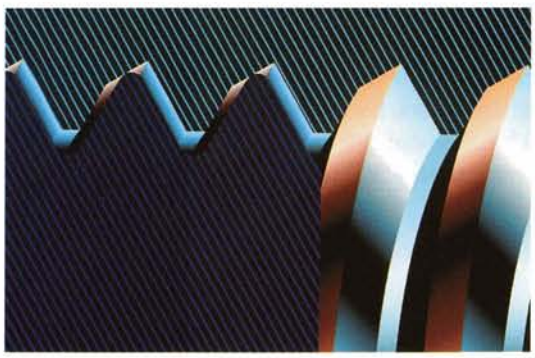
VIBRATION-RESISTANT FASTENER

Each of the three main engines of the Space Shuttle generates 400,000 pounds of thrust and, of course, terrific vibration. In developing the engines, NASA looked for a special type of fastener, one that could withstand the great shock and vibration of a Shuttle launch without loosening. That was a very big order, but it got bigger: NASA also wanted a 15-cycle reuse capability for the fastener.

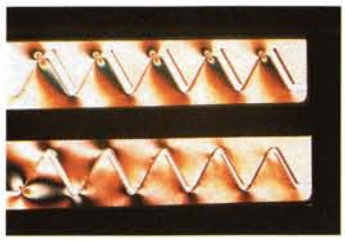
Those demanding requirements are met — and exceeded — by the Spiralock® internal thread form type of fastener, manufactured by Detroit Tool Industries, Madison Heights, Michigan. NASA tests of the superfastener showed that the Spiralock did not back off or loosen even when subjected to vibrations 10 times greater than the specified requirement. And the fastener easily topped the 15-cycle requirement; it was found to have no loss of clamping power after 50 cycles. Every Shuttle engine built incorporates more than 750 Spiralock fasteners.



The key Spiralock feature is a unique 30 degree wedge ramp, outlined in blue **at left.** When clamp load is applied during assembly, the Spiralock thread form locks the standard male fastener in place by drawing the crests of the male thread tightly against the wedge ramp. That "wedge-locking" makes Spiralock exceptionally resistant to transverse vibration, the major cause of thread loosening, and substantially reduces the potential of fatigue failure.

To better visualize the unique load distribution properties of Spiralock, Detroit Tool conducted a photoelastic study of conventional and Spiralock threads. The photo **above** illustrates the difference between Spiralock (upper strip) and a standard thread form (lower strip); in the latter the load is concentrated on the first thread and in the Spiralock the load is distributed evenly across the length of the fastener.

A user testimonial to Spiralock's effectiveness is supplied by Philips Broadband Networks, Inc. (PBN), Manlius, New York. A manufacturer of broadband



radio frequency and fiber optic networks, Philips had long used a special, high quality fastener of another make due to the large number of insertions and withdrawals necessary in certain of the company's products. The fastener provided a high level of joint integrity but it was costly and difficult to assemble.

Pete Strong of the PBN engineering department read in *NASA Tech Briefs* (see page 137) about the use of Spiralock thread form in space applications. He brought the article to the attention of the Mechanical Engineering Group, which decided to perform comparative strength and insertion/withdrawal testing of their regularly used fastener and Spiralock over a wide temperature range. The performance results for both fasteners were similar, and both far exceeded PBN's customers' requirements. PBN was able to switch to Spiralock in most of its products, eliminating a troublesome installation problem and gaining a bonus in cost reduction on certain product lines where Spiralock fasteners contributed to easier assembly.

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