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From Soup to Nuts, building an AK-47 Receiver Part II - Heat Treating

Article by Rob Summerhill (RapidRob)

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As stated in the [last section](#), all of the metal parts in the frame flat kit are not heat-treated. The use of the parts in the softened state will result in a short-lived, ruined receiver. A common misunderstanding with any of the AK type rifles is that the receiver has to be as hard as stone to hold the rifle together. This thought could not be further from the truth. The design of the AK-47 type rifles and machine guns is that the total force of the cartridge, while firing, is held with in the bolt and the barrel extension. The rest of the receiver is there to allow the bolt to move, provide a mounting of the barrel and it's extension, house the magazine, hold the trigger group together, and mount some sort of butt stock, if needed.

Heat-treating the metal parts is very easy to do. Each builder of these rifles has their own way of doing these steps. In this section, I will describe the steps I have used in the past with both good results and long wearing parts.

Needed items are:

1. A heat source that is capable of bringing the steel parts up to about 1,600 degrees.

I use an Oxygen / Propane torch with a small burning tip. A MAAP torch can also be used.

2. A water mixture or oil for cooling the hot parts;

3. Tongs or pliers to hold the hot parts; and
4. A way to extinguish an uncontrolled fire, if one happens.

The first step is to clean off any grease or oils used to lubricate the flats while bending in the jig.

At this point you will need to decide what type of coolant you want to use for the quenching of the hot parts. Water is just as good as oil for the sheet metal receiver. The metal is thin enough to allow very quick cooling with out warping if water is used. My preferred method is a mixture of four gallons of water, one pound of table salt and six ounces of liquid dish detergent. Any medium bodied oil, such as 20 weight motor oil, can also be used.

Remember, you will be placing red-hot parts into this oil and fire is a real threat while doing so. Have a way to douse the flames, if the oil catches fire during the hardening. Never use water to put out an oil fire.

Adjust your torch flame to where the inner white/ blue flame is about 3/8ths of an inch long. You do not want a flame so strong as to melt the steel parts or holes in the receiver. Keep the torch moving at all times while heating the part or holes. A circular motion works well while heating. Heat the part or holes until they are a bright yellow/orange color.



As you bring the up to temperature you will see the metal go from silver to gray, to deep blue then to start to glow a dull purple. Take note of this color. This will be the second tempering color you will need to do the annealing step. Continue to heat the metal, remembering to keep the torch in constant motion.



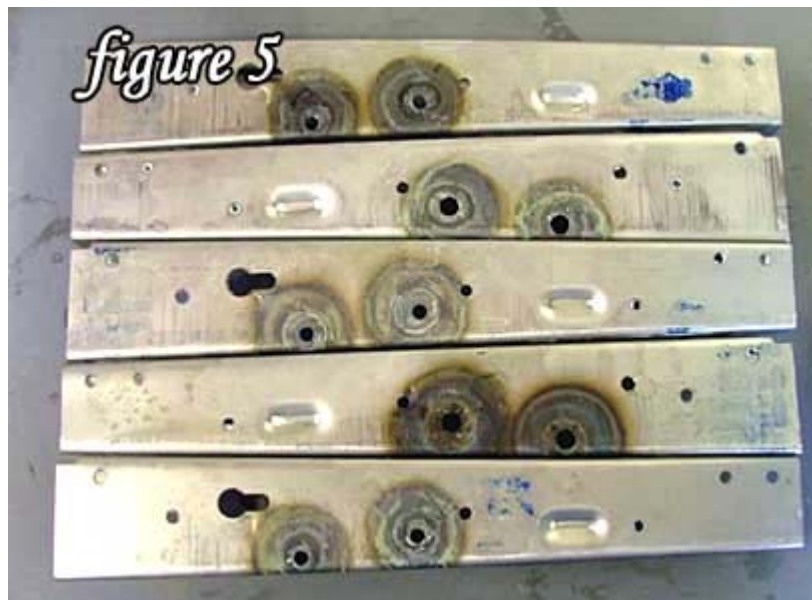
Here the metal is at the right temperature to harden the steel. Quickly dunk the receiver into the salt-water mix or oil, if you choose that method. Allow the metal to cool for a few seconds and then continue with the other three holes in the receiver.



The hole's that have the reinforcement dimples around them are the ones we are interested in for the heat-treating. You can do others, if you want, but do not do the forward holes for the barrel extension. These holes may have to be counter-sunk if you are using rivets to mount the barrel and butt stock assemblies.



Here is a photo of the coolant mixture. The salt in the water will form a thicker film to absorb the heat from the metal faster than just plain tap water. You may use what ever you like as a coolant.



Here are several receivers that have been heat treated for the first time. There will be a build up of a black scale on the surface of the steel. This scale will need to be removed before the next step. You can use steel wool or 400 grit sand paper to do the removal.



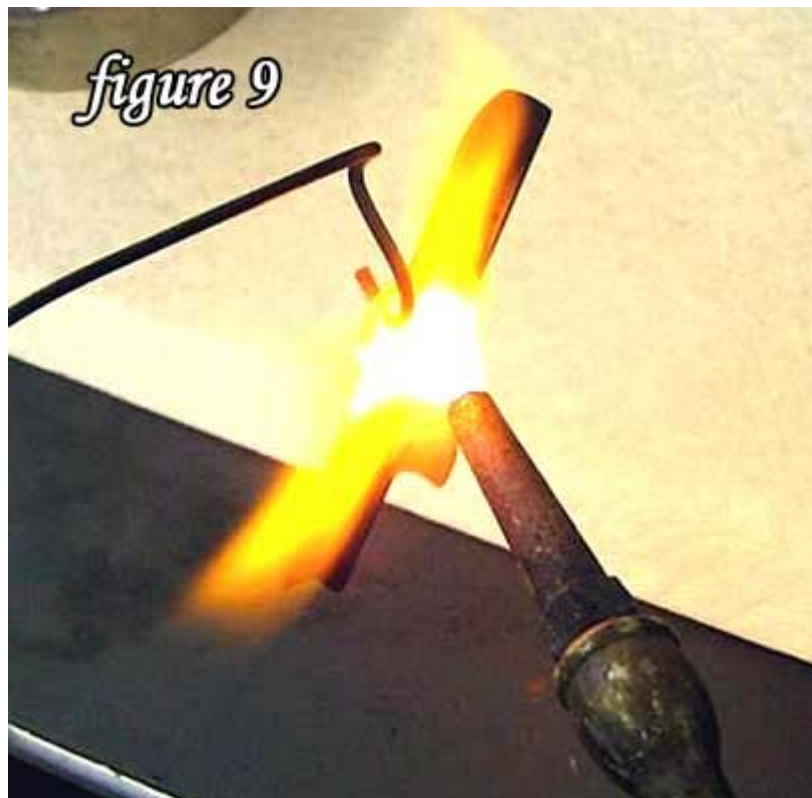
The scale has been removed, and the holes have been reheated to about 750-850 degrees F for the final annealing of the steel. When re-heat treating for the second time, the color of the steel will be a dull purple. Lay the part to one side and let it air cool. Do not use a coolant. The steel needs to be hardened but not brittle. When you first heat-treated and quenched the steel, the metal became very hard and brittle. If not annealed, the metal will crack after use. Note the two colors in the steel. This metal has been hardened to around Rockwell 90. The receiver should last for many years of use at the range.



The receivers have been “carded” off and polished ready for the next step. We now heat treat the two lower rails. The left rail is also the rifles ejector. Special attention will be made to ensure that the ejectors tip is hard enough to last for many thousand rounds.



I have made a bailing wire holder for the lower rails. This will allow heating and dunking into the oil without being splashed upon or burned. I am using oil instead of water for the purpose of illustrating a different technique of heat-treating.



Once again the steel is brought up to a bright yellow/orange color. The part is then immediately immersed into the oil bath.



As you can see, the steel has carbonized in the oil. At this point the part is too hard for our use. The part will be annealed to proper hardness later on.



All parts have had their initial heat-treating and are covered with scale. The cleaning of all surfaces is required for the next step.



The parts have been carded of the scale and are now ready for the annealing process.



figure 14

Many years ago I learned a Gunsmithing trick for the annealing of small parts. Small parts can be over or under annealed very easily and not hold up under normal use. The use of a burning oil will temper the steel as it burns away, leaving behind, a very consistent annealing of the steel.

This step requires an open flame of burning oil. Do not try this indoors or in high winds. I have set this pan on concrete, several feet away from any flammable objects. The rails are covered with Dot III brake fluid. A small amount of solvent has been placed on the surface of the brake fluid to ignite the mixture. A dry chemical fire extinguisher is on hand if needed.



figure 15

As the brake fluid burns away, the parts that are exposed to the open flames This

carbonizes the parts even further and the temper of the steel will be the hardest on the parts exposed to the flames the longest time. Dot III brake fluid burns around 750 degrees F. The oil takes 30 minutes to burn off and the parts will be very hard but flexible. The ejectors tip will be around Rockwell 90-95.



figure 16

You can see that the parts are hardened very evenly, and have a "case coloring" to them. While the parts are hard, they are not brittle. Both rails will add extra support to the sides of the receiver if the rifle is dropped. As before, the scale will be removed.



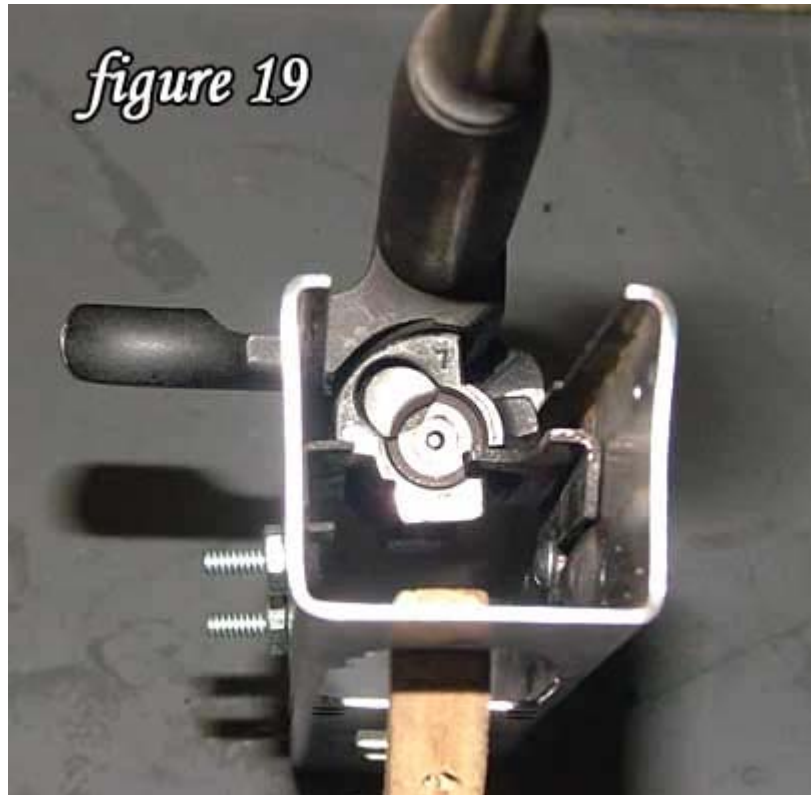
figure 17

The ejector has been cleaned of the scale and is ready for an applied finish. I will be spot-welding the rails onto the sides of the receiver. Dura-Coat will be used to finish the receiver.



figure 18

I have mounted the two lower rails to conduct a test fit of the bolt carrier assembly. 6/32 x 1/2" screws and nuts are used.



The bolt carrier assembly is now test fitted and checked for free movement. At this point no internal parts have been welded or riveted to the receiver.

In the steps above, you have seen for yourself how easy it is to flame harden the metal parts to build an AK-47 clone. Total time for hardening the receivers and all ten rails was less than one hour.

Next: Part three: Mounting the lower rails and completing the receiver.

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