Report On
Sequence IIIG Evaluation

Version

Conducted For

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

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

Test Number					
Test Stand		Stand Test		Lab Test	
Oil Code					
Formulation/Stand					
Alternate Codes					
EOT Date			EOT Time		

In my opinion this test 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.

Submitted By: _____
Testing Laboratory

_____
Signature

_____
Typed Name

_____
Title

Form 2

Sequence IIIG

Table of Contents

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 General Motors Powertrain 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 ^{o}C
Coolant Outlet Temperature	115 ^{o}C
Fuel Pressure	377.5 kPa
Intake Air Temperature	35 ^{o}C
Intake Air Pressure	0.05 kPa
Intake Air Dew Point	16.1 ^{o}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
Condenser Coolant Outlet Temperature	40 ^{o}C

Sequence IIIG
Form 4

Test Result Summary

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

Date Started		Engine No.	
Time Started		Fuel Batch	
Date Completed		SAE Viscosity	
Time Completed		TMC Oil Code[A]	
Test Length			

Pass/Fail Results			
	Viscosity Increase (%)	**Average Cam + Lifter Wear (µm)**	**Average Weighted Piston Deposits (merits)**
Original Units			
Transformed Results[B]			
Industry Correction Factor			
Corrected Transformed			
Severity Adjustment			
Final Transformed Result			
Final Original Unit Result			

Additional Results			
Oil Consumption Hours, h [C]		Oil Consumption, L	
Maximum Cam + Lifter Wear, µm		Number of Cold-Stuck Rings	
Average Oil Ring Plugging, %		Number of Hot-Stuck Ring	
Average Piston Varnish, merits			

Most Recent Stand Reference Oil Test History[D]			
Test Number			
Oil Code			
Date Completed		TMC Oil	
Final Viscosity Increase, %		Fuel Batch	
Final Average Cam + Lifter Wear, µm			
Final Average Weighted Piston Deposit, merits			
Maximum Cam + Lifter Wear, µm			

[A]Reference Oil Tests Only
[B]Viscosity Increase uses LN(PVIS), Average Cam + Lifter Wear uses LN(ACLW), Weighted Piston Deposits does not use a transformation
[C]Test Hours at which Oil Consumption was calculated
[D]Non-Reference Oil Tests Only

Sequence IIIG

Form 5

Operational Summary

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

	Parameter	Units	QI Threshold	EOT QI	Target	Average	Standard Deviation	Number of Samples	Number of BQD
Controlled Parameters	Speed	r/min	0.000		3600				
	Load	Nm	0.000		250				
	Oil Filter Block	°C	0.000		150.0				
	Engine Coolant Out	°C	0.000		115.0				
	Condenser Coolant Out	°C	0.000		40.0				
	Left Air-to-Fuel		0.000		15.0				
	Right Air-to-Fuel		0.000		15.0				
	Left Exhaust Back Pressure	kPa	0.000		6.0				
	Right Exhaust Back Pressure	kPa	0.000		6.0				
	Intake Air	kPa	0.000		0.05				
	Engine Coolant Flow	L/min	0.000		160.0				

	Parameter	Units	Average	Standard Deviation	Number of Samples	Number of BQD
Non-controlled Parameters	Oil Sump	°C				
	Pump Outlet Pressure	kPa				
	Gallery Pressure	kPa				
	Engine Coolant In	°C				
	Fuel Inlet	°C				
	Intake Air	°C				
	Intake Air Dew Point	°C				
	Intake Vacuum	kPa				
	Crankcase	kPa				
	Fuel Pressure	kPa				

Oil Consumption Data						
Hours	Initial Run-in					
Level (ml) low						
Total Oil Consumed (L)						

NO_x Measurement			
Hours			
NO_x, ppm			

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Form 6

Used Oil Analysis Results

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

Viscosity Increase Data (cSt at 40°C)			
Hours	Viscosity[A]	Change	Percent
New Oil			
Initial[B]			

Results of ICP Analysis of Used Oil			
Hours	Iron	Copper	Lead
Initial			

[A] 8000 cSt is maximum allowable viscosity
[B] At end of leveling run

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Form 7

Valve Lifter and Camshaft Wear Results

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

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

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

Note: CRC Manual 20 used for ALL Ratings

NOTE: These are un-weighted ratings

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

Note: These are un-weighted ratings

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

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	
Piston 2	
Piston 3	
Piston 4	
Piston 5	
Piston 6	

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	

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

Sequence IIIG
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		Average								
Blowby, L/min.										

Sequence IIIG

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	
Stand		Test No.	
Laboratory Oil Code			
Formulation Stand Code			

Build Completion Date		Piston Batch (Code)		
Block Serial Number		Piston Size (Grade)		
Crankshaft Serial Number		Piston Ring Batch Code		
Camshaft Serial Number		Oil Filter Batch Code		
Camshaft Batch Code		Oil Cooler Batch Code		
Cylinder Head Serial Number, Left		Valve Springs Batch Code		
Cylinder Head Serial Number, Right		Lifter Serial Number	1	
Bearing Kit Serial Number			2	
Top Ring Gap, mils			3	
Bottom Ring Gap, mils			4	
Intake Valve Seals Batch Code			5	
Exhaust Valve Seals Batch Code			6	
Rocker Arm Batch Code			7	
Connecting Rod Type (CAST or PM)			8	
			9	
			10	
			11	
			12	

Sequence IIIG

Form 13

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	

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	

Sequence IIIG

Form 14
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)

	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.

Comments

_____ _____
Signature Date

_____ _____
Typed Name Title