

Infineum Trends 2005
Power Transmission Fluids

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Infinium Trends 2005

KSTLE
Tim Hutchings/Oct, 2005

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Passenger Car Motor Oils

WE LOVE CHANGE, WE HATE CHANGE!

- Change creates an opportunity to add new value
- But current balance between development costs and “payback time” is unsustainable
- OEM “wants” translate to new formulating challenges

	North America	Western Europe	Asia Pacific	Latin America	Rest of World	Total
Top Tier (0Ws / 5Ws)	1,125	245	80	10	30	1,490
Mid Tier (10Ws / 15Ws)	1,480	670	980	135	390	3,655
Bottom Tier (all other)	240	80	1,680	560	660	3,220
Total	2,845	995	2,740	705	1,080	8,365

Source: Kline & Company

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Passenger Car motor Oils GF-4 API SM and beyond

- GF-4 considerably more expensive, delay in introduction
- First commercial use of GF-4 in 2004 in North America
- Followed by API SM, licensable after November 2004
- SM has no max %P nor %S limits
- Unclear if lack of chemical limits will impact emissions systems or warranties
- Introduction of High Mileage, start-up, specialist SUV oil
- Value perceived and customer willing to pay
- Factory fill and service fill becoming competitive

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Passenger Car motor Oils What's next, after GF-4/ SM/ ACEA -04

- ILSAC GF-5 - with OEM requirements
 - > backward compatibility – no PC Diesel
 - > Black sludge, turbo protection, aeration control, cam chain wear
- European specifications - and OEM requirements
 - > Most OEM's have their own specifications
 - > Clear and growing fragmentation driven by diverging OEM needs
 - > Fragmentation leads to complexity
 - > Growing interest in partnerships between OEM's and global fluid suppliers

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Passenger Car motor Oils

Euro IV –DPF's and new ACEA specifications

- Almost 50% of new Car sales in Europe are Diesel
- To meet Euro IV and durability drove need for DPF's and Mid SAPS
- New ACEA 2004 "C" specifications combine A's and B's
- From November 1, 2004 all new ACEA claims must be against -04
- BMW, VW, Daimler Chrysler issued lower SAPS specifications in 2005 (Opel expected)
 - > Low SAPS VW 504 00 and 570 00 define a new quality level
 - > Includes DPF and RNT tests

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Passenger Car Motor Oils

SUMMARY OF KEY TRENDS IN JAPAN

- 2003 domestic vehicle sales were 5.8 M units (+0.6%)
 - > Sales of Japanese vehicles are increasing faster in US, Europe and Asia Pacific particularly China
- ILSAC GF-4 and API SM will be introduced in 2005
 - > Market for lighter grades is expanding
- Some new LEVs meet or exceed 2010 fuel economy targets
 - > Early compliance has tax incentives
- New technologies are enhancing worldwide sales
 - > Expanded hybrid systems
 - > Common-rail and higher-pressure fuel injection systems
 - > Passenger cars with diesel particulate filters (DPF)

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Passenger Car Motor Oils
CREATING VALUE TO IMPROVE PROFITABILITY

- How can we as an industry get consumers to recognize additional value from the new generation of lubricants?
- New specifications such as GF-4 improve the quality of the products but do not create new value
 - > Effectively raises the bar on most if not all products
- What do consumers *really* want out of lubricants?
- There are crankcase products for which the consumer is willing to pay a premium.
 - > Perceive additional value beyond meeting standard claims

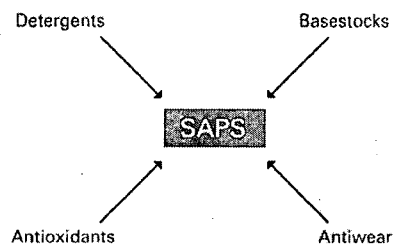
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**Heavy Duty Diesel
 PC-10**



- Chemical Restrictions
- All new tests
- Licensable by 2007

SAPS



- 2007 emissions limits
 - NO_x current 2.5 g/bhph → 0.25
 - PM current 0.1 g/bhph → 0.01
- Requires exhaust aftertreatment

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15% Noack

1.5% SASH

CI-4 Formulation Space

0.14% Phosphorus

0.8% Sulfur

13% Noack

1.00% SASH

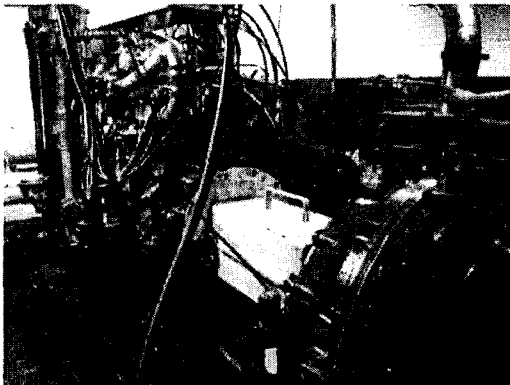
PC-10 Formulation Space

0.12% Phosphorus

0.4% Sulfur

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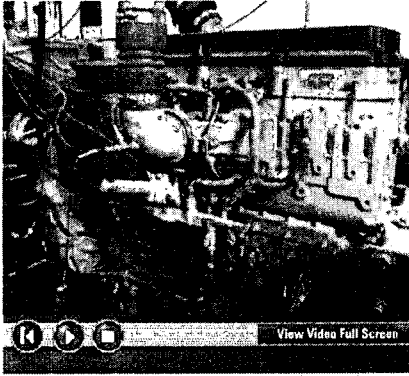
Heavy Duty Engine Oils
MACK T-11



- Measures soot / viscosity control in an EGR environment
- Needs ACC code acceptance

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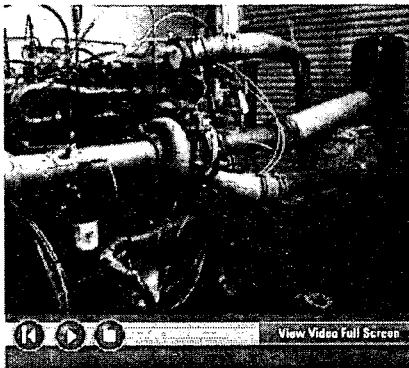
Heavy Duty Engine Oils
CATERPILLAR C-13



- Full ACERT® emissions controls
- Piston deposits
- Oil consumption
- Precision and BOI Matrix Running

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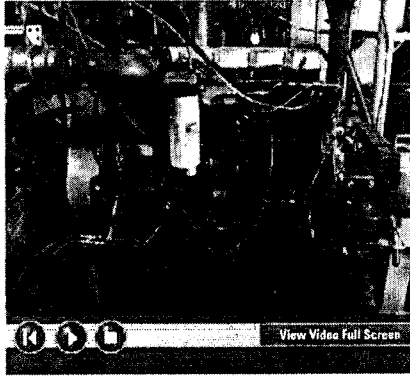
Heavy Duty Engine Oils
CUMMINS ISM



- Replacement for M11-EGR test with new hardware
- Valve train wear
- Sludge
- Filter plugging
- Tentatively approved for PC-10

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Heavy Duty Engine Oils
CUMMINS ISB



- 5.9 liter high volume production
- Valve train wear with mushroom flat tappet cam follower

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Heavy Duty Engine Oils
LIMITS COMPARISON

United States		Europe	
2002 / 2004 Limits		2005 Limits	
NO_x 3.4	PM 0.14	NO_x 3.5	PM 0.02
2007-2009 Limits		2008 Limits	
NO_x 1.6	PM 0.014	NO_x 2.0	PM 0.02
2010 Limits			
NO_x 0.27	PM 0.014		

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Heavy Duty Engine Oils
2010 NO_x LIMIT

2007-2009 \longrightarrow 2010
1.6 G/KW-H \longrightarrow 0.27 G/KW-H

May Require NO_x Reduction Catalyst

Additional Chemical Restrictions?

PC-11?



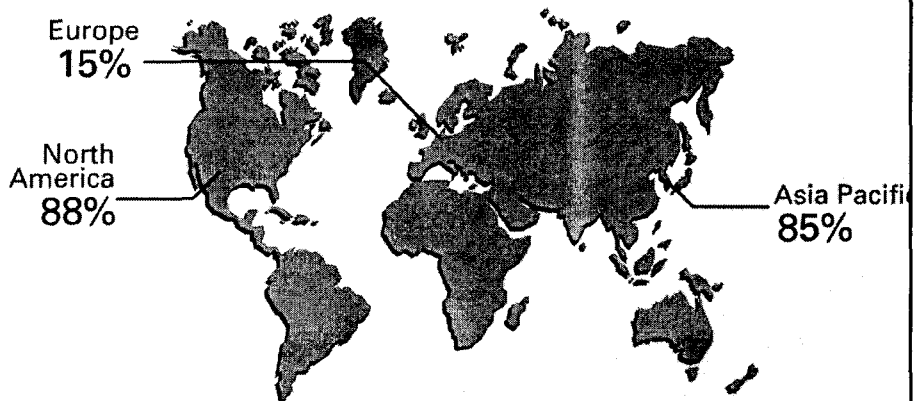
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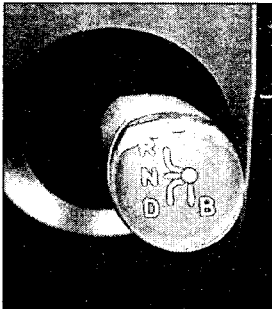
Power Transmission Fluids **AUTOMATIC TRANSMISSION USAGE**



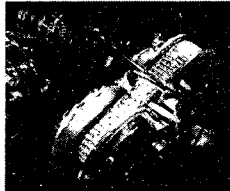
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Power Transmission Fluids

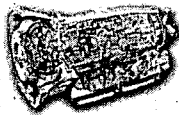
AUTO INDUSTRY DRIVERS – TRANSMISSION IMPROVEMENTS



- Emissions Compliance
- Better Fuel Economy
- Improved Driveability



- More Gears ----- No Gears (CVT)
 - > Better Fuel Economy
 - > Better Acceleration
 - > Smoother Driveability



Power Transmission Fluids

AUTOMATED MANUAL TRANSMISSIONS: DCT



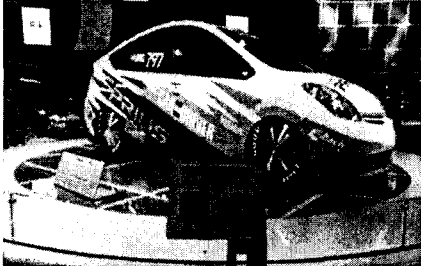
- Pro: No torque limitation
- Con: More difficult technology
- ODI: Every 60K Kilometers

Next Step Advancement:
Fluid with Real Fill-For-Life Capabilities

BLENDERS' CHALLENGE

- Small volume lots: blending/packaging/distribution
- Blend in-house versus buy finished fluids

Powertrain
HYBRID VEHICLES



Toyota
Ford

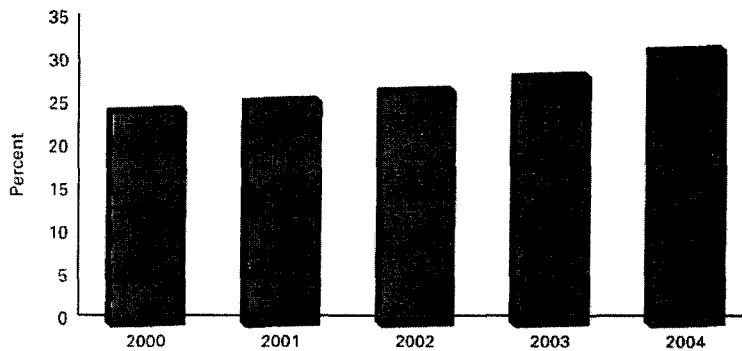
General Motors
DaimlerChrysler

Nissan
VW
Porsche

- 2004 U.S. Sales = 86K Units
- Total U.S. Light Vehicle Market ~ 17 million units
- DaimlerChrysler Hemi Engine Capacity = 480K Units
(Increasing to 520K Units in 2006)

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Powertrain
V-8 INSTALLATION RATE IN DOMESTIC LIGHT VEHICLE PRODUCTION



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Powertrain
HYBRID FUEL SAVINGS

20,000 Miles/Year

30 MPG ---- 25% Improvement ---- 37.5 MPG

Savings 134 Gallons

667 Gallons

533 Gallons

18 MPG ---- 25% Improvement ---- 22.5 MPG

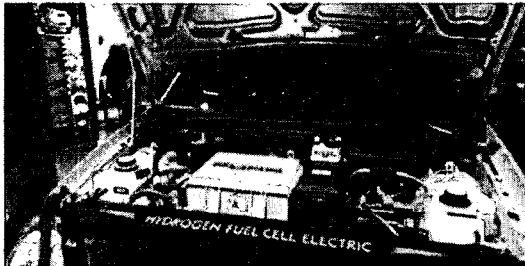
Savings 222 Gallons

1111 Gallons

889 Gallons

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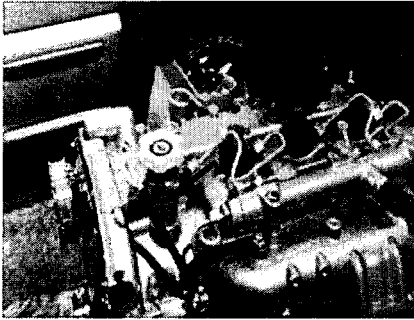
Powertrain
FUEL CELLS



- General Motors plans profitable commercial sales by 2010
- Most optimistic projection calls for 50M vehicles by 2030
- Requires a \$20 billion investment in infrastructure

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Powertrain
DIESELS



• U.S. Light Duty Trucks	514K Units
• Volkswagen	31K Units
• Heavy Duty Trucks	250K Units
Total	795K Units

Conclusions

- Trends 2005
- "Change"
- Low viscosity, high cost and value
- Rapid expensive redevelopments
- New transmissions (auto, DCT, CVT)
- New combustion technology

- Someone changed the game?

- How are the local OEM's to compete