

## DIAMONDS ARE A BLOCK'S BEST FRIEND FOR HONING

*TWO SHOPS WITH DIFFERENT NEEDS ILLUSTRATE HOW NEW MACHINE TECHNOLOGIES AND DIAMOND ABRASIVES SIMPLIFY THE PROCESS, CUT CYCLE TIMES AS MUCH AS HALF, AND IMPROVE DYNO RESULTS.*



White Performance owner, Fred White, is a former drag racer with a full-service 16,000-square-foot shop and eight employees located in Kingsport, Tennessee. Here he reviews a dyno test report at his shop.

ST. LOUIS, MO. – The technology and precision in today's automotive engines often exceed that of race engines from a few years ago, leaving no margin for error in honing. Bore geometry,

clearance and surface finish specs have tightened dramatically as new ring and piston technologies proliferate. Materials and surface coatings have evolved, and some now require diamond honing. Two businesses doing vastly different types of engine work – White Performance and JASPER Engines & Transmissions – illustrate how new honing technology, particularly diamond honing abrasives, can improve cycle time, product quality, and cost, not to mention horsepower and torque.

### Performance builder cuts honing cycle by half, improves dyno results

White Performance owner, Fred White, is a former drag racer with a full-service 16,000-square-foot shop and eight employees located in Kingsport, Tennessee. "Our bread and butter is custom high-performance engines for street rods and circle track, and we've built a strong business in high-performance marine engines, too," White said. "We also build stock engines and ship crate motors all over the world, as well as provide machine services to other shops."

The dyno-equipped shop is self-sufficient, with five CNC machines, including EDM, along with crankshaft grinders, balancers, assorted manual machines and all types of gaging and measurement equipment. White Performance does it all, from contract machine work to engine installation. "We hone about 200 blocks per month for ourselves and others, including high nickel, CGI, Nickasil, aluminum, regular cast iron, GM Bow Tie, Dart, Honda, Toyota, along with big-bore Chevy and Ford blocks – whatever comes through the door, even air compressors with 7-inch bores," said Chris Webb, a 40-year-experienced machinist who came to White's shop two years ago from Morgan-McClure Racing, where he worked on Sprint Cup cars.

White was using an older Sunnen CV616 honing machine with vitrified abrasives when Webb came on board with NASCAR shop experience. "Even the most



Webb uses a Sunnen tenth-reading dial bore gage for a quick check of his honing work.

experienced operator can struggle to get decent results with the 616 and vitrified abrasives, and it will still never match the roundness, straightness and finish quality that newer machines and diamond abrasives can produce," Webb said. "It takes an experienced operator and a lot of (continued)



A patented full-bore profile display on the SV-10's control shows a real-time cross section of the bore, which takes the guesswork out of removing taper.

reduced performance on the dyno." Having used a Sunnen CK21 and diamond tooling in his prior job, Webb was instrumental in convincing White to purchase the newest Sunnen SV-10 with diamond tooling.

"The SV-10 essentially doubled our capacity by cutting cycle time in half, while our quality and dyno results improved immediately," said White. The PLC-controlled SV-10 has a separate 3-hp (2.25 kW) spindle motor, as well as a stroker motor, so it has plenty of torque to drive the diamond hone head. The PLC and variable speed motors allow infinitely variable crosshatch angles for any bore diameter and cylinder length – all of which can be changed on the fly. A patented full-bore profile display shows a real-time cross section of the bore, which takes the guesswork out of removing taper. For unattended operation, the auto dwell feature will automatically dwell the honing action in the tightest areas of the bore. "You can see exactly what's going on during the honing cycle," Webb said. The DH diamond hone head provides multi-point abrasive contact on the bore and a cone-style feed system produces uniform feed pressure on the circumference of the tool for exceptional roundness.

"I can install a torque plate and still complete a block in half to two-thirds the

work to get acceptable results with the older technology. Changeovers from one finish to another require belt changes and adjustments on the machine. All this adds up to long cycle times on the hone, and

time it took on our 616 without torque plating the part," Webb added. "With all the different types of blocks and cylinders we run, it's a great advantage to have your current setup at your fingertips in the control to quickly make changes. Once you set your stroke, speed, load and crosshatch, every cylinder is the same, with no taper or roundness variations, and I can do other jobs in the shop while the machine runs. With the new hone and diamond tooling, our horsepower and torque are up one to two percent on various engine packages we build, and our run-in time on the dyno has lessened."



Sunnen DH diamond hone head provides multipoint abrasive contact on the bore and a cone-style feed system produces uniform feed pressure on the circumference of the tool for exceptional roundness. White's original set of abrasives lasted 18 months.

White runs roughing and finishing cycles with the diamond tool, then plateau hones with a Sunnen brush tool. "Our targets are 0.0002" or better on size, less than 0.0001" on out-of-round, with finishes in the range of 35-40 Rvk, 8-12 Rpk, and 23-28 Rk, depending on the rings used," **(continued)**



The SV-410 features full-height/walk-in access doors and stainless steel enclosure to ease part load/unload and improve maintenance.

Webb explained. "We take our measurements with a Mitutoyo Surface Finish Analyzer and Sunnen bore gages."

"This machine will make an inexperienced operator look really good, while an experienced operator will put

out much more work with lower cycle times," White added. "The variable speed motors and PLC control permit infinite crosshatch angles for any cylinder length or diameter – on the fly, without belt changes. We take out 0.007-0.009", working on a lot of bow tie and Dart blocks which are harder, yet our original abrasives lasted 18 months. My one regret is that we did not move up to this machine much sooner. I'd recommend it as a first machine for any automotive shop."

### Production remanufacturer automates honing for labor efficiency

The Jasper Engines and Transmissions plant in Willow Springs, Missouri, opened in 2004 and has ridden the market upswing for remanufactured engines brought on by the economy, the common-sense environmental rationale for recycling sound components, and high demand from the marine market. Originally dedicated to small block 350's, the plant processes about 15,000 engines per year, and plans to move into big block and performance work. "We are building stock engines now, but are already doing crank balancing for big blocks and expect to

move into light performance engines," said Plant Manager Matt Gregory.

"There was no good alternative for the CK-21 at our production levels until Sunnen introduced the SV-410 automated vertical hone," Gregory explained. "The CK-21 requires the honing tool to be manually started in each cylinder bore, so the demand on the operator's time is high – a drawback in a production environment. The SV-410 is a much heavier duty CNC machine with a 10-hp servo-controlled spindle and powerful tool-feed system to drive diamond or CBN tooling. The automation features of this machine would allow us to immediately increase our capacity, while the power of the machine makes it capable for harder metals and heavier blocks if our part mix changes."



Setup is simplified with a multi-axis hand wheel for fine-tuning vertical stroke, tool feed, column position and optional cradle position. The fully automated system indexes the tool from bore to bore and (for V-blocks) the servo fixture rolls the block for access to all cylinders, ending with a rollover of the block to dump oil/coolant.

After the operator hits cycle-start on the SV-410, the entire process is automated. The machine uses a guide pot to start the hone head in each bore. It then indexes the honing tool between each bore, tilts the block for access to each bank of cylinders, and automatically rolls the block over at the end of the process to dump the oil. Crosshatch angle is set via the control  
*(continued)*



The honing operator simply tells the control what block is in the fixture and what the oversize should be, then hits cycle start. The honing machine senses the size and knows what to do to produce the finished bore while the operator tends the CK-21 machine

in access doors allow easy part loading. Setup is simplified with a multi-axis hand wheel for fine-tuning vertical stroke, tool feed, column position and optional cradle position. The machine is also designed to use in-process or post-process air gaging for integrated SPC data collection, as well as automatic compensation of size, taper and straightness.

"Our incoming bore size is generated by a boring bar that is targeted to leave 0.0035 - 0.0055" of stock in the bore," Gregory said. "The honing operator simply tells the control what block is in the fixture and what the oversize should be, then hits cycle start. The honing machine senses the size and knows what to do to produce the finished bore. It's a real advantage to have the programs setup for a 350 or 262, and actually have the oversizes for the bores programmed in.

screen and easily changed for any ring application. The servo fixture adapts to any angle V-block via the setup screen, and can rotate a 500-pound block in one second, bank to bank. Full-height/walk-

"The big advantages are the simple setup and the fully automated cycle, which allow us to produce high quality cylinders for the lowest cost per bore," Gregory added. "Stone wear is automatically compensated, and it's precise, which is a great advantage in our application. The 'knowledge' in the control is head and shoulders over the CK-21. We have also been impressed with how easy it is to keep this machine clean. The coolant is magnetically filtered and has a paper separator, too. This eases maintenance and keeps the machine in production for more hours. One adjustment we had to make was to check for obstruction from the torque-plate gasket hanging out in the bore, which an operator would catch on a manual machine. An obstructed bore can wreck a set of honing stones."

As a builder of stock engines, Jasper aims for +0.0005" to -0.0003" on bore size, with a range of 15-25 Ra on finish and less than 0.0005" out of round. Using a single stage honing tool on the SV-410, the honing cycle is programmed for 90 percent roughing and 10 percent finishing with a slow feed rate on the abrasives. Plateauing is done offline. Several brands of piston rings may be used, all of them low tension.

"The automation of this machine makes much better use of our labor, freeing the operator to run the manual hone, while another operator can run two mills and do torque plate installation," said Gregory. "We also have the honing capacity and technology to handle growing volume and variety in our blocks, as our business evolves."



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