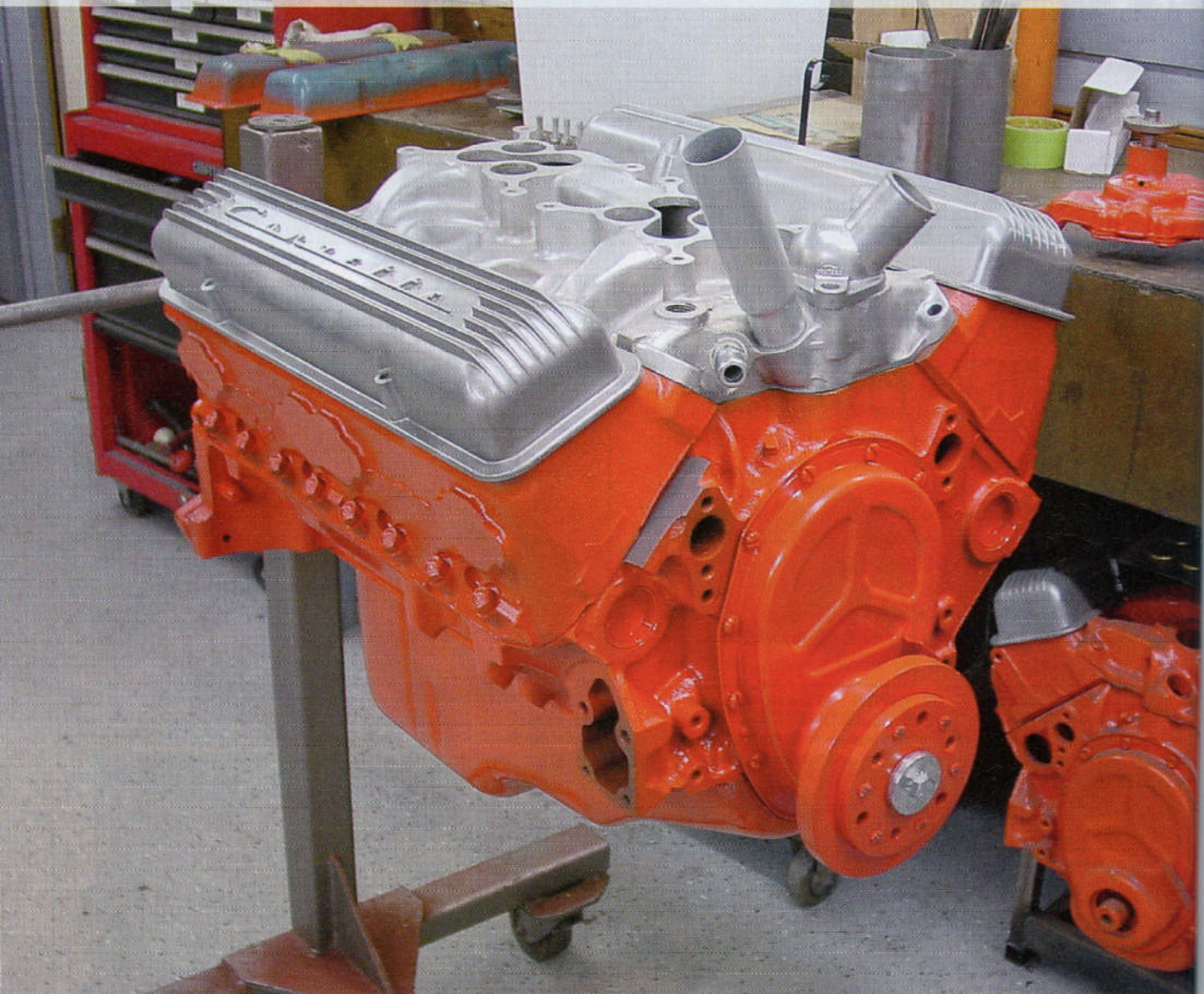


■ TECHNICAL REBUILD THE RIGHT WAY



Rebuild the right way

BUILDING BETTER THAN NEW HAS NEVER BEEN EASIER

BY JOHN HINCKLEY

Eventually, it happens to every 30-40 year-old engine; it seems down on power, throttle response isn't as crisp as it used to be, oil consumption is increasing, you're beginning to see some blue smoke, it doesn't respond to your tune-up routine like it used to, and compression and leak-down tests confirm that the old engine is just plain tired; it's time for a rebuild.

What do you do and where do you go to get a quality rebuild from someone who understands the unique aspects of rebuilding vintage restoration engines? In

the Detroit area, you might choose Motor City Muscle, a division of D&S Engine Specialists in Clawson, Michigan. D&S has been in business for over 20 years,

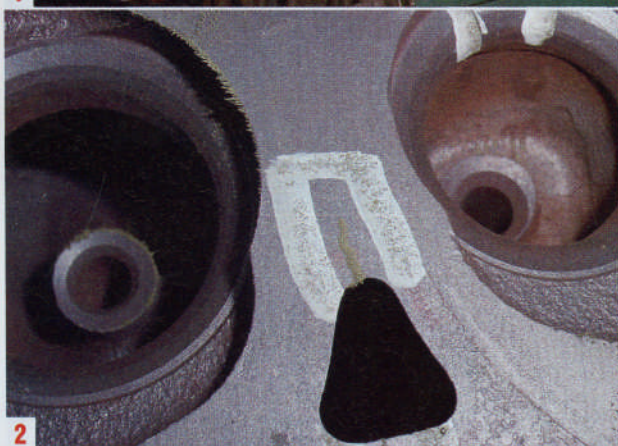
and their Motor City Muscle division specializes in numbers-matching original appearance rebuilds with varying levels of performance improvement.

Although you'll find everything from Triton V-10 truck engines to 2.5L cast-iron "Iron Duke" four-cylinders for U.S. Postal Service trucks on the D&S receiving dock, Motor City Muscle's specialty is vintage engine restoration. We spent a day with owner Mike Henderson and

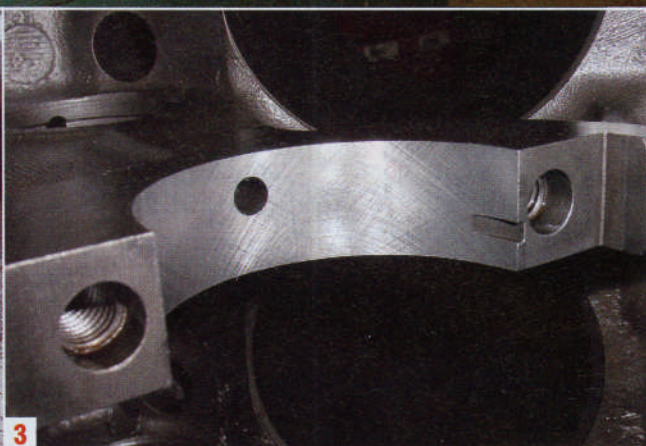
REBUILD THE RIGHT WAY **TECHNICAL** ■



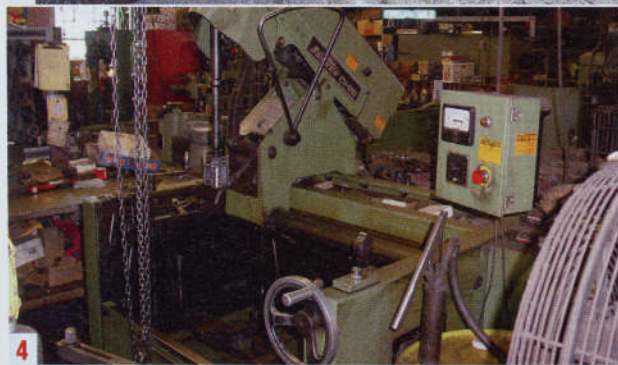
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1 In addition to the oven and hot-tank, this shot-blast cabinet rotates the block and bombards it with high-velocity soft media for effective rust removal.

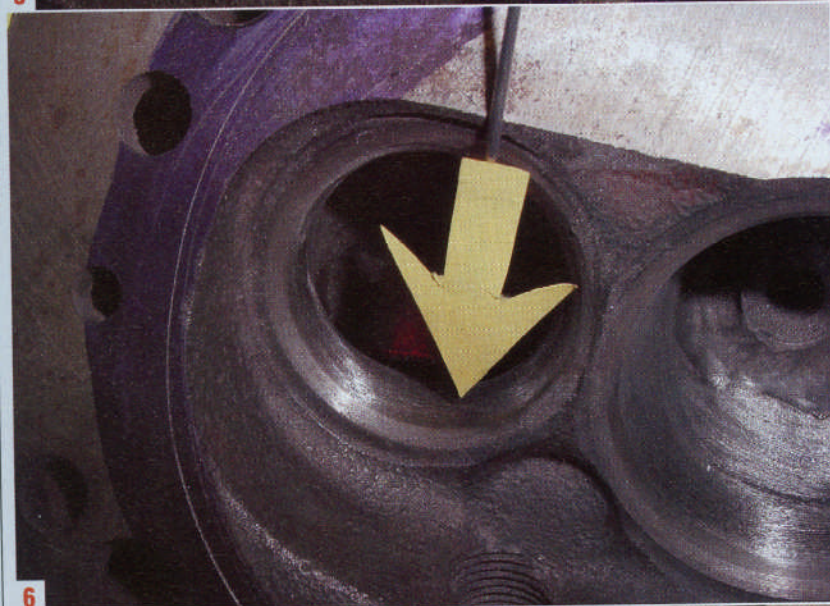
2 Magnaflux inspection of this cylinder head disclosed two tiny cracks at the coolant passage, and another in the intake valve seat; it's headed for the scrap heap.

3 Align-honing only removes a small amount of material in order to true-up the main bearing saddles and caps; don't confuse this with align-boring, which can alter the distance between the crank and cam centerlines.

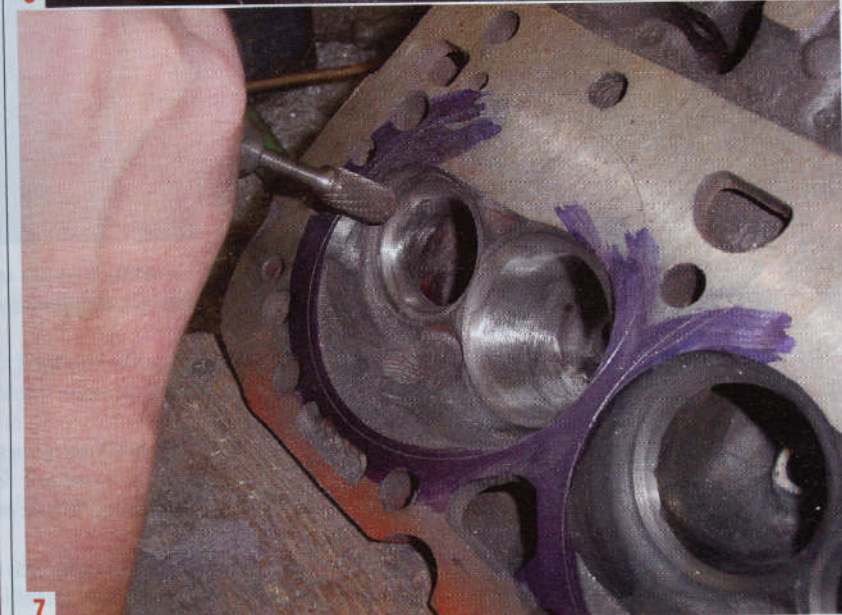
4 The Sunnen cylinder hone automatically surfaces the bores to the proper finish and cross-hatch pattern specified for the selected piston rings.



5 The arrow shows the sharp transition in the casting from the valve seat to the bowl area below the valve, which restricts airflow.



6 The arrow shows how the transition from the valve seat to the bowl has been ground and blended to eliminate the sharp corner of the casting, improving airflow.



7 The chamber wall adjacent to the intake and exhaust valves can also restrict airflow, especially with larger valve sizes; a cut is being started here to unshroud the exhaust valve.

walked through the process they use when presented with a tired old Corvette engine in need of a stock rebuild that must retain its original appearance.

DISASSEMBLY AND INSPECTION:

The engine is torn down, cleaned, inspected, and Magna-fluxed to ensure that the castings are sound. They have an oven, a hot-tank, and a shot-blast cabinet, using soft media for thorough cleaning and rust removal. Main and rod caps are marked, the crank and block main saddles are checked for straightness, and block decks and heads are checked for flatness.

Once the components have been cleaned and inspected, the results are reviewed with the owner, and a parts list and rebuild plan is developed, based on the engine's intended use and any performance enhancements desired. With those objectives established and the components inspected, the rebuild can proceed, with an accurate cost estimate.

If the main saddle inspection indicates minor warpage, the block and main caps can be align-honed as required. Mike's experience is that this is almost always required on 40-year-old engines. Composition head gaskets can usually accommodate minor deck surface flatness deviations, but if decking is necessary, they have the capability to deck the block, stopping short of the stamp pad surface, so the original pad surface and engine plant and VIN stampings aren't disturbed. Bores are normally taken .030-inch over, and honed on a Sunnen machine to provide a surface finish compatible with moly-faced rings.

PUTTING IT TOGETHER: Mike has a Superflow flow bench and offers several levels of porting, port-matching, blending, bowl cleanup, and chamber unshrouding for improved airflow, depending on customer requirements. A 30-degree back-cut can also be added to the valves



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1953-1982 Corvettes

for improved flow. If measurement indicates the need, heads will get a light cut to ensure that their deck is flat.

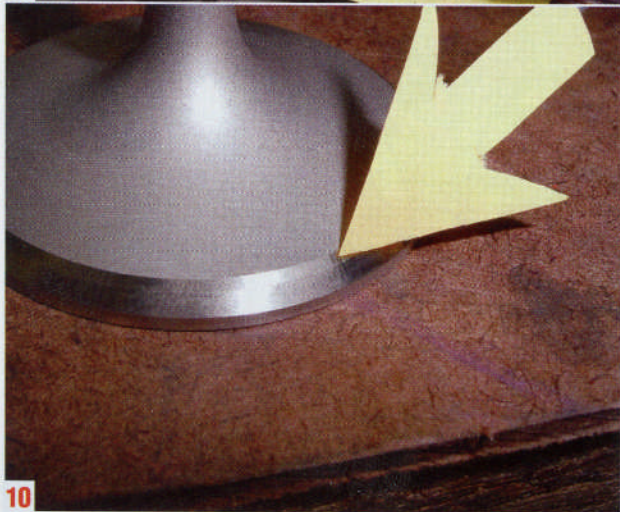
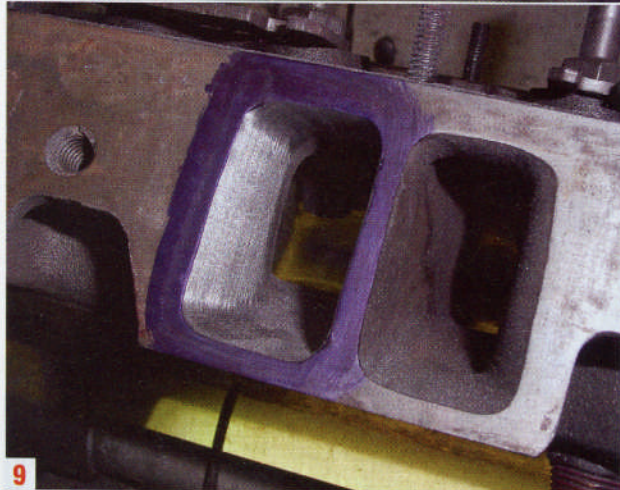
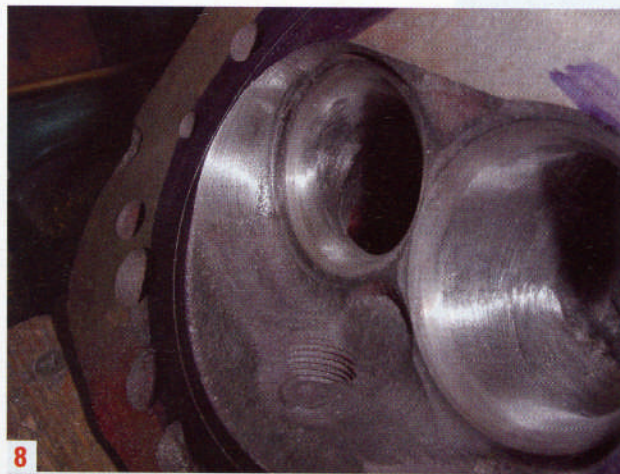
A state-of-the-art Serdi machine is used for accurate single-pass three-angle valve seat machining, and new iron valve guides are installed. Whether or not to install valve seat inserts is the customer's choice, and Viton valve stem seals are used. Rocker arm studs and bosses are drilled and pinned to avoid stud pull-out, as a less costly alternative to boss machining and screw-in studs.

A Melling blueprint cam with the same profile and specs as the original is used, with new lifters, valves, and stock-spec springs. If the customer wants a performance enhancement, just about any combination of proven valvetrain components can be provided.

Depending on the inspection measurements, the crank journals may be just polished or cut .010 inches on the rods and mains. Stock rods are reconditioned on a Sunnen machine, with ARP rod bolts replacing the originals. New Federal-Mogul/Speed-Pro original-spec pistons and moly-faced rings are used, and the rotating assembly is balanced. Oiling system enhancements are done via hole chamfering and crank cross-drilling.

After the short block is assembled, deck height (piston down-in-the-hole) is measured, heads are cc'd for chamber volume, and the final static compression ratio is managed by head gasket selection. Mike recommends and uses Brad Penn oil with enhanced ZDDP protection for flat-tappet cams, and an on-site dyno is available for break-in and power runs. The finished engine can be painted and detailed if the customer desires. Each Motor City Muscle rebuilt engine carries a 12-month/12,000-mile warranty, and an optional engine removal and installation service is also available if needed.

THE BOTTOM LINE: Many commercial rebuilders have a "standard plan" and process for all engines, and may not have the time or inclination to deal with the unique aspects of a Corvette restoration engine; it pays to shop around and find an individual or a shop that has the experience and knowledge to deal with your specific situation and needs for a numbers-matching correct-appearing stock rebuild.

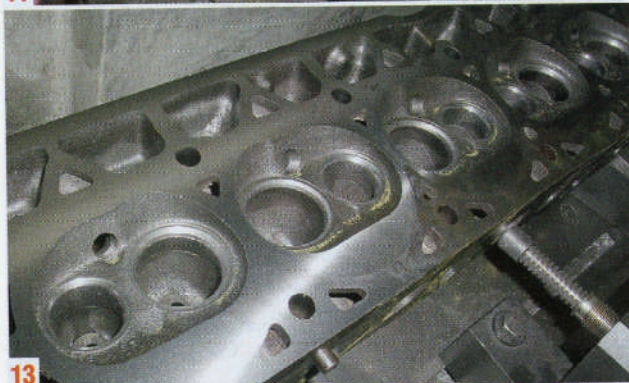
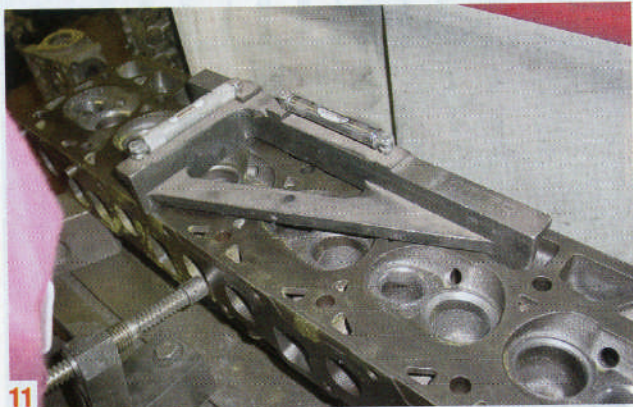


8 Here is the finished unshrouding cut adjacent to the exhaust valve; many small airflow improvements can really enhance performance with stock cylinder heads. Further blending work in the bowl area below the valve seats can bring even more performance at relatively low cost.

9 Matching the port shapes between the stock intake manifold and cylinder head provides further airflow improvements by eliminating any "steps" at the mating surface and blending rough areas in the casting.

10 The arrow shows a narrow area where the valve has been back-cut at a 30-degree angle adjacent to the 45-degree seat surface; this can improve airflow at low and mid-lift.

TECHNICAL REBUILD THE RIGHT WAY



11 This two-axis machinist's triangle is used to set up a cylinder head surface dead-level in the head mill prior to taking a light cut.

12 The head mill in action, taking an initial .006-inch cut to true-up the head surface; note the integral dial indicator used for setup before each cut.

13 The .006-inch cut wasn't quite enough on this head; it cleaned up the deck for the two cylinders at each end, but didn't touch it adjacent to the center two cylinders. It'll take at least one more cut to true-up the entire deck for a good head gasket sealing surface.

14 Sharp casting transitions and flash are also

common on stock intake manifold carb flanges; this one has been cleaned up as another minor airflow improvement.

15 This Serdi machine makes quick work of precision-machining accurate and concentric valve seats, and can cut multiple seat angles simultaneously in one stroke.

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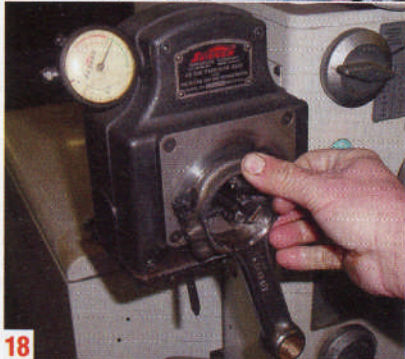
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16 The business end of the Serdi spindle, piloted in the valve guide; the cutting head can create any seat angle or combination of seat angles in one operation.

17 Finished crankshafts that have been polished or had the journals ground and polished are stored vertically, awaiting final assembly.

18 The precision gauge on the Sunnen rod reconditioning machine checks roundness and diameter of the rod big end during the honing operation.

19 The Sunnen rod honing machine in action — the operator moves the rod back and forth on the rotating hone spindle with a constant flow of lubricant, checking the rod on the precision gauge every few strokes until it's within specs.

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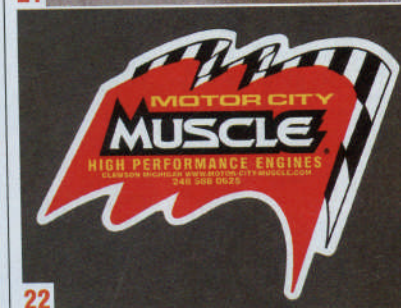
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20 A typical rod after reconditioning and honing to spec; ARP rod bolts are used exclusively on vintage and performance rebuilds.

21 A finish-machined Chevy block, fresh out of the cleaning cabinet, ready to move to final assembly.

22 The Motor City Muscle logo, a common sight in the Detroit area among performance enthusiasts for the last twenty years.

FOR YOUR INFORMATION

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