What impact does cam surface finish have on my engine’s performance?

There are two major areas of the engine performance that are directly impacted by the surface finish of the cam: Endurance (wear) and Power. Endurance will increase as the cam lobe’s Bearing Surface Area (BSA) — the effective area of the lobe that contacts the lifter wheel — increases, and the horsepower increases as the lobe gets smoother. One without the other can get you into trouble.

- Improving the BSA improves the cam’s wear characteristics. The more of the lobe that effectively contacts the wheel increases the lobe’s ability to withstand high loads. A microscopically smooth and flat surface produces the highest BSA, and very slight imperfections cause early wear and ultimate cam failure. Note, Ra and BSA are not the same. (See Fig. 1)
- Horsepower will increase if the lifter follows the lobe, exactly. Microscopic imperfections on the lobe surface, mainly waviness and flatness, will cause some interruption in the motion of the lifter and result in valve bounce, maybe a “whining” or other valve train noise, or a limiting of engine RPM. Regardless, any time the lifter does not do exactly what the cam is designed to do, horsepower is adversely affected. You can imagine how a lifter would react to a surface like this.

What is the most common misconception in the automotive aftermarket about cam surface finish?

- The market typically confuses “shiny” with “proper” surface finish. There is NO connection. Polishing a cam to make it shiny will NOT improve — and likely will harm — the surface finish. A cam with a good surface finish and high BSA can be shiny and very good, but a cam with a poor surface finish that is polished to be shiny will not perform well and is ultimately likely to fail. You have to really know what you are doing and must use very high-end equipment to tell the difference. This illustration shows very different surface conditions with the same Ra number, and they are all shiny, but the best one is obvious only when using very high-end testing equipment.

What is MSE (Micro Surface Enhancement™), and why is it better than belt polishing or other available processes?

- MSE is a post-grind process using a ceramic media and tumbling to remove the microscopic peaks from the lobe surface. It does not change the shape, flatness or waviness of the lobe. Belt polishing also removes the microscopic peaks, but it is almost impossible to belt polish without adding some amount of taper or waviness to the lobe.
- Belt polishing will not make a bad cam good, but it can make a good cam bad. On the other hand, MSE will not make a bad cam good, but it will definitely make a good cam better.
- The illustration to right shows a cam lobe with a very good Ra number, but the surface is extremely wavy and not flat. This would be a very bad cam lobe.
Many things contribute to the surface finish of a cam. Grinding wheel speeds, pressures, type of grinding wheel, cam spindle speeds, and many other factors determine surface finish. With the older manual grinders, it’s more often than not the technique of the operator, but with the newer CNC grinders, it’s the programmer. The basics of grinding are common to both types of grinders.

To make a good cam, it’s critical that the lobe be flat with no taper or waviness before it is polished.

When the LS engine was designed in the late ’90s, it was the first engine that the racing market had worked with that was designed from the ground up with a roller cam. The larger cam journals, stiffer block and entire valve train previously designed to be in constant compliance were now the norm, so lobe finish requirements took a giant leap. The old way of using Ra and a simple Pocket Surf tool as a measurement of surface finish was no longer adequate. Refer back to Fig. 1. All three surfaces measure the same Ra. It’s obvious which is best, but when using a simple profilometer, there was no way to measure and see the difference. We had to find a way to maximize the BSA without changing the waviness or flatness of the lobe. The engineers at COMP spent over 2 years and tens of thousands of dollars to develop a protocol and a machine to measure surface finish. Now at COMP, we know the “why” and the “how” to make the surface finish the best in the industry, and the MSE process makes the surface even better by micro-finishing to the millionths of an inch.

Cams for LS engines have always had more stringent tolerances than most other cams in earlier-designed engines. For quite some time, all LS cams from COMP® have been specially treated to meet these higher standards. MSE now replaces the extra processing on LS cams, therefore is standard on LS cams from COMP®. This feature will be available on other applications as an optional service.

Part #1-673-1, and the charge is $100.

Allow for an additional 24 hours in delivery time when the MSE process is added as an optional service.