

**1R SCOTE Test Procedure
Form 1**

Method
Version
Conducted For

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

	RO = Reference Oil Test
	NR = 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

Test Number	
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

**1R 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 ^B 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 ^A							
Test Target Std ^A							
API ^B Pass Limit							

	Referee Lab	WD	TGC	TLC			
Referee Ratings							

	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: ^AReference oil tests or as requested by test sponsor
^BNon-reference oil tests only

**1R SCOTE Test Procedure
Form 3
Operational Summary**

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

CONTROLLED PARAMETERS	Operating Parameter	Quality Index Threshold	EOT Quality Index	Process		Total Data Points		
				Units	Target	Average	Samples ^A	BQD ^B
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				
NON-CONTROLLED PARAMETERS	Operating Parameter	Process			Total Data Points			
		Units	Typical Range ^D	Average	Samples ^A	BQD ^B	Over/Under Range ^C	
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					

^A Total number of data points taken as determined from test length and procedural specified sampling rate.

^B Number of Bad Quality Data points not used in the calculation of the statistical measures.

^C Number of points clipped by over/under range limits of the statistical measures.

^D Gathered from 1Q Matrix Test data.

**1R 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				

^A On liner O.D.

^B On liner O.D. (NNNN)

^C On box label

^D On top of piston

^E On paper envelope containing the ring

^F Number below "E" located on piston top

^G Number below "E" located on piston top

^H On bottom surface skirt

^I On bottom surface under pin bore

^J On top surface of plunger

^K On top surface of plunger – 6 digits

^L 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 Initials:	Verified By:	
Last Stand Reference Information	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,%	Demeit	A,%	Demerit
	A,%	Demerit	A,%	Demerit	A,%	Demerit	A,%	Demerit		A,%	Demerit	A,%	Demerit						
C a r b o n	HC - 1.0																		
	MC - 0.5																		
	LC - .25																		
	Total																		
V a r i s h	8 - 9																		
	7 - 7.9																		
	6 - 6.9								7.5										
	5 - 5.9																		
	4 - 4.9																		
	3 - 3.9								4.5										
	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																			
WD:	TLHC %:				TGF %:				IGF %:				TLFC %:						
Unweighted:	TLC:				TGC:				IGC:				Under Crown Carbon:						

**1R SCOTE Test Procedure
Form 5A**

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

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														
Additional Deposit & Condition Ratings														
Piston Crown														
Piston Skirt														
Rings														
Liner														

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

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

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,%	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																				
	MC - 0.5																				
	LC - .25																				
	TOTAL																				
V A R I E T Y	8 - 9								7.5												
	7 - 7.9																				
	6 - 6.9																				
	5 - 5.9								4.5												
	4 - 4.9																				
	3 - 3.9																				
	2 - 2.9								1.5												
	1 - 1.9																				
	>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																					
WD:	TLHC %:				TGF %:				IGF %:				TLFC %:								
Unweighted:	TLC:				TGC:				IGC:				Undercrown Carbon:								

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

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

Oil Analysis	New	1	2	3	4	5	6	7	8	9	10	11	12	13	14
VISC @ 100 °C															
VISC @ 40 °C															
TBN D4739															
TAN D664															
TGA Soot %															
Wear Metals (ppm)															
Fe															
Al															
Si															
Cu															
Cr															
Pb															
Other Results															
Fuel Dilution															
IR O ₂															
Blowby(L/min)															
Oil Consumption g/h for hrs ending															
Oil Consumption r ²															
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.

**1R 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 Top	1Y4013 Intermediate	1Y4012 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
Top	Pre-Test							0.090 mm – 0.127 mm
	Post-Test							
	LSC							
Int.	Pre-Test							0.060 mm – 0.110 mm
	Post-Test							
	LSC							
Oil	Pre-Test							0.030 mm – 0.080 mm
	Post-Test							
	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.

**1R 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			
Total Average (Spec: 0.4 – 0.8 μm)			

% 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	AT
Wear Step @ 13 mm				

**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)
Operation Conditions							
Engine Speed (r/min)							
Engine Power (kW)							
Fuel Flow (g/min)							
Humidity (g/kg)							
Temperatures (°C)							
Coolant Out							
Coolant In							
Oil to Manifold							
Oil Cooler In							
Inlet Air							
Exhaust							
Fuel To Head							
Pressures (kPa)							
Oil to Manifold							
Inlet Air							
Exhaust							
Fuel from Head							
Crankcase							
Flows (L/min)							
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

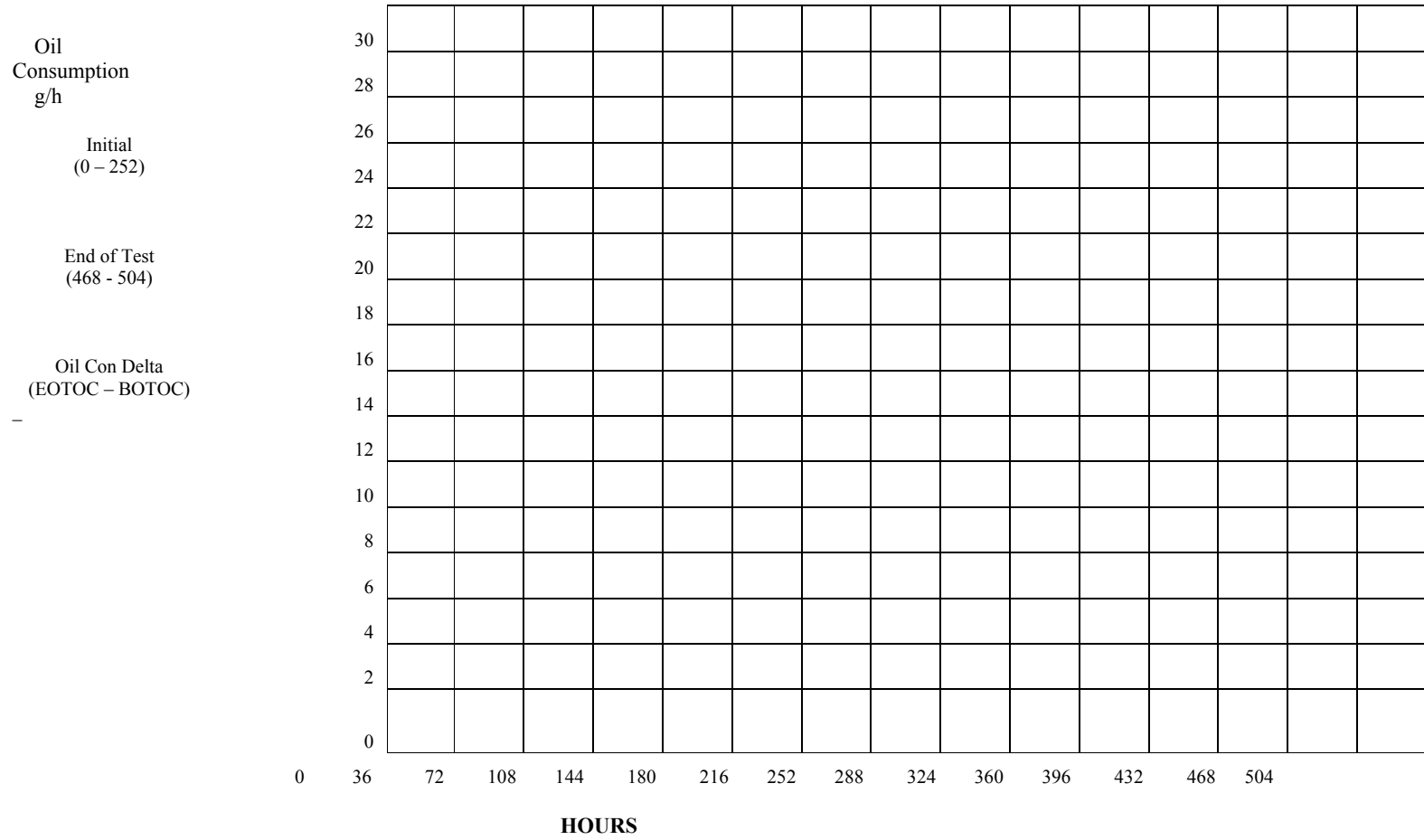
- (5) DATA OBSERVED BUT ONLY RECORDED IF OFF SPEC.
- (6) DATA ARE RECORDED BUT ARE NOT RETAINED AT EOT
- (7) DATA ARE LOGGED AS PERMANENT RECORD, NOTE SPECIFY:
 - SS – SNAPSHOT TAKEN AT SPECIFIED FREQUENCY
 - AG/X – AVERAGE OF X DATA POINTS AT SPECIFIED FREQUENCY
- (8) TIME FOR THE OUTPUT TO REACH 63.2% OF FINAL VALUE FOR STEP CHANGE AT INPUT

**1R 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:			



**1R SCOTE Test Procedure
Form 15
Piston, Ring and Liner Photographs**

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

Refer to Appendix A14 for an example of Photo

**1R SCOTE Test Procedure
Form 17
Fuel Batch Analysis**

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

Refer to Appendix A14 for examples of appropriate Fuel Batch Analysis

**1R SCOTE Test Procedure
Form 18
TMC Control Chart Analysis
(Reference Oil Tests Only)**

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

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