Transcript of Question 8

Presented by
Engine Builder magazine

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Engine Builder Engine Bearing Summit Participants

Bob Sturk
Federal-Mogul Corp.

Dr. Dimitri Kopeliovich
King Engine Bearings

John Havel
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Raymond King
Federal-Mogul Corp.

Michael James
King Engine Bearings

Bill McKnight
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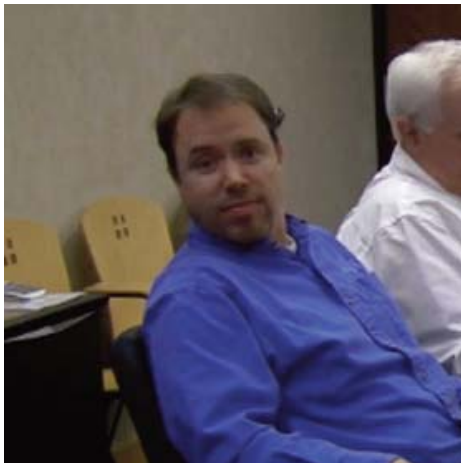
Engine Builder magazine



Brendan Baker, Senior Editor
Engine Builder magazine

Larry Carley, Technical Editor
Engine Builder magazine

To answer questions and allow an open discussion about engine bearings without falling into a "pizza wars" debate we convened the inaugural *Engine Builder* Engine Bearing Summit on March 31 at the Babcox Media corporate headquarters. We invited participants from the leading bearing manufacturers to participate in a roundtable discussion on pre-determined topics.

To say the day exceeded expectations would be an understatement. Participants were prepared, cooperative and frank about engine bearing technology and applications.

The following industry experts participated in the Summit. From Federal-Mogul Corporation: **Bob Sturk**, Chief Applications Engineer, Bearings: North America; and **Raymond King**, Director of Global Engine Parts. From King Engine Bearings: **Dr. Dmitri Kopeliovich**, R&D Manager at King's manufacturing facility in Israel; and **Michael James**, with King's export and high performance programs. From MAHLE Clevite Inc.: **John Havel**, former Director of Aftermarket Engineering (Retired); and **Bill McKnight**, Team Leader – Training.

Brendan Baker, senior editor and **Larry Carley**, technical editor of Engine Builder joined editor **Doug Kaufman** in moderating the discussion.

Question 8: What type of bearing do you recommend for the following applications: stock engine, street performance, race engine and diesel?

STURK (Federal-Mogul Corp.): I think we are probably going to be three for three on agreement on a lot of these. Stock engines you probably should use the stock material, as close as you can get to it, which for most pass. car engines would be bi-metal aluminum today. If I were trying to up the performance, street performance, maybe you'd start looking at one of these coatings to help you out or you go right to the tri-metal. Certainly anything under race I would be looking at tri-metal today. And diesel, you have to stick again with what the manufacturers started with and get as close as you can to what was used there. The ranges of operation of these materials, there is a reason why certain engines have certain materials. And you want to stick to as close as you can stay with what the manufacturer started with.

KOPELIOVICH (King Engine Bearings): I think that before selecting the material for a particular engine, I would like to summarize parameters that should be taken into account. And it is actually the parameters that we have already discussed, but there is some summary. The selection of bearing material suitable for a particular engine should be based on the following parameters:

Maximum specific load applied to the bearing: The bearing load capacity should be higher than maximum specific load. There is some safety factor, maybe 10, 15 percent.

Crankshaft material: The nodular cast iron shafts work better with aluminum/silicon bearings and steel crankshafts work better with tri-metal bearings.

Possible misalignments and distortions: Aluminum bearings are more tolerant to misalignments and distortions due to they have greater thickness of the bearing layer. Tri-metal bearings with Babbitt overlay are more sensitive to geometrical defects.

And the minimum oil film thickness: The value of this parameter is not always known, but it is important for proper selection of bearing material. If the minimal oil film

thickness is lower than 60 millionths on an inch, it means that mixed lubrication regime occurs and tri-metal bearings with soft, thin overlays are less suitable than aluminum/silicon bearings.

So if we take all these parameters into account, I would say that stock engines, street performance and circle track racing engines may use conventional aluminum/silicon bi-metal or tri-metal copper base material. Depending on the load and the crankshaft material, aluminum/silicon for nodular cast iron and tri-metal for forged steel shafts. Tri-metal bearings I recommended for off-road and off-shore racing engines. And high strength tri-metal materials like Sputter or GP is recommended for racing applications with high bearing loading where conventional tri-metal bearings undergo fatigue. And the same I would say for diesel engines without fuel injection where the load is extremely high and only Sputter or GP bearings with high load capacity may be used for upper connecting rod bearings. The lower may be tri-metal or even the aluminum silicon.

MCKNIGHT (MAHLE Clevite): I brought some samples since I don't disagree with what everybody is saying. Here is a Cummins rod bearing here. And upper is tri-metal, lower is aluminum. You know, that seems to be the way the world is going.

STURK: It's cost.

MCKNIGHT: It seems to be. You know, the bottom is just going along for the ride so why spend any money in making a tough bearing?

HAVEL (MAHLE Clevite): Especially in a diesel.

MCKNIGHT: So our policy at MAHLE Clevite by and large parallels what you have just said. And that is what is OE is what we want to supply back to it. So this was the OE for the B Series, late model B Series Cummins. So when you buy a replacement bearing from us, it's going to look like the OE. Another good example of that is a Duratec Ford.

But that's a bi-metal aluminum bearing, no tang on it. So that's what our customer is going to get back from us. Now, we have a little issue there. It seems to be more so in South America than here, but that's a real popular engine now for racing. And so when the specific output of that engine really gets cranked up, nobody wants a bi-metal aluminum bearing. So we have an alternate option there, and that is a tri-metal cast copper/lead bearing.

And so what I wanted to point out there was where you really end up in the compromise position is street performance because street performance starts out here and then may ultimately end up there. Because it's just bizarre what guys are doing on the street now, 1,200, 1,400, 1,600, 1,800 horsepower. And boy, you know, that's a long way from what we envisioned when we put bi-metal aluminum bearings in these things at the factory. So of all of these four categories, the one with the most slag there where it really takes sometimes help from us as suppliers is street performance because there's such a large group of diversity there from low end to high end.

KAUFMAN (*Engine Builder* magazine): And everybody wants to do something different, wants to stand aside from their competitor.

STURK: It's custom.

JAMES (King Engine Bearings): And that is where the original design intent of the engine is completely changed.

MCKNIGHT: Oh, yes.

JAMES: The parameters are totally different.

HAVEL: The problem you have is defining what is street performance. You've got a spec? Show it to me. What is NASCAR other than the limitations that NASCAR puts on it? Every engine builder is doing something just a little bit different that he thinks is going to give them an edge over the other guy.

KAUFMAN: NASCAR ranges from the Cup Series to the Whelen Series to the –

HAVEL: Absolutely.

CARLEY (*Engine Builder* magazine): The street guys can make a rule of thumb. Like you talk to a piston guy, you say at what point do you need to upgrade from a cast piston to, you know, hypereutectic. They'll throw some kind of a number at you. Can you do something like that with bearings? You know, "Once you get beyond a certain point, where you might have run an aluminum bearing, you need to switch to a tri-metal."

HAVEL: Yes. But can the street guy tell you that now I'm going to get, you know, 80 megapascals out of this thing instead of 60? You just don't know.

JAMES: It's better to calculate the load and the torque. The torque really has more to do with the horsepower.

STURK: But we have guidelines based on unit loads, you know.

HAVEL: But some of these street performance guys don't dyno test the engines. They go out in the aftermarket, buy some part.

MCKNIGHT: Typically what happens, it fails early, it looks awful when they take it apart. Now they know they have got an issue.

JAMES: Well, they look at their oil filter and they say well, I think I need to upgrade my bearing.

STURK: Throw some sparkly stuff in here.

MCKNIGHT: But very few guys sit there and plan this out ahead of time. It's usually a reaction to, you know, a bad problem. And that leads them to something other than the stock bearing.

You know, what's interesting is we spent the afternoon here talking about a lot of technology, you know, and a lot of really interesting subjects. Probably 70 percent of our customers don't even understand what the tang on a bearing does, which is what's scary. We've spent all afternoon talking about technology and we have got such a gap in the education level of our customers that very few of them have a clue what the tang does.

HAVEL: How many phone calls do you get saying hey, how come this bearing doesn't have a tang?

MCKNIGHT: Oh, I have an answer saved for me online where I can copy and paste the same answer in every time I get the question.

JAMES: They're afraid it's going to spin.

MCKNIGHT: Yes, yes. And, frankly, I've got racing customers that don't understand it either.

JAMES: But we can help those engine builders by explaining it. When you put that information out, they understand. And if they hear it from more than one source, then it tends to confirm that, well, yeah, you must have been right. And it's good when we all understand the same things.

HAVEL: That is true. I'm not saying that it's a bad answer at all, but the problem that you run into, is what complicates that is every guy that walks in an auto parts store and buys that bearing and takes it home, if he is a do-it-yourselfer or whatever, he's his own inspector, he's his own QC guy. It's not like selling this bearing to OE or to an engine remanufacturer, where you can explain to one guy why that bearing doesn't have a lug on it. You sell 10,000 of those bearings, you may have 9,000 different customers that don't understand why it doesn't have a lug. And the problem is getting to all of them and getting the message to them so that they can understand.

JAMES: So many times those do-it-yourself articles, the engine build articles that are in the magazines help a lot. But I think that the greatest help is if people realize it's helping you more and you might be better off to let it help you to understand what your machinist or engine builder is telling you, not necessarily to encourage you to go out and do it on your own just because you can buy the parts mail order and you can read an article and you think that there is nothing more complicated than putting it together like a jigsaw puzzle. These engines are not jigsaw puzzles, and that's why machinists do charge what they charge and they do what they do.

BAKER (*Engine Builder* magazine): To play devil's advocate, why did you get away from the tangs?

MCKNIGHT: Sure, we'll answer you. You've got a million conrods. You've got a machine with a tang in it and a million conrods. Each one costs you 50 cents: do the math.

HAVEL: It won't cost you a penny.

MCKNIGHT: Right.

HAVEL: It doesn't take long to figure that out.

JAMES: And what's the purpose of the tang anyway but to locate it?

MCKNIGHT: To locate the bearing.

JAMES: And that's all it is. And even then there is a little play between the recess and the tang so it isn't like snap fit you're done anyway. You still have to line it up.

HAVEL: I was going to suggest that you guys could do the marketplace a service by a future article on this thing.

KAUFMAN: Has the knowledge level of our engine builder readers changed over the years? Has this new crop of younger people kind of lost that knowledge?

MCKNIGHT: What's happened to us, and it's probably happened to Federal-Mogul too, although I'm not positive. I worked for 20-some years for Dana and I taught engine rebuilding 45 weeks a year. Customers would come in from all over the country. And we covered stuff like this in a classroom. We've got no school anymore. The head of the engine building program at one of the votech schools – actually a community college, called me yesterday. Told me about all these programs closing.

KAUFMAN: Auto shop is not in the schools anymore.

MCKNIGHT: You know, we don't have much education to our customers anymore. The world just has changed.

KING (Federal-Mogul Corp.): We have both; you don't have as much education readily available and the engines have gotten more diverse so there is more complexity. But at the same time also, the people we are trying to talk to really is a smaller group of people. You know, there is just in some of the trends of the builds and all that, there is still an opportunity to educate and train and direct.

HAVEL: Oh, absolutely.

MCKNIGHT: Yes. I've been real thrilled with these AERA regional seminars. I've done a couple of them, you know. As a matter of fact, I just did one out in LA about a month ago. And we had 85 engine builders show up on a Saturday to attend a tech seminar. That

was pretty impressive – there's a lot to do in LA on a Saturday besides go to an engine tech seminar. So that tells me that there is a desire out there to learn stuff by our customers, we just maybe don't have many avenues for them to do that anymore. Even though it's a small group, the desire is still there. There aren't many avenues left.

BAKER: There is also a lot of misinformation on the Internet. Everyone thinks they can get their information off the Internet and it depends on where you go, you know.

MCKNIGHT: If you want to do something shocking, any of you manufacturers, look at what's talked about with our product in the chat rooms day in and day out. And, man, I shudder at the information being passed out by so-called experts to other guys in these chat rooms. It's scary, you know.

KING: That's part of our world. That's probably no more scarier than what's going around about the latest computers available, how to use your iPod or those kinds of things. But there is instantly available communication. And I think whether it's the better engine builder or the better consumer, they figure out how to legitimize who is on the other end of that portal.

HAVEL: I collect and restore old British motorcycles. And there is one particular that is just one of my favorites. I've have been restoring one called an Aerial Square 4. They are absolutely hell on camshafts and lifters. I have never taken one apart where the camshafts or lifters or followers were not worn out.

When the low zinc additive oils came out, I thought that it was worthwhile to write a little article for the owner's club that I belong to alerting people that they ought to try to add the zinc additive to these modern oils that don't have it for these old engines. So I wrote this article and it was published in our club newsletter, which goes to about 350 people.

Next thing I know, I'm getting an email from somebody saying the BSA owners' club wanted to have permission to reprint that article in their club magazine. And I said sure, go ahead. That's fine. The next thing I know, the article is showing up on the Internet, my article. And the Vincent owners have got it published in their newsletter. So, you know, what Bill is talking about is the way things can end up on the Internet is unbelievable.

KAUFMAN: And to that point, John, we have spent a lot of time talking today about the technology. And we've spent a lot of time writing about the technology of which overlay is right and which construction, where I think all of a sudden we have come up with an idea that maybe we need to take a step back too on our readers and reeducate people about basic construction and basic technology.

HAVEL: There is no one single answer.

JAMES: And the different balance that the different materials and constructions lend in terms of how they solve problems.

KAUFMAN: Sure. We may think that our readers know everything about it and are waiting for all of the latest information. They may need to learn some of the basics again.

MCKNIGHT: Well, they need and they want both of them. There needs to be a balance there.

KAUFMAN: There again, it's a combination just like we have talked today.

MCKNIGHT: Technology is exciting.

KAUFMAN: Right.

MCKNIGHT: Geometry, locking loads, they don't get anybody too excited, but technology is.

KAUFMAN: Right. As we have said, it's a balance and I think it's been the theme today, the combination of everything that's required to understand this technology. I really appreciate everybody's time and the enthusiasm you have shown. And the professionalism that has been exhibited here, has been tremendous and great information that I hope has been as helpful to you as it has been to our magazine and its readers.