

**IR SCOTE Test Procedure  
Form 1**

Method  
Version  
Conducted For

	<b>V = Valid</b>
	<b>I = Invalid</b>
	<b>N = Results Can Not Be Interpreted As Representative of Oil Performance (Non-Reference Oil) and Shall Not Be Used For Multiple Test Acceptance Criteria.</b>

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

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

\* Check box only if YES

<b>Test Number</b>	
Test Stand	Engine Run
EOT Time	EOT Date
Oil Code	
Formulation/Stand	
Alternate Codes	
SAE Viscosity Grade	

In my opinion this test	been conducted in accordance with the Test Procedure (Research Report) and the appropriate amendments through the information letter system. 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

**IR SCOTE Test Procedure  
Form 2  
Test Report Summary**

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

Start Date	Start Time	Total Test Length	TMC Oil
Lab Internal Oil		Engine Serial Number	

	CORRECTION EFFECTIVE DATE	WD	TGC	TLC	BOTOC g/h	EOTOC g/h	Oil Con. Delta EOTOC-BOTOC g/h
Unadjusted Lab Rating							
Industry Correction (If Any)							
Subtotal							
Lab Severity <sup>B</sup> Adjustment (If Any)							
Total							

	EFFECTIVE DATE	WD	TGC	TLC	BOTOC g/h	EOTOC g/h	Oil Con. Delta EOTOC-BOTOC g/h
Test Target Mean <sup>A</sup>							
Test Target Std <sup>A</sup>							
API <sup>B</sup> Pass Limit							

Referee Ratings	Referee Lab	WD	TGC	TLC	
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	Rings			Piston		Cylinder Liner
	Top	Inter. 1	Oil	Crown	Skirt	
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

**IR SCOTE Test Procedure  
Form 3  
Operational Summary**

Lab	EOT Date	End Time	Method						
Stand	Run Number								
Formulation/Stand Code									
Oilcode									
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	240					
Humidity	0.00		g/kg	17.8					
Coolant Flow	0.00		L/min	75					
Temperature									
Coolant Out	0.00		°C	105					
Oil to Manifold	0.00		°C	120					
Inlet Air Manifold	0.00		°C	60					
Fuel into Head	0.00		°C	42					
Pressures									
Oil to Manifold	0.00		kPa	415					
Inlet Air (Abs.)	0.00		kPa	292					
Fuel From Head	0.00		kPa	275					
Exhaust (Abs.)	0.00		kPa	252					
Operating Parameter	Units	Typical Range <sup>D</sup>	Average	Samples <sup>A</sup>	Total Data Points				
					BQD <sup>B</sup>	Over/Under Range <sup>C</sup>			
Intake Air Flow	kg/h	360-410							
Power	kW	65-70							
Torque	Nm	330-350							
Blowby	L/min	20-56							
Temperature									
Coolant In	°C	97-101							
Coolant Delta T	°C	4-8							
Oil Cooler In	°C	120-124							
Heating Oil	°C	165 max.							
Exhaust	°C	590-620							
Pressures									
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 IQ Matrix Test data.

**IR SCOTE Test Procedure  
Form 4  
Assembly Measurements And Part Record**

Lab	EOT Date	End Time	Method
Stand	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	Date Code	Inspection Code
Liner	A	B	A	
Top Ring	C	E		
Intermediate Ring	C	E		
Oil Ring	C	E		
Piston Crown	D	D	F	G
Piston Skirt	H	I		
Fuel Injector	J	K		
ECM EPROM	L			
Piston Cooling Jet				

<sup>A</sup> On liner O.D.  
<sup>B</sup> On liner O.D. (NNNN)  
<sup>C</sup> On box label  
<sup>D</sup> On top of piston

<sup>E</sup> On paper envelope containing the ring  
<sup>F</sup> Number below "E" located on piston top  
<sup>G</sup> Number below "E" located on piston top

<sup>H</sup> On bottom surface skirt  
<sup>I</sup> On bottom surface under pin bore  
<sup>J</sup> On top surface of plunger  
<sup>K</sup> On top surface of plunger – 6 digits  
<sup>L</sup> On ECAT software

**1R SCOTE Test Procedure  
Form 5  
Piston Rating Summary**

Lab	EOT Date	End Time	Stand	Run	Method
Formulation/Stand Code			Oilcode		
Test Fuel	Fuel Batch	Date Rated	Rater Initial	Verified By	
<b>Last Stand Reference Information</b>	Date Completed	Stand	Run	TMC Oil Code	
	WD	TGC	TLC	BOTOC g/h	EOTOC g/h
Last Reference on this Stand					
Industry Average					
Industry Standard Deviation					

**Total Piston Ratings Summary**

	Grooves				Lands				Deposit Factor	Groove		Lands				Oil Cooling		Under Crown	
	No. 1		No. 2		No. 1		No. 2			No. 3		No. 3		No. 4		A,%	Demerit	A,%	Demerit
	A,%	Demerit	A,%	Demerit	A,%	Demerit	A,%	Demerit		A,%	Demerit	A,%	Demerit	A,%	Demerit	A,%	Demerit	A,%	Demerit
<b>C a r b o n</b>	HC - 1.0																		
	MC - 0.5																		
	LC - .25																		
	<b>Total</b>																		
<b>V a r i s h</b>	8 - 9																		
	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	0		0		0		0		Clean	0		0		0		0		0
<b>Total</b>																			
Rating																			
Location Factor	2		3		1		3			20		20		60		0.5		1	
Industry Rating																			
<b>WD:</b>	<b>TLHC %:</b>				<b>TGF %:</b>				<b>IGF %:</b>				<b>TLFC %:</b>						
<b>Unweighted:</b>	<b>TLC:</b>				<b>TGC:</b>				<b>IGC:</b>				<b>Under Crown Carbon:</b>						

**IR SCOTE Test Procedure  
Form 5A**

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

Refer to Appendix A14 for an example of Piston Raing Worksheet.

**1R SCOTE Test Procedure  
Form 6  
Supplemental Piston Deposits (Groove Sides and Rings)**

Lab		EOT Date			End Time			Method							
Stand					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															

**1R SCOTE Test Procedure  
Form 6A  
Referee Rating**

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

<b>Total Piston Ratings Summary</b>																				
	Grooves				Lands				Deposit Factor	Groove		Lands				Oil Cooling		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.					
<b>CARBON</b>	HC - 1.0																			
	MC - 0.5																			
	LC - .25																			
	TOTAL																			
<b>VAHNSH</b>	8 - 9								7.5											
	7 - 7.9																			
	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	Clean		0		0		0		0		0
Total																				
Rating																				
Location Factor	2		3		1		3		20		20		60		0.5		1			
Industry Rating																				
<b>WD:</b>	<b>TLHC %:</b>				<b>TGF %:</b>				<b>IGF %:</b>				<b>TLFC %:</b>							
<b>Unweighted:</b>	<b>TLC:</b>				<b>TGC:</b>				<b>IGC:</b>				<b>Undercrown Carbon:</b>							



**1R SCOTE Test Procedure  
Form 7  
Oil Analysis Data**

<b>Test Identification</b>			
Lab	EOT Date	End Time	Method
Stand	Run		
Formulation/Stand Code			
Oilcode			
Test Fuel	Fuel Batch		

<b>Oil Analysis</b>	New														
VISC @ 100 °C															
VISC @ 40 °C															
TBN D4739															
TAN D664															
TGA Soot %															
<b>Wear Metals (ppm)</b>															
Fe															
Al															
Si															
Cu															
Cr															
Pb															
<b>Other Results</b>															
Fuel Dilution															
IR O <sub>2</sub>															
Blowby(L/min)															
Oil Consumption g/h for hrs ending															
Oil Consumption r <sup>2</sup>															
Fuel Position (mm)															

Note:

- (1) Total oil in system 5800 ± 50 g
- (2) Refill oil scale cart to full level every 36 h. Take oil samples at hours shown before adding oil.







**IR SCOTE Test Procedure  
Form 9  
Ring Measurements**

Lab	EOT Date	End Time	Method
Stand	Run		
Formulation/Stand Code			
Oilcode			

All Ring Measurements Are Made Using Metric Feeler Gages

Ring Gaps Specifications (mm)	1Y4014	1Y4013	1Y4012
	Top	Intermediate	Oil
0.350 – 0.550		0.754 – 0.906	0.400 – 0.750
Pre-Test			
Post-Test			
Increase			

Ring Side Clearance*	A	B	C	D	Average	Minimum	Specification
	Pre-Test						
Post-Test							0.090 mm – 0.127 mm
LSC							
Pre-Test							
Post-Test							0.060 mm – 0.110 mm
LSC							
Pre-Test							
Post-Test							0.030 mm – 0.080 mm
LSC							

\* Notes:

1. Write “STUCK” in place of dimension when applicable.
2. Write “<0.03 mm” for clearance when applicable.
3. Write “>” before calculated decrease or average decrease values that incorporate a “<0.03 mm” in calculation.
4. LSC = Loss of side clearance
5. MIN: Oil Ring minimum side clearance is measured 360° around piston.

**IR SCOTE Test Procedure  
Form 10  
Liner Measurements**

Lab	EOT Date	End Time	Method
Stand	Run		
Formulation/Stand Code			
Oilcode			

Liner Surface Finish (µm)			
Distance From Top	Transverse	Longitudinal	Average
130 mm			
50 mm			
25 mm			
<b>Total Average (Spec: 0.4 – 0.8 µm)</b>			

% Liner Bore Polish – Grid (Add T/AT Values From Grid)	
Thrust	
Anti-Thrust	
Total	

Liner Bore Measurement (137.154 mm minimum)			
Before Test - Diameter (Dial Bore Gage)			
Bore Height	Longitudinal	Transverse	Out of Round (0.038 mm max)
250 mm			
210 mm			
170 mm			
130 mm			
50 mm			
25 mm			
15 mm			
Taper (0.050 mm max.)			
After Test – (Surface Profile)			
Longitudinal µm		Transverse µm	
	Front	Rear	T
Wear Step @ 13 mm			AT

**1R SCOTE Test Procedure  
Form 11  
Characteristics of the Data Acquisition System**

Lab	EOT Date	End Time	Method
Stand	Run		
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 from 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) THE FREQUENCY AT WHICH THE MEASUREMENT IS CALIBRATED
- (4) THE TYPE OF DEVICE WHERE DATA IS RECORDED  
 LG – HANDLOG SHEET  
 DL – AUTOMATIC DATA LOGGER  
 SC – STRIP CART RECORDER  
 C/N – COMPUTER, USING MANUAL ENTRY  
 C/D – COMPUTER, USING DIRECT I/O ENTRY

- (5) DATA OBSERVED BUT ONLY RECORDED IF OFF SPEC.
- (6) DATA ARE RECORDED BUT ARE NOT RETAINED AT EOT
- (7) DATA ARE LOGGED AS PERMANENT RECORD, NOTE SPECIFY:  
 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

**IR SCOTE Test Procedure  
Form 12  
Engine Operational Data Plots**

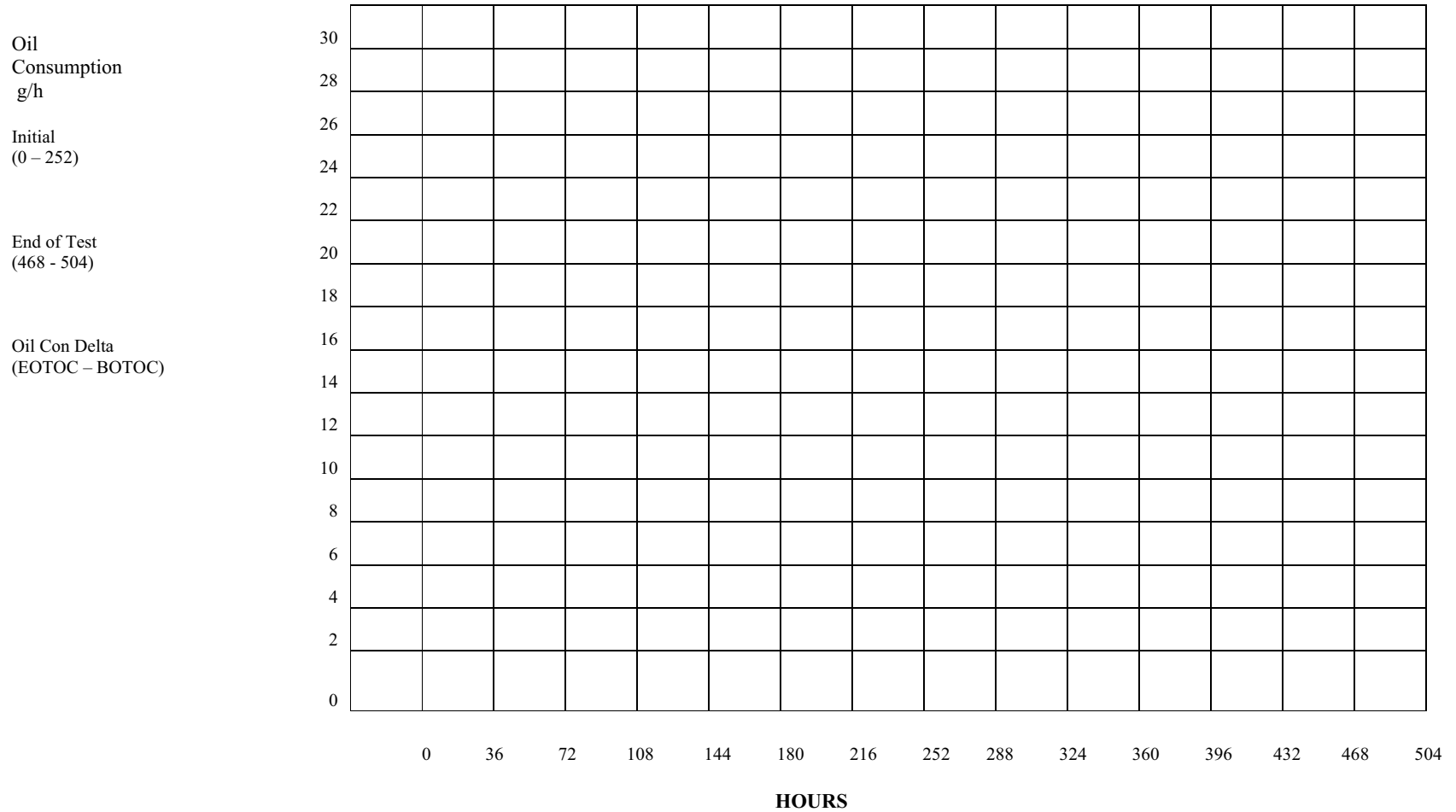
Lab	EOT Date	End Time	Method
Stand		Run	
Formulation/Stand Code			
Oilcode			





**1R SCOTE Test Procedure  
Form 14  
Oil Consumption**

Lab	EOT Date	End Time	Method
Stand	Run		
Formulation/Stand Code:			
Oilcode			



**IR SCOTTE Test Procedure  
Form 15  
Piston, Ring and Liner Photographs**

Lab	EOT Date	End Time	Run	Method
Formulation/Stand Code				
Oilcode				

Refer to Appendix A14 for an example of Photo



**IR SCOTE Test Procedure**  
**Form 17**  
**Fuel Batch Analysis**

Lab	EOT Date	End Time	Run	Method
Stand				
Formulation/Stand Code				
Oilcode				

Refer to Appendix A14 for examples of appropriate Fuel Batch Analysis

**IR SCOTE Test Procedure**  
**Form 18**  
**TMC Control Chart Analysis**  
**(Reference Oil Tests Only)**

Lab	EOT Date	End Time	Run	Method
Stand	Formulation/Stand Code			
Oilcode				

Refer to Appendix A14 for examples of Control Chart Analysis page.

**IR SCOTE Test Procedure**  
Form 19  
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

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)*

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.

Comments

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

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

\_\_\_\_\_  
Title