The two numbers given in most of our military rifle listings, ME muzzle erosion and TE throat erosion, are relative indications of barrel use. The military developed this method of evaluating barrel condition, and replaced barrels when wear became excessive. Here is some detail about what the measurements mean. This is about M1 or Garand barrels, although other rifle barrels have obvious similarities. First, ME muzzle erosion.

The first step of manufacturing the bore is drilling a plain round hole down the length of the barrel blank. For the Garand this hole measures 0.300 inches.

The next step is to cut the grooves, which forms the rifling. A specialized cutter and machine remove metal in a spiral pattern. Some rifling is technically formed by other means than cutting but the result is the same.
The blue circle is the dimension measured by the ME muzzle erosion gauge. This is a tapered rod marked in increments of diameter. 0 = 0.300”, 1 = .301”, and so on. Theoretically, a new barrel will measure 0 or 0.300” at the crown. However, we have rarely seen a new or used US military barrel that measured less than ME 1, or 0.301”. We have seen new commercial barrels that measure 0.300”.

The next drawing shows the rifled barrel with bullet, in yellow. The .30-06 or 30 caliber bullet actually has a diameter of 0.308”, equal to the groove diameter but larger than the lands (so this is where the .308 Winchester cartridge gets its name….). But if the bullet is larger than the distance between the lands, how can it fit down the barrel? Well, the 50,000 pounds per square inch of pressure generated by the powder in the cartridge has no problem jamming the bullet down the barrel, regardless of a little obstruction. The lands cut grooves in the bullet (technically “striations”), and the spiral pattern of the lands and grooves makes the bullet spin very rapidly when it leaves the barrel.

Fun with online calculators: the bullet is accelerated from 0 to about 2900 feet per second (almost 2000 miles per hour) in 22 inches. The bullet is subjected to a g-force of about 65,000 (times the force of gravity). The bullet momentarily “weighs” 1200 pounds. When the bullet exits the barrel, it is spinning at about 175,000 RPM.

If a bullet is fired into water and recovered, it will show 4 grooves cut into it by the lands. A new barrel will make the best possible cuts in the bullet, and spin it as efficiently as possible. A severely eroded barrel, with the diameter of the lands sufficiently increased, will not cut into the bullet as much, and may not spin it as well as a new barrel. The diameter of the grooves, which is not measured by the ME gauge but will slightly increase with use, may let some of the expanding gas past the bullet as it accelerates, reducing bullet velocity. A significant effect of an eroded bore or crown damage can be inconsistent distribution of expanding gas at the crown as the bullet exits the barrel. All this does not mean the rifle doesn’t work, it is just somewhat less accurate. Groups on target will get a little larger as the barrel erodes.

The next drawing shows, in an exaggerated way, the effects of bore erosion on a rifle barrel’s performance. The high pressure hot gas of firing and the friction of bullets forced down the barrel thousands of times have worn away some of the bore’s metal, from the lands and
grooves. The groove diameter is now slightly larger than the bullet. The land diameter is larger than before but still smaller than the bullet, so the lands still cut into the bullet, but not quite as deeply as in a new barrel.

The corners of the lands also tend to become less sharp as the barrel erodes.

TE or throat erosion is a measurement of barrel condition at the chamber end. Rather than a simple measurement of bore diameter like ME, TE is a measurement of the distance between the breech end of the barrel and the point where the start of the rifling (lede) is at correct bore diameter. This is because the beginning of the rifling in front of the chamber is tapered. The front section of the TE gauge is also tapered. The TE measurement is read from increments marked on the gauge according to which one lines up with the end of the barrel, much like reading the ME gauge, even though technically a different parameter is being measured. As many rounds are fired through the barrel, the high pressure hot gas, and friction against the bullet wear some metal from the lede. The point where the lede is at bore diameter moves forward a little, resulting in a higher TE measurement.

For the M1 Garand, TE of a used barrel usually measures about twice the ME. TE is generally less important for accuracy than ME. Many barrels with TE of 5, just to pick a number, will shoot very well if the ME is 2 or 3. Once the ME is at 5, a barrel will probably produce noticeably larger groups on target than it did when it measured 2 or 3. By ME 5, the TE has probably increased to 8 or more, and this barrel should probably be replaced if accurate target shooting is its purpose. For correct parts collector rifles, having the original barrel regardless of bore measurements is often most important.

A rifle barrel will withstand many thousands of rounds before it would be considered “worn out” by the military. Competetive target shooters are much more concerned about small amounts of bore erosion than the military or an occasional shooter would be. A general approximation of rounds vs erosion is 1000 rounds per 0.001 of erosion, or increment on the ME gauge. Tests in recent years have shown that this may be conservative; more than 1000 rounds fired per increment in practice.
Some Garand shooters figure that a barrel is good for 5000 rounds from new, and therefore a barrel with ME 2 1/2 is halfway worn out. Maybe, but if we consider that the barrel measured no better than 1 to begin with, if it is military, halfway worn out is still in the future.

Military training, with the government providing ammunition, wore out trainloads of barrels. Given the cost of ammunition, many of us will never fire one thousand rounds of 30-06, let alone tens of thousands. So we may not require a new-condition barrel; a used one with decent measurements that will still perform well after a realistic number of rounds will be fine.

ME and TE measurements are a good way to evaluate the condition of a barrel, and a reasonable estimate of what its accuracy will be, when it is not possible to simply go out and shoot it. Most buying situations are not at a gun range. A military rifle that has a barrel with low ME and TE measurements is more valuable than an otherwise identical rifle with a worn barrel, and high ME and TE measurements. Bore condition should be an important factor in deciding whether to pay the seller’s price.

We generally don’t list a rifle for sale with ME more than 3, or TE more than 5. Collector rifles are sometimes an exception. We usually replace high gauge number barrels, with new or better used barrels.

Bore gauge measurements are not the only factors in accuracy; stock fit, op rod condition, and gas cylinder fit can also cause problems.

Barrels with high TE measurement may also have excessive headspace, but not necessarily. This is a chamber/bolt parameter that is too complicated to get into here. Excessive headspace is a safety issue, and almost always requires barrel replacement. All rifles we list for sale have been carefully checked for safe headspace.

30 caliber barrel gauges. Top: two types of ME gauge. Below: TE gauge with M1 insert installed, M1A and M1903 inserts. More types of gauges are available. Some are a single unit that can be used to measure both ME and TE.