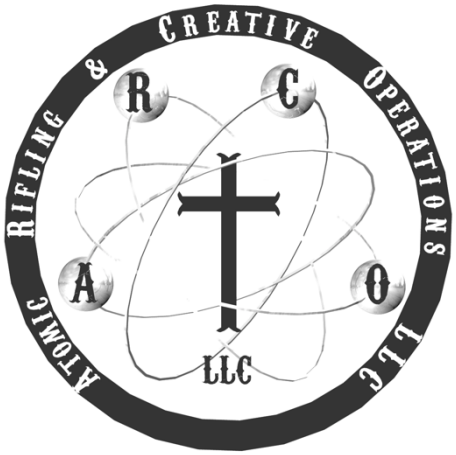


Standard Pattern Beta Release Muzzleloader Manual

Last Updated: June 3, 2020

PLEASE NOTE: This manual is written under the assumption that the reader is already familiar with the general principles and practices of muzzleloader shooting and firearm safety, as well as workshop safety and gunsmithing where applicable. As such, this manual provides specific information relevant to Standard Pattern Beta Release Muzzleloaders produced by Atomic Rifling and Creative Operations LLC, but does not address general safety precautions or techniques that would be common knowledge among experienced persons. If you are not already proficient in the safe handling, use, and gunsmithing (where applicable) of muzzleloading firearms, obtain appropriate training to develop said proficiency before using this product or before attempting the applicable operations described in this manual.

INTRODUCTION

The Standard Pattern Muzzleloading Rifle produced by Atomic Rifling and Creative Operations LLC for the beta release of the design is initially produced as a "90% kit" consisting of a mechanically functional barreled receiver which may be finished out by constructing a stock and applying a cosmetic finish to the gun, if desired. Some of these kits are finished out at the factory and sold as ready-for-use muzzleloaders, while others kits are sold as is and may be finished either by the end user or by an intermediate dealer. This manual provides loading and maintenance information for finished muzzleloaders, as well as information on finishing a 90% kit.

LOADING

All standard pattern muzzleloaders, whether finished or in kit form, are proof tested before leaving the factory. It is not necessary to proof test your standard pattern muzzleloader unless you make modifications that would invalidate the original factory proof (e.g. welding something to the barrel, modifying the breech plug, or firing loads in excess of the recommended maximum).

The standard pattern muzzleloader was designed to be loaded with loose black powder or Pyrodex and cast lead projectiles (e.g. round ball or minie ball). The maximum recommended load for the standard pattern muzzleloader is as follows:

Maximum powder charge: 120 grains
Maximum bullet weight: 500 grains

However, note that the maximum load is not necessarily the most accurate load. In testing, it was found that each rifle tends to shoot most accurately with a particular load, and that the ideal load for maximum accuracy was unique to each particular rifle. When experimenting with different powder charges to determine the optimal loading, a minimum charge of 50 grains of black powder or Pyrodex is recommended to ensure reliable functioning of the muzzleloader. In most cases, projectiles that fit more snugly in the bore will provide better accuracy, but the tighter the fit the more difficult they will be to ram down the barrel and seat on top of the powder charge. Recommended projectile diameters for use in standard pattern muzzleloader rifles are as follows:

- If loading a patched lead roundball, a 0.490-inch diameter round ball with a patch 0.010 inches thick is recommended.
- If loading lead roundballs without patches, a 0.495-inch diameter round ball is recommended. In this case, powder-coating the roundballs may also be helpful to improve projectile fit and reduce the potential for barrel leading.
- If loading minie balls, sizing to a diameter of 0.499 inches seems to provide good compromise between accuracy and ease of loading.

SIGHTS & SIGHTING-IN

The standard pattern muzzleloader is equipped with a front blade sight and a rear aperture sight. The rear aperture is adjustable for both windage and elevation, and provides about one-half inch of travel on both axes. To adjust the aperture on either axis, first loosen the thumb nut on the aperture screw slightly. Windage can then be adjusted by turning the aperture screw. Elevation can be adjusted by sliding the aperture screw up or down in the slot where it is mounted; the elevation screw facilitates precise adjustment of elevation, provided that the nut on the aperture screw riding in the slot is kept in contact with the end of the elevation screw. Once the necessary adjustments have been made, re-tighten the thumb nut to secure the aperture in place.

For added versatility, two aperture sizes are provided. The smaller aperture allows for greater precision, while the larger aperture allows for faster target acquisition and is easier to see through in low light. The aperture that is not currently in use is used as the elevation screw, allowing both apertures to be kept with the gun at all times.

Both the aperture screw and the elevation screw feature a 32 TPI thread, so rotating the screw 180 degrees will move the aperture $^{1}/_{64}^{th}$ of an inch. The angular displacement that this will produce depends on the sight radius, which varies with barrel length. For example, if the sight radius (distance from the rear aperture to the front blade) on a particular rifle is 14 inches, then moving the aperture $^{1}/_{64}^{th}$ of an inch would move the point of aim 1 inch at a range of 64 x 14 = 896 inches, or approximately 25 yards. Thus, as a rule of thumb for rifles with a sight radius of about 14 inches, one half turn equates to 1 inch at 25 yards, 2 inches at 50 yards, or 4 inches at 100 yards when adjusting the sights. If the sight radius is doubled to 28 inches, then these displacements would be cut in half. When adjusting windage, the aperture screw must be rotated in 180-degree increments, so as to keep the aperture in the correct orientation for viewing. Elevation, however, is not constrained to be adjusted in discrete intervals.

MAINTENANCE

Like all muzzleloaders using traditional propellants, the standard pattern muzzleloading rifle requires frequent cleaning in order to deliver its best performance. The minimum level and frequency of cleaning will depend somewhat on the environment in which the rifle is used/stored, and the surface-treatment (if any) of the metal components. In humid climates it is important to remove every possible trace of fouling before placing the rifle in storage, so as to minimize the potential for rusting. In dry environments the potential for rusting is significantly reduced. Application of rust-preventative coatings to the metal components of the rifle can also help to mitigate corrosion concerns.

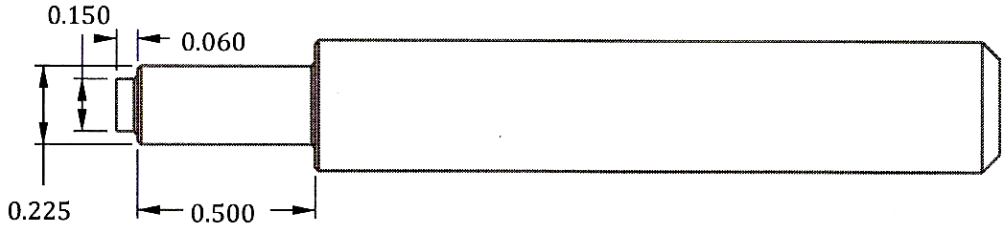
For maximum accuracy, it is preferable to clean the bore after each shot, although this may not always be practical in the field. At a minimum, the bore should be dry-brushed every 20 to 25 rounds and given a full wet cleaning every 75 rounds. Additionally, for maximum reliability it is advisable to clean the hammer, trigger, and the inside of the receiver so as to avoid accumulation of fouling in the receiver that can rob the hammer of its kinetic energy as the hammer is falling, potentially leading to light strikes on percussion caps. The process for cleaning the receiver is as follows:

1. Punch out the hammer pin.
2. Lift out the hammer.
3. Turn the receiver upside down and catch the hammer spring with its two end bearings as they fall out of their groove.

4. Punch out the trigger spring.
5. Push the trigger up into the receiver from the bottom, and lift it out through the top of the receiver.
6. Clean the components. A toothbrush dipped in hot, soapy water is useful for cleaning the hammer and trigger. A .30-caliber bore brush dipped in hot soapy water is about the right size for scrubbing the inside of the receiver.
7. After cleaning, all components should be thoroughly dried and lightly oiled.
8. Reassembly begins with insertion of the trigger into the receiver. Line up the hole in the trigger with the pin hole in the receiver, and tap the pin back into place.
9. Drop one of the ball bearings into the spring groove in the receiver, followed by the spring, and then the other bearing.
10. Insert the hammer into the receiver, line it up with the pin hole, and tap the hammer pin back into place.

Caution: when pounding pins in and out, be careful not to hammer on the receiver side plates; if the side plates are bent or dented inward, this could cause them to pinch the hammer and/or trigger, binding up the mechanism.

Note: A punch of the following dimensions can be useful for routine cleaning, as it allows the pins to be easily driven out far enough for removal of components, without completely removing the pins from the receiver:



It is also advisable to remove the breech plug and thoroughly clean out any accumulation of fowling in the plug and/or the breech end of the barrel. At this time the percussion cap nipple should also be cleaned and inspected, and re-crowned or replaced if it has become worn or mushroomed. The nipple can be removed/installed using a $^{3}/_{16}$ inch open-ended wrench, and the breech plug can be removed/installed using a $^{13}/_{16}$ open-ended wrench. The required frequency of cleaning the breech will depend on the environment in which the gun is used. If it is used and stored in a dry environment, and subjected to frequent use, the breech should be cleaned at least once every 300 rounds. In more humid environments or if the gun is to be stored for a long period of time between uses, then it may be necessary to clean the breech every time it is used in order to prevent corrosion in the breech area.

FRONT SIGHT MODIFICATIONS

The front sight of a standard pattern muzzle loader 90% kit is a simple rectangular blade, usually with slightly beveled edges. While this shape is serviceable as a front sight, there are advantages to be gained by modifying it, and the preferred modifications depend on the particular role that the rifle in question is to play. One way to modify the sight is to grind the flat top of the rectangle down to an arc segment, leaving no sharp corners to snag on brush or clothing when the rifle is being carried afield. Another possible modification consists of first filing the top and sides of the

sight to give it a crisp barley-corn profile in lieu of the original dull bevel, and then grinding or filing the sight down to a ramp in the rear, with an undercut section at the top to ensure the top of the sight is almost always in shadow. This allows for a more precise sight-picture, potentially improving the practical accuracy of the rifle. These modifications are illustrated in Figure 1. However, other front sight contours are certainly possible as well, depending on the intended role and desired aesthetics of the finished rifle.

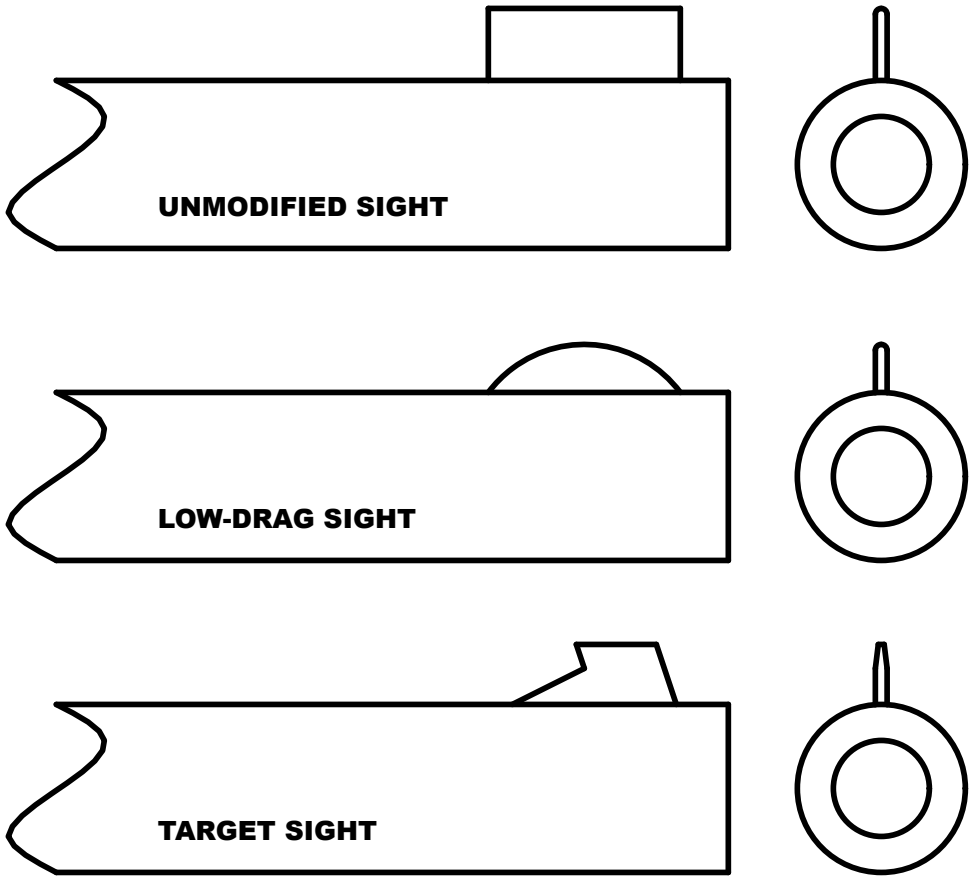


Figure 1: Comparison of typical front-sight options.

ADJUSTING TRIGGER PULL

As manufactured, the trigger pull of the standard pattern muzzleloader typically measures 8 to 12 pounds. Initial testing indicated that this trigger pull would provide maximum safety and reliability of the mechanism without being so stiff as to compromise practical accuracy. Due to normal wear on components, the trigger pull will typically be stiffest when the gun is new and will gradually become slightly lighter and smoother with use. This break-in process can be expedited by carefully polishing the mating surfaces of the hammer and trigger, without removing enough material to change their shape.

If a significantly lighter trigger pull is desired, the hammer can be modified so as to reduce the force and/or travel required for the trigger to release the hammer. Such modification is permanent

and irreversible, and if done incorrectly can render the mechanism unsafe or completely unusable, and thus should only be attempted by a competent gunsmith.

To reduce the force required to pull the trigger, the angle of the bearing surface of the hammer that the trigger catches when the hammer is cocked must be made more oblique. If this modification is undertaken, the angle of the surface should be ground down a little at a time until the desired trigger pull is reached. Meanwhile, if the outer surface of the hammer adjacent to the bearing surface is ground down, the amount of trigger travel required to release the hammer will be reduced. However, if the travel is reduced, the outer surface of the hammer above the half-cock notch must also be ground down by the same amount; otherwise when the trigger is pulled, the face adjacent the half-cock notch may impact the trigger and prevent the hammer from falling all the way. Beveling the end of the trigger so that its surface is flush with the mating surface of the hammer instead of riding on a corner may marginally reduce trigger pull as well, and is often performed in conjunction with the other modifications discussed herein.

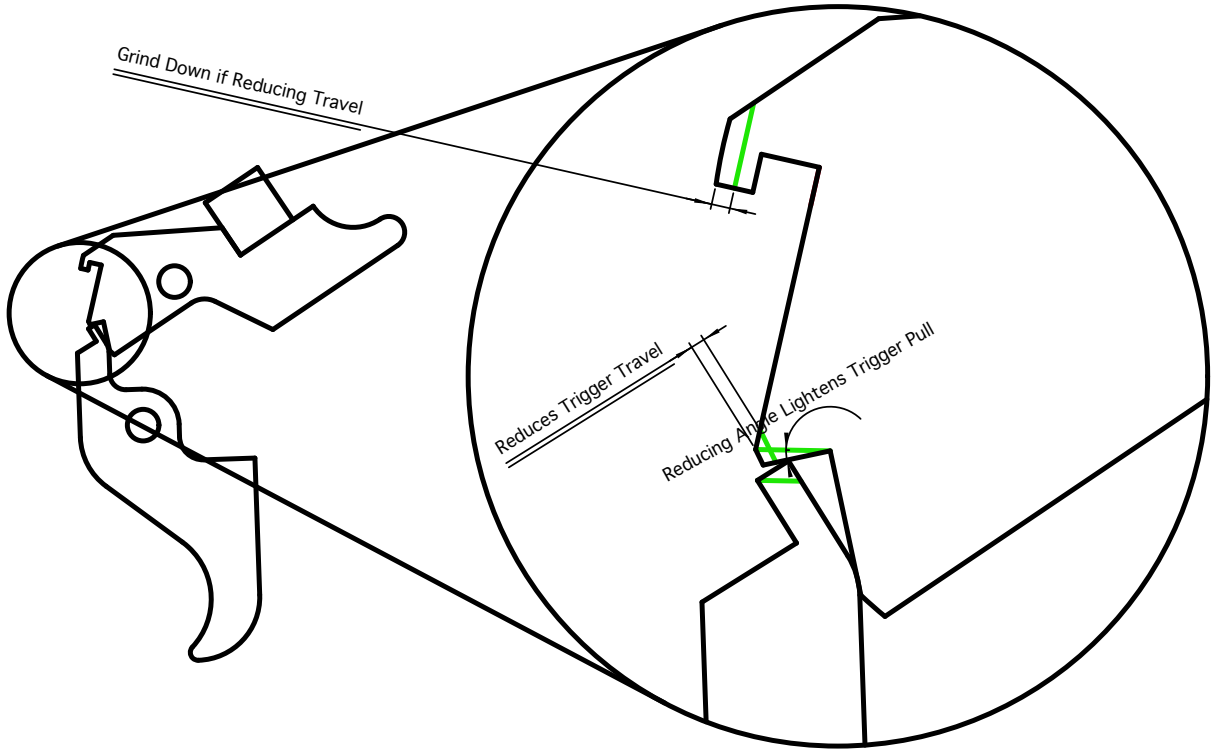


Figure 2: Illustration of hammer modifications to reduce trigger pull.

METAL FINISHING

There are many surface treatments available for metal components from various suppliers, including bluing, Parkerizing, plating, and anodizing. In general, any surface treatment that is compatible with the materials of its construction and does not materially change the dimensions of the working components can be used on the standard pattern muzzle loader. The barrel and receiver of the standard pattern muzzle loader are made of low-carbon cold-drawn steel. The hammer and trigger are made of hardened chrome-moly alloy steel. In both cases, composition of

welds may vary slightly from that of the base metal. For instructions on applying a given surface treatment, refer to the documentation provided by the manufacturer of the surface treatment product in question.

MAKING THE STOCK

Making the stock is generally the most significant task involved in finishing a 90% kit. Stocks can be made out of many different materials in many different styles by many different methods. Most stocks will be inletted to fit around the rifle and secured by means of the slotted pins provided for that purpose, although it is possible to attach stocks by other methods. For ideal fit-up, it is best to measure the actual dimensions of the rifle for which the stock is being made, or to use the rifle itself as a template, laying it against the stock blank and drilling the pin holes in the stock through the mating holes in the gun. However, for reference, as-built dimensions of a typical standard-pattern muzzleloader are shown in Figure 3.

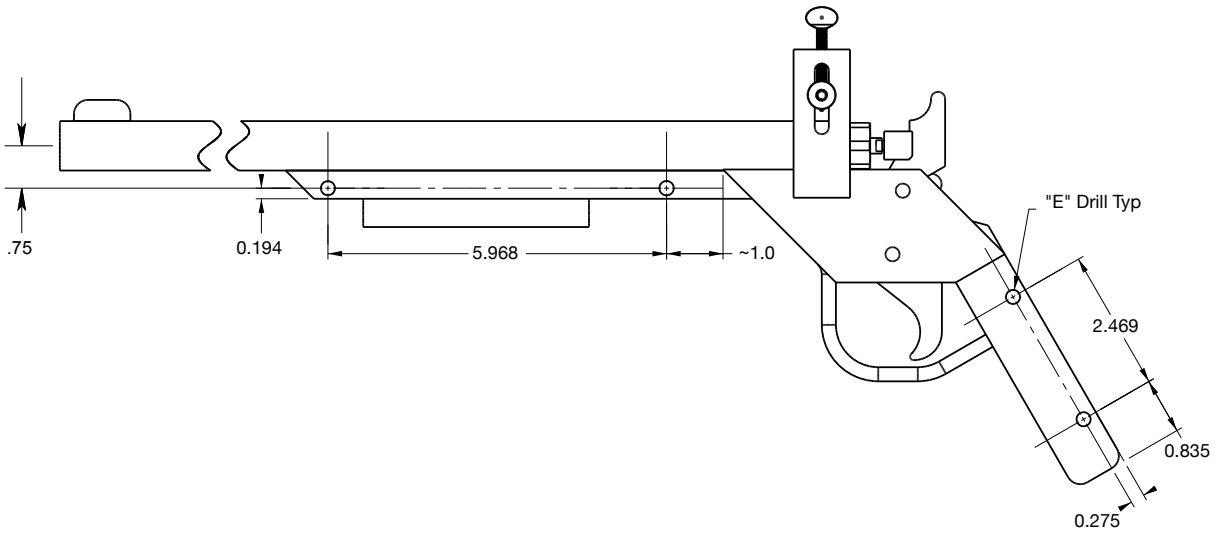


Figure 3: Typical as-built dimensions of a standard-pattern muzzleloader pertaining to stock attachment.

Usually, the stock is made in two pieces, which are inletted separately and pinned to the rifle separately. To wrap halfway around the barrel while clearing the stock attachment lug and ramrod guide tube, the fore stock is typically inletted as shown in Figure 4. However, it is often easier to drill the pin holes in the fore stock before inletting and shaping it.

The tang to which the butt stock attaches is $^1/_4$ inch thick and 1 inch wide; it angles back about 30º from vertical. An example of a contour for a traditional-style butt stock is provided in Figure 5. To use Figure 5 as a template, print it out with the print scale adjusted such that the grid boxes measure 1" square. At this scale, the figure will fill one sheet of 8x14 legal paper. A butt-stock blank may then be produced by gluing the paper to a hardwood slab $1^1/_2$ to 2 inches thick, and cutting along the contour line with a jigsaw or vertical band saw. After the blank is cut out, it is inletted with a slot to accommodate the tang, and holes for the attachment pins are drilled. Then the edges of the blank are rounded and carved down to give the stock a smooth, flowing shape. Rough carving may be done with wood chisels or power tools, final sanding renders the stock smooth, and various wood finishes can be applied as desired.

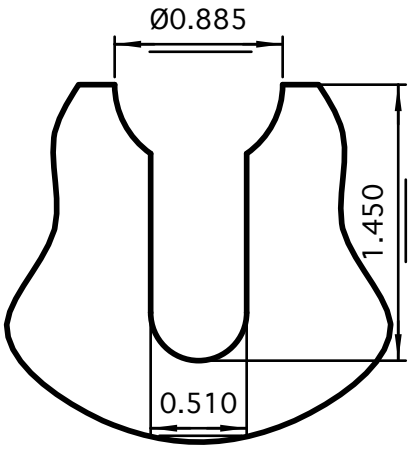


Figure 4: Cross-section sketch of typical fore-stock, showing dimensions of required inletting.

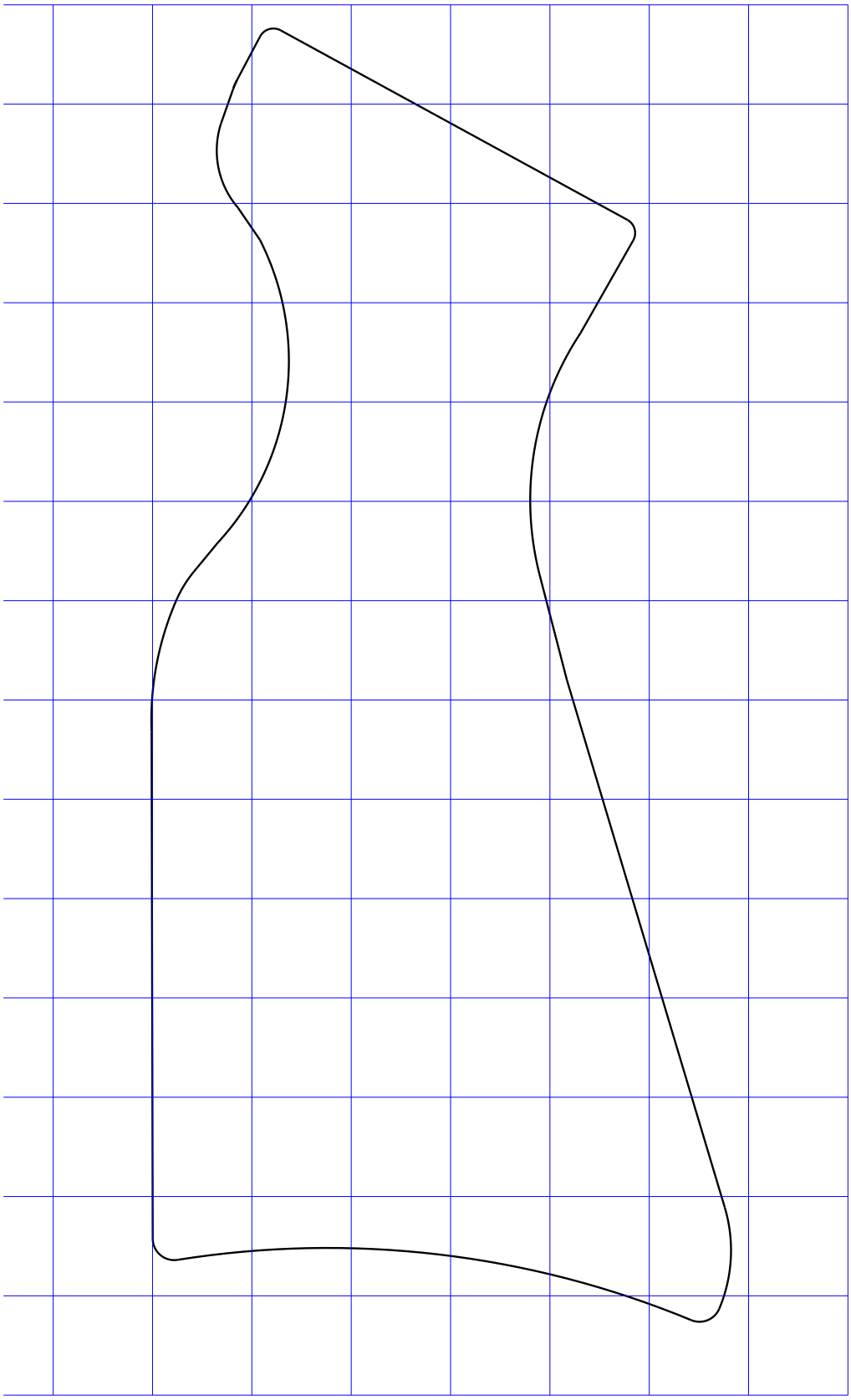


Figure 5: Template sketch for typical butt stock. Grid pattern measures 1-inch square.

TROUBLESHOOTING

Causes and solutions for some potential problems that could be encountered are listed below:

- **Problem:** Light strike: Cap fails to go off when hammer falls.
  Possible Cause(s) & Solutions: 1) Dud cap: replace the cap. 2) Dirt or fouling in the gun: clean the hammer, trigger, & receiver as directed in the maintenance section. 3) Fouling or spent caps caught inside the hammer shroud are cushioning the impact of the hammer: remove the fouling or spent caps from the shroud. 4) Worn out percussion cap nipple: replace the nipple. 5) Worn out hammer spring: replace the hammer spring. 6) Half-cock notch on hammer is hitting trigger as hammer is falling (this is most common on hammers that have been modified to provide a shorter, lighter trigger pull): outer surface of half-cock notch will need to be ground down slightly to eliminate the interference.
- **Problem:** Cap goes off but gun fails to fire.
  Probable Causes & Solutions: 1) Clogged flash-hole: clean the flash hole with a nipple pick. 2) Excessive accumulation of fouling in or in front of the breech plug: clean the breech as described in the maintenance section. 3) Gun is empty or bullet was loaded without powder: pull the bullet if possible/applicable and load the gun normally. 4) Moisture in the flash hole: firing another cap may dry out the flash hole enough to ignite the powder. Magnum caps are preferable for this. 5) Wet powder charge: treat like a ball loaded without powder.
- **Problem:** Hang-fire: gun goes off, but there is a noticeable delay between the explosion of the cap and the time the gun discharges.
  Probable Causes & Solutions: 1) Moisture in the flash hole: if this is the problem, usually the heat generated by the first shot dries out the flash hole and corrects the problem for subsequent shots. 2) Fouling in the flash hole: clean out the flash hole with a nipple pick. 3) Damp powder: use dry powder.
- **Problem:** Difficulty in loading: projectile is unusually difficult to drive down the barrel.
  Probable Causes & Solutions: 1) Oversize projectile or patch: use a smaller projectile or a thinner patch. 2) Fouling in the bore: clean the bore.
- **Problem:** Poor Accuracy. When loaded with patched round balls, a standard pattern muzzleloader typically delivers about 10 MOA accuracy, meaning it should shoot approximately a 5-inch group and 50 yards and a 10-inch group at 100 yards. If the accuracy is significantly worse than this, there are a number of possible causes.
  Probable Causes & Solutions: 1) Bullet is of poor quality/uniformity: use a better bullet. 2) Bullet is loose in the bore: try a larger diameter bullet, or use a thicker patch if shooting patched roundballs. 3) Dirty bore: clean the bore. 4) Gun doesn't "like" this load: try varying the powder charge to see if the bullet will shoot more accurately with a different charge. 5) Sights are loose: make sure the aperture thumb nut is secure and the aperture is not moving between shots. 6) User-error/flinching: To see if you have a flinch, have a friend load your rifle for you for several shots, sometimes loading it normally and sometimes with only a cap and no powder or ball. When shooting normally, the effects of recoil may mask a flinch response, but when you pull the trigger expecting the gun to fire and it doesn't, your flinch will be much more noticeable. Once identified, correcting a flinch is not necessarily easy and generally requires much practice. However, shooting lighter loads to reduce recoil and holding the gun firmly with good posture and proper body position will help to minimize the flinch response.

CONTACT

If you have any questions regarding your standard pattern muzzleloader, the best way to contact Atomic Rifling and Creative Operations LLC is by email at:

ARCO.LLC.Idaho@gmail.com

Telephone enquiries are also possible. However, the company does not employ full-time office staff; during working hours usually all the workers are in the shop, where it is difficult to hear the phone ringing, so chances are that your call will go to voicemail. If you leave a message, we will call you back. Our phone number is:

(208) 557-9024

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