



European  
Automobile  
Manufacturers  
Association

# ACEA EUROPEAN OIL SEQUENCES FOR LIGHT-DUTY ENGINES

## 2021

**SERVICE FILL ENGINE OILS  
for GASOLINE & LIGHT-DUTY DIESEL ENGINES  
(A/B Categories),  
GASOLINE & LIGHT-DUTY DIESEL ENGINES  
with EXHAUST AFTERTREATMENT DEVICES  
(C Categories)**

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| Date          |        | Update   |
|---------------|--------|--|
| 30 April 2021 | Rev. 0 | Initial Release of ACEA 2021 LIGHT-DUTY ENGINE OIL SEQUENCES |
|               |        |  |

ACEA EUROPEAN OIL SEQUENCES, GENERAL REQUIREMENTS

[https://acea.be/uploads/news\\_documents/2021\\_ACEA\\_oil\\_sequences\\_general\\_requirements.pdf](https://acea.be/uploads/news_documents/2021_ACEA_oil_sequences_general_requirements.pdf) are an integral constituent for compliance with requirements specified in this document.

### VALIDITY OF OLD AND NEW EDITIONS OF ACEA LIGHT-DUTY OIL SEQUENCES

As new sequence editions are published older editions have to be withdrawn. Validities of new and old editions are overlapping for limited periods of time as shown in the following table and the accompanying text below. When a new ACEA Oil Sequence is introduced, oils with claims against the previous issue can be marketed only for another two years.

| Sequence Issue                        | First allowable use            | Mandatory for new claims       | Oils with this claim may be marketed until |
|---------------------------------------|--------------------------------|--------------------------------|--|
| 2004                                  | 1 <sup>st</sup> November 2004  | 1 <sup>st</sup> November 2005  | 31 <sup>st</sup> December 2009             |
| 2007                                  | 1 <sup>st</sup> February 2007  | 1 <sup>st</sup> February 2008  | 23 <sup>rd</sup> December 2010             |
| 2008                                  | 22 <sup>nd</sup> December 2008 | 22 <sup>nd</sup> December 2009 | 22 <sup>nd</sup> December 2012             |
| 2010                                  | 22 <sup>nd</sup> December 2010 | 22 <sup>nd</sup> December 2011 | 22 <sup>nd</sup> December 2014             |
| 2012                                  | 14 <sup>th</sup> December 2012 | 14 <sup>th</sup> December 2013 | 1 <sup>st</sup> December 2018              |
| 2016                                  | 1 <sup>st</sup> December 2016  | 1 <sup>st</sup> December 2017  | 1 <sup>st</sup> May 2023*                  |
| 2021                                  | 1 <sup>st</sup> May 2021*      | 1 <sup>st</sup> May 2022*      |  |
| *) ACEA LIGHT-DUTY OIL SEQUENCES only |                                |                                |  |

- First allowable use means that claims cannot be made against the specification before the date indicated.
- Mandatory for new claims means that from this date onward all claims for new oil formulations must be made according to the latest ACEA Oil Sequences issue. Up to that date new claims can also be made according to the previous ACEA Oil Sequences issue. After the date indicated no new claims according to the previous ACEA Sequence can be made. Then all oil formulations must be developed according to the latest ACEA Oil Sequence release.
- Oils with this claim may be marketed until means that no further marketing of oils with claims to this issue is allowed after the date indicated.

The supplier of any oil claiming ACEA performance requirements is responsible for all aspects of product liability.

Where limits are shown relative to a reference oil, then these must be compared to the last valid reference result on that test stand prior to the candidate and using the same hardware. Further details are in the ATIEL Code of Practice.

Where claims are made that oil performance meets the requirements of the ACEA Oil Sequences (e.g. product literature, packaging, labels) they must specify the ACEA Class and Category (see Nomenclature & ACEA Process for definitions).

«Consumer Language»:

### **A/B: Gasoline and Diesel Engine Oils – “High SAPS”**

- A3/B3** Category withdrawn with these Oil Sequences. Stable, stay-in-grade engine oil intended for use in passenger car and light-duty gasoline & diesel engines and/or for extended oil drain intervals where specified by the engine manufacturer.
- A3/B4** Stable, stay-in-grade engine oil intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines, but also suitable for applications described under A3/B3.
- A5/B5** Stable, stay-in-grade engine oil intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines designed for low viscosity engine oils with HTHS viscosity of 2.9 to 3.5 mPa·s. These engine oils are unsuitable for use in certain engines - consult vehicle-OEM's owner's manual/handbook in case of doubt.
- A7/B7** Stable, stay-in-grade engine oil intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines designed for low viscosity engine oils with HTHS viscosity of 2.9 to 3.5 mPa·s. Relative to A5/B5 these engine oils provide also low speed pre-ignition- and wear protection for turbocharged gasoline DI engines as well as turbocharger compressor deposit (TCCD) protection for modern DI diesel engines. These engine oils are unsuitable for use in certain engines - consult vehicle-OEM's owner's manual/handbook in case of doubt.

### **C: Catalyst & GPF/DPF compatible Engine Oils for Gasoline & Diesel Engines – “Low SAPS”**

*Note: These Oils will increase the DPF/GPF and TWC life and maintain the Vehicle's Fuel Economy.*

**Warning: Some of these Categories may be unsuitable for use in certain Engine Types – consult the vehicle-OEM's owner's manual/handbook in case of doubt.**

- C1** Category is withdrawn with these Oil Sequences.
- C2** Stable, stay-in-grade engine oil with mid-SAPS Level, for aftertreatment system compatibility. Intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines designed for low viscosity engine oils with HTHS viscosity of 2.9 to 3.5 mPa·s.
- C3** Stable, stay-in-grade engine oil with mid-SAPS Level, for aftertreatment system compatibility. Intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines designed for engine oils with HTHS viscosity of minimum 3.5 mPa·s.
- C4** Stable, stay-in-grade engine oil with low-SAPS Level, for aftertreatment system compatibility. Intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines designed for engine oils with HTHS viscosity of minimum 3.5 mPa·s.
- C5** Stable, stay-in-grade engine oil for improved fuel economy, with mid-SAPS Level, for aftertreatment system compatibility. Intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines designed and OEM-approved for engine oils with HTHS viscosity of minimum 2.6 mPa·s.
- C6** Stable, stay-in-grade engine oil for improved fuel economy, with mid-SAPS Level, for aftertreatment system compatibility. Intended for use at extended oil drain intervals in passenger car and light-duty gasoline & DI diesel engines designed and OEM-approved for engine oils with HTHS viscosity of minimum 2.6 mPa·s. Relative to C5 these engine oils provide also low speed pre-ignition- and wear protection for turbocharged gasoline DI engines as well as turbocharger compressor deposit (TCCD) protection for modern DI diesel engines.

SAPS: Sulphated Ash, Phosphorus, Sulphur  
 HTHS: High Temperature High Shear Viscosity  
 DI: Direct Injection  
 DPF: Diesel Particle Filter  
 GPF: Gasoline Particle Filter  
 TWC: Three-Way Catalyst

This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members.  
Individual member companies may indicate performance parameters other than those covered by the tests shown or more stringent limits.

| REQUIREMENT  | TEST METHOD   | PROPERTIES  | UNIT               | LIMITS   |               |               |              |
|--|---|---|--------------------|--|---------------|---------------|--------------|
|  |   |   |                    | A3/B4-21   | A5/B5-21      | A7/B7-21      |              |
| <b>1. Laboratory tests</b>   |   |   |                    |  |               |               |              |
| <b>1.1 Viscosity Grades</b>  |   | Viscosity Class according to SAE J300 - Latest active issue                                   |                    | No restriction except as defined by HTHS and Shear Stability requirements. Manufacturers may indicate specific Viscosity requirements related to |               |               |              |
| <b>1.2 Shear Stability</b>   | CEC L-14-93<br>or<br>ASTM D6278<br>or<br>ASTM D7109 | 100 °C Viscosity after 30 cycles  | mm <sup>2</sup> /s | All grades to be "stay in grade"   |               |               |              |
| <b>1.3 HTHS Viscosity</b>  | CEC L-36-90   | Dynamic Viscosity at 150 °C and Shear Rate of 10 <sup>6</sup> s <sup>-1</sup>                 | mPa·s              | ≥ 3.5  | ≥ 2.9 & ≤ 3.5 | ≥ 2.9 & ≤ 3.5 |              |
|  | CEC L-36-90   | Dynamic Viscosity at 100 °C and Shear Rate of 10 <sup>6</sup> s <sup>-1</sup>                 | mPa·s              | --   | Report        |               |              |
| <b>1.4 Evaporative Loss</b>  | CEC L-40-93 (Noack)                                 | Max. Weight Loss after 1 h at 250 °C  | %                  | ≤ 13   |               |               |              |
| <b>1.5 TBN</b>   | ASTM D2896  |   | mgKOH/g            | ≥ 10.0   | ≥ 8.0         | Report        |              |
|  | ASTM D4739  |   | mgKOH/g            | Report   |               | ≥ 6.0         |              |
| <b>1.6 Sulphur</b>   | ASTM D5185 or<br>ASTM D4951                         |   | % m/m              | Report   |               |               |              |
| <b>1.7 Phosphorus</b>  | ASTM D5185 or<br>ASTM D4951                         |   | % m/m              | Report   |               |               |              |
| <b>1.8* Sulphated Ash</b>  | ASTM D874   |   | % m/m              | ≥ 1.0 and ≤ 1.6  | ≤ 1.6         | ≤ 1.6         |              |
| <b>1.9 Chlorine</b>  | ASTM D6443  |   | ppm                | Report   |               |               |              |
| <b>1.10 Oil – Elastomer Compatibility</b>  | CEC L-112-16  | Max. Variation of Characteristics after immersion for 7 days in Fresh Oil without Pre-Ageing: | Elastomer          | RE6  | RE7           | RE8           | RE9          |
|  |   | - Tensile Strength  | %                  | Report   | Report        | Report        | Report       |
|  |   | - Elongation at Rupture   | %                  | -70 / +20  | -65 / +15     | -51 / +9      | -65 / +19    |
|  |   | - Volume Variation  | %                  | -1.5 / +1.8  | -1.8 / +7.7   | 0.0 / +10.7   | -1.5 / +13.8 |
| <b>1.11 Foaming Tendency</b>   | ASTM D892<br>with or without Option A               | Tendency - stability  | ml                 | Sequence I (24 °C) 10 – nil<br>Sequence II (94 °C) 50 – nil<br>Sequence III (24 °C) 10 – nil   |               |               |              |
| <b>1.12 High Temperature Foaming Tendency</b>  | ASTM D6082  | Tendency - stability  | ml                 | Sequence IV (150 °C) 100 – nil   |               |               |              |
| <b>1.13 Low-Temperature Pumpability</b>  | CEC L-105-12  | MRV   | mPa·s              | According to SAE J300 for Fresh Oil  |               |               |              |
|  |   | Yield stress (MRV at SAE J300 Temperatures, applicable for the Fresh Oil Viscosity Grade)     | Pa                 |  |               |               |              |
| <b>1.14 Oil Oxidation with Biodiesel for Engine Oils operating in the presence of Biodiesel Fuel</b> | CEC L-109-14  | Oil Oxidation at 168 h (DIN 51453)  | A/cm               | ≤ 120  | ≤ 100         | ≤ 100         |              |
|  |   | Oil Oxidation at 216 h (DIN 51453)  | A/cm               | Report   | ≤ 120         | ≤ 120         |              |
|  |   | Viscosity Increase, relative at 168 h (Delta KV100)   | %                  | ≤ 150  | ≤ 60          | ≤ 60          |              |
|  |   | Viscosity Increase, relative at 216 h (Delta KV100)   | %                  | Report   | ≤ 150         | ≤ 150         |              |

This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members.  
Individual member companies may indicate performance parameters other than those covered by the tests shown or more stringent limits.

| REQUIREMENT  | TEST METHOD                              | PROPERTIES  | UNIT                                      | LIMITS        |          |          |
|--|--|---|---|---------------|----------|----------|
|  |  |   |   | A3/B4-21      | A5/B5-21 | A7/B7-21 |
| <b>2. ENGINE TESTS</b>                                       |  |   |   |               |          |          |
| <b>2.1* Gasoline DI Engine Cleanliness Test</b>              | CEC L-111-16 (EP6CDT)                    | Piston Cleanliness  | Merit                                     | ≥ RL259       |          |          |
|  |  | Turbo Charger Deposits **, average value of zones C, D, E & F | Merit                                     | ≥ 6.0         |          |          |
| <b>2.2* Low Temperature Sludge</b>                           | ASTM D8256 (Sequence VH, Ford)           | Average Engine Sludge   | Merit                                     | ≥ 7.6         |          |          |
|  |  | Rocker Cover Sludge   | Merit                                     | ≥ 7.7         |          |          |
|  |  | Average Engine Varnish  | Merit                                     | ≥ 8.6         |          |          |
|  |  | Average Piston Skirt Varnish                                  | Merit                                     | ≥ 7.6         |          |          |
|  |  | Compression Ring (hot stuck)                                  |   | none          |          |          |
|  |  | Oil Screen Clogging   | %   | report        |          |          |
| <b>2.3* Valvetrain Wear</b>                                  | ASTM D8350 (Sequence IVB, Toyota 2NR-FE) | Average Intake Lifter Volume Loss (8 position average)        | mm <sup>3</sup>                           | ≤ 3.3         | ≤ 3.3    | ≤ 2.7    |
|  |  | End of Test Iron  | ppm                                       | ≤ 400         | ≤ 400    | ≤ 400    |
| <b>2.4* Black Sludge</b>                                     | CEC L-107-19 (M271 EVO)                  | Engine Sludge, average  | Merit                                     | ≥ 8.3         |          |          |
| <b>2.5 Fuel Economy</b>                                      | CEC L-54-96 (M111)                       | Fuel Economy Improvement                                      | %   | -----         | ≥ 2.5    | ≥ 2.5    |
| <b>2.6* DI Diesel Oil Dispersion at Medium Temperature</b>   | CEC L-106-14 (DV6C)                      | Absolute Viscosity Increase at 100 °C and 5.5 % Soot          | mm <sup>2</sup> /s                        | ≤ 0.9 x RL248 |          |          |
|  |  | Piston Cleanliness **   | Merit                                     | ≥ 2.5         |          |          |
| <b>2.7* DI Diesel Piston Cleanliness &amp; Ring Sticking</b> | CEC L-117-20 (VW TDI)                    | Piston Cleanliness  | Merit                                     | ≥ RL276 - 5   |          |          |
|  |  | Cylinder-spreading limit**                                    | Merit                                     | ≤ 13          |          |          |
|  |  | No Ring Sticking, max for any ring**                          | ASF                                       | 0             |          |          |
| <b>2.8 Turbocharger Compressor Deposit (Diesel)</b>          | CEC L-114-19 (Toyoya 1KD-FTV)            | Turbocharger rating   | Merit                                     | -----         | ≥ 25     |          |
| <b>2.9 Low Speed Pre-Ignition GDI Turbo</b>                  | ASTM D8291 (Sequence IX, Ford)           | Pre-Ignition events   | Average number of events for 4 iterations | -----         | ≤ 5      |          |
|  |  |   | Number of events per iteration            | -----         | ≤ 8      |          |
| <b>2.10 Chain Wear GDI</b>                                   | ASTM D8279 (Sequence X, Ford)            | Elongation of Timing Chain                                    | %   | -----         | ≤ 0.085  |          |

\*\*/: Footnotes see last page

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Individual member companies may indicate performance parameters other than those covered by the tests shown or more stringent limits.

| REQUIREMENT  | TEST METHOD                                   | PROPERTIES  | UNIT               | LIMITS   |             |               |                 |              |
|--|---|---|--------------------|--|-------------|---------------|-----------------|--------------|
|  |   |   |                    | C2-21  | C3-21       | C4-21         | C5-21           | C6-21        |
| <b>1. Laboratory tests</b>   |   |   |                    |  |             |               |                 |              |
| <b>1.1 Viscosity Grades</b>  |   | Viscosity Class according to SAE J300 - Latest active issue                                   |                    | No restriction except as defined by HTHS and Shear Stability requirements. Manufacturers may indicate specific Viscosity requirements related to |             |               |                 |              |
| <b>1.2* Shear Stability</b>  | CEC L-14-93<br>or ASTM D6278<br>or ASTM D7109 | 100 °C Viscosity after 30 cycles  | mm <sup>2</sup> /s | All grades to be "stay in grade"   |             |               |                 |              |
| <b>1.3. HTHS Viscosity</b>   | CEC L-36-90                                   | Dynamic Viscosity at 150 °C and Shear Rate of 10 <sup>6</sup> s <sup>-1</sup>                 | mPa·s              | ≥ 2.9  | ≥ 3.5       | ≥ 2.6 & < 2.9 |                 |              |
|  | CEC L-36-90                                   | Dynamic Viscosity at 100 °C and Shear Rate of 10 <sup>6</sup> s <sup>-1</sup>                 | mPa·s              | Report   |             |               |                 |              |
| <b>1.4 Evaporative loss</b>  | CEC L-40-93 (Noack)                           | Max. weight loss after 1 h at 250 °C  | %                  | ≤ 13   |             | ≤ 11          | ≤ 13            |              |
| <b>1.5 TBN</b>   | ASTM D2896                                    |   | mgKOH/g            | -----  | ≥ 6.0       |               |                 | Report       |
|  | ASTM D4739                                    |   | mgKOH/g            | Report   |             |               |                 | ≥ 4.0        |
| <b>1.6* Sulphur</b>  | ASTM D5185 or<br>ASTM D4951                   |   | % m/m              | ≤ 0.3  |             | ≤ 0.2         | ≤ 0.3           |              |
| <b>1.7* Phosphorus</b>   | ASTM D5185 or<br>ASTM D4951                   |   | % m/m              | ≥ 0.07 / ≤ 0.09  |             | ≤ 0.09        | ≥ 0.07 / ≤ 0.09 |              |
| <b>1.8* Sulphated Ash</b>  | ASTM D874                                     |   | % m/m              | ≤ 0.8  |             | ≤ 0.5         | ≤ 0.8           |              |
| <b>1.9 Chlorine</b>  | ASTM D6443                                    |   | ppm                | Report   |             |               |                 |              |
| <b>1.10 Oil – Elastomer Compatibility</b>  |   | Max. Variation of Characteristics after immersion for 7 days in fresh oil without pre-ageing: | Elastomer          | RE6  | RE7         |               | RE8             | RE9          |
|  |   | - Tensile Strength  | %                  | Report   | Report      |               | Report          | Report       |
|  |   | - Elongation at Rupture   | %                  | -70 / +20  | -65 / +15   |               | -51 / +9        | -65 / +19    |
|  |   | - Volume Variation  | %                  | -1.5 / +1.8  | -1.8 / +7.7 |               | 0.0 / +10.7     | -1.5 / +13.8 |
| <b>1.11 Foaming Tendency</b>   | ASTM D892<br>with or without Option A         | Tendency - stability  | ml                 | Sequence I (24 °C) 10 – nil<br>Sequence II (94 °C) 50 – nil<br>Sequence III (24 °C) 10 – nil   |             |               |                 |              |
| <b>1.12 High Temperature Foaming Tendency</b>  | ASTM D6082                                    | Tendency - stability  | ml                 | Sequence IV (150 °C) 100 – nil   |             |               |                 |              |
| <b>1.13 Low Temperature Pumpability</b>  | CEC L-105-12                                  | MRV   | mPa·s              | According to SAE J300 for Fresh Oil  |             |               |                 |              |
|  |   | Yield stress (MRV at SAE J300 Temperatures, applicable for the Fresh Oil Viscosity Grade)     | Pa                 |  |             |               |                 |              |
| <b>1.14 Oil Oxidation with Biodiesel for Engine Oils operating in the presence of Biodiesel Fuel</b> | CEC L-109-14                                  | Oil Oxidation at 168 h (DIN 51453)  | A/cm               | ≤ 100  | ≤ 100       | ≤ 100         | ≤ 100           | ≤ 100        |
|  |   | Oil Oxidation at 216 h (DIN 51453)  | A/cm               | ≤ 120  | ≤ 120       | ≤ 120         | ≤ 120           | ≤ 120        |
|  |   | Viscosity Increase, relative at 168 h (Delta KV100)   | %                  | ≤ 60   | ≤ 60        | ≤ 60          | ≤ 60            | ≤ 60         |
|  |   | Viscosity Increase, relative at 216 h (Delta KV100)   | %                  | ≤ 150  | ≤ 150       | ≤ 150         | ≤ 150           | ≤ 150        |

This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members.  
Individual member companies may indicate performance parameters other than those covered by the tests shown or more stringent limits.

| REQUIREMENT  | TEST METHOD                              | PROPERTIES  | UNIT                                      | LIMITS        |  |       |         |       |
|--|--|---|---|---------------|--|-------|---------|-------|
|  |  |   |   | C2-21         | C3-21                                      | C4-21 | C5-21   | C6-21 |
| <b>2. ENGINE TESTS</b>                                       |  |   |   |               |  |       |         |       |
| <b>2.1* Gasoline DI Engine Cleanliness</b>                   | CEC L-111-16 (EP6CDT)                    | Piston Cleanliness  | Merit                                     | ≥ RL259       |  |       |         |       |
|  |  | Turbo Charger Deposits **, average value of zones C, D, E & F | Merit                                     | ≥ 6.0         |  |       |         |       |
| <b>2.2* Low Temperature Sludge</b>                           | ASTM D8256 (Sequence VH)                 | Average Engine Sludge   | Merit                                     | ≥ 7.6         |  |       |         |       |
|  |  | Rocker Cover Sludge   | Merit                                     | ≥ 7.7         |  |       |         |       |
|  |  | Average Engine Varnish  | Merit                                     | ≥ 8.6         |  |       |         |       |
|  |  | Average Piston Skirt Varnish                                  | Merit                                     | ≥ 7.6         |  |       |         |       |
|  |  | Compression Ring (hot stuck)                                  |   | None          |  |       |         |       |
|  |  | Oil Screen Clogging   | %   | Report        |  |       |         |       |
| <b>2.3* Valvetrain Wear</b>                                  | ASTM D8350 (Sequence IVB, Toyota 2NR-FE) | Average Intake Lifter Volume Loss (8 position average)        | mm <sup>3</sup>                           | ≤ 3.3         |  |       | ≤ 2.7   |       |
|  |  | End of Test Iron  | ppm                                       | ≤ 400         |  |       | ≤ 400   |       |
| <b>2.4* Black Sludge</b>                                     | CEC L-107-19 (M271 EVO)                  | Engine Sludge, average  | Merit                                     | ≥ 8.3         |  |       |         |       |
| <b>2.5 Fuel Economy</b>                                      | CEC L-54-96 (M111)                       | Fuel Economy Improvement                                      | %   | ≥ 2.5         | ≥ 1.0 (for xW-30 only, no limit for xW-40) |       | ≥ 3.0   | ----- |
|  | JASO FE M366 (Toyota 2ZR-FXE)            | Fuel Economy Improvement                                      | %   | -----         |  |       |         | ≥ 0.0 |
| <b>2.6* DI Diesel Oil Dispersion at Medium Temperature</b>   | CEC L-106-14 (DV6C)                      | Absolute Viscosity Increase at 100 °C and 5.5% Soot           | mm <sup>2</sup> /s                        | ≤ 0.9 x RL248 |  |       |         |       |
|  |  | Piston Cleanliness **   | Merit                                     | ≥ 2.5         |  |       |         |       |
| <b>2.7* DI Diesel piston Cleanliness &amp; Ring Sticking</b> | CEC L-117-20 (VW TDI)                    | Piston Cleanliness  | Merit                                     | ≥ RL276 - 5   |  |       |         |       |
|  |  | Cylinder-spreading limit**                                    | Merit                                     | ≤ 13          |  |       |         |       |
|  |  | No Ring Sticking, max for any ring**                          | ASF                                       | 0             |  |       |         |       |
| <b>2.8 Turbocharger Compressor Deposit (Diesel)</b>          | CEC L-114-19 (Toyota 1KD-FTV)            | Turbocharger rating   | Merit                                     | -----         |  |       | ≥ 25    |       |
| <b>2.9 Low Speed Pre-Ignition GDI Turbo</b>                  | ASTM D8291 (Sequence IX, Ford)           | Pre-Ignition events   | Average number of events for 4 iterations | -----         |  |       | ≤ 5     |       |
|  |  |   | Number of events per iteration            |               | -----                                      |       |         | ≤ 8   |
| <b>2.10 Chain Wear GDI</b>                                   | ASTM D8279 (Sequence X, Ford)            | Elongation of Timing Chain                                    | %   | -----         |  |       | ≤ 0.085 |       |

\*/\*\*: Footnotes referring to the following Requirements in the A-/B- and C-Classes:

- Footnotes**
- No. 1.6, 1.7, 1.8      Maximum limits, Values take into account method and production tolerances
- No. 2.1, 2.6, 2.7      \*\* Parameter is not an official CEC Parameter
- No. 2.1      The CEC L-111-16 (EP6) lifetime is limited. If the test becomes unavailable during the lifetime of these ACEA Engine Oil Sequences, ACEA intends to introduce a successor test on PSA hardware at a similar severity level.
- No. 2.2      Alternatively, Sequence VG (ASTM D6593) results meeting ACEA 2016 requirements can be used in place of Sequence VH for all categories. The Sequence VG limits for ACEA 2016 are: Average engine sludge, merits: ≥7.8; Average rocker cover sludge, merits: ≥8.0; Average engine varnish, merits: ≥8.9; Average piston skirt varnish, merits: ≥7.5; Hot-stuck compression rings: None; Oil screen clogging, % area: ≤ 20.
- No. 2.3      Alternatively, Sequence IVA (ASTM D6891) data can be used for A3/B4, A5/B5, C2, C3, C4 and C5 categories at the following limit: Cam wear average: max 90 microns.
- No. 2.4:      Alternatively to the CEC L-107-19, results of the Daimler M271 Sludge test as described by Daimler AG can be used for A3/B4, A5/B5 and C2, C3, C4, C5. For this test, reference oil changed from RL140 to RL261. Results relative to RL140 or RL261 can be used to demonstrate ACEA performance. The applicable limit with RL261 is ≥ RL261 + 1σ. The applicable limit with RL140 is ≥ RL140 + 4σ. Test results obtained by the Daimler M271 test procedure will be accepted only under the condition that they come from test rigs being referenced and quality controlled by Daimler AG.
- No. 2.6      The CEC L-106-16 (DV6C) lifetime is limited. If the test becomes unavailable during the lifetime of these ACEA Engine Oil Sequences, ACEA intends to introduce a successor test on PSA hardware at a similar severity level.
- No. 2.7      Alternatively, CEC L-78-99 (TDI2) results can be used as specified in the table below.

| CEC L-78-99 limits applicable for: |         | A3/B4   | A5/B5, A7/B7 | C2      | C3, C4, C5, C6 |
|------------------------------------|---------|---------|--------------|---------|----------------|
| Piston Cleanliness                 | Merit   | ≥ RL206 | ≥ RL206      | ≥ RL206 | ≥ RL206        |
| Ring Sticking (Rings 1 & 2)        |         |         |              |         |                |
| Average of all 8 rings             | ASF     | ≤ 1.0   | ≤ 1.0        | ≤ 1.2   | ≤ 1.0          |
| Max. for any 1st ring              | ASF     | ≤ 1.0   | ≤ 1.0        | ≤ 2.5   | ≤ 1.0          |
| Max for any 2nd ring               | ASF     | 0.0     | 0.0          | 0.0     | 0.0            |
| EoT TBN (ISO 3771) **              | mgKOH/g | ≥ 6.0   | ≥ 4.0        | Report  | Report         |
| EoT TAN (ASTM D664) **             | mgKOH/g | Report  | Report       | Report  | Report         |