Thrust bearing failures are not usually very common, but when they do happen the cost of repair can be significant. Looking for the root cause of a failure has caused some difference of opinions between engine and transmission builders.

About 15 years ago Dennis Madden of ATRA, Dave Hagen of AERA, Ed Anderson of ASA, Roy Berndt of PERA and John Havel of AE Clevite addressed the causes and suggested some remedies in AERA’s Technical Bulletin #1465. In my opinion these five people were the experts in their field and did an incredible job of sorting out the issues and presenting some solutions.

Even though thrust bearings are a different design from rod and main bearings the material they are made of can handle high pressures if properly lubricated. A big problem is if the forward pressure from an outside source exceeds the ability of the oil to prevent metal to metal contact a failure will occur. The surface finish of the crankshaft plays an integral part in how much pressure the oil will withstand.

In some cases crankshaft thrust surfaces have to be ground for an oversized thrust bearing. An increase in the number of times a crankshaft has been ground can help increase the thrust width. During regrounding a common practice is to “kiss” the rear thrust surface to clean it up. After a number of “kisses” the clearance can be excessive. Oversized thrust bearings are showing up to take care of that problem.

Whether a thrust surface has just been “kissed” or ground to an oversize the surface finish and angle is really critical, especially with the decrease in viscosity of current motor oils. The thrust surface must be ground at 90˚ to the main bearing surface and the surface finish must be extremely smooth. You cannot have grinding marks left on the surface that can destroy the oil film. The grinding pattern has to go around the thrust to prevent it from wiping the oil film from the bearing. A thrust bearing has a terrible time trying to create the hydrodynamic wedge that is needed to prevent metal to metal contact and needs to have the grinding pattern in the direction of rotation.

To get the proper finish on a thrust after grinding the ideal way is to use a hard shoe polisher that exerts pressure on a polishing tape. Trying to polish a thrust by hand is very difficult to obtain an acceptable surface finish. Measuring the surface finish...
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with a profilometer is the only way to know what you have. There are varying opinions as to what the thrust surface should measure with a profilometer but 10 Ra or less with all polishing marks running in a circumferential pattern is recommended.

Forward pressures from OEM standard transmission clutches are well within the design limits of thrust bearings. Although clutches that are out of adjustment, drivers that ride the clutch pedal or extremely heavy duty clutches can create pressures that can exceed design limits and cause failures.

On the automatic transmission side there are some issues that an installer should be aware of and corrected when installing a transmission. Using the wrong flex plate bolts, the wrong torque converter, the transmission pump gears being installed backward or the torque converter not installed completely seem to be the major ones.

A rare problem is having the torque converter ballooning from excessive line pressure. However, high line pressure from a plugged or restricted cooler line will cause excessive forward pressure from the converter. The amount of pressure exerted is determined by the line pressure (psi) and the diameter of the opening in the converter. The opening in a GM 4L60-E converter is 1.490”. As an example if you take 200 psi x 1.490 you will have 298 lbs forward thrust from the converter to the crankshaft. Transmission experts say that many more hundreds of pounds of line pressure can be generated by a transmission.
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Normal transmission line pressure should be approximately 30 psi or less. The highest intermittent line pressure an automatic transmission should ever see is about 110 psi. In addition to a cooler line being plugged, a larger aftermarket oil cooler can keep the fluid too cold to circulate, causing higher than normal line pressure.

Another issue is that some computer controlled vehicles will have extremely high line pressure when the engine goes into a “limp home” mode. Continuing to drive a vehicle with the “Check Engine” light on could cause a problem.

Because many crankshaft cores are becoming scarce it is becoming a more common practice to use an oversize thrust bearing to salvage cranks. This appears to be a far more economical method than welding up a worn thrust surface.

Higher viscosity oils are definitely a help with keeping thrust bearings alive when excessive pressures occur. As our oils become thinner, lower viscosity oils could become a factor with thrust wear. Only time will tell how good these future oils will be at providing protection for crankshaft thrust bearings. The bottom line is that proper surface finish of the crankshaft thrust is paramount to preventing problems.

Lyle Haley started his engine rebuilding career in 1961 by tearing down engines for a small production engine rebuilder. He later owned his own custom machine shop and also sold machine shop equipment as a manufacturers’ representative. He was later with Peterson Machine Tool as their sales manager. During his career he has worked with many OE engine rebuilders along with the US Army and their diesel engine rebuilding program. Currently, his business is training and consulting for engine rebuilders. For additional information he can be reached at lylehaley@earthlink.net or 763-464-1286.

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