European PCMO Specification

Meeting The Challenging Requirements

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Topics

- Industry Drivers
- PCMO Specification Update
  - ACEA 2008
  - OEMs
    - Daimler
    - VW
    - BMW
    - Ford
    - GM
    - Renault
    - PSA Peugeot Citroen
    - Porsche

- Summary
EMEA Lubes Business Drivers - Challenges and Opportunities

- **Environment**
  - Emission legislation driving new hardware designs
  - Increased used of alternative fuels

- **Cost of ownership**
  - Cost-sensitivity through the entire value chain

- **Globalization**
  - Standardization of requirements on a world-wide basis
  - Minimum standards set at a higher quality level

- **Shortage of natural resources**
  - Increased cost pressures
  - Trend towards enhanced conservation and re-use

- **Tougher HSE regulations**
  - Higher product registration costs
  - Driving product simplification and reformulation

- **Opportunities for advantaged fluids**
  - Enabling new OEM equipment designs
  - Protecting the environment
  - Providing measurable benefits to manufacturers and end users
  - Offering enhanced equipment protection on a global basis
  - Delivering a value proposition targeted to specific needs
EMEA Lubes Business Drivers – Infineum Response

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Biofuels
Fuel Economy
REACH
Technology Investments & New Product Developments
New ACEA & OEM Requirements
Euro 2009 Crankcase Lubricants Market Update

-European Crankcase Lubes Industry driven by OEM and ACEA Specifications-

-Key changes in 2008-

- ACEA upgrading specifications for engines meeting the Euro V emissions standards (new OM501LA & OM646LA tests)
- ACEA acknowledge globalization in HDD (API CJ-4)
- Daimler introducing re-approval process / upgraded specs for 2009
- VW increasing specification severity (already require re-approval)
- Recent new specifications from GM/Opel, Renault, Ford and PSA

-Significant increase in lubricant quality for ACEA and OEM approved products-

- bigger impact on PCMO than HDD
- ACEA PCMO specs generally more complex
Euro 2008 – ACEA 2008 Sequences

- ACEA 2008 sequences issued December 2008

- Timetable for Product Claims

<table>
<thead>
<tr>
<th>Dec 2008</th>
<th>ACEA 2008 specifications released. First allowable use for products meeting these latest requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 2009</td>
<td>ACEA claims for new formulations must be made against the ACEA 2008 specification. Claims on older formulations can still be made against the previous ACEA specification.</td>
</tr>
<tr>
<td>Dec 2010</td>
<td>ACEA claims for all formulations must be made against the ACEA 2008 specification. Previous ACEA specifications withdrawn.</td>
</tr>
</tbody>
</table>

- Effectively this gives a 2 year window for products to rollover to ACEA 08 – no major customer pressure to date for new product introductions
OEM Reasons behind ACEA’08 - PCMO

- No ‘Needs’ Statement from OEMs to support ACEA’08. Broad issue addressed
  - Alignment to OEM specifications
  - Continued protection of emission systems where required
    - C1-C4 chemical limits
  - Help manage variable fuel quality
    - OM646LA uses B5 fuel
    - Increase in sludge protection, better diesel deposit protection, minimum TBN requirements (fresh and at EOT in VW TDi)
  - Update specifications to replace older engine tests with newer designs and drive overall quality level upwards
    - OM646LA replaces OM602A
    - VW ICTD test becomes obsolete – use VW TDi which is more severe
### Industry Specification Update - ACEA 2008 A/B

<table>
<thead>
<tr>
<th>Category</th>
<th>Hardware</th>
<th>Changes</th>
</tr>
</thead>
</table>
| ACEA A1/B1 | Petrol and light duty diesel, low friction, low viscosity | - OM646LA replaces OM602A at ‘equivalent severity’ (can use OM602A data)  
- VWTDi replaces VWICT (TBN >= 4 at EOT)  
- TBN >= 8.0  
- XW30 grades >= 9.3cSt shear stability |
| ACEA A3/B3 | Petrol and light duty diesel                  | - OM646LA replaces OM602A at ‘equivalent severity’  
- Increase in M111SL severity  
- VWTDi replaces VWICT (TBN >= 4 at EOT)  
- TBN >= 8.0 |
| ACEA A3/B4 | As A3/B3 + DI Diesel                          | - OM646LA replaces OM602A at ‘equivalent severity’  
- Increase in M111SL severity  
- Increase in VW TDi severity (merit and r/stick, TBN >= 4 at EOT)  
- TBN >= 8.0 |
| ACEA A5/B5 | High performance petrol and light duty diesel, low friction, low viscosity | - OM646LA replaces OM602A at ‘equivalent severity’  
- Increase in M111SL severity  
- Increase in VW TDi severity (r/stick, TBN >= 4 at EOT)  
- TBN >= 8.0 |
## Industry Specification Update - ACEA 2008 C

<table>
<thead>
<tr>
<th>Category</th>
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| ACEA C1  | High performance petrol and light duty diesel, low friction, low viscosity with DPF and TWC compatibility (low SAPS) | - OM646LA replaces OM602A at ‘equivalent severity’ (can use OM602A data)  
- Increase in VWTDi severity (r/stick)  
- Increase in M111SL severity  
- Increase in M111FE severity (2.5% to 3%) |
| ACEA C2  | High performance petrol and light duty diesel, low friction, low viscosity with DPF and TWC compatibility (mid SAPS) | - OM646LA replaces OM602A at ‘equivalent severity’ (no cam inlet wear requirement)  
- Increase in M111SL severity |
| ACEA C3  | High performance petrol and light duty diesel, with DPF and TWC compatibility (mid SAPS) | - OM646LA replaces OM602A at ‘equivalent severity’  
- Increase in VWTDi severity (r/stick)  
- Increase in M111SL severity |
| ACEA C4  | High performance petrol and light duty diesel, with DPF and TWC compatibility (low SAPS) | - OM646LA replaces OM602A at ‘equivalent severity’  
- Increase in VWTDi severity (r/stick) |
OEM Needs and Specification Update – Daimler

- Evolutionary updates to Daimler 229.X passenger car specifications released in March 2009 ➔ updated after ACEA 08
  - Approvals against MB V2007.1 (current) spec will only be possible until March 2010
  - OM611/OM602A dropped and replaced by OM646 (B5 fuel)
  - VW TDI limits in MB 229.1 now relaxed and aligned with ACEA A3/B3-08
  - Minimum Phosphorus now 0.05% for 229.3/31, 229.5/51
  - New Oxidation and SRV tests and four new FE tests (as requested for RACE 2010 FF) included but no limits (rate & report)
  - Ash limits more clearly defined ➔ neither P.229.3 and 229.31 nor P.229.5 and 229.51 can be claimed on the same branded oil
OEM Needs and Specification Update – Daimler

- New Daimler Factory Fill specifications in PCMO (RACE 2010)
  - Very expensive development – aimed at future engine requirements (EuroVI)
  - Additional in-house testing above service fill specification requirements

- Daimler approvals limited to 5 years maximum
  - need to re-qualify against the latest or second latest spec when trying to extend approval
  - run-time of re-brands/re-blends is limited to the same as the run-time of original approval - limited to 5 yrs max unless original approval re-qualified against latest/second latest spec
OEM Needs and Specification Update – VW

2008 changes

- Effective Jan 1st 2008 VW 505 00 service fill approvals will only be granted to products meeting VW 505 00 and all the requirements of either VW 501 01 or VW 502 00

- VW 505 00 updated to include AEM (VAMAC) and ACM (Silicon) elastomer material similar to VW 501 01 and VW 502 00 plus C&T test at 1700 N (C&T test unavailable for most of 2008, now tests are available again).

- No new VW 503 01 approvals / existing approvals expiring on April 1st, 2009. VW 504 00 should be used instead.
OEM Needs and Specification Update – VW

- No major changes to specs in medium term, but biofuel issues could change this
  - VW 504 00/507 00 primary recommendation for long drain oils in Euro IV/V engines for Europe and North America. VW 502 00/505 01 quality OK for standard drain if no DPF used. VW 502 00/505 00 primary recommendation for AP and LA.
  - Unclear if increased fuel dilution due to BXX fuels will result in the need for improved wear performance in diesel engines.
  - Re-approvals under 5 year rule continue to be significant cost for Lube developers

- VW 505 00 being revised. Likely changes are:
  - Adoption of ACEA 2008 limits – limited formulation changes if adding VW specs
  - VW ICTD to be replaced by the VW TDI in VW 505 00 with piston cleanliness limit at max ACEA B3-08 level, better ring stick and 4 TBN min. at EOT
OEM Needs and Specification Update – BMW

Most, if not all, Euro V/VI gasoline engines will switch to direct injection (DI)

- Partly running lean and equipped with DeNOx Storage Catalysts (DSC), partly equipped with turbochargers, depending on region and fuel quality

No performance test nor any other changes expected for LL-01, LL-01FE and LL-04 specifications in 2009

- Short to medium term BMW prefer to kept LL-01 quality for gasoline engines outside Europe
- Only potential change: TBN minimum of 9.0 for LL-01, but no min P limit
- New spec released for cost optimised LL-01FE first fill oils: now all Grp III instead Grp III/IV

Euro V/VI diesel engines covered sufficiently by ACEA C3/LL-04 at the moment
OEM Needs and Specification Update – Ford

🔗 Ford 913B

- Now primary recommendation for Service Fill but will be required outside Europe
- 5W30, low HTHSV (>2.9cP), ACEA A1/B1 base + GF3 + additional Ford requirements
- Current approvals for Ford 913B expected to remain in place but would lose A1/B1 claims in Dec’10. New approvals need to meet A1/B1 08 requirements (TDi/DV4).

🔗 Ford 913C

- New spec released, replacing 913B as primary recommendation for Europe only
- 5W30, low HTHSV (>2.9cP), A5/B5 08 base + fuel economy (3% M111FE) + Ford wear test
  - Increased performance versus 913B (OM646LA, TDi, M111SL)
  - Ford in-house wear test not yet fully defined
OEM Needs and Specification Update – Ford

- **Ford 925B**
  - Upgrade of 925A – limited application in DI Turbo engines for extended drain
    - 5W20, ACEA A5/B5-08, except 2.6-2.9cP HTHSV, 8.5 min. TBN
    - M111FE avg.3.3%, VIB @GF4 (Factory Fill only), Ford in-house wear test

- **Ford 934A**
  - Conceived for Euro V vehicles with DPFs but not currently used – Ford believe full SAPS products are OK for DPF compatibility – future unclear
  - 5W30, low SAPS, low HTHSV (>2.9cP), ACEA C1 base + additional Ford requirements
  - Future of the specification is unclear
Current specifications

- Will be phased out, timing not yet defined although GM-LL-B-025 approvals still possible
- Even on markets with high Sulphur-Fuel Dexos B – at reduced ODI – is intended to replace GM-LL-B-025

<table>
<thead>
<tr>
<th></th>
<th>Service Fill</th>
<th>Factory Fill</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>Gasoline</td>
<td>GM 6094M</td>
<td>GF-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GM 4718M</td>
<td>GF-4 High Performance</td>
</tr>
<tr>
<td></td>
<td>Gasoline</td>
<td>GM 9986231</td>
<td>GF-4</td>
</tr>
<tr>
<td></td>
<td>Gasoline</td>
<td>GM 9986232</td>
<td>GF-4 High Performance</td>
</tr>
<tr>
<td>Diesel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gasoline</td>
<td>B 040 1095</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diesel</td>
<td>GM-LL-B-025</td>
<td>high HTHS, ACEA A3/B4, Opel Diesel</td>
</tr>
<tr>
<td></td>
<td>Diesel</td>
<td>B 040 1089</td>
<td></td>
</tr>
</tbody>
</table>
OEM Needs and Specification Update – GM/Opel

- New Dexos A and Dexos B specifications released
  - Global Engine Oil Specification GEOS A and GEOS B first issued in 2007, updated 1Q’09 as Dexos A/B

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<thead>
<tr>
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<th>Service Fill</th>
<th>Factory Fill</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>GEO A</td>
<td>GEO A</td>
<td>GF-4 High Performance + ACEA C3 Gasoline + Opel Gasoline; low HTHS</td>
</tr>
<tr>
<td></td>
<td>GEO B</td>
<td>GEO B</td>
<td>GF-4 High Performance + ACEA C3 Diesel + Opel Diesel &amp; Gasoline; high HTHS, mid SAPS</td>
</tr>
<tr>
<td>Europe</td>
<td>GEO B</td>
<td>GEO A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GEO B</td>
<td>GEO B</td>
<td></td>
</tr>
</tbody>
</table>

- Impact of GF5 on Dexos A?
- Dexos B Factory Fill tender now out for supply 3/4Q’09, Service Fill approvals will follow
- Factory Fill has limited vis grades and requires corrosion inhibitor
## OEM Needs and Specification Update – Renault

<table>
<thead>
<tr>
<th></th>
<th>Gasoline</th>
<th>Turbocharger gasoline + diesel without DPF</th>
<th>Diesel with DPF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Original Requirements</strong></td>
<td>ACEA A3/B4 or A5/B5</td>
<td>Diesel : ACEA A3/B4 0-5-10W40</td>
<td>ACEA C3</td>
</tr>
<tr>
<td></td>
<td>0-5W30 0-5W40 10W40</td>
<td>Gasoline : ACEA A3/B4 &amp; A5/B5</td>
<td>0-5W30</td>
</tr>
<tr>
<td><strong>Norme « RN0700 »</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grades: 0 - 5W40</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ACEA A3/B4-08 + lab test</td>
<td></td>
</tr>
<tr>
<td><strong>New Requirements</strong></td>
<td>Grades: 0-5W30 0-5W40 10W40</td>
<td>Grades: 0-5W30 / 0-5W40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ACEA A3/B4 or A5/B5 (-08)</td>
<td>ACEA A3/B4-08 + lab test</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Lab test</td>
<td></td>
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</tbody>
</table>
- Alignment with ACEA sequences + in-house oxidation test
OEM Needs and Specification Update – PSA

- PSA released new Service Fill specifications

<table>
<thead>
<tr>
<th>Specification (Séquence)</th>
<th>Standard (Norme)</th>
<th>PSA designation</th>
<th>Approximate ACEA category</th>
</tr>
</thead>
<tbody>
<tr>
<td>B71 2295</td>
<td>B71 2291</td>
<td>Niveau 1</td>
<td>A1/B1-08</td>
</tr>
<tr>
<td>B71 2294</td>
<td>B71 2292</td>
<td>Niveau 2</td>
<td>A3/B3-08</td>
</tr>
<tr>
<td>B71 2296</td>
<td>B71 2293</td>
<td>Niveau 3</td>
<td>A5/B5-08</td>
</tr>
<tr>
<td>B71 2290</td>
<td>B71 2288</td>
<td>Low SAPS</td>
<td>C2-08</td>
</tr>
</tbody>
</table>

- Limits vary according to specification, some minimum TBN requirements (higher outside Europe) and lab/bench tests
- Includes PSA in-house diesel test
OEM Needs and Specification Update – Porsche

- Current Porsche approval likely to be renamed Porsche A40
  - 5 year approval life
  - Potential extension for further 3 years if new sample provided and approval fee paid (no engine retesting)

- New category Porsche C30
  - Covers diesel engines in Porsche Cheyenne
  - VW 504/507 required – no additional testing
Summary

Euro 2009

ACEA 08 introduced Dec 2008
- No immediate market drive because a further 8 months for new products to be qualified and 20 months before old specs withdrawn. Expect gradual change.

Key issue in PCMO
- Significant increase in severity of requirements
- Re-approvals required by Daimler and VW against later test specifications
- New OEM specifications – upgraded for ACEA-08