

The Tribology Laboratory: A Handy Environment for Failure Analysis?

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OUTLINE

- ROUTINE TESTING
 - Fuel & Lubricant performance
 - Physical properties
- IN-HOUSE MODIFICATIONS
- FAILURE ANALYSIS SUPPORT



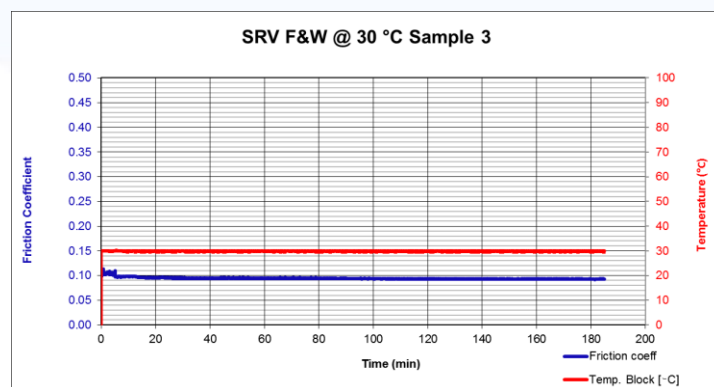
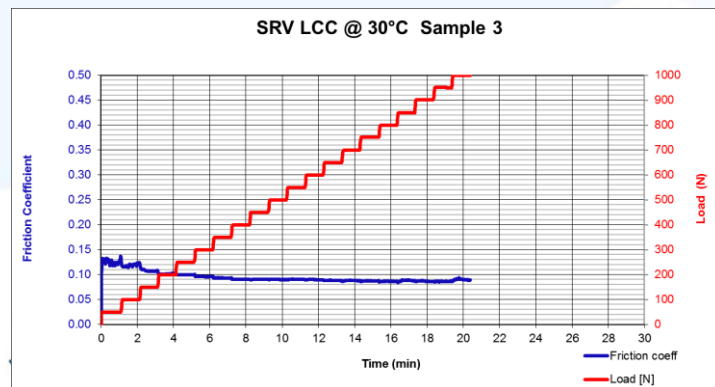
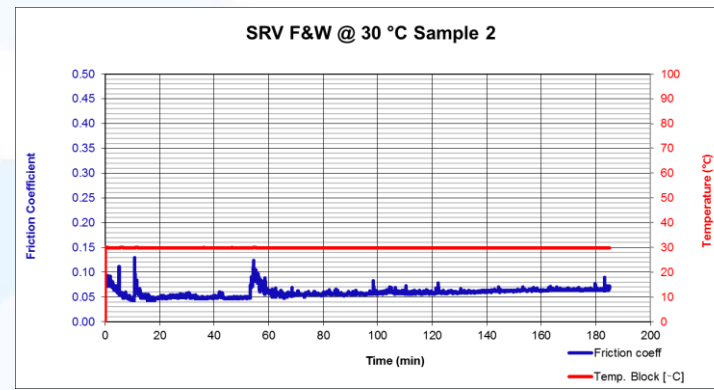
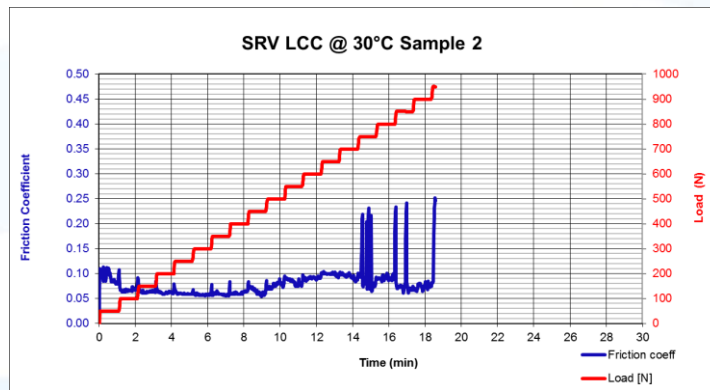
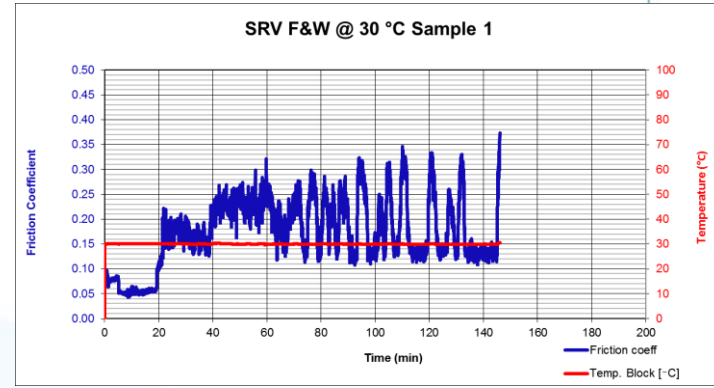
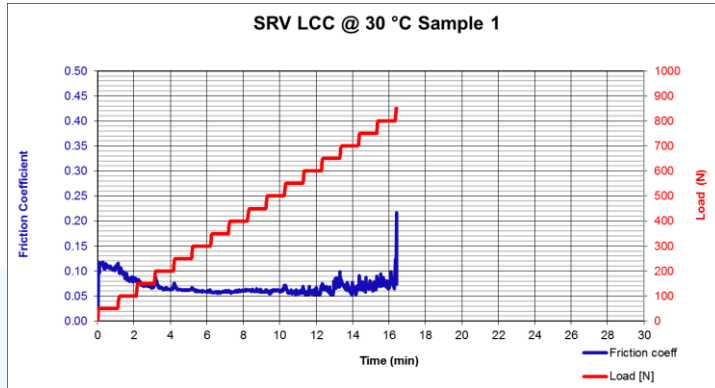


ROUTINE TESTING

- PERFORMANCE TESTING
 - SRV, HFRR, BOCLE, SLBOCLE
 - FZG – Spur Gear Testing
- WEAR SCAR ANALYSIS
 - Optical microscope
 - Non-contact surface profiler
 - Particle size analysis
- PHYSICAL PROPERTIES
 - Viscosity: BROOKFIELD, STABINGER
 - Boiling point Curve, Flash point



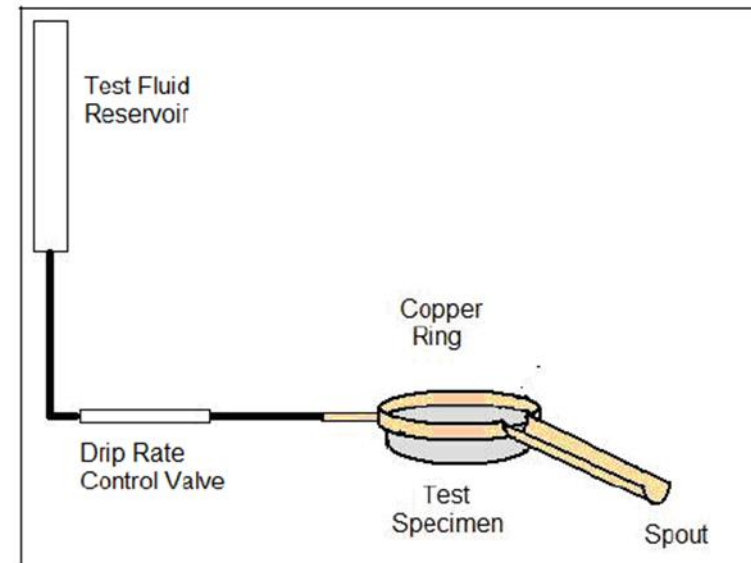
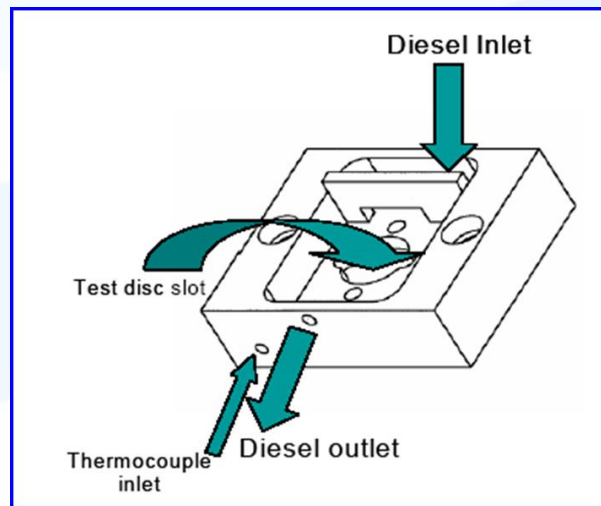
ROUTINE TESTING





IN-HOUSE MODIFICATIONS

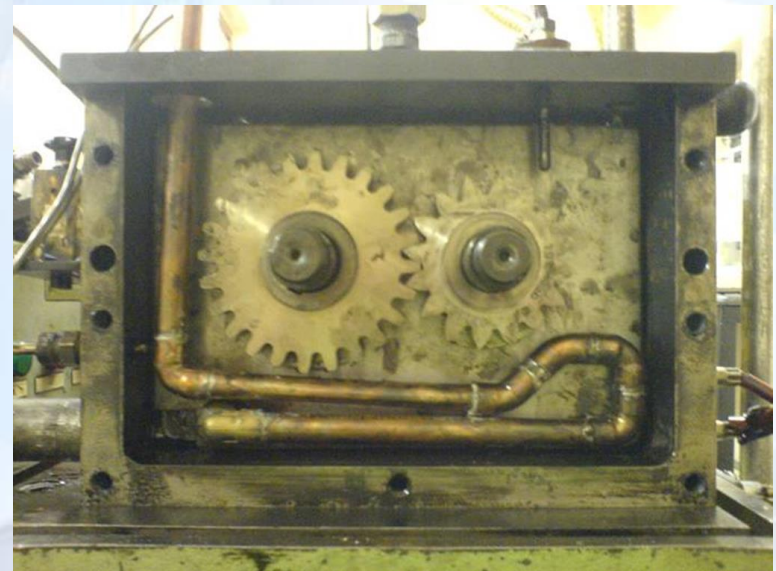
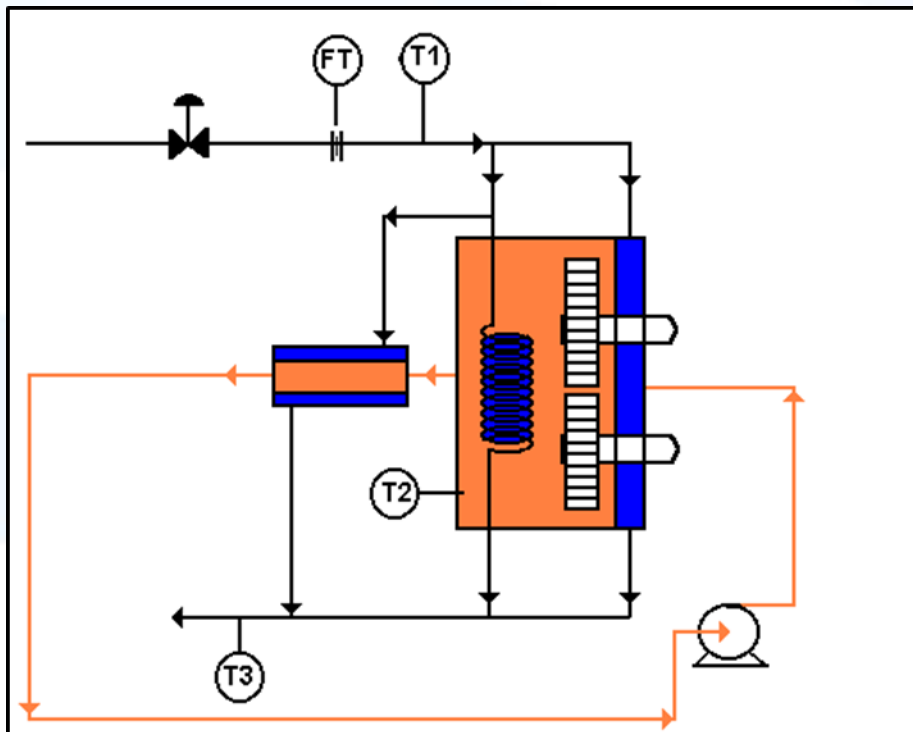
- DIESEL
 - Continuous vs Batch flow
 - Effect of Atmosphere: Water & Oxygen
 - Initial conditions: Running-in





IN-HOUSE MODIFICATIONS

- OPEN GEAR LUBRICANTS
 - FZG at constant temperature: Energy-efficiency determination





IN-HOUSE MODIFICATIONS

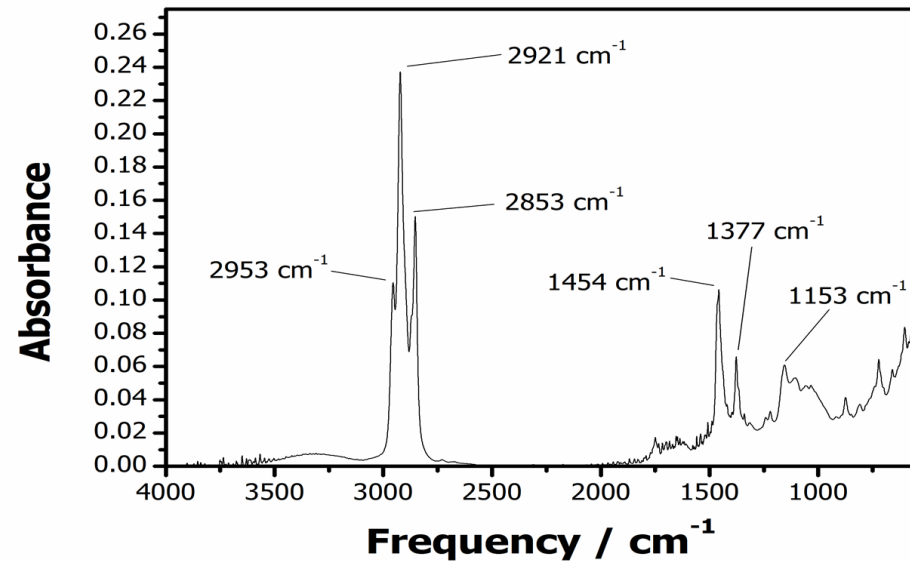
TEST NUMBER	TEMPERATURE (°C)	GEAR SPEED (ms ⁻¹)	LOAD STAGE	TEST DURATION (hr)
1	90 (50)	8.33 (8.33)	11 (11)	1
2	70 (70)	2.76 (8.33)	11 (11)	1
3	90 (90)	8.33 (8.33)	10 (11)	1
4	70 (70)	2.76 (16.66)	10 (11)	1
5	70 (90)	8.33 (16.66)	10 (11)	1
TOTAL DURATION FOR A TEST SEQUENCE:				5 hrs



FAILURE ANALYSIS SUPPORT



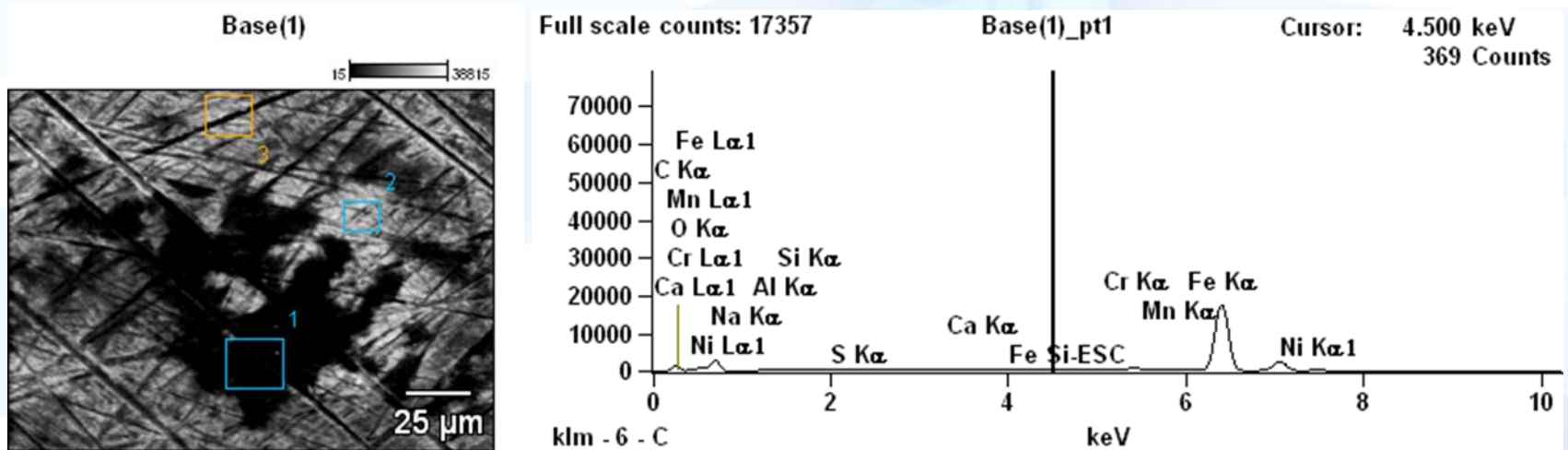
- Analytical methods:
 - FTIR
 - TGA-GC-MS
 - ICP



FAILURE ANALYSIS SUPPORT



- Electron-microscopy: (SEM)



CONCLUSION



- Lubricants are complex – their behaviour even more so.
- Laboratory performance test results need to relate to an industrial environment.
- Understanding why lubricants behave in the way they do, is the purpose of laboratory-based research.





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