Engine Porting and Polishing
What It Is?

“Porting” or “Port & Polish” refers to the reshaping and smoothing of the intake and exhaust passageways in engine cylinder heads.

Polishing heads, or removing flaws that restrict airflow, is not difficult or costly. Beginners can polish their engine and realize horsepower gains of up to 10%!

Safety

Polishing cylinder heads, when done properly, is safe and a straightforward task. However, you must take precautions to protect yourself as well as your engine.

Safety Goggles, Dust Mask, and Gloves must be worn at all times. Also avoid loose-fitting clothing, jewelry, or long-hair. Polishing involves removing metal with a high-speed die grinder. It is essential that you, and anyone else helping or watching, wear proper safety equipment to avoid injury from any flying metal particles.
Basics

Basic cylinder head polishing on OE cast iron heads can produce respectable performance gains. Removing the flaws and imperfections that are found on OE heads and manifolds can improve air flow, allowing more air to reach the combustion chamber. As more air reaches the combustion chamber, you can add more fuel, increasing your engine’s horsepower!

There are typically three main areas which restrict air flow:

1. Rough Casting
2. Unmatched Passageways
3. Combustion Chamber

Addressing these three problematic areas can make a big performance gains!

Throughout this project, we want to remove as little material as possible. Air flow is more sensitive to shape rather than overall size. Over-enlarged ports will not increase your horsepower. Haphazardly grinding-out your ports will weaken your heads, potentially causing leaks or cracks.

Reshaping or redesigning ports is a much more advanced processes that requires a higher degree of scientific methodology and equipment to redesign the cylinder heads. However, if you are building a race motor and want to reshape ports and valve guide bosses, Eastwood sells many different carbide burrs that you can use.

Procedure

Polishing is not an expensive job but it does take time and patience. Polishing is a great winter project, especially if you are already working on your engine. Typical V8 cylinder heads take 12 hours to polish.

- Match the Intake Port Entry & Gaskets
- Polish the Intake & Exhaust Valve-Guides Areas
- Polish the Exhaust Ports
- Polish the Intake & Exhaust Runners
- Polish the Combustion Chambers
- Match the Intake Manifold
Tools

The Eastwood Company offers all of the tools and materials you need to port your engine!

Grinder’s Grease
Abraive cartridge rolls and carbide bits often load up, reducing their cutting ability. This all-natural lubricant keeps your cutting tools clean for fastest work. A must for cutting aluminum and other soft metals; 8 oz. tube. NOTE: The Grinder’s Grease is supplied in a semi-hard state. The friction of spinning buff, felt or burr melts a small amount onto the abrasive.

Mandrels for Abrasive Rolls
For abrasive rolls with 1/4” arbor hole. Fits in standard die grinders, both electric and pneumatic.

Specialty Carbide Burrs
These burrs really speed up the porting and polishing process! Use the double cut, heat treated, carbide precision ground burrs with either 3” or 6” long length shafts. 20,000 max RPM.

Shape and deburr quickly
Carbide burrs mounted on a 1-1/2”L - 1/4” dia shaft.

Engine Porting Kit
This kit contains all the abrasive rolls and mandrels you’ll need to port a set of V8 heads! Includes (20) tapered 80-grit rolls, (20) cylinder 80-grit rolls, (2) 4” mandrels, and (2) 6” mandrels. Simply attach the mandrel to your electric or pneumatic die-grinder and screw on an abrasive roll. (Grinder maximum RPM 18,000). For Iron or Aluminum heads.

Abrasive Rolls
Extra rolls for your project! Choose 80 grit (coarse), 120 grit (medium), 240 grit (fine) or 320 grit (extra fine). When working on aluminum or other soft metals, use Grinder’s Grease for a smooth cut.

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Getting Started

If this is your first porting job, we highly recommend that you find junk engine heads to practice on (preferably from the same engine). Practice operating your die-grinder so that it removes metal in a smooth and controlled manner. Use a regulator to keep the RPMs below the max speed. This will ensure a smooth and even finish while removing as little metal as possible.

If you are working on aluminum heads, remember that aluminum will abrade much faster than cast iron.

After you begin to feel comfortable using your die-grinder and abrasive rolls, completely clean your 'good' engine heads. They will need to be cleaned using an abrasive blaster, wire-wheel brushes, or taken to a shop to be “hot-tanked”.

Once your heads are cleaned, carefully check for cracks and have them “pressure checked” for leaks if they are suspect to damage. Repair any damage before continuing.

You will need the following:
Intake manifold gaskets that will be used on the engine
Intake manifold bolts
Exhaust manifolds that will be used on the engine
Old valves that fit in your heads (these will protect your valve seats from damage)
A metal scribe or finishing nail
Safety glasses, gloves, and a dust-mask
Step 1: Match the Intake Port Entry and Gaskets

Attach the Intake Manifold gasket to the head with the manifold bolts. Be certain that you have properly installed this gasket.

Using your scribe or finishing nail, outline the shape of the gasket onto the head.

Remove the gasket and grind away any material that is within your scribe lines. Enlarging these ports will allow the air to flow easier as they enter the head from the intake manifold.

Step 2: Smooth the Intake and Exhaust Runners

Once you have enlarged the entry ports, begin working into the runners. Use your abrasive rolls to have a smooth transition between the entry port and the runner.

Look and feel down into each port for casting flash or other rough spots. Grind away any casting flash or rough spots you encounter, removing as little metal as possible.

Once all of the rough areas are grounded down, smooth and blend the entire runner so it is a smooth, continuous surface.

Intake runners are to be smooth, however, do not use an abrasive roll smoother than 80-grit. If the intake runners are polished to a mirror-like finish, the air and fuel may not atomize correctly.
Step 3: Polish the Intake and Exhaust Valve-Guide Area

You will find sharp edges on your short-side radius. These edges cause a lot of turbulence. It is very important to grind them down as these edges cause a lot of air turbulence.

When grinding short side radii, your grinder will be very close to your valve seats.

**BE VERY CAREFUL NOT TO TOUCH THE VALVE SEAT WITH ANY MOVING PART OF YOUR GRINDER!**

Touching the valve seat may result in an unusable valve seat, which will require a machine shop to repair.

Step 4: Polish the Combustion Chambers

When polishing your combustion chambers, keep your junk valves in the heads to protect the valve seats.

Combustion chambers often have sharp-edges that can cause pre-ignition. Smooth these edges, removing as little metal as possible.

As you work into the bowl, smooth the casting. Tapered abrasive rolls work well in this situation.

Remember that any metal removed from the combustion chamber will proportionately reduce your compression ratio.

**DO NOT use carbide burrs when working in your combustion chambers.**
Step 5: Polish the Exhaust Port

Polishing the exhaust port is similar to the intake port, however, we want a much more ‘mirror-like’ finish. Exhaust gases, containing carbon, build-up on exhaust port walls, restricting air flow. The ‘mirror-like’ finish will help prevent future carbon build-up.

We offer abrasive rolls in 240 grit and 320 grit which can achieve a very smooth, polished finish.

Almost all manifolds and headers have larger port sizes than the heads. This causes the exhaust to ‘step’ down as it exits the engine. This ‘step’ helps prevent exhaust gases from flowing back into the engine. In the rare case that your manifold or header has smaller ports than the head, you will want to port-match the manifold or headers (similar to step 6).

Step 6: Match the Intake Manifold

Like the intake port, clean the gasket surface, attach the new gasket, and outline the gasket with a scribe. If there is a lot of metal within the scribe lines, use a carbide burr. Otherwise use your abrasive rolls.

Clean Up

Once you are finishing polishing, clean the engine heads very well. Do not want any metal debris inside! Wash the heads thoroughly with hot soapy water and, while wearing safety glasses, blow them dry with compressed air. Be very careful of flying metal debris!

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