Herguth Laboratories, Inc.
101 CORPORATE PLACE · P.O. BOX B · VALLEJO, CA 94590

LABORATORY ANALYSIS REPORT

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Herguth Project Number: #717258A
Sample Description: Electrical Contact Resistance Analysis, Pin-On- Disk Method (ECR-POD) of Motor Silk CLS Bond

Dear Mike:

Please accept this report as our findings on the above project. If you have any questions or comments, please feel free to call.

Conclusion: When added to the reference lubricant, Motor Silk - CLS Bond, forms a protective antiwear film faster than the reference lubricant alone.

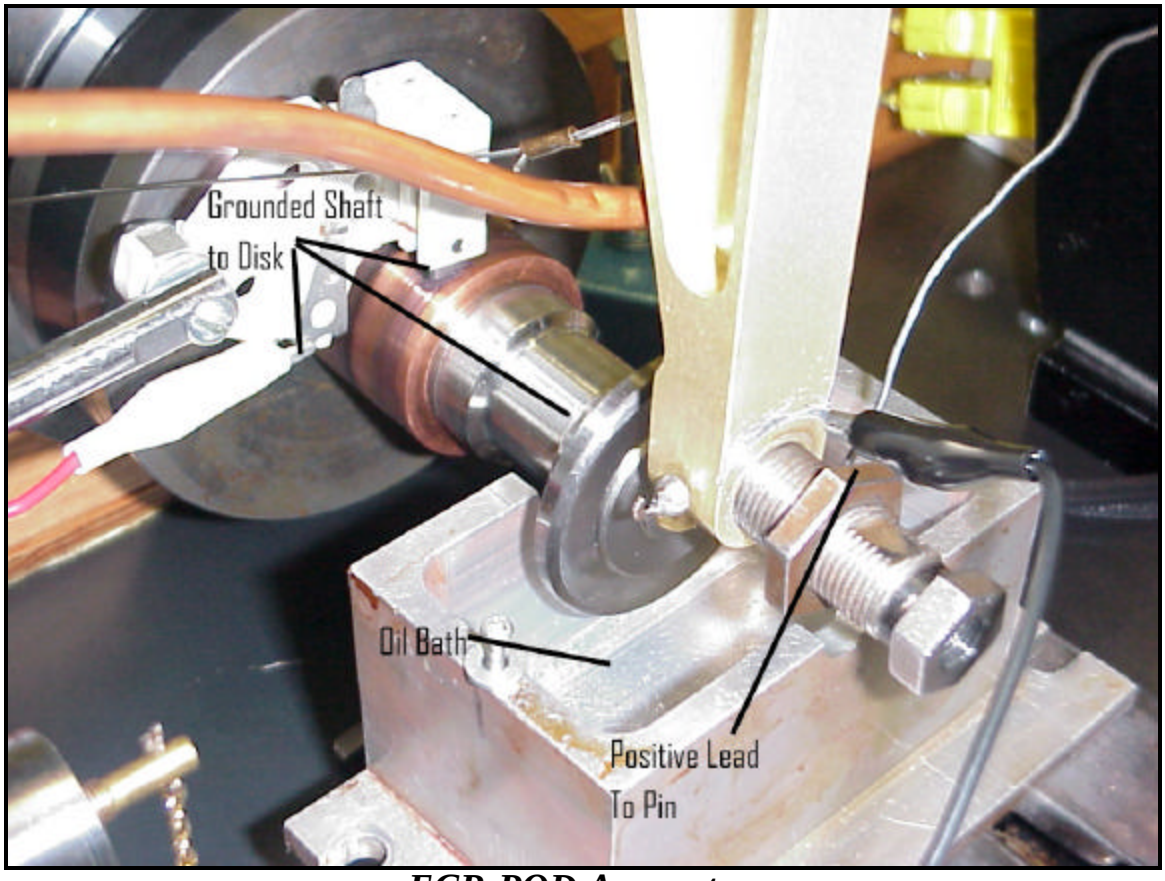
Background and Analysis: Antiwear additives are able to perform their boundary lubrication function by forming films on the surface of the metals. Without these films the asperities on the surfaces would touch and generate severe adhesive wear in the boundary region.

In order to measure the time it takes for the film(s) form we use a technique known as Electrical Contact Resistance (ECR). A small voltage is applied to a steel pin. Initially, this pin is in contact with a grounded steel disk completing an electrical circuit. As the disk rotates with the pin riding on the surface under load, in an oil bath, film(s) form and act as an electrical insulator. The electrical contact (or lack of contact) is recorded using data acquisition software every few seconds.

Three tests were conducted. The first test was the reference lubricant alone (Chevron SAE 30). The time it took to insulate the contact was ~ 187 seconds (Graph #1).

The second test was the reference Chevron lubricant with Motor Silk added in the recommended concentration. In this test a majority of the insulating film was formed immediately (Graph #2)

The third and final test was performed on a pin and disk pair that had been soaked for 24 hours in a blend of Motor Silk and Chevron reference oil. As can be seen in Graph # 3 a film had formed simply by soaking the pin and disk.

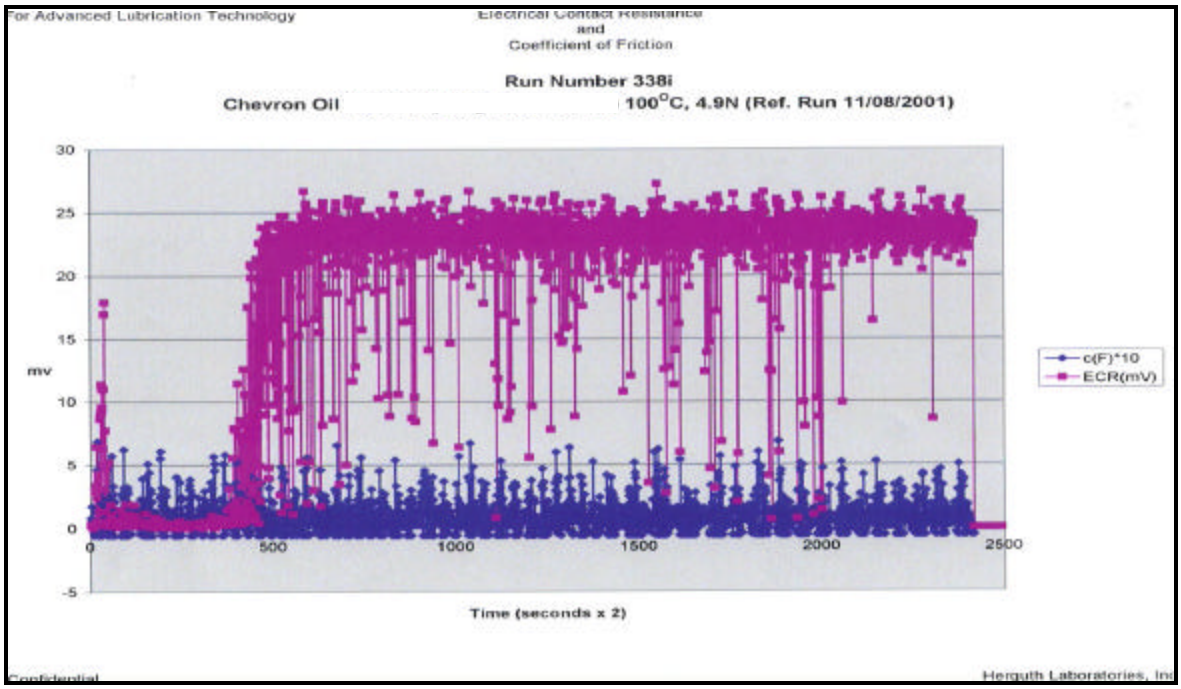


ECR-POD Apparatus

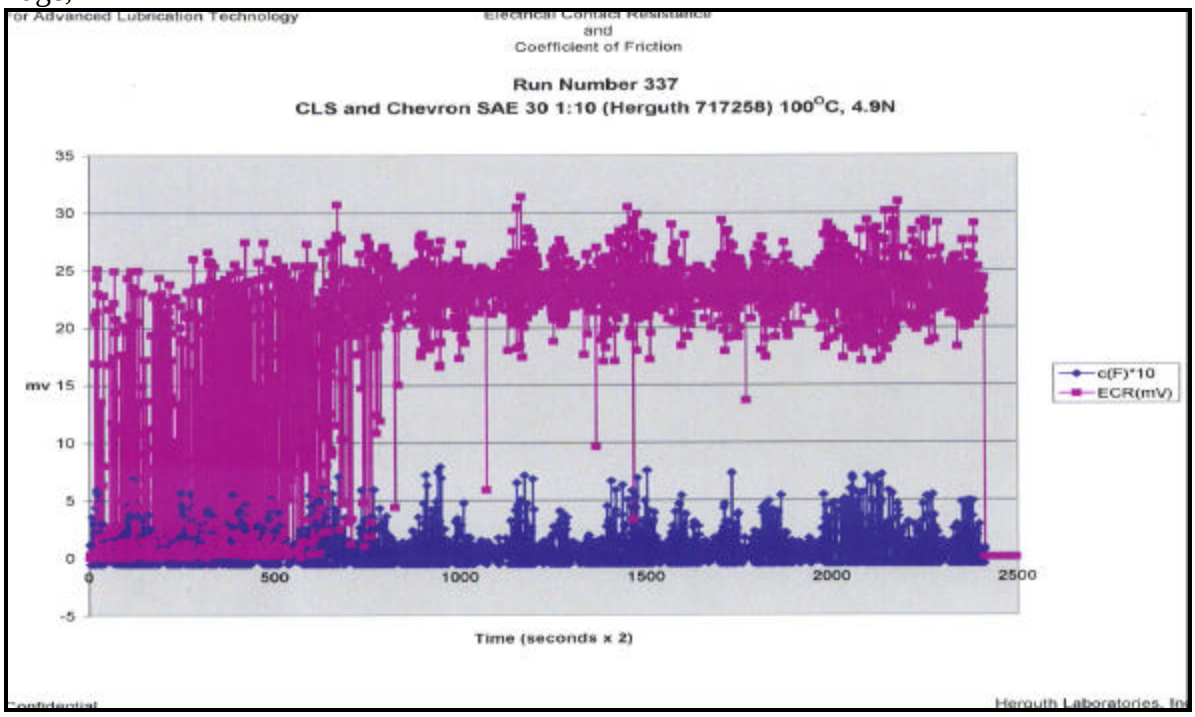
***Graphic Presentation Discussion*:** The data points on the top of the graphs (purple) represent the electrical contact between the pin and disk. When the data point is at the bottom (downward motion) the pin and disk are in electrical contact. When the data points are at the top of the graph there is insulation (film formed). As can be seen there is sporadic contact as the data point shifts rapidly from top to bottom. This represents a film that is not completely covering the contact and has an occasional area that is "unprotected".

It is interesting to note that the Motor Silk not only formed a film faster, but as evidenced by the stability of the data points, the film was more effective.

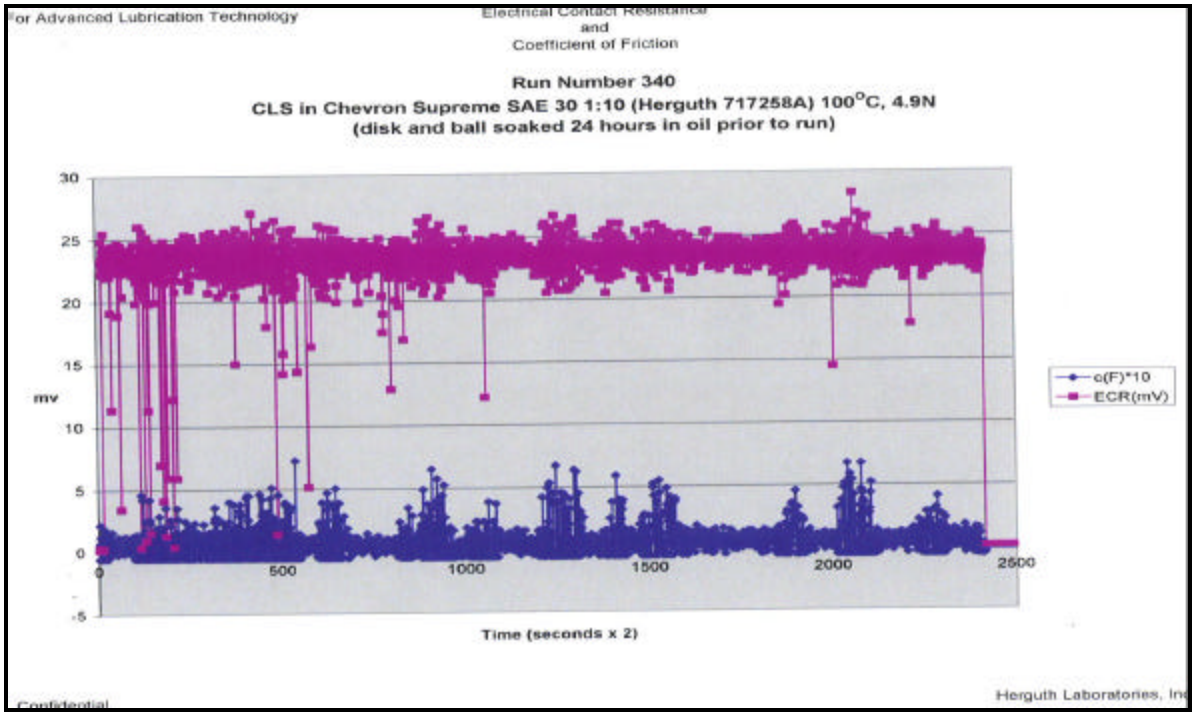
The lower points (blue) represent the coefficient of friction. This test was not intended to evaluate the coefficient of friction. However, looking at the overall graph there is some information that can be obtained. It appears that the coefficient of friction decreases overall with the blend of Motor Silk and lubricant.



ECR-POD CHEVRON SAE 30 MOTOR OIL



ECR-POD CHEVRON SAE 30 MOTOR OIL and MOTOR SILK



24 Hours Soaking
ECR-POD CHEVRON SAE 30 MOTOR OIL and MOTOR SILK

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Herguth Lab No. 717258A
ERC - Pin-on-Disk Run No. 337

Description: CLS mixed with Chevron SAE 30 1:10
Temperature of run 100 degrees C
Load of 4.9N
Time of 20 minutes

Photo of Disk 100X

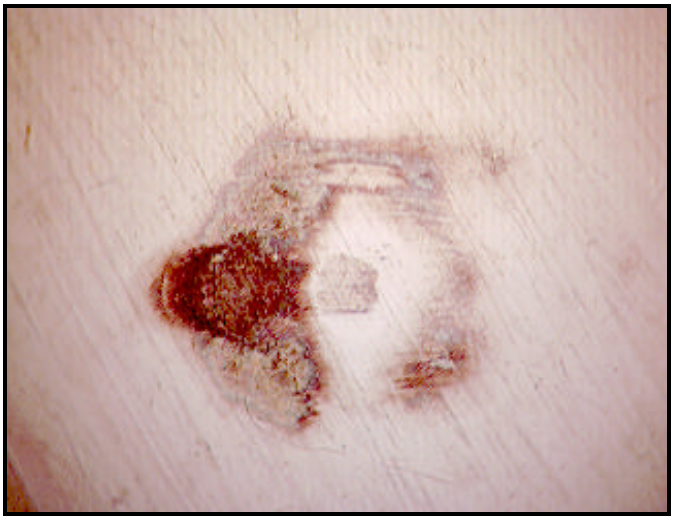

Photo of Film on Pin 100X

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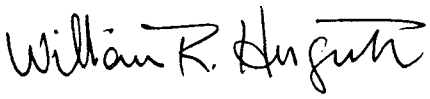
Once again, if you have any questions or comments please feel free to call.

Respectfully Submitted,



William R. Herguth, CLS

cc: Herguth file - L:\FOX\HLMAIN\Lab Reports\717258a.doc