Report Forms
SEQUENCE VIB

VERSION: ***20010716 BETA***

CONDUCTED FOR:

	V = VALID
	I = INVALID
	N = RESULTS CANNOT BE INTERPRETED (REFER TO COMMENT SECTION)

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

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			
Alternate Codes			

In my opinion this test been conducted in a valid manner in accordance with the VIB Test Procedure (RR:) and the appropriate amendments through the Information Letter System. The remarks included in the report describe the anomalies associated with this test.

SUBMITTED BY: _____
Testing Laboratory

_____
Signature

_____
Typed Name

_____
Title

Fig. A7.1 Test Report Cover

Form 2

Sequence VIB

Table of Contents

FIG. A7.2 Table of Contents

Sequence VIB
Form 3

Summary of Test Method

The Sequence VIB is an engine dynamometer test that measures a lubricant's ability to improve the fuel economy of passenger cars and light-duty trucks. The method compares the performance of a test lubricant to the performance of a baseline lubricant over five different stages of operation.

A 1993 Ford 4.6L spark ignition, V-8 cylinder design, 4-cycle engine is used as the test apparatus. The engine incorporates overhead camshafts, a cross-flow, fast-burn cylinder head design, two valves per cylinder, and an electronic port fuel injection.

The Sequence VIB test incorporates a flush and run type procedure. Each test consists of two 5-stage fuel economy measurements on baseline oil (BC), one at the beginning of the test and one at the end. The test oil is evaluated in between the two baseline runs. The test oil is initially aged during 16 hours of engine operation at 1500 r/min and 125˚C oil temperature. After the initial aging, a 5-stage fuel economy measurement is taken. The test oil is then aged an additional 80 hours at an engine speed of 2250 r/min and 135˚C oil temperature. Following this final aging, the test oil once again goes through a 5-stage fuel economy measurement. The two fuel economy measurements taken on the baseline oil (BC) and a final value for Fuel Economy Improvement is calculated for the test oil.

Below is a summary of the operation conditions for the aging and 5-stage fuel economy portions of the test.

Fuel Economy Measurement and Aging Condition				
FE Stage	**Speed (r/min)**	**Torque (N-m)**	**Oil Temp. (˚C)**	**Coolant Temp. (˚C)**
1	1500	98	125	105
2	800	26	105	95
3	800	26	70	60
4	1500	98	70	60
5	1500	98	45	45

Aging Stage	**Speed (r/min)**	**Torque (N-m)**	**Oil Temp. (˚C)**	**Coolant Temp. (˚C)**
1	1500	98	125	105
2	2250	98	135	105

FIG. A7.3 Summary of Test Method

SEQUENCE VIB
FORM 4
TEST RESULT SUMMARY
NON-REFERENCE & REFERENCE OIL TESTS

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:		Engine Serial Number:	
Formulation/Stand Code:			

TEST DOCUMENTATION			
	BC Before	Test Oil	BC After
Start Date			
Start Time			
End Date			
End Time			
Oil Test Length, hhh:mm			
Calibration Oil Batch			
Flush Oil Batch			
Laboratory Oil Code			
SAE Viscosity Grade			
TMC Oil Code (Reference Oil Tests Only)			
New Oil Viscosity @ 40 ˚C, cSt			
New Oil Viscosity @ 100˚C, cSt			
Aged (80 h) Oil Viscosity @ 40 ˚C, cSt			
Aged (80 h) Oil Viscosity @ 100˚C, cSt			
Total Test Length, hhh:mm			
Total Engine Hours @ EOT			
Most Recent Fuel Batch			

OVERALL RESULTS				
	BC Oil		Test Oil	
	Before	After	Phase I	Phase II
Fuel Consumed, kg				
Shift Delta, %				
Fuel Economy Improvement, %				
FEI Industry Correction Factor, %				
FEI Severity Adjustment, % (non-reference tests only)				
FEI Final Result, %				
Total Oil Consumption, mL				

Last Reference Oil Test on Stand/Engine History (Non-Reference Tests Only)			
Date Completed		Fuel Batch	
TMC Oil Code		SAE Viscosity Grade	
Oilcode		Calibration Oil Batch	
Runs on Stand		Runs on Engine	
		Phase I	Phase II
Final FEI Results			

Fig. A7.4 Test Result Summary - Non-reference and Reference Oil Tests

SEQUENCE VIB
FORM 5
OPERATIONAL DATA ANALYSIS

Lab:	Date Completed:	Time Completed:
Test Number		
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:		
Formulation/Stand Code:		

Computed Averages						
Oil	Stage	BSFC kg/kW-h	BSFC C.V.%	Nominal Power kW	Weight Factor	Weighted Fuel Consumed kg
BC Before Test Oil	**1**			15.39	0.0802	
	2			2.18	0.0787	
	3			2.18	0.0848	
	4			15.39	0.0864	
	5			15.39	0.0699	
Total Fuel Consumed						

Computed Averages						
Oil	Stage	BSFC kg/kW-h	BSFC C.V.%	Nominal Power kW	Weight Factor	Weighted Fuel Consumed kg
Test Oil Phase I	**1**			15.39	0.0802	
	2			2.18	0.0787	
	3			2.18	0.0848	
	4			15.39	0.0864	
	5			15.39	0.0699	
Total Fuel Consumed						

Fig. A7.5 Operational Data Analysis

SEQUENCE VIB
FORM 6
OPERATIONAL DATA ANALYSIS

Lab:	Date Completed:	Time Completed:
Test Number		
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:		
Formulation/Stand Code:		

Computed Averages						
Oil	Stage	BSFC kg/kW-h	BSFC C.V.%	Nominal Power kW	Weight Factor	Weighted Fuel Consumed kg
Test Oil Phase II	**1**			15.39	0.0802	
	2			2.18	0.0787	
	3			2.18	0.0848	
	4			15.39	0.0864	
	5			15.39	0.0699	
Total Fuel Consumed						

Computed Averages						
Oil	Stage	BSFC kg/kW-h	BSFC C.V.%	Nominal Power kW	Weight Factor	Weighted Fuel Consumed kg
BC After Test Oil	**1**			15.39	0.0802	
	2			2.18	0.0787	
	3			2.18	0.0848	
	4			15.39	0.0864	
	5			15.39	0.0699	
Total Fuel Consumed						

Fig. A7.6 Operational Data Analysis

SEQUENCE VIB
FORM 7

GENERAL PARAMETER LISTING

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

16 Hour Aging

	SPEC	AVERAGE [A]	MAX [A]	MIN [A]
1. Speed, r/min	1500 ± 5			
2. Torque, N-m	98 ± 0.10			
3. Oil Gallery Temperature, ˚C	125 ± 2			
4. Coolant Inlet Temperature, ˚C	105 ± 2			
5. Oil Circulation Temperature, ˚C	Record			
6. Coolant Out Temperature, ˚C	Record			
7. Intake Air Temperature, ˚C	27 ± 2			
8. Fuel to Flowmeter Temperature, ˚C	20 - 32			
9. Fuel to Fuel Rail Temperature, ˚C	20 ± 2			
10. Load Cell Temperature, ˚C	Record			
11. Oil Heater Temperature, ˚C	205 max			
12. Intake Air Pressure, kPa	0.05 ± 0.02			
13. Fuel to Flowmeter Pressure, kPa	100 min			
14. Fuel to Fuel Rail Pressure, kPa	205 - 310			
15. Intake Manifold Pressure, kPa abs.	Record			
16. Exhaust Back Pressure, kPa abs.	104 ± 0.20			
17. Engine Oil Pressure, kPa	Record			
18. Coolant Flow, L/min	130 ± 4			
19. Fuel Flow, kg/h	Record			
20. Intake Air Humidity, grains/kg	11.4 ± 0.8			
21. Air/Fuel Ratio	Record			
22. Crankcase Pressure, kPa	0.00 ± 0.25			

[A] *Based on a minimum of one determination per hour*

Fig. A7.7 General Parameter Listing

SEQUENCE VIB
FORM 8
GENERAL PARAMETER LISTING

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

80 Hour Aging

	SPEC	AVERAGE [A]	MAX [A]	MIN [A]
1. Speed, r/min	2250 ± 5			
2. Torque, N-m	98 ± 0.10			
3. Oil Gallery Temperature, ˚C	135 ± 2			
4. Coolant Inlet Temperature, ˚C	105 ± 2			
5. Oil Circulation Temperature, ˚C	Record			
6. Coolant Out Temperature, ˚C	Record			
7. Intake Air Temperature, ˚C	27 ± 2			
8. Fuel to Flowmeter Temperature, ˚C	20 - 32			
9. Fuel to Fuel Rail Temperature, ˚C	20 ± 2			
10. Load Cell Temperature, ˚C	Record			
11. Oil Heater Temperature, ˚C	205 max			
12. Intake Air Pressure, kPa	0.05 ± 0.02			
13. Fuel to Flowmeter Pressure, kPa	100 min			
14. Fuel to Fuel Rail Pressure, kPa	205 - 310			
15. Intake Manifold Pressure, kPa abs.	Record			
16. Exhaust Back Pressure, kPa abs.	104 ± 0.20			
17. Engine Oil Pressure, kPa	Record			
18. Coolant Flow, L/min	130 ± 4			
19. Fuel Flow, kg/h	Record			
20. Intake Air Humidity, grains/kg	11.4 ± 0.8			
21. Air/Fuel Ratio	Record			
22. Crankcase Pressure, kPa	0.00 ± 0.25			

[A] *Based on a minimum of one determination per hour*

Fig. A7.8 General Parameter Listing

SEQUENCE VIB
FORM 9
GENERAL PARAMETER SUMMARY

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

BC Before Test Oil

General Parameters

		Stage				
	Spec	**1**	**2**	**3**	**4**	**5**
1. Oil Circulation Temperature, ˚C	Record					
2. Coolant Out Temperature, ˚C	Record					
3. Fuel to Flowmeter Temperature, ˚C	20-32					
4. Delta Fuel to Flowmeter Temp., ˚C [A]	≤ 4					
5. Test Cell Temperature, ˚C	Record					
6. Load Cell Temperature, ˚C	Record					
7. Delta Load Cell Temperature, ˚C [A]	≤ 12					
8. Oil Heater Temperature, ˚C	205 max					
9. Intake Air Pressure, kPa	0.05 ± .02					
10. Fuel to Flowmeter Pressure, kPa	100 min					
11. Fuel to Fuel Rail Pressure, kPa	205 - 310					
12. Intake Manifold Pressure, kPa abs.	Record					
13. Engine Oil Pressure, kPa	Record					
14. Coolant Flow, L/min	130 ± 4					
15. Intake Air Humidity, grains/kg	11.4 ± 0.8					
16. Crankcase Pressure, kPa	0.00 ± 0.25					
17. Blowby, L/min [B]	Record					
18. Barometric Pressure, kPa	Record					

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

[B] Not required by test procedure

Fig. A7.9 General Parameter Summary

SEQUENCE VIB
FORM 10
GENERAL PARAMETER SUMMARY

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

Test Oil Phase I

General Parameters

		Stage				
	Spec	**1**	**2**	**3**	**4**	**5**
1. Oil Circulation Temperature, ˚C	Record					
2. Coolant Out Temperature, ˚C	Record					
3. Fuel to Flowmeter Temperature, ˚C	20-32					
4. Delta Fuel to Flowmeter Temp., ˚C [A]	≤ 4					
5. Test Cell Temperature, ˚C	Record					
6. Load Cell Temperature, ˚C	Record					
7. Delta Load Cell Temperature, ˚C [A]	≤ 12					
8. Oil Heater Temperature, ˚C	205 max					
9. Intake Air Pressure, kPa	0.05 ± .02					
10. Fuel to Flowmeter Pressure, kPa	100 min					
11. Fuel to Fuel Rail Pressure, kPa	205 - 310					
12. Intake Manifold Pressure, kPa abs.	Record					
13. Engine Oil Pressure, kPa	Record					
14. Coolant Flow, L/min	130 ± 4					
15. Intake Air Humidity, grains/kg	11.4 ± 0.8					
16. Crankcase Pressure, kPa	0.00 ± 0.25					
17. Barometric Pressure, kPa	Record					

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.10 General Parameter Summary

SEQUENCE VIB
FORM 11
GENERAL PARAMETER SUMMARY

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs on Test Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

Test Oil Phase II

General Parameters

		Stage				
	Spec	**1**	**2**	**3**	**4**	**5**
1. Oil Circulation Temperature, ˚C	Record					
2. Coolant Out Temperature, ˚C	Record					
3. Fuel to Flowmeter Temperature, ˚C	20-32					
4. Delta Fuel to Flowmeter Temp., ˚C [A]	≤ 4					
5. Test Cell Temperature, ˚C	Record					
6. Load Cell Temperature, ˚C	Record					
7. Delta Load Cell Temperature, ˚C [A]	≤ 12					
8. Oil Heater Temperature, ˚C	205 max					
9. Intake Air Pressure, kPa	0.05 ± .02					
10. Fuel to Flowmeter Pressure, kPa	100 min					
11. Fuel to Fuel Rail Pressure, kPa	205 - 310					
12. Intake Manifold Pressure, kPa abs.	Record					
13. Engine Oil Pressure, kPa	Record					
14. Coolant Flow, L/min	130 ± 4					
15. Intake Air Humidity, grains/kg	11.4 ± 0.8					
16. Crankcase Pressure, kPa	0.00 ± 0.25					
17. Barometric Pressure, kPa	Record					

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.11 General Parameter Summary

SEQUENCE VIB
FORM 12
GENERAL PARAMETER SUMMARY

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

BC After Test Oil

General Parameters

		Stage				
	Spec	**1**	**2**	**3**	**4**	**5**
1. Oil Circulation Temperature, ˚C	Record					
2. Coolant Out Temperature, ˚C	Record					
3. Fuel to Flowmeter Temperature, ˚C	20-32					
4. Delta Fuel to Flowmeter Temp.,˚C [A]	≤ 4					
5. Test Cell Temperature, ˚C	Record					
6. Load Cell Temperature, ˚C	Record					
7. Delta Load Cell Temperature, ˚C [A]	≤ 12					
8. Oil Heater Temperature, ˚C	205 max					
9. Intake Air Pressure, kPa	0.05 ± .02					
10. Fuel to Flowmeter Pressure, kPa	100 min					
11. Fuel to Fuel Rail Pressure, kPa	205 - 310					
12. Intake Manifold Pressure, kPa abs.	Record					
13. Engine Oil Pressure, kPa	Record					
14. Coolant Flow, L/min	130 ± 4					
15. Intake Air Humidity, grains/kg	11.4 ± 0.8					
16. Crankcase Pressure, kPa	0.00 ± 0.25					
17. Barometric Pressure, kPa	Record					

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.12 General Parameter Summary

SEQUENCE VIB
FORM 13
CRITICAL PARAMETER SUMMARY- STAGE 1

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

BC Before Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. ˚C 125 ± 1	Coolant In Temp, ˚C 105 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

Test Oil Phase I

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. ˚C 125 ± 1	Coolant In Temp, ˚C 105 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings.

Fig. A7.13 Critical Parameter Summary - Stage 1

SEQUENCE VIB
FORM 13A
CRITICAL PARAMETER SUMMARY- STAGE 1

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

Test Oil Phase II

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. ˚C 125 ± 1	Coolant In Temp, ˚C 105 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR < .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

BC After Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. ˚C 125 ± 1	Coolant In Temp, ˚C 105 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings.

Fig. A7.13A Critical Parameter Summary - Stage 1

SEQUENCE VIB
FORM 14
CRITICAL PARAMETER SUMMARY- STAGE 2

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

BC Before Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. ˚C 105 ± 1	Coolant In Temp, ˚C 95 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

Test Oil Phase I

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. ˚C 105 ± 1	Coolant In Temp, ˚C 95 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.14 Critical Parameter Summary - Stage 2

SEQUENCE VIB
FORM 14A
CRITICAL PARAMETER SUMMARY- STAGE 2

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

Test Oil Phase II

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. ˚C 105 ± 1	Coolant In Temp, ˚C 95 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

BC After Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. ˚C 105 ± 1	Coolant In Temp, ˚C 95 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.14A Critical Parameter Summary - Stage 2

SEQUENCE VIB
FORM 15
CRITICAL PARAMETER SUMMARY- STAGE 3

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

BC Before Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. °C 70 ± 1	Coolant In Temp, °C 60 ± 1	Intake Air Temp, °C 27 ± 2	Fuel Rail Temp, °C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

Test Oil Phase I

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. °C 70 ± 1	Coolant In Temp, °C 60 ± 1	Intake Air Temp, °C 27 ± 2	Fuel Rail Temp, °C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.15 Critical Parameter Summary - Stage 3

SEQUENCE VIB
FORM 15A
CRITICAL PARAMETER SUMMARY- STAGE 3

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

Test Oil Phase II

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. ˚C 70 ± 1	Coolant In Temp, ˚C 60 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

BC After Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 800 ± 2	Torque N-m 26 ± .07	Oil Gallery Temp. ˚C 70 ± 1	Coolant In Temp, ˚C 60 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.15A Critical Parameter Summary - Stage 3

SEQUENCE VIB
FORM 16
CRITICAL PARAMETER SUMMARY- STAGE 4

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

BC Before Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. °C 70 ± 1	Coolant In Temp, °C 60 ± 1	Intake Air Temp, °C 27 ± 2	Fuel Rail Temp, °C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

Test Oil Phase I

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. °C 70 ± 1	Coolant In Temp, °C 60 ± 1	Intake Air Temp, °C 27 ± 2	Fuel Rail Temp, °C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.16 Critical Parameter Summary - Stage 4

SEQUENCE VIB
FORM 16A
CRITICAL PARAMETER SUMMARY- STAGE 4

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

Test Oil Phase II

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. ˚C 70 ± 1	Coolant In Temp, ˚C 60 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

BC After Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. ˚C 70 ± 1	Coolant In Temp, ˚C 60 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.16A Critical Parameter Summary - Stage 4

SEQUENCE VIB
FORM 17
CRITICAL PARAMETER SUMMARY- STAGE 5

Lab:	Date Completed:		Time Completed:
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

BC Before Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. °C 45 ± 1	Coolant In Temp, °C 45 ± 1	Intake Air Temp, °C 27 ± 2	Fuel Rail Temp, °C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

Test Oil Phase I

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. °C 45 ± 1	Coolant In Temp, °C 45 ± 1	Intake Air Temp, °C 27 ± 2	Fuel Rail Temp, °C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.17 Critical Parameter Summary - Stage 5

SEQUENCE VIB
FORM 17A
CRITICAL PARAMETER SUMMARY- STAGE 5

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

Test Oil Phase II

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torque N-m 98 ± .07	Oil Gallery Temp. ˚C 45 ± 1	Coolant In Temp, ˚C 45 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

BC After Test Oil

Step SPEC	BSFC kg/kW-h	Speed r/min 1500 ± 2	Torue N-m 98 ± .07	Oil Gallery Temp. ˚C 45 ± 1	Coolant In Temp, ˚C 45 ± 1	Intake Air Temp, ˚C 27 ± 2	Fuel Rail Temp, ˚C 20 ± 2	EBP kPa 104 ± .17	Fuel Flow kg/h Record	AFR 14.25-15.25	Delta AFR ≤ .50 [A]
1											
2											
3											
4											
5											
6											
AVG.											
SD											
C.V.											

[A] Difference between the maximum stage average reading of the entire test and the individual stage average readings

Fig. A7.17A Critical Parameter Summary - Stage 5

SEQUENCE VIB
FORM 18
DOWNTIME AND OTHER COMMENTS

Lab:	Date Completed:	Time Completed:
Test Number		
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:		
Formulation/Stand Code:		

Downtime Occurrences	

Test Hours	Date	Downtime	Reasons
Total Downtime			

Total Number of Comments & Outlier Lines	

Fig. A7.18 Downtime and Other Comments

SEQUENCE VIB
FORM 19
Used Oil Analysis

Lab:	Date Completed:	Time Completed:	
Test Number			
Test Stand:	Runs On The Stand:	Engine No.:	Runs on Engine:
Oil Code:			
Formulation/Stand Code:			

USED OIL ANALYSIS	
High Temperature High Shear @ 100˚C, cP	
Cold Crank Simulator Viscosity, cP/˚C	
Friction Coefficient by HFRR @ 105˚C, mm	
Fuel Dilution, %	
Infrared for Oxidation, Abs./.01 mm	
Infrared for Nitration, Abs./.01 mm	

Fig. A7.19 Used Oil Analysis