Report On
Sequence IIIG Evaluation

Version IIIG VERSION 20030421

Conducted For

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

C	**V = Valid**
	I = Invalid
	N = Results Cannot Be Interpreted As Representative Of Oil Perfromance (Non-Reference Oil) And Shall Not Be Used For Multiple Test Acceptance

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

Test Number					
Test Stand	CCCCC	**Stand Test**	CCCC	**Lab Test**	CCCCC
Oil Code	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand	CC-CCCCCCCCCC-C-C-CCCCCC-CC-CC-CCCCC				
Alternate Codes	CCCCCCCCCCCCCCC		CCCCCCCCCCCCCCC		CCCCCCCCCCCCCCC
EOT Date	YYYYMMDD		**EOT Time**		HH:MM

In my opinion this test has been conducted in a valid manner in accordance with the latest draft of Sequence IIIG procedure and the appropriate amendments through the information letter system. The remarks included in the report describe the anomalies associated with this test.

CCCCCC

Submitted By: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

Testing Laboratory

Signature Image

Signature

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

Typed Name

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

Title

Form 2

Sequence IIIG

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Sequence IIIG

Form 3

Summary of Test Method

The Sequence IIIG Test is a fired-engine, dynamometer lubricant test for evaluating automotive engine oils for certain high-temperature performance characteristics, including oil thickening, varnish deposition, oil consumption, and engine wear. Such oils include both single viscosity grade and multi-viscosity grade oils that are used in spark-ignition, gasoline-fueled engines, as well as diesel engines.

The Sequence IIIG Test utilizes a 1996 model Buick 3800 Series II, water-cooled, 4 cycle, V-6 engine as the test apparatus. The Sequence IIIG test engine is an overhead valve design (OHV) and uses a single camshaft operating both intake and exhaust valves via pushrods and hydraulic valve lifters in a sliding-follower arrangement. The engine uses one intake and one exhaust valve per cylinder. Induction is handled by a modified GM port fuel injection system setting the Air-to-Fuel ratio at 15:1. The test engine is overhauled prior to each test, during which critical engine dimensions are measured and rated or measured parts (pistons, camshaft, valve lifters, etc.) are replaced.

The Sequence IIIG Test consists of a 10-minute operational check, followed by 100 hours of engine operation at moderately high speed, load, and temperature conditions. The 100-hour segment is broken down into five 20-hour test segments. Following each 20-hour segment, and the 10-minute operational check, oil samples are drawn from the engine. The kinematic viscosities of the 20-hour segment samples are compared to the viscosity of the 10-minute sample to determine the viscosity increase of the test oil.

The Sequence IIIG Test is operated at the following test states during the 100-hour portion of the test:

Parameter	Set Point
Engine Speed	3600 r/min
Engine Load	250 N-m
Oil Filter Block Temperature	150 °C
Coolant Outlet Temperature	115 °C
Fuel Pressure	365 kPa
Intake Air Temperature	35 °C
Intake Air Pressure	0.05 kPa
Intake Air Dew Point	16.1 °C
Exhaust Back Pressure	6 kPa
Engine Coolant Flow	160 L/min
Breather Tube Coolant Flow	10 L/min
Air-to-Fuel Ratio	15.0:1
Breather Tube Coolant Outlet Temperature	40 °C

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FORM 4

TEST RESULT SUMMARY

Lab	CC	**Oil Code**	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Stand	CCCCC	**Test No.**	CCCCC -- CCCC -- CCCCC
Laboratory Oil Code		CCCCCCCCCCCCCCCCCCC	
Formulation Stand Code		CC-CCCCCCCCCC-C-C-CCCCCC-CC-CC-CCCCC	

Date Started	YYYYMMDD	**Engine No.**	CCCCCCCCCCCCCCC
Time Started	HH:MM	**Fuel Batch**	CCCCCCCCCCCCCCC
Date Completed	YYYYMMDD	**SAE Viscosity**	CCCCCCC
Time Completed	HH:MM	**TMC Oil Code**	CCCCCC
Test Length	S1234		

Pass/Fail Results						
	Viscosity Increase (%)	**Average Cam + Lifter Wear (µm)**	**Average Weighted Piston Deposits (merits)**	**Average Piston Skirt Varnish (merits)**	**Number of Hot-Stuck Rings**	**Oil Consumption (L)[B]**
Original Units	S1234.12	S1234.1	S12.12	S12.12	S12	S12.12
Transformed Results	S12.123456	S1234.1				
Industry Correction Factor	S12.123456	S1.1234	S1.1234	S1.1234		
Corrected Transformed	S12.123456	S1234.1				
Severity Adjustment	S12.123456	S1234.1	S1.1234	S1.1234		
Final Transformed Result	S12.123456	S1234.1				
Final Original Unit Result	S1234.1	S1234.1	S12.12	S12.12		

Additional Results					
Oil Consumption Hours, h [B]	S12		**Average Oil Ring Plugging, %**		S1234
Maximum Cam + Lifter Wear,	S12345		**Number of Cold-Stuck Rings**		S12
MRV Temperature, °C	AAA	**MRV Result, cP**	AAAAAA	**Yield Stress, cP**	AAAA

Most Recent Stand Reference Oil Test History[C]			
Test Number	CCCCC - CCCC - CCCCC		
Oil Code	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Date Completed	YYYYMMDD	**TMC Oil**	CCCCCC
Final Viscosity Increase, %	S1234.1	**Fuel Batch**	CCCCCCCCCCCCCCC
Final Average Piston Skirt Varnish, merits	S12.12		
Final Average Cam + Lifter Wear, µm	S1234.1		
Final Maximum Cam + Lifter Wear, µm	S12345		
Final Average Weighted Piston Deposit, merits	S12.12		

[A]Reference Oil Tests Only
[B]Test Hours at which Oil Consumption was calculated
[C]Non-Reference Oil Tests Only

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Form 5

Operational Summary

Lab	CC	**Oil Code**	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Stand	CCCCC	**Test No.**	CCCCC -- CCCC -- CCCCC
Laboratory Oil Code		CCCCCCCCCCCCCCCCCCCC	
Formulation Stand Code		CC-CCCCCCCCCC-C-C-CCCCCC-CC-CC-CCCCC	

	Parameter	Units	QI	EOT	Target	Average	Standard Deviation	Number of Samples	Number of BQD
Controlled Parameters	**Speed**	**r/min**	**0.000**	S12.123	**3600**	S12345	S12.123	S12345	S12345
	Load	**Nm**	**0.000**	S12.123	**250**	S12345	S12.123	S12345	S12345
	Oil Filter Block	**°C**	**0.000**	S12.123	**150.0**	S12345	S12.123	S12345	S12345
	Engine Coolant Out	**°C**	**0.000**	S12.123	**115.0**	S123.1	S12.123	S12345	S12345
	Condenser Coolant Out	**°C**	**0.000**	S12.123	**40.0**	S123.1	S12.123	S12345	S12345
	Left Air-to-Fuel Ratio		**0.000**	S12.123	**15.0**	S12.1	S12.123	S12345	S12345
	Right Air-to-Fuel Ratio		**0.000**	S12.123	**15.0**	S12.1	S12.123	S12345	S12345
	Left Exhaust Back Pressure	**kPa**	**0.000**	S12.123	**6.0**	S1.12	S12.123	S12345	S12345
	Right Exhaust Back Pressure	**kPa**	**0.000**	S12.123	**6.0**	S1.12	S12.123	S12345	S12345
	Intake Air	**kPa**	**0.000**	S12.123		S1.12	S12.123	S12345	S12345
	Engine Coolant Flow	**L/min**	**0.000**	S12.123	**160.0**	S123.1	S12.123	S12345	S12345

	Parameter	Units	Average	Standard Deviation	Number of Samples	Number of BQD
Non-controlled Parameters	**Oil Sump**	**°C**	S123.1	S12.123	S12345	S12345
	Pump Outlet Pressure	**kPa**	S123.1	S12.123	S12345	S12345
	Gallery Pressure	**kPa**	S1234	S12.123	S12345	S12345
	Engine Coolant In	**°C**	S1234	S12.123	S12345	S12345
	Fuel Inlet	**°C**	S12345	S12.123	S12345	S12345
	Intake Air	**°C**	S12345	S12.123	S12345	S12345
	Intake Air Dew Point	**°C**	S123.1	S12.123	S12345	S12345
	Intake Vacuum	**kPa**	S12345	S12.123	S12345	S12345
	Crankcase	**kPa**	S1.123	S12.123	S12345	S12345
	Fuel Pressure	**kPa**	S1234	S12.123	S12345	S12345

Oil Consumption Data						
Hours	**Initial Run-in**	S12	S12	S12	S12	S12
Level (ml) low	S123	S123	S123	S123	S123	S123

NO_x Measurement			
Hours	S12	S12	S12
NO_x, ppm	S12345	S12345	S12345

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Form 6

Used Oil Analysis Results

Lab	CC	**Oil Code**	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Stand	CCCCC	**Test No.**	CCCCC -- CCCC -- CCCCC
Laboratory Oil Code		CCCCCCCCCCCCCCCCCCCC	
Formulation Stand Code		CC-CCCCCCCCCC-C-C-CCCCCC-CC-CC-CCCCC	

Viscosity Increase Data (cST at 40°C)			
Hours	**Viscosity[A]**	**Change**	**Percent**
New Oil	S1234.12		
Initial[B]	S1234.12		
S12	S1234.12	S1234.12	S1234.12
S12	S1234.12	S1234.12	S1234.12
S12	S1234.12	S1234.12	S1234.12
S12	S1234.12	S1234.12	S1234.12
S12	S1234.12	S1234.12	S1234.12
S1234	S1234.12	S1234.12	S1234.12

Results of ICP Analysis of Used Oil			
Hours	**Iron**	**Copper**	**Lead**
Initial	AAAAAA	AAAAAA	AAAAAA
S12	AAAAAA	AAAAAA	AAAAAA
S12	AAAAAA	AAAAAA	AAAAAA
S12	AAAAAA	AAAAAA	AAAAAA
S12	AAAAAA	AAAAAA	AAAAAA
S12	AAAAAA	AAAAAA	AAAAAA
S1234	AAAAAA	AAAAAA	

[A] 8000 cSt is maximum allowable viscosity

[B] At end of leveling run

Cold Crank Simulator Results, D 5293	
Final Temperature, °C	AAA
Final Cold-Crank Simulator Viscosity, cP	AAAAAA

Mini-Rotary Viscometer Results, D 4684	
MRV Temperature, °C	AAA
MRV Result, cP	AAAAAA
Yield Stress, cP	AAAA

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Form 7

Valve Lifter And Camshaft Wear Results

Lab	CC	**Oil Code**	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Stand	CCCCC	**Test No.**	CCCCC -- CCCC -- CCCCC
Laboratory Oil Code		CCCCCCCCCCCCCCCCCCCC	
Formulation Stand Code		CC-CCCCCCCCCC-C-C-CCCCCC-CC-CC-CCCCC	

Number	Camshaft Lobe, µm	Valve Lifter, µm	Cam & Lifter Wear, µm
1	S1234	S1234	S1234
2	S1234	S1234	S1234
3	S1234	S1234	S1234
4	S1234	S1234	S1234
5	S1234	S1234	S1234
6	S1234	S1234	S1234
7	S1234	S1234	S1234
8	S1234	S1234	S1234
9	S1234	S1234	S1234
10	S1234	S1234	S1234
11	S1234	S1234	S1234
12	S1234	S1234	S1234
Maximum	S1234	S1234	S12345
Minimum	S1234	S1234	S12345
Average	S1234	S1234	S1234.1

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Form 8

Summary Of Oil Ring Land Deposit Rating

Lab		**Oil Code**	
Stand		**Test No.**	
Laboratory Oil Code			
Formulation Stand Code			
Rater		**Rating Date**	

Piston	Oil Ring Land Deposit, Merits	% Chipped
1		
2		
3		
4		
5		
6		
Average		

Piston	% Oil Ring Plugging	Ring Sticking[A]	
		Hot-Stuck Rings	Cold-Stuck Rings
1			
2			
3			
4			
5			
6			
Total			
Average			

[A] Possible values T = top compression ring
B = bottom compression ring
O = oil ring
N = none

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Form 9

Summary Of Piston Deposits

Lab		**Oil Code**	CC
Stand		**Test No.**	-- CCCCC -- CCCC CCCCC
Laboratory Oil Code		CCCCC	
Formulation Stand Code		CCCCCCCCCCCCCCCCCCCC	
Rater		CC-CCCCCCCCCC-C-C-CCCCCC-CC-CC-CCCCC	**Rating Date** YYYYMMDD

Note: CRC Manual 14 used for ALL Ratings

NOTE: These are un-weighted ratings

	Grooves, merits			Lands, merits			Undercrown, merits
	1	**2**	**3**	**Crown**	**2**	**3**	
Piston 1							
Piston 2	S12.12	S12.12	S12.12		S12.12	S12.12	S12.12
Piston 3	S12.12	S12.12	S12.12		S12.12	S12.12	S12.12
Piston 4	S12.12	S12.12	S12.12		S12.12	S12.12	S12.12
Piston 5	S12.12	S12.12	S12.12		S12.12	S12.12	S12.12
Piston 6	S12.12	S12.12	S12.12		S12.12	S12.12	S12.12
WF	S12.12 **0.05**	S12.12 **0.10**	S12.12 **0.20**		S12.12 **0.15**	S12.12 **0.30**	S12.12 **0.10**

Note: These are unweighted ratings

	Piston Skirt Varnish, merits		
	Thrust	**Anti-Thrust**	**Average**
Piston 1			
Piston 2	S12.12	S12.12	S1.12
Piston 3	S12.12	S12.12	S1.12
Piston 4	S12.12	S12.12	S1.12
Piston 5	S12.12	S12.12	S1.12
Piston 6	S12.12	S12.12	S1.12
Average	S12.12	S12.12	S1.12
WF	S12.12	S12.12	S1.12 **0.10**

S12.12 S12.12 S12.12

PSVAVx = (PSVTx + PSVAx)/2 ***where x = Number of Piston***
PSVTAV = average of six Thrust Piston Skirt ratings.
PSVAAV = average of six Anti-Thrust Piston Skirt ratings.
APV = average of all 12 Piston Skirt ratings.

	Total Weighted Deposits, merits
Piston 1	S12.12
Piston 2	S12.12
Piston 3	S12.12
Piston 4	S12.12
Piston 5	S12.12
Piston 6	S12.12

S12.12

WPDx = (WF*G1Px)+(WF*G2Px)+(WF*G3Px)+ (WF*L2Px)+ (WF*ORLDx)+(WF*UCPx)+(WF*PSVAVx)

where: x = Number of Piston
WF = Appropriate Weighting Factor (WF) for part, from table.

Average Weighted Piston Deposits, merits	S12.12

WPD = (WPD1+WPD2+WPD3+WPD4+WPD5+WPD6)/6

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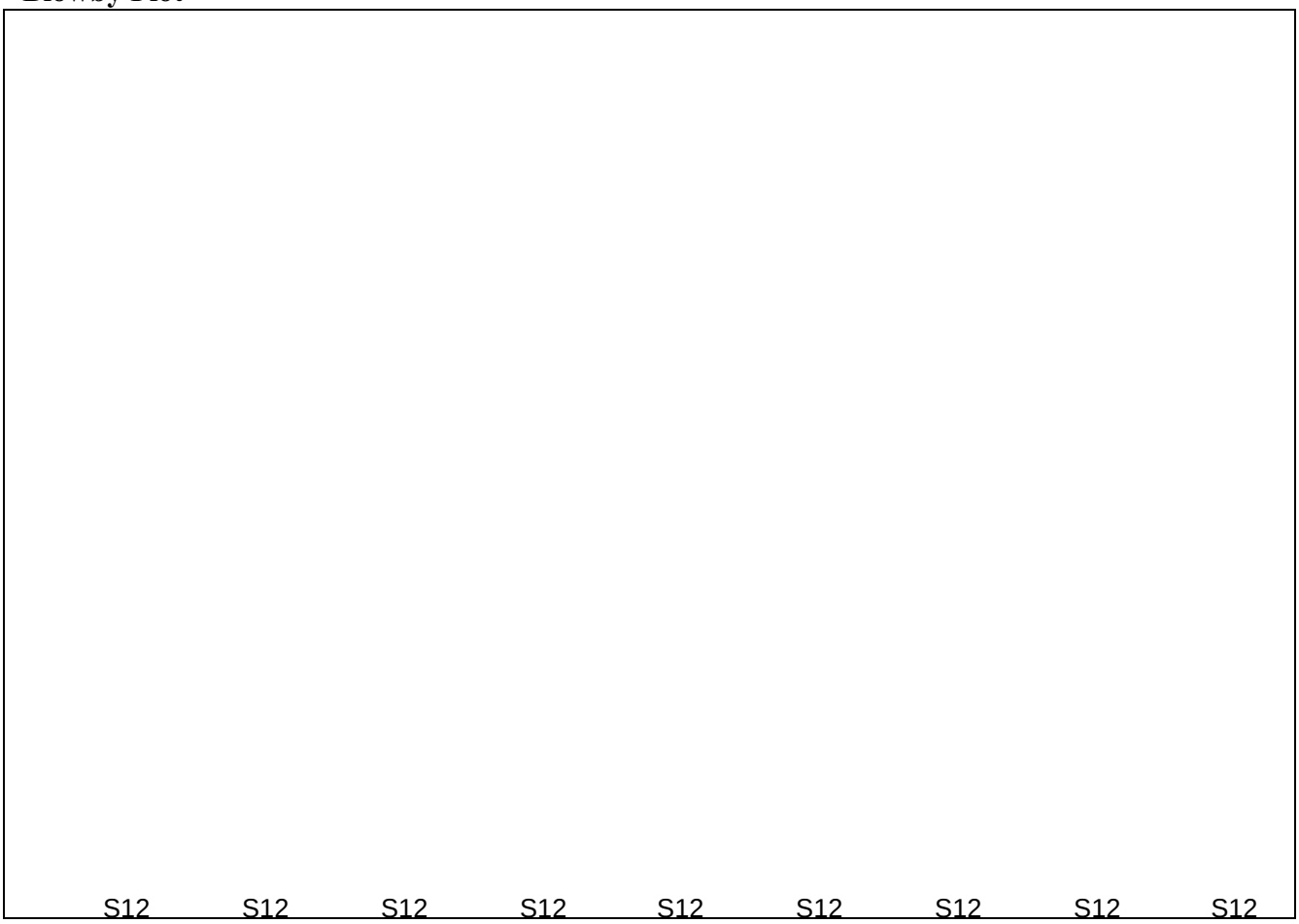
Form 10

Blowby Values & Plot

Lab		**Oil Code**	
Stand		**Test No.**	
Laboratory Oil Code			
Formulation Stand Code			

Blowby Plot



Test Hours										
Blowby, L/min.										
Test Hours										
Blowby, L/min.										
Test Hours										
Blowby, L/min.										

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Form 11

Viscosity Increase Plot

Lab		**Oil Code**	
Stand		**Test No.**	-- --
Laboratory Oil Code			
Formulation Stand Code			

Sequence IIIG

Form 12

Hardware Information

Lab		**Oil Code**	CC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Stand		**Test No.**	CCCCC	--	CCCCC	CCCC	CCCCC
Laboratory Oil Code		CCCCCCCCCCCCCCCCCCCC					
Formulation Stand Code		CC-CCCCCCCCCC-C-C-CCCCCC-CC-CC-CCCCC					

Build Completion Date	YYYYMMDD	**Piston Batch (Code)**		CCCCC	
Block Serial Number	CCCCCC	**Piston Size (Grade)**		CC	
Crankshaft Serial Number	CCCCCC CCCCCCC	**Piston Ring Batch Code**		CCCCC CCCCC	
Camshaft Serial Number	CCCCCCCCCCC	**Oil Filter Batch Code**		CCCCC	
Cylinder Head Serial Number, Left	CCCCCCCCCCC CCCCCC	**Intake Valve Seals Batch Code**		CCCCC CCCCCCCC	
Cylinder Head Serial Number, Right	S12	**Valve Springs Batch Code**		CCCCCCCC	
Bearing Kit Serial Number	S12	**Lifter Serial Number**	**1**	CCCCCCCC	
Top Ring Gap, mils			**2**	CCCCCCCC CCCCCCCC	
Bottom Ring Gap, mils			**3**	CCCCCCCC	
			4	CCCCCCCC	
			5	CCCCCCCC CCCCCCCC	
			6	CCCCCCCC	
			7	CCCCCCCC	
			8	CCCCCCCC	
			9		
			10		
			11		
			12		

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Form 13

Downtime & Outlier Report Form

Lab		**Oil Code**	
Stand		**Test No.**	CC -- CCCCCCCCC--CCCCCCCCCCCCCCCCCCCCCCCCCCCC
Laboratory Oil Code	CCCCC CCCCC CCCC CCCCC		
Formulation Stand Code	CCCCCCCCCCCCCCCCCCCC CC CCCCCCCCCC C C CCCCCC CC CC CCCCC		

Number of Downtime Occurrences			
Test Hours	**Date**	**Downtime**	**Reasons**
		S1	
CCCCCC	CCCCCCCC	CCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCC	CCCCCCCC	CCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCC	CCCCCCCC	CCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCC	CCCCCCCC	CCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCC	CCCCCCCC	CCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCC	CCCCCCCC	CCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
		HHH:MM	
		S1	
			Total Downtime (hours) – Maximum allowable downtime: 24 hours

Other Comments
Number of Comment Lines
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
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Sequence IIIG

Form 13A

Downtime & Outlier Report Form

Lab		**Oil Code**	
Stand		**Test No.**	--
Laboratory Oil Code			
Formulation Stand Code			

Number of Downtime Occurrences			
Test Hours	**Date**	**Downtime**	**Reasons**
			Total Downtime (hours) – Maximum allowable downtime: 24 hours

Other Comments	
Number of Comment Lines	