

**REPORT ON**  
**SEQUENCE IIIFHD EVALUATION**

VERSION    20020325 BETA

CONDUCTED FOR

*TSTSPON1*  
*TSTSPON2*

<i>LABVALID</i>	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

<i>TSTOIL</i>	NR = Non-Reference Oil Test
	RO = Reference Oil Test

Test Number					
Test Stand	<i>STAND</i>	Stand Test Number	<i>STRUN</i>	Lab Test Number	<i>LABRUN</i>
Oil Code	<i>OILCODE</i>				
Formulation/Stand Code	<i>FORM</i>				
Alternate Codes	<i>ALTCODE1</i>	<i>ALTCODE2</i>	<i>ALTCODE3</i>		
EOT Date	<i>DTCOMP</i>	EOT Time	<i>EOTTIME</i>		

In my opinion this test *OPVALID* been conducted in a valid manner in accordance with the latest draft of Sequence IIIF-HD 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: *SUBLAB*

\_\_\_\_\_  
Testing Laboratory

*SUBSIGIM*

\_\_\_\_\_  
Signature

*SUBNAME*

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

*SUBTITLE*

\_\_\_\_\_  
Title

## **Form 2**

### **Sequence IIIFHD**

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# Sequence IIIFHD

## FORM 3

### Summary of Test Method

The Sequence IIIFHD 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 IIIFHD Test utilizes a 1996 model Buick 3800 Series II, water-cooled, 4 cycle, V-6 engine as the test apparatus. The Sequence IIIF 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 IIIFHD Test consists of a 10-minute operational check, followed by 60 hours of engine operation at moderately high speed, load, and temperature conditions. The 60-hour segment is broken down into six 10-hour test segments. Following each 10-hour segment, and the 10-minute operational check, oil samples are drawn from the engine. The kinematic viscosities of the 10-hour segment samples are compared to the viscosity of the 10-minute sample to determine the viscosity increase of the test oil.

The Sequence IIIFHD Test is operated at the following test states during the 60-hour portion of the test:

Parameter	Set Point
Engine Speed	3600 r/min
Engine Load	200 N-m
Oil Filter Block Temperature	155 °C
Coolant Outlet Temperature	122 °C
Fuel Pressure	365 kPa
Intake Air Temperature	27 °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 IIFHD  
FORM 4  
TEST RESULT SUMMARY**

LAB	<i>LAB</i>	OIL CODE	<i>OILCODE</i>
TEST STAND NO.	<i>STAND</i>	TEST NO.	<i>STAND - STRUN - LABRUN</i>
LABORATORY OIL CODE	<i>LABOCODE</i>		
FORMULATION STAND CODE	<i>FORM</i>		

DATE STARTED	<i>DTSTRT</i>	ENGINE NO.	<i>ENGINENO</i>
TIME STARTED	<i>STRTIME</i>	FUEL BATCH	<i>FUELBTID</i>
DATE COMPLETED	<i>DTCOMP</i>	SAE VISCOSITY	<i>SAEVISC</i>
TIME COMPLETED	<i>EOTTIME</i>	TMC OIL CODE <sup>A</sup>	<i>IND</i>
TEST LENGTH	<i>TESTLEN</i>		

<b>Pass/Fail Results</b>	
	Viscosity Increase (%)
Original Units	<i>PVIS</i>
Transformed Results	<i>TPVIS</i>
Industry Correction Factor	<i>PVIS_CF</i>
Corrected Transformed Result	<i>PVIS_COR</i>
Severity Adjustment	<i>PVIS_SA</i>
Final Transformed Result	<i>TPVISFNL</i>
Final Original Unit Result	<i>PVISFNL</i>

<b>Additional Results</b>			
Oil Consumption Hours, h <sup>B</sup>	<i>OCNHRS</i>	Oil Consumption (L) <sup>B</sup>	<i>OILCON</i>

<b>Most Recent Stand Reference Oil Test History<sup>C</sup></b>			
Test Number	<i>RSTAND RSTRUN - RLABRUN</i>		
Oilcode	<i>ROILCODE</i>		
Date Completed	<i>RDTCOMP</i>	TMC Oil Code	<i>RIND</i>
Final Viscosity Increase, %	<i>RPVISFNL</i>	Fuel Batch	<i>RFUELBITD</i>

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

<sup>B</sup> Test Hours at which Oil Consumption was calculated

<sup>C</sup> Non-Reference Oil Tests Only

**SEQUENCE IIFHD  
FORM 5  
OPERATIONAL SUMMARY**

LAB	<i>LAB</i>	OIL CODE	<i>OILCODE</i>
TEST STAND NO.	<i>STAND</i>	TEST NO.	<i>STAND - STRUN - LABRUN</i>
LABORATORY OIL CODE	<i>LABOCODE</i>		
FORMULATION STAND CODE	<i>FORM</i>		

	Parameter	Units	QI Threshold	EOT QI	Target	Average	Standard Deviation	Number Of	
								Samples	BQD
<b>Controlled Parameters</b>	Speed	r/min	0.000	<i>QRPM</i>	3600	<i>ARPM</i>	<i>SRPM</i>	<i>NRPM</i>	<i>BRPM</i>
	Load	Nm	0.000	<i>QLOAD</i>	200	<i>ALOAD</i>	<i>SLOAD</i>	<i>NLOAD</i>	<i>BLOAD</i>
	Oil Filter Block	°C	0.000	<i>QOTEMP</i>	155.0	<i>AOTEMP</i>	<i>SOTEMP</i>	<i>NOTEMP</i>	<i>BOTEMP</i>
	Engine Coolant Out	°C	0.000	<i>QCOLOUT</i>	122.0	<i>ACOLOUT</i>	<i>SCOLOUT</i>	<i>NCOLOUT</i>	<i>BCOLOUT</i>
	Condenser Coolant Out	°C	0.000	<i>QCCOLOUT</i>	40.0	<i>ACCOLOUT</i>	<i>SCCOLOUT</i>	<i>NCCOLOUT</i>	<i>BCCOLOUT</i>
	Left Air-to-Fuel Ratio		0.000	<i>QLAFR</i>	15.0	<i>ALAFR</i>	<i>SLAFR</i>	<i>NLAFR</i>	<i>BLAFR</i>
	Right Air-to-Fuel Ratio		0.000	<i>QRAFR</i>	15.0	<i>ARAFR</i>	<i>SRAFR</i>	<i>NRAFR</i>	<i>BRAFR</i>
	Left Exhaust Back Pressure	kPa	0.000	<i>QLEXBP</i>	6.0	<i>ALEXBP</i>	<i>SLEXBP</i>	<i>NLEXBP</i>	<i>BLEXBP</i>
	Right Exhaust Back Pressure	kPa	0.000	<i>QREXBP</i>	6.0	<i>AREXBP</i>	<i>SREXBP</i>	<i>NREXBP</i>	<i>BREXBP</i>
	Intake Air	kPa	0.000	<i>QINAIR</i>	0.05	<i>AINAIR</i>	<i>SINAIR</i>	<i>NINAIR</i>	<i>BINAIR</i>
	Engine Coolant Flow	L/min	0.000	<i>QCOLFLO</i>	160.0	<i>ACOLFLO</i>	<i>SCOLFLO</i>	<i>NCOLFLO</i>	<i>BCOLFLO</i>

	Parameter	Units	Average	Standard Deviation	Number Of	
					Samples	BQD
<b>Non-controlled Parameters</b>	Oil Sump	°C	<i>AOSUMP</i>	<i>SOSUMP</i>	<i>NOSUMP</i>	<i>BOSUMP</i>
	Pump Outlet Pressure	kPa	<i>APOUTP</i>	<i>SPOUTP</i>	<i>NPOUTP</i>	<i>BPOUTP</i>
	Gallery Pressure	kPa	<i>AOILPRS</i>	<i>SOILPRS</i>	<i>NOILPRS</i>	<i>BOILPRS</i>
	Engine Coolant In	°C	<i>AECOLIN</i>	<i>SECOLIN</i>	<i>NECOLIN</i>	<i>BECOLIN</i>
	Fuel Inlet	°C	<i>AFUELIN</i>	<i>SFUELIN</i>	<i>NFUELIN</i>	<i>BFUELIN</i>
	Intake Air	°C	<i>AINAT</i>	<i>SINAT</i>	<i>NINAT</i>	<i>BINAT</i>
	Intake Air Dew Point	°C	<i>AINDEW</i>	<i>SINDEW</i>	<i>NINDEW</i>	<i>BINDEW</i>
	Intake Vacuum	kPa	<i>AINVAC</i>	<i>SINVAC</i>	<i>NINVAC</i>	<i>BINVAC</i>
	Crankcase	kPa	<i>ACCASEP</i>	<i>SCCASEP</i>	<i>NCCASEP</i>	<i>BCCASEP</i>
	Fuel Pressure	kPa	<i>APFUEL</i>	<i>SPFUEL</i>	<i>NPFUEL</i>	<i>BPFUEL</i>

OIL CONSUMPTION DATA							
HOURS	Initial Run-in	<i>OCONH010</i>	<i>CONH020</i>	<i>CONH030</i>	<i>CONH040</i>	<i>CONH050</i>	<i>CONH060</i>
LEVEL (ml) low	<i>OILLINI</i>	<i>OILLH010</i>	<i>OILLH020</i>	<i>OILLH030</i>	<i>OILLH040</i>	<i>OILLH050</i>	<i>OILLH060</i>

NO <sub>x</sub> Measurement		
Hours	<i>NOXHH007</i>	<i>NOXHH039</i>
NO <sub>x</sub> , ppm	<i>NOX_H007</i>	<i>NOX_H039</i>

**SEQUENCE IIFHD  
FORM 6  
USED OIL ANALYSIS RESULTS**

LAB	<i>LAB</i>	OIL CODE	<i>OILCODE</i>
TEST STAND NO.	<i>STAND</i>	TEST NO.	<i>STAND - STRUN - LABRUN</i>
LABORATORY OIL CODE	<i>LABOCODE</i>		
FORMULATION STAND CODE	<i>FORM</i>		

<b>VISCOSITY INCREASE DATA (cSt AT 40°C)</b>			
HOURS	VISCOSITY <sup>A</sup>	CHANGE	PERCENT
NEW OIL	<i>VNEW</i>		
INITIAL <sup>B</sup>	<i>VINI</i>		
<i>VISTH010</i>	<i>VIS_H010</i>	<i>DVISH010</i>	<i>PVISH010</i>
<i>VISTH020</i>	<i>VIS_H020</i>	<i>DVISH020</i>	<i>PVISH020</i>
<i>VISTH030</i>	<i>VIS_H030</i>	<i>DVISH030</i>	<i>PVISH030</i>
<i>VISTH040</i>	<i>VIS_H040</i>	<i>DVISH040</i>	<i>PVISH040</i>
<i>VISTH050</i>	<i>VIS_H050</i>	<i>DVISH050</i>	<i>PVISH050</i>
<i>VISTH060</i>	<i>VIS_H060</i>	<i>DVISH060</i>	<i>PVISH060</i>
<i>TESTLEN</i>	<i>WISEOT</i>	<i>DWISEOT</i>	<i>PVIS</i>

<sup>A</sup> 8000 cSt is maximum allowable viscosity

<sup>B</sup> At end of leveling run

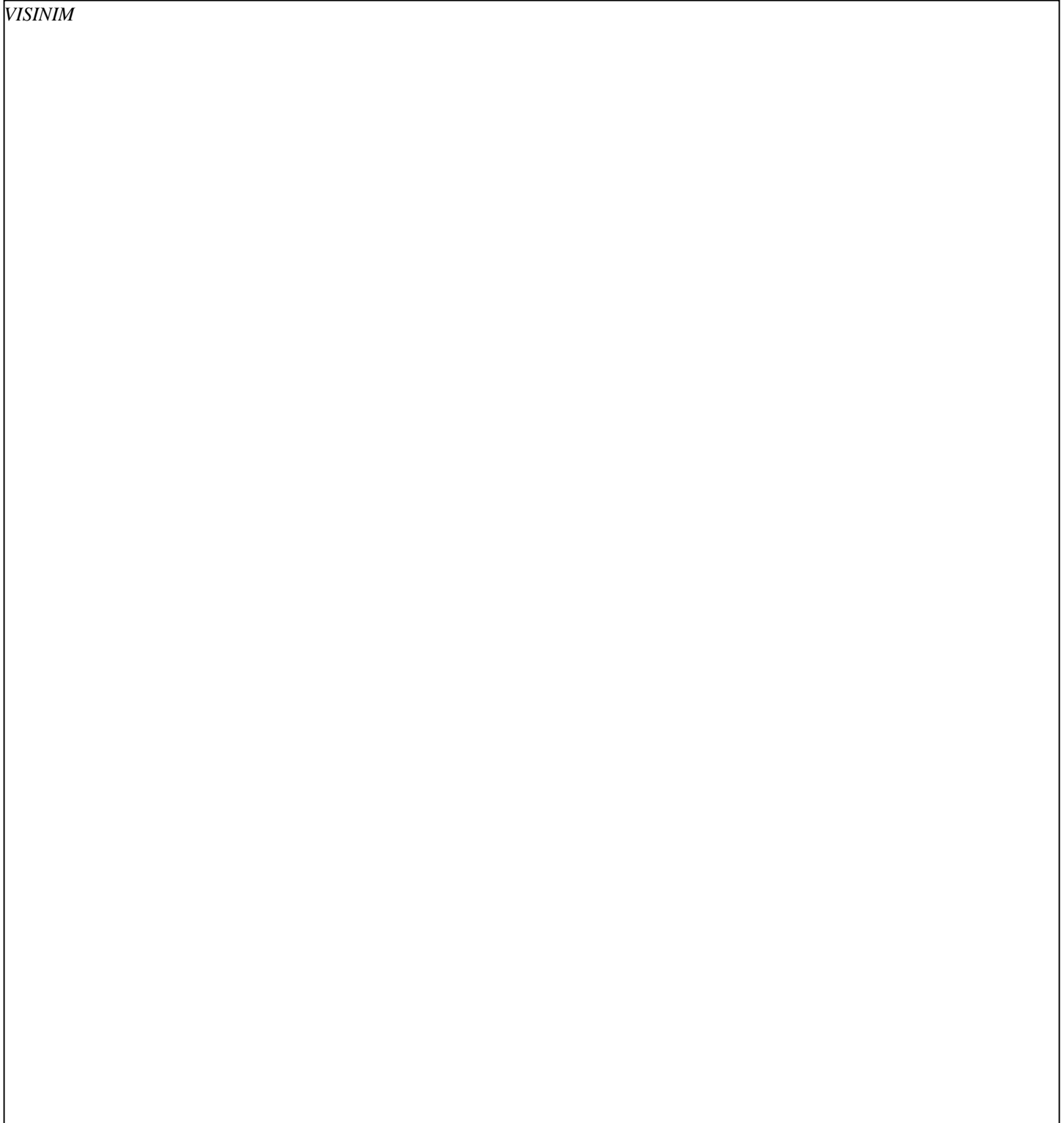
<b>Results of ICP Analysis of Used Oil</b>								
Test Hours	Initial	<i>TST_H010</i>	<i>TST_H020</i>	<i>TST_H030</i>	<i>TST_H040</i>	<i>TST_H050</i>	<i>TST_H060</i>	<i>TESTLEN</i>
Iron	<i>FEWMINI</i>	<i>FEWMH010</i>	<i>FEWMH020</i>	<i>FEWMH030</i>	<i>FEWMH040</i>	<i>FEWMH050</i>	<i>FEWMH060</i>	<i>FEWMEOT</i>
Copper	<i>CUWMINI</i>	<i>CUWMH010</i>	<i>CUWMH020</i>	<i>CUWMH030</i>	<i>CUWMH040</i>	<i>CUWMH050</i>	<i>CUWMH060</i>	<i>CUWMEOT</i>
Lead	<i>PBWMINI</i>	<i>PBWMH010</i>	<i>PBWMH020</i>	<i>PBWMH030</i>	<i>PBWMH040</i>	<i>PBWMH050</i>	<i>PBWMH060</i>	<i>PBWMEOT</i>



**SEQUENCE IIFHD  
FORM 8  
VISCOSITY INCREASE PLOT**

LAB	<i>LAB</i>	OIL CODE	<i>OILCODE</i>
TEST STAND NO.	<i>STAND</i>	TEST NO.	<i>STAND - STRUN - LABRUN</i>
LABORATORY OIL CODE	<i>LABOCODE</i>		
FORMULATION STAND CODE	<i>FORM</i>		

*VISINIM*





**SEQUENCE IIFHD  
FORM 9  
HARDWARE INFORMATION**

LAB	<i>LAB</i>	OIL CODE	<i>OILCODE</i>
TEST STAND NO.	<i>STAND</i>	TEST NO.	<i>STAND - STRUN - LABRUN</i>
LABORATORY OIL CODE	<i>LABOCODE</i>		
FORMULATION STAND CODE	<i>FORM</i>		

Build Completion Date	<i>BUILDDT</i>	Piston Batch (Code)	<i>PISTBAT</i>
Block Serial Number	<i>BLOCKSN</i>	Piston Size (Grade)	<i>PISTSIZE</i>
Crankshaft Serial Number	<i>CRANKSN</i>	Piston Ring Batch Code	<i>RINGCODE</i>
Camshaft Serial Number	<i>CAMSN</i>	Oil Filter Batch Code	<i>OILFIBAT</i>
Cylinder Head Serial Number, Left	<i>LHEADSN</i>	Intake Valve Seals Batch Code	<i>INVSLBAT</i>
Cylinder Head Serial Number, Right	<i>RHEADSN</i>	Valve Springs Batch Code	<i>VALSPBAT</i>
Bearing Kit Serial Number	<i>BRNGSN</i>	Lifter Serial Number	1 <i>LFTR1SN</i>
Top Ring Gap, mils	<i>TRINGGAP</i>		2 <i>LFTR2SN</i>
Bottom Ring Gap, mils	<i>BRINGGAP</i>		3 <i>LFTR3SN</i>
			4 <i>LFTR4SN</i>
			5 <i>LFTR5SN</i>
			6 <i>LFTR6SN</i>
			7 <i>LFTR7SN</i>
			8 <i>LFTR8SN</i>
			9 <i>LFTR9SN</i>
			10 <i>LFTR10SN</i>
			11 <i>LFTR11SN</i>
			12 <i>LFTR12SN</i>

**SEQUENCE IIFHD  
FORM 10  
DOWNTIME & OUTLIER REPORT FORM**

LAB	<i>LAB</i>	OIL CODE	<i>OILCODE</i>
TEST STAND NO.	<i>STAND</i>	TEST NO.	<i>STAND - STRUN - LABRUN</i>
LABORATORY OIL CODE	<i>LABOCODE</i>		
FORMULATION STAND CODE	<i>FORM</i>		

Downtime Occurrences		<i>DWNOCR</i>	
Test Hours	Date	Total Downtime	Reasons
<i>DOWNR001</i>	<i>DDATR001</i>	<i>DTIMR001</i>	<i>DREAR001</i>
Total Downtime		<i>TOTLDOWN</i> Maximum allowable downtime: 24 hours	

Other Comments & Outliers	<i>TOTCOM</i>
<i>OCOMR001</i>	