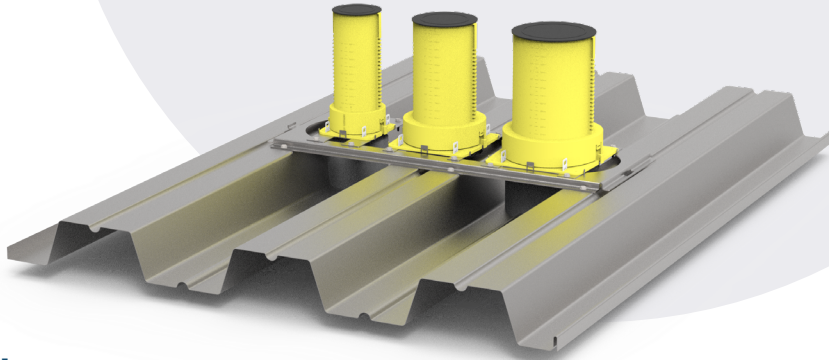


Steel Deck Plate and Penetrations

SpecSeal® Cast-In Deck Reinforcement Kit



Introduction

In recent years, the use of Steel Composite Decking has increased due to its exceptional structural strength, speed of construction, and cost-effectiveness. Additionally, it offers enhanced fire resistance, as the concrete component helps protect the steel deck from high temperatures, thereby reducing the risk of structural failure.

Steel Composite Decking is a two-part system, consisting of a fluted steel deck and a concrete slab that conforms to the fluted profile of the steel deck. The fluted steel deck serves multiple roles: it acts as a working platform during construction, and once the concrete has cured, it reinforces the slab to support loads throughout the life of the building. The system's strength is derived from the tensile properties of the steel and the compressive properties of the concrete, which work together to create a robust, durable structure. This makes Steel Composite Decking a popular choice in commercial and industrial buildings.

The Steel Deck Institute (SDI), the leading authority in steel deck construction, provides comprehensive guidelines on various aspects of the process. These include guidance on deck profiles, shipping, handling, storage, on-site erection, and managing deck damage and penetrations.

Penetrations through Steel Composite Decking are common in building construction to accommodate pipes, ducts, and other utilities required for plumbing, electrical, and HVAC systems. While these penetrations are necessary, they can compromise the fire resistance of the decking if not properly managed. This underscores the critical need for effective firestopping solutions to maintain the assembly's fire rating. It is essential for the professional designer and structural engineer involved in each project to thoroughly review all proposed penetrations and the recommended firestopping solutions presented in this white paper.

Traditional methods for creating and firestopping penetrations in Steel Composite Decking are often labor-intensive and time-consuming, leading to higher costs. This white paper explores the SDI's recommendations for creating openings in fluted steel decking and introduces the new Cast-In Deck Reinforcement Kit, designed to streamline the process. The Reinforcement Kit is engineered to reduce labor, improve project scheduling, and minimize the need for specialized tools. This white paper will also cover the installation of the Reinforcement Kit and its ability to restore structural integrity to the steel deck after creating openings.

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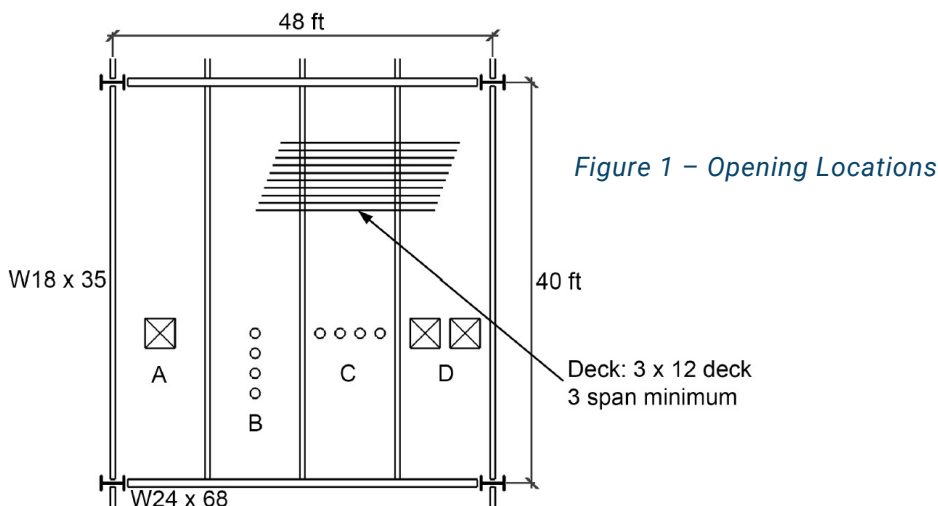
Considerations for Penetrations in Steel Composite Decking

Openings in Steel Composite Decking are common in commercial and industrial buildings to accommodate pipes, ducts, and other utilities. There are several methods for cutting these openings, which can be done either before or after the concrete pour. Typically, general contractors either core through the concrete or block out the area during the pour and later burn away the steel deck. While these methods are viable, they often require additional labor and careful scheduling to cut the openings through the Steel Composite Decking after the concrete has been poured.

The Steel Deck Institute (SDI) publication for “Manual Construction with Steel Deck”, or SDI MOC3, addresses all facets of steel deck construction for roof decking and floor decking. This publication includes provisions for penetrations and deck damage. In the imperfect world of construction, damaged decks or pre-penetration of the deck may be unavoidable. STI’s solution for fire stopping pre-penetrations of decks is the new Deck Reinforcement Kit, which includes a structural plate to reinforce the deck prior to concrete pour. Following SDI’s recommendation, all structural reinforcement should be reviewed by the structural engineer to remediate penetrations or deck damage.

SDI’s manual titled “Floor Deck Design” provides guidance on proper considerations for the placement of penetrations. Per SDI’s guidelines:

Proper consideration must be given to the location and spacing of openings or holes.



- A. Hole A in Figure 1 is a typical basic condition and needs no further consideration.
- B. The holes shown as B in the figure are small in diameter, but run perpendicular to the span of the deck-slab. When in this configuration, unless there is adequate deck remaining between the holes, the width of the hole should be considered to be the overall length along the string of holes. The determination as to if the hole spacing is adequate to consider each hole as separate can only be determined through an analysis of the deck-slab.
- C. The holes shown as C in the figure are lined up parallel to the bearing direction of the deck. These holes can be considered as the width of a single hole.
- D. The openings shown as D in the figure can be considered as 2 separate holes, or as a single hole.

The guidance from SDI served as the foundation for developing the new Cast-In Deck Reinforcement Kit. This Reinforcement Kit enables the creation of openings in the steel deck before the concrete is poured, in accordance with SDI guidelines. This innovative product simplifies the process, allows for customized penetration layouts, and improves project scheduling.

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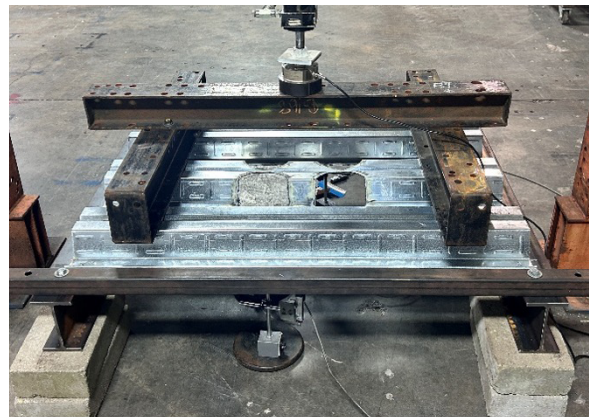
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Testing in Application of Cast-In Deck Reinforcement Kit

Specified Technologies Inc. (STI) initiated a testing project at third-party laboratory ICC Evaluation Service (ICC ES) to test the new Cast-In Deck Reinforcement Plate (Plate is included in the Reinforcement Kit) in accordance with ASTM E72 to evaluate its performance compared to other configurations. ASTM E72 is a standard test for determining the loading capacity of commercial building panels. STI tested a configuration of the new Reinforcement Plate supporting four (4) evenly spaced 6-inch diameter holes within a 13" x 13" (330 mm x 330 mm) area. Additionally, three other configurations were tested for comparison using the same size and manufacturer of steel deck panels, as listed below.



Specimen 1: Standard steel deck panel without concrete, no openings in the deck



Specimen 2: Steel Deck Panel without concrete, with openings in the deck and no support plate



Specimen 3: Steel Deck Panel without concrete, with openings in the deck and STI's new Reinforcement Plate



Specimen 4: Steel Deck Panel without concrete, with opening in the deck and a 0.07" standard support plate.

Steel Deck Plate and Penetrations

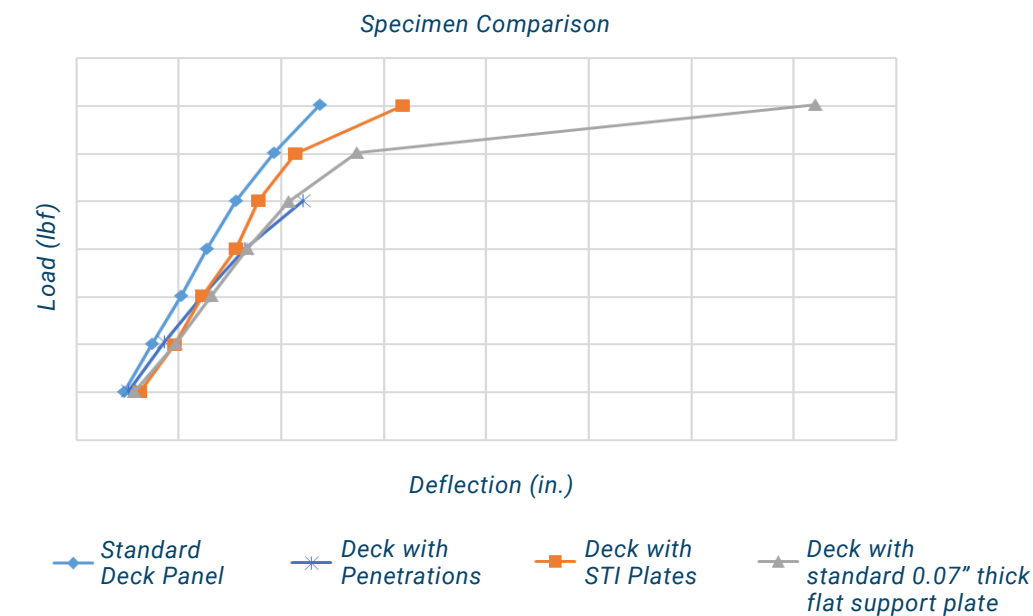
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The performance of the new Reinforcement Plate was evaluated and compared to the other specimens tested. The table below presents a comparison of the maximum load applied to each specimen until catastrophic failure of the steel deck flutes.

Specimen No.	Max Load (lbf)	% of Spec. 1 Max Load	Max Load (N)
Specimen 1- Standard Deck Panel (Unpenetrated)	9,511	--	42,307
Specimen 2 – Deck with Openings (No support)	7,555	79.4%	33,606
Specimen 3 – Deck with STI Reinforcement Plates	9,083	95.5%	40,403
Specimen 4 – Deck with standard 0.07” thick flat support plate	8,985	94.4%	39,967

As shown in the table above, Specimen 3, featuring the new Reinforcement Plate, restored the majority of the structural load-bearing capacity to the steel deck panel. It outperformed Specimen 4 (standard 0.07” thick flat support plate) in terms of restoring load-bearing capability.

In addition to restoring the load-bearing capacity of the steel deck panel, the new Reinforcement Plate significantly reduced the allowable deflection after openings were cut into the deck. The graph below illustrates the load-deflection performance of each specimen.



While STI has conducted testing and validated the design of the new Reinforcement Plate, it is strongly recommended that the structural engineer assess the penetration layout for their project before implementing the use of the Reinforcement Plate.

Steel Deck Plate and Penetrations

SpecSeal® Cast-In Deck Reinforcement Kit

Introducing the SpecSeal® Cast-In Deck Reinforcement Kit

Our new SpecSeal® Cast-In Deck Reinforcement Kit allows for the creation of openings in the steel deck before the concrete is poured, following SDI guidelines. This innovative product simplifies the process, reducing labor and improving project scheduling. The Reinforcement Kit is designed to be installed easily, requiring minimal specialized tools, and it ensures that the structural integrity of the steel deck is maintained after creating openings.

The Reinforcement Kit offers several benefits:

- **Efficiency:** Reduces the time and labor required for creating openings.
- **Cost-Effective:** Minimizes the need for additional labor and specialized tools.
- **Compliance:** Follows SDI guidelines, ensuring safety and structural integrity.
- **Fire Resistance:** Maintains the fire rating of the deck by providing effective fire stopping solutions.
- **Pre-Installation:** No labor required after the concrete is poured.

Installation Process

The installation of the Cast-In Deck Reinforcement Kit involves several key steps to ensure proper integration with the steel deck and concrete slab:

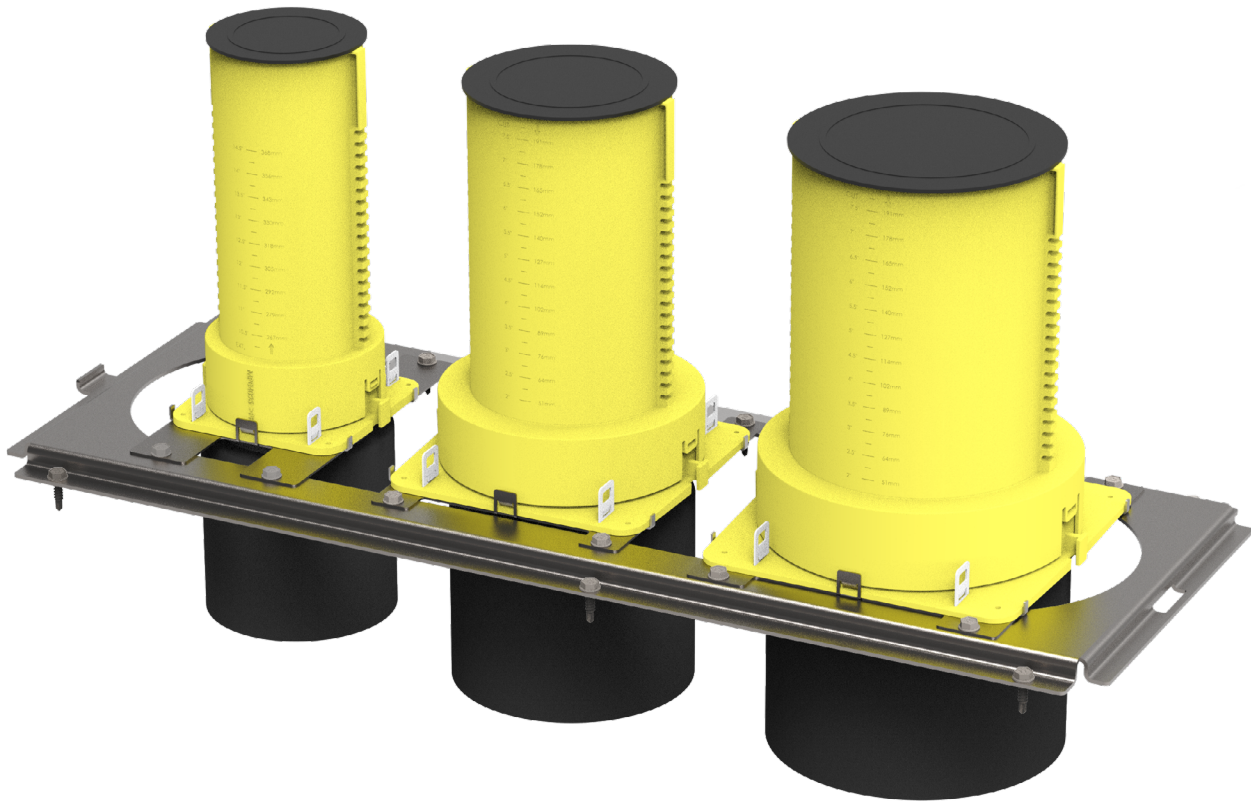
1. **Preparation:** Identify the locations for penetrations and mark them on the steel deck. Ensure that the markings align with the project's design specifications and SDI guidelines.
2. **Cutting the Deck:** Use appropriate tools to cut the steel deck at the marked locations. Ensure that the cuts are clean and precise to facilitate the installation of the Reinforcement Kit.
3. **Installing the Reinforcement Kit:** Position the Reinforcement Kit over the cut opening and secure it to the steel deck using welding or fasteners as specified in the product guidelines. Ensure that the Reinforcement Kit is firmly attached and properly aligned.
4. **Pouring the Concrete:** Once the Reinforcement Kit is installed, proceed with pouring the concrete slab. Ensure that the concrete flows around the Reinforcement Kit and fills the fluted profile of the steel deck.

For the full installation sheet, click [here](#) or scan the QR code.



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Conclusion

The SpecSeal® Cast-In Deck Reinforcement Kit represents a significant advancement for addressing building service element penetrations in the use of Steel Composite Decking. By allowing for the creation of openings before the concrete is poured, it streamlines the construction process, reduces costs, and ensures compliance with SDI guidelines. This innovative solution addresses the challenges associated with traditional methods, offering a more efficient and effective approach to managing penetrations in Steel Composite Decking.

The Cast-In Deck Reinforcement Kit is available from Specified Technologies Inc. (STI) authorized distributors. For additional purchasing and technical information or for the names and locations of the nearest representative and/or distributor, regarding this and other Specified Technologies products, please call 1-800-992-1180 or visit www.stifirestop.com.

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