



## Cylinder Liner Application

**“Above & Beyond Honing”**



### Executive Summary

Sunnen Products Company was founded in 1924 in the U.S. by Joseph Sunnen, a man who was truly “ahead of his time” in many ways. His initial creative genius was geared toward the repair of automotive engines to improve the productivity of the automotive repair shops of his era. Over the ensuing years Joe sought to improve the performance of industrial manufacturing. This work led to the development of honing tools, gages, machines, and processes which obtain incredible accuracies! Today Sunnen Products Company is the world’s largest vertically integrated manufacturer of precision bore sizing equipment and tooling. With more than 700 employees worldwide and global Sales & Service through 50 distributors, Sunnen Products Company has become a leader in fully automated flexible honing systems for medium to high-volume production. Standard products are also available from the extensive Sunnen Honing Supplies catalog for high, medium and low-volume production. Sunnen Products Company delivers *‘the best total solution’* for our customers. No matter what the production requirements, Sunnen Products Company has a honing solution that is right for you – *all from one supplier!*

*Precision Abrasive Bore Sizing and Finishing Systems...Worldwide*



## Application Summary – Cylinder Liner Systems

Sunnen Products Company has '*cracked the code*' for high volume cylinder liner production! Cylinder liners require a precise fitting piston within the cylinder to achieve the performance needed in today's demanding engine designs. Roundness and straightness below 25 microns (.001 inch) are routine, along with tight control over Rpk, Rvk, and Rk values for exceptional bearing surface texture requirements.

The cylinder in an engine provides the chamber where the chemical energy contained within the air/fuel mixture is converted through combustion into the mechanical energy to drive the crankshaft. This chamber is sealed by the interface between the piston rings and the cylinder wall. The cylinder wall must be carefully prepared to provide the best sealing surface and geometry with a minimum amount of wear from the sliding contact with the piston rings. Sunnen Products Company provides *the best total solution* for this honing application. The optimum roundness, straightness, surface finish and texture can be controlled by the Sunnen solution, transferring the maximum amount of energy from the combustion process to the torque output of the engine. "Green" concerns regarding emissions control are also addressed by the honing solution. The better seal from the honing process minimizes the transfer of exhaust gases into the environment.

The cylinder preparation is critical to a smooth-running, efficient, and long-lasting engine. The cylinder material can be various types of cast iron, sprayed or plated coatings, aluminum, or steel. Honing is used to process all types of cylinder materials successfully. The choice of abrasive type, coolant, and tooling are keys to the successful honing operation for cylinder liners.

The long life of engines today compared to 20 years ago is due to advancements in the honing process, materials used in the cylinder liners, and engine oil improvements. The lubrication of the cylinder wall at the interface with the piston rings is crucial to the lifetime of the engine assembly. Engines today routinely achieve over 300,000 km (180,000 miles) without an overhaul. The cylinders are prepared in the honing process so that no break-in period is necessary. The honed surface duplicates the "break-in" process without the associated cylinder wear. This process is called "plateau honing" and achieves the surface texture parameters that are crucial to engine longevity.



## Diesel Cylinder Liner Application



Sunnen Products Company has '*cracked the code*' for diesel cylinder liner honing! Since engines were invented it has been well-known that the crosshatch surface texture developed by the honing process is a key to proper lubrication of the piston rings reciprocating each stroke during the engine cycle. The newest development from Sunnen Products Company improves the crosshatch pattern using servo driven motor technology! The Sunnen SV-500 vertical machine system is the first honing machine to control the crosshatch angle precisely from one end of the cylinder bore to the other end. The angle of the crosshatch pattern is precisely controlled without the "rollover effect" apparent on older technology hydraulic stroked honing machines. On the hydraulic machines, the spindle continues to rotate for the amount of time the stroke takes to reverse direction. This causes a "rollover effect" in the crosshatch pattern in the top and bottom of the cylinder bore. Using modern servo systems, the Sunnen process can precisely synchronize the spindle motion to the stroke motion, eliminating the rollover effect completely! A simple as well as elegant solution to the "rollover effect"!

Surface texture is also a key to engine longevity. This special surface texture generated is a "plateau honed" surface finish. Plateau honing involves a carefully engineered process combining the abrasive and tooling selection needed to generate a consistent and measurable surface texture result. The final honing step removes just enough material to simulate the break-in period that would result during initial engine startup, only without the resultant wear within the cylinder bore. Plateau honing generates a surface texture that has a typical honing crosshatch pattern in the bore. In addition, Plateau Honing generates a surface texture with better load bearing characteristics and allows better lubrication along the cylinder bore surface. A similar process is used in the fuel injector assemblies for diesel engines, and has extended injector life by thousands of miles per engine!



The Sunnen honing process achieves the results in large part due to the precision honing tool design that can include in-process air gauging built into the tool itself or using a size plug that physically enters the bore at size to signal the end of cycle. This honing tool design and manufacturing requires attention to precision from start to finish. Sunnen provides the *'best total solution'* as honing tools are completely designed and built at Sunnen. The honing abrasives are also crucial to achieving consistent results in production honing of engine liners. Sunnen manufactures all the abrasives used in diesel cylinder liner honing to precise dimensions to fit our honing tools. In addition, the abrasives will not deliver the best results without the proper honing coolant. Sunnen Products Company supplies the optimum honing coolants for diesel cylinder liner honing. Our coolants can improve abrasive life by a factor of 2 or more.

Workpiece fixturing is also crucial to a successful honing process. The diesel cylinder liners must be held without distortion as the cylinder is honed. Sunnen Products Company designs and builds custom fixtures based on the application. Bladder fixtures, clamping fixtures, and compression ring fixtures are among the wide variety of designs available. These are integrated into the total package solution to provide a turnkey solution for our customers – no excuses!

## **Summary**

The *'best total solution'* – machine, tooling, abrasive, coolant, gauging, workpiece fixture, automation, and service/support all come direct from one supplier - Sunnen Products Company! Sunnen Products Company is the world's largest vertically integrated manufacturer of precision bore sizing equipment and tooling. Our team of dedicated research and design engineers provides solutions for our customers. Providing solutions to improve the performance of our customers fulfills our corporate mission. Honing is applied to all materials from Alnico to Zinc! Diesel cylinder liners, no matter the size or material, can be processed on Sunnen Honing systems. Better production quality and lower costs are the result. Sunnen Products Company has the solution!