

**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		
Stand:	Stand Run No.:	
End of Test Date:	End of Test Time:	
Oil Code / CMIR: ^A		
Formulation / Stand Code: ^B		
Altcode 1:	Altcode 2:	Altcode 3:

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.

^A CMIR or Non-Reference Oil Code ^B ACC-Registered Tests Only

Submitted By: _____
Testing Laboratory

Signature

Typed Name

Title

**Caterpillar C-13
Engine Oil Test**

**Form 2
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**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.

C-13 Test Conditions	
Parameter	Value
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
Humidity, g/kg	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**

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

Start Date:	Start Time:	Test Length:
Laboratory Oil Code:		TMC Oil Code^A:
Engine Number:	Engine Hours:	Engine Serial No.:

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						

^A Reference Oil Tests Only

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

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

Controlled Parameters					
Parameter	Units	Target	Tolerance	Average	Samples
Engine Speed	r/min	1800	± 5		
Fuel Flow	g/min	1200	± 6		
Temperature					
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		
Pressure					
Inlet Air	kPa	95	± 3		
Exhaust Stack	kPa	6	± 1		
Intake Manifold	kPa	280	± 5		
Non-Controlled Parameters					
Parameter	Units	Target	Tolerance	Average	Samples
Engine Torque	Nm	1800	Record		
Humidity	g/kg	Record	Record		

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

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

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**

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

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 nd Ring SOT Weight, g	2 nd Ring EOT Weight, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
	2 nd Ring Average Weight Loss, mg		
	2 nd Ring Weight Loss Std. Dev., mg		
	2 nd Ring Min. Weight Loss, mg		
	2 nd 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**

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

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

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

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

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

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

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

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

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

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

Summary	As Measured
Average, µm	
Minimum, µm	
Maximum, µm	

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

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

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

^A 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**

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

Hardware	
Part	Part Number
Intake Valve	
Exhaust Valve	
Cylinder Head	
Head Gasket	
Pistons	
Injectors	
Rod Bearings	
Liners	
Top Ring	
2 nd Ring	
Oil Ring	

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

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

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

**Caterpillar C-13
Engine Oil Test
Rating Summary: Piston No. 1
Form 15**

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

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

**Caterpillar C-13
Engine Oil Test
Rating Summary: Piston No. 2
Form 16**

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

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

**Caterpillar C-13
Engine Oil Test
Rating Summary: Piston No. 3
Form 17**

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

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

**Caterpillar C-13
Engine Oil Test
Rating Summary: Piston No. 4
Form 18**

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

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

**Caterpillar C-13
Engine Oil Test
Rating Summary: Piston No. 5
Form 19**

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

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

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

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

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

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

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

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**

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

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**

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

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. 6
Form 26**

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

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**

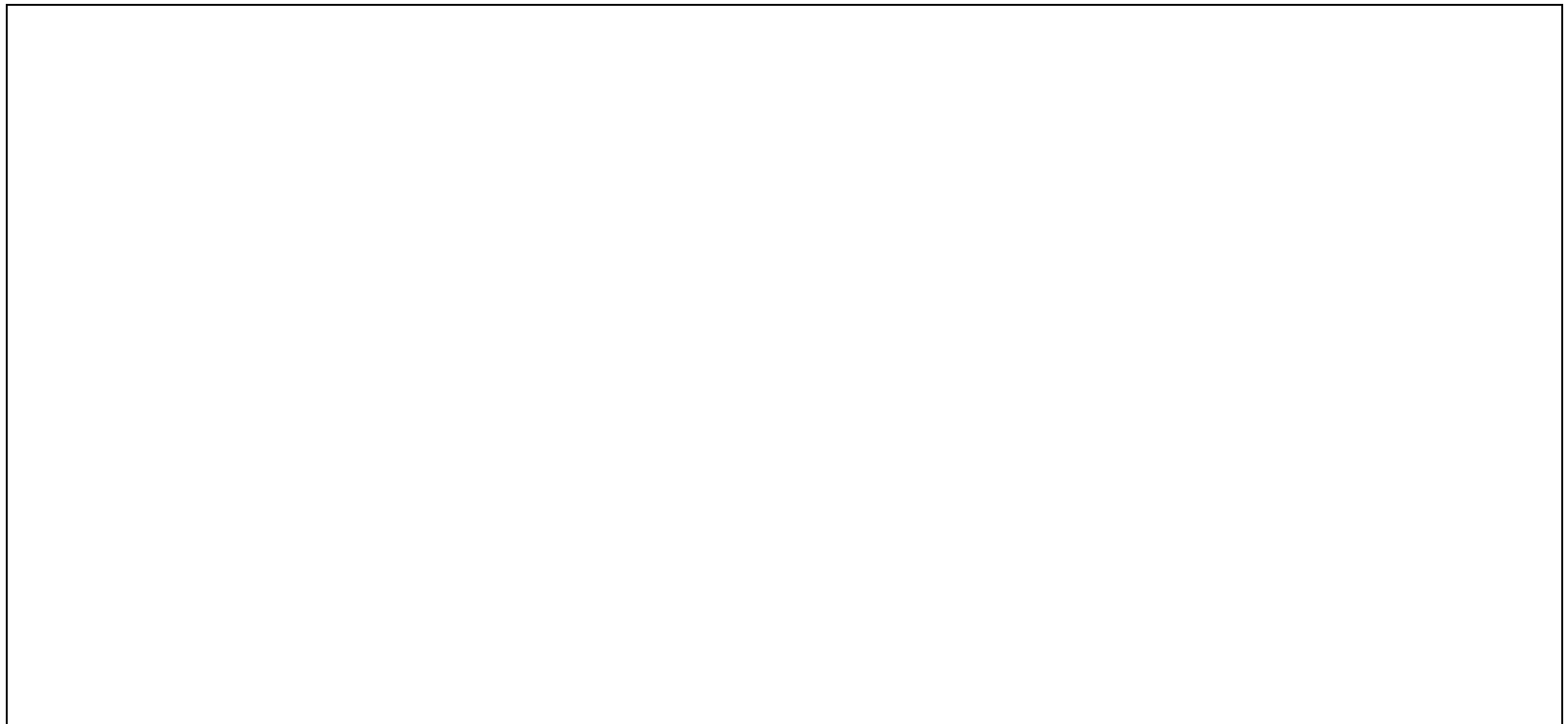
Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation / Stand Code:		

Test Hours	50	100	150	200	250	300	350	400	450	500
Oil Consumption, g/h										
R²										

**100 – 150 h
Oil
Consumption:**

**450 – 500 h
Oil
Consumption:**

% Increase:



Test Hours