REMINC

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to the Fastener Industry

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What's Different About the Design of TAPTITE 2000® Screw Joints? - Part 1

By Matthias Jokisch *

Unlike conventional fastening systems (nut/bolt) where the geometry of both parts is standardized, it is well-known that fastened joints utilizing TAPTITE 2000® screws and bolts require no pre-tapped thread in the nut. The use of thread rolling TAPTITE 2000® screws leads to cost savings for end-users if this is taken into account in due time in the construction and design of the joint, because the nut tapping and cleaning processes are no longer needed. These savings have been proven in a number of different industrial applications.

However, the parameters that have to be taken into account, when designing an optimum joint with TAPTITE 2000® screws, are different from those for standard metric screw joints. This article aims to explain those aspects that have to be taken into account by the manufacturer and end-user during any investigation of the application technology and design of the joint.

In a standard screw joint both elements are defined by geometry and material properties. In other words, both elements have defined values and tolerances for their dimensions and material strengths under which they create the desired joint, for example a necessary minimum pre-tensioning force.

If a TAPTITE 2000® screw joint is to be used, only the geometry of the screw and its tolerances are known in the first instance. With respect to the necessary pre-tensioning force in the joint, the grade strength of the screws can be defined in advance. Grades in the categories 8.8 or 10.9 are common. In the majority of cases the type and strength or hardness of the nut material is also known. All materials used as nuts must in principle be sufficiently ductile.

A normal quality category of the screws in the required grade strength is usually adequate for soft non-ferrous metals such as zinc, aluminium or magnesium. In joints with TAPTITE 2000® screws this is also called CORFLEX®-'N', whereby the "N" stands for neutral hardening as common for metric screws. If TAPTITE 2000® screws are to be used in a steel material, which places a higher load on the rolling zone at the tip of the screw, the neutral hardened screw should be additionally reinforced up to at least the first fully formed thread by means of induction hardening. This heat treatment is called CORFLEX®-'I'. Alternatively and if allowed, case-hardened TAPTITE 2000® screws can also be used in both steel and light alloys.

High hardness zone of a CORFLEX®-'I' fastener - shown by crescent shaped areas

TAPTITE 2000® thread rolling screws are used in thread-less nuts. These can be made either by drilling, punching or casting. The thread rolling process is a cold forming process. This means that the TAPTITE 2000® screw not only acts as a connecting element but also as a tool to produce a non-cut, cold-formed thread.

Compared to other thread rolling screws for metal available in the market, the TAPTITE 2000® screw has a patented thread geometry that has been optimized for the material forming process. The

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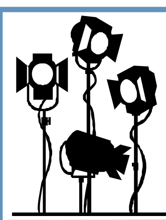
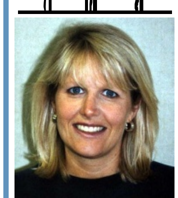




Beth has been Director of Financial Administration at REMINC since 1997. Her duties include preparing REMINC's financial documents, revenue collection, employee benefit administration and human resource management. Beth holds a BA degree from Dartmouth College and an MBA from New York University's Stern School of Business. She resides in Rhode Island with her husband and three children.

R E G I S T E R

CHAIRMAN'S CORNER
"PLAN B"
by Laurie Mandly

Having worked at REMINC since 1985 and being its Chairman since 2005, I have gained valuable business experience, which has served me well. At REMINC we have experienced many business cycles, difficult competitive situations, currency exchange fluctuations, licensee ownership and management transitions and numerous other unexpected challenges. When faced with a serious business challenge, I tend to take "time out" and temporarily remove myself from my day-to-day management duties. Stepping back like this allows me the opportunity to examine the pending problem in the third-dimension, giving consideration to all relevant matters, an exercise that often uncovers a solution that at first might not appear to be obvious. When the current plan of action, "Plan A", encounters an obstacle, I want to have "Plan B" ready to invoke, in order to continue business in an orderly fashion.

In the past few months, the world has experienced two major environmental crises, the eruption of an Icelandic volcano and an explosion of an oil-drilling rig in the Gulf of Mexico. In both cases, management's initial reactions to these two separate events were hastily organized and they resulted in no solutions.

Soon after the volcano, Eyjafjallajoekull, began spewing ash into the atmosphere in April, 2010, all North Atlantic and much of Europe's air traffic was necessarily grounded, causing huge delays and scheduling problems for travelers and adverse financial consequences for the airlines affected. It was only several days after the eruption that serious consideration was given to providing alternative means of transportation to stranded passengers wherever possible. It became readily apparent that that neither the affected airlines nor North Atlantic Air Traffic Control had any plan in reserve to deal with this unusual natural event, no "Plan B".

Six days after the volcanic eruption, the once heralded "Deepwater Horizon" oil-drilling rig, operated on behalf of the giant oil company BP, exploded and toppled into the Gulf of Mexico. In an attempt to diminish or stop the flow of leaking oil, several experimental devices were employed but none met with any material success. During each of the next 85 days an estimated 50,000 barrels of crude oil gushed into the Gulf from the underwater well for a total of about 4.5 million barrels. This accident created what is thought to be one of the most damaging man-caused environmental disasters of all time, and full extent of which will be unknown for years to come. We have learned that BP had no workable solution to resolve a problem of this kind and magnitude, short of plugging the original well shaft and then drilling a relief well, which they finally employed; but it took several weeks to complete the operation. Hopefully their efforts will provide a permanent solution. BP had no "Plan B".

In our industry we too often face challenges, perhaps not as momentous or devastating as the volcano or the crude oil leak, but never-the-less threatening to our respective businesses. Events such as fire, flood, strike, a customer's financial crises, quality issues, material shortages and currency fluctuations, to name a few, can create havoc when unexpected.

I am rehearsing these potential threats to a smoothly running business operation because any one of them can occur without warning. I therefore suggest you consider taking "time-out" now in order to draft a business "Plan B". Anticipate the unexpected and plan for it, in order to be better prepared to manage it. You will need to first identify the possible threats to your business and then develop a plan to handle each of them in order to minimize any undue interruption to your business. Drafting a "Plan B" surely takes time and effort but it should prove to be a worthwhile investment when and if implemented by necessity.

TRADEMARK USAGE

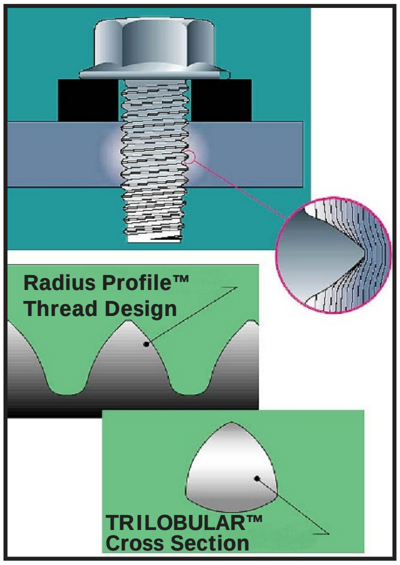
Our licensed products' trademarks are valuable assets of REMINC and are presently registered in 32 countries worldwide. We maintain these registrations in order that our licensees can use them in association with genuine TAPTITE® and REMFORM® fasteners. In addition, their authorized use is carefully monitored by us to prevent infringers from using any of our marks when selling counterfeit parts.

For many reasons, it is important that our trademarks are displayed and used properly in marketing literature, websites, packaging and all other printed materials or electronic forms. A trademark should be set off from its surrounding text by using LARGE TYPE, "quotation marks", *a distinctive font* or by stating TAPTITE® brand fasteners. In addition, the registration marks **®** or **™** should appear after the trademark with proper credit annotated, such as "TAPTITE**®** is a Registered Trademark licensed by REMINC". A trademark should always be used as an adjective. It should not be used as a noun and it should not be used in plural or possessive grammatical forms.

Trademarks, properly used, help assure end-users that they are buying and using genuine licensed products, not counterfeit alternatives. We solicit your cooperation to follow the above suggestions to protect our trademarks, because they are valuable forms of REMINC intellectual property.

What's Different About the Design of TAPTITE 2000® Screw Joints? - Part 1
By Matthias Jokisch *(cont. from Page 1)*

TRILOBULAR™ shaft cross-section in combination with the RADIUS PROFILE™ of the thread flanks reduces the forming forces, reflected by a minimized thread forming torque. Competitive products often have the disadvantage of a high or variable thread forming torque and possibly a highly undesirable chip formation on account of the generally circular shaft cross-sections. Experience has shown that high and irregular thread forming torques often lead to erratic performance on the assembly line in practice. In addition, the circular cross-section has a lower -to-no resistance against an autonomous loosening of the joint caused by vibration, compared to the TRILOBULAR™ shaft cross-section's vibrational resistance. The optimized geometry of the TAPTITE 2000® screw allows the end-user to produce screw joints as reliable as with metric screws with an optimum design of the pilot holes and dry lubrication of the screws suitable for the application.



In the application laboratories of the manufacturers of TAPTITE 2000® screws and/or REMINC, appropriate tests are performed in original component materials or test pieces. These generally begin with a rough pre-selection of the pilot hole diameter. Documents and tables with values are available in the information material provided by REMINC that relate to the constant-volume law with respect to the nut material displaced by thread rolling in the first instance.

Screw driving tests are performed utilizing specialized equipment that can record torque values, angle of rotation and ideally the pre-tensioning force in combination with a force measuring device. The measured variables in these tests are the thread forming torque, failure moment and pre-tensioning force in the connection.

The thread forming torque performance depends on the strength of the nut, the pilot hole diameter, the component thickness (thread engagement depth) and friction relationships. Generally speaking, little can be changed to the strength of the nut. Similarly, the component thickness is often fixed in the design. This means that the test engineer can only work with the hole diameter and friction parameters. If the thread forming torques are too high, either the hole diameter has to be enlarged or the friction reduced by a low-cost lubricant suitable for serial production. A corresponding number of tests make the results statistically significant. However, it should be remembered that under certain circumstances, "too good" a lubrication of the overall screw can also reduce the failure moment on account of lower thread and head friction torques. In this case a selective lubrication of the screw in the rolling zone is an option.

If the thread engagement depths are too short or if the pilot holes are too large the nut thread can be stripped. To overcome this situation, a larger screw head diameter can be chosen to increase the under-head contact area and thus the head friction. Furthermore, the friction values should not be reduced under the head and in the thread. If the connection is designed to fail by means of screw breakage when overloaded, the thread engagement depth and pilot hole diameter have to be properly designed for the desired joint properties. This failure mode cannot always be achieved on account of marginal conditions in the application.

The difference between the thread forming torque and failure moment should be as large as possible to ensure optimum process reliability for standard screw joints. A large differential allows you to select an assembly moment within a large tolerance window and this increases the process reliability.

The lowest possible thread forming torque and highest possible failure moment are contrary in thread rolling technology and have to be optimized by tests taking into account the minimum pre-tensioning force specified by the design engineer. This calls for a concerted approach by the screw manufacturer's application engineering department and the end-user's design, development and assembly team that is aimed at finding the most efficient, reliable and cost-optimized solution.

This article initially deals with basic topics in the technology of thread rolling. In the next Register we will demonstrate these principles on the basis of some practical examples.

* *Matthias Jokisch is a Market Development Engineer at CONTI Fasteners AG, a sister company to REMINC.*

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