

Sequence VH Report Forms

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 in determining an average test result using multiple test acceptance criteria. |

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

| Test Number | | | |
|-------------------------|---------------------------------|--|----------------------|
| Stand: | Runs Between Calibration Tests: | | Total Runs on Stand: |
| Date Completed: | End of Test Time: | | |
| Oil Code: | | | |
| Formulation/Stand Code: | | | |
| Alternate Codes: | | | |

In my opinion this test _____ been conducted in a valid manner in accordance with the VG 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.

SUBMITTED BY

Testing Laboratory

Signature

Typed Name

Title

Sequence VH

Form 2

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

Sequence VH Sludge and Varnish Deposit Test Form 3

Summary of Test Method

The Sequence VH engine sludge and varnish deposit test is a fired engine-dynamometer test which evaluates the ability of a lubricant to minimize the formation of sludge and varnish deposits. This test method is a cyclic test, with a total running duration of 216 hours.

The test engine is a Ford 4.6L, spark ignition, four stroke, eight cylinder “V” configuration engine. Features of this engine include dual overhead camshafts, a cross-flow fast burn cylinder head design, two valves per cylinder and electronic port fuel injection. A 90 minute break-in schedule is conducted prior to each test, since a new engine build is used for each test.

The Sequence VH test requires a new engine for each test. Each test is run for 180 hours, consisting of 45 cycles of 4 hours each. Each cycle consists of 3 stages. The stages of the test cycle are set at the following conditions:

| Condition | Stage I | Stage II | Stage III |
|--------------------------------------|--------------|--------------|-------------|
| Duration, minutes | 120 | 75 | 45 |
| Engine Speed, r/min | 1200 | 2900 | 700 |
| Engine Power, kW | Record | Record | 1.10 - 1.50 |
| Manifold Abs Press, kPa (abs) | 69 | 66 | Record |
| Engine Oil In, °C | 68 | 100 | 45 |
| Engine Coolant Out, °C | 57 | 85 | 45 |
| Engine Coolant Flow, L/min | 48 | Record | Record |
| Engine Coolant Pressure, kPa (gauge) | 70 | 70 | 70 |
| RAC Coolant In, °C | 29 | 85 | 29 |
| Rocker Cover Flow, L/min | 15 | 15 | 15 |
| Intake Air, °C | 30 | 30 | 30 |
| Intake Air, Press, kPa (gauge) | 0.05 | 0.05 | 0.05 |
| Exhaust Gas Analysis, Lambda | 1.0 | 1.0 | 0.75 |
| Blowby Flow Rate Avg, L/min | Record | 60 - 70 | ----- |
| Air/Fuel Ratio | Stoichmetric | Stoichmetric | 11.5:1 |
| Intake Air Humidity, g/kg | 11.4 | 11.4 | 11.4 |
| Exhaust Back Pressure, kPa abs | 104 | 107 | Record |
| Fuel Flow, kg/h | Record | Record | Record |

Upon test completion, the engine is disassembled and rated for sludge and varnish. Average Engine Sludge and Average Engine Varnish are calculated.

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

| | | | |
|-------------------------|--------|-------------|----------------------|
| Laboratory: | Stand: | Stand Runs: | Total Runs on Stand: |
| Oilcode: | | | |
| Formulation/Stand Code: | | | |

| | | |
|--|--------------------------|--------------------|
| Date Started: | Time Started: | SAE Viscosity: |
| Date Complete: | Time Complete: | Lab Engine Number: |
| Test Length: | Fuel Batch: | |
| Number of Valid Tests Since Stand Calibration ^B | | |
| Industry Oil Code: | Nominal Piston Oversize: | |

| Critical Parameters | | | | | | |
|---|-------------------------------|-----------------------------|--------------------------------|--------------------------------------|---------------------------|---------------------------|
| | Average Engine Sludge, Merits | Rocker Cover Sludge, Merits | Average Engine Varnish, Merits | Average Piston Skirt Varnish, Merits | Oil Screen Sludge, % Area | Number of Hot Stuck Rings |
| Original Result | | | | | | |
| Transformed Result | | | | | | |
| Industry Correction Factor ^A | | | | | | |
| Corrected Transformed Result | | | | | | |
| Severity Adjustment | | | | | | |
| Final Transformed Result | | | | | | |
| Final Original Unit Result | | | | | | |

^AIndustry correction factor can be found in Section 13 of Test Method DXXXX

| Clogging Information | | Additional Information | |
|-----------------------------|--|------------------------------------|--|
| Oil Screen Debris, % Area | | Number of Cold Stuck Rings | |
| Oil Ring Clogging, % Area | | Average Blowby Stage II, L/min | |
| PCV Valve @ 25 kPa, % | | Oil Consumption, grams | |
| PCV Valve @ 60 kPa, % | | Avg. Follower Pin Wear, Cylinder 8 | |

^B Non-Reference Tests Only, includes current test if valid.

**Sequence VH
Form 5
Test Result Summary
Non-Reference & Reference Oil Tests**

| | | | |
|-------------------------|--------|-------------|----------------------|
| Laboratory: | Stand: | Stand Runs: | Total Runs on Stand: |
| Oilcode: | | | |
| Formulation/Stand Code: | | | |

| | | | |
|------------------------------|--------|------------------|--------------|
| Date Completed: | | Time Completed : | |
| Camshaft Serial Numbers | | Cam, Left: | Cam, Right: |
| Cylinder Head Serial Numbers | | Head, Left: | Head, Right: |
| Number of Runs | Block: | Left Head: | Right Head: |

| Sludge Deposits | |
|------------------------------|-------|
| Area | Merit |
| Rocker Arm Cover, Left | |
| Rocker Arm Cover, Right | |
| Camshaft Baffle, Left | |
| Camshaft Baffle, Right | |
| Timing Chain Cover | |
| Oil Pan Baffle | |
| Oil Pan | |
| Valve Deck Area, Left | |
| Valve Deck Area, Right | |
| Average Engine Sludge | |

| Varnish Deposits | |
|-------------------------------|-------|
| Area | Merit |
| Piston Skirt, Thrust | |
| Cam Baffle, Left | |
| Cam Baffle, Right | |
| Average Engine Varnish | |

| Wear Measurements | | |
|-------------------------------------|-------|-------|
| Ring Wear | Units | Value |
| Follower Pin Wear, Cyl #8, Intake | µm | |
| Follower Pin Wear, Cyl #8, Exhaust. | µm | |
| Ring Gap Increase, Cyl #1 & #8, Max | µm | |
| Ring Gap Increase, Cyl #1 & #8, Avg | µm | |

| Piston Varnish Deposits, Thrust Side | |
|---|-------|
| Piston Number | Merit |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| Average | |

**Sequence VH
Form 6
Operational Summary**

| | | | |
|-------------------------|--------|-------------|----------------------|
| Laboratory: | Stand: | Stand Runs: | Total Runs on Stand: |
| Oilcode: | | | |
| Formulation/Stand Code: | | | |

| Controlled Parameters | Parameter | Units | QI Threshold | EOT QI | Target | | | Average | | | Samples | BQD | Over/Under Range | |
|-----------------------|-------------------------|-------|--------------|--------|----------------|---------|-----------|---------|---------|---------|---------|-----|------------------|--|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 1 | Stage 2 | Stage 3 | | | | |
| | Speed | r/min | 0.000 | | 1200 | 2900 | 700 | | | | | | | |
| | Manifold Abs Press | kPa | 0.000 | | 69 | 66 | Record | | | | | | | |
| | Engine Oil, In | °C | 0.000 | | 68 | 100 | 45 | | | | | | | |
| | Engine Coolant, Out | °C | 0.000 | | 57 | 85 | 45 | | | | | | | |
| | Engine Coolant Flow | L/min | 0.000 | | 48 | Record | Record | | | | | | | |
| | Engine Coolant Pressure | kPa | 0.000 | | 70 | 70 | 70 | | | | | | | |
| | RAC Coolant, In | °C | 0.000 | | 29 | 85 | 29 | | | | | | | |
| | RAC Flow | L/min | 0.000 | | 15 | 15 | 15 | | | | | | | |
| | Intake Air | °C | 0.000 | | 30 | 30 | 30 | | | | | | | |
| | Intake Air Pressure | kPa | 0.000 | | 0.05 | 0.05 | 0.05 | | | | | | | |
| | Intake Air Humidity | g/kg | 0.000 | | 11.4 | 11.4 | 11.4 | | | | | | | |
| | Exhaust Backpressure | kPa | 0.000 | | 104 | 107 | Record | | | | | | | |
| Non-controlled | Parameter | Units | | | Specifications | | | | | | | | | |
| | Fuel Flow | kg/h | | | Record | Record | Record | | | | | | | |
| | Blowby | L/min | | | Record | 60-70 | | | | | | | | |
| | Power | kW | | | Record | Record | 1.3 ± 0.2 | | | | | | | |
| | Exhaust Gas | | | | | | | | | | | | | |
| | Lambda, Left Bank | AFR | | | 1.0 | 1.0 | 0.75 | | | | | | | |
| | Lambda, Right Bank | AFR | | | 1.0 | 1.0 | 0.75 | | | | | | | |

**Sequence VH
Form 8
Analysis of Oil**

| | | | |
|-------------------------|--------|-------------|----------------------|
| Laboratory: | Stand: | Stand Runs: | Total Runs on Stand: |
| Oilcode: | | | |
| Formulation/Stand Code: | | | |

| Test Hours | Ag, ppm | Al, ppm | Cr, ppm | Cu, ppm | Fe, ppm | Pb, Ppm | Si, ppm | Sn, ppm | Fuel Dilution by GC, Wt.% D3525 | Pentane Insolubles, Wt.% D893B ^A | TBN D4739 ^A | Vis. @ 40°C, cSt D445 | Vis. @ 100°C, cSt D445 ^A |
|------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------------|---|------------------------|-----------------------|-------------------------------------|
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^A Analyses not required by Test Method

**Sequence VH
Form 10
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 | |

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

Signature

Date

Typed Name

Title