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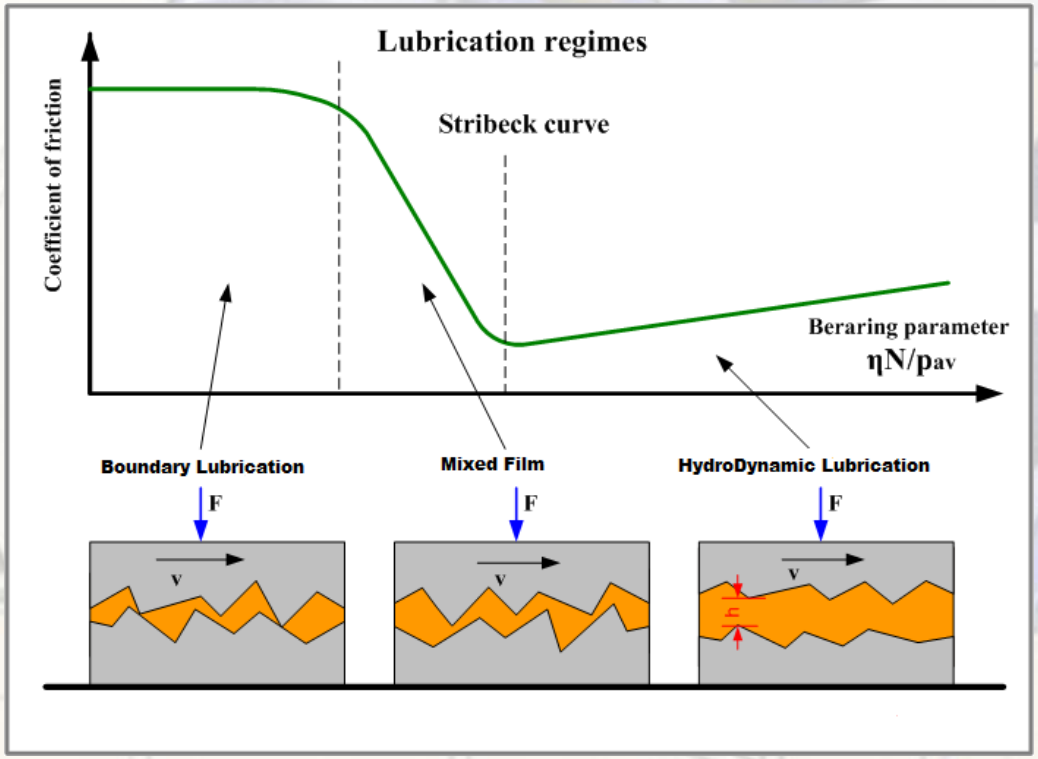
INCREASE IN TOOTH FLANK TEMPERATURE WHEN USING HIGH VISCOSITY RESIDUAL PRODUCTS

Do you observe an increase in tooth flank temperatures when you switch to high viscosity residual products?

Do not panic as we have relevant technical facts to substantiate the cause of the elevated temperatures:

- Higher internal fluid friction of high viscosity base oils
- Thicker film will insulate the gear and will result in lower heat dissipation through the thick film
- The darker film will affect the accuracy of the reading on the IR guns and proper emissivity settings have to be used

If you have a new set of gears that has smooth surface finish with less asperities you can achieve Hydrodynamic Lubrication (HD). HD lubrication is often referred to as the ideal lubricated contact condition because $h/\sigma > 5$, i.e. the lubricated films are many times thicker (typically 5 to 500 μm) than the height of the surface roughness on gearing surface.



However, due to the laws of Thermal Conductivity, the heat that is trying to leave the gear face and escape to the air must flow through the lubricant medium.

We define heat conduction, *H*:

$$H = \frac{\Delta Q}{\Delta t} = kA\frac{\Delta T}{x}$$

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where $\frac{\Delta Q}{\Delta t}$ is the rate of heat flow, k is the thermal conductivity, A is the total cross-sectional area of conducting surface, ΔT is temperature difference, and x is the thickness of conducting lubricant separating the gear face from the air.

So, by using this formula a gear-set that has the thinnest possible film (1 lambda) but still maintain the full HD Lubrication mode would show face temperature 16.25 Deg F lower than a lubricant that had a very thick film (8 lambda) at 130 Deg F.

However, as you know this "ideal" state is rarely achieved. Any imperfections at all on the gear face or any interruptions of the optimized lubricant flow will cause a gear set running with 1 lambda of film to crash into boundary film lubrication. Then the forces of pressure and friction will overwhelm the thin lubricant film causing a vicious cycle of premature wear, cold welding and metal loss.

OK, still have doubts??

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