

# TECBLOG SEALING SURFACE FINISH

## ***SURFACE FINISH CAN MAKE OR BREAK A REPAIR, SO IT'S IMPORTANT TO KNOW WHAT FINISH IS REQUIRED FOR THE GASKETS AND METALLURGY YOU'RE WORKING WITH.***

The head gasket is an engine's most dynamic and critical seal. It must contain the cylinder pressure generated during the combustion process, in addition to high pressure oil, oil drainbacks and engine coolant. A head gasket must withstand high temperatures and casting movement to create a perfect and reliable seal. There are a number of variables that contribute to both the horizontal and vertical motion that occurs between the cylinder head and engine block (deck area). Fel-Pro uses the latest sealing technologies to create a gasket that conforms and compensates for minor surface imperfections, while being dense enough to maintain even loading between the cylinder head and block. All Fel-Pro replacement gasket are made of OE equivalent materials or better. However, even the best head gasket can't seal a surface that is improperly prepared. Surface conditions of the engine block and cylinder head must be inspected, and refinished if they are out of spec, before installing a new head gasket.



Surface finish comparator

### **CHOOSING THE RIGHT FINISH**

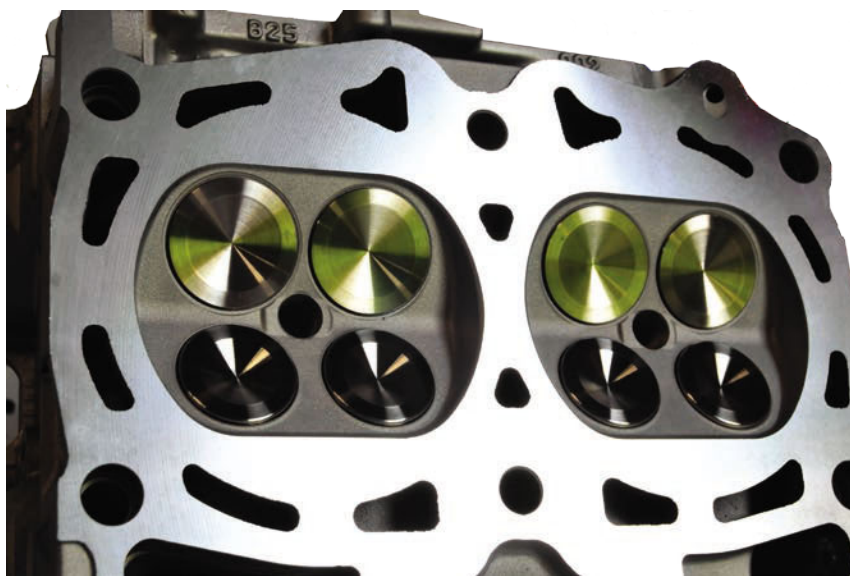
In order to reach an appropriate surface finish, consider the metallurgy of the head and block castings, as well as the material and design of the head gasket being used. Different gaskets require different surface finishes, so the surface finish must be matched to the type of gasket that is required for the application. To determine surface finish requirements, consult the OEM repair manual if using an OE head gasket, or follow the gasket manufacturer's instructions. The importance of attaining the appropriate surface finish cannot be overstated. Each type of Fel-Pro head gasket, whether it be PermaTorque® MLS, PermaTorque Blue Stripe®, single layer embossed steel, or other types, has specific surface finish requirements. If the surface is too smooth, the gasket can slip and leak; but if the surface is too rough, the gasket will have a difficult time conforming to surface imperfections and it may also leak. Surface finish can be checked using a surface finish comparator or a profilometer.



John Gurnig using a handheld profilometer in the Fel-Pro Field Test Garage

### **ROUGHNESS AVERAGE ( $R_a$ )**

Roughness Average ( $R_a$ ) is the average micro inch measurement of peak-to-valley roughness height of a "flat" surface. The lower the  $R_a$  number, the smoother the surface. Fel-Pro recommends a finish of 60 to 100  $R_a$  (roughness average) for cast iron cylinder heads and blocks, and 50 to 60  $R_a$  for aluminum. Fel-Pro uses head gasket coatings and facing materials designed to fill in minor surface imperfections and allow for improved sealing on the imperfect surfaces found in the repair environment. OEM MLS gaskets work well on new, flat, clean castings, since they require a very smooth surface finish, usually 20-30  $R_a$  or less. Fel-Pro's PermaTorque® MLS head gaskets use a specialized coating that accommodates finishes as rough as 60  $R_a$ .



Subaru cylinder head resurfaced for MLS gaskets

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## **SURFACE FLATNESS**

Surface flatness is equally important to surface finish, so always check components to ensure they are not warped or distorted. To maintain constant contact between the head gasket and mating surfaces, all deck surfaces must start out flat and remain flat after being torqued to specification. A good rule for flatness is that surface flatness, measured in thousandths of an inch, should never exceed the number of cylinders on each bank across the length of the block.

For example, no block or cylinder head should exceed .003" out-of-flat if there are 3 cylinders, as there would be in an inline-3 or V6 engine. Inline-4 and V8 applications should never exceed .004" out-of-flat, and so on. No block or head should be more than .002" out-of-flat across the width of the surface.



John Gurnig checking flatness across an inline-4 cylinder head  
in the Fel-Pro Field Test Garage