

LABORATORY ANALYSIS REPORT

Report Date/Time: 2/21/01 3:55:24 PM
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Herguth Project: Brake System Rubber Seal Swell Test

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

Conclusion: Oil contamination in brake fluid swells the rubber seals within hours.

Background and Analysis: The question posed to Herguth Laboratories, Inc. was; how long does it take for the oil to swell rubber seals?

It has been established and documented, that oil contamination does in fact swell rubber seals that are found in brake systems. The Society of Automotive Engineers (SAE) claims this swelling happens “rapidly”.

SAE Recommended Practice J1707 NOV91 – SERVICE MAINTENANCE OF SAE J1703 BRAKE FLUIDS IN MOTOR VEHICLE BRAKE SYSTEMS - States in Part;

“Commercial brake fluids are susceptible to various types of contamination which can be detrimental to the performance and safety of brake actuating systems. ...”

CONTAMINATION WITH PETROLEUM PRODUCTS:

“Petroleum products are rapidly and selectively absorbed by brake system rubber parts, resulting in a high degree of softening, dimensional swelling, and general deterioration of the functional properties of these rubber parts. This type of brake fluid contamination will result in unsafe braking action and may be the direct cause of complete brake failure.”

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The question is; what does rapidly mean?

To answer this question we performed the following experiment:

Experiment Scope: Contaminate brake fluid with oil and determine the length of time it takes to swell rubber. Determine how much swelling occurs during the measured time interval.

In order to contaminate known fresh DOT 4 brake fluid, we purchased a new bottle of Valvoline, SynPower - DOT 4 brake fluid and a mineral oil based power steering fluid, made by Heartland. The reason we chose power steering fluid is because it is the most likely source of oil contamination in the brake system reservoir. This is due to the proximity and similarity between the brake cylinder reservoir and the power steering reservoir. In addition, we purchased a rubber master cylinder cover made to replace old brake master cylinder covers (see photos).

Into separate 250 ml glass beakers we added brake fluid and oil in the following ratios:

- Beaker #1 - 100 Brake Fluid
- Beaker # 2 - 100 Power Steering Fluid
- Beaker # 3 - 95% Brake Fluid 5% Power Steering Fluid
- Beaker # 4 - 90 Brake Fluid 10% Power Steering Fluid

We cut portions of the rubber material, measured them to 0.001 inch with calibrated calipers. We then put the individual pieces of rubber into beakers and hand stirring the fluid for about 30 seconds, at room temperature (see photos).

After periods of 4, 24 and 30 hours we removed the rubber from each beaker, wiped off the fluid and measured the same dimension as at the start. Table #1 shows the measurements and the change in size after soaking.

	Brake Fluid Control		100 % Oil		5% Oil 95% Brake		10% Oil 90% Brake	
	Size	% Change	Size	% Change	Size	% Change	Size	% Change
Initial	0.502		0.499		0.503		0.497	
4 Hours	0.5	-0.4	0.51	2.16	0.505	0.4	0.505	1.6
24 Hours	0.501	-0.2	0.518	3.66	0.51	1.4	0.514	3.3
30 Hours	.501	-0.2	.521	4.22	.516	2.5	.518	4.05

TABLE #1



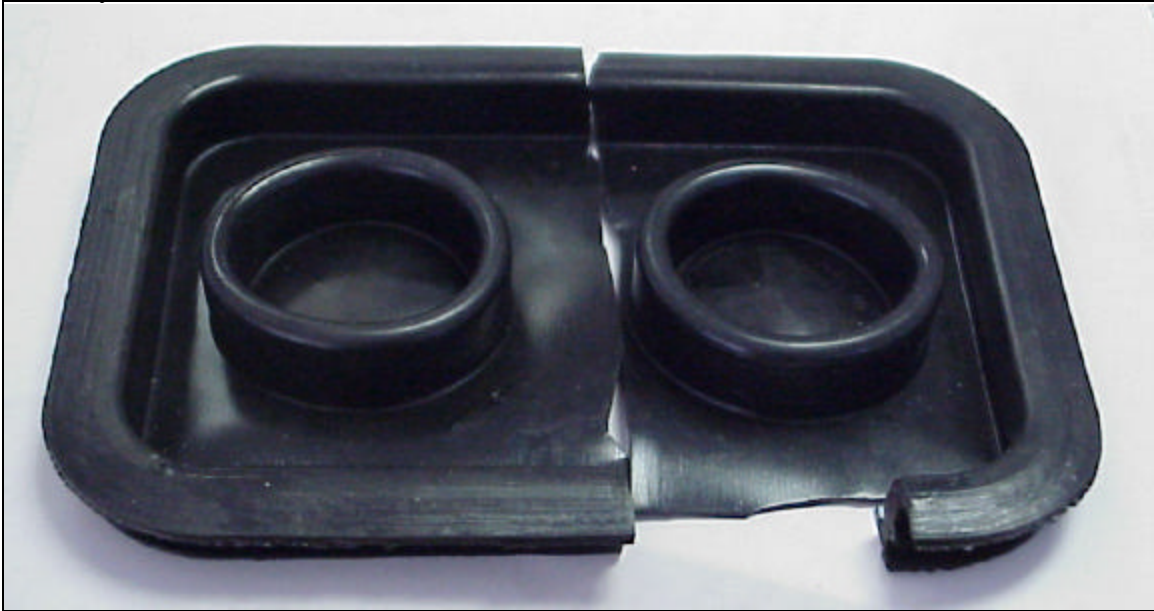
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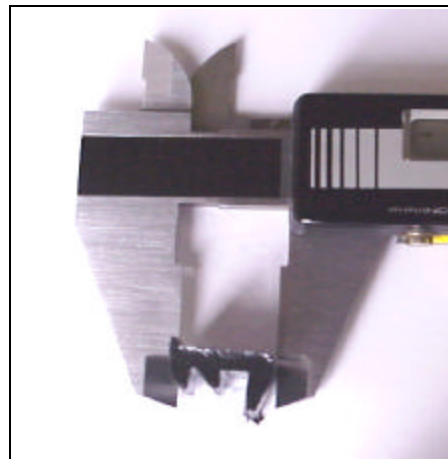
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**Brake Master Cylinder Rubber Cover
After Removal of Test Specimens**



**Brake Master Cylinder Rubber
Cross Section ~0.50 Inch Across**



Measured Dimension



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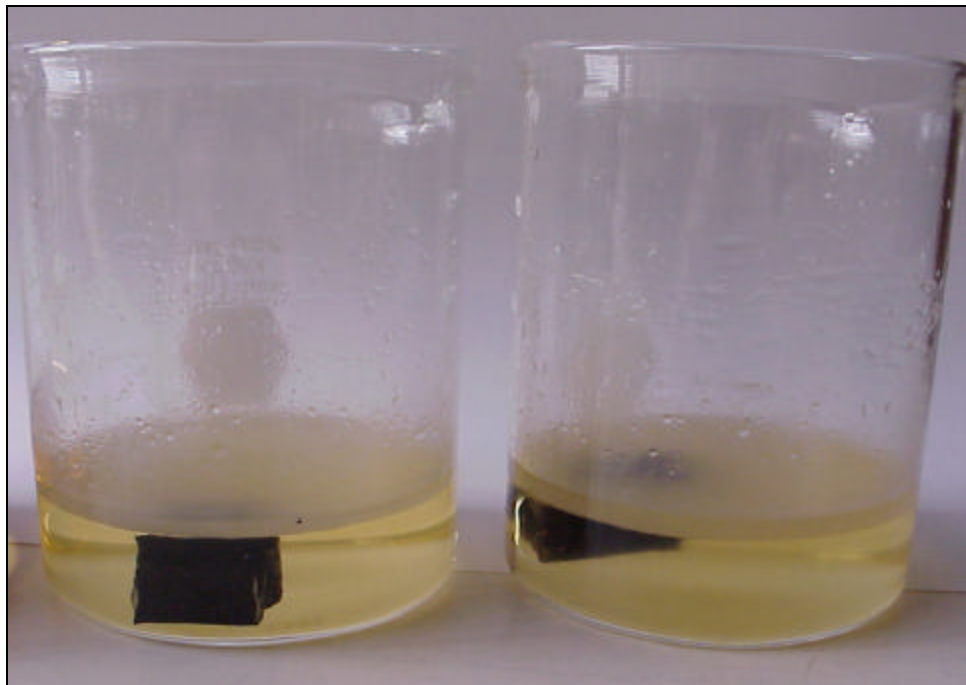
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**Brake
Fluid**

**Power Steering
Fluid**



5% Contamination

10% Contamination



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

Respectfully Submitted,

William R. Herguth
Certified Lubrication Specialist

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