A New Approach to Fastening Thin Panels

by Ken Gomes

For years assemblers of thin panels have focused on reducing stripped joints. The low expense of purchasing standard type A, B and AB screws is mitigated by the high incidence of "strippers". Many innovative fastener suppliers have tried to improve the stripping resistance of standard type A, AB and B sheet metal screws. Most of the efforts centered on improving the torque that came from the underhead bearing surface. Various undercuts and torque robbing nibs and serrations have been used with modest improvement.

Unfortunately, these approaches do not address the limitations of spaced threads on standard sheet metal screws.

The current disadvantage of using standard sheet metal screws with spaced threads is that the sheet metal deflects due to the single lead thread, particularly when the nut material thickness is equal to or less than the thread pitch. This condition occurs more often as the trend is to use thinner material. Under these conditions, the sheet metal nut material is not really thread formed, but is deflected to conform to the screw helix into the root area of the screw. **See Figures 1 & 2.**

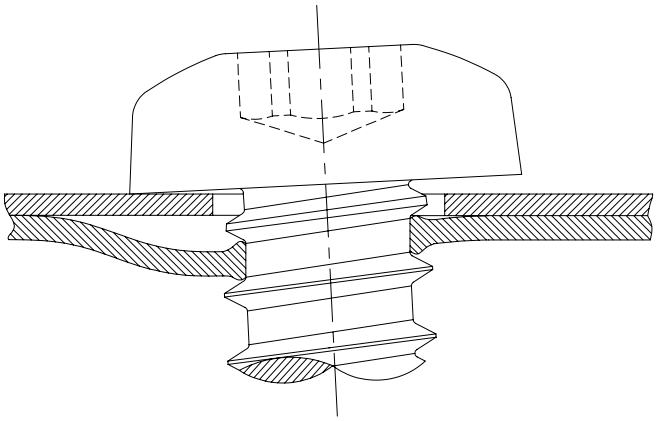


Figure 1

Figure 2

This condition using standard sheet metal screws causes the screw to frequently be off axis causing the head to seat off axis. Since the underhead bearing surface does not seat flush on the laminate, stripping resistance is reduced. Another factor is the reduced thread diameter under the screw head. **See Figure 3.**

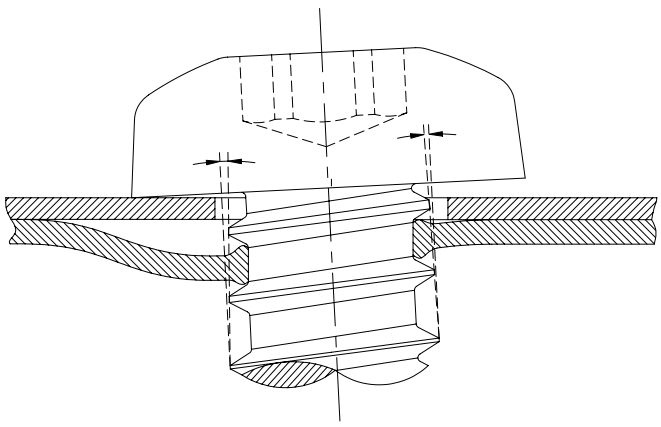


Figure 3

To avoid the aforementioned inherent condition when using standard sheet metal screws, RESEARCH ENGINEERING & MANUFACTURING INC. (REMINC), the licensors of the TAPTITE® family of fasteners, have developed the FASTITE® 2000™ line of fasteners. **See Figure 4.**

FASTITE® 2000™ thread forming screws were developed to create strong mechanical joints into untapped thin sheets while providing "in-place cost savings", long associated with the TAPTITE® range of thread rolling screws.

FASTITE® 2000™ screws are very different from other proprietary screws designed for use in sheet metal. FASTITE® 2000™ screws have standard machine screw pitches, in both inch and metric sizes. A double lead is used and the body has a unique subtle TRILOBULAR™ shape. FASTITE® 2000™ screws have several features, which combine to provide improved performance in sheet metal.

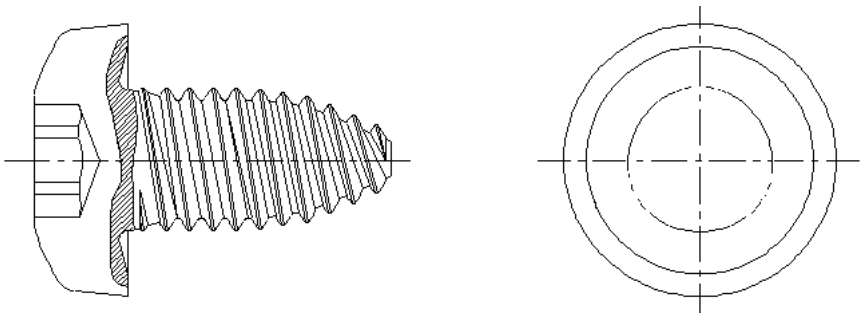


Figure 4

FASTITE® 2000™ performance features **(See Figure 5)**.

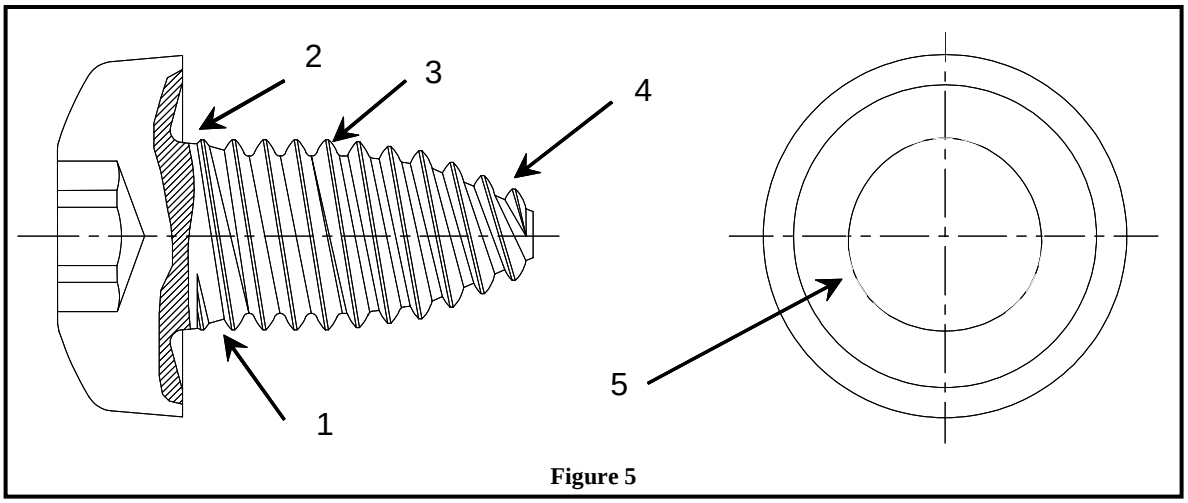
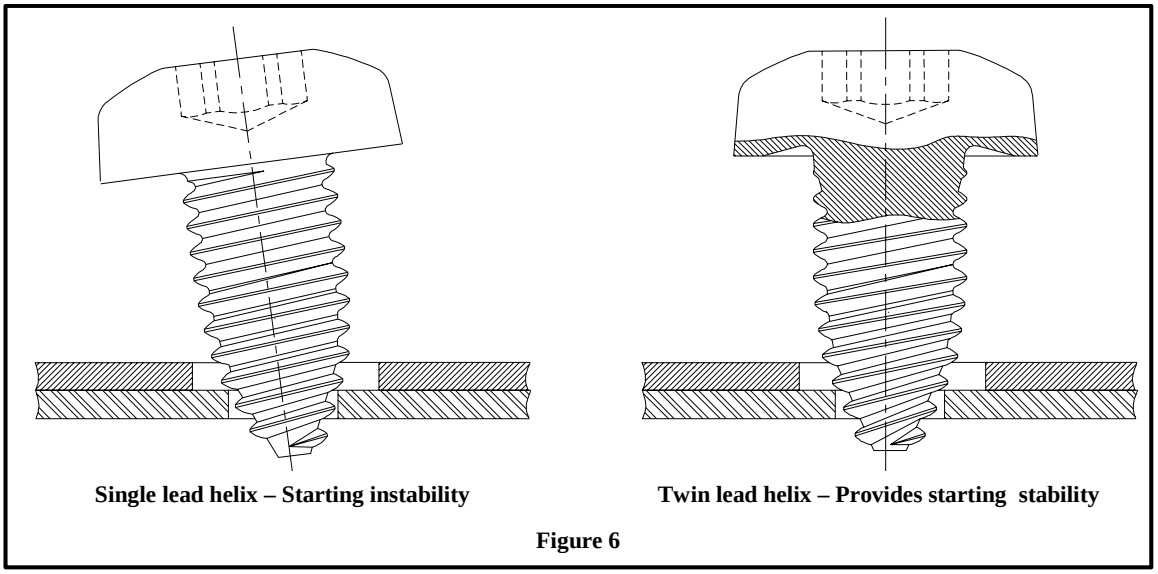


Figure 5

1. A tapered root adjacent to the screw head to maintain thread major diameter close to the screw head.
2. An undercut feature to increase assembly failure torque.
3. A Radius Profile™ thread design combined with a twin lead helix angle to provide a mating thread system whereby diametrically opposed threads are engaged.
4. A non-cut-off "CA" style point for extruding in relatively small holes.
5. An unique TRILOBULAR™ shape thread body to provide "resistance to loosening".

The double lead helix creates two thread starts, 180° opposite each other. The twin helix provides starting stability by contacting the hole on two sides. Single helix screws, with spaced threads or machine screw threads have starting instability causing the screw to cock. **(See Figure 6)**



Single lead helix – Starting instability **Twin lead helix – Provides starting stability**

Figure 6

A blunt end "CA" style point is used rather than the more common sharp "needle" point. The small diameter of the blunt "CA" point allows the screw to enter relatively small holes, creating a situation where there is more nut material than can fill the screw body threads. The FASTITE® 2000™ screw, due to the unique TRILOBULAR™ shape, extrudes material towards the screw head (backward extrusion) and screw point (forward extrusion) increasing the amount of engagement to more than the base thickness of the panel.

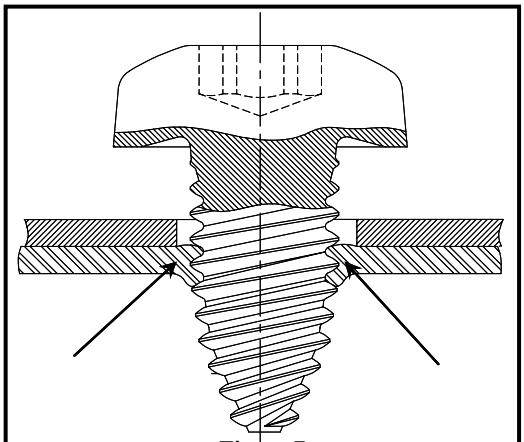


Figure 7
Diametrically opposed thread engagement resulting in improved failure torque.

Figure 7 shows a graphical representation of how FASTITE® 2000™ screws extrude the material. Also shown is another feature of the double lead design - the diametrically opposed threads engagement resulting in improved stripping resistance from the screw threads.

Figure 8 shows an actual cross section of a FASTITE® 2000™ screw driven into sheet steel, which shows the diametrically opposed threads engaged in the sheet and the forward and backward extrusion of the sheet material. Notice the undercut section below the screw head. This feature also increases the stripping resistance provided by the screw head bearing surface. The diametrically opposed threads ensure that the head will seat parallel against the sheet material.

The increased core diameter, caused by the thread root rising under the head, results in additional forward and backward extrusion, providing increased thread engagement which enhances stripping resistance. **See Figures 9 and 10.**

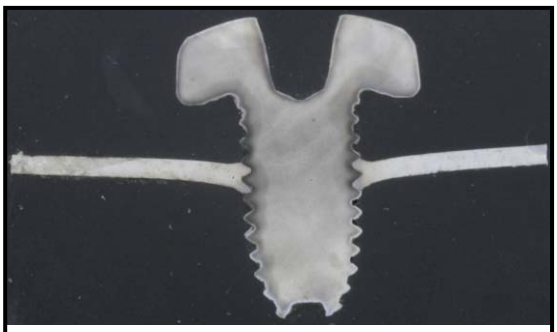


Figure 8

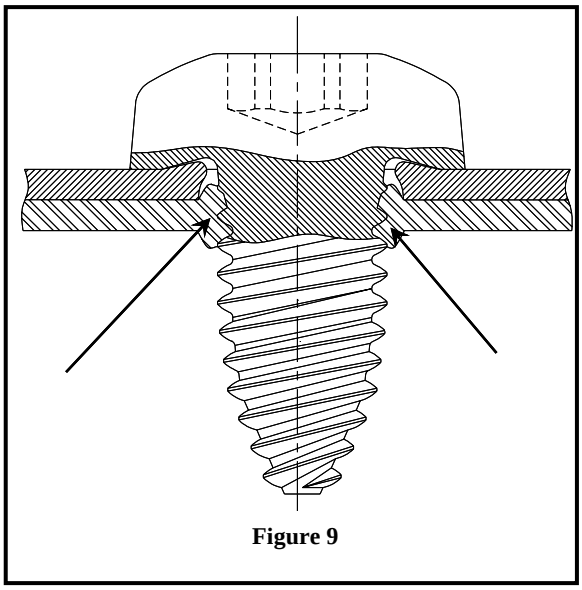


Figure 9

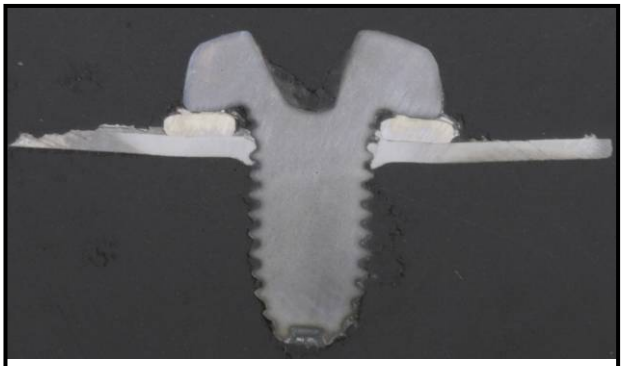


Figure 10

FASTITE® 2000™ screws can also be supplied with underhead serrations. If the serrations rubbing against the sheet laminate being fastened are not a concern, underhead serrations further increase the stripping resistance.

The undercut, which is an integral part of the FASTITE® 2000™ design, makes FASTITE® 2000™ screws an ideal choice for securing grounding connections. In combination with the TRILOBULAR™ shape, the undercut also significantly increases resistance to vibrational loosening.

As an example of the benefits described, M6 size FASTITE® 2000™ screws are used in a new model North American vehicle to assemble the inner wheel well to the fender inside the engine compartment, a fender rail application. The sheet metal thickness on the older model was 1.5mm thick. On the newer model, the sheet steel thickness was reduced to 1mm thick. The strip failure torque of the original fastener was not to a sufficient level to allow its use. Replacing the original fastener with an M6 FASTITE® 2000™ screws in the 1mm thick steel resulted in an average strip failure torque of 18Nm, compared to 8.7Nm, an improvement of 107 %!

Contact our application engineers at REMINC and learn how FASTITE® 2000™ fasteners can be used in your sheet metal applications to improve your assembly, reducing the “in-place cost of assembly”.

For more information, contact Research Engineering & Manufacturing Inc. (REMINC), 55 Hammarlund Way, Tech II, Middletown, RI 02842, USA Tel: 401-841-8880, Fax: 401-841-5008, E-mail: reminc@reminc.net or visit us on the web at www.taptite.com.

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