

ARCHITECTURAL GUIDE





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JOIST

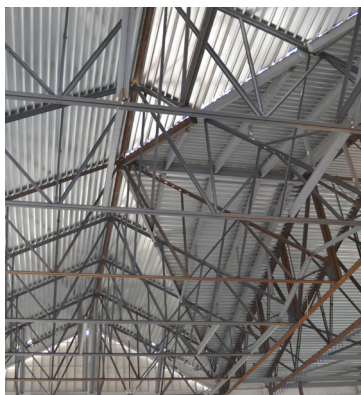
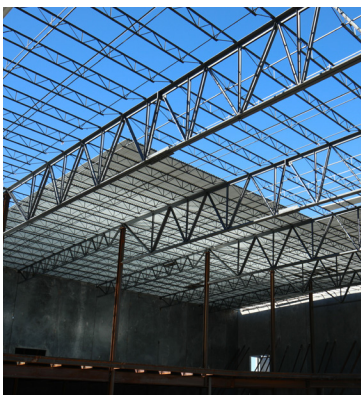
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QUALITY IS OUR

OUR MISSION:

GROW THE CORE | EXPAND BEYOND | LIVE OUR CULTURE

Our challenge is
TO BECOME THE WORDS SAFEST STEEL COMPANY.

We live each day with
GRATITUDE
for the families, customers and partners that make our work possible.

**FOCUSING ON
RELATIONSHIPS.**

Vulcraft and Verco have invested a great deal of time and resources to build companies that focus on the relationship with our customers. As a result, our companies have the highest quality of products in the industry, the expertise to complete jobs correctly, and the goal to always seek out win-win solutions. Powerful partnerships get powerful results.



A WORD ABOUT QUALITY

In the manufacture of open web steel joists and Joist Girders, there can be no compromise on quality. Your business depends on it. Our reputation and success depends on it. As the largest manufacturer of open web steel joists and Joist Girders in North America, a lot of buildings and a lot of people depend on Vulcraft for consistently high standards of quality demonstrated through reliable performance.

In the manufacture of open web steel joists and Joist Girders, Vulcraft uses high quality steel. Welding to exact specifications is the key to making structurally sound joists and is the most critical step in the entire process. All Vulcraft welders are certified in accordance with the standards of the American Welding Society. All welds are in accordance with the welding criteria specified by the Steel Joist Institute and joists and Joist Girders are manufactured to meet the loading indicated by the specifying professional.

To further ensure the quality of every weld, every Vulcraft Quality Assurance Inspector is also certified to these same high standards. To further manage quality assurance in our manufacturing processes, Vulcraft employs an ongoing program of mechanical testing that includes full scale load tests at our facilities.

As the leading Manufacturer of open web steel joists and Joist Girders in North America, Vulcraft's reputation depends on successfully managed Quality Assurance programs. That is why Quality is important at Vulcraft. You have our word on it.

ABOUT US

PROJECTS

Vulcraft/Verco Products have a large variety of applications within all types of architectural projects. From our traditional products like steel bar joists, steel deck and grating, to our new product systems like the Ecospan Composite Floor System and the RediCor Modular Steel Form System.

Within this document we have provided all the data for our products that the specifying architect will need. This includes, Vibration Information, Acoustical Data, Fire Ratings, and BIM Information.

In addition, we have included in-depth information about our more architecturally focused products, Special Profile Joists, Dovetail Deck, and Cellular Deck.

For additional engineering and structural information please see our Steel Joist and Joists Girders Systems Manual, and our Steel Deck Solutions Manual available for download on our website:

www.vulcraft.com



FARMINGTON HIGH SCHOOL
Farmington, UT



SHELDON CHALET
Denali National Park, AK



BLOCK 9
Virginia Beach, VA



BIM

Vulcraft is pairing their proven track record of quality and service with the future of 3D modeling to give fabricators, erectors, general contractors, engineers, and architects an edge over competitors in the market. Providing customers with a detailed model that can display a replica of their building, BIM leads to confidence and peace of mind for the life cycle of the project.

Vulcraft's distinct advantages include multiple platforms, including Revit®, Tekla, and SDS/2, designed web layouts, bridging, specialty joist profiles, and seat profiles with slots.

NUBIM® FOR REVIT

Our NuBIM for Revit add-in allows users to specify and model all parallel chord joists and Joist Girders available from Vulcraft as well as a number of common special profile joists, Ecospan, and composite joists. Users have the ability to apply a variety of common loading conditions to all joists, as well as create load tables and diagrams. All Vulcraft and Verco deck profiles can be added to standard Revit floor and roof components through the add-in. When your project is complete, a file can be exported containing all information related to our products, which can be sent to your Vulcraft sales rep to aid in the quoting and detailing process.

NUBIM® FOR TEKLA

With the NuBIM for Tekla Plug-In you can now build and manage projects more effectively within Tekla Structures. Vulcraft's Joist Plug-In for Tekla Structures enables you to specify Vulcraft joists during the creation of the building model. The joist parameters from the model can then be exported directly into Vulcraft's Detailing and Design Programs.

DESIGNED JOIST

When viewing the BIM provided by Vulcraft engineers, replicas of the steel joists are laid into each aspect of the project. Simple lines, and inexplicable renderings have been replaced with steel joists crafted by Vulcraft to represent the "as-built" product that will be delivered to job sites. Joists manufactured by Vulcraft can be supplied in BIM as they are actually built and put into the field. While viewing the joists in BIM, contractors and other parties have the advantage of reviewing the actual size of the members and panel layouts.

BRIDGING COMPONENTS

To further aid the design and construction of every aspect, Vulcraft has developed a bridging component for BIM to accurately depict all structural elements. Not only does the duct work, wiring and piping have to weave around the joists, but also around the bridging elements. Having these elements in place leads to decreased errors on the job site and saves valuable time and effort by specialty contractors.

SPECIALTY JOIST PROFILES

Vulcraft engineers and designers have taken joists to another level offering specialty joist profiles such as bowstrings, arches, scissors joists, double pitch, single pitch, and gable joists. Eliminating guesswork around specialty profiles reduces on-site error, saving money and valuable time and effort. Utilizing these specialty joists in BIM also enhances design review with customers.

LINKING COMPONENTS

Vulcraft can provide a number of things in BIM to benefit individual users. However, when used with an Integrated Project Delivery (IPD) system, BIM leverages the power of modeling to facilitate collaborative decision-making. IPD brings key construction management, fabricators and product manufacturing expertise together with design professionals and the owner earlier in the process. This produces a design that is optimized for quality, aesthetics, constructibility, affordability, timeliness, and seamless flow into lifecycle management.

To download Vulcraft's BIM tools and for additional information on Vulcraft's BIM capabilities, please visit:

<https://vulcraft.com/DesignTools/#bim-tools>





SUSTAINABILITY

For more than 50 years, Nucor has been built on a sustainable model of recycling steel to produce new steel and steel products. Every Nucor steel mill uses an electric arc furnace (EAF) that melts recycled scrap and turns it into new steel products. EAFs are far less carbon-intensive and more energy-efficient than traditional blast furnace steelmaking, which makes steel by burning iron ore and coking coal.

Nucor is extending beyond its fence line to lower its carbon footprint and is committed to increasing the utilization of renewable energy. Nucor has invested in multiple virtual power purchase agreements to lower its carbon footprint and build partnerships to support the development of new clean energy infrastructure.

Nucor continues to develop product-specific Environmental Product Declarations and Health Product Declarations for all its steel products. Additionally, Nucor will work individually with any customer requiring product life cycle inventory data or other environmental footprint information

EMBODIED CARBON

Embodied carbon values for Vulcraft products can be found in the joists and deck Environmental Product Declarations (EPDs), available at <https://www.nucor.com/sustainability/#resources>. EPDs summarize the results of a cradle-to-gate life-cycle assessment, which includes the greenhouse gas emissions derived from raw material supply, transport, and manufacturing of steel joists and deck. The resulting global warming potential (GWP), along with other impact category indicators, can be found in the EPDs. Facility-specific GWP values are also available.

RECYCLED MATERIAL CONTENT

JOISTS/STRUCTURAL PRODUCTS - The bar steel for Vulcraft joists is typically obtained from one of the ten (10) Nucor bar mills. The average recycled content percentage for the Vulcraft joists is 97.0%. Specific project information is available from facility representatives.

DECK - Steel for decking produced by Vulcraft facilities is typically obtained from one of the seven (7) Nucor sheet mills. The Vulcraft deck products contain 56.5% recycled steel. Verco Decking, Inc. may obtain steel from sources outside of Nucor that may contain lower amounts of recycled content. Specific product information regarding Verco Decking, Inc. and individual Vulcraft locations is available from facility representatives.

All the steel produced by Nucor is 100% recyclable at the end of its useful life. Additional industry information is available online through the American Iron and Steel Institute at <https://www.steel.org/sustainability/>.

LEED INFORMATION

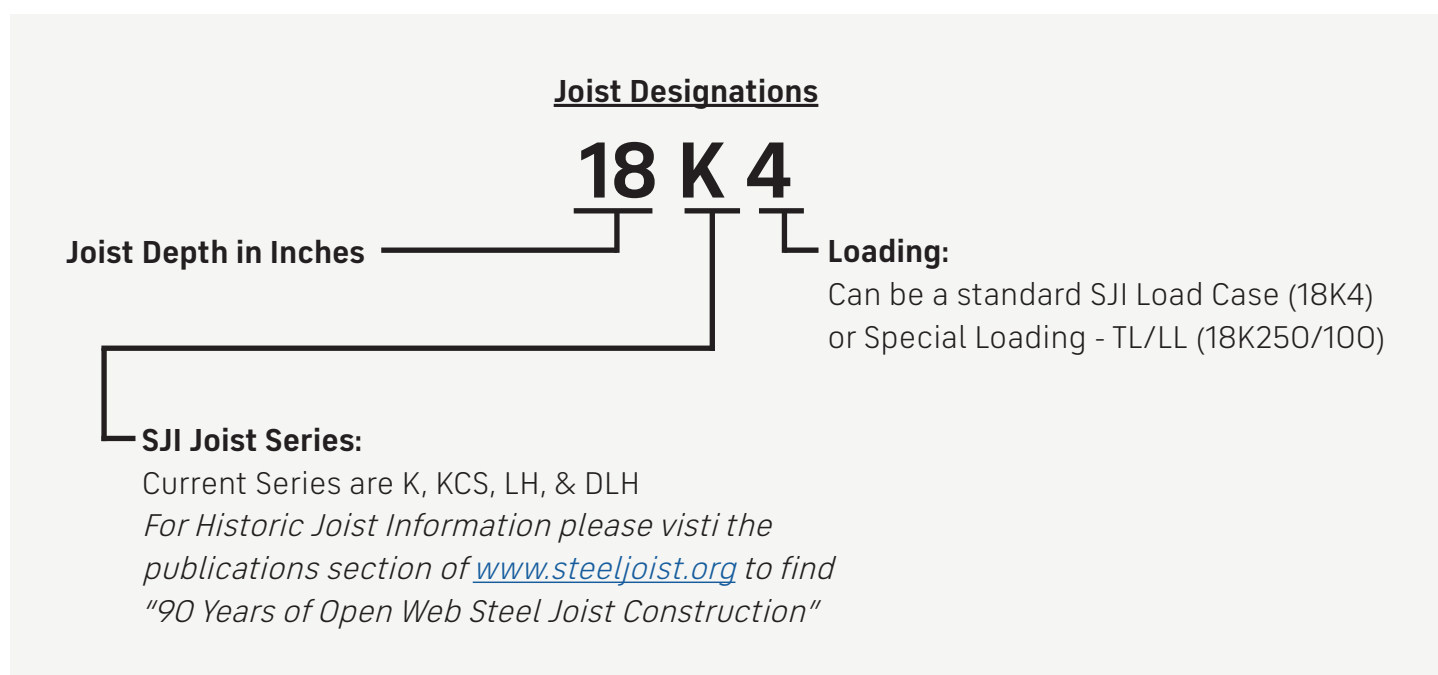
Nucor can provide a variety of documentation to help projects satisfy LEED credit requirements. Nucor publishes a Corporate Sustainability Report bi-annually which can be found here - <https://www.nucor.com/sustainability>. Additional LEED and/or other environmental information regarding specific Nucor Corporation products for a customer's specific order is available from facility representatives or the corporate office. A current contact list can be found here <https://www.nucor.com/locations/>.

REGIONAL MATERIALS - LEED 2009 Credit 5; LEED v4.1 Local Sourcing of Raw Materials

Nucor tracks the origin of scrap shipments to our mills. Nucor can approximate the amount of scrap recovered from any project site region. Nucor owns steel and steel products manufacturing facilities throughout the US that are often within 500 miles of the project site.

GENERAL JOIST INFORMATION

Standard Steel Joist Institute open web steel joists are designed for simple span uniform loads which result in a linearly sloped shear diagram for web forces and a parabolic moment diagram for chord forces. Projects often require that the open web joist support loads that are non-uniform or concentrated loads which alter the shape of the shear and moment diagrams. When specifying joists for these loads, the specifying professional should first attempt to specify a larger standard joist or possibly a KCS series joist (K-series Constant Shear). The interior webs for KCS joists are designed for 100% stress reversal and the chords are designed for a flat positive bending moment. The specified joist must have adequate moment and shear resistance throughout the entire length of the joist.



As can be seen, this designation clearly provides the breakdown necessary for the proper application of the building code required load combinations. In addition, for LH and DLH joists it allows specification of depths not included in the standard load tables. The total load / live load format can also be used for specification of panel point loads on Joist Girders and for the specification of concentrated loads applied to the joists.

For complete joist loading specification information please see the Steel Joists & Joist Girder Systems Manual available in the literature section of www.vulcraft.com.

JOIST SEAT & CHORD WIDTHS

For maximum joist seat & chord widths please see the Economic Joist Guide in the Steel Joists & Joist Girder Systems Manual available in the literature section of www.vulcraft.com.

GENERAL DECK INFORMATION

Steel roof and floor decks have long been recognized for their economy because of their light weight and high strength-to-weight ratio. They provide a durable and attractive roof or floor system for fast all-weather construction. Steel decks also provide excellent lateral diaphragm action thus reducing the necessity for structural bracing and their incombustible nature assures architects, engineers, and owners of excellent fire ratings.

ROOF DECK

Deck Profile	Standard Span	Long Span (≥10')	Clean Appearance	Fire Rated	Sound Absorbing	Reconfigurable Hangers
1.5B, 1.5BI, 1.5PLB	✓			✓		
3N, 3NI, 3PLN		✓		✓		
1.5BA, 1.5BIA	✓			✓	✓	
3NA, 3NIA, 3PLNA		✓		✓	✓	
2.0D		✓	✓	✓		✓
3.5D		✓	✓	✓		✓
2.0DA		✓	✓	✓	✓	✓
3.5DA		✓	✓	✓	✓	✓

FLOOR DECK

Deck Profile	Standard Span	Long Span (≥10')	Clean Appearance	Fire Rated	Reconfigurable Hangers
1.5VL, 1.5VLI, 1.5VLR	✓			✓	
2VLI		✓		✓	
3VLI		✓		✓	
2.0D FormLok®		✓	✓	✓	✓
3.5D FormLok®		✓	✓	✓	✓

NON-COMPOSITE FLOOR DECK

Non-Composite Floor Deck Profiles: 0.6C, 1.0C, 1.3C, 1.5C, 2C, 3C

FINISHES

Vulcraft offers a selection of finishes: primer painted over cold-rolled or galvanized, galvanized, or black (uncoated).

Primer painted: Prior to applying a baked-on acrylic medium gray or white primer, the cold-rolled or galvanized sheet is chemically cleaned and pre-treated.

Galvanized: Galvanized decks are supplied from mill coated sheets and are offered in two standard coated finishes.

NON-STANDARD CONFIGURATIONS

In addition to the standard configurations Vulcraft can also provide the following joist configurations:



Bowstring



Arch Chord



Scissor



Multi-Pitch



Double Pitch



Single Pitch

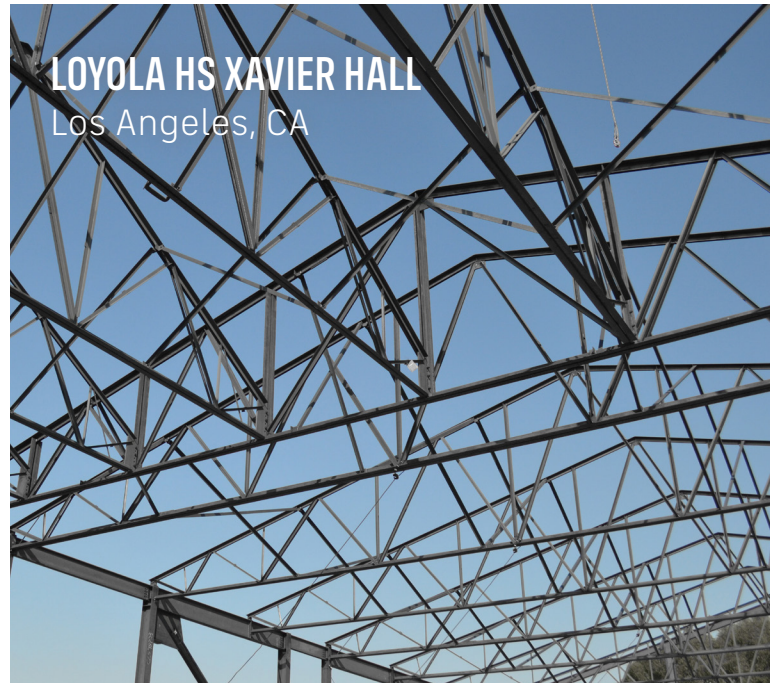
In the fabrication of joists, a sufficient end depth must be provided. The appropriate end depth varies with the size, shape, and loading of the joist. The end depth is the distance between the top chord and the bottom chord or the projection of the bottom chord near the center line of the support. End depth requirements increase for bottom-chord-bearing joists and sloped joists. An absolute minimum end depth of 12" must be provided in all cases, with 18" minimum end depth recommended in most cases and for large joists it will increase. Contact Vulcraft for minimum end depth requirements.

Note that both Scissor and Arched Chord type joists require special attention for their supports due to the horizontal deflections. These joists can be designed with either pinned end restraints at both ends or pinned on one end with a roller on the other. The pinned/pinned condition may result in significant horizontal forces being applied to the structure. Analyzing the effect of increasing the stiffness of these joists shows little change in horizontal force magnitude with significant increase in stiffness. The pinned/roller condition requires that the roller bearing condition allow for horizontal movement. In this case increasing the joist stiffness does affect the horizontal displacement.

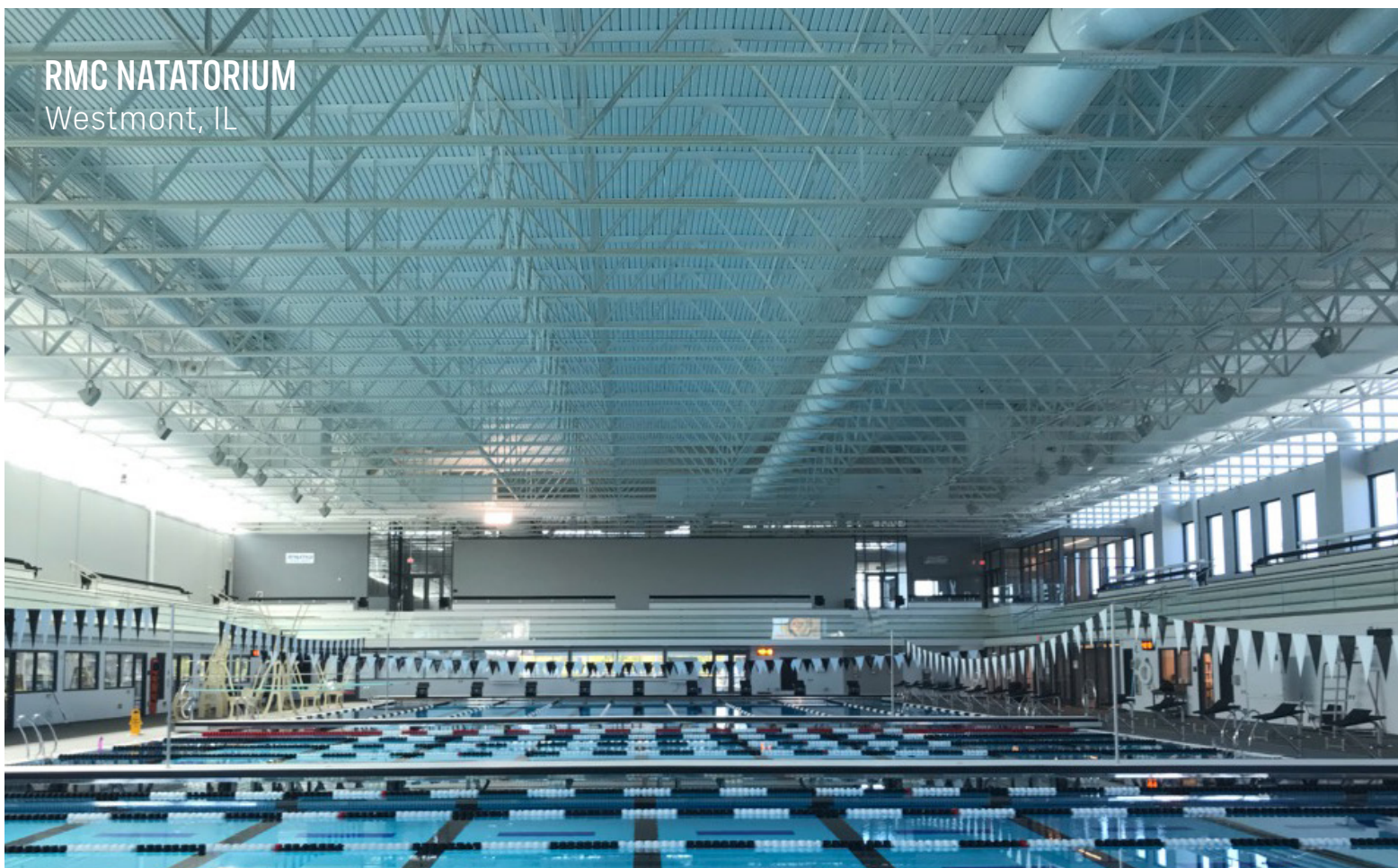
PLEASE [CONTACT](#) EITHER YOUR LOCAL DISTRICT SALES OFFICE OR THE NEAREST VULCRAFT MANUFACTURING FACILITY FOR LIMITATIONS IN DEPTH OR LENGTH.



PROUD BIRD RESTAURANT
Los Angeles, CA



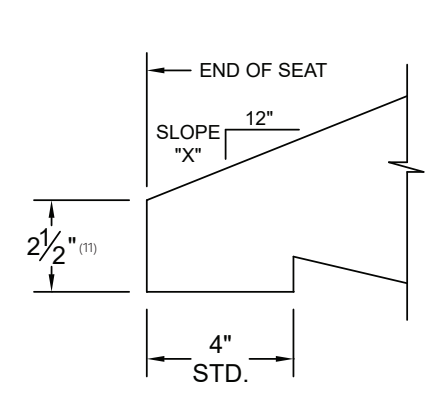
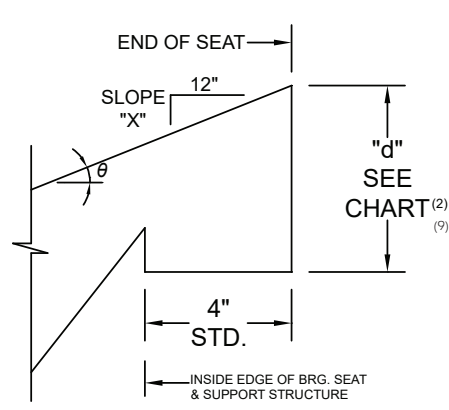
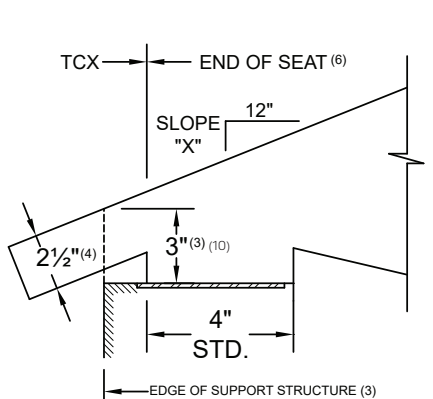
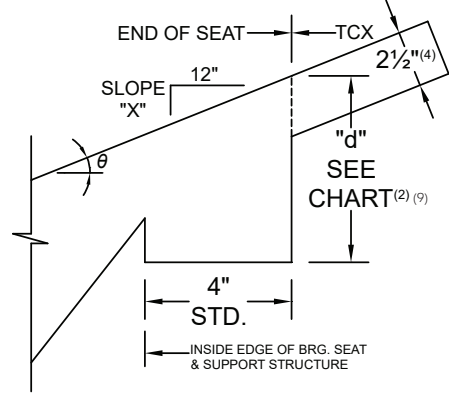
LOYOLA HS XAVIER HALL
Los Angeles, CA



RMC NATATORIUM
Westmont, IL

SLOPED SEAT REQUIREMENTS FOR SLOPES 3/8":12 AND GREATER
K-SERIES OPEN WEB STEEL JOISTS
(VARIES FROM SJI CODE OF STANDARD PRACTICE)

Standard joist bearing seat depths ($K=2.5"$ $LH=5"$ $JG=7.5"$) are based on typical chord sizes and not greater than 1/4":12 top chord slopes. Bearing length, in some cases, will also factor in to the joist seat depth. In general when slopes increase, so must the bearing seat depth. Special profile joists all require non-typical bearing seat depths due to the slope of the top chord. These tables were developed to clarify the bearing seat depth requirements of non-typical joists.

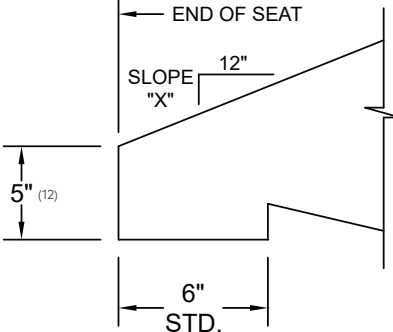
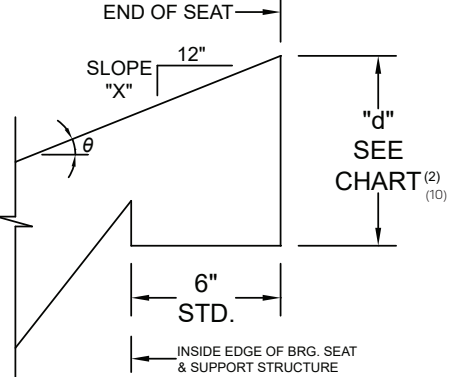
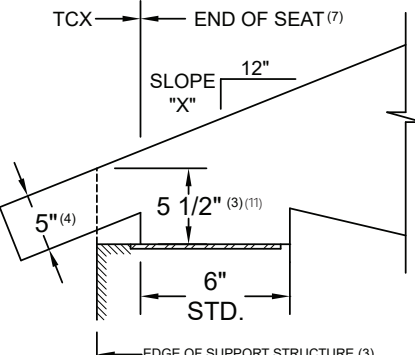
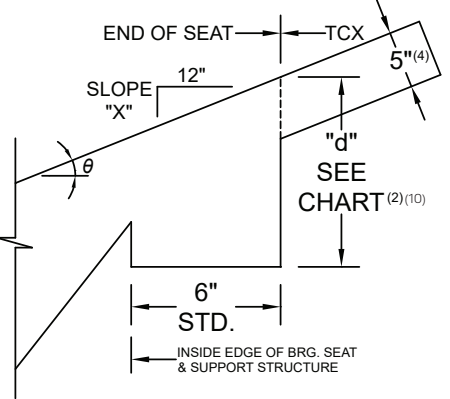
LOW END W/OUT TOP CHORD EXTENSIONS	HIGH END W/OUT TOP CHORD EXTENSIONS	SLOPE "X":12	MINIMUM HIGH END SEAT DEPTH "d"
			VULCRAFT RECOMMENDED FOR SPECIAL CONDITIONS (8)
		3/8	5"
		1/2	5"
		1	5"
		1 1/2	5 1/2"
		2	5 1/2"
		2 1/2	5 1/2"
		3	6"
		3 1/2	6"
		4	6"
		4 1/2	6 1/2"
		5	6 1/2"
		5 1/2	7"
		6	7"
		> 6:12	SEE NOTE (9)
LOW END W/ TOP CHORD EXTENSIONS	HIGH END W/ TOP CHORD EXTENSIONS		
			

NOTES:

1. Depths shown are the minimum required for manufacturing of sloped seats. Depths may vary depending on actual bearing conditions.
2. $d = 1/2 + 2.5/\cos\theta + 4\tan\theta$ (Rounded up to the nearest 1/2")
3. Clearance must be checked on outer edge of support. Increase bearing depths as required to allow passage of 2 1/2" deep extension.
4. If extension depth greater than 2 1/2" is required, increase bearing depths accordingly.
5. If slope is 1/4:12 or less, sloped seats are not required.
6. Required bearing seat depth is determined at END OF SEAT.
7. Also, refer to SJI Specification 5.4 for special considerations of joist end reaction location.
8. For extensions greater than 1'-6" or when net uplift reactions exceed the values listed on page 14.
9. $d = 2 + 2.5/\cos\theta + 4\tan\theta$ (Rounded up to the nearest 1/2")
10. 4 1/2" for special conditions per Note 8
11. 3" for special conditions per Note 8

SLOPED SEAT REQUIREMENTS FOR SLOPES 3/8":12 AND GREATER LH- AND DLH-SERIES OPEN WEB STEEL JOISTS (VARIES FROM SJI CODE OF STANDARD PRACTICE)

Standard joist bearing seat depths ($K=2.5"$ $LH=5"$ $JG=7.5"$) are based on typical chord sizes and not greater than 1/4":12 top chord slopes. Bearing length, in some cases, will also factor in to the joist seat depth. In general when slopes increase, so must the bearing seat depth. Special profile joists all require non-typical bearing seat depths due to the slope of the top chord. These tables were developed to clarify the bearing seat depth requirements of non-typical joists.

LOW END W/OUT TOP CHORD EXTENSIONS	HIGH END W/OUT TOP CHORD EXTENSIONS	SLOPE "X":12	MINIMUM HIGH END SEAT DEPTH "d"
			VULCRAFT RECOMMENDED FOR SPECIAL CONDITIONS (9)
		3/8	7 1/2"
		1/2	7 1/2"
		1	8"
		1 1/2	8"
		2	8 1/2"
		2 1/2	8 1/2"
		3	9"
		3 1/2	9"
		4	9 1/2"
		4 1/2	10"
		5	10"
		5 1/2	10 1/2"
		6	11"
		> 6:12	SEE NOTE (10)
LOW END W/ TOP CHORD EXTENSIONS	HIGH END W/ TOP CHORD EXTENSIONS		
			

NOTES:

1. Depths shown are the minimum required for manufacturing of sloped seats. Depths may vary depending on actual bearing conditions.
2. $d = 1/2 + 5/\cos\theta + 6\tan\theta$ (Rounded up to the nearest 1/2")
3. Clearance must be checked on outer edge of support. Increase bearing depths as required to allow passage of 5" deep extension.
4. If extension depth greater than 5" is required, increase bearing depths accordingly.
5. Add 2 1/2" to seat depth at 18 thru 25 chord section numbers. Consult with Vulcraft for information when TCXs are present.
6. If slope is 1/4:12 or less, sloped seats are not required.
7. Required bearing seat depth is determined at END OF SEAT.
8. Also, refer to SJI Specification 5.4 for special considerations of joist end reaction location.
9. For extensions greater than 2'-6".
10. $d = 2 + 5/\cos\theta + 6\tan\theta$ (Rounded up to the nearest 1/2")
11. 7" for special conditions per Note 9
12. 6" for special conditions per Note 9

FLOOR VIBRATION

Floor vibration due to human activity occurs, in varying degrees, in all types of building construction. Unlike steady state vibration due to machinery, which can be isolated, vibration due to human occupancy is inconsistent in both amplitude and frequency and must be controlled by proper design of the elements supporting the floor.

The Steel Joist Institute and Nucor Research and Development have been studying this phenomenon for years. Laboratory research continues to be performed along with gathering measurements on numerous buildings, exhibiting both good and bad characteristics, using seismic recording instruments. AISC Design Guide 11 "Vibrations of Steel-Framed Structural Systems Due to Human Activity" Second Edition and SJI Technical Digest 5 "Vibration of Steel Joist Concrete Floor Slabs" discuss in detail methods for calculating vibration characteristics of open web steel joist supported floors. Vibration of Vulcraft steel joist/steel deck supported concrete floors can easily be checked for walking excitation utilizing Vulcraft's new Vibration Analysis Tool, <https://www.vulcraft.com/design-tools/>.

The clear majority of floors, including those utilizing steel joists, do not exhibit floor vibrations severe enough to be considered objectionable. However, human sensitivity to vibratory motion varies, and a satisfactory framing solution is dependent upon the sound judgment of qualified design professionals.

Floor vibration is measured in terms of acceleration, displacement amplitude, and frequency. These factors are not objectionable to all people at the same level since human sensitivity and tolerance for vibration varies.

The following observations are recommended only as a guide to the design professional:

OPEN FLOOR AREAS are often subject to vibration issues. Modern "electronic offices" tend to have lower live loading and lower damping. Partitions, file cabinets, book stacks, heavy furnishings, and even crowds of people provide additional damping and reduce vibration levels.

PARTITIONS increase damping more than any other element and often eliminate vibration issues. They are effective either above or below a floor as long as they are full height partitions connected to the floor above and below the partition. Consideration should be given to potential changes in occupancy of the floor over the life of the building.

SUPPORT FRAMING BEAMS can contribute to floor vibration. The natural frequency and amplitude of both the joists and supporting Joist Girders or hot rolled girders must be calculated. In this manner, the resulting system acceleration, displacement, and frequency can be determined.

TYPE of STEEL JOIST END CONNECTION to a girder can significantly affect the natural frequency and the effective mass of floor framing systems subjected to walking motion. Joists fabricated with flush framed top chord bolted connections, Ecospan® flush joist seats, or stiffened top chord bearing seats have been shown to reduce floor vibration versus standard top chord bearing seats.

BRIDGING of all standard types provides equal floor vibrational characteristics.

THICKER FLOOR SLABS can be an economical solution for controlling floor vibrations. The additional thickness increases floor system stiffness transverse to the joists, often improving vibration characteristics. The additional mass of the system can also reduce vibration levels.

WIDER JOIST SPACINGS improve vibrational characteristics only when combined with thicker floor slabs. The resulting increase in joist size does not contribute significantly. When used with a thicker slab, greater resistance to vibration can be achieved, and, since fewer pieces must be installed, may be more economical.

NON-COMPOSITE JOISTS are considered to be fully composite joists in vibration analyses. Human-induced loads typically cause mid-bay displacement amplitudes smaller than 0.01 in. - implying very low horizontal shears between the joists and the slab. Also, deck fasteners, including spot welds and screws, provide enough slip resistance to warrant using the composite transformed moment of inertia in vibration analyses.

LONGER FLOOR SPANS have many advantages over shorter spans both in construction and vibrational response. There are many long spanning joist supported floors that have satisfactory vibration performance.

INCREASING JOIST STIFFNESS beyond that required to meet the live load deflection limitations can be beneficial when only a small decrease in predicted acceleration is needed. Increase the stiffness of the joist or Girder (whichever has the lowest frequency) until the criterion is met. When the joist and girder have the same frequency, increase the stiffness of both until the required vibration criteria is achieved.

PC – based software for the evaluation of joist supported floor systems subjected to walking, rhythmic, or sensitive equipment / occupants is available from:

STRUCTURAL ENGINEERS, INC

537 Wisteria Drive

Radford, VA 24141

Phone (540) 731-3330

www.floorvibe.com

CONCLUSIONS

Partitions will usually eliminate vibration issues. When a floor cannot have partitions, changing the type of joist end connection, increasing the slab thickness, increasing the joist spacing, and/or increasing the joist or girder stiffness can be economical and effective ways to reduce vibrations.

For more information refer to the Steel Joist Institute Technical Digest No. 5 "Vibration of Steel Joist-Concrete Slab Floors" and the AISC Steel Design Guide 11 "Vibrations of Steel-Framed Structural Systems Due to Human Activity" Second Edition.

DEFINITIONS

Acceleration - is the primary measure of vibration level used in the assessment of human comfort, and is usually expressed as a percentage of the acceleration due to gravity.

Frequency - is the number of cycles per second or Hz.

Damping - is the loss of energy over time in a vibrating system and is usually presented as a percent of critical damping.

Critical Damping - is the damping required to bring a displaced system to rest without oscillation.

DUCTWORK

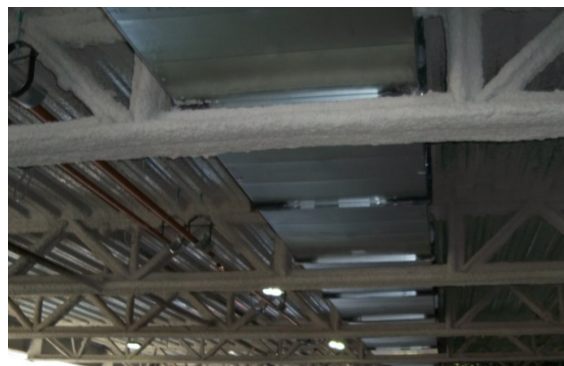
ALLOWABLE DUCTWORK

Joist Depth (in.)	Panel Length (in.)	Round (in.)	Square (in.)	Rectangular (in. x in.)
10	19*	5	4	3x6
12	19*	6	5	4x7
14	19*	7	6	5x7
16	19*	8	6	6x7
18	24*	9	7	6x9
20	24*	10	8	7x9
22	24*	10	9	8x9
24	24*	11	9	9x9
18	48	10	8	6x18
20	48	10	8	7x18
22	48	10	9	8x18
24	48	12	10	8x19
26	48	15	12	9x19
28	48	16	13	10x18
30	48	17	14	11x19
32	64	20	16	11x25
34	68	22	18	12x28
36	72	24	18	13x29
38	76	25	20	13x30
40	80	26	22	14x32
42	84	27	22	16x34
44	88	28	23	17x36
46	92	30	24	18x36
48	96	32	26	19x40
50	100	33	27	20x42

* rod joist

VIERENDEEL OPENINGS

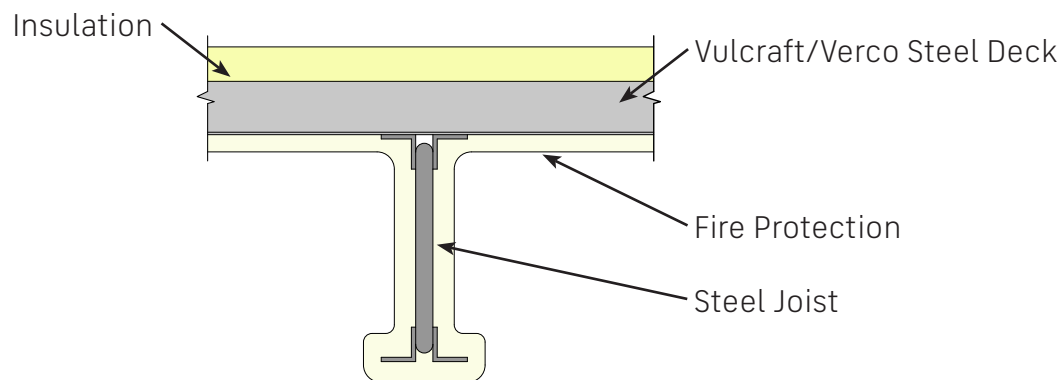
For cases in which larger openings in joists are required, Vulcraft can provide Vierendeel Openings. Please contact your Vulcraft Sales Representative for more information about Vierendeel options.



FIRE RESISTANCE: ROOF

The use of steel joists and Joist Girders in buildings frequently requires the use of fire rated systems of construction. The fire ratings of systems are expressed in hours ranging from one to four hours. The required rating for a roof-ceiling or floor-ceiling assembly in a building is established by the Building Code and is a function of the building's occupancy, area and height. The ratings are to be met using rated assemblies meeting or exceeding the required rating. Such assemblies typically consist of steel deck, structural members, fireproofing protection, and other appropriate materials. Assemblies are constructed and tested according to the methods and acceptance criteria described in ASTM Standard E119, "Standard Test Methods for Fire Tests of Building Construction and Materials" (ASTM, 2018).

The purpose of fire tests is to establish the relative performance of different assemblies under identical laboratory test conditions. Most fire tests over the years have been conducted by Underwriters Laboratories Inc. and descriptions of the rated assemblies are compiled in the UL "Fire Resistance Directory." It is important when applying rated assemblies to a project that all the features of the rated assembly be carried over into the design, or it will not be valid and can delay the issuance of a Building Permit.



Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Deck Material	Insulation				
1 Hr.	Exposed Grid	12K1	22 MSG Min.	Fiber Board	84	W8 x 17	P201	1.5B,1.5BI
		10K1	26 MSG Min.	Fiber Board	48	W6 x 12	P202	None
		10K1	26 MSG Min.	Fiber Board	48	20G@13plf	P211	1.5B,1.5BI
		12K3	28 MSG Min.	Fiber Board	72	20G@13plf W8 x 17	P214	1.5B,1.5BI
		12K1	26 MSG Min.	Fiber Board	72	20G@13plf W6 x 12	P225	1.5B,1.5BI,3N, 3NI
		12K3	24 MSG Min.	Building Units	48	NS	P227	1.5B,1.5BI
		12K3	26 MSG Min.	Fiber Board	72	20G@13plf W6 x 12	P230	1.5B,1.5BI
		12K1	26 MSG Min.	Insulating Concrete	48	20G@14plf* W8 x 15	P231	1.0C, 1.3C, 1.5C
		12K3	24 MSG Min.	Foamed Plastic	72	W8 x 15	P235	1.5B,1.5BI
		10K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W8 x 15	P246	0.6C,1.0C, 1.3C, 1.5C

* Special Area Requirements

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Deck Material	Insulation				
1 Hr.	Exposed Grid	12K5	26 MSG Min.	Fiber Board	48	W6 x 12	P250	1.5B,1.5BI
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251	0.6C,1.0C, 1.3C, 1.5C
		10K1	22 MSG Min.	Fiber Board	72	W6 x 12	P254	1.5B,1.5BI
		10K1	28 MSG Min.	Insulating Concrete	72	W8 x 15	P255	0.6C,1.0C, 1.3C, 1.5C
		10K1	24 MSG Min.	Fiber Board	72	NS	P259	1.5B,1.5BI
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P261	0.6C,1.0C, 1.3C, 1.5C
		12K1	26 MSG Min.	Insulating Concrete	72	W8 x 15	P264	1.0C, 1.3C, 1.5C
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P265	Metal Roof Panels
		10K1	26 MSG Min.	Fiber Board	48	W6 x 16	P267	1.0C, 1.5C
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P268	Metal Roof Panels
		12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 15	P269	0.6C,1.0C, 1.3C, 1.5C
1 Hr.	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301	1.5B,1.5BI
		10K1	22 MSG Min.	Fiber Board	48	NS	P302	1.5B,1.5BI
		10K1	22 MSG Min.	Fiber Board	NS	W6 x 16	P303	1.5B,1.5BI
	Gypsum Board	12K3	26 MSG Min.	Insulating Concrete	60	W8 x 24	P509	1.3C, 1.5C
		12K3	24 MSG Min.	Fiber Board	72	20G@13plf W8 x 13	P510	1.5B,1.5BI
		10K1	22 MSG Min.	Fiber Board	72	20G@13plf	P514	1.5B,1.5BI
		10K1	20 MSG Min.	Fiber Board	48	NS	P519	1.5B,1.5BI
1 1/2 Hr.	Exposed Grid	12K1	26 MSG Min.	Fiber Board	72	20G@13plf W6 x 12	P225	1.5B,1.5BI,3N, 3NI
		12K3	24 MSG Min.	Building Units	48	NS	P227	1.5B,1.5BI
		12K3	26 MSG Min.	Fiber Board	48	20G@13plf W6 x 12	P230	1.5B,1.5BI
		12K1	26 MSG Min.	Insulating Concrete	48	20G@14plf* W8 x 24	P231	1.0C, 1.3C, 1.5C
		12K5	26 MSG Min.	Fiber Board	48	W6 x 12	P250	1.5B,1.5BI

* Special Area Requirements

FIRE RESISTANCE: ROOF

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Deck Material	Insulation				
1 1/2 Hr.	Exposed Grid	12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251	0.6C,1.0C, 1.3C, 1.5C
		10K1	24 MSG Min.	Fiber Board	72	NS	P259	1.5B,1.5BI
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P265	Metal Roof Panels
		10K1	20 MSG Min.	Fiber Board	48	NS	P266	1.5B,1.5BI
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P268	Metal Roof Panels
		12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 24	P269	0.6C,1.0C, 1.3C, 1.5C
	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301	1.5B,1.5BI
	Metal Lath	12K5	22 MSG Min.	Fiber Board	72	NS	P404	1.5B,1.5BI
	Gypsum Board	12K3	24 MSG Min.	Fiber Board	72	20G@13plf W8 x 13	P510	1.5B,1.5BI,3N, 3NI
2 Hr.	Exposed Grid	10K1	24 MSG Min.	Fiber Board	72	W6 x 12	P237	1.5B,1.5BI
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251	0.6C,1.0C, 1.3C, 1.5C
		10K1	20 MSG Min.	Fiber Board	48	NS	P266	1.5B,1.5BI
	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301	1.5B,1.5BI
	Metal Lath	12K5	22 MSG Min.	Fiber Board	72	NS	P404	1.5B,1.5BI
	Gypsum Board	10K1	22 MSG Min.	Fiber Board	72	20G@13plf	P514	1.5B,1.5BI
		10K1	20 MSG Min.	Fiber Board	48	NS	P519	1.5B,1.5BI
		14K1	26 MSG Min.	Insulating Concrete	66	NS	P520	1.0C, 1.3C, 1.5C
3 Hr.	Metal Lath	10K1	28 MSG Min.	Insulating Concrete	48	NS	P405	0.6C,1.0C, 1.3C, 1.5C
1 Hr.	SAFRM	10K1	22 MSG Min.	Building Units	NS	NS	P822	NA
		12K3	22 MSG Min.	Fiber Board	NS	W8 x 20	P824	1.5B,1.5BI
1 Hr. and 1-1/2 Hr.	SAFRM	12K5	28 MSG Min.	Insulating Concrete	96	W6 x 16	P919	1.5B,1.5BI,3N, 3NI
1-1/2 Hr. and 2 Hr.	SAFRM	10K1	22 MSG Min.	Building Units	NS	W6 x 16	P728	1.5B,1.5BI

* Special Area Requirements

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Deck Material	Insulation				
1 Hr., 1-1/2 Hr. and 2 Hr.	SAFRM	14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P701	1.5B,1.5BI,3N, 3NI
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P711	1.5B,1.5BI,3N, 3NI
		12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P717	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Foamed Plastic	NS	20G@13plf W8 x 28	P725	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P726	1.5B,1.5BI,3N, 3NI
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P734	1.5B,1.5BI,3N, 3NI
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P736	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P739	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Fiber Board	NS	W6 x 16	P740	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P743	1.5B,1.5BI,3N, 3NI
		12K3	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P801	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P815	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Fiber Board	NS	W6 x 16	P816	1.5B,1.5BI,3N,3NI
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P819	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P825	1.5B,1.5BI
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P827	1.5B,1.5BI,3N,3NI
		12K1	22 MSG Min.	Fiber Board	NS	20G@13plf W8 x 20	P828	1.5B,1.5BI,3N,3NI
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P902	1.5B,1.5BI,3N, 3NI
		10K1	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P907	1.5B,1.5BI,3N, 3NI
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P908	1.5B,1.5BI,3N, 3NI, 2.0D, 3.5D
		10K1	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P920	1.5B,1.5BI,3N, 3NI
		12K5	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P921	1.5B,1.5BI,3N, 3NI, 2.0D, 3.5D
		10K1	28 MSG Min.	Insulating Concrete	NS	W6 x 16	P922	1.5B,1.5BI,3N, 3NI
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P923	1.5B,1.5BI,3N, 3NI

* Special Area Requirements

FIRE RESISTANCE: ROOF

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Deck Material	Insulation				
1 Hr., 1-1/2 Hr. and 2 Hr.	SAFRM	10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P925	0.6C,1.0C,1.3C,1.5C,2C,3C,1.5B, 1.5BI,3N, 3NI
		12K5	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P926	0.6C,1.0C,1.3C,1.5C,2C,3C,1.5B, 1.5BI,3N, 3NI
		14K4	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P927	0.6C,1.0C,1.3C,1.5C,2C,3C,1.5B, 1.5BI,3N, 3NI
		12K5	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P928	0.6C,1.0C,1.3C,1.5C,2C,3C,1.5B, 1.5BI,3N, 3NI
		12K3	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P929	0.6C,1.0C,1.3C,1.5C,2C,3C,1.5B, 1.5BI,3N, 3NI
		10K1	28 MSG Min.	Insulating Concrete	NS	W6 x 16	P936	0.6C,1.0C,1.3C,1.5C,2C,3C,1.5B, 1.5BI,3N, 3NI
2 Hr.	SAFRM	12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P718	1.5B,1.5BI
		12K3	22 MSG Min.	Foamed Plastic	NS	20G@13plf W6 x 16	P720	1.5B,1.5BI
		12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P729	1.5B,1.5BI
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	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P722	1.5B,1.5BI
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P723	1.5B,1.5BI,3N, 3NI
		10K1	22 MSG Min.	Foamed Plastic	NS	W8 x 28	P732	1.5B,1.5BI,3N, 3NI
		10K1*,16K2	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P733	1.5B,1.5BI
		10K1*	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P826	1.5B,1.5BI

* Special Area Requirements

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Minimum Thickness (in.)	Type				
1 Hr.	Acoustical	12K1, 18LH02	2.5	LW,NW	NL	20G@13plf W8 x 15	D216, D219	1.5VL, 1.5VLI, 2VL, 3VL, 2VLP, 3VLP
	Exposed Grid	10K1	2.5	NW	48*	20G@14plf W6 x 12	G205	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.0	NW	72	W6 x 12	G208	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	48*	20G@14plf W6 x 12	G256	0.6C, 1.0C, 1.3C, 1.5C
	Gypsum Board	10K1	2.5	NW	48	W8 x 24	G548	1.0C
1 1/2 Hr.	Acoustical	12K1, 18LH02	2.5	LW,NW	NL	20G@13plf W8 x 15	D216	1.5VLI, 2VL, 3VL, 2VLP, 3VLP
							D219	1.5VL, 1.5VLI, 2VL, 3VL, 2VLP, 3VLP
	Gypsum Board	12K1, 18LH02	2.5	NW	NL	20G@20plf W8 x 28	D502	1.5VL, 1.5VLI, 2VL, 3VL, 2VLP, 3VLP
	Exposed Grid	10K1	2.5	NW	24 (48)	20G@13plf W6 x 12	G203	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	48*	20G@14plf W6 x 12	G205	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.0	NW	72	W6 x 12	G208	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	24 (48)	W6 x 12	G213	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	24 (48)	20G@13plf W8 x 31	G228	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.0	NW	24 (48)	20G@13plf W8 x 24	G229	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	24 (48)	20G@13plf W6 x 12	G243	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	24 (48)	20G@13plf W8 x 31	G268	0.6C, 1.0C, 1.3C, 1.5C
	Gypsum Board	12K1	2.0	NW	24 (48)	NS	G502	0.6C, 1.0C, 1.3C, 1.5C
2 Hr.	Acoustical	12K1, 18LH02	2.5	LW,NW	NL	20G@13plf W8 x 15	D216	1.5VLI, 2VL, 3VL, 2VLP, 3VLP
							D219	1.5VL, 1.5VLI, 2VL, 3VL, 2VLP, 3VLP
	Gypsum Board	12K1, 18LH02	2.5	NW	NL	20G@20plf W8 x 28	D502	1.5VL, 1.5VLI, 2VL, 3VL, 2VLP, 3VLP
	Concealed Grid	10K1	2.25	NW	24 (48)	W6 x 25	G023	0.6C, 1.0C, 1.3C, 1.5C
		8K1	2.5	NW	24 (48)	20G@13plf W8 x 20	G031	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	30 (48)	20G@13plf W10 x 21	G036	0.6C, 1.0C, 1.3C, 1.5C
	Exposed Grid	10K1	2.5	NW	24 (48)	20G@13plf W6 x 12	G203	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	48*	20G@14plf W6 x 12	G205	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	72	W6 x 12	G208	0.6C, 1.0C, 1.3C, 1.5C

* Special Area Requirements

FIRE RESISTANCE: FLOOR

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Minimum Thickness (in.)	Type				
2 Hr.		10K1	2.5		24 (48)		G213	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5		24 (48)	W8 x 31	G227	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G228	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5		24 (48)	20G@13plf W8 x 24	G229	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5		24 (48)	20G@13plf W6 x 12	G243	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5		48*	20G@14plf W6 x 12	G256	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G268	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.0	NW	24 (48)	NS	G505	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	24 (48)	20G14plf W8 x 31	G514	0.6C, 1.0C, 1.3C, 1.5C
		10K1	2.5	NW	24 (48)	20G@13plf W10 x 21	G523	0.6C, 1.0C, 1.3C, 1.5C
3 Hr.	Acoustical	12K1, 18LH02	3.25	LW,NW	NL	20G@13plf W8 x 15	D216	1.5VLI, 2VL, 3VL, 2VLP, 3VLP
							D219	1.5VL, 1.5VLI, 2VL, 3VL, 2VLP, 3VLP
	Concealed Grid	10K1	3.5	NW	24 (48)	20G@13plf W8 x 20	G033	0.6C, 1.0C, 1.3C, 1.5C
		10K1	3.25	NW	30 (48)	20G@13plf W10 x 21	G036	0.6C, 1.0C, 1.3C, 1.5C
	Exposed Grid	10K1	3.5	NW	48*	20G@14plf W6 x 12	G205	0.6C, 1.0C, 1.3C, 1.5C
		10K1	3.5	NW	24 (48)	W6 x 12	G213	0.6C, 1.0C, 1.3C, 1.5C
		10K1	3.25	NW	24 (48)	20G@13plf W8 x 24	G229	0.6C, 1.0C, 1.3C, 1.5C
		10K1	3.5	NW	48*	W6 x 12	G256	0.6C, 1.0C, 1.3C, 1.5C
		10K1 (22 ksi max.)	2.63	NW	24 (48)	20G@13plf W8 x 31	G268	0.6C, 1.0C, 1.3C, 1.5C
		10K1	3.0	NW	24 (48)	20G@13plf W10 x 21	G523	1.5C
	Gypsum Board	10K1	2.75	NW	24 (48)	20G@13plf W8 x 24	G529	0.6C, 1.0C, 1.3C, 1.5C
		10K1	3.0	NW	24 (48)	20G@13plf W10 x 21	G547	1.5C

* Special Area Requirements

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Minimum Thickness (in.)	Type				
1 Hr.	SAFRM	NS	2.5	LW,NW	NL	W8 x 28	D759	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
		10K1	2.5	LW,NW	NL	W8 x 28	D779	1.5VLI, 2VL, 3VL
		10K1	2.5	LW,NW	NL	W8 x 28	D780	1.5VLI, 2VL, 3VL
		NS	3.25	LW	NL	W8 x 28	D782	1.5VLI, 2VL, 3VL
		10K1*	2.5	LW	NL	W8 x 28	D925	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
			3.5	NW	NL	W8 x 28		
		16K6*	NS	LW,NW	42	20G@20plf W8 x 28	G701	0.6C, 1.0C, 1.3C, 1.5C
		16K6	3.0	LW	50.5	NS	G702	1.5C
		16K6	3.75	NW	50.5	NS	G702	1.5C
		16K6*	2.5	LW,NW	42	NS	G705	0.6C, 1.0C, 1.3C, 1.5C
		16K6	3.0	LW	50.5	NS	G706	1.5C
		16K6	3.75	NW	50.5	NS	G706	1.5C
		16K6*	2.5	LW,NW	42	20G@20plf W8 x 28	G708	0.6C, 1.0C, 1.3C, 1.5C
		NS	2.5	LW,NW	42	W8 x 28	G709	0.6C, 1.0C, 1.3C, 1.5C
		16K6*	2.5	LW,NW	42	20g@20plf W8 x 24	G801	0.6C, 1.0C, 1.3C, 1.5C
		12K1	3.0	LW	50.5	NS	G802	0.6C, 1.0C, 1.3C, 1.5C
		12K1	3.75	NW	50.5	NS	G802	0.6C, 1.0C, 1.3C, 1.5C
1 1/2 Hr.	SAFRM	NS	2.5	LW,NW	NL	W8 x 28	D759	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
		10K1	2.5	LW,NW	NL	W8 x 28	D779	1.5VLI, 2VL, 3VL
		10K1	2.5	LW,NW	NL	W8 x 28	D780	1.5VLI, 2VL, 3VL
		NS	3.25	LW	NL	W8 x 28	D782	1.5VLI, 2VL, 3VL
		10K1*	3.0	LW	NL	W8 x 28	D925	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
			4.0	NW	NL	W8 x 28		
		16K6*	2.5	LW,NW	42	20G@20plf W8 x 28	G701	0.6C, 1.0C, 1.3C, 1.5C
		16K6	3.5	LW	50.5	NS	G702	1.5C
		16K6	4.5	NW	50.5	NS	G702	1.5C
		16K6*	2.5	LW,NW	42	NS	G705	0.6C, 1.0C, 1.3C, 1.5C
		16K6	3.5	LW	50.5	NS	G706	1.5C
		16K6	4.5	NW	50.5	NS	G706	1.5C
		16K6*	2.5	LW,NW	42	20G@20plf W8 x 28	G708	0.6C, 1.0C, 1.3C, 1.5C
		NS	2.5	LW,NW	42	W8 x 28	G709	0.6C, 1.0C, 1.3C, 1.5C
		16K6*	2.5	LW,NW	42	20G@20plf W8 x 24	G801	0.6C, 1.0C, 1.3C, 1.5C
		12K5	3.5	LW	50.5	NS	G802	0.6C, 1.0C, 1.3C, 1.5C
		12K5	4.5	NW	50.5	NS	G802	0.6C, 1.0C, 1.3C, 1.5C

* Special Area Requirements

FIRE RESISTANCE: FLOOR

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	Deck Types
			Minimum Thickness (in.)	Type				
2 Hr.	SAFRM	NS	2.5	LW,NW	NL	W8 x 28	D759	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
		10K1	2.5	LW,NW	NL	W8 x 28	D779	1.5VLI, 2VL, 3VL
		10K1	2.5	LW,NW	NL	W8 x 28	D780	1.5VLI, 2VL, 3VL
		NS	3.25	LW	NL	W8 x 28	D782	1.5VLI, 2VL, 3VL
		10K1*	3.25	LW	NL	W8 x 28	D925	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
			4.5	NW	NL	W8 x 28		
		16K6*	2.5	LW,NW	42	20G@20plf W8 x 28	G701	0.6C, 1.0C, 1.3C, 1.5C
		16K6	4.0	LW	50.5	NS	G702	1.5C
		16K6	5.25	NW	50.5	NS	G702	1.5C
		16K6*	2.5	LW,NW	42	NS	G705	0.6C, 1.0C, 1.3C, 1.5C
		16K6	4.0	LW	50.5	NS	G706	1.5C
		16K6	5.25	NW	50.5	NS	G706	1.5C
		16K6*	2.5	LW,NW	42	20G@20plf W8 x 28	G708	0.6C, 1.0C, 1.3C, 1.5C
		NS	2.5	LW,NW	42	W8 x 28	G709	0.6C, 1.0C, 1.3C, 1.5C
		16K6*	2.5	LW,NW	42	20G@20plf W8 x 24	G801	0.6C, 1.0C, 1.3C, 1.5C
		12K5	4.0	LW	50.5	NS	G802	0.6C, 1.0C, 1.3C, 1.5C
		12K5	5.25	NW	50.5	NS	G802	0.6C, 1.0C, 1.3C, 1.5C
3 Hr.	SAFRM	NS	2.5	LW,NW	NL	W8 x 28	D759	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
		10K1	2.5	LW,NW	NL	W8 x 28	D779	1.5VLI, 2VL, 3VL
		10K1	2.5	LW,NW	NL	W8 x 28	D780	1.5VLI, 2VL, 3VL
		NS	3.25	LW	NL	W8 x 28	D782	1.5VLI, 2VL, 3VL
		10K1*	4.19	LW	NL	W8 x 28	D925	1.5VL,1.5VLI, 1.5VLP, 2VL, 3VL, 2VLP, 3VLP
			5.25	NW	NL	W8 x 28		
		16K6*	NS	LW,NW	42	20G@20plf W8 x 28	G701	0.6C, 1.0C, 1.3C, 1.5C
		16K6*	2.75	LW,NW	42	NS	G705	0.6C, 1.0C, 1.3C, 1.5C
		16K6*	2.75	LW,NW	42	20G@20plf W8 x 28	G708	0.6C, 1.0C, 1.3C, 1.5C
		NS	2.75	LW,NW	42	W8 x 28	G709	0.6C, 1.0C, 1.3C, 1.5C
		16K6*	2.75	LW,NW	42	20G@20plf W8 x 24	G801	0.6C, 1.0C, 1.3C, 1.5C
4 Hr.	SAFRM	10K1	2.5	LW,NW	NL	W8 x 28	D779	1.5VLI, 2VL, 3VL
		NS	3.25	LW	NL	W8 x 28	D782	1.5VLI, 2VL, 3VL

* Special Area Requirements

FIRE RESISTANCE: FLOOR-DOVETAIL

UL Fire Resistance Ratings

Restrained Assembly Ratings (hr.)	Type of Protection	Concrete Thickness & Type	UL Design No.	Deck Type		Unrestrained Beam Rating (hr.)
				2D	3.5D	
1⁵	Unprotected Deck	2" LW & 2¾" NW	D904	✓		¾
			D961	✓		¾
			D917	✓		
			D928	✓		¾
1½	Unprotected Deck	2" LW & 2" NW	D947		✓	
			D964		✓	
			D984		✓	
2	Unprotected Deck	2½" LW, 3" SLW & 3¾" NW	D904	✓		1
			D961	✓		1
			D917	✓		¾
			D928	✓		1
		2" LW & 2¼" NW	D947		✓	¾
			D964		✓	¾
			D984		✓	¾
3	Unprotected Deck	3¾" LW, 4" SLW & 4¾" NW	D904	✓		1
			D961	✓		1
			D917	✓		¾
			D928	✓		1
		2¼" LW & 3¾" NW	D947		✓	1½
			D964		✓	1½
			D984		✓	1½

NOTES:

1. Refer to the UL "Fire Resistance Directory" for the necessary construction details.
2. Concrete thickness is thickness of slab above deck, in.
3. All Dovetail FormLok composite deck assemblies are subject to an upper live load limit of 130 psf.
4. Dramix® fibers may be used in UL or ULC fire rated assemblies in lieu of WWR. See UL file R19307 for additional information.
5. Restrained Assembly Rating is 1½ hr with listed NW concrete thickness.



DOVETAIL DECK

DOVETAIL DECK

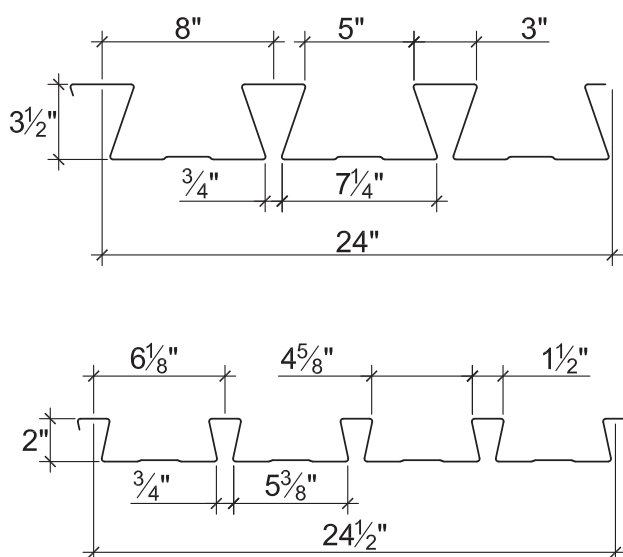
If you need the best, you need Vulcraft's Dovetail steel roof deck. The innovative, high-quality decking system boasts a clean, sleek design with distinct shadow lines to provide texture to the ceiling surface.

The Dovetail acoustic steel deck uses pioneering sound-reducing technology to deliver a calm, quiet interior environment – all while reducing overall design costs

Vulcraft's Dovetail deck delivers.

- Economical 2-inch-deep and long spanning 3.5-inch-deep products
- Excellent acoustic performance with Noise Reduction Coefficient (NRC) of 0.95 to 1.15
- Naturally hides unsightly roof system fasteners with the re-entrant shape of Dovetail Deck
- Factory painted options
- Proven performance listed with UL, FM and IAPMO-UES

For complete performance information, contact Vulcraft to get your Vulcraft Dovetail Roof Deck Catalog or download directly at www.vulcraft.com/literature.



The Vulcraft Structural Dovetail Ceiling/Deck is available in 2-inch-deep and 3.5-inch-deep profiles.



HANGING SOLUTIONS



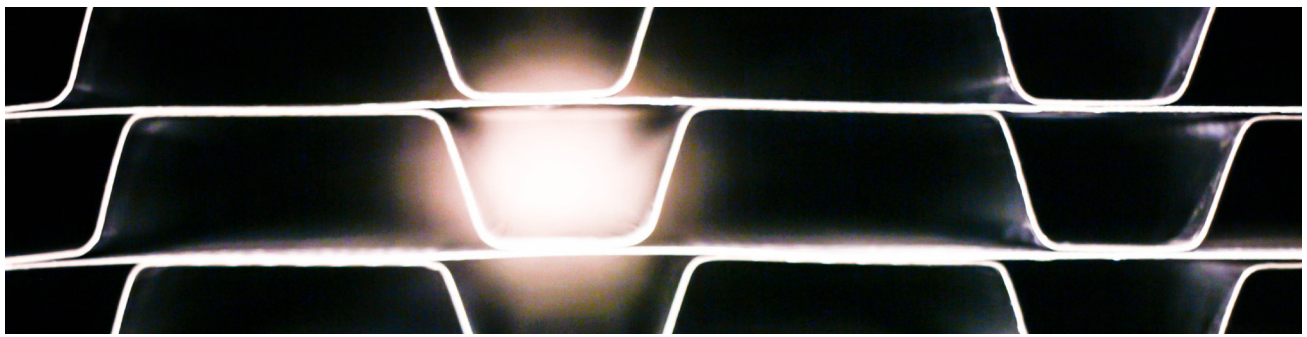
**Sammy X-Press Hanger for
Roof and Acoustical
Roof Deck**



**Wedge Nut Hanger for
Dovetail FormLok Deck**

For more information on hanging solutions download the Vulcraft Deck Solutions Manual at www.vulcraft.com/literature





CELLULAR DECK

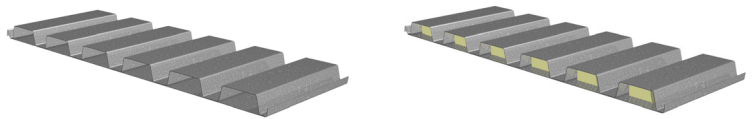
Combining functional structural and aesthetic design and affordability in one product, the Vulcraft 1.5BP Structural Cellular Ceiling/Deck is the best of all design options. By acting as both a ceiling and roof, this versatile product helps you achieve economies in construction, and it provides a clean and uncluttered appearance that is perfect for many different applications.

The expense and trouble of suspended ceilings is eliminated when you choose our acoustical option. Sound absorption is provided through inert, non-organic glass fiber sound absorbing batts placed in the panels. They are capable of absorbing up to 90% of the sound that strikes the ceiling. Whether in protected or harsh environments, the specially designed Vulcraft Structural Cellular Ceiling/Deck systems perform as expected. Use them for interior ceilings, soffits, and exterior metal ceilings. Economical and easy to use, our system requires no fasteners and gives you a flush look featuring an even, solid surface.

CELLULAR DECK PRODUCT OFFER

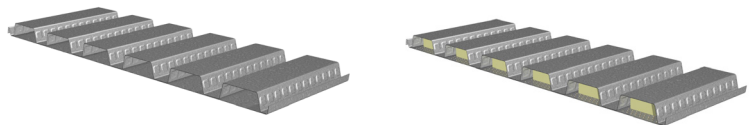
1.5BP CELLULAR DECKS

COVER WIDTH: 24", 36"



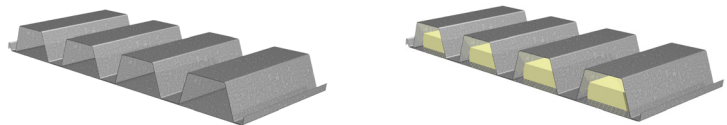
1.5VLP CELLULAR DECKS

COVER WIDTH: 24", 36"



32" WIDE 3NP CELLULAR DECKS

COVER WIDTH: 32"



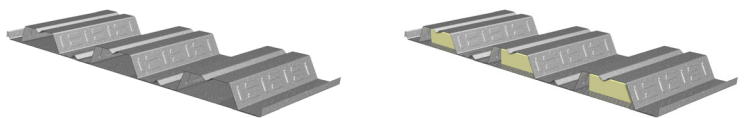
24" WIDE 3NP CELLULAR DECKS

COVER WIDTH: 24"



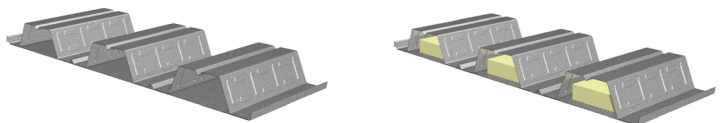
2VLP CELLULAR DECKS

COVER WIDTH: 24", 36"



3VLP CELLULAR DECKS

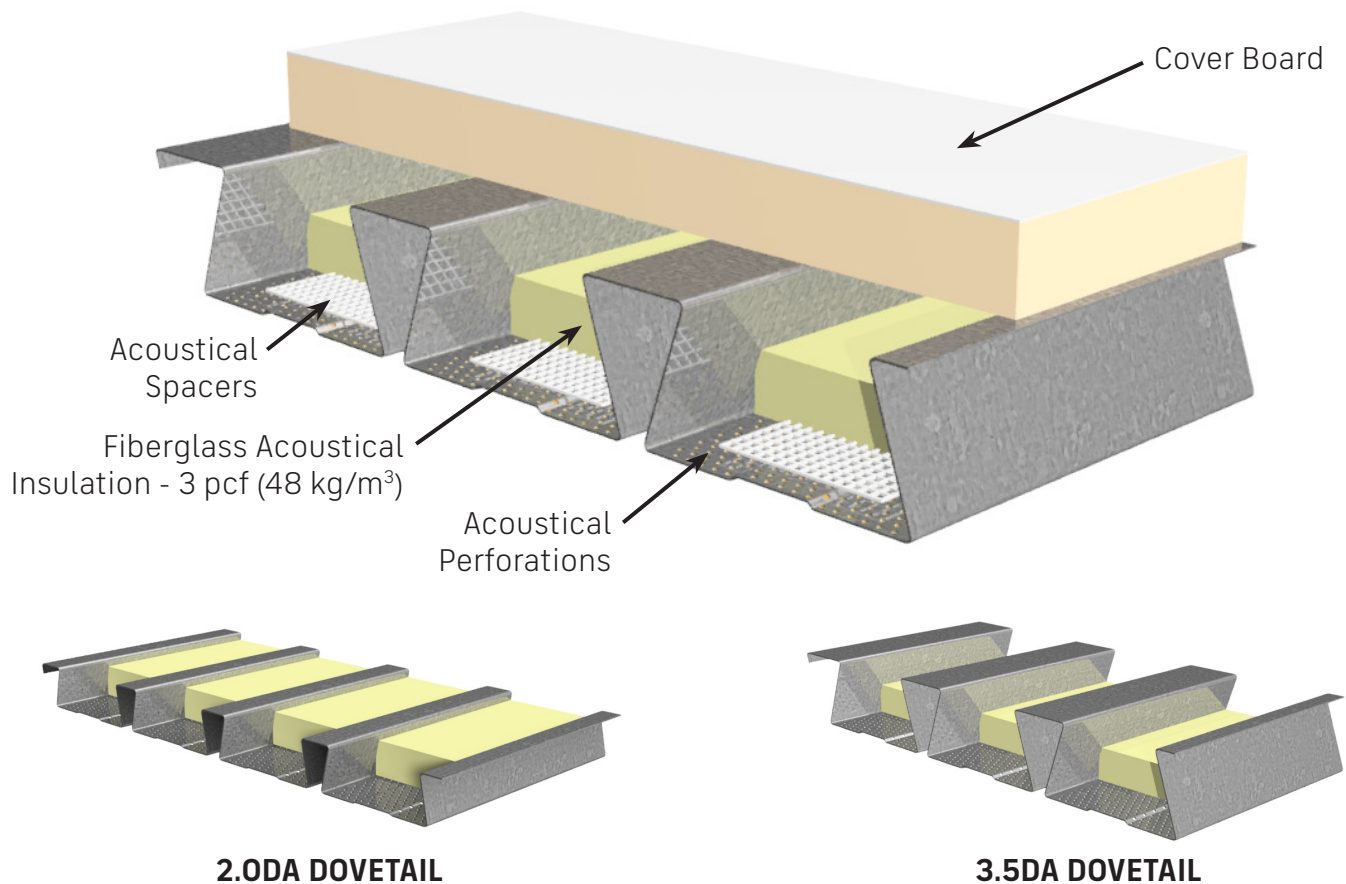
COVER WIDTH: 24", 36"



BOB EVANS HEADQUARTERS New Albany, OH



REDUCE INTERIOR NOISE WITH THE SOUND ABSORPTION CAPABILITIES OF VULCRAFT ACOUSTICAL ROOF DECK

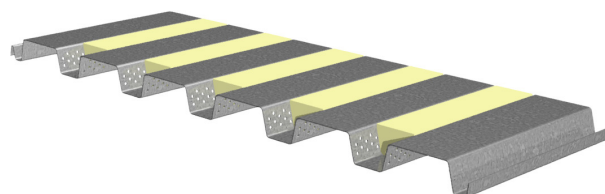
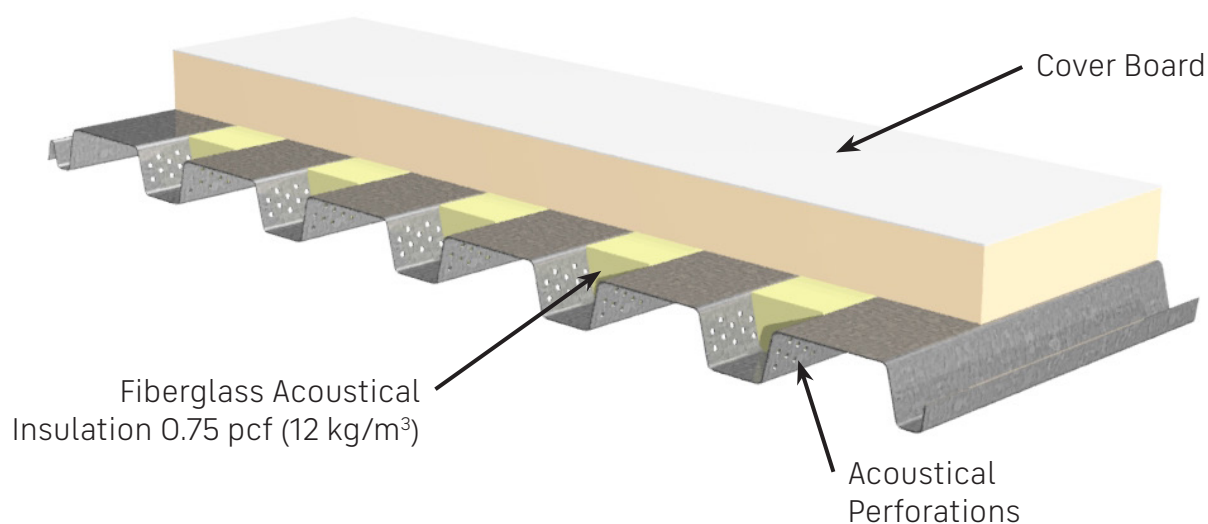


Roof Insulation	AC Insulation	Absorption Coefficients								RAL Test. No.
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	SSA	NRC	
2.0DA DOVETAIL										
Poly-Iso	Plain	0.19	0.54	1.15	1.07	1.01	0.79	0.95	0.95	A14-170
	Encapsulated	0.35	0.82	1.15	0.99	0.97	0.72	0.96	1.00	A14-167
Fiberglass	Plain	0.74	1.40	1.25	1.03	0.98	0.80	1.14	1.15	A14-169
	Encapsulated	0.62	1.18	1.08	0.93	0.97	0.77	1.02	1.05	A14-168
½" (13 mm) Roof Board	Plain	0.17	0.51	1.05	1.05	0.85	0.77	0.85	0.85	A19-101
	Encapsulated	0.30	0.56	1.02	0.99	0.92	0.78	0.86	0.85	A19-102
3.5DA DOVETAIL										
Poly-Iso	Plain	0.25	0.74	1.13	1.06	0.97	0.75	0.96	1.00	A14-186
	Encapsulated	0.38	0.86	1.18	1.03	0.93	0.65	0.98	1.00	A14-189
Fiberglass	Plain	0.92	1.51	1.13	1.06	0.98	0.78	1.14	1.15	A14-187
	Encapsulated	0.97	1.50	1.09	1.00	0.91	0.67	1.10	1.15	A14-188
½" (13 mm) Roof Board	Plain	0.33	0.95	1.20	1.00	0.96	0.74	1.01	1.05	A19-220
	Encapsulated	0.56	1.10	1.13	0.91	0.94	0.64	1.02	1.00	A19-223

NOTE:

1. Plain 3.0 pcf (48 kg/m³) fiberglass acoustical insulation standard. Inquire regarding lead time for encapsulated insulation.

DECK ACOUSTIC INFORMATION

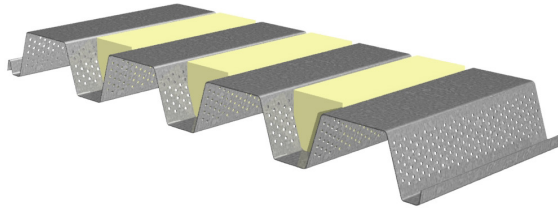


1.5BA-36 / 1.5BIA-36 / 1.5PLBA-36

Roof Insulation	AC Insulation	Absorption Coefficients							SSA	NRC	RAL Test. No.
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz				
1.5BA-36 / 1.5BIA-36 / 1.5PLBA-36											
Poly-Iso	Plain	0.09	0.20	0.47	0.86	0.55	0.32	0.55	0.55	A15-125	
	Encapsulated	0.14	0.35	0.74	0.76	0.44	0.27	0.57	0.55	A15-124	
Fiberglass	Plain	0.68	1.16	1.17	0.96	0.52	0.31	0.95	0.95	A15-126	
	Encapsulated	0.75	0.83	0.78	0.68	0.42	0.28	0.67	0.70	A15-123	

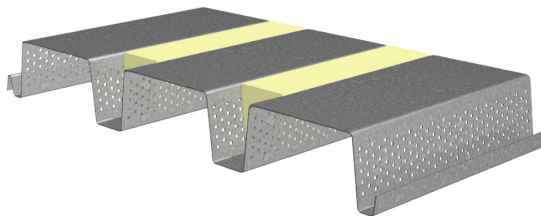
NOTE:

1. Plain 0.75 pcf (12 kg/m³) fiberglass acoustical insulation standard for all BA decks. Inquire regarding lead time for encapsulated insulation.



3NLA-32 / 3NIA-32 / 3PLNA-32

Roof Insulation	AC Insulation	Absorption Coefficients								RAL Test. No.
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	SSA	NRC	
3NLA-32 / 3NIA-32 / 3PLNA-32										
Poly-Iso	Plain	0.23	0.42	0.85	0.95	0.50	0.41	0.68	0.70	A19-032
	Encapsulated	0.30	0.62	1.09	0.79	0.52	0.31	0.74	0.75	A19-111
Fiberglass	Plain	0.78	1.17	1.20	0.98	0.50	0.41	0.96	0.95	A19-031
	Encapsulated	0.89	1.08	1.09	0.74	0.46	0.30	0.83	0.85	A19-110
½" (13 mm)Roof Board	Plain	0.21	0.41	0.81	0.89	0.49	0.41	0.64	0.65	A19-033



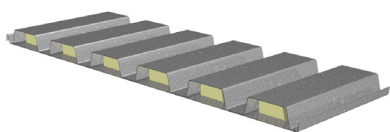
3NA-24 / 3NIA-24

Roof Insulation	AC Insulation	Absorption Coefficients								RAL Test. No.
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	SSA	NRC	
3NA-24 / 3NIA-24										
Poly-Iso	Plain	0.19	0.33	0.73	0.83	0.48	0.33	0.59	0.60	A15-130
	Encapsulated	0.17	0.39	0.94	0.86	0.48	0.27	0.67	0.65	A15-138
Fiberglass	Plain	0.81	1.16	1.15	0.91	0.47	0.27	0.92	0.90	A15-128
	Encapsulated	1.07	1.13	1.04	0.81	0.43	0.26	0.85	0.85	A15-137

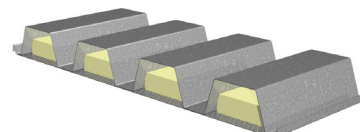
NOTE:

1. Plain 0.75 pcf (12 kg/m³) fiberglass acoustical insulation standard for all NA decks. Inquire regarding lead time for encapsulated insulation.

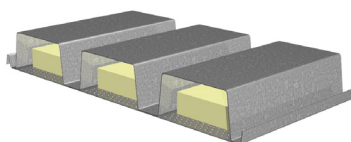
DECK ACOUSTIC INFORMATION



1.5BPA-36 / 1.5PLBPA-36 ROOF DECK
1.5VLPA-36 / 1.5PLVLPA-36 COMPOSITE DECK

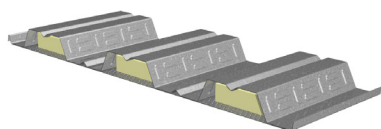


3NPA-32 / 3PLNPA-32 ROOF DECK

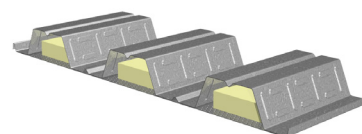


3NPA-24 / 3PLNPA-24 ROOF DECK

Roof Insulation	AC Insulation	Absorption Coefficients							SSA	NRC	RAL Test. No.
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz				
1.5BPA-36 / 1.5PLBPA-36 ROOF DECK OR 1.5VLPA-36 / 1.5PLVLPA-36 COMPOSITE DECK											
Poly-Iso	Plain	0.27	0.32	0.70	1.02	0.80	0.52	0.69	0.70	A15-114	
	Encapsulated	0.26	0.44	0.84	0.98	0.67	0.45	0.72	0.75	A15-115	
3NPA-32 / 3PLNPA-32 ROOF DECK											
Poly-Iso	Plain	0.47	0.61	1.08	1.03	0.83	0.67	0.90	0.90	A22-125	
	Encapsulated	0.52	0.71	1.12	0.80	0.62	0.45	0.83	0.80	A22-188	
3NPA-24 / 3PLNPA-24 ROOF DECK											
Poly-Iso	Plain	0.25	0.47	0.92	0.75	0.62	0.54	0.69	0.70	A15-141	
	Encapsulated	0.39	0.62	1.19	0.74	0.66	0.44	0.80	0.80	A15-231	



2VLPA-36 / 2PLVLPA-36 COMPOSITE DECK



3VLPA-36 / 3PLVLPA-36 COMPOSITE DECK

Floor	AC Insulation	Absorption Coefficients							SSA	NRC	RAL Test. No.
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz				
2VLPA-36 / 2PLVLPA-36 COMPOSITE DECK											
Concrete	Plain	0.31	0.44	0.72	0.77	0.47	0.47	0.60	0.60	A15-120	
	Encapsulated	0.39	0.45	0.87	0.66	0.31	0.19	0.58	0.55	A15-119	
3VLPA-36 / 3PLVLPA-36 COMPOSITE DECK											
Concrete	Plain	0.48	0.56	1.00	0.75	0.49	0.49	0.69	0.70	A15-121	
	Encapsulated	0.51	0.63	0.83	0.49	0.39	0.28	0.58	0.60	A15-122	

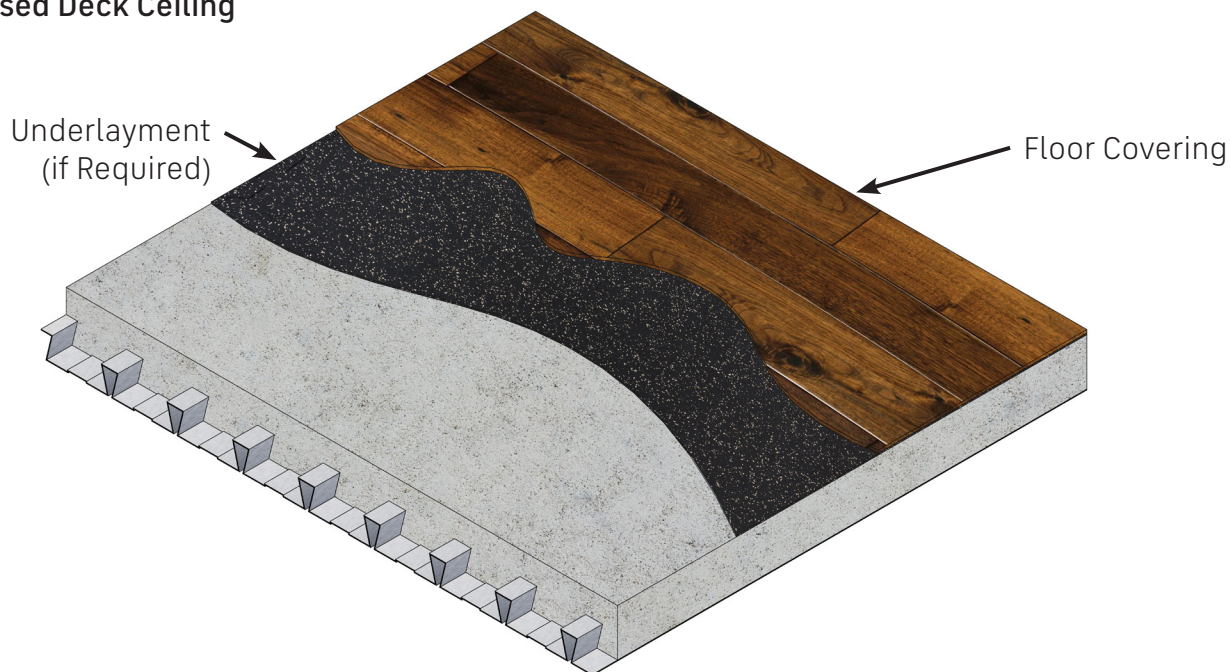
NOTE:

1. Factory installed plain 3.0 pcf (48 kg/m³) fiberglass acoustical insulation standard for all cellular decks. Inquire regarding lead time for encapsulated insulation.

ACHIEVE QUIET SPACES WITH PREMIUM FINISHES BY USING THE SUPERIOR STC AND IIC RATINGS OF 2.0D FORMLOK DECK-SLABS

2.0D FORMLOK DECK-SLAB

- 2" (51 mm) Deep Composite Deck
- 5½" (140 mm) Total Slab Depth
- Normal Weight Concrete (145 pcf / 2235 kg/m³)
- Exposed Deck Ceiling



Exposed Deck (No Ceiling)

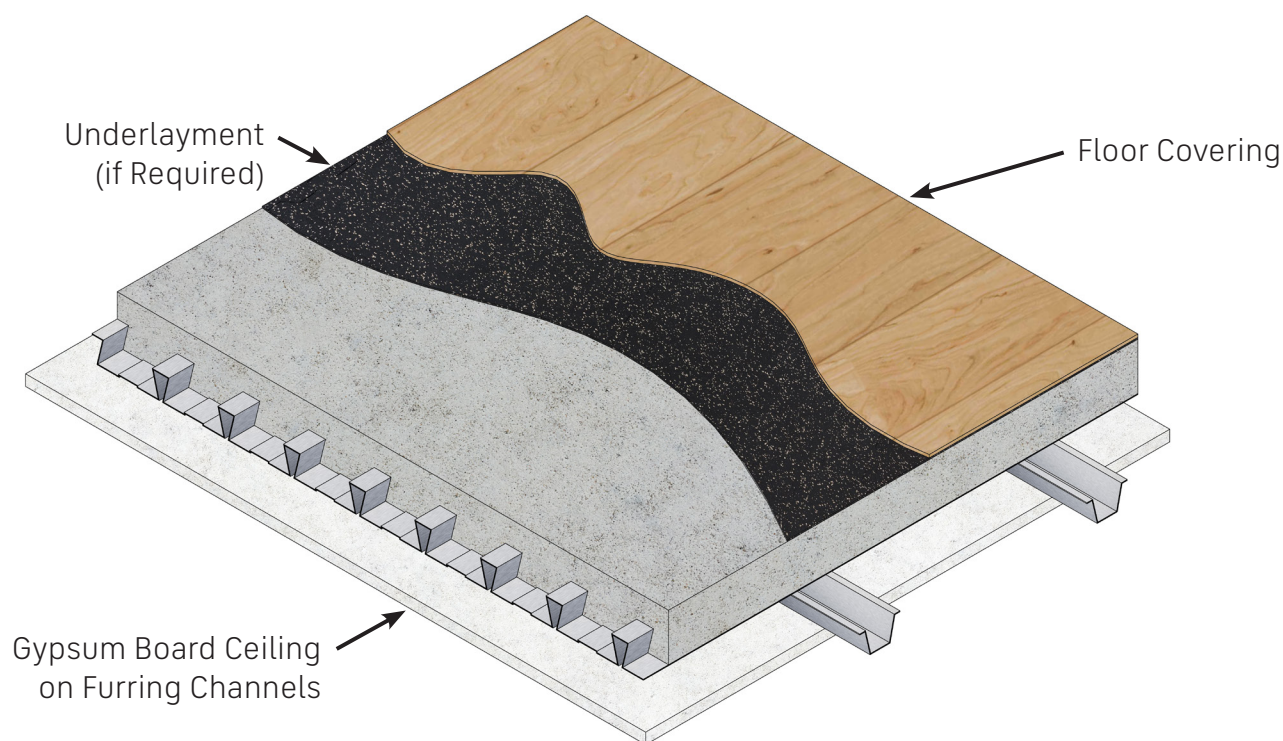
Floor Covering	Underlayment	STC	IIC	Intertek Test No.
Ceramic Tile	5 mm ECOsilence	51	41	H7786.06
Engineered Wood	5 mm ECOsilence	50	50	H7786.05
Fusion Hybrid Vinyl Plank	2 mm ECOsilence	46	51	H7786.02
Attain Luxury Vinyl Tile	5 mm ECOsilence	52	51	H7786.03
Forest Rx Rubber Backed Sheet Vinyl	None	51	51	H7786.04
Exposed Concrete	None	52	23	H7786.01

NOTES:

1. The acoustical test reports with complete assembly details are available from www.dovetaildeck.com.
2. The testing was performed in accordance with the following standards:
 - **ASTM E90-09 (2016)**, *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions*
 - **ASTM E492-09(2016)e1**, *Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine*

2.0D FORMLOK DECK-SLAB

- 2" (51 mm) Deep Composite Deck
- 5½" (140 mm) Total Slab Depth
- Normal Weight Concrete (145 pcf / 2235 kg/m³)
- Gypsum Board Ceiling



Gypsum Board Ceiling on Furring Channels Directly Attached to Deck

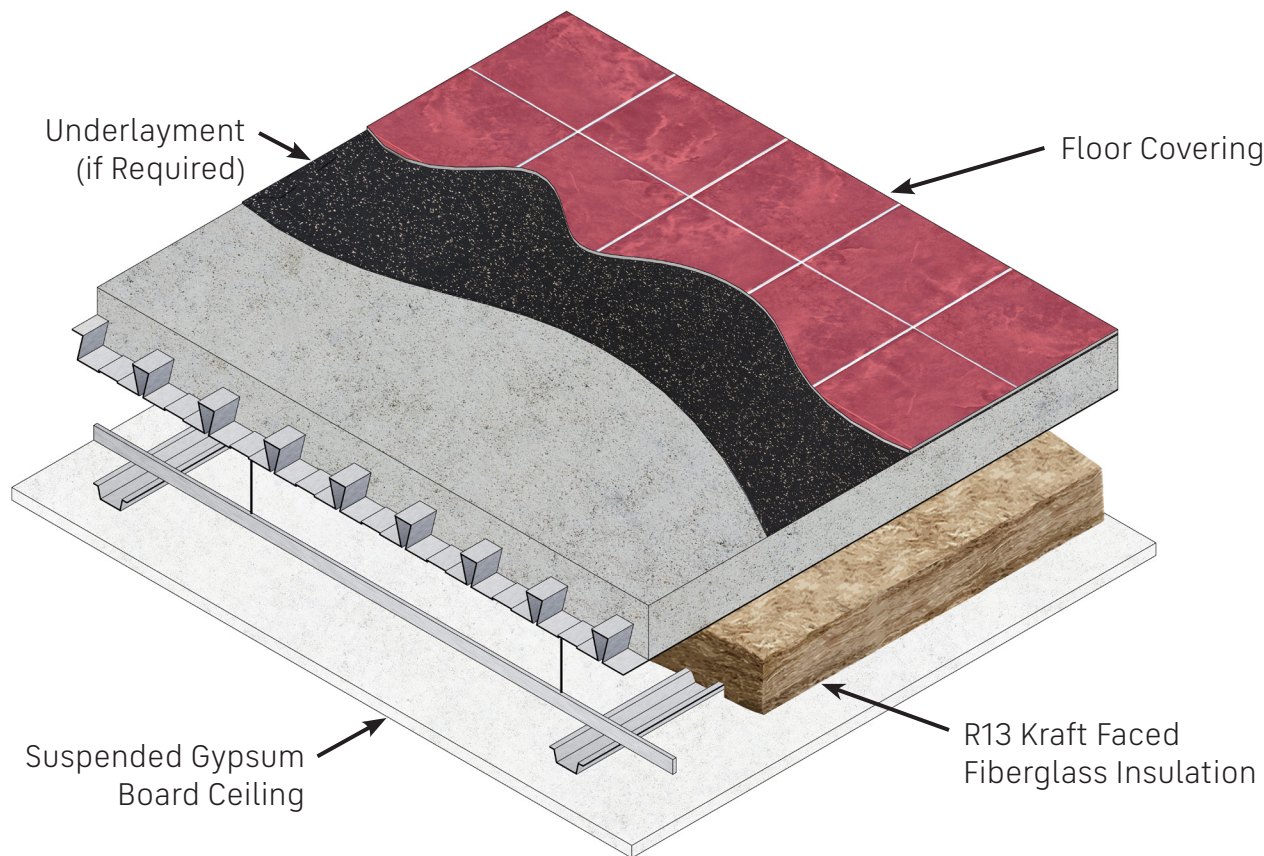
Floor Covering	Underlayment	STC	IIC	Intertek Test No.
Ceramic Tile	5 mm ECOsilence	53	47	H7786.12
Engineered Wood	5 mm ECOsilence	50	50	H7786.11
Fusion Hybrid Vinyl Plank	2 mm ECOsilence	51	50	H7786.08
Attain Luxury Vinyl Tile	2 mm ECOsilence	52	50	H7786.09
Forest Rx Rubber Backed Sheet Vinyl	None	50	50	H7786.10
Exposed Concrete	None	52	32	H7786.07

NOTE:

1. Values shown are for gypsum board on furring channels directly connected to the underside of the slab. Gypsum board ceilings attached to the deck by methods providing acoustical separation will provide improved STC and IIC values.

2.0D FORMLOK DECK-SLAB

- 2" (51 mm) Deep Composite Deck
- 5½" (140 mm) Total Slab Depth
- Normal Weight Concrete (145 pcf / 2235 kg/m³)
- Suspended Gypsum Board Ceiling



Suspended Gypsum Board Ceiling

Floor Covering	Underlayment	STC	IIC	Intertek Test No.
Ceramic Tile	5 mm ECOsilence	62	60	I5133.01

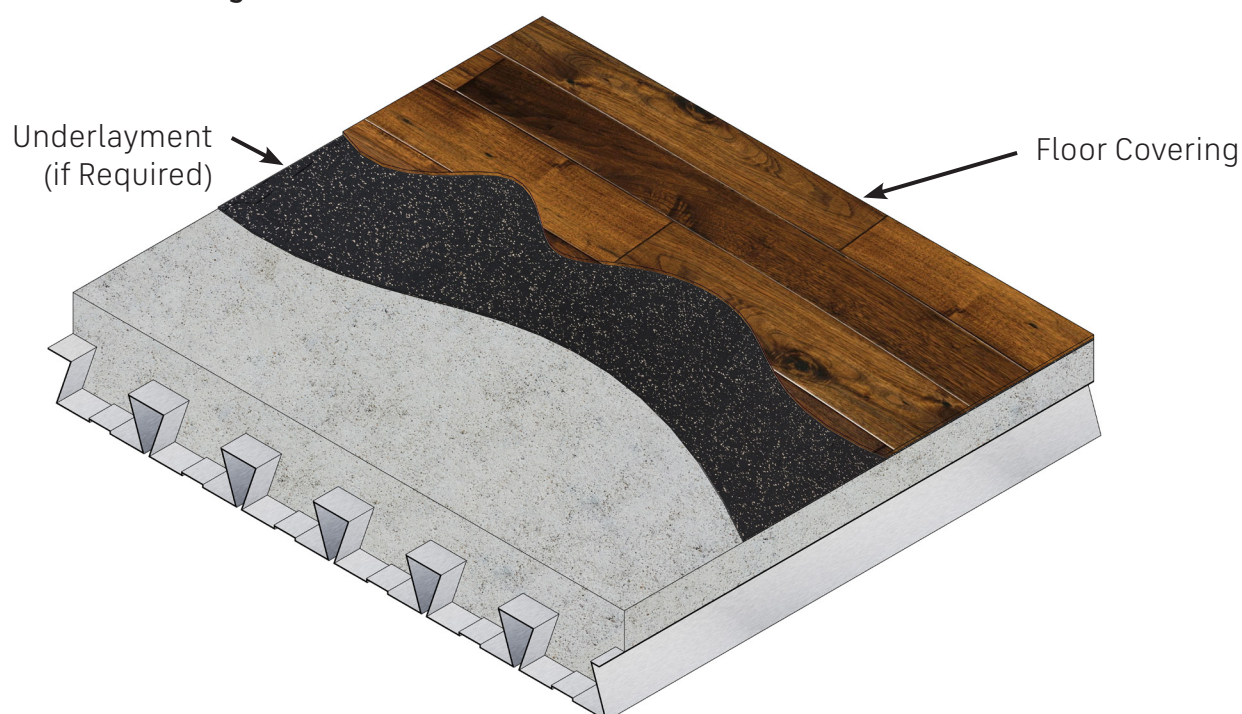
NOTE:

1. Laboratory tests determining STC and IIC for DoveTail FormLok deck with a suspended ceiling were conducted with ceramic tile and underlayment. Adding a suspended ceiling to the ceramic tile assembly improved the STC rating by 11 and the IIC rating by 19 compared to an assembly with no ceiling. Other flooring types can expect similar improvement in performance.

ACHIEVE QUIET SPACES WITH PREMIUM FINISHES BY USING THE SUPERIOR STC AND IIC RATINGS OF 3.5D FORMLOK DECK-SLABS

3.5D FORMLOK DECK-SLAB

- 3½" (89 mm) Deep Composite Deck
- 6" (152 mm) Total Slab Depth
- Normal Weight Concrete (145 pcf / 2235 kg/m³)
- Exposed Deck Ceiling

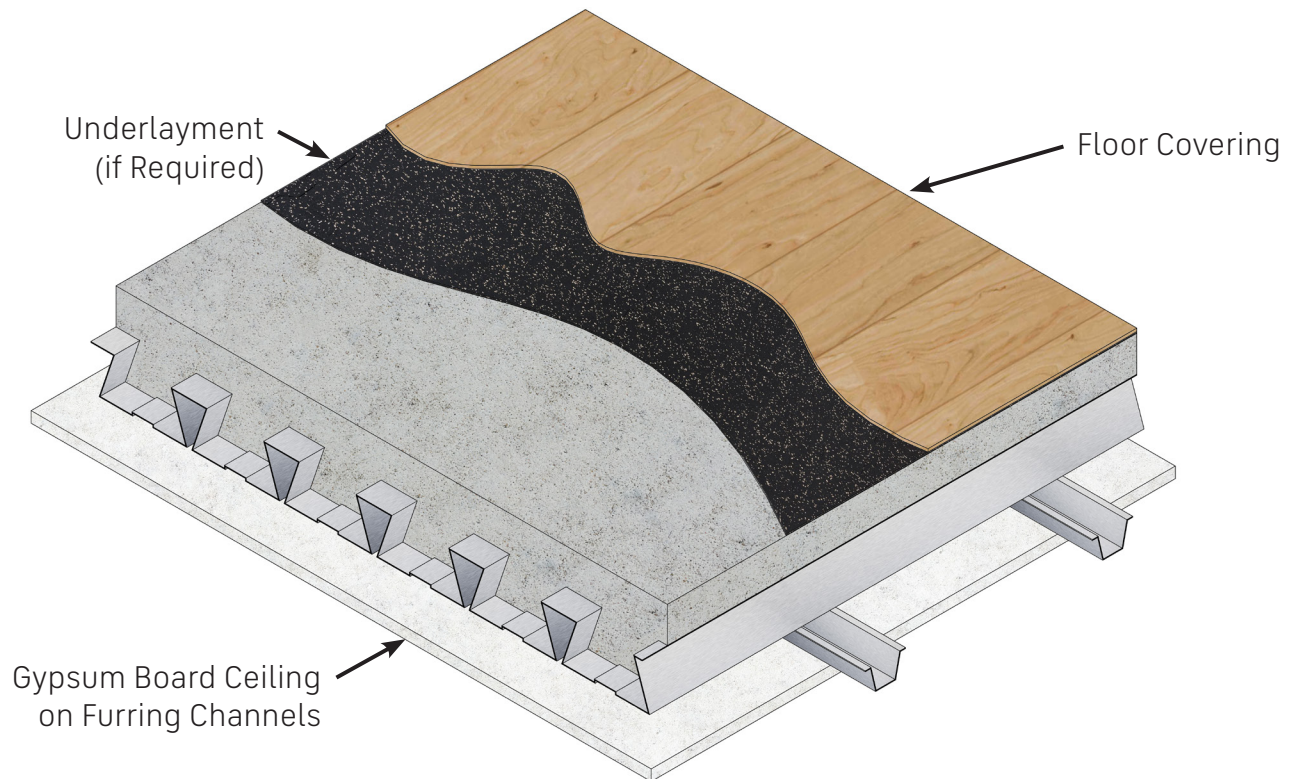


Exposed Deck (No Ceiling)

Floor Covering	Underlayment	STC	IIC	Intertek Test No.
Ceramic Tile	5 mm ECOsilence	50	42	H7787.06
Engineered Wood	5 mm ECOsilence	45	46	H7787.05
Fusion Hybrid Vinyl Plank	2 mm ECOsilence	47	47	H7787.02
Attain Luxury Vinyl Tile	5 mm ECOsilence	50	50	H7787.03
Forest Rx Rubber Backed Sheet Vinyl	None	49	49	H7787.04
Exposed Concrete	None	50	24	H7787.01

3.5D FORMLOK DECK-SLAB

- 3½" (89 mm) Deep Composite Deck
- 6" (152 mm) Total Slab Depth
- Normal Weight Concrete (145 pcf / 2235 kg/m³)
- Gypsum Board Ceiling



Gypsum Board Ceiling on Furring Channels Directly Attached to Deck

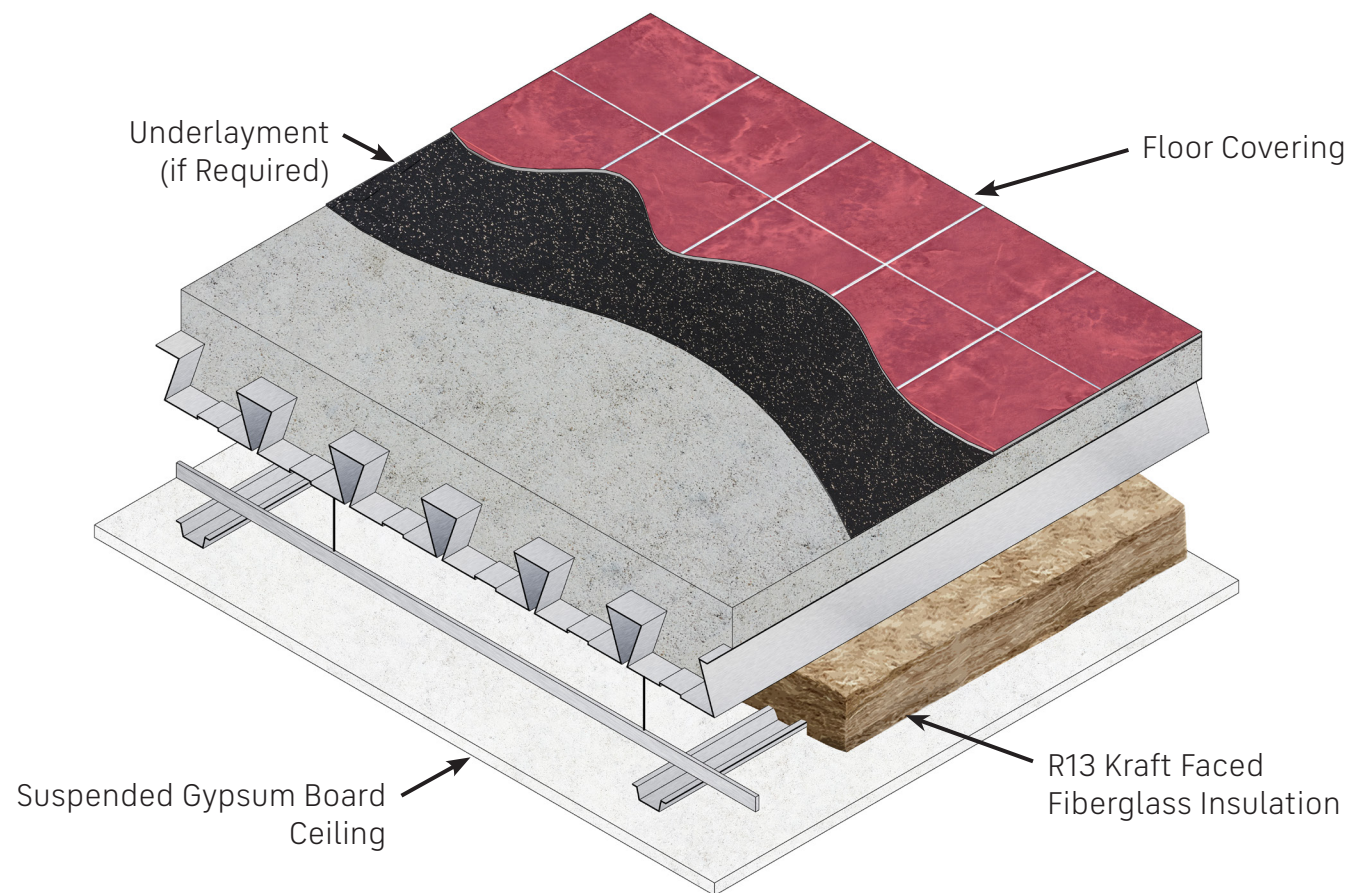
Floor Covering	Underlayment	STC	IIC	Intertek Test No.
Ceramic Tile	5 mm ECOsilence	56	49	H7787.12
Engineered Wood	5 mm ECOsilence	55	52	H7787.11
Fusion Hybrid Vinyl Plank	2 mm ECOsilence	55	53	H7787.08
Attain Luxury Vinyl Tile	5 mm ECOsilence	56	52	H7787.09
Forest Rx Rubber Backed Sheet Vinyl	None	55	52	H7787.10
Exposed Concrete	None	55	32	H7787.07

NOTE:

1. Values shown are for gypsum board on furring channels directly connected to the underside of the slab. Gypsum board ceilings attached to the deck by methods providing acoustical separation will provide improved STC and IIC values.

3.5D FORMLOK DECK-SLAB

- 3½" (89 mm) Deep Composite Deck
- 6" (152 mm) Total Slab Depth
- Normal Weight Concrete (145 pcf / 2235 kg/m³)
- Suspended Gypsum Board Ceiling



Suspended Gypsum Board Ceiling

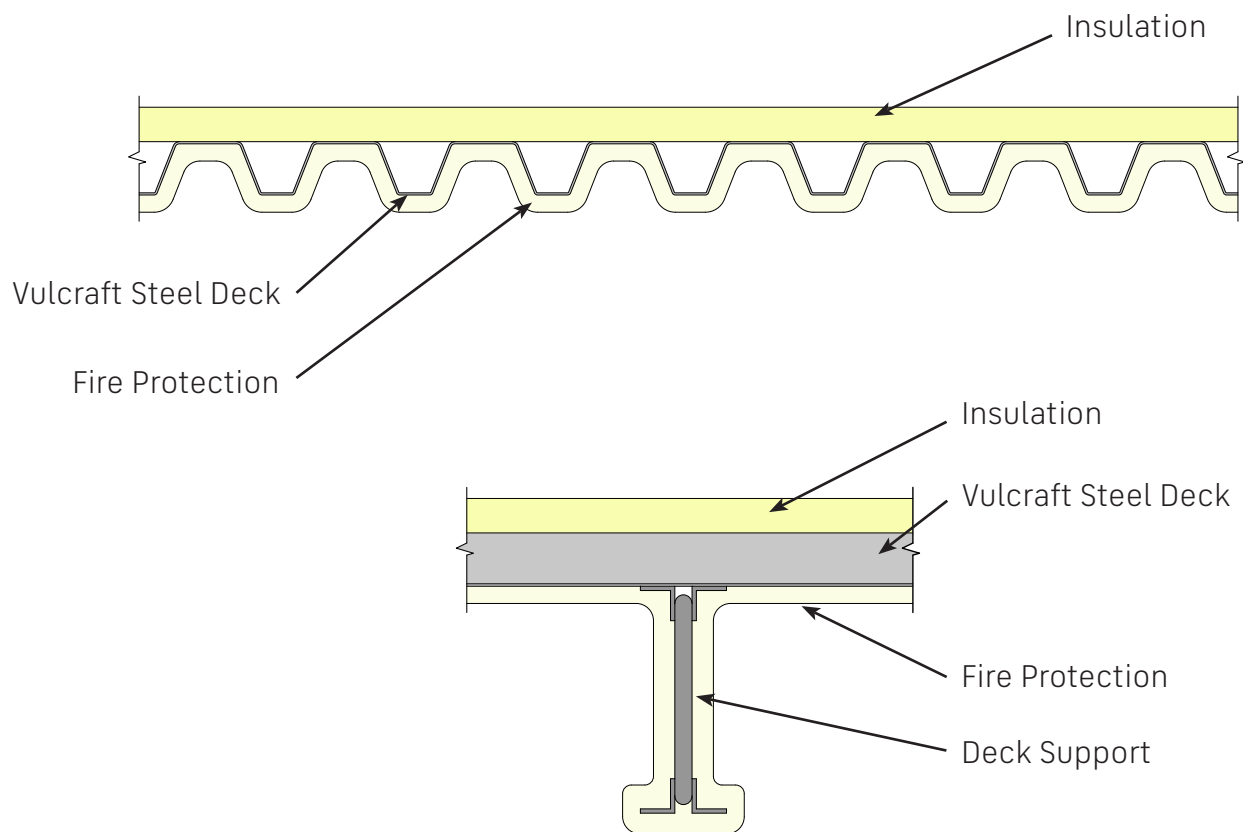
Floor Covering	Underlayment	STC	IIC	Intertek Test No.
Ceramic Tile	5 mm ECOsilence	62	62	I5133.02

NOTE:

1. Laboratory tests determining STC and IIC for DoveTail FormLok deck with a suspended ceiling were conducted with ceramic tile and underlayment. Adding a suspended ceiling to the ceramic tile assembly improved the STC rating by 12 and the IIC rating by 20 compared to an assembly with no ceiling. Other flooring types can expect similar improvement in performance.

USE UL RECOGNIZED VULCRAFT ROOF DECKS FOR YOUR FIRE RATED ASSEMBLIES

Vulcraft steel decks may be used in assemblies which are required to meet hourly fire ratings. Approved hourly fire rated assemblies are a combination of specific proprietary materials as listed in UL fire resistance ratings.



REPRESENTATIVE FIRE RATED ASSEMBLY

Refer to the table on the following pages for a listing of UL fire-rated assemblies utilizing Vulcraft steel deck profiles. Refer to the particular UL assembly being considered for full details of construction, including specific information about fill or fireproofing thicknesses and span limitations.

UL Fire Resistance Ratings

Restrained Assembly Ratings (hr.)	Type of Protection	Type of Insulation	UL Design No.	Deck Type					Unrestrained Beam Rating (hr.)
				B	32" 3N	24" 3N	2.0D	3.5D	
1	Exposed Grid	Rigid Insulation	P211+	✓					
			P214+	✓					1
			P225+	✓	✓	✓			1,1½
			P227+	✓					
			P230+	✓					1,1½
			P235+	✓					1
	Gypsum Board	Rigid Insulation	P214+	✓					1
			P510+	✓	✓	✓			
	Cementitious	Rigid Insulation	P514	✓					
			P701*	✓	✓	✓			1,1½,2
			P711*	✓	✓	✓			1,1½,2
	Sprayed Fiber	Rigid Insulation	P717*	✓	✓	✓			1,1½,2
			P801*	✓	✓	✓			1,1½,2,3
			P815*	✓	✓	✓			1,1½,2,3
	Unprotected Deck	Insulating Fill	P819*	✓	✓	✓			1,1½,2
			P902	✓	✓	✓			1,1½,2
			P907	✓	✓	✓			1,1½,2
			P908	✓	✓	✓	✓	✓	1,1½,2
			P919	✓	✓	✓			1,1½
			P920	✓	✓	✓			1,1½,2
			P921	✓	✓	✓	✓	✓	1,1½,2
			P922	✓	✓	✓			1,1½,2
			P923	✓	✓	✓			1,1½,2
			P937				✓	✓	
			P938				✓	✓	1,1½,2
1½	Exposed Grid	Rigid Insulation	P225+	✓	✓	✓			1,1½
			P227+	✓					1,1½
			P230+	✓					1,1½
	Metal Lath	Rigid Insulation	P404+	✓					
	Gypsum Board	Rigid Insulation	P510+	✓	✓	✓			
	Cementitious	Rigid Insulation	P701*	✓	✓	✓			1,1½,2
			P711*	✓	✓	✓			1,1½,2
			P717*	✓	✓	✓			1,1½,2

UL Fire Resistance Ratings (continued)

Restrained Assembly Ratings (hr.)	Type of Protection	Type of Insulation	UL Design No.	Deck Type					Unrestrained Beam Rating (hr.)
				B	32" 3N	24" 3N	2.0D	3.5D	
1½	Sprayed Fiber	Rigid Insulation	P801*	✓	✓	✓			1,1½,2
			P815*	✓	✓	✓			1,1½,2,3
			P819*	✓	✓	✓			1,1½,2,3
	Unprotected Deck	Insulating Fill	P902	✓	✓	✓			1,1½,2
			P907	✓	✓	✓			1,1½,2
			P908	✓	✓	✓	✓	✓	1,1½,2
			P919	✓	✓	✓			1,1½
			P920	✓	✓	✓			1,1½,2
			P921	✓	✓	✓	✓	✓	1,1½,2
			P922	✓	✓	✓			1,1½,2
			P923	✓	✓	✓			1,1½,2
			P937				✓	✓	
			P938				✓	✓	1,1½,2
	Exposed Grid	Rigid Insulation	P237+	✓					2
	Metal Lath	Rigid Insulation	P404+	✓					
	Gypsum Board	Rigid Insulation	P514+	✓					
	Cementitious	Rigid Insulation	P701*	✓	✓	✓			1,1½,2
			P711*	✓	✓	✓			1,1½,2
			P717*	✓	✓	✓			1,1½,2
2	Sprayed Fiber	Rigid Insulation	P801*	✓	✓	✓			1,1½,2
			P815*	✓	✓	✓			1,1½,2
			P819*	✓	✓	✓			1,1½,2,3
	Unprotected Deck	Insulating Fill	P902	✓	✓	✓			1,1½,2
			P907	✓	✓	✓			1,1½,2
			P908	✓	✓	✓	✓	✓	1,1½,2
			P920	✓	✓	✓			1,1½,2
			P921	✓	✓	✓	✓	✓	1,1½,2
			P922	✓	✓	✓			1,1½,2
			P923	✓	✓	✓			1,1½,2
			P937				✓	✓	
			P938				✓	✓	1,1½,2

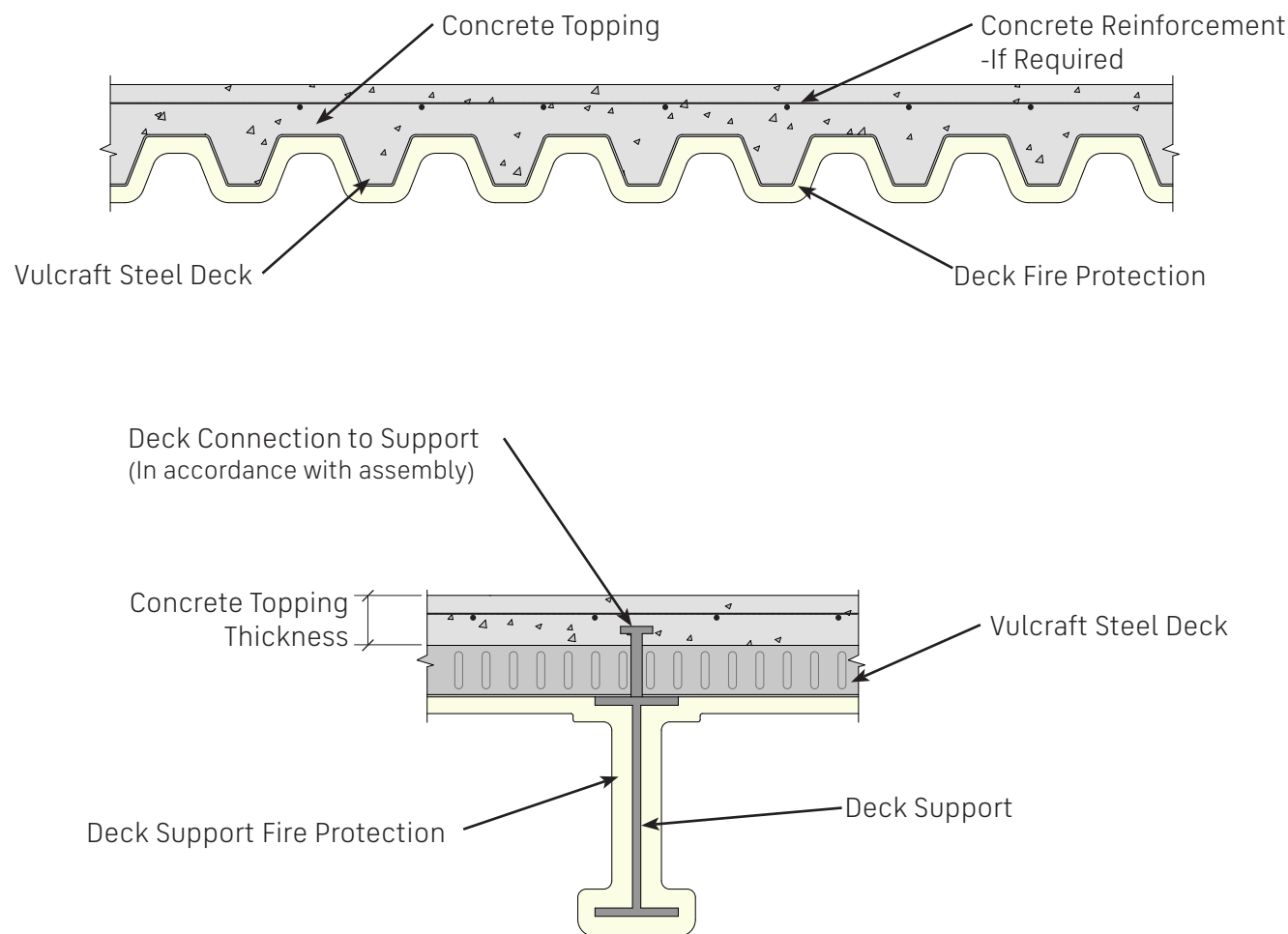
NOTES:

1. Refer to the UL "Fire Resistance Directory" for the necessary construction details.
2. Deck finish shall be galvanized unless noted otherwise.
 - + Deck finish is not critical for fire resistance when used in P2--, P4--, & P5-- Series designs.
Deck finish shall be galvanized or painted.
 - * Denotes deck finish is critical for fire resistance. Deck finish shall be galvanized or painted.
This gray paint is a special type of paint and is compatible with the spray-applied fire protection and is U.L. approved for use in the denoted P7-- & P8-- Series designs.
3. B = 1.5B, 1.5BI, and 1.5PLB
 - 32" 3N = 32" (813 mm) Wide 3NL, 3NI, and 3PLN
 - 24" 3N = 24" (610 mm) Wide 3N and 3NI

FLOOR DECK FIRE RATINGS

USE UL RECOGNIZED COMPOSITE AND NON-COMPOSITE DECKS FOR YOUR FIRE RATED ASSEMBLIES WITH STRUCTURAL CONCRETE FILL

Vulcraft composite and non-composite slabs may be used to meet hourly fire ratings. The type and thickness of concrete specified will generally determine whether fireproofing will be required on the underside of the composite or non-composite deck.



REPRESENTATIVE FIRE RATED ASSEMBLY

The table on the following pages lists the UL fire rated assemblies that include Vulcraft composite and non-composite deckprofiles. This summary table is provided to assist in identification of assemblies to meet specific project requirements. Refer to the particular UL assembly for full details of construction, including specific information about concrete slab, framing, type of fire protection, deck types, and span limitations.

FLOOR DECK FIRE RATINGS: COMPOSITE

UL Fire Resistance Ratings

Restrained Assembly Ratings (hr.)	Type of Protection	Concrete Thickness & Type	UL Design No.	Deck Type						Unrestrained Beam Rating (hr.)
				1.5VL	2VL	3VL	1.5VLP	2VLP	3VLP	
¾	Unprotected Deck	2½" LW	D914 #	✓	✓	✓	✓	✓	✓	1
			D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
1	Exposed Grid	2½" NW	D216 +	✓	✓	✓		✓	✓	2,3
		2" NW & LW	D743 *		✓	✓		✓	✓	1,1½,2,3
	Cementitious	2½" NW & LW	D703 *	✓	✓	✓	✓	✓	✓	1½
			D712 *		✓	✓			✓	2
			D722 *		✓	✓		✓	✓	1,1½,2
			D739 *	✓	✓	✓	✓	✓	✓	1,1½,2,3,4
			D759 *	✓	✓	✓	✓	✓	✓	1,1½,2,3
	Sprayed Fiber	2" NW & LW	D859 *		✓	✓		✓	✓	1,1.5,2,3
		2½" NW & LW	D832 *	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D847 *		✓	✓		✓	✓	1,1½,3
			D858 *		✓	✓		✓	✓	1,1½,2,3,4
			D871 *		✓	✓		✓	✓	1,1½,2,3
	Unprotected Deck	2½" LW	D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D914 #	✓	✓	✓	✓	✓	✓	1
			D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D919 #	✓	✓	✓	✓	✓	✓	1,1½
		3½" NW	D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
1½	Gypsum Board	2½" NW	D502 *	✓	✓	✓		✓	✓	1½,2
		2" NW & LW	D743 *		✓	✓		✓	✓	1,1½,2,3
	Cementitious	2½" NW & LW	D703 *	✓	✓	✓	✓	✓	✓	1½
			D712 *		✓	✓			✓	2
			D722 *		✓	✓		✓	✓	1,1½,2
			D739 *	✓	✓	✓	✓	✓	✓	1,1½,2,3,4
			D759 *	✓	✓	✓	✓	✓	✓	1,1½,2,3

✓⁺ 1.5VLI Only

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UL Fire Resistance Ratings (continued)

Restrained Assembly Ratings (hr.)	Type of Protection	Concrete Thickness & Type	UL Design No.	Deck Type						Unrestrained Beam Rating (hr.)
				1.5VL	2VL	3VL	1.5VLP	2VLP	3VLP	
1½	Sprayed Fiber	2" NW & LW	D859 *		✓	✓		✓	✓	1,1½,2,3
			D832 *	✓	✓	✓	✓	✓	✓	1,1½,2,3
		2½" NW & LW	D847 *		✓	✓		✓	✓	1,1½,3
			D858 *		✓	✓		✓	✓	1,1½,2,3,4
			D871 *		✓	✓		✓	✓	1,1½,2,3
	Unprotected Deck	3" LW	D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D919 #	✓	✓	✓	✓	✓	✓	1,1½
		4" NW	D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D919 #	✓	✓	✓	✓	✓	✓	1,1½
	Exposed Grid	2½" NW	D216 +	✓	✓	✓		✓	✓	2,3
	Gypsum Board	2½" NW	D502 +	✓	✓	✓		✓	✓	1½,2
2	Cementitious	2" NW & LW	D743 *		✓	✓		✓	✓	1,1½,2,3
		2½" LW	D746 *	✓						1,1½,2,3
			D752 *	✓	✓	✓	✓	✓	✓	1,1½,2,
			D703 *	✓	✓	✓	✓	✓	✓	1½
		2½" NW & LW	D712 *		✓	✓			✓	2
			D716 *	✓	✓	✓		✓	✓	1½,2
			D722 *		✓	✓		✓	✓	1,1½,2
			D739 *		✓	✓	✓	✓	✓	1,1½,2,3,4
			D745 *		✓	✓				1,1½,2
			D750 *	✓	✓	✓				1½,2
			D755*	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D759*	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D760 *	✓ ⁺	✓	✓				1,1½,2,3,4
		2½" NW	D730 *		✓	✓		✓	✓	
			D742 *	✓	✓	✓				1,1½

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FLOOR DECK FIRE RATINGS: COMPOSITE

UL Fire Resistance Ratings (continued)

Restrained Assembly Ratings (hr.)	Type of Protection	Concrete Thickness & Type	UL Design No.	Deck Type						Unrestrained Beam Rating (hr.)
				1.5VL	2VL	3VL	1.5VLP	2VLP	3VLP	
2	Sprayed Fiber	2" NW & LW	D859 *		✓	✓		✓	✓	1,1½,2,3
			D822 *		✓	✓		✓	✓	1
			D825 *	✓	✓	✓		✓	✓	1,1½,2
			D831 *		✓	✓		✓	✓	1,1½,2
			D832 *	✓	✓	✓	✓	✓	✓	1,1½,2,3
		2½" NW & LW	D833 *	✓	✓	✓		✓	✓	1½
			D847 *		✓	✓		✓	✓	1,1½,3
			D858 *		✓	✓		✓	✓	1,1½,2,3,4
			D861 *		✓	✓				1,1½
			D871 *		✓	✓		✓	✓	1,1½,2,3
		2½" LW	D862 *		✓	✓				1
		¾" LW	D860 *		✓	✓				1,1½,2
	Unprotected Deck	¾" LW	D826 #	✓	✓	✓	✓	✓	✓	1,1½,2
			D840 #	✓	✓	✓	✓	✓	✓	1,1½
			D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D907 #	✓	✓	✓	✓	✓	✓	1,2
			D913 #	✓	✓	✓	✓	✓	✓	1
			D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D919 #	✓	✓	✓	✓	✓	✓	1,1½
			D920 #		✓	✓		✓	✓	1½
		4½" NW	D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D919 #	✓	✓	✓	✓	✓	✓	1,1½

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FLOOR DECK FIRE RATINGS: COMPOSITE

UL Fire Resistance Ratings (continued)

Restrained Assembly Ratings (hr.)	Type of Protection	Concrete Thickness & Type	UL Design No.	Deck Type						Unrestrained Beam Rating (hr.)
				1.5VL	2VL	3VL	1.5VLP	2VLP	3VLP	
3	Exposed Grid	3¼" NW	D216 +	✓	✓	✓		✓	✓	2,3
		2" NW & LW	D743 *		✓	✓		✓	✓	1,1½,2,3
		2½" LW	D746 *	✓						1,1½,2,3
			D703 *	✓	✓	✓	✓	✓	✓	1½
			D708 *	✓+	✓	✓	✓	✓	✓	1½,3
	Cementitious	2½" NW & LW	D739 *	✓	✓	✓	✓	✓	✓	1,1½,2,3,4
			D755	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D759	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D760 *	✓+	✓	✓				1,1½,2,3,4
		3¼" LW	D754 *	✓	✓	✓				1½,2
		3¼" NW	D742 *	✓	✓	✓				1,1½
		2" NW & LW	D859 *		✓	✓		✓	✓	1,1½,2,3
			D816 *	✓	✓	✓		✓	✓	1½,2
			D831 *		✓	✓		✓	✓	1,1½,2
	Sprayed Fiber	2½" NW & LW	D832 *	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D833 *	✓	✓	✓		✓	✓	1½
			D858*		✓	✓		✓	✓	1,1½,2,3,4
			D871 *		✓	✓		✓	✓	1,1½,2,3
		3¼" LW	D860 *		✓	✓				1,1½,2
			D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
	Unprotected Deck	4 ³⁄₁₆" LW	D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D919 #	✓	✓	✓	✓	✓	✓	1,1½
			D902 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
		5¼" NW	D916 #	✓	✓	✓	✓	✓	✓	1,1½,2,3
			D919 #	✓	✓	✓	✓	✓	✓	1,1½
4	Cementitious	2½" NW & LW	D760 *	✓+	✓	✓				1,1½,2,3,4
			D739 *	✓	✓	✓	✓	✓	✓	1,1½,2,3,4
		3¼" LW	D754 *	✓	✓	✓				1½,2
	Sprayed Fiber	2½" NW & LW	D858 *		✓	✓		✓	✓	1,1½,2,3,4
		3¼" LW	D860 *		✓	✓				1,1½,2

✓⁺ 1.5VLI Only

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FLOOR DECK FIRE RATINGS: NON-COMPOSITE

UL Fire Resistance Ratings

Restrained Assembly Ratings (hr.)	Type of Protection	Concrete Thickness & Type	UL Design No.	Deck Type				Unrestrained Beam Rating (hr.)
				0.6C	1.0C	1.3C	1.5C	
1	Exposed Grid	2½" NW	G256 +	✓	✓	✓	✓	1,2,3
	Cementitious	2½" NW & LW	G701	✓	✓	✓	✓	1,1½,2,3
			G705	✓	✓	✓	✓	1,1½,2,3
	Sprayed Fiber	2¾" NW & LW	G801	✓	✓	✓	✓	1,1½,2
1½	Exposed Grid	2" NW	G229 +	✓	✓	✓	✓	1½,2,3
			G228 +	✓	✓	✓	✓	1½,2
		2½" NW	G243 +	✓	✓	✓	✓	1½,2
			G213 +	✓	✓	✓	✓	1½,2,3
	Gypsum Board	2" NW & LW	G502 +	✓	✓	✓	✓	
	Cementitious	2½" NW & LW	G701	✓	✓	✓	✓	1,1½,2,3
			G705	✓	✓	✓	✓	1,1½,2,3
	Sprayed Fiber	2¾" NW & LW	G801	✓	✓	✓	✓	1,1½,2
2	Exposed Grid	2½" NW	G227 +	✓	✓	✓	✓	2,3
			G228 +	✓	✓	✓	✓	1½,2
			G229 +	✓	✓	✓	✓	1½,2,3
			G243 +	✓	✓	✓	✓	1½,2
			G256 +	✓	✓	✓	✓	1,2,3
			G213 +	✓	✓	✓	✓	1½,2,3
	Gypsum Board	2" NW	G505 +	✓	✓	✓	✓	
		2½" NW & LW	G529 +	✓	✓	✓	✓	2,3
		2½" NW	G514 +	✓	✓	✓	✓	3
			G523 +	✓	✓	✓	✓	2,3
	Cementitious	2½" NW & LW	G701	✓	✓	✓	✓	1,1½,2,3
			G705	✓	✓	✓	✓	1,1½,2,3
	Sprayed Fiber	2¾" NW & LW	G801	✓	✓	✓	✓	1,1½,2
3	Exposed Grid	3¼" NW	G229 +	✓	✓	✓	✓	1½,2,3
		3½" NW	G213 +	✓	✓	✓	✓	1½,2,3
			G256 +	✓	✓	✓	✓	1½,2,3
	Gypsum Board	3¼" NW & LW	G529 +	✓	✓	✓	✓	2,3
	Cementitious	2¾" NW & LW	G701	✓	✓	✓	✓	1,1½,2,3
			G705	✓	✓	✓	✓	1,1½,2,3
	Sprayed Fiber	2¾" NW & LW	G801	✓	✓	✓	✓	1,1½,2

FLOOR DECK FIRE RATINGS: DOVETAIL

UL Fire Resistance Ratings

Restrained Assembly Ratings (hr.)	Type of Protection	Concrete Thickness & Type	UL Design No.	Deck Type		Unrestrained Beam Rating (hr.)
				2D	3.5D	
1¹⁰	Unprotected Deck	2" LW & 2¾" NW	D904	✓		¾
			D961	✓		¾
			D917	✓		
			D928	✓		¾
1½	Unprotected Deck	2" LW & 2" NW	D947		✓	
			D964		✓	
			D984		✓	
2	Unprotected Deck	2½" LW, 3" SLW & ¾" NW	D904	✓		1
			D961	✓		1
			D917	✓		¾
			D928	✓		1
		2" LW & 2¼" NW	D947		✓	¾
			D964		✓	¾
			D984		✓	¾
3	Unprotected Deck	¾" LW, 4" SLW & ¾" NW	D904	✓		1
			D961	✓		1
			D917	✓		¾
			D928	✓		1
		2¼" LW & ¾" NW	D947		✓	1½
			D964		✓	1½
			D984		✓	1½

Concrete Thickness	
(in.)	(mm)
2	51
2½	64
2¾	70
3¼	83
3½	89
4	102
4¾	106
4½	114
4¾	121
5¼	133

NOTES:

1. Refer to the UL "Fire Resistance Directory" for the necessary construction details.
2. 1.5VL = 1.5VL, 1.5VLI, and 1.5PLVLI
 2VL = 2VLI, 2VLJ, and 2PLVLI
 3VL = 3VLI, 3VLJ, and 3PLVLI
 1.5VLP = 1.5VLP and 1.5PLVLP
 2VLP = 2VLP, and 2PLVLP
 3VLP = 3VLP, and 3PLVLP
3. Concrete thickness is thickness of slab above deck, in.
4. 1.5VLR may be used in designs D832, D902, and D916.
5. All Dovetail FormLok composite deck assemblies are subject to an upper live load limit of 130 psf.
6. Fluted deck finish shall be galvanized unless noted otherwise.
 + Denotes fluted deck finish is not critical when used in D2-- & D5-- Series designs. Deck finish shall be galvanized or phosphatized/painted.
 * Fluted deck finish is critical for fire resistance. Fluted deck finish shall be galvanized or phosphatized/painted. This gray paint is a special type of paint and is compatible with the spray-applied fire protection and is U.L. approved for use in the denoted D7-- & D8-- Series designs.
 # Denotes fluted deck finish is not critical for fire resistance. Fluted deck finish shall be galvanized or phosphatized/painted.
7. Vulcraft cellular deck used in the listed assemblies shall be galvanized.
8. Vulcraft cellular deck units are approved by UL for use as electrical raceways under UL Standard 209.
9. Dramix® fibers may be used in UL or ULC fire rated assemblies in lieu of WWR. See UL file R19307 for additional information.
10. Restrained Assembly Rating is 1½ hr with listed NW concrete thickness.

WHY GRATING?

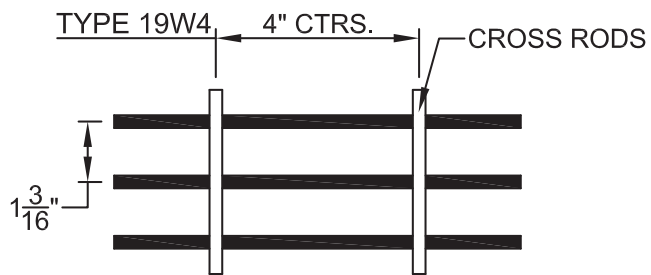
- Easy Installation and Fabrication
- Adaptable to Complex Floor Layouts

APPLICATIONS

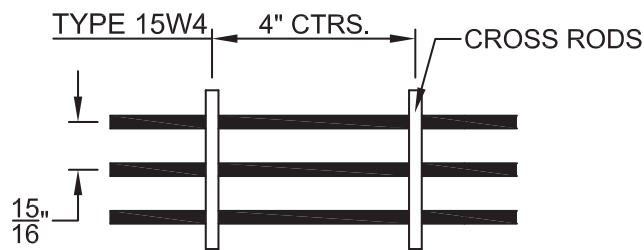
- Walkways
- Bridge Decks
- Trenches
- Wall Cladding
- Sun Shades
- Industrial Flooring

- Allows Passage of Light and Air
- High Strength-to-Weight Ratio
- Durable and Long Lasting Surface

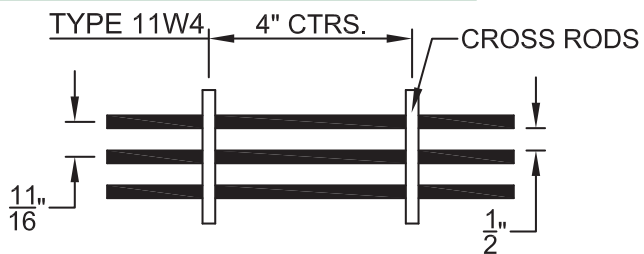
Standard



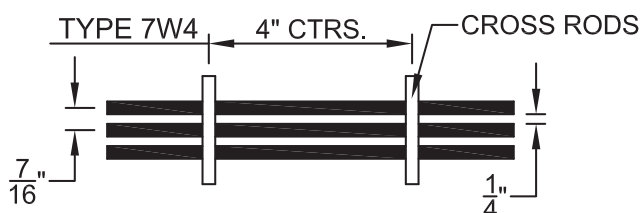
Close-Mesh



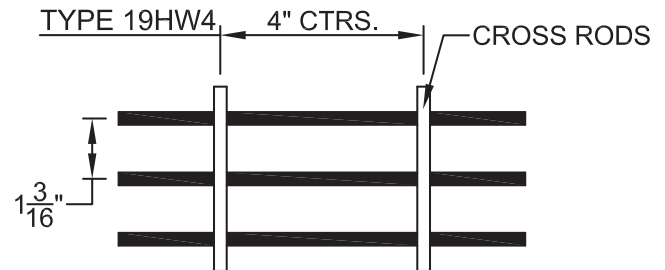
ADA-Compliant



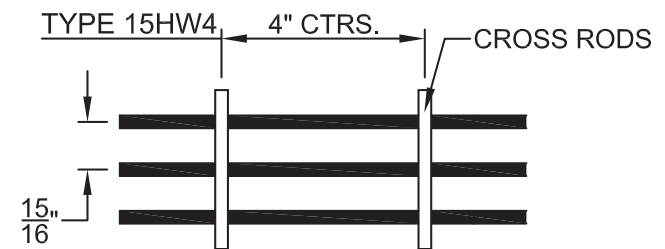
Heels-Friendly



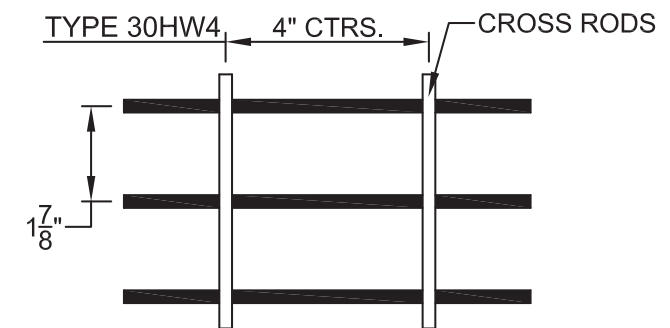
Heavy-Duty



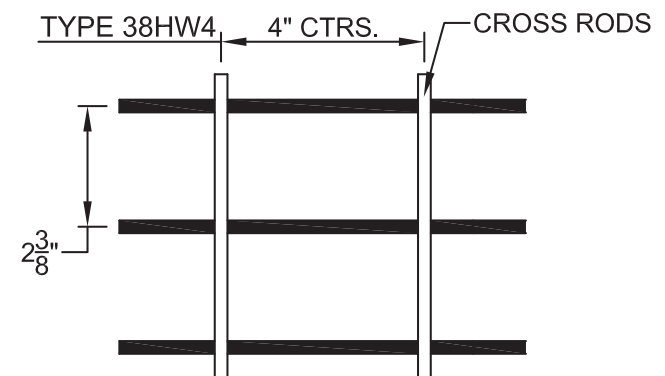
HD Close-Mesh

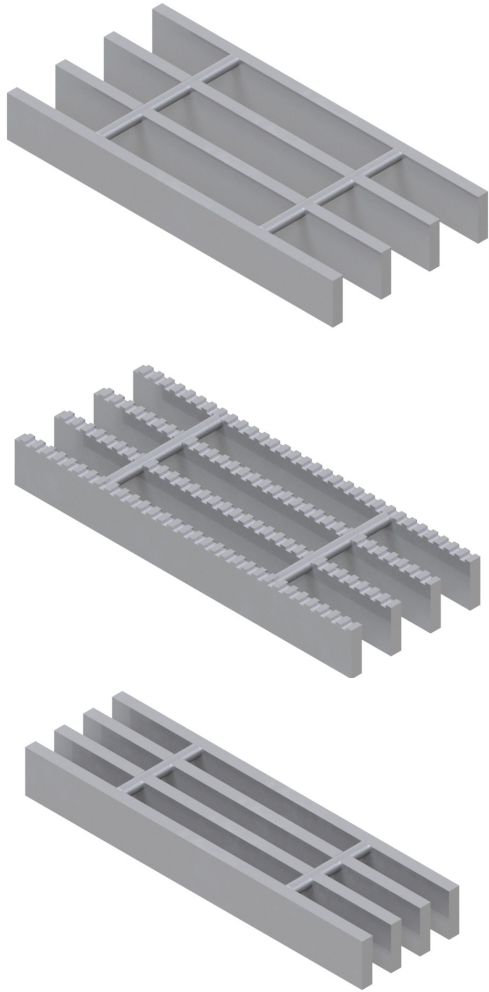


Wide-Gap



Extra-Wide-Gap





Vulcraft Grating offers both ADA compliant and Heels-Friendly Grating.



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