TECH

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Influence of Grooving on Main Bearing Performance

Various forms of main bearing grooving have been used over the years. We are frequently asked what difference grooving makes.

First, it's essential to understand that bearings depend on a film of oil to keep them separated from the shaft surface. This oil film is developed by shaft rotation. As the shaft rotates it pulls oil into the loaded area of the bearing and rides up on this film much like a tire hydroplaning on wet pavement. Grooving in a bearing acts like tread in a tire to break up the oil film. While you want your tires to grip the road, you don't want your bearings to grip the shaft, so grooving is bad for maintaining an oil film. The primary reason for having any grooving in a main bearing is to provide oil to the connecting rods. Without rod bearings to feed, a simple oil hole would be sufficient to lubricate a main bearing.

Many early engines used full grooved bearings and some even used multiple grooves. Those choices were based on what engineers knew at the time. As engine and bearing technology developed, the negative effect of grooving was recognized and bearing grooving was removed from modern lower main bearings. The result is in a thicker film of oil for the shaft to ride on. This provides a greater safety margin and improved bearing life. Upper main shells, which see lower loads than the lowers, and hence don't apply the same load to the oil film, have retained a groove to supply the connecting rods with oil.

In an effort to develop the best possible main bearing designs for High Performance engines, we've investigated the effects of main bearing grooving on bearing performance. The graphs on the next page illustrate that a simple 180° groove in the upper main shell is still the best overall design.

While a slightly shorter groove of 140° provides a marginal gain, most of the benefit is to the upper shell, which doesn't need improvement. On the other hand, extending the groove into the lower half, even as little as 20° at each parting line (220° in total), takes away from upper bearing performance without providing any benefit to the lower half. It's also interesting to note that as groove length increases so do Horsepower Loss and Peak Oil Film Pressure which is transmitted directly to the bearing.

Notes: The aftermarket bearing business being a look back in time, (bearings generally represent the technology of the time the engine was developed)means you will still find some full-grooved main sets offered for older engines where demand is low and the engineering cost to bring the sets to 2010 standards is not warranted.

For further information contact:

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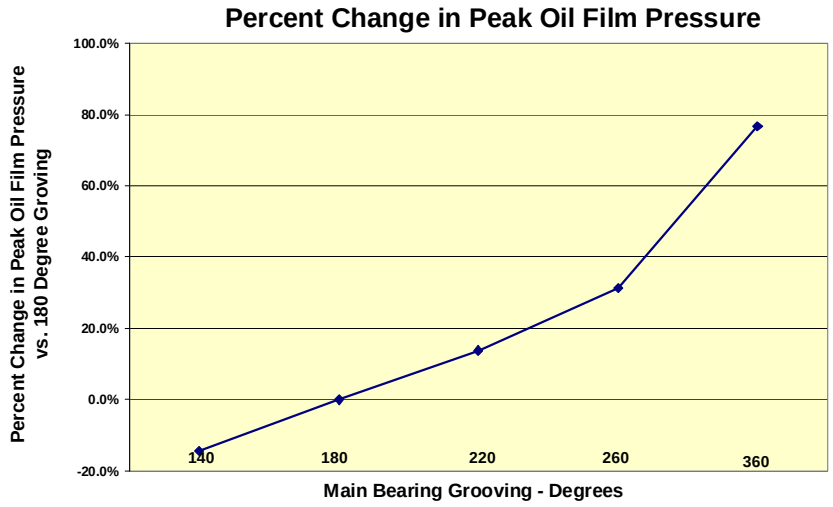
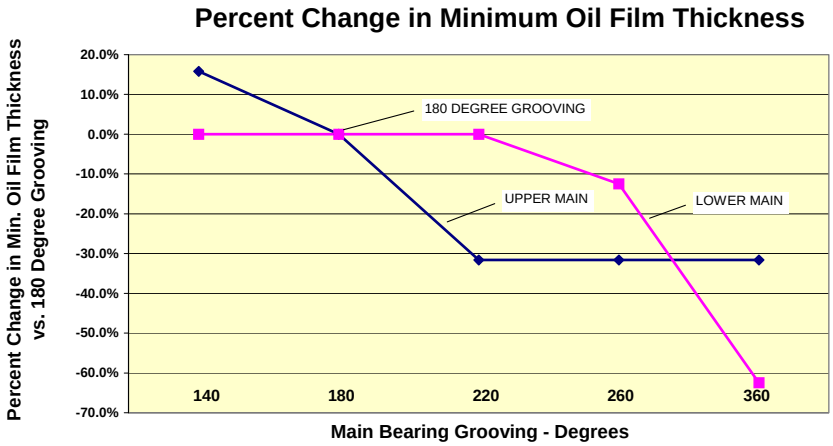
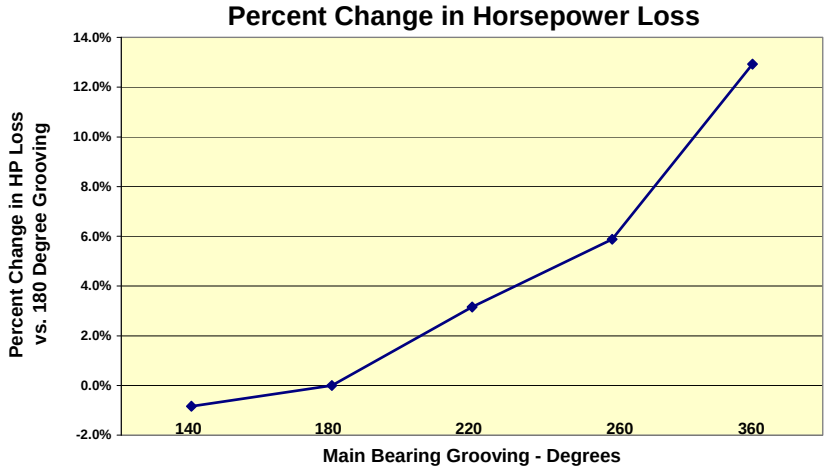

Percent Change in Peak Oil Film Pressure
Percent Change in Peak Oil Film Pressure vs. 180 Degree Groving
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
-20.0%
140
180
220
260
360
Main Bearing Grooving - Degrees


Percent Change in Minimum Oil Film Thickness
Percent Change in Min. Oil Film Thickness vs. 180 Degree Grooving
20.0%
10.0%
0.0%
-10.0%
-20.0%
-30.0%
-40.0%
-50.0%
-60.0%
-70.0%
180 DEGREE GROOVING
UPPER MAIN
LOWER MAIN
140
180
220
260
360
Main Bearing Grooving - Degrees


Percent Change in Horsepower Loss
Percent Change in HP Loss vs. 180 Degree Grooving
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
140
180
220
260
360
Main Bearing Grooving - Degrees