Head Gaskets

Copper Racing Head Gaskets for Mitsubishi Inline 4 Cylinder Engines

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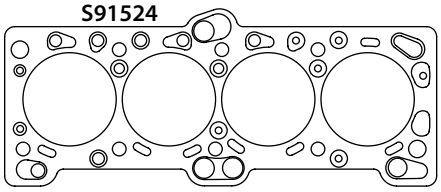

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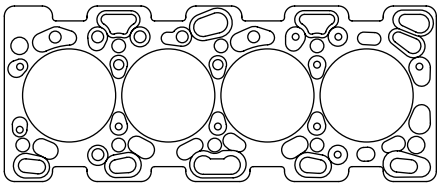

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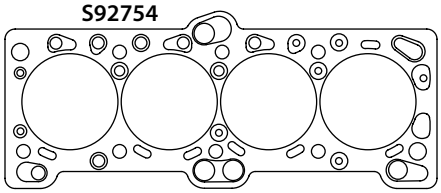

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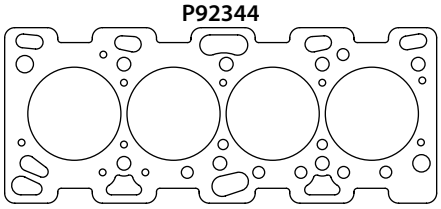

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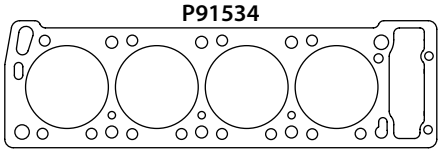

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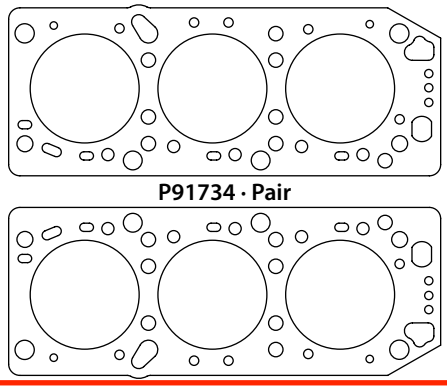


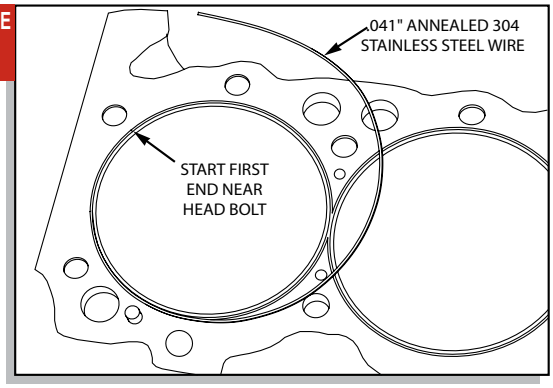
Engine Code Application	Bore	Thickness .021"	.032"	.043"	.050"	.062"	.072"	.080"	.093"
1989 & Later 2.0L 4G63 (T) DOHC except EVO	3.375" 85.7mm round	P91522	P91523	P91524	P91525	P91526	P91527	P91528	P91529
			T91523	T91524	T91525	T91526	T91527	T91528	T91529
				S91524	S91525	S91526	S91527	S91528	S91529
1989 & Later 2.0L 4G63 (T) DOHC Big Bore except EVO	3.437" 87.3mm round	P92752	P92753	P92754	P92755	P92756	P92757	P92758	P92759
			T92753	T92754	T92755	T92756	T92757	T92758	T92759
				S92754	S92755	S92756	S92757	S92758	S92759
2003 & Later 2.0L 4G63 EVO	3.437" 87.3mm round	P92672	P92673	P92674	P92675	P92676	P92677	P92678	P92679
			T92673	T92674	T92675	T92676	T92677	T92678	T92679
				S92674	S92675	S92676	S92677	S92678	S92679
2.4L 4G64 SOHC	3.437" 87.3mm round	P92342	P92343	P92344	P92345	P92346	P92347	P92348	P92349
2.6L 4G54 SOHC	3.670" 93.2mm round	P91532	P91533	P91534	P91535	P91536	P91537	P91538	P91539
			T91533	T91534	T91535	T91536	T91537	T91538	T91539
				S91534	S91535	S91536	S91537	S91538	S91539
1991-93 3.0L 6G72 DOHC	3.670" 93.2mm round	P91732	P91733	P91734	P91735	P91736	P91737	P91738	P91739

"P" Prefix: *Pro Copper for use with o-rings & sealant* • ***"T" Prefix:*** *Titan sealed coolant passages, for use with o-rings*
"S" Prefix: *ICS Titan sealed coolant passages, integral combustion o-ring* • *"P" Prefix supersedes "0" Prefix*

IN-BLOCK O-RING WIRE INSTALLATION INSTRUCTIONS

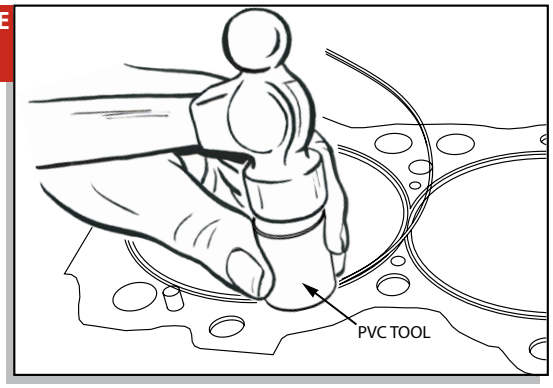
Step 1. When installing o-rings there are two main considerations for placement.
A. The o-ring must be clear of the sealant beads on the gasket where applicable. This will determine the maximum outer diameter of the o-ring.
B. The o-ring diameter and location must accommodate bore opening and combustion chamber size and shape. This will determine the minimum inside diameter of the o-ring.
Step 2. Recommended o-ring protrusion is not more than 25% gasket thickness Example: 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 -ring height more than .012".
Step 3. If the combustion chamber or bore is so large that the o-rings will be placed less than .100" apart between cylinders, it is advisable to use a "figure 8" pattern for o-rings. This allows for more even clamping load over the entire head surface.
Step 4. New head studs/bolts are recommended for proper gasket sealing. Threads must be in good condition otherwise replace, a die can be used to remove old sealant and/or rust. Use a tap to clean threads in block. If threads are tapped through the deck, use care in sealing threads to prevent coolant migration up the bolt. If studs are to be used check for proper length so nuts do not "bottom out". Always use quality hardened washers and thread lubricant to prevent galling.

FIGURE 1



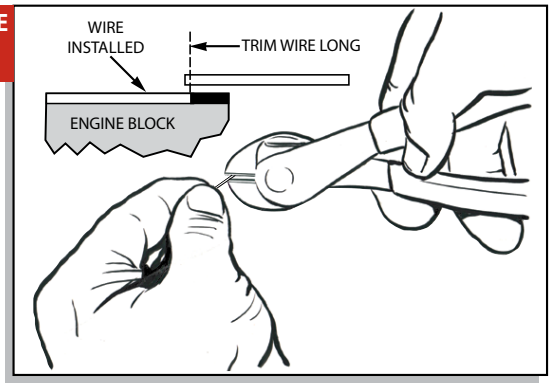
Trial fit and cut wire to approximate length +1.00". Using pliers and a fine mill file, square the starting end and insert near a head bolt.

FIGURE 2



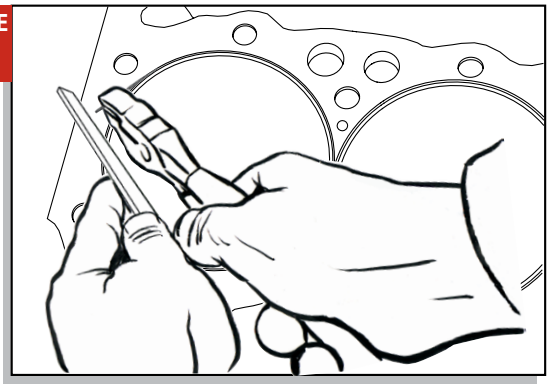
Seat the wire using the PVC tool provided in kit #31542. This will evenly distribute hammer blows and prevent flattening the wire.

FIGURE 3



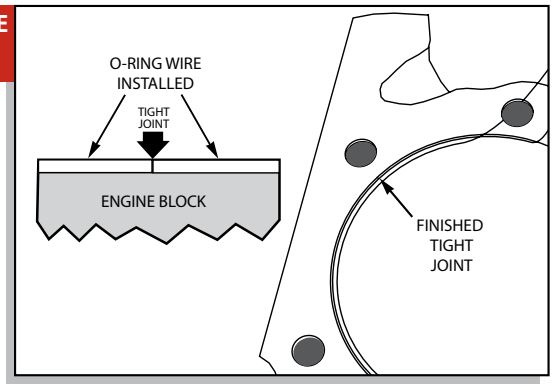
After working your way around the bore, stop a few inches short and trim the wire slightly long in preparation for final fit.

FIGURE 4



Next using pliers and fine mill file, carefully fit the wire making a tight joint. If the gap is too wide start over. There is enough wire in the kit #31542 for approximately 10 cylinders.

FIGURE 5



After a few tries you can get the joint so tight that it is almost invisible. You can then take pride in having done by hand one of the most important steps in sealing your high performance engine.

Titan™ Copper Head Gaskets

SAMPLE Part # T11064

Recommended uses: Racing Engines with Heavy Boost or Nitrous running liquid coolant.

NOTE: O-rings are required in the block or head, Sealant is not required.

STEP 1 - Before installing head gasket, visually inspect for shipment damage. Sealant beads must be continuous without gaps or scratches.

STEP 2 - Titan series head gaskets require o-ring combustion seals installed in the head or block. (p/n 31542 o-ring kit) Great care has been taken to allow as much room as possible for o-ring placement, if your o-rings are already in the head or block check to see that the sealant beads are clear of the o-ring. (Continue to step 3 below)

Pro Copper™ Head Gaskets

SAMPLE Part # P11064

Recommended uses: Extreme Racing Engines such as Blown Alcohol or Nitromethane.

NOTE: This gasket requires o-rings (receiver grooves may also be needed with extreme extreme boost or nitrous) and sealant for coolant or oil passages.

STEP 1 - Before installing the gasket perform a visual check to insure that no damage occurred during shipping. The gaskets should be flat and free of dents or scratches.

STEP 2 - All SCE copper head gaskets are annealed in a vacuum oven after the punching process to provide malleable gaskets which are ready to use, do not use a torch to soften the gaskets. (Continue to step 3 below)

The Following Instructions Are Common to Both Titan Copper Head Gaskets and Pro Copper Head Gaskets.

STEP 3 - 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.

STEP 4 - Recommended o-ring protrusion is not more than 25% of gasket thickness (SEE FIGURE 1 BELOW). Example: 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".

STEP 5 - If the combustion chamber or bore is so large that the o-rings will be placed less than .100" apart between cylinders, it is advisable to use a "figure 8" pattern for o-rings (SEE FIGURE 2 BELOW). This allows for more even clamp load over the entire head surface.

STEP 6 - New head studs/bolts are recommended for proper gasket sealing. Threads must be in good condition otherwise replace, a die can be used to remove old sealant and/or rust. Use a tap to clean threads in block. If threads are tapped through the deck, use care in sealing threads to prevent coolant migration up the bolt. If studs are to be used check for proper length so nuts do not "bottom out". Always use quality hardened washers and thread lubricant to prevent thread galling.

STEP 7 - As with any performance application it is strongly recommended that head bolts/studs be re-torqued. 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.

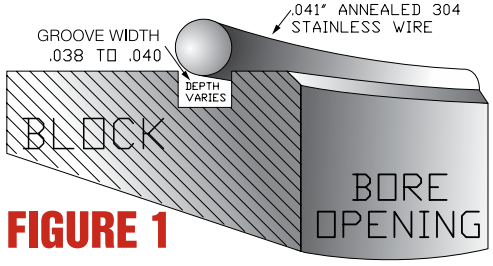
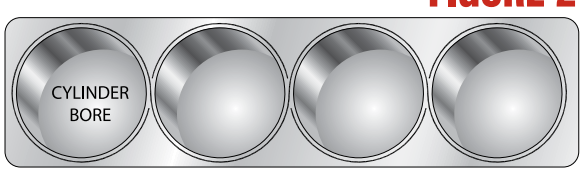


FIGURE 1

FIGURE 2



SERPENTINE WITH 2 HALF CIRCLE WIRE PATTERN

ICS Titan™ Self-Sealing Head Gaskets

Sample Part # S11064

Recommended uses: High Performance Street, Mild to Heavy Race, with Medium to High Boost or Nitrous.

Note: *Do not use o-rings, sealant (such as Copper Coat or Hylomar) may be used if desired.*

STEP 1 Before installing head gasket, visually inspect for shipment damage. Sealant beads must be continuous without gaps or scratches and the wire should not protrude out from combustion seal.

STEP 2 Gasket to head check, place cylinder head on a bench flat side up. Align new gasket on head in the assembled location, check to insure 360° metal to metal contact on combustion seal paying close attention to valve reliefs, see illustrations below.

STEP 3 Using extreme care, block and head mating surfaces should be scraped clean of any gasket material. Remove oil, grease, or sealant with proper cleaning solvent.

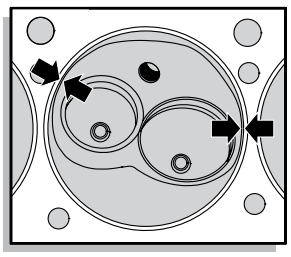
STEP 4 Check head and block mating surfaces to insure flatness within .002" using a steel straight edge and thickness gauge. If a sealing surface exceeds .002" out of flat, have the component resurfaced to an 80ra finish or better.

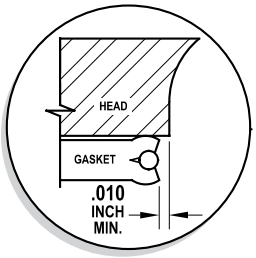
STEP 5 New head studs/bolts are recommended for proper gasket sealing. Threads must be in good condition otherwise replace, a die can be used to remove old sealant and/or rust. Use a tap to clean threads in block. If threads are tapped through the deck, use care in sealing threads to prevent coolant migration up the bolt. If studs are to be used check for proper length so nuts do not "bottom out". Always use quality hardened washers and thread lubricant to prevent thread galling.

STEP 6 If sealant is desired for street engines, apply a light coat of spray Copper Coat or Hylomar on both sides, then let the gasket set for at least an hour before installing. Position new gasket over locating dowels on block. Position cylinder head over dowel pins without disturbing gasket, Tighten bolts and torque in sequence per manufacturers' specifications.

STEP 7 These gaskets must be re-torqued. 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.

INSURE 360° CONTACT





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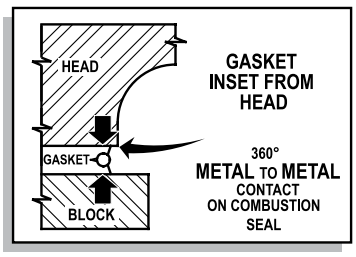

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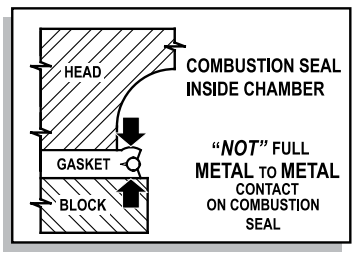


POWER ENHANCEMENT

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

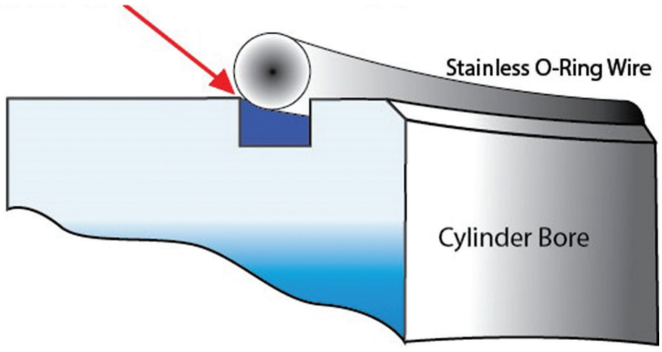


Figure 2 "Figure 8" O-Ring Example

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.

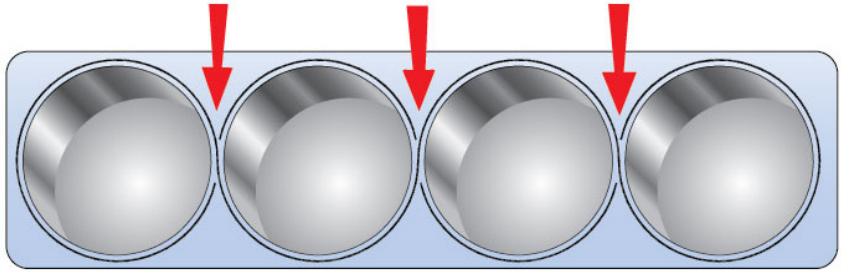
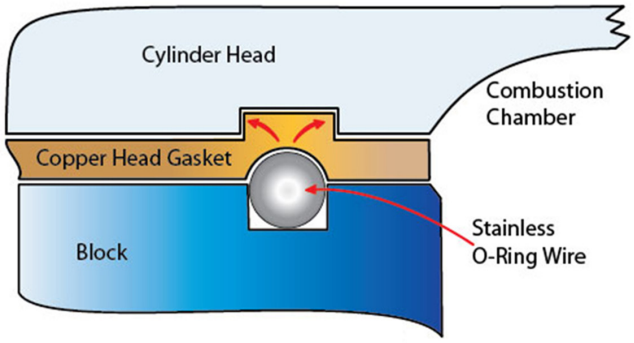


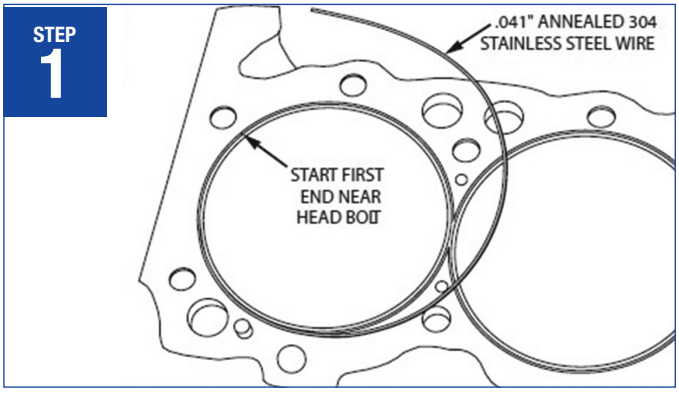
Figure 3 O-Ring in Block-Receiver Groove in Head

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

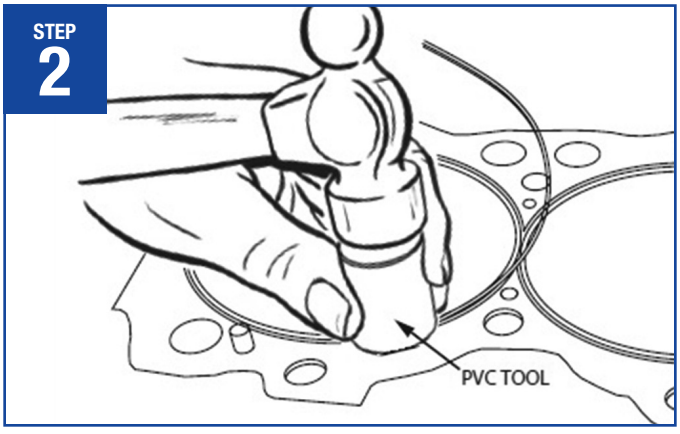
This will force the copper gasket to displace to the corners of the receiver groove forming an effective barrier against leakage in case the head lifts.



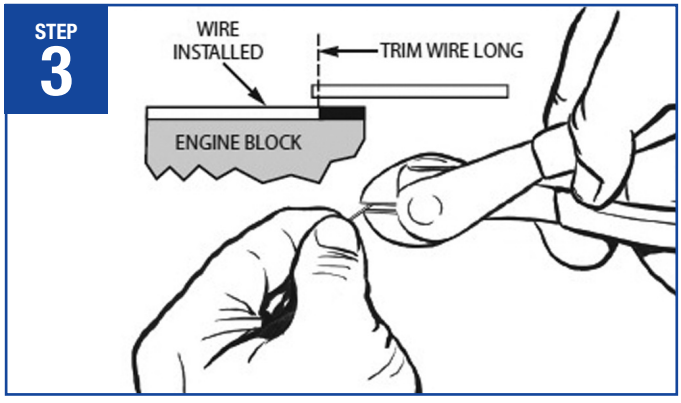
below, being careful not to kink or bend sharply the newly obtained SS wire. It wants to curl so use that feature to your advantage by not trying to straighten it out.



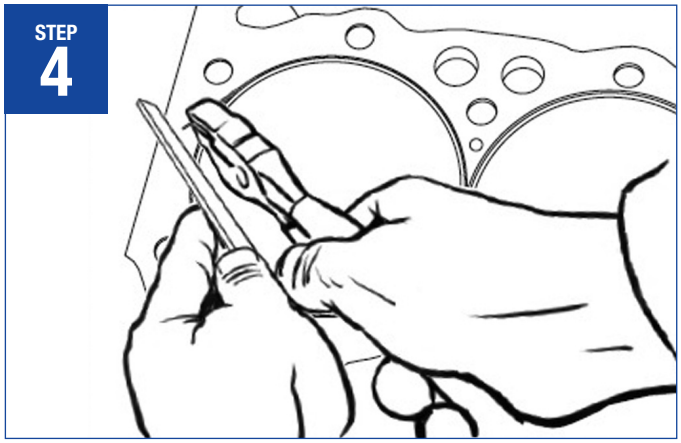
Trial fit and cut wire to an approximate length of circumference + 1.00". Using a pliers and a new fine mile file square the starting end and position that end near a head bolt hole. Then, lay it in the newly created track and circle it around in the racers' direction.



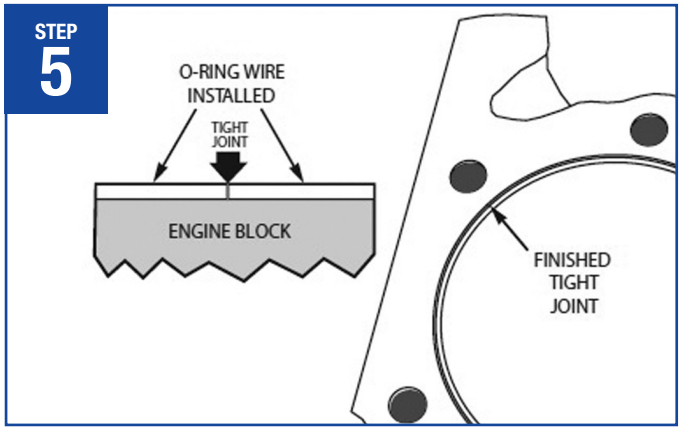
Seat the wire in the groove using a PVC tool as shown (Included in some kits), first with hand pressure and then going back with a more forceful impact using a hammer while trying to roll it into position. Doing so will evenly distribute hammer blows and prevent uneven flattening of the wire.



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.