

**Report On**  
**General Motors Oxidation & Deposit Test 2**  
**For dexos®**

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 _____ been conducted in a valid manner in accordance with the test procedure, GMW17043, issue _____, publication date _____. The remarks included in the report describe the anomalies associated with this test.
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Submitted By: \_\_\_\_\_

Testing Laboratory

Signature

Typed Name

Title

## General Motors Oxidation & Deposit Test2

### Form 2

#### Table of Contents

1.	Title / Validity Declaration Page	Form 1
2.	Table of Contents	Form 2
3.	Summary of Test Method	Form 3
4.	Test Result Summary	Form 4
5.	Test Result Summary	Form 4a
6.	Operational Summary	Form 5
7.	Operational Summary-Non Critical Parameters	Form 5a
8.	Oil Consumption Data Plot	Form 6
9.	Used Oil Analysis	Form 7
10.	Used Oil Analysis	Form 7a
11.	Summary of Ring Sticking	Form 8
12.	Summary of Piston Deposits	Form 9
13.	Blowby Values & Plot	Form 10
14.	Viscosity Increase Plot	Form 11
15.	Hardware Information	Form 12
16.	Downtime & Outlier Report Form	Form 13
17.	Test Comments	Form 14
18.	Piston Skirt Photos, Thrust	Form 15
19.	Piston Skirt Photos, Anti-Thrust	Form 16
20.	Piston Crown Photos	Form 17
21.	Engine Build Data	Form 18
22.	Engine Build Data	Form 19
23.	Engine Control Module Data	Form 20
24.	Fuel Flow Data Plot	Form 21

**General Motors Oxidation & Deposit Test2**  
**Form 3**  
**Summary of Test Method**

The GM Oxidation and Deposit Test (GMOD2) is a fired-engine, dynamometer lubricant test for evaluating automotive engine oils for certain high-temperature performance characteristics, including oil thickening, piston deposits, oil consumption, low-temperature performance, and the ability of an oil to retain Phosphorus. 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 GMOD Test utilizes a General Motors LSX, water-cooled, four cycle, V-8 engine as the test apparatus. The GMOD 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. The engine uses a GM port fuel injection system. The test engine is overhauled prior to each test following the Engine Assembly/Disassembly Manual.

The GMOD Test consists of a ten-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 ten-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 ten-minute sample to determine the viscosity increase of the test oil.

The GMOD is operated at the following test states during the 100-hour portion of the test:

<b>Parameter</b>	<b>Set Point</b>
Engine Speed	3000 r/min
Engine Load	250 N-m
Oil Filter Block Temperature	145 °C
Coolant Outlet Temperature	115 °C
Fuel Pressure	410 kPa
Intake Air Temperature	35 °C
Intake Air Pressure	0.05 kPa
Intake Air Humidity	11.4 g/kg
Exhaust Back Pressure	3 kPa
Engine Coolant Flow	190 L/min
Coolant System Pressure	123 kPa
Fuel Temperature	35°C

## General Motors Oxidation & Deposit Test2

### 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		Reference Oil <sup>A</sup>	
Test Length			

Pass/Fail Results		
	Viscosity Increase at 100 hours (%)	Average Weighted Piston Deposits (merits)
Original Units		
Transformed Results <sup>B</sup>		
Industry Correction Factor		
Corrected Transformed Result		
Severity Adjustment		
Final Transformed Result		
Final Original Unit Result		

Additional Results			
Oil Consumption Hours, h <sup>C</sup>		Total Oil Consumption, L	
Average Oil Ring Plugging, %		Number of Cold-Stuck Rings	
Number of Hot-Stuck Ring		Average Piston Varnish, merits	
Average Groove 3, merits		Average Piston Varnish, thrust, merits	
Evaporation Loss % <sup>D</sup>		Average Piston Varnish, anti thrust, merits	
Kinematic Viscosity @ 100° EOT <sup>D</sup>		HTHS @ 150° EOT <sup>D</sup>	

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

<sup>B</sup>Viscosity Increase uses a natural log(ln) transformation.

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

<sup>D</sup>Not required for Reference Tests

## General Motors Oxidation & Deposit Test2

### Form 4a

#### Test Result Summary

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

<b>Pass/Fail Results</b>	
<b>Phosphorus Retention</b>	
Original Units, %	
Transformed Result	
Industry Correction Factor	
Corrected Transformed Result	
Severity Adjustment	
Final Transformed Result	
Final Original Unit Result	

<b>Pass/Fail Results</b>	
<b>Mini Rotary Viscometer Viscosity, D 4684</b>	
Temperature, °C	
Original Units, cP	
Transformed Result <sup>TBD</sup>	
Industry Correction Factor	
Corrected Transformed Result	
Severity Adjustment	
Final Transformed Result	
Final Original Unit Result	
Yield Stress, Pa	

<b>Cold Crank Simulator Results, D 5293</b>	
Specified Temperature, °C	
Cold-Crank Simulator Viscosity at Specified Temperature, cP	

**General Motors Oxidation & Deposit Test2**  
**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	BQD
<b>Controlled Parameters</b>	Speed	r/min	0.000		3000				
	Load	Nm	0.000		250				
	Oil Filter Return	°C	0.000		145				
	Coolant Out	°C	0.000		115				
	Coolant System	kPa	0.000		123				
	Intake Air	°C	0.000		35				
	Intake Air	kPa	0.000		0.05				
	Intake Air	g/kg	0.000		11.4				
	EBP Rt.	kPa	0.000		3.0				
	EBP Lt.	kPa	0.000		3.0				
	Fuel @ Rail	°C	0.000		35				
	Fuel @ Rail	kPa	0.000		410				
	Ex. Manifold, Rt.	L/min	0.000		15				
	Ex. Manifold, Lt.	L/min	0.000		15				
	Coolant Flow	L/min	0.000		190				
Load Cell Δ	°C			0 <sup>A</sup>					

<sup>A</sup>The maximum deviation from the temperature during load cell calibration is ± 6°C

## General Motors Oxidation & Deposit Test2

### Form 5a

#### Operational Summary-Non Controlled Parameters

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

Non-controlled Parameters	Parameter	Units	Average	Standard Deviation	Number of	
					Samples	BQD
	Oil Sump	°C				
	Coolant Inlet	°C				
	Oil Filter	kPa				
	Oil Pump	kPa				
	Intake Manifold	kPaA				
	Rt. AFR via Lambda Sensor					
	Lt. AFR via Lambda Sensor					
	Rt. Exhaust Gas NO <sub>x</sub>	ppm				
	Lt. Exhaust Gas NO <sub>x</sub>	ppm				
	Fuel Flow	kg/h				
	Crankcase	kPa				
	Cylinder #1 Exhaust	°C				
	Cylinder #2 Exhaust	°C				
	Cylinder #3 Exhaust	°C				
	Cylinder #4 Exhaust	°C				
	Cylinder #5 Exhaust	°C				
	Cylinder #6 Exhaust	°C				
	Cylinder #7 Exhaust	°C				
	Cylinder #8 Exhaust	°C				

**General Motors Oxidation & Deposit Test2**

**Form 6**

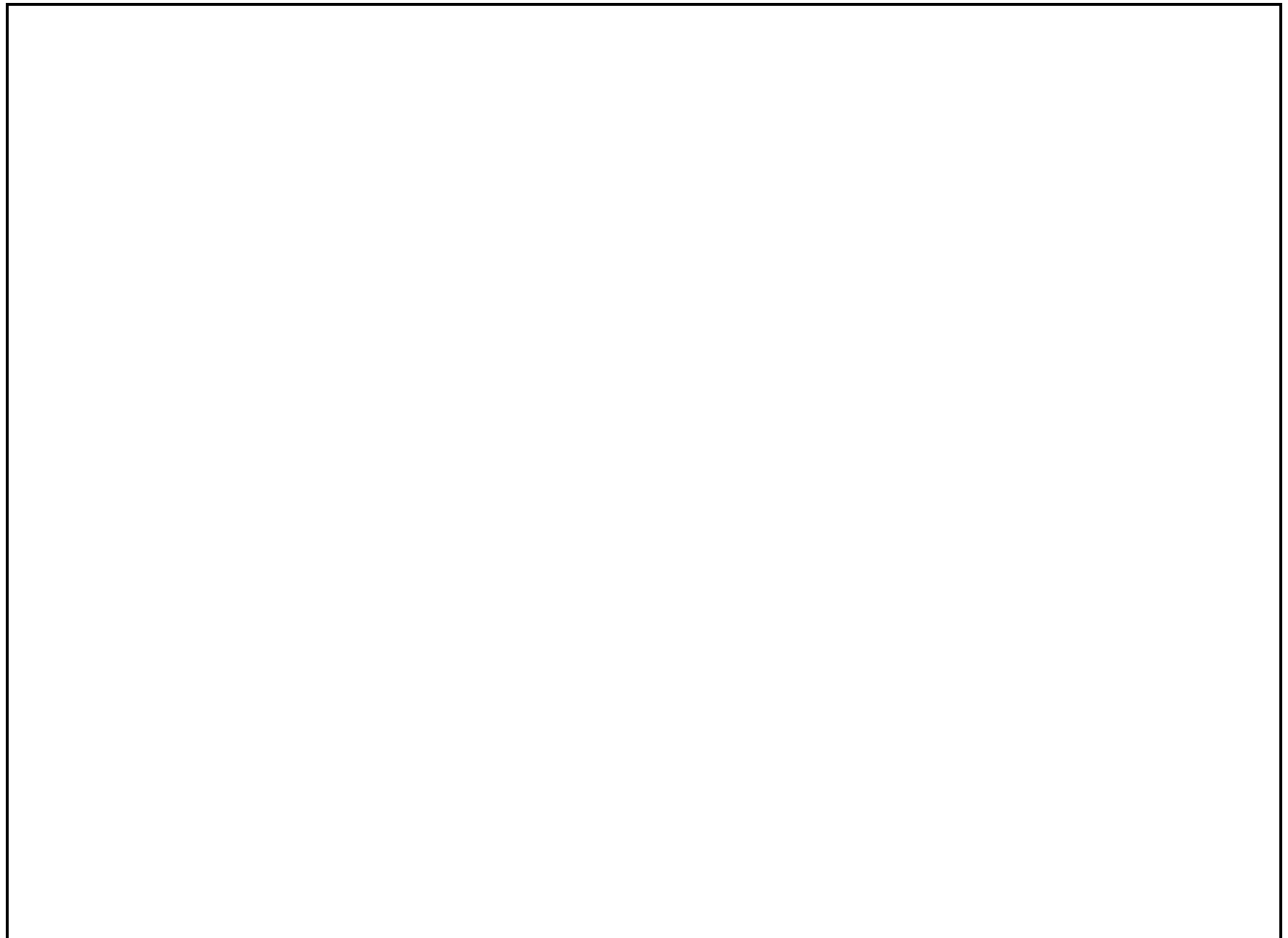
**Oil Consumption Data Plot**

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

**Oil Consumption Data**

Hours					
Level low (mL)					
Total Oil Consumed (L)					

**Oil Consumption Plot**





## General Motors Oxidation & Deposit Test2

### Form 7

#### Used Oil Analysis Results

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

Viscosity Increase Data (cSt @40 °C)			
Hours	Viscosity <sup>A</sup>	Change	Percent
New Oil			
Initial <sup>B</sup>			
EOT			

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

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

Highest Detergent Metal and Phosphorus Results by ICP (D 5185)			
Test Hour	Detergent Metal	Phosphorus (P)	Phosphorus Retention <sup>C</sup>
	mg/kg	mg/kg	Percent (%)
Initial <sup>B</sup>			
EOT			
Detergent Metal used for this test			

<sup>C</sup> See GMOD test procedure for calculation of Phosphorus Retention

**General Motors Oxidation & Deposit Test2**  
**Form 7a**  
**Used Oil Analysis Results**

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

<b>Oxidation &amp; Nitration Results</b>						
<b>Parameter</b>	<b>Method</b>	<b>20 hours</b>	<b>40 hours</b>	<b>60 hours</b>	<b>80 hours</b>	<b>EOT</b>
DIR Oxidation	E168 IIIG Area					
DIR Nitration	E168 IIIG Area					
DIR Oxidation	DIN 51453 Peak					
DIR Nitration	DIN 51453 Peak					
<b>Total Acid Number</b>						
<b>Parameter</b>	<b>Method</b>	<b>20 hours</b>	<b>40 hours</b>	<b>60 hours</b>	<b>80 hours</b>	<b>EOT</b>
TAN	D664					
<b>Metals Element Analysis – ICP Method D5185 (mg/kg)</b>						
<b>Element</b>	<b>Initial</b>	<b>20 hours</b>	<b>40 hours</b>	<b>60 hours</b>	<b>80 hours</b>	<b>EOT</b>
Aluminum (Al)						
Boron (B)						
Calcium (Ca)						
Copper (Cu)						
Iron (Fe)						
Potassium (K)						
Magnesium (Mg)						
Manganese (Mn)						
Molybdenum (Mo)						
Sodium (Na)						
Phosphorus (P)						
Lead (Pb)						
Silicon (Si)						
Tin (Sn)						
Zinc (Zn)						

## General Motors Oxidation & Deposit Test2

### Form 8

#### Summary of Ring Sticking

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

Piston	% Oil Ring Plugging	Ring Sticking <sup>A</sup>	
		Hot-Stuck Rings	Cold-Stuck Rings
1			
2			
3			
4			
5			
6			
7			
8			
Total			
Average			

<sup>A</sup> Possible values    T = top compression ring  
                                   B = bottom compression ring  
                                   O = oil ring  
                                   N = none

**General Motors Oxidation & Deposit Test2**

**Form 9**

**Summary of Piston Deposits**

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

<b>Un-Weighted Piston Deposits – Merits</b>					<b>Weighted Piston Deposits</b>	<b>Other Deposits</b>			
<b>Grooves</b>		<b>Lands</b>		<b>Undercrown</b>		<b>Piston Skirt Varnish</b>			<b>Groove 3</b>
1	2	2	3			Thrust	Anti-Thrust	Average	
Piston 1					Piston 1				
Piston 2					Piston 2				
Piston 3					Piston 3				
Piston 4					Piston 4				
Piston 5					Piston 5				
Piston 6					Piston 6				
Piston 7					Piston 7				
Piston 8					Piston 8				
WF	0.071	0.143	0.214	0.429	0.143	Average			



**General Motors Oxidation & Deposit Test2**

**Form 11**

**Viscosity Increase Plot**

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



**General Motors Oxidation & Deposit Test2**  
**Form 12**  
**Hardware Information**

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

<b>Hardware Information</b>	
Engine Build Date	
Block Serial Number	
Engine Run Number	
Cylinder Head Serial Number, Left	
Cylinder Head Serial Number, Right	
Ring Batch Code	
Oil Control (OC) Ring Batch Code	
Expander Ring (EXP) Batch Code	
Main Bearing (M) Batch Code	
Connecting Rod Bearings (CR) Batch Code	
Camshaft Bushing (CB) Batch Code	
Piston Batch Code	
Lifter Part Number	
Oil Pump Part Number	
Rocker Arm Part Number	
Valve Spring Part Number	
Exhaust Valve Part Number	







**General Motors Oxidation & Deposit Test2**

**Form 15**

**Piston Skirt Photos, Thrust**

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

**General Motors Oxidation & Deposit Test2**

**Form 16**

**Piston Skirt Photos, Anti-Thrust**

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

**General Motors Oxidation & Deposit Test2**

**Form 17**

**Piston Crown Photos**

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

## General Motors Oxidation & Deposit Test2

### Form 18

#### Engine Build Data

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

A.1 Cylinder Bore Diameter, Transverse (inches)								
	1	3	5	7	2	4	6	8
Top								
Middle								
Bottom								
Average								
A.1 Cylinder Bore Diameter, Longitudinal (inches)								
	1	3	5	7	2	4	6	8
Top								
Middle								
Bottom								
Average								

A.2 Piston Clearance (inches)								
	1	3	5	7	2	4	6	8
Piston Diameter								
Piston Clearance*								

\*Piston Clearance = Average Transverse-Piston Skirt Diameter

A.3 Piston Ring End Gap (inches)								
	1	3	5	7	2	4	6	8
Top Pre-Test								
2 <sup>nd</sup> Pre-Test								

A.4 Cylinder Bore Surface Finish Final (µin)									
	Spec.	1	3	5	7	2	4	6	8
<b>R<sub>pk</sub></b>	<b>(1-12)</b>								
<b>R<sub>k</sub></b>	<b>(1 – 41)</b>								
<b>R<sub>vk</sub></b>	<b>(16 – 57)</b>								

## General Motors Oxidation & Deposit Test2

### Form 19

#### Engine Build Data

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

<b>A.5 Camshaft End Play (inches)</b>

<b>A.6 Crankshaft End Play (inches)</b>

<b>A.7 Main Bearing Clearance (inches)</b>				
1	2	3	4	5

<b>A.8 Cam Bearing Clearance (inches)</b>				
1	2	3	4	5

<b>A.9 Piston Ring Side Clearance (inches)</b>								
	1	3	5	7	2	4	6	8
Top Ring								
Second Ring								
Oil Ring								

<b>A.10 Connecting Rod Bearing Clearance (inches)</b>								
	1	3	5	7	2	4	6	8
Clearance								

<b>A.11 Connecting Rod Side Clearance (inches)</b>				
	1 and 2	3 and 4	5 and 6	7 and 8
Clearance				

<b>A.12 Fuel Injector Flow Rates (mL/30s)</b>								
	1	3	5	7	2	4	6	8
Fuel Flow								

<b>A.13 Valve Recession (inches)</b>								
Position	1	3	5	7	2	4	6	8
Intake Pre-Test								
Intake Post-Test								
Intake Recession								
Exhaust Pre-Test								
Exhaust Post-Test								
Exhaust Recession								
<b>Average Valve Recession</b>								
Intake					Left			
Exhaust					Right			

**General Motors Oxidation & Deposit Test2**  
**Form 20**  
**Engine Control Module (ECM) Data**

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

ECM Data						
ECM Parameters	Parameter	Units	Average	Standard Deviation	Number of	
					Samples	BQD
	Engine Speed	r/min				
	ECT	°C				
	IAT	°C				
	MAF	g/sec				
	STFT B1					
	STFT B2					
	LTFT B1					
	LTFT B2					
	Timing Advance	Degree				
Control Voltage	V					

**General Motors Oxidation & Deposit Test2**  
**Form 21**  
**Fuel Flow Plot**

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