Southwest Research Institute 3rd Party Evaluation on OilPure Performance in Removing Oil Oxidation with No Change in Original Oil Additives.

OILPURE SYSTEMS The Machine Reliability Company

SOUTHWEST RESEARCH INSTITUTE

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February 26, 2001

Mr. John Welsh

Re: Various ASTM Tests
WS#43898
Telephone: 770-806-1071
Fax: 770-806-0942

Third Party Test Evaluation by Southwest Research Institute for OilPure Test Result

Dear Mr. Welsh:

Analysis of your samples received on February 7, 2001 has been completed as requested. The samples were received in good condition in quart plastic containers. Sample identification, test method and results are shown in the attached table.

Test aliquots were taken in accordance with the test procedure. Analyses were performed in accordance with the test procedures used with no deviations or modifications. Precision should be consistent with that stated in the ASTM procedure. The analysis pertains only to the sample received by Southwest Research Institute and represents only a sampling of a batch. This report shall not be reproduced except in full without the express written permission of Southwest Research Institute.

The requested analysis of ASTM D 2272 could not be completed due to insufficient sample.

The ASTM E 168 FTIR fingerprint remained essentially unchanged for all three samples listed below. Although FTIR overlap showed no significant variations specifically in nitration or additive depletion regions, an improvement in the purified sample was noted in the FTIR oxidation region near 1700 wavenumbers. The dirty oil(AOT Dirty/Lab #102424) showed a total oxidation of 0.55 abs/cm, while the purified oil (AOT Purified/Lab #102425) showed only 0.24 abs/cm. Please note that both measurements were baseline corrected using the fresh oil (AOT New/Lab #102423). This is a noted improvement in the purified oil's oxidation of 56.4%.

ASTM D 5185 Metals Analysis by ICP-AES showed only minor changes in wear metals and additive concentrations. Oils with healthy additive packages contain zinc to phosphorus ratios from 1.0 to 1.5%. The ratio of zinc (Zn) to phosphorus (P) remained within this range for all three samples.

ASTM D6304 showed a reduction of water contamination in the purified oil for a total water reduction of 36.1%. ASTM D664 Total Acid Number showed a reduction of 0.09

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mg KOH/g from the dirty to the purified sample for a total acid reduction of 36.0%. ASTM D445 Viscosity at 100°F was essentially unchanged from the new, dirty, and purified samples.

ISO 4406-1999 Particle Count showed a slight improvement from the dirty to the purified sample. Please note that although the actual ISO code showed only a slight improvement the actual numbers of particles counted at >4, >6, and >14 microns showed a significant improvement from the dirty to the purified oil. Particles of >4 microns were reduced by 85.6%, particles of >6 microns were reduced by 82.8% and particles >16 microns were reduced by 57.3%.

In conclusion, the analyses of these samples showed that the purified oil contained fewer contaminants than were found in the dirty oil. It can therefore be assumed that the purification process used to purify the dirty oil and obtain the purified sample removed these contaminants without affecting the oil's oxidation stability.

If there are any questions I may answer regarding these analyses, please contact me at 210-522-6924.

Sincerely,

Janet L. S. Barker
Research Scientist
Petroleum Products Research Dept.
Automotive Products and
Emissions Research Division

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Test result shows that the purified oil has lubrication quality as good as new oil.

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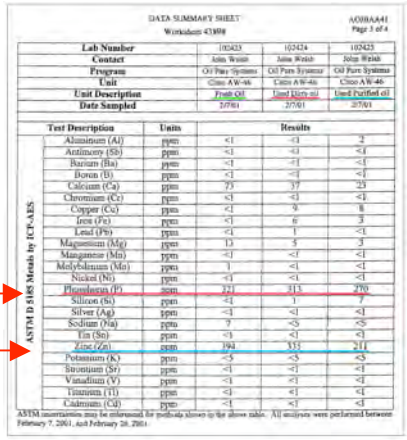
Lab Number		102423	102424	102425	
Contact		John Welsh	John Welsh	John Welsh	
Program		Oil Pure Systems	Oil Pure Systems	Oil Pure Systems	
Unit		Citco AW-46	Citco AW-46	Citco AW-46	
Unit Description		Fresh Oil	Used Dirty oil	Used Purified oil	
Date Sampled		2/7/01	2/7/01	2/7/01	
Test Description		**Units**	**Results**		% Improvement Dirty to Clean
ASTM E168 FTIR	Fingerprint	N/A	Attached	Attached	Attached	
ASTM E168 FTIR	Oxidation	Abs/cm	N/A	0.55	0.24	56.4 %
ASTM E168 FTIR	Nitration	Abs/cm	N/A	<0.50	<0.50	-
ASTM D 2272 RBOT	Oxidation Induction	minutes	N/A	N/A	N/A	N/A
ASTM D6304	Water	ppm	84	72	46	36.1 %
ASTM D664	Total Acid Number	mg KOH/g	0.47	0.25	0.16	36.0 %
ASTM D445	Viscosity @ 100°F	SUS	221.4	268.2	266.6	-
ISO 4406-1999	Particle Count	ISO Code	21/20/17	23/21/18	20/19/17	-
	>4 microns	Counts/mL	13556	59275	8532	85.6 %
	>6 microns	Counts/mL	5222	14950	2576	82.8 %
	>14 microns	Counts/mL	830	1685	720	57.3 %

ASTM uncertainties may be referenced for methods shown in the above table. All analyses were performed between February 7, 2001, and February 26, 2001.

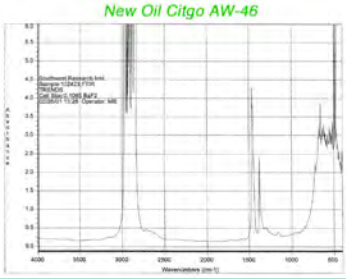


Summary Report from Southwest Research Inst.

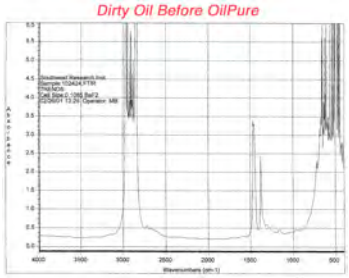
- 56.4% Improvement in **Oil Oxidation**.
- 36.0% Reduction in **Total Acid Number** (TAN)
- 36.1% Reduction in **Water Content**.
- No change in Zinc & Phosphorus additives.
- 85.6% reduction in **>4 micron** particulate.
- 82.8% reduction in **>6 micron** particulate.
- 57.3% reduction in **>16 micron** particulate.

Dirty oil sample was obtained from high speed injection molder (Husky) after 22,000 hours (2.5 years) of service.
Purified oil sample was obtained after OilPure unit to compare the before & after test results.
New Oil Sample is Citgo AW 68 hydraulic oil for reference.

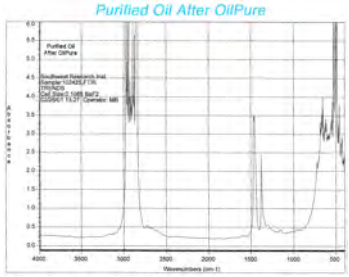
New Oil Citgo AW-46



Dirty Oil Before OilPure



Purified Oil After OilPure



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