

# The Los Angeles Silhouette Club

## Marlin's Microgroove Barrels

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Before 1950 all Marlin barrels were made by drilling the bore, and then cutting the rifling one groove at a time on a sine-bar machine. This required multiple iterative passes of a cutting head for each groove (at first this was done with a "scrape cutter", and later a "hook cutter"). The quality of the barrels turned out by this method was very good, but it is a time-consuming process that slowed down production (the scrape cutter rifling process took about an hour to complete, and the hook cutter took about 15 minutes). Marlin likes to call this process "Ballard rifling" because this was how the barrels were cut on the Ballard target rifles that Marlin produced, which were famous for their accuracy. Most of Marlin's cut-rifled barrels from this period had 6 grooves, but Marlin also made 4-groove (some of their .30 and .32 caliber guns), 5-groove (.22 caliber) and 7-groove (.35 caliber) barrels.

For .22 caliber barrels, these grooves were generally in the range of .069-.090" wide (usually about .075"), and .0015-.003" deep (these specifications changed over time). For centerfire rifle barrels the grooves were .0785" to .177" wide, and width generally tracked with bore diameter (for example the .25-20 had grooves that were .0785" wide, while the .45-70 had grooves that were .141" wide). On the older centerfire rifles (i.e. pre-WWI), these grooves were typically cut .002-.0025" deep. However, on the post-WWII .30-30s the specifications called for grooves that were .004" deep, and for the .35 Remington's, grooves that were .005" deep.

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These barrels served the needs of America's sportsmen very well and were highly

regarded. However, America was entering the "baby boom" years of the 1950s, with their unprecedented growth and opportunity, and America's manufacturers were looking for ways to speed up production to keep up with demand. Remington was experimenting with a new rifling method called "button rifling" in which a hardened swedge was pulled through the barrel. In 1950 Marlin tested some of Remington's .22 barrels and studied the rifling method and found that it resulted in more uniform dimensions, better bore finish, longer tool life and much faster production time. Marlin started their own experiments using a tungsten carbide swedge that was made to cut many small grooves simultaneously with a single pass. Marlin could now rifle a barrel in 2-5 seconds, instead of 15-60 minutes. Wow!

In 1953 Marlin applied for a patent on Microgroove rifling (US Patent #3,100,358 was granted on Aug. 13, 1953). In this patent, Microgroove rifling was described as having 5 grooves for every 1/10th of an inch bore diameter, and that the driving side of each land would be "tangentially disposed" (i.e. beveled, presumably to prevent the accumulation of fouling). On July 29, 1953, Marlin introduced Microgroove rifling in their .22 rimfire barrels, with 16 grooves that were .014" wide, and nominally .0015" deep. In their 1954 catalog, they outlined numerous advantages that this new form of rifling had, including better accuracy, ease of cleaning, elimination of gas leakage, higher velocities and lower chamber pressures. They also mentioned "... a bore of greater than standard size..." in their discussion of how Microgroove rifling did not engrave (distort) a bullet jacket as deeply as conventional rifling. Hold that thought...

Marlin continued to experiment with Microgroove rifling in their centerfire barrels, primarily in the Model 322 chambered for the .222 Remington (the highest velocity round that Marlin chambered for). The results of this testing convinced the Marlin engineers that Microgroove rifling was indeed suitable for high-velocity centerfire rifles and in early 1956 Marlin announced that all of their high-powered rifles would henceforth be equipped with Microgroove rifling.

For the common centerfire calibers, the initial specifications (circa 1956) for Microgroove barrels were as follows:

- .22 centerfire -- 16 grooves, .015" wide, .001" deep
- .30 caliber -- 16 grooves, .030" wide and .002" deep (this would be changed in 1958 to 22 grooves .024" wide, and .002" deep; and then again in 1968 to 12 grooves, .040" wide, .0028" deep)
- .32 caliber -- 16 grooves, .035" wide, and .0015" deep
- .35 caliber -- 16 grooves, .040" wide, and .002" deep (this would be changed in 1968 to 12 grooves, .055" wide, .0028" deep)

Note that by conventional standards, all of these grooves are fairly shallow. Microgroove rifling makes up for this by having many lands/grooves to grip and spin the bullet.

In 1968, the .444 Marlin was introduced, and of course it had Microgroove rifling. It was given a 1 in 38" twist appropriate for the short, stumpy, high velocity bullet that factory ammo was loaded with. There were 12 grooves, .056" wide and .0045" deep. It

is worth noting that the factory specifications called for the .444 Marlin to have a groove diameter of .433" (and a bore diameter of .424"), indicating that oversized bullets would be necessary for best accuracy when shooting cast bullets.

Also in the 1960s, Marlin introduced the .44 Magnum to the Model 336. This rifle was fitted with Microgroove barrels, containing 12 grooves that were .062" wide and .0043" deep. Factory specs for the .44 Magnum barrels also called for a 1 in 38" twist, but that this time nominal groove diameter was to be held to .4315", and a bore diameter of .4230", so oversized cast bullets are once again called for. It is interesting to note that given the difference in groove width, groove diameter and bore diameter, suggesting that the .44 Magnum barrels were produced using a separate process and tooling than were the .444 Marlin barrels.

In 1969 the .44 Magnum was used to re-introduce the Model 1894. Ten years later the .357 Magnum was added to the 1894 line. This easy-handling carbine was also made with Microgroove rifling. In this case it had 12 grooves, each of which was .055" wide and .003" deep, and had a 1 in 16" twist. The groove diameter specification was listed as .3577", so .358" cast bullets generally shoot just fine. Later (in 1987) the .41 Magnum was added to the Model 1894. The .41 Magnums had 12 grooves that were .072" wide and .0035" deep, with a 1 in 20" twist. Factory specifications for groove diameter is listed at .4107", but these barrels sometimes run a little bit larger than this.

In 1972, Marlin introduced the Model 1895 chambered in .45-70. Initially, these rifles were made with 8-groove Microgroove barrels, with grooves that were .060" wide and .003" deep. The next year this was changed to a 12-groove barrel, with the other specs remaining the same. Again, groove diameter is spec-ed out at .4587", so oversized cast bullets are called for in these guns. All of these .45-70 Microgroove barrels had a 1 in 20-" twist.

There has been a great deal of concern over the years about whether or not Microgroove rifling would shoot cast bullets well. One group of folks says that Microgroove rifles can't hit a barn from the inside with cast bullets, one group says that Microgroove barrels shoot cast just fine just so long as velocities are kept below 1600 fps, and one groups says that Microgroove barrels shoot cast just fine at full throttle. The key to success with cast bullets in a Marlin with Microgroove rifling is to keep in mind that these barrels tend to have oversized groove diameters, and that the grooves/lands are shallow. Therefore, in order to get proper engraving (and minimize "slippage" of the cast bullet as it enters the shallow rifling), it is necessary that the bullet completely fill up the groove diameter of the barrel, and engage the maximum amount of the driving surface of the lands. Since Microgroove barrels are commonly oversized, this means that the cast bullet must also be oversized to effectively "fill up" the grooves. Other factors that also contribute to good accuracy with cast bullet in Microgroove barrels are the use of a GC bullet (which helps to provide a better grip and seal), and making sure that bullet are cast hard enough for the application (generally a BHN of 12 or more). It is also worth remembering that throats in modern rifles are almost always cut larger than groove diameter of the barrel (to insure that ammunition can chamber easily), and that best cast bullet accuracy is obtained by fitting the bullet to the throat, hence reinforcing the need for oversized cast bullets in Microgroove

barrels (for example, the throats on my .30-30s run almost .311", so I size cast bullets to .310" for these guns).

Examples of Microgroove barrels shooting cast bullets accurately are easy to find. For example, I have a Marlin 1894 in .41 Magnum that was made in the first production run about 20 years ago. I don't know the throat diameter on this gun, but it shoots it's best with .412" bullets. Bullets sized .410" don't shoot well at all, and while .411" bullets group so-so, they have a really annoying habit of throwing flyers wide of the group by a notable margin. In this levergun the NEI .410-260-GC (#215F) is the key to success. I cast these bullets to a BHN of 13, size them .412" and lube them with homemade Moly lube. Loaded over 19.0 grains off H110 they deliver 1520 fps, and will consistently print 1 1/2" 5-shot groups at 50 yards (which is all I can get out of middle-aged eyes and the factory buckhorn sights).

Another example is found in the .35 Remington shooting the Lyman 358315 GC-HP (which weighs 206 grains as it drops from the blocks, when cast to a BHN of 13). Sized .359", checked with a Hornady crimp-on GC, and lubed with Moly lube, a very accurate load is obtained by seating these bullets over 36.0 grains of H4895. This combination generates right at 2000 fps, and will routinely group 5 shots into an inch at 50 yards from a Microgroove Marlin 336. The cast HP expands violently at 2000 fps.

Other examples can be found in the .30-30, .32 Special, .444 Marlin, etc., but you get the point. Microgroove rifles can shoot cast bullets just fine -- just keep them oversized, GC-ed and hard enough.



Back in the late 1990s, with the rising popularity of cowboy action shooting and its emphasis on historical accuracy, a whole new group of shooters started picking up Marlin leverguns. Because of their desire to load cast bullets in them, and because of the on-going, nagging (and inaccurate) rumors of poor accuracy from Microgroove barrels, Marlin eventually caved in and dropped Microgroove rifling for a number of their leverguns in the late 1990s. Sales of the cowboy guns have been brisk (especially those chambered for period correct cartridges, like the .45 Colt and .45-70). Marlin helps to feed this nostalgia by referring to these guns as "Ballard rifled".

As of fall of 2007, Marlin still makes a number of guns that have Microgroove barrels on them (according to the 2007 Marlin catalog posted on their website; [Marlin Firearms](#)). All of their .22 LR and .22 Magnum rifles still have Microgroove barrels. The 336s in .30-30 and .35 Remington are still made with Microgroove barrels, however the stainless 336XLR in .30-30 and .35 Remington have Ballard rifled barrels. All of the big-bore Marlin leverguns (e.g. 444, 1895, etc.) are now fitted with Ballard rifled barrels (both blued and stainless guns), as are the 1894 and 1895 Cowboy models. Interestingly, in the 1894 series, the .44 Magnum and .357 Magnum guns are Ballard rifled, but the .32-20 1894CL and .41 Magnum 1894 FG are both fitted with Microgroove barrels.

Microgroove rifling is a fascinating, and misunderstood, innovation by one of America's leading arms makers. It speeds up production time and significantly extends the service life of the tooling (thereby holding production costs down). It provides very uniform bore dimensions and a very smooth bore finish. And the bottom line is, as generations of American hunters can testify to, Microgroove rifling provides fine accuracy in the hunting fields. Because of the specifications adopted by Marlin, Microgroove barrels tend to have oversized groove diameters, and as a result, Microgroove barrels early on earned a reputation for not shooting cast bullets well. In fact, when loaded with bullets that are the appropriate size for the barrel (and cast to a suitable hardness and wearing a GC), these guns are capable of fine accuracy with cast bullets. Some of my favorite cast bullet rifles wear Microgroove barrels.

The historical data used in this article was taken in large part from William S. Brophy's book "Marlin Firearms: A History of the Guns and the Company That Made Them". For more information on Marlin firearms, this extraordinary book is highly recommended.

- Glen E. Fryxell

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