

Report On
Sequence IIIHB Evaluation
 Version

Conducted For

| | |
|--|---|
| | V = Valid |
| | I = Invalid |
| | N = Results cannot be interpreted as representative of oil performance (Non-reference oil) and shall not be used for multiple test acceptance |

| | |
|--|-----------------------------|
| | NR = Non-reference oil test |
| | RO = Reference oil test |

| Test Number | | | | | |
|-------------------|--|-----------------------------|--|---------------------|--|
| Test Stand | | Runs Since Last Calibration | | Total Runs on Stand | |
| Oil Code | | | | | |
| Formulation/Stand | | | | | |
| Alternate Codes | | | | | |
| EOT Date | | EOT Time | | | |

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

Submitted By:

Testing Laboratory

Signature

Typed Name

Title

Sequence IIIHB
Form 2
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**Sequence IIIHB
Form 3
Summary of Test Method**

The Sequence IIIHB Test is a fired-engine, dynamometer lubricant test for evaluating automotive engine oils for certain high-temperature performance characteristics. Such oils include both single viscosity grade and multi-viscosity grade oils that are used in spark-ignition, gasoline-fueled engines, as well as diesel engines. The Sequence IIIHB Test utilizes a 2012 Chrysler Pentastar 3.6 Liter, water-cooled, 4 cycle, V-6 engine as the test apparatus. The Sequence IIIHB test engine is an overhead valve design (OHV) and uses dual overhead camshafts operating both intake and exhaust valves. The engine uses two intake and two exhaust valve per cylinder. The test engine is overhauled prior to each test, during which critical engine dimensions are measured and rated or measured parts (pistons, rings, etc.) are replaced.

The Sequence IIIHB Test consists 90 hours of engine operation at moderately high speed, load, and temperature conditions. The 90-hour segment is broken down into four 20-hour test segments and one 10-hour segment. Following each 20-hour segment, the 10 hour segment, and the 10-minute operational check, oil samples are drawn from the engine. The ICP analysis of the 20-hour segment samples and 10 hour segment samples are compared to the ICP analysis of the initial sample to determine the phosphorus retention of the test oil.

The Sequence IIIHB Test is operated at the following test states during the 90-hour portion of the test:

| Quantity | Set Point |
|----------------------------|------------|
| Engine Speed | 3900 r/min |
| Engine Load | 250 N·m |
| Oil Temperature, Block | 151° C |
| Coolant Outlet Temperature | 115° C |
| Fuel Temperature | 30° C |
| Intake Air Temperature | 35° C |
| Intake Air Pressure | 0.05 kPa |
| Intake Air Dew Point | 16.1° C |
| Exhaust Back Pressure | 4.5 kPa |
| Engine Coolant Flow | 170 L/min |
| Coolant Pressure | 200 kPa |

Sequence IIIHB

Form 4

Test Result Summary

| | | | |
|------------------------|--|----------|--|
| Lab | | Oil Code | |
| Stand | | Test No. | |
| Laboratory Oil Code | | | |
| Formulation Stand Code | | | |

| | | | |
|----------------|--|----------------------------|--|
| Date Started | | Engine No. | |
| Time Started | | Fuel Batch | |
| Date Completed | | SAE Viscosity | |
| Time Completed | | Reference Oil ^A | |
| Test Length | | | |

| | Phosphorus Retention % |
|----------------------------------|-----------------------------------|
| Original Units | |
| Transformed Results ^B | |
| Industry Correction Factor | |
| Corrected Transformed Result | |
| Severity Adjustment | |
| Final Transformed Result | |
| Final Original Unit Result | |

Additional Results

| | | | |
|---------------------------------------|--|--------------------|--|
| Oil Consumption Hours, h ^B | | Oil Consumption, L | |
|---------------------------------------|--|--------------------|--|

^A Reference Oil Tests Only

^B Test Hours at which Oil Consumption was calculated

**Sequence IIIHB
Form 5
Operational Summary**

| | | | |
|------------------------|--|----------|--|
| Lab | | Oil Code | |
| Stand | | Test No. | |
| Laboratory Oil Code | | | |
| Formulation Stand Code | | | |

| | Quantity | Units | QI Threshold | EOT QI | Target | Average | Standard Deviation | Number of | |
|------------------------------|----------------|-------|--------------|--------|--------|---------|--------------------|-----------|-----|
| | | | | | | | | Samples | BQD |
| Controlled Parameters | Speed | r/min | 0.000 | | 3900 | | | | |
| | Load | N·m | 0.000 | | 250 | | | | |
| | Oil, Block | °C | 0.000 | | 151 | | | | |
| | Coolant Out | °C | 0.000 | | 115 | | | | |
| | Coolant System | kPa | | | 200 | | | | |
| | Intake Air | °C | 0.000 | | 35 | | | | |
| | Intake Air | kPa | 0.000 | | 0.05 | | | | |
| | Dew Point | °C | 0.000 | | 16.1 | | | | |
| | EBP Rt. | kPa | 0.000 | | 4.5 | | | | |
| | EBP Lt. | kPa | 0.000 | | 4.5 | | | | |
| | Fuel @ Rail | °C | 0.000 | | 30 | | | | |
| | Fuel @ Rail | kPa | | | 420 | | | | |
| | Coolant Flow | L/min | 0.000 | | 170 | | | | |

| | Quantity | Units | Average | Standard Deviation | Number of | |
|----------------------------------|----------------------------|-------|---------|--------------------|-----------|-----|
| | | | | | Samples | BQD |
| Non-controlled Parameters | Oil Sump | °C | | | | |
| | Oil Pump | °C | | | | |
| | Oil Cooler | °C | | | | |
| | Coolant In | °C | | | | |
| | Oil Gallery | kPa | | | | |
| | Oil Pump | kPa | | | | |
| | Manifold Absolute Pressure | kPaA | | | | |
| | Right Exhaust Temperature | °C | | | | |
| | Left Exhaust Temperature | °C | | | | |
| | Fuel Flow Rate | kg/h | | | | |
| | Crankcase | kPa | | | | |
| | Right NOx | mg/kg | | | | |
| | Left NOx | mg/kg | | | | |
| | AFR, Rt. | | | | | |
| | AFR, Lt. | | | | | |

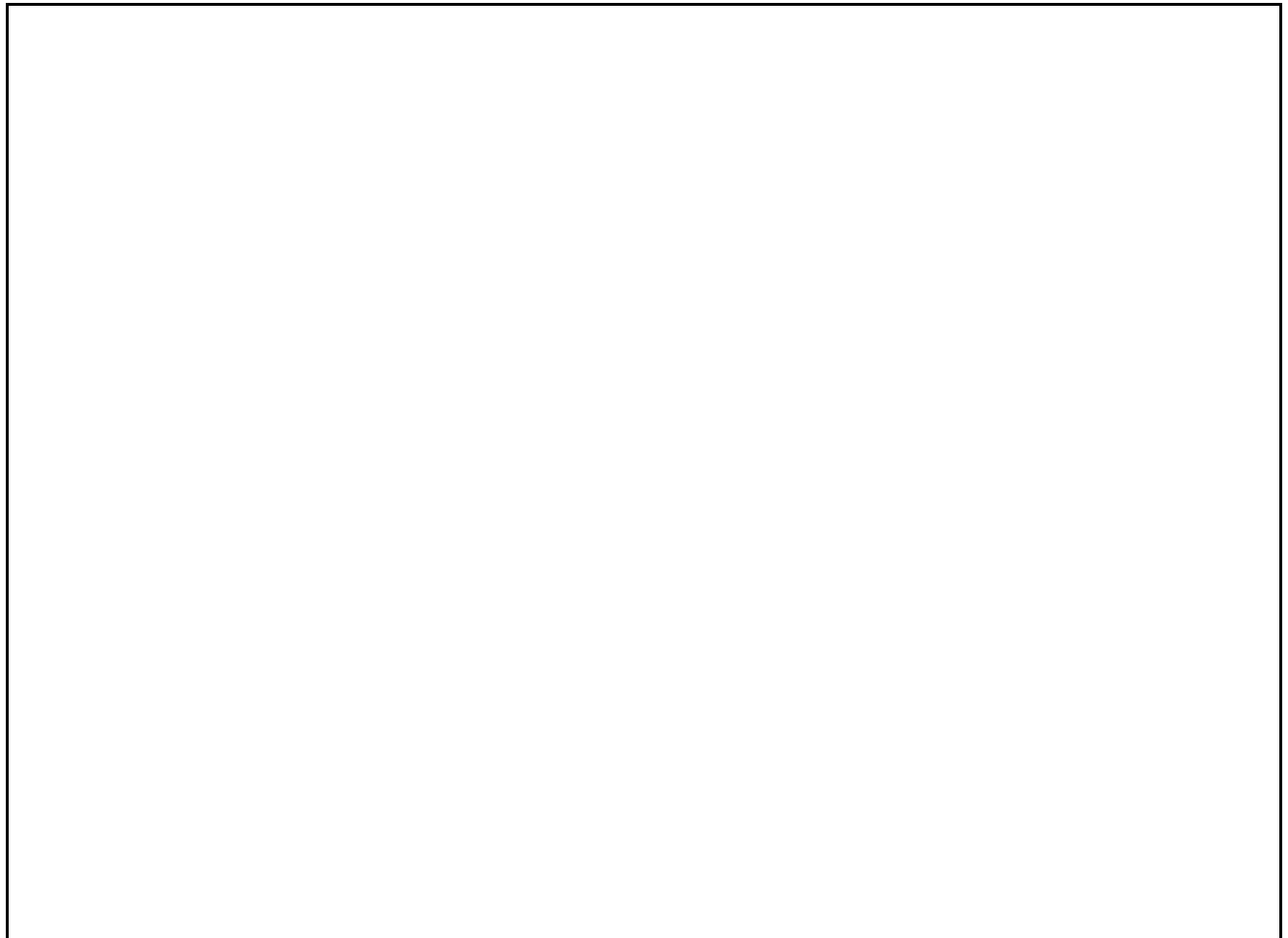
**Sequence IIIHB
Form 6
Oil Consumption Data Plot**

| | | | |
|------------------------|--|----------|--|
| Lab | | Oil Code | |
| Stand | | Test No. | |
| Laboratory Oil Code | | | |
| Formulation Stand Code | | | |

Oil Consumption Data

| | | | | | |
|------------------------|--|--|--|--|------------|
| Hours | | | | | EOT |
| Level low (mL) | | | | | |
| Total Oil Consumed (L) | | | | | |

Oil Consumption Plot



**Sequence IIIHB
Form 7
Used Oil Analysis Results**

| | | | |
|------------------------|--|----------|--|
| Lab | | Oil Code | |
| Stand | | Test No. | |
| Laboratory Oil Code | | | |
| Formulation Stand Code | | | |

| Oxidation & Nitration Results | | | | | | |
|---|----------------|----------------------|--|--|--|-----|
| Parameter | Method | Test Hours | | | | EOT |
| | | | | | | |
| DIR Oxidation | E168 IIIG Area | | | | | |
| DIR Nitration | E168 IIIG Area | | | | | |
| Total Acid Number | | | | | | |
| Parameter | Method | | | | | EOT |
| TAN | D664 | | | | | |
| TBN | D4739 | | | | | |
| Metals Element Analysis – ICP Method D5185 mg/kg | | | | | | |
| Element | New Oil | Initial ^A | | | | EOT |
| Aluminum (Al) | | | | | | |
| Boron (B) | | | | | | |
| Calcium (Ca) | | | | | | |
| Copper (Cu) | | | | | | |
| Iron (Fe) | | | | | | |
| Potassium (K) | | | | | | |
| Magnesium (Mg) | | | | | | |
| Manganese (Mn) | | | | | | |
| Molybdenum (Mo) | | | | | | |
| Sodium (Na) | | | | | | |
| Phosphorus (P) | | | | | | |
| Lead (Pb) | | | | | | |
| Silicon (Si) | | | | | | |
| Tin (Sn) | | | | | | |
| Zinc (Zn) | | | | | | |

^A Initial = At end of leveling run

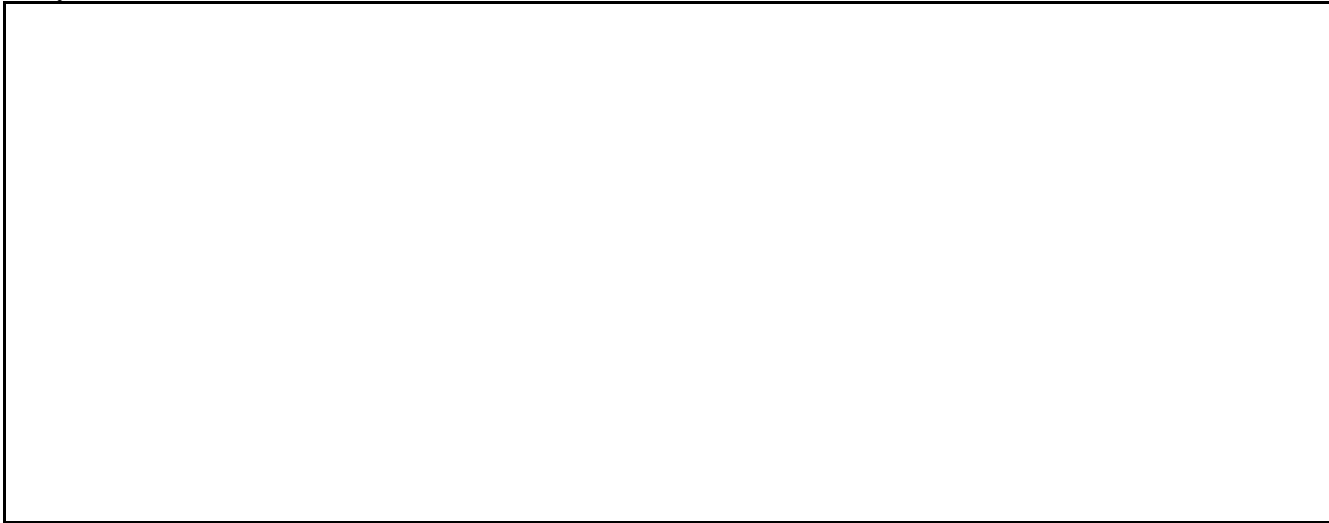
| Highest Detergent Metal and Phosphorus Results by ICP (D 5185 Modified) | | | |
|--|-----------------|----------------|-----------------------------------|
| Test Hour | Detergent Metal | Phosphorus (P) | Phosphorus Retention ^C |
| | mg/kg | mg/kg | Percent (%) |
| Initial ^B | | | |
| EOT | | | |
| | | | |
| Detergent Metal used for this test | | | |

^B Phosphorus results analyzed by IIIGB Method.

**Sequence IIIHB
Form 8
Blowby Values & Plot**

| | | | |
|------------------------|--|----------|--|
| Lab | | Oil Code | |
| Stand | | Test No. | |
| Laboratory Oil Code | | | |
| Formulation Stand Code | | | |

Blowby Plot



| Test Hours | Blowby, L/min | Test Hours | Blowby, L/min | Test Hours | Blowby, L/min |
|------------|---------------|------------|---------------|----------------|---------------|
| | | | | | |
| | | | | | |
| | | | | Average | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Sequence IIIHB
Form 9
Hardware Information**

| | | | |
|------------------------|--|----------|--|
| Lab | | Oil Code | |
| Stand | | Test No. | |
| Laboratory Oil Code | | | |
| Formulation Stand Code | | | |

| Hardware Information | |
|------------------------------------|--|
| Engine Build Date | |
| Block Serial Number | |
| Ring Batch Code | |
| Oil Control (OC) Ring Batch Code | |
| Expander Ring (EXP) Batch Code | |
| Cylinder Head Serial Number, Left | |
| Cylinder Head Serial Number, Right | |
| Lab Block Number | |
| Piston Batch Code | |

| Cylinder Bore Measurements | | | | | | | | |
|-----------------------------------|------------|--------|--------|-------|--------------|--------|--------|-------|
| Cylinder | Transverse | | | | Longitudinal | | | |
| | Top | Middle | Bottom | Taper | Top | Middle | Bottom | Taper |
| 2 | | | | | | | | |
| 4 | | | | | | | | |
| 6 | | | | | | | | |
| 1 | | | | | | | | |
| 3 | | | | | | | | |
| 5 | | | | | | | | |

| Cylinder Bore Measurements | | | | | |
|-----------------------------------|----|-----|-----|----|-----|
| Cylinder | Rk | Rpk | Rvk | Rz | Mr2 |
| 2 | | | | | |
| 4 | | | | | |
| 6 | | | | | |
| 1 | | | | | |
| 3 | | | | | |
| 5 | | | | | |

Sequence IIIHB
Form 12
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)

| | |
|--|---|
| | 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