Fastener improvements cure rooftop insecurity

The search for quality roofing has led to changes in many industry practices. One of these changes is the way roof systems are attached to the substrate. Today, in response to new industry requirements and customer expectations, nearly all roofs are mechanically fastened.

But with this change has come a new dependence on quality fastening systems. Contractors and regulatory agencies are beginning to demand fasteners that will hold a roof securely throughout its expected life as well as fasteners that can withstand problems peculiar to certain types of roofing assemblies and conditions.

Raising the standards

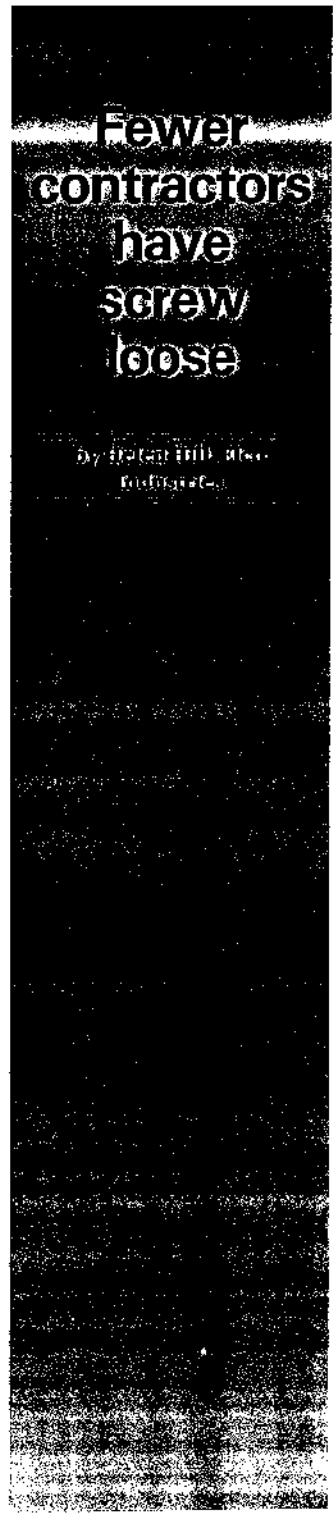
The impetus for raising fastener performance standards has come primarily from two sources. One source is Factory Mutual (FM), which now requires the mechanical attachment of at least the first layer of a roof assembly's insulation if the system is installed over a metal deck. FM also is in the process of setting fastener corrosion standards.

The way roofing component manufacturers market their products also has created an increased demand for high-quality fasteners. The trend among membrane manufacturers to offer longer warranties, for example, means that all the roof components used in the warranted assembly must perform well for an extended length of time.

Manufacturers have responded to these increased demands by developing engineered fasteners, products that have been designed to perform specific functions.

Wet roofs endanger fastener

Rooftop conditions can present fastening systems with some unique challenges. In a 1984 *Roofing Spec* article, Stanley Warshaw, president of membrane manufacturer Sarnafil, Inc., said, "Residual or trapped moisture within the thermal insulation or the decking material is another design problem. This moisture should concern the building owner because it can significantly decrease the insulation material's thermal efficiency. Even more alarming is the compromised security of the membrane attachment this moisture can cause."



The moisture Warshaw referred to in his article may accumulate on the underside of some single-ply membranes or it may be trapped within a wet assembly. If this moisture seeps into insulation through which a fastener is driven, it can corrode the fastener and eventually lead to roof failure. Manufacturers have developed fluorocarbon anti-corrosion coatings to counter this threat.

Single-ply fasteners must also be designed to withstand wind uplift forces. These forces are felt most by fasteners holding down a roof's corners. In fact, fasteners located anywhere along a roof's perimeter will be subjected to greater wind uplift than fasteners in the field of the roof. In its 1-90 specifications FM acknowledges the need for greater holding power at a roof's corners and perimeter by requiring 50 percent more fasteners in these areas.

Adding extra fasteners isn't enough, however. To combat wind uplift, each fastener must possess pullout resistance of its own. Contrary to some perceptions, this resistance is not a function of a screw's length, but its diameter. Larger diameter screws possess a larger root. This permits deeper threads and greater holding power.

Another weapon in the wind uplift struggle is the stress plate through which the fastener is driven. When a screw head is seated in a flat metal or plastic stress plate, the fastener's holding pressure can be spread more widely over the surface of the insulation board.

Locking out roof problems

Manufacturers are developing many screw and stress plate designs to answer particular roofing dilemmas. A fastener system recently introduced by Elco Industries of Rockford, Ill., illustrates how one

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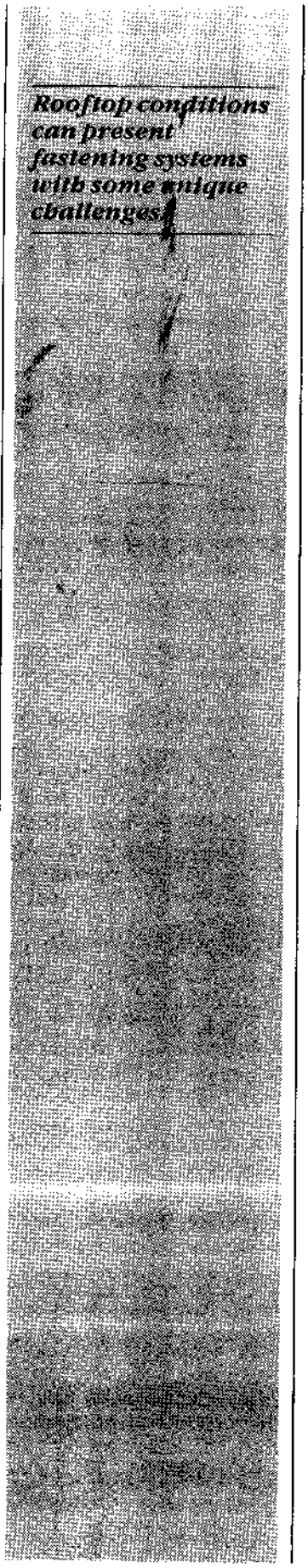

fastener and stress plate pairing helped solve a nagging roof problem.

Elco's fastening system includes a self-drilling screw with a locking collar and a 3-inch diameter plastic stress plate engineered to lock into the fastener. As the screw is driven through the disk, the locking collar of the fastener passes through the disk and past the locking tabs at the end of the disk hub. Once it is installed on a roof, the disk is locked into place between the fastener head and the collar and cannot shift its position.

The locking mechanism helps prevent external pressure on the roof assembly from damaging the membrane. Some fastener systems allow the stress plate to sink when an insulation sheet is compressed. This can happen when the roof is subjected to the weight of a worker or a piece of equipment, or the ravages of wind and weather reduce insulation thickness. The screw head, protruding from the sunken plate, can penetrate the membrane. With Elco's fastener/plate match-up, the two act as one and the screw head cannot raise up independently.

Going to great lengths

The extra-long screw is another product designed to meet the needs of changing roofing techniques. Fasteners 6 inches or more in length can be used to attach thicker insulation to a deck even through an old roof assembly.

A recently completed single-ply job in Rockford, Ill., illustrates the type of reroofing situation that makes the use of longer fasteners necessary. The roof system that was installed included 900 squares of fully adhered rubber and mechanically attached 2-inch thick sheets of 3-foot-by-4-foot isocyanurate foam insulation. Because the old roof was not being torn off, the new roof's insulation had to be fastened to the 27-gauge steel deck through the old roof and its insulation. Each fastener was required to clear the bottom rib of the deck by $^{3}/_{4}$ inch.

The contractor used 6- and 7 1/2-inch self-drilling Elco fasteners to attach the new insulation, employing six fasteners and plates per sheet. The fastener's drill point enabled it to pierce the steel roof deck and attach the insulation in one operation. To combat corrosion the screw was made of heat-treated carbon steel and coated with Elco's proprietary silver fluorocarbon coating.

Elco has also developed fasteners to handle other difficult roofing situations. There are special fasteners available for masonry or lightweight decks such as gypsum and lightweight cellular concrete.

Kesternich's torture chamber

As engineered fasteners for roofing are developed they must go through standard testing procedures, including a battery of FM approval tests. Pullout tests are conducted to determine if the fastener meets holding requirements, while other tests evaluate the anti-corrosion effectiveness of the fastener's coating.

In the Kesternich test chamber an intensely corrosive atmosphere is created to simulate the conditions a coating meets when exposed to a heavy industrial or commercial atmosphere over a period of years. During the test, sulfur dioxide, nitrogen dioxide and 100 percent humidity are introduced into the test chamber's atmosphere while the temperature is raised to 100F. When the gases combine with the moisture, they form sulfurous and nitric acid, and attack the coating sample placed inside the chamber.

A fastener coating under study is also subjected to a salt spray test, where it is exposed to an atmospheric mixture of distilled water and sodium chloride in 100 percent humidity at 100F. Coatings are sometimes subjected to 800 continuous hours of this treatment.

Holding down costs

When fasteners are developed to meet specific roofing needs, they can help bring about high-quality roof installations, longer-lasting roof systems and greater customer satisfaction. The contractor will find that a well-designed, self-drilling fastening system will allow his crew to securely fasten a roof in a shorter span of time, and that the simpler, one-step installation will lead to less trouble and fewer call-backs. The bottom line for any contractor using quality fastening systems should be more secure roofs, more secure customers and more secure finances.