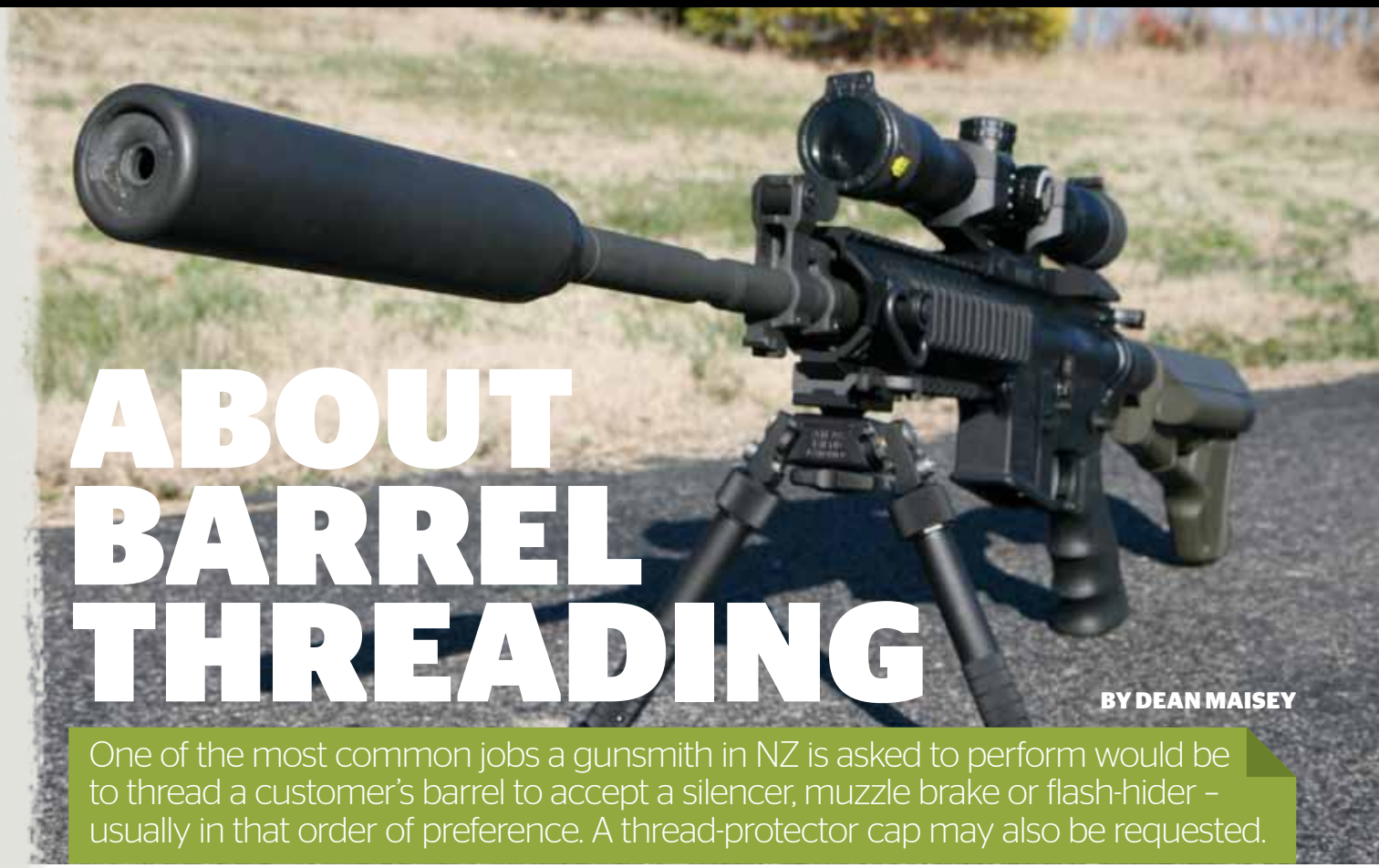


ABOUT BARREL THREADING

BY DEAN MAISEY

One of the most common jobs a gunsmith in NZ is asked to perform would be to thread a customer's barrel to accept a silencer, muzzle brake or flash-hider – usually in that order of preference. A thread-protector cap may also be requested.

With the proliferation of silencers/suppressors in NZ now – as well as a sudden increase in manufacturers of them – it is probably timely to look at the actual threading/fitting process, as the method used will vary depending on the type of muzzle attachment that the barrel is to be threaded for. Note: that this is not a home gunsmithing/DIY guide, just an overview of how a dedicated gunsmithing shop may go about the job. Remembering also that different gunsmiths may have their own preferred methods.

Types of muzzle attachments

Suppressors or silencers come in two basic types – single point mount ('muzzle can' type) or two point mount ('over-barrel' type – usually with a rearward locating bushing which is machined to match the barrel diameter at that location on the tapered barrel).

Most of the suppressors fitted to centrefire hunting rifles in NZ would be the over-barrel type, whereas the muzzle-can type are quite popular for varmint hunting or target shooting applications. Muzzlebrakes or flash-hiders are usually always single-point mounted.

There is a different thread-fit tolerance class required for either single-point mount or two-point mount muzzle-fitted attachments.

CLASSES OF THREAD FIT

Tolerance classes (from Wikipedia)

A classification system exists for ease of manufacture and interchangeability of fabricated threaded items. Most (but certainly not all) threaded items are made to a classification standard called the Unified Screw Thread Standard Series. This system is analogous to the 'fits' used with assembled parts.

Classes 1A, 2A, 3A apply to external threads; Classes 1B, 2B, 3B apply to internal threads.

Class 1 threads are loosely fitting threads intended for ease of assembly or use in a dirty environment.

Class 2 threads are the most common. They are designed to maximize strength considering typical machine shop capability and machine practice.

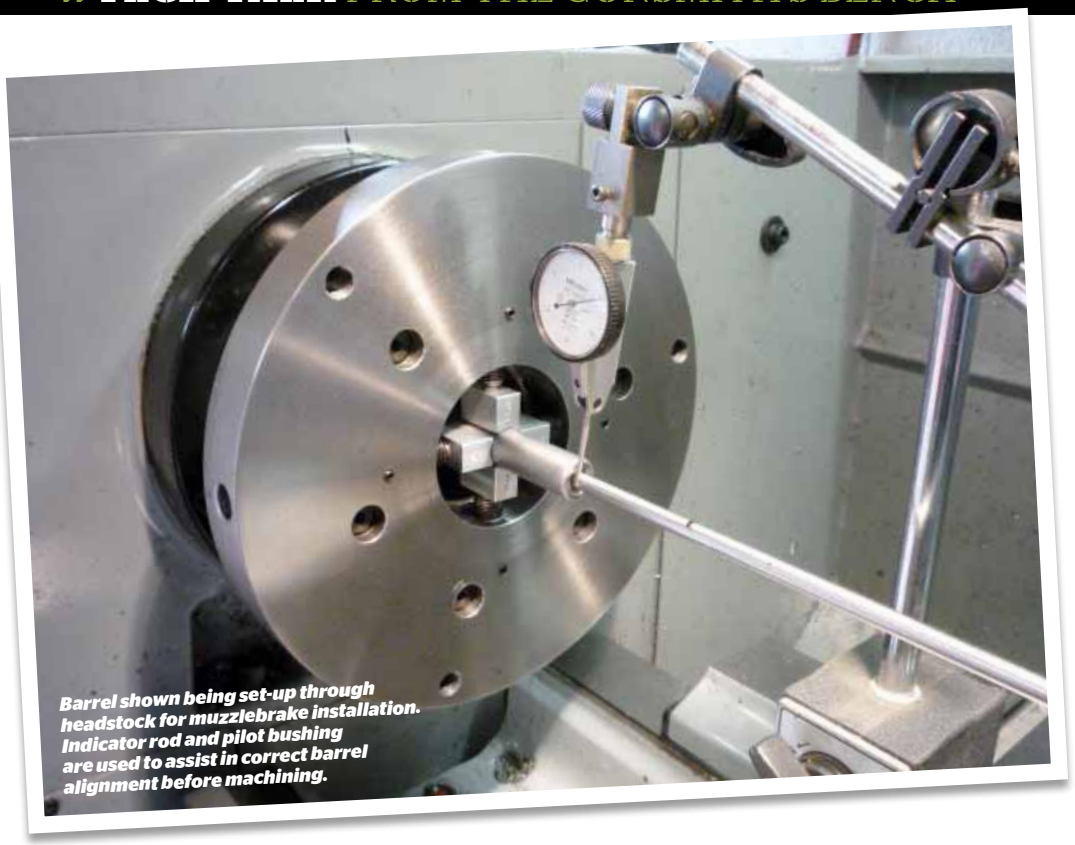
Class 3 threads are used for closer tolerances.

Thread class refers to the acceptable range of pitch diameter for any given thread. The most common method used in a production scenario is by way of a go/no-go gauge.

In the (American) gun trade they refer to a 'class 4' fit as one that is a very snug fit between the mating parts, bordering on slight interference between the male and female thread. This is the sort of fit we are looking to achieve when installing a muzzlebrake or a muzzle-can silencer (single-point mount). Due to the increased length of the muzzle-can silencer, alignment to the bore is critical to avoid the bullet striking any of the silencer baffles. As the thread and shoulder section is the only part of the barrel that influences this alignment, the thread must be precision cut to a fit as snug and perfectly matched to the silencer as possible, and with no 'slop' or 'play' before pulling up tight on the shoulder section. For single-point mounting the golden rule is: snug is good, sloppy is not! This is to ensure that the silencer does not drop down out of alignment should it loosen off the thread shoulder during firing, as can happen particularly on centrefire rifles. If the silencer works loose and drops down into the bore line then bullet strike damage to the silencer can be the unfortunate result. This is also something to be aware of particularly on factory-threaded rimfire rifles. Quite often the male thread has been cut too deeply, resulting in a loose/sloppy fit to most of the standard threaded silencers. The only way to overcome this problem is to have a custom silencer made with the female thread single-point machined to be a snug fit to that particular barrel thread, or else cut the barrel back and have it re-threaded correctly.

For over-barrel suppressors however the thread fit/class is not quite so critical, as alignment of the suppressor is also influenced and aided by the rear bushing/guide on the barrel. This is arguably a more robust and secure mounting system for a rifle being used in the field where knocks and bumps may be a common occurrence. When installing these units to a rifle barrel we are looking to deliberately cut a slight clearance into the thread fit, to what I would refer to (in gunsmithing terms) as a class 3 fit. This is to compensate for any minor internal alignment issues that may exist in the suppressor itself and to help to prevent bowing or stressing the barrel when the suppressor is installed and tightened. If there is a stress induced, then this may affect bullet point of impact depending on how hard the silencer is tightened on.

Having a bit of clearance in the thread can also help to overcome problems if you get a bit of dirt or gunk in the female thread in an over-barrel silencer, which could be difficult to get out due to its location in the middle of the unit. However on a muzzle-can silencer or muzzlebrake, the female thread section is more easily accessed for cleaning if required. »



Barrel shown being set-up through headstock for muzzlebrake installation. Indicator rod and pilot bushing are used to assist in correct barrel alignment before machining.

STANDARDISATION

With the increasing use of CNC lathes for parts manufacture, it seems as though the standardisation of threads has almost gone out the window. In the past when a lot of the female threading was cut with conventional threading 'taps' the resultant thread sizes were a lot more uniform and predictable. Nowadays though it seems that – to a certain degree – every silencer maker has their own set of tolerances that they work to. Some may cut female threads that are close to accepted 'standard', whereas some may cut their threads deliberately tight (undersized), or loose (oversize). Sometimes thread sections from the same manufacturer can vary from one production run to the next depending on who the machine operator was, and on what machine the parts were made. This sort of thing plays havoc with the gunsmith who has to do the fitting work, as not only does he have to individually check each silencer for correct thread alignment, but he has to determine the actual true thread size to be cut before even setting the barrel up in the lathe. I have had some silencers come into the shop for fitting recently where the female threads had been cut grossly oversize – so much so that even an industry-standard 'oversize' thread tap was a rattley fit when installed in there as a sort of sample thread-fit gauge. Clearly these threads were CNC machined poorly and way out of specification, and should have never passed final inspection.

EQUIPMENT USED

There are specialist tools used by a properly equipped gunsmith, which is one of the main things that set apart their ability to perform the barrel-threading job better than a general engineering shop as well, of course, as their prior experience .The tooling required will depend a bit on the lathe set-up method used to accommodate the barrel in the lathe for the threading operation. Basically the main two methods are referred to as 'between centres' – where the barrel/action is installed above the main bed-ways of the lathe, or 'through the headstock'- where just the muzzle of the barrel protrudes from the lathe spindle face. Either method can be used for installing muzzlebrakes or muzzle-can silencers, but generally for over-barrel silencers installations are usually done 'between centres'.

When preparing a barrel to be threaded 'between centres' most gunsmiths will own a set of five or more centring reamers, which have a removable pilot bushing on a stem at the front end, followed by a 4-flute or 6-flute cutter with a 60° included angle to perfectly match the angle that is on a rotating lathe centre. Currently, centring reamers cost about US$66.00 – US$75.00 each, and pilot bushings cost about US$10.00 – US$25.00 each. Your gunsmith will probably need about a dozen or more of these pilot bushings per calibre. As you can see the costs start adding up. This is the sort of specialist tooling that your general engineer is just not going to get in to do a one-off (or occasional) barrel-threading job.

Alternatively, if setting the barrel up in the lathe 'through the headstock', the same pilot bushings can be used on a special indicator rod to assist in adjusting or 'dialling-in' the barrel-bore to run true – or a long-stem dial indicator can be used instead. There may be less specialist tooling outlay with this method, but the big problem is that there are not many general engineering lathes set up with a short headstock and a large enough spindle bore to accommodate a rifle barrel, as well as having an adjustment system specifically for holding the barrel at both ends. In most cases, it is just best to get a properly equipped gunsmith to do the installation job for you.

LATHE SET-UP METHOD

In the accompanying photos you can see the barrel for this suppressor installation is being done between centres, with an adjustable centre in the lathe chuck to allow the barrel position to be correctly centred and running true at the location of the rear bushing. The muzzle end of the barrel has already been carefully reamed with a piloted centring reamer to produce a precision 60° chamfer that is aligned and centred perfectly with the barrel's bore. It is never acceptable practice to simply force an unreamed muzzle/crown against a hardened lathe centre, as this may cause the rifling edges at the crown to distort and skew off-centre, usually casting up some nasty burrs into the bore at the same time. This sort of practice is 'goon-smithing', not gunsmithing. Unfortunately this sort of thing does occur.

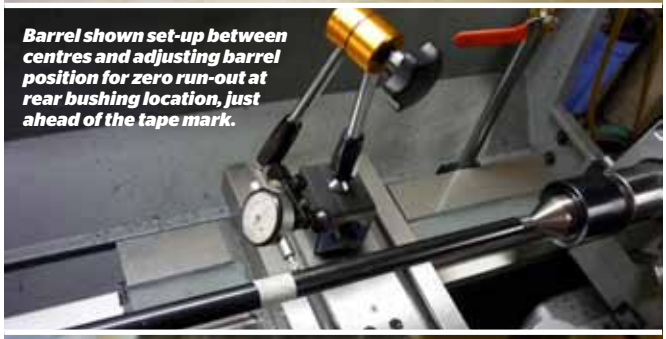
Once dialled-in and running true, the muzzle is machined to the correct major diameter for the thread size given, then the (usual) 60° threading tool is used to progressively cut the muzzle thread deeper into the barrel at the correct threads-per-inch (TPI) setting, taking gradually smaller cuts per pass. When at about 90% estimated thread depth the suppressor (in this case) is then used as a gauge to determine the correct degree of 'fit' required. This is why it is so imperative to have the exact unit on hand that you want to match the thread-fit to, to ensure that you get the absolutely correct class of fit that is required, with no gambling or guesswork. In custom gunsmithing, things are either done right and perfect the first time, or they are best not done at all. With so many gunsmithing tasks it is always best not to have to do the job twice, and in some cases you don't get a second chance at all. Often going the route of a cheap job up front, can end up costing you more in the long run, especially if you have to pay someone more later to fix up a botched first attempt, compared with just doing it right the first time. I have seen some really screwed-up barrel threading jobs and damaged silencers over the years. Not all of these have been from home workshops either.

PROBLEMS

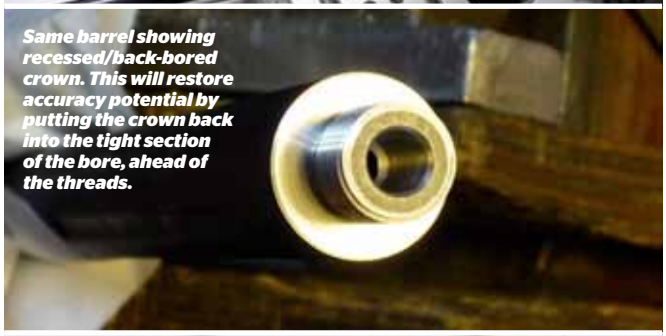
Getting the barrel set-up to be running true and correct is one issue that needs to be dealt with, but another one is determining the correct thread size to use.

For so long the good old ½-20UNF thread has been the industry standard for silencers – particularly for rimfire rifles. For a time this has been carried on into

Centre reamers, pilot bushing, and recess-crown reamers. Over $4000.00 worth of specialist rifle tooling is shown in this sample photo.



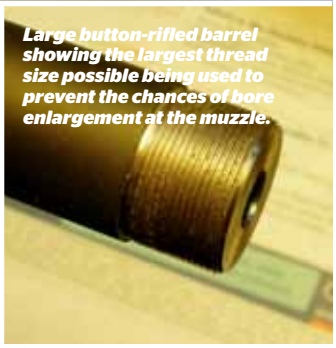
Barrel shown set-up between centres and adjusting barrel position for zero run-out at rear bushing location, just ahead of the tape mark.



Same barrel showing recessed/back-bored crown. This will restore accuracy potential by putting the crown back into the tight section of the bore, ahead of the threads.

Side view of heavy rimfire barrel showing small ½-20 thread. This sort of thing is not really an ideal scenario for accuracy.

BELOW This tragic example shows a badly burred-up crown, which is also off-centre, and a very roughly cut thread which was crooked to the bore-line, resulting in a poorly aligned silencer - damaged by bullet strike. This is one of the worst 'goon-smithing' barrel thread jobs I have seen.



Large button-rifled barrel showing the largest thread size possible being used to prevent the chances of bore enlargement at the muzzle.

centre-fire suppressors as well, which have really only taken off here in the last 10-15 years. Now though, with a bit of pressure from gunsmiths such as myself and others, there is more of a move to use larger thread sizes where possible, to something more appropriate for the barrel size in question. This is not only to create a stronger thread section at the end of the barrel, but also to prevent the chances of 'bore enlargement', especially when machining down the muzzles on button-rifled barrels. What can happen if too much metal is removed, is the hoop-stresses in the barrel steel are relieved and in some cases this can cause the bore immediately under the thread section to enlarge enough to create a loose spot at the muzzle end of the bore, which may degrade accuracy. This is a particular issue especially for lead-bullet rifles, such as the common .22 rimfire.

Cut-rifled barrels are usually a lot more stable in the bore when threaded at the muzzle, but hammer-forged barrels often tighten very slightly when muzzle-threaded, which can actually be a good thing!

Many silencers can now be ordered from the manufacturer with larger thread size options, whereas some are still stuck in the '½-20-or-nothing' mode.

A system that I developed several years ago to deal with the problem of ½-20 threads on heavy-profile barrels, was a series of piloted back-bore crowning reamers that would remove the enlarged bore section under the threads, effectively shifting the crown of the barrel back into the tight section of the bore ahead of the threads, thus maintaining the accuracy of the barrel.

Naturally this extra work takes more time to complete compared to a standard muzzle-threading job, but it is one solution to the problem. Another is to custom thread the female thread in the silencer itself out to a larger size first, but this is not always possible.

One of the main problems I also look out for is alignment and concentricity problems with the female thread in the silencer itself. This is less of a problem now than it used to be, but it does seem to occur still on some lower quality units where correct machining practices may not be so closely controlled.

SUMMING UP

I think the main thing that I would want to convey in this article is that having your barrel threaded correctly is not a five-minute slap-up job, and it requires some forward planning and understanding of how the job is done. Also, that threading to suit an over-barrel suppressor is different to threading set-up in order to suit a muzzlebrake. This can be difficult to explain to someone who wants to use both on the same rifle – it is possible, but it involves some extra work to get the thread fit and alignment right for both attachments. If this is what you want to achieve then it's best to talk with your gunsmith about it first in order to get things done correctly, and in the right order.

Another thing is that all generic threads are not all exactly the same – there are always differences to the actual cut thread size within the tolerance range, and sometimes outside of the tolerance range! So many times I have been asked by customers to "bang a thread on the end there too, bro," while I have their rifle in the workshop for some other task to be performed. I always explain that I can't do the job properly unless I have the exact silencer or brake that they want to have fitted to the barrel on hand, firstly to ensure that correct thread fit for that exact unit is achieved, and also that the silencer-to-bore alignment is correct as well. As explained earlier, with gunsmithing it is always best practice to ensure that you get the job done right first time, rather than having to re-do the job again correctly later. Not only does this approach avoid unnecessary complications, but often ends up being cheaper in the long run too. R&R