

**1P – D 6681  
Final Report Cover Sheet**

Method  
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 in Determining an Average Test Result Using Multiple Test Criteria.

	<b>RO</b> = Reference Oil Test
	<b>NR</b> = All Other Tests

	Was This Test Run Under a Valid Calibration? (Y/N)
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	Lab Is Currently Operating Under An LTMS Precision Alarm *
	Stand Is Currently Operating Under An LTMS Precision Alarm *

\* Check box only if YES

<b>Test Number</b>			
Test Stand	Engine Run Number		
EOT Time	EOT Date		
Oil Code <sup>A</sup>			
Formulation/Stand Code			
Alternate Codes			

In my opinion this test _____ been conducted in a valid manner in accordance with the ASTM Test Method D 6681 and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.
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<sup>A</sup> CMIR or Non-Reference Oil Code

Submitted By: \_\_\_\_\_

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

\_\_\_\_\_ Signature

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

\_\_\_\_\_ Title

**1P**  
**Form 1**  
**Test Report Summary**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

Start Date	Total Test Length	TMC Oil	SAE Vis. Grade
Lab Internal Oil Code		Engine Serial Number	

	Correction Effective Date	WDP	TGC	TLC	Oil Consumption g/h	Transformed Oil Consumption	EOTOC g/h	Transformed EOTOC
Unadjusted Lab Rating								
Industry Correction (If Any)								
Subtotal								
Lab Severity Adjustment (If Any) <sup>B</sup>								
Total								

	Correction Effective Date	WDP	TGC	TLC	Oil Consumption g/h	Transformed Oil Consumption	EOTOC g/h	Transformed EOTOC
Test Target Mean <sup>A</sup>								
Test Target STD <sup>A</sup>								
API Pass Limit <sup>B</sup>								

	Referee Lab	WDP	TGC	TLC	
Referee Ratings					

	Top	Int. 1	Oil	Piston Crown	Piston Skirt	Liner
Ring Loss of Side Clearance (mm)						
Ring End Gap Increase (mm)						
Is the Ring Stuck?						
Scuffed Area %						
Average Wear Step (µm)						
% Bore Polish						

Notes: <sup>A</sup> Reference oil tests or as requested by test sponsor

<sup>B</sup> Non-reference oil tests only

**1P**  
**Form 2**  
**Operational Summary**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

Controlled Parameters	Operating Parameter	Quality Index Threshold	EOT Quality Index	Process			Total Data Points		
				Units	Target	Average	Samples <sup>A</sup>	BQD <sup>B</sup>	Over/Under Range <sup>C</sup>
				Engine Speed	0.00		r/min	1800	
Fuel Flow	0.00		g/min	185					
Humidity	0.00		g/kg	17.8					
Coolant Flow	0.00		L/min	75					
<b>Temperature</b>									
Coolant Out	0.00		°C	90					
Oil To Manifold	0.00		°C	130					
Inlet Air	0.00		°C	60					
Fuel Into Head	0.00		°C	42					
<b>Pressures</b>									
Oil To Manifold	0.00		kPa	415					
Inlet Air (Absolute)	0.00		kPa	272					
Exhaust (Absolute)	0.00		kPa	265					
Fuel From Head	0.00		kPa	275					

NON-CONTROLLED PARAMETERS	Operating Parameter	Process			Total Data Points		
		Units	Typical Range <sup>D</sup>	Average	Samples <sup>A</sup>	BQD <sup>B</sup>	Over/Under Range <sup>C</sup>
		Intake Air Flow	kg/h	312-378			
Power	kW	53-57					
Torque	Nm	248-301					
Blowby	L/min	20-56					
<b>Temperature</b>							
Coolant In	°C	85-88					
Coolant Delta T	°C	2-6					
Oil Cooler In	°C	128-131					
Heating Oil	°C	165 max.					
Exhaust	°C	463-492					
<b>Pressures</b>							
Crankcase	kPa	0.09-0.3					
Coolant to Jug	kPa	64-92					

<sup>A</sup> Total number of data points taken as determined from test length and procedural specified sampling rate.

<sup>B</sup> Number of Bad Quality Data points not used in the calculation of the statistical measures.

<sup>C</sup> Number of points clipped by over/under range limits of the statistical measures.

<sup>D</sup> Gathered from 1P Matrix Test data.

**1P  
Form 3  
Assembly Measurements and Parts Record**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

Assembly Measurements and Parts Record	
Injector Setting ( GO / NO-GO )	
Was Timing Initialized? (YES/NO)	
Piston/Head Clearance mm	
Cam Gear Backlash mm	
Desired Fuel Timing °BTC	
Intake Valve Open °ATC	
Injector Plunger Lift mm @ 72°	
Intake Valve Lift mm @ 456°	
Exhaust Valve Lift mm @ 247°	

	Part Number	Serial Number/Casting Date Code <sup>A</sup>	Date Code	Inspection/Supplier Code	Box Date Code
Liner					
Top Ring					
Intermediate Ring					
Oil Ring					
Piston Crown					
Piston Skirt					
Fuel Injector					
ECM EPROM					
Piston Cooling Jet					

NOTE – See 1P Part ID Codes document for location and format of numbers and codes.

<sup>A</sup>- Piston crown is only part with a casting date code in place of serial number. All other parts have a serial number code.

**1P  
Form 4  
Piston Rating Summary**

<b>Test Identification</b>	Lab	EOT Date	EOT Time	Stand	Run No.	Method
Formulation/Stand Code				Oilcode		
Test Fuel	Fuel Batch		Date Rated	Rater Initials		Verified By
<b>Last Stand Reference Information</b>	Date Completed		Stand	Run		TMC Oil Code
	WDP	TGC	TLC	Oil Consumption g/h	Transformed Oil Consumption	EOTOC g/h
	Last Reference this Stand					
	Industry Average					
	Industry STD					

Total Piston Ratings Summary																					
	Grooves				Lands					Groove		Lands				Oil Cooling		Under Crown			
	Deposit Factor	No. 1		No. 2		No. 1		No. 2		Deposit Factor	No. 3		No. 3		No. 4		A,%	DEM.	A,%	DEM.	
		A,%	DEM.	A,%	DEM.	A,%	DEM.	A,%			DEM.	A,%	DEM.	A,%	DEM.	A,%					DEM.
C A R B O N	HC - 1.0									7.5											
	MC - 0.5																				
	LC - .25																				
	Total																				
V A R I S H	8 - 9									4.5											
	7 - 7.9																				
	6 - 6.9																				
	5 - 5.9																				
	4 - 4.9																				
	3 - 3.9																				
	2 - 2.9																				
	1 - 1.9																				
	>0 - 0.9																				
	Clean										Clean		0		0		0		0		0
Total																					
Rating																					
Location Factor		2		3		1		3		20		20		60		0.5		1			
Ind. Rating																					
<b>WDP</b>				<b>TGC</b>				<b>Top Land Carbon</b>		<b>Unweighted Deposits</b>						<b>Top Land Flaked Carbon %</b>					

**1P**  
**Form 4A**  
**Piston Rating Worksheet**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

**1P**  
**Form 5**  
**Supplemental Piston Deposits (Groove Sides and Rings)**

Lab		EOT Date			EOT Time			Method						
Stand					Engine Run Number									
Formulation/Stand Code														
Oilcode														
Deposit Type		Carbon			Varnish									
		HC	MC	LC	8 - 9	7 - 7.9	6 - 6.9	5 - 5.9	4 - 4.9	3 - 3.9	2 - 2.9	1 - 1.9	>0 -	Clean
Groove Top and Bottom	1	T												
		B												
	2	T												
		B												
	3	T												
		B												
Top Bottom and Back of Rings	1	T												
		B												
		BK												
	2	T												
		B												
		BK												
	3	T												
		B												
		BK												
<b>Additional Deposit &amp; Condition Ratings</b>														
Piston Crown														
Piston Skirt														
Rings														
Liner														

**1P  
Form 5A  
Referee Rating**

<b>Test Identification</b>			
Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			
<b>Referee Rating Information</b>			
Company	Rating Number	Date Rated	Rater

<b>Total Piston Ratings Summary</b>																				
	Deposit Factor	Grooves				Lands				Deposit Factor	Groove		Lands				Oil Cooling Gallery		Under Crown	
		No. 1		No. 2		No. 1		No. 2			No. 3	No. 3	No. 4		A,%	DEM.	A,%	DEM.	A,%	DEM.
		A,%	DEM.	A,%	DEM.	A,%	DEM.	A,%	DEM.		A,%	DEM.	A,%	DEM.	A,%	DEM.	A,%	DEM.	A,%	DEM.
<b>C A R B O N</b>	HC - 1.0																			
	MC - 0.5																			
	LC - .25																			
	Total																			
<b>V A R I A T I O N</b>	8 - 9																			
	7 - 7.9									7.5										
	6 - 6.9																			
	5 - 5.9																			
	4 - 4.9									4.5										
	3 - 3.9																			
	2 - 2.9																			
	1 - 1.9									1.5										
	>0 - 0.9																			
	Clean		0		0		0		0			0		0		0		0		0
Total																				
Rating																				
Location Factor		2		3		1		3			20		20		60		0.5		1	
Ind. Rating																				
<b>WDP</b>				<b>TGC</b>				<b>TLC</b>				<b>Unweighted Deposits</b>				<b>Top Land Flaked Carbon %</b>				











**1P**  
**Form 8**  
**Ring Measurements**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

All Ring Measurements Are Made Using Metric Feeler Gages

Ring Gaps (mm)	Top	Intermediate	Oil
<b>Specifications</b>	0.661 ± 0.076 mm	1.080 ± 0.076 mm	0.509 ± 0.127 mm
Pre-Test			
Post-Test			
Increase			

Ring Side Clearance*		A	B	C	D	Average	Minimum	Specification
<b>Top</b>	Pre-Test							0.080 mm minimum
	Post-Test							
	LSC							
<b>Int.</b>	Pre-Test							0.140 – 0.214 mm
	Post-Test							
	LSC							
<b>Oil</b>	Pre-Test							0.057 – 0.089 mm
	Post-Test							
	LSC							

\* Notes:

1. Write "STUCK" in place of dimension when applicable.
2. Write "<0.038 mm " for clearance when applicable.
3. Write ">" before calculated decrease or average decrease values that incorporate a "<0.038 mm" in calculation.
4. LSC: Loss of Side Clearance
5. MIN: Intermediate and Oil Ring minimum side clearance is measured 360° around piston.

**1P**  
**Form 9**  
**Liner Measurements**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

<b>Liner Surface Finish (Micrometer)</b>			
<b>Distance From Top</b>	<b>Transverse</b>	<b>Longitudinal</b>	<b>Average</b>
130 mm			
50 mm			
25 mm			
Total Average (Spec: 0.4-0.8 $\mu$ m)			

<b>%Liner Bore Polish - Grid (Add T/AT Values From Grid)</b>	
Thrust	
Anti_thrust	
Total	

<b>Liner Bore Measurement (137.154mm minimum)</b>				
<b>Before Test - Diameter (Dial Bore Gage)</b>				
<b>Bore Height</b>	<b>Longitudinal</b>	<b>Transverse</b>	<b>Out of Round (0.038 mm maximum)</b>	
250 mm				
210 mm				
170 mm				
130 mm				
50 mm				
25 mm				
15 mm				
Taper (0.050 max)				
<b>After Test - (Surface Profile)</b>				
	<b>Longitudinal</b>		<b>Transverse</b>	
	<b>Front</b>	<b>Rear</b>	<b>T</b>	<b>A</b>
Wear Step @ 15mm				

**1P**  
**Form 10**  
**Characteristics of the Data Acquisition System**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

Parameter (1)	Sensing Device (2)	Calibration Frequency (3)	Record Device (4)	Observation Frequency (5)	Record Frequency (6)	Log Frequency (7)	System Response (8)
<b>Operation Conditions</b>							
Engine Speed (r/min)							
Engine Power (kW)							
Fuel Flow (g/min)							
Humidity (g/kg)							
<b>Temperatures (°C)</b>							
Coolant Out							
Coolant In							
Oil to Manifold							
Oil Cooler In							
Inlet Air							
Exhaust							
Fuel to Head							
<b>Pressures (kPa)</b>							
Oil To Manifold							
Inlet Air							
Exhaust							
Fuel to Head							
Crankcase							
<b>Flows (L/min)</b>							
Blowby							
Coolant Flow							

Legend:

- (1) Operating Parameter
- (2) The type of device used to measure temperature, pressure or flow
- (3) Frequency at which the measurement system is calibrated
- (4) The type of device where data is recorded  
 LG – Hand log sheet  
 DL – Automatic data logger  
 C/M – Computer, using manual data entry

- (5) Data area observed but only recorded if off specification
- (6) Data are recorded but are not retained at EOT
- (7) Data are logged as permanent record, note specify if:  
 SS – Snapshot taken at specified frequency  
 AG/X average of x data points at specified frequency
- (8) Time for the output to reach 63.2% of final value for step change at input

**1P**  
**Form 11**  
**Engine Operational Data Plots**

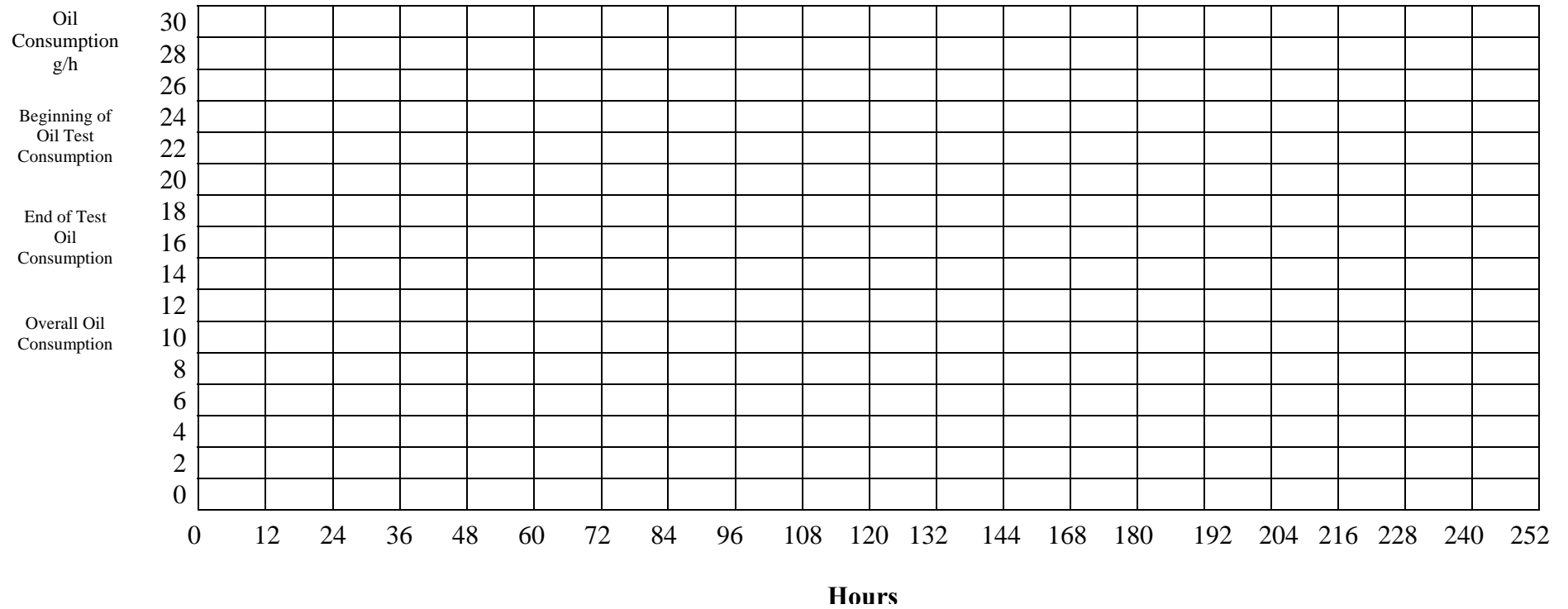
Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			





**1P  
Form 13  
Oil Consumption Plot**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			



**1P**  
**Form 14**  
**Piston Ring and Liner Photographs**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

Refer to Appendix A14 for example of Photo Layout



**1P**  
**Form 16**  
**Fuel Batch Analysis**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

**1P**  
**Form 17**  
**TMC Control Chart Analysis**  
**(Reference Oil Tests Only)**

Lab	EOT Date	EOT Time	Method
Stand	Engine Run Number		
Formulation/Stand Code			
Oilcode			

**1P**  
**Form 18**  
**American Chemistry Council Code of Practice**  
**Test Laboratory Conformance Statement**

Test Laboratory				
Test Sponsor				
Formulation / Stand Code				
Test Number				
Start Date		Start Time		Time Zone

***Declarations***

- No. 1 All requirements of the ACC Code of Practice for which the test laboratory is responsible were met in the conduct of this test. Yes \_\_\_\_\_ No \_\_\_\_\_ \*
- No. 2 The laboratory ran this test for the full duration following all procedural requirements; and all operational validity requirements of the latest version of the applicable test procedure (ASTM or other), including all updates issued by the organization responsible for the test, were met.  
 Yes \_\_\_\_\_ No \_\_\_\_\_ \*
- If the response to this Declaration is “No”, does the test engineer consider the deviations from operational validity requirements that occurred to be beyond the control of the laboratory?  
 Yes \_\_\_\_\_ \* No \_\_\_\_\_
- No 3. A deviation occurred for one of the test parameters identified by the organization responsible for the test as being a special case. Yes \_\_\_\_\_ \* No \_\_\_\_\_ (*This currently applies only to specific deviations identified in the ASTM Information Letter System*)

***Check Appropriate Conclusion***

	Operational review of this test indicates that the results should be included in the Multiple Test Acceptance Criteria calculations.
	*Operational review of this test indicates that the results should not be included in the Multiple Test Acceptance Criteria calculations.

Note: *Supporting comments are required for all responses identified with an asterisk.*

<b>Comments</b>

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

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

\_\_\_\_\_  
Title