

Background

- Wabtec locomotives require proper gear case lubrication
- Manual gear case oil checks introduces risks
- Automated system to monitor oil levels more frequently

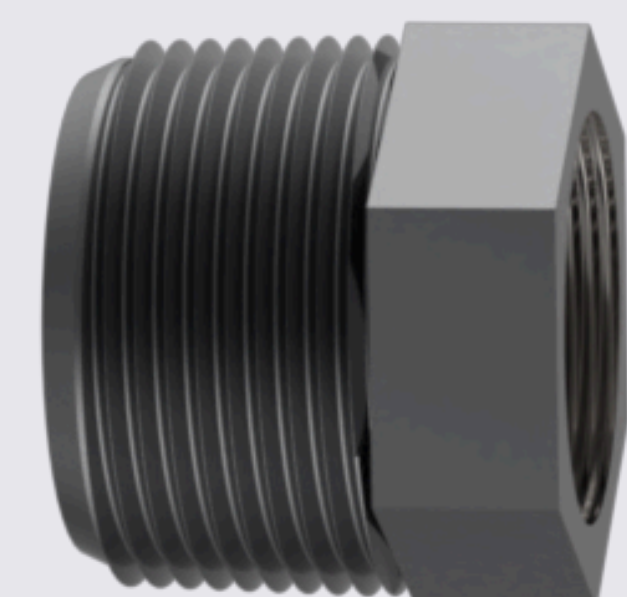
Objectives

- ✓ Design a device that doesn't modify the gear case and limits new leakage paths
- ✓ Eliminate the need for manual inspections
- ✓ Ensure oil level measurements are within specified tolerance
- ✓ Long lifespan in the harsh environment of locomotive
- ✓ Low weight & low exposure

Impact

- Proactive measurements to prevent component failure
- Reduce downtime caused by overheating
- Reduce operational cost over lifetime

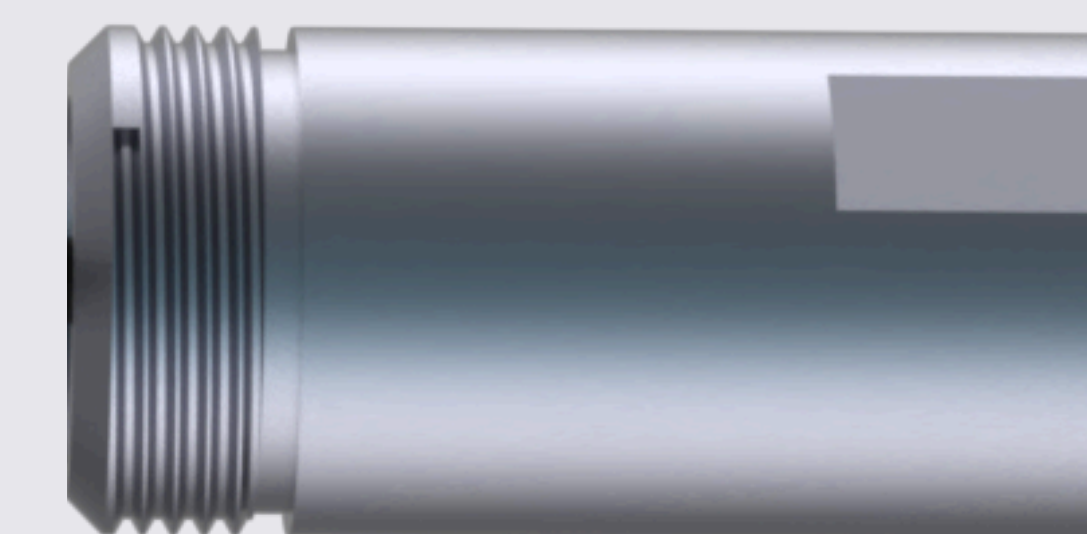
Drain Plug



Sensor



Protective Case



Shock and Fatigue Testing

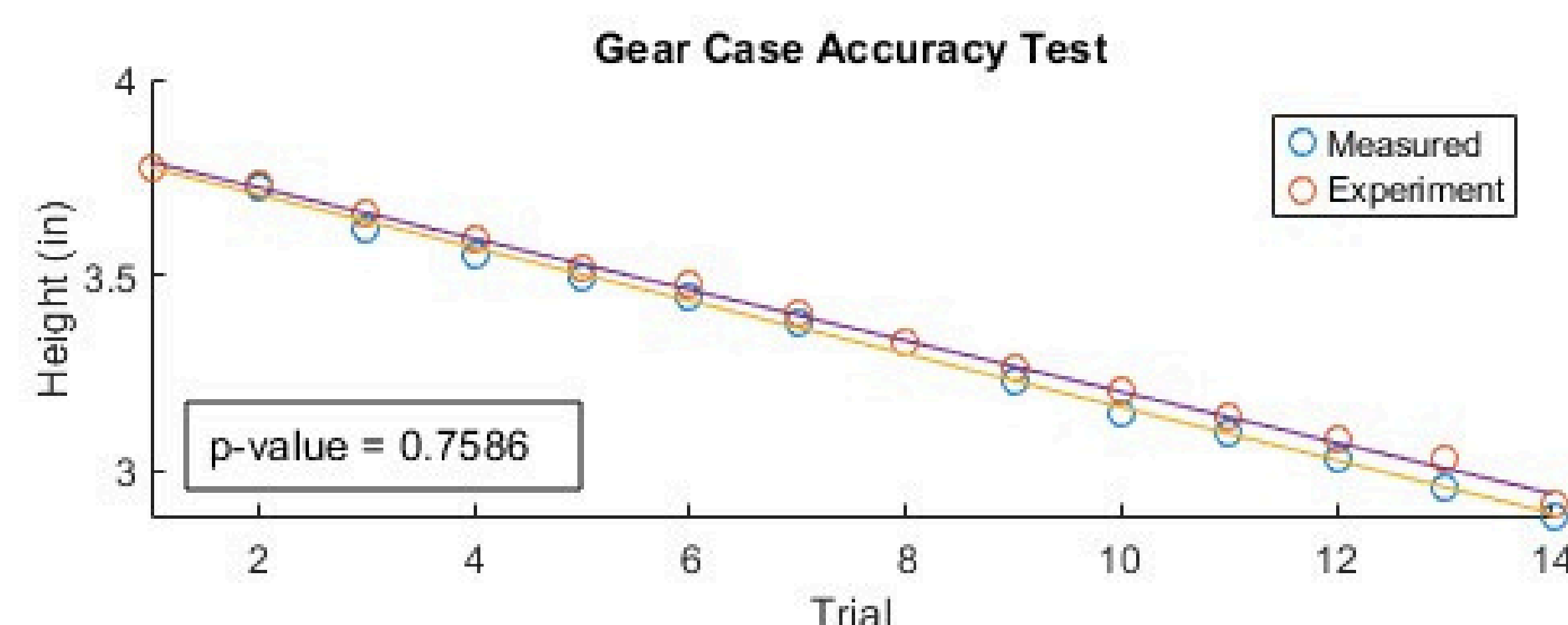
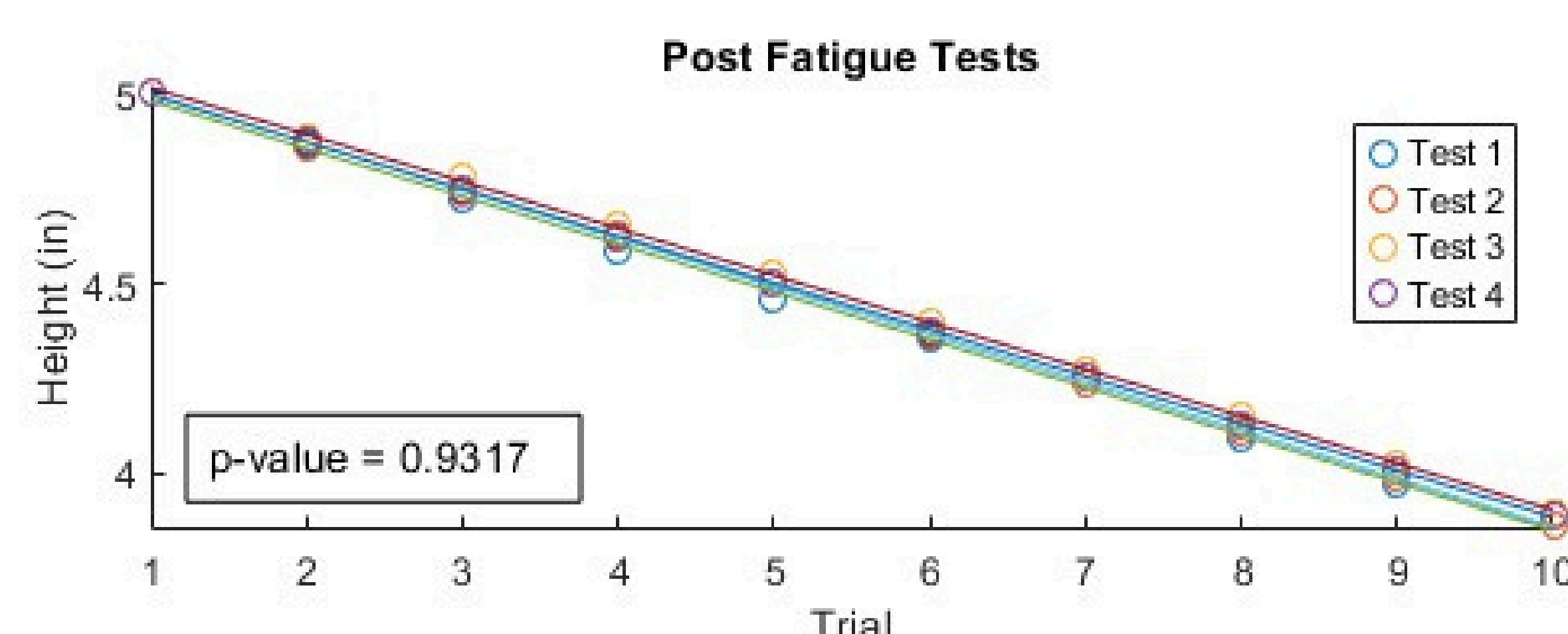
Tested accuracy of 0.25 quarts

Endures vibration fatigue of 8 GRMS

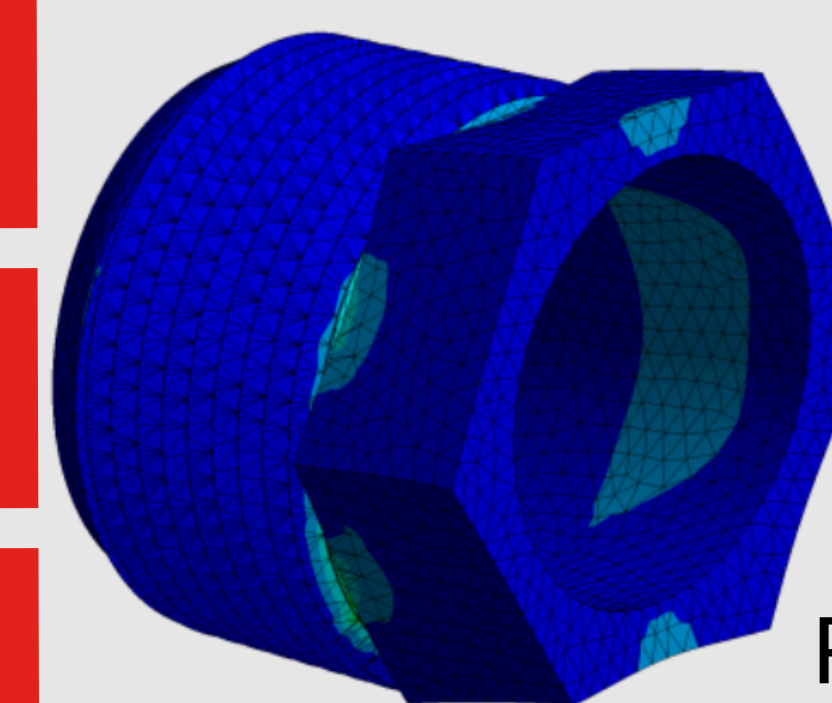
Simulated 10-year lifecycle on a vibration table

Withstands shock loads up to 33 G

Sensor Accuracy Testing

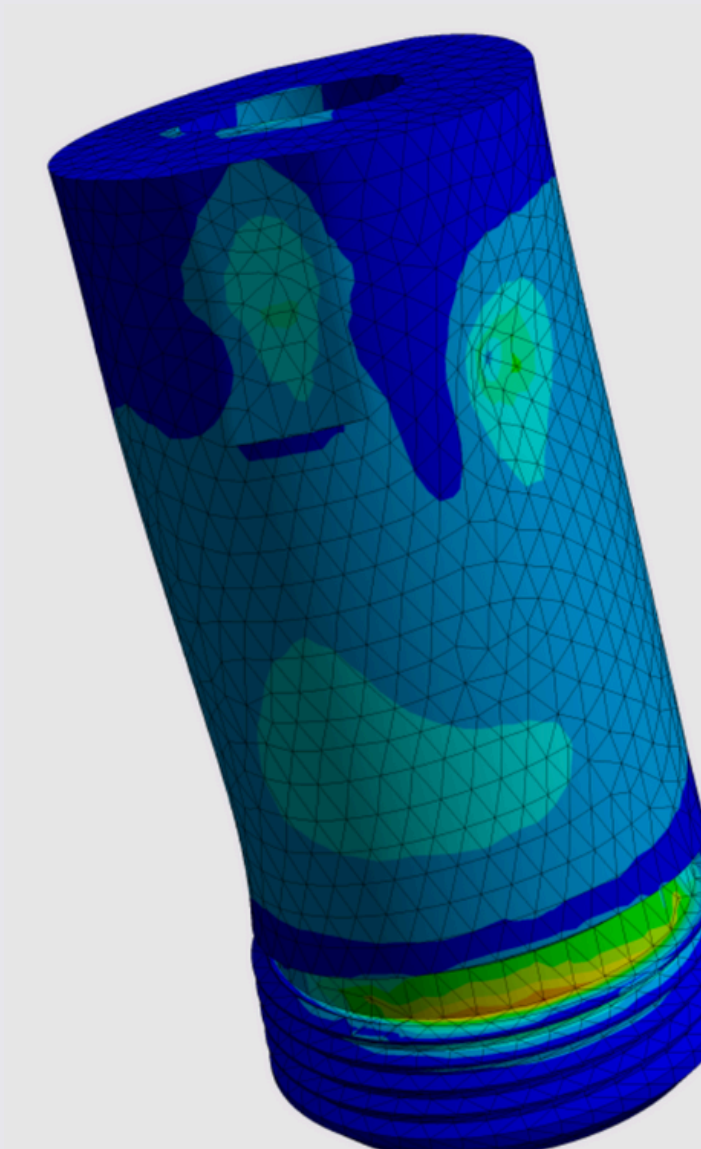


FEA Simulation



Force Analysis

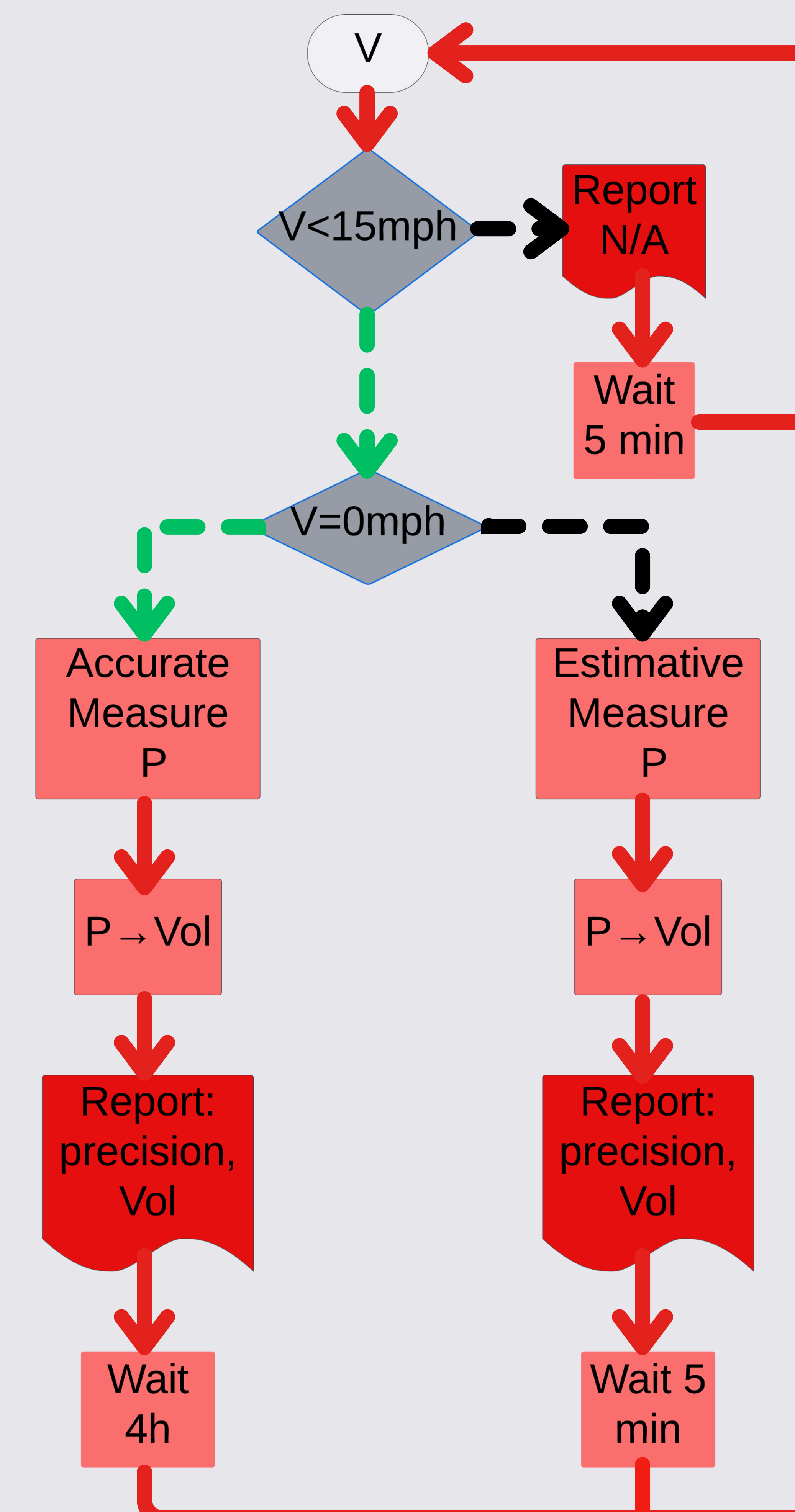
Max. Stress: 84 psi
Yield Stress: 38,000 psi
Fatigue Stress: 28,000 psi
Factor of Safety: >300



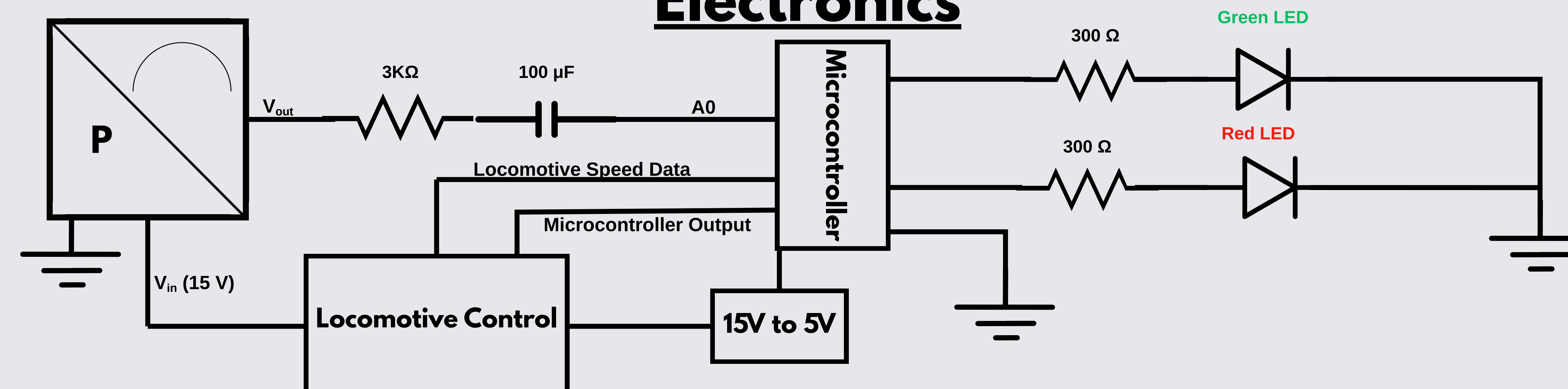
Impact Analysis

Force Applied: 400 lb
Max. Stress: 17000 psi
Yield Stress: 35,000 psi
Factor of Safety: ~2

Logic



Electronics



Future Steps

- Perform field testing to validate performance in real operating conditions
- Explore integration of an oil quality sensor