SOUTHWEST RESEARCH INSTITUTE

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February 26, 2001

Mr. John Welsh

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

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

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

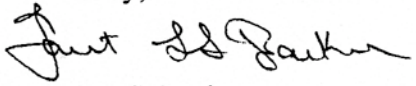
mg KOH/g from the dirty to the purified sample for a total acid reduction of 36.0%. ASTM D445 Viscosity at 100°F was essentially unchanged from the new, dirty, and purified samples.

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

DATA SUMMARY SHEET

Worksheet 43898

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		
ASTM D 5185 Metals by ICP-AES	Aluminum (Al)	ppm	<1	<1	2
	Antimony (Sb)	ppm	<1	<1	<1
	Barium (Ba)	ppm	<1	<1	<1
	Boron (B)	ppm	<1	<1	<1
	Calcium (Ca)	ppm	73	37	23
	Chromium (Cr)	ppm	<1	<1	<1
	Copper (Cu)	ppm	<1	9	8
	Iron (Fe)	ppm	<1	6	3
	Lead (Pb)	ppm	<1	1	<1
	Magnesium (Mg)	ppm	13	5	3
	Manganese (Mn)	ppm	<1	<1	<1
	Molybdenum (Mo)	ppm	1	<1	<1
	Nickel (Ni)	ppm	<1	<1	<1
	Phosphorus (P)	ppm	321	313	270
	Silicon (Si)	ppm	<1	1	7
	Silver (Ag)	ppm	<1	<1	<1
	Sodium (Na)	ppm	7	<5	<5
	Tin (Sn)	ppm	<1	<1	<1
	Zinc (Zn)	ppm	394	335	211
	Potassium (K)	ppm	<5	<5	<5
	Strontium (Sr)	ppm	<1	<1	<1
	Vanadium (V)	ppm	<1	<1	<1
	Titanium (Ti)	ppm	<1	<1	<1
	Cadmium (Cd)	ppm	<1	<1	<1

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

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Worksheet 43898

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

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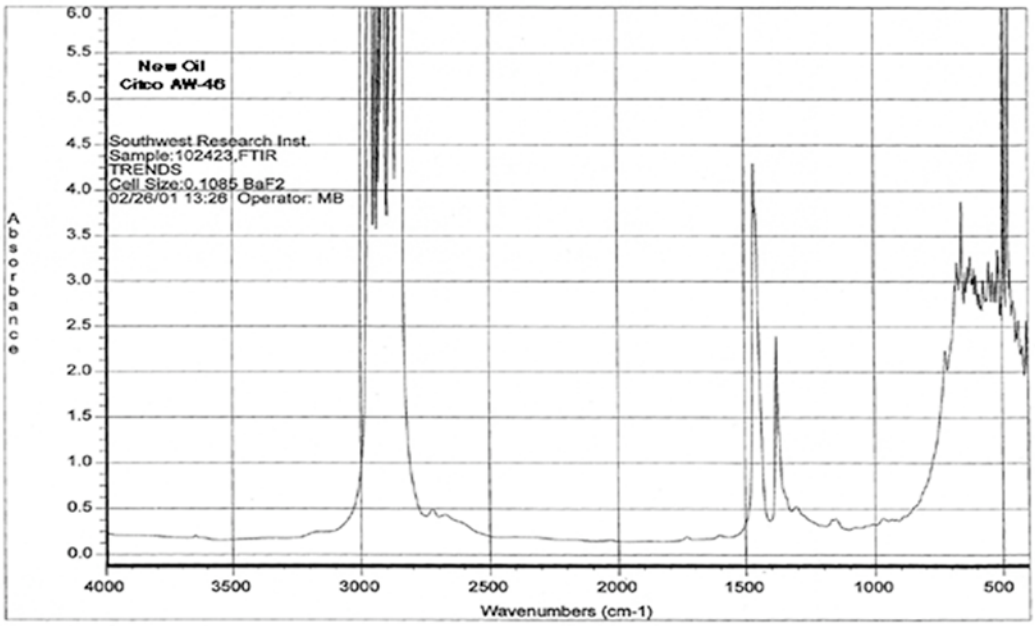
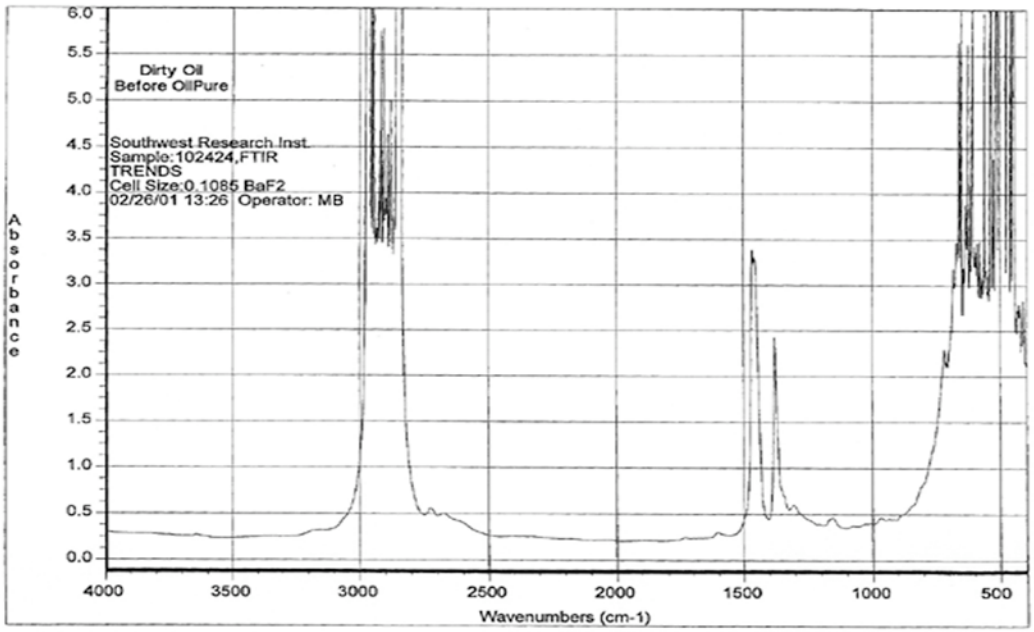
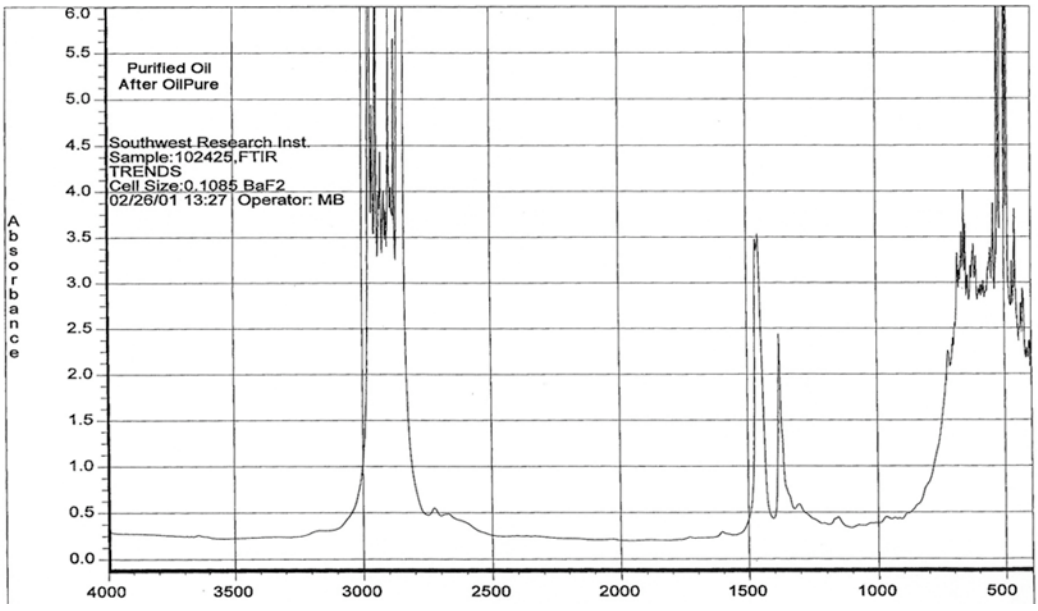

New Oil
Citco AW-46
Southwest Research Inst.
Sample:102423,FTIR
TRENDS
Cell Size:0.1085 BaF2
02/26/01 13:26 Operator: MB
Absorbance
Wavenumbers (cm-1)


Dirty Oil
Before OilPure
Southwest Research Inst.
Sample:102424,FTIR
TRENDS
Cell Size:0.1085 BaF2
02/26/01 13:26 Operator: MB
Absorbance
Wavenumbers (cm-1)


Purified Oil
After OilPure
Southwest Research Inst.
Sample:102425,FTIR
TRENDS
Cell Size:0.1085 BaF2
02/26/01 13:27 Operator: MB
Absorbance