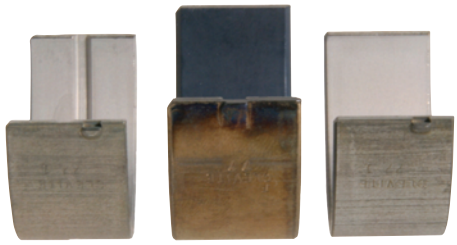
Notice the relative size from the 2" NASCAR main bearing to the 2.448" Chevy shaft size from the older days.



Shown is the the 1.850" NASCAR rod bearing, narrowed to less than .755" compared to the 2.100" SBC Chevy at .792" wides.

Race Engine Bearings

BY **BILL MCKNIGHT**

Race engine bearings are called upon to handle stresses almost un-imaginable to the average person. Extreme high RPM, extreme operating conditions including high heat, cylinder pressures of 10,000 psi and higher and extremely thin oil viscosity are common. Add to this the fact you have a bearing size limited either by racing rules or a team's desire to reduce friction and you have what one might call: "A Perfect Storm". How to survive the "storm" is obviously critical to the success of a race engine builder. In this article, I'll cover thoughts, observations and tips gleaned from my time working with both race engine builders and professional race teams. Most of these apply at the extremes of our sport/industry but also have practical application for a broader range of performance engines! Also, I speak often of "race engine" and really mean "high performing engine" regardless of how it is used!

Leaving horsepower on the table

If engine bearings in a race engine look really good when you tear an engine down to freshen it, you're leaving horsepower on the table. You're almost always going to replace the bearings anyway, might as well use them up! Food for thought — if racing rules and budgets allow it, reduce the size of the engine bearings. Smaller bearings have less friction and reduced drag, equating to more horsepower. NASCAR finally put a limit on bearing minimum size last season, standardizing on a 2" main journal minimum and a 1.771" rod journal. (Remember where they started: 2.448" main and 2.100" rods). Also, think about the reduced mass of the crankshafts! Bearing width can be and is often reduced as well, especially on the rod bearings.

Reduce friction and drag

Many race teams invest in coating their engine bearings. Anti-friction coatings can reduce drag and resist damage when oil films get so thin that bearings and crankshafts contact each other. We are experiencing very promising results with special coatings and continue to experiment with professional teams. For example, we're testing a coating right now that will allow an alcohol funny car team to get extended life on their rear main bearing. We've gone in initial testing from one pass per bearing shell to 3 to 4 passes, perhaps more. This can make a coating very cost effective and very attractive. Keep an open mind and remember technology is constantly changing!

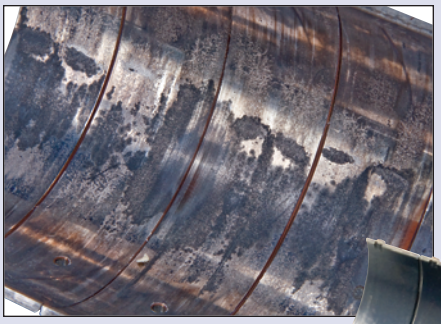
All oil is not the same

Racing engines need racing oil! There is a number of racing oil suppliers/manufacturers and they exist for a very good reason: the demands of racing engines overwhelm the average motor oil! Also, it'd be silly to think the oil requirement of a NASCAR restrictor plate engine is the same as an alcohol pulling tractor or an off-shore power boat. Your goal with specialty lubricants should be the same as your goal with engine bearings, pistons, piston rings, crankshafts, connecting rods and all the other highly complex parts to a racing engine: find a supplier who you like, who knows what he/she is talking about and most importantly, will take time to help and guide you. Knowledge is power, so ask questions, take notes, suck up all you can get and store it away.

Recognize the obvious

Upper rod bearings and lower main shells get most of the load so your inspection always focuses on them first! A simple thought, not always possible especially on older performance engines, is: no groove on the lower main shell. All that groove does is effectively reduce the load bearing capability of an already heavily loaded part. Most of our NASCAR customers make their own upper main shells from un-grooved lower shells. Without giving away any secrets, they look carefully at both the width of the groove as well as its overall length.

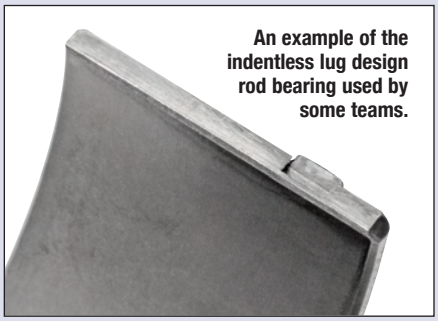
Always remember, regardless of the type of performance engines you build or the type of service the engine sees, as you increase the demand for making power, you will exceed the capabilities of the standard bearing and eventually, even the capabilities of the standard racing bearing. A recent example is a well-known



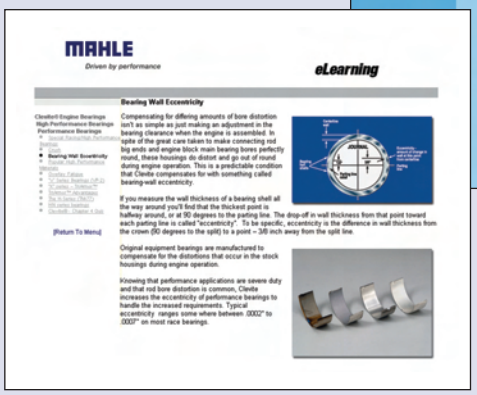
Pictured above is an example of smaller bearings, 900 HP or so, things are pretty well used up – OK for cup, not so good for Nationwide and Truck where engines need to run 2 or 3 races!

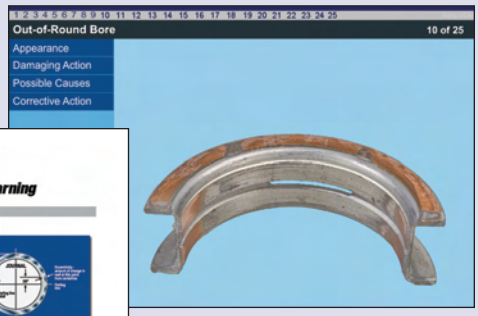
Here is a used set of rods after a race — when they look this good, there's power to be gained! Note: teams will use masking tape to keep the samples together making them easy to inspect and to show a customer.

MAHLE Clevite coated bearings.



An example of the indentless lug design rod bearing used by some teams.





A screen shot of the MAHLE Clevite bearing eLearning course (left) and online bearing distress guide (above).

west coast builder of performance diesels. They've done much work with the GM Duramax® diesel and have documented examples producing in excess of 1300 HP on the dyno. This was a gradual process for them as are many performance engine projects…someone wondering what'd be possible. (Just a side note: NASCAR has found another 100 HP in the past 10 years, while still being limited to 355 CID) The stock parts worked pretty well at first, but they kept pushing the limits. First it was the limit of the stock piston, then it was the stock rod and next the stock engine bearings. We produced a racing rod and main set for them and it works very well, but I know if they keep increasing the power, we'll reach the limits of that set, too.

Understand the basics

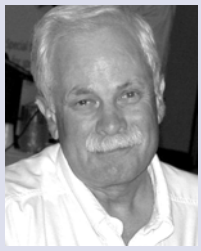
If these terms aren't failure to you, you have problems: Minimum oil film thickness, eccentricity of a bearing shell, parting line relief, B wall thickness, crush, cavitation, fatigue, overlay thickness, locating lug location, just to name a few. MAHLE Clevite has an excellent eLearning class on engine bearings and the best part is, it's free!

Utilize all the tools you can

AERA has failure guides and of course, tech help. MAHLE Clevite elected earlier this year to put our bearing guide online. It consists of 25 different bearing distress modes. I don't like to call them failures since in many cases they didn't fail, just look distressed when you tear the engine down, plus, bearing manufacturers don't like to talk about failed bearings — bad for business! Anyhow, you get 25 currently listed (I keep adding them as I get good examples), complete with multiple examples illustrated by digital photos (I keep adding photos and better photos as I get them, too). The modes each have: appearance, damaging action, possible causes and correction action outlined. Finally, **askmahleclevite.com** is available to all too. It's our online tech help, available 24/7.

Where do we go from here

The more I learn about our business of race engines, the more humble I am. I get to call on and visit with the absolute "top of the heap", "pick of the crop" of race engine builders in the USA. They're young and they're old. They're polished and they're plain. Some are shy, others outgoing. What I realize is they have one thing in common: They're never satisfied with just "good enough". They keep asking, looking, questioning, and challenging me and the other suppliers with: "what if we did this, what if we changed that?" It never ends and hopefully never will!■



Bill McKnight has worked for MAHLE Clevite Inc for 28 years. He ran the engine rebuilding training provided by Dana for 22 years, then moved to Clevite as director of training. Over the years at Clevite he served as director of marketing, motorsports sales management, and in his current position as team leader of training. He has a master's degree in education and has served on the board of directors of AERA, program committee of PERA and as a technical presenter at both AERA and PERA. He's often found at the race track, especially NHRA and NASCAR events and loves engines that make lots of power!