POWER ENHANCEMENT

Head Gasket O-Ringing

BY **DAVE HAGEN** WITH **RYAN HUNTER**

Many performance engine builders are always looking for additional ways to improve their product and possibly provide a longer lasting engine. Always using new and possibly better engine fasteners than the original equipment is one option many routinely use. It would be hard to argue against using upgraded components improving engine durability but that also drains one's pocketbook. So, where is the biggest bang for the buck, well now you can start arguing in haste. If you're also raising the compression from the original engine design you may want to consider O-ringing the head gasket seal.

It's a well-known fact that head gasket failure is still one of the most common engine failures even on stock engines. Why is that? Well, we could talk about many reasons but it would be less of a concern if engine manufacturers used more and better fastener per cylinder in engine design. To enhance performance, on almost any engine, O-ringing the block or head and installing a quality wire is one option many performance engine builders use. Doing so will provide another barrier for the combustion chamber seal. One would then use quality fasteners, but, adding additional head bolt locations is not a very viable option.

The question has been asked many times, is it better to O-ring the block, or the head? In reality, it's really up to personal preference, but consider the options first. Or, in the case of using a copper head gasket, you may opt to do both the block and heads. If you've got a set of heads that are "one of a kind" or "way too expensive", it may be a better idea to do the block if another one can be obtained easier. Look at it as replacing the lesser of two evils if you wanted to convert backwards.

We asked shops interested about getting into this practice and came up with a short list of questions listed below and I hope to answer or comment on all of them by the end of this article.

> Is it better to O-ring the block or the head? In reality, it's really up to personal preference, but consider the options first…

- When is it better to O-ring the block rather than the head, does it really matter?
- Are there different cutting procedures for aluminum and cast iron components?
- What is the best placement of the wire in relation to the head gasket fire ring? (Outside edge, middle, inside edge etc.)
- What are the guidelines for wire protrusion for different applications, (diesel, gas, big boost, head gasket make, aluminum head vs. cast head etc.)
- Types of wire, SS only, thickness?
- I would like to know some hints on how to measure the wire when installing to get as little gap as possible when the wire is installed in the groove.
- As well as what the best trick or tooling is for installing the wire.
- Do you want to grind the ends flat?

As an example, we're going to go through the steps of doing the block and head, using a copper head gasket. First, it is imperative that your components are clean and dry so you can see what you're doing. If you're using a composite gasket in hand to make sure your groove locations are not going to any sealants applied to the gasket.

When installing O-rings there are two main considerations for placement:

A. The O-ring must be clear of the sealant beads on the gasket. This will determine the maximum outer diameter of the O-ring.

B. The O-ring diameter and location must accommodate bore opening and combustion

chamber size and shape, this will determine the minimum inside diameter of the O-ring.

1. Recommended O-ring protrusion is not more than 25% of gasket thickness (see Figure 1).

2. Gasket thickness .043", O-ring protrusion height is .008" to .010". This standard works with all thicknesses that are .050" and less. Gaskets that are thicker than .050" do not require O-ring height more than .012". NOTE: For extreme boost or heavy nitrous an O-ring -Receiver-Groove arrangement is recommended (see Figure 3).

When using a receiver-groove the wire may be higher than 25% of gasket thickness; the wire height and width will dictate the receiver groove depth and width by maintaining the relationships shown in Figure 3.

3. If the combustion chamber or bore is so large that the O-ring s will be placed less than .100" apart between cylinders, it is advisable to use a "figure 8" pattern for O-rings (see Figure 2). This allows for more even clamp load over the entire head surface.

4. New head studs/bolts are always recommended for proper gasket sealing. If used bolts are considered the threads must be in good condition or otherwise replaced. A thread die in good condition can be used to help clean the threads. A new bottoming tap can be used to remove old sealant and/or rust to clean the threads in block. If threads are tapped through the deck, use care in sealing the threads when installing them to prevent coolant migration up the bolt. If studs are to be used check for proper length so the nuts do not "bottom out". Always use quality hardened washers and thread lubricant to prevent thread galling.

5. As with any performance application it is strongly recommended that head bolts/studs be re-torqued. To do so, start the engine and allow it to reach operating temperature without placing any load on the motor. Shut down and allow the motor to cool to ambient temperature. With the engine cold and following the recommended torque sequence, one at a time back each fastener off just enough to relieve the friction set, then re-torque to specified torque value.

Once the head/block have been machined for the wire, placement of the wire can begin. Follow the steps listed

Figure 1 O-Ring in Block

O-Ring Groove

width for .041" wire = .038" to .040"
for .062" wire = .059" to .061"

depth if no receiver groove, set depth to allow .010" to .012" wire height but no more than 25% of gasket thickness

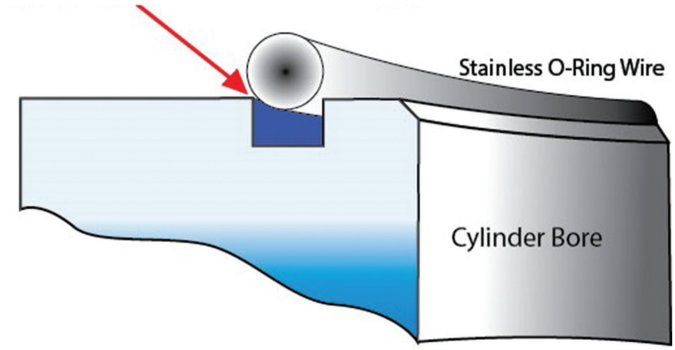


Figure 2 "Figure 8" O-Ring Example

The Figure 8 pattern is used for large bore engines where deck surface between bores is less than .200". The machined grooves intersect between bores (arrows) where a continuous O-Ring wire is installed, then smaller pieces of wire are fitted tightly at intersect points.

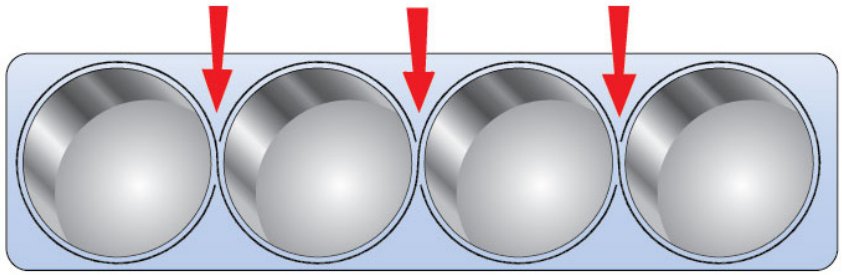
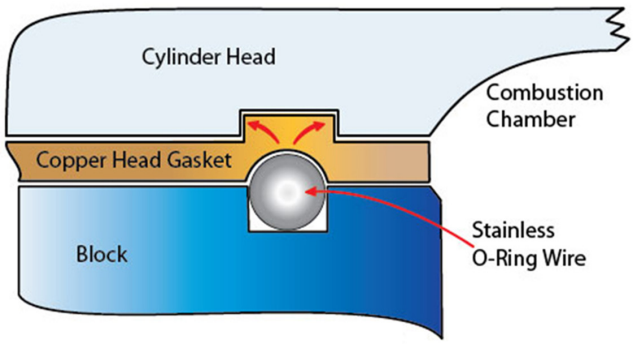


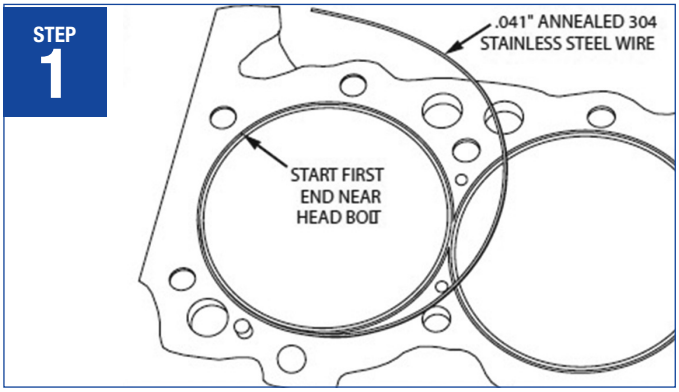
Figure 3 O-Ring in Block-Receiver Groove in Head

Receiver groove width should be 150% of wire width
Receiver groove depth should be 75% of wire width

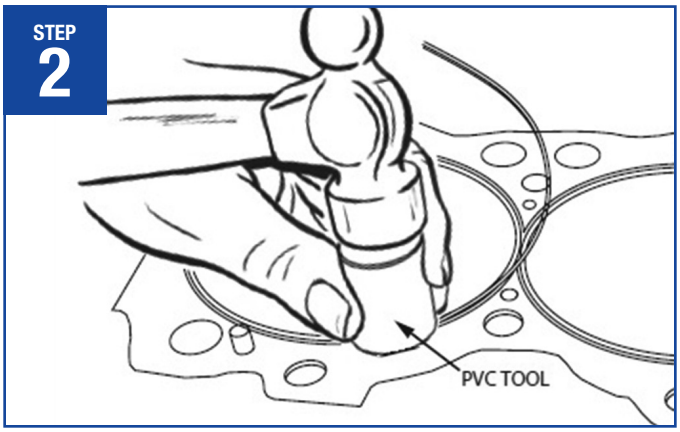
This will force the copper gasket to displace to the corners of the receiver groove forming an effective barrier against leakage in case the head lifts.



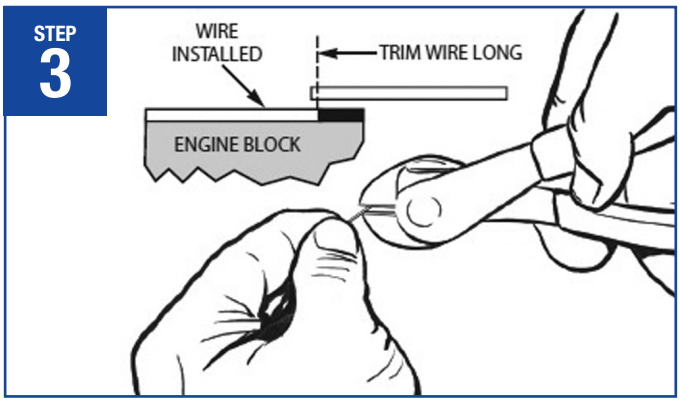
below, being careful not to kink or bend sharply the newly obtained SS wire. It wants to curl so use that feature to your advantage by not trying to straighten it out.



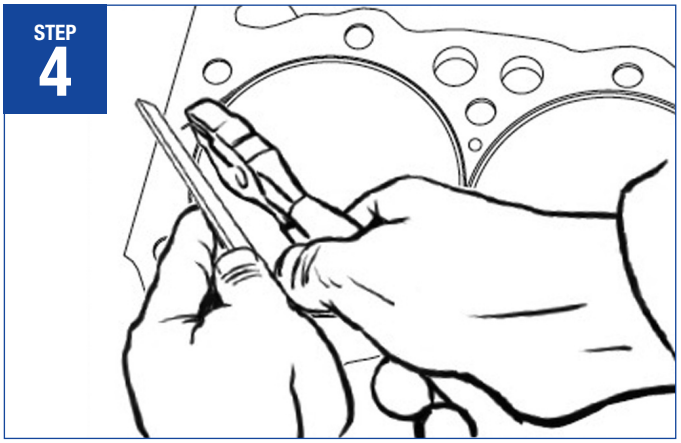
Trial fit and cut wire to an approximate length of circumference + 1.00". Using a pliers and a new fine mile file square the starting end and position that end near a head bolt hole. Then, lay it in the newly created track and circle it around in the racers' direction.



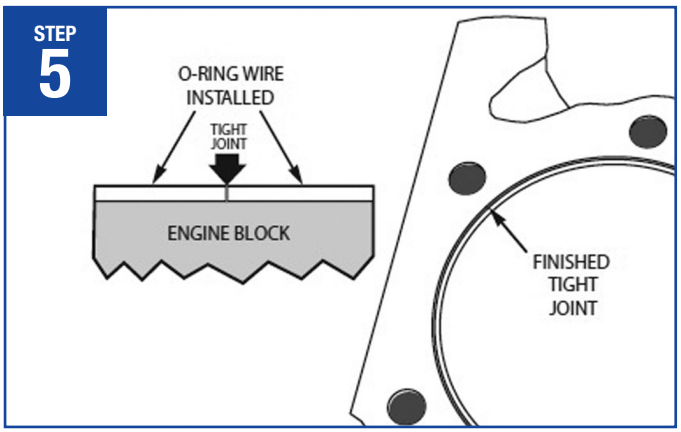
Seat the wire in the groove using a PVC tool as shown (Included in some kits), first with hand pressure and then going back with a more forceful impact using a hammer while trying to roll it into position. Doing so will evenly distribute hammer blows and prevent uneven flattening of the wire.



After working the wire almost all the way around the track, stop a few inches short and trim the wire slightly longer than the required length. This is in preparation for the final cut.



Using a wide face pliers and the new fine mill file, carefully hold the wire and file the end at a 90° angle till it is the exact length to make a tight fitting joint with the other end. Take your time, as you don't want a large gap here, which will force you to start all over.



Taking your time fitting the ends will come with practice and at some point you'll be able to get the joint so tight it is almost unnoticeable. You can then take pride in knowing you've done by hand one of the most important steps in sealing combustion in this high performance engine.■

We would like to thank Ryan Hunter from SCE Gaskets for their contributions to this article and suggest you contact them if you need gaskets and materials for "O" ringing your performance builds at scegaskets.com or (661) 728-9200.