

**Caterpillar C-13  
Engine Oil Test**

**Version**

**Title / Validity Declaration Page  
Form 1**

**Conducted For**

V =	Valid; The Reference Oil / Non-Reference Oil was evaluated in accordance with the test procedure.
I =	Invalid; The Reference / Non-Reference Oil was not evaluated in accordance with the test procedure.
N =	Results cannot be interpreted as representative of oil performance (Non-Reference Oil) and shall not be used in determining average test results using Multiple Test Criteria.

NR = Non-Reference Oil Test
RO = Reference Oil Test

Test Number		
<b>Stand:</b>	<b>Stand Run No.:</b>	
<b>End of Test Date:</b>	<b>End of Test Time:</b>	
<b>Oil Code / CMIR:</b> <sup>A</sup>		
<b>Formulation / Stand Code:</b> <sup>B</sup>		
<b>Altcode 1:</b>	<b>Altcode 2:</b>	<b>Altcode 3:</b>

In my opinion the test \_\_\_\_\_ been conducted in a valid manner in accordance with Test Method D XXXX and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.

<sup>A</sup> CMIR or Non-Reference Oil Code <sup>B</sup> ACC-Registered Tests Only

Submitted By: \_\_\_\_\_  
Testing Laboratory

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Typed Name

\_\_\_\_\_  
Title

**Caterpillar C-13  
Engine Oil Test**

**Form 2  
Table of Contents**

1. Title / Validity Declaration Page	Form 1
2. Table of Contents	Form 2
3. Summary of Test Method	Form 3
4. Test Results Summary	Form 4
5. Operational Summary	Form 5
6. Rod Bearing Weight Loss	Form 6
7. Ring Weight Loss Summary	Form 7
8. Ring Side Clearance	Form 8
9. Oil Analysis Summary	Form 9
10. Liner Wear Summary	Form 10
11. Unscheduled Downtime & Maintenance Summary	Form 11
12. Test Fuel Analysis (Last Batch)	Form 12
13. Build-Up and Hardware Information	Form 13
14. Piston Rating Summary	Form 14
15. Piston 1 Deposit Ratings	Form 15
16. Piston 2 Deposit Ratings	Form 16
17. Piston 3 Deposit Ratings	Form 17
18. Piston 4 Deposit Ratings	Form 18
19. Piston 5 Deposit Ratings	Form 19
20. Piston 6 Deposit Ratings	Form 20
21. Piston 1 Supplemental Rating Summary	Form 21
22. Piston 2 Supplemental Rating Summary	Form 22
23. Piston 3 Supplemental Rating Summary	Form 23
24. Piston 4 Supplemental Rating Summary	Form 24
25. Piston 5 Supplemental Rating Summary	Form 25
26. Piston 6 Supplemental Rating Summary	Form 26
27. Oil Consumption Plot	Form 27
28. ACC Conformance Statement	Form 28

**Caterpillar C-13  
Engine Oil Test**

**Form 3  
Summary of Test Method**

The CAT C-13 Engine Oil Test is an engine-dynamometer test which evaluates the ability of an engine oil to protect against ring sticking and oil consumption.

The test engine is a CAT C-13 diesel engine with ACERT technology. It is an in-line six cylinder, four stroke, turbocharged engine with electronically controlled fuel injection.

<b>C-13 Test Conditions</b>	
<b>Parameter</b>	<b>Value</b>
Time, h	500
Speed, r/min	1800
Fuel Flow, g/min	1200
Inlet Manifold Temperature, °C	40
Coolant Out Temperature, °C	88
Fuel In Temperature, °C	40
Oil Gallery Temperature, °C	98
Intake Air Temperature, °C	25
Tailpipe Exhaust Temperature, °C	Record
Intake Air Restriction, kPa Absolute	95
Intake Manifold Pressure, kPa	280
Exhaust Back Pressure, kPa	6
Dew Point, °C	Record
Coolant System Pressure, kPa	99 - 107
Power, kW	Record
Torque, Nm	Record
Oil Gallery Pressure, kPa	Record

**Caterpillar C-13  
Engine Oil Test**

**Test Results Summary  
Form 4**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

<b>Start Date:</b>	<b>Start Time:</b>	<b>Test Length:</b>
<b>Laboratory Oil Code:</b>		<b>TMC Oil Code<sup>A</sup>:</b>
<b>Engine Number:</b>	<b>Engine Hours:</b>	<b>Engine Serial No.:</b>

Oil Consumption, g/hr		
100 – 150	450 – 500	% Inc.

Piston No.	WD	TGC	TLC	TGF	IGF	IGC	AGF	Loss of Ring Side Clearance		
								Top	Int.	Oil
1										
2										
3										
4										
5										
6										
Average										

Piston No.		Top	Int.	Oil	Crown	Skirt	Liner
1	Stuck Ring						
	Scuffed						
2	Stuck Ring						
	Scuffed						
3	Stuck Ring						
	Scuffed						
4	Stuck Ring						
	Scuffed						
5	Stuck Ring						
	Scuffed						
6	Stuck Ring						
	Scuffed						

<sup>A</sup> Reference Oil Tests Only

**Caterpillar C-13  
Engine Oil Test  
Operational Summary  
Form 5**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

<b>Controlled Parameters</b>					
<b>Parameter</b>	<b>Units</b>	<b>Target</b>	<b>Tolerance</b>	<b>Average</b>	<b>Samples</b>
Engine Speed	r/min	1800	± 5		
Fuel Flow	g/min	1200	± 6		
<b>Temperature</b>					
Inlet Air	°C	25	± 2		
Intake Manifold Air	°C	40	± 2		
Fuel Inlet	°C	40	± 1		
Coolant Outlet	°C	88	± 2		
Oil Gallery	°C	98	± 2		
<b>Pressure</b>					
Inlet Air	kPa	95	± 3		
Exhaust Stack	kPa	6	± 1		
Intake Manifold	kPa	280	± 5		
<b>Non-Controlled Parameters</b>					
<b>Parameter</b>	<b>Units</b>	<b>Target</b>	<b>Tolerance</b>	<b>Average</b>	<b>Samples</b>
Engine Torque	Nm	1800	Record		
Dew Point	°C	Record	Record		

**Caterpillar C-13  
Engine Oil Test  
Rod Bearing Weight Loss  
Form 6**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

Cylinder No.	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	Upper			
2	Upper			
3	Upper			
4	Upper			
5	Upper			
6	Upper			
Upper Bearing Average Weight Loss, mg				
Upper Bearing Minimum Weight Loss, mg				
Upper Bearing Maximum Weight Loss, mg				

Cylinder No.	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	Lower			
2	Lower			
3	Lower			
4	Lower			
5	Lower			
6	Lower			
Lower Bearing Average Weight Loss, mg				
Lower Bearing Minimum Weight Loss, mg				
Lower Bearing Maximum Weight Loss, mg				

**Caterpillar C-13  
Engine Oil Test  
Ring Weight Loss  
Form 7**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

Cylinder No.	Top Ring SOT Weight, g	Top Ring EOT Weight, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
	Top Ring Average Weight Loss, mg		
	Top Ring Weight Loss Std. Dev., mg		
	Top Ring Min. Weight Loss, mg		
	Top Ring Max. Weight Loss, mg		

Cylinder No.	2 <sup>nd</sup> Ring SOT Weight, g	2 <sup>nd</sup> Ring EOT Weight, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
	2 <sup>nd</sup> Ring Average Weight Loss, mg		
	2 <sup>nd</sup> Ring Weight Loss Std. Dev., mg		
	2 <sup>nd</sup> Ring Min. Weight Loss, mg		
	2 <sup>nd</sup> Ring Max. Weight Loss, mg		

Cylinder No.	Oil Ring SOT Weight, g	Oil Ring EOT Weight, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
	Oil Ring Average Weight Loss, mg		
	Oil Ring Weight Loss Std. Dev., mg		
	Oil Ring Min. Weight Loss, mg		
	Oil Ring Max. Weight Loss, mg		

**Caterpillar C-13  
Engine Oil Test**

**Ring Side Clearance - Form 8**

<b>Laboratory:</b>	<b>EOT Time:</b>
<b>Test Number:</b>	
<b>Oil Code:</b>	
<b>Formulation / Stand Code:</b>	

Piston No. 1		A	B	C	D	Avg.	Max
<b>Top</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Int.</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Oil</b>	Pre-Test						
	Post-Test						
	LSC						

Piston No. 2		A	B	C	D	Avg.	Max
<b>Top</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Int.</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Oil</b>	Pre-Test						
	Post-Test						
	LSC						

Piston No. 3		A	B	C	D	Avg.	Max
<b>Top</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Int.</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Oil</b>	Pre-Test						
	Post-Test						
	LSC						

Piston No. 4		A	B	C	D	Avg.	Max
<b>Top</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Int.</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Oil</b>	Pre-Test						
	Post-Test						
	LSC						

Piston No. 5		A	B	C	D	Avg.	Max
<b>Top</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Int.</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Oil</b>	Pre-Test						
	Post-Test						
	LSC						

Piston No. 6		A	B	C	D	Avg.	Max
<b>Top</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Int.</b>	Pre-Test						
	Post-Test						
	LSC						
<b>Oil</b>	Pre-Test						
	Post-Test						
	LSC						





**Caterpillar C-13  
Engine Oil Test  
Liner Wear Summary  
Form 10**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

<b>Position</b>	<b>Wear Step (µm)</b>						
	<b>Cylinder Number</b>						
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>Average</b>
3:00 (Thrust)							
6:00 (Rear)							
9:00 (Anti-Thrust)							
12:00 (Front)							
<b>Average</b>							

<b>Summary</b>	<b>As Measured</b>
Average, µm	
Minimum, µm	
Maximum, µm	







**Caterpillar C-13  
Engine Oil Test  
Test Fuel Analysis (Last Batch)  
Form 12**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		
<b>Fuel Supplier:</b>		<b>Fuel Batch ID:</b>

Measurement	Specs.	Analysis		Test Method
		New	EOT	
<b>Total Sulfur, ppm</b>	<b>7 - 15</b>			<b>D 5453</b>
<b>Gravity, °API</b>	<b>34 - 37</b>			<b>D 4052</b>
<b>Hydrocarbon Composition</b>				
<b>Aromatics, % Weight</b>	<b>26 – 31.5</b>			<b>D 5186</b>
<b>Olefins, % Volume</b>	<b>Report</b>			<b>D 1319</b>
<b>Cetane Index</b>	<b>Report</b>			<b>D 976</b>
<b>Cetane No.</b>	<b>43 – 47</b>			<b>D 613</b>
<b>Copper Strip Corrosion</b>	<b>1 Maximum</b>			<b>D 130</b>
<b>Flash Point, °C</b>	<b>54 Minimum</b>			<b>D 93</b>
<b>Pour Point, °C</b>	<b>-18 Maximum</b>			<b>D 97</b>
<b>Carbon Residue on 10% Residuum, %</b>	<b>0.35 Maximum</b>			<b>D 524 (10% Bottoms)</b>
<b>Water &amp; Sediment, % Volume</b>	<b>0.05 Maximum</b>			<b>D 2709</b>
<b>Viscosity, cSt @ 40°C</b>	<b>2.0 – 2.6</b>			<b>D 445</b>
<b>Total Acid Number</b>	<b>0.05 Maximum</b>			<b>D 664</b>
<b>Strong Acid Number</b>	<b>0.00 Maximum</b>			<b>D 664</b>
<b>Accelerated Stability</b>	<b>1.5 max</b>			<b>D 2274</b>
<b>Ash, % Weight</b>	<b>0.005 Maximum</b>			<b>D 482</b>
<b>SLBOCLE, g</b>	<b>3100 min<sup>A</sup></b>			<b>D 6078<sup>A</sup></b>
<b>90% Distillation, °C</b>	<b>282 – 338</b>			<b>D 86</b>

<sup>A</sup> May be altered to be consistent with CARB or ASTM diesel fuel specifications.

**Caterpillar C-13  
Engine Oil Test  
Build-Up and Hardware Information  
Form 13**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

<b>Hardware</b>	
<b>Part</b>	<b>Part Number</b>
Intake Valve	
Exhaust Valve	
Cylinder Head	
Head Gasket	
Pistons	
Injectors	
Rod Bearings	
Liners	
Top Ring	
2 <sup>nd</sup> Ring	
Oil Ring	

**Caterpillar C-13  
Engine Oil Test  
Piston Deposit Rating Summary  
Form 14**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

<b>Piston Number</b>							
<b>Parameter</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>Average</b>
<b>TLHC, %</b>							
<b>TLC, dem.</b>							
<b>TGC, dem.</b>							
<b>AGF, %</b>							
<b>WD, dem.</b>							
<b>IGC, dem.</b>							
<b>2LC, dem.</b>							













**Caterpillar C-13  
Engine Oil Test  
Rating Summary: Piston No. 6  
Form 20**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>	<b>Oil Code:</b>	
<b>Formulation / Stand Code:</b>		
<b>Date Rated:</b>	<b>Rater Initials:</b>	<b>Verified By:</b>

Total Piston Ratings Summary																	
	Deposit Factor	Grooves						Deposit Factor	Lands								
		No. 1 A, DEM.	No. 2 A, DEM.	No. 1 A, DEM.	No. 1 A, DEM.	No. 2 A, DEM.	No. 2 A, DEM.		No. 3 A, DEM.	No. 3 A, DEM.	No. 3 A, DEM.	No. 4 A, DEM.	No. 4 A, DEM.	Oil Cooling Gallery	Under Crown A, DEM.		
C																	
A	HC - 1.0																
R	MC - 0.5																
B	LC - .25																
O																	
N	Total																
	8 - 9																
	7 - 7.9							7.5									
	6 - 6.9																
V	5 - 5.9																
A	4 - 4.9							4.5									
R	3 - 3.9																
N	2 - 2.9																
I	1 - 1.9							1.5									
S	>0 - 0.9																
H	Clean	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
	Total																
Rating																	
Location Factor		2	3	3	1	3			20	20	20	60	1				
Ind. Rating																	
		<b>WDP</b>			<b>TGC</b>			<b>TLC</b>			<b>Unweighted Deposits</b>			<b>Top Land Flaked Carbon %</b>			
<b>TGF</b>		<b>IGF %</b>			<b>TLHC %</b>			<b>Acc. Groove Fill %</b>									

**Caterpillar C-13  
Engine Oil Test  
Supplemental Rating Summary: Piston No. 1  
Form 21**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

Carbon				Varnish											
Deposit		HC	MC	LC	9.0-8	7.9-7	6.9-6	5.9-5	4.9-4	3.9-3	2.9-2	1.9-1	0.9-0	Clean	
Groove Top And Bottom	1	T													
		B													
	2	T													
		B													
	3	T													
		B													
Top Bottom And Back Of Rings	1	T													
		B													
		BK													
	2	T													
		B													
		BK													
	3	T													
		B													
		BK													
Top Ring Stuck						%									
Top Ring Scuffed						%									
Second Ring Stuck						%									
Second Ring Scuffed						%									
Oil Ring Stuck						%									
Oil Ring Scuffed						%									
Crown Scuffed						%									
Skirt Scuffed						%									
Liner Scuffed						%									

**Caterpillar C-13  
Engine Oil Test  
Supplemental Rating Summary: Piston No. 2  
Form 22**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

Carbon				Varnish										
Deposit		HC	MC	LC	9.0-8	7.9-7	6.9-6	5.9-5	4.9-4	3.9-3	2.9-2	1.9-1	0.9-0	Clean
Groove Top And Bottom	1	T												
		B												
	2	T												
		B												
	3	T												
		B												
Top Bottom And Back Of Rings	1	T												
		B												
		BK												
	2	T												
		B												
		BK												
	3	T												
		B												
		BK												
Top Ring Stuck								%						
Top Ring Scuffed								%						
Second Ring Stuck								%						
Second Ring Scuffed								%						
Oil Ring Stuck								%						
Oil Ring Scuffed								%						
Crown Scuffed								%						
Skirt Scuffed								%						
Liner Scuffed								%						





**Caterpillar C-13  
Engine Oil Test  
Supplemental Rating Summary: Piston No. 4  
Form 24**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

Carbon				Varnish										
Deposit		HC	MC	LC	9.0-8	7.9-7	6.9-6	5.9-5	4.9-4	3.9-3	2.9-2	1.9-1	0.9-0	Clean
Groove Top And Bottom	1	T												
		B												
	2	T												
		B												
	3	T												
		B												
Top Bottom And Back Of Rings	1	T												
		B												
		BK												
	2	T												
		B												
		BK												
	3	T												
		B												
		BK												
Top Ring Stuck						%								
Top Ring Scuffed						%								
Second Ring Stuck						%								
Second Ring Scuffed						%								
Oil Ring Stuck						%								
Oil Ring Scuffed						%								
Crown Scuffed						%								
Skirt Scuffed						%								
Liner Scuffed						%								

**Caterpillar C-13  
Engine Oil Test  
Supplemental Rating Summary: Piston No. 5  
Form 25**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

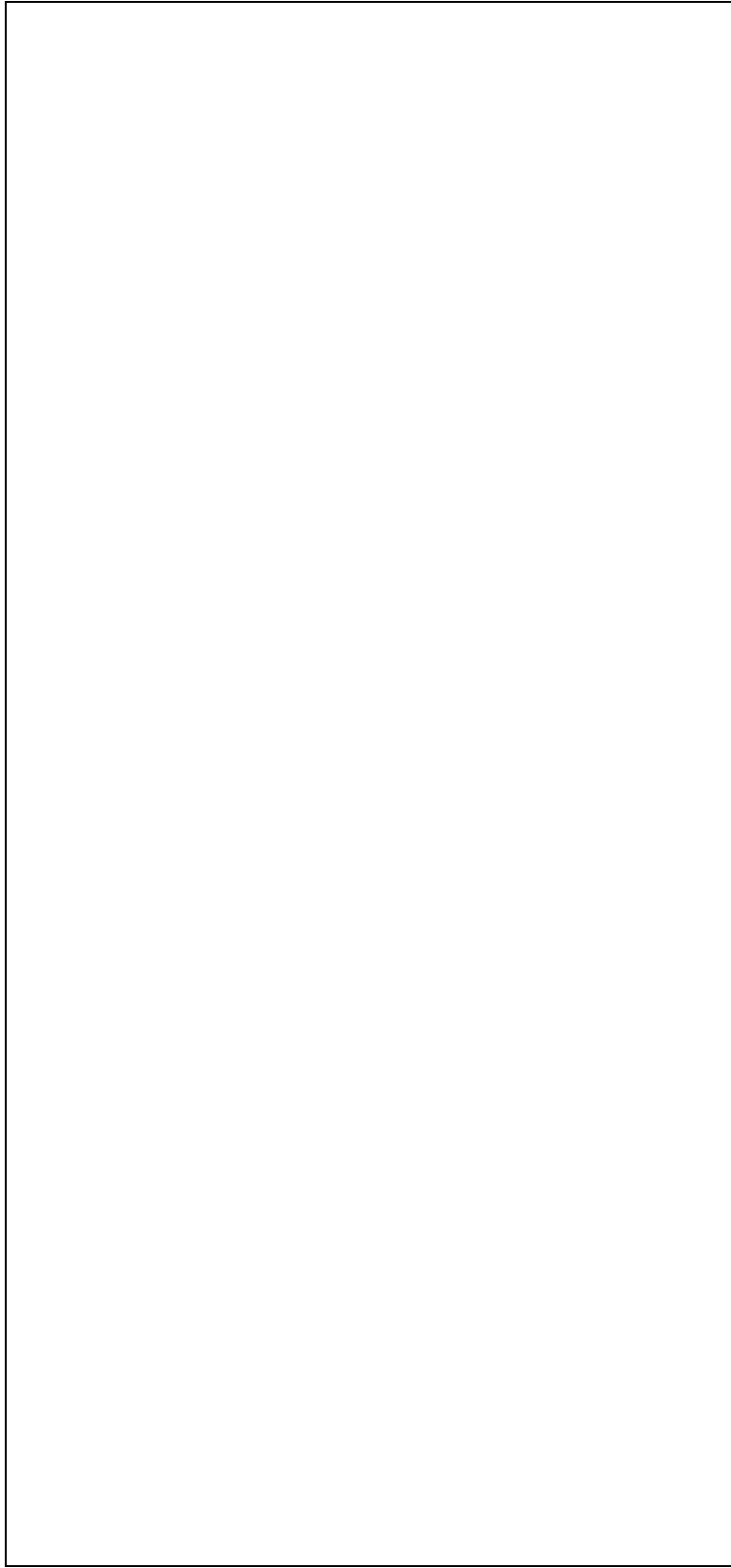
Carbon				Varnish										
Deposit		HC	MC	LC	9.0-8	7.9-7	6.9-6	5.9-5	4.9-4	3.9-3	2.9-2	1.9-1	0.9-0	Clean
Groove Top And Bottom	1	T												
		B												
	2	T												
		B												
	3	T												
		B												
Top Bottom And Back Of Rings	1	T												
		B												
		BK												
	2	T												
		B												
		BK												
	3	T												
		B												
		BK												
Top Ring Stuck						%								
Top Ring Scuffed						%								
Second Ring Stuck						%								
Second Ring Scuffed						%								
Oil Ring Stuck						%								
Oil Ring Scuffed						%								
Crown Scuffed						%								
Skirt Scuffed						%								
Liner Scuffed						%								



**Caterpillar C-13  
Engine Oil Test  
Oil Consumption Plot  
Form 27**

<b>Laboratory:</b>	<b>EOT Date:</b>	<b>EOT Time:</b>
<b>Test Number:</b>		
<b>Oil Code:</b>		
<b>Formulation / Stand Code:</b>		

Test Hours	50	100	150	200	250	300	350	400	450	500
Oil Consumption, g/h										
R <sup>2</sup>										



**100 – 150 h  
Oil  
Consumption:**

**450 – 500 h  
Oil  
Consumption:**

**% Increase:**

Test Hours

**Caterpillar C-13  
Engine Oil Test  
Form 28  
American Chemistry Council Code of Practice  
Test Laboratory Conformance Statement**

Test Laboratory					
Test Sponsor					
Formulation/Stand Code					
Test Number					
Start Date		Start Time		Time Zone	

**Declarations**

- No. 1 All requirements of the ACC Code of Practice for which the test laboratory is responsible were met in the conduct of this test. Yes \_\_\_\_\_ No \_\_\_\_\_ \*
- No. 2 The laboratory ran this test for the full duration following all procedural requirements; and all operational validity requirements of the latest version of the applicable test procedure (ASTM or other), including all updates issued by the organization responsible for the test, were met. Yes \_\_\_\_\_ No \_\_\_\_\_ \*
- If the response to this Declaration is “No”, does the test engineer consider the deviations from operational validity requirements that occurred to be beyond the control of the laboratory? Yes \_\_\_\_\_ \* No \_\_\_\_\_
- No. 3 A deviation occurred for one of the test parameters identified by the organization responsible for the test as being a special case. Yes \_\_\_\_\_ \* No \_\_\_\_\_ *(This currently applies only to specific deviations identified in the ASTM Information Letter System)*

**Check The Appropriate Conclusion**

	Operational review of this test indicates that the results should be included in the Multiple Test Acceptance Criteria calculations.
	*Operational review of this test indicates that the results should not be included in the Multiple Test Acceptance Criteria calculations.

Note: *Supporting comments are required for all responses identified with an asterisk.*

<b>Comments</b>

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Typed Name

\_\_\_\_\_  
Title