REPORT ON
SEQUENCE IIIG EVALUATION

VERSION *20030331*

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

In my opinion this test 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.

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 multiviscosity grade oils that are used in spark-ignition, gasoline-fueled engines, as well as diesel engines.

The Sequence IIIG Test utilizes a 1996 model General Motors 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

SEQUENCE IIIG
FORM 4
TEST RESULT SUMMARY

LAB		OIL CODE	
TEST STAND NO.		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)	Average Piston Skirt Varnish (merits)	Number of Hot-Stuck Rings	Oil Consumption (L)[B]
Original Units						
Transformed Results						
Industry Correction Factor						
Corrected Transformed Result						
Severity Adjustment						
Final Transformed Result						
Final Original Unit Result						

Additional Results			
Oil Consumption Hours, h [B]		Average Oil Ring Plugging , %	
Maximum Cam + Lifter Wear, µm		Number of Cold-Stuck Rings	

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

[A] Reference Oil Tests Only

[B] Test Hours at which Oil Consumption was calculated

[C] Non-Reference Oil Tests Only

SEQUENCE IIIG
FORM 5
OPERATIONAL SUMMARY

LAB		OIL CODE	
TEST STAND NO.		TEST NO.	- -
LABORATORY OIL CODE			
FORMULATION STAND CODE			

	Parameter	Units	QI Threshold	EOT QI	Target	Average	Standard Deviation	Number Of	
								Samples	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 Ratio		0.000		15.0				
	Right Air-to-Fuel Ratio		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	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						

NO_x Measurement			
Hours			
NO_x, ppm			

SEQUENCE IIIG
FORM 6
USED OIL ANALYSIS RESULTS

LAB		OIL CODE	
TEST STAND NO.		TEST NO.	- -
LABORATORY OIL CODE			
FORMULATION STAND CODE			

VISCOSITY INCREASE DATA (cSt AT 40˚C)			
HOURS	VISCOSITY [A]	CHANGE	PERCENT
NEW OIL			
INITIAL [B]			

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

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

Cold Crank Simulator Results, D 5293	
Specified Temperature, ˚C	
Cold-Crank Simulator Viscosity at Specifield Temperature, cP	
Second Temperatue, ˚C	
Cold-Crank Simulator Viscosity at Second Temperature, cP	

Mini-Rotary Viscometer Results, D 4684	
MRV Temperature, ˚C	
MRV Result, cP	
Yield Stress, cP	

SEQUENCE IIIG
FORM 7
VALVE LIFTER AND CAMSHAFT WEAR RESULTS

LAB		OIL CODE	
TEST STAND NO.		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			

SEQUENCE IIIG
FORM 8
SUMMARY OF OIL RING LAND DEPOSIT RATING

LAB		OIL CODE	
TEST STAND NO.		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

SEQUENCE IIIG
FORM 9
SUMMARY OF PISTON DEPOSITS

LAB		OIL CODE	
TEST STAND NO.		TEST NO.	- -
LABORATORY OIL CODE			
FORMULATION STAND CODE			
RATER		RATING DATE	

NOTE: CRC Manual 14 used for ALL Ratings

NOTE: These are unweighted 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 unweighted 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	
TEST STAND NO.		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	
TEST STAND NO.		TEST NO.	- -
LABORATORY OIL CODE			
FORMULATION STAND CODE			

SEQUENCE IIIG
FORM 12
HARDWARE INFORMATION

LAB		OIL CODE	
TEST STAND NO.		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		
Cylinder Head Serial Number, Left		Intake Valve Seals Batch Code		
Cylinder Head Serial Number, Right		Valve Springs Batch Code		
Bearing Kit Serial Number		Lifter Serial Number	1	
Top Ring Gap, mils			2	
Bottom Ring Gap, mils			3	
			4	
			5	
			6	
			7	
			8	
			9	
			10	
			11	
			12	

SEQUENCE IIIG
FORM 13
DOWNTIME & OUTLIER REPORT FORM

LAB		OIL CODE	
TEST STAND NO.		TEST NO.	- -
LABORATORY OIL CODE			
FORMULATION STAND CODE			

Downtime Occurrences			
Test Hours	Date	Total Downtime	Reasons
Total Downtime			Maximum allowable downtime: 24 hours

Other Comments & Outliers	