 47	137 37
R4	1.147	1.433	825 550	825 550	825 550	825 550	825 507	639 302	495 195	394 132	321 94	267 69	225 52	141 41
R5	1.249	1.561	825 550	825 550	825 550	825 550	825 329	696 212	538 144	429 103	349 75	291 57	246 44	144 44
R6	1.352	1.690	825 550	825 550	825 550	825 550	825 357	753 230	583 156	465 111	379 82	315 62	265 48	148 48
R7	1.422	1.802	825 550	825 550	825 550	825 550	825 380	792 245	613 167	489 119	399 87	331 66	279 51	151 51
R8	1.558	1.948	825 550	825 550	825 550	825 550	825 411	825 265	672 180	535 128	436 94	363 71	306 55	155 55
R9	1.673	2.091	825 550	825 550	825 550	825 550	825 442	825 284	721 194	576 138	469 101	390 77	328 59	159 59
R10	1.931	2.414	825 550	825 550	825 550	825 550	825 510	825 328	825 224	664 159	541 117	450 89	379 69	169 69
R11	2.183	2.729	825 550	825 550	825 550	825 550	825 550	825 371	825 253	751 180	612 132	508 100	430 78	178 78
R12	2.413	3.016	825 550	825 550	825 550	825 550	825 550	825 410	825 279	825 199	676 146	562 111	475 86	186 86



ASD

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TOP CHORD EXTENSION LOAD TABLE (S TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)								
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"
S1	0.099	0.088	550	363	178	105					
			550	363	127	58					
S2	0.127	0.138	550	467	229	135					
			550	422	200	91					
S3	0.144	0.156	550	529	259	153					
			550	510	226	104					
S4	0.160	0.172	550	550	288	170	112				
			550	550	249	113	60				
S5	0.176	0.188	550	550	316	187	123				
			550	550	272	124	66				
S6	0.192	0.204	550	550	345	204	135				
			550	550	295	134	72				
S7	0.241	0.306	550	550	433	256	169	120			
			550	550	433	201	108	64			
S8	0.266	0.332	550	550	478	283	187	132			
			550	550	481	219	117	70			
S9	0.288	0.358	550	550	518	306	202	143	107		
			550	550	518	236	126	75	48		
S10	0.380	0.544	550	550	550	404	267	189	141	109	
			550	550	550	359	192	115	74	50	
S11	0.438	0.622	550	550	550	466	307	218	162	126	100
			550	550	550	410	220	131	84	57	41
S12	0.494	0.696	550	550	550	526	347	246	183	142	113
			550	550	550	459	246	147	94	64	45

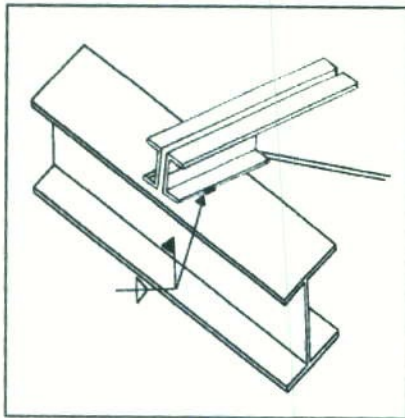
ASD

TOP CHORD EXTENSION LOAD TABLE (R TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

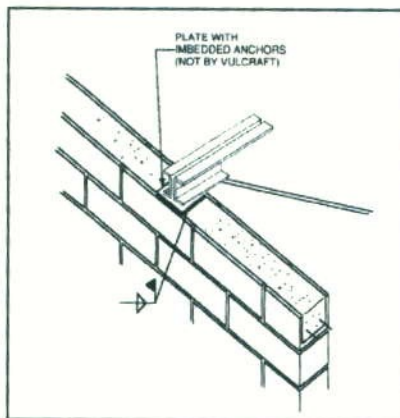
TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)											
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"
R1	0.895	1.119	550	550	550	550	550	446	332	257	205	167	139	117
			550	550	550	550	396	236	152	103	73	54	41	32
R2	0.923	1.157	550	550	550	550	550	460	343	266	212	173	144	121
			550	550	550	550	409	244	157	107	76	56	42	33
R3	1.039	1.299	550	550	550	550	550	518	386	299	239	195	162	137
			550	550	550	550	459	274	176	120	85	63	47	37
R4	1.147	1.433	550	550	550	550	550	550	426	330	263	214	178	150
			550	550	550	550	507	302	195	132	94	69	52	41
R5	1.249	1.561	550	550	550	550	550	550	464	359	286	233	194	164
			550	550	550	550	550	329	212	144	103	75	57	44
R6	1.352	1.690	550	550	550	550	550	550	502	389	310	253	210	177
			550	550	550	550	550	357	230	156	111	82	62	48
R7	1.422	1.802	550	550	550	550	550	550	528	409	326	266	221	186
			550	550	550	550	550	380	245	167	119	87	66	51
R8	1.558	1.948	550	550	550	550	550	550	550	448	357	291	242	204
			550	550	550	550	550	411	265	180	128	94	71	55
R9	1.673	2.091	550	550	550	550	550	550	550	481	384	313	260	219
			550	550	550	550	550	442	284	194	138	101	77	59
R10	1.931	2.414	550	550	550	550	550	550	550	550	443	361	300	253
			550	550	550	550	550	510	328	224	159	117	89	69
R11	2.183	2.729	550	550	550	550	550	550	550	550	501	408	339	287
			550	550	550	550	550	550	371	253	180	132	100	78
R12	2.413	3.016	550	550	550	550	550	550	550	550	550	451	375	317
			550	550	550	550	550	550	410	279	199	146	111	86



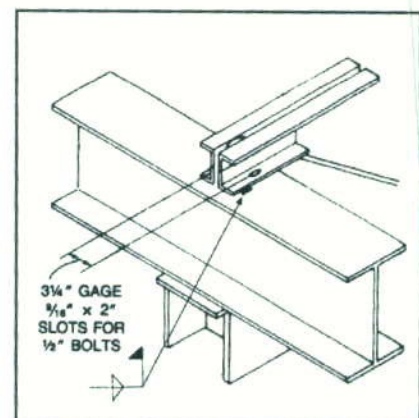
K SERIES OPEN WEB STEEL JOISTS



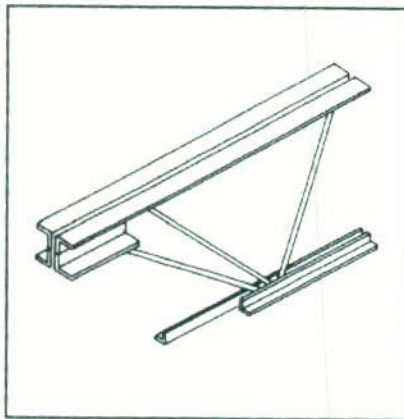
ANCHORAGE TO STEEL
SEE SJI SPECIFICATION 5.3 (b) AND 5.6



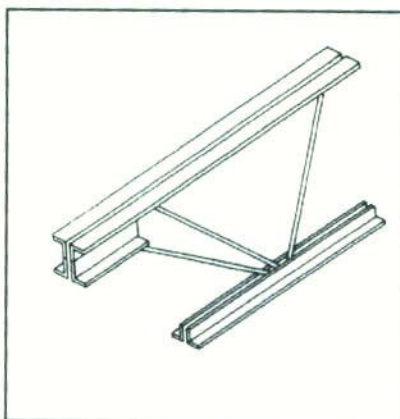
ANCHORAGE TO MASONRY
SEE SJI SPECIFICATION 5.3 (a) AND 5.6



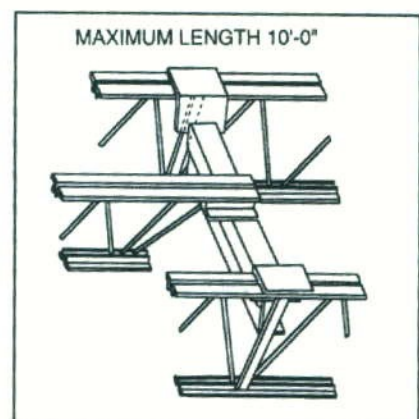
BOLTED CONNECTION*
TYPICALLY REQUIRED AT COLUMNS



CEILING EXTENSION



BOTTOM CHORD STRUT



HEADERS

Note: If header does not bear at a Joist Panel Point add extra web in field as shown.
EW or Panel Point by Vulcraft

MAXIMUM DUCT OPENING SIZES (K SERIES)*

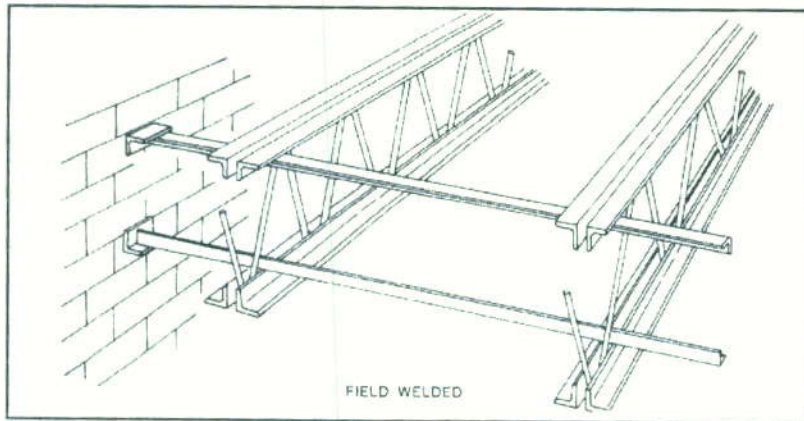
JOIST DEPTH	ROUND	SQUARE	RECTANGLE
8 inches	5 inches	4x4 inches	3x8 inches
10 inches	6 inches	5x5 inches	3x8 inches
12 inches	7 inches	6x6 inches	4x9 inches
14 inches	8 inches	6x6 inches	5x9 inches
16 inches	9 inches	7 1/2x 7 1/2 inches	6X10 inches
18 inches	11 inches	8x8 inches	7x11 inches
20 inches	11 inches	9x9 inches	7x12 inches
22 inches	12 inches	9 1/2 x9 1/2 inches	8x12 inches
24 inches	13 inches	10x10 inches	8x13 inches
26 inches	15 1/2 inches	12x12 inches	9x18 inches
28 inches	16 inches	13x13 inches	9x18 inches
30 inches	17 inches	14x14 inches	10x18 inches

*FOR LH SERIES CONSULT WITH VULCRAFT

SEE SJI SPECIFICATION - SECTION 6.
FOR HANDLING AND ERECTION OF K-SERIES OPEN WEB STEEL JOISTS AND SJI TECHNICAL DIGEST NO. 9.

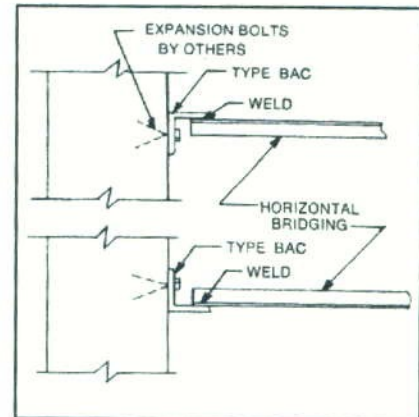
SPECIFYING PROFESSIONAL MUST INDICATE ON STRUCTURAL DRAWINGS SIZE AND LOCATION OF ANY DUCT THAT IS TO PASS THRU JOIST.

K SERIES OPEN WEB STEEL JOISTS

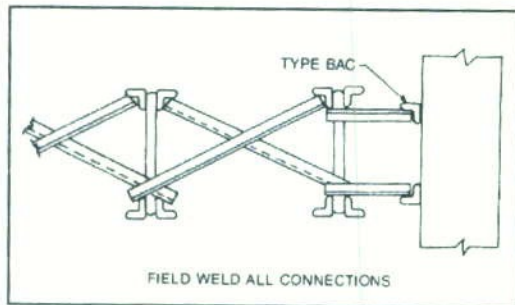


HORIZONTAL BRIDGING
SEE SJI SPECIFICATION 5.5 AND 6.

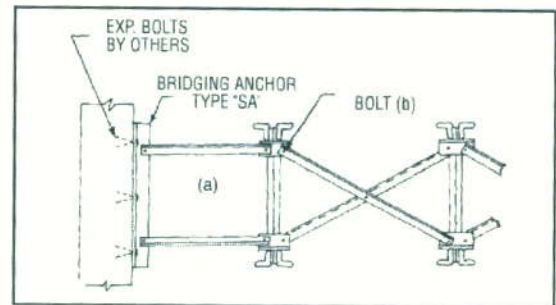
NOTE: DO NOT WELD BRIDGING TO JOIST WEB MEMBERS.
DO NOT HANG ANY MECHANICAL, ELECTRICAL, ETC. FROM BRIDGING.



BRIDGING ANCHORS
SEE SJI SPECIFICATION 5.5 AND 6.



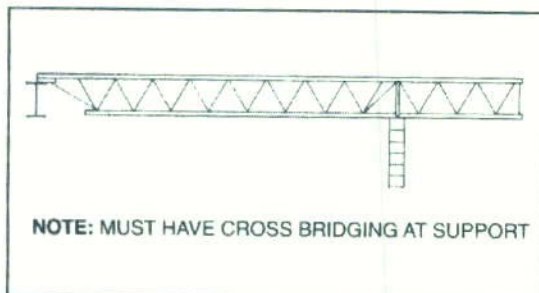
WELDED CROSS BRIDGING
SEE SJI SPECIFICATION 5.5 AND 6.
HORIZONTAL BRIDGING SHALL BE USED IN
SPACE ADJACENT TO THE WALL TO ALLOW FOR
PROPER DEFLECTION OF THE JOIST NEAREST
THE WALL.



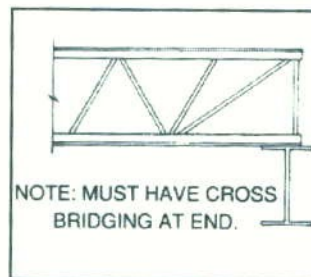
BOLTED CROSS BRIDGING
SEE SJI SPECIFICATION 5.5 AND 6.

(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.

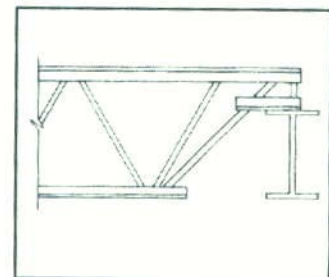
(b) For required bolt size refer to bridging table on page 136.
NOTE: Clip configuration may vary from that shown.



FULL DEPTH CANTILEVER END
SEE SJI SPECIFICATION 5.4 (d) AND 5.5 FOR BRIDGING
REQUIREMENTS.



SQUARE END
SEE SJI SPECIFICATION 5.4 (d)
AND 5.5 FOR BRIDGING
REQUIREMENTS.



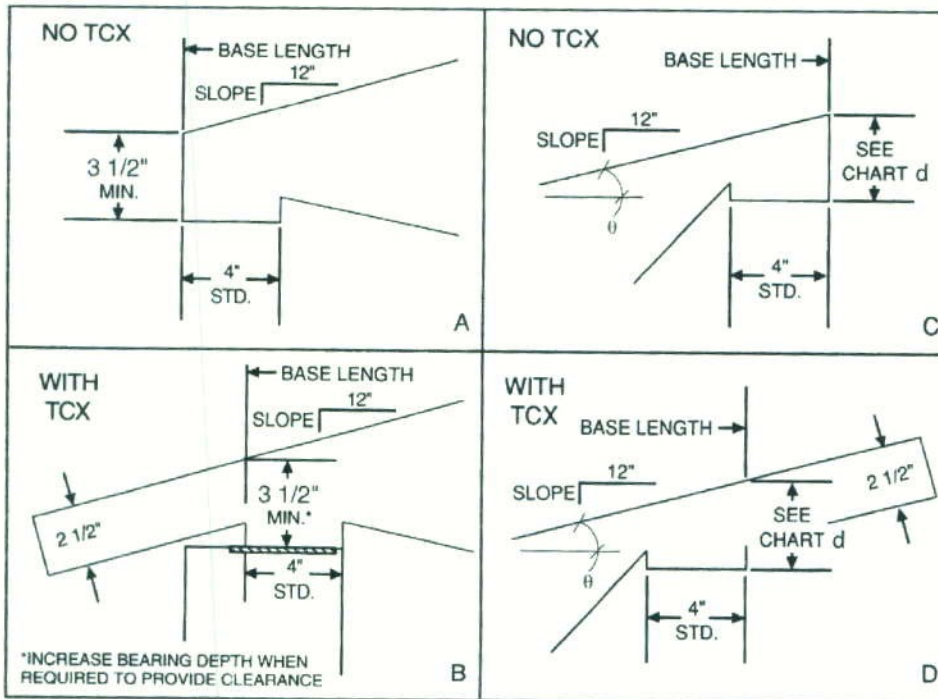
DEEP BEARINGS
CONFIGURATION MAY VARY

K SERIES OPEN WEB STEEL JOISTS

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

LOW END

HIGH END

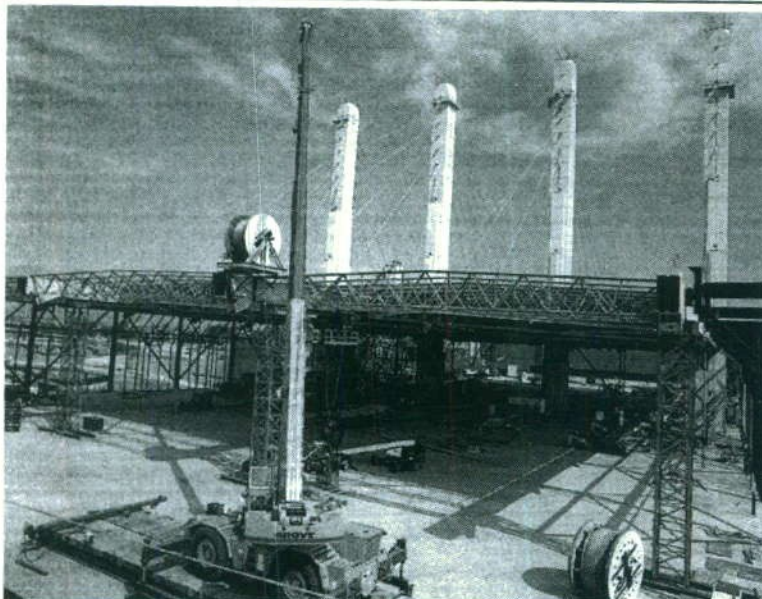


Slope Rate	High End Recommended Seat Depth d
3/8:12	3 1/2"
1/2:12	3 1/2"
1:12	4"
1 1/2:12	4"
2:12	4"
2 1/2:12	4 1/2"
3:12	4 1/2"
3 1/2:12	5"
4:12	5"
4 1/2:12	5"
5:12	5 1/2"
5 1/2:12	5 1/2"
6:12	5 1/2"

IF OVER 6:12 SEE BELOW

NOTES:

- (1) Depths shown are the minimums required for fabrication of sloped bearing seats. Depths may vary depending on actual bearing conditions.
- (2) $d = 5/8 + 2.5 / \cos \theta + 4 \tan \theta$
- (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.



**BARTLE HALL
CONVENTION CENTER**

Kansas City, Missouri

Architect-Engineer: HNTB Corp.
General Contractor: Watson General Contractors, Inc.
Steel Fabricator: Havens Steel, Inc.
Steel Erector: Danny's Construction Co., Inc.

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BRIDGING REQUIREMENTS FOR K-SERIES JOISTS

Number of Rows of Bridging***
 Distances are Span Lengths
 (see "Definition of Span" on page 20.)

Section Numbers*	ERECTION STABILITY SPANS (SJI Spec. Section 6)		1 Row	2 Rows	3 Rows	4 Rows	5 Rows
	Depth	Span Less Than**					
1	8	17'	Up thru 16'	Over 16' thru 24'	Over 24' thru 28'		
	10	21'					
	12	23'					
	14	27'					
2	16	29'	Up thru 17'	Over 17' thru 25'	Over 25' thru 32'		
3	12	25'	Up thru 18'	Over 18' thru 28'	Over 28' thru 38'	Over 38' thru 40'	
	14	29'					
	16	30'					
	18	31'					
4	20	32'	Up thru 19'	Over 19' thru 28'	Over 28' thru 38'	Over 38' thru 48'	
	14	29'					
	16	32'					
	18	32'					
5	20	34'	Up thru 19'	Over 19' thru 29'	Over 29' thru 39'	Over 39' thru 50'	Over 50' thru 52'
	22	34'					
	24	36'					
	26	36'					
6	12	25'	Up thru 19'	Over 19' thru 29'	Over 29' thru 39'	Over 39' thru 51'	Over 51' thru 56'
	16	32'					
	18	33'					
	20	33'					
7	22	35'	Up thru 19'	Over 19' thru 29'	Over 29' thru 39'	Over 39' thru 51'	Over 51' thru 56'
	24	36'					
	26	39'					
	28	39'					
8	30	40'	Up thru 20'	Over 20' thru 33'	Over 33' thru 45'	Over 45' thru 58'	Over 58' thru 60'
	16	33'					
	18	37'					
	20	39'					
9	22	40'	Up thru 20'	Over 20' thru 33'	Over 33' thru 46'	Over 46' thru 59'	Over 59' thru 60'
	24	43'					
	26	43'					
	28	43'					
10	30	44'	Up thru 20'	Over 20' thru 33'	Over 33' thru 46'	Over 46' thru 59'	Over 59' thru 60'
	16	33'					
	18	37'					
	20	39'					
11	22	40'	Up thru 20'	Over 20' thru 33'	Over 33' thru 46'	Over 46' thru 59'	Over 59' thru 60'
	24	44'					
	26	44'					
	28	45'					
12	30	45'	Up thru 20'	Over 20' thru 33'	Over 33' thru 46'	Over 46' thru 59'	Over 59' thru 60'
	18	37'					
	20	41'					
	22	45'					

* Last digit(s) of joist designation.

** For spans **EQUAL TO OR EXCEEDING** that shown above, one of the required rows, nearest mid-span, must be bolted diagonal type. Bolted diagonal bridging shall be installed and connected BEFORE releasing the hoisting lines. Refer to Specification Section 6 for handling and erection requirements.

*** See SJI Specifications 5.11 for uplift requirement, page 18.



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K-Series Joist Maximum Joist Spacing for Horizontal Bridging						
*Bridging Material Size						
Equal Leg Angles						
Section Numbers**	1x7/64 r = .20"	1-1/4x7/64 r = .25"	1-1/2x7/64 r = .30"	1-3/4x7/64 r = .35"	2x1/8 r = .40"	2-1/2x5/32 r = .50"
1 thru 9	5'-0"	6'-3"	7'-6"	8'-7"	10'-0"	12'-6"
10	4'-8"	6'-3"	7'-6"	8'-7"	10'-0"	12'-6"
11 & 12	4'-0"	5'-8"	7'-6"	8'-7"	10'-0"	12'-6"

* Connection to Joist must resist 700 pounds.
** Refer to last digit(s) of Joist Designation.

K, LH & DLH Series Joist Maximum Joist Spacing for Diagonal Bridging					
Bridging Angle Size					
Joist Depth	1x7/64 r = .20"	1-1/4x7/64 r = .25"	1-1/2x7/64 r = .30"	1-3/4x7/64 r = .35"	2x1/8 r = .40"
12	6'-6"	8'-3"	9'-11"	11'-7"	
14	6'-6"	8'-3"	9'-11"	11'-7"	
16	6'-6"	8'-2"	9'-10"	11'-6"	
18	6'-6"	8'-2"	9'-10"	11'-6"	
20	6'-5"	8'-2"	9'-10"	11'-6"	
22	6'-4"	8'-1"	9'-10"	11'-6"	
24	6'-4"	8'-1"	9'-9"	11'-5"	
26	6'-3"	8'-0"	9'-9"	11'-5"	
28	6'-2"	8'-0"	9'-8"	11'-5"	
30	6'-2"	7'-11"	9'-8"	11'-4"	
32	6'-1"	7'-10"	9'-7"	11'-4"	13'-0"
36		7'-9"	9'-6"	11'-3"	12'-11"
40		7'-7"	9'-5"	11'-2"	12'-10"
44		7'-5"	9'-3"	11'-0"	12'-9"
48		7'-3"	9'-2"	10'-11"	12'-8"
52			9'-0"	10'-9"	12'-7"
56			8'-10"	10'-8"	12'-5"
60			8'-7"	10'-6"	12'-4"
64			8'-5"	10'-4"	12'-2"
68			8'-2"	10'-2"	12'-0"
72			8'-0"	10'-0"	11'-10"

LH-Series Joist* Maximum Joist Spacing for Horizontal Bridging						
Bridging Angle Size						
Section Numbers**	1x7/64 r = .20"	1-1/4x7/64 r = .25"	1-1/2x7/64 r = .30"	1-3/4x7/64 r = .35"	2x1/8 r = .40"	2-1/2x5/32 r = .50"
02,03,04	4'-7"	6'-3"	7'-6"	8'-9"	10'-0"	12'-4"
05,06	4'-1"	5'-9"	7'-6"	8'-9"	10'-0"	12'-4"
07,08	3'-9"	5'-1"	6'-8"	8'-6"	10'-0"	12'-4"
09,10		4'-6"	6'-0"	7'-8"	10'-0"	12'-4"
11,12		4'-1"	5'-5"	6'-10"	8'-11"	12'-4"
13,14		3'-9"	4'-11"	6'-3"	8'-2"	12'-4"
15,16			4'-3"	5'-5"	7'-1"	11'-0"
17			4'-0"	5'-1"	6'-8"	10'-5"

* Connection to Joist must resist 700 pounds.
** Refer to last digit(s) of Joist Designation.

Bridging Requirements for LH-Series and DLH-Series Joists***		
Erection Stability Spans (SJI Spec. Section 105)		
Depth	Section Number	Spans less than **
18	02 03 thru 09	33' 37'
20	02 03 04 thru 10	33' 38' 41'
24	03 04 05 06 07 thru 11	35' 39' 40' 45' 49'
28	05 06 07 thru 08 09 thru 13	42' 46' 54' 57'
32	06 thru 07 08 09 thru 15	47' 55' 60'
36	07 thru 08 09 10 thru 15	47' 57' 60'
40	08 thru 09 10 thru 17	47' 60'
44	09 10 thru 17	52' 60'
48	10 thru 17	60'

* Last two digits of joist designation.
** NOTE: Erection Stability Span = Clear span + 8". (See SJI Specifications Section 104.2) For spans EQUAL TO OR EXCEEDING that shown, one of the rows nearest mid-span must be bolted diagonal type. For spans through 60 feet, the bolted diagonal bridging must be installed BEFORE releasing the hoisting lines. FOR SPANS OVER 60 FEET, ALL BRIDGING ROWS MUST BE BOLTED DIAGONAL TYPE. Spans over 60 feet through 100 feet require two rows of bolted diagonal bridging to be installed, at one-third points, BEFORE releasing the hoisting lines. Spans over 100 feet require ALL rows of bolted diagonal bridging to be installed BEFORE releasing the hoisting lines.
*** All DLH-Series JOISTS REQUIRE ALL BRIDGING ROWS TO BE BOLTED DIAGONAL TYPE.

Bridging Spacing		
LH-DLH Sect. Number*	Minimum Bolt Diameter**	Max.Spacing of Bridging Lines
02,03,04	3/8"	11'-0"
05,06	3/8"	12'-0"
07,08	3/8"	13'-0"
09,10	3/8"	14'-0"
11,12	3/8"	16'-0"
13,14	1/2"	16'-0"
15,16,17	1/2"	21'-0"
18,19	5/8"	26'-0"

* Last two digits of joist designation.
** Size required due to requirements as indicated for bolted diagonal bridging connections per SJI Specifications Section 104.5(e). Minimum A307 Bolt required for connection.



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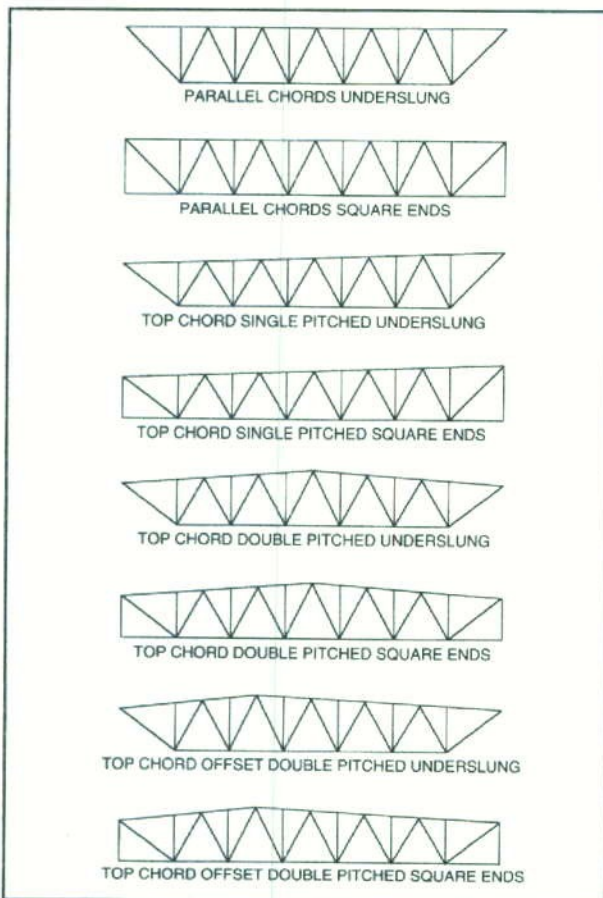
LH & DLH SERIES LONGSPAN STEEL JOISTS

STANDARD TYPES

Longspan steel joists can be furnished with either underslung or square ends, with parallel chords or with single or double pitched top chords to provide sufficient slope for roof drainage.

The Longspan joist designation is determined by its nominal depth at the center of the span, except for offset double pitched joists, where the depth should be given at the ridge. A part of the designation should be either the section number or the total design load over the design live load (TL/LL given in plf).

All pitched joists will be cambered in addition to the pitch unless specified otherwise.



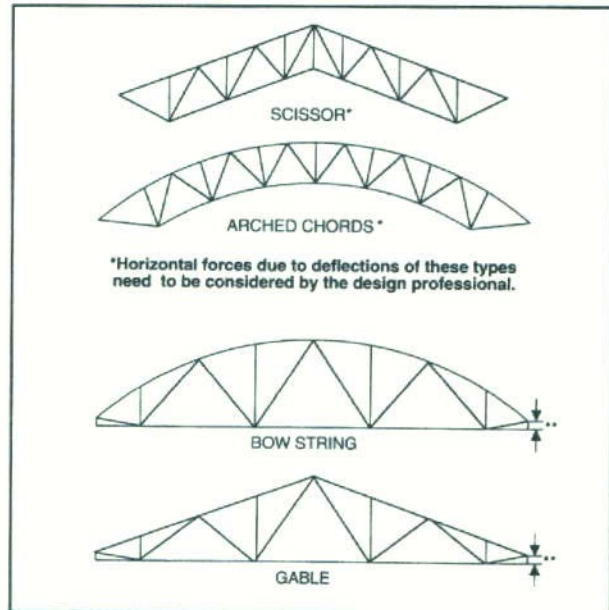
CAMBER

Non-Standard Types: The design professional shall provide on the structural drawings the amount of camber desired in inches. If camber is not specified, Vulcraft will use the camber values for LH and DLH joists based on top chord length.

Standard Types: The camber listed in the table will be fabricated into the joists unless the design professional specifically states otherwise on the structural drawings.

NON-STANDARD TYPES

The following joists can also be supplied by Vulcraft, however, **THE DISTRICT SALES OFFICE OR MANUFACTURING FACILITY NEAREST YOU SHOULD BE CONTACTED FOR ANY LIMITATIONS IN DEPTH OR LENGTH.**



**Contact Vulcraft for minimum depth at ends.

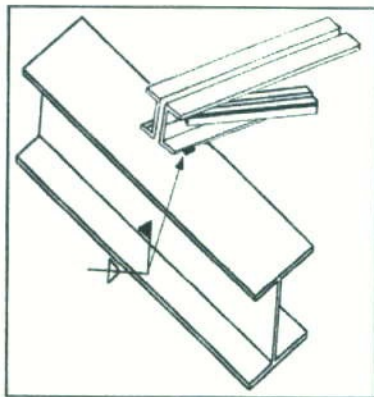
CAMBER FOR STANDARD TYPES

LH & DLH series joists shall have camber in accordance with the following table:***

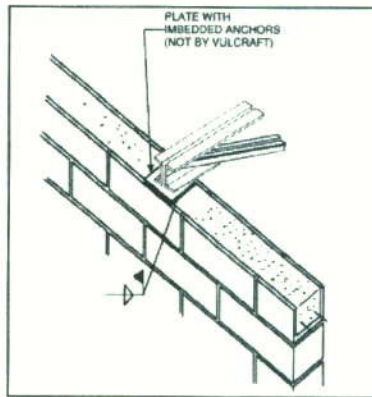
Top Chord Length	Approx. Camber
20'-0" (6096 mm)	1/4" (6 mm)
30'-0" (9144 mm)	3/8" (10 mm)
40'-0" (12192 mm)	5/8" (16 mm)
50'-0" (15240 mm)	1" (25 mm)
60'-0" (18288 mm)	1 1/2" (38 mm)
70'-0" (21336 mm)	2" (51 mm)
80'-0" (24384 mm)	2 3/4" (70 mm)
90'-0" (27432 mm)	3 1/2" (89 mm)
100'-0" (30480 mm)	4 1/4" (108 mm)
110'-0" (33528 mm)	5" (127 mm)
120'-0" (36576 mm)	6" (152 mm)
130'-0" (39621 mm)	7" (178 mm)
140'-0" (42672 mm)	8" (203 mm)
144'-0" (43890 mm)	8 1/2" (216 mm)

*** NOTE: If full camber is not desired near walls or other structural members please note on the structural drawings.

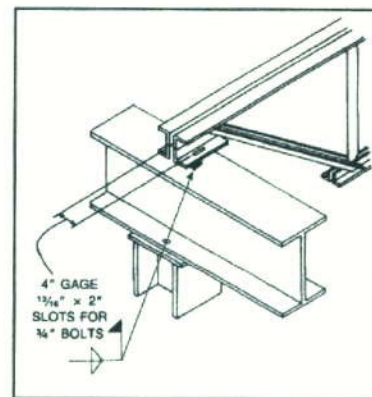
LH & DLH SERIES LONGSPAN STEEL JOISTS



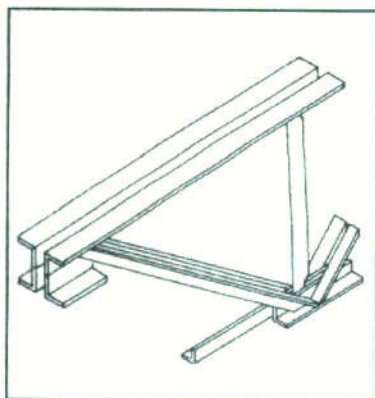
ANCHORAGE TO STEEL
SEE SJI SPECIFICATION
104.4 (b) AND 104.7 (b)



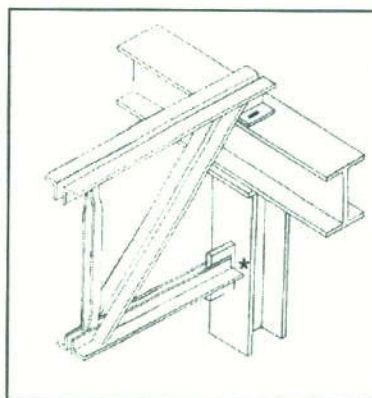
ANCHORAGE TO MASONRY
SEE SJI SPECIFICATION
104.4 (a) AND 104.7 (a)



BOLTED CONNECTION
See Note (c)
Typically required at columns

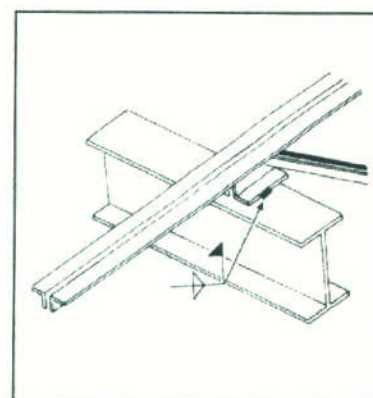


CEILING EXTENSION



BOTTOM CHORD EXTENSION

*If bottom chord extension is to be bolted or welded the specifying professional must provide axial loads on structural drawings.



TOP CHORD EXTENSION
See Note (a)

- (a) Extended top chords or full depth cantilever ends require the special attention of the specifying professional.

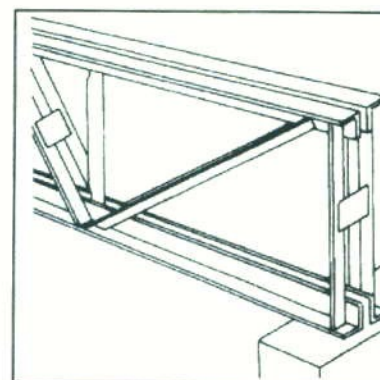
The magnitude and location of the design loads to be supported, the deflection requirements, and the proper bracing shall be clearly indicated on the structural drawings.

- (b) See SJI Specification - Section 105 for Handling and Erection of LH and DLH joists.

- (c) The Occupational Safety and Health Administration Standards (OSHA), Paragraph 1910.12 refers to Paragraph 1518.751 of "Construction Standards" which states:

"In steel framing, where bar joists are utilized, and columns are not framed in at least two directions with structural steel members, a bar joist shall be field-bolted at columns to provide lateral stability during construction."

NOTE: Configurations may vary from that shown.



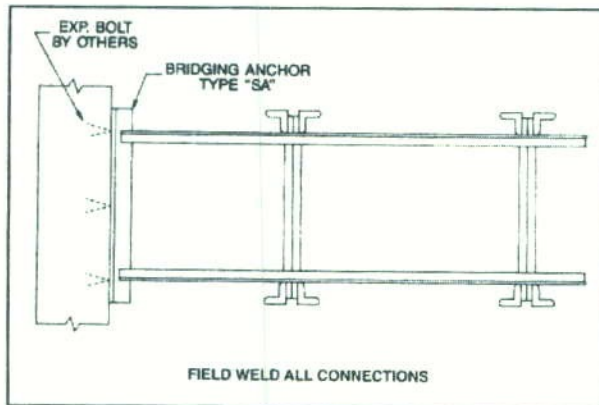
SQUARE END

See SJI Specification 104.5 (f).
Cross bridging required at end of bottom bearing joist.

ACCESSORIES AND DETAILS

LH & DLH SERIES LONGSPAN STEEL JOISTS

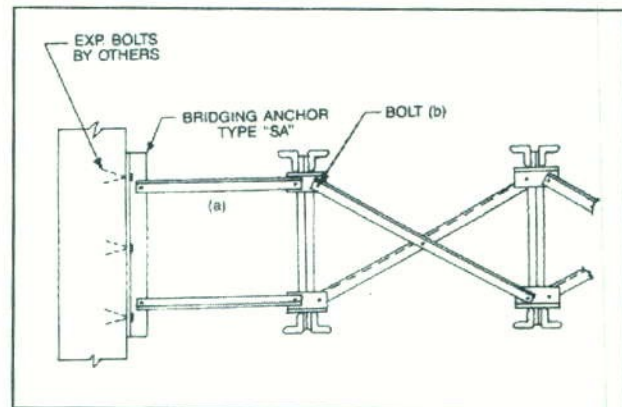
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HORIZONTAL BRIDGING

For the proper use of horizontal bridging refer to sections 104.5(a) and 105.

NOTE: Do not weld bridging to web members. Do not hang any mechanical, electrical, etc. from bridging.



CROSS BRIDGING

(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 on page 136. **NOTE:** Clip configuration may vary from that shown.

LH & DLH SERIES OPEN WEB STEEL JOISTS SLOPED SEAT REQUIREMENTS

LOW END		HIGH END		SLOPE RATE	HIGH END MINIMUM **SEAT DEPTH d
A	B	C	D		
				1/4:12	6 1/2"
				3/8:12	6 1/2"
				1/2:12	6 1/2"
				1:12	6 1/2"
				1 1/2:12	7"
				2:12	7"
				2 1/2:12	7 1/2"
				3:12	7 1/2"
				3 1/2:12	8"
				4:12	8 1/2"
				4 1/2:12	8 1/2"
				5:12	9 1/2"
				6:12 & OVER SEE BELOW	

* 7 1/2" at 18 and 19 chord section numbers. Consult Vulcraft for information when TCX's are present.

** Add 2 1/2" to seat depths at 18 and 19 chord section numbers.

NOTES:

- (1) Depths shown are the minimums required for fabrication of sloped bearing seats.
- (2) $d = 5/8 + 5 / \cos \theta + 6 \tan \theta$
- (3) Clearance must be checked at outer edge of support as shown in detail B. Increase bearing depth as required to permit passage of 5" deep extension.
- (4) If extension depth greater than 5" is required (see detail B and D) increase bearing depths accordingly.

NOTES

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VULCRAFT LH & DLH SERIES / GENERAL INFORMATION

HIGH STRENGTH

ECONOMICAL

DESIGN – Vulcraft LH & DLH Series long span steel joists are designed in accordance with the specifications of the Steel Joist Institute.

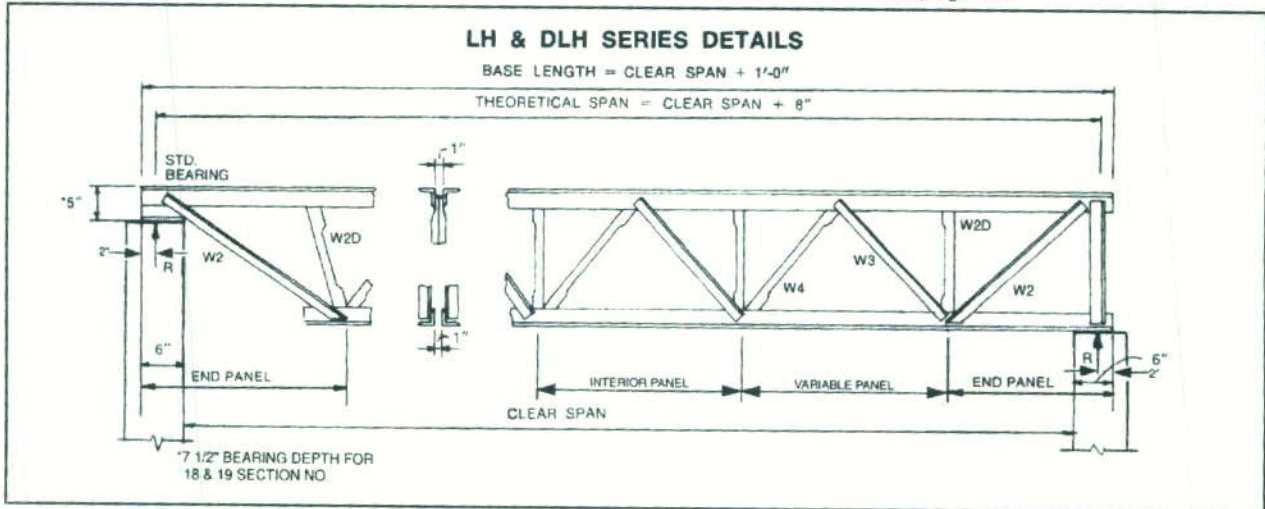
ACCESSORIES see page 45.

ROOF SPANS TO 144'-0"

FLOOR SPANS TO 120'-0"

PAINT – Vulcraft joists receive a shop-coat of rust inhibitive primer whose performance characteristics conform to those of the Steel Joist Institute specification 102.4.

SPECIFICATIONS see page 50.



MAXIMUM JOIST SPACING FOR DIAGONAL BRIDGING					
BRIDGING ANGLE SIZE-EQUAL LEG ANGLES					
JOIST DEPTH	1x7/64 (25mm x 3mm) r = .20"	1-1/4x7/64 (32mm x 3mm) r = .25"	1-1/2x7/64 (38mm x 3mm) r = .30"	1-3/4x7/64 (45mm x 3mm) r = .35"	2x1/8 (51mm x 3mm) r = .40"
32	6'-1" (1854mm)	7'-10" (2387mm)	9'-7" (2921mm)	11'-4" (3454mm)	13'-0" (3962mm)
36		7'-9" (2362mm)	9'-6" (2895 mm)	11'-3" (3429mm)	12'-11" (3973mm)
40		7'-7" (2311mm)	9'-5" (2870 mm)	11'-2" (3403mm)	12'-10" (3911mm)
44		7'-5" (2260mm)	9'-3" (2819 mm)	11'-0" (3352mm)	12'-9" (3886mm)
48		7'-3" (2209mm)	9'-2" (2794 mm)	10'-11" (3327mm)	12'-8" (3860mm)
52			9'-0" (2743 mm)	10'-9" (3276mm)	12'-7" (3835mm)
56			8'-10" (2692 mm)	10'-8" (3251mm)	12'-5" (3784mm)
60			8'-7" (2616 mm)	10'-6" (3200mm)	12'-4" (3759mm)
64			8'-5" (2565 mm)	10'-4" (3149mm)	12'-2" (3708mm)
68			8'-2" (2489 mm)	10'-2" (3098mm)	12'-0" (3657mm)
72			8'-0" (2438 mm)	10'-0" (3048mm)	11'-10" (3606mm)

LH & DLH TABLE MINIMUM BEARING LENGTHS			
Joist Type	On Masonry	On Concrete	On Steel
LH 02 thru 17			
DLH 10 thru 19	6"	6"	4"
MINIMUM BEARING PLATE WIDTHS			
LH 02 thru LH 12			
DLH 10 thru DLH 12	9"	9"	
LH 13 thru LH 17			
DLH 13 thru DLH 19	12"	12"	

SECTION NUMBER*	MAX. SPACING OF LINES OF BRIDGING	HORIZONTAL BRACING FORCE**
		lbs. (N)
02, 03, 04	11'-0" (3352mm)	400 (1779)
05 - 06	12'-0" (3657mm)	500 (2224)
07 - 08	13'-0" (3962mm)	650 (2891)
09 - 10	14'-0" (4267mm)	800 (3558)
11 - 12	16'-0" (4876mm)	1000 (4448)
13 - 14	16'-0" (4876mm)	1200 (5337)
15 - 16	21'-0" (6400mm)	1600 (7117)
17	21'-0" (6400mm)	1800 (8006)
18 - 19	26'-0" (7924mm)	2000 (8896)

MAXIMUM JOIST SPACING FOR HORIZONTAL BRIDGING						
SPANS OVER 60' REQUIRE BOLTED DIAGONAL BRIDGING						
BRIDGING ANGLE SIZE-EQUAL LEG ANGLES						
SECTION NUMBER*	1x7/64 (25mm x 3mm) r = .20"	1-1/4x7/64 (32mm x 3mm) r = .25"	1-1/2x7/64 (38mm x 3mm) r = .30"	1-3/4x7/64 (45mm x 3mm) r = .35"	2x1/8 (51mm x 3mm) r = .40"	2-1/2x5/32 (64mm x 4mm) r = .50"
02, 03, 04	4'-7" (1397mm)	6'-3" (1905mm)	7'-6" (2286mm)	8'-9" (2667mm)	10'-0" (3048mm)	12'-4" (3759mm)
05 - 06	4'-1" (1245mm)	5'-9" (1753mm)	7'-6" (2286mm)	8'-9" (2667mm)	10'-0" (3048mm)	12'-4" (3759mm)
07 - 08	3'-9" (1143mm)	5'-1" (1549mm)	6'-8" (2032mm)	8'-6" (2590mm)	10'-0" (3048mm)	12'-4" (3759mm)
09 - 10		4'-6" (1372mm)	6'-0" (1829mm)	7'-8" (2337mm)	10'-0" (3048mm)	12'-4" (3759mm)
11 - 12		4'-1" (1245mm)	5'-5" (1651mm)	6'-10" (2083mm)	8'-11" (2718mm)	12'-4" (3759mm)
13 - 14		3'-9" (1143mm)	4'-11" (1499mm)	6'-3" (1905mm)	8'-2" (2489mm)	12'-4" (3759mm)
15 - 16			4'-3" (1295mm)	5'-5" (1651mm)	7'-1" (2159mm)	11'-0" (3353mm)
17			4'-0" (1219mm)	5'-1" (1549mm)	6'-8" (2032mm)	10'-5" (3175mm)

*REFER TO THE LAST DIGITS OF JOIST DESIGNATION CONNECTION TO JOIST MUST RESIST FORCES LISTED IN TABLE 104.5.1.

NUMBER OF LINES OF BRIDGING BASED ON CLEAR SPAN.
*LAST TWO DIGITS OF JOIST DESIGNATION.
**NOMINAL BRACING FORCE IS UNFACTORED.

MIN. A307 BOLT REQ'D FOR CONNECTION		
SERIES	SECTION NUMBER*	A307 BOLT DIAMETER
LH/DLH	2 - 12	3/8" (9mm)
LH/DLH	13 - 17	1/2" (12mm)
DLH	18 & 19	5/8" (15mm)

*LAST TWO DIGITS OF JOIST DESIGNATION.

NOTES: 1. Special designed LH and DLH can be supplied in longer lengths. See SLH Series Page 73.

2. Additional bridging may be required when joists support standing seam roof decks. The specifying professional should require that the joist manufacturer check the system and provide bridging as required to adequately brace the joists against lateral movement. For bridging requirements due to uplift pressures refer to sect. 104.12.



STANDARD SPECIFICATIONS FOR LONGSPAN STEEL JOISTS, LH-SERIES AND DEEP LONGSPAN STEEL JOISTS, DLH-SERIES

Adopted by the Steel Joist Institute February 15, 1978
Revised to November 10, 2003 - Effective March 01, 2005

SECTION 100. SCOPE

This specification covers the design, manufacture and use of Longspan Steel Joists **LH-Series**, and Deep Longspan Steel Joists, **DLH-Series**. Load and Resistance Factor Design (LRFD) and Allowable Strength Design (ASD) are included in this specification.

SECTION 101. DEFINITION

The term "Longspan Steel Joists **LH-Series** and Deep Longspan Steel Joists **DLH-Series**", as used herein, refers to open web, load-carrying members utilizing hot-rolled or cold-formed steel, including cold-formed steel whose yield strength* has been attained by cold working. **LH-Series** are suitable for the direct support of floors and roof decks in buildings, and **DLH-Series** are suitable for direct support of roof decks in buildings.

The design of **LH-** and **DLH-Series** joist chord and web sections shall be based on a yield strength of at least 36 ksi (250 MPa), but not greater than 50 ksi (345 MPa). Steel used for **LH-** and **DLH-Series** joist chord or web sections shall have a minimum yield strength determined in accordance with one of the procedures specified in Section 102.2, which is equal to the yield strength assumed in the design. **LH-** and **DLH-Series** Joists shall be designed in accordance with these specifications to support the loads given in the Standard Load Tables for Longspan and Deep Longspan Steel Joists, **LH-** and **DLH-Series**, attached hereto.

* The term "Yield Strength" as used herein shall designate the yield level of a material as determined by the applicable method outlined in paragraph 13.1, "Yield Point" and in paragraph 13.2, "Yield Strength", of ASTM Standard A370, "Standard Test Methods and Definitions for Mechanical Testing of Steel Products", or as specified in Section 102.2 of this Specification.

Standard Specifications and Load Tables, Longspan Steel Joists **LH-Series** And Deep Longspan Steel Joist **DLH-Series**

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SECTION 102. MATERIALS

102.1 STEEL

The steel used in the manufacture of chord and web sections shall conform to one of the following ASTM Specifications:

- Carbon Structural Steel, ASTM A36/A36M.
- High-Strength, Low-Alloy Structural Steel, ASTM A242/A242M.
- High-Strength Carbon-Manganese Steel of Structural Quality ASTM A529/A529M, Grade 50.
- High-Strength Low-Alloy Columbium-Vanadium Structural Steel, ASTM A572/A572M Grade 42 or 50.
- High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 inches (100 mm) Thick, ASTM A588/A588M.
- Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Corrosion Resistance, ASTM A606.
- Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1008/A1008M
- Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1011/A1011M

or shall be of suitable quality ordered or produced to other than the listed specifications, provided that such material in the state used for final assembly and manufacture is weldable and is proved by tests performed by the producer or manufacturer to have the properties specified in Section 102.2.

102.2 MECHANICAL PROPERTIES

The yield strength used as a basis for the design stresses prescribed in Section 103 shall be at least 36 ksi (250 MPa), but shall not be greater than 50 ksi (345 MPa). Evidence that the steel furnished meets or exceeds the design yield strength shall, if requested, be provided in the form of an affidavit or by witnessed or certified test reports.

For material used without consideration of increase in yield strength resulting from cold forming, the specimens shall be taken from as-rolled material. In the case of material, the mechanical properties of which conform to the requirements of one of the listed specifications, the test specimens and



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procedures shall conform to those of such specifications and to ASTM A370.

In the case of material, the mechanical properties of which do not conform to the requirements of one of the listed specifications, the test specimens and procedures shall conform to the applicable requirements of ASTM A370, and the specimens shall exhibit a yield strength equal to or exceeding the design yield strength and an elongation of not less than (a) 20 percent in 2 inches (51 millimeters) for sheet and strip, or (b) 18 percent in 8 inches (203 millimeters) for plates, shapes and bars with adjustments for thickness for plates, shapes and bars as prescribed in ASTM A36/A36M, A242/A242M, A529/A529M, A572/A572M, A588/A588M, whichever specification is applicable on the basis of design yield strength.

The number of tests shall be as prescribed in ASTM A6/A6M for plates, shapes, and bars; and ASTM A606, A1008/A1008M and A1011/A1011M for sheet and strip.

If as-formed strength is utilized, the test reports shall show the results of tests performed on full section specimens in accordance with the provisions of the AISI North American Specification for the Design of Cold-Formed Steel Structural Members. They shall also indicate compliance with these provisions and with the following additional requirements:

- a) The yield strength calculated from the test data shall equal or exceed the design yield strength.
- b) Where tension tests are made for acceptance and control purposes, the tensile strength shall be at least 6 percent greater than the yield strength of the section.
- c) Where compression tests are used for acceptance and control purposes, the specimen shall withstand a gross shortening of 2 percent of its original length without cracking. The length of the specimen shall be not greater than 20 times its least radius of gyration.
- d) If any test specimen fails to pass the requirements of subparagraphs (a), (b), or (c) above, as applicable, two retests shall be made of specimens from the same lot. Failure of one of the retest specimens to meet such requirements shall be the cause for rejection of the lot represented by the specimens.

102.3 WELDING ELECTRODES

The following electrodes shall be used for arc welding:

- a) For connected members both having a specified yield strength greater than 36 ksi (250 MPa).
 - AWS A5.1: E70XX
 - AWS A5.5: E70XX-X
 - AWS A5.17: F7XX-EXXX, F7XX-ECXXX flux electrode combination
 - AWS A5.18: ER70S-X, E70C-XC, E70C-XM
 - AWS A5.20: E7XT-X, E7XT-XM
 - AWS A5.23: F7XX-EXXX-XX, F7XX-ECXXX-XX
 - AWS A5.28: ER70S-XXX, E70C-XXX
 - AWS A5.29: E7XTX-X, E7XTX-XM

- b) For connected members both having a specified minimum yield strength of 36 ksi (250 MPa) or one having a specified minimum yield strength of 36 ksi (250 MPa), and the other having a specified minimum yield strength greater than 36 ksi (250 MPa).

AWS A5.1: E60XX

AWS A5.17: F6XX-EXXX, F6XX-ECXXX flux electrode combination

AWS A5.20: E6XT-X, E6XT-XM

AWS A5.29: E6XTX-X, E6XTX-XM

or any of those listed in Section 102.3(a).

Other welding methods, providing equivalent strength as demonstrated by tests, may be used.

102.4 PAINT

The standard shop paint is intended to protect the steel for only a short period of exposure in ordinary atmospheric conditions and shall be considered an impermanent and provisional coating.

When specified, the standard shop paint shall conform to one of the following:

- a) Steel Structures Painting Council Specification, SSPC No. 15
- b) Or, shall be a shop paint which meets the minimum performance requirements of the above listed specification.

SECTION 103.

DESIGN AND MANUFACTURE

103.1 METHOD

Joists shall be designed in accordance with these specifications as simply supported, uniformly loaded trusses supporting a floor or roof deck so constructed as to brace the top chord of the joists against lateral buckling. Where any applicable design feature is not specifically covered herein, the design shall be in accordance with the following specifications:

- a) Where the steel used consists of hot-rolled shapes, bars or plates, use the American Institute of Steel Construction, *Specification for Structural Steel Buildings*.
- b) For members that are cold-formed from sheet or strip steel, use the American Iron and Steel Institute, *North American Specification for the Design of Cold-Formed Steel Structural Members*.

Design Basis:

Designs shall be made according to the provisions in this Specification for either Load and Resistance Factor Design (LRFD) or for Allowable Strength Design (ASD).

Load Combinations:

LRFD:

When load combinations are not specified to the joist manufacturer, the required stress shall be computed for the



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factored loads based on the factors and load combinations as follows:

1.4D

1.2D + 1.6 (L, or L_r, or S, or R)

ASD:

When load combinations are not specified to the joist manufacturer, the required stress shall be computed based on the load combinations as follows:

D

D + (L, or L_r, or S, or R)

Where:

D = dead load due to the weight of the structural elements and the permanent features of the structure

L = live load due to occupancy and movable equipment

L_r = roof live load

S = snow load

R = load due to initial rainwater or ice exclusive of the ponding contribution

When special loads are specified and the specifying professional does not provide the load combinations, the provisions of ASCE 7, "Minimum Design Loads for Buildings and Other Structures" shall be used for LRFD and ASD load combinations.

103.2 DESIGN AND ALLOWABLE STRESSES

Design Using Load and Resistance Factor Design (LRFD)

Joists shall have their components so proportioned that the required stresses, f_u , shall not exceed ϕF_n where,

f_u = required stress ksi (MPa)

F_n = nominal stress ksi (MPa)

ϕ = resistance factor

ϕF_n = design stress

Design Using Allowable Strength Design (ASD)

Joists shall have their components so proportioned that the required stresses, f , shall not exceed F_n / Ω where,

f = required stress ksi (MPa)

F_n = nominal stress ksi (MPa)

Ω = safety factor

F_n / Ω = allowable stress

Stresses:

(a) **Tension:** $\phi_t = 0.90$ (LRFD) $\Omega_t = 1.67$ (ASD)

For Chords: $F_y = 50$ ksi (345 MPa)

For Webs: $F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

Design Stress = $0.9F_y$ (LRFD) (103.2-1)

Allowable Stress = $0.6F_y$ (ASD) (103.2-2)

(b) **Compression:** $\phi_c = 0.90$ (LRFD) $\Omega_c = 1.67$ (ASD)

For members with $K\ell/r \leq 4.71 \sqrt{E/QF_y}$

$$F_{cr} = Q \left[0.658 \left(\frac{QF_y}{F_e} \right) \right] F_y \quad (103.2-3)$$

For members with $K\ell/r > 4.71 \sqrt{E/QF_y}$

$$F_{cr} = 0.877F_e \quad (103.2-4)$$

Where, F_e = elastic buckling stress determined in accordance with Equation 103.2-5.

$$F_e = \frac{\pi^2 E}{\left(\frac{K\ell}{r} \right)^2} \quad (103.2-5)$$

For hot-rolled sections, "Q" is the full reduction factor for slender compression elements.

Design Stress = $0.9F_{cr}$ (LRFD) (103.2-6)

Allowable Stress = $0.6F_{cr}$ (ASD) (103.2-7)

In the above equations, ℓ is taken as the distance in inches (millimeters) between panel points for the chord members and the appropriate length for web members, and r is the corresponding least radius of gyration of the member or any component thereof. E is equal to 29,000 ksi (200,000 MPa).

Use $1.2\ell/r_x$ for a crimped, first primary compression web member when a moment-resistant weld group is not used for this member; where r_x = member radius of gyration in the plane of the joist.

For cold-formed sections the method of calculating the nominal column strength is given in the AISI, *North American Specification for the Design of Cold-Formed Steel Structural Members*.



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(c) Bending: $\phi_b = 0.90$ (LRFD) $\Omega_b = 1.67$ (ASD)

Bending calculations are to be based on using the elastic section modulus.

For chords and web members other than solid rounds:

$F_y = 50$ ksi (345 MPa)

Design Stress = $0.9F_y$ (LRFD) (103.2-8)

Allowable Stress = $0.6F_y$ (ASD) (103.2-9)

For web members of solid round cross section:

$F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

Design Stress = $1.45F_y$ (LRFD) (103.2-10)

Allowable Stress = $0.95F_y$ (ASD) (103.2-11)

For bearing plates:

$F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

Design Stress = $1.35F_y$ (LRFD) (103.2-12)

Allowable Stress = $0.9F_y$ (ASD) (103.2-13)

(d) Weld Strength:

Shear at throat of fillet welds:

Nominal Shear Stress = $F_{nw} = 0.6F_{exx}$ (103.2-14)

LRFD: $\phi_w = 0.75$

Design Shear Strength =

$\phi R_n = \phi_w F_{nw} A = 0.45F_{exx} A$ (103.2-15)

ASD: $\Omega_w = 2.0$

Allowable Shear Strength =

$R_n/\Omega_w = F_{nw} A/\Omega_w = 0.3F_{exx} A$ (103.2-16)

A = effective throat area

Made with E70 series electrodes or F7XX-EXXX flux-electrode combinations..... $F_{exx} = 70$ ksi (483 MPa)

Made with E60 series electrodes or F6XX-EXXX flux-electrode combinations..... $F_{exx} = 60$ ksi (414 MPa)

Tension or compression on groove or butt welds shall be the same as those specified for the connected material.

103.3 MAXIMUM SLENDERNESS RATIOS

The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_s/r$ of members as a whole or any component part shall not exceed the values given in Table 103.3-1, Parts A.

The effective slenderness ratio, $K \ell/r^*$, to be used in calculating the nominal stresses F_{cr} and F_e , is the largest value as determined from Table 103.3-1, Parts B and C.

In compression members when fillers or ties are used, they shall be spaced so that the ℓ_s/r_z ratio of each component does not exceed the governing ℓ/r ratio of the member as a whole.

The terms used in Table 103.3-1 are defined as follows:

ℓ = Length center-to-center of panel points, except $\ell = 36$ in. (914 mm) for calculating ℓ/r_y of top chord member.

ℓ_s = maximum length center-to-center between panel point and filler (tie), or between adjacent fillers (ties).

r_x = member radius of gyration in the plane of the joist.

r_y = member radius of gyration out of the plane of the joist.

r_z = least radius of gyration of a member component.

* See P.N. Chod and T. V. Galambos, Compression Chords Without Fillers in Longspan Steel Joists, Research Report No. 36, June 1975 Structural Division, Civil Engineering Department, Washington University, St. Louis, MO.



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TABLE 103.3-1
MAXIMUM AND EFFECTIVE SLENDERNESS RATIOS

I TOP CHORD INTERIOR PANEL

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 90.
- B. *The effective slenderness ratio to determine "F_{cr}"*
- | | | | |
|-----------------------------|-----------------|----------------|------------------|
| 1. With fillers or ties | $0.75 \ell/r_x$ | $1.0 \ell/r_y$ | $1.0 \ell_g/r_z$ |
| 2. Without fillers or ties | | | $0.75 \ell/r_z$ |
| 3. Single component members | $0.75 \ell/r_x$ | $1.0 \ell/r_y$ | |
- C. *The effective slenderness ratio to determine "F'_e"*
- | | | | |
|-----------------------------|-----------------|--|--|
| 1. With fillers or ties | $0.75 \ell/r_x$ | | |
| 2. Without fillers or ties | $0.75 \ell/r_x$ | | |
| 3. Single component members | $0.75 \ell/r_x$ | | |

II TOP CHORD END PANEL

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 120.
- B. *The effective slenderness ratio to determine "F_{cr}"*
- | | | | |
|-----------------------------|----------------|----------------|------------------|
| 1. With fillers or ties | $1.0 \ell/r_x$ | $1.0 \ell/r_y$ | $1.0 \ell_g/r_z$ |
| 2. Without fillers or ties | | | $1.0 \ell/r_z$ |
| 3. Single component members | $1.0 \ell/r_x$ | $1.0 \ell/r_y$ | |
- C. *The effective slenderness ratio to determine "F'_e"*
- | | | | |
|-----------------------------|----------------|--|--|
| 1. With fillers or ties | $1.0 \ell/r_x$ | | |
| 2. Without fillers or ties | $1.0 \ell/r_x$ | | |
| 3. Single component members | $1.0 \ell/r_x$ | | |

III TENSION MEMBERS - CHORDS AND WEBS

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 240.

IV COMPRESSION WEB MEMBERS

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 200.
- B. *The effective slenderness ratio to determine "F_{cr}"*
- | | | | |
|-----------------------------|-------------------|----------------|------------------|
| 1. With fillers or ties | $0.75 \ell/r_x$ | $1.0 \ell/r_y$ | $1.0 \ell_g/r_z$ |
| 2. Without fillers or ties | | | $1.0 \ell/r_z$ |
| 3. Single component members | $0.75 \ell/r_x^*$ | $1.0 \ell/r_y$ | |

* Use $1.2 \ell/r_x$ for a crimped, first primary compression web member when a moment-resistant weld group is not used for this member.



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103.4 MEMBERS

(a) Chords

The bottom chord shall be designed as an axially loaded tension member.

The radius of gyration of the top chord about its vertical axis shall not be less than $\ell/170$ where ℓ is the spacing in inches (millimeters) between lines of bridging as specified in Section 104.5(d)

The top chord shall be considered as stayed laterally by the floor slab or roof deck provided the requirements of Section 104.9(e) of this specification are met.

The top chord shall be designed as a continuous member subject to combined axial and bending stresses and shall be so proportioned that

For LRFD:

at the panel point:

$$f_{au} + f_{bu} \leq 0.9F_y \quad (103.4-1)$$

at the mid panel: for $\frac{f_{au}}{\phi_c F_{cr}} \geq 0.2$,

$$\frac{f_{au}}{\phi_c F_{cr}} + \frac{8}{9} \left[\frac{C_m f_{bu}}{1 - \left(\frac{f_{au}}{\phi_c F_{cr}} \right)} \right] Q \phi_b F_y \leq 1.0 \quad (103.4-2)$$

for $\frac{f_{au}}{\phi_c F_{cr}} < 0.2$,

$$\left(\frac{f_{au}}{2\phi_c F_{cr}} \right) + \left[\frac{C_m f_{bu}}{1 - \left(\frac{f_{au}}{\phi_c F_{cr}} \right)} \right] Q \phi_b F_y \leq 1.0 \quad (103.4-3)$$

$f_{au} = P_u/A$ = Required compressive stress, ksi (MPa)

P_u = Required axial strength using LRFD load combinations, kips (N)

$f_{bu} = M_u/S$ = Required bending stress at the location under consideration, ksi (MPa)

M_u = Required flexural strength using LRFD load combinations, kip-in. (N-mm)

S = Elastic Section Modulus, in.³ (mm³)

F_{cr} = Nominal axial compressive stress in ksi (MPa) based on ℓ/r as defined in Section 103.2(b)

$C_m = 1 - 0.3 f_{au}/\phi F_e$ for end panels

$C_m = 1 - 0.4 f_{au}/\phi F_e$ for interior panels

F_y = Specified minimum yield strength, ksi (MPa)

$F_e = \frac{\pi^2 E}{\left(\frac{K \ell}{r_x} \right)^2}$, ksi (MPa)

$$\left(\frac{K \ell}{r_x} \right)^2$$

Where ℓ is the panel length, in inches (millimeters), as defined in Section 103.2(b) and r_x is the radius of gyration about the axis of bending.

Q = Form factor defined in Section 103.2(b)

A = Area of the top chord, in.² (mm²)

For ASD:

at the panel point:

$$f_a + f_b \leq 0.6F_y \quad (103.4-4)$$

at the mid panel: for $\frac{f_a}{F_a} \geq 0.2$,

$$\frac{f_a}{F_a} + \frac{8}{9} \left[\frac{C_m f_b}{1 - \left(\frac{1.67 f_a}{F_e} \right)} \right] Q F_b \leq 1.0 \quad (103.4-5)$$

for $\frac{f_a}{F_a} < 0.2$,

$$\left(\frac{f_a}{2F_a} \right) + \left[\frac{C_m f_b}{1 - \left(\frac{1.67 f_a}{F_e} \right)} \right] Q F_b \leq 1.0 \quad (103.4-6)$$

$f_a = P/A$ = Required compressive stress, ksi (MPa)

P = Required axial strength using ASD load combinations, kips (N)

$f_b = M/S$ = Required bending stress at the location under consideration, ksi (MPa)

M = Required flexural strength using ASD load combinations, kip-in. (N-mm)

S = Elastic Section Modulus, in.³ (mm³)

F_a = Allowable axial compressive stress, based on ℓ/r as defined in Section 103.2(b), ksi (MPa)

F_b = Allowable bending stress; $0.6F_y$, ksi (MPa)

$C_m = 1 - 0.50 f_a/F_e$ for end panels

$C_m = 1 - 0.67 f_a/F_e$ for interior panels

(b) Web

The vertical shears to be used in the design of the web members shall be determined from full uniform loading, but such vertical shears shall be not less than 25 percent of the end reaction.

Interior vertical web members used in modified Warren type web systems shall be designed to resist the gravity loads supported by the member plus an additional axial load of 1/2 of 1.0 percent of the top chord axial force.



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(c) Depth

Joists may have either parallel chords or a top chord slope of 1/8 inch per foot (1:96). The depth, for the purpose of design, in all cases shall be the depth at mid-span.

(d) Eccentricity

Members connected at a joint shall have their center of gravity lines meet at a point, if practical. Eccentricity on either side of the neutral axis of chord members may be neglected when it does not exceed the distance between the neutral axis and the back of the chord. Otherwise, provision shall be made for the stresses due to eccentricity. Ends of joists shall be proportioned to resist bending produced by eccentricity at the support.

In those cases where a single angle compression member is attached to the outside of the stem of a tee or double angle chord, due consideration shall be given to eccentricity.

(e) Extended Ends

Extended top chords or full depth cantilever ends require the special attention of the specifying professional. The magnitude and location of the loads to be supported, deflection requirements, and proper bracing shall be clearly indicated on the structural drawings.

103.5 CONNECTIONS

(a) Methods

Joist connections and splices shall be made by attaching the members to one another by arc or resistance welding or other accredited methods.

(1) Welded Connections

- Selected welds shall be inspected visually by the manufacturer. Prior to this inspection, weld slag shall be removed.
- Cracks are not acceptable and shall be repaired.
- Thorough fusion shall exist between layers of weld metal and between weld metal and base metal for the required design length of the weld; such fusion shall be verified by visual inspection.
- Unfilled weld craters shall not be included in the design length of the weld.
- Undercut shall not exceed 1/16 inch (2 millimeters) for welds oriented parallel to the principal stress.
- The sum of surface (piping) porosity diameters shall not exceed 1/16 inch (2 millimeters) in any 1 inch (25 millimeters) of design weld length.
- Weld spatter that does not interfere with paint coverage is acceptable.

(2) Welding Program

Manufacturers shall have a program for establishing weld procedures and operator qualification, and for weld sampling and testing.

- Weld Inspection by Outside Agencies (See Section 104.13 of this specification).

The agency shall arrange for visual inspection to determine that welds meet the acceptance standards of Section 103.5(a)(1). Ultrasonic, X-Ray, and magnetic particle testing are inappropriate for joists due to the configurations of the components and welds.

(b) Strength

- Joint Connections** – Joint connections shall develop the maximum force due to any of the design loads, but not less than 50 percent of the strength of the member in tension or compression, whichever force is the controlling factor in the selection of the member.
- Shop Splices** – Shop splices may occur at any point in chord or web members. Splices shall be designed for the member force but not less than 50 percent of the member strength. Members containing a butt weld splice shall develop an ultimate tensile force of at least 57 ksi (393 MPa) times the full design area of the chord or web. The term "member" shall be defined as all component parts comprising the chord or web, at the point of splice.

(c) Field Splices

Field Splices shall be designed by the manufacturer and may be either bolted or welded. Splices shall be designed for the member force, but not less than 50 percent of the member strength.

103.6 CAMBER

Joists shall have approximate cambers in accordance with the following:

TABLE 103.6-1

Top Chord Length	Approximate Camber
20'-0" (6096 mm)	1/4" (6 mm)
30'-0" (9144 mm)	3/8" (10 mm)
40'-0" (12192 mm)	5/8" (16 mm)
50'-0" (15240 mm)	1" (25 mm)
60'-0" (18288 mm)	1 1/2" (38 mm)
70'-0" (21336 mm)	2" (51 mm)
80'-0" (24384 mm)	2 3/4" (70 mm)
90'-0" (27432 mm)	3 1/2" (89 mm)
100'-0" (30480 mm)	4 1/4" (108 mm)
110'-0" (33528 mm)	5" (127 mm)
120'-0" (36576 mm)	6" (152 mm)
130'-0" (39621 mm)	7" (178 mm)
140'-0" (42672 mm)	8" (203 mm)
144'-0" (43890 mm)	8 1/2" (216 mm)

The specifying professional shall give consideration to coordinating joist camber with adjacent framing.



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103.7 VERIFICATION OF DESIGN AND MANUFACTURE**(a) Design Calculations**

Companies manufacturing any LH- or DLH-Series Joists shall submit design data to the Steel Joist Institute (or an independent agency approved by the Steel Joist Institute) for verification of compliance with the SJI Specifications.

(b) In-Plant Inspections

Each manufacturer shall verify their ability to manufacture LH- and DLH-Series Joists through periodic In-Plant Inspections. Inspections shall be performed by an independent agency approved by the Steel Joist Institute. The frequency, manner of inspection, and manner of reporting shall be determined by the Steel Joist Institute. The plant inspections are not a guarantee of the quality of any specific joists; this responsibility lies fully and solely with the individual manufacturer.

SECTION 104.**APPLICATION****104.1 USAGE**

This specification shall apply to any type of structure where floors and roofs are to be supported directly by steel joists installed as hereinafter specified. Where joists are used other than on simple spans under uniformly distributed loading as prescribed in Section 103.1, they shall be investigated and modified if necessary to limit the required stresses to those listed in Section 103.2.

CAUTION: If a rigid connection of the bottom chord is to be made to a column or other support, it shall be made only after the application of the dead loads. The joist is then no longer simply supported, and the system must be investigated for continuous frame action by the specifying professional.

The designed detail of a rigid type connection and moment plates shall be shown on the structural drawings by the specifying professional. The moment plates shall be furnished by other than the joist manufacturer.

104.2 SPAN

The clear span of a joist shall not exceed 24 times its depth. The term "Span" as used herein is defined as the clear span plus 8 inches (203 millimeters).

104.3 DEPTH

The nominal depth of sloping chord joists shall be the depth at mid-span. The standard slope of the top chord shall be 1/8 inch per foot (1:96).

104.4 END SUPPORTS**(a) Masonry and Concrete**

LH- and DLH-Series Joists supported by masonry or concrete are to bear on steel bearing plates and shall be designed as steel bearing. Due consideration of the end

reactions and all other vertical and lateral forces shall be taken by the specifying professional in the design of the steel bearing plate and the masonry or concrete. The ends of LH- and DLH-Series Joists shall extend a distance of not less than 6 inches (152 millimeters) over the masonry or concrete support and be anchored to the steel bearing plate. The plate shall be located not more than 1/2 inch (13 millimeters) from the face of the wall and shall be not less than 9 inches (229 millimeters) wide perpendicular to the length of the joist. The plate is to be designed by the specifying professional and shall be furnished by other than the joist manufacturer.

Where it is deemed necessary to bear less than 6 inches (152 millimeters) over the masonry or concrete support, special consideration is to be given to the design of the steel bearing plate and the masonry or concrete by the specifying professional. The joists must bear a minimum 4 inches (102 millimeters) on the steel bearing plate.

(b) Steel

Due consideration of the end reactions and all other vertical and lateral forces shall be taken by the specifying professional in the design of the steel support.

The ends of LH- or DLH-Series Joists shall extend a distance of not less than 4 inches (102 millimeters) over the steel supports. Where it is deemed necessary to butt opposite joists over a narrow steel support with bearing less than that noted above, special ends must be specified, and such ends shall have positive attachment to the support, either by bolting or welding.

104.5 BRIDGING

Top and bottom chord bridging is required and shall consist of one or both of the following types.

(a) Horizontal

Horizontal bridging lines shall consist of continuous horizontal steel members. The ℓ/r of the bridging member shall not exceed 300, where ℓ is the distance in inches (millimeters) between attachments and r is the least radius of gyration of the bridging member.

(b) Diagonal

Diagonal bridging shall consist of cross-bracing with a ℓ/r ratio of not more than 200, where ℓ is the distance in inches (millimeters) between connections, and r is the least radius of gyration of the bridging member. Where cross-bracing members are connected at their point of intersection, the ℓ distance shall be taken as the distance in inches (millimeters) between connections at the point of intersection of the bridging members and the connections to the chord of the joists.

(c) Bridging Lines

For spans up through 60 feet (18288 mm), welded horizontal bridging may be used except where the row of bridging near-



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est the center is required to be bolted diagonal bridging as indicated by the **Red shaded area** in the Load Table. For spans over 60 feet (18288 mm) bolted diagonal bridging shall be used as indicated by the **Blue and Gray shaded areas** of the Load Table.

(d) Quantity and Spacing

The maximum spacing of lines of top chord bridging shall not exceed the values in Table 104.5-1. The number of rows of bottom chord bridging, including bridging required per Section 104.12, shall not be less than the number of top chord rows. Rows of bottom chord bridging are permitted to be spaced independently of rows of top chord bridging. The spacing of rows of bottom chord bridging shall meet the slenderness requirement of Section 103.4(a) and any specified strength requirements.

Table 104.5-1

LH-DLH SECTION* NUMBER	MAX. SPACING OF LINES OF TOP CHORD BRIDGING	NOMINAL** HORIZONTAL BRACING FORCE	
		lbs	(N)
02,03,04	11'-0" (3352 mm)	400	(1779)
05,06	12'-0" (3657 mm)	500	(2224)
07,08	13'-0" (3962 mm)	650	(2891)
09,10	14'-0" (4267 mm)	800	(3558)
11,12	16'-0" (4876 mm)	1000	(4448)
13,14	16'-0" (4876 mm)	1200	(5337)
15,16	21'-0" (6400 mm)	1600	(7117)
17	21'-0" (6400 mm)	1800	(8006)
18,19	26'-0" (7924 mm)	2000	(8896)

Number of lines of bridging is based on joist clear span dimensions.
 * Last two digits of joist designation shown in load table.
 ** Nominal bracing force is unfactored.

(e) Connections

Connections to the chords of the steel joists shall be made by positive mechanical means or by welding, and capable of resisting a horizontal force not less than that specified in Table 104.5-1.

(f) Bottom Chord Bearing Joists

Where bottom chord bearing joists are utilized, a row of diagonal bridging shall be provided near the support(s). This bridging shall be installed and anchored before the hoisting cable(s) is released.

104.6 INSTALLATION OF BRIDGING

Bridging shall support the top and bottom chords against lateral movement during the construction period and shall hold the steel joists in the approximate position as shown on the joist placement plans.

The ends of all bridging lines terminating at walls or beams shall be anchored to resist the nominal force shown in Table 104.5-1.

104.7 END ANCHORAGE

(a) Masonry and Concrete

Ends of LH- and DLH-Series Joists resting on steel bearing plates on masonry or structural concrete shall be attached thereto with a minimum of two 1/4 inch (6 millimeters) fillet welds 2 inches (51 millimeters) long, or with two 3/4 inch (19 millimeters) ASTM A307 bolts (minimum), or the equivalent.

(b) Steel

Ends of LH- and DLH-Series Joists resting on steel supports shall be attached thereto with a minimum of two 1/4 inch (6 millimeters) fillet welds 2 inches (51 millimeters) long, or with two 3/4 inch (19 millimeters) ASTM A307 bolts, or the equivalent. When LH/DLH series joists are used to provide lateral stability to the supporting member, the final connection shall be made by welding or as designated by the specifying professional.

(c) Uplift

Where uplift forces are a design consideration, roof joists shall be anchored to resist such forces (Refer to Section 104.12).

104.8 JOIST SPACING

Joists shall be spaced so that the loading on each joist does not exceed the design load (LRFD or ASD) for the particular joist designation and span as shown in the applicable load tables.

104.9 FLOOR AND ROOF DECKS

(a) Material

Floor and roof decks may consist of cast-in-place or pre-cast concrete or gypsum, formed steel, wood, or other suitable material capable of supporting the required load at the specified joist spacing.

(b) Thickness

Cast-in-place slabs shall be not less than 2 inches (51 millimeters) thick.

(c) Centering

Centering for structural slabs may be ribbed metal lath, corrugated steel sheets, paper-backed welded wire fabric, removable centering or any other suitable material capable of supporting the slab at the designated joist spacing. Centering shall not cause lateral displacement or damage to the top chord of joists during installation or removal of the centering or placing of the concrete.

(d) Bearing

Slabs or decks shall bear uniformly along the top chords of the joists.



(11)

(e) Attachments

The spacing of attachments along the top chord shall not exceed 36 inches (914 millimeters). Such attachments of the slab or deck to the top chords of joists shall be capable of resisting the following forces:

Table 104.9-1	
SECTION* NUMBER	NOMINAL** FORCE REQUIRED
02 to 04 incl.	120 lbs/ft (1.75 kN/m)
05 to 09 incl.	150 lbs/ft (2.19 kN/m)
10 to 17 incl.	200 lbs/ft (2.92 kN/m)
18 and 19	250 lbs/ft (3.65 kN/m)

* Last two digits of joist designation shown in the load table.
** Nominal force is unfactored.

(f) Wood Nailers

Where wood nailers are used, such nailers in conjunction with deck or slab shall be firmly attached to the top chords of the joists in conformance with Section 104.9(e).

(g) Joist with Standing Seam Roofing

The stiffness and strength of standing-seam roof clips varies from one manufacturer to another. Therefore, some roof systems cannot be counted on to provide lateral stability to the joists which support the roof. Sufficient stability must be provided to brace the joists laterally under the full design load. The compression chord must resist the chord axial design force in the plane of the joist (i.e., x-x axis buckling) and out of the plane of the joist (i.e., y-y axis buckling). Out of plane strength may be achieved by adjusting the bridging spacing and/or increasing the compression chord area, the joist depth, and the y-axis radius of gyration. The effective slenderness ratio in the y-direction equals $0.94 L/r_y$, where L is the bridging spacing in inches (millimeters). The maximum bridging spacing may not exceed that specified in Section 104.5(d).

Horizontal bridging members attached to the compression chords and their anchorages must be designed for a compressive axial force of $0.0025nP$, where n is the number of joists between end anchors and P is the chord design force in kips (Newtons). The attachment force between the horizontal bridging member and the compression chord is $0.005P$. Horizontal bridging attached to the tension chords shall be proportioned so that the slenderness ratio between attachments does not exceed 300. Diagonal bridging shall be proportioned so that the slenderness ratio between attachments does not exceed 200.

104.10 DEFLECTION

The deflection due to the design live load shall not exceed the following:

Floors: 1/360 of span.

Roofs: 1/360 of span where a plaster ceiling is attached or suspended.

1/240 of span for all other cases.

The specifying professional shall give consideration to the effects of deflection and vibration* in the selection of joists.

* For further reference, refer to Steel Joist Institute Technical Digest #5, "Vibration of Steel Joist-Concrete Slab Floors" and the Institute's Computer Vibration Program.

104.11 PONDING*

The ponding investigation shall be performed by the specifying professional.

* For further reference, refer to Steel Joist Institute Technical Digest #3, "Structural Design of Steel Joist Roofs to Resist Ponding Loads" and AISC Specifications.

104.12 UPLIFT

Where uplift forces due to wind are a design requirement, these forces must be indicated on the contract drawings in terms of NET uplift in pounds per square foot (Pascals). The contract documents shall indicate if the net uplift is based on ASD or LRFD. When these forces are specified, they must be considered in the design of joists and/or bridging. A single line of **bottom chord** bridging must be provided near the first bottom chord panel points whenever uplift due to wind forces is a design consideration.*

* For further reference, refer to Steel Joist Institute Technical Digest #6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads".

104.13 INSPECTION

Joists shall be inspected by the manufacturer before shipment to verify compliance of materials and workmanship with the requirements of these specifications. If the purchaser wishes an inspection of the steel joists by someone other than the manufacturer's own inspectors, they may reserve the right to do so in their "Invitation to Bid" or the accompanying "Job Specifications".

Arrangements shall be made with the manufacturer for such shop inspection of the joists at the manufacturing shop by the purchaser's inspectors at purchaser's expense.

104.14 PARALLEL CHORD SLOPED JOISTS

The span of a parallel chord sloped joist shall be defined by the length along the slope. Minimum depth, load-carrying capacity, and bridging requirements shall be determined by the sloped definition of span. The Load Table capacity shall be the component normal to the joist.



SECTION 105.*

**ERECTION STABILITY
AND HANDLING**

When it is necessary for the erector to climb on the joists, extreme caution must be exercised since unbridged joists may exhibit some degree of instability under the erector's weight.

(a) Stability Requirements

- 1) Before an employee is allowed on the steel joist: BOTH ends of joists at columns (or joists designated as column joists) shall be attached to its supports. For all other joists a minimum of one end shall be attached before the employee is allowed on the joist. The attachment shall be in accordance with Section 104.7 – End Anchorage.

When a bolted seat connection is used for erection purposes, as a minimum, the bolts must be snug tightened. The snug tight condition is defined as the tightness that exists when all plies of a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of an employee using an ordinary spud wrench.

- 2) On steel joists that do not require erection bridging as shown by the unshaded area of the Load Table, only one employee shall be allowed on the joist unless all bridging is installed and anchored.

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

- 3) Where the span of the steel joist is within the Red shaded area of the Load Table, the following shall apply:
 - a) The row of bridging nearest the mid span of the steel joist shall be bolted diagonal erection bridging; and
 - b) Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored, unless an alternate method of stabilizing the joist has been provided; and
 - c) No more than one employee shall be allowed on these spans until all other bridging is installed and anchored.
- 4) Where the span of the steel joist is within the Blue shaded area of the Load Table, the following shall apply:
 - a) All rows of bridging shall be bolted diagonal bridging; and
 - b) Hoisting cables shall not be released until the two rows of bolted diagonal erection bridging nearest the third points of the steel joist are installed and anchored; and

- c) No more than two employees shall be allowed on these spans until all other bridging is installed and anchored.

- 5) Where the span of the steel joist is in the Gray shaded area of the Load Table, the following shall apply:

- a) All rows of bridging shall be bolted diagonal bridging; and
- b) Hoisting cables shall not be released until all bridging is installed and anchored; and
- c) No more than two employees shall be allowed on these spans until all other bridging is installed and anchored.

- 6) When permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points are required to provide lateral stability.

- 7) In the case of bottom chord bearing joists, the ends of the joist must be restrained laterally per Section 104.5(f) before releasing the hoisting cables.

- 8) After the joist is straightened and plumbed, and all bridging is completely installed and anchored, the ends of the joists shall be fully connected to the supports in accordance with Section 104.7- End Anchorage.

(b) Landing and Placing Loads

- 1) Except as stated in paragraph 105(b)(3) of this section, no "construction loads"⁽¹⁾ are allowed on the steel joists until all bridging is installed and anchored, and all joist bearing ends are attached.
- 2) During the construction period, loads placed on the joists shall be distributed so as not to exceed the capacity of the joists.
- 3) No bundle of deck may be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless the following conditions are met:
 - a) The contractor has first determined from a "qualified person"⁽²⁾ and documented in a site specific erection plan that the structure or portion of structure is capable of supporting the load;
 - b) The bundle of decking is placed on a minimum of 3 steel joists;
 - c) The joists supporting the bundle of decking are attached at both ends;
 - d) At least one row of bridging is installed and anchored;
 - e) The total weight of the decking does not exceed 4000 pounds (1816 kilograms); and
 - f) The edge of the bundle of decking shall be placed within 1 foot (0.30 meters) of the bearing surface of the joist end.



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- g) The edge of the construction load shall be placed within 1 foot (0.30 meters) of the bearing surface of the joist end.

(c) Field Welding

- 1) All field welding shall be performed in accordance with contract documents. Field welding shall not damage the joists.
 - 2) On cold-formed members whose yield strength has been attained by cold working, and whose as-formed strength is used in the design, the total length of weld at any one point shall not exceed 50 percent of the overall developed width of the cold-formed section.
- ⁽¹⁾ See page 150 for definition of "construction load". A copy of the OSHA Steel Erection Standard §1926.757, Open Web Steel Joists, is included in Appendix E for reference purposes.

(d) Handling

Particular attention should be paid to the erection of Longspan and Deep Longspan Steel Joists. Care shall be exercised at all times to avoid damage to the joists and accessories.

Each joist shall be adequately braced laterally before any loads are applied. If lateral support is provided by bridging, the bridging lines as defined in Section 105(a), paragraphs 2, 3, 4 and 5, must be anchored to prevent lateral movement.

(e) Fall Arrest Systems

Steel joists shall not be used as anchorage points for a fall arrest system unless written approval to do so is obtained from a "qualified person" ⁽²⁾.

- ⁽²⁾ See page 150 for OSHA definition of "qualified person".



STANDARD LRFD LOAD TABLE

LONGSPAN STEEL JOISTS, LH-SERIES

Based on a 50 ksi Maximum Yield Strength
 Adopted by the Steel Joist Institute May 1, 2000
 Revised to November 10, 2003 - Effective March 01, 2005

The black figures in the following table give the TOTAL safe factored uniformly distributed load-carrying capacities, in pounds per linear foot, of LRFD LH-Series Steel Joists. The weight of factored DEAD loads, including the joists, must in all cases be deducted to determine the factored LIVE load-carrying capacities of the joists. The approximate DEAD load of the joists may be determined from the weights per linear foot shown in the tables.

The RED figures in this load table are the unfactored, nominal LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the RED figures by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

This load table applies to joists with either parallel chords or standard pitched top chords. When top chords are pitched, the carrying capacities are determined by the nominal depth of the joists at the center of the span. Standard top chord pitch is 1/8 inch per foot. If pitch exceeds this standard, the load table does not apply. Sloped parallel-chord joists shall use span as defined by the length along the slope.

Where the joist span is in the RED SHADED area of the load table, the row of bridging nearest the midspan shall be diagonal bridging with bolted connections at chords and intersection. Hoisting cables shall not be released until this row of bolted diagonal bridging is completely installed.

Where the joist span is in the BLUE SHADED area of the load table, all rows of bridging shall be diagonal bridging with bolted connections at chords and intersection. Hoisting cables shall not be released until the two rows of bridging nearest the third points are completely installed.

The approximate moment of inertia of the joist, in inches⁴ is; $I_x = 26.767(W_{LL})(L^3)(10^{-6})$, where W_{LL} = RED figure in the Load Table, and L = (clear span + 0.67) in feet.

When holes are required in top or bottom chords, the carrying capacities must be reduced in proportion to the reduction of chord areas.

The top chords are considered as being stayed laterally by floor slab or roof deck.

The approximate joist weights per linear foot shown in these tables do not include accessories.

LRFD

STANDARD LOAD TABLE FOR LONGSPAN STEEL JOISTS, LH-SERIES																			
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)																			
Joist Designation	Approx. Wt in Lbs. Per Linear Ft (Joists only)	Depth in inches	SAFE LOAD* in Lbs. Between	CLEAR SPAN IN FEET															
				21-24	25	26	27	28	29	30	31	32	33	34	35	36			
18LH02	10	18	18000		702	663	627	586	550	517	486	459	433	409	388	367			
					313	284	259	234	212	193	175	160	147	135	124	114			
18LH03	11	18	19950		781	739	700	657	613	573	538	505	475	448	424	400			
					348	317	289	262	236	213	194	177	161	148	136	124			
18LH04	12	18	23250		906	856	802	750	703	660	619	582	547	516	487	462			
					403	367	329	296	266	242	219	200	182	167	153	141			
18LH05	15	18	26250		1026	972	921	871	814	762	714	672	631	595	562	532			
					454	414	378	345	311	282	256	233	212	195	179	164			
18LH06	15	18	31050		1213	1123	1044	972	907	849	796	748	705	664	627	594			
					526	469	419	377	340	307	280	254	232	212	195	180			
18LH07	17	18	32250		1260	1213	1170	1089	1017	952	892	838	789	744	703	666			
					553	513	476	428	386	349	317	288	264	241	222	204			
18LH08	19	18	33600		1314	1264	1218	1176	1137	1075	1020	961	906	856	810	768			
					577	534	496	462	427	387	351	320	292	267	246	226			
18LH09	21	18	36000		1404	1351	1302	1257	1215	1174	1138	1069	1006	949	897	849			
					616	571	527	491	458	418	380	346	316	289	266	245			
			22-24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
20LH02	10	20	16950		663	655	646	615	582	547	516	487	460	436	412	393	373	355	337
					306	303	298	274	250	228	208	190	174	160	147	136	126	117	108
20LH03	11	20	18000		703	694	687	678	651	621	592	558	528	499	474	448	424	403	382
					337	333	317	302	280	258	238	218	200	184	169	156	143	133	123
20LH04	12	20	22050		861	849	837	792	744	700	660	624	589	558	529	502	477	454	433
					428	406	386	352	320	291	265	243	223	205	189	174	161	149	139
20LH05	14	20	23700		924	913	903	892	856	816	769	726	687	651	616	585	556	529	504
					459	437	416	395	366	337	308	281	258	238	219	202	187	173	161
20LH06	15	20	31650		1233	1186	1144	1084	1018	952	894	840	790	745	703	666	631	598	568
					606	561	521	477	427	386	351	320	292	267	246	226	209	192	178
20LH07	17	20	33750		1317	1267	1221	1179	1140	1066	1000	940	885	834	789	745	706	670	637
					647	599	556	518	484	438	398	362	331	303	278	256	236	218	202
20LH08	19	20	34800		1362	1309	1263	1219	1177	1140	1083	1030	981	931	882	837	795	754	718
					669	619	575	536	500	468	428	395	365	336	309	285	262	242	225
20LH09	21	20	38100		1485	1429	1377	1329	1284	1242	1203	1167	1132	1068	1009	954	904	858	816
					729	675	626	581	542	507	475	437	399	366	336	309	285	264	244
20LH10	23	20	41100		1602	1542	1486	1434	1386	1341	1297	1258	1221	1186	1122	1060	1005	954	906
					786	724	673	626	585	545	510	479	448	411	377	346	320	296	274



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LRFD

STANDARD LOAD TABLE FOR LONGSPAN STEEL JOISTS, LH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	Approx. Wt in Lbs. Per Linear Ft. (Joists only)	Depth in inches	SAFELOAD* in Lbs. Between	CLEAR SPAN IN FEET															
				28-32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
24LH03	11	24	17250	513	508	504	484	460	439	418	400	382	366	351	336	322	310	298	286
24LH04	12	24	21150	235	226	218	204	188	175	162	152	141	132	124	116	109	102	96	90
24LH05	13	24	22650	628	597	568	540	514	490	468	447	427	409	393	376	361	346	333	321
24LH06	16	24	30450	288	265	246	227	210	195	182	169	158	148	138	130	122	114	107	101
24LH07	17	24	33450	673	669	660	628	598	570	544	520	496	475	456	436	420	403	387	372
24LH08	18	24	35700	308	297	285	264	244	226	210	196	182	171	160	150	141	132	124	117
24LH09	21	24	42000	906	868	832	795	756	720	685	655	625	598	571	546	522	501	480	460
24LH10	23	24	44400	411	382	356	331	306	284	263	245	228	211	197	184	172	161	152	142
24LH11	25	24	46800	997	957	919	882	847	811	774	736	702	669	639	610	583	559	535	514
28LH05	13	28	21000	452	421	393	367	343	320	297	276	257	239	223	208	195	182	171	161
28LH06	16	28	27900	1060	1015	973	933	895	858	817	780	745	712	682	652	625	600	576	553
28LH07	17	28	31500	480	447	416	388	362	338	314	292	272	254	238	222	208	196	184	173
28LH08	18	28	33750	1248	1212	1177	1146	1096	1044	994	948	903	861	822	786	751	720	690	661
28LH09	21	28	41550	562	530	501	460	424	393	363	337	313	292	272	254	238	223	209	196
28LH10	23	28	45450	1323	1284	1248	1213	1182	1152	1105	1053	1002	955	912	873	834	799	766	735
28LH11	25	28	48750	596	559	528	500	474	439	406	378	351	326	304	285	266	249	234	220
28LH12	27	28	53550	1390	1350	1312	1276	1243	1210	1180	1152	1101	1051	1006	963	924	885	850	816
28LH13	30	28	55800	624	588	555	525	498	472	449	418	388	361	337	315	294	276	259	243
32LH06	14	32	25050	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
32LH07	16	32	28200	505	484	465	445	429	412	397	382	367	355	342	330	319	309	298	289
32LH08	17	32	30600	219	205	192	180	169	159	150	142	133	126	119	113	107	102	97	92
32LH09	21	32	38400	672	643	618	592	568	546	525	505	486	469	451	436	421	406	393	379
32LH10	21	32	42450	289	270	253	238	223	209	197	186	175	166	156	148	140	133	126	120
32LH11	24	32	46500	757	726	696	667	640	615	591	568	547	528	508	490	474	457	442	427
32LH12	27	32	54600	326	305	285	267	251	236	222	209	197	186	176	166	158	150	142	135
32LH13	30	32	60900	810	775	744	712	684	657	630	604	580	556	535	516	496	478	462	445
32LH14	33	32	62700	348	325	305	285	268	252	236	222	209	196	185	175	165	156	148	140
32LH15	35	32	64800	1000	958	918	879	844	810	778	748	721	694	669	645	622	601	580	561
36LH07	16	36	25200	428	400	375	351	329	309	291	274	258	243	228	216	204	193	183	173
36LH08	18	36	27750	1093	1056	1018	976	937	900	864	831	799	769	742	715	690	666	643	622
36LH09	21	36	35550	466	439	414	388	364	342	322	303	285	269	255	241	228	215	204	193
36LH10	21	36	39150	1170	1143	1104	1066	1023	982	943	907	873	841	810	781	753	727	702	679
36LH11	23	36	42750	498	475	448	423	397	373	351	331	312	294	278	263	249	236	223	212
36LH12	25	36	51150	1285	1255	1227	1200	1173	1149	1105	1063	1023	984	948	913	880	849	819	790
36LH13	30	36	60150	545	520	496	476	454	435	408	383	361	340	321	303	285	270	256	243
36LH14	36	36	66300	1342	1311	1281	1252	1224	1198	1173	1149	1126	1083	1041	1002	964	930	897	865
36LH15	36	36	69900	569	543	518	495	472	452	433	415	396	373	352	332	314	297	281	266
36LH07	16	36	25200	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
36LH08	18	36	27750	507	489	472	456	441	426	412	399	385	373	363	351	340	330	321	312
36LH09	21	36	35550	211	199	189	179	169	161	153	145	138	131	125	119	114	108	104	99
36LH10	21	36	39150	568	549	529	511	493	477	462	447	432	418	406	393	381	370	360	349
36LH11	23	36	42750	235	223	211	200	189	179	170	162	154	146	140	133	127	121	116	111
36LH12	25	36	51150	616	595	574	553	535	517	499	483	468	453	439	426	412	400	388	378
36LH13	30	36	60150	255	242	229	216	205	194	184	175	167	159	151	144	137	131	125	120
36LH14	36	36	66300	774	747	720	694	670	648	627	606	586	568	550	534	517	502	487	472
36LH15	36	36	69900	319	302	285	270	256	243	230	219	208	198	189	180	172	164	157	149
36LH07	16	36	25200	856	825	796	768	742	717	693	667	645	624	603	583	564	546	529	513
36LH08	18	36	27750	352	332	315	297	282	267	254	240	228	217	206	196	186	178	169	162
36LH09	21	36	35550	937	903	870	840	811	783	757	732	709	687	664	643	624	604	585	567
36LH10	21	36	39150	385	363	343	325	308	292	277	263	251	239	227	216	206	196	187	179
36LH11	23	36	42750	1101	1068	1032	996	961	928	897	867	838	811	786	762	738	715	694	673
36LH12	25	36	51150	450	428	406	384	364	345	327	311	295	281	267	255	243	232	221	211
36LH13	30	36	60150	1225	1201	1177	1156	1133	1107	1085	1069	1053	1037	1021	1005	989	973	957	941
36LH14	36	36	66300	500	480	461	444	420	397	376	354	336	319	304	288	275	262	249	238
36LH15	36	36	69900	1264	1239	1215	1192	1170	1149	1107	1069	1032	997	964	933	903	874	846	820
36LH07	16	36	25200	515	495	476	458	440	417	395	374	355	337	321	304	290	276	264	251
36LH08	18	36	27750	1305	1279	1255	1231	1207	1186	1164	1144	1125	1087	1051	1017	984	952	924	895
36LH09	21	36	35550	532	511	492	473	454	438	422	407	393	374	355	338	322	306	292	279
36LH10	21	36	39150	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
36LH11	23	36	42750	438	424	411	399	387	376	366	355	345	336	327	318	310	301	294	286
36LH12	25	36	51150	177	168	160	153	146	140	134	128	122	117	112	107	103	99	95	91
36LH13	30	36	60150	481	466	453	439	426	414	402	390	379	369	358	349	340	331	322	313
36LH14	36	36	66300	194	185	176	168	160	153	146									

LRFD

STANDARD LOAD TABLE FOR LONGSPAN STEEL JOISTS, LH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	Approx. Wt in Lbs. Per Linear Ft. (Joists Only)	Depth in Inches	SAFELOAD* in Lbs. Between		CLEAR SPAN IN FEET															
			47-59	60-64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
40LH08	16	40	24900	24900	381	370	361	351	342	333	325	316	309	301	294	288	280	274	267	261
40LH09	21	40	32700	32700	498	484	472	459	447	436	424	414	403	394	384	375	366	358	349	342
40LH10	21	40	36000	36000	550	535	520	507	493	481	469	457	445	435	424	414	403	393	382	373
40LH11	22	40	39300	39300	598	582	567	552	537	523	510	498	484	472	462	450	439	429	418	409
40LH12	25	40	47850	47850	729	708	688	670	652	636	619	603	588	573	559	546	532	519	507	495
40LH13	30	40	56400	56400	859	835	813	792	771	750	730	712	694	676	660	643	628	613	598	585
40LH14	35	40	64500	64500	984	957	930	904	880	856	834	813	792	772	753	735	717	699	682	666
40LH15	36	40	72150	72150	1101	1068	1036	1006	978	949	924	898	874	850	828	807	786	766	747	729
40LH16	42	40	79500	79500	1212	1194	1176	1158	1141	1126	1095	1065	1036	1009	982	957	933	909	886	864
					469	455	441	428	416	404	387	371	356	342	329	316	304	292	282	271
			52-59	60-72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
44LH09	19	44	30000	30000	408	397	388	379	370	363	354	346	339	331	324	316	310	303	297	291
44LH10	21	44	33150	33150	450	439	429	418	408	399	390	381	373	364	357	349	342	334	327	321
44LH11	22	44	35850	35850	487	475	465	453	442	433	423	414	403	396	387	378	370	363	354	348
44LH12	25	44	44400	44400	603	589	574	561	547	534	520	508	496	484	472	462	450	439	430	420
44LH13	30	44	52650	52650	715	699	681	666	649	634	619	606	592	579	565	553	541	529	519	507
44LH14	31	44	60600	60600	823	801	780	759	739	721	703	685	669	654	637	622	609	594	580	568
44LH15	36	44	70500	70500	958	934	912	889	868	847	826	805	786	768	750	732	714	699	682	667
44LH16	42	44	81300	81300	1105	1078	1051	1026	1002	978	955	933	912	891	870	852	832	814	796	780
44LH17	47	44	87300	87300	1185	1170	1153	1138	1125	1098	1072	1048	1024	1000	978	957	936	915	895	876
					450	438	426	415	405	390	376	363	351	338	327	316	305	295	285	276
			56-59	60-80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
48LH10	21	48	30000	30000	369	361	354	346	339	331	325	318	312	306	300	294	288	282	277	271
48LH11	22	48	32550	32550	399	390	382	373	366	358	351	343	337	330	324	318	312	306	300	294
48LH12	25	48	41100	41100	504	493	483	472	462	451	442	433	424	415	408	399	391	384	376	369
48LH13	29	48	49200	49200	603	589	576	564	552	540	529	517	507	498	487	477	468	459	450	441
48LH14	32	48	58050	58050	712	696	681	666	651	637	624	610	598	585	574	562	550	540	529	519
48LH15	36	48	66750	66750	817	799	781	765	748	732	717	702	687	672	658	645	633	619	607	595
48LH16	42	48	76950	76950	943	922	901	882	864	844	826	810	792	777	760	745	730	715	702	688
48LH17	47	48	86400	86400	1059	1035	1012	990	969	948	928	909	889	871	853	837	820	804	787	772
					397	383	371	358	346	335	324	314	304	294	285	276	268	260	252	245

* The safe factored uniform load for the clear spans shown in the Safe Load Column is equal to (Safe Load) / (Clear span + 0.67). (The added 0.67 feet (8 inches) is required to obtain the proper length on which the Load Tables were developed).

In no case shall the safe factored uniform load, for clear spans less than the minimum clear span shown in the Safe Load Column, exceed the uniform load calculated for the minimum clear span listed in the Safe Load Column.

To solve for live loads for clear spans shown in the Safe Load Column (or lesser clear spans), multiply the live load of the shortest clear span shown in the Load Table by the (the shortest clear span shown in the Load Table + 0.67 feet)² and divide by (the actual clear span + 0.67 feet)². The live load shall not exceed the safe uniform load.



STANDARD ASD LOAD TABLE

LONGSPAN STEEL JOISTS, LH-SERIES

Based on a 50 ksi Maximum Yield Strength
 Adopted by the Steel Joist Institute May 25, 1983
 Revised to November 10, 2003 - Effective March 01, 2005

The black figures in the following table give the TOTAL safe uniformly distributed load-carrying capacities, in pounds per linear foot, of ASD LH-Series Steel Joists. The weight of DEAD loads, including the joists, must in all cases be deducted to determine the LIVE load-carrying capacities of the joists. The approximate DEAD load of the joists may be determined from the weights per linear foot shown in the tables.

The RED figures in this load table are the nominal LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the RED figures by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

This load table applies to joists with either parallel chords or standard pitched top chords. When top chords are pitched, the carrying capacities are determined by the nominal depth of the joists at the center of the span. Standard top chord pitch is 1/8 inch per foot. If pitch exceeds this standard, the load table does not apply. Sloped parallel-chord joists shall use span as defined by the length along the slope.

Where the joist span is in the RED SHADED area of the load table, the row of bridging nearest the midspan shall be diagonal bridging with bolted connections at chords and intersection. Hoisting cables shall not be released until this row of bolted diagonal bridging is completely installed.

Where the joist span is in the BLUE SHADED area of the load table, all rows of bridging shall be diagonal bridging with bolted connections at chords and intersection. Hoisting cables shall not be released until the two rows of bridging nearest the third points are completely installed.

The approximate moment of inertia of the joist, in inches⁴ is; $I_x = 26.767(W_{LL})(L^3)(10^{-6})$, where W_{LL} = RED figure in the Load Table, and L = (clear span + 0.67) in feet.

When holes are required in top or bottom chords, the carrying capacities must be reduced in proportion to the reduction of chord areas.

The top chords are considered as being stayed laterally by floor slab or roof deck.

The approximate joist weights per linear foot shown in these tables do not include accessories.

ASD

STANDARD LOAD TABLE FOR LONGSPAN STEEL JOISTS, LH-SERIES																
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)																
Joist Designation	Approx. Wt in Lbs. Per Linear Ft (Joists only)	Depth in inches	SAFE LOAD* in Lbs. Between	CLEAR SPAN IN FEET												
				21-24	25	26	27	28	29	30	31	32	33	34	35	36
18LH02	10	18	12000	468	442	418	391	367	345	324	306	289	273	259	245	
18LH03	11	18	13300	521	493	467	438	409	382	359	337	317	299	283	267	
18LH04	12	18	15500	604	571	535	500	469	440	413	388	365	344	325	308	
18LH05	15	18	17500	684	648	614	581	543	508	476	448	421	397	375	355	
18LH06	15	18	20700	809	749	696	648	605	566	531	499	470	443	418	396	
18LH07	17	18	21500	840	809	780	726	678	635	595	559	526	496	469	444	
18LH08	19	18	22400	876	843	812	784	758	717	680	641	604	571	540	512	
18LH09	21	18	24000	936	901	868	838	810	783	759	713	671	633	598	566	
				616	571	527	491	458	418	380	346	316	289	266	245	
			22-24	25	26	27	28	29	30	31	32	33	34	35	36	37
20LH02	10	20	11300	442	437	431	410	388	365	344	325	307	291	275	262	249
20LH03	11	20	12000	306	303	298	274	250	228	208	190	174	160	147	136	126
20LH04	12	20	14700	469	463	458	452	434	414	395	372	352	333	316	299	283
20LH05	14	20	15800	337	333	317	302	280	258	238	218	200	184	169	156	143
20LH06	15	20	21100	574	566	558	528	496	467	440	416	393	372	353	335	318
20LH07	17	20	22500	428	406	386	352	320	291	265	243	223	205	189	174	161
20LH08	19	20	23200	616	609	602	595	571	544	513	484	458	434	411	390	371
20LH09	21	20	25400	459	437	416	395	366	337	308	281	258	238	219	202	187
20LH10	23	20	27400	822	791	763	723	679	635	596	560	527	497	469	444	421
				606	561	521	477	427	386	351	320	292	267	246	226	209
				878	845	814	786	760	711	667	627	590	556	526	497	471
				647	599	556	518	484	438	398	362	331	303	278	256	236
				908	873	842	813	785	760	722	687	654	621	588	558	530
				669	619	575	536	500	468	428	395	365	336	309	285	264
				990	953	918	886	856	828	802	778	755	712	673	636	603
				729	675	626	581	542	507	475	437	399	366	336	309	285
				1068	1028	991	956	924	894	865	839	814	791	748	707	670
				786	724	673	626	585	545	510	479	448	411	377	346	320



ASD

STANDARD LOAD TABLE FOR LONGSPAN STEEL JOISTS, LH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	Approx. Wt in Lbs. Per Linear Ft. (Joists only)	Depth in inches	SAFELOAD* in Lbs. Between	CLEAR SPAN IN FEET																	
				28-32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
24LH03	11	24	11500	342	339	336	323	307	293	279	267	255	244	234	224	215	207	199	191		
24LH04	12	24	14100	235	226	218	204	188	175	162	152	141	132	124	116	109	102	96	90		
24LH05	13	24	15100	419	398	379	360	343	327	312	298	285	273	262	251	241	231	222	214		
24LH06	16	24	20300	288	265	246	227	210	195	182	169	158	148	138	130	122	114	107	101		
24LH07	17	24		449	446	440	419	399	380	363	347	331	317	304	291	280	269	258	248		
24LH08	18	24		308	297	285	264	244	226	210	196	182	171	160	150	141	132	124	117		
24LH09	21	24		604	579	555	530	504	480	457	437	417	399	381	364	348	334	320	307		
24LH10	23	24		411	382	356	331	306	284	263	245	228	211	197	184	172	161	152	142		
24LH11	25	24		665	638	613	588	565	541	516	491	468	446	426	407	389	373	357	343		
				452	421	393	367	343	320	297	276	257	239	223	208	195	182	171	161		
				707	677	649	622	597	572	545	520	497	475	455	435	417	400	384	369		
				480	447	416	388	362	338	314	292	272	254	238	222	208	196	184	173		
				832	808	785	764	731	696	663	632	602	574	548	524	501	480	460	441		
				562	530	501	460	424	393	363	337	313	292	272	254	238	223	209	196		
				882	856	832	809	788	768	737	702	668	637	608	582	556	533	511	490		
				596	559	528	500	474	439	406	378	351	326	304	285	266	249	234	220		
				927	900	875	851	829	807	787	768	734	701	671	642	616	590	567	544		
				624	588	555	525	498	472	449	418	388	361	337	315	294	276	259	243		
				33-40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	
28LH05	13	28	14000	337	323	310	297	286	275	265	255	245	237	228	220	213	206	199	193		
28LH06	16	28	18600	219	205	192	180	169	159	150	142	133	126	119	113	107	102	97	92		
28LH07	17	28	21000	448	429	412	395	379	364	350	337	324	313	301	291	281	271	262	253		
28LH08	18	28	22500	289	270	253	238	223	209	197	186	175	166	156	148	140	133	126	120		
28LH09	21	28	27700	505	484	464	445	427	410	394	379	365	352	339	327	316	305	295	285		
28LH10	23	28	30300	326	305	285	267	251	236	222	209	197	186	176	166	158	150	142	135		
28LH11	25	28	32500	540	517	496	475	456	438	420	403	387	371	357	344	331	319	308	297		
28LH12	27	28	35700	348	325	305	285	268	252	236	222	209	196	185	175	165	156	148	140		
28LH13	30	28	37200	667	639	612	586	563	540	519	499	481	463	446	430	415	401	387	374		
				428	400	375	351	329	309	291	274	258	243	228	216	204	193	183	173		
				729	704	679	651	625	600	576	554	533	513	495	477	460	444	429	415		
				466	439	414	388	364	342	322	303	285	269	255	241	228	215	204	193		
				780	762	736	711	682	655	629	605	582	561	540	521	502	485	468	453		
				498	475	448	423	397	373	351	331	312	294	278	263	249	236	223	212		
				857	837	818	800	782	766	737	709	682	656	632	609	587	566	546	527		
				545	520	496	476	454	435	408	383	361	340	321	303	285	270	256	243		
				895	874	854	835	816	799	782	766	751	722	694	668	643	620	598	577		
				569	543	518	495	472	452	433	415	396	373	352	332	314	297	281	266		
				38-46	47-48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
32LH06	14	32	16700	338	326	315	304	294	284	275	266	257	249	242	234	227	220	214	208		
32LH07	16	32	18800	211	199	189	179	169	161	153	145	138	131	125	119	114	108	104	99		
32LH08	17	32	20400	379	366	353	341	329	318	308	298	288	279	271	262	254	247	240	233		
32LH09	21	32	25600	235	223	211	200	189	179	170	162	154	146	140	133	127	121	116	111		
32LH10	21	32	28300	411	397	383	369	357	345	333	322	312	302	293	284	275	267	259	252		
32LH11	24	32	31000	255	242	229	216	205	194	184	175	167	159	151	144	137	131	125	120		
32LH12	27	32	36400	516	498	480	463	447	432	418	404	391	379	367	356	345	335	325	315		
32LH13	30	32	40600	319	302	285	270	256	243	230	219	208	198	189	180	172	164	157	149		
32LH14	33	32	41800	571	550	531	512	495	478	462	445	430	416	402	389	376	364	353	342		
32LH15	35	32	43200	352	332	315	297	282	267	254	240	228	217	206	196	186	178	169	162		
				625	602	580	560	541	522	505	488	473	458	443	429	416	403	390	378		
				385	363	343	325	308	292	277	263	251	239	227	216	206	196	187	179		
				734	712	688	664	641	619	598	578	559	541	524	508	492	477	463	449		
				450	428	406	384	364	345	327	311	295	281	267	255	243	232	221	211		
				817	801	785	771	742	715	690	666	643	621	600	581	562	544	527	511		
				500	480	461	444	420	397	376	354	336	319	304	288	275	262	249	238		
				843	826	810	795	780	766	738	713	688	665	643	622	602	583	564	547		
				515	495	476	458	440	417	395	374	355	337	321	304	290	276	264	251		
				870	853	837	821	805	791	776	763	750	725	701	678	656	635	616	597		
				532	511	492	473	454	438	422	407	393	374	355	338	322	306	292	279		
				42-46	47-56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
36LH07	16	36	16800	292	283	274	266	258	251	244	237	230	224	218	212	207	201	196	191		
36LH08	18	36	18500	177	168	160	153	146	140	134	128	122	117	112	107	103	99	95	91		
36LH09	21	36	23700	321	311	302	293	284	276	268	260	253	246	239	233	227	221	215	209		
36LH10	21	36	26100	194	185	176	168	160	153	146	140	134	128	123	118	113	109	104	100		
36LH11	23	36	28500	411	398	386	374	363	352	342	333	323	314	306	297	289	282	275	267		
36LH12	25	36	34100	247	235	224	214	204	195	186	179	171	163	157	150	144	138	133	127		
36LH13	30	36	40100	454	440	426	413	401	389	378	367	357	347	338	328	320	311	303	295		
36LH14	36	36	44200	273	260																

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ASD

STANDARD LOAD TABLE FOR LONGSPAN STEEL JOISTS, LH-SERIES																			
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)																			
Joist Designation	Approx. Wt in Lbs. Per Linear Ft. (Joists Only)	Depth in inches	SAFELOAD* in Lbs. Between		CLEAR SPAN IN FEET														
			47-59	60-64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
40LH08	16	40	16600	16600	254	247	241	234	228	222	217	211	206	201	196	192	187	183	178
40LH09	21	40	21800	21800	332	323	315	306	298	291	283	276	269	263	256	250	244	239	233
40LH10	21	40	24000	24000	367	357	347	338	329	321	313	305	297	290	283	276	269	262	255
40LH11	22	40	26200	26200	399	388	378	368	358	349	340	332	323	315	308	300	293	286	279
40LH12	25	40	31900	31900	486	472	459	447	435	424	413	402	392	382	373	364	355	346	338
40LH13	30	40	37600	37600	573	557	542	528	514	500	487	475	463	451	440	429	419	409	399
40LH14	35	40	43000	43000	656	638	620	603	587	571	556	542	528	515	502	490	478	466	455
40LH15	36	40	48100	48100	734	712	691	671	652	633	616	599	583	567	552	538	524	511	498
40LH16	42	40	53000	53000	808	796	784	772	761	751	739	710	691	673	655	638	622	606	591
					469	455	441	428	416	404	387	371	356	342	329	316	304	292	282
			52-59	60-72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
44LH09	19	44	20000	20000	272	265	259	253	247	242	236	231	226	221	216	211	207	202	198
44LH10	21	44	22100	22100	300	293	286	279	272	266	260	254	249	243	238	233	228	223	218
44LH11	22	44	23900	23900	325	317	310	302	295	289	282	276	269	264	258	252	247	242	236
44LH12	25	44	29600	29600	402	393	383	374	365	356	347	339	331	323	315	308	300	293	287
44LH13	30	44	35100	35100	477	466	454	444	433	423	413	404	395	386	377	369	361	353	346
44LH14	31	44	40400	40400	549	534	520	506	493	481	469	457	446	436	425	415	406	396	387
44LH15	36	44	47000	47000	639	623	608	593	579	565	551	537	524	512	500	488	476	466	455
44LH16	42	44	54200	54200	737	719	701	684	668	652	637	622	608	594	580	568	555	543	531
44LH17	47	44	58200	58200	790	780	769	759	750	732	715	699	683	667	652	638	624	610	597
					450	438	426	415	405	390	376	363	351	338	327	316	305	295	285
			56-59	60-80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
48LH10	21	48	20000	20000	246	241	236	231	226	221	217	212	208	204	200	196	192	188	185
48LH11	22	48	21700	21700	266	260	255	249	244	239	234	229	225	220	216	212	208	204	200
48LH12	25	48	27400	27400	336	329	322	315	308	301	295	289	283	277	272	266	261	256	251
48LH13	29	48	32800	32800	402	393	384	376	368	360	353	345	338	332	325	318	312	306	300
48LH14	32	48	38700	38700	475	464	454	444	434	425	416	407	399	390	383	375	367	360	353
48LH15	36	48	44500	44500	545	533	521	510	499	488	478	468	458	448	439	430	422	413	405
48LH16	42	48	51300	51300	629	615	601	588	576	563	551	540	528	518	507	497	487	477	468
48LH17	47	48	57600	57600	706	690	675	660	646	632	619	606	593	581	569	558	547	536	525
					397	383	371	358	346	335	324	314	304	294	285	276	268	260	252

* The safe uniform load for the clear spans shown in the Safe Load Column is equal to (Safe Load) / (Clear span + 0.67). (The added 0.67 feet (8 inches) is required to obtain the proper length on which the Load Tables were developed).

In no case shall the safe uniform load, for clear spans less than the minimum clear span shown in the Safe Load Column, exceed the uniform load calculated for the minimum clear span listed in the Safe Load Column.

To solve for live loads for clear spans shown in the Safe Load Column (or lesser clear spans), multiply the live load of the shortest clear span shown in the Load Table by the (the shortest clear span shown in the Load Table + 0.67 feet)² and divide by (the actual clear span + 0.67 feet)². The live load shall not exceed the safe uniform load.



STANDARD LRFD LOAD TABLE

DEEP LONGSPAN STEEL JOISTS, DLH-SERIES

Based on a 50 ksi Maximum Yield Strength
 Adopted by the Steel Joist Institute May 1, 2000
 Revised to November 10, 2003 - Effective March 01, 2005

The black figures in the following table give the TOTAL safe factored uniformly distributed load-carrying capacities, in pounds per linear foot, of an LRFD DLH-Series Steel Joists. The weight of factored DEAD loads, including the joists, must in all cases be deducted to determine the factored LIVE load-carrying capacities of the joists. The approximate DEAD load of the joists may be determined from the weights per linear foot shown in the tables. All loads shown are for roof construction only.

The RED figures in this load table are the unfactored, nominal LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the RED figures by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

This load table applies to joists with either parallel chords or standard pitched top chords. When top chords are pitched, the carrying capacities are determined by the nominal depth of the joists at the center of the span. Standard top chord pitch is 1/8 inch per foot. If pitch exceeds this standard, the load table does not apply. Sloped parallel-chord joists shall use span as defined by the length along the slope.

All rows of bridging shall be diagonal bridging with bolted connections at the chords and intersections.

Where the joist span is in the **BLUE SHADED** area of the load table hoisting cables shall not be released until the two rows of bridging nearest the third points are completely installed.

Where the joist span is in the **GRAY SHADED** area of the load table hoisting cables shall not be released until all rows of bridging are completely installed.

The approximate moment of inertia of the joist, in inches⁴ is; $I_j = 26.767(W_{LL})(L^3)(10^{-6})$, where W_{LL} = RED figure in the Load Table, and L = (clear span + 0.67) in feet.

When holes are required in top or bottom chords, the carrying capacities must be reduced in proportion to the reduction of chord areas.

The top chords are considered as being stayed laterally by floor slab or roof deck.

The approximate joist weights per linear foot shown in these tables do not include accessories.

LRFD

STANDARD LOAD TABLE FOR DEEP LONGSPAN STEEL JOISTS, DLH-SERIES
 Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	Approx. Wt in Lbs. Per Linear Ft (Joists only)	Depth in inches	SAFELOAD* in Lbs. Between	CLEAR SPAN IN LINEAR FEET														
				61-88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
52DLH10	25	52	40050	447	436	427	418	409	400	391	384	376	369	361	354	346	340	334
				171	165	159	154	150	145	140	136	132	128	124	120	116	114	110
52DLH11	26	52	43950	490	480	469	459	448	439	430	421	412	405	396	388	381	373	366
				187	181	174	169	164	158	153	149	144	140	135	132	128	124	120
52DLH12	29	52	49050	547	535	523	513	501	490	480	471	460	451	442	433	426	417	409
				204	197	191	185	179	173	168	163	158	153	149	144	140	135	132
52DLH13	34	52	59550	664	649	636	621	609	595	583	571	559	549	537	526	516	507	496
				247	239	231	224	216	209	203	197	191	185	180	174	170	164	159
52DLH14	39	52	68100	760	745	729	714	699	685	670	657	645	631	619	607	595	585	573
				276	266	258	249	242	234	227	220	213	207	201	194	189	184	178
52DLH15	42	52	76500	853	835	817	799	783	766	750	735	720	705	691	676	664	651	639
				311	301	291	282	272	264	256	247	240	233	226	219	213	207	201
52DLH16	45	52	82500	921	901	882	862	844	826	810	792	777	760	745	730	717	702	688
				346	335	324	314	304	294	285	276	267	260	252	245	237	230	224
52DLH17	52	52	94950	1059	1036	1014	991	970	951	930	912	892	874	858	840	823	808	792
				395	381	369	357	346	335	324	315	304	296	286	279	270	263	255
				97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
56DLH11	26	56	42150	432	424	415	408	400	393	385	379	372	366	358	352	346	340	334
				169	163	158	153	149	145	140	136	133	129	125	122	118	115	113
56DLH12	30	56	48450	496	486	477	468	459	450	442	433	426	417	409	402	394	388	381
				184	178	173	168	163	158	153	150	145	141	137	133	130	126	123
56DLH13	34	56	58650	601	591	579	568	558	547	537	526	516	507	496	487	478	471	462
				223	216	209	204	197	191	186	181	175	171	166	161	157	152	149
56DLH14	39	56	66300	679	666	652	640	628	616	604	594	582	571	562	552	541	532	523
				249	242	234	228	221	214	209	202	196	190	186	181	175	171	167
56DLH15	42	56	75750	777	762	747	732	717	703	690	676	664	651	639	628	616	604	594
				281	272	264	256	248	242	234	228	221	215	209	204	198	192	188
56DLH16	46	56	81750	838	822	805	789	774	759	744	730	717	703	690	678	666	654	642
				313	304	294	285	277	269	262	254	247	240	233	227	221	214	209
56DLH17	51	56	94200	964	945	927	907	891	873	856	840	823	808	793	780	765	751	738
				356	345	335	325	316	306	298	289	281	273	266	258	251	245	238



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LRFD

STANDARD LOAD TABLE LONGSPAN STEEL JOISTS, LRFD DLH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

STANDARD LOAD TABLE LONGSPAN STEEL JOISTS, LRFD DLH-SERIES																					
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)																					
Joist Designation	Approx. Wt in Lbs. Per Linear Ft (Joists only)	Depth in inches	SAFE LOAD* in Lbs. Between		CLEAR SPAN IN LINEAR FEET																
			70-99	100-104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	
60DLH12	29	60	46650	46650	442	433	426	418	411	405	397	391	384	378	372	366	360	354	348	342	
60DLH13	35	60	56700	56700	537	526	517	508	499	490	483	474	466	459	451	444	436	429	423	415	
					203	197	191	187	181	176	171	167	163	158	154	151	147	143	139	135	
60DLH14	40	60	63000	63000	597	586	574	564	555	544	534	525	516	507	498	490	481	474	465	457	
60DLH15	43	60	73950	73950	216	210	205	199	193	189	183	178	173	170	165	161	156	152	149	145	
					255	248	242	235	228	223	216	210	205	200	194	190	185	180	175	171	
60DLH16	46	60	81300	81300	769	756	741	727	714	702	690	676	666	654	642	631	621	610	600	589	
60DLH17	52	60	93450	93450	285	277	269	262	255	247	241	235	228	223	217	211	206	201	196	190	
					885	868	853	837	822	807	793	778	765	751	739	726	714	702	690	679	
60DLH18	59	60	107850	107850	324	315	306	298	290	283	275	267	261	254	247	241	235	228	223	217	
					1021	1002	984	966	948	931	915	898	883	867	852	838	823	810	796	783	
					366	357	346	337	327	319	310	303	294	286	279	272	266	259	252	246	
			75-99	100-112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	
64DLH12	31	64	45000	45000	396	388	382	376	370	364	358	352	346	342	336	331	327	321	316	312	
64DLH13	34	64	54600	54600	153	150	146	142	138	135	132	129	125	122	119	116	114	111	109	106	
					481	472	465	457	450	442	436	429	421	415	409	403	396	390	385	379	
64DLH14	40	64	62550	62550	186	181	176	171	168	163	159	155	152	148	144	141	137	134	131	128	
64DLH15	43	64	71700	71700	550	540	531	523	514	505	498	489	481	474	466	459	451	444	438	430	
					199	193	189	184	179	174	171	166	162	158	154	151	147	143	140	136	
64DLH16	46	64	80700	80700	631	621	610	600	591	580	571	562	553	544	537	528	520	511	504	496	
64DLH17	52	64	93000	93000	234	228	223	217	211	206	201	196	191	187	182	177	173	170	165	161	
					819	804	790	777	763	751	738	726	714	702	691	681	669	658	648	639	
64DLH18	59	64	107400	107400	298	290	283	275	268	262	255	248	243	237	231	226	220	215	210	205	
					945	928	912	897	880	867	852	838	823	810	798	784	772	760	748	736	
					337	328	320	311	304	296	288	282	274	267	261	255	249	243	237	232	
			80-99	100-120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	
68DLH13	37	68	52500	52500	432	426	418	412	406	400	394	388	382	378	372	366	361	355	351	346	
68DLH14	40	68	60450	60450	171	168	164	159	155	152	149	145	142	138	135	133	130	127	124	121	
					498	490	483	475	468	462	454	448	441	435	429	421	415	409	403	399	
68DLH15	44	68	67800	67800	184	179	175	171	167	163	159	155	152	148	145	141	138	135	133	130	
68DLH16	49	68	80400	80400	558	547	540	531	522	514	505	498	490	483	475	468	462	454	448	441	
					206	201	196	191	187	182	178	174	170	166	162	158	155	152	148	145	
68DLH17	55	68	90600	90600	661	649	640	630	619	610	600	591	582	573	564	556	547	540	531	523	
68DLH18	61	68	104850	104850	242	236	230	225	219	214	209	204	199	195	190	186	182	178	174	171	
					745	733	721	711	700	690	679	669	658	649	640	630	621	612	604	595	
68DLH19	67	68	120750	120750	275	268	262	256	249	244	238	232	228	222	217	212	208	203	198	194	
					862	849	835	823	810	798	786	774	762	751	739	729	718	708	697	688	
					311	304	297	289	283	276	269	263	257	251	246	240	234	230	225	219	
					993	976	961	946	931	916	901	888	874	861	847	835	822	810	798	787	
					353	344	336	328	320	313	305	298	291	285	278	272	266	260	254	248	
			84-99	100-128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	
72DLH14	41	72	58800	58800	454	447	441	435	427	421	415	411	405	399	393	388	382	378	372	367	
72DLH15	44	72	67350	67350	171	167	163	159	155	152	149	146	143	139	136	133	131	128	125	123	
					520	513	504	496	489	483	475	468	462	454	448	442	436	429	423	418	
72DLH16	50	72	77850	77850	191	187	183	178	174	171	167	163	160	156	152	150	147	143	140	137	
72DLH17	56	72	87600	87600	601	592	585	576	567	559	552	544	537	529	522	514	507	501	493	487	
					225	219	214	209	205	200	196	191	188	183	179	175	171	169	165	161	
72DLH18	59	72	102600	102600	676	667	657	648	639	630	621	612	603	595	586	579	571	564	556	549	
72DLH19	70	72	120300	120300	256	250	245	239	233	228	224	218	213	209	205	200	196	191	188	184	
					792	780	768	757	745	735	724	718	705	694	685	675	666	657	648	639	
					289	283	276	270	265	258	252	247	242	236	231	227	222	217	212	209	
					928	913	900	886	873	859	847	835	823	811	799	789	777	766	756	745	
					328	321	313	306	300	293	286	280	274	268	263	259	257	251	247	241	236

* The safe factored uniform load for the clear spans shown in the Safe Load Column is equal to (Safe Load) / (Clear span + 0.67). (The added 0.67 feet (8 inches) is required to obtain the proper length on which the Load Tables were developed).

In no case shall the safe uniform load, for clear spans less than the minimum clear span shown in the Safe Load Column, exceed the uniform load calculated for the minimum clear span listed in the Safe Load Column.

To solve for *live* loads for clear spans shown in the Safe Load Column (or lesser clear spans), multiply the live load of the shortest clear span shown in the Load Table by (the shortest clear span shown in the Load Table + 0.67 feet)² and divide by (the actual clear span + 0.67 feet)². The live load shall not exceed the safe uniform load.



METAL PRODUCTS RESOURCES ASS. S.A.S.

STANDARD ASD LOAD TABLE

DEEP LONGSPAN STEEL JOISTS, DLH-SERIES

Based on a 50 ksi Maximum Yield Strength
 Adopted by the Steel Joist Institute May 25, 1983
 Revised to November 10, 2003 - Effective March 01, 2005

The black figures in the following table give the TOTAL safe uniformly distributed load-carrying capacities, in pounds per linear foot, of an **ASD DLH-Series** Steel Joists. The weight of DEAD loads, including the joists, must in all cases be deducted to determine the LIVE load-carrying capacities of the joists. The approximate DEAD load of the joists may be determined from the weights per linear foot shown in the tables. All loads shown are for roof construction only.

The **RED** figures in this load table are the nominal LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the **RED** figures by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

This load table applies to joists with either parallel chords or standard pitched top chords. When top chords are pitched, the carrying capacities are determined by the nominal depth of the joists at the center of the span. Standard top chord pitch is 1/8 inch per foot. If pitch exceeds this standard, the load table does not apply. Sloped parallel-chord joists shall use span as defined by the length along the slope.

All rows of bridging shall be diagonal bridging with bolted connections at the chords and intersections.

Where the joist span is in the **BLUE SHADED** area of the load table hoisting cables shall not be released until the two rows of bridging nearest the third points are completely installed.

Where the joist span is in the **GRAY SHADED** area of the load table hoisting cables shall not be released until all rows of bridging are completely installed.

The approximate moment of inertia of the joist, in inches⁴ is; $I_j = 26.767(W_{LL})(L^3)(10^{-6})$, where W_{LL} = **RED** figure in the Load Table, and L = (clear span + 0.67) in feet.

When holes are required in top or bottom chords, the carrying capacities must be reduced in proportion to the reduction of chord areas.

The top chords are considered as being stayed laterally by floor slab or roof deck.

The approximate joist weights per linear foot shown in these tables do not include accessories.

ASD

STANDARD LOAD TABLE LONGSPAN STEEL JOISTS, DLH-SERIES
 Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	Approx. Wt in Lbs. Per Linear Ft (Joists only)	Depth in inches	SAFELOAD*	CLEAR SPAN IN FEET																	
			in Lbs. Between																		
			61-88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104		
52DLH10	25	52	26700	298	291	285	279	273	267	261	256	251	246	241	236	231	227	223	218		
52DLH11	26	52	29300	171	165	159	154	150	145	140	136	132	128	124	120	116	114	110	107		
				187	181	174	169	164	158	153	149	144	140	135	132	128	124	120	117		
52DLH12	29	52	32700	365	357	349	342	334	327	320	314	307	301	295	289	284	278	273	268		
52DLH13	34	52	39700	204	197	191	185	179	173	168	163	158	153	149	144	140	135	132	128		
				443	433	424	414	406	397	389	381	373	366	358	351	344	338	331	325		
52DLH14	39	52	45400	247	239	231	224	216	209	203	197	191	185	180	174	170	164	159	155		
52DLH15	42	52	51000	507	497	486	476	466	457	447	438	430	421	413	405	397	390	382	375		
				276	266	258	249	242	234	227	220	213	207	201	194	189	184	178	173		
52DLH16	45	52	55000	569	557	545	533	522	511	500	490	480	470	461	451	443	434	426	418		
				311	301	291	282	272	264	256	247	240	233	226	219	213	207	201	195		
52DLH17	52	52	63300	614	601	588	575	563	551	540	528	518	507	497	487	478	468	459	451		
				346	335	324	314	304	294	285	276	267	260	252	245	237	230	224	217		
				706	691	676	661	647	634	620	608	595	583	572	560	549	539	528	518		
				395	381	369	357	346	335	324	315	304	296	286	279	270	263	255	247		
				66-96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	
				288	283	277	272	267	262	257	253	248	244	239	235	231	227	223	219		
56DLH11	26	56	28100	169	163	158	153	149	145	140	136	133	129	125	122	118	115	113	110		
56DLH12	30	56	32300	331	324	318	312	306	300	295	289	284	278	273	268	263	259	254	249		
				184	178	173	168	163	158	153	150	145	141	137	133	130	126	123	119		
56DLH13	34	56	39100	401	394	386	379	372	365	358	351	344	338	331	325	319	314	308	303		
56DLH14	39	56	44200	223	216	209	204	197	191	186	181	175	171	166	161	157	152	149	145		
				453	444	435	427	419	411	403	396	388	381	375	368	361	355	349	343		
56DLH15	42	56	50500	249	242	234	228	221	214	209	202	196	190	186	181	175	171	167	162		
				518	508	498	488	478	469	460	451	443	434	426	419	411	403	396	389		
56DLH16	46	56	54500	281	272	264	256	248	242	234	228	221	215	209	204	198	192	188	182		
				559	548	537	526	516	506	496	487	478	469	460	452	444	436	428	420		
56DLH17	51	56	62800	313	304	294	285	277	269	262	254	247	240	233	227	221	214	209	204		
				643	630	618	605	594	582	571	560	549	539	529	520	510	501	492	483		
				356	345	335	325	316	306	298	289	281	273	266	258	251	245	238	231		



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ASD

STANDARD LOAD TABLE LONGSPAN STEEL JOISTS, DLH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	Approx. Wt in Lbs. Per Linear Ft (Joists only)	Depth in inches	SAFE LOAD* in Lbs. Between		CLEAR SPAN IN FEET																		
			70-99	100-104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120			
60DLH12	29	60	31100	31100	295	289	284	279	274	270	265	261	256	252	248	244	240	236	232	228			
					188	183	178	174	169	165	161	157	153	149	145	141	137	133	129	125			
60DLH13	35	60	37800	37800	358	351	345	339	333	327	322	316	311	306	301	296	291	286	282	277			
					203	197	191	187	181	176	171	167	163	158	154	151	147	143	139	135			
60DLH14	40	60	42000	42000	398	391	383	376	370	363	356	350	344	338	332	327	321	316	310	305			
					216	210	205	199	193	189	183	178	173	170	165	161	156	152	149	145			
60DLH15	43	60	49300	49300	467	458	450	442	434	427	419	412	405	398	392	385	379	373	367	361			
					255	248	242	235	228	223	216	210	205	200	194	190	185	180	175	171			
60DLH16	46	60	54200	54200	513	504	494	485	476	468	460	451	444	436	428	421	414	407	400	393			
					285	277	269	262	255	247	241	235	228	223	217	211	206	201	196	190			
60DLH17	52	60	62300	62300	590	579	569	558	548	538	529	519	510	501	493	484	476	468	460	453			
					324	315	306	298	290	283	275	267	261	254	247	241	235	228	223	217			
60DLH18	59	60	71900	71900	681	668	656	644	632	621	610	599	589	578	568	559	549	540	531	522			
					366	357	346	337	327	319	310	303	294	286	279	272	266	259	252	246			
			75-99	100-112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128			
64DLH12	31	64	30000	30000	264	259	255	251	247	243	239	235	231	228	224	221	218	214	211	208			
					153	150	146	142	138	135	132	129	125	122	119	116	114	111	109	106			
64DLH13	34	64	36400	36400	321	315	310	305	300	295	291	286	281	277	273	269	264	260	257	253			
					186	181	176	171	168	163	159	155	152	148	144	141	137	134	131	128			
64DLH14	40	64	41700	41700	367	360	354	349	343	337	332	326	321	316	311	306	301	296	292	287			
					199	193	189	184	179	174	171	166	162	158	154	151	147	143	140	136			
64DLH15	43	64	47800	47800	421	414	407	400	394	387	381	375	369	363	358	352	347	341	336	331			
					234	228	223	217	211	206	201	196	191	187	182	177	173	170	165	161			
64DLH16	46	64	53800	53800	474	466	458	450	443	435	428	421	414	407	401	394	388	382	376	370			
					262	254	248	242	235	229	224	218	213	208	203	198	193	189	184	180			
64DLH17	52	64	62000	62000	546	536	527	518	509	501	492	484	476	468	461	454	446	439	432	426			
					298	290	283	275	268	262	255	248	243	237	231	226	220	215	210	205			
64DLH18	59	64	71600	71600	630	619	608	598	587	578	568	559	549	540	532	523	515	507	499	491			
					337	328	320	311	304	296	288	282	274	267	261	255	249	243	237	232			
			80-99	100-120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136			
68DLH13	37	68	35000	35000	288	284	279	275	271	267	263	259	255	252	248	244	241	237	234	231			
					171	168	164	159	155	152	149	145	142	138	135	133	130	127	124	121			
68DLH14	40	68	40300	40300	332	327	322	317	312	308	303	299	294	290	286	281	277	273	269	266			
					184	179	175	171	167	163	159	155	152	148	145	141	138	135	133	130			
68DLH15	44	68	45200	45200	372	365	360	354	348	343	337	332	327	322	317	312	308	303	299	294			
					206	201	196	191	187	182	178	174	170	166	162	158	155	152	148	145			
68DLH16	49	68	53600	53600	441	433	427	420	413	407	400	394	388	382	376	371	365	360	354	349			
					242	236	230	225	219	214	209	204	199	195	190	186	182	178	174	171			
68DLH17	55	68	60400	60400	497	489	481	474	467	460	453	446	439	433	427	420	414	408	403	397			
					275	268	262	256	249	244	238	232	228	222	217	212	208	203	198	194			
68DLH18	61	68	69900	69900	575	566	557	549	540	532	524	516	508	501	493	486	479	472	465	459			
					311	304	297	289	283	276	269	263	257	251	246	240	234	230	225	219			
68DLH19	67	68	80500	80500	662	651	641	631	621	611	601	592	583	574	565	557	548	540	532	525			
					353	344	336	328	320	313	305	298	291	285	278	272	266	260	254	248			
			84-99	100-128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144			
72DLH14	41	72	39200	39200	303	298	294	290	285	281	277	274	270	266	262	259	255	252	248	245			
					171	167	163	159	155	152	149	146	143	139	136	133	131	128	125	123			
72DLH15	44	72	44900	44900	347	342	336	331	326	322	317	312	308	303	299	295	291	286	282	279			
					191	187	183	178	174	171	167	163	160	156	152	150	147	143	140	137			
72DLH16	50	72	51900	51900	401	395	390	384	378	373	368	363	358	353	348	343	338	334	329	325			
					225	219	214	209	205	200	196	191	188	183	179	175	171	169	165	161			
72DLH17	56	72	58400	58400	451	445	438	432	426	420	414	408	402	397	391	386	381	376	371	366			
					256	250	245	239	233	228	224	218	213	209	205	200	196	191	188	184			
72DLH18	59	72	68400	68400	528	520	512	505	497	490	483	479	470	463	457	450	444	438	432	426			
					289	283	276	270	265	258	252	247	242	236	231	227	222	217	212	209			
72DLH19	70	72	80200	80200	619	609	600	591	582	573	565	557	549	541	533	526	518	511	504	497			
					328	321	313	306	300	293	286	280	274	268	263	257	251	247	241	236			

* The safe uniform load for the clear spans shown in the Safe Load Column is equal to (Safe Load) / (Clear Span + 0.67). (The added 0.67 feet (8 inches) is required to obtain the proper length on which the Load Tables were developed).

In no case shall the safe uniform load, for clear spans less than the minimum clear span shown in the Safe Load Column, exceed the uniform load calculated for the minimum clear span listed in the Safe Load Column.

To solve for live loads for clear spans shown in the Safe Load Column (or lesser clear spans), multiply the live load of the shortest clear span shown in the Load Table by (the shortest clear span shown in the Load Table + 0.67 feet)² and divide by (the actual clear span + 0.67 feet)². The live load shall not exceed the safe uniform load.



NOTES



VULCRAFT SLH / GENERAL INFORMATION

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HIGH STRENGTH

ECONOMICAL

DESIGN - Vulcraft SLH Series long span steel joists are designed in accordance with the specifications included in this section.

ACCESSORIES see page 74.

PAINT - Vulcraft SLH Series joists receive a shop-coat of rust inhibitive primer that conforms to specification 202.4.

SPECIFICATIONS - see page 80.

TABLE 1

SLH- SERIES BRIDGING SPACING		
JOIST SECTION NUMBER*	MINIMUM BOLT DIAMETER	MAXIMUM SPACING OF BRIDGING LINES
SLH 15-18	5/8" dia A325	21'-0"
SLH 19-20	5/8" dia A325	26'-0"
SLH 21-22	5/8" dia A325	30'-0"
SLH 23-25	3/4" dia A325	30'-0"

*LAST TWO DIGITS OF JOIST DESIGNATION SHOWN IN LOAD TABLE.

TABLE 2

SLH-SERIES BEARING DATA				
JOIST SECTION NUMBER*	BEARING DEPTH	MINIMUM BEARING LENGTH	BEARING SEAT FILLET WELD (1)	BEARING SEAT BOLTS FOR ERECTION (1)
SLH 15-18	7-1/2"	4"	2-1/4" x 2"	2-3/4" dia A325
SLH 19-25	7-1/2"	6"	2-1/4" x 4"	2-3/4" dia A325

(1) BEARING SEATS MUST BE WELDED IN ADDITION TO BEING BOLTED.

TABLE 3

JOIST DEPTH	HORIZONTAL PLUS DIAGONAL BRIDGING*		MIN. JOIST SPACE FOR DIAGONAL ONLY BRIDGING	DIAGONAL ONLY BRIDGING			
	.66 X DEPTH*	HORIZONTAL AND DIAGONAL ANGLE SIZE		MAXIMUM JOIST SPACING FOR DIAGONAL BRIDGING SIZE			
				2' x 2' x 1/8"	2 1/2' x 2 1/2' x 3/16"	3' x 3' x 3/16"	3 1/2' x 3 1/2' x 1/4"
80"	4'-4"	1 3/4" x 1 3/4" x 1/8"	4'-5"	9'-11"	15'-1"	18'-8"	22'-1"
88"	4'-9"	1 3/4" x 1 3/4" x 1/8"	4'-10"	7'-3"	14'-9"	18'-5"	21'-11"
96"	5'-3"	2" x 2" x 1/8"	5'-4"		14'-5"	18'-2"	21'-8"
104"	5'-8"	2 1/2" x 2 1/2" x 3/16"	5'-9"		14'-0"	17'-10"	21'-5"
112"	6'-1"	2 1/2" x 2 1/2" x 3/16"	6'-2"		11'-11"	17'-6"	21'-1"
120"	6'-7"	2 1/2" x 2 1/2" x 3/16"	6'-8"			17'-0"	20'-10"

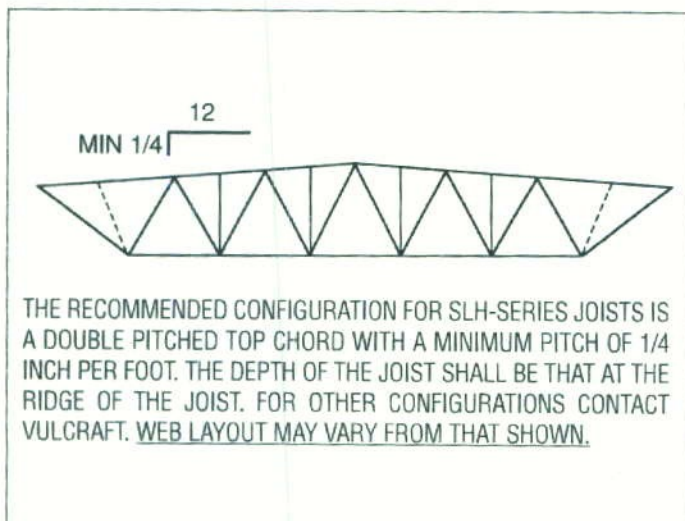
***NOTE: WHEN THE JOIST SPACING IS LESS THAN 0.66 x JOIST DEPTH, BOLTED HORIZONTAL BRIDGING SHALL BE USED IN ADDITION TO THE DIAGONAL BRIDGING.**

NOTES: 1. For lengths and depths greater than those shown in the load tables contact Vulcraft.

2. Additional bridging may be required when joists support a standing seam roof. The specifying professional should require the joist manufacturer to check the system and provide bridging as required to adequately brace the joists against lateral movement. For bridging requirements due to uplift loading refer to specification section 204.13.



ACCESSORIES AND DETAILS SLH SERIES LONGSPAN STEEL JOISTS.

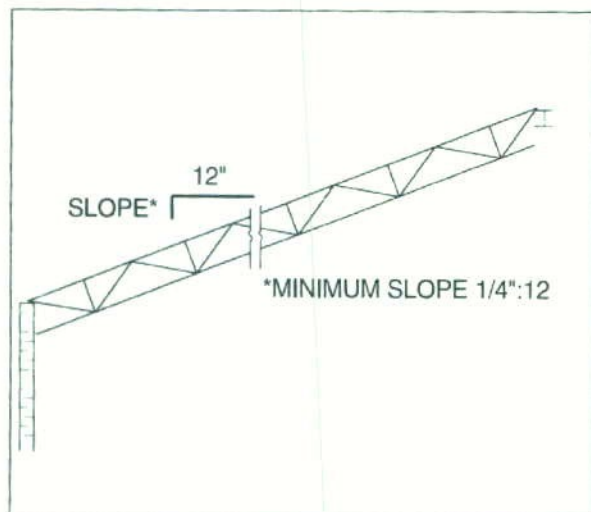


SLH-SERIES CAMBER*		
TOP CHORD LENGTH	DOUBLE PITCH JOISTS**	PARALLEL CHORD JOISTS
111'-0"	3 1/4"	5 1/4"
120'-0"	3 1/2"	6"
130'-0"	3 7/8"	7"
140'-0"	4 1/8"	8"
150'-0"	4 3/8"	8 3/4"
160'-0"	4 3/4"	9 1/2"
180'-0"	5 1/4"	10 1/2"
200'-0"	5 7/8"	11 3/4"
220'-0"	6 1/2"	13"
240'-0"	7"	14"

**JOISTS WITH TOP CHORD PITCH OF 1/4" PER FOOT OR GREATER.

*For walls or other structural members near SLH-Series Joists provisions need to be made to match top chord elevation.

Specifying professional must provide camber requirements in inches if camber is different from that shown.

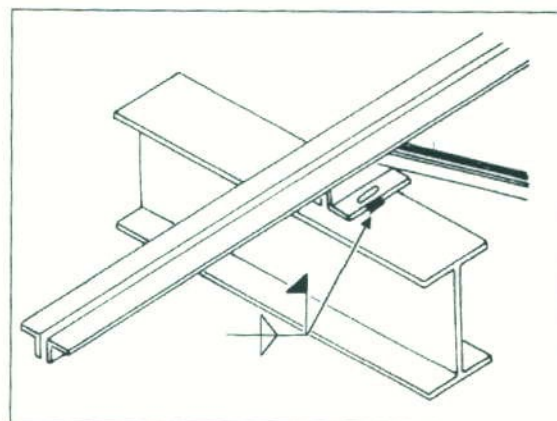


- (a) Extend top chords require the special attention of the specifying engineer.

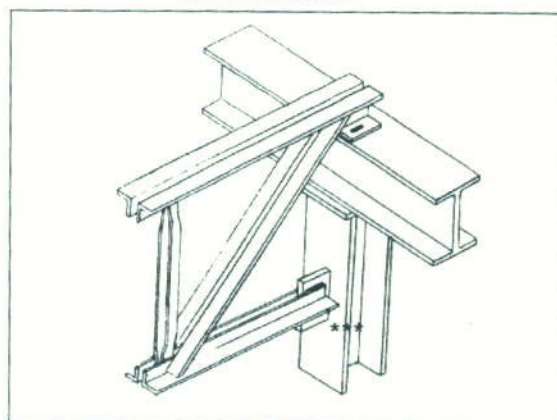
The magnitude and location of the design loads to be supported, the deflection requirements, and the proper bracing shall be clearly indicated on the structural drawings.

NOTE:

FOR ANY CONCENTRATED LOADS SUCH AS BASKETBALL GOALS, CURTAINS, SCORE BOARDS, HVAC UNITS, ETC. IT IS ESSENTIAL THAT THE SPECIFYING ENGINEER PROVIDE THE MAGNITUDE AND LOCATION OF ALL LOADS ON THE STRUCTURAL DRAWINGS.



TOP CHORD EXTENSION (a)
SEE TABLE 204.8.1

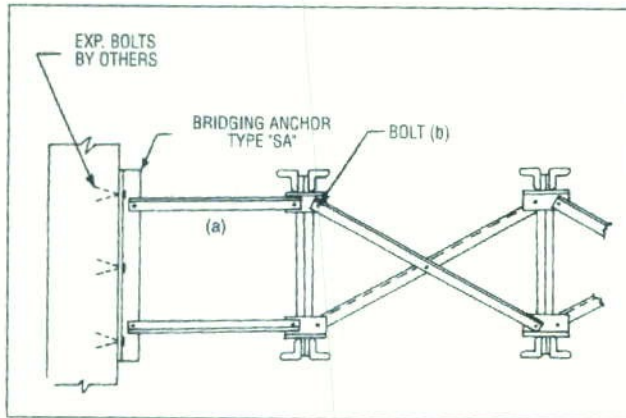


BOTTOM CHORD STRUT
(SEE SPECIFICATION 204.1)

*** If bottom chord is to be bolted or welded the specifying professional must provide axial loads on structural drawings.

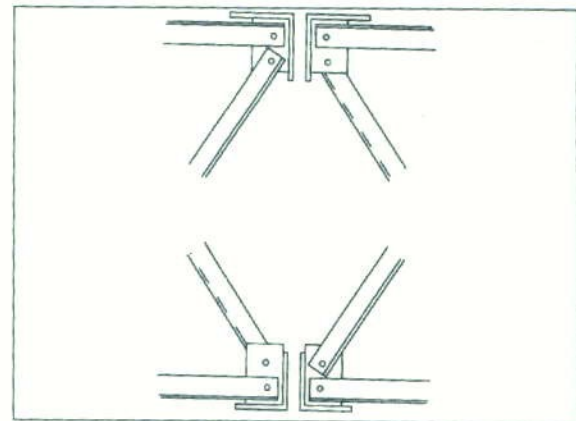
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ACCESSORIES AND DETAILS SLH SERIES LONGSPAN STEEL JOISTS



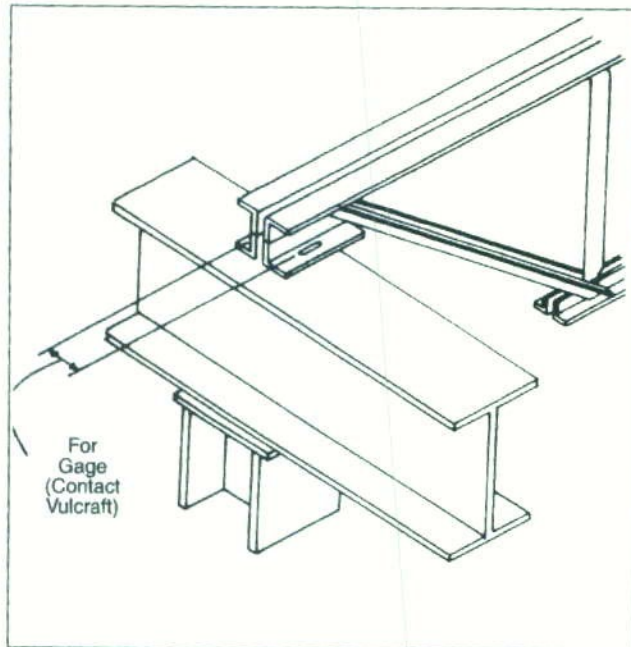
CROSS BRIDGING

A) HORIZONTAL BRIDGING IS TO BE USED IN THE SPACE ADJACENT TO THE WALL TO ALLOW FOR PROPER DEFLECTION OF THE JOIST NEAREST THE WALL. SEE TABLES 1 AND 3 PAGE 73.
B) FOR REQUIRED BOLT SIZE REFER TO BRIDGING TABLE ON PAGE 73. NOTE: CLIP CONFIGURATION MAY VARY FROM THAT SHOWN.



BOLTED, HORIZONTAL PLUS DIAGONAL, BRIDGING

SEE TABLE 3, PAGE 73 AND SPECIFICATION 204.6.
NOTE: CLIP CONFIGURATION MAY VARY FROM THAT SHOWN.
NOTE: DO NOT HANG ANY MECHANICAL, ELECTRICAL, ETC. FROM BRIDGING.

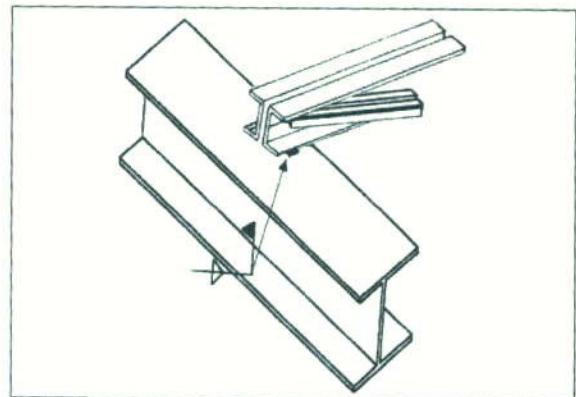


BOLTED CONNECTION (b)

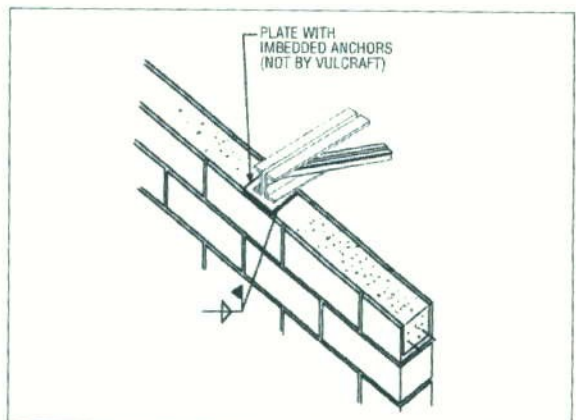
SEE TABLE 2, PAGE 73.
TYPICALLY USED AT COLUMNS

The Occupation Safety and Health Administration Standards (OSHA), Paragraph 1910.12 refers to Paragraph 1518.751 of "Construction Standards" which states:

"In steel framing, where bar joists are utilized, and columns are not framed in at least two directions with structural steel members, a bar joist shall be field-bolted at columns to provide lateral stability during construction."



ANCHORAGE TO STEEL
SEE TABLE 2, PAGE 73.



ANCHORAGE TO MASONRY
SEE SPECIFICATION 204.5 (a)
SEE TABLE 2, PAGE 73.

VULCRAFT SLH / GENERAL INFORMATION

VULCRAFT LOAD TABLE SUPER LONGSPAN STEEL JOISTS, LRFD SLH-SERIES

JANUARY 1, 2007

Based on a 50 ksi Maximum Yield Strength

The black figures in the following table give the TOTAL safe uniformly-distributed load-carrying capacities, in pounds per linear foot, of LRFD SLH-Series Joists. The weight of DEAD loads, including the joists, must in all cases be deducted to determine the LIVE load-carrying capacities of the joists. The approximate DEAD load of the joists may be determined from the weights per linear foot shown in the tables. All loads shown are for roof construction only.

The red figures in this table are the LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the red figures by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

*The safe load for the clear spans shown in the shaded section is equal to (Safe Load) / (Clear Span + 0.67). [The added 0.67 feet (8 inches) is required to obtain the proper length on which the Load Tables were developed.] In no case shall the safe uniform load, for clear spans less than the minimum clear span shown in the shaded area, exceed the uniform load calculated for the minimum clear span listed in the shaded area.

This load table applies to joists with either parallel chords or standard pitched top chords. When top chords are pitched, the design capacities are determined by the nominal depth of the joists at the center of the span. Standard top chord pitch is 1/4 inch per foot. If pitch exceeds this standard, the load table does not apply. This load table may be used for parallel chord joists installed to a maximum slope of 1/2 inch per foot.

When holes are required in top or bottom chords, the carrying capacities must be reduced in proportion to reduction of chord areas.

The top chords are considered as being stayed laterally by the roof deck.

The approximate joist weights per linear foot shown in these table do not include accessories.

When erecting SLH joists, hoisting cables shall not be released until all rows of bridging are completely installed.

To solve for live loads for clear spans shown in the shaded area (or lesser clear spans), multiply the live load of the shortest clear span shown in the Load tables by (the shortest clear span shown in the Load table + 0.67 feet)² and divide by (the actual clear span + 0.67 feet)². The live load shall not exceed the safe uniform load.

**For spans between those listed use a linear interpolation.

LRFD

Joist Designation	Approx. Wt. In Lbs. per Linear Ft. (Joists Only)	Depth In Inches	Safe Load* In Lbs. Between	CLEAR SPAN IN FEET**														
				80-110	111	114	117	120	123	126	129	132	135	138	141	144	147	150
80SLH15	40	80	78,000	699	663	632	602	575	549	525	503	482	461	443	425	408	392	366
80SLH16	46	80	93,750	840	802	763	727	691	658	628	600	574	549	525	504	483	463	433
80SLH17	53	80	108,300	971	926	881	839	800	765	731	699	669	641	615	590	567	545	510
80SLH18	60	80	122,400	1097	1044	993	947	903	863	825	789	756	723	695	666	641	615	576
80SLH19	67	80	142,800	1280	1218	1160	1104	1052	1005	960	918	878	840	806	774	743	714	668
80SLH20	75	80	160,500	1446	1382	1323	1268	1211	1157	1104	1056	1011	968	927	891	855	821	770
				646	596	552	512	475	443	412	385	360	337	316	297	279	263	238
				88-119	120	123	126	129	132	135	138	141	144	147	150	155	160	165
88SLH16	46	88	93,000	771	735	701	671	642	615	591	567	545	524	503	471	443	417	393
88SLH17	51	88	105,150	871	830	789	753	719	687	659	630	605	579	557	521	489	459	432
88SLH18	58	88	120,600	1001	953	908	866	827	791	756	725	695	666	639	599	561	528	497
88SLH19	65	88	139,500	1157	1101	1049	999	954	912	873	836	801	770	738	692	648	609	573
88SLH20	76	88	160,500	1334	1281	1232	1184	1133	1085	1041	998	959	921	885	830	780	734	692
88SLH21	89	88	198,000	1649	1568	1494	1425	1361	1301	1244	1191	1143	1097	1053	986	924	869	816
				724	673	626	584	545	509	477	447	420	395	372	337	307	280	256



VULCRAFT LOAD TABLE **SUPER LONGSPAN STEEL JOISTS, SLH-SERIES**

Based on a 50 ksi Maximum Yield Strength

LRFD

Joist Designation	Approx. Wt. In Lbs. per Linear Ft. (Joists Only)	Depth In Inches	Safe Load* In Lbs. Between	CLEAR SPAN IN FEET**																
			96-128	129	132	135	138	141	144	147	150	155	160	165	170	175	180	185	190	
96SLH17	52	96	105,000	810	776	744	711	684	657	632	608	570	536	503	474	447	422	399	378	
				389	363	339	318	298	280	263	247	224	204	186	170	156	143	132	122	
96SLH18	58	96	118,200	912	875	839	803	770	740	713	686	645	608	572	540	510	483	458	434	
				443	413	386	362	340	319	300	282	256	232	212	194	178	163	150	139	
96SLH19	66	96	141,300	1091	1046	1001	957	917	878	842	809	758	711	668	629	594	560	530	501	
				502	469	438	410	385	361	340	320	290	264	241	220	202	186	171	158	
96SLH20	74	96	159,000	1236	1184	1131	1083	1037	993	952	915	857	804	756	713	672	635	600	567	
				569	531	496	465	436	409	385	362	329	299	272	249	229	210	193	178	
96SLH21	90	96	199,500	1541	1473	1410	1350	1296	1243	1196	1149	1079	1013	953	897	846	800	756	716	
				698	652	610	571	535	503	473	445	404	367	335	306	281	258	238	220	
96SLH22	102	96	223,500	1725	1662	1601	1542	1487	1436	1382	1329	1248	1173	1104	1041	984	930	881	834	
				811	757	708	663	622	584	549	517	469	426	389	355	326	300	276	255	
			104-137	138	141	144	147	150	155	160	165	170	175	180	185	190	195	200	205	
104SLH18	59	104	115,200	831	798	768	734	708	666	627	594	561	531	503	477	453	431	410	390	
				426	400	375	353	332	301	274	250	229	209	192	177	164	152	140	130	
104SLH19	67	104	140,100	1011	971	933	897	861	809	761	719	678	641	606	575	546	519	488	468	
				484	453	426	401	377	342	311	284	260	238	218	201	186	172	160	148	
104SLH20	75	104	157,500	1146	1107	1071	1032	992	932	875	822	774	731	690	653	620	587	557	530	
				548	513	483	453	427	387	352	321	293	269	247	228	210	195	181	167	
104SLH21	90	104	198,000	1434	1376	1322	1271	1220	1145	1077	1016	959	906	857	812	771	732	696	662	
				673	632	593	558	525	476	433	395	361	331	301	280	259	240	222	206	
104SLH22	104	104	222,000	1607	1551	1499	1449	1401	1325	1245	1175	1107	1047	990	939	891	846	804	767	
				783	734	689	648	610	563	503	459	420	385	353	326	301	278	258	240	
104SLH23	109	104	244,500	1772	1712	1644	1578	1514	1418	1331	1251	1178	1112	1050	993	942	893	848	806	
				819	768	721	678	638	578	526	480	439	403	370	341	315	291	270	250	
			112-146	147	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	
112SLH19	67	112	137,850	935	900	846	795	750	708	669	636	603	573	543	518	494	471	450	429	
				466	439	398	362	330	302	276	255	234	216	200	186	172	160	149	140	
112SLH20	76	112	156,000	1065	1032	974	915	863	815	771	732	695	660	626	597	569	542	518	495	
				528	497	450	410	374	342	313	288	266	245	227	210	195	181	169	158	
112SLH21	91	112	196,500	1337	1287	1208	1136	1070	1010	956	905	858	815	774	737	702	669	639	611	
				650	612	555	504	460	421	386	355	327	301	279	259	240	224	208	195	
112SLH22	104	112	220,500	1499	1451	1377	1307	1236	1167	1104	1046	992	942	894	852	812	774	738	705	
				755	711	644	586	535	489	449	412	380	350	324	301	279	260	242	226	
112SLH23	110	112	243,000	1653	1601	1518	1439	1352	1272	1200	1134	1074	1019	966	918	873	831	792	756	
				790	744	674	613	560	512	469	431	397	367	340	315	292	272	253	236	
112SLH24	131	112	288,000	1956	1895	1799	1709	1611	1521	1439	1364	1293	1229	1167	1112	1059	1010	963	920	
				957	901	817	743	678	620	569	523	481	444	411	381	354	329	307	287	
			102-164	165	170	175	180	185	190	195	200	205	210	215	220	230	235	240		
120SLH20	77	120	148,350	896	846	798	758	719	684	651	621	593	564	539	516	494	473	453	435	
				430	393	361	332	306	282	261	242	225	209	195	182	170	159	149	140	
120SLH21	92	120	184,500	1122	1059	1001	948	899	855	813	774	738	704	672	642	615	588	564	540	
				530	485	444	409	376	347	321	298	277	258	240	224	209	196	184	173	
120SLH22	104	120	211,500	1283	1223	1155	1094	1038	987	939	894	852	813	776	743	710	680	651	624	
				616	564	516	475	438	404	374	347	322	300	279	261	244	228	214	201	
120SLH23	111	120	234,000	1415	1347	1272	1206	1145	1088	1035	986	939	894	854	815	779	744	713	683	
				644	590	541	497	458	423	391	363	336	313	292	272	255	238	224	210	
120SLH24	132	120	277,500	1676	1593	1505	1425	1353	1287	1224	1166	1112	1059	1013	968	926	887	849	815	
				781	715	655	603	555	512	474	440	408	380	354	330	309	289	271	255	
120SLH25	152	120	318,000	1926	1827	1728	1638	1554	1476	1404	1337	1275	1217	1163	1112	1064	1017	975	935	
				915	837	768	706	650	600	555	515	478	445	415	387	362	339	318	298	

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VULCRAFT SLH / GENERAL INFORMATION

VULCRAFT LOAD TABLE SUPER LONGSPAN STEEL JOISTS, ASD SLH-SERIES

JANUARY 1, 2007

Based on a 50 ksi Maximum Yield Strength

The black figures in the following table give the TOTAL safe uniformly-distributed load-carrying capacities, in pounds per linear foot, of ASD **SLH-Series** Joists. The weight of DEAD loads, including the joists, must in all cases be deducted to determine the LIVE load-carrying capacities of the joists. The approximate DEAD load of the joists may be determined from the weights per linear foot shown in the tables. All loads shown are for roof construction only.

The red figures in this table are the LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the red figures by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

*The safe load for the clear spans shown in the shaded section is equal to (Safe Load) / (Clear Span + 0.67). [The added 0.67 feet (8 inches) is required to obtain the proper length on which the Load Tables were developed.] In no case shall the safe uniform load, for clear spans less than the minimum clear span shown in the shaded area, exceed the uniform load calculated for the minimum clear span listed in the shaded area.

This load table applies to joists with either parallel chords or standard pitched top chords. When top chords are pitched, the design capacities are determined by the nominal depth of the joists at the center of the span. Standard top chord pitch is 1/4 inch per foot. If pitch exceeds this standard, the load table does not apply. This load table may be used for parallel chord joists installed to a maximum slope of 1/2 inch per foot.

When holes are required in top or bottom chords, the carrying capacities must be reduced in proportion to reduction of chord areas.

The top chords are considered as being stayed laterally by the roof deck.

The approximate joist weights per linear foot shown in these table do not include accessories.

When erecting SLH joists, hoisting cables shall not be released until all rows of bridging are completely installed.

To solve for live loads for clear spans shown in the shaded area (or lesser clear spans), multiply the live load of the shortest clear span shown in the Load tables by (the shortest clear span shown in the Load table + 0.67 feet)² and divide by (the actual clear span + 0.67 feet)². The live load shall **not** exceed the safe uniform load.

**For spans between those listed use a linear interpolation.

ASD

Joist Designation	Approx. Wt. In Lbs. per Linear Ft. (Joists Only)	Depth In Inches	Safe Load* In Lbs. Between	CLEAR SPAN IN FEET**														
				80-110	111	114	117	120	123	126	129	132	135	138	141	144	147	150
80SLH15	40	80	52,000	466	442	421	401	383	366	350	335	321	307	295	283	272	261	244
				321	296	275	255	236	220	205	192	179	167	157	147	139	130	118
80SLH16	46	80	62,500	560	535	509	485	461	439	419	400	383	366	350	336	322	309	289
				375	347	321	297	276	257	240	224	209	196	184	172	162	162	138
80SLH17	53	80	72,200	647	617	587	559	533	510	487	466	446	427	410	393	378	363	340
				451	416	386	358	332	309	288	269	252	235	221	207	195	183	166
80SLH18	60	80	81,600	731	696	662	631	602	575	550	526	504	482	463	444	427	410	384
				516	477	441	409	380	354	330	308	288	270	253	237	223	210	190
80SLH19	67	80	95,200	853	812	773	736	701	670	640	612	585	560	537	516	495	476	445
				578	533	493	458	425	396	369	344	322	301	283	266	250	235	213
80SLH20	75	80	107,000	964	921	882	845	807	771	736	704	674	645	618	594	570	547	513
				646	596	552	512	475	443	412	385	360	337	316	297	279	263	238
				120	123	126	129	132	135	138	141	144	147	150	155	160	165	170
88SLH16	46	88	62,000	514	490	467	447	428	410	394	378	363	349	335	314	295	278	262
				361	336	313	291	272	254	238	223	210	197	186	168	153	140	127
88SLH17	51	88	70,100	581	553	526	502	479	458	439	420	403	386	371	347	326	306	288
				404	375	349	325	304	284	266	249	234	220	207	187	170	156	143
88SLH18	58	88	80,400	667	635	605	577	551	527	504	483	463	444	426	399	374	352	331
				460	427	397	370	346	323	303	284	267	250	236	214	195	177	162
88SLH19	65	88	93,000	771	734	699	666	636	608	582	557	534	513	492	461	432	406	382
				521	484	450	420	392	367	343	322	302	284	267	243	221	201	184
88SLH20	76	88	107,000	889	854	821	789	755	723	694	665	639	614	590	553	520	489	461
				623	579	539	502	469	438	410	385	361	340	320	290	264	241	220
88SLH21	89	88	132,000	1099	1045	996	950	907	867	829	794	762	731	702	657	616	579	544
				724	673	626	584	545	509	477	447	420	395	372	337	307	280	256



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VULCRAFT LOAD TABLE SUPER LONGSPAN STEEL JOISTS, SLH-SERIES

Based on a 50 ksi Maximum Yield Strength

ASD

Joist Designation	Approx. Wt. In Lbs. per Linear Ft. (Joists Only)	Depth In Inches	Safe Load In Lbs. Between	CLEAR SPAN IN FEET**																
				96-128	129	132	135	138	141	144	147	150	155	160	165	170	175	180	185	190
96SLH17	52	96	70,000	540	517	496	474	456	438	421	405	380	357	335	316	298	281	266	252	
				389	363	339	318	298	280	263	247	224	204	186	170	156	143	132	122	
96SLH18	58	96	78,800	608	583	559	535	513	493	475	457	430	405	381	360	340	322	305	289	
				443	413	386	362	340	319	300	282	256	232	212	194	178	163	150	139	
96SLH19	66	96	94,200	727	697	667	638	611	585	561	539	505	474	445	419	396	373	353	334	
				502	469	438	410	385	361	340	320	290	264	241	220	202	186	171	158	
96SLH20	74	96	106,000	824	789	754	722	691	662	635	610	571	536	504	475	448	423	400	378	
				569	531	496	465	436	409	385	362	329	299	272	249	229	210	193	178	
96SLH21	90	96	133,000	1027	982	940	900	864	829	797	766	719	675	635	598	564	533	504	477	
				698	652	610	571	535	503	473	445	404	367	335	306	281	258	238	220	
96SLH22	102	96	149,000	1150	1108	1067	1028	991	957	921	886	832	782	736	694	656	620	587	556	
				811	757	708	663	622	584	549	517	469	426	389	355	326	300	276	255	
			104-137	138	141	144	147	150	155	160	165	170	175	180	185	190	195	200	205	
104SLH18	59	104	76,800	554	532	512	489	472	444	418	396	374	354	335	318	302	287	273	260	
				426	400	375	353	332	301	274	250	229	209	192	177	164	152	140	130	
104SLH19	67	104	93,400	674	647	622	598	574	539	507	479	452	427	404	383	364	346	325	312	
				484	453	426	401	377	342	311	284	260	238	218	201	186	172	160	148	
104SLH20	75	104	105,000	764	738	714	688	661	621	583	548	516	487	460	435	413	391	371	353	
				548	513	483	453	427	387	352	321	293	269	247	228	210	195	181	167	
104SLH21	90	104	132,000	956	917	881	847	813	763	718	677	639	604	571	541	514	488	464	441	
				673	632	593	558	525	476	433	395	361	331	301	280	259	240	222	206	
104SLH22	104	104	148,000	1071	1034	999	966	934	883	830	783	738	698	660	626	594	564	536	511	
				783	734	689	648	610	553	503	459	420	385	353	326	301	278	258	240	
104SLH23	109	104	163,000	1181	1141	1096	1052	1009	945	887	834	785	741	700	662	628	595	565	537	
				819	768	721	678	638	578	526	480	439	403	370	341	315	291	270	250	
			112-146	147	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	
112SLH19	67	112	91,900	623	600	564	530	500	472	446	424	402	382	362	345	329	314	300	286	
				466	439	398	362	330	302	276	255	234	216	200	186	172	160	149	140	
112SLH20	76	112	104,000	710	688	649	610	575	543	514	488	463	440	417	398	379	361	345	330	
				528	497	450	410	374	342	313	288	266	245	227	210	195	181	169	158	
112SLH21	91	112	131,000	891	858	805	757	713	673	637	603	572	543	516	491	468	446	426	407	
				650	612	555	504	460	421	386	355	327	301	279	259	240	224	208	195	
112SLH22	104	112	147,000	999	967	918	871	824	778	736	697	661	628	596	568	541	516	492	470	
				755	711	644	586	535	489	449	412	380	350	324	301	279	260	242	226	
112SLH23	110	112	162,000	1102	1067	1012	959	901	848	800	756	716	679	644	612	582	554	528	504	
				790	744	674	613	560	512	469	431	397	367	340	315	292	272	253	236	
112SLH24	131	112	192,000	1304	1263	1199	1139	1074	1014	959	909	862	819	778	741	706	673	642	613	
				957	901	817	743	678	620	569	523	481	444	411	381	354	329	307	287	
			102-164	165	170	175	180	185	190	195	200	205	210	215	220	230	235	240		
120SLH20	77	120	98,900	597	564	532	505	479	456	434	414	395	376	359	344	329	315	302	290	
				430	393	361	332	306	282	261	242	225	209	195	182	170	159	149	140	
120SLH21	92	120	123,000	748	706	667	632	599	570	542	516	492	469	448	428	410	392	376	360	
				530	485	444	409	376	347	321	298	277	258	240	224	209	196	184	173	
120SLH22	104	120	141,000	855	815	770	729	692	658	626	596	568	542	517	495	473	453	434	416	
				616	564	516	475	438	404	374	347	322	300	279	261	244	228	214	201	
120SLH23	111	120	156,000	943	898	848	804	763	725	690	657	626	596	569	543	519	496	475	455	
				644	590	541	497	458	423	391	363	336	313	292	272	255	238	224	210	
120SLH24	132	120	185,000	1117	1062	1003	950	902	858	816	777	741	706	675	645	617	591	566	543	
				781	715	655	603	555	512	474	440	408	380	354	330	309	289	271	255	
120SLH25	152	120	212,000	1284	1218	1152	1092	1036	984	936	891	850	811	775	741	709	678	650	623	
				915	837	768	706	650	600	555	515	478	445	415	387	362	339	318	298	



SPECIFICATIONS FOR VULCRAFT SUPER LONGSPAN STEEL JOISTS, SLH-SERIES

JANUARY 1, 1991
REVISED JANUARY 1, 2007

SECTION 200. SCOPE

These specifications cover the design, manufacture and use of Super Longspan Steel Joists SLH Series.

SECTION 201. DEFINITION

The term "Super Longspan Steel Joists SLH Series" as used herein, refers to open web, load-carrying members utilizing hot-rolled steel. SLH series are suitable for the direct support of roof decks in buildings.

The design for SLH Series joist chord or web sections shall be based on a yield strength of at least 36,000 psi, but not greater than 50,000 psi. Steel used for SLH Series joist chord or web sections shall have a minimum yield strength determined in accordance with one of the procedures specified in Section 202.2, which is equal to the yield strength assumed in the design. SLH Series joists shall be designed in accordance with these specifications to support the loads given in the attached Standard Load Tables for SLH Series joists.

SECTION 202. MATERIALS

202.1 STEEL

The steel used in the manufacture of chord and web sections shall conform to one of the following ASTM Specifications:

- Carbon Structural Steel, ASTM A36/A36M.
- High-Strength, Low-Alloy Structural Steel, ASTM A242/A242M.
- High-Strength Carbon-Manganese Steel of Structural Quality ASTM A529/A529M, Grade 50.
- High-Strength Low-Alloy Columbium-Vanadium Structural Steel, ASTM A572/A572M Grade 42, 45, and 50.
- High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 inches (102 mm) thick, ASTM A588/A588M.
- Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Corrosion Resistance, ASTM A606.
- Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1008/A1008M.
- Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1011/A1011M.

or shall be of suitable quality ordered or produced to other than the listed specifications, provided that such material in the state used for final assembly and manufacture is weldable and is proved by tests performed by the producer or manufacturer to have the properties specified in Section 102.2.

202.2 MECHANICAL PROPERTIES

The yield strength used as a basis for the design stresses prescribed in Section 203 shall be at least 36,000 psi, but shall not be greater than 50,000 psi. Evidence that the steel furnished meets or exceeds the design yield

strength shall, if requested, be provided in the form of an affidavit or by witnessed or certified test reports.

In the case of material, the mechanical properties of which conform to the requirements of one of the listed specifications, test specimens and procedure shall conform to those of such specifications and to ASTM A370.

In the case of material, the mechanical properties of which do not conform to the requirements of one of the listed specifications, the test specimens and procedure shall conform to the applicable requirements of ASTM A370 and the specimens shall exhibit a yield strength equal to or exceeding the design yield strength and an elongation of not less than (a) 20 percent in 2 inches for sheet and strip or (b) 18 percent in 8 inches for plates, shapes and bars with adjustments for thickness for plates, shapes, and bars as prescribed in ASTM A36/A36M, A242/A242M, A529/A529M, A572/A572M, and A588/A588M whichever specification is applicable on the basis of design yield strength. The number of tests shall be as prescribed in ASTM A6 for plates, shapes, and bars; and ASTM A570/A570M, A606, AND A607 for the sheet and strip.

202.3 WELDING ELECTRODES

The following electrodes shall be used for arc welding:

(a) For connected members both having a specified minimum yield strength greater than 36,000 psi

AWS A5.1 or A5.5, E70XX

AWS A5.17, F7X, EXXX flux electrode combination

AWS A5.18, E70S-X or E70U-1

AWS A5.20, E70T-X

(b) For connected members both having a specified minimum yield strength of 36,000 psi or one having a specified minimum yield strength of 36,000 psi and the other having a specified minimum yield strength greater than 36,000 psi

AWS A5.1, E60XX

AWS A5.17, F6X-EXXX flux electrode combination

AWS A5.20, E60T-X

or any of those listed in Section 202.3 (a)

Other welding methods, providing equivalent strength as demonstrated by tests, may be used.

202.4 PAINT

The Standard shop paint is a **primer coat** intended to protect the steel for only a short period of exposure in ordinary atmospheric conditions and shall be considered an impermanent and provisional coating. The Standard shop paint shall conform to one of the following:

(a) Steel Structures Painting Council Specification, SSPC No. 15.

(b) Or, shall be a shop paint which meets the minimum performance requirements of one of the above listed specifications.

SECTION 203. DESIGN AND MANUFACTURE

203.1 METHOD

Joists shall be designed in accordance with these specifications as simply supported uniformly loaded



SPECIFICATIONS FOR VULCRAFT SUPER LONGSPAN STEEL JOISTS SLH-SERIES

trusses supporting a roof deck so constructed as to brace the top chord of the joists against lateral buckling. Where any applicable design feature is not specifically covered herein, the design shall be in accordance with the American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, latest adoption, where the material used consists of plates, shapes or bars.

Design Basis:

Designs shall be made according to the provisions in this Specification for either Load and Resistance Factor Design (LRFD) or for Allowable Strength Design (ASD).

Load Combinations:

LRFD:

When load combinations are not specified to the joist manufacturer, the required stress shall be computed for the factored loads based on the factors and load combinations as follows:

$$1.4D$$

$$1.2D + 1.6 (L, \text{ or } L_r, \text{ or } S, \text{ or } R)$$

ASD:

When load combinations are not specified to the joist manufacturer, the required stress shall be computed based on the load combinations as follows:

$$D$$

$$D + (L, \text{ or } L_r, \text{ or } S, \text{ or } R)$$

Where:

D = dead load due to the weight of the structural elements and the permanent features of the structure

L = live load due to occupancy and movable equipment

L_r = roof live load

S = snow load

R = load due to initial rainwater or ice exclusive of the ponding contribution

When special loads are specified and the specifying professional does not provide the load combinations, the provisions of ASCE 7, "Minimum Design Loads for Buildings and Other Structures" shall be used for LRFD and ASD load combinations.

203.2 DESIGN AND ALLOWABLE STRESSES

Design Using Load and Resistance Factor Design (LRFD)

Joists shall have their components so proportioned that the required stresses, f_u , shall not exceed ϕF_n where,

f_u = required stress ksi (MPa)

F_n = nominal stress ksi (MPa)

ϕ = resistance factor

ϕF_n = design stress

Design Using Allowable Strength Design (ASD)

Joists shall have their components so proportioned that the required stresses, f , shall not exceed F_n / Ω where,

f = required stress ksi (MPa)

F_n = nominal stress ksi (MPa)

Ω = safety factor

F_n / Ω = allowable stress

Stresses:

(a) Tension: $\phi_t = 0.90$ (LRFD) $\Omega_t = 1.67$ (ASD)

For Chords: $F_y = 50$ ksi (345 MPa)

For Webs: $F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

Design Stress = $0.9F_y$ (LRFD) (203.2-1)

Allowable Stress = $0.6F_y$ (ASD) (203.2-2)

(b) Compression: $\phi_c = 0.90$ (LRFD) $\Omega_c = 1.67$ (ASD)

For members with $K\ell/r \leq 4.71 \sqrt{E/QF_y}$

$$F_{cr} = Q \left[0.658 \left(\frac{QF_y}{F_e} \right) \right] F_y \quad (203.2-3)$$

For members with $K\ell/r > 4.71 \sqrt{E/QF_y}$

$$F_{cr} = 0.877F_e \quad (203.2-4)$$

Where, F_e = elastic buckling stress determined in accordance with Equation 203.2-5.

$$F_e = \frac{\pi^2 E}{\left(K\ell/r \right)^2} \quad (203.2-5)$$

For hot-rolled sections, "Q" is the full reduction factor for slender compression elements.

Design Stress = $0.9F_{cr}$ (LRFD) (203.2-6)

Allowable Stress = $0.6F_{cr}$ (ASD) (203.2-7)

In the above equations, ℓ is taken as the distance in inches (millimeters) between panel points for the chord members and the appropriate length for web members, and r is the corresponding least radius of gyration of the member or any component thereof. E is equal to 29,000 ksi (200,000 MPa).

Use $1.2 \ell/r_x$ for a crimped, first primary compression web member when a moment-resistant weld group is not used for this member; where r_x member radius of gyration in the plane of the joist.

For cold-formed sections the method of calculating the nominal column strength is given in the AISI, North American Specification for the Design of Cold-Formed Steel Structural Members.

SPECIFICATIONS FOR VULCRAFT SUPER LONGSPAN STEEL JOISTS SLH-SERIES

(c) Bending: $\phi_b = 0.90$ (LRFD) $\Omega_b = 1.67$ (ASD)

Bending calculations are to be based on using the elastic section modulus.

For chords and web members other than solid rounds:

$$F_y = 50 \text{ ksi (345 MPa)}$$

$$\text{Design Stress} = 0.9F_y \text{ (LRFD)} \quad (203.2-8)$$

$$\text{Allowable Stress} = 0.6F_y \text{ (ASD)} \quad (203.2-9)$$

For web members of solid round cross section:

$$F_y = 50 \text{ ksi (345 MPa), or } F_y = 36 \text{ ksi (250 MPa)}$$

$$\text{Design Stress} = 1.45F_y \text{ (LRFD)} \quad (203.2-10)$$

$$\text{Allowable Stress} = 0.95F_y \text{ (ASD)} \quad (203.2-11)$$

For bearing plates:

$$F_y = 50 \text{ ksi (345 MPa), or } F_y = 36 \text{ ksi (250 MPa)}$$

$$\text{Design Stress} = 1.35F_y \text{ (LRFD)} \quad (203.2-12)$$

$$\text{Allowable Stress} = 0.9F_y \text{ (ASD)} \quad (203.2-13)$$

(d) Weld Strength:

Shear at throat of fillet welds:

$$\text{Nominal Shear Stress} = F_{nw} = 0.6F_{exx} \quad (203.2-14)$$

LRFD: $\phi_w = 0.75$

Design Shear Strength =

$$\phi R_n = \phi_w F_{nw} A = 0.45F_{exx} A \quad (203.2-15)$$

ASD: $\Omega_w = 2.0$

Allowable Shear Strength =

$$R_n/\Omega_w = F_{nw} A/\Omega_w = 0.3F_{exx} A \quad (203.2-16)$$

A = effective throat area

Made with E70 series electrodes or

F7XX-EXXX flux-electrode

combinations. $F_{exx} = 70 \text{ ksi (483 MPa)}$

Made with E60 series electrodes or

F6XX-EXXX flux-electrode

combinations. $F_{exx} = 60 \text{ ksi (414 MPa)}$

Tension or compression on groove or butt welds shall be the same as those specified for the connected material.

203.3 MAXIMUM SLENDERNESS RATIOS

The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_s/r$ of members as a whole or any component part shall not exceed the values given in Table 203.3-1, Parts A.

The effective slenderness ratio, $K \ell/r^*$, to be used in calculating the nominal stresses F_{cr} and F_e , is the largest value as determined from Table 203.3-1, Parts B and C.

In compression members when fillers or ties are used, they shall be spaced so that the ℓ_s/r_z ratio of each component does not exceed the governing ℓ/r ratio of the member as a whole.

The terms used in Table 203.3-1 are defined as follows:

ℓ = Length center-to-center of panel points, except $\ell = 36 \text{ in. (914 mm)}$ for calculating ℓ/r_y of top chord member.

ℓ_s = maximum length center-to-center between panel point and filler (tie), or between adjacent fillers (ties).

r_x = member radius of gyration in the plane of the joist.

r_y = member radius of gyration out of the plane of the joist.

r_z = least radius of gyration of a member component.

* See P.N. Chod and T. V. Galambos, Compression Chords Without Fillers in Longspan Steel Joists, Research Report No. 36, June 1975 Structural Division, Civil Engineering Department, Washington University, St. Louis, MO.

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SPECIFICATIONS FOR VULCRAFT SUPER LONGSPAN STEEL JOISTS SLH-SERIES

TABLE 203.3-1
MAXIMUM AND EFFECTIVE SLENDERNESS RATIOS

I TOP CHORD INTERIOR PANEL

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 90.
- B. *The effective slenderness ratio to determine "F_{cr}"*
- | | | | |
|-----------------------------|-----------------|----------------|------------------|
| 1. With fillers or ties | $0.75 \ell/r_x$ | $1.0 \ell/r_y$ | $1.0 \ell_g/r_z$ |
| 2. Without fillers or ties | | | $0.75 \ell/r_z$ |
| 3. Single component members | $0.75 \ell/r_x$ | $1.0 \ell/r_y$ | |
- C. *The effective slenderness ratio to determine "F_e"*
- | | | | |
|-----------------------------|-----------------|--|--|
| 1. With fillers or ties | $0.75 \ell/r_x$ | | |
| 2. Without fillers or ties | $0.75 \ell/r_x$ | | |
| 3. Single component members | $0.75 \ell/r_x$ | | |

II TOP CHORD END PANEL

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 120.
- B. *The effective slenderness ratio to determine "F_{cr}"*
- | | | | |
|-----------------------------|----------------|----------------|------------------|
| 1. With fillers or ties | $1.0 \ell/r_x$ | $1.0 \ell/r_y$ | $1.0 \ell_g/r_z$ |
| 2. Without fillers or ties | | | $1.0 \ell/r_z$ |
| 3. Single component members | $1.0 \ell/r_x$ | $1.0 \ell/r_y$ | |
- C. *The effective slenderness ratio to determine "F_e"*
- | | | | |
|-----------------------------|----------------|--|--|
| 1. With fillers or ties | $1.0 \ell/r_x$ | | |
| 2. Without fillers or ties | $1.0 \ell/r_x$ | | |
| 3. Single component members | $1.0 \ell/r_x$ | | |

III TENSION MEMBERS - CHORDS AND WEBS

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 240.

IV COMPRESSION WEB MEMBERS

- A. The slenderness ratios, $1.0 \ell/r$ and $1.0 \ell_g/r$, of members as a whole or any component part shall not exceed 200.
- B. *The effective slenderness ratio to determine "F_{cr}"*
- | | | | |
|-----------------------------|-------------------|----------------|------------------|
| 1. With fillers or ties | $0.75 \ell/r_x$ | $1.0 \ell/r_y$ | $1.0 \ell_g/r_z$ |
| 2. Without fillers or ties | | | $1.0 \ell/r_z$ |
| 3. Single component members | $0.75 \ell/r_x^*$ | $1.0 \ell/r_y$ | |

* Use $1.2 \ell/r_x$ for a crimped, first primary compression web member when a moment-resistant weld group is not used for this member.

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203.4 MEMBERS

(a) Chords

The bottom chord shall be designed as an axially loaded tension member.

The radius of gyration of the top chord about its vertical axis shall not be less than $\ell/170$ where ℓ is the spacing in inches (millimeters) between lines of bridging as specified in Section 204.5(d)

The top chord shall be considered as stayed laterally by the floor slab or roof deck provided the requirements of Section 204.9(e) of this specification are met.

The top chord shall be designed as a continuous member subject to combined axial and bending stresses and shall be so proportioned that

For LRFD:

at the panel point:

$$f_{au} + f_{bu} \leq 0.9F_y \quad (203.4-1)$$

at the mid panel: for $\frac{f_{au}}{\phi_c F_{cr}} \geq 0.2$,

$$\frac{f_{au}}{\phi_c F_{cr}} + \frac{8}{9} \left[\frac{C_m f_{bu}}{1 - \left(\frac{f_{au}}{\phi_c F_e} \right)} \right] Q \phi_b F_y \leq 1.0 \quad (203.4-2)$$

for $\frac{f_{au}}{\phi_c F_{cr}} < 0.2$,

$$\left(\frac{f_{au}}{2\phi_c F_{cr}} \right) + \left[\frac{C_m f_{bu}}{1 - \left(\frac{f_{au}}{\phi_c F_e} \right)} \right] Q \phi_b F_y \leq 1.0 \quad (203.4-3)$$

$f_{au} = P_u/A$ = Required compressive stress, ksi (MPa)

P_u = Required axial strength using LRFD load combinations, kips (N)

$f_{bu} = M_u/S$ = Required bending stress at the location under consideration, ksi (MPa)

M_u = Required flexural strength using LRFD load combinations, kip-in. (N-mm)

S = Elastic Section Modulus, in.³ (mm³)

F_{cr} = Nominal axial compressive stress in ksi (MPa) based on ℓ/r as defined in Section 203.2(b)

$C_m = 1 - 0.3 f_{au}/\phi F_e$ for end panels

$C_m = 1 - 0.4 f_{au}/\phi F_e$ for interior panels

F_y = Specified minimum yield strength, ksi (MPa)

$F_e = \frac{\pi^2 E}{\left(\frac{K \ell}{r_x} \right)^2}$, ksi (MPa)

Where ℓ is the panel length, in inches (millimeters), as defined in Section 203.2(b) and r_x is the radius of gyration about the axis of bending.

Q = Form factor defined in Section 203.2(b)

A = Area of the top chord, in.², (mm²)

For ASD:

at the panel point:

$$f_a + f_b \leq 0.6F_y \quad (203.4-4)$$

at the mid panel: for $\frac{f_a}{F_a} \geq 0.2$,

$$\frac{f_a}{F_a} + \frac{8}{9} \left[\frac{C_m f_b}{1 - \left(\frac{1.67 f_a}{F_e} \right)} \right] Q F_b \leq 1.0 \quad (203.4-5)$$

for $\frac{f_a}{F_a} < 0.2$,

$$\left(\frac{f_a}{2F_a} \right) + \left[\frac{C_m f_b}{1 - \left(\frac{1.67 f_a}{F_e} \right)} \right] Q F_b \leq 1.0 \quad (203.4-6)$$

$f_a = P/A$ = Required compressive stress, ksi (MPa)

P = Required axial strength using ASD load combinations, kips (N)

$f_b = M/S$ = Required bending stress at the location under consideration, ksi (MPa)

M = Required flexural strength using ASD load combinations, kip-in. (N-mm)

S = Elastic Section Modulus, in.³ (mm³)

F_a = Allowable axial compressive stress, based on ℓ/r as defined in Section 203.2(b), ksi (MPa)

F_b = Allowable bending stress; $0.6F_y$, ksi (MPa)

$C_m = 1 - 0.50 f_a/F_e$ for end panels

$C_m = 1 - 0.67 f_a/F_e$ for interior panels

(b) Web

The vertical shears to be used in the design of the web members shall be determined from full uniform loading, but such vertical shears shall be not less than 25 percent of the end reaction.

Interior vertical web members used in modified Warren type web systems shall be designed to resist the gravity loads supported by the member plus an additional axial load of 1½ percent of the top chord axial force.

SPECIFICATIONS FOR VULCRAFT SUPER LONGSPAN STEEL JOISTS SLH-SERIES

(c) Depth

Joists can have either a top chord pitch of 1/4 inch per foot or parallel chords. The depth, for the purpose of design, in all cases shall be the depth at mid-span. Parallel chord joists must be installed with a minimum slope of 1/4 inch per foot.

(d) Eccentricity

Members connected at a joint shall have their center of gravity lines meet at a point, if practical. Eccentricity on either side of the neutral axis of chord members may be neglected when it does not exceed the distance between the neutral axis and the back of the chord. Otherwise, provision shall be made for the stresses due to eccentricity. Ends of joists shall be proportioned to resist bending produced by eccentricity at the support.

(e) Extended Ends

Extended top chords or full depth cantilever ends require the special attention of the specifying engineer or architect.

The magnitude and location of the design loads to be supported, the deflection requirements, and the proper bracing shall be clearly indicated on the structural drawings.

203.5 CONNECTIONS

(a) Methods

Joint connections and splices shall be made by attaching the members to one another by arc or resistance welding or other approved method.

1) Welded Connections

- (a) Selected welds shall be inspected visually by the manufacturer. Prior to this inspection, weld slag shall be removed.
- (b) Cracks are not acceptable and shall be repaired.
- (c) Thorough fusion shall exist between layers of weld metal and between weld metal and base metal for the required design length of the weld; such fusion shall be verified by visual inspection.
- (d) Unfilled weld craters shall not be included in the design length of the weld.
- (e) Undercut shall not exceed 1/16 inch for welds oriented parallel to the principal stress.
- (f) The sum of surface (piping) porosity diameters shall not exceed 1/16 inch in any 1 inch of design weld length.
- (g) Weld spatter that does not interfere with paint coverage is acceptable.

2) Welding Program

Manufacturers shall have a program for establishing weld procedures and operator qualification and for weld sampling and testing.

3) Weld inspection by Outside Agencies (See Section 204.14 of these specifications).

The agency shall arrange for visual inspection to determine that welds meet the acceptance standards of Section 203.5 a. 1) above. Ultrasonic X-Ray, and magnetic particle testing are inappropriate for joists due to the configurations of the components and welds.

(b) Strength

Joint connections shall develop the maximum force due to any of the design loads, but not less than 50 percent of the allowable strength of the member in tension or compression, whichever force is the controlling factor in the selection of the member.

(c) Shop Splices

Shop splices may occur at any point in chord or web members. Splices shall be designed for the member force, but not less than 50 percent of the allowable member strength. Members containing a butt weld splice shall develop an ultimate tensile force of at least 57,000 psi times the full design area of the chord or web. The term "member" shall be defined as all component parts, comprising the chord or web, at the point of splice.

(d) Field Splices

Field splices shall be bolted connections designed by the manufacturer. Splices shall be designed for the member shear and moment forces, but not less than 50 percent of the member strength.

(e) Bridging Clips

Where double angles, separated by a nominal gap, are used as chord members, the two angles must be tied together with a filler or tie at all bridging clip locations. These fillers and their connections must be capable of developing the bridging forces indicated by Section 204.6 (d).

SPECIFICATIONS FOR VULCRAFT SUPER LONGSPAN STEEL JOISTS SLH-SERIES

203.6 CAMBER

Joists shall have approximate cambers in accordance with the following:

TABLE 203.6.1		
Top Chord Length	Double Pitch Joists*	Parallel Chord Joists
111'-0"	3 1/4"	5 1/4"
120'-0"	3 1/2"	6"
130'-0"	3 7/8"	7"
140'-0"	4 1/8"	8"
150'-0"	4 3/8"	8 3/4"
160'-0"	4 3/4"	9 1/2"
180'-0"	5 1/4"	10 1/2"
200'-0"	5 7/8"	11 3/4"
220'-0"	6 1/2"	13"
240'-0"	7"	14"

* Pitched 1 1/4 in 12" or greater

203.7 SHOP PAINTING

Joists and accessories shall receive one shop coat of protective paint as specified in Section 202.4.

203.8 VERIFICATION OF DESIGN

Design data on SLH series joists will be supplied to the specifying engineer upon request.

SECTION 204. APPLICATION

204.1 USAGE

These specifications shall apply to any type of structure where roof decks are to be supported directly by steel joists installed as herein specified. Where joists are used other than on simple spans under uniformly distributed loading, as prescribed in Section 203.1, they shall be investigated and modified if necessary to limit the unit stresses to those listed in Section 203.2.

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 is then no longer simply supported and the system must be investigated for continuous frame action by the specifying professional.

204.2 SPAN

The clear span of joists shall not exceed 24 times their nominal depth.

204.3 DEPTH

The nominal depth of pitched chord joists shall be the depth at mid-span. The standard pitch of the top chord shall be 1/4 inch per foot.

204.4 PITCH

The standard configuration for SLH Series Joists is a double pitched top chord with a pitch of 1/4 inch per foot. The double pitched design was selected for economy and positive roof drainage.

204.5 END SUPPORTS

(a) Masonry and Concrete

SLH Series Joists supported by masonry or concrete are to bear on steel bearing plates, and shall be designed as steel bearing. Due consideration of the end reactions and all other vertical and lateral forces shall be taken by the specifying engineer or architect in the design of the steel bearing plate and the masonry or concrete. The ends of SLH Series Joists shall extend over the masonry or concrete support not less than the distance shown in Table 204.5.1. The plate shall be located not more than 1/2 inch from the face of the wall and shall be not less than 9 inches wide perpendicular to the length of the joist. It is to be designed by the specifying engineer or architect in compliance with the allowable unit stresses in Section A5.1 (Allowable Stress Design) of the AISC Specifications, of latest adoption. The steel bearing plate shall be furnished by other than the joist manufacturer.

(b) Steel

Due consideration of the end reactions and all other vertical and lateral forces shall be taken by the specifying engineer or architect in the design of the steel support. The end of SLH Series Joists shall extend over the steel support a distance not less than that shown in Table 204.5.1.

TABLE 204.5.1

Joist Section Number	Minimum Bearing Length*
SLH 15-18	4"
SLH 19-25	6"

*Excluding extension

204.6 BRIDGING

(a) Horizontal

Horizontal bridging lines shall consist of two continuous horizontal steel members, one attached to the top chord and the other attached to the bottom chord. The l/r ratio of the bridging member shall not exceed 300, where l is the distance in inches between attachments and r is the least radius of gyration of the bridging member.

(b) Diagonal

Diagonal bridging lines shall consist of cross-bracing with l/r ratio of not more than 200, where l is the distance in inches between connections and r is the least radius of gyration of the bracing member. Where cross-bracing members are connected at their point of intersection, the l distance shall be taken as the distance in inches between connections at the point of intersection of the bracing members and the connections to the chords of the joists.

(c) Bridging Lines

Bolted diagonal bridging shall be used except when the joist spacing is less than .66 x joist depth, then bolted horizontal bridging shall be used in addition to diagonal bridging.

(d) Spacing

The maximum spacing of lines of bridging shall not exceed the values in Table 204.6.1. Bridging shall be installed near a bottom chord panel point or an extra web member shall be furnished to brace the bottom chord for the vertical component of the bridging force equal to the horizontal bracing force. See Section 204.13 for bridging required for uplift forces.

TABLE 204.6.1

Joist-Section Number*	Max. Spac. Of Lines Of Bridging	Horizontal Bracing Force**
15 to 17	21'-0"	2,700 lbs
18	21'-0"	3,400 lbs
19	26'-0"	3,400 lbs
20	26'-0"	3,700 lbs
21	30'-0"	4,200 lbs
22	30'-0"	5,000 lbs
23	30'-0"	5,500 lbs
24	30'-0"	6,300 lbs
25	30'-0"	7,100 lbs

The number of lines of bridging is based on the joists clear span dimensions.

* Last two digits of designation shown in load table.

** Each connection to the chord shall resist one-half of this force.

(e) Connections

Connections to the chords of the steel joists and bridging anchors shall be made by positive mechanical means and capable of resisting a horizontal force not less than that specified in Table 204.6.1.

(f) Bottom Chord Bearing Joists

It is not recommended that SLH-Series joists be used in bottom chord bearing configuration.

204.7 INSTALLATION OF BRIDGING

All bridging and bridging anchors shall be completely installed before construction loads are placed on the joists. Bridging shall support the top and bottom chords against lateral movement during the construction period and shall hold the steel joists in the approximate position as shown on the plans.

The ends of all bridging lines terminating at walls or beams shall be anchored thereto.

204.8 END ANCHORAGE

(a) Masonry and Concrete

Ends of SLH Series Joists resting on steel bearing plates on masonry or structural concrete shall be attached thereto as shown Table 204.8.1.

(b) Steel

Ends of SLH Series Joists resting on steel supports shall be attached thereto as shown in Table 204.8.1. In steel frames, where columns are not framed in at least two directions with structural steel members, joists at column lines shall be field bolted at the columns to provide lateral stability during construction.

TABLE 204.8.1 END ANCHORAGE

Joist Section No.*	Fillet Weld	Bearing Seat Bolts For Erection
SLH 15-18	2 - 1/4" x 2"	2 - 3/4" A325
SLH 19-25	2 - 1/4" x 4"	2 - 3/4" A325

*Last two digits of designation shown in load table.

(c) Uplift

Where uplift forces are a design consideration, roof joists shall be anchored to resist such forces.

204.9 JOIST SPACING

Joists shall be spaced so that the loading on each joist does not exceed the allowable load given for the particular designation and span in the Load Table.

204.10 ROOF DECKS

(a) Material

Decks may consist of cast-in-place or precast concrete or gypsum, formed steel, wood or other suitable material capable of supporting the required load at the specified joist spacing.

(b) Thickness

Cast-in-place slabs shall not be less than 2 inches thick.

(c) Bearing

Slabs or decks shall bear uniformly along the top chords of the joist.

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(d) **Attachments**

The spacing of attachments along the top chord shall not exceed 36 inches. Such attachments of the slab or deck to the top chords of joists shall be capable of resisting the following forces:

TABLE 204.10.1

Joist Section Number*	Equivalent Force Required
15 - 16 incl.	300 lbs./ft.
17 - 19 incl.	300 lbs./ft.
20 - 21 incl.	300 lbs./ft.
22 - 24 incl.	420 lbs./ft.
25	520 lbs./ft.

*Last two digits of designation shown in load table.

(e) **Wood Nailers**

It is not recommended that SLH-Series joists be used in conjunction with wood nailers.

(f) **Joist With Standing Seam Roofing**

The stiffness and strength of standing-seam roof clips varies from one manufacturer to another. Therefore, some roof systems cannot be counted on to provide lateral stability to the joists which support the roof. Sufficient stability must be provided to brace the joists laterally under the full design load. The compression chord must resist the chord axial design force in the plane of the joist (i.e., x-x axis buckling) and out of the plane of the joist (i.e., y-y axis buckling). Out of plane strength may be achieved by adjusting the bridging spacing and/or increasing the compression chord area, the joist depth, and the y-axis radius of gyration. The effective slenderness ratio in the y-direction equals $0.94 L/r_y$, where L is the bridging spacing. The maximum bridging spacing may not exceed that specified in Section 204.6d.

204.11 DEFLECTION

The deflection due to the design live load shall not exceed the following:

Roofs

$l/360$ of span where plaster ceiling is attached or suspended.

$l/240$ of span for all other cases.

The specifying engineer or architect shall give due consideration to the effects of deflection in selection of joists.

204.12 PONDING

Unless a roof surface is provided with sufficient slope toward points of free drainage or adequate individual drains to prevent the accumulation of rain water, the roof system shall be investigated to assure stability under ponding conditions in accordance with Section K2 (Allowable Stress Design) of the AISC Specifications.*

A top chord pitch of $1/4"$ or more per foot is recommended to minimize ponding.

The ponding investigation shall be performed by the specifying engineer or architect.

* For further information, refer to Steel Joist Institute Technical Digest #3, "Structural Design of Steel Joist Roofs to Resist Ponding Loads".

204.13 UPLIFT

Where uplift forces due to wind are a design requirement, these forces must be indicated on the structural drawings in terms of net uplift in pounds per square foot. When these forces are specified, they must be considered in the design of joists and bridging. A single line of bottom chord bridging must be provided near the first bottom chord panel points, whenever uplift due to wind forces is a design consideration.**

** For further information, refer to Steel Joist Institute Technical Digest #6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads".

204.14 INSPECTION

Joists shall be inspected by the manufacturer before shipment to insure compliance of materials and workmanship with the requirements of these specifications. If the purchaser wishes an inspection of the steel joists by someone other than the manufacturer's own inspectors, he may reserve the right to do so in the "Invitation to Bid" or the accompanying "Job Specifications". Arrangements shall be made with the manufacturer for such inspection of the joists at the manufacturing facility by the purchaser's inspectors at purchaser's expense.

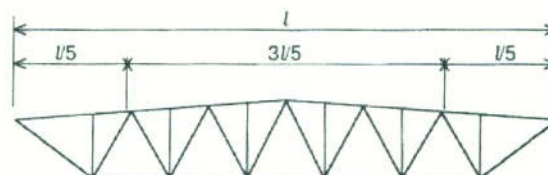
**SECTION 205.
HANDLING AND ERECTION***

Particular attention should be paid to the erection of Super Longspan Steel Joists.

Care shall be exercised at all times to avoid damage through careless handling during unloading, storing, and erecting. Dropping of joists shall not be permitted.

Each joist shall be adequately braced laterally before any loads are applied. If lateral support is provided by bridging, the bridging lines must be anchored to prevent lateral movement.

Hoisting cables attached at a panel point approximately $1/5$ of the span from each end will minimize erection stresses in the steel joist. **The angle of the hoisting cables from the vertical shall not exceed 30 degrees.** Two cranes are recommended for spans greater than 150 feet.



Hoisting cables shall not be released until all bridging lines are installed. For ease of alignment, anchorage of joist ends in accordance with Section 204.8 should follow the installation of bridging. During the construction period, the contractor shall provide means for the adequate distribution of concentrated loads so the carrying capacity of any joist is not exceeded.

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

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WHAT ARE JOIST GIRDERS?

Joist girders are primary framing members. The design is simple span, supporting equally spaced concentrated loads from open web steel joists. These concentrated loads are considered to act at the panel points of the joist girder.

Joist girders are designed to allow for the efficient use of steel in longer spans for primary framing members.

The following weight tables list joist girders from 20" to 96" deep and spans up to 100 feet. (For depths and lengths not listed contact Vulcraft.) The depth designation is determined by the nominal depth at the center of the span, except for offset double pitched girders, where the depth is determined at the ridge.

The standard configuration of a joist girder is parallel chord with underslung ends and bottom chord extensions. (Joist girders can be furnished in other configurations, see below.) The standard depth of bearing for joist girders is 7 1/2 inches at the end of the bearing seat.*

The standard method of connecting girders to columns is two 3/4" diameter A325 bolts. A loose connection of the lower chord to the column or other support is required during erection in order to stabilize the lower chord laterally and to help brace the joist girder against overturning. **CAUTION: IF A RIGID CONNECTION OF THE BOTTOM CHORD IS TO BE MADE TO COLUMN OR OTHER SUPPORT, IT IS TO 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.

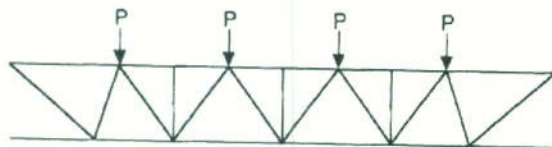
Joist girders along the perimeter, with joists coming in from one side only, and those with unbalanced loads must be designed such that the reactions pass through the center of the joist girder.

The weight tables list the approximate weight per linear foot for a joist girder supporting the panel point loads given by the specifying engineer. **NOTE: THE WEIGHT OF THE JOIST GIRDER MUST BE INCLUDED IN THE PANEL POINT LOAD. (SEE THE EXAMPLE ON PAGE 101).**

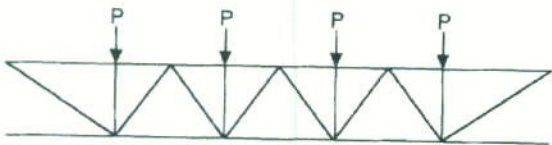
For calculating the approximate deflection or checking ponding the following formula may be used in determining the approximate moment of inertia of the joist girder. $I_{JG} = 0.027 \text{ NPLd}$

Where N = number of joist spaces, P = panel point load in kips, L = joist girder length in feet and d = effective depth of the joist girder in inches. Contact Vulcraft if a more exact joist girder moment of inertia must be known.

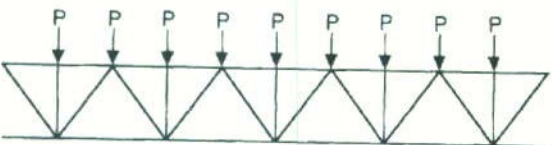
*Increase seat depth to 10" if weight of joist girder appears to the right of the stepped blue lines in the weight tables.



G TYPE



VG TYPE



BG TYPE

OTHER CONFIGURATIONS

AVAILABLE ARE:

DOUBLE PITCH TC, UNDERSLUNG

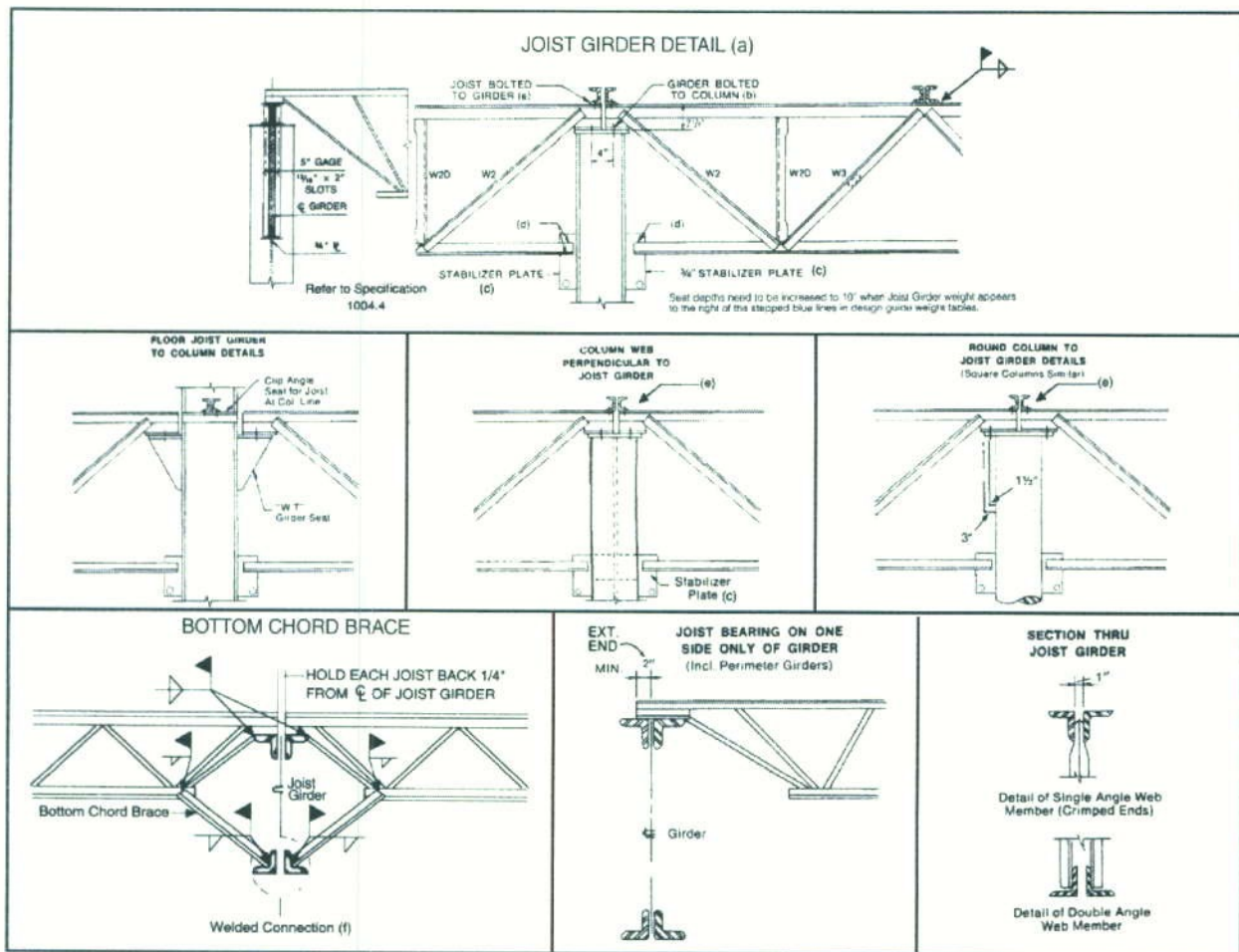
SINGLE PITCH TC, UNDERSLUNG

OFFSET DOUBLE PITCH TC, UNDERSLUNG

SEE PAGE 101
FOR DESIGN EXAMPLE

NOTE: JOIST GIRDER WEB CONFIGURATION MAY VARY FROM THAT SHOWN. IF EXACT CONFIGURATION IS REQUIRED CONTACT VULCRAFT.

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SEE PAGE 93 FOR MOMENT CONNECTION DETAILS

JOIST GIRDER NOTES

- (a) All Joist Girder dimensions shown are subject to change when required by the physical size of large Joist Girders. If changes are necessary Vulcraft will so note on the placement plans.
- (b) The standard connection for Joist Girders to columns is 13/16 inch slots for 3/4 inch bolts in girder bearings. **The girder erection bolts are by others.** If the specifying professional wishes to use the Joist Girder bearing to transmit horizontal loads, the required amount of weld to connect the Joist Girder seat to the column should be specified. For additional information see the section of this catalog "JOIST GIRDERS IN MOMENT RESISTIVE FRAMES." (page 92)
- (c) Stabilizer plates between bottom chord angles stabilize the bottom chord laterally and brace the Joist Girder against overturning during erection. (Refer to 1004.4)
- (d) Joist Girder bottom chord struts do not require welding to the stabilizer plate unless required by design to transmit horizontal forces. When welding is required, the amount of weld should be specified by the specifying professional. **UNLESS OTHERWISE SPECIFIED, BOTTOM CHORD STRUTS SHOULD NOT BE WELDED.**
- (e) Joists are connected to the girder by welding except that the joists at (or nearest) the column shall also be bolted (O.S.H.A. Sec. 1910.12 Construction Standards Sec 1518.751).
- (f) The l/r_y of the bottom chord of the Joist Girder cannot exceed 240. For STANDARD Joist Girders, the specifying engineer can use the "Joist Girder Bottom Chord Brace Chart" in conjunction with the "Design Guide Weight Table/Joist Girders, G Series" to select the correct number of bottom chord braces. Joist Girders which must resist uplift, end moments, or axial bottom chord forces may require additional braces.

JOIST GIRDER NOTES

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If fixed end moments or uplift are present, the specifying professional should also specify bottom chord braces to be designed and furnished by the joist girder manufacturer. If any additional braces are required due to

the compression load in the bottom chord, Vulcraft will indicate their location on the placement plans. Bottom chord braces may be either welded or bolted to the girder, but are typically welded to the joist.

JOIST GIRDER BOTTOM CHORD BRACE CHART*			
SPAN IN FEET			
JOIST GIRDER WEIGHT/FT	NO BC BRACES	ONE BC BRACE @ CENTERLINE	TWO BC BRACES @ 1/3 POINTS
0-22	0' to 24'	>24' to 49'	>49' to 73'
23-30	0' to 28'	>28' to 57'	>57' to 85'
31-45	0' to 32'	>32' to 65'	>65' to 97'
46-66	0' to 36'	>36' to 73'	>73' to 110'
67-87	0' to 41'	>41' to 82'	>82' to 123'
88-135	0' to 49'	>49' to 98'	>98' to 147'
136-173	0' to 57'	>57' to 114'	>114' to 171'

* The bottom chords must be restrained in accordance with Section 1004.5 of The SJI Specifications.

ECONOMY TIPS

1. Designate Joist Girder with exact load required, such as 60G8N11.2K.
2. If Joist Girder depth is limited below the optimum depth as shown in the weight tables, use the maximum depth permitted by the building system: such as 53G8N12K (odd depths can be designed and furnished).
3. The Joist Girder designations shown in the weight guide are typical types included only as a guide. The specifying professional is encouraged to specify the exact depth, span and loading that best suits the building.
4. A Joist Girder depth in inches approximately equal to the span in feet is often a good combination for economy.
5. The specifying professional is urged to investigate several combinations of bay sizes and joist spaces to find the most economical combination.
6. The following table illustrates the economy possible using this system.

Table G-1 ROOF SYSTEM WEIGHT FOR RECOMMENDED BAY SIZES							
BAY SIZE		Weight of joists* + Girders** = Total (PSF)***					
Joist Span	Girder Span	Design Load (PSF)				Joist Space (Ft.)	Girder Depth (In.)
		35 (PSF)	40 (PSF)	45 (PSF)	50 (PSF)		
40'	40'	1.69 + .75 = 2.44	1.78 + .83 = 2.61	1.90 + .90 = 2.80	2.07 + 1.03 = 3.10	6.67	48
40'	50'	1.73 + .95 = 2.68	1.90 + 1.08 = 2.98	2.02 + 1.18 = 3.20	2.13 + 1.28 = 3.41	6.25	60
40'	60'	1.69 + 1.13 = 2.82	1.78 + 1.30 = 3.08	1.90 + 1.40 = 3.30	2.07 + 1.53 = 3.60	6.67	72
45'	40'	1.89 + .71 = 2.60	2.04 + .80 = 2.84	2.14 + .89 = 3.03	2.41 + .96 = 3.37	6.67	48
45'	50'	1.98 + .96 = 2.94	2.11 + 1.09 = 3.20	2.22 + 1.16 = 3.38	2.40 + 1.29 = 3.69	6.25	60
45'	60'	1.89 + 1.16 = 3.05	2.04 + 1.24 = 3.28	2.14 + 1.38 = 3.52	2.41 + 1.49 = 3.90	6.67	72
50'	40'	2.19 + .72 = 2.91	2.28 + .80 = 3.08	2.53 + .86 = 3.39	2.80 + 1.06 = 3.86	6.67	48
50'	50'	2.21 + .92 = 3.13	2.43 + 1.00 = 3.43	2.61 + 1.12 = 3.73	2.70 + 1.20 = 3.90	6.25	60
50'	60'	2.19 + 1.12 = 3.31	2.28 + 1.22 = 3.50	2.53 + 1.34 = 3.87	2.80 + 1.50 = 4.30	6.67	72

* Weight of joists in pounds per square foot.

** Weight of the joist girders in pounds per square foot.

*** Total weight of joists and joist girders in pounds per square foot.

The larger bay sizes become more economical as the column heights increase and in localities with high erection labor costs. Larger bays speed construction by reducing the number of pieces and therefore the number of crane lifts. Encasing the columns for fire proofing or decoration also makes the larger bays more attractive.



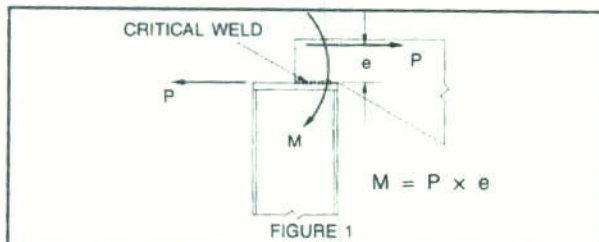
JOIST GIRDERS IN MOMENT RESISTANT FRAMES

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When a Joist Girder is used as a component of a moment resistive frame, both the design wind moment and any continuity (usually live load) moment must be specified for each end of each affected Joist Girder. Provided this information, Vulcraft will design the Joist Girder as a simply supported truss for full gravity loading. The "fixed end" moments are then applied to the Joist Girder. Using the appropriate combinations of the gravity loads, the wind moments, and/or the continuity moments, the critical member stresses are identified and the Joist Girder members are sized accordingly.

The Specifying Professional shall clarify when allowable stresses are permitted to be increased or load combinations reduced. **(Vulcraft does not design the Joist Girder for any dead load moments unless specifically instructed to do so on the structural drawings.)** For this reason it is very important that on the structural drawings the specifying professional specify that all dead loads be applied to the Joist Girders before the bottom chord struts are welded to the stabilizer plates.

One of the most important considerations of using a Joist Girder in a moment resistive frame is the connection of the Joist Girder to the column. As with a beam connection, special provisions must be made to develop the required moment capacity. As can be readily seen in Figure 1, the use of a standard Joist Girder seat results in an eccentric moment due to the depth of the seat. This moment must be resisted by the weld group connecting the Joist Girder seat to the cap plate of the column.



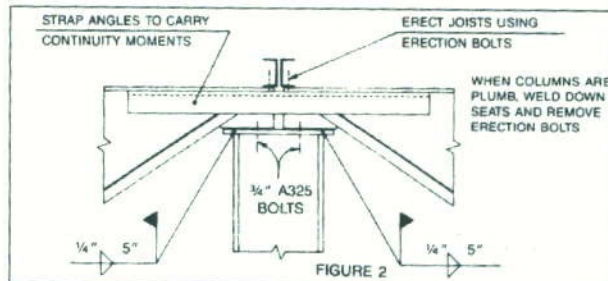
Vulcraft has done extensive testing of the maximum eccentric top chord force capacity for joist girders. Based on this test program, the maximum horizontal load for 7.5 inch deep seats are presented in Table 1 (below)

Joist Girder (7.5" Seat) Top Chord Leg Size	ASD P_a kips	LRFD ϕP_n kips
2.5"	4	6
3.0"	8	12
3.5" and larger	10	15

Table 1

*These values are based on using 3/4 inch A325 bolts and a minimum of two 1/4 inch fillet welds 5 inches long along the sides of the seat. Vulcraft must be notified of seat forces for final seat design.

If the axial load due only to the wind moment does not exceed the values in Table 1, a strap angle connecting the Joist Girders together as shown in Figure 2 can be used to resist the continuity moments. By tying the Joist Girder ends together, the Joist Girder-to-cap plate connection need only resist the wind loads, **the strap angles do not transfer wind moments.** The design of such a strap angle to resist the continuity moments is the responsibility of the specifying professional.



When the end moments on the Joist Girders are too large for the seat to resist, it is necessary to utilize a moment plate as shown in Details A-F. The use of this simple moment plate virtually eliminates all eccentricity problems.

By using the equations and Table 2 below, the specifying professional can determine the minimum Joist Girder top chord width for most Joist Girders. If the end moments are very large, the Joist Girder loads and/or spacings vary, or other special conditions exist, a more exact analysis is required. Once the Joist Girder top chord width is known, the specifying professional can easily size the moment plate and its weld requirements to complete the connection detail.

EQUATION 1 (ODD NO. OF JOIST SPACES)

$$A = \frac{.028P}{D} (N^2S - .67N + .67 - S)$$

EQUATION 2 (EVEN NO. OF JOIST SPACES)

$$A = \frac{.028P}{D} (N^2S - .67N + .67)$$

Where:

P = Panel point load (kips)

N = No. of joist spaces

S = Joist spacing (ft.)

D = Joist Girder depth (in.)

Table 2*

A	Minimum Top Chord Width
0.95 - 1.19	6"
1.20 - 1.78	7"
1.79 - 2.48	8"
2.49 - 3.75	9"
3.76 - 4.76	11"
4.78 - 8.44	13"
Greater than 8.44	Consult Vulcraft

Please note that this chart is to be used only for designing moment plates. It is not intended for use as a general detailing aid.

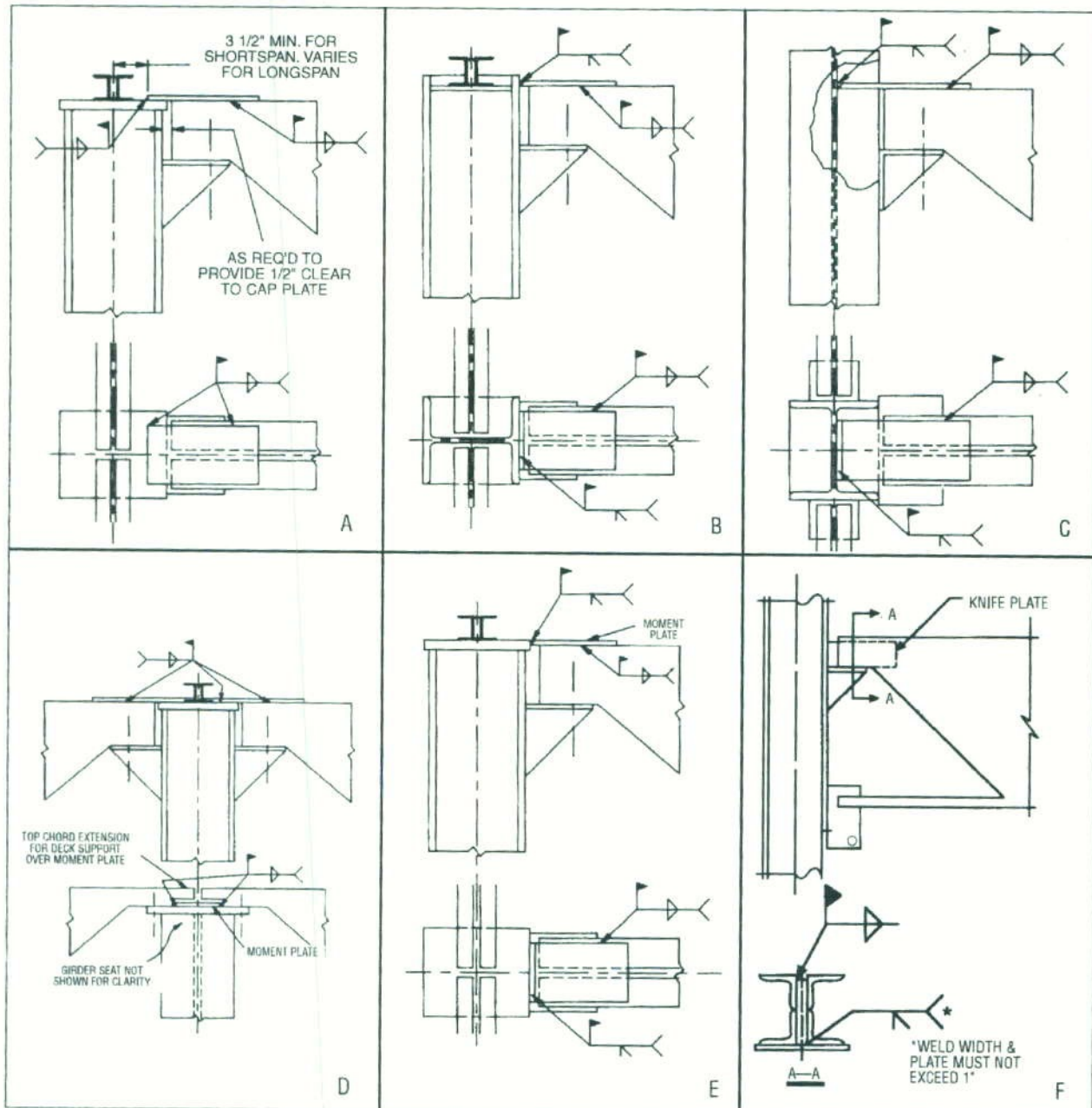
*The bearing seat width may be larger than the top chord width. Contact Vulcraft if seat width is needed for determining column plate sizes.

MOMENT CONNECTION DETAILS

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Presented below are six suggested details for a moment resistive connection involving roof Joist Girders. Similar details should be utilized for longspan joists with end moments. In all cases, the bottom chord is to be connected to the column with a vertical stabilizer plate

which is to be sized to carry the required load and obtain required weld (use 6 x 6 x 3/4 plate minimum for Joist Girders).



NOTES:

- (1) Connections type B & C would also be recommended for floor girder details.
- (2) Where a backer bar is required for groove welds, additional clearance must be provided when determining girder hold back dimension.
- (3) Similar details would apply at other types of columns.
- (4) Additional stiffener plates as required not shown for clarity.
- (5) In all details, moment plate design and material is not by Vulcraft.

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STANDARD SPECIFICATIONS FOR JOIST GIRDERS

Adopted by the Steel Joist Institute November 4, 1985
Revised to November 10, 2003 - Effective March 01, 2005

SECTION 1000. SCOPE

This specification covers the design, manufacture and use of Joist Girders. Load and Resistance Factor Design (LRFD) and Allowable Strength Design (ASD) are included in this specification.

SECTION 1001. DEFINITION

The term "Joist Girders", as used herein, refers to open web, load-carrying members utilizing hot-rolled or cold-formed steel, including cold-formed steel whose yield strength* has been attained by cold working.

The design of Joist Girder chord and web sections shall be based on a yield strength of at least 36 ksi (250 MPa), but not greater than 50 ksi (345 MPa). Steel used for Joist Girder chord or web sections shall have a minimum yield strength determined in accordance with one of the procedures specified in Section 1002.2, which is equal to the yield strength assumed in the design. Joist Girders shall be designed in accordance with this specification to support panel point loadings.

* The term "Yield Strength" as used herein shall designate the yield level of a material as determined by the applicable method outlined in paragraph 13.1, "Yield Point" and in paragraph 13.2, "Yield Strength", of ASTM Standard A370, "Standard Test Methods and Definitions for Mechanical Testing of Steel Products", or as specified in Section 1002.2 of this Specification.

Standard Specifications and Weight Tables for Joist Girders

Steel Joist Institute - Copyright 2005

SECTION 1002. MATERIALS

1002.1 STEEL

The steel used in the manufacture of chord and web sections shall conform to one of the following ASTM Specifications:

- Carbon Structural Steel, ASTM A36/A36M.
- High-Strength, Low-Alloy Structural Steel, ASTM A242/A242M.
- High-Strength Carbon-Manganese Steel of Structural Quality ASTM A529/A529M, Grade 50.
- High-Strength Low-Alloy Columbium-Vanadium Structural Steel, ASTM A572/A572M Grade 42 and 50.
- High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 inches (100 mm) Thick, ASTM A588/A588M.
- Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Corrosion Resistance, ASTM A606.
- Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1008/A1008M.
- Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, ASTM A1011/A1011M.

or shall be of suitable quality ordered or produced to other than the listed specifications, provided that such material in the state used for final assembly and manufacture is weldable and is proved by tests performed by the producer or manufacturer to have the properties specified in Section 1002.2.

1002.2 MECHANICAL PROPERTIES

The yield strength used as a basis for the design stresses prescribed in Section 1003 shall be at least 36 ksi (250 MPa), but shall not be greater than 50 ksi (345 MPa). Evidence that the steel furnished meets or exceeds the design yield strength shall, if requested, be provided in the form of an affidavit or by witnessed or certified test reports.

For material used without consideration of increase in yield strength resulting from cold forming, the specimens shall be taken from as-rolled material. In the case of material properties of which conform to the requirements of one of the listed specifications, the test specimens and procedures shall conform to those of such specifications and to ASTM A370.



In the case of material the mechanical properties of which do not conform to the requirements of one of the listed specifications, the test specimens and procedures shall conform to the applicable requirements of ASTM A370 and the specimens shall exhibit a yield strength equal to or exceeding the design yield strength and an elongation of not less than (a) 20 percent in 2 inches (51 millimeters) for sheet and strip, or (b) 18 percent in 8 inches (203 millimeters) for plates, shapes and bars with adjustments for thickness for plates, shapes and bars as prescribed in ASTM A36/A36M, A242/A242M, A529/A529M, A572/A572M, A588/A588M, whichever specification is applicable on the basis of design yield strength.

The number of tests shall be as prescribed in ASTM A6/A6M for plates, shapes, and bars; and ASTM A606, A1008/A1008M and A1011/A1011M for sheet and strip.

If as-formed strength is utilized, the test reports shall show the results of tests performed on full section specimens in accordance with the provisions of the AISI Specifications for the Design of Cold-Formed Steel Structural Members and shall indicate compliance with these provisions and with the following additional requirements:

- The yield strength calculated from the test data shall equal or exceed the design yield strength.
- Where tension tests are made for acceptance and control purposes, the tensile strength shall be at least 6 percent greater than the yield strength of the section.
- Where compression tests are used for acceptance and control purposes, the specimen shall withstand a gross shortening of 2 percent of its original length without cracking. The length of the specimen shall not be greater than 20 times its least radius of gyration.
- If any test specimen fails to pass the requirements of the subparagraphs (a), (b), or (c) above, as applicable, two retests shall be made of specimens from the same lot. Failure of one of the retest specimens to meet such requirements shall be the cause for rejection of the lot represented by the specimens.

1002.3 WELDING ELECTRODES

The following electrodes shall be used for arc welding:

- For connected members both having a specified yield strength greater than 36 ksi (250 MPa).

AWS A5.1: E70XX
 AWS A5.5: E70XX-X
 AWS A5.17: F7XX-EXXX, F7XX-ECXXX flux electrode combination
 AWS A5.18: ER70S-X, E70C-XC, E70C-XM
 AWS A5.20: E7XT-X, E7XT-XM
 AWS A5.23: F7XX-EXXX-XX, F7XX-ECXXX-XX
 AWS A5.28: ER70S-XXX, E70C-XXX
 AWS A5.29: E7XTX-X, E7XTX-XM

- For connected members both having a specified minimum yield strength of 36 ksi (250 MPa) or one having a specified minimum yield strength of 36 ksi (250 MPa), and the other having a specified minimum yield strength greater than 36 ksi (250 MPa).

AWS A5.1: E60XX

AWS A5.17: F6XX-EXXX, F6XX-ECXXX flux electrode combination

AWS A5.20: E6XT-X, E6XT-XM

AWS A5.29: E6XTX-X, E6XTX-XM

or any of those listed in Section 1002.3(a).

Other welding methods, providing equivalent strength as demonstrated by tests, may be used.

1002.4 PAINT

The standard shop paint is intended to protect the steel for only a short period of exposure in ordinary atmospheric conditions and shall be considered an impermanent and provisional coating.

When specified, the standard shop paint shall conform to one of the following:

- Steel Structures Painting Council Specification, SSPC No. 15
- Or, shall be a shop paint which meets the minimum performance requirements of the above listed specification.

SECTION 1003.

DESIGN AND MANUFACTURE

1003.1 METHOD

Joist Girders shall be designed in accordance with this specification as simply supported primary members. All loads shall be applied through steel joists, and will be equal in magnitude and evenly spaced along the joist girder top chord. Where any applicable design feature is not specifically covered herein, the design shall be in accordance with the following specifications:

- Where the steel used consists of hot-rolled shapes, bars or plates, use the American Institute of Steel Construction, *Specification for Structural Steel Buildings*.
- For members that are cold-formed from sheet or strip steel, use the American Iron and Steel Institute, *North American Specification for the Design of Cold-Formed Steel Structural Members*.

Design Basis:

Designs shall be made according to the provisions in this Specification for either Load and Resistance Factor Design (LRFD) or for Allowable Strength Design (ASD).



Load Combinations:**LRFD:**

When load combinations are not specified to the joist manufacturer, the required stress shall be computed for the factored loads based on the factors and load combinations as follows:

$$1.4D$$

$$1.2D + 1.6(L, \text{ or } L_r, \text{ or } S, \text{ or } R)$$

ASD:

When load combinations are not specified to the joist manufacturer, the required stress shall be computed based on the load combinations as follows:

$$D$$

$$D + (L, \text{ or } L_r, \text{ or } S, \text{ or } R)$$

Where:

D = dead load due to the weight of the structural elements and the permanent features of the structure

L = live load due to occupancy and movable equipment

L_r = roof live load

S = snow load

R = load due to initial rainwater or ice exclusive of the ponding contribution

When special loads are specified and the specifying professional does not provide the load combinations, the provisions of ASCE 7, "Minimum Design Loads for Buildings and Other Structures" shall be used for LRFD and ASD load combinations.

1003.2 DESIGN AND ALLOWABLE STRESSES**Design Using Load and Resistance Factor Design (LRFD)**

Joist Girders shall have their components so proportioned that the required stresses, f_u , shall not exceed ϕF_n where,

$$f_u = \text{required stress} \quad \text{ksi (MPa)}$$

$$F_n = \text{nominal stress} \quad \text{ksi (MPa)}$$

$$\phi = \text{resistance factor}$$

$$\phi F_n = \text{design stress}$$

Design Using Allowable Strength Design (ASD)

Joist Girders shall have their components so proportioned that the required stresses, f , shall not exceed F_n/Ω where,

$$f = \text{required stress} \quad \text{ksi (MPa)}$$

$$F_n = \text{nominal stress} \quad \text{ksi (MPa)}$$

$$\Omega = \text{safety factor}$$

$$F_n/\Omega = \text{allowable stress}$$

Stresses:

(a) **Tension:** $\phi_t = 0.90$ (LRFD) $\Omega_t = 1.67$ (ASD)

For Chords: $F_y = 50$ ksi (345 MPa)

For Webs: $F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

$$\text{Design Stress} = 0.9F_y \text{ (LRFD)} \quad (1003.2-1)$$

$$\text{Allowable Stress} = 0.6F_y \text{ (ASD)} \quad (1003.2-2)$$

(b) **Compression:** $\phi_c = 0.90$ (LRFD) $\Omega_c = 1.67$ (ASD)

For members with $\ell/r \leq 4.71 \sqrt{E/QF_y}$

$$F_{cr} = Q \left[0.658 \left(\frac{QF_y}{F_e} \right) \right] F_y \quad (1003.2-3)$$

For members with $\ell/r > 4.71 \sqrt{E/QF_y}$

$$F_{cr} = 0.877F_e \quad (1003.2-4)$$

Where F_e = Elastic buckling stress determined in accordance with Equation 1003.2-5.

$$F_e = \frac{\pi^2 E}{\left(\frac{\ell}{r} \right)^2} \quad (1003.2-5)$$

For hot-rolled sections, "Q" is the full reduction factor for slender compression elements.

$$\text{Design Stress} = 0.9F_{cr} \text{ (LRFD)} \quad (1003.2-6)$$

$$\text{Allowable Stress} = 0.6F_{cr} \text{ (ASD)} \quad (1003.2-7)$$

In the above equations, ℓ is taken as the distance, in inches (millimeters), between panel points for the chord members and the appropriate length for web members, and r is the corresponding least radius of gyration of the member or any component thereof. E is equal to 29,000 ksi (200,000 MPa).

Use $1.2 \ell/r_x$ for a crimped, first primary compression web member when a moment-resistant weld group is not used for this member; where r_x = member radius of gyration in the plane of the joist.

For cold-formed sections, the method of calculating the nominal column strength is given in the AISI, *North American Specification for the Design of Cold-Formed Steel Structural Members*.



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(c) Bending: $\phi_b = 0.90$ (LRFD) $\Omega_b = 1.67$ (ASD)

Bending calculations are to be based on using the elastic section modulus.

For chords and web members other than solid rounds:

$F_y = 50$ ksi (345 MPa)

Design Stress = $0.90F_y$ (LRFD) (1003.2-8)

Allowable Stress = $0.60F_y$ (ASD) (1003.2-9)

For web members of solid round cross section:

$F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

Design Stress = $1.45F_y$ (LRFD) (1003.2-10)

Allowable Stress = $0.95F_y$ (ASD) (1003.2-11)

For bearing plates:

$F_y = 50$ ksi (345 MPa), or $F_y = 36$ ksi (250 MPa)

Design Stress = $1.35F_y$ (LRFD) (1003.2-12)

Allowable Stress = $0.90F_y$ (ASD) (1003.2-13)

(d) Weld Strength:

Shear at throat of fillet welds:

Nominal Shear Stress = $F_{nw} = 0.6F_{EXX}$ (1003.2-14)

LRFD: $\phi_w = 0.75$

Design Shear Strength =

$\phi R_n = \phi_w F_{nw} A = 0.45F_{EXX} A$ (1003.2-15)

ASD: $\Omega_w = 2.0$

Allowable Shear Strength = (1003.2-16)

$R_n / \Omega_w = F_{nw} A / \Omega_w = 0.3F_{EXX} A$

A = effective throat area

Made with E70 series electrodes or F7XX-EXXX flux-electrode combinations $F_{EXX} = 70$ ksi (483 MPa)

Made with E60 series electrodes or F6XX-EXXX flux-electrode combinations $F_{EXX} = 60$ ksi (414 MPa)

Tension or compression on groove or butt welds shall be the same as those specified for the connected material.

1003.3 MAXIMUM SLENDERNESS RATIOS

The slenderness ratio ℓ/r , where ℓ is the length center-to-center of support points and r is the corresponding least radius of gyration, shall not exceed the following:

Top chord interior panels 90

Top chord end panels 120

Compression members other than top chord 200

Tension members 240

1003.4 MEMBERS**(a) Chords**

The bottom chord shall be designed as an axially loaded tension member. The radius of gyration of the bottom

chord about its vertical axis shall not be less than $\ell/240$ where ℓ is the distance between lines of bracing.

The top chord shall be designed as an axial loaded compression member. The radius of gyration of the top chord about the vertical axis shall not be less than $\text{Span}/575$.

The top chord shall be considered as stayed laterally by the steel joists provided positive attachment is made.

(b) Web

The vertical shears to be used in the design of the web members shall be determined from full loading, but such vertical shear shall be not less than 25 percent of the end reaction.

Interior vertical web members used in modified Warren type web systems that do not support the direct loads through steel joists shall be designed to resist an axial load of 2 percent of the top chord axial force.

Tension members shall be designed to resist at least 25 percent of their axial force in compression.

(c) Fillers and Ties

In compression members composed of two components, when fillers, ties or welds are used, they shall be spaced so the ℓ/r ratio for each component does not exceed the ℓ/r ratio of the member as a whole. In tension members composed of two components, when fillers, ties or welds are used, they shall be spaced so that the ℓ/r ratio of each component does not exceed 240. The least radius of gyration shall be used in computing the ℓ/r ratio of a component.

(d) Eccentricity

Members connected at a joint shall have their center of gravity lines meet at a point, if practical. Eccentricity on either side of the centroid of chord members may be neglected when it does not exceed the distance between the centroid and the back of the chord. Otherwise, provision shall be made for the stresses due to eccentricity. Ends of Joist Girders shall be proportioned to resist bending produced by eccentricity at the support.

In those cases where a single angle compression member is attached to the outside of the stem of a tee or double angle chord, due consideration shall be given to eccentricity.

(e) Extended Ends

Extended top chords or full depth cantilever ends require the special attention of the specifying professional. The magnitude and location of the loads to be supported, deflection requirements, and proper bracing shall be clearly indicated on the structural drawings.



1003.5 CONNECTIONS**(a) Methods**

Joint connections and splices shall be made by attaching the members to one another by arc or resistance welding or other accredited methods.

(1) Welded Connections

- a) Selected welds shall be inspected visually by the manufacturer. Prior to this inspection, weld slag shall be removed.
- b) Cracks are not acceptable and shall be repaired.
- c) Thorough fusion shall exist between layers of weld metal and between weld metal and base metal for the required design length of the weld; such fusion shall be verified by visual inspection.
- d) Unfilled weld craters shall not be included in the design length of the weld.
- e) Undercut shall not exceed 1/16 inch (2 millimeters) for welds oriented parallel to the principal stress.
- f) The sum of surface (piping) porosity diameters shall not exceed 1/16 inch (2 millimeters) in any 1 inch (25 millimeters) of design weld length.
- g) Weld spatter that does not interfere with paint coverage is acceptable.

(2) Welding Program

Manufacturers shall have a program for establishing weld procedures and operator qualification, and for weld sampling and testing.

(3) Weld Inspection by Outside Agencies (See Section 1004.10 of this specification).

The agency shall arrange for visual inspection to determine that welds meet the acceptance standards of Section 1003.5(a)(1). Ultrasonic, X-Ray, and magnetic particle testing are inappropriate for Joists Girders due to the configurations of the components and welds.

(b) Strength

- (1) Joint Connections - Joint connections shall develop the maximum force due to any of the design loads, but not less than 50 percent of the strength of the member in tension or compression, whichever force is the controlling factor in the selection of the member.
- (2) Shop Splices - Shop splices may occur at any point in chord or web members. Splices shall be designed for the member force but not less than 50 percent of the member strength. Members containing a butt weld splice shall develop an ultimate tensile force of at least 57 ksi (393 MPa) times the full design area of the chord or web. The term "member" shall be defined as all component parts comprising the chord or web, at the point of splice.

(c) Field Splices

Field Splices shall be designed by the manufacturer and may be either bolted or welded. Splices shall be designed for the member force, but not less than 50 percent of the member strength.

1003.6 CAMBER

Joist Girders shall have approximate cambers in accordance with the following:

TABLE 1003.6-1

Top Chord Length		Approximate Camber	
20'-0"	(6096 mm)	1/4"	(6 mm)
30'-0"	(9144 mm)	3/8"	(10 mm)
40'-0"	(12192 mm)	5/8"	(16 mm)
50'-0"	(15240 mm)	1"	(25 mm)
60'-0"	(18288 mm)	1 1/2"	(38 mm)
70'-0"	(21336 mm)	2"	(51 mm)
80'-0"	(24384 mm)	2 3/4"	(70 mm)
90'-0"	(27342 mm)	3 1/2"	(89 mm)
100'-0"	(30480 mm)	4 1/4"	(108 mm)
110'-0"	(33528 mm)	5"	(127 mm)
120'-0"	(36576 mm)	6"	(152 mm)

The specifying professional shall give consideration to coordinating Joist Girder camber with adjacent framing.

1003.7 VERIFICATION OF DESIGN AND MANUFACTURE**(a) Design Calculations**

Companies manufacturing Joist Girders shall submit design data to the Steel Joist Institute (or an independent agency approved by the Steel Joist Institute) for verification of compliance with the SJI Specifications.

(b) In-Plant Inspections

Each manufacturer shall verify their ability to manufacture Joist Girders through periodic In-Plant Inspections. Inspections shall be performed by an independent agency approved by the Steel Joist Institute. The frequency, manner of inspection, and manner of reporting shall be determined by the Steel Joist Institute. The In-Plant Inspections are not a guarantee of the quality of any specific Joist Girder; this responsibility lies fully and solely with the individual manufacturer.



SECTION 1004. APPLICATION

1004.1 USAGE

This specification shall apply to any type of structure where steel joists are to be supported directly by Joist Girders installed as hereinafter specified. Where Joist Girders are used other than on simple spans under equal concentrated gravity loading, as prescribed in Section 1003.1, they shall be investigated and modified if necessary to limit the unit stresses to those listed in Section 1003.2. The magnitude and location of all loads and forces, other than equal concentrated gravity loading, shall be provided on the structural drawings. The specifying professional shall design the supporting structure, including the design of columns, connections, and moment plates*. This design shall account for the stresses caused by lateral forces and the stresses due to connecting the bottom chord to the column or other support.

The designed detail of a rigid type connection and moment plates shall be shown on the structural drawings by the specifying professional. The moment plates shall be furnished by other than the joist manufacturer.

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

1004.2 SPAN

The span of a Joist Girder shall not exceed 24 times its depth.

1004.3 DEPTH

Joist Girders may have either parallel top chords or a top chord slope of 1/8 inch per foot (1:96). The nominal depth of sloping chord Joist Girders shall be the depth at mid-span.

1004.4 END SUPPORTS

(a) Masonry and Concrete

Joist Girders supported by masonry or concrete are to bear on steel bearing plates and shall be designed as steel bearing. Due consideration of the end reactions and all other vertical and lateral forces shall be taken by the specifying professional in the design of the steel bearing plate and the masonry or concrete. The ends of Joist Girders shall extend a distance of not less than 6 inches (152 millimeters) over the masonry or concrete support and be anchored to the steel bearing plate. The plate shall be located not more than 1/2 inch (13 millimeters) from the face of the wall and shall be not less than 9 inches (229 millimeters) wide perpendicular to the length of the girder. The plate is to be designed by the specifying professional and shall be furnished by other than the joist manufacturer.

Where it is deemed necessary to bear less than 6 inches (152 millimeters) over the masonry or concrete support, special consideration is to be given to the design of the steel bearing plate and the masonry or concrete by the

specifying professional. The girders must bear a minimum of 4 inches (102 millimeters) on the steel bearing plate.

(b) Steel

Due consideration of the end reactions and all other vertical and lateral forces shall be taken by the specifying professional in the design of the steel support. The ends of Joist Girders shall extend a distance of not less than 4 inches (102 millimeters) over the steel supports and shall have positive attachment to the support, either by bolting or welding.

1004.5 BRACING

Joist Girders shall be proportioned such that they can be erected without bridging (See Section 1004.9 for bracing required for uplift forces). Therefore, the following requirements must be met:

- The ends of the bottom chord are restrained from lateral movement to brace the girder from overturning. For Joist Girders at columns in steel frames, restraint shall be provided by a stabilizer plate on the column.
- No other loads shall be placed on the Joist Girder until the steel joists bearing on the girder are in place and welded to the girder.

1004.6 END ANCHORAGE

(a) Masonry and Concrete

Ends of Joist Girders resting on steel bearing plates on masonry or structural concrete shall be attached thereto with a minimum of two 1/4 inch (6 millimeters) fillet welds 2 inches (51 millimeters) long, or with two 3/4 inch (19 millimeters) bolts, or the equivalent.

(b) Steel

Ends of Joist Girders resting on steel supports shall be attached thereto with a minimum of two 1/4 inch (6 millimeters) fillet welds 2 inches (51 millimeters) long, or with two 3/4 inch (19 millimeters) bolts, or the equivalent. In steel frames, bearing seats for Joist Girders shall be fabricated to allow for field bolting.

(c) Uplift

Where uplift forces are a design consideration, roof Joist Girders shall be anchored to resist such forces (Refer to Section 1004.9).

1004.7 DEFLECTION

The deflections due to the design live load shall not exceed the following:

Floors: 1/360 of span.

Roofs: 1/360 of span where a plaster ceiling is attached or suspended.

1/240 of span for all other cases.

The specifying professional shall give consideration to the



effects of deflection and vibration* in the selection of Joist Girders.

- * For further reference, refer to Steel Joist Institute Technical Digest #5, "Vibration of Steel Joist-Concrete Slab Floors" and the Institute's Computer Vibration Program.

1004.8 PONDING*

The ponding investigation shall be performed by the specifying professional.

- * For further reference, refer to Steel Joist Institute Technical Digest #3, "Structural Design of Steel Joist Roofs to Resist Ponding Loads" and AISC Specifications.

1004.9 UPLIFT

Where uplift forces due to wind are a design requirement, these forces must be indicated on the contract drawings in terms of NET uplift in pounds per square foot (Pascals). The contract drawings must indicate if the net uplift is based on ASD or LRFD. When these forces are specified, they must be considered in the design of Joist Girders and/or bracing. If the ends of the bottom chord are not strutted, bracing must be provided near the first bottom chord panel points whenever uplift due to wind forces is a design consideration.*

- * For further reference, refer to Steel Joist Institute Technical Digest #6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads".

1004.10 INSPECTION

Joist Girders shall be inspected by the manufacturer before shipment to verify compliance of materials and workmanship with the requirements of this specification. If the purchaser wishes an inspection of the Joist Girders by someone other than the manufacturer's own inspectors, they may reserve the right to do so in their "Invitation to Bid" or the accompanying "Job Specifications". Arrangements shall be made with the manufacturer for such inspection of the Joist Girders at the manufacturing shop by the purchaser's inspectors at purchaser's expense.

SECTION 1005.*

HANDLING AND ERECTION

Particular attention should be paid to the erection of Joist Girders.

Care shall be exercised at all times to avoid damage through careless handling during unloading, storing and erecting. Dropping of Joist Girders shall not be permitted.

In steel framing, where Joist Girders are utilized at column lines, the Joist Girder shall be field-bolted at the column. Before hoisting cables are released and before an employee is allowed

on the Joist Girder the following conditions must be met:

- a) The seat at each end of the Joist Girder is attached in accordance with Section 1004.6.

When a bolted seat connection is used for erection purposes, as a minimum, the bolts must be snug tightened. The snug tight condition is defined as the tightness that exists when all plies of a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of an employee using an ordinary spud wrench.

- b) Where stabilizer plates are required the Joist Girder bottom chord must engage the stabilizer plate.

During the construction period, the contractor shall provide means for the adequate distribution of loads so that the carrying capacity of any Joist Girder is not exceeded.

Joist Girders shall not be used as anchorage points for a fall arrest system unless written direction to do so is obtained from a "qualified person".⁽¹⁾

Field welding shall not damage the Joist Girder. The total length of weld at any one cross-section on cold-formed members whose yield strength has been attained by cold working and whose as-formed strength is used in the design, shall not exceed 50 percent of the overall developed width of the cold-formed section.

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

⁽¹⁾ See Appendix E for OSHA definition of "qualified person".

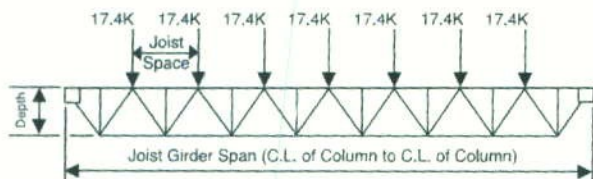
SECTION 1006.

HOW TO SPECIFY JOIST GIRDERS

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 following tables give 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 must 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.



Example using Load and Resistance Factor Design (LRFD) and U. S. Customary units:

STANDARD DESIGNATION

44G	8N	17.4F
Depth in Inches	Number of Joist Spaces	Factored Load in Kips at Each Panel Point

Given 42'-0" x 50'-0" bay. Joists spaced on 5'-3" centers

Live Load = 30 psf x 1.6

Dead Load = 15 psf x 1.2

(includes the approximate Joist Girder weight)

Total Load = 66 psf (factored)

Note: Web configuration may vary from that shown. Contact Joist Girder manufacturer if exact layout must be known.

- Determine number of actual joist spaces (N).
In this example, N = 8
- Compute total factored load:
Total load = 5.25 x 66 psf = 346.5 plf
- Joist Girder Section: (Interior)
 - Compute the factored concentrated load at top chord panel points
 $P = 346.5 \times 50 = 17,325 \text{ lbs} = 17.4 \text{ kips}$
(use 18K for depth selection).
 - 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.
 - The Joist Girder will 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.
 - The LRFD Joist Girder Design Guide Weight Table shows the weight for a 44G8N17.4K 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.

e) Check live load deflection:

Live load = 30 psf x 50 ft = 1500 plf

Approximate Joist Girder moment of inertia

$$= 0.018 \text{ NPLd}$$

$$= 0.018 \times 8 \times 17.4 \times 42 \times 44 = 4630 \text{ in.}^4$$

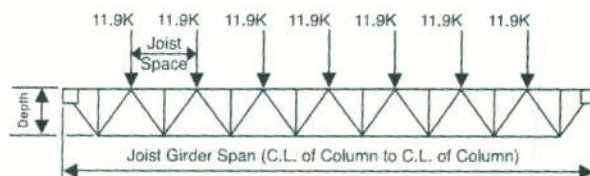
Allowable deflection for plastered ceilings

$$= L/360 = \frac{42(12)}{360} = 1.40 \text{ in.}$$

$$\text{Deflection} = 1.15 \left[\frac{5wL^4}{384EI} \right] = \frac{1.15(5)(1500/12)(42 \times 12)^4}{384(29000)(4630)}$$

$$= 0.90 \text{ in.} < 1.40 \text{ in., Okay}$$

Live load deflection rarely governs because of the relatively small span-depth ratios of Joist Girders.

Example using Allowable Strength Design (ASD) and U. S. Customary units:

STANDARD DESIGNATION

44G	8N	11.9K
Depth in Inches	Number of Joist Spaces	Load in Kips at Each Panel Point

Given 42'-0" x 50'-0" bay. Joists spaced on 5'-3" centers.

Live Load = 30 psf

Dead Load = 15 psf

(includes the approximate Joist Girder weight)

Total Load = 45 psf

Note: Web configuration may vary from that shown. Contact Joist Girder manufacturer if exact layout must be known.

- Determine number of actual joist spaces (N).
In this example, N = 8
- Compute total load:
Total load = 5.25 x 45 psf = 236.25 plf
- Joist Girder Section: (Interior)
 - Compute the concentrated load at top chord panel points
 $P = 236.25 \times 50 = 11,813 \text{ lbs} = 11.9 \text{ kips}$
(use 12K for depth selection).
 - 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.



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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.

- c) The Joist Girder will then be designated 44G8N11.9K.
- 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.
- e) Check live load deflection:

Live load = 30 psf x 50 ft = 1500 plf.

Approximate Joist Girder moment of inertia

$$= 0.027 \text{ NPLd}$$

$$= 0.027 \times 8 \times 11.9 \times 42 \times 44 = 4750 \text{ in.}^4$$

Allowable deflection for plastered ceilings

$$= L/360 = \frac{42(12)}{360} = 1.40 \text{ in.}$$

$$\text{Deflection} = 1.15 \left[\frac{5wL^4}{384EI} \right] = \frac{1.15(5)(1500/12)(42 \times 12)^4}{384(29000)(4750)}$$

$$= 0.88 \text{ in.} < 1.40 \text{ in., Okay}$$

Live load deflection rarely governs because of the relatively small span-depth ratios of Joist Girders.



DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS

U. S. CUSTOMARY

Based on a 50ksi maximum yield strength

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Girder Span (ft)	Joist Spaces (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																									
			Load on Each Panel Point																									
			LRFD	6K	7.5K	9K	10.5K	12K	13.5K	15K	16.5K	18K	21K	24K	27K	30K	37.5K	45K	52.5K	60K	75K	90K	105K	120K	150K			
ASD			4K	5K	6K	7K	8K	9K	10K	11K	12K	14K	16K	18K	20K	25K	30K	35K	40K	50K	60K	70K	80K	100K				
20	2N@ 10.00	16	16	16	16	16	16	16	16	16	17	18	21	23	26	30	35	41	47	54	69	83	100	108	140			
		20	16	16	16	16	16	16	16	16	16	16	17	19	22	24	31	35	39	44	56	64	76	85	104			
		24	16	16	16	16	16	16	16	16	17	17	17	17	19	22	24	30	26	29	34	37	48	57	66	73	88	
	3N@ 6.67	16	16	16	16	16	16	18	20	22	24	27	31	35	38	48	54	69	79	101	114	141	152	187				
		20	16	16	16	16	16	16	17	19	21	23	26	28	31	38	47	56	64	78	95	109	117	156				
		24	16	16	17	17	17	17	17	17	18	19	21	23	25	26	31	34	38	45	51	67	80	97	109	122		
	4N@ 5.00	16	16	16	18	20	22	26	28	29	32	38	42	50	54	66	83	100	108	140	162	188	209	314				
		20	16	16	16	17	20	20	21	23	26	30	34	39	43	52	60	76	85	105	124	145	169	238				
		24	16	16	16	16	17	19	20	21	22	25	28	32	38	44	54	61	75	89	107	126	149	189				
	5N@ 4.00	16	16	18	19	24	26	29	33	37	39	47	54	59	66	83	101	113	140	172	212	247	296					
20		16	16	17	19	21	26	28	29	32	37	41	49	53	65	80	95	104	134	167	198	221	296					
24		16	16	17	19	20	22	24	28	28	31	35	39	45	55	67	78	88	109	128	152	183	244					
10N@ 2.00	16	28	33	39	47	54	62	72	78	83	101	109	131	141	195	226	247	358										
	20	23	29	31	37	43	49	56	61	64	77	86	104	108	145	179	203	236	317									
	24	21	25	28	32	39	43	46	55	54	66	80	84	89	119	141	171	197	250	313								
22	2N@ 11	16	18	18	18	18	18	18	19	20	23	26	29	32	39	46	53	61	77	98	107	119	158					
		20	18	18	18	18	18	18	18	19	20	21	23	27	33	37	46	48	62	70	83	101	121					
		24	19	19	19	19	19	19	19	19	19	20	21	24	29	33	36	42	49	63	72	81	103					
	3N@ 7.33	16	15	15	15	16	17	19	23	24	25	29	33	37	40	53	61	73	90	103	129	149	170	207				
		20	16	16	16	16	16	17	19	20	23	24	27	30	34	42	48	55	67	80	102	115	132	165				
		24	16	16	16	16	16	16	17	18	19	24	24	27	28	36	43	48	57	70	82	97	111	137				
	4N@ 5.5	16	16	17	18	21	24	28	30	33	36	40	46	53	58	77	98	100	119	159	179	206	235					
		20	16	16	17	18	20	22	25	27	28	33	37	42	48	60	71	84	102	115	143	165	187	244				
		24	16	16	16	17	19	20	20	21	26	27	31	34	40	47	61	69	76	104	113	145	148	206				
	6N@ 3.67	16	17	21	26	29	35	39	42	49	50	58	73	82	99	107	139	160	180	237								
20		17	19	21	26	28	31	34	38	42	51	59	60	68	85	103	122	143	175	222	252	322						
24		16	17	19	21	25	27	30	32	34	40	47	54	61	75	87	106	113	148	178	202	240	330					
11N@ 2.00	16	32	39	49	57	64	77	82	99	100	113	140	150	162	222	256												
	20	26	31	37	43	52	59	64	76	80	94	103	116	133	168	203	235	289										
	24	24	28	32	38	43	50	54	62	65	78	90	108	110	138	182	205	238	301									
24	2N@ 12.00	20	18	18	18	18	18	18	18	19	19	21	24	27	30	36	44	47	54	68	78	99	103	131				
		24	18	18	18	18	18	18	18	18	19	20	21	22	26	32	34	40	46	55	67	79	93	106				
		28	19	19	19	19	19	19	19	19	19	19	20	21	23	28	32	35	41	48	57	69	72	95				
	3N@ 8.00	20	16	16	16	16	16	16	16	16	17	19	21	24	27	29	31	38	47	55	64	78	94	108	117	156		
		24	16	16	16	16	16	16	16	17	19	21	24	27	29	31	38	47	54	62	74	92	105	130	151	175		
		28	16	16	16	16	17	17	17	18	18	24	26	26	30	35	40	48	55	67	86	97	108	122				
	4N@ 6.00	20	16	16	17	19	21	25	27	28	31	36	39	47	50	63	78	100	101	130	161	183	192	246				
		24	17	17	17	18	19	22	24	25	28	32	35	38	43	54	65	76	85	107	124	147	168	225				
		28	16	16	16	16	17	20	20	21	25	27	30	36	38	44	53	62	74	88	108	126	149	187				
	5N@ 4.8	20	16	17	20	22	25	28	31	35	36	43	51	55	62	78	100	105	131	164	196	225	282					
24		16	16	18	20	21	26	28	29	32	36	41	49	53	65	80	94	104	134	157	186	218	285					
28		16	16	17	19	20	22	25	27	29	32	36	42	46	58	66	82	97	115	138	168	180	231					
6N@ 4.00	20	17	20	23	27	30	33	38	41	44	51	59	69	74	101	109	141	163	192	245	294							
	24	16	17	20	23	26	29	32	34	38	43	53	60	61	76	103	106	124	172	196	232	267						
	28	17	17	20	22	25	28	29	31	33	39	44	49	55	76	84	106	112	129	177	202	240	289					
12N@ 2.00	20	29	38	45	51	59	70	75	84	101	103	122	143	166	196	265	320											
	24	27	31	38	45	53	61	62	72	77	87	105	113	126	175	199	249	288										
	28	25	29	33	40	45	54	56	69	71	79	91	113	114	144	183	215	234	305									
26	2N@ 13.00	20	22	22	22	22	22	22	23	24	24	26	27	29	32	37	45	53	60	68	90	99	112	140				
		24	23	23	23	23	23	23	23	23	24	25	25	27	29	32	38	44	51	61	70	83	101	115				
		28	23	23	23	23	23	23	23	23	23	24	25	25	26	27	31	34	39	45	52	62	71	81	103			
	3N@ 8.67	20	15	15	16	16	17	19	22	23	25	28	33	36	39	50	57	68	78	99	113	140	151	196				
		24	16	16	16	16	16	17	19	21	23	25	28	31	34	40	51	58	67	80	102	113	132	155				
		28	16	16	16	16	16	17	17	19	20	25	28	29	38	45	48	56	69	81	97	110	136					
	4N@ 6.5	20	16	16	18	21	24	27	28	30	33	39	42	50	54	69	82	100	107	140	161	186	213	284				
		24	16	16	17	18	20	23	25	27	28	33	37	40	48	60	71	79	101	110	143	166	188	223				
		28	16	16	16	17	19	20	20	22	26	29	32	35	39	50	60	69	76	104	112	145	149	204				
	5N@ 5.2	20	17	18	21	25	28	31	35	39	40	48	54	62	69	91	100	114	140	172	200	239	275					
24		16	16	19	21	24	27	28	31	34	38	43	51	55	71	84	103	108	143	166	201	225						
28		16	16	17	19	21	23	27	28	29	34	39	43	50	61	80	86	104	118	147	178	200	249					
7N@ 3.71	20	20	24	28	33	36	42	47	54	58	65	78	91	100	119	140	162	192	238	308								
	24	17	20	26	28	31	35	40	44	49	56	64	71	80	103	116	143	166	198	242	293							
	28	17	20	22	27	29	32	35	38	42	50	58	62	70	86	106	114	137	178	212	253	292						
13N@ 2.00	20	42	50	58	70	86	91	103	109	110	131	152	173	202	252													
	24	35	43	50	62	66	76	88	93	97	112	127	154	166	225	248												
	28	32	40	48	55	64	68	74	90	90	100	115	130	148	177	232	283											
Bearing Depth			7 1/2 in.														10 in.											

DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS

U. S. CUSTOMARY

Based on a 50ksi maximum yield strength

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Girder Span (ft)	Joist Spaces (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																									
			Load on Each Panel Point																									
			LRFD		6K	7.5K	9K	10.5K	12K	13.5K	15K	16.5K	18K	21K	24K	27K	30K	37.5K	45K	52.5K	60K	75K	90K	105K	120K	150K		
ASD		4K	5K	6K	7K	8K	9K	10K	11K	12K	14K	16K	18K	20K	25K	30K	35K	40K	50K	60K	70K	80K	100K					
28	2N@ 14.00	24	29	29	29	29	29	29	29	30	31	31	33	34	37	39	42	49	57	65	77	91	103	129				
		28	29	29	30	30	30	30	30	30	30	30	31	32	34	34	38	40	43	46	58	66	78	93	106			
	3N@ 9.33	24	16	16	16	16	16	18	21	22	23	26	29	33	36	44	54	61	70	91	105	124	133	174				
		32	16	16	16	16	17	17	18	19	21	23	26	29	31	39	47	52	61	77	94	107	115	156				
	4N@ 7.00	24	16	16	17	19	21	24	27	28	31	35	39	45	50	62	74	91	101	121	143	165	190	244				
		32	16	16	16	18	19	20	21	22	24	27	31	37	39	44	57	64	76	85	109	124	151	170	206			
	5N@ 5.6	24	16	17	19	22	24	28	31	33	35	41	47	55	62	78	92	105	114	152	176	215	244					
		32	16	16	17	20	21	26	28	29	32	35	40	47	52	64	80	94	104	134	156	186	213	260	232			
	6N@ 4.67	24	17	19	21	25	29	32	36	39	43	50	59	66	73	100	109	121	142	191	219	254	314					
		32	16	19	21	22	26	29	32	34	37	44	52	57	60	76	103	105	123	149	194	223	253	301				
30	7N@ 4.00	24	18	22	26	31	33	37	43	48	51	59	67	79	84	103	131	144	166	219	261							
		28	17	20	24	26	29	32	36	41	45	53	61	65	74	95	109	125	147	184	224	272	312					
	14N@ 2.00	24	33	43	51	59	66	79	84	102	103	121	143	155	173	221	281											
		28	30	38	45	53	61	70	75	82	88	106	114	137	149	198	235	274	332									
	2N@ 15.00	24	29	29	29	29	29	29	30	30	31	32	33	35	37	40	46	53	60	72	85	102	103	139				
		32	29	29	29	29	29	29	30	30	30	30	32	32	34	36	38	41	44	49	65	74	86	92	115			
	3N@ 10.00	24	15	16	16	16	18	19	22	24	25	29	31	34	38	48	57	65	74	91	109	130	151	176				
		32	16	16	16	16	16	17	18	19	21	24	25	28	31	33	43	50	58	67	79	94	108	126	156			
	4N@ 7.5	24	16	16	17	20	24	26	27	30	32	37	42	47	54	66	78	99	104	140	161	183	210	265				
		32	16	16	16	18	19	20	21	23	27	29	32	36	41	50	60	69	76	104	112	146	179	223				
32	5N@ 6.00	24	16	17	20	23	26	29	32	34	38	45	53	58	62	78	100	108	131	162	193	231	262					
		32	16	16	19	21	24	27	28	31	34	38	46	49	56	71	79	102	107	143	166	195	224	285				
	6N@ 5.00	24	17	19	24	28	31	34	39	42	47	54	62	69	78	100	109	140	161	190	237	288						
		32	16	19	20	26	28	31	34	37	40	46	52	60	67	84	102	111	143	167	195	222	289					
	8N@ 3.75	24	21	25	31	36	41	47	50	58	62	73	83	100	102	131	162	188	216	255								
		32	19	22	26	30	32	36	41	45	50	57	65	75	82	105	114	147	175	224	241	282	343					
	15N@ 2.00	24	40	50	58	66	78	92	101	106	115	142	165	181	196	257	326											
		32	34	41	52	60	68	76	85	103	105	113	137	152	176	216	265	329										
	3N@ 10.67	24	15	15	15	17	19	21	23	25	26	31	34	37	42	50	63	72	86	102	123	130	150	197				
		32	16	16	16	16	17	19	21	22	24	27	29	32	35	44	51	64	67	87	105	114	132	173				
32	4N@ 8.00	24	16	16	18	22	24	26	29	31	34	40	45	53	58	69	89	99	107	139	161	187	222	273				
		32	17	17	17	18	20	24	25	28	32	36	39	46	56	65	73	85	109	124	151	172	203					
	5N@ 6.4	24	16	19	22	26	29	31	34	38	41	47	54	61	68	91	103	113	140	172	200	237	275					
		32	16	16	18	20	22	26	27	30	33	36	42	47	55	64	80	94	103	133	156	187	203	305				
	6N@ 5.33	24	18	21	25	29	33	36	40	46	49	57	65	73	82	100	119	141	161	214	242	307						
		32	16	19	20	24	26	28	32	34	37	44	52	57	60	76	103	105	123	149	194	223	253	321				
	8N@ 4.00	24	23	28	33	39	42	50	57	58	65	77	91	100	108	140	162	188	216	282								
		32	20	26	28	33	37	42	48	51	59	67	75	85	101	111	143	167	192	241	292	304	316					
	Bearing Depth			7 1/2 in.													10 in.											

Joist Girder weights between the heavy black and blue lines have 7 1/2 inch bearing depths.

Joist Girder weights to the right of the heavy blue line have 10 inch bearing depths. Check with Vulcraft for material availability.



DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS

Based on a 50ksi maximum yield strength

U. S. CUSTOMARY

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Girder Span (ft)	Joist Spacing (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																										
			Load on Each Panel Point																										
			LRFD ASD	6K 4K	7.5K 5K	9K 6K	10.5K 7K	12K 8K	13.5K 9K	15K 10K	16.5K 11K	18K 12K	21K 14K	24K 16K	27K 18K	30K 20K	37.5K 25K	45K 30K	52.5K 35K	60K 40K	75K 50K	90K 60K	105K 70K	120K 80K	150K 100K				
34	3N@ 11.33	32	18	18	18	19	19	19	19	20	22	23	26	28	32	35	42	49	58	66	87	91	112	126	156				
		36	18	19	19	19	19	19	19	20	22	26	27	29	31	39	45	51	60	73	89	99	115	136					
		40	19	19	19	19	19	19	20	20	21	25	27	28	32	37	44	46	54	70	79	92	110	132					
	4N@ 8.50	32	16	16	18	20	23	26	27	29	32	36	40	47	54	62	78	91	100	130	152	174	199	243					
		36	16	16	17	19	20	24	24	27	30	32	37	42	47	56	71	79	92	108	134	155	177	223					
		40	16	17	18	18	19	21	23	26	27	29	33	38	41	50	61	69	76	104	113	146	149	200					
	5N@ 6.80	32	16	17	21	23	26	29	32	35	38	45	47	54	62	77	99	106	120	153	185	212	248						
		36	16	17	18	21	24	27	30	32	34	39	46	48	55	70	79	101	107	133	156	197	214	267					
		40	16	16	17	20	21	25	28	28	33	36	39	47	50	64	73	85	104	119	146	170	198	241					
	6N@ 5.67	32	17	20	24	28	30	33	36	41	44	54	58	65	73	100	108	130	142	190	220	248	307						
		36	17	19	21	25	28	31	34	37	40	48	52	59	67	83	102	110	123	167	193	224	252						
		40	17	18	20	22	26	28	31	32	36	41	50	53	60	74	86	105	113	148	177	199	228	298					
36	7N@ 4.86	32	19	23	27	31	34	39	43	47	54	62	70	78	91	105	131	152	175	219	255								
		36	18	20	26	27	31	35	38	42	47	56	64	71	79	102	111	134	155	193	223	268							
		40	17	20	22	27	29	32	36	38	42	50	57	65	69	86	105	118	136	176	203	241	285						
	9N@ 3.78	32	25	28	34	39	43	51	58	63	67	78	92	101	109	142	164	194	220	284									
		36	21	26	30	35	40	44	49	56	60	70	80	95	103	124	148	175	198	265	325								
		40	19	23	28	30	34	38	43	46	51	59	68	76	84	107	116	142	159	206	250	299							
	3N@ 12.00	32	18	18	18	18	19	21	23	25	27	30	33	40	41	48	60	69	81	94	109	130	151	186					
		36	18	18	18	18	19	19	19	21	23	25	27	30	33	36	44	54	61	71	87	104	112	132	164				
		40	19	19	19	19	19	19	19	20	22	26	26	29	32	40	44	51	57	69	89	97	110	131					
	4N@ 9.00	32	16	16	19	21	23	27	29	31	34	39	45	50	54	69	81	99	104	140	161	183	211	265					
		36	16	16	17	20	23	24	26	28	31	35	40	46	48	62	70	83	101	115	143	165	188	230					
		40	16	18	18	18	19	21	23	23	26	28	32	37	40	46	57	65	73	85	109	125	150	172	212				
	5N@ 7.20	32	16	18	21	25	26	31	34	36	40	45	54	61	68	81	100	114	130	162	196	231	262						
		36	16	17	20	22	24	27	30	34	35	41	46	54	59	70	91	101	112	143	177	199	233	300					
		40	16	17	17	20	21	23	26	28	30	33	37	42	47	55	63	79	93	104	133	156	186	200	258				
	6N@ 6.00	32	18	20	25	27	33	36	39	42	47	57	62	69	77	99	113	140	160	191	236	282							
		36	17	20	23	25	28	31	35	39	42	48	55	62	70	83	102	121	142	167	199	241	285						
		40	17	18	20	22	26	27	30	33	35	41	46	53	58	71	86	105	111	148	177	200	228	317					
	7N@ 5.14	32	19	24	28	33	37	40	47	50	54	62	77	82	99	113	140	162	188	225	291								
		36	18	21	26	28	32	37	40	43	49	56	64	71	80	102	116	143	166	196	246	297							
		40	17	20	25	28	31	33	36	41	44	53	57	65	73	94	109	125	147	183	213	256	306						
	9N@ 4.00	32	24	31	36	41	46	54	57	65	69	82	99	104	113	141	173	205	236	293									
		36	21	26	29	33	37	41	50	52	56	65	74	85	95	113	133	157	185	215	268								
		40	20	24	27	30	35	39	43	46	51	62	68	76	87	107	121	151	178	207	270	307							
38	3N@ 12.67	32	22	23	23	23	24	25	26	26	29	33	36	40	47	57	65	74	91	109	124	142	173						
		36	23	23	23	23	24	25	26	26	27	28	32	36	43	50	61	67	85	97	112	126	156						
		44	23	24	24	24	24	24	25	26	28	29	33	39	44	50	58	70	88	96	110	131							
	4N@ 9.50	32	16	16	18	21	23	26	28	30	32	36	41	46	54	62	78	91	100	120	152	175	190	244					
		36	16	17	17	19	23	24	26	29	34	38	42	47	56	71	79	93	108	134	155	177	223						
		44	18	18	18	19	21	23	24	28	31	35	38	41	51	61	72	80	104	113	146	149	199						
	5N@ 7.60	32	16	17	20	23	26	29	32	35	37	44	47	55	62	77	91	105	115	152	177	207	233						
		36	16	17	18	22	24	27	29	31	34	38	46	49	56	71	79	93	107	134	158	184	213	274					
		44	16	16	17	20	22	25	28	30	33	37	41	47	50	63	74	93	104	118	147	171	197	239					
	6N@ 6.33	32	17	20	23	27	31	34	36	39	43	51	58	65	73	99	106	121	142	189	218	251	305						
		36	17	19	21	26	28	32	34	37	40	48	52	59	64	83	102	110	123	167	192	222	260						
		44	17	18	20	23	26	29	32	33	36	42	50	56	61	73	86	105	113	148	176	199	228	298					
	8N@ 4.75	32	20	26	30	35	39	43	49	55	59	67	79	92	101	121	143	167	191	239	309								
		36	20	24	28	32	36	41	44	50	53	61	69	81	86	106	125	147	175	224	258	325							
		44	20	25	28	31	34	37	43	48	51	58	66	74	82	106	115	139	168	202	240	292	333						
	10N@ 3.80	32	27	32	38	45	48	55	62	70	78	91	102	107	121	155	191	212	260										
		36	25	30	35	39	47	49	56	64	71	79	93	103	108	145	173	196	214	282									
		44	23	28	33	37	42	48	50	57	64	76	81	95	106	120	150	176	203	264	314								
Bearing Depth			7 1/2 in.															10 in.											

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Joist Girder weights between the heavy black and blue lines have 7 1/2 inch bearing depths.
Joist Girder weights to the right of the heavy blue line have 10 inch bearing depths. Check with Vulcraft for material availability.

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DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS

Based on a 50ksi maximum yield strength

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Girder Span (ft)		Joist Spaces (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																										
				Load on Each Panel Point																										
LRFD ASD				6K 4K	7.5K 5K	9K 6K	10.5K 7K	12K 8K	13.5K 9K	15K 10K	16.5K 11K	18K 12K	21K 14K	24K 16K	27K 18K	30K 20K	37.5K 25K	45K 30K	52.5K 35K	60K 40K	75K 50K	90K 60K	105K 70K	120K 80K	150K 100K					
45	3N@ 15.00	36	30	30	30	30	31	31	32	34	35	36	38	39	44	52	60	69	81	95	120	134	151	187						
		40	30	30	30	30	31	31	32	33	35	35	37	38	39	51	59	62	70	88	110	122	141	166						
		44	30	30	30	31	31	31	32	33	34	34	36	37	38	46	53	59	67	85	98	113	126	157						
		48	30	30	30	31	31	31	32	32	33	36	36	38	37	41	48	58	63	82	90	101	117	148						
	4N@ 11.25	54	30	30	30	32	32	32	32	32	33	36	36	37	39	41	48	53	60	71	89	97	104	132						
		36	18	19	20	23	25	27	29	31	34	42	43	50	57	65	77	90	104	130	152	174	199	252						
		40	19	19	20	21	24	25	28	30	32	37	43	46	51	65	75	87	101	115	143	165	178	230						
		44	19	19	20	21	23	26	26	28	30	34	40	44	47	59	68	76	93	109	134	156	178	211						
	5N@ 9.00	48	19	20	20	21	22	25	25	26	29	32	35	40	42	54	64	73	81	104	114	136	151	198						
		54	20	20	20	21	22	24	25	26	27	30	33	38	41	50	58	66	74	97	108	116	140	176						
		36	16	18	23	25	28	30	33	36	39	46	54	58	65	78	99	110	131	152	194	228	254							
		40	16	18	21	23	26	28	31	34	37	44	46	54	58	75	91	105	112	143	176	206	231	295						
	6N@ 7.50	44	16	17	20	23	24	27	29	32	34	39	45	48	56	67	79	94	107	133	156	182	209	265						
		48	17	18	19	24	25	26	28	30	32	37	41	46	53	64	78	89	96	118	148	162	186	238						
		54	17	18	18	21	24	26	26	29	31	33	40	43	47	58	70	79	92	112	131	153	166	217						
		36	17	22	24	29	32	35	39	43	47	54	62	69	78	99	109	140	151	189	217	261								
	7N@ 6.43	40	17	20	24	27	30	33	35	38	42	49	55	62	71	92	102	116	142	168	196	246	281							
		44	17	19	23	26	28	31	33	36	39	47	52	56	64	80	103	109	123	159	192	222	250							
		48	17	19	22	24	27	29	31	34	37	43	50	57	61	74	87	105	113	148	175	199	227	295						
		54	17	18	21	24	25	28	30	33	35	38	45	52	55	68	83	98	108	128	155	178	202	266						
	9N@ 5.00	36	20	24	28	32	36	40	46	47	54	62	70	77	91	105	130	152	175	217	255									
		40	19	22	27	30	34	38	41	46	49	56	63	71	79	102	116	143	155	196	231	290								
		44	18	22	25	28	31	36	39	42	47	56	63	65	72	94	109	123	147	182	213	257	299							
		48	18	21	24	27	29	33	37	40	43	50	57	65	73	82	105	119	136	175	201	238	278							
	12N@ 3.75	54	24	24	26	30	32	35	39	41	45	49	57	63	72	83	100	114	125	165	195	231	263							
		36	25	30	35	39	47	54	58	63	70	78	92	101	109	141	164	194	226	282										
		40	22	28	32	37	42	48	52	56	64	72	84	93	103	123	156	179	197	250										
		44	23	28	31	36	39	45	50	53	57	66	76	86	130	113	146	175	187	244	295									
48	4N@ 12.00	48	22	26	29	34	37	41	46	51	54	63	74	81	88	109	129	152	177	226	269	313								
		54	21	24	28	31	35	39	43	46	51	60	69	76	84	108	116	144	159	193	243	280	321							
		36	32	39	48	55	62	70	78	83	100	106	121	142	155	191	225	272												
		40	30	35	42	49	56	64	71	79	84	103	108	123	145	171	198	246	294											
	5N@ 9.60	44	28	33	40	48	53	57	65	74	81	95	105	111	125	163	196	216	264											
		48	27	31	37	43	52	58	63	68	75	83	97	108	116	153	179	201	240	301										
		54	25	30	36	40	47	52	58	62	73	79	86	101	112	133	158	184	218	274	333									
		36	17	21	24	27	30	33	36	39	44	50	57	64	68	90	103	113	130	171	197	228	266							
	6N@ 8.00	40	17	19	24	25	27	31	33	37	39	44	51	57	65	77	91	106	125	153	177	206	234							
		44	17	18	23	25	26	29	31	34	36	43	47	52	59	71	87	101	107	133	156	195	222	278						
		48	17	17	22	24	24	27	30	32	35	39	45	47	53	67	78	90	108	128	157	184	207	266						
		54	18	18	21	22	24	26	28	30	32	37	41	46	49	61	70	81	96	116	137	163	185	229						
	8N@ 6.00	36	18	23	26	30	34	37	40	45	50	61	68	76	81	99	119	140	160	201	236	288								
		40	17	22	24	27	32	35	38	41	46	54	62	69	77	92	106	130	143	176	218	250	292							
		44	17	20	24	27	30	33	36	39	42	48	55	63	71	84	103	111	132	168	195	231	265							
		48	17	20	24	25	28	31	34	36	39	47	50	57	64	80	94	108	118	148	182	213	251	313						
	9N@ 5.33	54	17	20	22	24	27	29	32	35	38	40	49	52	58	74	83	106	111	139	163	195	216	279						
		36	24	28	33	39	43	50	54	61	65	77	91	100	105	140	163	188	216	278										
		40	21	27	31	35	40	46	49	55	59	71	79	92	101	116	143	167	191	246	300									
		44	21	27	29	33	37	41	47	50	56	64	72	81	94	109	135	159	174	223	280									
	12N@ 4.00	48	21	24	29	32	36	39	43	49	51	61	67	76	82	107	120	150	175	203	249	301								
		54	23	26	28	33	37	40	43	49	51	59	67	75	81	98	114	130	154	191	229	268	314							
		36	27	31	37	42	47	54	61	69	70	91	99	105	114	151	174	206	237											
		40	24	29	35	38	43	49	55	63	67	78	92	101	107	142	165	191	219	266										
	Bearing Depth				7 1/2 in.																10 in.									

DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS

Based on a 50ksi maximum yield strength

U. S. CUSTOMARY

1.60

Girder Span (ft)	Joist Spaces (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																																
			Load on Each Panel Point																																
			LRFD ASD	6K	7.5K	9K	10.5K	12K	13.5K	15K	16.5K	18K	21K	24K	27K	30K	37.5K	45K	52.5K	60K	75K	90K	105K	120K	150K										
50	4N@ 12.50	40	23	24	24	27	27	28	31	33	36	42	44	50	56	65	85	90	104	130	152	173	199	252											
		44	23	24	24	26	28	28	29	31	34	38	43	49	51	66	74	87	104	115	153	174	180	230											
		48	23	24	24	26	28	28	29	30	32	36	42	44	50	60	68	79	93	108	133	156	178	213											
		54	27	27	27	28	28	28	28	30	31	33	38	42	45	55	62	73	82	106	112	137	159	197											
	5N@ 10.00	40	17	21	24	25	29	32	35	38	42	46	54	58	65	86	100	110	125	152	184	219	253												
		44	16	19	23	24	28	30	33	36	39	44	50	54	58	75	91	105	113	152	177	205	230	294											
		48	17	19	22	25	29	31	33	36	40	46	53	59	68	88	94	107	134	159	183	209	269												
		54	18	18	21	24	26	27	30	31	33	38	42	46	52	61	78	90	96	117	138	162	184	238											
	6N@ 8.33	40	18	22	26	29	32	36	41	46	47	54	62	70	78	100	109	131	151	188	226	260													
		44	17	22	24	27	30	34	37	40	46	49	55	63	71	92	106	116	142	168	205	246	281												
		48	17	22	23	26	28	32	35	38	39	47	56	63	65	80	103	109	123	159	191	222	258												
		54	18	20	23	25	29	32	35	37	43	49	57	58	73	87	105	112	148	174	197	226	293												
	8N@ 6.25	40	23	27	31	37	41	48	54	55	62	71	83	92	102	122	153	176	195	248															
		44	22	27	31	34	39	44	49	52	56	65	75	84	102	111	144	167	182	222	288														
		48	22	25	29	33	37	40	45	50	53	61	73	81	86	107	126	149	175	214	263	310													
		54	25	26	31	34	37	41	46	48	51	58	70	76	83	106	114	141	163	193	239	283	315												
	10N@ 5.00	40	28	33	41	46	55	62	66	74	78	92	105	115	131	156	193	229	267																
		44	27	32	37	44	49	56	63	67	72	88	102	107	116	155	180	208	239	302															
		48	27	32	35	41	48	54	57	64	68	80	94	103	109	135	160	186	214	274															
		54	26	29	33	40	43	50	55	58	62	74	82	96	106	121	152	173	188	251	306														
	13N@ 3.85	40	35	41	51	59	67	74	83	92	102	111	132	144	169	196	252	303																	
		44	32	39	48	56	61	69	75	85	95	105	117	134	148	194	228	260	313																
		48	30	36	44	51	57	66	74	77	87	105	111	120	138	174	200	248	288																
		54	29	34	40	48	53	60	68	74	78	90	108	114	125	157	191	216	256	326															
55	5N@ 11.00	44	19	22	25	27	30	32	35	38	43	49	54	61	66	85	95	111	125	153	180	219	253												
		48	19	21	24	25	29	30	33	36	39	45	50	58	62	75	91	106	112	153	177	205	230												
		54	20	21	23	25	26	29	31	34	36	44	46	52	60	67	88	94	108	128	158	182	207	265											
		60	20	22	22	24	27	27	31	32	34	39	45	47	53	64	77	90	97	116	137	162	185	237											
	6N@ 9.17	44	18	23	26	29	33	37	40	46	47	54	62	70	77	100	114	131	151	188	226	261													
		48	18	23	24	29	31	34	37	42	46	52	59	66	71	92	106	116	143	177	205	246	279												
		54	19	22	24	27	30	33	35	39	41	47	56	60	65	80	95	109	119	160	181	211	251												
		60	19	20	23	25	30	31	34	37	40	44	50	58	61	77	96	105	112	149	174	197	226	279											
	7N@ 7.86	44	22	25	28	33	36	41	46	51	54	62	71	78	91	105	131	153	176	216	263														
		48	21	24	28	31	34	39	45	46	52	59	68	77	79	106	117	143	158	205	237	291													
		54	19	24	26	29	32	36	39	43	48	57	64	69	78	95	109	129	148	182	213	259	301												
		60	20	23	25	29	31	34	37	41	43	50	59	67	70	84	106	113	138	166	199	235	277												
	9N@ 6.11	44	25	30	35	41	46	54	58	63	70	78	92	101	110	143	166	195	228	282															
		48	25	28	33	39	43	49	55	60	64	72	84	102	108	134	157	182	205	266															
		54	25	28	33	38	42	46	51	57	58	69	79	87	97	114	148	164	187	243	282														
		60	24	28	33	37	40	43	48	50	58	67	79	83	89	108	124	154	174	202	264	309													
	11N@ 5.00	44	31	37	46	52	58	66	70	78	91	101	107	131	142	179	205	253	297																
		48	29	34	41	47	55	63	67	72	79	93	106	116	113	158	195	231	269																
		54	28	33	39	46	49	57	62	69	73	81	96	109	116	150	181	199	241	302															
		60	26	32	37	41	48	51	59	64	68	80	84	98	112	140	166	189	214	269															
	14N@ 3.93	44	39	46	55	63	71	79	92	102	107	121	144	157	179	218	269																		
		48	36	43	50	63	71	77	80	94	104	112	134	148	172	206	254	302																	
		54	34	41	49	57	66	71	75	83	97	107	120	138	152	187	215	263	307																
		60	31	39	46	52	61	68	77	78	85	101	114	123	142	168	202	241	284																
Bearing Depth			7 1/2 in.																							10 in.									

DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS

Based on a 50ksi maximum yield strength

U. S. CUSTOMARY

Girder Span (ft)		Joist Spaces (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																									
				Load on Each Panel Point																									
LRFD				6K	7.5K	9K	10.5K	12K	13.5K	15K	16.5K	18K	21K	24K	27K	30K	37.5K	45K	52.5K	60K	75K	90K	105K	120K	150K				
ASD				4K	5K	6K	7K	8K	9K	10K	11K	12K	14K	16K	18K	20K	25K	30K	35K	40K	50K	60K	70K	80K	100K				
60	5N@ 12.00	48	21	23	26	28	31	34	37	42	43	50	55	62	66	85	96	111	125	153	189	218	252						
		54	21	21	24	27	30	32	35	38	42	44	51	56	62	75	88	106	112	144	168	204	221	281					
		60	21	22	23	26	28	30	33	35	38	44	46	51	57	68	86	95	108	128	158	182	208	256					
		66	22	22	23	25	28	29	33	34	36	40	46	47	53	65	78	91	97	117	139	162	188	228					
		72	22	23	23	24	27	29	31	34	35	38	44	47	52	62	72	81	93	113	135	164	177	217					
	6N@ 10.00	48	21	23	26	31	34	38	40	46	47	58	66	70	77	100	114	131	152	188	227	262							
		54	19	23	25	29	32	35	38	41	45	53	59	67	71	92	106	117	119	169	204	229	269						
		60	19	22	26	28	31	34	36	39	42	48	55	61	68	81	95	110	134	160	181	209	242						
		66	20	22	25	27	30	32	34	67	41	47	50	58	62	77	96	106	112	140	175	198	216	278					
		72	20	21	24	27	29	32	33	35	38	43	50	52	60	72	84	99	114	142	166	188	206	266					
	8N@ 7.50	48	24	28	32	38	41	48	54	55	62	70	78	92	101	121	152	176	192	241									
		54	23	26	31	35	39	43	47	55	56	64	72	81	94	109	134	158	180	221	268								
		60	23	26	29	32	38	41	44	49	52	59	66	76	83	106	120	149	163	199	239	290							
		66	29	31	34	36	40	46	48	50	56	64	72	76	82	101	116	142	165	191	230	280	313						
		72	30	31	33	34	38	43	47	49	51	59	69	74	83	102	118	126	147	190	228	255	191						
	10N@ 6.00	48	30	36	43	50	58	65	66	75	78	92	106	116	132	157	193	229	265										
		54	29	34	40	46	51	59	60	68	76	88	95	107	144	147	180	205	232	296									
		60	27	33	38	41	47	53	61	61	70	79	90	97	110	136	162	183	210	272									
		66	27	32	36	40	46	49	55	62	64	75	81	97	99	120	143	165	190	254	296								
		72	27	32	35	39	43	48	53	58	61	73	77	86	100	116	137	169	191	225	283								
12N@ 5.00	48	35	41	49	55	63	71	79	92	93	107	116	142	156	191	229	266												
	54	33	39	46	50	57	65	73	80	81	104	109	118	135	172	197	238	274											
	60	32	37	41	50	56	59	67	74	79	96	107	112	121	163	187	219	247	316										
	66	31	36	40	47	53	60	61	68	76	85	99	110	115	145	177	201	228	288										
	72	30	35	40	44	52	54	63	64	75	80	89	104	114	130	160	194	219	273	319									
15N@ 4.00	48	39	49	62	70	78	92	101	106	110	132	155	167	189	228	289													
	54	37	47	56	64	73	81	94	95	105	118	135	158	171	208	254	298												
	60	35	42	51	59	68	76	83	88	98	112	122	141	164	197	229	276	307											
	66	36	44	54	57	65	73	80	88	94	113	118	130	158	193	221	261	294											
	72	36	43	49	57	67	75	77	84	91	107	121	126	143	178	219	240	283											
65	6N@ 10.83	54	22	25	28	31	34	38	43	45	47	55	66	69	75	92	107	132	152	177	207	250	288						
		60	22	24	26	31	32	36	38	42	46	53	60	67	71	92	107	116	133	169	195	231	262						
		66	22	24	26	29	31	34	36	40	43	49	54	61	68	80	96	110	119	159	184	209	236						
		72	23	24	26	29	30	33	35	39	43	47	50	56	63	75	92	107	113	141	166	196	218	276					
	8N@ 8.13	54	24	28	33	38	42	47	52	55	63	70	78	92	101	116	143	166	192	229	284								
		60	23	26	32	36	39	43	48	50	57	65	72	80	94	109	135	158	180	210	259								
		66	32	34	41	43	44	48	53	55	61	68	73	81	93	114	133	151	167	212	246	296							
		72	32	34	34	42	45	47	49	54	57	69	74	82	83	106	121	143	167	194	241	277							
	10N@ 6.50	54	31	37	44	50	56	63	67	75	76	92	107	113	127	156	182	220	243										
		60	30	35	41	46	52	58	64	68	77	88	95	109	115	136	180	196	222	283									
		66	28	34	39	44	47	54	61	65	70	82	91	98	112	132	163	184	210	263									
		72	28	34	37	41	47	50	56	63	63	72	81	94	100	120	143	168	193	247	295								
	11N@ 5.91	54	32	39	45	52	59	66	71	77	87	101	107	126	133	176	205	230	264										
		60	32	36	45	48	54	61	69	73	78	94	108	110	118	160	181	208	243										
		66	30	36	41	46	50	56	62	70	71	83	97	111	113	141	166	200	215	287									
72		29	34	39	43	50	55	60	65	73	81	93	100	114	167	166	187	214	257										
13N@ 5.00	54	36	42	50	57	65	72	80	92	102	108	123	144	158	192	229	269												
	60	34	40	49	57	61	70	74	81	94	105	111	125	148	182	209	252	286											
	66	33	38	45	52	60	67	72	75	83	99	109	116	129	167	199	234	263											
	72	32	38	43	51	55	62	70	77	78	88	110	116	120	158	182	210	253	309										
Bearing Depth			7 1/2 in.															10 in.											

Joist Girder weights between the heavy black and blue lines have 7 1/2 inch bearing depths.

Joist Girder weights to the right of the heavy blue line have 10 inch bearing depths. Check with Vulcraft for material availability.



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DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS

Based on a 50ksi maximum yield strength

U. S. CUSTOMARY

Girder Span (ft)		Joist Spaces (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																										
				Load on Each Panel Point																										
				LRFD ASD	6K 4K	7.5K 5K	9K 6K	10.5K 7K	12K 8K	13.5K 9K	15K 10K	16.5K 11K	18K 12K	21K 14K	24K 16K	27K 18K	30K 20K	37.5K 25K	45K 30K	52.5K 35K	60K 40K	75K 50K	90K 60K	105K 70K	120K 80K	150K 100K				
70	7N@ 10.00	54	24	28	32	36	40	44	50	54	58	65	73	86	91	111	131	153	175	226	263									
		60	23	26	31	33	38	44	46	51	53	63	67	75	87	106	126	153	165	204	242	284								
		66	23	27	31	32	36	39	45	47	52	59	67	71	78	94	114	135	156	184	222	260								
		72	23	26	29	33	35	39	42	47	48	55	62	70	78	96	111	121	140	183	211	145	286							
	84	26	28	30	32	35	37	40	44	47	51	59	66	71	83	102	117	125	170	192	220	254	313							
	9N@ 7.78	54	27	33	37	44	48	54	61	66	70	90	100	105	114	151	174	202	225	276										
		60	25	31	35	40	47	49	56	64	67	76	93	102	107	134	156	180	205	256										
		66	25	31	35	40	47	49	56	62	69	74	82	96	106	121	149	174	200	244	300									
		72	25	31	35	40	46	49	56	57	63	72	81	93	99	115	141	163	185	216	273									
	84	25	31	35	40	43	49	51	53	58	67	76	80	89	104	119	145	171	195	234	287	317								
	11N@ 6.36	54	33	43	50	58	66	67	75	86	92	106	115	132	153	177	217	250	258											
		60	32	40	46	51	59	67	68	76	87	94	108	118	134	167	205	231	236											
		66	32	38	44	47	55	61	68	40	78	91	97	110	120	160	183	207	221	290										
		72	31	36	41	47	54	57	63	72	73	83	98	112	114	142	166	191	196	256	300									
	84	31	35	39	45	50	53	58	68	68	76	87	99	106	126	149	172													
	12N@ 5.83	54	36	45	52	59	67	75	78	92	101	107	132	142	154	192	229	268	287											
		60	34	41	48	56	60	68	77	80	93	107	115	133	145	180	205	245	267											
		66	32	39	47	50	58	65	70	78	82	96	110	120	136	163	198	224	246	304										
		72	33	38	44	50	57	63	69	73	71	94	108	117	124	156	188	214												
	84	31	37	42	47	53	55	65	69	80	86	91	106	119	142	170	196	221	277	318										
14N@ 5.00	54	40	48	58	66	75	90	92	105	106	131	152	164	177	225	266														
	60	38	46	56	64	71	79	92	93	104	117	133	155	169	205	244	288													
	66	36	43	50	58	65	74	81	94	96	110	120	136	160	184	233	267													
	72	36	42	51	58	65	72	76	84	95	110	115	126	145	189	223	251	285												
84	34	43	47	54	62	66	74	78	83	101	108	122	134	166	199	234	262	320												
80	8N@ 10.00	60	29	32	38	43	47	52	58	65	66	78	91	100	105	131	153	189	205	253										
		66	29	32	36	40	46	48	53	59	63	71	79	93	105	126	154	177	192	233	284									
		72	30	32	34	38	43	47	79	54	61	69	78	89	95	115	136	159	182	260	258									
		84	30	32	34	38	43	47	48	54	61	69	78	89	95	115	134	157	179	217	264									
	96	30	32	34	38	43	47	49	54	61	69	78	89	95	115	126	141	163	199	225	272	301								
	10N@ 8.00	60	32	37	42	49	55	62	70	78	78	100	105	115	132	164	191	226	252											
		66	35	42	46	55	61	64	72	77	86	98	109	114	129	169	194	219	250											
		72	34	38	46	51	57	64	65	74	78	91	101	110	126	159	183	207	235											
		84	34	37	46	48	53	59	61	67	72	82	95	104	113	135	166	185	212	256										
	96	35	36	42	48	50	55	58	64	72	78	86	98	104	125	143	171	192	239	281										
	13N@ 6.15	60	40	47	59	66	71	78	92	101	106	116	143	155	175	206	252													
		66	38	47	54	60	68	77	80	94	103	109	134	145	157	195	231	261												
		72	37	44	50	59	67	71	79	83	96	111	120	137	152	186	213	253	298											
		84	36	43	50	54	59	67	75	79	84	101	112	119	128	170	193	229	255											
	96	37	42	47	53	57	66	72	81	79	94	109	118	124	155	177	201	235	294											
	16N@ 5.00	60	47	55	67	78	92	101	107	115	132	153	175	192	206	252														
66		44	55	65	72	80	94	104	109	117	134	158	180	194	232	287														
72		43	51	59	70	79	83	97	107	111	121	149	162	185	225	268														
84		42	49	57	64	74	81	90	104	106	120	131	152	174	207	253	287													
96	44	48	58	64	70	81	86	92	97	114	128	140	159	196	231	268	298													
90	9N@ 10.00	72	38	40	44	47	52	57	61	68	76	88	94	108	115	145	178	205	228	278										
		84	38	40	44	47	52	57	61	69	73	82	94	104	114	134	162	187	212	258										
		96	38	40	44	47	52	57	61	67	71	77	85	98	108	125	139	170	190	221	278									
		108	38	40	44	47	52	57	61	67	70	75	80	89	99	114	129	152	176	205	247	286								
	11N@ 8.18	72	41	46	51	61	64	73	78	89	94	108	115	131	146	181	216	246												
		84	41	45	47	53	61	67	72	78	90	94	113	120	133	161	190	220	250											
		96	44	45	47	50	56	64	70	72	80	94	98	107	123	146	180	196	235	286										
		108	45	46	48	51	57	60	66	75	76	84	98	104	113	140	164	186	204	262										
	15N@ 6.00	72	45	55	61	72	80	94	103	109	114	134	156	179	184	233	285													
		84	47	50	58	65	73	81	93	98	112	121	140	163	166	210	242	295												
		96	48	50	57	64	71	81	87	92	106	121	128	144	163	199	232	261	302											
		108	49	53	57	62	70	75	83	93	97	113	126	134	152	182	210	249	277											
18N@ 5.00	72	49	62	73	80	94	108	115	128	135	157	181	205	229	280															
	84	49	62	74	82	91	107	117	122	130	149	174	195	210	256	306														
	96	49	60	69	77	86	95	111	121	126	139	156	181	199	233	285														
	108	49	61	66	74	87	92	101	115	118	132	145	165	184	223	267	298													
Bearing Depth			7 1/2 in.															10 in.												

DESIGN GUIDE WEIGHT TABLE FOR JOIST GIRDERS U. S. CUSTOMARY

Based on a 50ksi maximum yield strength

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Girder Span (ft)	Joist Spaces (ft)	Girder Depth (in)	Joist Girder Weight – Pounds Per Linear Foot																									
			Load on Each Panel Point																									
LRFD			6K	7.5K	9K	10.5K	12K	13.5K	15K	16.5K	18K	21K	24K	27K	30K	37.5K	45K	52.5K	60K	75K	90K	105K	120K	150K				
ASD			4K	5K	6K	7K	8K	9K	10K	11K	12K	14K	16K	18K	20K	25K	30K	35K	40K	50K	60K	70K	80K	100K				
100	10N@ 10.00	84	56	57	58	62	64	72	76	88	90	103	118	129	142	172	200	225	257									
		96	58	58	59	61	64	67	70	78	88	94	106	120	131	152	180	204	228									
		108	58	60	60	61	63	68	70	73	77	93	96	111	111	139	170	188	209	258								
	120	60	60	62	64	66	67	68	71	74	85	99	108	113	139	157	188	201	242	289								
	12N@ 8.33	84	50	54	58	66	70	75	89	92	101	112	129	138	159	187	221	257										
		96	50	54	57	61	68	70	80	84	96	106	116	123	137	179	205	228	271									
		108	52	54	58	62	65	72	74	79	89	101	110	121	128	164	193	221	246	299								
	120	54	57	60	62	66	69	77	79	86	92	107	117	126	151	178	206	239	283									
	16N@ 6.25	84	55	60	71	76	83	96	110	112	119	139	161	184	199	235	288											
		96	56	60	67	75	79	88	102	105	119	128	145	168	191	218	265	301										
		108	58	63	67	72	81	87	93	106	111	125	136	157	180	204	251	292										
	120	60	65	68	74	79	90	93	98	110	117	134	147	166	208	248	275	304										
	17N@ 5.88	84	57	65	73	82	92	98	112	114	123	151	164	187	203	250												
		96	60	65	72	81	89	103	110	123	123	145	177	179	198	256	285											
		108	64	67	72	76	86	96	108	113	123	135	158	172	182	231	264	308										
	120	67	68	73	80	85	90	99	112	119	133	143	167	178	214	250	281	330										
	20N@ 5.00	84	67	77	87	105	115	122	132	148	159	193	208	226	246													
		96	67	73	82	95	111	120	126	135	152	177	199	211	227	279												
		108	66	72	79	91	101	116	125	130	131	162	184	197	207	267	316											
	120	71	75	82	88	96	106	120	123	136	149	170	193	205	246	289	332											
Bearing Depth			7 1/2 in.													10 in.												

Joist Girder weights between the heavy black and blue lines have 7 1/2 inch bearing depths.
Joist Girder weights to the right of the heavy blue line have 10 inch bearing depths. Check with Vulcraft for material availability.



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NOTES



FIRE-RESISTANCE RATINGS WITH STEEL JOISTS

The Underwriters Laboratories (U.L.) Fire Resistance Directory lists hundreds of assemblies and their fire resistance ratings. The Specifying Professional can choose between numerous Floor-Ceiling and Roof-Ceiling assemblies that include steel joists and Joist Girders.

As a convenience, a selected number of assemblies are listed on the following pages. In addition, the Steel Joist Institute's Technical Digest #10 "Design of Fire Resistive Assemblies with Steel Joists" has a complete listing of steel joist assemblies and additional information about fire ratings. However, the listing that follows and the Technical Digest are intended as a guide only, and the Specifying Professional must refer to the current U.L. Fire Resistance Directory for complete design requirements.

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 (203 mm to 356 mm) deep. This practice was advantageous in that it established the minimum acceptable joists at the shallow and lightweight end of the joist load tables. This also resulted in a specified minimum joist designation being listed in the U.L. Fire Resistance Assembly, which is the joist that combines the required minimum depth and minimum weight per foot. Joists of the same series which equal or exceed the specified minimum joist depth and joist weight per foot may be used provided the accessories are compatible. The dimension from the bottom chord of the joists to the ceiling, whether given or calculated, is a minimum.

Where a U.L. Fire Resistance Assembly is being utilized, the Specifying Professional shall indicate the assembly number being used on the structural contract drawings. In addition, the Specifying Professional shall consider the following, as applicable:

- Joist designations specified on the structural contract drawings shall not be less than the minimum size for that assembly. The assembly may also require a minimum bridging size that may be larger than required by the SJI Specifications for the particular designation and joist spacing.
- Some assemblies stipulate minimum size materials or minimum cross sectional areas for individual joist and Joist Girder components. It is the responsibility of the Specifying Professional to show all special requirements on the contract drawings.
- Note that the maximum joist spacing shown for Floor-Ceiling Assemblies may be increased from the spacing listed in the U.L. Fire Resistance 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.

- Some assemblies stipulate an allowable maximum joist design stress level less than the 30 ksi (207 MPa) used in the joist and Joist Girder Specifications. It is the responsibility of the Specifying Professional to apply the proper stress level reductions (when applicable) when selecting joists and/or Joist Girders. This is accomplished by prorating the joist and/or Joist Girder capacities. To adjust the stress level of joists or Joist Girders, multiply the design load by the ratio of the joist design stress to the required maximum [e.g. 30/26 (207/179), 30/24 (207/165), 30/22 (207/152)], and then using this increased load, select a joist or Joist Girder from the load and/or weight tables.
- Some U.L. Roof-Ceiling Assemblies using direct applied protection limit the spacing of the joists for certain types and gages of metal decking – refer to the U.L. Fire Resistance Directory for this information.
- Where fire protective materials are to be applied directly to the steel joists or Joist Girders, it is often desired to have the joist furnished as unpainted. The Specifying Professional should indicate on the structural contract drawings if the joists or Joist Girders are to be painted or not.
- Certain older U.L. fire rated assemblies may refer to joist series that predate the K-Series joists. Where one of these assemblies is selected, refer to the U.L. Fire Resistance Directory for special provisions for substituting a K-Series joist in lieu of an S-, J-, and/or H-Series joist.



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FLOOR - CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	
			Minimum Thickness (in.)	Type				
1 Hr.	Acoustical	12K1, 18LH02	2.5	LW, NW	NL	20G@13plf W8 x 15	D216 D219	
	Exposed Grid	10K1	2.5	NW	72	20G@14plf* W6 x 12	G205	
		10K1	2		72	W6 x 12	G208	
		10K1	2.5		72	20G@14plf* W6 x 12	G256	
	Gypsum Board	10K1	2.5	NW	48	W8 x 24	G548	
1 1/2 Hr.	Acoustical	12K1, 18LH02	2.5	LW, NW	NL	20G@13plf W8 x 15	D216 D219	
	Gypsum Board			NW		20G@20plf W8 x 28	D502	
	Exposed Grid	10K1	2.5	NW	24 (48)	20G@13plf W6 x 12	G203	
		10K1	2.5		72	20G@14plf* W6 x 12	G205	
		10K1	2		72	W6 x 12	G208	
		10K1	2.5		24 (48)	W6 x 12	G213	
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G228	
		10K1	2		24 (48)	20G@13plf W8 x 24	G229	
		10K1	2.5		24 (48)	20G@13plf W6 x 12	G243	
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G268	
	Gypsum Board	12K1	2	NW	24 (48)	NS	G502	
	2 Hr.	Acoustical	12K1, 18LH02	2.5	LW, NW	NL	20G@13plf W8 x 15	D216 D219
		Gypsum Board			NW		20G@20plf W8 x 28	D502
Concealed Grid		10K1	2.25	NW	24 (48)	W6 x 25	G023	
		8K1	2.5		24 (48)	20G@13plf W8 x 20	G031	
		10K1			30 (48)	20G@13plf W10 x 21	G036	
Exposed Grid		10K1	2.5	NW	24 (48)	20G@13plf W6 x 12	G203	
		10K1	2.5		72	20G@14plf* W6 x 12	G205	
		10K1	2.5		72	W6 x 12	G208	
		10K1	2.5		24 (48)	W6 x 12	G213	
		10K1	2.5		24 (48)	W8 x 31	G227	
	10K1	2.5	24 (48)		20G@13plf W8 x 31	G228		

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FLOOR - CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Minimum Thickness (in.)	Type			
2 Hr.	Exposed Grid	10K1	2.5	NW	24 (48)	20G@13plf W8 x 24	G229
		10K1	2.5		24 (48)	20G@13plf W6 x 12	G243
		10K1	2.5		72	20G@14plf* W6 x 12	G256
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G268
	Gypsum Board	10K1	2	NW	24 (48)	NS	G505
		10K1	2.5		24 (48)	20G@14plf* W8 x 31	G514
		10K1	2.5		24 (48)	20G@13plf W10 x 21	G523
		10K1	2.5		24 (48)	20G@13plf W8 x 24	G529
		10K1	2.5		24 (48)	20G@13plf W10 x 21	G547
3 Hr.	Acoustical	12K1, 18LH02	3.25	LW, NW	NL	20G@13plf W8 x 15	D216 D219
	Concealed Grid	10K1	3.5	NW	24 (48)	20G@13plf W8 x 20	G033
		10K1	3.25		30 (48)	20G@13plf W10 x 21	G036
	Exposed Grid	10K1	3.5	NW	48	20G@14plf* W6 x 12	G205
		10K1	3.5		24 (48)	W6 x 12	G213
		10K1	3.25		24 (48)	20G@13plf W8 x 24	G229
		10K1	3.5		48	20G@14plf* W6 x 12	G256
		10K1 (22 ksi max.)	2.63		24 (48)	20G@13plf W8 x 31	G268
		10K1	3		24 (48)	20G@13plf W10 x 21	G523
	Gypsum Board	10K1	2.75	NW	24 (48)	20G@13plf W8 x 24	G529
		10K1	3		24 (48)	20G@13plf W10 x 21	G547
		10K1	3		24 (48)	20G@13plf W10 x 21	G547

* Special Area Requirements
 NL = Not Listed
 NS = Not Specified



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FLOOR - CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing	Minimum Primary Support Member	UL Design Number
			Minimum Thickness (in.)	Type			
1 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	2.5	LW			D925
			3.5	NW			
		16K6*	NS	LW, NW	42	20G@20plf W8 x 28	G701
		16K6	3	LW	50.5	NS	G702
			3.75	NW			
		16K6*	2.5	LW, NW	42	NS	G705
		16K6	3	LW	50.5	NS	G706
			3.75	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G708
		NS	2.5		42	W8 x 28	G709
		16K6*	2.5		42	20g@20plf W8 x 24	G801
		12K1	3	LW	50.5	NS	G802
			3.75	NW			
1 1/2 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	3	LW			D925
			4	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G701
		16K6	3.5	LW	50.5	NS	G702
			4.5	NW			
		16K6*	2.5	LW, NW	42	NS	G705
		16K6	3.5	LW	50.5	NS	G706
			4.5	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G708
		NS	2.5		42	W8 x 28	G709
		16K6*	2.5		42	20G@20plf W8 x 24	G801
		12K5	3.5	LW	50.5	NS	G802
			4.5	NW			

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FLOOR - CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing	Minimum Primary Support Member	UL Design Number
			Minimum Thickness (in.)	Type			
2 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	3.25	LW			D925
			4.5	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G701
		16K6	4	LW	50.5	NS	G702
			5.25	NW			
		16K6*	2.5	LW, NW	42	NS	G705
		16K6	4	LW	50.5	NS	G706
			5.25	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G708
		NS	2.5		42	W8 x 28	G709
		16K6*	2.5		42	20G@20plf W8 x 24	G801
		12K5	4	LW	50.5	NS	G802
			5.25	NW			
3 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	4.19	LW			D925
			5.25	NW			
		16K6*	NS	LW, NW	42	20G@20plf W8 x 28	G701
		16K6*	2.75		42	NS	G705
		16K6*	2.75		42	20G@20plf W8 x 28	G708
		NS	2.75		42	W8 x 28	G709
		16K6*	2.75		42	20G@20plf W8 x 24	G801
4 Hr.	SAFRM	10K1	2.5	LW, NW	NL	W8 x 28	D779
		NS	3.25	LW			D782

* Special Area Requirements
 NL = Not Listed
 NS = Not Specified



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ROOF - CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Deck Material Description	Insulation			
1 Hr.	Exposed Grid	12K1	22 MSG Min.	Fiber Board	84	W8 x 17	P201
		10K1	26 MSG Min.		48	W6 x 12	P202
		10K1	26 MSG Min.		48	20G@13plf	P211
		12K3	28 MSG Min.		72	20G@13plf W8 x 17	P214
		12K1	26 MSG Min.		72	20G@13plf W6 x 12	P225
		12K3	24 MSG Min.	Building Units	48	NS	P227
		12K3	26 MSG Min.	Fiber Board	72	20G@13plf W6 x 12	P230
		12K1	26 MSG Min.	Insulating Concrete	48	20G@14plf* W8 x 15	P231
		12K3	24 MSG Min.	Foamed Plastic	72	W8 x 15	P235
		10K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W8 x 15	P246
		12K5	26 MSG Min.	Fiber Board	48	W6 x 12	P250
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251
		10K1	22 MSG Min.	Fiber Board	72	W6 x 12	P254
		10K1	28 MSG Min.	Insulating Concrete	72	W8 x 15	P255
		10K1	24 MSG Min.	Fiber Board	72	NS	P259
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P261
		12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 15	P264
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P265
		10K1	26 MSG Min.	Fiber Board	48	W6 x 16	P267
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P268
		12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 15	P269
	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301
		10K1	22 MSG Min.		48	NS	P302
		10K1	22 MSG Min.		NS	W6 x 16	P303
	Gypsum Board	12K3	26 MSG Min.	Insulating Concrete	60	W8 x 24	P509
		12K3	24 MSG Min.	Fiber Board	72	20G@13plf W8 x 13	P510
		10K1	20 MSG Min.	Fiber Board	48	NS	P519

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ROOF - CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Deck Material Description	Insulation			
1 1/2 Hr.	Exposed Grid	12K1	26 MSG Min.	Fiber Board	72	20G@13plf W6 x 12	P225
		12K3	24 MSG Min.	Building Units	48	NS	P227
		12K3	26 MSG Min.	Fiber Board	48	20G@13plf W6 x 12	P230
		12K1	26 MSG Min.	Insulating Concrete	48	20G@14plf* W8 x 24	P231
		12K5	26 MSG Min.	Fiber Board	48	W6 x 12	P250
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251
		10K1	24 MSG Min.	Fiber Board	72	NS	P259
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P265
		10K1	20 MSG Min.	Fiber Board	48	NS	P266
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P268
		12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 24	P269
	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301
	Metal Lath	12K5	22 MSG Min.	Fiber Board	72	NS	P404
	Gypsum Board	12K3	24 MSG Min.	Fiber Board	72	20G@13plf W8 x 13	P510
2 Hr.	Exposed Grid	10K1	24 MSG Min.	Fiber Board	72	W6 x 12	P237
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251
		10K1	20 MSG Min.	Fiber Board	48	NS	P266
	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301
	Metal Lath	12K5	22 MSG Min.	Fiber Board	72	NS	P404
	Gypsum Board	10K1	22 MSG Min.	Fiber Board	72	20G@13plf	P514
			20 MSG Min.		48	NS	P519
		14K1	26 MSG Min.	Insulating Concrete	66	NS	P520
3 Hr.	Metal Lath	10K1	28 MSG Min.	Insulating Concrete	48	NS	P405

* Special Area Requirements

NL = Not Listed

NS = Not Specified



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ROOF - CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Deck Material Description	Insulation			
1 Hr.	SAFRM	10K1	22 MSG Min.	Building Units	NS	NS	P822
		12K3	22 MSG Min.	Fiber Board	NS	W8 x 20	P824
1 Hr. and 1-1/2 Hr.	SAFRM	12K5	28 MSG Min.	Insulating Concrete	96	W6 x 16	P919
1-1/2 Hr. and 2 Hr.	SAFRM	10K1	22 MSG Min.	Building Units	NS	W6 x 16	P728
1 Hr., 1-1/2 Hr. and 2 Hr.	SAFRM	14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P701
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P711
		12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P717
		10K1	22 MSG Min.	Foamed Plastic	NS	20G@13plf W8 x 28	P725
		10K1	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P726
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P734
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P736
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P739
		10K1	22 MSG Min.	Fiber Board	NS	W6 x 16	P740
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P743
		12K3	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P801
		10K1	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P815
		10K1	22 MSG Min.	Fiber Board	NS	W6 x 16	P816
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P819
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P825
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P827
		12K1	22 MSG Min.	Fiber Board	NS	20G@13plf W8 x 20	P828
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P902
		10K1	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P907
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P908

(Continued Next Page)



METAL PRODUCTS RESOURCES ASS. S.A.S.

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ROOF - CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Deck Material Description	Insulation			
1 Hr., 1-1/2 Hr. and 2 Hr.	SAFRM	10K1	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P920
		12K5	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P921
		10K1	28 MSG Min.	Insulating Concrete	NS	W6 x 16	P922
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P923
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P925
		12K5	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P926
		14K4	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P927
		12K5	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P928
		12K3	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P929
		10K1	28 MSG Min.	Insulating Concrete	NS	W6 x 16	P936
2 Hr.	SAFRM	12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P718
		12K3	22 MSG Min.	Foamed Plastic	NS	20G@13plf W6 x 16	P720
		12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P729
1 Hr., 1-1/2 Hr., 2 Hr. and 3 Hr.	SAFRM	10K1	22 MSG Min.	Foamed Plastic	NS	20G@13plf W6 x 16	P719
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P722
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P723
		10K1	22 MSG Min.	Foamed Plastic	NS	W8 x 28	P732
		10K1*, 16K2	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P733
		10K1*	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P826

* Special Area Requirements

NS = Not Specified



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NOTES



Combined K, VS, LH & DLH Series Load Table

The following table is an economy guide with the Joists listed in sequence of increasing relative cost. That is, the most economical joist for given length is listed first. The economies were based on production costs and do not include bridging requirements or erection costs.

HOW TO USE THE ECONOMICAL JOIST GUIDE: The specifying professional simply turns to the length required and proceeds down the allowable loads column until the first joist type in the list that will carry the required load is found. (However, additional bridging due to erection stability requirements should be taken into consideration.) This will then be the most economical joist type for the combination of length and required load. The approximate weight per foot of the joist is listed to the right of the live load.

EXAMPLE: Given 40'-0" length and a required load of 300 plf. On page 126 of the table under 40', it is found that a 30K7 at 40'-0" will carry 319 plf TL.

The figures shown in red are the live loads per lineal foot of joist which will produce an approximate deflection of 1/360 of the length. If a deflection limitation of 1/240 is required multiply the figures in red by 1.5. In no case shall the total load capacity of the joist be exceeded.

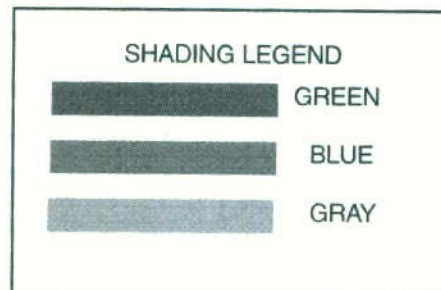
NOTE: Length as used in the economical joist guide means: **clear span + 8" for K Series and clear span + 12" for LH and DLH Series joists.**

You will note that the tables have been shaded to match the load tables. This shading indicates when bolted cross bridging needs to be installed per the Steel Joist Institute specification for a particular joist series.

Where the joist span is in the **GREEN SHADED** area of the table, the row of bridging nearest the mid span shall be diagonal bridging with bolted connections at chords and intersection. Hoisting cables shall not be released until this row of bolted diagonal bridging is completely installed.

Where the joist span is in the **BLUE SHADED** area of the table, all rows of bridging shall be diagonal bridging with bolted connections at chords and intersection. Hoist cables shall not be released until the two rows of bridging nearest the third points are completely installed.

Where the joist span is in the **GRAY SHADED** area of the table hoisting cables shall not be released until all rows of bridging are completely installed.



Total loads shown in the table are allowable total loads in ASD; the loads multiplied by 1.5 are approximately factored total loads in LRFD.

ECONOMICAL JOIST GUIDE
Combined K, VS, LH & DLH Series Load Table

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Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight
10' LENGTH				20' LENGTH (Cont.)				24' LENGTH (Cont.)				26' LENGTH (Cont.)			
10K 1	550	550	5.0	16K2	368	297	5.5	16K2	254	170	5.5	24K6	543	493	8.9
11' LENGTH				16K3	410	330	6.2	16K3	283	189	6.1	24K7	550	499	9.2
10K 1	550	542	5.0	18K3	463	423	6.5	18K3	320	242	6.5	20LH4	574	428	11
12' LENGTH				16K4	493	386	7.0	16K4	340	221	6.9	18LH4	604	403	12
10K 1	550	455	5.0	16K5	550	426	7.5	20K3	357	302	6.7	20LH5	616	459	11
13' LENGTH				21' LENGTH				18K4	385	284	7.2	18LH5	684	454	13
10K 1	479	363	5.0	12K1	218	123	5.0	20K4	430	353	7.6	20LH6	822	606	15
12K 1	550	510	5.0	14K1	257	170	5.2	18K5	434	318	7.7	18LH7	840	553	16
14' LENGTH				12K3	273	153	5.5	18K6	473	345	8.5	18LH8	876	577	16
10K 1	412	289	5.0	14K3	322	212	5.7	20K5	485	396	8.2	20LH7	878	647	16
14K 1	550	550	5.2	16K2	333	255	5.5	24K6	550	544	7.7	18LH9	936	616	17
15' LENGTH				16K3	371	285	6.3	18LH3	562	409	10	20LH9	990	729	17
10K 1	358	234	5.0	18K3	420	364	6.6	20LH4	621	503	10	20LH10	1068	786	18
12K 1	434	344	5.0	16K4	447	333	7.0	18LH4	655	474	11	27' LENGTH			
14K 1	511	475	5.2	20K3	468	453	6.7	20LH5	668	540	11	14K1	154	79	5.1
14K 3	550	507	5.9	16K5	503	373	7.5	18LH6	739	534	12	16K2	200	119	5.5
16' LENGTH				18K4	506	426	7.2	20LH7	908	650	15	16K3	223	132	5.9
10K 1	313	192	5.0	20K4	550	520	7.6	18LH8	946	679	16	18K3	252	169	6.3
12K 1	380	282	5.0	22' LENGTH				20LH7	951	761	15	16K4	268	155	6.8
14K 1	448	390	5.2	12K1	199	106	5.0	20LH8	980	787	16	20K3	281	211	6.6
12K 3	476	351	5.7	14K1	234	147	5.1	18LH9	1014	725	17	18K4	303	198	7.0
14K 3	550	467	5.9	12K3	249	132	5.5	20LH9	1073	857	16	20K4	339	247	7.4
17' LENGTH				14K3	293	184	5.6	20LH10	1158	924	17	18K5	342	222	7.7
10K 1	277	159	5.0	16K2	303	222	5.5	25' LENGTH				22K4	374	301	8.0
12K 1	336	234	5.0	16K3	337	247	6.2	14K1	180	100	5.1	20K5	382	277	8.2
14K 1	395	324	5.2	18K3	382	316	6.5	16K2	234	150	5.5	20K6	416	301	8.8
12K 3	420	291	5.7	16K4	406	289	6.9	16K3	260	167	5.9	22K5	422	337	8.7
16K 2	512	488	5.5	20K3	426	393	6.7	18K3	294	214	6.3	24K6	503	439	8.6
16K 3	550	526	6.3	18K4	460	370	7.2	16K4	313	195	6.9	26K6	547	519	8.9
18' LENGTH				20K4	514	461	7.6	20K3	329	266	6.7	26K7	550	522	9.1
10K 1	246	134	5.0	18K5	518	414	7.7	18K4	355	250	7.1	20LH4	566	406	11
12K 1	299	197	5.0	22K6	550	548	7.5	16K6	384	238	8.1	18LH4	571	367	12
14K 1	352	272	5.2	18LH2	554	439	8.8	18K5	400	281	7.7	20LH5	609	437	12
12K 3	374	245	5.5	18LH3	614	488	10	16K7	428	263	8.6	18LH5	648	414	14
14K 3	441	339	5.8	18LH4	715	566	11	18K6	435	305	8.5	20LH6	791	561	15
16K 2	456	409	5.5	18LH5	808	637	12	20K5	446	350	8.2	20LH7	845	599	16
16K 3	508	456	6.3	18LH6	955	738	14	18K7	485	337	9.0	20LH8	873	619	16
14K 4	530	397	6.7	18LH7	992	776	15	20K6	486	380	8.9	20LH9	953	675	17
14K 6	550	408	6.9	18LH8	1034	810	15	16K9	514	311	10	20LH10	1028	724	19
19' LENGTH				18LH9	1108	864	16	24K6	550	520	8.6	28' LENGTH			
10K1	221	113	5.0	23' LENGTH				20LH4	596	463	10	14K1	143	70	5.1
12K1	268	167	5.0	14K1	214	128	5.1	18LH4	628	436	11	16K2	186	106	5.5
14K1	315	230	5.2	12K3	227	116	5.5	20LH5	641	497	11	16K3	207	118	5.8
12K3	335	207	5.6	16K2	277	194	5.5	18LH5	709	492	13	18K3	234	151	6.2
16K2	408	347	5.5	16K3	308	216	6.0	20LH6	855	656	15	16K4	249	138	6.6
16K3	455	386	6.3	18K3	349	276	6.6	18LH7	872	599	16	20K3	261	189	6.7
18K3	514	494	6.6	16K4	371	252	7.0	20LH8	908	625	16	16K5	281	155	7.4
16K4	547	452	7.0	20K3	389	344	6.7	20LH9	941	724	16	18K4	282	177	7.2
16K5	550	455	7.2	18K4	420	323	7.2	18LH9	973	667	17	20K4	315	221	7.5
20' LENGTH				20K4	469	402	7.6	20LH10	1030	789	17	18K5	318	199	7.7
12K 1	241	142	5.0	18K5	473	362	7.7	20LH10	1111	851	18	18K6	346	216	8.5
14K 1	284	197	5.2	22K6	550	518	7.7	26' LENGTH				20K5	355	248	8.2
12K 3	302	177	5.5	18LH3	587	446	10	14K1	166	83	5.1	22K5	392	302	8.8
21' LENGTH				18LH4	684	517	11	16K2	216	133	5.5	26K5	466	427	8.1
14K1	196	113	5.1	20LH5	697	589	11	16K3	240	148	5.9	24K6	467	393	8.5
12K3	208	101	5.6	18LH5	772	582	13	18K3	272	190	6.4	22K7	475	364	9.2
22' LENGTH				18LH6	913	674	15	16K4	289	173	6.8	26K6	508	464	8.9
14K1	196	113	5.1	18LH7	949	709	15	20K3	304	236	6.7	28K6	548	541	9.2
12K3	208	101	5.6	20LH8	1024	858	15	18K4	328	222	7.2	20LH4	558	386	12
23' LENGTH				18LH9	1059	790	16	20K4	366	277	7.6	20LH5	602	416	13
14K1	196	113	5.1	20LH9	1121	935	16	18K5	369	249	7.7	18LH5	614	378	14
12K3	208	101	5.6	20LH10	1209	1008	17	22K4	404	338	8.0	20LH6	763	521	15
24' LENGTH				26' LENGTH				20K5	412	310	8.2	20LH7	814	556	16
14K1	196	113	5.1	14K1	166	83	5.1	20K6	449	337	8.9	20LH8	842	575	17
12K3	208	101	5.6	16K2	216	133	5.5	22K5	455	379	8.8	20LH9	918	626	18
25' LENGTH				16K3	240	148	5.9	26K5	542	535	8.8	20LH10	991	673	20
26' LENGTH				18K3	272	190	6.4	27' LENGTH				28' LENGTH			
27' LENGTH				16K4	289	173	6.8	14K1	143	70	5.1	14K1	143	70	5.1
28' LENGTH				20K3	304	236	6.7	16K2	186	106	5.5	16K2	186	106	5.5
29' LENGTH				18K4	328	222	7.2	16K3	207	118	5.8	16K3	207	118	5.8
30' LENGTH				20K4	366	277	7.6	18K3	234	151	6.2	18K3	234	151	6.2
31' LENGTH				18K5	369	249	7.7	16K4	249	138	6.6	16K4	249	138	6.6
32' LENGTH				22K4	404	338	8.0	20K3	261	189	6.7	20K3	261	189	6.7
33' LENGTH				20K5	412	310	8.2	16K5	281	155	7.4	16K5	281	155	7.4
34' LENGTH				20K6	449	337	8.9	18K4	282	177	7.2	18K4	282	177	7.2
35' LENGTH				22K5	455	379	8.8	20K4	315	221	7.5	20K4	315	221	7.5
36' LENGTH				26K5	542	535	8.8	18K5	318	199	7.7	18K5	318	199	7.7
37' LENGTH				28' LENGTH				18K6	346	216	8.5	18K6	346	216	8.5
38' LENGTH				14K1	143	70	5.1	20K5	355	248	8.2	20K5	355	248	8.2
39' LENGTH				16K2	186	106	5.5	22K5	392	302	8.8	22K5	392	302	8.8
40' LENGTH				16K3	207	118	5.8	26K5	466	427	8.1	26K5	466	427	8.1
41' LENGTH				18K3	234	151	6.2	24K6	467	393	8.5	24K6	467	393	8.5
42' LENGTH				16K4	249	138	6.6	22K7	475	364	9.2	22K7	475	364	9.2
43' LENGTH				20K3	261	189	6.7	26K6	508	464	8.9	26K6	508	464	8.9
44' LENGTH				16K5	281	155	7.4	28K6	548	541	9.2	28K6	548	541	9.2
45' LENGTH				18K4	282	177	7.2	20LH4	558	386	12	20LH4	558	386	12
46' LENGTH				20K4	315	221	7.5	20LH5	602	416	13	20LH5	602	416	13
47' LENGTH				18K5	318	199	7.7								

ECONOMICAL JOIST GUIDE
Combined K, VS, LH & DLH Series Load Table

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Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight
29' LENGTH				31' LENGTH (Cont.)				34' LENGTH (Cont.)				37' LENGTH (Cont.)			
16K3	193	106	5.9	24LH7	727	545	15	24K9	423	286	10	26K5	265	183	7.9
18K3	218	136	6.2	24LH8	776	579	16	28K8	456	364	10	24K6	266	169	8.3
16K4	232	124	6.7	24LH9	913	677	19	28K9	496	395	11	28K6	312	232	8.7
20K3	243	170	6.6	24LH10	965	718	20	28K10	516	410	11	26K7	322	221	9.1
18K4	263	159	7.0	24LH11	1017	752	21	28LH6	552	443	13	28K7	348	257	9.3
20K4	293	199	7.4					28LH7	624	499	14	30K7	373	297	9.5
18K5	296	179	7.7					28LH8	668	533	15	28K8	384	282	9.9
22K4	324	242	7.8					24LH8	707	480	17	26K9	387	262	10
20K5	330	223	8.1					28LH9	823	656	17	30K8	413	325	10
22K5	365	272	8.7					24LH9	832	562	20	28K9	418	305	11
26K5	434	384	8.0					28LH10	900	714	19	30K9	449	352	11
24K6	435	354	8.4					28LH11	965	763	20	30K10	474	374	12
28K6	511	486	9.1					28LH12	1060	835	23	28LH6	507	373	13
28K7	550	522	9.5					28LH13	1105	872	23	24LH6	530	331	15
18LH5	581	345	14									28LH7	573	421	15
20LH5	595	395	13									24LH7	588	367	16
18LH6	648	377	15									28LH8	614	449	16
24LH6	708	567	14									24LH8	622	388	17
24LH7	778	623	15									28LH9	755	553	18
20LH7	786	518	16									28LH10	826	602	21
24LH8	830	662	16									28LH11	886	643	21
24LH9	977	775	18									28LH12	974	704	23
24LH10	1033	822	19									28LH13	1015	735	25
24LH11	1088	861	20												
30' LENGTH												38' LENGTH			
18K3	203	123	6.1	24LH6	641	465	14	28K7	389	305	9.4	20K3	141	74	6.3
16K4	216	112	6.6	24LH7	704	511	15	28K8	430	333	9.9	20K4	170	87	7.2
20K3	227	153	6.5	24LH8	752	543	16	26K9	433	310	10	24K6	252	156	8.3
18K4	245	144	6.9	24LH9	884	635	19	28K9	468	361	11	28K6	296	214	8.6
20K4	274	179	7.3	24LH10	935	674	20	28K10	501	389	11	26K7	305	204	9.0
18K5	276	161	7.7	24LH11	985	705	20	28LH6	537	417	13	28K7	329	237	9.2
20K5	308	201	8.0					28LH7	606	471	14	30K7	354	274	9.5
20K6	336	218	8.7					28LH8	649	503	15	28K8	364	260	9.9
22K6	371	266	9.2					24LH8	677	447	17	26K9	367	241	10
26K5	405	346	8.0					28LH9	799	618	18	30K8	391	300	10
24K6	406	319	8.4					28LH10	874	673	20	28K9	396	282	11
26K6	441	377	8.8					28LH11	938	719	21	30K9	426	325	11
28K6	477	439	9.0					28LH12	1030	787	23	30K10	461	353	11
26K7	492	417	9.2					28LH13	1073	822	24	28LH6	494	354	13
28K7	531	486	9.5									24LH6	504	306	15
26K8	544	457	10									28LH7	558	399	15
26K9	550	459	10									24LH7	565	343	16
20LH5	571	366	13									28LH8	597	426	16
18LH6	605	340	15									28LH9	735	524	19
24LH6	684	529	14									28LH10	804	570	20
24LH7	752	582	15									28LH11	863	609	22
24LH8	802	618	16									28LH12	948	667	23
24LH9	944	724	18									28LH13	988	696	26
24LH10	998	768	19												
24LH11	1052	804	21									39' LENGTH			
31' LENGTH															
16K4	203	101	6.6	24LH6	621	437	15	26K7	340	240	9.1	20K3	133	69	6.4
20K3	212	138	6.6	24LH7	683	480	16	24K8	346	222	9.5	20K4	161	81	7.3
18K4	229	130	6.9	24LH8	729	510	16	28K7	367	280	9.4	20K5	181	90	7.9
20K4	256	162	7.4	24LH9	857	597	19	26K8	376	263	9.8	28K6	280	198	8.6
18K5	258	146	7.7	24LH10	906	633	20	30K7	395	323	9.6	26K7	289	188	9.0
22K4	283	198	7.8	24LH11	955	663	22	28K9	442	332	11	28K7	313	219	9.1
20K5	289	182	8.1					28K10	487	366	12	30K7	336	253	9.5
24K4	310	237	8.4					28LH6	521	394	13	28K8	346	240	9.9
20K6	314	198	8.8					28LH7	589	445	14	26K9	348	223	10
22K5	319	222	8.7					28LH8	631	475	15	30K8	371	277	10
22K6	347	241	8.3					24LH8	649	416	17	28K9	376	260	11
26K5	379	314	8.1					28LH9	777	584	18	30K9	404	300	11
24K6	380	289	8.6					28LH10	850	636	19	26K10	413	262	12
22K7	387	267	8.8					28LH11	911	680	21	30K10	449	333	12
28K6	446	397	9.0					28LH12	1001	744	23	32LH7	486	388	13
22K9	465	316	10					28LH13	1043	777	24	32LH8	528	421	14
28K8	550	480	10									28LH7	543	379	15
24LH6	662	495	14									32LH9	662	526	17
												32LH10	732	581	18
												32LH11	802	635	20
												28LH11	841	578	22

ECONOMICAL JOIST GUIDE
Combined K, VS, LH & DLH Series Load Table

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Joist	Allowable Loads (PLF)	Joist Weight	Joist	Allowable Loads (PLF)	Joist Weight	Joist	Allowable Loads (PLF)	Joist Weight	Joist	Allowable Loads (PLF)	Joist Weight		
39' LENGTH (Cont.)			42' LENGTH (Cont.)			45' LENGTH			47' LENGTH (Cont.)				
32LH12	941	742	23	28K10	384	245	12	24K4	146	76	7.8		
28LH13	962	661	26	30K10	413	282	12	26K5	179	101	7.9		
32LH13	1050	825	25	30K11	417	284	12	26K6	194	110	8.5		
32LH14	1081	850	26	32LH7	451	334	14	28K6	210	128	8.6		
32LH15	1117	878	26	32LH8	490	362	15	26K7	217	122	9.0		
40' LENGTH			28LH7	505	326	16	24K8	220	113	9.5			
20K3	127	64	6.4	28LH8	540	348	16	28K7	234	142	9.2		
20K4	153	75	7.2	32LH9	614	453	17	24K10	285	144	12		
22K4	169	91	7.6	32LH10	679	500	19	26K10	310	170	12		
20K5	172	84	7.9	32LH11	744	547	21	28K10	334	198	12		
24K7	253	148	8.9	32LH12	874	639	24	30K10	359	229	12		
26K7	275	174	9.0	32LH13	974	710	26	30K11	389	246	13		
28K7	297	203	9.1	32LH14	1003	732	27	36LH8	414	323	13		
30K7	319	234	9.4	32LH15	1037	756	28	32LH7	421	291	14		
28K8	328	222	9.9	43' LENGTH			32LH8	457	315	15			
26K9	331	207	10	22K4	146	73	7.5	36LH9	531	412	16		
28K9	357	241	11	24K4	160	88	8.0	36LH10	584	455	17		
30K9	384	278	11	26K5	196	116	7.9	36LH11	638	495	19		
26K10	393	243	12	30K7	276	188	9.3	36LH12	763	590	21		
30K10	438	315	12	26K9	286	166	10	32LH12	815	556	26		
32LH7	474	368	13	30K8	305	206	10	36LH13	898	692	25		
32LH8	514	400	14	28K9	309	194	11	36LH14	990	760	28		
28LH7	529	360	15	30K9	332	223	11	36LH15	1043	800	29		
32LH9	645	500	16	26K10	339	195	12	46' LENGTH					
32LH10	713	552	18	28K10	367	228	12	24K4	139	71	7.9		
32LH11	782	604	20	30K10	394	263	12	26K5	171	95	7.9		
32LH12	918	705	23	30K11	407	270	13	26K6	186	103	8.5		
32LH13	1024	784	26	36LH8	434	354	13	28K6	201	120	8.6		
32LH14	1054	807	26	32LH7	441	318	14	26K7	207	114	9.1		
32LH15	1089	834	27	32LH8	478	346	15	24K8	211	106	9.6		
41' LENGTH			36LH9	555	451	16	26K8	229	125	9.7			
22K4	161	85	7.6	36LH10	612	499	17	26K10	296	159	12		
24K4	176	101	8.0	36LH11	668	543	18	28K10	320	186	12		
24K7	241	137	8.9	32LH11	727	522	21	30K10	344	214	12		
26K7	262	162	9.0	36LH12	799	647	21	30K11	380	236	14		
24K8	266	150	9.5	32LH12	853	610	25	36LH8	405	309	13		
24K9	290	162	10	36LH13	940	758	25	32LH7	412	278	14		
30K7	303	217	9.5	32LH13	952	678	27	28LH7	427	251	16		
26K9	315	192	10	36LH14	1036	833	28	32LH8	447	302	16		
28K9	340	224	11	36LH15	1092	877	29	36LH9	519	394	16		
30K9	365	258	11	44' LENGTH			36LH10	572	435	18			
26K10	374	225	12	22K4	139	68	7.5	36LH11	624	474	19		
30K10	427	300	12	24K4	153	82	8.1	32LH11	679	455	22		
32LH7	462	351	13	22K5	157	76	8.3	36LH12	747	564	23		
32LH8	502	380	14	26K5	187	108	7.9	32LH12	797	532	26		
28LH7	516	342	16	26K6	204	118	8.5	36LH13	878	662	26		
32LH9	630	476	17	24K7	209	110	8.9	36LH14	968	727	28		
32LH10	696	525	19	28K6	220	137	8.6	36LH15	1020	765	30		
32LH11	762	574	21	30K8	291	192	10	47' LENGTH					
28LH11	799	523	23	28K9	295	181	11	24K4	133	67	7.9		
32LH12	895	671	23	30K9	317	208	11	26K5	164	89	7.9		
32LH13	998	746	26	26K10	324	182	12	26K6	178	96	8.5		
32LH14	1028	768	26	28K10	350	212	12	28K6	192	112	8.6		
32LH15	1062	794	28	30K10	376	245	12	24K8	202	99	9.6		
42' LENGTH			30K11	398	258	13	24K10	261	126	12			
22K4	153	79	7.6	36LH8	424	338	13	26K10	284	149	12		
24K7	229	127	8.9	32LH7	431	304	14	28K10	306	174	12		
26K7	249	150	9.0	32LH8	467	330	15	30K10	329	201	12		
24K8	253	139	9.6	36LH9	543	431	16	36LH7	360	270	12		
28K7	269	175	9.2	36LH10	598	476	17	30K11	372	226	14		
26K8	275	164	9.7	36LH11	653	518	18	36LH8	396	296	13		
30K7	289	202	9.5	36LH12	781	617	21	32LH7	403	266	15		
26K9	300	178	10	32LH12	834	582	25	28LH7	410	236	16		
30K8	320	221	10	36LH13	918	724	25	32LH8	437	289	16		
28K9	324	208	11	36LH14	1012	795	28	28LH8	438	525	17		
30K9	348	240	11	36LH15	1067	837	29	36LH9	508	377	17		
26K10	356	210	12	48' LENGTH			36LH10	559	417	18			
43' LENGTH			24K4	128	63	7.9	36LH11	611	454	20			
24K4	128	63	7.9	26K5	157	83	7.8	32LH11	664	436	22		
26K5	157	83	7.8	26K6	171	90	8.4	49' LENGTH					
26K6	171	90	8.4	24K7	175	85	8.9	26K5	150	78	7.9		
28K6	184	105	8.6	24K8	194	93	9.6	26K6	164	85	8.4		
24K6	194	93	9.6	24K10	250	118	12	28K6	177	99	8.6		
26K10	272	140	12	26K10	272	140	12	26K7	183	94	9.1		
28K10	294	163	12	30K10	315	188	12	28K7	197	110	9.3		
30K10	315	188	12	30K12	365	216	14	26K8	202	103	9.7		
36LH8	388	284	14	36LH8	388	284	14	30K7	212	127	9.4		
28LH7	394	222	16	32LH7	428	277	16	28K8	218	120	9.9		
32LH8	428	277	16	36LH9	497	362	17	26K9	220	112	10		
36LH9	497	362	17	36LH10	548	400	18	30K8	234	139	10		
36LH10	548	400	18	36LH11	598	435	20	30K10	303	177	12		
36LH11	598	435	20	32LH11	650	418	23	30K11	347	202	14		
32LH11	650	418	23	36LH12	715	518	23	30K12	357	207	14		
36LH12	715	518	23	32LH12	764	489	27	28LH7	379	209	16		
32LH12	764	489	27	36LH13	841	607	26	32LH8	419	266	16		
36LH13	841	607	26	36LH14	927	667	29	36LH9	487	347	17		
36LH14	927	667	29	36LH15	978	703	31	36LH10	536	383	18		
40LH15	1009	810	31	40LH15	1009	810	31	36LH11	586	417	20		
40LH16	1112	890	34	40LH16	1112	890	34	32LH11	637	401	23		
49' LENGTH			50' LENGTH			26K5	144	73	7.9	36LH12	701	497	24
26K5	150	78	7.9	26K5	144	73	7.9	26K6	157	80	8.5		
26K6	164	85	8.4	26K6	157	80	8.5	26K7	175	89	9.1		
28K6	177	99	8.6	26K7	175	89	9.1	28K7	189	103	9.3		
26K7	183	94	9.1	28K7	189	103	9.3	26K8	194	97	9.7		
28K7	197	110	9.3	26K8	194	97	9.7						
26K8	202	103	9.7										
30K7	212	127	9.4										
28K8	218	120	9.9										
26K9	220	112	10										
30K8	234	139	10										
30K10	303	177	12										
30K11	347	202	14										
30K12	357	207	14										
28LH7	379	209	16										
32LH8	419	266	16										
36LH9	487	347	17										
36LH10	536	383	18										
36LH11	586	417	20										
32LH11	637	401	23										
36LH12	701	497	24										
32LH12	748	469	27										
36LH13	824	583	28										
32LH13	834	521	30										
32LH14	859	536	31										
36LH14	908	640	30										
36LH15	958	674	31										
40LH15	988	777	31										
40LH16	1089	854	34										
50' LENGTH													
26K5	144	73	7.9										
26K6	157	80	8.5										
26K7	175	89	9.1										
28K7	189	103	9.3										
26K8	194	97	9.7										

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METAL PRODUCTS RESOURCES ASC. S.A.S.

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Combined K, VS, LH & DLH Series Load Table

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Joist	Allowable Loads (PLF)		Joist Weight
59' LENGTH (Cont.)			
48LH17	982	769	37
44LH17	992	710	39
60' LENGTH			
30K7	141	69	9.4
30K8	156	75	10
30K9	169	81	11
30K10	201	96	12
30K11	231	109	14
40LH8	278	182	13
48LH10	335	264	15
44LH10	370	265	16
44LH11	401	287	17
36LH10	426	248	20
40LH11	439	283	19
36LH11	465	269	23
36LH12	557	322	25
44LH13	588	419	25
36LH13	654	376	30
44LH14	677	480	28
36LH14	729	412	34
48LH15	746	577	28
36LH15	781	448	36
44LH15	788	558	31
48LH16	860	665	32
44LH16	908	642	36
48LH17	965	744	37
44LH17	975	686	39
61' LENGTH			
40LH8	274	176	13
48LH10	330	256	15
44LH10	364	257	16
44LH11	394	277	17
40LH10	396	253	18
36LH10	413	236	21
40LH11	432	274	21
36LH11	451	257	23
44LH12	488	342	21
40LH12	526	334	25
44LH13	579	405	25
40LH13	620	391	28
48LH14	638	487	26
44LH14	666	464	28
48LH15	734	558	29
44LH15	775	540	31
40LH15	793	500	36
48LH16	846	643	33
44LH16	893	621	37
48LH17	949	719	37
44LH17	959	664	39
62' LENGTH			
40LH8	269	170	14
48LH10	324	247	15
44LH10	358	248	17
44LH11	388	268	18
40LH10	389	245	19
36LH10	401	225	21
40LH11	425	265	21
36LH11	438	246	23
44LH12	480	331	21
40LH12	517	323	25
44LH13	569	392	25
40LH13	610	379	29
48LH14	628	472	26
44LH14	655	450	29
52DLH14	736	584	29
44LH15	762	522	31
52DLH15	827	658	32
63' LENGTH			
40LH8	265	165	14
48LH10	319	239	15
40LH9	348	215	18
44LH10	353	240	17
44LH11	381	260	18
40LH10	383	237	19
36LH10	389	215	21
40LH11	418	257	21
36LH11	425	234	23
44LH12	472	321	22
40LH12	509	313	25
44LH13	560	380	25
40LH13	600	367	28
52DLH13	634	506	26
44LH14	645	435	29
52DLH14	724	565	29
44LH15	750	506	31
52DLH15	814	637	32
48LH16	819	603	33
44LH16	865	582	37
52DLH16	878	708	35
48LH17	919	674	38
44LH17	929	622	40
52DLH17	1010	809	40
64' LENGTH			
40LH8	261	160	15
48LH10	314	232	15
40LH9	342	209	18
44LH10	347	233	17
44LH11	375	252	18
40LH10	377	230	19
36LH10	378	206	21
40LH11	412	249	21
48LH12	430	314	19
44LH12	465	311	22
36LH12	493	267	25
44LH13	551	368	25
40LH13	591	355	28
52DLH13	625	490	26
44LH14	635	422	29
52DLH14	713	547	29
44LH15	738	490	31
52DLH15	801	617	32
48LH16	806	584	34
52DLH16	864	686	35
48LH17	905	653	39
44LH17	914	602	43
52DLH17	994	783	40
65' LENGTH			
40LH8	257	155	15
48LH10	309	225	15
44LH10	342	226	17
44LH11	370	244	18
40LH10	371	223	19
40LH11	405	241	21
48LH12	424	305	20
44LH12	458	301	23
36LH12	478	255	25
40LH12	493	294	25
52DLH12	506	392	22
65' LENGTH (Cont.)			
44LH13	543	357	26
40LH13	581	344	28
52DLH13	614	475	26
44LH14	625	409	29
52DLH14	702	531	30
44LH15	727	475	31
52DLH15	789	598	33
52DLH16	851	665	34
44LH17	900	584	43
52DLH17	979	759	40
66' LENGTH			
40LH8	254	150	15
48LH10	305	216	16
44LH10	337	219	17
44LH11	364	237	18
40LH10	367	216	20
40LH11	399	234	22
48LH12	417	295	20
44LH12	451	292	23
40LH12	486	285	25
52DLH12	498	380	23
44LH13	535	346	26
52DLH13	605	461	26
44LH14	615	396	31
52DLH14	691	515	30
44LH15	716	461	31
40LH15	734	427	36
52DLH15	777	580	34
48LH16	781	549	35
52DLH16	838	645	37
44LH17	886	566	43
52DLH17	964	736	40
67' LENGTH			
40LH8	247	144	15
44LH9	300	193	16
40LH9	323	188	18
44LH10	332	212	18
44LH11	359	230	18
56DLH11	422	363	20
44LH12	444	283	23
36LH12	450	232	25
40LH12	472	273	25
52DLH12	491	369	23
44LH13	527	336	26
48LH14	581	404	27
52DLH13	596	447	27
44LH14	606	385	30
40LH14	638	367	34
48LH15	668	462	31
52DLH14	681	499	31
44LH15	705	447	31
40LH15	712	408	36
52DLH15	765	563	34
48LH16	770	533	35
52DLH16	825	626	37
48LH17	864	596	40
44LH17	873	549	44
52DLH17	950	715	40
68' LENGTH			
40LH8	241	138	15
44LH9	296	187	17
40LH9	315	180	18
44LH10	327	206	18
56DLH11	415	352	20
44LH12	437	275	23
40LH12	459	261	25
44LH13	519	326	26
68' LENGTH (Cont.)			
48LH14	572	392	28
52DLH13	587	434	27
44LH14	597	373	30
48LH15	658	449	32
52DLH14	671	485	31
44LH15	695	434	31
52DLH15	754	546	34
48LH16	758	517	36
52DLH16	813	608	37
48LH17	851	578	41
44LH17	860	533	45
52DLH17	935	694	42
69' LENGTH			
40LH8	234	132	15
44LH9	291	182	17
40LH9	306	173	18
44LH10	322	200	18
40LH10	338	190	20
44LH11	348	216	20
56DLH11	409	342	21
44LH12	431	267	23
40LH12	447	251	25
48LH13	478	323	24
44LH13	511	317	29
52DLH13	578	421	27
44LH14	588	363	31
48LH15	648	436	32
52DLH14	661	471	31
44LH15	684	421	31
56DLH15	735	568	32
52DLH15	743	530	34
48LH16	747	502	36
52DLH16	801	590	38
48LH17	839	562	41
44LH17	848	518	45
52DLH17	922	674	44
70' LENGTH			
40LH8	228	127	15
40LH9	298	166	18
44LH10	317	195	18
40LH10	329	183	20
44LH11	343	210	20
36LH11	348	173	23
40LH11	358	198	22
56DLH11	403	332	21
44LH12	425	259	24
40LH12	435	241	25
52DLH12	469	338	24
48LH13	471	313	24
44LH13	504	307	27
48LH14	556	370	29
52DLH13	570	409	29
44LH14	580	352	31
48LH15	639	423	32
52DLH14	652	457	31
44LH15	675	409	31
52DLH15	732	515	34
48LH16	736	488	36
52DLH16	789	573	37
48LH17	827	546	41
44LH17	835	503	45
56DLH17	901	700	40
52DLH17	909	654	44
71' LENGTH			
40LH8	222	122	15
44LH9	283	172	17
40LH9	291	160	18

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Combined K, VS, LH & DLH Series Load Table

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Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight
71' LENGTH (Cont.)				74' LENGTH				76' LENGTH (Cont.)				79' LENGTH (Cont.)			
44LH10	313	189	18	40LH8	206	108	15	44LH17	769	428	47	48LH16	652	383	40
40LH10	321	176	20	40LH9	269	141	18	60DLH17	823	532	41	60DLH16	689	514	38
44LH11	338	204	20	44LH9	272	158	18	52DLH17	837	555	45	56DLH16	693	482	38
40LH11	349	190	22	40LH10	297	156	20	60DLH18	950	714	47	52DLH16	699	450	41
56DLH11	398	323	21	44LH10	300	174	19	77' LENGTH				48LH17	732	428	45
44LH12	419	252	24	56DLH11	381	297	21	40LH8	192	97	16	64DLH17	788	622	41
40LH12	424	231	25	44LH12	402	232	25	44LH9	253	141	18	60DLH17	792	585	44
52DLH12	463	328	24	52DLH12	444	302	24	44LH10	279	155	19	52DLH17	805	513	48
48LH13	464	305	26	48LH13	445	280	25	48LH11	283	172	18	60DLH18	914	660	47
44LH13	497	299	28	44LH13	477	275	29	44LH11	302	168	21	80' LENGTH			
40LH13	500	271	30	48LH14	525	331	29	44LH12	374	207	25	40LH8	178	86	15
52DLH13	562	398	28	52DLH13	539	366	29	52DLH11	382	256	24	40LH9	233	113	18
44LH14	572	342	31	44LH14	549	315	31	52DLH12	427	279	26	44LH9	236	127	18
52DLH14	642	444	31	52DLH14	616	409	32	48LH13	428	259	27	40LH10	255	124	20
44LH15	665	398	31	44LH15	639	366	31	44LH13	444	246	28	44LH10	260	139	19
52DLH15	722	501	35	60DLH15	669	525	32	52DLH13	518	338	30	48LH11	272	160	18
52DLH16	778	557	37	52DLH15	692	461	37	40LH15	538	268	36	44LH11	282	151	21
48LH17	815	530	41	52DLH16	747	513	38	56DLH14	577	404	32	52DLH10	335	217	22
44LH17	824	489	45	48LH17	782	488	45	52DLH14	592	378	34	44LH12	347	185	25
56DLH17	889	680	40	44LH17	790	450	47	44LH15	593	326	31	52DLH11	368	237	24
52DLH17	896	636	44	60DLH17	846	667	40	60DLH15	643	484	34	52DLH12	410	258	26
60DLH18	1017	818	46	52DLH17	859	585	45	52DLH15	665	425	38	48LH13	412	240	26
72' LENGTH				60DLH18	976	753	46	60DLH16	707	541	36	44LH13	413	220	29
				75' LENGTH				56DLH16	711	508	37	48LH14	486	283	32
36LH7	196	95	15	40LH8	201	104	15	52DLH16	717	473	40	52DLH13	498	313	31
36LH8	215	104	16	44LH9	265	152	18	48LH17	751	450	45	60DLH14	527	380	30
40LH8	217	117	16	40LH10	290	150	20	52DLH17	826	540	46	56DLH14	555	374	32
44LH9	279	167	17	44LH10	293	168	19	60DLH18	938	695	47	52DLH14	570	350	35
40LH9	283	153	18	56DLH11	376	289	21	78' LENGTH				52DLH15	640	394	38
44LH10	308	184	18	44LH12	393	224	25	40LH8	187	93	16	64DLH16	675	533	35
40LH10	313	169	20	48LH13	439	273	25	44LH9	247	136	18	60DLH16	680	501	38
44LH11	333	199	19	44LH13	466	265	28	44LH10	272	150	19	56DLH16	684	470	38
56DLH11	392	314	20	48LH14	518	322	29	48LH11	279	168	18	52DLH16	690	438	41
44LH12	413	245	25	56DLH13	532	356	29	44LH11	295	162	21	48LH17	723	417	47
52DLH12	456	319	24	44LH14	534	302	31	44LH12	365	200	25	60DLH17	782	570	44
48LH13	458	296	26	52DLH14	608	398	33	52DLH11	377	249	24	52DLH17	795	500	48
44LH13	490	291	29	44LH15	623	352	31	52DLH12	421	272	26	60DLH18	903	644	48
52DLH13	554	387	28	60DLH15	660	511	32	48LH13	422	252	26	81' LENGTH			
44LH14	564	333	31	52DLH15	683	449	37	44LH13	433	236	28	44LH9	231	122	18
52DLH14	633	432	31	48LH16	687	425	39	52DLH13	511	329	30	44LH10	254	134	19
44LH15	656	387	31	60DLH16	726	571	35	40LH15	524	258	36	48LH11	269	156	18
52DLH15	712	487	35	52DLH16	737	499	40	56DLH14	569	394	32	44LH11	276	146	21
48LH16	716	461	38	48LH17	771	475	45	52DLH14	585	368	34	52DLH10	331	211	22
52DLH16	767	542	38	44LH17	780	438	47	52DLH15	657	415	38	44LH12	339	179	25
44LH17	812	475	45	60DLH17	834	649	40	48LH16	661	393	40	48LH12	340	196	23
52DLH17	883	618	44	52DLH17	848	570	45	60DLH16	698	528	38	52DLH11	363	231	23
60DLH18	1003	796	46	60DLH18	963	733	47	56DLH16	702	495	38	52DLH12	405	252	26
73' LENGTH				76' LENGTH				52DLH16	708	461	41	48LH13	407	234	27
40LH8	211	112	15	40LH8	196	100	15	48LH17	742	439	45	48LH14	480	276	32
44LH9	275	162	17	44LH9	259	146	17	52DLH17	815	526	45	52DLH13	492	305	31
40LH9	276	147	18	40LH10	283	144	20	60DLH18	926	677	46	56DLH14	548	385	32
44LH10	304	179	18	44LH10	286	162	19	79' LENGTH				52DLH14	563	341	35
40LH10	305	162	20	48LH11	287	177	18	40LH8	183	90	15	52DLH15	632	384	38
44LH11	329	193	19	44LH11	310	175	21	44LH9	242	131	18	64DLH16	667	520	36
56DLH11	387	305	20	52DLH10	353	240	21	44LH10	266	144	19	60DLH16	672	489	38
44LH12	407	238	25	44LH12	383	215	25	48LH11	276	164	18	52DLH16	682	428	42
52DLH12	450	311	24	52DLH11	387	263	23	44LH11	289	157	21	48LH17	714	407	47
48LH13	451	288	26	52DLH12	432	286	26	52DLH10	339	222	22	64DLH17	769	592	41
44LH13	483	283	29	48LH13	433	266	26	44LH12	356	192	25	52DLH17	785	488	48
52DLH13	546	376	28	44LH13	454	254	28	52DLH11	372	243	24	64DLH18	888	669	47
44LH14	556	324	31	48LH14	511	313	30	52DLH12	416	265	26	60DLH18	891	628	53
52DLH14	625	420	32	52DLH13	525	347	30	48LH13	417	246	26	68DLH19	998	803	52
44LH15	647	376	31	52DLH14	600	388	34	44LH13	423	228	29	82' LENGTH			
52DLH15	702	474	37	44LH15	608	339	31	52DLH13	505	321	30	44LH9	226	118	18
48LH16	706	448	37	60DLH15	652	497	32	56DLH14	562	384	31	44LH10	249	130	19
52DLH16	757	527	38	52DLH15	674	437	37	52DLH14	577	359	34	44LH11	269	140	21
44LH17	801	462	47	60DLH16	716	556	36	52DLH15	648	404	38	44LH12	331	172	25
52DLH17	871	601	44	52DLH16	727	486	40								
60DLH18	989	774	46	48LH17	761	462	45								

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Joist	Allowable Loads (PLF)	Joist Weight	Joist	Allowable Loads (PLF)	Joist Weight	Joist	Allowable Loads (PLF)	Joist Weight	Joist	Allowable Loads (PLF)	Joist Weight						
82' LENGTH (Cont.)			84' LENGTH (Cont.)			87' LENGTH (Cont.)			89' LENGTH (Cont.)								
52DLH11	359	225	24	68DLH19	962	746	54	44LH14	396	193	31	52DLH17	714	404	52		
52DLH12	400	246	27	85' LENGTH			48LH14	425	227	32	72DLH18	771	581	47			
48LH13	402	228	28	44LH9	211	108	18	56DLH13	451	283	31	68DLH18	788	586	48		
44LH14	446	231	31	44LH10	233	117	19	52DLH13	458	264	33	60DLH18	811	520	53		
52DLH13	486	298	31	44LH11	252	127	21	44LH15	466	227	31	72DLH19	905	659	54		
60DLH14	514	362	31	44LH12	308	155	25	60DLH14	485	321	32	68DLH19	908	665	55		
44LH15	524	271	31	52DLH10	315	192	24	48LH15	488	260	36	90' LENGTH					
52DLH14	556	333	35	52DLH11	346	210	25	52DLH14	524	295	37	48LH10	208	108	18		
60DLH15	604	427	34	52DLH12	386	229	27	64DLH15	552	403	35	48LH11	225	117	20		
52DLH15	624	375	39	44LH14	415	207	31	56DLH15	583	357	38	52DLH10	298	171	24		
64DLH16	659	508	36	56DLH13	462	297	30	52DLH15	588	333	41	52DLH11	327	187	26		
60DLH16	664	477	38	52DLH13	469	277	32	64DLH16	621	451	38	48LH13	338	175	29		
52DLH16	673	417	44	44LH15	488	243	31	56DLH16	629	397	41	52DLH12	365	204	29		
48LH17	706	397	47	60DLH14	496	336	31	52DLH16	635	370	45	48LH14	399	206	32		
52DLH17	775	476	48	48LH15	510	278	36	60DLH17	719	482	46	60DLH13	422	282	30		
64DLH18	877	653	46	52DLH14	536	310	37	56DLH17	725	452	48	56DLH13	436	265	31		
60DLH18	880	613	53	60DLH15	582	397	34	68DLH18	807	613	46	52DLH13	443	247	34		
68DLH19	986	783	52	56DLH15	596	374	38	60DLH18	830	544	53	60DLH14	468	300	32		
83' LENGTH			60DLH16	640	444	39	88' LENGTH			68DLH19	929	696	54	52DLH14	507	276	38
44LH9	221	114	18	56DLH16	644	416	41	44LH9	198	96	18	64DLH15	533	376	34		
44LH10	243	125	19	52DLH16	650	388	45	44LH10	218	106	19	60DLH15	550	354	37		
44LH11	264	136	21	48LH17	660	358	47	44LH11	236	115	21	64DLH16	600	421	39		
44LH12	323	166	25	72DLH17	690	564	38	44LH12	287	139	25	60DLH16	604	396	40		
48LH12	329	185	24	60DLH17	736	505	45	52DLH10	305	179	23	52DLH16	614	346	45		
52DLH11	354	220	25	56DLH17	742	474	46	44LH14	387	187	31	72DLH17	651	503	40		
52DLH12	396	240	27	52DLH17	748	443	52	48LH14	416	220	32	60DLH17	695	504	46		
44LH14	436	223	31	64DLH18	846	607	47	52DLH11	334	196	26	72DLH18	763	568	46		
60DLH13	457	332	28	60DLH18	849	570	53	52DLH12	373	213	27	68DLH18	780	573	48		
56DLH13	473	311	30	68DLH19	951	729	54	44LH14	387	187	31	60DLH18	802	508	53		
52DLH13	480	291	32	86' LENGTH			48LH14	416	220	32	72DLH19	894	644	54			
60DLH14	508	353	30	44LH9	207	103	18	56DLH13	446	277	31	68DLH19	898	650	55		
44LH15	512	261	31	44LH10	228	113	19	52DLH13	453	258	33	91' LENGTH					
52DLH14	549	325	35	44LH11	247	123	21	44LH15	455	219	31	48LH10	204	105	18		
60DLH15	596	417	34	44LH12	300	149	25	60DLH14	479	314	32	48LH11	220	113	20		
56DLH15	611	392	37	52DLH10	312	187	24	52DLH14	518	289	37	52DLH10	291	165	24		
60DLH16	656	466	38	52DLH11	342	205	26	64DLH15	545	393	35	52DLH11	320	181	26		
52DLH16	665	407	44	52DLH12	382	223	27	60DLH15	562	370	37	48LH13	332	170	29		
48LH17	690	383	47	44LH14	406	200	31	56DLH15	582	325	41	52DLH12	357	197	29		
60DLH17	754	529	45	56DLH13	456	290	30	64DLH16	614	440	38	48LH14	390	199	32		
52DLH17	766	465	48	52DLH13	463	271	33	52DLH16	627	362	45	60DLH13	417	276	30		
64DLH18	866	637	48	60DLH14	490	329	32	72DLH17	666	526	41	52DLH13	433	239	33		
60DLH18	870	598	53	48LH15	499	269	36	60DLH17	711	471	46	48LH15	448	228	36		
68DLH19	974	765	54	52DLH14	530	302	37	56DLH17	716	442	48	64DLH14	460	313	32		
84' LENGTH			60DLH15	575	388	36	52DLH17	722	413	52	60DLH14	463	293	34			
44LH9	216	110	18	56DLH15	589	365	38	72DLH18	780	594	47	52DLH14	497	266	38		
44LH10	238	121	19	52DLH15	595	341	41	68DLH18	797	599	48	64DLH15	527	368	35		
44LH11	258	131	21	68DLH16	626	488	37	60DLH18	820	532	53	60DLH15	544	346	37		
44LH12	315	160	25	64DLH16	628	461	38	72DLH19	915	674	54	64DLH16	593	412	39		
52DLH10	319	196	23	60DLH16	633	434	40	68DLH19	918	680	56	60DLH16	598	387	42		
48LH12	322	179	24	56DLH16	636	407	41	89' LENGTH			52DLH16	601	335	45			
52DLH11	350	215	25	52DLH16	642	379	45	48LH10	212	112	18	60DLH17	687	440	46		
52DLH12	391	234	27	48LH17	646	346	47	48LH11	229	120	20	72DLH18	754	555	46		
44LH14	425	215	31	72DLH17	682	551	38	52DLH10	301	175	23	67DLH18	771	560	48		
56DLH13	467	304	30	60DLH17	727	493	45	52DLH11	330	191	26	60DLH18	793	497	53		
52DLH13	475	284	32	56DLH17	733	463	48	52DLH12	369	209	28	72DLH19	885	630	54		
44LH15	500	252	31	52DLH17	739	433	52	48LH14	407	212	32	68DLH19	888	636	55		
60DLH14	502	345	31	68DLH18	816	627	46	52DLH13	448	253	33	92' LENGTH					
48LH15	521	287	36	60DLH18	839	557	53	60DLH14	474	307	32	48LH10	200	102	18		
52DLH14	543	317	37	68DLH19	940	712	54	52DLH14	512	282	38	48LH11	216	110	20		
60DLH15	589	407	34	87' LENGTH			64DLH15	539	385	34	52DLH10	285	159	24			
56DLH15	604	383	38	44LH9	202	99	18	60DLH15	556	362	37	52DLH11	313	174	26		
60DLH16	648	455	39	44LH10	223	110	19	52DLH15	575	318	41	48LH13	325	164	29		
52DLH16	657	397	44	44LH11	242	119	21	64DLH16	607	431	38	52DLH12	349	191	29		
48LH17	675	371	47	44LH12	293	144	25	60DLH16	611	405	40	56DLH12	352	209	27		
60DLH17	745	517	45	52DLH10	308	183	24	52DLH16	620	354	45	48LH14	383	193	32		
56DLH17	751	485	46	52DLH11	338	200	26	72DLH17	659	514	41	60DLH13	412	270	30		
52DLH17	757	454	52	52DLH12	377	218	27	60DLH17	703	460	46	52DLH13	424	231	33		
64DLH18	856	622	48				56DLH17	708	432	49							
60DLH18	859	584	53														

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92' LENGTH (Cont.)				95' LENGTH				97' LENGTH (Cont.)				100' LENGTH (Cont.)			
Joist	Allowable Loads (PLF)		Joist Weight	Joist	Allowable Loads (PLF)		Joist Weight	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)
56DLH13	427	253	32	48LH10	188	93	18	64DLH15	494	324	37	52DLH13	358	180	33
48LH15	439	221	36	48LH11	204	100	20	60DLH15	510	305	40	60DLH13	379	228	32
60DLH14	458	287	34	52DLH10	267	145	23	72DLH16	537	380	38	56DLH13	386	209	33
52DLH14	486	258	38	52DLH11	293	158	26	64DLH16	557	362	42	52DLH14	413	201	37
64DLH15	521	360	35	52DLH12	327	173	29	60DLH16	561	341	44	60DLH14	421	243	35
60DLH15	538	339	38	56DLH12	341	196	27	72DLH17	604	433	42	56DLH14	435	234	38
52DLH15	545	291	42	48LH14	360	176	32	64DLH17	641	412	46	64DLH15	480	304	37
56DLH15	551	319	41	52DLH13	397	209	33	56DLH17	650	363	51	60DLH15	495	287	41
60DLH16	591	379	42	60DLH13	399	253	31	72DLH18	708	488	48	72DLH16	521	358	39
56DLH16	595	355	45	48LH15	413	201	36	64DLH18	741	466	53	60DLH16	544	320	45
60DLH17	680	431	46	60DLH14	444	269	34	60DLH18	744	437	59	72DLH17	586	407	44
72DLH18	746	543	46	52DLH14	457	234	37	72DLH19	830	554	55	64DLH17	622	388	49
68DLH18	763	548	48	56DLH14	467	265	37	68DLH19	833	559	60	72DLH18	686	459	48
60DLH18	784	486	53	68DLH15	477	340	34	98' LENGTH				64DLH18	718	438	55
68DLH19	878	622	55	60DLH15	521	318	38	52DLH10	251	132	24	60DLH18	721	411	59
93' LENGTH				56DLH15	533	299	41	52DLH11	275	144	26	72DLH19	805	521	58
48LH10	196	99	18	68DLH16	566	400	38	60DLH12	307	158	29	68DLH19	808	526	61
48LH11	212	106	20	64DLH16	568	378	41	56DLH12	318	197	27	101' LENGTH			
52DLH10	279	154	23	60DLH16	573	355	44	56DLH13	331	184	30	52DLH10	236	120	23
52DLH11	306	169	26	56DLH16	576	333	45	60DLH13	387	238	32	52DLH11	259	132	26
48LH13	318	159	29	72DLH17	617	451	42	56DLH14	401	223	34	56DLH12	289	144	29
52DLH12	342	185	29	60DLH17	658	404	48	56DLH15	430	253	34	60DLH12	309	185	27
56DLH12	349	204	27	56DLH17	663	379	51	56DLH16	453	249	38	56DLH13	312	168	29
48LH14	375	187	32	72DLH18	723	509	48	64DLH15	489	317	37	52DLH13	351	174	33
52DLH13	414	224	33	60DLH18	760	456	56	60DLH15	505	298	40	60DLH13	375	224	32
48LH15	430	214	36	72DLH19	847	578	55	72DLH16	531	373	39	56DLH13	379	204	33
60DLH14	453	281	34	68DLH19	850	583	60	64DLH16	551	355	42	52DLH14	405	194	37
52DLH14	476	249	38	96' LENGTH				60DLH16	555	334	44	60DLH14	417	238	35
56DLH14	477	277	37	48LH10	185	90	18	56DLH17	559	313	46	56DLH14	427	228	37
60DLH15	532	332	38	48LH11	200	91	20	72DLH17	588	424	43	68DLH15	449	301	35
52DLH15	533	292	42	52DLH10	261	140	24	64DLH17	635	404	46	64DLH15	475	298	39
56DLH15	545	312	41	52DLH11	287	153	26	56DLH17	643	356	51	60DLH15	490	281	41
68DLH16	578	417	38	48LH13	300	145	29	72DLH18	700	478	48	60DLH16	538	314	46
60DLH16	585	371	42	52DLH12	320	168	29	64DLH18	733	456	53	72DLH17	580	399	44
56DLH16	588	348	45	60DLH12	325	205	27	60DLH18	736	428	59	64DLH17	616	380	49
64DLH17	669	448	46	56DLH12	338	192	29	72DLH19	821	543	55	60DLH17	619	357	52
60DLH17	672	421	49	48LH14	353	171	32	68DLH19	824	548	60	72DLH18	679	450	51
56DLH17	678	395	51	52DLH13	389	203	33	99' LENGTH				64DLH18	711	430	56
68DLH18	754	536	48	60DLH13	395	248	32	52DLH10	246	128	24	60DLH18	714	403	59
64DLH18	773	507	53	48LH15	405	195	36	52DLH11	270	140	26	72DLH19	797	511	60
60DLH18	776	476	56	64DLH14	436	281	32	52DLH12	301	153	29	68DLH19	800	516	61
68DLH19	869	609	54	60DLH14	439	264	34	56DLH12	315	193	27	102' LENGTH			
94' LENGTH				52DLH14	447	227	38	56DLH13	324	178	29	52DLH10	231	116	23
48LH10	192	96	18	56DLH14	462	260	38	56DLH14	366	185	33	52DLH11	254	128	26
48LH11	208	103	20	60DLH15	515	311	38	60DLH13	383	233	33	52DLH12	284	140	29
52DLH10	273	150	23	48LH17	525	252	47	56DLH13	394	216	33	56DLH12	306	163	29
52DLH11	299	164	26	64DLH16	562	370	41	60DLH14	426	248	34	52DLH13	344	170	33
48LH13	312	154	29	60DLH16	567	348	44	56DLH14	444	242	38	64DLH13	358	232	31
52DLH12	334	179	29	56DLH16	570	326	45	64DLH15	484	311	37	60DLH13	372	219	34
56DLH12	345	200	27	72DLH17	610	442	42	60DLH15	500	292	40	52DLH14	397	189	37
48LH14	367	181	32	64DLH17	648	421	46	64DLH16	545	348	42	60DLH14	413	233	35
52DLH13	406	216	33	60DLH17	651	395	49	72DLH16	549	327	44	56DLH14	419	221	38
48LH15	422	208	36	56DLH17	656	371	51	72DLH17	592	415	43	68DLH15	445	295	35
60DLH14	448	275	34	72DLH18	715	499	48	64DLH17	628	395	46	64DLH15	470	292	39
52DLH14	466	242	37	64DLH18	748	476	53	56DLH17	630	345	51	60DLH15	485	275	41
52DLH14	472	271	37	60DLH18	752	447	57	72DLH18	693	469	48	60DLH16	533	308	46
60DLH15	526	325	38	72DLH19	838	566	55	64DLH18	726	447	53	72DLH17	574	391	45
56DLH15	539	306	41	68DLH19	841	571	60	72DLH19	813	532	58	64DLH17	610	372	49
68DLH16	572	408	38	97' LENGTH				68DLH19	816	537	61	60DLH17	613	350	52
60DLH16	579	363	41	52DLH10	256	136	24	100' LENGTH				72DLH18	673	442	51
56DLH16	582	340	45	52DLH11	281	149	26	52DLH10	241	124	24	60DLH18	707	395	59
72DLH17	623	461	42	52DLH12	314	163	29	52DLH11	264	135	26	72DLH19	789	501	60
60DLH17	665	412	49	60DLH12	322	201	27	52DLH12	295	149	29	68DLH19	792	506	61
56DLH17	670	387	51	56DLH12	334	188	28	60DLH12	312	189	27	103' LENGTH			
72DLH18	730	520	47	52DLH13	381	197	33	56DLH12	318	173	29	52DLH10	227	114	24
60DLH18	768	466	55	60DLH13	391	243	32	101' LENGTH				52DLH11	249	124	26
72DLH19	856	590	55	60DLH14	434	258	34	52DLH10	241	124	24	52DLH12	278	135	29
68DLH19	859	596	58	52DLH14	438	220	38	52DLH11	264	135	26				
				56DLH14	457	254	38	52DLH12	295	149	29				



ECONOMICAL JOIST GUIDE
Combined K, VS, LH & DLH Series Load Table

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Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)
Total	Live			Total	Live			Total	Live			Total	Live		
103' LENGTH (Cont.)				106' LENGTH (Cont.)				109' LENGTH (Cont.)				112' LENGTH (Cont.)			
60DLH12	303	178	28	56DLH12	284	145	29	60DLH15	442	235	43	72DLH17	523	324	47
52DLH13	338	184	33	60DLH12	295	168	29	72DLH16	478	301	41	64DLH17	555	309	52
64DLH13	355	228	32	56DLH13	344	175	34	64DLH16	495	287	46	72DLH18	613	366	53
60DLH13	368	215	34	60DLH13	358	203	34	72DLH17	537	342	47	64DLH18	641	349	58
52DLH14	390	184	38	64DLH14	395	230	34	60DLH17	558	298	52	72DLH19	718	415	61
64DLH14	406	244	34	60DLH14	398	216	37	64DLH17	571	326	52	68DLH19	721	419	67
60DLH14	409	229	37	68DLH15	426	273	37	60DLH18	644	337	59	113' LENGTH			
56DLH14	411	214	38	64DLH15	452	271	40	64DLH18	659	369	59	60DLH12	261	138	29
68DLH15	440	289	35	60DLH15	467	255	43	72DLH19	738	439	61	64DLH12	266	156	28
64DLH15	466	287	39	72DLH16	491	316	41	68DLH19	741	443	67	60DLH13	316	167	34
60DLH15	480	270	41	64DLH16	509	303	45	110' LENGTH				64DLH13	323	189	34
68DLH16	522	340	41	60DLH16	513	285	46	56DLH11	231	118	26	60DLH14	350	178	37
60DLH16	528	302	46	68DLH17	572	365	46	60DLH12	274	150	29	64DLH14	370	203	37
72DLH17	569	384	45	60DLH17	590	324	52	60DLH13	333	181	34	68DLH15	401	240	39
68DLH17	588	386	47	68DLH18	662	412	53	60DLH14	370	193	37	64DLH15	424	238	41
60DLH17	607	343	52	60DLH18	681	366	59	64DLH14	380	214	37	60DLH16	451	235	46
64DLH18	697	413	56	68DLH19	762	468	60	72DLH15	409	251	36	72DLH16	461	280	43
60DLH18	700	388	59	107' LENGTH				68DLH15	412	254	38	68DLH16	476	282	45
72DLH19	781	491	60	56DLH11	244	129	36	60DLH15	434	228	43	72DLH17	518	318	47
68DLH19	784	496	61	56DLH12	278	141	29	64DLH15	436	251	41	60DLH17	519	267	52
104' LENGTH				60DLH12	289	163	29	72DLH16	473	295	41	64DLH17	550	303	52
52DLH10	223	110	24	60DLH13	351	197	34	60DLH16	476	255	46	72DLH18	607	360	53
52DLH11	244	120	26	64DLH14	391	226	34	64DLH16	491	281	46	64DLH18	636	343	59
52DLH12	273	132	29	68DLH15	424	268	38	72DLH17	533	336	47	72DLH19	712	408	62
56DLH12	295	153	30	64DLH15	448	266	40	60DLH17	548	290	52	68DLH19	714	412	67
60DLH12	300	175	29	60DLH15	458	248	43	68DLH17	551	338	49	114' LENGTH			
52DLH13	331	159	33	72DLH16	487	312	41	64DLH17	565	320	52	60DLH12	256	134	29
64DLH13	351	224	32	64DLH16	504	298	46	60DLH18	632	327	59	64DLH12	264	153	29
58DLH13	358	186	34	72DLH17	548	355	46	68DLH18	637	383	56	60DLH13	311	163	34
60DLH13	365	211	34	68DLH17	566	358	49	64DLH18	653	362	59	64DLH13	321	186	34
52DLH14	382	178	38	60DLH17	579	315	52	72DLH19	731	431	61	60DLH14	344	173	37
64DLH14	402	239	34	64DLH17	581	338	52	68DLH19	734	434	67	64DLH14	367	199	37
60DLH14	405	224	37	68DLH18	655	405	53	111' LENGTH				68DLH15	398	236	39
64DLH15	461	281	39	60DLH18	668	357	59	56DLH11	227	115	26	60DLH15	405	205	43
60DLH15	476	265	43	64DLH18	671	383	59	56DLH12	259	126	30	64DLH15	421	234	43
72DLH16	501	331	40	68DLH19	755	459	61	60DLH12	270	146	29	60DLH16	444	228	46
68DLH16	517	333	41	108' LENGTH				64DLH12	271	161	28	72DLH16	457	275	43
60DLH16	523	296	46	56DLH11	239	125	26	56DLH13	314	152	34	68DLH16	472	277	46
72DLH17	563	376	45	56DLH12	273	137	29	60DLH13	327	176	34	64DLH16	474	262	46
68DLH17	583	379	46	60DLH12	284	158	29	64DLH13	329	196	33	72DLH17	514	313	50
60DLH17	601	337	52	60DLH13	345	191	34	60DLH14	363	189	37	64DLH17	546	298	52
72DLH18	660	425	53	60DLH14	383	205	37	64DLH14	377	210	37	60DLH18	589	394	58
68DLH18	674	428	53	64DLH14	387	222	36	68DLH15	408	249	38	64DLH18	630	337	59
60DLH18	694	390	59	72DLH15	417	260	36	64DLH15	432	247	41	72DLH19	706	401	64
68DLH19	777	486	61	68DLH15	420	263	38	56DLH16	436	214	46	68DLH19	708	404	67
105' LENGTH				64DLH15	444	261	40	64DLH16	486	276	46	115' LENGTH			
56DLH11	253	136	26	60DLH15	450	242	43	72DLH17	528	330	47	60DLH12	252	131	29
56DLH12	289	150	29	72DLH16	482	307	41	68DLH17	546	332	49	64DLH12	259	150	29
60DLH12	297	171	29	64DLH16	500	292	46	64DLH17	560	314	52	60DLH13	306	158	34
64DLH13	348	219	32	72DLH17	542	349	46	72DLH18	618	373	53	64DLH13	315	181	34
56DLH13	351	181	34	60DLH17	569	306	52	60DLH18	621	319	59	60DLH14	338	170	37
60DLH13	361	207	34	64DLH17	576	332	52	64DLH18	647	356	59	64DLH14	360	193	37
64DLH14	398	235	34	60DLH18	656	346	58	72DLH19	725	423	61	68DLH15	394	232	39
60DLH14	401	220	37	64DLH18	665	376	59	68DLH19	727	427	67	60DLH15	398	200	43
68DLH15	432	278	37	72DLH19	745	447	61	112' LENGTH				64DLH15	414	228	43
64DLH15	457	276	40	68DLH19	748	451	61	56DLH11	223	113	26	72DLH16	453	270	43
60DLH15	471	260	43	109' LENGTH				56DLH12	254	123	29	68DLH16	467	272	46
72DLH16	496	324	40	56DLH11	235	122	26	60DLH12	265	142	29	72DLH17	509	307	50
68DLH16	512	327	42	56DLH12	268	133	29	64DLH12	269	159	29	64DLH17	536	290	52
60DLH16	518	290	45	60DLH12	279	154	29	56DLH13	308	149	33	60DLH18	578	286	58
68DLH17	577	372	46	56DLH13	325	161	33	60DLH13	322	171	34	72DLH18	597	347	54
60DLH17	595	330	52	60DLH13	339	187	34	64DLH13	326	193	34	64DLH18	619	328	59
68DLH18	668	420	53	60DLH14	376	199	37	60DLH14	356	183	37	68DLH19	702	397	66
60DLH18	687	373	59	64DLH14	384	218	37	64DLH14	373	206	37	116' LENGTH			
68DLH19	769	477	61	72DLH15	413	255	36	68DLH15	405	245	38	60DLH12	248	128	29
106' LENGTH				68DLH15	416	258	38	64DLH15	428	242	41				
56DLH11	248	133	26	64DLH15	440	256	41	64DLH16	482	271	46				



ECONOMICAL JOIST GUIDE
Combined K, VS, LH & DLH Series Load Table

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Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)	Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)
Total	Live			Total	Live			Total	Live			Total	Live		
116' LENGTH (Cont.)				119' LENGTH (Cont.)				123' LENGTH (Cont.)				127' LENGTH (Cont.)			
64DLH12	255	146	29	64DLH15	387	206	43	64DLH13	277	148	34	72DLH15	354	188	41
60DLH13	301	154	34	60DLH16	407	201	46	68DLH13	284	168	35	64DLH16	382	189	46
64DLH13	310	176	34	72DLH16	437	252	45	64DLH14	316	158	37	72DLH16	410	221	47
60DLH14	332	165	37	68DLH16	452	254	46	68DLH14	327	179	38	64DLH17	439	215	52
64DLH14	354	189	37	72DLH17	492	287	49	68DLH15	365	201	42	72DLH17	461	252	53
68DLH15	391	226	39	64DLH17	501	262	52	72DLH15	366	200	41	64DLH18	507	243	59
60DLH15	392	194	43	68DLH17	509	289	53	72DLH16	423	236	45	68DLH18	532	276	60
64DLH15	407	223	43	60DLH18	540	259	59	68DLH16	433	236	49	72DLH18	540	284	59
60DLH16	428	217	46	64DLH18	578	296	59	64DLH17	468	237	52	72DLH19	633	323	67
68DLH16	463	268	46	68DLH18	589	327	60	68DLH17	489	268	53	128' LENGTH			
60DLH17	493	247	52	72DLH19	676	368	67	64DLH18	540	267	59	64DLH12	211	109	29
72DLH17	505	302	50	68DLH19	678	371	67	68DLH18	566	304	60	64DLH13	257	131	34
64DLH17	527	283	52	120' LENGTH				72DLH19	654	344	67	64DLH14	292	140	37
60DLH18	568	279	59	60DLH12	232	115	29	124' LENGTH				68DLH14	303	159	38
64DLH18	608	320	59	64DLH12	239	132	29	64DLH12	224	119	29	72DLH14	307	166	37
68DLH19	696	391	66	60DLH13	282	139	34	64DLH13	273	144	34	68DLH15	337	178	41
117' LENGTH				64DLH13	291	159	34	68DLH13	279	164	35	72DLH15	352	185	41
60DLH12	244	124	29	60DLH14	310	149	37	64DLH14	311	154	37	64DLH16	376	185	46
64DLH12	251	142	29	64DLH14	332	171	37	68DLH14	322	175	38	72DLH16	407	218	47
60DLH13	296	151	34	68DLH14	337	190	38	68DLH15	360	196	42	64DLH17	432	210	52
64DLH13	305	171	34	72DLH15	375	211	38	72DLH15	363	197	41	68DLH17	453	238	53
60DLH14	327	161	37	68DLH15	378	213	40	64DLH16	401	203	46	72DLH17	457	248	53
64DLH14	349	184	37	64DLH15	381	201	43	72DLH16	420	232	47	64DLH18	499	237	59
72DLH15	385	222	38	60DLH16	400	196	46	68DLH16	427	230	49	68DLH18	524	269	60
68DLH15	387	224	41	72DLH16	434	248	45	64DLH17	461	231	52	72DLH18	536	280	59
64DLH15	400	217	43	68DLH16	448	250	46	68DLH17	481	262	53	68DLH19	601	305	67
60DLH16	421	211	46	72DLH17	488	282	49	64DLH18	532	261	59	72DLH19	628	318	67
64DLH16	450	242	46	64DLH17	492	255	52	68DLH18	557	297	60	129' LENGTH			
68DLH16	459	263	46	68DLH17	505	284	53	72DLH19	649	339	68	68DLH13	259	145	35
60DLH17	484	241	52	60DLH18	531	252	59	125' LENGTH				68DLH14	299	155	38
72DLH17	501	297	50	64DLH18	568	288	59	64DLH12	221	216	29	72DLH14	305	163	38
64DLH17	518	275	52	68DLH18	584	321	60	64DLH13	269	141	34	72DLH15	349	182	41
60DLH18	559	272	59	68DLH19	673	365	67	64DLH14	306	151	37	72DLH16	403	215	49
64DLH18	598	311	59	121' LENGTH				68DLH14	317	171	38	68DLH17	446	232	53
68DLH18	599	388	60	64DLH12	235	129	29	68DLH15	354	191	41	72DLH17	454	244	53
72DLH19	687	381	67	64DLH13	286	155	34	72DLH15	360	194	41	68DLH18	516	263	60
68DLH19	690	384	67	64DLH14	326	166	37	64DLH16	394	198	46	72DLH18	532	276	59
118' LENGTH				68DLH14	334	187	38	72DLH16	416	229	47	72DLH19	623	313	67
60DLH12	240	121	29	72DLH15	372	207	40	68DLH16	420	225	49	130' LENGTH			
64DLH12	247	138	29	68DLH15	375	209	40	64DLH17	454	226	52	68DLH13	255	142	35
60DLH13	291	147	34	72DLH16	430	244	45	68DLH17	474	256	53	68DLH14	294	152	38
60DLH14	321	156	37	68DLH16	444	246	49	64DLH18	523	255	59	72DLH14	303	171	38
64DLH14	343	179	37	72DLH17	484	278	49	68DLH18	549	289	60	72DLH15	347	191	41
72DLH15	382	218	38	68DLH17	501	280	53	72DLH19	643	333	67	72DLH16	401	225	49
68DLH15	384	220	41	64DLH18	559	282	59	126' LENGTH				68DLH17	439	228	55
64DLH15	394	211	43	68DLH18	579	316	60	64DLH12	218	114	29	72DLH17	451	256	56
60DLH16	414	206	46	68DLH19	667	359	67	64DLH13	264	131	34	68DLH18	508	257	60
72DLH16	441	257	45	122' LENGTH				64DLH14	301	147	37	72DLH18	528	289	59
68DLH16	456	259	46	64DLH12	231	125	29	68DLH14	312	167	38	68DLH19	583	291	67
72DLH17	496	292	50	64DLH13	281	152	34	72DLH15	357	191	41	72DLH19	619	328	70
64DLH17	509	268	52	68DLH13	288	171	35	64DLH16	388	193	46	131' LENGTH			
68DLH17	513	294	53	64DLH14	321	162	37	72DLH16	413	225	47	68DLH13	252	138	35
60DLH18	549	266	59	68DLH14	332	185	38	64DLH17	446	220	52	68DLH14	290	148	38
64DLH18	587	304	59	72DLH15	369	204	40	68DLH17	467	249	53	72DLH14	298	167	38
68DLH18	594	333	60	68DLH15	372	206	42	64DLH18	515	249	59	68DLH15	322	166	41
72DLH19	682	374	67	72DLH16	427	240	45	68DLH18	540	283	60	72DLH15	342	187	43
68DLH19	684	377	67	68DLH16	441	242	49	72DLH18	544	289	59	72DLH16	395	219	49
119' LENGTH				64DLH17	476	243	52	72DLH19	638	328	67	68DLH17	433	222	53
60DLH12	236	118	29	68DLH17	497	275	53	127' LENGTH				72DLH17	445	250	53
64DLH12	243	135	29	64DLH18	549	274	59	64DLH12	214	111	29	68DLH18	501	251	59
60DLH13	286	143	34	68DLH18	575	311	60	64DLH13	260	134	34	72DLH18	520	283	59
64DLH13	295	163	34	72DLH19	659	350	67	64DLH14	296	143	37	68DLH19	574	285	67
60DLH14	316	152	37	68DLH19	662	353	67	72DLH14	309	168	37	72DLH19	609	321	70
64DLH14	337	174	37	123' LENGTH				68DLH15	343	182	41				
68DLH14	340	193	38	64DLH12	228	122	29								
72DLH15	378	214	38												
68DLH15	381	217	40												



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ECONOMICAL JOIST GUIDE
Combined K, VS, LH & DLH Series Load Table

Joist Type	Allowable Loads (PLF)		Joist Weight (lbs./ft.)
	Total	Live	
132' LENGTH			
68DLH13	248	135	35
68DLH14	286	145	38
72DLH14	294	163	38
68DLH15	317	162	41
72DLH15	336	183	43
68DLH16	376	190	49
72DLH16	390	214	49
68DLH17	427	217	53
72DLH17	438	245	56
68DLH18	493	246	59
72DLH18	512	276	59
68DLH19	565	278	67
72DLH19	600	313	70
133' LENGTH			
68DLH13	244	133	35
68DLH14	281	141	38
72DLH14	290	159	38
68DLH15	312	158	41
72DLH15	331	178	41
68DLH16	371	186	49
72DLH16	384	209	49
68DLH17	420	212	53
72DLH17	432	239	56
68DLH18	486	240	59
72DLH18	505	270	59
68DLH19	557	272	67
72DLH19	591	306	70
134' LENGTH			
68DLH13	241	130	35
68DLH14	277	138	38
72DLH14	285	155	38
68DLH15	308	155	41
72DLH15	326	174	41
68DLH16	365	182	49
72DLH16	378	205	49
72DLH17	426	233	53
68DLH18	479	234	60
72DLH18	497	265	59
68DLH19	548	266	67
72DLH19	582	300	70
135' LENGTH			
68DLH13	237	127	35
68DLH14	273	135	38
72DLH14	281	152	38
68DLH15	303	152	42
72DLH15	322	171	42
68DLH16	360	178	49
72DLH16	373	200	49
68DLH17	408	203	53
72DLH17	420	228	53
68DLH18	472	230	60
72DLH18	490	258	59
68DLH19	540	260	67
72DLH19	573	293	70
136' LENGTH			
68DLH13	234	124	35
68DLH14	269	133	38
72DLH14	277	149	38
68DLH15	299	148	41
72DLH15	317	167	42
68DLH16	354	174	49
72DLH16	368	196	49
68DLH17	403	198	53
72DLH17	414	224	56
68DLH18	465	225	60
136' LENGTH (Cont.)			
72DLH18	483	252	59
68DLH19	532	254	67
72DLH19	565	286	70
137' LENGTH			
72DLH14	274	146	38
72DLH15	312	163	41
72DLH16	363	191	49
72DLH17	408	218	53
72DLH18	479	247	59
72DLH19	557	280	70
138' LENGTH			
72DLH14	270	143	38
72DLH15	308	160	42
72DLH16	358	188	49
72DLH17	402	213	53
72DLH18	470	242	59
72DLH19	549	274	70
139' LENGTH			
72DLH14	266	139	38
72DLH15	303	156	41
72DLH16	353	183	49
72DLH17	397	209	53
72DLH18	463	236	59
72DLH19	541	261	70
140' LENGTH			
72DLH14	262	136	38
72DLH15	299	152	41
72DLH16	348	179	49
72DLH17	391	205	53
72DLH18	457	231	59
72DLH19	533	263	70
141' LENGTH			
72DLH14	259	133	38
72DLH15	295	150	42
72DLH16	343	175	49
72DLH17	386	200	53
72DLH18	450	227	59
72DLH19	526	257	70
142' LENGTH			
72DLH14	255	131	38
72DLH15	291	147	42
72DLH16	338	171	49
72DLH17	381	196	53
72DLH18	444	222	59
72DLH19	518	251	70
143' LENGTH			
72DLH14	252	128	38
72DLH15	286	143	41
72DLH16	334	169	49
72DLH17	376	191	53
72DLH18	438	217	59
72DLH19	511	247	70
144' LENGTH			
72DLH14	248	125	38
72DLH15	282	140	41
72DLH16	329	165	49
72DLH17	371	188	53
144' LENGTH (Cont.)			
72DLH18	432	212	59
72DLH19	504	241	70



CODE OF STANDARD PRACTICE FOR STEEL JOISTS AND JOIST GIRDERS

Adopted by the Steel Joist Institute April 7, 1931
Revised to May 1, 2000 - Effective May 03, 2005

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

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

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

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

Owner. The entity that is identified as such in the Contract Documents.

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

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.

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 and/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.

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 TEST FOR K-SERIES STEEL JOIST CONSTRUCTION

When performance tests on a structure are required, joists in the test panel shall have bridging and top deck applied as used. In addition to the full dead load, the test panel shall sustain for one hour a test load of 1.65 times the nominal live load. After this test load has been removed for a minimum of 30 minutes, the remaining deflection shall not exceed 20% of the deflection caused by the test load. The weight of the test panel itself shall constitute the dead load of the construction and shall include the weight of the joists, bridging, top deck, slab, ceiling materials, etc. The nominal live load shall be the live load specified and in no case shall it be more than the published joist capacity less the dead load. The cost of such tests shall be borne by the purchaser.

SECTION 2. JOISTS 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 minimum standard end bearing depth of 2 1/2 inches (64 mm).

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 standard end bearing depth of 5 inches (127 mm) for



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LH-Series. **DLH-Series** are furnished with standard end bearing depths of 5 inches (127 mm) for section numbers thru 17 and 7 1/2 inches (191 mm) for section numbers 18 and 19. The standard pitch is 1/8 inch in 12 inches (1:96). The nominal depth of a pitched Longspan Joist is taken at the center of the span.

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). The standard pitch is 1/8 inch in 12 inches (1:96). The nominal depth of a pitched Joist Girder is taken at the center of the span.

Because **LH-** and **DLH-Series** joists may have exceptionally high 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 Pascal).

2.2 JOIST LOCATION AND SPACING

The maximum joist spacing shall be in accordance with the requirements of the Steel Joist Institute 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 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 will not be beveled for slopes of 1/4 inch or less in 12 inches (1:48).

2.4 EXTENDED ENDS

Steel joist extended ends shall be in accordance with Manufacturer's Standard and shall meet the requirements of — See page 37.

2.5 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.

TABLE 2.6-1a
K-SERIES JOISTS
MAXIMUM JOIST SPACING FOR HORIZONTAL BRIDGING

		**BRIDGING MATERIAL SIZE					
SECTION NUMBER*	Round Rod	Equal Leg Angles					
	1/2" round (13 mm) r = 0.13" (3.30 mm)	1 x 7/64 (25 mm x 3 mm) r = 0.20" (5.08 mm)	1-1/4 x 7/64 (32 mm x 3 mm) r = 0.25" (6.35 mm)	1-1/2 x 7/64 (38 mm x 3 mm) r = 0.30" (7.62 mm)	1-3/4 x 7/64 (45 mm x 3 mm) r = 0.35" (8.89 mm)	2 x 1/8 (52 mm x 3 mm) r = 0.40" (10.16 mm)	2-1/2 x 5/32 (64 mm x 4 mm) r = 0.50" (12.70 mm)
1 - 9	3'- 3" (991 mm)	5'- 0" (1524 mm)	6'- 3" (1905 mm)	7'- 6" (2286 mm)	8'- 7" (2616 mm)	10'- 0" (3048 mm)	12'- 6" (3810 mm)
10	3'- 0" (914 mm)	4'- 8" (1422 mm)	6'- 3" (1905 mm)	7'- 6" (2286 mm)	8'- 7" (2616 mm)	10'- 0" (3048 mm)	12'- 6" (3810 mm)
11-12	2'- 7" (787 mm)	4'- 0" (1219 mm)	5'- 8" (1727 mm)	7'- 6" (2286 mm)	8'- 7" (2616 mm)	10'- 0" (3048 mm)	12'- 6" (3810 mm)

* Refer to last digit(s) of Joist Designation

** Connection to Joist must resist a nominal unfactored 700 pound force (3114 N)



TABLE 2.6-1b
LH-SERIES JOISTS
MAXIMUM JOIST SPACING FOR HORIZONTAL BRIDGING
SPANS OVER 60 ft. (18.3 m) REQUIRE BOLTED DIAGONAL BRIDGING

SECTION NUMBER*	**BRIDGING ANGLE SIZE – (EQUAL LEG ANGLE)					
	1 x 7/64 (25 mm x 3 mm) r = 0.20" (5.08 mm)	1-1/4 x 7/64 (32 mm x 3 mm) r = 0.25" (6.35 mm)	1-1/2 x 7/64 (38 mm x 3 mm) r = 0.30" (7.62 mm)	1-3/4 x 7/64 (45 mm x 3 mm) r = 0.35" (8.89 mm)	2 x 1/8 (52 mm x 3 mm) r = 0.40" (10.16 mm)	2-1/2 x 5/32 (64 mm x 4 mm) r = 0.50" (12.70 mm)
02, 03, 04	4' – 7" (1397 mm)	6' – 3" (1905 mm)	7' – 6" (2286 mm)	8' – 9" (2667 mm)	10' – 0" (3048 mm)	12' – 4" (3759 mm)
05 – 06	4' – 1" (1245 mm)	5' – 9" (1753 mm)	7' – 6" (2286 mm)	8' – 9" (2667 mm)	10' – 0" (3048 mm)	12' – 4" (3759 mm)
07 – 08	3' – 9" (1143 mm)	5' – 1" (1549 mm)	6' – 8" (2032 mm)	8' – 6" (2590 mm)	10' – 0" (3048 mm)	12' – 4" (3759 mm)
09 – 10		4' – 6" (1372 mm)	6' – 0" (1829 mm)	7' – 8" (2337 mm)	10' – 0" (3048 mm)	12' – 4" (3759 mm)
11 – 12		4' – 1" (1245 mm)	5' – 5" (1651 mm)	6' – 10" (2083 mm)	8' – 11" (2718 mm)	12' – 4" (3759 mm)
13 – 14		3' – 9" (1143 mm)	4' – 11" (1499 mm)	6' – 3" (1905 mm)	8' – 2" (2489 mm)	12' – 4" (3759 mm)
15 – 16			4' – 3" (1295 mm)	5' – 5" (1651 mm)	7' – 1" (2159 mm)	11' – 0" (3353 mm)
17			4' – 0" (1219 mm)	5' – 1" (1549 mm)	6' – 8" (2032 mm)	10' – 5" (3175 mm)

* Refer to last two digits of Joist Designation

** Connection to Joist must resist force listed in Table 104.5-1

2.6 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 (18.3 m) 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 (18.3 m) in length shall have bolted diagonal bridging for all rows.

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

Refer to page 150 for OSHA steel joist erection stability requirements.

Horizontal bridging shall consist of continuous horizontal steel members. The ℓ/r ratio for horizontal bridging shall not exceed 300. The material sizes shown in Tables 2.6-1a and 2.6-1b meet the criteria.

- (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 applicable Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.

Diagonal bridging, when used, shall have an ℓ/r ratio not exceeding 200.

When the bridging members are connected at their point of intersection, the material sizes listed in Table 2.6-2 will meet the above specification.



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(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.

TABLE 2.6-2
K, LH AND DLH SERIES JOISTS
MAXIMUM JOIST SPACING FOR DIAGONAL BRIDGING

JOIST DEPTH	**BRIDGING ANGLE SIZE - (EQUAL LEG ANGLE)				
	1 x 7/64 (25 mm x 3 mm) r = 0.20" (5.08 mm)	1-1/4 x 7/64 (32 mm x 3 mm) r = 0.25" (6.35 mm)	1-1/2 x 7/64 (38 mm x 3 mm) r = 0.30" (7.62 mm)	1-3/4 x 7/64 (45 mm x 3 mm) r = 0.35" (8.89 mm)	2 x 1/8 (50 mm x 3 mm) r = 0.40" (10.16 mm)
12" (305 mm)	6' - 6" (1981 mm)	8' - 3" (2514 mm)	9' - 11" (3022 mm)	11' - 7" (3530 mm)	
14" (356 mm)	6' - 6" (1981 mm)	8' - 3" (2514 mm)	9' - 11" (3022 mm)	11' - 7" (3530 mm)	
16" (406 mm)	6' - 6" (1981 mm)	8' - 2" (2489 mm)	9' - 10" (2997 mm)	11' - 6" (3505 mm)	
18" (457 mm)	6' - 6" (1981 mm)	8' - 2" (2489 mm)	9' - 10" (2997 mm)	11' - 6" (3505 mm)	
20" (508 mm)	6' - 5" (1955 mm)	8' - 2" (2489 mm)	9' - 10" (2997 mm)	11' - 6" (3505 mm)	
22" (559 mm)	6' - 4" (1930 mm)	8' - 1" (2463 mm)	9' - 10" (2997 mm)	11' - 6" (3505 mm)	
24" (610 mm)	6' - 4" (1930 mm)	8' - 1" (2463 mm)	9' - 9" (2971 mm)	11' - 5" (3479 mm)	
26" (660 mm)	6' - 3" (1905 mm)	8' - 0" (2438 mm)	9' - 9" (2971 mm)	11' - 5" (3479 mm)	
28" (711 mm)	6' - 2" (1879 mm)	8' - 0" (2438 mm)	9' - 8" (2946 mm)	11' - 5" (3479 mm)	
30" (762 mm)	6' - 2" (1879 mm)	7' - 11" (2413 mm)	9' - 8" (2946 mm)	11' - 4" (3454 mm)	
32" (813 mm)	6' - 1" (1854 mm)	7' - 10" (2387 mm)	9' - 7" (2921 mm)	11' - 4" (3454 mm)	13' - 0" (3962 mm)
36" (914 mm)		7' - 9" (2362 mm)	9' - 6" (2895 mm)	11' - 3" (3429 mm)	12' - 11" (3973 mm)
40" (1016 mm)		7' - 7" (2311 mm)	9' - 5" (2870 mm)	11' - 2" (3403 mm)	12' - 10" (3911 mm)
44" (1118 mm)		7' - 5" (2260 mm)	9' - 3" (2819 mm)	11' - 0" (3352 mm)	12' - 9" (3886 mm)
48" (1219 mm)		7' - 3" (2209 mm)	9' - 2" (2794 mm)	10' - 11" (3327 mm)	12' - 8" (3860 mm)
52" (1321 mm)			9' - 0" (2743 mm)	10' - 9" (3276 mm)	12' - 7" (3835 mm)
56" (1422 mm)			8' - 10" (2692 mm)	10' - 8" (3251 mm)	12' - 5" (3784 mm)
60" (1524 mm)			8' - 7" (2616 mm)	10' - 6" (3200 mm)	12' - 4" (3759 mm)
64" (1626 mm)			8' - 5" (2565 mm)	10' - 4" (3149 mm)	12' - 2" (3708 mm)
68" (1727 mm)			8' - 2" (2489 mm)	10' - 2" (3098 mm)	12' - 0" (3657 mm)
72" (1829 mm)			8' - 0" (2438 mm)	10' - 0" (3048 mm)	11' - 10" (3606 mm)

MINIMUM A307 BOLT REQUIRED FOR CONNECTION

SERIES	*SECTION NUMBER	BOLT DIAMETER
K	ALL	3/8" (10 mm)
LH, DLH	2 - 12	3/8" (10 mm)
LH, DLH	13 - 17	1/2" (13 mm)
DLH	18 and 19	5/8" (16 mm)

*Refer to last digit(s) of Joist Designation



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2.7 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**.

2.8 BOTTOM CHORD LATERAL BRACING FOR JOIST GIRDERS

Bottom chord lateral bracing may 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 will 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 may not be uniform and may include drips, runs, and sags. Compatibility of any coating including fire protective coatings applied over a 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.

Inspections shall be made in accordance with the Steel Joist

SECTION 4. INSPECTION

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 may 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 duct-work 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 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 mono-rails, fans, blowers, tanks, etc., shall be indicated. 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 Steel Joist Institute does not presume to establish the loading requirements for which structures are designed.

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 Steel Joist Institute Joist Girder Weight Tables 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.

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 near the end 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 resolving 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 may require consideration by the joist manufacturer.

The **specifying professional** shall use one of the following options that allows the:

- Estimator to price the joists.
- Joist manufacturer to design the joists properly.
- Owner to obtain the most economical joists.

Option 1: Select a Standard Steel Joist Institute joist for the uniform design loading and provide the load and location of any additional loads on the structural plan with a note "Joist manufacturer shall design joists for additional loads as shown". This option works well for a few added loads per joist with known locations.



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Option 2: Select a KCS joist using moment and end reaction. This option works well for concentrated loads for which exact locations are not known or for multiple loading. See examples and limitations on the pages accompanying the KCS Joist Load Tables.

- Determine the maximum moment
- Determine the maximum end reaction (shear)
- Select the required KCS joist that provides the required moment and end reaction (shear).

Option 3: Specify a SPECIAL joist with load diagrams. This option is preferred when the joist includes loading that cannot clearly be denoted on the structural drawings.

- Provide a load diagram to clearly define ALL loads
- Place the designation (i.e. 18K SP or 18LH SP) under the load diagram with the following note: "Joist manufacturer to design joist to support loads as shown above".

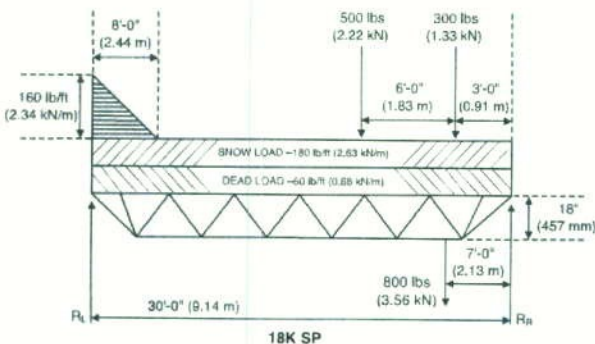
CAUTION: The **specifying professional** shall compare the equivalent uniform loads derived from the maximum moment and shear to the uniform loads tabulated in the K-Series Load Table. An equivalent unfactored uniform load in excess of 550 plf (8020 N/m) or a maximum unfactored end reaction exceeding 9200 lbs (40.9 kN) indicates that the **specifying professional** shall consider using additional joists to reduce the loading or use an LH-Series Joist and make provisions for 5 inch (127 mm) deep bearing seats.

SPECIAL LOADING : Please note the load combinations shown are for referenced examples only and it is not to be presumed that the joist designer is responsible for the applicable building code load combinations. If the loading criteria are too complex to adequately communicate in a simple load diagram, then the specifying professional shall provide a load schedule showing the specified design loads, load categories, and required load combinations with applicable load factors.

ASD EXAMPLE:

U.S. CUSTOMARY UNITS AND (METRIC UNITS)

Load diagram per ASCE 7 2.4.1(3) D + S

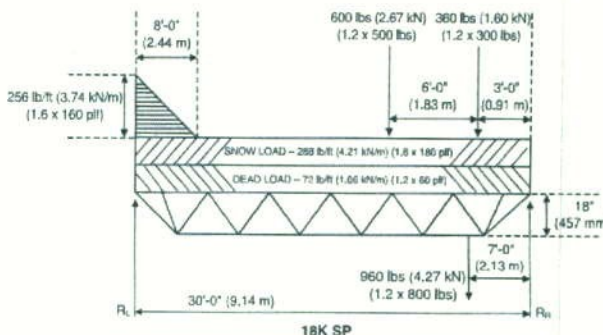


Joist manufacturer to design joist to support loads as shown above.

LRFD EXAMPLE:

U.S. CUSTOMARY UNITS AND (METRIC UNITS)

Factored Load diagram per ASCE 7 2.3.2(3) 1.2D + 1.6S



Joist manufacturer to design joist to support factored loads as shown.

(b) Connections -

Minimum End Anchorage for simple span gravity loading shall be in accordance with Steel Joist Institute Standard Specifications Load Tables & Weight Tables Section 5.6 for K-Series, Section 104.4 for LH- and DLH-Series, and Section 1004.6 for Joist Girders. The **specifying professional** is responsible for the design of the joist and Joist Girder connection when it is subject to any loads other than simple span gravity loading including uplift and lateral loads. The **specifying professional** is also responsible for bridging termination connections. The contract documents must clearly illustrate these connections.

(c) Special Considerations

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

- 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).
- Oversized or other non-standard web openings
- Extended ends
- Deflection criteria for live and total loads for non-SJI standard joists
- 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:

- 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.



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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) Joists 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. Joists 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 will 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 buyers 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 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 must 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"⁽¹⁾.



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 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.

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".

⁽¹⁾ See page 150 for OSHA definition of a 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 must 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.



GLOSSARY

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NOTES:

Terms in **Bold** and their definitions come from the AISC AND AISI STANDARD Standard Definitions for Use in the Design of Steel Structures, 2004 Edition, First Printing April 2005.

* These terms are usually qualified by the type of *load effect*, e.g., nominal tensile strength, available compressive strength, design flexural strength.

** Term usually qualified by the type of component, e.g. local web buckling, local flange buckling, etc.

Accessories. Structural components related to the design, fabrication and erection of *joists* and *Joist Girders* including, but not limited to sloped *end bearings*, *extended ends*, *ceiling extensions*, *bridging* and bridging anchors, *headers* and bottom chord lateral bracing for *Joist Girders*.

ASD (Allowable Strength Design). Method of proportioning structural components such that the *allowable strength* equals or exceeds the *required strength* of the component under the action of the *ASD load combinations*.

ASD Load Combination. *Load combination* in the *applicable building code* intended for allowable strength design (allowable stress design).

Allowable Strength*. *Nominal strength* divided by the safety factor, R_n/Ω .

Applicable Building Code. Building code under which the structure is designed.

Available Strength*. *Design strength* or *allowable strength* as appropriate.

Bay. The distance between the main structural frames or walls of a building.

Bearing. The distance that the bearing shoe or seat of a *joist* or *Joist Girder* extends over its masonry, concrete or steel support.

Bearing Plate. The steel plate used for a *joist* or *Joist Girder* to bear on when it is supported by masonry or concrete supports. The plate is designed by the *Specifying Professional* to carry the *joist* reaction to the supporting structure.

Bottom Chord Extension (BCX). The two angle extended part of a *joist* bottom chord from the first bottom chord panel point towards the end of the *joist*.

Bridging. In general, a member connected to a *joist* to brace it from lateral movement. See also *Diagonal Bridging* and *Horizontal Bridging*.

Buckling. *Limit state* of sudden change in the geometry of a structure or any of its elements under a critical loading condition.

Buckling Strength. *Nominal strength* for buckling or instability *limit states*.

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

Camber. An upward curvature of the chords of a *joist* or *Joist Girder* induced during shop fabrication. Note this is in addition to the pitch of the top chord.

Ceiling Extension. A *bottom chord extension* except that only one angle of the *joist* bottom chord is extended from the first bottom chord panel point towards the end of the *joist*.

Chords. The top and bottom members of a *joist* or *Joist Girder*. When a chord is comprised of two angles there is usually a gap between the members.

Clear Span. The actual clear distance or opening between supports for a *joist*, that is the distance between walls or the distance between the edges of flanges of beams.

Cold-Formed Steel Structural Member. Shape manufactured by press-braking blanks sheared from sheets, cut lengths of coils or plates, or by roll forming cold- or hot-rolled coils or sheets; both forming operations being performed at ambient room temperature, that is, without manifest addition of heat such as would be required for hot forming.

Collateral Load. All additional dead loads other than the weight of the building, such as sprinklers, pipes, ceilings, and mechanical or electrical components.

Connection. Combination of structural elements and *joints* used to transmit forces between two or more members. See also *Splice*.

Deck. A floor or roof covering made out of gage metal attached by welding or mechanical means to *joists*, beams, *purlins*, or other structural members and can be galvanized, painted, or unpainted.

Design Load. Applied load determined in accordance with either *LRFD load combinations* or *ASD load combinations*, whichever is applicable.

Design Strength*. *Resistance factor* multiplied by the *nominal strength*, ϕR_n .

Diagonal Bridging. Two angles or other structural shapes connected from the top chord of one *joist* to the bottom chord of the next *joist* to form an 'X' shape. These members are almost always connected at their point of intersection.

Diaphragm. Roof, floor or other membrane or bracing system that transfers in-plane forces to the lateral force resisting system.

Effective Length. Length of an otherwise identical column with the same strength when analyzed with pin-ended boundary conditions.

Elastic Analysis. *Structural analysis* based on the assumption that the structure returns to its original geometry on removal of the *load*.



End Diagonal or Web. The first web member on either end of a joist or Joist Girder which begins at the top chord at the seat and ends at the first bottom chord panel point.

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

Extended End. The extended part of a joist top chord with the seat angles also being extended from the end of the joist extension back into the joist and maintaining the standard end bearing depth over the entire length of the extension.

Factored Load. Product of a *load factor* and the *nominal load*.

Filler. A rod, plate or angle welded between a two angle web member or between a top or bottom chord panel to tie them together, usually located at the middle of the member.

Flexural Buckling. Buckling mode in which a compression member deflects laterally without twist or change in cross-sectional shape.

Flexural-Torsional Buckling. Buckling mode in which a compression member bends and twists simultaneously without change in cross-sectional shape.

Girt. Horizontal structural member that supports wall panels and is primarily subjected to bending under horizontal loads, such as wind load.

Gravity Load. *Load*, such as that produced by dead and live loads, acting in the downward direction.

Header. A structural member located between two *joists* or between a joist and a wall which carries another joist or joists. It is usually made up of an angle, channel, or beam with saddle angle connections on each end for bearing.

Horizontal Bridging. A continuous angle or other structural shape connected to the top and bottom chord of a joist.

Inelastic Analysis. *Structural analysis* that takes into account inelastic material behavior, including plastic analysis.

Instability. *Limit state* reached in the loading of a *structural component*, frame or structure in which a slight disturbance in the loads or geometry produces large displacements.

Joint. Area where two or more ends, surfaces or edges are attached. Categorized by type of fastener or weld used and the method of force transfer.

Joist. A structural load-carrying member with an open web system which supports floors and roofs utilizing hot-rolled or cold-formed steel and is designed as a simple span member. Currently, the SJI has the following joist designations: K-Series including KCS, LH-Series and DLH-Series.

Joist Girder. A primary structural load-carrying member with an open web system designed as a simple span supporting equally spaced concentrated loads of a floor or roof system acting at the panel points of the member and utilizing hot-rolled or cold-formed steel.

Joist Substitute. A structural member whose intended use is for very short spans (10 feet or less) where open web steel joists are impractical. They are usually used for short spans in skewed bays, over corridors or for outriggers. It can be made up of two or four angles to form channel sections or box sections.

Lateral Buckling. Buckling mode of a flexural member involving deflection normal to the plane of bending.

Lateral-Torsional Buckling. Buckling mode of a flexural member involving deflection normal to the plane of bending occurring simultaneously with twist about the shear center of the cross section.

Limit State. Condition in which a structure or component becomes unfit for service and is judged either to be no longer useful for its intended function (*serviceability limit state*) or to have reached its ultimate load-carrying capacity (*strength limit state*).

Load. Force or other action that results from the weight of building materials, occupants and their possessions, environmental effects, differential movement, or restrained dimensional changes.

Load Effect. Forces, stresses, and deformations produced in a *structural component* by the applied loads.

Load Factor. Factor that accounts for deviations of the *nominal load* from the actual *load*, for uncertainties in the analysis that transforms the *load* into a *load effect*, and for the probability that more than one extreme *load* will occur simultaneously.

Local Buckling.** *Limit state* of buckling of a compression element within a cross section.

LRFD (Load and Resistance Factor Design). Method of proportioning *structural components* such that the *design strength* equals or exceeds the *required strength* of the component under the action of the LRFD load combinations.

LRFD Load Combination. Load combination in the *applicable building code* intended for strength design (*Load and Resistance Factor Design*).

Material. *Joists*, *Joist Girders* and accessories as provided by the *Seller*.

Nailers. Strips of lumber attached to the top chord of a *joist* so plywood or other flooring can be nailed directly to the *joist*.

Nominal Load. Magnitude of the load specified by the *applicable building code*.

Nominal Strength*. Strength of a structure or component (without the *resistance factor* or *safety factor* applied) to resist the *load effects*, as determined in accordance with these *Standard Specifications*.

Owner. The entity that is identified as such in the Contract Documents.



Permanent Load. Load in which variations over time are rare or of small magnitude. All other loads are *variable loads*.

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 and/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 *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.

Ponding. Retention of water at low or irregular areas on a roof due solely to the deflection of flat roof framing.

Purlin. Horizontal structural member that supports roof deck and is primarily subjected to bending under vertical loads such as dead, snow or wind loads.

Quality Assurance. System of shop and field activities and controls implemented by the *owner* or his/her designated representative to provide confidence to the *owner* and the building authority that quality requirements are implemented.

Quality Control. System of shop and field controls implemented by the *seller* and *erector* to ensure that contract and company fabrication and erection requirements are met.

Required Strength*. Forces, stress, and deformations produced in a *structural component*, determined by either *structural analysis*, for the *LRFD* or *ASD* load combinations, as appropriate, or as specified by these *Standard Specifications*.

Resistance Factor, ϕ . Factor that accounts for unavoidable deviations of the *nominal strength* from the actual strength and for the manner and consequences of failure.

Safety Factor, Ω . Factor that accounts for deviations of the actual strength from the *nominal strength*, deviations of the actual load from the *nominal load*, uncertainties in the analysis that transforms the load into a load effect and for the manner and consequences of failure.

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

Service Load. Load under which serviceability limit states are evaluated.

Serviceability Limit State. Limiting condition affecting the ability of a structure to preserve its appearance, maintainability, durability, or the comfort of its occupants or function of machinery, under normal usage.

Slenderness Ratio. The ratio of the effective length of a column to the radius of gyration of the column about the same axis of bending.

Span. The centerline-to-centerline distance between structural steel supports such as a beam, column or *Joist Girder* or the *clear span* distance plus four inches onto a masonry or concrete wall.

Specified Minimum Yield Stress. Lower limit of *yield stress* specified for a material as defined by ASTM.

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.

Splice. *Connection* between two structural members joined at their ends by either bolting or welding to form a single, longer member.

Stability. Condition reached in the loading of a *structural component*, frame or structure in which a slight disturbance in the loads or geometry does not produce large displacements.

Stabilizer Plate. A steel plate at a column or wall inserted between the end of a bottom *chord* of a *joist* or *Joist Girder*.

Standard Specifications. Documents developed and maintained by the Steel Joist Institute for the design and manufacture of open web steel joists and Joist Girders. The term "SJI Standard Specifications" encompass by reference the following:

ANSI/SJI-K-1.1 Standard Specifications for Open Web Steel Joists, **K-Series**; ANSI/SJI-LH/DLH-1.1 Standard Specifications for Longspan Steel Joists, **LH-Series** and Deep Longspan Steel Joists, **DLH-Series**; and ANSI/SJI-JG-1.1 Standard Specifications for **Joist Girders**.

Strength Limit State. Limiting condition affecting the safety of the structure, in which the ultimate load-carrying capacity is reached.

Structural Analysis. Determination of *load effects* on members and connections based on principles of structural mechanics.

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.

Tagged End. The end of a *joist* or *Joist Girder* where an identification or piece mark is shown by a metal tag. The member must be erected with this tagged end in the same position as the tagged end noted on the *placement plan*.

Tensile Strength (of material). Maximum tensile stress that a material is capable of sustaining as defined by ASTM.

Tie Joist. A *joist* that is bolted at a column.



Top Chord Extension (TCX). The extended part of a *joist* top chord. This type of extension only has the two top chord angles extended past the joist seat.

Torsional Buckling. *Buckling* mode in which a compression member twists about its shear center axis.

Unbraced Length. Distance between braced points of a member, measured between the centers of gravity of the bracing members.

Variable Load. Load not classified as *permanent load*.

Webs. The vertical or diagonal members joined at the top and bottom *chords* of a *joist* or *Joist Girder* to form triangular patterns.

Yield Point. First stress in a material at which an increase in strain occurs without an increase in stress as defined by ASTM.

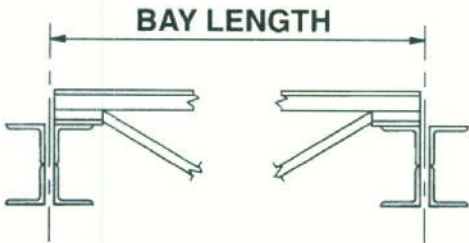
Yield Strength. Stress at which a material exhibits a specified limiting deviation from the proportionality of stress to strain as defined by ASTM.

Yield Stress. Generic term to denote either *yield point* or *yield strength*, as appropriate for the material.

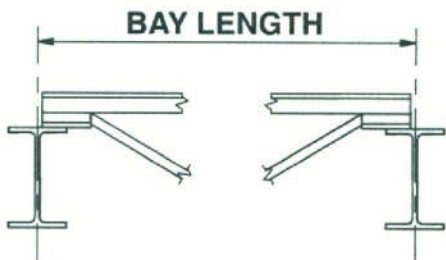


**OSHA SAFETY STANDARDS
FOR STEEL ERECTION**

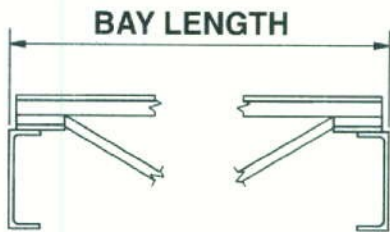
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DEFINITIONS**



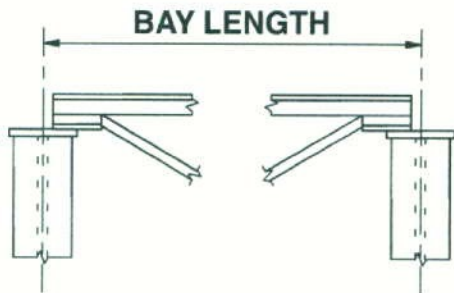
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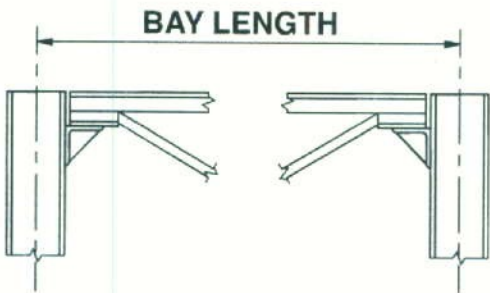
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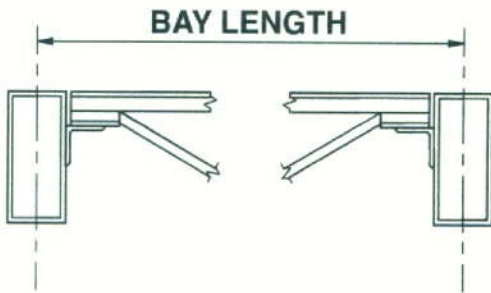
STEEL CHANNEL



STEEL COLUMN

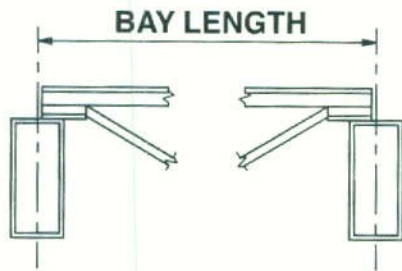


STEEL COLUMN

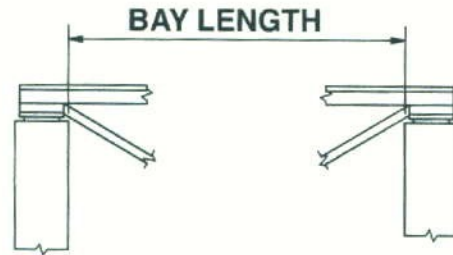


STEEL TUBE

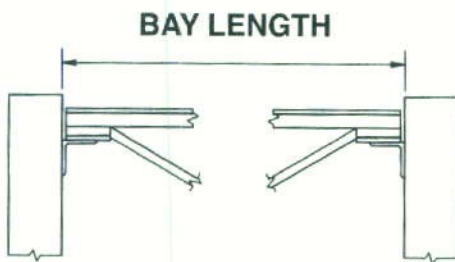




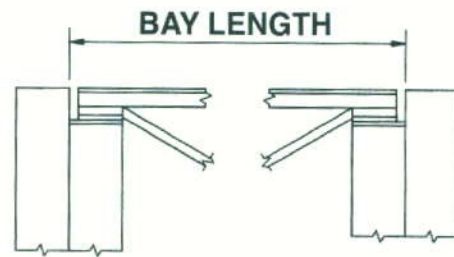
STEEL TUBE



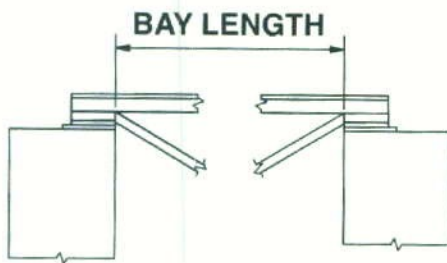
MASONRY OR TILT-UP



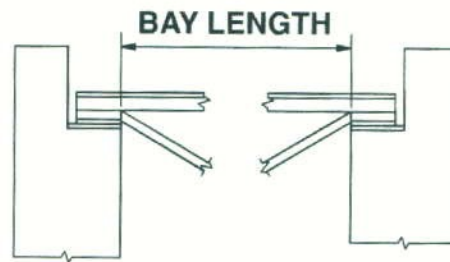
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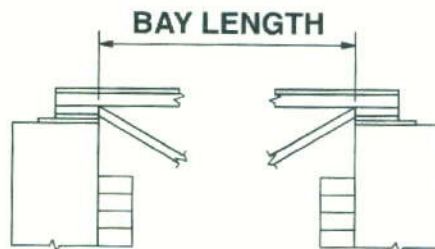
MASONRY WITH PILASTER



MASONRY OR TILT-UP



MASONRY OR TILT-UP



MASONRY WITH FACE BRICK



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§ 1926.751 DEFINITIONS (Selected items only).

Anchored bridging means that the steel joist bridging is connected to a bridging terminus point.

Bolted diagonal bridging means diagonal bridging that is bolted to a steel joist or joists.

Bridging clip means a device that is attached to the steel joist to allow the bolting of the bridging to the steel joist.

Bridging terminus point means a wall, a beam, tandem joists (with all bridging installed and a horizontal truss in the plane of the top chord) or other element at an end or intermediate point(s) of a line of bridging that provides an anchor point for the steel joist bridging.

Column means a load-carrying vertical member that is part of the primary skeletal framing system. Columns do not include posts.

Constructibility means the ability to erect structural steel members in accordance with subpart R without having to alter the over-all structural design.

Construction load (for joist erection) means any load other than the weight of the employee(s), the joists and the bridging bundle.

Erection bridging means the bolted diagonal bridging that is required to be installed prior to releasing the hoisting cables from the steel joists.

Personal fall arrest system means a system used to arrest an employee in a fall from a working level. A personal fall arrest system consists of an anchorage, connectors, a body harness and may include a lanyard, deceleration device, lifeline, or suitable combination of these. The use of a body belt for fall arrest is prohibited.

Project structural engineer means the registered, licensed professional responsible for the design of structural steel framing and whose seal appears on the structural contract documents.

Qualified person (also defined in § 1926.32) means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

Steel joist means an open web, secondary load-carrying member of 144 feet (43.9 m) or less, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses or cold-formed joists.

Steel joist girder means an open web, primary load-carrying member, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses.

Structural steel means a steel member, or a member made of a substitute material (such as, but not limited to, fiberglass, aluminum or composite members). These members include, but are not limited to, steel joists, joist girders, purlins, columns, beams, trusses, splices, seats, metal decking, girts, and all bridging, and cold formed metal framing which is integrated with the structural steel framing of a building.

§ 1926.757 OPEN WEB STEEL JOISTS

(a) General.

(1) Except as provided in paragraph (a)(2) of this section, where steel joists are used and columns are not framed in at least two directions with solid web structural steel members, a steel joist shall be field-bolted at the column to provide lateral stability to the column during erection. For the installation of this joist:

- (i) A vertical stabilizer plate shall be provided on each column for steel joists. The plate shall be a minimum of 6 inch by 6 inch (152 mm by 152 mm) and shall extend at least 3 inches (76 mm) below the bottom chord of the joist with a 13/16 inch (21 mm) hole to provide an attachment point for guying or plumbing cables.
- (ii) The bottom chords of steel joists at columns shall be stabilized to prevent rotation during erection.
- (iii) Hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted, and each end of the bottom chord is restrained by the column stabilizer plate.

(2) Where constructibility does not allow a steel joist to be installed at the column:

- (i) an alternate means of stabilizing joists shall be installed on both sides near the column and shall:
 - (A) provide stability equivalent to paragraph (a)(1) of this section;
 - (B) be designed by a qualified person;
 - (C) be shop installed; and
 - (D) be included in the erection drawings.
- (ii) hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted and the joist is stabilized.

(3) Where steel joists at or near columns span 60 feet (18.3 m) or less, the joist shall be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging.

(4) Where steel joists at or near columns span more than 60 feet (18.3 m), the joists shall be set in tandem with all bridging installed unless an alternative method of erection, which provides equivalent stability to the steel joist, is designed by a qualified person and is included in the site-specific erection plan.



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(5) A steel joist or steel joist girder shall not be placed on any support structure unless such structure is stabilized.

(6) When steel joist(s) are landed on a structure, they shall be secured to prevent unintentional displacement prior to installation.

(7) No modification that affects the strength of a steel joist or steel joist girder shall be made without the approval of the project structural engineer of record.

(8) *Field-bolted joists.*

- (i) Except for steel joists that have been pre-assembled into panels, connections of individual steel joists to steel structures in bays of 40 feet (12.2 m) or more shall be fabricated to allow for field bolting during erection.
- (ii) These connections shall be field-bolted unless constructibility does not allow.

(9) Steel joists and steel joist girders shall not be used as anchorage points for a fall arrest system unless written approval to do so is obtained from a qualified person.

(10) A bridging terminus point shall be established before bridging is installed.

(b) Attachment of steel joists and steel joist girders.

(1) Each end of "K" series steel joists shall be attached to the support structure with a minimum of two 1/8 -inch (3 mm) fillet welds 1 inch (25 mm) long or with two 1/2 -inch (13 mm) bolts, or the equivalent.

(2) Each end of "LH" and "DLH" series steel joists and steel joist girders shall be attached to the support structure with a minimum of two 1/4 -inch (6 mm) fillet welds 2 inches (51 mm) long, or with two 3/4 -inch (19 mm) bolts, or the equivalent.

(3) Except as provided in paragraph (b)(4) of this section, each steel joist shall be attached to the support structure, at least at one end on both sides of the seat, immediately upon placement in the final erection position and before additional joists are placed.

(4) Panels that have been pre-assembled from steel joists with bridging shall be attached to the structure at each corner before the hoisting cables are released.

(c) Erection of steel joists.

(1) Both sides of the seat of one end of each steel joist that requires bridging under Tables A and B shall be attached to the support structure before hoisting cables are released.

(2) For joists over 60 feet, both ends of the joist shall be attached as specified in paragraph (b) of this section and the provisions of paragraph (d) of this section met before the hoisting cables are released.

(3) On steel joists that do not require erection bridging under Tables A and B, only one employee shall be allowed on the joist until all bridging is installed and anchored.

► NOTE: TABLES "A" & "B" HAVE BEEN EDITED TO CONFORM WITH STEEL JOIST INSTITUTE BOLTED DIAGONAL BRIDGING REQUIREMENTS. EDITED ITEMS ARE SHOWN WITH A STRIKE THROUGH NOTATION. NEW ITEMS ARE SHOWN IN RED

► TABLE A. — ERECTION BRIDGING FOR SHORT SPAN JOISTS

Joist	Span
8L 8K1	NM
10K1	NM
12K1	23-0
12K3	NM
12K5	NM
14K1	27-0
14K3	NM
14K4	NM
14K6	NM
16K2	29-0
16K3	30-0
16K4	32-0
16K5	32-0
16K6	NM
16K7	NM
16K9	NM
18K3	31-0
18K4	32-0
18K5	33-0
18K6	35-0
18K7	NM
18K9	NM
18K10	NM
20K3	32-0
20K4	34-0
20K5	34-0
20K6	36-0
20K7	39-0
20K9	39-0
20K10	NM
22K4	34-0
22K5	35-0
22K6	36-0
22K7	40-0
22K9	40-0
22K10	40-0 NM
22K11	40-0 NM
24K4	36-0
24K5	38-0
24K6	39-0
24K7	43-0
24K8	43-0
24K9	44-0
24K10	NM
24K12	NM
26K5	38-0
26K6	39-0

NM = diagonal bolted bridging not mandatory for joists under 40 feet.



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► TABLE A. — ERECTION BRIDGING FOR SHORT SPAN JOISTS (continued)

Joist	Span
26K7	43-0
26K8	44-0
26K9	45-0 44-0
26K10	49-0
26K12	NM
28K6	40-0
28K7	43-0
28K8	44-0
28K9	45-0
28K10	49-0
28K12	53-0
30K7	44-0
30K8	45-0
30K9	45-0
30K10	50-0
30K11	52-0
30K12	54-0
10KCS1	NM
10KCS2	NM
10KCS3	NM
12KCS1	NM
12KCS2	NM
12KCS3	NM
14KCS1	NM
14KCS2	NM
14KCS3	NM
16KCS2	NM
16KCS3	NM
16KCS4	NM
16KCS5	NM
18KCS2	35-0
18KCS3	NM
18KCS4	NM
18KCS5	NM
20KCS2	36-0
20KCS3	39-0
20KCS4	NM
20KCS5	NM
22KCS2	36-0
22KCS3	40-0
22KCS4	NM
22KCS5	NM
24KCS2	39-0
24KCS3	44-0
24KCS4	NM
24KCS5	NM
26KCS2	39-0
26KCS3	44-0
26KCS4	NM
26KCS5	NM
28KCS2	40-0
28KCS3	45-0
28KCS4	53-0
28KCS5	53-0
30KCS2 30KCS3	45-0
30KCS4	54-0
30KCS5	54-0

NM = diagonal bolted bridging not mandatory for joists under 40 feet.

► TABLE B. — ERECTION BRIDGING FOR LONG SPAN JOISTS

Joist	Span
18LH02	33-0
18LH03	NM
18LH04	NM
18LH05	NM
18LH06	NM
18LH07	NM
18LH08	NM
18LH09	NM
20LH02	33-0
20LH03	38-0
20LH04	NM
20LH05	NM
20LH06	NM
20LH07	NM
20LH08	NM
20LH09	NM
20LH10	NM
24LH03	35-0
24LH04	39-0
24LH05	40-0
24LH06	45-0
24LH07	NM
24LH08	NM
24LH09	NM
24LH10	NM
24LH11	NM
28LH05	42-0
28LH06	42-0 46-0
28LH07	NM 54-0
28LH08	NM 54-0
28LH09	NM
28LH10	NM
28LH11	NM
28LH12	NM
28LH13	NM
32LH06	47-0 through 60-0
32LH07	47-0 through 60-0
32LH08	55-0 through 60-0
32LH09	NM through 60-0
32LH10	NM through 60-0
32LH11	NM through 60-0
32LH12	NM through 60-0
32LH13	NM through 60-0
32LH14	NM through 60-0
32LH15	NM through 60-0
36LH07	47-0 through 60-0
36LH08	47-0 through 60-0
36LH09	57-0 through 60-0
36LH10	NM through 60-0
36LH11	NM through 60-0
36LH12	NM through 60-0
36LH13	NM through 60-0
36LH14	NM through 60-0
36LH15	NM through 60-0
40LH08	47-0 through 59-0
40LH09	47-0 through 59-0
44LH09	52-0 through 59-0

NM = diagonal bolted bridging not mandatory for joists under 40 feet.



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(4) Employees shall not be allowed on steel joists where the span of the steel joist is equal to or greater than the span shown in Tables A and B except in accordance with § 1926.757(d).

(5) When permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points are required to provide stability.

(d) Erection bridging.

(1) Where the span of the steel joist is equal to or greater than the span shown in Tables A and B, the following shall apply:

- (i) A row of bolted diagonal erection bridging shall be installed near the midspan of the steel joist;
- (ii) Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored; and
- (iii) No more than one employee shall be allowed on these spans until all other bridging is installed and anchored.

(2) Where the span of the steel joist is over 60 feet (18.3 m) through 100 feet (30.5 m), the following shall apply:

- (i) All rows of bridging shall be bolted diagonal bridging;
- (ii) Two rows of bolted diagonal erection bridging shall be installed near the third points of the steel joist;
- (iii) Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored; and
- (iv) No more than two employees shall be allowed on these spans until all other bridging is installed and anchored.

(3) Where the span of the steel joist is over 100 feet (30.5 m) through 144 feet (43.9 m), the following shall apply:

- (i) All rows of bridging shall be bolted diagonal bridging;
- (ii) Hoisting cables shall not be released until all bridging is installed and anchored; and
- (iii) No more than two employees shall be allowed on these spans until all bridging is installed and anchored.

(4) For steel members spanning over 144 feet (43.9 m), the erection methods used shall be in accordance with § 1926.756.

(5) Where any steel joist specified in paragraphs (c)(2) and (d)(1), (d)(2), and (d)(3) of this section is a bottom chord bearing joist, a row of bolted diagonal bridging shall be provided near the support(s). This bridging shall be installed and anchored before the hoisting cable(s) is released.

(6) When bolted diagonal erection bridging is required by this section, the following shall apply:

- (i) The bridging shall be indicated on the erection drawing;
- (ii) The erection drawing shall be the exclusive indicator of the proper placement of this bridging;
- (iii) Shop-installed bridging clips, or functional equivalents, shall be used where the bridging bolts to the steel joists;
- (iv) 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; and
- (v) Bridging attachments shall not protrude above the top chord of the steel joist.

(e) Landing and placing loads.

(1) During the construction period, the employer placing a load on steel joists shall ensure that the load is distributed so as not to exceed the carrying capacity of any steel joist.

(2) Except for paragraph (e)(4) of this section, no construction loads are allowed on the steel joists until all bridging is installed and anchored and all joist-bearing ends are attached.

(3) The weight of a bundle of joist bridging shall not exceed a total of 1,000 pounds (454 kg). A bundle of joist bridging shall be placed on a minimum of three steel joists that are secured at one end. The edge of the bridging bundle shall be positioned within 1 foot (.30 m) of the secured end.

(4) No bundle of decking may be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless all of the following conditions are met:

- (i) The employer has first determined from a qualified person and documented in a site-specific erection plan that the structure or portion of the structure is capable of supporting the load;
- (ii) The bundle of decking is placed on a minimum of three steel joists;
- (iii) The joists supporting the bundle of decking are attached at both ends;
- (iv) At least one row of bridging is installed and anchored;
- (v) The total weight of the bundle of decking does not exceed 4,000 pounds (1816 kg); and
- (vi) Placement of the bundle of decking shall be in accordance with paragraph (e)(5) of this section.

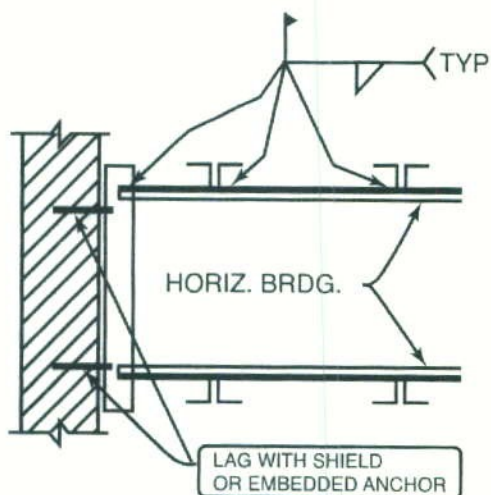
(5) The edge of the construction load shall be placed within 1 foot (.30 m) of the bearing surface of the joist end.



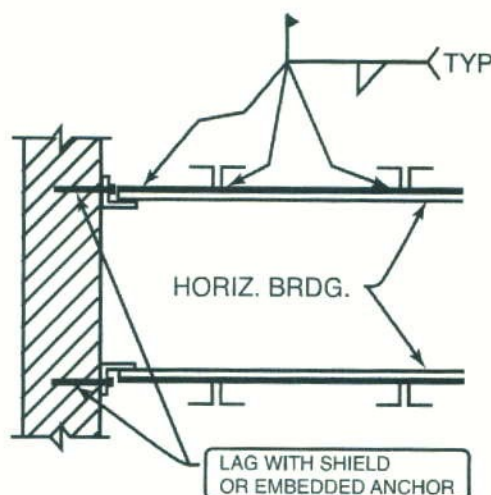
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ILLUSTRATIONS OF OSHA BRIDGING TERMINUS POINTS (NON-MANDATORY)

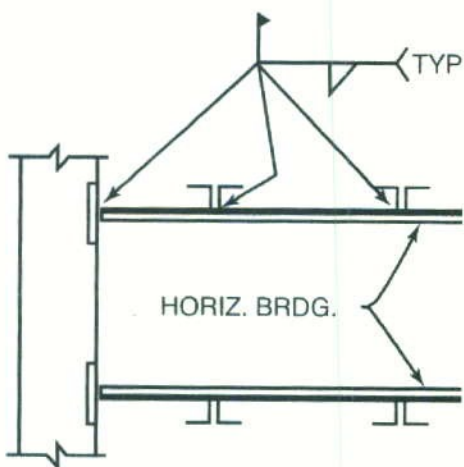
Guidelines for Complying with OSHA Steel Erection Standard, Paragraph §1926.757(a)(10) and §1926.757(c)(5).



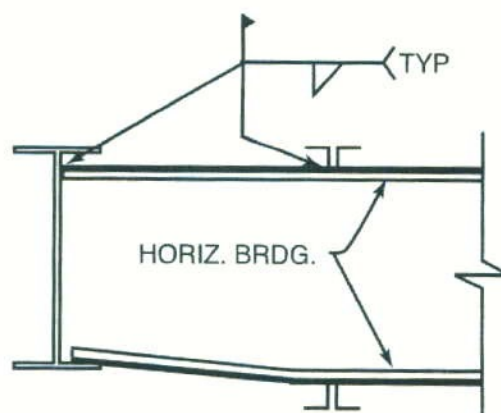
HORIZONTAL BRIDGING
TERMINUS AT WALL



HORIZONTAL BRIDGING
TERMINUS AT WALL



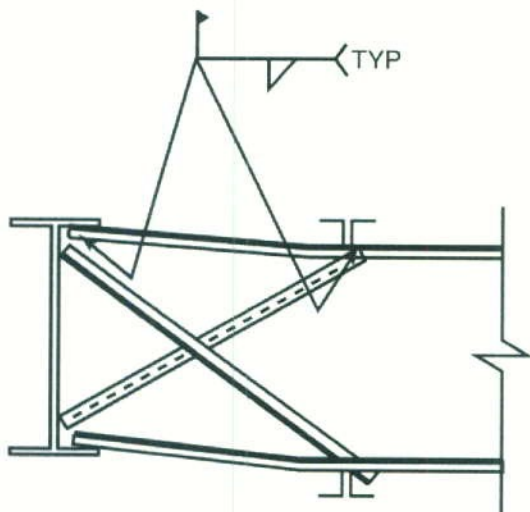
HORIZONTAL BRIDGING
TERMINUS AT PANEL WALL



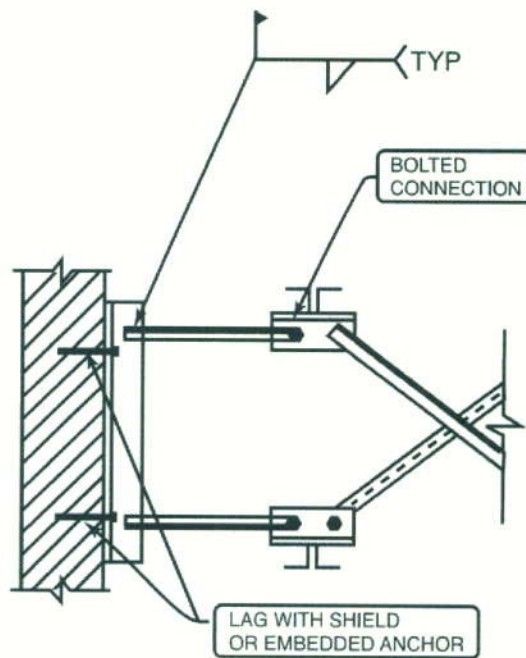
HORIZONTAL BRIDGING
TERMINUS AT
STRUCTURAL SHAPE



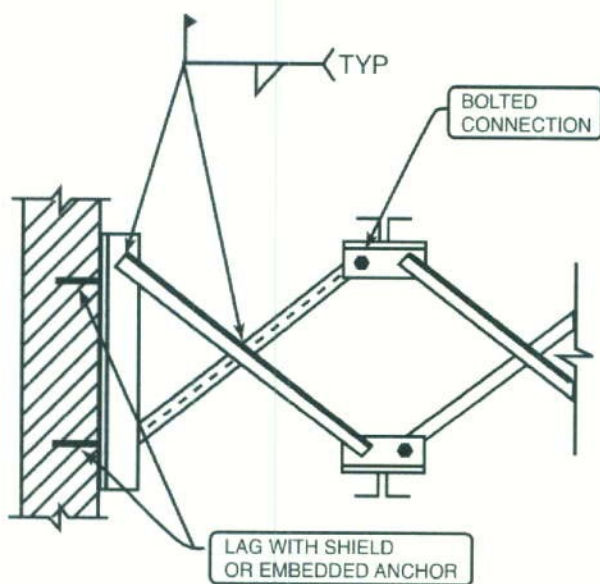
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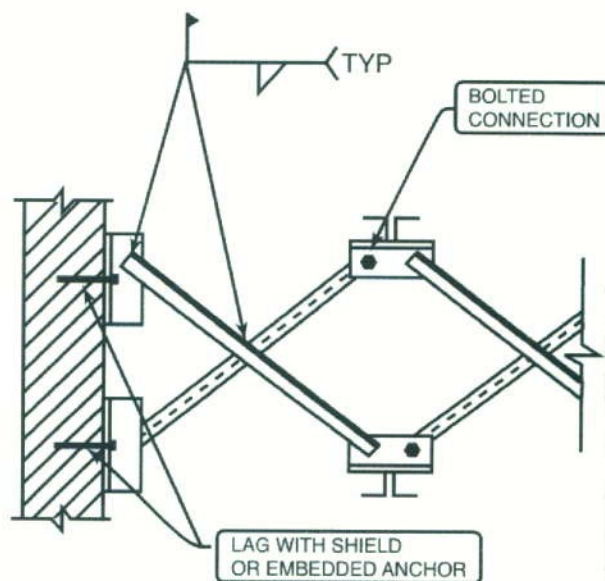
HORIZONTAL BRIDGING
TERMINUS AT STRUCTURAL
SHAPE WITH OPTIONAL
"X-BRIDGING"



BOLTED DIAGONAL BRIDGING
TERMINUS AT WALL

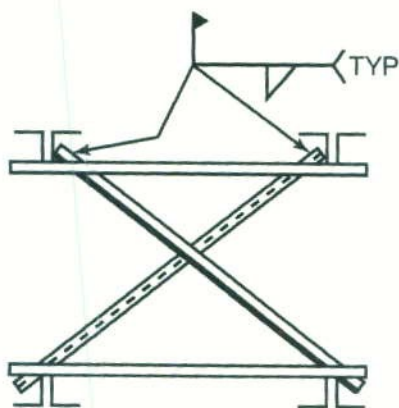


BOLTED DIAGONAL BRIDGING
TERMINUS AT WALL

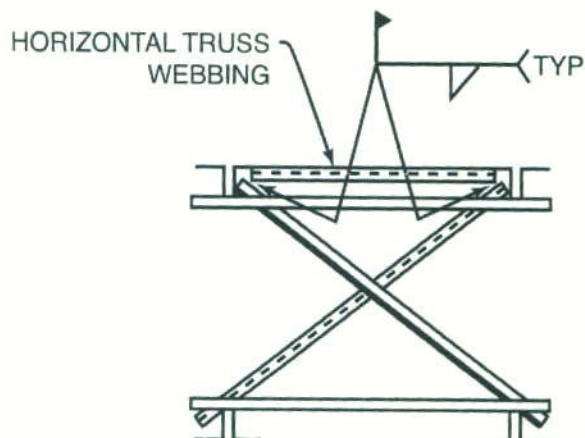


BOLTED DIAGONAL BRIDGING
TERMINUS AT WALL

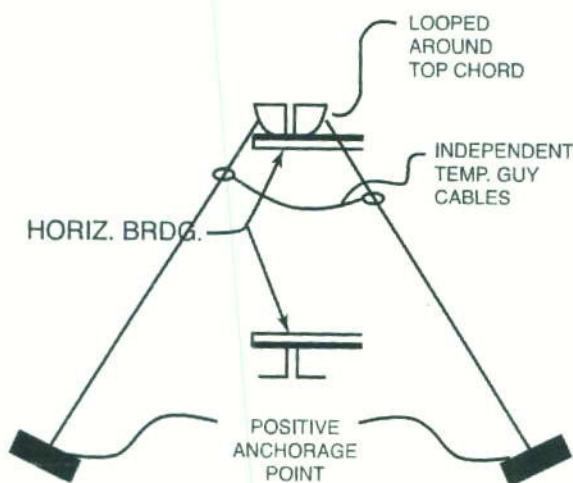




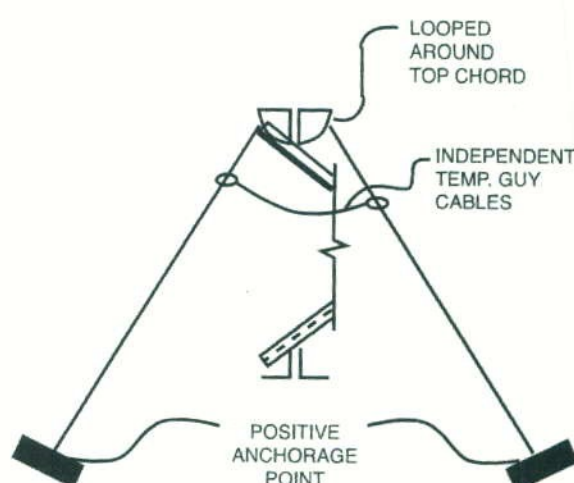
JOISTS PAIR BRIDGING
TERMINUS POINT



JOISTS PAIR BRIDGING
TERMINUS POINT



HORIZONTAL BRIDGING
TERMINUS POINT
SECURED BY TEMP.
GUY CABLES



DIAGONAL BRIDGING
TERMINUS POINT
SECURED BY TEMP.
GUY CABLES