

**ISB Viscosity
D XXXX - Engine Oil Test**

Report Packet Version No.

Conducted For

| | |
|--|--|
| | V = Valid; The reference oil/non-reference oil was evaluated in accordance with the test procedure. |
| | I = Invalid; The reference oil/non-reference oil was not evaluated in accordance with the test procedure. |
| | 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 criteria. |

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

| Test Number | | | |
|---------------------------------------|----------------|-------------------------|-------------------------|
| Stand: | Stand Run No.: | Engine: | Engine Hours: |
| End Of Test Date: | | End Of Test Time: | |
| Oil Code/Test Key ^A : | | | |
| Formulation/Stand Code ^B : | | | |
| Altcode1 ^C : | | Altcode2 ^C : | Altcode3 ^C : |

| |
|---|
| <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 this report describe the anomalies associated with this test.</p> |
|---|

^A Testkey or Non-Reference Oil Code

^B Registered Tests Only

^C When provided or required

Submitted By: _____
Testing Laboratory

Signature

Typed Name

Title

**ISB Viscosity
D XXXX - Engine Oil Test
Form 2**

Table of Contents

| | | |
|-----|--|---------|
| 1. | Title/Validity Declarations Page | Form 1 |
| 2. | Table of Contents | Form 2 |
| 3. | Summary of Test Method | Form 3 |
| 4. | Test Results Summary | Form 4 |
| 5. | Operational Summary | Form 5 |
| 6. | Oil Analysis Summary | Form 6 |
| 7. | Oil Analysis Summary | Form 7 |
| 8. | Test Fuel Analysis (Last Batch) | Form 8 |
| 9. | Build-up and Hardware Information | Form 9 |
| 10. | Unscheduled Downtime & Maintenance Summary | Form 10 |
| 11. | ACC Conformance Statement | Form 11 |

**ISB Viscosity
D XXXX - Engine Oil Test
Form 3
Summary of Test Method**

The ISB Viscosity Engine Oil Test is a fuel engine-dynamometer test which evaluates diesel engine oils for performance characteristics including viscosity increase and soot concentrations (loading). This test is a single-phase, steady state test (constant speed and load). The test is up to 156 hours and is run with retarded fuel injection timing to produce elevated soot levels in the oil.

The test engine is a Cummins 5.9L diesel engine. It is an in-line six cylinder, four-stroke, turbocharged engine. It has electronically controlled fuel injection with a common rail fuel system.

ISB Viscosity Test Conditions

| Parameter | Value |
|--------------------------------|--------------|
| Time, h | 120-156 |
| Injection Timing, °BTDC | Variable |
| Speed, r/min | 1600 |
| Fuel Flow, kg/h | 25 |
| Intake CO ₂ , % | 0.6 +/- 0.25 |
| Exhaust CO ₂ , % | Record |
| Inlet Manifold Temp., °C | 68 |
| Coolant Out Temp., °C | 66 |
| Fuel In Temp., °C | 40 |
| Oil Gallery Temp., °C | 88 |
| Intake Air Temp., °C | 30 |
| Intake Air Restriction, kPa | 2.0 |
| Inlet Manifold Pressure, kPaA | 215 +/- 15 |
| Exhaust Back Pressure, kPa | 7.0 |
| Crankcase Pressure, kPa | 0.75 minimum |
| Power, kW | Record |
| Torque, Nm | Record |
| Tailpipe Exhaust Temp., °C | Record |
| Oil Sump Temp., °C | Record |
| Inlet Air Dew Point, °C | Record |
| Fuel Pressure, kPa | Record |
| Main Gallery Oil Pressure, kPa | Record |
| Oil Filter Delta P, kPa | Record |

**ISB Viscosity
D XXXX - Engine Oil Test
Form 4
Test Results Summary**

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

| Test Results | | | | |
|-------------------------------------|------------------------------|-------------------------------|-------------------------------|-----------------|
| Date Test Started: | | Start Time: | | |
| SAE Viscosity: | | Test Length: | | |
| TMC Oil Code:⁴ | | Laboratory Oil Code: | | |
| TGA Soot % at 108 h | | | | |
| TGA Soot % at 156 h | | | | |
| Oil Filter Delta P, kPa | | | | |
| EOT TBN | | | | |
| Oil Consumption, g/hr | | | | |
| MRV Yield Stress, Pa | | | | |
| | Soot at 4 cSt (%) | Soot at 12 cSt (%) | Soot at 15 cSt (%) | MRV (cP) |
| Original Result | | | | |
| Transformed Result | | | | |
| Correction Factor | | | | |
| Corrected Transformed Result | | | | |
| Severity Adjustment | | | | |
| Final Transformed Result | | | | |
| Final Original Unit Result | | | | |

| Last Stand Reference Results | | | | |
|---|------------------------------|-------------------------------|-------------------------------|-----------------|
| Test Number: | | | | |
| Oil Code: | | | | |
| Test Length: | | TMC Oil Code: | | |
| EOT Date: | | EOT Time: | | |
| Stand Calibration Expiration Date: | | | | |
| TGA Soot % at 108 h | | | | |
| TGA Soot % at 156 h | | | | |
| Oil Consumption, g/hr | | | | |
| | Soot at 4 cSt (%) | Soot at 12 cSt (%) | Soot at 15 cSt (%) | MRV (cP) |
| Final Original Unit Result | | | | |

⁴ Reference Tests only.

**ISB Viscosity
D XXXX - Engine Oil Test
Form 5
Operational Summary**

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

| | Parameter | Units | QI Threshold | EOT QI ^A | Target | Average | Samples ^B | BQD ^C | Over/Under Range ^D |
|-------------------------|------------------------------|-------|-----------------------------|---------------------|--------------|---------|----------------------|------------------|-------------------------------|
| | Controlled Parameters | Speed | r/min | 0.000 | | 1600 | | | |
| Fuel Flow | | kg/h | 0.000 | | 25 | | | | |
| Inlet Manifold Temp. | | °C | 0.000 | | 68 | | | | |
| Coolant Out Temp. | | °C | 0.000 | | 66 | | | | |
| Fuel In Temp. | | °C | 0.000 | | 40 | | | | |
| Oil Gallery Temp. | | °C | 0.000 | | 88 | | | | |
| Inlet Air Temp. | | °C | 0.000 | | 30 | | | | |
| Inlet Air Restriction | | kPa | 0.000 | | 2.0 | | | | |
| Inlet Man. Pressure | | kPaA | | | 215 +/- 15 | | | | |
| Exh. Back Pressure | | kPa | 0.000 | | 7.0 | | | | |
| Crankcase Pressure | | kPa | | | 0.75 minimum | | | | |
| Intake CO ₂ | | % | | | 0.6+/- 0.25 | | | | |
| Non-controlled | Parameter | Units | Typical Values ^E | | Average | | | | |
| | Power | kW | TBD | | | | | | |
| | Torque | Nm | TBD | | | | | | |
| | Exhaust CO ₂ | % | TBD | | | | | | |
| | Tailpipe Temp. | °C | TBD | | | | | | |
| | Oil Sump Temp. | °C | TBD | | | | | | |
| | Blowby | L/min | TBD | | | | | | |
| | Inlet Air Dew Point | °C | TBD | | | | | | |
| | Fuel Pressure | kPa | TBD | | | | | | |
| Main Gallery Oil Press. | kPa | TBD | | | | | | | |

A QI values above the threshold are acceptable by the Mack Surveillance Panel. QI values below the threshold may not be considered acceptable based on an engineering review. Refer to Annex A3

B Total number of data points taken.

C Number of Bad Quality Data points not used in the calculation of the statistical measures.

D Number of points clipped by over/under range limits.

E Typical values determined from reference oil test database

**ISB Viscosity
D XXXX - Engine Oil Test
Form 6
Oil Analysis Summary**

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

| Hours | Soot (Wt. %) D 5967 Annex 4 | Viscosity at 100°C (cSt) D 5967 Annex A3 | Viscosity Increase (cSt) | TBN D 4739 | TAN D 664 | Peak IR Oxidation |
|-------|--------------------------------------|--|--------------------------------|---------------|--------------|----------------------|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | |
|--|--|---|
| D 6278 or D 7109 30-Pass Shear Viscosity (cSt) at 0 h | D 7109 90-Pass Shear Viscosity (cSt) at 0 h | D 6896 MRV Viscosity (cP) at 108 h⁴ |
| | | |

⁴ The maximum reported value allowed is 400,000 cP. Use this value if the results are TVTM or solid.

**ISB Viscosity
D XXXX - Engine Oil Test
Form 8
Test Fuel Analysis (Last Batch)**

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

| Measurement | Specs. | Analysis | | Test Method |
|--------------------------------------|--------------|----------|-----|------------------------|
| | | NEW | EOT | |
| Total Sulfur, % Weight | 0.04 – 0.05 | | | D 2622 |
| Gravity, °API | 34.5 – 36.5 | | | D 287 or D 4052 |
| Hydrocarbon Composition | | | | |
| Aromatics % Vol. | 28 – 33 | | | D 1319 |
| Olefin | Report | | | D 1319 |
| Cetane Index | Report | | | D 976 & D 4737 |
| Cetane No. | 42 – 48 | | | D 613 |
| Copper Strip Corrosion | 1 Maximum | | | D 130 |
| Flash Point, °C | 54 Minimum | | | D 93 |
| Pour Point, °C | -18 Maximum | | | D 97 |
| Carbon Residue on 10% Residuam, % | 0.35 Maximum | | | D 524 (10% Bottoms) |
| Water & Sediment, % Vol. | 0.05 Maximum | | | D 2709 |
| Viscosity, cSt @ 40°C | 2.4 – 5.0 | | | D 445 |
| Total Acid Number | 0.05 Maximum | | | D 664 |
| Strong Acid Number | 0.00 Maximum | | | D 664 |
| Accelerated Stability | tbd | | | D 2274 |
| Distillation, °C | | | | |
| IBP | Report | | | D 86 |
| 10% | Report | | | D 86 |
| 50% | Report | | | D 86 |
| 90% | 282 – 338 | | | D 86 |
| EP | Report | | | D 86 |

**ISB Viscosity
D XXXX - Engine Oil Test
Form 11
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 |
| |
| |
| |
| |

Signature

Date

Typed Name

Title