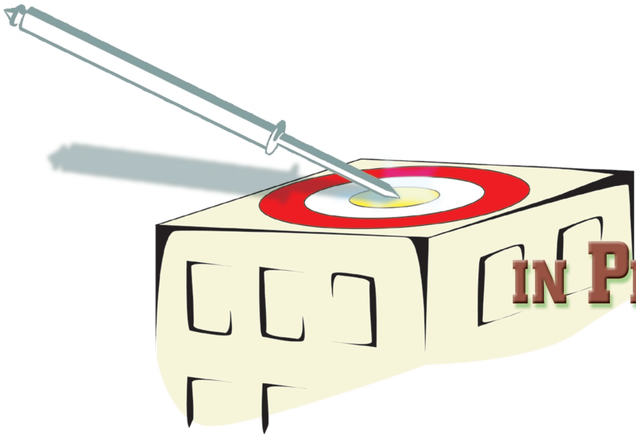


# Mechanical Fasteners Get to the Point in Providing Roof System Success

By SPRI's Fasteners Subcommittee

Mechanically fastened roofing systems have played a significant role in the impressive market gains achieved over the past 20-plus years by flexible membrane systems. Mechanically fastened seams make up a significant portion of the flexible membrane market and represent almost half of the total square feet of thermoset and thermoplastic roofs installed in 2001. Additionally, mechanical fasteners are the predominant method of insulation attachment for fully adhered systems.

Mechanically fastened flexible membrane systems offer a number of advantages, such as:

- low installed cost,
- consistent performance,
- ease of installation,
- low equipment costs; and
- light weight.

Factory Mutual (FM) Global, Norwood, MA, first spurred the use of mechanically fastened systems when it changed its position on how roof systems should be secured after a devastating fire at the GM plant in Livonia, MI, in the 1950s. Asphalt strip mopping had been used to attach the roof insulation, and it dripped from the roof, providing fuel to spread the fire.

At that time, in fact, there were no fasteners designed specifically for use in roofing assemblies as there are today. Early efforts utilized screws designed for other purposes, such as for wood and drywall. The need was created for new products designed especially to attach roofing materials. The roofing fastener industry was born.

## FM spurs fastener demand

FM's standard specification 4450-83 put the teeth into the demand for fasteners. This approval standard, issued in 1983, outlined which steps should be taken to reduce potential fire hazards by substituting mechanical fastening methods. Initially, however, FM's solution created a new problem because, early on, corrosion was an issue for some fasteners. Not all early coatings were up to the demands imposed on them.

*Contractor installing seam fasteners with a labor-saving and less tiring installation tool. Photo courtesy of Olympic Fasteners.*

*Contractor using a two-part urethane adhesive fastener where penetration of a mechanical fastener was unacceptable. Photo courtesy of Olympic Fasteners.*

Furthermore, flexible membranes' appealing ability to be installed over an existing roof system further increased chances that fasteners might be exposed to moisture.

To address this issue, SPRI (the Sheet Membrane & Component Suppliers to the Commercial Roofing Industry) proactively developed its own standard for determining corrosion resistance. This pioneering effort, later adopted as a national standard in conjunction with the American National Standards Institute (ANSI), is entitled ANSI/SPRI 4470 – "Corrosion Resistance of Mechanical Fasteners." Subsequently, SPRI worked hard to encourage FM to adopt a similar standard. Per SPRI's recommendation, FM approved the use of the Kesternich cabinet as a way to test the corrosion resistance of fasteners.

The Kesternich cabinet had originally been used in Germany to test mufflers on Volkswagen cars and was found to be substantially tougher (and potentially more predictive) than the previously used salt spray test.

These tests provided the impetus for the initial changes in coatings. However, coatings have continued to change over time as different options became available. Newer electrodeposit or electrostatic coatings (E-Coat) provide a smooth, better-looking appearance while eliminating the drive recess from becoming clogged with paint. Electrostatic plating also reduces the cost of coatings. Furthermore, E-Coating is more environmentally friendly because of reduced solvent emissions during the coating process. E-Coats are also available in several colors.

In the early 1990s, FM went from a 5- by 9-foot test table to a 12- by 24-foot table in an effort to better simulate the wind loads they thought roofing systems experienced in the real world. This move changed the dynamics of how fasteners were tested and located in roof systems, as well as what pullout values were needed. It reduced fastener spacing from 18 or 24 inches on center back to 6 inches on center. Initially, that did create the need for more fasteners, but it also added significant cost to a mechanically fastened system.

*Technician predrilling a concrete deck before installing a fastener. Photo courtesy of Olympic Fasteners.*

## Fastener Design Evolves

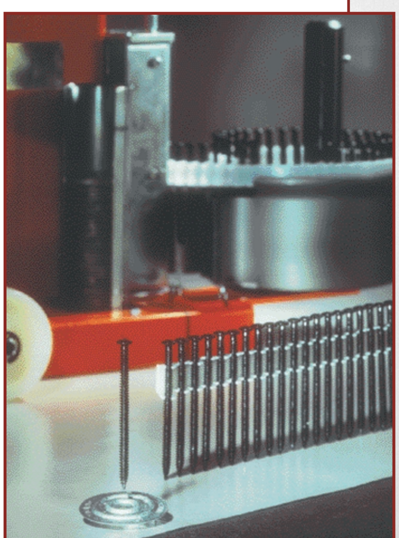
To keep up with changes in the approval requirements and design of roofing systems, fastener threads, points, heads, and diameters have been improved to meet these new demands. Thread, point, and head designs started with configurations developed for the drywall industry. To better adapt these fasteners for roofing, manufacturers moved to using buttress-style threads for improved pullout performance. Over time, they have introduced deeper and finer threads to impart even better pullout resistance.

Drill points evolved from the old gimlet points to pinch points, then to drill points, to mini drill points. These point changes were needed to address increased steel hardness caused by the escalating use of recycled steel. On top of improved drill performance, mini drill points actually produce a smaller hole that enhances both pullout and backout resistance.

Head designs moved from the drywall #2 Phillips "bugle"-type head to the more familiar #3 Phillips pan head. These heads provided more pull-through resistance with plates, and the larger #3 recess imparted better bit engagement.

Diameters of fasteners have increased from the original #10 diameter to #11s, #12s, #14s, and finally #15s. The demand for #15s around 1996 resulted in fasteners yielding withdrawal resistance values 50% higher than #14 fasteners and significant back-out resistance. These parts were some of the first to utilize deeper fine buttress threads and mini drill points and allowed most system manufacturers to increase fastener spacing from 6 inches to 12 inches on center.

More recently, the introduction of 10-foot-wide flexible membranes created another opportunity to ramp up fastener designs. This resulted in the development of the new #20 Super Heavy-Duty Fasteners. These fasteners feature all of the attributes of the high performing #15 fasteners with a significantly larger diameter to provide about 1,000 pounds of pullout strength on a 22-gauge metal deck.

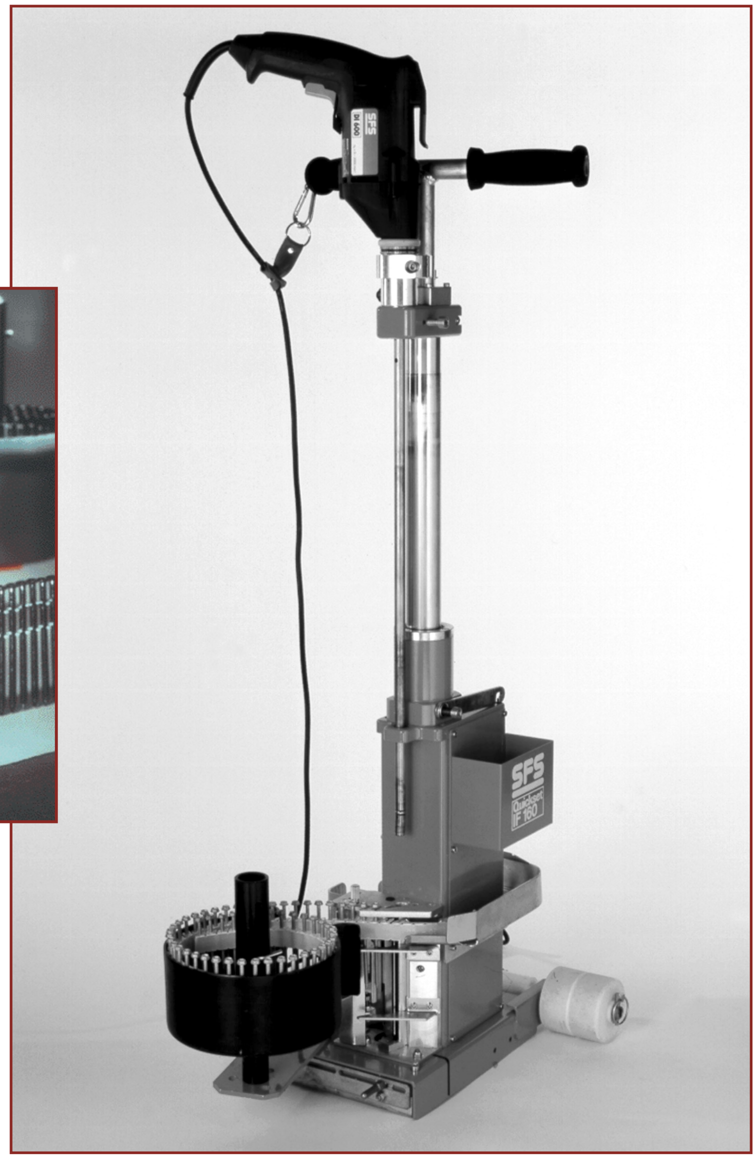


*Above: Isofast belted fasteners and stacked plates increase productivity while decreasing the contractor's installed costs. Photo courtesy of SFS Intec.*

However, as these fasteners evolve further from the original drywall fasteners, they also require contractors to move away from traditional drywall screw guns. Recommendations include using more durable and powerful screw guns, such as a minimum 5.5 amp gun with a maximum speed of 2,500 rpm for the new #20 fasteners. Lower amp guns can still be used for these parts if the speed is also reduced to provide more torque (e.g., minimum 5 amp, maximum 2,000 rpm).

Plate designs have also needed to keep up with improvements in membrane and fastener design. Many unique solutions have been developed to improve the way that

*Right: The Peel Rivet (TPR) is used for unique projects involving "problematic" decks where threaded fasteners will not yield sufficient pull-out values. Photo courtesy SFS Intec.*




*The IF160 machine is an ergonomically correct installation tool that aids in reducing workmen's compensation claims from fastening insulation and membrane. Photo courtesy of SFS Intec.*

*An example of a pullout tester as described in FX-1. Photo courtesy of Olympic Fasteners.*

plates grip the membrane, resulting in the common use of barbs and other proprietary features. Additional innovations in plate shape and rib design have improved their strength, thereby enabling systems to take full advantage of improved fastener performance.

## SPRI develops industry standards

In 1996, SPRI continued its standards development work to address the need for a unified method to perform pullout resistance tests. Its purpose is to provide the roofing system designer, whether he is a system manufacturer or consultant, with reliable data. This standard, ANSI/SPRI FX-1-1996, "Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners," was recanvassed and approved, per the American National Standards Institute policy, in 2001.

Fastening tools have also implemented a variety of approaches over the years, from automated tools to stand-up screw guns that reduce fatigue and improve productivity on the jobsite. Pre-assembling screws and plates in the factory is a newer approach that enables manufacturers to offer a simple way to reduce labor costs for roofing contractors not using automated systems.

During the past 20-plus years, as all elements of the entire roofing assembly (such as decks and membranes) continue to be refined, mechanical fastener suppliers have pointedly met those changes with innovations of their own. As we are assured of constant change in the roofing industry, you can also count on fastener manufacturers to continue developing innovative solutions to maintain top notch performance. ■

