Report On
General Motors Oxidation & Deposit Test
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.

Submitted By: _____
Testing Laboratory

_____
Signature

_____
Typed Name

_____
Title

General Motors Oxidation & Deposit Test
Form 2
Table of Contents

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

The GM Oxidation and Deposit Test (GMOD) 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:

Parameter	Set Point
Engine Speed	3000 r/min
Engine Load	250 N-m
Oil Filter Block Temperature	145 ^{o}C
Coolant Outlet Temperature	115 ^{o}C
Fuel Pressure	410 kPa
Intake Air Temperature	35 ^{o}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 Test
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 [A]	
Test Length			

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

Additional Results			
Oil Consumption Hours, h [C]		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 by NOACK[D]		Average Piston Varnish, anti thrust, merits	
Shear Stability @ 100° EOT[D]		Shear Stability @ 150° EOT[D]	

[A] *Reference Oil Tests Only*

[B] *Viscosity Increase uses a natural log(ln) transformation.*

[C] *Test Hours at which Oil Consumption was calculated*

[D] *Not required for Reference Tests*

General Motors Oxidation & Deposit Test
Form 4a

Test Result Summary

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

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

Pass/Fail Results	
Mini Rotary Viscometer Viscosity, D 4684	
Temperature, ºC	
Original Units, cP	
Transformed Result [TBD]	
Industry Correction Factor	
Corrected Transformed Result	
Severity Adjustment	
Final Transformed Result	
Final Original Unit Result	
Yield Stress, Pa	

Cold Crank Simulator Results, D 5293	
Specified Temperature, ^{o}C	
Cold-Crank Simulator Viscosity at Specified Temperature, cP	

General Motors Oxidation & Deposit Test
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		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[A]				

[A]The maximum deviation from the temperature during load cell calibration is ± 6°C

General Motors Oxidation & Deposit Test

Form 5a
Operational Summary-Non Controlled Parameters

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

	Parameter	Units	Average	Standard Deviation	Number of Samples	Number of BQD
Non-controlled Parameters	Oil Sump	^{o}C				
	Coolant Inlet	^{o}C				
	Oil Filter	kPa				
	Oil Pump	kPa				
	Intake Manifold	kPaA				
	Rt. AFR via Lambda Sensor					
	Lt. AFR via Lambda Sensor					
	Rt. Exhaust Gas NO_X	ppm				
	Lt. Exhaust Gas NO_X	ppm				
	Fuel Flow	kg/h				
	Crankcase	kPa				
	Cylinder #1 Exhaust	^{o}C				
	Cylinder #2 Exhaust	^{o}C				
	Cylinder #3 Exhaust	^{o}C				
	Cylinder #4 Exhaust	^{o}C				
	Cylinder #5 Exhaust	^{o}C				
	Cylinder #6 Exhaust	^{o}C				
	Cylinder #7 Exhaust	^{o}C				
	Cylinder #8 Exhaust	^{o}C				

General Motors Oxidation & Deposit Test
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 Test

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 [A]**	**Change**	**Percent**
New Oil			
Initial [B]			
EOT			

[A] *8000 cSt is maximum allowable viscosity*

[B] *Initial = At end of leveling run*

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

[C] *See GMOD test procedure for calculation of Phosphorus Retention*

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

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

Oxidation & Nitration Results						
Parameter	**Method**	**20 hours**	**40 hours**	**60 hours**	**80 hours**	**EOT**
DIR Oxidation	E168 IIIG Area					
DIR Nitration	E168 IIIG Area					
DIR Oxidation	DIN 51453 Peak					
DIR Nitration	DIN 51453 Peak					
Total Acid Number						
Parameter	**Method**	**20 hours**	**40 hours**	**60 hours**	**80 hours**	**EOT**
TAN	D664					
Metals Element Analysis – ICP Method D5185 (mg/kg)						
Element	**Initial**	**20 hours**	**40 hours**	**60 hours**	**80 hours**	**EOT**
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 Test
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[A]	
		Hot-Stuck Rings	Cold-Stuck Rings
1			
2			
3			
4			
5			
6			
7			
8			
Total			
Average			

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

General Motors Oxidation & Deposit Test
Form 9
Summary of Piston Deposits

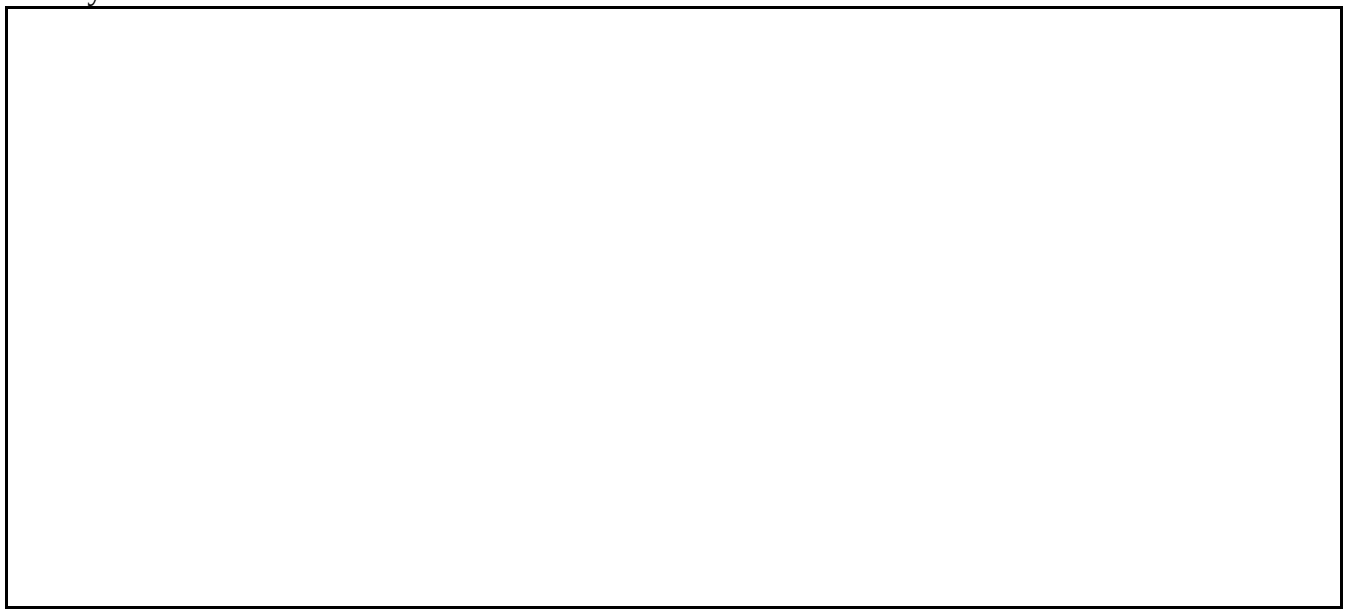
Lab		Oil Code	
Stand		Test No.	
Laboratory Oil Code			
Formulation Stand Code			
Rater		Rating Date	

Un-Weighted Piston Deposits - Merits							**Weighted Piston Deposits**		**Other Deposits**			
	Grooves		Lands		Undercrown				**Piston Skirt Varnish**			
	1	2	2	3					Thrust	Anti-Thrust	Average	Groove 3
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 Test
Form 10
Blowby Values & Plot

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

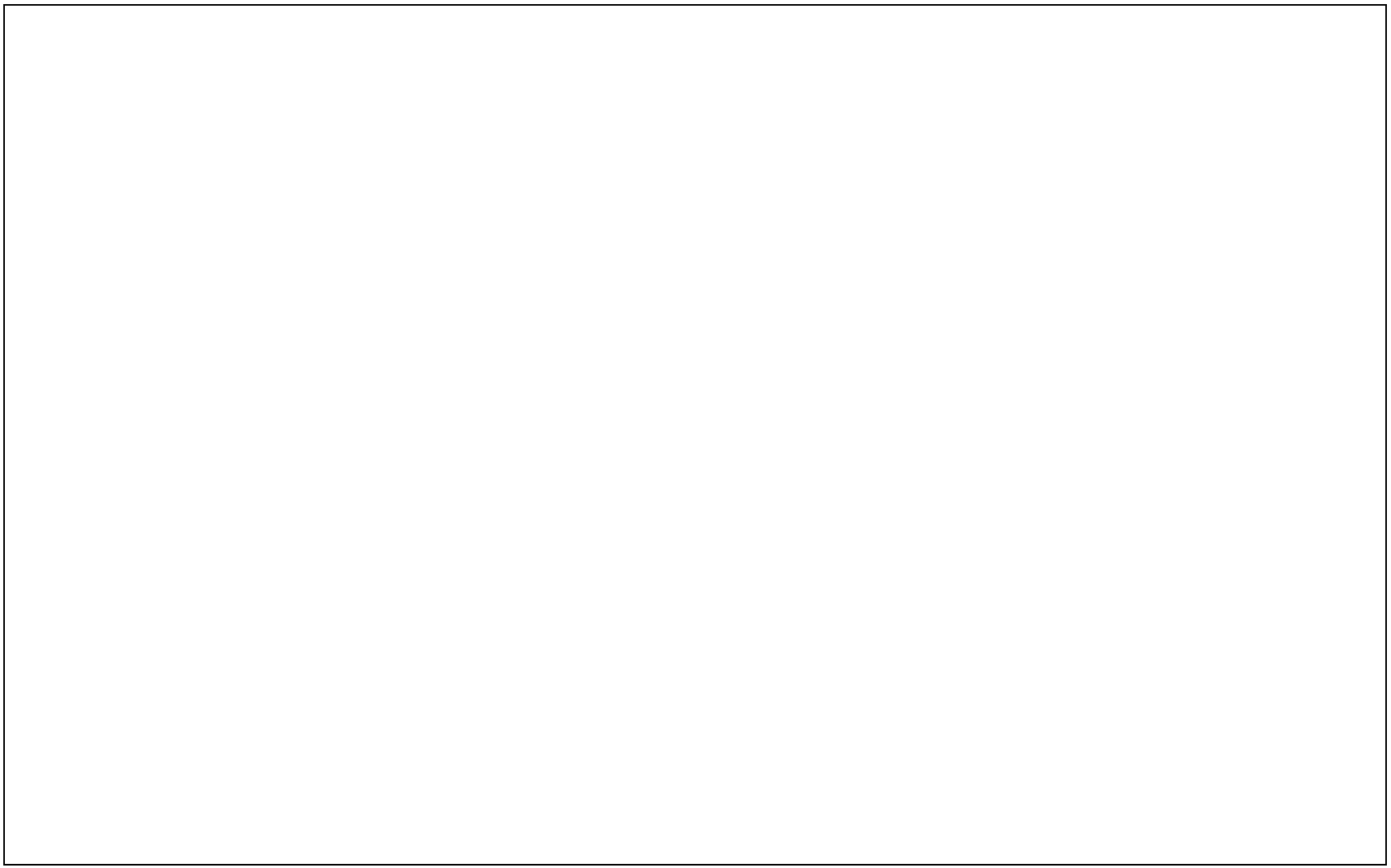
Blowby Plot



Test Hours	Blowby, L/min	Test Hours	Blowby, L/min	Test Hours	Blowby, L/min
				Average	

General Motors Oxidation & Deposit Test
Form 11
Viscosity Increase Plot

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



General Motors Oxidation & Deposit Test
Form 12
Hardware Information

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

Hardware Information	
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	

General Motors Oxidation & Deposit Test
Form 13
Downtime Summary

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

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

General Motors Oxidation & Deposit Test
Form 14
Test Comments

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

Number of Comment Lines		

General Motors Oxidation & Deposit Test
Form 15
Piston Skirt Photos

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

General Motors Oxidation & Deposit Test
Form 16
Piston Skirt Photos, Anti-Thrust

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

General Motors Oxidation & Deposit Test
Form 17
Piston Crown Photos

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

General Motors Oxidation & Deposit Test
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								
2nd Pre-Test								

A.4 Cylinder Bore Surface Finish Final (µin)									
	Spec.	**1**	**3**	**5**	**7**	**2**	**4**	**6**	**8**
R_{pk}	**(1-12)**								
R_k	**(1 – 41)**								
R_{vk}	**(16 – 57)**								

General Motors Oxidation & Deposit Test
Form 19
Engine Build Data

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

A.5 Camshaft End Play (inches)

A.6 Crankshaft End Play (inches)

A.7 Main Bearing Clearance (inches)				
1	2	3	4	5

A.8 Cam Bearing Clearance (inches)				
1	2	3	4	5

A.9 Piston Ring Side Clearance (inches)								
	1	3	5	7	2	4	6	8
Top Ring								
Second Ring								
Oil Ring								
A.10 Connecting Rod Bearing Clearance (inches)								
	1	3	5	7	2	4	6	8
Clearance								

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

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

A.13 Valve Recession (inches)								
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								
Average Valve Recession								
Intake				Left				
Exhaust				Right				

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

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

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

General Motors Oxidation & Deposit Test
Form 21
Fuel Flow Plot

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