



# Improving Gear Tooth Bending Fatigue Life

DANTE Solutions, Inc.

**Problem Statement:**  
Helicopter transmission life limits load carrying capacity and acceleration. Improved gear bending fatigue life will allow heavier loads and improved acceleration.

New designs are costly and require long development times. A process improvement for an existing design saves time and money.

**Process Description:**  
A change from conventional oil quench hardening to intensive water quenching produced higher compressive surface residual stress. This in turn resulted in a 15% increase in bending fatigue endurance in carburized Pyrowear 53 gears.

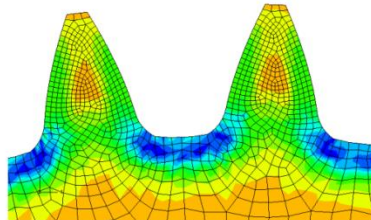
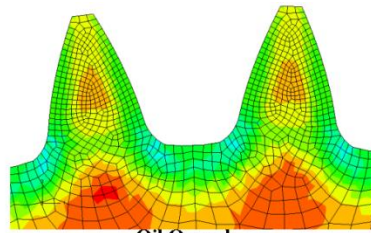
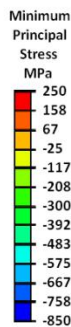
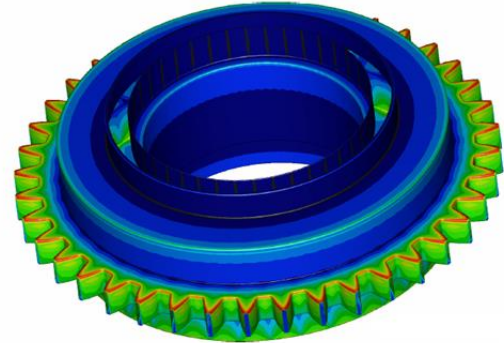
**Benefits:**  
The quench process change achieved improved bending fatigue life with no gear redesign or alloy change. The water quenching method was more environmentally friendly than oil quenching and safer.

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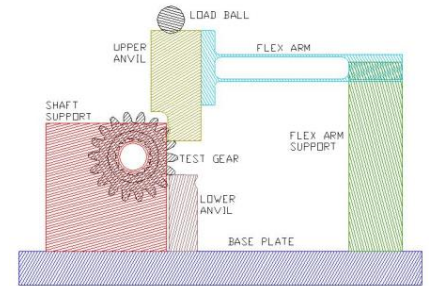
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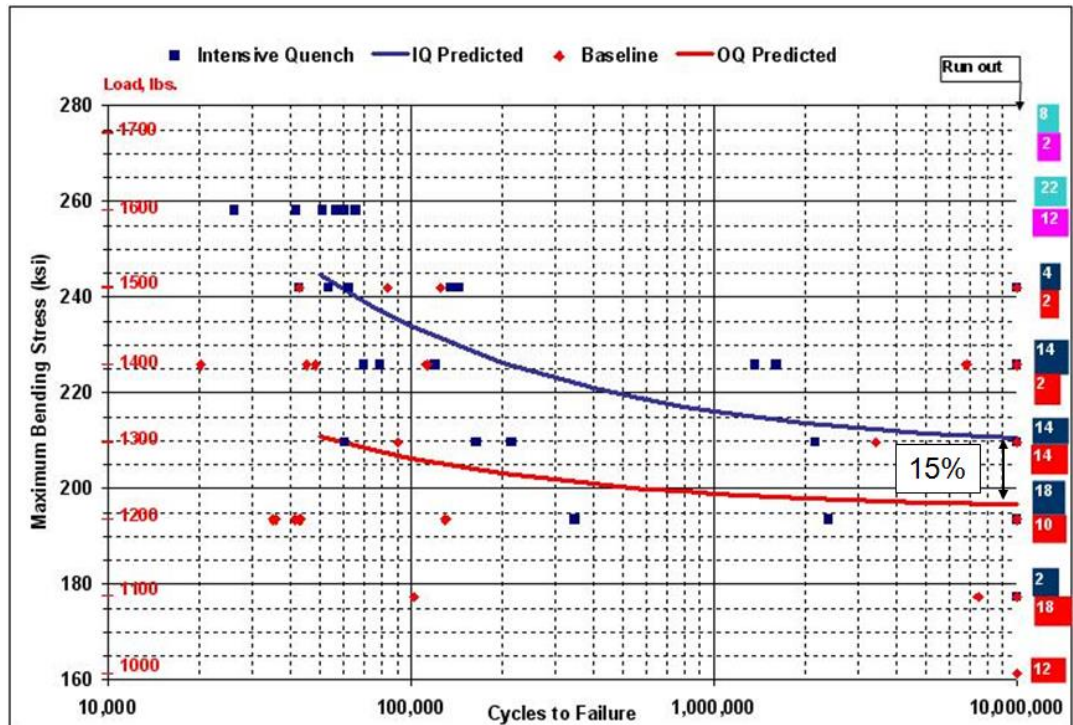
Straight Spur Gear with 40 Teeth, DP of 10, and 6 mm Face Width



Comparison of Residual Stress Profiles at Mid-Planes of Carburized & Quenched Gears.



Schematic of Single Tooth Bending Fatigue Test



Single Tooth Bending Fatigue Test Data Showing 15% Improvement in Endurance Limit Due to Increased Residual Compressive Surface Stress