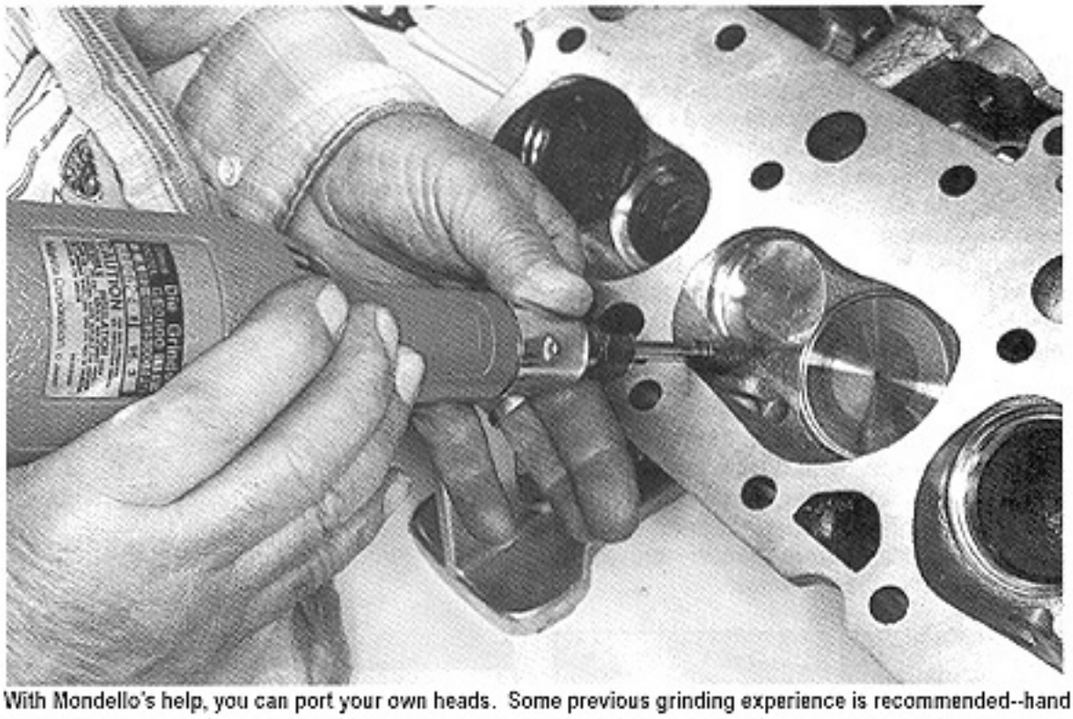
HEAD PORTING AT HOME



PHOTOS BY MARLAN DAVIS

With Mondello's help, you can port your own heads. Some previous grinding experience is recommended--hand control is important. Grinders like this 25,000-max rpm Makita unit (Mondello MG-600) work best when regulated by a variable-speed-control reducer, available from neighborhood electronics stores. Use the lower speeds until you gain the right "feel."

Professionally Prep Your Own Heads With Mondello's Home-Porting Kit

By Marlan Davis

Every racer knows the value of "trick" heads. It's no secret that professional-quality cylinder-head porting can unlock gobs of hidden power from virtually any engine. But even on the street, a set of ported heads can allow you to make enough power without resorting to a radical, un-streetable cam. Unfortunately, a good set of ported heads can cost several thousand bucks—until now.

Longtime cylinder-head porter and Oldsmobile-engine-guru Joe Mondello has developed a professional home-porting program that, with a little practice, permits a competent home mechanic with previous hand-grinder experience to achieve professional-quality results...right in his or her garage!

You start by sending one head (for a V-type engine) of a *matched* set of two to Mondello. Note the operative word "matched": Both heads must have the same casting numbers, valve sizes, combustion chambers, intake and exhaust runners and bolt flanges. A single factory so-called "service replacement head" is not considered a match for the original head if the casting number differs.

After receiving the head, Mondello will port a single intake port, exhaust port and combustion chamber, then rough-in the valve job. Then he'll send the head back, and you simply copy what Mondello did on the remaining ports and chambers.

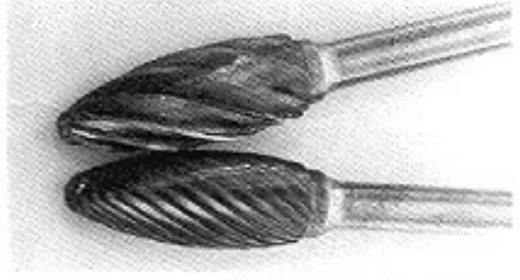
Mondello gets between $200 and $350 for prepping one chamber and its ports, with the price varying according to the extent of the porting (street/strip, bracket or full-competition). Cutting the seats for oversize valves, installing new valve guides, setting up the valvesprings or performing a full, three-angle valve job on one or all chambers aren't included in the base price but are available as extras. Nevertheless, even assuming all new valves and farming out a finished valve job to a competent shop, you should usually come out under $600.

Recently, we left our daily office grind and visited Mondello's Paso Robles, California, shop to scope out the new kits and find out what it takes to get a head. Follow along as we show you how to achieve a truly polished performance.

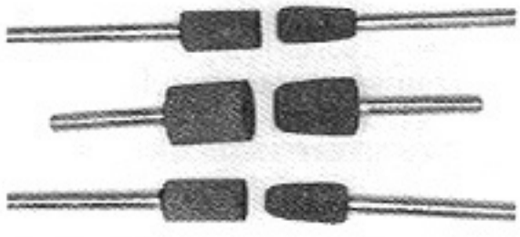
True Grit

Porting a set of cylinder heads requires more than a die-grinder plus an assortment of cartridge rolls. You'll also need carbide grinding burrs, various stones and flat grinding discs. Aluminum-head porting applications demand a special lubricant that prevents particles from clogging up the carbides and stones, plus carbides with a wider flute pattern. Although purchasing these materials from Mondello is strictly optional, his complete "one-stop" kits make life lots easier because they come with all necessary materials. Use the $129 kit PK-230 on cast-iron heads; the $135 PK-235 kit is for aluminum castings. Hint: Recoup your investment by doing all your buddies' heads!

Mondello includes everything you need for both shaping and porting the runners and chambers. Carbide-steel burrs and varying shape and grit stones are provided in addition to the usual cartridge rolls. The extra-long shanks can be shortened to a convenient length as needed for a particular job.



Carbide-steel burrs used with aluminum heads have wider flutes (top) than those used with cast-iron heads.



As delivered, the stones all have 90-degree corners (left). They must be reshaped as shown (right) to properly fit the port contours.

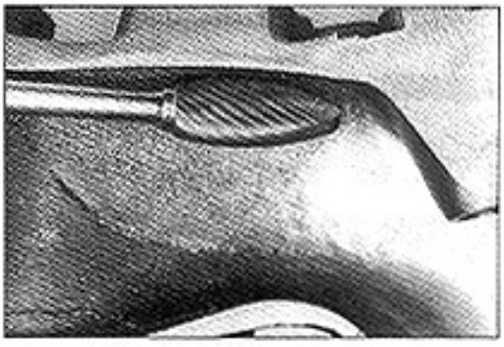
Reshape the stones using a steel-wheel stone dresser (such as Mondello's SD-240).

Introduction To Induction

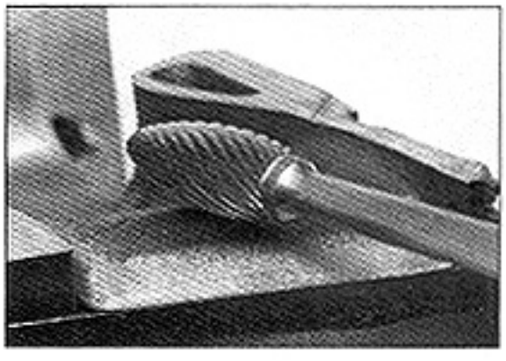
On the intake side, the most gains per amount of work invested will be seen in the valve-pocket and short-turn radius area. The idea is to smoothly contour the runner around the short-side radius, blend the roof to the valve-guide protrusion, smoothly transition and blend the square runner to mate with the round valve seat, streamline the valve guide, and round off and radius the sharp edges between the floor, roof and walls. Lesser gains are seen matching the intake-port entrance to the intake-manifold runner exit.

Because Mondello likes to run a constant ¾-inch radius, he supplies ¾-inch radii carbides. The carbides' overall shape doesn't wear down, so always do the rough shaping and contouring with the carbides, and you'll consistently maintain the desired ¾-inch radii. The egg-shaped carbide works well for the short-turn radius, roof and valve-pocket areas. Use the round-nose carbide around the pushrod tube turn and in the intake- and exhaust-flange areas. Radius the roof and floor to the walls using the flame carbide.

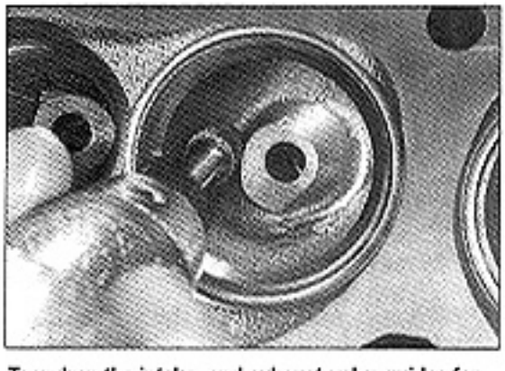
Employ the stones and cartridge rolls to blend and polish, respectively. Start with the bigger stone, then use the smaller stone and finally the cartridge rolls, coarsest to finest. As a cartridge-roll tip wears down in use on the big areas, the now-worn roll can be used to get into the finer areas.



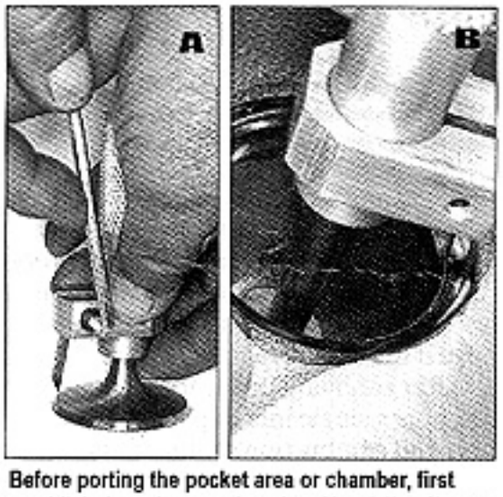
The banana or flame-shaped carbide works well along the full body of the intake runner from valve guide to intake-opening flange. It's especially important to smoothly radius the corners where the floor and roof join the vertical walls of the runner.



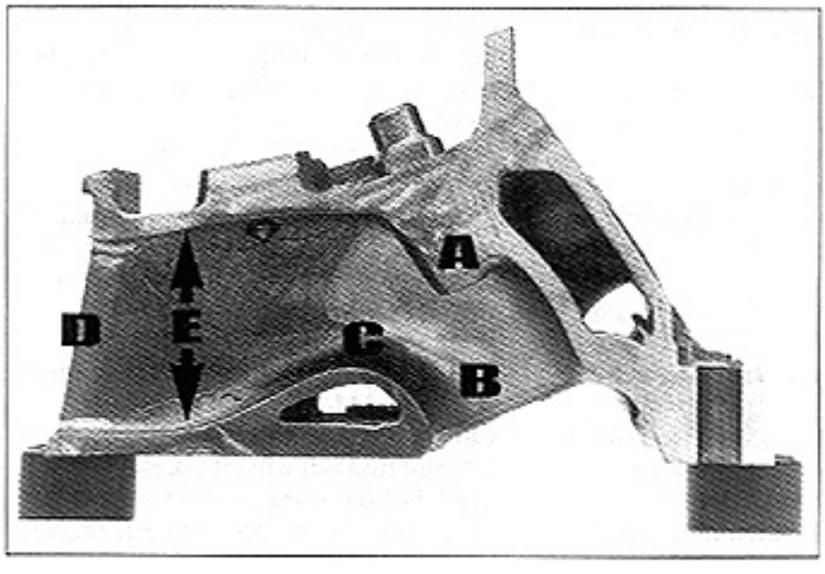
Use the round-nose carbide to open up the intake-runner entry and exhaust-port exit, to tear-drop the valve guides and for the beginning approach around the pushrod tube.



Tear-drop the intake- and exhaust-valve guides for max area and flow around the guide using the round-nose carbide.



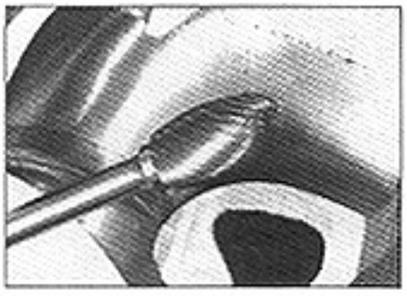
Before porting the pocket area or chamber, first establish the valve-seat location. Mondello offers a $59 scribe tool with pilot (VST-405) that positively transfers the valve-head diameter (A) to the valve seat (B). Then protect the scribed-seat location with duct tape before porting the valve-pocket area.



A typical small-block Chevy street/strip intake port: Mondello streamlines the valve guide area (A), blends the runner into the valve pocket (B), contours the short-turn radius (C), opens up the entry to match the standard intake gasket outline (D) and radiuses the vertical walls to the roof and floor (E). On a street/strip intake port, it is not necessary to polish the entire port.

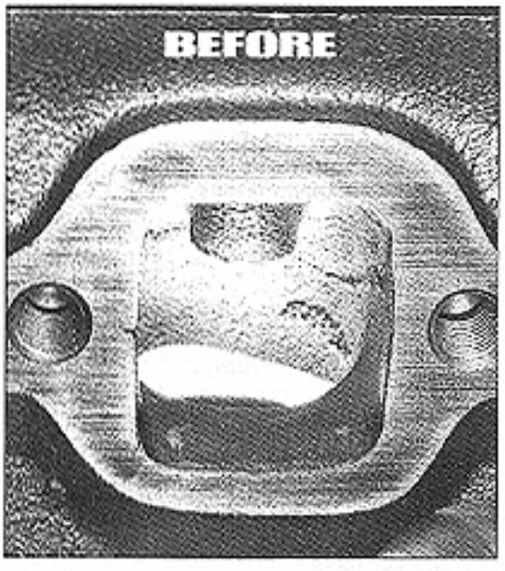
Exhaustive Work

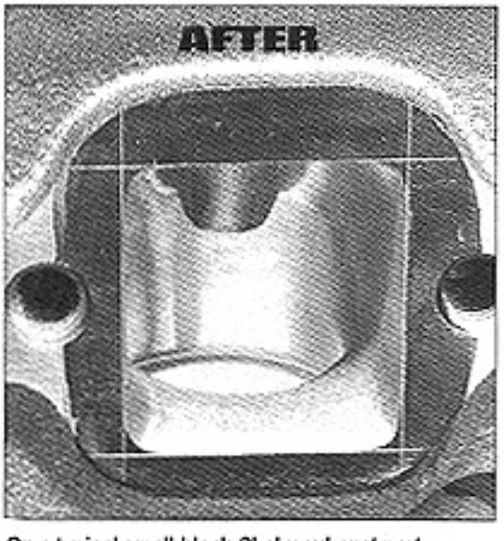
The same, basic procedures used to port the intake hold true on the exhaust side. However, fully polishing the exhaust side is important for achieving optimum performance, even on a street/strip job. Raising a small-block Chevy's exhaust-port roof approximately 0.100 inch from its stock location definitely adds power.



Shape the short-turn radius on the exhaust port with the egg-shaped carbide. However, the round-nose carbide works better near the port exit and around the guide.

After contouring and radiusing the ports using the carbides, employ the stones to smooth and blend. Leave the cartridge rolls for final polishing.





On a typical small-block Cheby exhaust port, Mondello slightly raises the roof, opens up the port exit all the way around, radiuses the wall/floor/roof corners and streamlines the valve guide. Deburr and polish the entire exhaust port.

Star Chambers

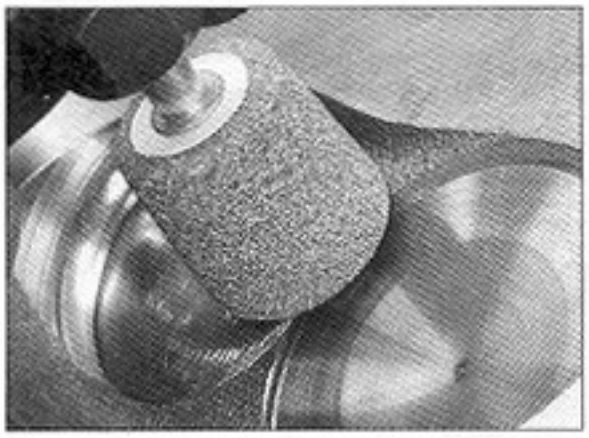
Fully polish the chamber and port the runners before doing the final valve job. But first protect the machined deck surface near the chambers with racer's tape. Safeguard the valve seats using old valves that have been thinly refaced. The valves should sit approximately 0.020 inch above the valve seats; mask the valve as necessary to achieve this.

Begin contouring the chamber using the egg-shaped carbide to shape the back wall of the chamber, blending the machined and cast radii together. There should be a smooth, gentle radius that extends from the valve seat to the deck. Blend and shape the cast "bump" near the spark-plug hole.

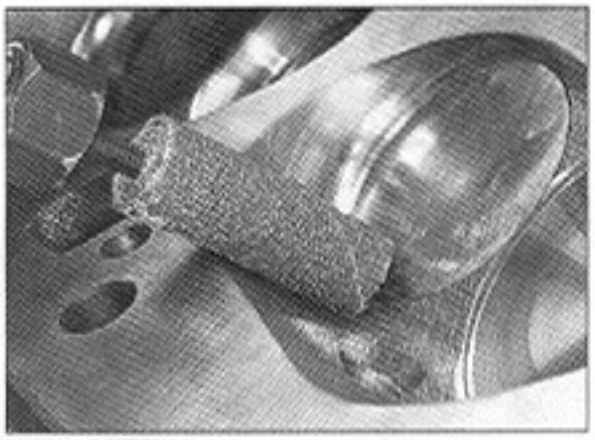
After properly radiusing the red-cupped stone with the stone dresser, use that stone to clean up the close-side radius, and flatten the floor between the valves. Final-blend and polish the chamber using progressively finer sanding disks and stones.

Blend in the back wall of the chamber with a round-nose stone that's been properly shaped to match the wall radius and angle.

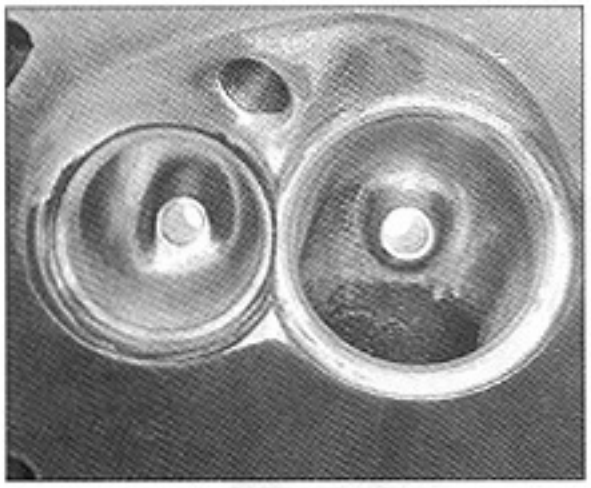
Take a 40-grit disk, install it on the disk pad, and—so it won't cut into the chamber wall—break/bend the disk edge with your thumb. Use the disk to final-blend the flat portion of the chamber floor to the chamber walls.



The red stone's "cup" prevents the stone from jumping out of the chamber when it's used to flatten the floor between the valves.



For final-blending and polishing the back and sidewalls, use progressively finer-grit round cartridge rolls.



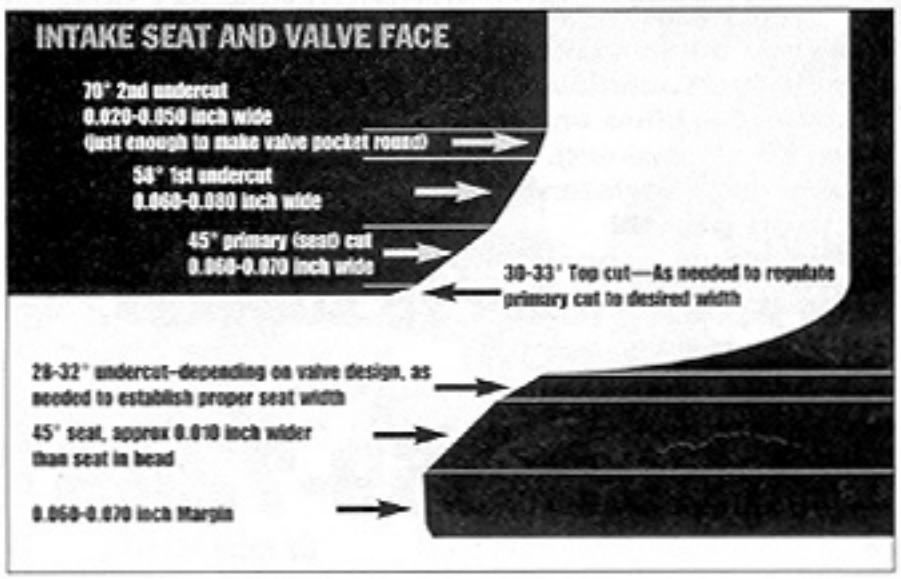
The advanced heart-shaped combustion chamber on this World Products' small-block Chevy head has been fully polished. The back wall is laid back and radiused, and the spark-plug boss smoothed out. Note the streamlined valve guides.

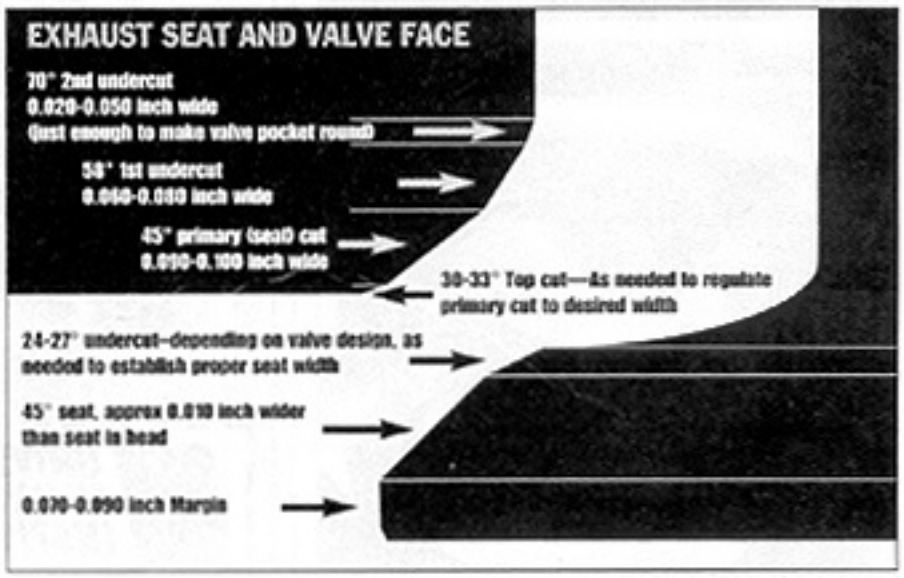
Quick Tip

When reworking cylinder heads cast before the early '70s, it pays to add hardened exhaust-seat inserts to withstand the effects of unleaded gas. Later heads are okay because they were manufactured with induction-hardened seats.

In the same vein, Mondello cautions against the use of solid-bronze valve guides in unleaded gas applications. Unleaded fuel has no lubricity; eventually the valve seizes in the guide. Instead, use thin wall bronze K-Liners or cast-iron or knurled-steel guides, along with hard-chrome-stem stainless-steel valves. Set stem-to-guide clearance at 0.015-0.002 inch on the intake and 0.002-0.0025 inch on the exhaust.

Seating Arrangements





Mondello feels that a quality, uniform, multiangle performance valve job requires precision tooling not available in the typical home workshop—farm it out to a competent local shop. Most engines respond to the angles and widths shown in the diagram. The exhaust seats should always be wider than the intakes, both for longevity and to pull more heat out of the valve. Make the valve-seat contact point approximately 0.010 inch wider than the seat in the head. Back-cutting a 45-degree seat-angle intake valve helps narrow the seat and improve flow. Back-cutting the exhaust doesn't seem to help flow but is acceptable as a last resort to establish proper valve-head seat-angle width as required to avoid too thick a margin. CC

Source

Mondello Performance Products, Inc.
Dept. CC
1103 Paso Robles St.
Paso Robles, CA 93446
805/237-8808