

**General Motors Turbocharger Coking Test  
For dexos®  
Form 1**

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
	RO = Reference oil

Test Number			
Stand:		Stand Run:	
Formulation/Stand Code			
Oil Code			
Ref. Oil Code <sup>A</sup>			
Date Started		Time Started	
Date Completed		Time Completed	
Test Length		Total Downtime	
Alternate Codes			

<sup>A</sup> Reference Tests Only

In my opinion this test _____ been conducted in a valid manner in accordance with test procedure GMTC and appropriate amendments. The remarks included in the report describe the anomalies associated with this test.
--

Submitted By: \_\_\_\_\_  
Testing Laboratory

\_\_\_\_\_  
Signature

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

\_\_\_\_\_  
Title

# General Motors dexos® Turbocharger Coking Test

## 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 Results Summary	Form 4
5.	Operational Summary – Soak Stage	Form 5
6.	Operational Summary – Idle Stage	Form 6
7.	Operational Summary – 3000 RPM Stage	Form 7
8.	Operational Summary – 2000 RPM Stage	Form 8
9.	100-Cycle Period Averages	Form 9
10.	Rating Summary	Form 10
11.	Oil Analysis Part 1	Form 11
12.	Oil Analysis Part 2	Form 12
13.	Turbo Cool Inside Temperature Graph	Form 13
14.	Turbo Cool Outside Temperature Graph	Form 14
15.	Turbo Boost Pressure Graph	Form 15
16.	Turbo Feed Pipe Temperature Graph	Form 16
17.	Turbo Oil Delta Pressure Graph	Form 17
18.	Turbo Speed Graph	Form 18
19.	Downtime Record	Form 19
20.	Comment Record	Form 20

**General Motors dexos® Turbocharger Coking Test  
Form 3  
Summary of Test Method**

The purpose of this engine dynamometer test is to rapidly evaluate engine oil's potential to create hydrocarbon deposits in turbocharger oil passages and bushings under elevated temperature conditions. The test takes approximately 3 weeks to run and consists of a 0.26 hour schedule which is repeated for 2000 cycles. The schedule is defined by 8.5 minutes of engine operation followed by 7.5 minutes of engine off soak period. At the conclusion of the test, the oil is sampled, drained, weighed, and oil consumption is calculated.

Best test repeatability occurs when the engine is operated 24 hours /day until the end of test. The deposit level severity is determined by the calculating the percent temperature increase in the turbo housing, rating the components post-test and the degradation of turbocharger rotor rotation. The deposit rating technique is used in current ASTM methods. If engine fails to attain specified boost pressure due to the reduction turbocharger rotor rotation the test should be terminated.

**Turbocharger Coking Procedure**

<b>Step</b>	<b>Action</b>	<b>Ramp time, seconds</b>	<b>Engine speed, rpm</b>	<b>Engine MAP, kPa</b>	<b>Engine run time, minutes</b>
1	Start engine and idle	30	Idle	No load	0.5
2	Ramp up and maintain conditions	30	3000	80	6.5
3	Ramp down and maintain conditions	10	2000	80	50/60
4	Shut engine off	-	-	-	-
5	Engine stop and soak	0	0	0	7.5
6	Repeat steps 1 – 5 1999 more times	-	-	-	-

**General Motors dexos® Turbocharger Coking Test**

**Form 4**

**Test Results Summary**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			
SAE Viscosity Grade			
Engine Block ID		Total Engine Block Hours	
Cylinder Head ID		Total Cylinder Head Hours	
Turbocharger ID		Fuel Batch Code	

<b>% Change, 100 - 1800 Period Cycle</b>	<b>%</b>
Turbo Coolant Outside, 3000 rpm	
Banjo Bolt Oil Delta Pressure, 3000 rpm	
Turbo Speed at Idle	
<b>Rating Area</b>	<b>Merits</b>
Turbine Shaft Area (A)	
Turbine Shaft Area (B)	
Center Housing Turbine End Hole (C)	
Center Housing Turbine Inlet Hole (D)	
Center Housing Turbine Outlet Hole (E)	
Inlet Pipe (F)	
<b>Total Average Merit Rating</b>	

<b>Result</b>	<b>Value</b>
Percent Viscosity Increase at 40°C, %	
Oxidation, DIN 51453	
Nitration, DIN 51453	
TAN, D 664	
TBN, D4739	

**General Motors dexos® Turbocharger Coking Test**  
**Form 5**  
**Operational Summary – Soak Stage**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

<b>Parameter</b>	<b>Average</b>	<b>N</b>	<b>Std. Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Oil Gallery Temperature, °C					
Oil Sump Temperature, °C					
Coolant In Temperature, °C					
Coolant Out Temperature, °C					
Turbo Coolant Inside, °C					
Turbo Coolant Outside, °C					
Turbo Feed Pipe Temp., °C					

**General Motors dexos® Turbocharger Coking Test**  
**Form 6**  
**Operational Summary – Idle Stage**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

<b>Parameter</b>	<b>Average</b>	<b>N</b>	<b>Std. Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Engine Speed, rpm					
Fuel Flow, kg/h					
Man. Abs. Pressure(MAP), kPa					
Torque, Nm					
Fuel Pressure, kPa					
Inlet Air Pressure, kPa					
Crankcase Pressure, kPa					
Exhaust Back Pressure, kPa					
Post Turbo Boost Pressure, kPa					
Oil Gallery Pressure, kPa					
Humidity, g/kg					
Fuel Temperature, °C					
Oil Gallery Temperature, °C					
Oil Sump Temperature, °C					
Coolant In Temperature, °C					
Coolant Out Temperature, °C					
Pre-Turbo Inlet Air Temp., °C					
Pre-Intercooler Boost Temp., °C					
Turbo Coolant Inside, °C					
Turbo Coolant Outside, °C					
Turbo Feed Pipe Temp., °C					
Turbo Speed, rpm					
Turbo Feed Oil Pressure, kPa					
Banjo Bolt Oil Delta Press., kPa					







**General Motors dexos® Turbocharger Coking Test  
Form 9  
100-Cycle Period Averages**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

100-Cycle Period	End of Period Test Time (hhh:mm)	Turbo Coolant Outside Temp (°C)		Banjo Bolt Oil Pressure (kPa)		Turbo Speed at Idle (rpm)	
		3,000 rpm <sup>A</sup>	% Change	Delta <sup>B</sup>	% Change	At Idle <sup>C</sup>	% Change
100							
200							
300							
400							
500							
600							
700							
800							
900							
1000							
1100							
1200							
1300							
1400							
1500							
1600							
1700							
1800							
1900							
2000							

<sup>A</sup> 60 - 150 seconds

<sup>B</sup> 3,000 rpm

<sup>C</sup> 18 seconds

**General Motors dexos® Turbocharger Coking Test  
Form 10  
Rating Summary**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

<b>ASTM Manual 20 Non-Rubbing Carbon Method</b>					
<b>Turbine Shaft Area (A)</b>			<b>Turbine Shaft Area (B)</b>		
Area %	Rating	Merit	Area %	Rating	Merit
<b>Total Merit:</b>			<b>Total Merit:</b>		
<b>Center Housing Turbine End Hole (C)</b>			<b>Center Housing Turbine Inlet Hole (D)</b>		
Area %	Rating	Merit	Area %	Rating	Merit
<b>Total Merit:</b>			<b>Total Merit:</b>		
<b>Center Housing Turbine Outlet Hole (E)</b>			<b>Inlet Pipe (F)</b>		
Area %	Rating	Merit	Area %	Rating	Merit
<b>Total Merit:</b>			<b>Total Merit:</b>		
			<b>Rating Date:</b>		
			<b>Rater:</b>		

<b>Total Average Merit Rating</b>	
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**General Motors dexos® Turbocharger Coking Test**

**Form 11**

**Oil Analysis Part 1**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

<b>Oil Analysis</b>							
Test Hours	Fresh Oil						EOT
Viscosity 40°C, cSt							
Vis. Increase, %							
Oxidation, DIN 51453							
Nitration, DIN 51453							
TAN, D 664							
TBN, D4739							

<b>Oil Consumption Summary</b>	
Oil Charge (g)	
Oil Drain Weight (g)	
Oil Consumption (g)	
Oil Consumption Rate (g/h)	

**General Motors dexos® Turbocharger Coking Test  
Form 12 - Oil Analysis Part 2**

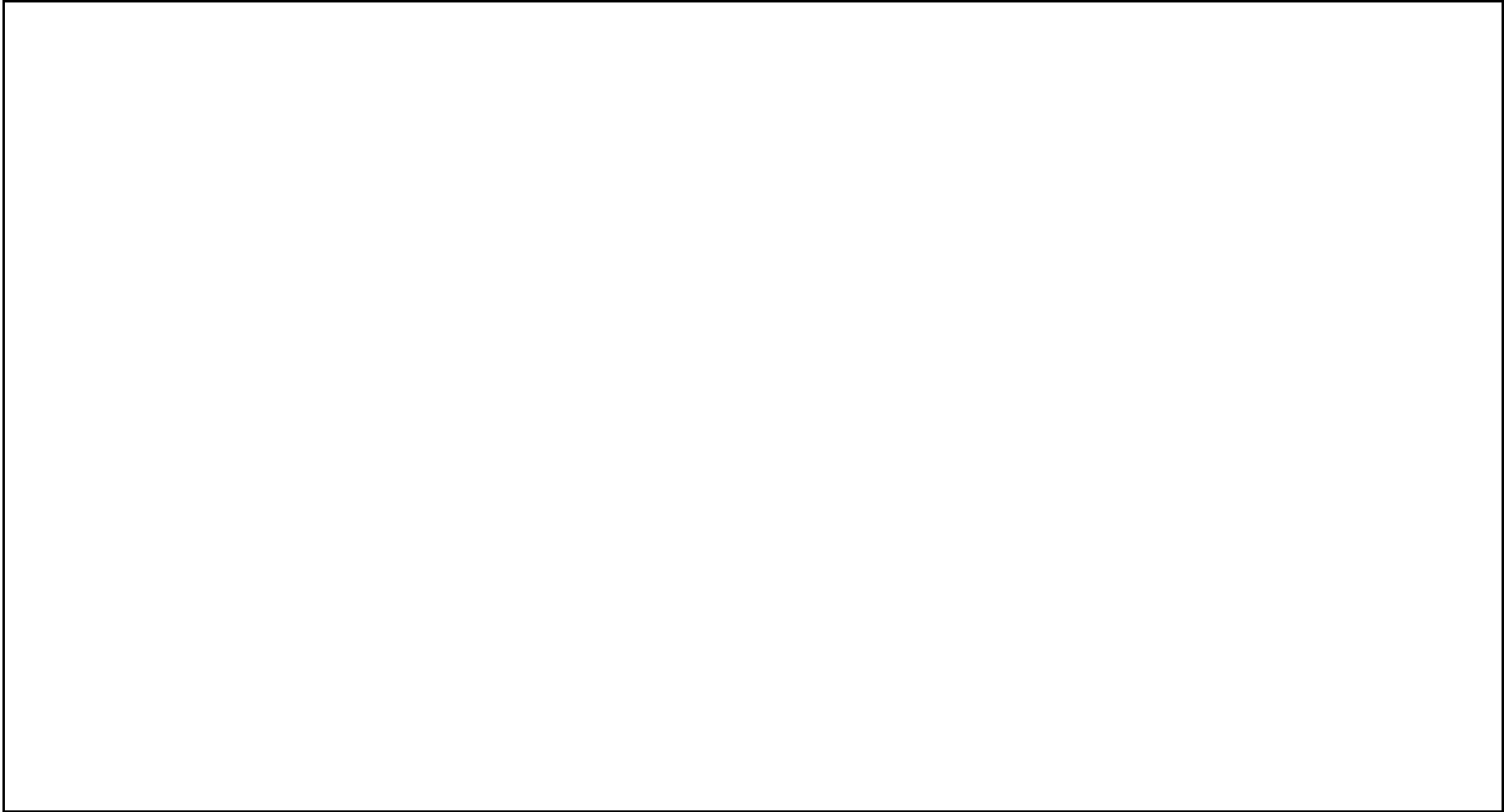
Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

<b>Metal Elements (ppm)</b>	<b>Fresh Oil</b>	<b>100</b>	<b>200</b>	<b>300</b>	<b>400</b>	<b>500</b>	<b>EOT</b>
Aluminum (Al)							
Boron (B)							
Calcium (Ca)							
Chromium (Cr)							
Copper (Cu)							
Iron (Fe)							
Potassium (K)							
Magnesium (Mg)							
Manganese (Mn)							
Molybdenum (Mo)							
Sodium (Na)							
Nickel (Ni)							
Phosphorus (P)							
Lead (Pb)							
Sulfur (S)							
Silicon (Si)							
Tin (Sn)							
Titanium (Ti)							
Zinc (Zn)							

**General Motors dexos® Turbocharger Coking Test  
Form 13  
Turbo Cool Inside Temperature Graph**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

**Turbo Cool Inside Temperature (°C)**



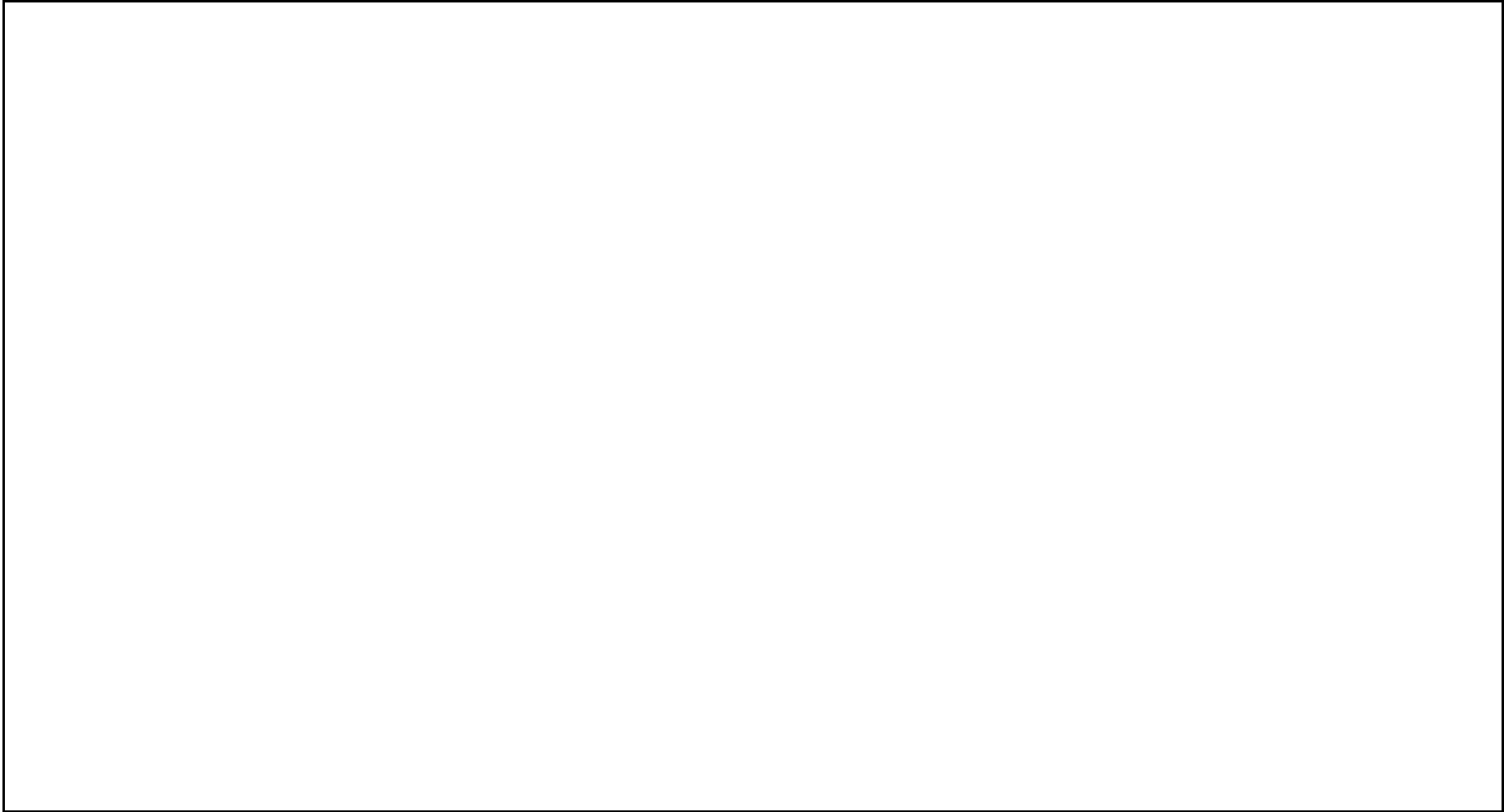
**General Motors dexos® Turbocharger Coking Test**

**Form 14**

**Turbo Cool Outside Temperature Graph**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

**Turbo Cool Outside Temperature (°C)**



**General Motors dexos® Turbocharger Coking Test**

**Form 15**

**Turbo Boost Pressure Graph**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

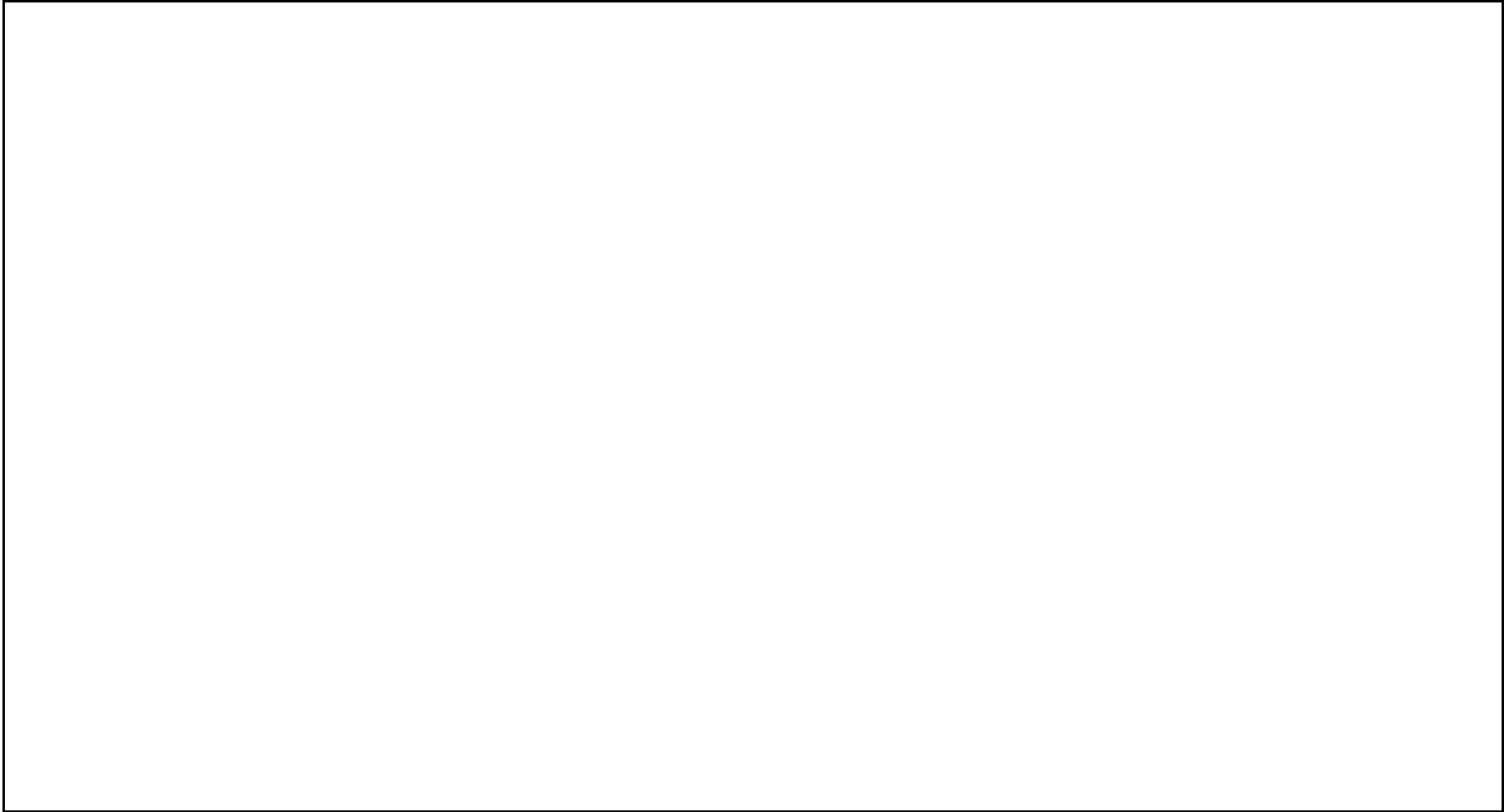
**Turbo Boost Pressure (kPa)**



**General Motors dexos® Turbocharger Coking Test**  
**Form 16**  
**Turbo Feed Pipe Temperature Graph**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

**Turbo Feed Pipe Temperature (°C)**





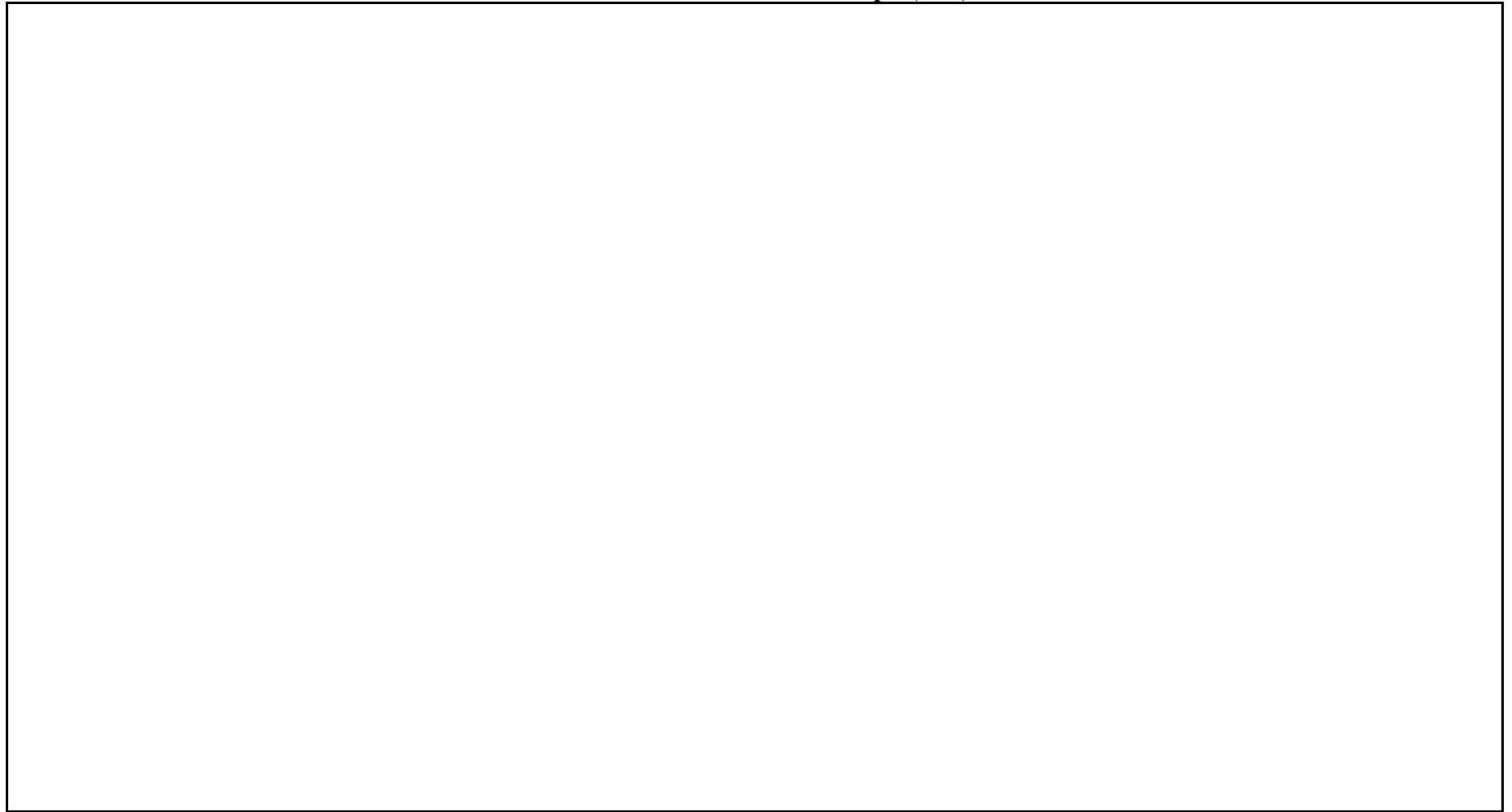
**General Motors dexos® Turbocharger Coking Test**

**Form 17**

**Turbo Oil Delta Pressure Graph**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

**Turbo Oil Delta Pressure Graph (kPa)**



**General Motors dexos® Turbocharger Coking Test**

**Form 18**

**Turbo Speed Graph**

Lab		Oil Code	
Stand		Test Number	
Lab Oil Code			
Formulation/Stand Code			

**Turbo Speed (rpm)**

