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Producing Threads

Using taps and dies

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At a glance...

- Taps and dies
- How to use them
- When not to use them

This article was first published in 2006.

Anyone who makes things comes across threads all the time – most frequently, external threads on bolts and internal threads on nuts. But although maybe you've never thought of it, there are also lots of other threads that you're constantly in contact with. Take an inlet manifold – almost certainly there are some bosses cast into it that have been threaded to take bolts. Or even the head itself – the manifold bolts to the head using studs screwed into holes tapped in the head. It doesn't take much thought to realise that having the ability to form threads yourself could be damn' useful.

Sound hard? It isn't – and you need only a cheapish set of hand tools.

Taps and Dies

A tool that forms an internal thread is called a tap. Unlike one that runs water, a thread-forming tap looks a bit like a threaded bolt, except the thread is not continuous around the diameter (there are longitudinal

clearance slots) and the thread is formed with a sharp cutting edge. In brief (we'll cover the use of the tool in more detail below), a hole of the correct diameter is drilled in the material and then the tap used to form the internal thread in the hole.

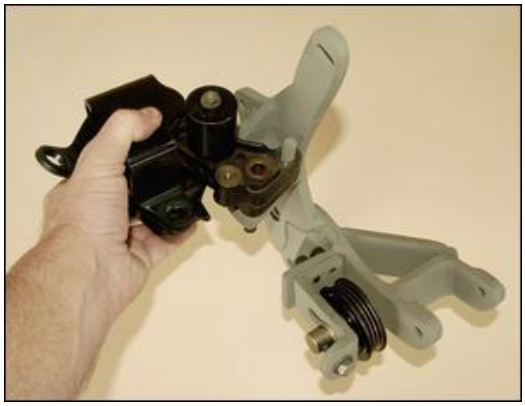
A die is the equivalent tool that forms external threads – for example, you might have a bar and want a thread on it. In that case, you'd use a die. A die has cutting teeth on its inside diameter and forms the thread as it's screwed down over the round material.

A single tap or die can form just the one type of thread – whether that's metric or imperial and whether it's a coarse or fine thread (or something in between!). Taps and dies are available in sets and are usually categorised as metric or imperial. Obviously, pick whichever type best matches your car and other tools – these days, that's almost always metric.

Tap and die sets can cost the earth – or alternatively, be quite reasonably priced. For home use, where the set isn't going to be in frequent use, a medium priced one makes a lot of sense. In addition to the taps and dies, look for the presence of appropriate driving handles (usually two sizes for the taps and two sizes for the dies) and most importantly, a chart that shows the correct drill size for the different taps.

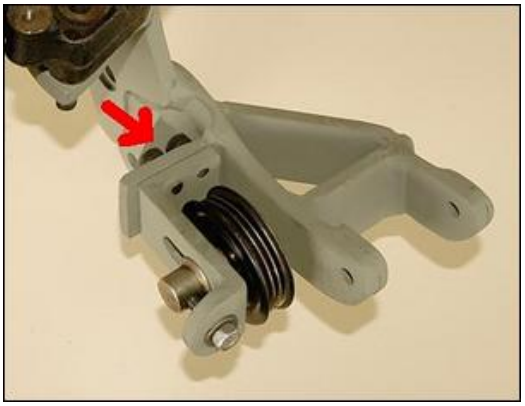
So When Would You Use Them?

About now you might be thinking – Yeah, sounds fine but I'd never use them. And you might be right! Huh? Using taps and dies requires a certain approach – you need to start thinking: Hey, I could tap this to take a thread and boy, would that save me a lot of pain! But if you never think that way, you'll never use the tools...



Take this supercharger bracket I made. The bracket incorporated a belt idler pulley and it was important that the flanged pulley was adjustable so it could be set at exactly 90 degrees to the surface of the belt. That meant it had to be bolted into place not welded – loosen the bolts and the pulley could be adjusted.

But there wasn't much room for nuts – and because of tight access, holding any nuts still while the bolts were done up would have been near-impossible. The answer was to tap threads in the steel plate that formed part of the bracket. Neat, easy, quick and strong!



Or take the job I was working on today. It's the crush tube through a custom poly suspension bush. The crush tubes are being made from 12.7mm (1/2 inch) chrome-plated steel bar salvaged from shock absorbers. To hold them in place, a hole has been drilled through the length of each crush tube and then the hole has been tapped to take two 8mm stainless steel bolts inserted from each end. The alternative would be to insert a single bolt (complete with nut at the other end) but 8mm diameter bolts this long in stainless steel are hard to source and the completed assembly would be heavier (and every gram counts in this particular project).

Again, having a set of taps made it soooo easy.

But what about dies, then? When do you use them? Frankly, I don't use them anywhere near as often – often it's easier to buy an off-the-shelf bolt and modify it. However, if you need an external thread in an unusual material (eg as pictured here in aluminium), using a die will be the easiest way to get it. (Note that the need to have a precise diameter of material before you can use the die often necessitates the use of a lathe to turn the material down.)

Using Taps

There are three key aspects in using taps:

- Get the hole size right
- Keep the tap square
- Use intelligent feel

Let's take them one by one

- **Hole Size**

As stated earlier, any decent set of taps should include a table that shows the tap thread size and the appropriate hole to drill to take that tap. Getting the hole size right is vital. If the hole is too small, the tap will jam and may break off. (And removing a broken tap is a nightmare!) If the hole is too large, the thread depth will be shallow and the thread will lack strength.

Rather than go on the nominal marked size of the drill, always use a pair of calipers (a digital caliper is

quick, easy and accurate) to measure the actual size of the shank. Creep up to the correct hole size in a number of steps by using a succession of increasing size drills. In this way, the final hole size will be more accurate. Make sure that you are drilling at right-angles to the work – it is preferable to use a drill press.

- **Keeping it square**

Even if your hole is at 90 degrees to the surface, there's no guarantee that the thread will be – it's easy to cock the tap in the hole and so have an angled thread. That's especially the case if thin plate is being tapped. If the object you're tapping is small and portable, place the tap in the chuck of a drill press and the object beneath it on the table. **Don't switch on the drill press motor!** Instead, get the tap started by turning the chuck by hand. Once the tap is well on its way, you can remove the object from the drill press and place it in a vice, continuing the tapping by the use of the handles provided in the tap set.

Another trick is to thread the tap through a nut of the correct thread and then hold the nut on the surface of the material, centred on the newly-drilled hole. This will start the tap square to the surface.

- **Feel**

It's easy to stuff-up the threading of a hole by using a heap of strong-man torque and no brains. Always lubricate the tap (the lubricant to use depends on the material but you can't really go wrong with plenty of WD40 or cutting oil) and back it out after every few turns, cleaning the chips of metal off the tap and relubricating it. If the tapping effort ever suddenly increases, back out the tap and clean the chips.

If you're tapping into a blind hole, be aware that without the use of special bottoming taps the thread won't go right to the base of the hole. If you're tapping through a plate, when the tap is right through, it should spin easily on the thread it has just made.

After the hole has been tapped, clean it thoroughly with compressed air or high pressure water to remove residual chips. Check with the bolt that the tapped thread works well – if it doesn't, run the tap though a few more times.

Using Dies

Much the same advice applies to dies, but of course the hole size becomes the diameter of the stock. In addition to getting the tap started square (a little easier than with a die because you can see the thread being formed), be careful that the die is centred on the stock. Otherwise, you can get a weird thread where it's deeper on one side than the other. Most dies are adjustable –make the initial thread with the die open as fas as possible and then squeeze it smaller for subsequent runs, using the adjustment screws built into the drive wrench.

When Not to

When using taps and dies, keep in mind the strength required in the application.

As a very general statement, a hand-formed thread is not going to be as strong as the rolled thread of a bolt or nut. So if a die is being used, the material being tapped to take the bolt or stud should be **at least** as thick as an equivalent threaded nut. For example, the steel supercharger bracket described above had the tapped holes made in 10mm steel plate. That's pretty strong to hold a few adjusting bolts! The crush tubes being made from steel bar used 30mm long bolts with over 15mm engaging in the threads. But tapping plate that's (say) 2mm thick and then expecting the bolt to hold a big load isn't too wise.

The other aspect to keep in mind is the material on

which the thread is being formed. Aluminium takes taps and dies beautifully – but the thread won't be as strong as steel. Plastics can be tapped easily – but again the result won't be very strong. (Might be ideal to hold a dress panel in place, though.)

Selecting Threads

If you are making components with both internal and external threads and the two parts are going to screw together, make sure you select the matching tap and die! (Don't laugh, I picked up the die one across in the set just yesterday – hmm, big thread, this one...)

If you are making a thread that will be matched with an off the shelf bolt or nut, make sure you have that bolt or nut in hand before starting to cut the thread. Why? Well (1) you can check that in fact it is exactly the same thread and (2) you are certain you can actually buy the appropriate nut or bolt.

As an example of the latter, I originally cut an 8mm x 1mm thread in my suspension pivot crush tubes. I had a bolt that matched that thread and so I wasn't concerned about sourcing more – even though the bolt wasn't the stainless steel, button head, Allen key design that I eventually wanted to use. After making two of the crush tubes I went off to source some 8mm x 1mm stainless steel, button head, Allen key bolts. To find they're impossible to get. 8 x 1.25mm? Hell yes, plenty of those... I had to make the crush tubes again...

Conclusion

If you make things, a tap and die set allows you to achieve outcomes that would otherwise be ugly, weak, messy or inconvenient. And those are all good things to avoid!

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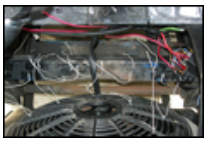

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