

Port Matching

By David Suesz

Popular performance upgrades for smallblock Ford V8 engines typically include four-barrel intakes, upgrade camshafts, and dual exhaust. Of course, your upgrade intake and exhaust is largely wasted money if you are using stock, unported, 289 or 302 cylinder heads. The exhaust ports of these heads were a universally poor design, which seemed to get a little worse every year. These ports should be enlarged to match the manifolds or headers you are planning to use. Before you dismiss all this with "Well, my car has a two-barrel carburetor and single exhaust, so this will do nothing for me", rest assured that any smallblock Ford engine will benefit from this procedure. (all images may be enlarged clicking)



This is an unported head with gray shading where material is typically removed. Note the excessive iron around the edge of the opening, particularly at the top. This particular head has a thermactor injector cast into it, which is the thing inside the port which looks like a nose. This should be removed entirely, leaving a smooth curve. Other heads, designed for external injectors, have a thick, filled-in upper left corner, as shown in red below. The red represents typical areas that are cast too small on these heads, and must be removed to bring the ports up to the size and shape they were actually designed to have.

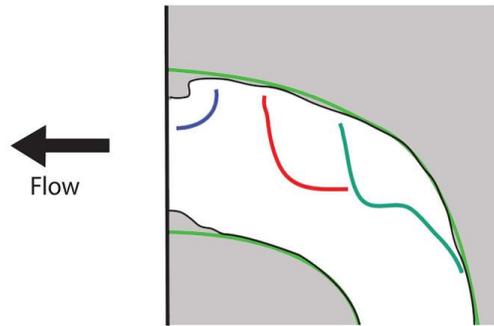


After reading extensively on the benefits of port-matching, I decided I had to do the heads on my 1965 289 High Performance engine. I did mine assembled, since they had fairly recently had the valve guides redone. Since it's only necessary to go 1/2" – 3/4" into the port, I packed them with paper towels before starting. You will need a air-powered or electric die grinder, and cylindrical ball-end and/or acorn-shaped mill. Even a grinding stone will do, since cast iron cuts pretty easily. Use an exhaust gasket that perfectly matches your exhaust manifolds or headers, mark the manifolds or headers, and grind off any irregularities. Using the same gasket, mark the exhaust port 1/16" smaller all the way around the opening, grind to this line, and begin blending into the port, for a smooth transition from the opening to the natural curve of the port design. 1/16" smaller (1/8" in total height and width) is necessary to prevent the escaping exhaust gas from hitting a "step", very detrimental to exhaust flow. After the porting is done, dump any debris out, and while the ports are facing down, Shop-Vac™ the ports clean, and pull the paper towels out.



This is a 289 High Performance head which has already been ported. The opening itself had been very restrictive, but it is not necessary to go deeply into the port, usually only 1/2" – 3/4" or so inward from the gasket surface. The improvement is astonishing.

Typical 289/302 exhaust port

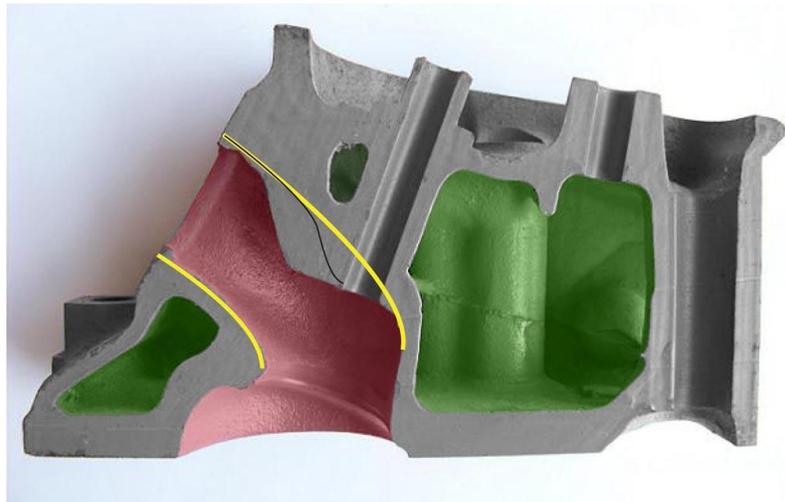


Gasket surface

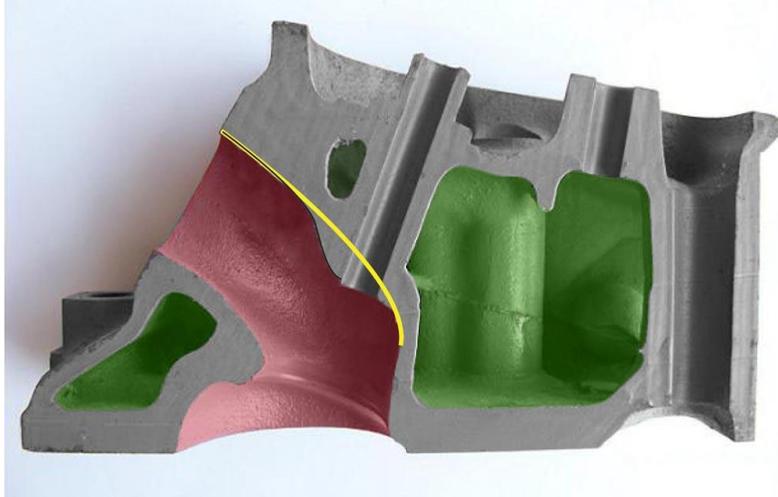
- Stock port wall
- Ideal port wall
- External type smog "bump"
- Internal type smog "bump"
- Valve guide

Glazier/Nolan Mustang Barn

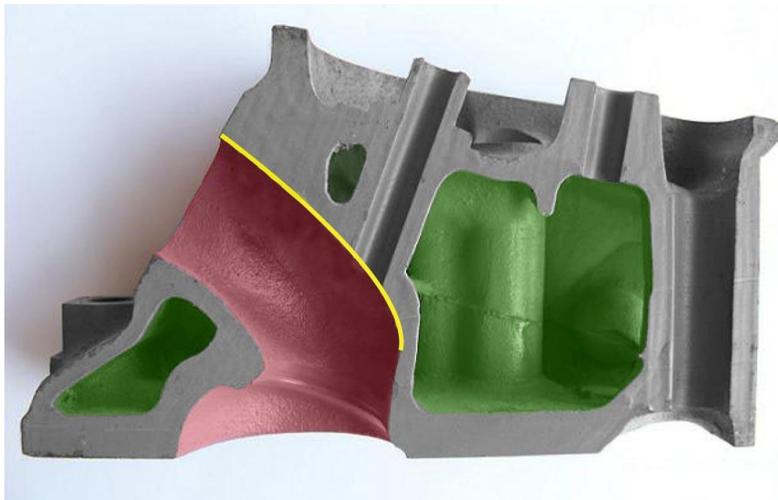
This is a cross-section of an un-ported 289 head with internal-type Thermactor (smog) pump injectors. The external type has a similar bump, but it's near the opening. Hard to say which is worse. The yellow line represents the ideal port shape, which is actually present in places, especially on either side of the boss provided for the valve guide, and the smog injector. The black line marks where you'll need to stop if you are doing an assembled head, or wish to leave the maximum possible valve guide. Note the constricted ring right at the opening where the port meets the exhaust manifold. This is sadly quite common. The photos above also illustrate this.



This head now has the constricted opening smoothed out, and the smog bump removed to the black line. This is a major improvement, so much so that a true "seat of the pants" increase in power will be felt.



This head has now been opened up to the full, ideal port design. Notice that since the original port shape is all we've cut to, we really haven't gone any closer to the water jacket, which was designed for this port shape.



One thing people often ask is "will I grind through to the water jacket?" While anything involving is possible when working on a sand casting, it is unlikely. Remember, you are only clearing the port to it's original design dimensions, and the water jacket was designed for that. If you are going deeply into the port, or trying to enlarge beyond the original design, anything is possible, so plan ahead and take care.



There is a lot to work with, though. Crane used to offer "Fireball" heads (shown above), which started out as over-the-counter Ford K code (and later J code) replacement heads, and Crane would dramatically open the exhaust ports, far beyond what I would recommend, especially since they then required special "Fireball" headers.

One odd thing is, the reproduction 289 High Performance exhaust manifolds are better than the OE in one respect. There are casting bungs on two passages on each side, which were used for core support when casting the originals. Problem is, the inner part of the bump is in exactly the worst place possible for exhaust flow. The reproductions have the outer bump for appearance, but since they are non-functional, the inside is smooth. You must grind these down (on the inside of the manifold) when using originals.

