

Ford and ACEA lubricant developments

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17th February 2005



ACEA Introduction Statement

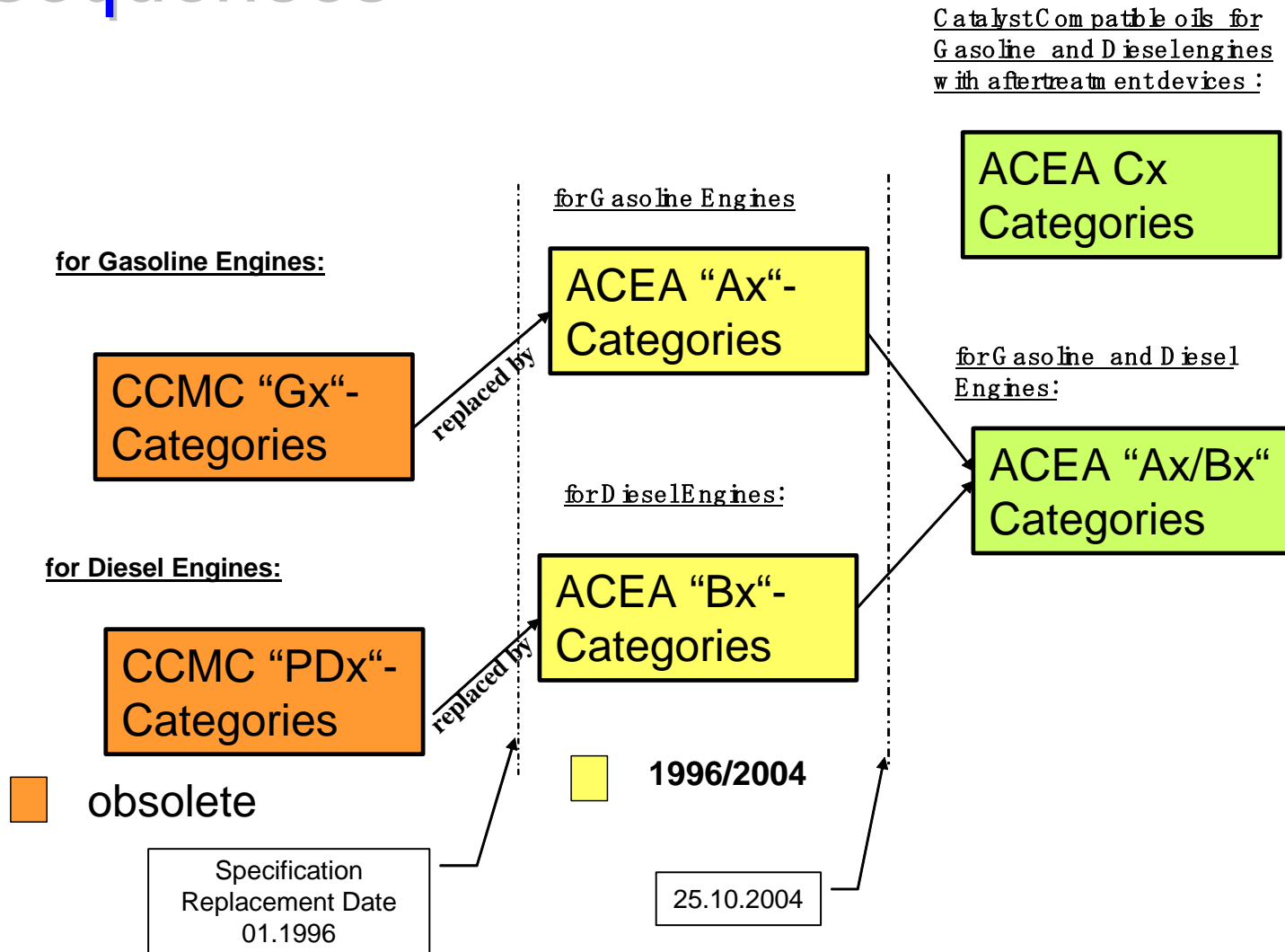
“This document details the ACEA 2004 European Oil Sequences for Service-fill Oils for Gasoline engines, for Light Duty Diesel engines, for Gasoline & Diesel engines with after treatment devices and for Heavy Duty Diesel engines. **These sequences define the minimum quality level of a product for presentation to ACEA members.** Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.”

■ **CONDITIONS FOR USE OF PERFORMANCE CLAIMS AGAINST THE ACEA OIL SEQUENCES**

- ◆ must be based on credible data and controlled tests in accredited test laboratories
- ◆ Data must be generated according to the European Engine Lubricants Quality Management System (EELQMS)
- ◆ Compliance with the ATIEL Code of Practice is mandatory for any claim to meet the requirements of 2004 issue of these ACEA sequences



Evolution of the European oil sequences



ACEA issue years

Issue year*	First allowable use	New claims by	Withdrawn
1996	1st March 1996	1st March 1999	1st March 2000
1998	1st March 1998	1st September 2000	1st March 2002
1999	1st September 1999	1st February 2003	1st February 2004
2002	1st February 2002	1st November 2005	1st November 2006
2004	1st November 2004		

* *Issue year of full document*

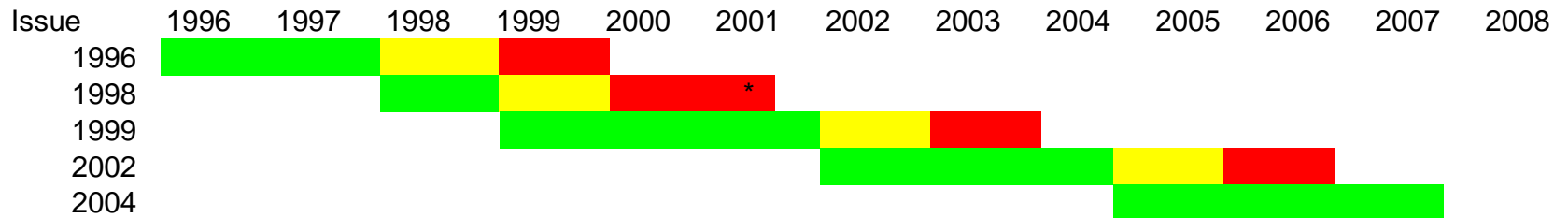
First allowable use means that claims cannot be made against the specification before the date indicated.

New claims by means that from this date all claims for new oil formulations must be according to the latest ACEA release. (For example until 1st November 2005, oil marketers can claim engine oils meeting the ACEA 2002 release even though the 2004 release is active. After 1st November 2005, any new oil claims must be according to the ACEA 2004 sequences.)

Withdrawn means that no claims can be made against the issue after the date indicated



ACEA issue timelines



* Extra six months allowed to give reasonable life of specification

- New claims allowed during this period to this issue number
- New issue in existence, but new claims can still be made according to the old issue
- No new claims to this issue number, but oil can still be marketed



Drivers for 2004 ACEA release

- A reduction in the number of sequences
- Combining the A+B sequences
- Update outgoing tests with new replacements
- Introduction of new catalyst compatible sequences
 - ◆ So called low and mid-SAPS
 - Sulphated Ash, Phosphorous, Sulphur
 - ◆ Released 8th November 2004
 - ◆ Also HD sequences released at this time
 - ◆ www.acea.be

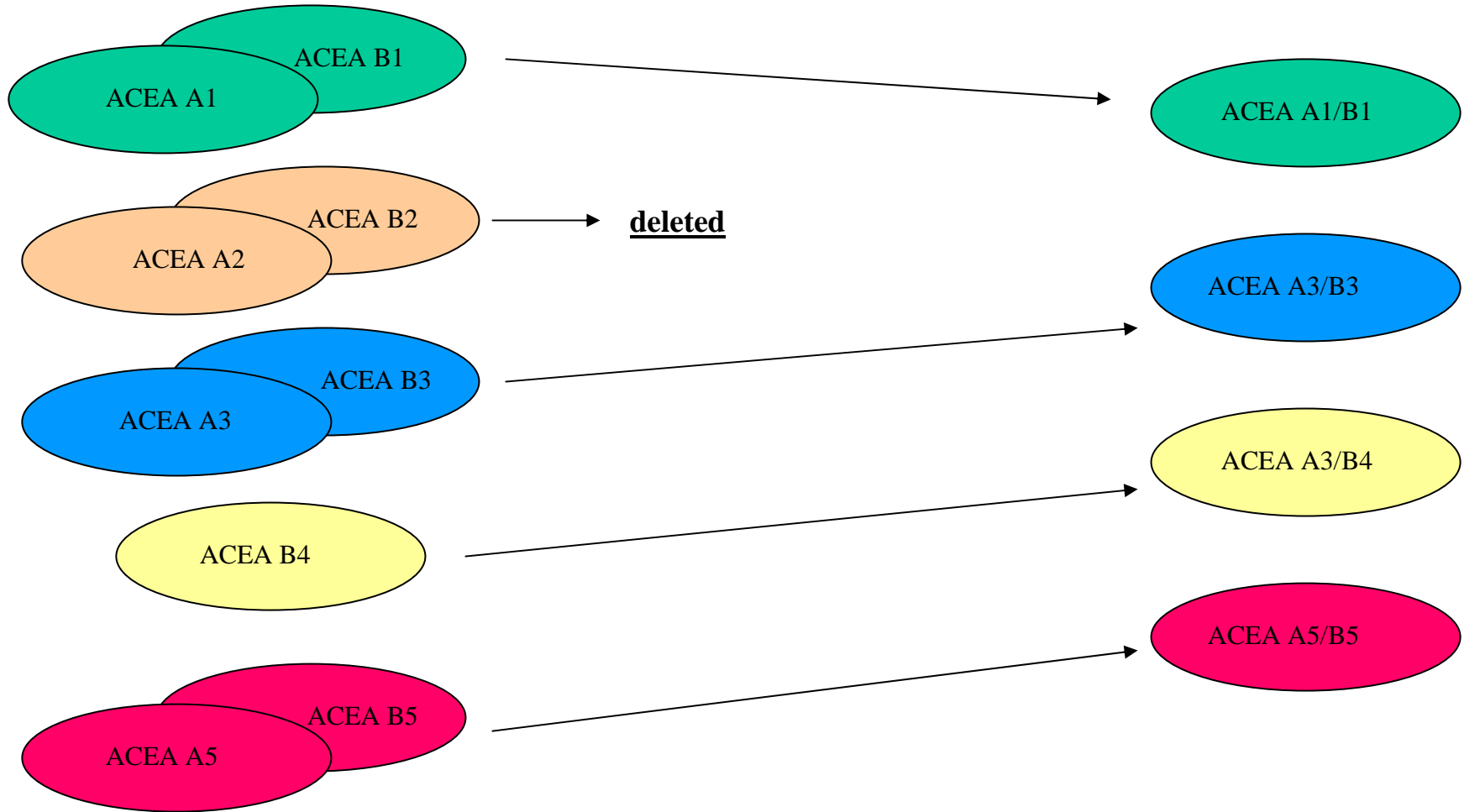


Legacy Categories

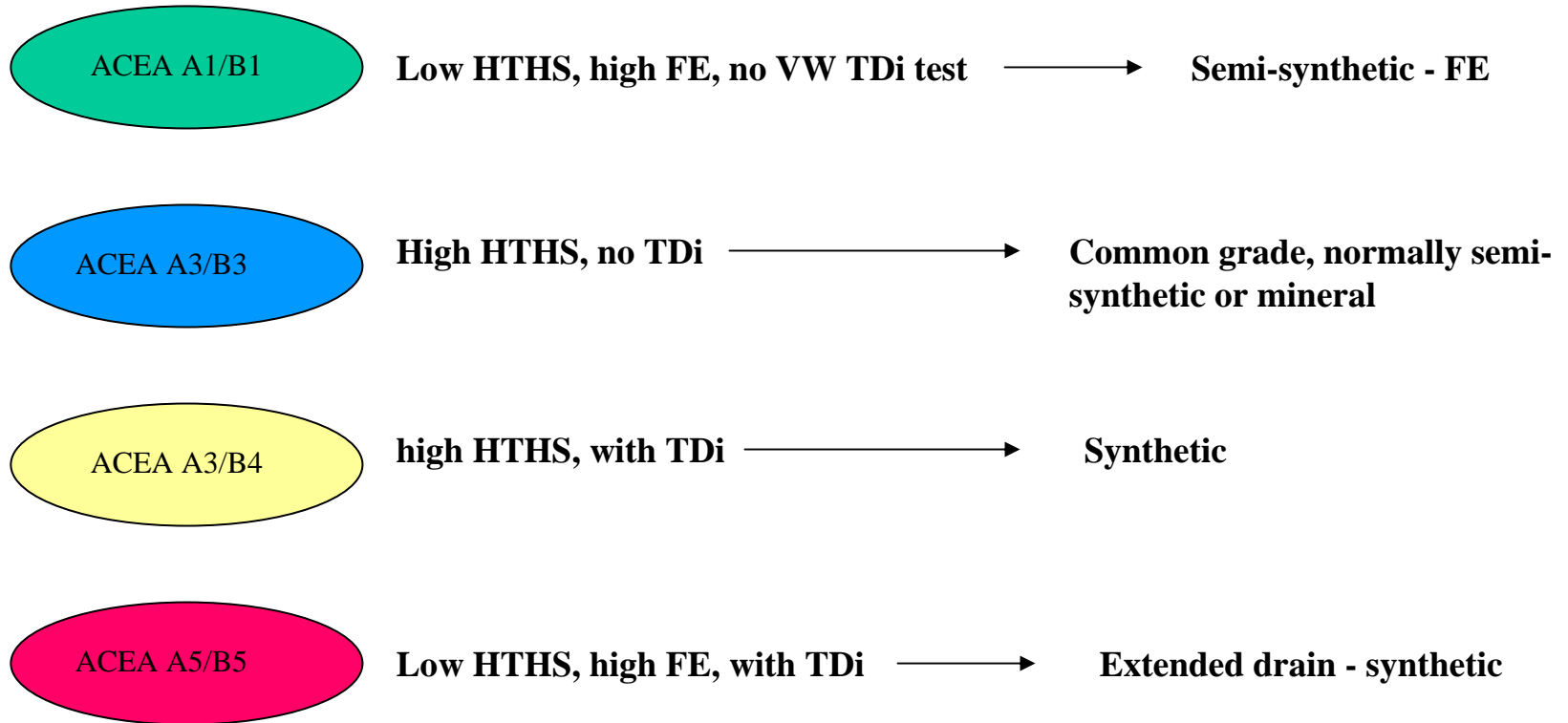
- New:- ACEA A1/B1, A3/B3, A3/B4, A5/B5
- Lower number of categories: 4 instead of 9
- All products must have combined performance
 - ◆ Diesel oils must now have eg. TU5 performance
 - ◆ The classic oil failure modes were not adequately addressed in the older categories in isolation
- No consumer re-education needed for new nomenclature
- Maintain established performance levels
 - ◆ Although replacing obsolete tests



Legacy categories rationalised



New legacy category structure



Note:- ACEA A2, B2 deleted – B2 lives on for now in DLD



Consumer Language

- **A/B : gasoline and diesel engine oils**

- **A1/B1** Oil intended for use in gasoline and car + light van diesel engines specifically designed to be capable of using low friction low viscosity oils with a High temperature / High shear rate viscosity of 2.6 to 3.5 mPas.s

These oils may be unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

- **A3/B3** Stable, stay-in-grade oil intended for use in high performance gasoline and car + light van diesel engines and/or for extended drain intervals where specified by the engine manufacturer, and/or for year-round use of low viscosity oils , and/or for sever operating conditions as defined by the engine manufacturer.

- **A3/B4** Stable, stay-in-grade oil intended for use in high performance gasoline and direct injection diesel engines, but also suitable for applications described under B3.

- **A5/B5** Stable, stay-in-grade oil intended for use at extended drain intervals in high performance gasoline and car + light van diesel engines designed to be capable of using low friction low viscosity oils with a High temperature / High shear rate viscosity of 2.9 to 3.5 mPa.s

These oils may be unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

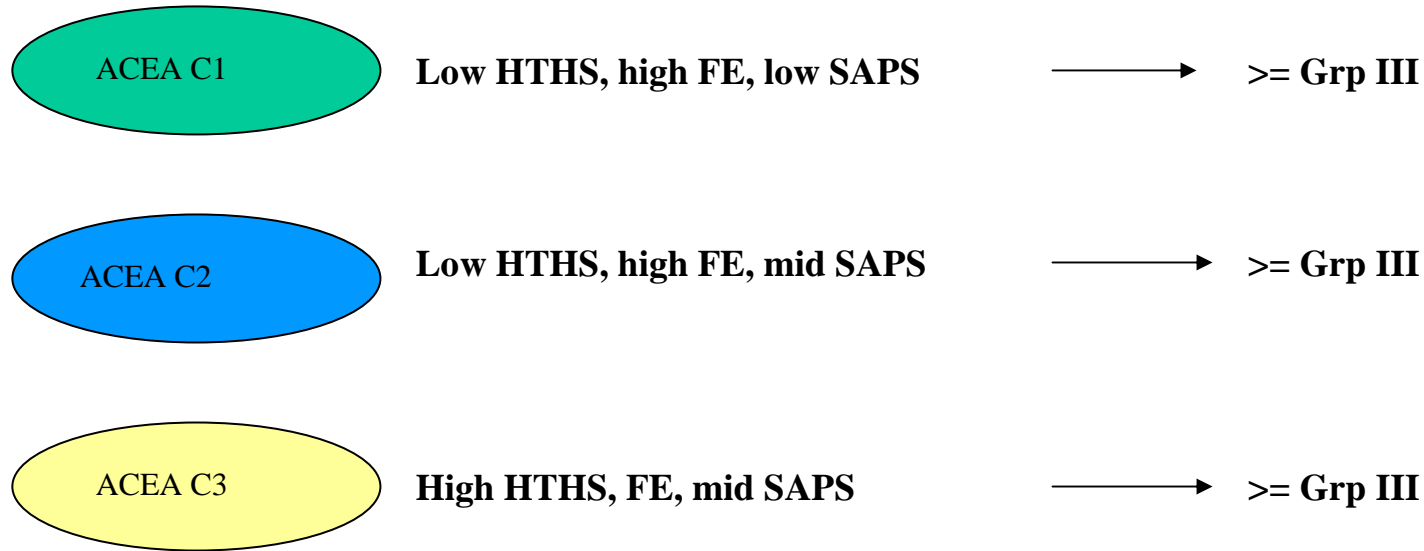


Aftertreatment system compatible categories

- 3 new and different 'C' categories
- Designed to be friendly to modern Euro I V+ exhaust aftertreatment systems
- Suitable for both gasoline and diesel engines
- 3 categories represents the different approaches taken by OEMs for base engine and exhaust aftertreatment system design
 - ◆ Chemical limits on Ash, P and S
 - ◆ Different viscosity needs
 - ◆ Different fuel economy needs



New 'C' category structure



Note :- All OEMs do not regard C categories as backward compatible for older vehicles at this stage



New 'Catalyst compatible' categories

	C1	C2	C3
HTHS	low	low	high
Base engine performance level	A5/B5	A5/B5	A5/B4 DC 229.3
SAPS level	low	mid	mid
FE	yes	yes	small

Note:- All OEM's prefer SAE 5W-30 viscosity grades



C categories - detail

	C1	C2	C3
S-ash	0.5% max	0.8% max	0.8% max
S	0.2% max	0.3% max	0.3% max
P	0.05% max	0.070 to 0.090	0.070 to 0.090
HTHS	2.9 min	2.9 min	3.5 min
M111FE	2.5% min	2.5% min	1.0% min (xw30 only)
VW TDI	As B5	As B5	As B4
TU5	As A5	As A5	As A5
DV4 or XUD11BTE	As A3	As A3	As A3
OM602	As A5	As A5	As DC229.31
TU3 S	As A3	As A3	As A3
M111 SL	As A3	As A3	As A3
Seq VG	As A3	As A3	As A3
Shear Stability	stay-in-grade	stay-in-grade	stay-in-grade
Noack	13% max	13% max	13% max
TBN	no	no	6 min
Seals	ACEA+DC AEM or DC+RE3	ACEA+DC AEM or DC+RE3	ACEA+DC AEM or DC+RE3



Consumer Language

C : Catalyst compatibility oils

- **C1** Stable, stay-in-grade oil intended for use as catalyst compatible oil in vehicles with DPF and TWC in high performance car and light van diesel and gasoline engines requiring low friction, low viscosity, low SAPS oils with a HTHS higher than 2.9 mPa.s. These oils will increase the DPF and TWC life and maintain the vehicles fuel economy.

Warning : these oils have the lowest SAPS limits and may be unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

- **C2** Stable, stay-in-grade oil intended for use as catalyst compatible oil in vehicles with DPF and TWC in high performance car and light van diesel and gasoline engines designed to be capable of using low friction, low viscosity oils with a HTHS higher than 2.9 mPa.s. These oils will increase the DPF and TWC life and maintain the vehicles fuel economy.

Warning : these oils may be unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

- **C3** Stable, stay-in-grade oil intended for use as catalyst compatible oil in vehicles with DPF and TWC in high performance car and light van diesel and gasoline engines. These oils will increase the DPF and TWC duration.

Warning : these oils may be unsuitable for use in some engines. Consult owner manual or handbook if in doubt.



Process

- 2 yrs in development
- Regular meetings throughout with oil and additive industry bodies
 - ◆ AAA forum (ACEA, ATIEL, ATC)
- Consultation in AAA
 - ◆ Feedback received was extensive and very helpful in shaping the 2004 sequences
 - ◆ Lots of difficult issues were overcome
- Overall a successful approach to the development of European oil sequences
- Sequences delivered on time



New Tests and limits

- Medium temperature dispersivity
 - ◆ PSA XUD11BTE (CEC L-56-T-98) outgoing
 - ◆ PSA DV4TD test (CEC L-093) incoming
 - Now approved by CEC
 - ◆ Limits for DV4TD currently being defined
 - A revision will be made as soon as this happens
 - ◆ XUD11BTE still accepted as alternative while test parts still available
- Seal compatibility
 - ◆ new RE3-04 material
 - ◆ new limits defined



Ford Specification WSS-M2C934A

- 2 yr development
- So far over 5M km run on prototype oils
- Base formulation as ACEA C1
 - ◆ With stretch FE target
 - ◆ 3.0% min (average of 3x M111FE test)
- Ford 2007 MY vehicles with DPF
- A cross Ford/Volvo/Jaguar/Land Rover, diesel/gasoline solution
 - ◆ Target 2007



Impact of ash on DPF

- Physical blockage of DPF
 - ◆ Replacement or cleaning required
- Increased back pressure across the DPF
 - ◆ Increased fuel consumption
 - ◆ Damage to the engine
- Reduction in catalytic efficiency of the DPF
 - ◆ Replacement of DPF
- Percentage sulphated ash in the original formulation can be used to rank DPF ash loading of different lubricant
 - ◆ Ford studies with oil and additive companies
 - ◆ Data used to validate ash blocking models to enable predictions to be made w.r.t vehicle/cycle/DPF size



Fleet testing on C1 prototypes

- 53 vehicles with 6 different engine types have completed mileage accumulation up to 120,000 km
 - ◆ 23 Transit 2.0L TDCI diesel, delivery service, normal operation
 - two 50,000 km oil changes
 - ◆ 7 Fiesta 1.4L TDCI diesel, mixed rural/highway, normal operation
 - two 40,000 km oil changes
 - ◆ 8 Focus 1.8L TDCI diesel, rapid mileage accumulation, severe operation
 - two 60,000 km oil changes
 - ◆ 1 Mondeo 2.0L I 4 gasoline, mixed rural/highway, severe operation
 - one 40,000 km oil change
 - ◆ 8 Focus 1.6L I 4 gasoline mixed rural/highway, severe operation
 - two 40,000 km oil changes
 - ◆ 6 Transit 2.4L DI diesel, delivery service, heavy load, severe operation
 - two 60,000 km oil changes
- Total vehicle mileage = 5.22M km
- Oil analysis and engine teardowns had no significant issues.
- Further fleet testing ongoing throughout 2005 on qualified C1/934 oils



Base Oil trends in Ford

- Fords key lube oil goals lie in:
 - ◆ aftertreatment compatibility
 - ◆ fuel economy
 - ◆ long drain capability
 - ◆ volume
 - Consolidation of specs across Ford/PAG will significantly grow Ford WSS-M2C913B and WSS-M2C934 spec volumes
- Ford prefers the use of Grp III base stocks
 - ◆ advanced performance level
 - Low S, good FE, good VI
 - ◆ met at the lowest cost
- For the future our technology watch is on mainly on GTL base oils
 - ◆ Ford Advanced and Research beginning to scope benefits from GTL

