Muzzlebrakes

FROM THE GUNSMITH'S BENCH

BY DEAN MAISEY

How they work and why they're gaining favour

TECHNICAL BACKGROUND

When a high-powered rifle is fired, the gas that propels the projectile out of the end of the rifle's barrel accumulates behind the projectile and creates a recoil force back towards the shooter. This is largely due to the 'jetting effect' of that propellant gas as it is released into the atmosphere. This force is proportional to the mass and type of propellant and its operating pressure, and it is inversely proportional to the mass of the weapon. Another recoil force associated with the discharge of a firearm relates to the inertia effect of the bullet/projectile being fired down the barrel of the firearm. This is directly proportional to the projectile's given mass and velocity as it travels through the barrel. However, because the time taken for the bullet to travel from the breech end of the barrel to the muzzle is relatively short, the recoil factors are blended into one. This combined recoil force can be quite severe, especially in high-powered rifles used for long-range hunting, target or tactical shooting applications, and may result in pain, discomfort and fatigue to the shooter. It also puts considerable stress on the component parts of the firearm and can cause the shooter to lose sight of the target being aimed at. Muzzlebrakes are often used to reduce these side effects as they lessen the recoil force.

Many and diverse muzzlebrakes have been developed over the years. Some try to compensate for muzzle rise as well as reducing recoil force, and some claim to create less noise or shockwave effect compared with other muzzlebrake designs.

Most muzzlebrakes comprise an attachment placed on the muzzle end of a firearm (either by a threaded joint or a clamping arrangement), which reduces recoil by dissipating propellant gases radially from the direction of the barrel/bore of the firearm through a series of openings within that attachment. In deflecting the gas away from the end of the barrel, often at right angles to it, some of the gas impinges on the opening surfaces (baffles) inside the muzzlebrake and is reflected to the sides and/or back towards the shooter. Thus, firearms equipped with conventional muzzlebrakes often (appear to) sound much louder to the shooter than the same firearms with no muzzlebrake. The redirection of the propellant gas also creates a shock-wave effect that can be extremely damaging to human hearing; it is very important that firearms equipped with muzzlebrakes are never fired without first ensuring that the shooter and others nearby are wearing adequate hearing protection.

Most audiologists recommend that no high-powered firearm should ever be discharged without the use of adequate hearing protection, whether they have a muzzlebrake, no muzzlebrake or a sound suppressor/silencer fitted, as in many cases the noise signature is still above the 140dB recommended 'safe standard' limit when firing full-power 'supersonic' ammunition. It is misleading for some foreign manufacturers to claim that they produce a 'quiet muzzlebrake' when in reality such a thing is an impossibility.

MY BACKGROUND IN MUZZLEBRAKE DEVELOPMENT

When I returned to NZ fifteen years ago to set up my gunsmithing business in Tauranga, muzzlebrakes weren't overly popular and the

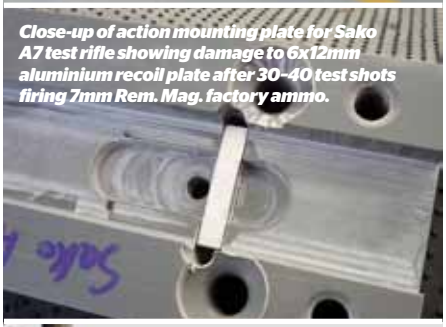
A muzzlebrake can aid accurate shooting in the field. Steve is happy with his first mature bull tahr taken on his very first tahr hunt with NZDA BOP Branch. Remington 700 7mm Rem. Mag. with DFM muzzlebrake fitted. A single well-placed shot from 450 yards with a 162gr A-Max did the business.

NZ suppressor market was still in its infancy. I made a few custom muzzlebrakes when required but also imported some from the US. Back then there were few restrictions on exporting gun parts out of the US, but that was all set to change after September 11, 2001. Since then the increase in bureaucratic red tape and compliance costs have severely restricted many smaller US manufacturers' ability (or willingness) to export. About five years ago I recognised a problem brewing. With the surge of interest in long-range shooting starting to filter through to NZ, the enquiries for muzzlebrakes started to increase. Working with a local CNC machining company we produced a few different muzzlebrakes suitable for sporting rifles at competitive prices that we could supply for the NZ trade. With advertising, promotion, favourable peer reviews and word-of-mouth recommendations sales eventually increased. The restrictions on exporting gun parts out of the states got worse, costs of importing increased and it became easier and cheaper for guys to buy NZ made instead.

A talented gunsmith or engineer can design and manufacture their own muzzlebrake, but in order to test the product and make measured

A sample of some (foreign) competitor's muzzlebrakes that were tested.

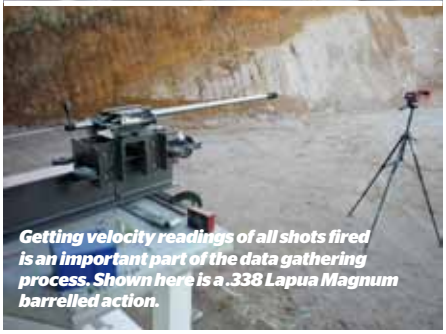
The DFM Type A muzzlebrake is a great performer for its size. Testing indicated measured recoil reductions of 60–63% with factory ammo in 7mm Rem. Mag. and .300 Win. Mag.



Close-up of action mounting plate for Sako A7 test rifle showing damage to 6x12mm aluminium recoil plate after 30–40 test shots firing 7mm Rem. Mag. factory ammo.

Measuring max reward travel against a known load. This works initially as a good visual comparison test, but findings can be used to calculate the recoil energy values for before and after comparisons.

Testfiring 7mm Rem. Mag barrelled action on purpose-built testing machine.



Getting velocity readings of all shots fired is an important part of the data gathering process. Shown here is a .338 Lapua Magnum barrelled action.

improvements you need a reasonably scientific method of testing and recording those results. Simply guessing the amount of felt recoil reduction or using some kind of a skid-plate arrangement just doesn't mean anything in scientific terms. You need hard data and repeatable, quantifiable results.

I had a purpose-built recoil-testing machine professionally constructed and this apparatus was used to test in excess of 20 prototypes over a period of more than six months. Some designs that should have provided big gains in recoil reduction didn't, and some alterations that seemed minor produced surprising improvements. This is true 'Myth-Busters' stuff. Just like any scientific study, these tests have to be undertaken with an open mind rather than trying to prove a point. You also have to ensure that any comparisons are fair and honest, especially when you are testing competitors' products as well.

WHAT TYPES OF MUZZLEBRAKES ARE COMMONLY AVAILABLE?

- Radial-ported muzzlebrakes with portholes around the circumference are the most common and are relatively easy for the gunsmith to install as they don't need to be indexed (set to screw on and lock up at a certain orientation point).
- Side-ported muzzlebrakes have the advantage that they can provide good recoil reduction without venting any gas downwards, which may kick up a bit of dust in some circumstances.
- In most hunting circumstances radial-ported muzzlebrakes perform just fine, but a side-ported brake may be better with a really big capacity magnum cartridge or when shooting prone over dusty or sandy ground. There are pros and cons with each type, but hearing protection must be used with either.
- The pressure/noise wave from side-port brakes is obviously stronger at the sides, and in order to maintain correct index/alignment they are usually secured to the barrel permanently with Loctite or some type of clamp or lock arrangement.
- With radial-ported brakes the gas (and pressure wave) is more universally distributed out and around the entire brake circumference. There is no need for the brake to be indexed to a correct final position when it is tight, or for it to be loctited on. This makes them a good choice if you want to take the muzzlebrake off regularly for cleaning, for bush hunting applications or maybe to screw on a suppressor.
- Integrally machined muzzlebrakes such as the Mag-na-port system, or the likes of the old ported BSA Majestic barrels, are not very common now. They are not removable and usually provide comparatively less recoil reduction than conventional muzzlebrakes, while still being subject to the 'noise' issue.

Reducing recoil to a manageable level is the main requirement of a muzzlebrake, but reducing muzzle rise and maintaining target acquisition is also important so that you »

Twin custom .338 Lapua Magnums. Both are shown with muzzlebrakes fitted to their 32-inch barrels. A muzzlebrake will reduce recoil significantly, as well as reducing muzzle jump. This allows you to spot your own shots and makes shooting these rigs a lot more pleasant.

can view and confirm target hits, especially when hunting alone. Another benefit of muzzlebrakes is that they enhance accuracy in the same way a barrel-tuner device does by reducing barrel vibration (or oscillation) at the crown of the barrel. A muzzlebrake also has to be cosmetically appealing, as well as strong and functional. There are some unnecessarily big, bulky muzzlebrakes on the market. Slab-sided brakes may be OK on a tank barrel but can be problematic in practical terms on a rifle, especially if they are overly wide or vent the gases back directly at the shooter.

SO WHAT SORT OF RECOIL REDUCTION ARE WE TALKING ABOUT?

If we look at the measured recoil energy of magnum calibres before and after fitting a muzzlebrake to a test rifle, most common muzzlebrake producers claim recoil reduction of 'around 50%' and our testing regime confirms this is about right. Some are actually a lot less than this though. The type of powder and bullet selection used can greatly influence these before and after percentages, but it would be more credible to test with bullet weights commonly used in factory ammo. You could get massive percentage recoil reductions by testing a good muzzlebrake on a .300 Win. Mag. with 110gr varmint bullets, but who is realistically going to use that sort of load on deer or tahr in the field?

With my new compact muzzlebrake designs, and using standard weight bullets (factory ammo), we have managed to gain measured recoil reductions (on our testing apparatus) of over 70% with 7mm Rem. Mag. and .300 Win. Mag– probably the two most popular big-game magnum calibres in NZ. This compares favourably with the 49 –62% reductions for some common brakes of similar size that were also tested. The percentage recoil reduction for smaller and more efficient calibres like .308Win. or 7mm-08 Rem. will always be a lot less. Longer barrels will burn a given powder charge more efficiently, and this will also reduce the measured effectiveness of a muzzlebrake, and vice versa. No more bruised shoulders, cut eyebrows or swollen and sore cheeks. No more recoil-induced concussion or headaches. The only thing you have to do is fit ear plugs or earmuffs. For most open-country hunting or range shooting situations this is no problem as it only takes a moment.

While conducting these recoil tests I could see first-hand the damage that can be done to the rifle's recoil lug system when dealing with high recoil forces. This can also impact on the integrity of the stock, scope and mount system. It's not just the shooter that takes a hammering from unbraked magnum recoil – the whole rifle system takes a battering. The internals of many cheap scopes can be destroyed by the hard recoiling that happens in lightweight centrefire rifles.

Suppressors can do a good job of managing recoil forces as well, but they cannot redirect the gas flow or reduce the recoil energy of large magnum calibres as much or as quickly as a muzzlebrake. (More testing is pending at the time of publication.) Suppressors also have their own pros and cons, but that will be covered in another article. As with muzzlebrakes there is always a trade-off. As the saying goes 'There's no such thing as a free lunch'.

I would be the first to advise against using a muzzlebrake-equipped rifle if you intend hunting over a dog, but otherwise, if you are prepared with earplugs or earmuffs (either conventional or electronic types), fitting a muzzlebrake to your magnum rifle makes sense. The benefits of being able to comfortably fire 30 or 40 shots, when previously 5 or 6 would leave you bruised and flinching, simply has to be experienced to be believed. I have fitted my original Type A & B brakes for customers who were a bit sceptical about just how much recoil reduction such a compact muzzlebrake could provide. In almost all cases the feedback has been positive, and in some cases – total amazement!

Once you negate the noise issue by use of hearing protection and get used to it, the fear of recoil will pass and this may also help to cure flinching. The effects of intense, unbraked recoil can definitely harm you, but noise won't hurt you if you are prepared for it.

In the opinion of many experienced shooters, serious long-range rifles start at .30cal, and .338cal is even better. Some guys are now exploring the .375cal as better match grade bullets become available. The 6.5mm and 7mm magnums are very good compromise calibres, with their main advantage being less recoil – except in very lightweight rifles. Some of these can be really hard kickers! However, when you step up to the .30cal or .338cal you get better efficiency, better consistency and accuracy, more retained energy at longer distances and often better barrel life. Muzzlebrakes may not be for everyone, but once you make the decision to fit one you can comfortably step up to using the bigger calibres and reap the benefits, while also experiencing less recoil and better muzzle control. It's a no-brainer really! R&R

Footnote: This article is intended to be informative and interesting for the intended readership of Rod&Rifle Magazine, but it is not a comprehensive scientific dissertation on the subject and is presented at a practical level.