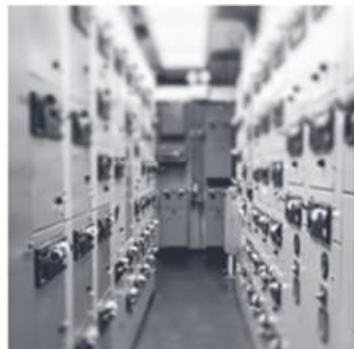
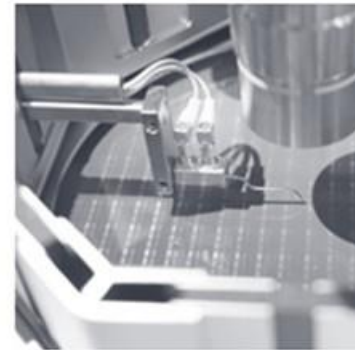




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Technical Tip
“Full Body Cut Threads vs. Undersized Body Roll Threads”
January 1, 2022

This month's TECH TIP is on "... Full Body Cut Threads vs. Undersized Body Roll Threads ..."



I'm sure your keen eye has already spotted the difference in the above image. We can see that the FULL BODY bolt is bigger in diameter than the UNDERSIZED BODY bolt. Hence the names.

To understand why there are two body styles we need to realize, that how threads are formed effects the outcome of the body type.

There are different ways of how screw threads are made.

*** They can be formed by cutting, rolling and single pointing ***

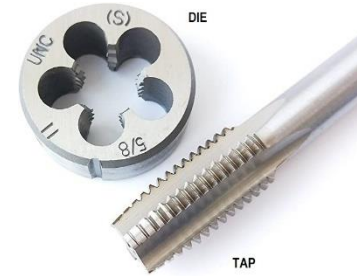
- Cutting and rolling are the methods used for most fasteners, with rolling being the majority of what you will encounter.
- Single pointing is a process used on screw machined parts; we'll leave that for another day.

Let's start with cutting threads



This process involves using cutting Dies for external threads and cutting Taps for internal threads.

They come in many shapes and forms and generally look something like this.



When we cut threads...this literally means we are cutting away the material and leaving threads.

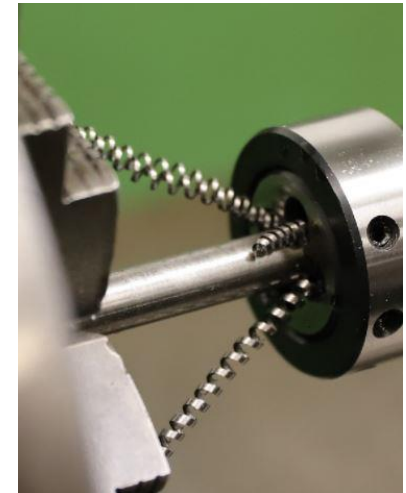
For external threads this can mean you drive the bolt into the die, or the die is driven onto the bolt. Either way this cutting leaves behind waste material called shavings or scrap.

Much like you get when you sharpen a pencil.

In order to cut the threads...the major diameter of the piece must be the full diameter of the thread you want to make. So...if you want 5/8" (.625") diameter thread you must start with material whose major diameter is 5/8" (.625").

This means the unthreaded portion of your bolt or screw will also be 5/8" (.625") and therefore we call this a **FULL BODY** size bolt or screw.

Note: the only way to undersize the unthreaded portion of a cut thread part would be to machine it down after threading and that costs money.



What about rolling threads?

For external threads we have Dies and for internal threads we have Taps. However, the external roll thread dies are very different from external cutting Dies.

FLAT DIES



ROUND DIES



PLANETARY DIES



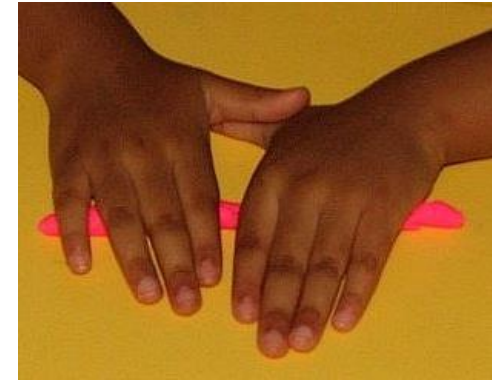
Internal thread rolling taps look like internal thread cutting taps.



Cutting Tap

Rolling Tap

When we roll external threads, this literally means we are rolling the material between two or more dies with the reverse impression of the thread on them. These dies progressively squeeze the material, using tremendous pressure, to shape or lift the material into threads. There is no waste or scrap material in this process. If, as a child, you loved to squish Play-Doh into snakes you already know how this process works.



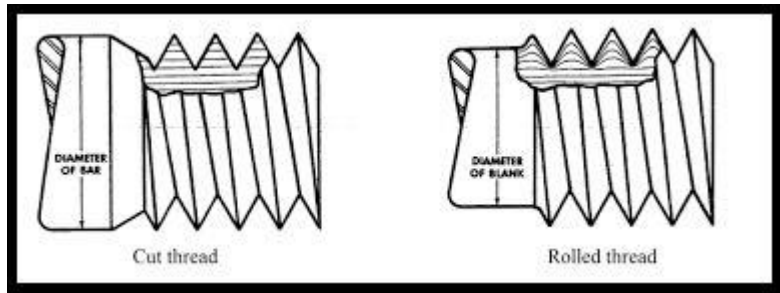
In order to roll threads...you must start with material that is NOT the major diameter of the thread you want to make. You start with material that is the pitch diameter of the thread you want to make.

So...if you want a 5/8" (.625") thread you must start with material whose diameter is 9/16" (.562"). During the rolling process, we are going to "squish" the smaller material into the larger diameter shape we need.

This means, of course, the part of the bolt or screw without any threads will remain at the smaller 9/16" (.562") diameter and therefore we call this an **UNDERSIZED BODY**.

Is one better than the other?

Well...in terms of thread strength...a rolled thread is stronger. In the below cut-a-way...you can see the grain of the material is interrupted in-between each thread when they are cut threads. Whereas the grain flows from thread to thread when they are rolled threads. Interrupted grain is weaker and can shear off or "strip" much easier than rolled thread.



Not sure if you've seen a rolled threaded screw? If you've ever handled a Deck Screw at your home, you've seen a rolled threaded screw. Notice the undersize body?



Now...there are, of course, pros & cons to both methods.

- If you specify cut threads, then you know the unthreaded portion of the bolt or screw is going to be FULL BODY and therefore the finished fastener will have a higher tensile strength.
- If you order roll threads, in theory, you could get a part that has an UNDERSIZED BODY and therefore the finished fastener's shank will be smaller & therefore will have less tensile strength.

Cold Headed Full Body Rolled Thread Hex Cap Screws - You can, of course, cold form a FULL BODY size part with roll threads, but you must first extrude the shank smaller in the area where the threads will be rolled. This is done daily, in the millions, to meet ASME B18.2.1, DIN 931/933 & ISO 4014/4017 requirements. Technically though, there will be a slightly weak point between where the rolled threads stop and the full body shank starts. That weakness is minimal in 99% of all applications.

This potential weak point is sometimes why a customer might prefer a FULL BODY cut thread bolt over a FULL BODY rolled thread bolt.



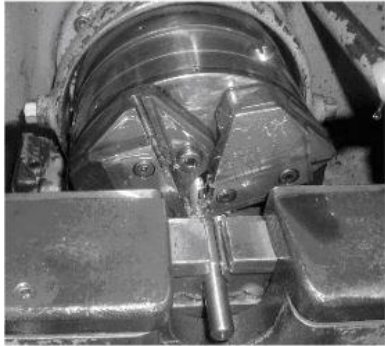
A few more things to consider...

Scrap – Cut Threads - As the pitch diameter in our example 5/8" thread is 9/16" (.562")...that means when cutting the threads, you are scrapping roughly 1/16" (.062") of material...remember you have to use full size 5/8" (.625") material in cut thread work. In essence, you are paying for material that gets thrown away. And, as you are using larger diameter material, to begin with, the cost of the raw material will be more for cut threads vs. the smaller diameter of material used to make rolled threads.

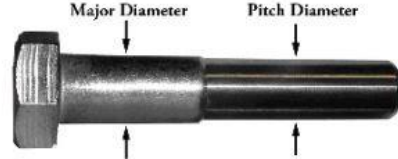
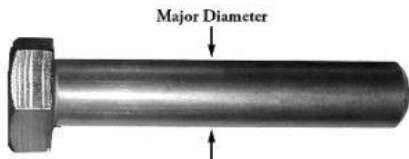
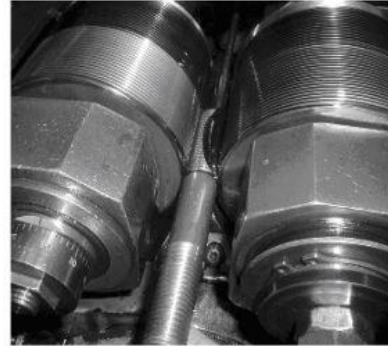
Scrap – Roll Thread - As the pitch diameter in our example 5/8" thread is 9/16" (.562") we get use smaller 9/16 (.562") diameter material...AND...no waste – no scrap! *Obviously, using small diameter material costs less than full diameter material.



Cut Thread



Rolled Thread



So why use cut threads?

Cut threads have the clear advantage in small runs, odd thread pitches and in reworking existing parts. Roll threading requires large quantities to be cost effective & would be too expensive for these scenarios.

Choosing between cut & roll threads depends on the part itself, it's attributes & how it will be used. The choice is how best to make the thread to get the most strength for the least cost.

To roll the threads on this full body blank bolt we must machine down the section to be rolled to the pitch diameter creating...SCRAP!

Fun Fact



...in the wooden boat building world...roll threaded wood screws are not liked...cut thread wood screws still rule.

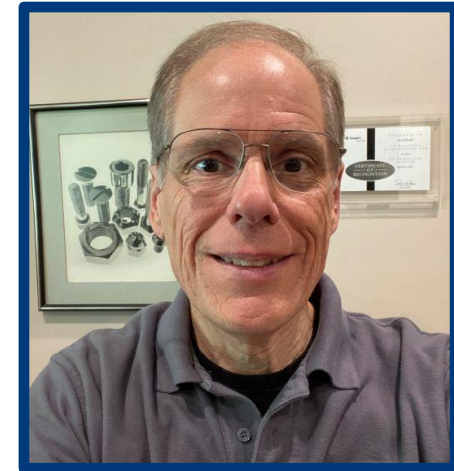
Why? Well...you must predrill the hole for the wood screw and the undersized body of the rolled wood screw does not completely fill that hole. The undersized shank of the screw leaves a tiny gap between the screw & the walls of the wooden hole that could leak.

Not something you want in your wooden boat. Therefore, there is still a large market for good old-fashioned cut thread wood screws.



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As always...If you have any questions, feel free to contact me at rbaudler@gexproservices.com