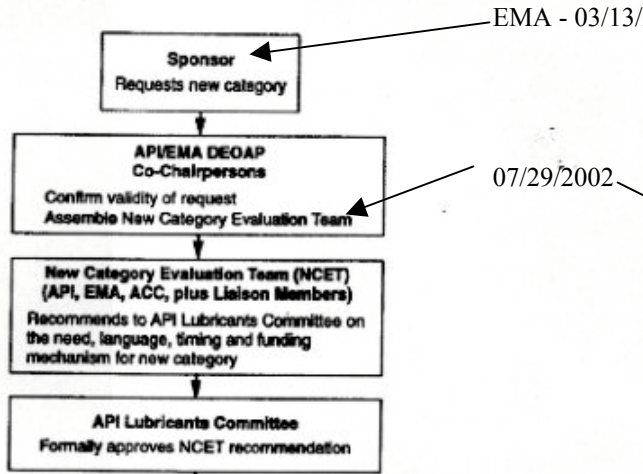


PC-10 New Category Evaluation Team

Progress Summary Report to ASTM
HDEOCP
12/10/2002

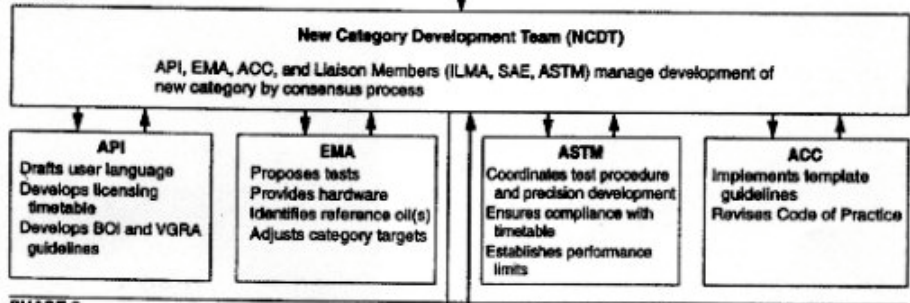
PHASE 1



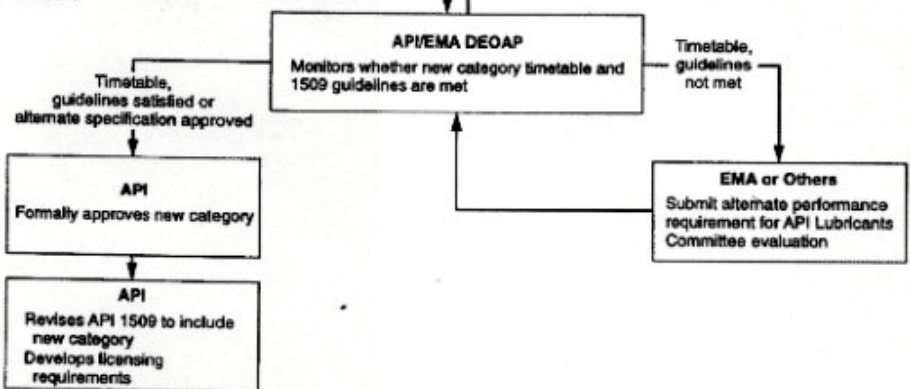
EMA - 03/13/2002

07/29/2002

PHASE 2

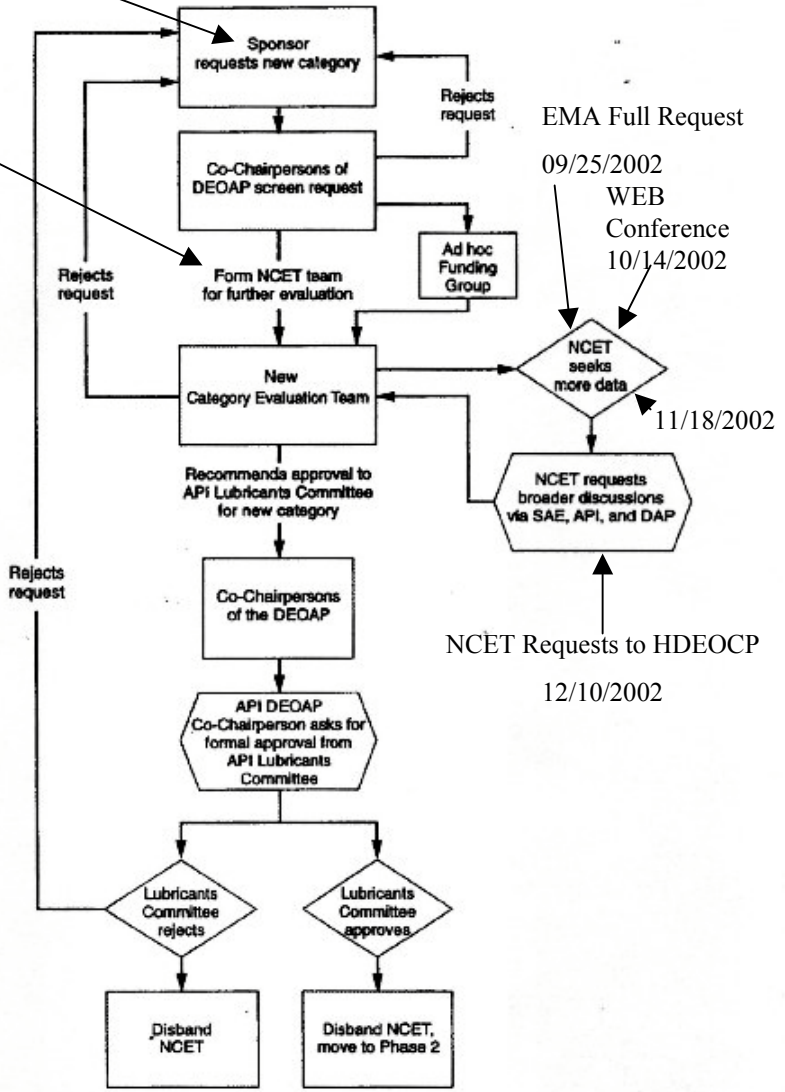


PHASE 3



- ACC = American Chemistry Council
- ASTM = American Society for Testing and Materials
- BOI = Base Oil Interchange
- DEOAP = Diesel Engine Oil Advisory Panel
- EMA = Engine Manufacturers Association
- ILMA = Independent Lubricant Manufacturers Association
- SAE = Society for Automotive Engineers
- VGRA = Viscosity Grade Read-Across

Figure D-1—Heavy Duty Category Request/Approval Process



DAP = Detroit Advisory Panel

Figure D-2—Phase 1: Category Request/Evaluation

Consensus Positions

- What is the proposed change?
 - Compatible with Engines Meeting 2007 Emissions Requirements
- Why is it required?
 - EPA required 90% reduction of NOX & PM
- Does data presented support the request?
 - Published industry data indicates potential aftertreatment durability issues related to engine oil ash, sulfur and phosphorus

Consensus Positions

- When is it needed in the marketplace?
 - ~3Q - CY2006
- What are the potential impacts on engines?
 - Enable use of aftertreatment, with ULSD
 - Use of pre-2006 fuel may reduce 2007 engine life
- What are potential impacts on consumers?
 - Drain intervals may be reduced

Consensus Positions

- What are the potential impacts on the environment?
 - Emissions should be reduced
 - More used oil may be generated
- How could the change affect existing API categories?
 - Backward compatibility may not be possible
 - Some prior category tests may not be available. If So, Alternatives Will Be Sought

Consensus Positions

- Are performance tests available that properly evaluate the performance needs requested?
 - Some current tests can be carried forward
 - Additional new tests need to be developed

Consensus Positions

- Do the perceived benefits outweigh the projected costs?
 - How much will it cost to develop test procedures, determine precision, and define, if necessary, BOI & VGRA guidelines?
 - Determine later in process.
 - What is the estimated total cost to carry out projected work for the new category, if the need is approved?
 - Determine later in process.

September 24, 2002

VIA ELECTRONIC MAIL

API/EMA Diesel Engine Oil Advisory Panel
c/o Steven Kennedy, Co-Chair
ExxonMobil Research & Engineering
Paulsboro Technical Center
P.O. Box 480
Paulsboro, New Jersey 08066-0480

Re: Request for New Category

Dear Steve:

In accordance with the procedures established in API 1509 Appendix D, the Engine Manufacturers Association requests that the API/EMA Diesel Engine Oil Advisory Panel (DEOAP) proceed with the development of a new heavy-duty diesel engine oil category (referred to as "PC-10").

As you are aware, the U.S. Environmental Protection Agency (EPA) has adopted regulations which will mandate an additional 90% reduction in nitrogen oxide (NOx) and particulate matter (PM) emissions from heavy-duty on-highway diesel engines and vehicles, beginning in 2007 (the "2007 Rule"). The 2007 Rule also mandates a phase-in of cleaner, ultra-low sulfur diesel fuel. Significant oil performance changes are critical if engine manufacturers are to have the ability to introduce the advanced aftertreatment devices and use the ultra-low sulfur fuel needed to achieve EPA's emission goals.

A table outlining proposed performance requirements for PC-10 is attached as Exhibit A. Please note that the proposal calls for PC-10 oils to include the performance properties of the earlier diesel engine oil service categories when used with either 500 ppm or 15 ppm sulfur fuel. As the category development process proceeds, EMA expects to provide information regarding the performance tests that may be available to evaluate the performance needs requested.

We look forward to working together again with API as we undertake this very important project.

Very truly yours,

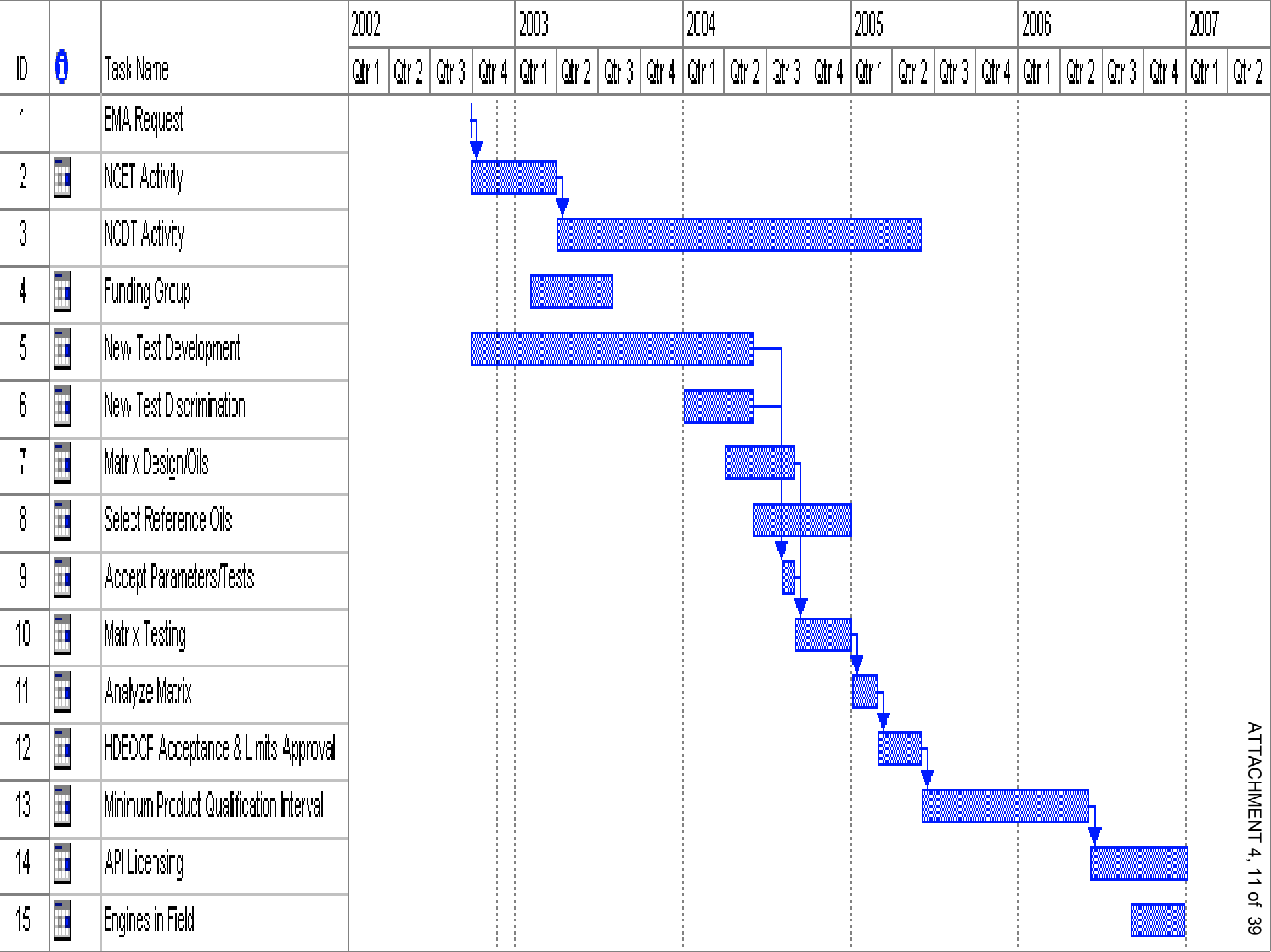
Greg Shank

Greg Shank
Engine Lubricants Committee Chair

cc: EMA Engine Lubricants Committee
Richard C. Clark, API

PC-10 Proposed Performance Requirements

Characteristic	Carryover from PC-9	New for PC-10
Piston Deposits, Fe Oil Consumption	X	
Piston Deposits, Al Oil Consumption	X	
Ring and Liner Wear (Corrosive), Bearing Corrosion	X	
Soot Valvetrain Wear (Abrasive and Rolling)	X	
Soot Valvetrain Wear (Sliding Wear)		X
Soot / EGR Valvetrain Wear Valve Stem / Guide Wear (Abrasive and Corrosive)	X	
Thermal Stability (Oxidation)	X	
Oil Aeration	X	
Turbo Coking Deposits		X
Closed Crankcase Deposit Control		X
Soot/Viscosity	X	
Soot/Viscosity in EGR Engines		X
Elastomer Compatibility	X	
Used Oil Viscometrics (Low Temp)	X	
Catalyst Aftertreatment Compatibility		X
High Temperature Corrosion Bench Test	X	
High Temperature/High Shear Limit (for New Oil)	X	
High Temperature/High Shear Limit (for Used Oil)		X
Shear Stability	X	
Shear Stability (Improved)		X
Volatility	X	
Foaming	X	
Ash Limit		X
Phosphorus Limit		X
Sulfur Limit		X
Backward Compatability with 15 ppm and 500 ppm Sulfur Fuels in pre-2007 Engines		X



Iron Piston Deposits, Oil Consumption

- CI-4 Requirement
- New Test
- New Engine - Caterpillar C-12
- Length - 500 - 650 hours
- Transient (Cyclic) Test
- Matrix Required
- Hardware Available ~ March 2003

Aluminum Piston Deposits, Oil Consumption

- CI-4 Requirement
- Caterpillar 1N/1K (Caterpillar Prefers 1N)
- Required for Backward Compatibility
- Matrix Not Required
- May Be Dropped, if Industry Shows No Harm

Ring & Liner Wear (Corrosive), Bearing Corrosion

- Mack T-10
- T-10 With New Hardware
- T-10 With ULS Fuel?
- Length - ~ 300 Hours
- Low Temp Used Oil Viscosity?
- Matrix Required

Soot Related Valvetrain Wear (Abrasive & Rolling)

- RFWT
- CI-4 Level
- Matrix Not Required

Soot Related Valvetrain Wear (Sliding Follower)

- New Test
- CUMMINS ISB
- 100 Hours Aftertreatment Compatibility
- Plus 250 Hours Wear
- Matrix Required
- Hardware & Procedure Late 2003/Early 2004

EGR Soot Related Valvetrain Wear (Abrasive & Corrosive)

- CUMMINS ISM EGR (May Replace M-11)
@ Lower Soot
- 5% to 6% Soot
- ~ 200 Hours Length
- Fuel Sulfur Level?
- Matrix Required
- Hardware & Procedure Late 2003/Early
2004

Thermal Stability (Oxidation)

- Sequence III G Probable
- Viscosity Increase Only
- PCEO Procedure
- Matrix Not Required

Turbo Coking Deposits

- European Bench Test?
- Added Test Parameter for Engine Test?
- Matrix?
- Request to HDEOCP to Form Task Force

Closed Crankcase Deposit Control

- European Bench Test?
- Added Parameter for Engine Test?
- Matrix?
- Request to HDEOCP to Form Task Force

Soot Related Viscosity Increase

- Mack T-8E?
- Mack Ring & Liner Wear Test or Other Test?
- CI-4 Level (If T-8E)
- (Separate) Matrix Not Required?

EGR Soot Related Viscosity Increase

- New Test (Mack)
- Mack Ring and Liner Wear Test or Other Test?
- (Separate) Matrix?

Elastomer Compatibility

- Carryover from CI-4
- EMA to Review Elastomers Used
- Request HDEOCP Form Task Force

Used Oil Viscometrics (Low Temperature)

- Mack T-10A
- Carryover from CI-4
- May Be Redundant, With Soot/Viscosity

Catalyst Aftertreatment Compatibility

- Caterpillar C-12
- CUMMINS ISB
- Other New Test (Caterpillar Looking at Bench Test)
- Select Two Most Severe Catalyst Systems
- EMA Monitor European Tests
- Additional Matrix?

High Temperature Corrosion Bench Test

- CI-4 Carryover

HT/HS Limit for Used Oil

- New Requirement
- TBS?
- Ravenfield?
- Other Test?
- Request HDEOCP Form Task Force (Test Method and Used Oil Generation)

Shear Stability (Improved)

- CI-4 Test Method (Modified?)
- Correlate to New Engines
- EMA to Provide Correlation Data
- Request HDEOCP Form Task Force to Evaluate Method and Correlation

Volatility

- NOACK
- 13% Maximum

Foaming

- CI-4 Carryover
- Same Test
- Same Limits

Chemical Property Limits

- Sulfated Ash Limit
- Phosphorus Limit
- Sulfur Limit
- Limits Required, if Aftertreatment Test Not Developed and Accepted
- EMA to Provide Additional Information ~ March 2003

Backward Compatibility

- Pre-2007 Engines
- <15 PPM Sulfur Fuel
- <500 PPM Sulfur Fuel
- Catalyst Compatibility May Preclude

Draft User Language

Version 1 - Backward Compatible

The PC-10 requirements describe oils for use in those high-speed four-stroke cycle diesel engines designed to meet exhaust emission standards being implemented between 2007 and 2010. These oils are compounded for use in all applications with diesel fuels ranging in sulfur content up to 0.05% by weight.

These oils are especially effective to sustain emission control system durability, where NOX adsorbers, particulate filters and other advanced aftertreatment systems are used. Optimum protection is provided control of catalyst poisoning, particulate filter blocking, piston deposits, low and high temperature stability, soot handling properties, oxidative thickening, foaming, and viscosity loss due to shear.

PC-10 oils are superior in performance to those meeting API CI-4, CH-4, CG-4 and CF-4 and can effectively lubricate engines calling for those API Service Categories.

Draft User Language

Version 2 - Backward Compatible, 15 ppm fuel

The PC-10 requirements describe oils for use in those high-speed four-stroke cycle diesel engines designed to meet exhaust emission standards being implemented between 2007 and 2010. These oils are compounded for use in all applications with diesel fuels ranging in sulfur content up to 0.0015% by weight.

These oils are especially effective to sustain emission control system durability, where NOX adsorbers, particulate filters and other advanced aftertreatment systems are used. Optimum protection is provided control of catalyst poisoning, particulate filter blocking, piston deposits, low and high temperature stability, soot handling properties, oxidative thickening, foaming, and viscosity loss due to shear.

When using diesel fuel with less than 0.0015% sulfur, PC-10 oils are superior in performance to those meeting API CI-4, CH-4, CG-4 and CF-4 and can effectively lubricate engines calling for those API Service Categories.

Draft User Language

Version 3 - Not Backward Compatible

The PC-10 requirements describe oils for use in those high-speed four-stroke cycle diesel engines designed to meet exhaust emission standards being implemented between 2007 and 2010. These oils are compounded for use in all applications with diesel fuels ranging in sulfur content up to 0.0015% by weight.

These oils are especially effective to sustain emission control system durability, where NOX adsorbers, particulate filters and other advanced aftertreatment systems are used. Optimum protection is provided control of catalyst poisoning, particulate filter blocking, piston deposits, low and high temperature stability, soot handling properties, oxidative thickening, foaming, and viscosity loss due to shear.

Since PC-10 oils are compounded for optimum in engines with advanced aftertreatment systems, they may not be suitable for use where API CI-4, CH-4, CG-4 and CF-4 are recommended. Consult your oil supplier regarding use in equipment calling for those API Service Categories.

NCET Proposal Elements

- Need for category validated ✓
- Feasibility (WAR review 11/18/02 minutes & draft position statement)
- Preliminary Timeline Established ✓
- Category language drafted - EMA Review Pending ✓
- Funding proposal (Report initiation of funding group activity)

NCET Draft Proposal and Recommended Guidelines

- To Be Completed, before DEOAP Phase 2
Proposal to API Lubricants Committee
- Target Date March 2003

NCET Requests to ASTM HDEOCP

- Form Task Force to Evaluate Methods for Measuring Turbo Coking and Closed Crankcase Ventilation Deposit Control
- Form Task Force to Evaluate Elastomer Compatibility Control Methodology for PC-10 Oils
- Form Task Force to Evaluate Used Oil HT/HS Method and Used Oil Source

NCET Requests to ASTM HDEOCP

- Form Task Force to Evaluate Shear Stability Test Method for PC-10 and Correlation Data
- Form Task Force to Develop an Ultra-Low Sulfur Test Fuel Specification for PC-10 Engine Testing.