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## Ballistics – The Science of Accuracy

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### Barrel Fouling, Fire Cracking & Erosion

Barrel fouling, fire cracking and erosion occur most severely where the heat and pressure are concentrated over the first several inches in front of the chamber. As the bullet moves further down the barrel, the pressure drops and the wear on the steel is much less.

Fire cracking develops in a barrel beginning at the chamber end. How many rounds it takes depends on the cartridge, the steel, and how stout the ammo is. Fire cracking can develop in as little as 50 rounds with a hot cartridge like 6 Creedmoor, or it could take 100's of rounds in something like 308 Win.

When fire cracking does develop, it elevates friction and resists the bullets' travel more. This added resistance feeds back to the burning powder and elevates the temperature and pressure of the powder burn, which gives you more velocity. So, the end result is counterintuitive because increased friction results in the muzzle velocity going up!

If you've ever lit a pile of smokeless powder on an open surface, you see it burn very slow compared to when it's contained in a cartridge. Same principle here; the more you constrain the burning powder with added friction, the faster and hotter it burns (which makes more pressure and velocity).

This effect is often noticed by shooters as a new barrel 'speeds up'. Common thinking is that it's speeding up because the barrel is smoothing out. But if you're starting with a lapped, non-fire-cracked barrel that becomes fire cracked, the increase in MV is due to the added friction of the fire cracking.



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## Cleaning

Fouling and fire cracking respond differently to various types of cleaning. Here's what we tell shooters who ask about cleaning:

- If you're shooting a relatively moderate chambering (223REM, 308WIN, etc.) it can be sufficient to clean with chemical solvents that dissolve the carbon and copper fouling because fire cracking isn't playing a big role.
- However, if you're shooting something high-performance like 300 Norma, 6.5 PRC, 6 Creedmoor, etc. then the fire cracking will be greater, and your cleaning/maintenance job is bigger. For these high-performance rounds, proper barrel maintenance requires something to smooth the fire cracking in addition to removing fouling, which is why I recommend abrasive cleaning for them.

### THE PROCEDURE I USE TO CLEAN ALL MY HIGH-PERFORMANCE GUNS IS:

1. Push a single lightly oiled patch.
2. On a very tight-fitting patch (maybe a patch-and-a-half to get it tight), smear a healthy amount of JB Bore Paste (blue/gray).
3. Go 30 strokes back and forth, working more in the chamber end.
4. Remove the used patch and repeat steps 2-3.
5. Run oily and then clean patches thru until the abrasive is all out of the barrel.

The abrasive cleaning will remove carbon and copper fouling, but also smooth the fire cracking and relieve any constraint that may develop from the fire cracking. Doing this will 'set back' the muzzle velocity because you've smoothed the bore and reduced the friction, so the powder doesn't get so angry pushing the bullet through the rough bore.

We converged on this method of cleaning while doing lifecycle testing on 375 EnABELR barrels, as well as 300 Norma. Even though chemical solvent cleaning would probably be good enough, we use abrasive anyway. It doesn't show any sign of wearing barrels out faster as some shooters fear, and it simplifies the process to do them all the same.

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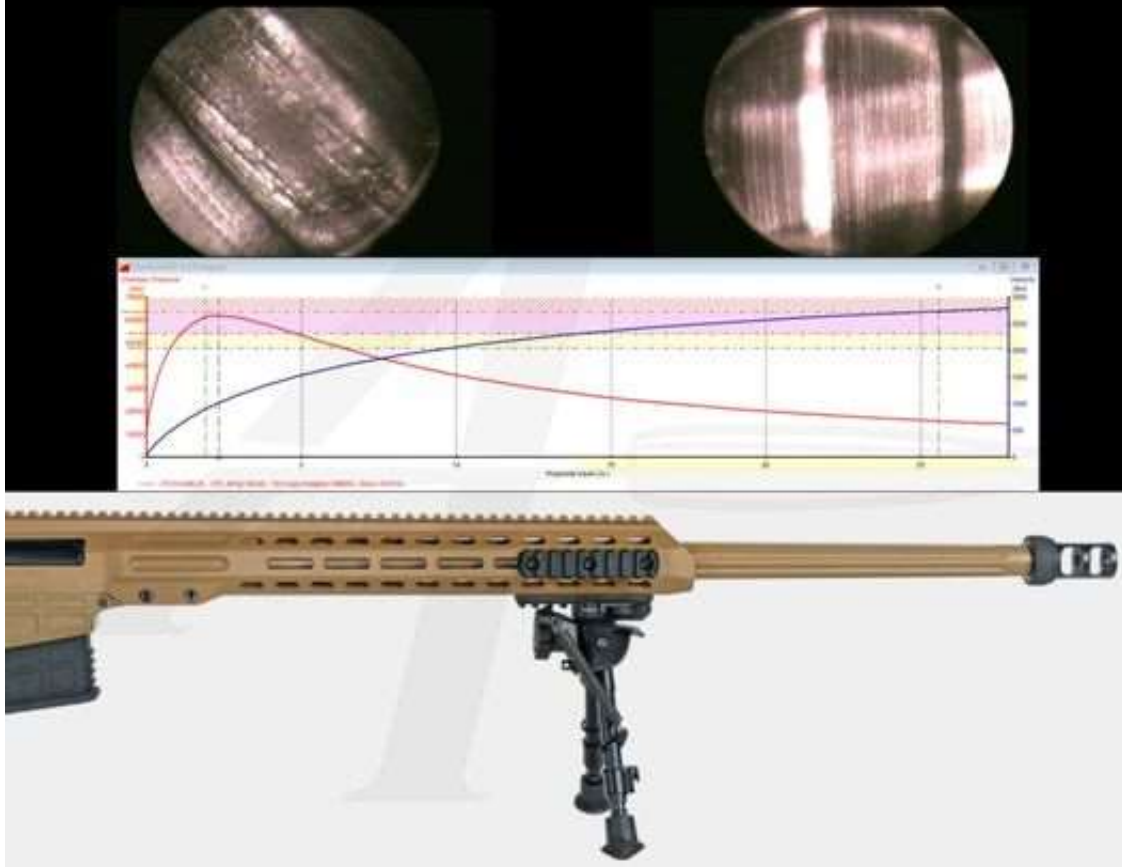


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## Barrel erosion and fouling near the chamber vs. muzzle



*Article provided to Manson Reamers on behalf of the studies done at Applied Ballistics.*



*Thank you to Applied Ballistics for sharing.*