**Appendix C**

**Performance Data Set requirements**

**Issue Number 22, 25 October 2021**

*This issue supersedes all previous issues.*

*All new engine lubricant developments initiated after the date of this issue must use this issue.*

**C.1 Introduction**

This Appendix contains checklists and ACEA Performance Data Set forms that may be used to ensure correct documentation of ACEA performance claims.

All lubricant marketers are required to prepare an ACEA Performance Data Set for each formulation making an ACEA performance claim. An example is given in Form C.3. This Data Set is derived from the Candidate Data Package and, if appropriate, the Programme Extension Data, as described in 6.1; the Candidate Data Package and any additional programme extension data contain a complete record of each test development programme conducted under the Code and is required to confirm the performance of an engine lubricant against the relevant ACEA Oil Sequence(s).

**Form C.1** Candidate Data Package checklist for ACEA Oil Sequence conformance

**Form C.2** Programme Extension Data checklist for ACEA Oil Sequence conformance

**Form C.3** ACEA Performance Data Set for ACEA Oil Sequence qualification

**Part A:** Details of lubricant marketer and engine lubricants

**Part B:** Laboratory tests

**Part C**: Engine test results

**Part D:** Qualification conformance

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| **Form C.1 Candidate Data Package checklist for ACEA Oil Sequence conformance** |
| **Conducted by:**  **Additive package designation:**  **Viscosity grades:**  **Lubricant codes:**  **ATC data package reference number (if available):**    **Included in this Data Package Yes No**  **1 Laboratory tests for formulations** 🞎🞎  **listed above**  **2 Formulations for all test lubricants** 🞎🞎  **3 Results of all registered ASTM, JASO and CEC** 🞎🞎  **engine tests**  **4 Test declared ‘out of control’** 🞎🞎  **5 Test(s) declared ‘not available’** 🞎 🞎  **6 Applicable test stand reference data** 🞎🞎  **7 Properties and identity of base stocks used** 🞎🞎  **8 Formulation modifications and read-across** 🞎🞎  **documentation**  **9 Test programme design document** 🞎 🞎 |
| **Signed on behalf of (company):**  **Function:**  **Authorised name:**  **Authorised signature:**  **Date:**  **Company reference document number:** |

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| **Form C.2 Programme Extension Data checklist for ACEA Oil Sequence conformance** |
| **Checklist for engine lubricant development programme** |
| **Lubricant Code(s):**  **Viscosity grade(s) covered by this Data Package:** |
| **Included in this Data package Yes No**   1. **Form C.1 completed** 🞎 🞎   ***For formulations developed in the programme extension***  **2 Formulations for all test lubricants** 🞎🞎  **3 Results of all laboratory tests on the final** 🞎🞎  **candidates**  **4 Results of all registered ASTM, JASO and CEC** 🞎🞎  **engine tests**  **5 Test has been declared ‘out of control’** 🞎🞎  **6 Test(s) declared ‘not available’** 🞎🞎  **7 Applicable test stand reference data** 🞎🞎  **8 Properties and identity of base stocks used** 🞎🞎  **9 Read-across documentation (VGRA, VMI, BOI)** 🞎 🞎 |
| **Signed on behalf of (company):**  **Function:**  **Authorised Name:**  **Authorised Signature:**  **Date:**  **Company reference document number:** |

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| **Form C.3 ACEA performance data set for ACEA Oil Sequence qualification** | |
| **Part A**  **Details of the lubricant marketer and engine lubricants** | |
| **Details of lubricant marketer**  Company:  Address:  Contact Person: Function:  Phone No: Fax No:  Email address: | |
| **Lubricant details**  Brand Name: SAE J300 viscosity grade:  Lubricant Code Number: ACEA performance(1): | |
| **Details of any rebrands**  Brand Name(s): | |
| (1) List each applicable ACEA Oil Sequence category | |
| Company Document Ref. No. |  |

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| **Form C.3 ACEA Performance Data Set for ACEA Oil Sequence**  **qualification** | | | | | |
| **Part B Laboratory tests** | | | | | |
| **Laboratory test** | **Parameter** | **Test method** | **Units** | **Test result** | **Limits** |
| SAE Viscosity | Kinematic viscosity at 100 °C  Low‑temperature cranking viscosity  Low‑temperature pumping viscosity | ASTM D445  ASTM D5293  ASTM D4684 | mm2/s  mPa.s  mPa.s |  |  |
| Shear Stability | Viscosity after 30 cycles measured at 100 °C | CEC L-14-93  Or ASTM D6278  Or ASTM D7109 | mm2/s |  |  |
| Shear Stability | Viscosity after 90 cycles measured at 100 °C | ASTM D7109 | mm2/s |  |  |
| HTHS Viscosity | Viscosity at 150 °C and 106 s-1 shear rate  Viscosity at 100 °C and 106 s-1 shear rate | CEC L-36-A-90 | mPa.s  mPa.s |  | ........  Report |
| Evaporative loss | Weight loss after 1 h at 250 °C | CEC L-40-93  Procedure B | mass % |  |  |
| TBN |  | ASTM D2896  ASTM D4739 | mg KOH/g |  |  |
| Sulphur |  | ASTM D5185  Or ASTM D4951 | mass % |  |  |
| Phosphorus |  | ASTM D5185  Or ASTM D4951 | mass % |  |  |
| Sulphated Ash |  | ASTM D874 | mass % |  |  |
| Chlorine |  | ASTM D6443 | mass % |  |  |
| Oil/Elastomer Compatibility | Max. variation of characteristics after immersion for 7 days in fresh oil without pre-ageing  RE-6  Tensile strength  Elongation at rupture  Volume variation  RE-7  Tensile strength  Elongation at rupture  Volume variation  RE-8  Tensile strength  Elongation at rupture  Volume variation  RE-9  Tensile strength  Elongation at rupture  Volume variation | CEC L-112-16 | %  %  %  %  %  %  %  %  %  %  %  % |  | Report  -70 / +20  Report  -65 / +15  Report  -51 / + 9  Report  -65 / +19 |
| Foaming Tendency | Tendency - stability | ASTM D892  Seq. I (24 °C)  Seq II (94 °C)  Seq. III (24 °C) | mL  mL  mL |  | 10 - nil  .........  10 - nil |
| High Temp  Foaming | Tendency - stability | ASTM D6082  Seq. IV(150 °C) | mL |  | 100 - nil |
| Oil Oxidation with Biodiesel for Engine Oils operating in the presence of Biodiesel Fuel | Oil Oxidation @ 168h  (DIN 51453)  Oil Oxidation @ 216h (EOT)  (DIN 51453)  Viscosity Increase, relative at 168h  (Delta KV100)  Viscosity Increase, relative at 216h  (Delta KV100 at EOT 216h) | CEC L-109-14 | A/cm  A/cm  %  % |  |  |
| Oxidation | Oxidation Induction time (PDSC) | CEC-L-085-99 | min |  |  |
| Low temperature pumpability | MRV  Yield stress  (MRV at SAE J300 temperatures applicable for the fresh oil viscosity grade) | CEC-L-105 | mPas  Pa |  |  |
| Corrosion | Copper increase  Lead increase  Copper strip rating | ASTM D6594 | ppm  ppm  max |  |  |
| Company Document Ref. No. | |  | | | |

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| **Form C.3 ACEA performance data set for ACEA Oil Sequence qualification** | | | | | | |
| **Part C Engine test results – light duty engines** | | | | | | |
| **Engine test** | **Parameter** | **Test method** | **Units** | **Test result** | **Ref. oil result** | **Limits** |
| EP6CDT | Piston Cleanliness  Turbo charger deposits | CEC L-111-16 | merit  merit |  |  |  |
| Sequence IVB | Average intake lifter volume loss (8 position average)  End of test Iron | ASTM D8350 | mm3  ppm |  |  |  |
| Sequence VH | Average engine sludge  Rocker cover sludge  Average piston skirt varnish  Average engine varnish  Compression ring (hot stuck)  Oil screen clogging | ASTM D8256 | merit  merit  merit  merit  % |  |  | ³ 7.6  ³ 7.7  ³ 8.6  ³ 7.6  none  Report |
| M271 EVO | Engine sludge, average | CEC L-107-19 | merit |  |  | ³ 8.3 |
| M111 | Fuel economy improvement vs reference oil RL 191 (SAE 15W-40) | CEC L-54-96 | % |  |  |  |
| JASO FE | Fuel economy improvement | JASO FE M366  (Toyota 2ZR-FXE) | % |  |  | ≥ 0.0 |
| TOYOTA 1KD-FTV | Turbo Charger Compressor Deposit | CEC L-114-19 | merit |  |  | ≥ 25 |
| Sequence IX | Low Speed Pre-Ignition events  Average number for 4 iterations  Number of events per iteration | ASTM D8291 | Number  Number |  |  | ≤ 5  ≤ 8 |
| Sequence X | Chain wear GDI  Elongation of timing chain | ASTM D8279 | % |  |  | ≤ 0.085 |
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| **Form C.3 ACEA performance data set for ACEA Oil Sequence qualification** | | | | | | |
| **Part C Engine test results - light-duty diesel engines** | | | | | | |
| **Engine test** | **Parameter** | **Test method** | **Units** | **Test result** | **Ref. oil result** | **Limits** |
| DV6C | Absolute viscosity increase at  100 °C and 5.5 % soot  Piston merit | CEC L-106-14 | mm2/s  merit |  |  | £ 0.9xRL248  ³ 2.5 |
| VW TDI | Piston cleanliness  Cylinder-spreading limit  No ring sticking, max for any ring | CEC L-117-20 | merit  merit  ASF |  |  | ≥ RL276 – 5  ≤ 13  0 |
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| **Form C.3 ACEA performance data set for ACEA Oil Sequence qualification** | | | | | | |
| **Part C Engine test results - heavy-duty diesel engines** | | | | | | |
| **Engine test** | **Parameter** | **Test method** | **Units** | **Test result** | **Ref. oil result** | **Limits** |
| OM646LA | Cam wear inlet, average  Cam wear outlet, average  Tappet wear inlet, average  Tappet wear outlet, average  Cylinder wear, average  Piston cleanliness  Bore polishing (13 mm) max value  Engine sludge, average | CEC L-099-08 | µm  µm  µm  µm  µm  merit  %  merit |  |  |  |
| Mack T8-E | Relative viscosity at 4.8 % soot  1st test  2 test average  3 test average | ASTM D5967 |  |  |  | £ 2.1  £ 2.2  £ 2.3 |
| Mack T-11 | Min TGA soot @ 4 cSt  Min TGA soot @ 12 cSt  Min TGA soot @ 15 cSt |  | %  %  % |  |  |  |
| OM501LA | Piston cleanliness  Bore polishing  Oil consumption  Engine sludge | CEC L-101-08 | merit  %  kg/test  merit |  |  |  |
| Cummins ISM | Merit  Crosshead, weight loss  1 test/2 test/3 test average  Oil Filter Diff. Press at 150 h  1 test/ 2 test/3 test average  Engine sludge  1 test/2 test/3 test average  Adj. screw weight loss | ASTM D7468 | Merit  mg  kPa  merit  mg |  |  |  |
| Mack T-12 | Merit  Average Liner wear  Average top ring weight loss  End of test lead concentration, mass fraction  Delta lead 250-300 h, mass fraction  Oil consumption phase 1 | ASTM D7422 | µm  mg  ppm  ppm  g/h |  |  |  |
| OM646LA BIO | Piston cleanliness  Ring sticking  Sludge | CEC L-104-16 | merit  ASF  merit |  |  |  |
| Company Document Ref. No. | |  | | | | |

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| **Form C.3 ACEA performance data set for ACEA Oil Sequence**  **qualification** |
| **Part D Qualification conformance** |
| I hereby attest to using and satisfying the guidelines as defined in ATIEL Code of Practice.  Name of Authorised Company Representative:  Function:  Phone no: Email address:  Signature of Authorised Company Representative:  Date:  Company document reference no: |