A16. Report Forms
Sequence VIII Engine Evaluation of Engine Oils

Form 1

VERSION *20000128 BETA*

CONDUCTED FOR

	V = VALID
	I = INVALID

	NR = Non-reference Oil Test
	RO = Reference Oil Test

Test Number			
Test Stand	Power Section	# of Runs on Power Section Since Calibration Test	Total Runs on Power Section

Date Completed:		Completion Time:	
Oil Code:			
Formulation/Stand Code:			
Alternate Codes:			

In my opinion this test been conducted in a valid manner in accordance with the Sequence VIII Test Method D6709 and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.

SUBMITTED BY: _____
Testing Laboratory

_____
Signature

_____
Typed Name

_____
Title

FIG. A16.1 Operational Validity Statement

Form 2

Sequence VIII Engine Evaluation of Engine Oils

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FIG. A16.2 Table of Contents

Sequence VIII Engine Evaluation of Engine Oils

Form 3

Summary of Test Method

The Sequence VIII test is designed to evaluate crankcase lubricating oils for their copper and lead corrosion control capabilities. It also evaluates shear stability under high temperature operating conditions.

The Sequence VIII involves steady state operation of the single cylinder CLR oil evaluation engine. After a 4 hour break-in and a 1/2 hour flush, the engine is operated under constant speed, air-fuel ratio and fuel flow conditions for an additional 40 hours. Prior to each run, the engine is thoroughly cleaned, and pertinent measurements of the engine parts are taken. A new piston, piston rings, copper/lead connecting rod bearing are installed. The cylinder head is also reconditioned.

The key operating conditions for this procedure are as follows:

Parameter	Set Point
Duration	40 h
Speed	3150 ± 25 r/min
Load	Adjusted to provide proper fuel flow at the specified Air:Fuel ratio
Fuel Flow	2.25 ± 0.11 kg/h
Air:Fuel Ratio	13.43 ± 0.5
Coolant Temperature	
Jacket Out	93.5 ± 1˚C
Jacket Delta	5.6 ± 1˚C
Gallery Oil Temperature	135.0 or 143.5 ± 1˚C [B]
Crankcase Off Gas	850 ± 28 SCL/h[A]

[A] Controlled by adding sufficient ambient air to rocker box to achieve an Off-Gas-Flow of 30 cfh.

[B] 135.0˚C for SAE 5W, 10W; 143.5˚C for SAE 20, 30, 40, 50 and multi-viscosity grade oils.

This test utilizes an unleaded fuel named "KA24E" which has a green identifying dye. It is supplied by Haltermann Products.

At the conclusion of the test, the engine is disassembled and the performance of the oil being tested is judged by the following:

1) by the weight loss of the copper/lead big end connecting rod bearing
2) by periodic oil sample analysis

FIG. A16.3 Summary of Test Method

Sequence VIII Engine Evaluation of Engine Oils
Form 4
Test Results

Laboratory		Oilcode	
Date Completed		Time Completed	
Test Number	/ / /		
Formulation/Stand			

SAE Viscosity		Test Oil Temperature (135.0˚ or 143.5˚C)	
Laboratory Oil Code		Date Started	
Test Fuel Type		Time Started	
Test Fuel Lot		Bearing Batch No.	
Bearing Storage Oil Lead, ppm [A]		Bearing Lot	
Test Length		Industry Reference Oil Code [A]	

Bearing Weight Loss Summary	
Test Length @ Measurement, hours	
Top Bearing Half, mg	
Bottom Bearing Half, mg	
Total, mg	
Industry Correction Factor	
Severity Adjustment (non-reference tests only)	
Final Bearing Weight Loss, mg	

Hours	Viscosity cSt @ 40˚C	Viscosity cSt @ 100˚C	Stripped Viscosity @ 100˚C
New Oil			
10			

Test Stand/Power Section Reference History					
Stand No.		Power Section No.		Runs on Power Section	
Bearing Batch No.				Bearing Lot No.	
Industry Reference Oil Code				Stripped Viscosity, cSt	
Completion Date				Completion Time	
Total Bearing Weight Loss, mg				Final Bearing Weight Loss, mg	
Oil Code					

[A] Reference Oil Tests Only

FIG. A16.4 Test Results

Sequence VIII Engine Evaluation of Engine Oils
Form 5
Operational Summary

Laboratory		Oil Code	
Date Completed			
Test No.	/ / /		
Formulation/Stand			

Test Parameter	Specification	Minimum	Maximum	Average
Speed, r/min	3150 ± 25			
Air/Fuel Ratio	13.43 ± 0.5:1			
Fuel Flow, kg/h	2.25 ± 0.11			
Output, W	Record			
Oil Heater Input, W (optional)	Record			
Crankcase Off-Gas, L/h	850 ± 28			
Temperatures	**Specification**	**Minimum**	**Maximum**	**Average**
Gallery Oil [A], ˚C	143.5 or 135.0 ± 1			
Coolant-In, ˚C	Record			
Coolant-Out, ˚C	93.5 ± 1			
Delta T Coolant, ˚C	5.6 ± 1			
Intake Air, ˚C	Record			
Pressures	**Specification**	**Minimum**	**Maximum**	**Average**
Oil, kPa	276 ± 14			
Intake Man. Vac., kPa	Record			
Exhaust, in. kPa	0 to 3.4			
Crankcase Vac., kPa	0.50 ± 0.12			
Spark Advance, ºBTDC	35 ± 1			
Blowby, L/h	Record			

Oil Consumption [B]	Initial Oil Charge (ml)	New Oil Added (ml)	Oil Samples (ml)	Final Oil Drain (ml)
			Total Oil Consumption	

[A] (See Table 1 for Viscosity-Related Temperature.)

[B] Total Oil Consumption = (Initial Oil Charge + New Oil Added) - (Oil Samples + Final Oil Drain)

FIG. A16.5 Operational Summary

Sequence VIII Engine Evaluation of Engine Oils
Form 6
Parts Measurement and Critical Parts Listing

Laboratory		Oil Code	
Date Completed			
Test Number	/	/	/
Formulation/Stand			

Power Section Measurements, mm				
Measurement	**Specification**	**Minimum**	**Maximum**	**Average**
Valve Stem Clearance in Guide, Inlet	0.0508 - 0.1016			
Valve Stem Clearance in Guide, Exhaust	0.0762 - 0.1270			
Connecting Rod Bearing Clearance	0.0610 - 0.0762			
Main Bearing Clearance, Front	0.0508 - 0.0762			
Main Bearing Clearance, Rear	0.0508 - 0.0762			
Connecting Rod Journal Out-of-Round	0.0254 Maximum			

Runs on Liner		Liner may be used as long as the piston to liner clearance is in the specified range.
Piston to Liner Clearance		0.0305 to 0.0635 mm

Critical Parts Listing	
Parts	**I.D. Code**
Crankshaft	
Camshaft	
Main Bearings	
Camshaft Bearings	
Connecting Rod	
Piston	
Cylinder Liner	

FIG. A16.6 Parts Measurement, Oil Analysis, and Critical Parts Listing

Sequence VIII Engine Evaluation of Engine Oils
Form 7
Downtime Occurrences and Other Comments

Laboratory		Oil Code	
Date Completed			
Test Number	/ / /		
Formulation/Stand			

Number of Downtime Occurrences			
Test Hours	Date	Downtime	Reasons
			Total Downtime

Other Comments		
Number of Comment Lines		

FIG. A16.7 Downtime Occurrences and Other Comments

Sequence VIII Engine Evaluation of Engine Oils
Form 8
Operational Outliers Occurrences

Laboratory		Oil Code	
Date Completed			
Test Number	/ / /		
Formulation/Stand			

Number of Operational Outliers Occurrences					
Test Hours	Parameter	Parameter Range	Reading	Time Out	Deviation Percentage

FIG. A16.8 Operational Outliers Occurrences

Sequence VIII Engine Evaluation of Engine Oils
Form 9
Deviations of Operational Parameters

Laboratory		Oil Code	
Date Completed			
Test Number	/ / /		
Formulation/Stand			

Primary Parameter	Maximum Permitted Deviation Percentage	Calculated Total Deviation Percentage
Engine Oil Gallery Temperature	2.5%	
Engine Coolant Outlet Temperature	2.5%	
Engine Coolant Delta Temperature	2.5%	
Fuel Flow	2.5%	
Crankcase Off Gas	2.5%	
Oil Pressure	2.5%	
Secondary Parameters		
Engine Speed	5%	
AFR	5%	
Spark Advance	5%	
Exhaust	5%	
Crankcase Vacuum	5%	

FIG. A16.9 Deviations of Operational Parameters

Sequence VIII Engine Evaluation of Engine Oils
Form 10
Data Acquisition System Details

Laboratory		Oil Code	
Date Completed			
Test Number	/ / /		
Formulation/Stand			

PARAMETER (1)	SENSING DEVICE (2)	CALIBRATION FREQUENCY (3)	RECORD DEVICE (4)	OBSERVATION FREQUENCY (5)	RECORD FREQUENCY (6)	LOG FREQUENCY (7)	SYSTEM RESPONSE (8)
TEMPERATURES							
OIL IN							
COOLANT OUT							
COOLANT DELTA							
OTHER							
FUEL FLOW							
ENGINE SPEED							
AFR							
EXHAUST PRESSURE							
CRANKCASE OFF GAS							
OIL							
CRANKCASE VAC.							

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 - HANDLOG SHEET
DL - AUTOMATIC DATA LOGGER
SC - STRIP CHART RECORDER
C/M - COMPUTER, USING MANUAL DATA ENTRY
C/D - COMPUTER, USING DIRECT I/O ENTRY
(5) DATA ARE 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 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
(9) SEE ANNEX A11 FOR PROCEDURE TO DETERMINE SYSTEM RESPONSE OF THE CHARACTERISTICS OF THE ACQUISITION SYSTEM.

FIG. A16.10 Data Acquisition System Details