

### AT A GLANCE

**Problem:**

A small but consistent percentage of hydrostatic transmissions showed unacceptable power loss during testing. With high production volumes, the problem was expensive and the root cause remained elusive, even after extensive internal investigation.

**Objective:**

Determine root cause of the low power condition.

**Solution:**

Prairiefire identified two specific, possible causes and initial testing validated one as the winner. A simple, sustainable fix is in development, supported by facts and data.



Products pictured are representative and not necessarily the products on which the work was performed

### SUMMARY

Our customer had a small but consistent failure rate of their hydrostatic transmissions due to low power during quality control. Though small, the problem was expensive at high production volumes. Several theories had been proposed, but testing was a challenge because transmission disassembly made isolating the variables difficult.

They called Prairiefire to find the root cause of the low power condition within the transmission's pump and motor system, minimize testing, and propose design solutions.

Prairiefire identified two root causes by simultaneously considering internal loads, assembly biases, and manufacturing variation. Combined with a probabilistic model of spline pattern fit, we predicted failure rates that matched our customer's real world quality statistics.

Testing and inspection narrowed it down to a single root cause. Our knowledge of system sensitivities adds confidence that the design change in development will be both effective and sustainable.

In the process of our investigation, we also solved two lingering wear and controllability issues. Since our sensitivity model already existed, it was quick and easy to extend it to other, related areas.

Our experience and multi-faceted approach allowed us to find the root cause and solve the problem. Solving low-percentage failures is often difficult because the answer does not lie in any one aspect alone (e.g. loads, assembly, tolerances, nominal design). Such problems are our specialty.

### BENEFITS

- Identified critical and non-critical contributors, significantly reducing testing and troubleshooting.
- Identified sensitivities to guide the design solutions, assembly procedures, and future engineering.
- Quickly and accurately diagnose manufacturing and assembly errors using existing test and inspection data.
- Guidance on future designs from our results and best practices documentation.

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Prairiefire has 20 years of industry experience helping improve performance, quality, and fit-up through design and analysis of variation. We are 6 $\sigma$  certified and have taught Sensitivity-Based Design, GD&T, and Dimensional Management to hundreds of engineers in 8 countries.