

**Test Method DXXXX for Measurement of the Effects of Automotive Engine Oils on
the Fuel Economy of Passenger Cars and Light Trucks in the Sequence VIE Spark
Ignition Engine
Report Cover Sheet**

Version:

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 | | | |

| |
|--|
| <p>In my opinion this test _____ been conducted in a valid manner in accordance with the Test Method D XXXX and the appropriate amendments through the Information Letter System. The remarks included in the report describe the anomalies associated with this test.</p> |
|--|

Submitted By: _____

Testing Laboratory

Signature

Typed Name

Title

Form 2

Sequence VIE

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^A ACC Conformance Statement is required only for ACC registered tests

Sequence VIE

Form 3

Summary of Test Method

The Sequence VIE 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 six different stages of operation.

A General Motors 3.6L (LY7) V6, 4-cycle engine is used as the test apparatus. The engine incorporates Dual Overhead Camshafts, 4 Valves / Cylinder, Dual Stage Plenum Induction Manifold, 94x85.6mm Bore & Stroke, with 10.2:1 compression ratio.

The Sequence VIE test incorporates a flush and run type procedure. Each test consists of two 6-stage fuel economy measurements on baseline oil (BL), 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 2250 r/min and 120°C oil temperature. After the initial aging, a 6-stage fuel economy measurement is taken. The test oil is then aged an additional 109 hours at an engine speed of 2250 r/min and 120°C oil temperature. Following this final aging, the test oil once again goes through a 6-stage fuel economy measurement. The two fuel economy measurements taken on the baseline oil (BL) 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 6-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 | 2000 | 105 | 115 | 109 |
| 2 | 2000 | 105 | 65 | 65 |
| 3 | 1500 | 105 | 115 | 109 |
| 4 | 695 | 20 | 115 | 109 |
| 5 | 695 | 20 | 35 | 35 |
| 6 | 695 | 40 | 115 | 109 |

| Aging Stage | Speed (r/min) | Torque (N-m) | Oil Temp. (°C) | Coolant Temp. (°C) |
|--------------------|----------------------|---------------------|-----------------------|---------------------------|
| 1 & 2 | 2250 | 110 | 120 | 110 |

**Sequence VIE
Form 4
Test Result Summary
Non-Reference & Reference Oil Tests**

| | | |
|--|-----------------------|-----------------|
| Lab: | Date Completed: | Time Completed: |
| Test Number | | |
| Stand: | Runs On The Stand: | Engine No. |
| Oil Code: | Engine Serial Number: | |
| Number of Full Length Tests Since Stand Calibration ^B | | |
| Formulation/Stand Code: | | |

| Test Documentation | | | | | |
|---|-------------|-------------|-------------|----------|----------|
| | BL Before 1 | BL Before 2 | BL Before 3 | Test Oil | BL 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 | | | | | |
| EOT Oil Viscosity @ 40 °C, cSt | | | | | |
| EOT Oil Viscosity @ 100°C, cSt | | | | | |
| Total Test Length, hhh:mm | | | | | |
| Total Engine Hours @ EOT | | | | | |
| Fuel Batch @ Start of Test | | | | | |
| Fuel Batch @ End of Test | | | | | |
| Test Hour During Which Fuel Batch was Changed | | | | | |

| Overall Results | | | | | | |
|---|----------|----------|----------|-------|----------|----------|
| | BL Oil | | | | Test Oil | |
| | Before 1 | Before 2 | Before 3 | After | Phase I | Phase II |
| Fuel Consumed, Unweighted, kg | | | | | | |
| Fuel Consumed, weighted, kg | | | | | | |
| Shift Delta, % ^A | | | | | | |
| Fuel Economy Improvement, % | | | | | | |
| FEI Engine Hour Adjustment, % | | | | | | |
| FEI Industry Correction Factor, % | | | | | | |
| FEI Severity Adjustment, % (non-reference tests only) | | | | | | |
| FEI Final Result, % | | | | | | |
| FEI Sum, sum of FEI1 and FEI2 final results | | | | | | |
| Total Oil Consumption, ml | | | | | | |

^A Calculate Baseline shift % using unweighted fuel consumed values. When a 3rd set of BL Before is used, calculate BL shift after using the BL Before 3 for BL Before 2

^B Non reference tests only, full length tests including current one, if full length

**Sequence VIE
Form 5
Operational Data Analysis**

| | | | |
|-------------------------|--------------------|-----------------|-----------------|
| Lab: | Date Completed: | Time Completed: | |
| Test Number | | | |
| 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. % | Stage Length h | Nominal Power kW | Weight Factor | Weighted Fuel Consumed kg |
| BL Before Test Oil 1 | 1 | | | 0.5 | 21.99 | 0.300 | |
| | 2 | | | 0.5 | 21.99 | 0.032 | |
| | 3 | | | 0.5 | 16.49 | 0.310 | |
| | 4 | | | 0.5 | 1.46 | 0.174 | |
| | 5 | | | 0.5 | 1.46 | 0.011 | |
| | 6 | | | 0.5 | 2.91 | 0.172 | |
| Total Fuel Consumed | | | | | | | |

| Computed Averages | | | | | | | |
|---|--------------|-------------------------|----------------------------|-------------------------------|-----------------------------|--------------------------|--------------------------------------|
| Oil | Stage | BSFC kg/kW-h | BSFC C.V. % | Stage Length h | Nominal Power kW | Weight Factor | Weighted Fuel Consumed kg |
| BL Before Test Oil 2 | 1 | | | 0.5 | 21.99 | 0.300 | |
| | 2 | | | 0.5 | 21.99 | 0.032 | |
| | 3 | | | 0.5 | 16.49 | 0.310 | |
| | 4 | | | 0.5 | 1.46 | 0.174 | |
| | 5 | | | 0.5 | 1.46 | 0.011 | |
| | 6 | | | 0.5 | 2.91 | 0.172 | |
| Total Fuel Consumed | | | | | | | |

Sequence VIE
Form 6
Operational Date Analysis

| | | |
|-------------------------|--------------------|-----------------|
| Lab: | Date Completed: | Time Completed: |
| Test Number | | |
| 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. % | Stage Length h | Nominal Power kW | Weight Factor | Weighted Fuel Consumed kg |
| BL Before Test Oil 3 | 1 | | | 0.5 | 21.99 | 0.300 | |
| | 2 | | | 0.5 | 21.99 | 0.032 | |
| | 3 | | | 0.5 | 16.49 | 0.310 | |
| | 4 | | | 0.5 | 1.46 | 0.174 | |
| | 5 | | | 0.5 | 1.46 | 0.011 | |
| | 6 | | | 0.5 | 2.91 | 0.172 | |
| Total Fuel Consumed | | | | | | | |

| Computed Averages | | | | | | | |
|-------------------------------------|--------------|-------------------------|----------------------------|-------------------------------|-----------------------------|--------------------------|--------------------------------------|
| Oil | Stage | BSFC kg/kW-h | BSFC C.V. % | Stage Length h | Nominal Power kW | Weight Factor | Weighted Fuel Consumed kg |
| Test Oil Phase I | 1 | | | 0.5 | 21.99 | 0.300 | |
| | 2 | | | 0.5 | 21.99 | 0.032 | |
| | 3 | | | 0.5 | 16.49 | 0.310 | |
| | 4 | | | 0.5 | 1.46 | 0.174 | |
| | 5 | | | 0.5 | 1.46 | 0.011 | |
| | 6 | | | 0.5 | 2.91 | 0.172 | |
| Total Fuel Consumed | | | | | | | |

Sequence VIE
Form 7
Operational Date Analysis

| | | |
|-------------------------|--------------------|---------------------------------|
| Lab: | Date Completed: | Time Completed: |
| Test Number | | |
| 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. % | Stage Length h | Nominal Power kW | Weight Factor | Weighted Fuel Consumed kg |
| Test Oil Phase II | 1 | | | 0.5 | 21.99 | 0.300 | |
| | 2 | | | 0.5 | 21.99 | 0.032 | |
| | 3 | | | 0.5 | 16.49 | 0.310 | |
| | 4 | | | 0.5 | 1.46 | 0.174 | |
| | 5 | | | 0.5 | 1.46 | 0.011 | |
| | 6 | | | 0.5 | 2.91 | 0.172 | |
| Total Fuel Consumed | | | | | | | |

| Computed Averages | | | | | | | |
|--------------------------------------|--------------|-------------------------|----------------------------|-------------------------------|-----------------------------|--------------------------|--------------------------------------|
| Oil | Stage | BSFC kg/kW-h | BSFC C.V. % | Stage Length h | Nominal Power kW | Weight Factor | Weighted Fuel Consumed kg |
| BL After Test Oil | 1 | | | 0.5 | 21.99 | 0.300 | |
| | 2 | | | 0.5 | 21.99 | 0.032 | |
| | 3 | | | 0.5 | 16.49 | 0.310 | |
| | 4 | | | 0.5 | 1.46 | 0.174 | |
| | 5 | | | 0.5 | 1.46 | 0.011 | |
| | 6 | | | 0.5 | 2.91 | 0.172 | |
| Total Fuel Consumed | | | | | | | |

**Sequence VIE
Form 8
General Parameter Listing**

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

16 Hour Aging

| | Spec | Average | Max | Min |
|--|-------------------|---------|-----|-----|
| 1. Speed, r/min | 2250 ±5 | | | |
| 2. Torque, N-m | 110 ±0.10 | | | |
| 3. Oil Gallery Temperature, °C | 120 ±2 | | | |
| 4. Coolant Inlet Temperature, °C | 110 ±2 | | | |
| 5. Oil Circulation Temperature, °C | Record | | | |
| 6. Coolant Out Temperature, °C | Record | | | |
| 7. Intake Air Temperature, °C | 29 ±2 | | | |
| 8. Fuel to Flowmeter Temperature, °C | 26 ± 2 | | | |
| 9. Fuel to Fuel Rail Temperature, °C | 22 ±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 | 110±10 | | | |
| 14. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | |
| 15. Intake Manifold Pressure, kPa abs. | Record | | | |
| 16. Exhaust Back Pressure, kPa abs. | 105 ±0.20 | | | |
| 17. Engine Oil Pressure, kPa | Record | | | |
| 18. Coolant Flow, L/min | 80 ±4 | | | |
| 19. Fuel Flow, kg/h | Record | | | |
| 20. Intake Air Humidity, g/kg | 11.4±0.8 | | | |
| 21. Air/Fuel Ratio | Record | | | |
| 22. Crankcase Pressure, kPa | 0.00 ±0.25 | | | |

**Sequence VIE
Form 9
General Parameter Listing**

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

109 Hour Aging

| | Spec | Average | Max | Min |
|--|-------------------|---------|-----|-----|
| 1. Speed, r/min | 2250 ± 5 | | | |
| 2. Torque, N-m | 110 ±0.10 | | | |
| 3. Oil Gallery Temperature, °C | 120±2 | | | |
| 4. Coolant Inlet Temperature, °C | 110 ±2 | | | |
| 5. Oil Circulation Temperature, °C | Record | | | |
| 6. Coolant Out Temperature, °C | Record | | | |
| 7. Intake Air Temperature, °C | 29 ± 2 | | | |
| 8. Fuel to Flowmeter Temperature, °C | 26 ± 2 | | | |
| 9. Fuel to Fuel Rail Temperature, °C | 22 ± 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 | 110±10 | | | |
| 14. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | |
| 15. Intake Manifold Pressure, kPa abs. | Record | | | |
| 16. Exhaust Back Pressure, kPa abs. | 105 ± 0.20 | | | |
| 17. Engine Oil Pressure, kPa | Record | | | |
| 18. Coolant Flow, L/min | 80±4 | | | |
| 19. Fuel Flow, kg/h | Record | | | |
| 20. Intake Air Humidity, g/kg | 11.4 ±0.8 | | | |
| 21. Air/Fuel Ratio | Record | | | |
| 22. Crankcase Pressure, kPa | 0.00 ±0.25 | | | |

**Sequence VIE
Form 10
General Parameter Summary**

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

BL Before Test Oil 1

General Parameters

| | Spec | Stage Average | | | | | |
|---|--------------------|---------------|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. Oil Circulation Temperature, °C | Record | | | | | | |
| 2. Coolant Out Temperature, °C | Record | | | | | | |
| 3. Load Cell Power Supply Temp., °C | Record | | | | | | |
| 4. Load Cell Temperature, °C | Record | | | | | | |
| 5. Delta Load Cell Temperature, °C ^A | <u>≤ 12</u> | | | | | | |
| 6. Oil Heater Temperature, °C | 205 max | | | | | | |
| 7. Intake Air Pressure, kPa | 0.05 ± .02 | | | | | | |
| 8. Fuel to Flowmeter Pressure, kPa | 110±10 | | | | | | |
| 9. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | | | | |
| 10. Intake Manifold Pressure, kPa abs. | Record | | | | | | |
| 11. Engine Oil Pressure, kPa | Record | | | | | | |
| 12. Coolant Flow, L/min | 80 ± 4 | | | | | | |
| 13. Intake Air Humidity, g/kg | 11.4 ± 0.8 | | | | | | |
| 14. Crankcase Pressure, kPa | 0.00 ± 0.25 | | | | | | |
| 15. Barometric Pressure, kPa | Record | | | | | | |

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

**Sequence VIE
Form 11
General Parameter Summary**

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

BL Before Test Oil 2

General Parameters

| | Spec | Stage Average | | | | | |
|---|--------------------|---------------|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. Oil Circulation Temperature, °C | Record | | | | | | |
| 2. Coolant Out Temperature, °C | Record | | | | | | |
| 3. Load Cell Power Supply Temp., °C | Record | | | | | | |
| 4. Load Cell Temperature, °C | Record | | | | | | |
| 5. Delta Load Cell Temperature, °C ^A | ≤ 12 | | | | | | |
| 6. Oil Heater Temperature, °C | 205 max | | | | | | |
| 7. Intake Air Pressure, kPa | 0.05 ± .02 | | | | | | |
| 8. Fuel to Flowmeter Pressure, kPa | 110±10 | | | | | | |
| 9. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | | | | |
| 10. Intake Manifold Pressure, kPa abs. | Record | | | | | | |
| 11. Engine Oil Pressure, kPa | Record | | | | | | |
| 12. Coolant Flow, L/min | 80 ± 4 | | | | | | |
| 13. Intake Air Humidity, g/kg | 11.4 ± 0.8 | | | | | | |
| 14. Crankcase Pressure, kPa | 0.00 ± 0.25 | | | | | | |
| 15. Barometric Pressure, kPa | Record | | | | | | |

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

**Sequence VIE
Form 12
General Parameter Summary**

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

BL Before Test Oil 3

General Parameters

| | | Stage Average | | | | | |
|---|--------------------|---------------|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| | Spec | | | | | | |
| 1. Oil Circulation Temperature, °C | Record | | | | | | |
| 2. Coolant Out Temperature, °C | Record | | | | | | |
| 3. Load Cell Power Supply Temp., °C | Record | | | | | | |
| 4. Load Cell Temperature, °C | Record | | | | | | |
| 5. Delta Load Cell Temperature, °C ^A | < 12 | | | | | | |
| 6. Oil Heater Temperature, °C | 205 max | | | | | | |
| 7. Intake Air Pressure, kPa | 0.05 ± .02 | | | | | | |
| 8. Fuel to Flowmeter Pressure, kPa | 110±10 | | | | | | |
| 9. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | | | | |
| 10. Intake Manifold Pressure, kPa abs. | Record | | | | | | |
| 11. Engine Oil Pressure, kPa | Record | | | | | | |
| 12. Coolant Flow, L/min | 80 ± 4 | | | | | | |
| 13. Intake Air Humidity, g/kg | 11.4 ± 0.8 | | | | | | |
| 14. Crankcase Pressure, kPa | 0.00 ± 0.25 | | | | | | |
| 15. Barometric Pressure, kPa | Record | | | | | | |

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

**Sequence VIE
Form 13
General Parameter Summary**

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

**Test Oil Phase I
General Parameters**

| | Spec | Stage Average | | | | | |
|---|--------------------|---------------|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. Oil Circulation Temperature, °C | Record | | | | | | |
| 2. Coolant Out Temperature, °C | Record | | | | | | |
| 3. Load Cell Power Supply Temp., °C | Record | | | | | | |
| 4. Load Cell Temperature, °C | Record | | | | | | |
| 5. Delta Load Cell Temperature, °C ^A | < 12 | | | | | | |
| 6. Oil Heater Temperature, °C | 205 max | | | | | | |
| 7. Intake Air Pressure, kPa | 0.05 ± .02 | | | | | | |
| 8. Fuel to Flowmeter Pressure, kPa | 110±10 | | | | | | |
| 9. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | | | | |
| 10. Intake Manifold Pressure, kPa abs. | Record | | | | | | |
| 11. Engine Oil Pressure, kPa | Record | | | | | | |
| 12. Coolant Flow, L/min | 80 ± 4 | | | | | | |
| 13. Intake Air Humidity, g/kg | 11.4 ± 0.8 | | | | | | |
| 14. Crankcase Pressure, kPa | 0.00 ± 0.25 | | | | | | |
| 15. Barometric Pressure, kPa | Record | | | | | | |

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

**Sequence VIE
Form 14
General Parameter Summary**

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

**Test Oil Phase II
General Parameters**

| | | Stage Average | | | | | |
|---|--------------------|---------------|---|---|---|---|---|
| | Spec | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. Oil Circulation Temperature, °C | Record | | | | | | |
| 2. Coolant Out Temperature, °C | Record | | | | | | |
| 3. Load Cell Power Supply Temp., °C | Record | | | | | | |
| 4. Load Cell Temperature, °C | Record | | | | | | |
| 5. Delta Load Cell Temperature, °C ^A | < 12 | | | | | | |
| 6. Oil Heater Temperature, °C | 205 max | | | | | | |
| 7. Intake Air Pressure, kPa | 0.05 ± .02 | | | | | | |
| 8. Fuel to Flowmeter Pressure, kPa | 110±10 | | | | | | |
| 9. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | | | | |
| 10. Intake Manifold Pressure, kPa abs. | Record | | | | | | |
| 11. Engine Oil Pressure, kPa | Record | | | | | | |
| 12. Coolant Flow, L/min | 80 ± 4 | | | | | | |
| 13. Intake Air Humidity, g/kg | 11.4 ± 0.8 | | | | | | |
| 14. Crankcase Pressure, kPa | 0.00 ± 0.25 | | | | | | |
| 15. Barometric Pressure, kPa | Record | | | | | | |

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

**Sequence VIE
Form 15
General Parameter Summary**

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

**BL After Test Oil Phase
General Parameters**

| | Spec | Stage Average | | | | | |
|---|--------------------|---------------|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. Oil Circulation Temperature, °C | Record | | | | | | |
| 2. Coolant Out Temperature, °C | Record | | | | | | |
| 3. Load Cell Power Supply Temp., °C | Record | | | | | | |
| 4. Load Cell Temperature, °C | Record | | | | | | |
| 5. Delta Load Cell Temperature, °C ^A | <u>≤ 12</u> | | | | | | |
| 6. Oil Heater Temperature, °C | 205 max | | | | | | |
| 7. Intake Air Pressure, kPa | 0.05 ± .02 | | | | | | |
| 8. Fuel to Flowmeter Pressure, kPa | 110±10 | | | | | | |
| 9. Fuel to Fuel Rail Pressure, kPa | 405±10 | | | | | | |
| 10. Intake Manifold Pressure, kPa abs. | Record | | | | | | |
| 11. Engine Oil Pressure, kPa | Record | | | | | | |
| 12. Coolant Flow, L/min | 80 ± 4 | | | | | | |
| 13. Intake Air Humidity, g/kg | 11.4 ± 0.8 | | | | | | |
| 14. Crankcase Pressure, kPa | 0.00 ± 0.25 | | | | | | |
| 15. Barometric Pressure, kPa | Record | | | | | | |

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

**Sequence VIE
Form 16
Critical Parameter Summary**

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

Stage 1 Average

| | Spec | BL Before Test Oil 1 | BL Before Test Oil 2 | BL Before Test Oil 3 | Test Oil Phase I | Test Oil Phase II | BL After Test Oil |
|-----------------------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|---------------------|----------------------|-------------------------|
| Speed, r/min | 2000±5 | | | | | | |
| Torque, N-m | 105±0.10 | | | | | | |
| Oil Gallery Temperature, °C | 115±2 | | | | | | |
| Coolant Inlet Temperature, °C | 109±2 | | | | | | |
| Intake Air Temperature, °C | 29±2 | | | | | | |
| Fuel to Fuel Rail Temperature, °C | 22±2 | | | | | | |
| Fuel to Flowmeter Temp., °C | 26±2 | | | | | | |
| Exhaust Back Pressure, kPa abs. | 105±0.17 | | | | | | |
| Fuel Flow, kg/h | Record | | | | | | |
| Air/Fuel Ratio | 14.00–15.00 | | | | | | |
| Delta AFR ^A | ≤ .50 | | | | | | |
| BSFC, kg/Kw-h | Record | | | | | | |
| BSFC, Standard Deviation | Record | | | | | | |
| BSFC C.V., % | Record | | | | | | |

Stage 2 Average

| | Spec | BL Before Test Oil 1 | BL Before Test Oil 2 | BL Before Test Oil 3 | Test Oil Phase I | Test Oil Phase II | BL After Test Oil |
|-----------------------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|---------------------|----------------------|-------------------------|
| Speed, r/min | 2000±5 | | | | | | |
| Torque, N-m | 105±0.10 | | | | | | |
| Oil Gallery Temperature, °C | 65±2 | | | | | | |
| Coolant Inlet Temperature, °C | 65±2 | | | | | | |
| Intake Air Temperature, °C | 29±2 | | | | | | |
| Fuel to Fuel Rail Temperature, °C | 22±2 | | | | | | |
| Fuel to Flowmeter Temp., °C | 26±2 | | | | | | |
| Exhaust Back Pressure, kPa abs. | 105±0.17 | | | | | | |
| Fuel Flow, kg/h | Record | | | | | | |
| Air/Fuel Ratio | 14.00–15.00 | | | | | | |
| Delta AFR ^A | ≤ .50 | | | | | | |
| BSFC, kg/Kw-h | Record | | | | | | |
| BSFC, Standard Deviation | Record | | | | | | |
| BSFC C.V., % | Record | | | | | | |

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

**Sequence VIE
Form 17
Critical Parameter Summary**

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

Stage 3 Average

| | Spec | BL Before Test Oil 1 | BL Before Test Oil 2 | BL Before Test Oil 3 | Test Oil Phase I | Test Oil Phase II | BL After Test Oil |
|-----------------------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|---------------------|----------------------|-------------------------|
| Speed, r/min | 1500±5 | | | | | | |
| Torque, N-m | 105±0.10 | | | | | | |
| Oil Gallery Temperature, °C | 115±2 | | | | | | |
| Coolant Inlet Temperature, °C | 109±2 | | | | | | |
| Intake Air Temperature, °C | 29±2 | | | | | | |
| Fuel to Fuel Rail Temperature, °C | 22±2 | | | | | | |
| Fuel to Flowmeter Temp., °C | 26±2 | | | | | | |
| Exhaust Back Pressure, kPa abs. | 105±0.17 | | | | | | |
| Fuel Flow, kg/h | Record | | | | | | |
| Air/Fuel Ratio | 14.00–15.00 | | | | | | |
| Delta AFR ^A | ≤ .50 | | | | | | |
| BSFC, kg/Kw-h | Record | | | | | | |
| BSFC, Standard Deviation | Record | | | | | | |
| BSFC C.V., % | Record | | | | | | |

Stage 4 Average

| | Spec | BL Before Test Oil 1 | BL Before Test Oil 2 | BL Before Test Oil 3 | Test Oil Phase I | Test Oil Phase II | BL After Test Oil |
|-----------------------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|---------------------|----------------------|-------------------------|
| Speed, r/min | 695±5 | | | | | | |
| Torque, N-m | 20±0.10 | | | | | | |
| Oil Gallery Temperature, °C | 115±2 | | | | | | |
| Coolant Inlet Temperature, °C | 109±2 | | | | | | |
| Intake Air Temperature, °C | 29±2 | | | | | | |
| Fuel to Fuel Rail Temperature, °C | 22±2 | | | | | | |
| Fuel to Flowmeter Temp., °C | 26±2 | | | | | | |
| Exhaust Back Pressure, kPa abs. | 104±0.17 | | | | | | |
| Fuel Flow, kg/h | Record | | | | | | |
| Air/Fuel Ratio | 14.00–15.00 | | | | | | |
| Delta AFR ^A | ≤ .50 | | | | | | |
| BSFC, kg/Kw-h | Record | | | | | | |
| BSFC, Standard Deviation | Record | | | | | | |
| BSFC C.V., % | Record | | | | | | |

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

**Sequence VIE
Form 18
Critical Parameter Summary**

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

Stage 5 Average

| | Spec | BL Before Test Oil 1 | BL Before Test Oil 2 | BL Before Test Oil 3 | Test Oil Phase I | Test Oil Phase II | BL After Test Oil |
|-----------------------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|---------------------|----------------------|-------------------------|
| Speed, r/min | 695±5 | | | | | | |
| Torque, N-m | 20±0.10 | | | | | | |
| Oil Gallery Temperature, °C | 35±2 | | | | | | |
| Coolant Inlet Temperature, °C | 35±2 | | | | | | |
| Intake Air Temperature, °C | 29±2 | | | | | | |
| Fuel to Fuel Rail Temperature, °C | 22±2 | | | | | | |
| Fuel to Flowmeter Temp., °C | 26±2 | | | | | | |
| Exhaust Back Pressure, kPa abs. | 104±0.17 | | | | | | |
| Fuel Flow, kg/h | Record | | | | | | |
| Air/Fuel Ratio | 14.00–15.00 | | | | | | |
| Delta AFR ^A | ≤ .50 | | | | | | |
| BSFC, kg/Kw-h | Record | | | | | | |
| BSFC, Standard Deviation | Record | | | | | | |
| BSFC C.V., % | Record | | | | | | |

Stage 6 Average

| | Spec | BL Before Test Oil 1 | BL Before Test Oil 2 | BL Before Test Oil 3 | Test Oil Phase I | Test Oil Phase II | BL After Test Oil |
|-----------------------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|---------------------|----------------------|-------------------------|
| Speed, r/min | 695±5 | | | | | | |
| Torque, N-m | 40±0.10 | | | | | | |
| Oil Gallery Temperature, °C | 115±2 | | | | | | |
| Coolant Inlet Temperature, °C | 109±2 | | | | | | |
| Intake Air Temperature, °C | 29±2 | | | | | | |
| Fuel to Fuel Rail Temperature, °C | 22±2 | | | | | | |
| Fuel to Flowmeter Temp., °C | 26±2 | | | | | | |
| Exhaust Back Pressure, kPa abs. | 104±0.17 | | | | | | |
| Fuel Flow, kg/h | Record | | | | | | |
| Air/Fuel Ratio | 14.00–15.00 | | | | | | |
| Delta AFR ^A | ≤ .50 | | | | | | |
| BSFC, kg/Kw-h | Record | | | | | | |
| BSFC, Standard Deviation | Record | | | | | | |
| BSFC C.V., % | Record | | | | | | |

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

**Sequence VIF
Form 19A
Downtime and Other Comments**

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

| Number of Downtime Occurrences | | | |
|--------------------------------|------|----------|---------|
| Test Hours | Date | Downtime | Reasons |
| | | | |
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| Total Downtime | | | |

| Other Comments | | |
|-------------------------|--|--|
| Number of Comment Lines | | |
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**Sequence VIE
Form 20
Test Fuel Analysis**

| | | |
|-------------------------|-----------|-----------|
| Laboratory: | EOT Date: | EOT Time: |
| Test Number: | | |
| Oil Code: | | |
| Formulation/Stand Code: | | |

| TEST | Method | Units | Haltermann Specifications | | | Results | |
|---------------------|------------|-------|---------------------------|--------|--------|---------|--|
| | | | Min | Target | Max | | |
| Distillation – IBP | ASTM D86 | °C | 23.9 | | 35.0 | | |
| 5% | | °C | | | | | |
| 10% | | °C | 48.9 | | 57.2 | | |
| 20% | | °C | | | | | |
| 30% | | °C | | | | | |
| 40% | | °C | | | | | |
| 50% | | °C | 93.3 | | 110.0 | | |
| 60% | | °C | | | | | |
| 70% | | °C | | | | | |
| 80% | | °C | | | | | |
| 90% | | °C | 151.7 | | 162.8 | | |
| 95% | | °C | | | | | |
| Distillation-EP | | | °C | | | 212.8 | |
| Recovery | | | Vol % | | Report | | |
| Residue | | Vol % | | Report | | | |
| Loss | | Vol % | | Report | | | |
| Gravity@60°F/60°F | ASTM D4052 | °API | 58.7 | | 61.2 | | |
| Residue | ASTM D4052 | kg/l | 0.734 | | 0.744 | | |
| Reid Vapor Pressure | D5191 | kPa | 60.1 | | 63.4 | | |

Sequence VIE
Form 21
Test Fuel Analysis (cont)

| | | |
|-------------------------|-----------|-----------|
| Laboratory: | EOT Date: | EOT Time: |
| Test Number: | | |
| Oil Code: | | |
| Formulation/Stand Code: | | |

| TEST | Method | Units | Haltermann Specifications | | | Results |
|---------------------------|------------|-------------|---------------------------|--------|------|---------|
| | | | Min | Target | Max | |
| Carbon | ASTM D3343 | wt fraction | | Report | | |
| Carbon | ASTM E191 | wt fraction | | Report | | |
| Hydrogen | ASTM E191 | wt fraction | | Report | | |
| Hydrogen/Carbon ratio | ASTM E191 | mole/mole | | Report | | |
| Oxygen | ASTM D4815 | wt % | | | 0.05 | |
| Sulfur | ASTM D5453 | mg/kg | 3 | | 15 | |
| Lead | ASTM D3237 | mg/l | | | 2.6 | |
| Phosphorous | ASTM D3231 | mg/l | | | 1.3 | |
| Composition, aromatics | ASTM D1319 | vol % | 26.0 | | 32.5 | |
| Composition, olefins | ASTM D1319 | vol % | | | 10.0 | |
| Composition, saturates | ASTM D1319 | vol % | | Report | | |
| Particulate matter | ASTM D5452 | mg/l | | | 1 | |
| Oxidation Stability | ASTM D525 | minutes | 1000 | | | |
| Copper Corrosion | ASTM D130 | | | | 1 | |
| Gum content, washed | ASTM D381 | mg/100mls | | | 5.0 | |
| Fuel Economy Numerator/C | | | 2401 | | 2441 | |
| Density | ASTM E191 | | | | | |
| C Factor | ASTM E191 | | | Report | | |
| Research Octane Number | ASTM D2699 | | 96.0 | | | |
| Motor Octane Number | ASTM D2700 | | | Report | | |
| Sensitivity | | | 7.5 | | | |
| Net Heating Value, btu/lb | ASTM D3338 | btu/lb | | Report | | |
| Net Heating Value, btu/lb | ASTM D240 | btu/lb | | Report | | |
| Color | VISUAL | 1.75 ptb | | Red | | |
| Top Tier Additive | | 69.3 ptb | | Report | | |

**Sequence VIE
Form 22
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 The 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.*

| |
|-----------------|
| Comments |
| |
| |
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| |

Signature

Date

Typed Name

Title