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SPECIAL SUPPLEMENT

TO ***PERFORMANCE & HOTROD BUSINESS*** MAGAZINE

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PRECISION ENGINE

THE ENGINE SPECIALIST'S TECHNICAL & PERFORMANCE RESOURCE

A supplement to *Performance & Hotrod Business* magazine.

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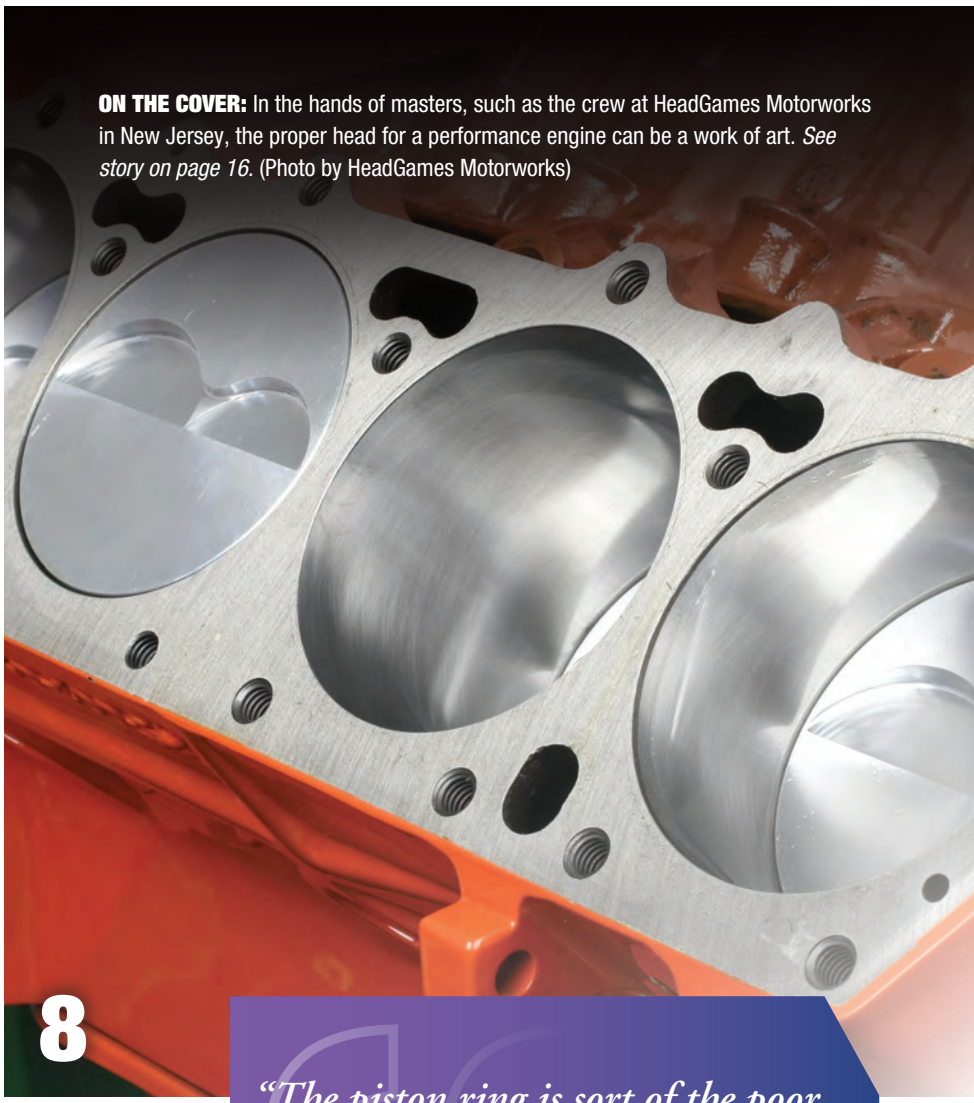

ON THE COVER: In the hands of masters, such as the crew at HeadGames Motorworks in New Jersey, the proper head for a performance engine can be a work of art. *See story on page 16.* (Photo by HeadGames Motorworks)

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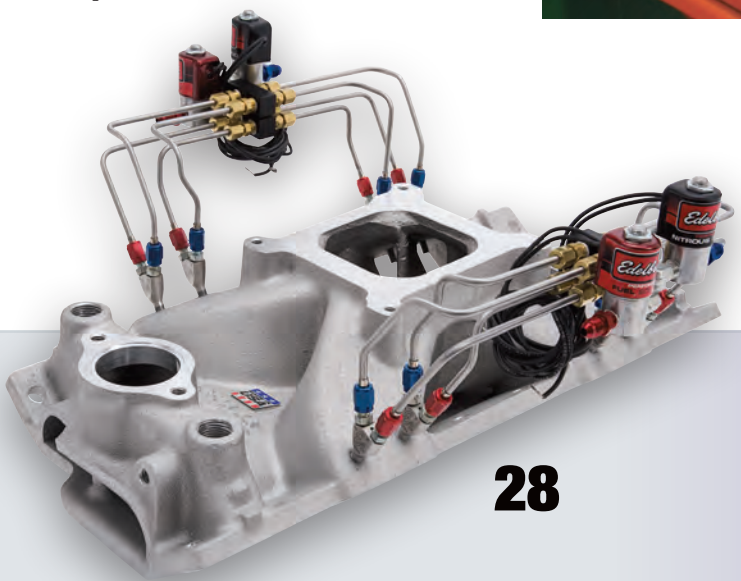

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"The piston ring is sort of the poor stepchild of the high-performance engine. They get blamed for just about everything."

— Keith Jones
Total Seal technical expert

On the importance of cylinder honing to alleviate piston ring failure.

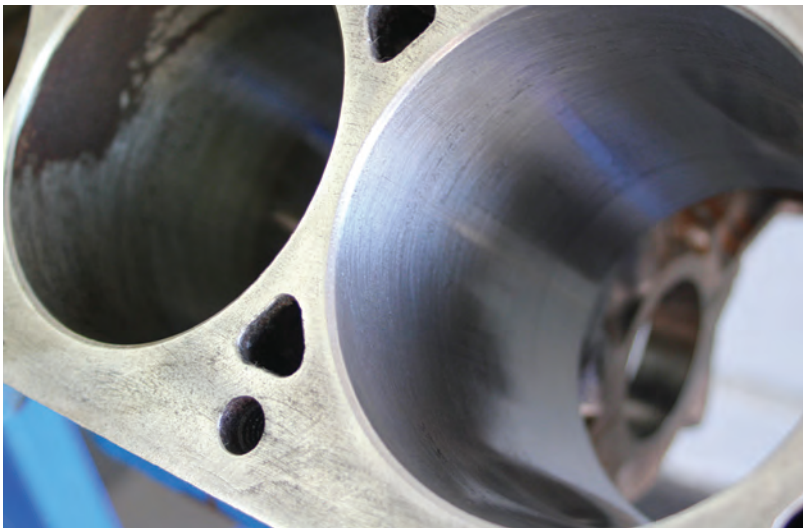
See page 26

Editor's note: *While piston rings often take the blame for engine problems, experts have found that in many of today's high-performance applications, increased engine block hardness doesn't allow rings to "break-in" quite like they used to, leading to blow-by and other problems. Here, professionals outline how the use of a handheld honing system can allow for the fine-tuning of cylinder bores, thereby increasing the rings' effectiveness.*

RINGS TRUE

'Foolproof' cylinder honing can improve piston ring performance.

By Ed Sullivan



Top: To facilitate proper cylinder bore surface preparation and piston ring-to-bore fit, high-performance ring manufacturers and distributors recommend honing cylinder bores to exacting tolerances (within a few microns). (Photo courtesy Brush Research Mfg.) **Above:** The cross-hatching capabilities of the BRM Flex-Hone are integral to the cylinder bore surfacing requirements of most internal combustion engines, ensuring that proper oil retention will be maintained in the cylinder bore walls at all times. (Photo courtesy Brush Research Mfg.)

For being such a small item, piston rings can take a lot of criticism when performance engines go bad.

"While unquestionably vital to performance, the piston ring is sort of the poor stepchild of the high-performance engine," says Keith Jones, technical expert at Phoenix-based Total Seal. "They get blamed for just about everything. If there is a compression problem, it's the piston rings. If there is oil consumption, it's the rings. I wouldn't be surprised if the rings got blamed for a flat tire on the way to the race track."

Jones knows a lot about piston rings and racing. Since 1967 his company has been manufacturing high-performance piston ring sets installed in racing engines used in competition events including IRL, NASCAR, World of Outlaws and other racing classes.

To stay informed of customer needs and satisfaction, Jones actively solicits feedback from customers, particularly questions concerning performance and critical installation procedures.

Except for its standard automotive line, the many ring sets that Total Seal offers are for customized engines, each having many individualized requirements, including cylinder block materials and piston ring designs.

In those applications, it is particularly important that the piston rings precisely maintain 100-percent contact with the walls of the block's cylinder bores. Otherwise, performance problems such as compression blow-by and oil leakage can cause severe, if not catastrophic, problems.

BETTER CONTACT

Providing the needed consistent contact between piston rings and cylinder bore almost always requires resurfacing of the bores in racing applications—because the bores are not perfectly round, have been damaged by previous ring or piston failure, or due to other wear factors.

Of course, in such cases, resurfacing the bores can sometimes be a challenge.

"High-performance engine blocks have changed a great deal over the past couple of decades," Jones says. "One of the most noteworthy changes is the hardness of the block metal, which can be several times harder than it used to be. This has dramatically affected cylinder ring installation requirements, because it is now crucial for the customer to achieve proper ring fit inside the cylinder bore at the time of installation."

Jones explains that in the "old days" when engine blocks were composed of relatively soft metals (e.g., 150 Brinell hardness), installers could usually rely on piston rings to adjust to cylinder bores by wearing into the bore surfaces after installation.

However, this approach is no longer realistic, because today's engine blocks are much harder (e.g., 330 Brinell), while the high-performance rings are considerably softer with lower tension. The combination simply doesn't permit that kind of "break-in" technique builders used to see.

To facilitate proper cylinder bore surface preparation and piston ring-to-bore fit, Jones and other high-performance ring manufacturers and distributors recommend the honing of cylinder bores to exacting tolerances (within a few microns). This procedure ensures that excessive compression blow-by and inadequate cylinder bore oil retention are avoided at the outset.

SIMPLIFIED HONING SOLUTION

Since bores differ widely according to block hardness, design and engine wear conditions, the proper honing of bore surfaces can at times become a tricky situation.

In many of these instances, Jones suggests approaching the job with a Flex-Hone tool produced by Brush Research Mfg. (*www.brushresearch.com*) in Los Angeles.

The Flex-Hone is a ball-style tool characterized by a shaft with small, abrasive globules that are permanently mounted to flexible filaments. The tool is available in many sizes with a wide selection of grit material, and according to the company works well when hand-held because the design is automatically self-centering.

Jones says the cross-hatching capabilities of the tool are integral to the cylinder bore surfacing requirements of most internal combustion engines, ensuring that proper oil retention will be maintained in the cylinder bore walls at all times.

Using the tool, parts such as carbide bushings, bore sleeves, hydraulic and pneumatic cylinders, and other cylindrical cavities can be surface-finished on the production line—or resurfaced in the field—using a relatively inexpensive tool that requires little set-up time.

The Flex-Hone is a ball-style tool featuring a shaft with small, abrasive globules that are permanently mounted to flexible filaments. It's self-centering characteristics make it particularly useful in hand-held applications. (Photo courtesy Brush Research Mfg.)

"We recommend this type of hone because it works very well, is easy to use with a hand-held drill motor, and is really foolproof for someone who is not an experienced machinist," explains Jones. "It's really easy to screw-up with an average rigid-style hone, but it's very difficult to screw up with a Flex-Hone."

The Flex-Hone is available in 11 abrasive types and eight grits. Jones says in the case of most automotive combustion cylinders, 120-grit works for older cast ring sets or where the cylinder has been re-bored and is a little rough. Hones with 180- to 240-grits are good choices for general deglazing where the cylinder is not going to be bored or honed. A 320-grit and even sometimes as fine as 400-grit are often used in high-performance applications with high-performance ring sets.

EXPERT SUPPORT

Because the Flex-Hone is available in a variety of sizes as well as abrasives and textures, Jones often refers customers to Brush Research for additional technical advice or specific product and process recommendations.

"We provide this type of support all the time," says Mike Miller, Brush Research vice president of global sales. "Total Seal recommends using our Levigated Alumina (super-fine) abrasive in one application, which is a little different from other requests we get. Total Seal does their homework and have found a combination that works best for their rings in harder block materials. We are asked to produce many different surface topologies, which is not a problem with the Flex-Hone."

He says the use of such hand-held honing devices allows customers to zero-in on the exact roughness they need for very specific applications, and notes that in addition to special, customized jobs, the company's flexible hone is also used in production environments, including with CNC equipment.

In a production example that required a custom solution, a diesel engine remanufacturer utilized Flex-Hones in a two-step operation to resurface cylinder bore liners.

"For that application we recommended one tool, a 120-grit model, to produce the cross-hatched surface with 'valleys' that would provide the necessary oil retention," Miller explains. "For a second honing step, we provided a 600-grit model that put a nice plateau finish on top of the deeper cross-hatching. Through this two-step process, the remanufacturer was able to bring their cylinder liners back to specification."

And help the piston rings do their job. PHB

***Ed Sullivan** is a Hermosa Beach, Calif.-based writer. He has researched and written about high technologies, healthcare, finance, and real estate for over 25 years.*