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Tips, Tricks, & Info

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Making Benchrest Quality Bullets

1. What makes a bullet benchrest quality?
2. What equipment is needed to make benchrest quality bullets and where can I get the equipment?
3. What are the essential techniques for producing benchrest quality bullets?

Bryan Armatys

1. What makes a bullet benchrest quality?

The heart of bullet making is in the dies. Bart Sauter advertises the fact that he "got lucky" and got a good set of dies. He is exactly right. The dies we use are hand-made and no two are alike. It does take a bit of luck to get a die that really sings.

A benchrest quality bullet must have consistent jacket walls to keep the bullet in balance. Variations in jacket wall thickness put the bullet in an imbalance situation similar to a washing machine with too many pairs of jeans on one side. At something around 200,000 RPM, the slightest out of balance situation can cause problems. Good quality jackets, being "outsourced" items, are critical.

Consistent core weight is another factor, but not as critical as some would have you believe. For short range benchrest, bullet total weight variances of 2 or 3 tenths of a grain will not be seen on the target. We normally have control of core weight, but different lots of jackets produce bullet weights that may vary by a half grain or more. I have intentionally shot bullets from 2 different lots, that weighed a half grain apart, into the same group with no notable dispersion.

Given a good set of dies and the skill to use them, the quality of the jacket is the single most important factor in producing benchrest bullets.

2. What equipment is needed to make benchrest quality bullets and where can I get the equipment?

Carbide dies are made to last a lifetime of continuous use. Steel dies are infinitely more affordable and will last the bullet maker that makes bullets for himself nearly forever. Steel dies for commercial use have a limited lifetime.

Niemi Engineering is a good source for carbide dies. Larry Blackmon (Bullet Swaging Supply) offers steel dies and my own personal experience with his dies has been very positive. There are other die makers out there that I don't have personal experience with. Others have had fantastic results with them. Talk to the manufacturers that build the dies and make up your mind from there.

Beyond that, modified presses to accommodate the dies, tumblers to lube the jackets, micrometers, scales, etc. will be necessary. These are available thru the die maker, and in the case of micrometers, scales, etc., check the reloading supply houses.

3. What are the essential techniques for producing benchrest quality bullets?

There is really no magic, smoke & mirrors, or God given talent involved in bullet making. To the contrary, it can be tedious factory work. There is checking and more checking the dimensions of jackets, cores, bullet dimensions, etc. After it is all set, bullet making involves endless handle pulling.

Cleanliness is extremely important in bullet making. Clean the jackets in lacquer thinner or acetone to remove all traces of manufacturing oils and to remove any dust or dirt that may scratch an expensive die. The core must be free of lubricant or it will not adhere to the inside of the jacket, or voids may occur. I use a 5 gallon bucket and a carburetor dip bucket, agitate the contents, and air dry.

Dies are occasionally removed and cleaned with brake cleaner. Be sure to use extra lube on the first few jackets after cleaning to make sure they don't stick in the die.

The amount of lube has a bearing on the final bullet dimensions, so it is of paramount importance.

The "dwell time" or time spent at the pressure end of the press stroke has to be consistent. The "feel" of the press stroke can signal a light or heavy core, or the presence of a folded jacket. This feel becomes ingrained and subtle differences between bullets are readily apparent. I have a certain CD I listen to when making bullets--especially during core seating. I get a rhythm going that makes sensing the differences easy.

By all means, keep records of each lot of bullets...all pertinent dimensions etc., and always check the first few bullets you make when resuming a session at the press.

Consider how to share bullet making with reloading operations. An "L" shaped bench, with the bullet equipment on one side and reloading stuff on the other is reasonable. There will be an overlap at times, so make sure to cover the cores, jackets, presses, etc. when not in use. Spilling powder on your freshly lubed jackets will definitely bring a scowl to your face! A clean reloading area promotes safety, as we all know. It also prevents time consuming re-washing of bullet components.

BA

Guy Chism

3. What are the essential techniques for producing benchrest quality bullets?

This is how I make bullets. I pull the lead wire though a wire straightener, then cut it to short lengths. I cut 30 cal. wire to 28 inch lengths and 6mm wire to 18 inch lengths. I cut 30 cal. cores 3 grs. over weight and 6mm cores 2.5 grs. over weight. I use 2 grs. of lube per pound of cores and tumble 6 pounds of cores at a time for 5 minutes. My core lube is 4 oz. of Marvel Mystery Oil, 4 oz. of STP, plus 60 grs. of Johnson #140 stick wax.

After lubing the cores, I squirt them to size in a core forming die. I have ground the stop on the press so the handle breaks over, which helps to keep the cores uniform.

To degrease the squirted cores, I use 2 buckets and a 3 lb. coffee can with holes punched from the inside. I put the cores in the coffee can and Coleman fuel in the buckets. Wash in the first bucket, rinse in the second bucket. To dry, put the cores on a towel and GENTLY roll them back and forth 20 times.

For washing jackets, I have 2 one-gallon plastic jugs. I wash the jackets in Coleman fuel in one of the jugs and use a funnel with filter paper to drain to the other jug. Put the clean jackets on a towel to dry.

Tumble the jackets to apply the lube. I use a jacket lube consisting of 50% anhydrous lanolin and 50% castor oil by weight. Jackets will vary sometimes from lot to lot and affect how much lube you have to use. For a bucket of 800, 30 cal., 1,150 jackets, I start with 13 grs. of lube. I want the bullet to stretch to it's maximum length with as little lube as possible when pointing up. Go up or down half a gr. at a time to find out how much lube for that lot. It also depends on whether you have carbide or steel dies and how slick they are.

Then stuff the clean cores in the jackets.

I seat the cores hard enough to expand the jacket to the size of the core seating die, from the base of the jacket to the lead line, and I stop. I don't want to deform or get close to rupturing the jacket.

Pointing bullets up. I run bullets in the point up die to where they will not hang on the knock-out pin and stop just before they start to stove-pipe.

P.S.

It is VERY important that you weigh your lube and use the same amount each time. I have a Thumlers tumbler that I converted to use 1 gal. paint cans. It has an automatic timer, I tumble cores for 5 minutes and jackets for 15 minutes.

As I cut the cores, I weigh the second core from each length of wire so that if the wire is running bad I can adjust. Try to keep cut cores to plus or minus 3 tenths of a grain. If some cut cores are heavy and some light, you can't make uniform cores.

When squirting cores you must squirt each one the same. You can't squirt one fast and the next slow. When I get tired I take a break.

Guy

Don Gentner

1. What makes a bullet benchrest quality?

The quality of a bullet is a function of the quality of the bullet dies used in manufacturing. The next item would be the individual person making the bullets. A bullet maker must continuously maintain exact consistency within the manufacturing processes to ensure a high-quality product. On the other hand, I have always said that the window is wide regarding size and shape of the benchrest quality bullet.

If the bullet dies are made correctly, meaning that the center line of the base of the bullet is aligned with the center line of the point, the ogive is between 7 and 8, and the bullet is of course round, the maker is well on his way to having a quality product.

However, regardless of the dies used, at this point it is the responsibility of the bullet maker to learn how to make the bullets correctly using the proper equipment. Most of us bullet makers are constantly learning. Various components involved in the manufacture of bullets, including jacket sizes and shapes and also metallurgical composition, have changed over the years. We must always be aware of these changes, and I say as I have said many times, we all learn from our mistakes and make better bullets because of them.

2. What equipment is needed to make benchrest quality bullets and where can I get the equipment?

Niemi Engineering has been in the bullet die making business for 20 years. The combined experience of this father and son team, built upon their own expertise and from listening closely over the years to hundreds of knowledgeable bullet makers, has allowed them to manufacture the finest equipment with which we can make bullets.

Niemi Engineering can supply all of the components to make benchrest quality bullets, dies, punches, presses and everything needed to get you started in the benchrest bullet making business, either as hobby or small business.

3. What are the essential techniques for producing benchrest quality bullets?

The most important operation in making bullets is maintaining core to jacket bonding. This bonding can only be ensured with the correct preparation of the lead cores. Proper preparation includes swaging the cores, and then both cleaning and oxidizing (editor's note -- see Gary Ocock's oxidizing procedure below). Although this two stage process is more time consuming, it is absolutely necessary to the extent that if not done, the next step, the pointing operation, will result in a poor quality bullet.

Don

Mike Marcelli

1. What makes a bullet benchrest quality?

Consistency.

2. What equipment is needed to make benchrest quality bullets and where can I get the equipment?

Niemi for carbide. Blackmon for steel. I also have an excellent Speedy die, but they are difficult to find. I've not used anyone else's dies, so I cannot comment on them. You should avoid buying used dies unless you can verify, with samples, that they make bullets that shoot to BR standards.

3. What are the essential techniques for producing benchrest quality bullets?

There are a number of factors that make a bullet BR quality. I would rank clean components as the biggest factor. I clean with methylene chloride. I used to be a synthetic organic research chemist, so I know a lot about commercial solvents. Methylene chloride is the only non-regulated commercial solvent that will clean the lube off of jackets and cores and not leave a polyolefin film. Leave any other solvent to evaporate in a glass. At the end of the day, you'll see an oily film in the glass. Methylene chloride, on the other hand, will either leave no film, or a fine white powder (dissolved silicates) which can mechanically lock the jacket and cores together. (Of course, the down side is that methylene chloride is a known carcinogen). All components should be cleaned twice to assure that all traces of lube are eliminated.

(editor's note -- Do NOT use methylene chloride if you don't have the training needed to handle, store, and dispose of it properly. Besides yourself, you are also potentially exposing your family and others to the chemicals you use. Read the label and treat all solvents with the proper care.)

The second most important factor is that the bullet maker establishes a protocol to assure consistency. Consistent lube. Consistent core seating pressure. Consistent point up procedure.

I use a mixture of 50:50 vaseline:lanoline for jacket lube. I make batches of 1200 bullets. I use 1 gr. of lube per 1200 jackets. I weigh the lube on a piece of wax paper -- a trick I was taught by Speedy. I tumble the jackets inside a clean dry J-4 bucket, inside a Thumler's tumbler barrel. The tumbling time is dependent on the temperature, colder temperatures require longer tumbling.

Consistent core seating. One key factor is determining the proper core seat punch. I try to select a punch that allows a minimal amount of lead to leak around the punch during the core seating operation. If everything is matched properly, one should see a thin, width of 2-3 hairs, uniform line around the outside of the jacket at the lead line. The line should be faint, not bright. If too much lead sneaks around the punch, the line will get wider and less distinct. If the punch is too tight, the line will become wider and shiny. Neither of these situations is acceptable because the jackets can fail at the lead line and this is bad juju for accuracy.

Once the die is set up, the bullet maker must strive for consistency. The core seating pressure must be the same. If it fluctuates, bullet dimensions will change. If a core seats easier or harder than the average core, it must be culled. I have a large reject ratio. That's why I start with 1200 cores to make 1000 bullets.

Consistent point up. I try to center the seated core on the point up punch. I do this by raising the core partially into the die, then letting it fall back onto the center of the punch before ramming it home. This eliminates the situation where a core is partially unsupported during the point up process and eliminates "banana bullets" -- bullets where the ogive of the unsupported side of the bullet is greater than the supported side.

Mike

Gary Ocock

1. What makes a bullet benchrest quality?

In simple terms a bullet that will allow a shooter to shoot small groups or hit where he/she aims. A more complicated answer - good jackets; uniform wall thickness varying less than .0003 (typically today, the last 7-8 years, we use jackets close to .0001) . Lead that is clean, uniform in weight and size, and seated properly into the jacket. Finally, bullets that are made in quality dies that will allow nearly every bullet to come out of the die being just like every other bullet in the lot. The bullet maker needs to manage this process, using the proper equipment and his/her knowledge to make it happen.

2. What equipment is needed to make benchrest quality bullets and where can I get the equipment?

Base equipment. A set of bullet dies, minimum a core seater and point up die, with associated punches. An RCBS or similar reloading press converted for bullet making (changing the ram to hold the punches and adding an ejection frame). For quality control a good micrometer capable of measuring .0001. Some sort of bullet lube.

3. What are the essential techniques for producing benchrest quality bullets?

Start with CLEAN and then just like bench rest shooting, do everything the same for each bullet and then practice. Now it's more complicated than that, but it's just that easy too. The challenge comes in fine tuning the lead and the jacket to your dies. Asking other bullet makers will help a bunch in not reinventing the wheel but not all bullet makers follow the same procedures, as such you'll fine tune your own technique. For the most part they all end up with very good products though. One bullet may be better for your gun than another (performance) but both bullets may be made very well. It's just that one will work better in a given chamber and barrel combination. My technique is very simple.

I make bullets for myself and every once in a while for a friend. Production guys, like Gentner, Bruno, Fowler, Euber, etc. use a different technique as they are concerned with quality AND speed, where I am looking at just quality. Don't read into this, they achieve quality just the same as I do, it's just they go at it differently. I make 5-6 thousand bullets a year, they make 100/200 thousand plus.

Start with clean jackets. Clean is free from any oil or lube on the inside of the jacket. They are usually clean from the manufacturer, if not they need to be washed in a highly evaporative degreaser.

Next you'll need clean and uniform cores. They can be purchased and many of the production guys purchase their cores made to a given weight. Hopefully they are super clean as well. If not, clean just the same as with jackets. I make my own cores from lead wire made with 1/2 of 1% antimony. I cut the core to a rough size and then form the core in what is called a core forming or squirt die. This die bleeds off excess lead, with each core coming out the same weight and size. Time it takes to make cores is anywhere from a half hour to one hour per thousand (while watching TV). You'll go nuts if you can't do something else while making bullets.

I then clean my cores and oxidize them. Many bullet makers don't do the oxidize step, I've experimented both ways and found very little difference either way. I continue to oxidize as I learned from Don Rorschach and Clarence Detsch.

This how I oxidize cores. Start with very clean cores, degreased after the core forming step. Use an old pot, add 1 tablespoon of Calgon dishwashing detergent (TSP will work as well), 1/2 gallon of water and bring to a boil on the stove. Place the cores in a strainer and hold them in the water for about 15 minutes. Remove and air dry the cores. This will turn the cores from bright shiny lead to a dull grayish color and they will feel slightly rough. In theory this oxidation will help the lead core stick to the bullet jacket during the manufacturing process.

I then seat the core into my very clean jacket. Seating the core is the fine tuning stage. It needs to be done properly. This means, no jacket scraping or excessive bleed by.

Last step and most fun is pointing up the bullet. No brainer here, just put 'em in the die and point 'em up. Only tweaking I do is with lube. Sometimes I put more lube on and sometimes I take lube off. This is how I point up to a particular size (e.g. .2431 or maybe .2433 on my pressure ring). My bullets are 95% boat-tails and usually small on the pressure ring when compared to most everyone's flatbase bullet. That's the way the die makes them, I've shot them that way for nearly 30 years and I've won with them, so I'm sticking with them.

Gary

R.G. Robinett

1. What makes a quality benchrest quality?

First and foremost, bullet jackets - the least total indicated run out (TIR) the better. However, .0003" TIR jackets are acceptable. In fact, such jackets are non-returnable, as they are within tolerances for BR quality jackets. J4 uses .0003" as maximum runout and Sierra uses .0004" as the upper limit for TIR at the first datum point above the jacket base.

2. What equipment is needed to make benchrest quality bullets and where can I get the equipment?

1) A good set of dies - preferably carbide, especially if one plans on making bullets to sell. Carbide dies are less likely to become damaged and will make more bullets. For the individual who plans on making bullets for himself and a few pals, tool steel dies make excellent bullets and should last a life-time.

2) Converted press(es) - that is presses which have had the ram replaced to accept bullet making punches. Preferably, the presses will either be true, or have been trued by the converter/manufacturer.

3) Paraphernalia to straighten and cut lead wire into slugs for squirting. Most of the die makers can supply the dies and core cutting paraphernalia. Though 'squirted' (preformed) cores may be purchased, my experience is that such cores are never as uniform as I can squirt by hand - this does require time, but I prefer to know every bullet by its first, last and middle name.

In my experience, Bill and Brian Niemi make excellent carbide dies:

W.B. Niemi Engineering
P.O. Box 126
Greensboro, VT 05841
(802) 533-7180

3. What are the essential techniques for producing benchrest quality bullets?

Though somewhat outdated with regard to equipment, THE ACCURATE RIFLE, by Warren Page, and available again through Precision Shooting, is worth the price just for the bullet making comments offered by M.H. Walker and Emory Tooley; this info is timeless. I will not bore the reader with my own procedure.

Assuming good jackets, degreasing and core seating are, in my opinion, the most critical steps in making precision bullets. The cores must not slip inside the jacket. Never squirt cores using a lube containing silicone. Removal of silicone can be very difficult, generally requiring one of the hard to get chlorinated hydrocarbon solvents. Cores should be washed a minimum of three times, the final wash always being via NEW (unused) solvent.

Next, core seating must be done with a properly fitting punch. One must either have a selection of punches, in no greater than .0005" increments, or size the core to fit the punch/jacket lot. The latter option (one or a limited number of punches) mandates a willingness to vary bullet weight slightly. Upon seating, a proper punch will allow for a very small amount of the core to uniformly bleed by the punch when peak pressure is reached. This small gap between the punch and jacket assures that no air is trapped between the core and jacket.

Lubrication of cores and jackets should be CONTROLLED. Always weigh and record the amount of lube used for these operations - this facilitates trouble shooting and helps produce uniform results. Use the least amount of lube necessary to accomplish the desired task: i.e., for pointing, use the SMALLEST volume/weight of lube which produces the LONGEST finished length.

Experimentation with your dies and jacket lot(s) will be necessary to determine the proper amounts of lube. For core squirting, I use COOL TOOL II (a cutting oil/cutting oil additive). For jackets (seating/pointing) I use a mixture of anhydrous lanolin and PURE Neatsfoot oil (one does not know what additives are present in the compounds) in a ratio of approximately 5:1. This results in a viscosity about like room temperature butter. It has proven to be a very reliable lube. Rich Griffen put me onto this a few years ago - very simple and no surprises.

I prefer to use a minimum amount of lube (on the jackets only) for core seating. I like a little 'drag' as the core seated jacket is ejected from the die. I add lube just prior to pointing. Doing this minimizes the likelihood of cores sticking to the core seating punch and also assures uniform distribution of lube for pointing.

Prior to pointing up, I de-lube the jar, apply the desired additional lube to the jar and re-tumble the cored jackets for five minutes. If the lube jar is not de-lubed prior to each tumbling session, the lube will build up, resulting in a drift away from the baseline. Keeping notes and weighing every time has proven beneficial. It also helps to control the temperature and relative humidity. Being 'old fashioned, I allow cored jackets to rest for at least 24 hours before pointing.

Bullet making is neither complicated nor difficult, the making of precision bullets has not changed in about fifty years. We do have better 'stuff', but the principal remains unchanged. The 'secret' to making BR quality bullets is an UNCOMPROMISING penchant for details and application of common sense.

Get a copy of the ACCURATE RIFLE and get not only the specifics of how to make bullets, but also a glimpse of BR history.

Good luck and good shootin'.

R.G.R.

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(Updated: 01/22/103)

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