Committee D-2 ON PETROLEUM PRODUCTS AND LUBRICANTS

Chairman: N. DAVID SMITH, North Carolina Dept. of Agric., 2 West Edenton St., P.O. Box 27647, Raleigh, NC 27611 (919-733-3313) FAX: 919-715-0524
First Vice-Chairman: SUSAN E. LITKA, UOP Research Center, 50 East Algonquin Rd., P.O. Box 5016, Des Plaines, IL 60017-5016 (708-391-3390)
Second Vice-Chairman: KURT H. STRAUSS, 69 Brookside Rd., Portland, ME 04103 (207-773-4380) FAX: 207-775-6214
Secretary: KENNETH O. HENDERSON, Castrol North America, Automotive Div., 240 Centennial Ave., Piscataway, NJ 08854 (908-980-3630) FAX: 908-980-9519
Assistant Secretary: W. JAMES BOVER, Exxon Biomedical Sciences, Inc., Mettlers Rd., CN2350, East Millstone, NJ 08875-2350 (908-873-6318) FAX: 908-873-6009
Staff Manager: EARL R. SULLIVAN (215-299-5514)

June 21, 2000

Reply to: Mark Cooper
Chevron Chemical Co.
4502 Centerview Dr. Ste. 210
San Antonio, TX 78228
P 210 731-5606
F 210 731-5699
mawc@chevron.com

Unconfirmed Minutes of the ASTM Mack T10 Task Force

Held in San Antonio, Texas On June 7, 2000

1. Call to Order

1.1 The agenda is shown as Attachment 1.

1.2 The attendance list is shown as Attachment 2.

2. Minutes from the April 18, 2000 Meeting

2.1 The minutes from the April 18 meeting were not available for review before this meeting. Mark Cooper commented that consistent difficulties have been encountered trying to obtain electronic copies of handouts, and he strongly encouraged everyone who makes presentations to bring electronic copies of the handouts to the meeting.

3. Membership Changes

3.1 There were no membership changes.

4. Test Sponsor Update

4.1 Discrimination Matrix Status

4.1.1 Greg Shank presented an updated copy of the data that he had presented at the April 18 meeting. Greg feels there is good discrimination on liner wear and lead but not much discrimination on top ring weight loss. Greg also noted that this data was from tests which ran at 225 and 235 F oil temperature. This data also includes tests that had excessive oil consumption.

4.1.2 Scott Richards asked if any repeat data would be available in the near future. Scott expressed concern about going into the matrix without any quantification for test repeatability and reproducibility.

4.1.3 Greg Shank indicated there should be more data available in the next couple of weeks using the current procedure.

4.2 Oil Consumption

4.2.1 Greg Shank noted that because the JDQ78A is not in PC-9, oil consumption is being considered as a pass/fail parameter to address oils which show good ring and liner wear but poor oil consumption.

4.2.2 Jeff Clark noted this means the T10 test could have five pass/fail parameters.

4.2.3 Brian Lawrence asked if the purpose of oil consumption limits is to screen out oils which have excessively high volatility.

4.2.4 Jim Collum asked if the concern is about volatility or bore polish.

4.2.5 Greg Shank commented that oil temperatures in the JDQ78A are similar to oil temperatures expected in 2002 engines. Ideally the EMA would like to see an engine test for volatility.

4.2.6 Brian Lawrence inquired about adding a bore polish rating to the T10 test.

4.2.7 Scott Richards noted that the industry (in the U.S.) uses liner wear step measurements because bore polish rating is more subjective.

4.2.8 Wim van Dam stated that some European tests use a mirror to rate bore polishing on engines without removable liners and that this technique is fairly repeatable between raters. Wim indicated that liners with bore polish could be sent to Europe for rating comparison.

4.2.9 Jim Collum commented that surface roughness measurements could also be performed. Jim indicated that he will see if he can correlate surface roughness to oil consumption. Scott Richards commented that only data from tests run at 235 F oil temperature should be used for correlation.

4.2.10 Greg Shank commented that bore polishing may be too difficult and that the task force may want to concentrate on deposits and wear.

4.2.11 Brian Lawrence asked Wim van Dam to provide a copy of the CEC Bore Polish Rating Procedure to the task force.

4.3 There were comments and a discussion about the possibility of using a Mack merit system to provide a single weighted number that would represent all of the pass / fail parameters.

4.4 Oxidation

4.4.1 Greg Shank stated that oxidation is a very important parameter for EGR engines. Mack has field data on oils run in production ETEC engines (non-EGR engines) under extended drain service. These oils have superior Sequence IIIE performance but have shown very high oxidation numbers in field testing. Brian Lawrence opined that it is important that the T10 task force provide data for the research report that shows oxidation correlation with field data.

5. Operations and Hardware Sub Group Report

5.1 Ken Goshorn provided a parts supply overview and indicated that new rings and liners should be available around the end of June.

5.2 A listing of issues discussed in the Operation and Hardware lab visitation group is shown below:

Standardize warmup schedule
EGR coolant return routing
0_2 sensor depth / location
Cleaning techniques
Crankcase vent location
6 minute blowby data
Standardize oil weigh bucket pumps
Oil suction / discharge location on oil pan
Centrifugal oil filter

5.3 Gary Tietze indicated that TEI will start assembling the revised EGR hardware immediately. The first unit should be available within one week of receipt of the engine from Perkin Elmer (the engine is expected to be delivered by June 8) . Two more EGR systems should be available within two to three weeks after the first system.

6. Chemical Analysis Sub Group Report

6.1 Joe Franklin presented a report from the Chemical Analysis Sub Group. A copy is shown in Attachment 3. Joe indicated the PDSC technique showed poor discrimination at all facilities, so the Chemical Analysis Sub Group recommended that oxidation analysis should be based on IR. Joe also provided details concerning the IR oxidation measurement technique that were discussed during the May 19 Chemical Analysis Sub Group meeting. These are also shown in Attachment 3. Analysis of data to develop a precision statement should be complete by the end of July. Sixty g intermediate samples and 100 g EOT samples should be submitted for the precision work along with a 1 quart new oil sample. Note on each sample that the sample is for the "T10 sub group analysis".

6.2 There was some discussion about the ester absorbency problem and problems with some synthetic oils in which the oxidation peak is almost out of the linear range. Jim Collum made the following motion (seconded by Scott Richards):

Motion: *Implement the Chemical Analysis Sub Group recommendation to utilize IR with area measurement to measure oxidation in the Mack T10 test*

Motion Passed: *Unanimously*

6.3 Joe Franklin will provide the area IR measurement procedure to Jeff Clark for inclusion in an Annex to the T10 test procedure.

6.4 Joe Franklin also asked labs to retain the raw data and unused portion of the oil samples.

6.5 Greg Shank asked the Chemical Analysis Sub Group to continue to look at alternative oxidation measurement techniques to improve precision.

7. Lab Visitation

7.1 The lab visitations at Perkin Elmer and SwRI were completed on June 5 and 6. Jeff Clark will schedule the lab visitations at Ethyl, Mobil and Lubrizol. The target is to complete the lab visitations by the end of July.

8. Timeline

8.1 Jim Collum presented an updated PC 9 and T10 timeline. The timelines are shown as Attachment 4.

8.2 Discussion ensued about whether the "proof of concept" had been completed. Some members reiterated the concerns that there was little data at the current operating conditions and no repeat data. After more discussions Greg Shank indicated he was looking for a recommendation from this panel suggesting that the proof of concept had been completed. After some additional discussion Jim Collum made the following motion (seconded by Scott Richards):

Motion: *The T10 task force recommends that the Mack T10 test move forward for proof of concept to the HDEOCP in June 2000 with the caveat that the task force will reconvene before the matrix is started and will approve that the test is matrix ready.*

Motion Passed: *Unanimously*

8.3 Greg Shank commented that he would like to see the T10 matrix begin as soon as it is reasonable to help deal with inevitable delays such as lost tests. The goal is to begin each PC 9 test matrix as soon as that particular test is ready and not wait for the rest of the tests.

8.4 Greg Shank reported that the matrix oils should be available at the TMC by mid July. Greg Shank also reiterated that the task force plans to use only one reference oil for the T10 test.

9. Scope and Objectives

9.1 Brian Lawrence presented the Scope and Objectives as shown in Attachment 5. The following changes were made to the Scope and Objectives:

1) Change "fit for purpose" to "proof of concept" in Objective 2
2) Move oxidation to the list of primary test parameters
3) Add oil consumption and related issues to the list of secondary test parameters

10. CMA Checklist

10.1 Bob Campbell reviewed the checklist with the group. A revised version including the changes made the meeting is shown as Attachment 6.

11. Adjournment

Attachment 1

Mack T-10 Task Force Meeting

Date: Wednesday, June 7, 2000
Time: 8:30 AM - Noon
Location: PerkinElmer Automotive Research
San Antonio, TX

Agenda

1. Membership	Mark Cooper
2. Previous Minutes	Mark Cooper
3. Test sponsor's update: – Discrimination matrix status – Oxidation – Oil consumption	Greg Shank
4. O&H Sub-Group Report: – Operational & procedural experience	Jim Collum
5. Chemical Analysis Sub-Group Report	Joe Franklin
6. Lab visitation: – Summary of issues arising	Jeff Clark
7. CPD issues arising	Gary Tietze
8. Timeline Update	Brent Shoffner/Jim Collum
9. TF Scope & Objectives - Review	Brian Lawrence
10. Next Meeting/Adjournment	

NB: Will presenters kindly remember to bring a copy of their material on a 3.5" floppy disk, for inclusion in the minutes (MS Word preferred, Powerpoint or Excel acceptable). Thank you.

Secretary:	Chairman:
Mark Cooper/Oronite	Brian Lawrence/Infineum
210-731-5606	210-732-8123

Attachment 2

Attendance Roster

Name	Company
Brian Lawrence	Infineum
Mark Cooper	Oronite
Andy Broff	SwRI
Bob Campbell	Ethyl
Jeff Clark	TMC
Jim Collum	Perkin Elmer
Riccardo Conti	ExxonMobil
Joe Franklin	Perkin Elmer
Ken Goshorn	Mack
Perry Grosch	SwRI
Jim Gutzwiler	Infineum
John Haegelin	Perkin Elmer
Bill Larch	Lubrizol
Scott Richards	SwRI
Greg Shank	Mack
Mark Sutherland	Ethyl
Gary Tietze	TEI
Warren Totten	Cummins
Wim van Dam	Oronite
Jim Wells	SwRI

Attachment 3

T10 Chem Sub-Group Report
06/07/2000

- **Meeting held 05/19/2000.**
- **Progress on alternate test procedures.**
  - **PDSC poor discrimination at all facilities – Dropped.**
  - **Primary methods look best.**
  - **IR procedure will be the focus of future work.**
- **New IR procedure.**
  - **Uses Standard FTIR techniques and cell (0.05mm Transmission)**
  - **Agreement was reached on a detailed procedure for analysis and instrument settings.**
  - **Precision will be established with available oils.**
  - **At least 9 test's oils will be provided with multiple base stocks.**
  - **At least 4 labs will generate data with the new IR procedure.**
  - **Most oils will be shipped to me by 06/10/2000 for distribution.**

Submitted by:

Joe Franklin
Sub-Group Chairman

Oxidation IR Meeting
Friday, May 19, 2000

Mark G. Stevens Infineum USA LP 1900 E Linden Ave Linden, NJ 07036 Phone: 908-474-2700 Fax: 908-474-3637 mark. stevens@infineum.com	**Tina Oliveto** Lubrizol Corporation 1275 Lloyd Rd. (Mail) 29400 Lakeland Blvd. (ship) Wickliffe, OH 44092 Phone: 440-347-2006 Fax: 440-943-8988 cmco@lubrizol.com	**Jamie Stuller** Perkin Elmer AR 5404 Bandera Rd. San Antonio, TX 78238 Phone: 210-523-4680 Fax: 210-523-4615 Jamie Stuller@perkinelmer.com
Joe Franklin Perkin Elmer AR 5404 Bandera Rd. San Antonio, TX 78238 Phone: 210-523-4671 Fax: 210-523-4615 Joe Franklin@perkinelmer.com	Don Pheneger Ethyl Corporation 500 Spring St. (mail) 101 W. Byrd St. (ship) Richmond, VA 23219 Phone: 804-788-5379 Fax: 804-788-6244 Don_Pheneger@ethyl.com	**John S. Szobota** - LD 186 ExxonMobile Research 1545 Route 10 East Annandale, NJ 08801 Phone: 908-730-2110 j sszobo@erenj .com
Mike Birke SWRl 6220 Culebra Rd. San Antonio, TX 78238 Phone: 210-522-5310 Fax: 210-522-5907 mbirke@swri.org	**Bill Abraham** Lubrizol Corporation 1275 Lloyd Rd. (Mail) 29400 Lakeland Blvd. (ship) Wickliffe, OH 44092 Phone: 440-347-2195 Fax: 440-943-9021 wda@lubrizol.com	Wim Van Dam Oronite WVDA@chevron.com

Introduction

A meeting was held to discuss the options for using an IR method to determine the extent of oil oxidation in a Mack T-10 engine test. Background presentations were given by Infineum, Lubrizol, and Oronite, indicating the need for an improved method. John Szobota of ExxonMobil Research presented the options available for using transmission IR on sooted oils and calculating the extent of the oxidation by differential integrated area (presentation attached). First, the experimental method was discussed and the required equipment defined. Next the methods of data analysis were discussed: integration method, dilution correction, range of integration, baseline correction. Finally, the requirements for reporting and samples were discussed.

Experimental method and equipment:

Requirements

Mid IR Cap.

DTGS Detector

Resolution: Min 4 at 16 scans

Transmission Method

0.05 mm cell

BaF (use any other internal to test reliability)

Path-length measurement (required)

- Heptane (HPLC grade) or other
- Multi-peak height
- Normalized to 0.05 mm

Linearity:

- Should be proved one time per instrument
- Method: weight to volume
- Based on Exxon S150N (MGS to send) in Carbon Tetrachloride

Dilution of used oil with fresh oil if necessary:

- 2:1 Fresh:Used

ATR

Any angle cell must be capable of correlation to transmission relative to 0.05 mm

No linearity issues

Procedure:

Differential Spectra

1:1 subtraction (corrected for dilution) of area

Integration (all relative to baseline)

Carbonyl: 1665 - 1825 (nearest min) baseline corrected

Report area normalized for 0.05 mm (absorbence * cm-1)

Metal Carboxylate: Do what seems best this time

- Try baseline extension 2000 - 1870 finding max net absorbence between 1605 & 1585

Nitration

- Second derivative of differential spectrum
- Baseline points 1665 - 1615 (maxima)
- Negative Peak height at 1629 (minima)
- Calculate RON02 by valley - valley baseline calculation
- We are all going to play around with this one & get back together

Report all basic system information

Participating Labs:
1. Clinton (for Infineum)
2. Lubrizol
3. Ethyl
4. Oronite
5. SwRI
6. P&E

Oils to be run:

Volumes required:
• New Oil 1 qt
• Intermediate: whatever possible
• Minimum lOg each
• Drain 100g

Information Required with samples:
• Base Stocks (Type, Sats & Sulfur)
• Lead, Soot TGA, TAN-D664/TBN-4739 (aq buffer), Test hours

Committed to supply:
• Infineum: Two runs on TMC-1005, Two Runs on Infineum Oil 2
• Ethyl: At least 1 oil
• Lubrizol: 1 - 2 Oil
• Oronite: ???????????

Oils to be shipped to Joe Franklin at P&E to be blind coded and distributed

Label oils: T-10 Subgroup Analytical Work

Still need more oils:
• Group 3+
• Especially ester
• May come from T-9

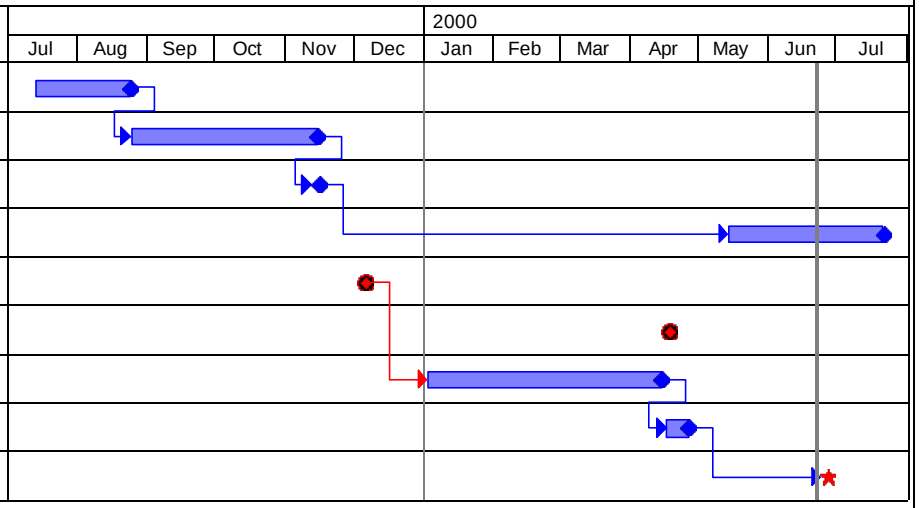
Do we need a control sample?
- Synthesized?
- From Engine Test?
- Standard Method?

Attachment 4

Time Line for the T-10 Test

Brent Shoffner - 4/26/00

ID	Task Name	Start	Finish
1	Final Kits/Parts Available (1 per lab)	07/14/99	08/24/99
2	Install engines and run shakedown	08/25/99	11/15/99
3	Procedure Available	11/16/99	11/16/99
4	Lab Visits for Precision Matrix	05/15/00	07/21/00
5	Procedure Adequate	12/06/99	12/06/99
6	Oil Gallery Temp 225F to 235F	04/18/00	04/18/00
7	Run Preliminary Tests & Report Data**	01/03/00	04/14/00
8	Data Analysis	04/17/00	04/26/00
9	HDEOCP Approves Proof of Concept*	06/27/00	06/27/00



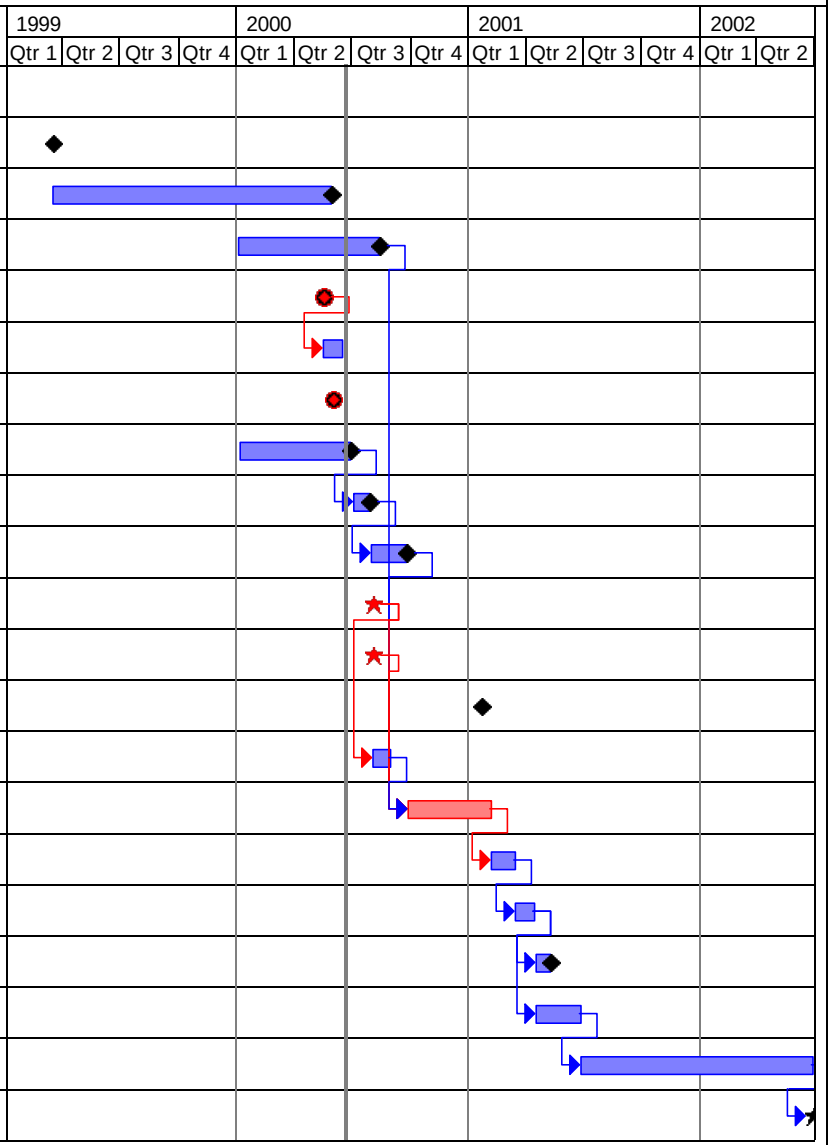
* Contingent on HDEOCP Meeting Date

** Will include TMC 1005-1

Summary of Events Required for PC-9 Licensing

Brent Shoffner 7/27/2000

ID	Task Name	Start	Finish
1			
2	Define PC-9 Performance Parameters	03/16/99	03/16/99
3	Design Prec. Mtx. Appr. API Lubes Comm	03/17/99	05/31/00
4	PC-9 Funding MOA Signed	01/03/00	08/15/00
5	1Q & M11EGR adequate for oil devel.	05/15/00	05/15/00
6	Identify Test Oils (with validation)	05/16/00	06/14/00
7	Finalize Base Oil selections for Prec. Mtx.	05/31/00	05/31/00
8	Finalize Additive selections for Prec. Mtx.	01/06/00	06/30/00
9	Base Oils Recd by Additive Companies	07/03/00	07/31/00
10	Blend Prec. Mtx. Oils>TMC>Labs	08/01/00	09/25/00
11	Final Acceptance of New Engine Tests *	08/02/00	08/02/00
12	Final Acceptance of Test Parameters	08/02/00	08/02/00
13	PC-9 Demonstration Oil is Validated	01/22/01	01/22/01
14	Pre-Matrix Activities	08/03/00	08/30/00
15	PC-9 Precision Matrix Testing	09/26/00	02/05/01
16	Precision Matrix Data Analysis	02/06/01	03/14/01
17	HDEOCP Post Matrix Test Acceptance	03/15/01	04/13/01
18	CMA Registrations Allowed	04/16/01	05/11/01
19	Finalize Pass/Fail Criteria (Sub B Mtg)	04/16/01	06/27/01
20	New Product Development	06/28/01	06/27/02
21	API Licensing Allowed	06/28/02	06/28/02



* Acceptance of each engine test (by HDEOCP) for discrimination and preliminary precision prior to starting the precision matrix.

Attachment 5

Mack T-10 Task Force

Scope & Objectives

Revision Date – April 18, 2000

Scope:

This Task Force is responsible for development of the Mack T-10 engine test. It is accountable to the ASTM Heavy Duty Engine Oil Classification Panel and subsequently to ASTM Sub-Committee B0.02.

The Task Force will strive to achieve its objectives via close co-operation and interaction with the test sponsor, participating test laboratories and other ASTM functions (including Task Force Sub-Groups, the Test Monitoring Center and designated Critical Parts Distributor).

Objectives:	**Completed**
1. Evaluate preliminary test configuration and operational conditions and develop accordingly.	4/18/00
2. Expedite "fit-for-purpose" test/test procedure consistent with PC-9 timeline.	
3. Identify and evaluate key performance criteria.	
4. Demonstrate discrimination with respect to key performance criteria.	
5. Optimise test procedure for maximum test precision and reliability.	
6. Monitor PC-9 Precision/BOI matrix execution.	
7. Monitor/assist statistical evaluation of matrix data.	
8. Review against CMA Template.	
9. Recommend HDEOCP endorsement of T-10 test, key performance criteria and associate limits.	
10. Complete ASTM ballots for test approval/PC-9 inclusion.	
11. Complete ASTM ballots of Mack T-10 Research report.	

Specific Activities:

Develop primary test parameters:

1. Average Ring Weight Loss.
2. Average Cylinder Liner Wear.
3. Lead content of EOT lubricant.

Evaluate and compare range of secondary test parameters including:

1. Lubricant TBN depletion.
2. Lubricant TAN accumulation.
3. TBN/TAN interaction.
4. Oxidation/Nitration assessment via IR or alternative analytical method.
5. Bearing weight loss.
6. Piston deposits.

Attachment 6

Mack T-10

TEMPLATE CHECKLIST

Purpose

The Checklist for Comparing Tests to the Template is used to assess progress in new engine test development against the Code Acceptance Criteria and Action Plans. The checklist is updated periodically during the course of test development and is provided to, and discussed with, the appropriate ASTM test development task force.

The rating scale for comparing test development to the Template is as follows:

A -- Completed

B -- In Progress

C -- Planned

D -- No Action

Test Name Mack T10 **Assessment Date** _____

CMA Code of Practice
Appendix K - Template for Acceptance of New Tests
Checklist for Comparing Tests to the Template

A. Precision, Discrimination and Parameter Independence

A.1 Precision $E_p = d_p / Spp$, $E_p \geq 1.0$ for all pass/fail parameters

d_p = Smallest difference of practical importance

Spp = Pooled standard deviation at target level of performance

Parameter	Dp	Spp	Ep	≥1.0?

Comments:

A.2 Discrimination

For each test parameter in A.1, at least one of the oils used in proof-of-concept testing, matrix testing, or calibration testing must be statistically significantly different from at least one of the remaining oils. This difference must be in the correct direction, i.e., a poor oil should not test out as significantly better than a good oil. Significant difference may be declared with a p-value of 10% or less. Multiple comparison techniques (Tukey, Scheffe, Bonferroni, etc.) for the least-square means of the oils are preferred comparison techniques and should be stated in the analysis. Note that these least-squares means are not necessarily proposed LTMS targets. An example is provided below.

Parameter: AAAAA

			p-value for t-test of equal means (Tukey)		
Oil	Least-Square Mean	95% Confidence Interval for Mean	Vs 1	Vs 2	vs 3
1	314.3	277.8 to 350.8		0.48	0.002
2	345.1	304.9 to 385.3	0.48		*0.04*
3	415.6	375.6 to 455.7	*0.002*	*0.04*	

Comments:

A.3. Parameter Independence

Each pass/fail parameter has a unique and significant purpose in terms of the engine oil performance standard. Parameter independence is concluded if a correlation coefficient is 0.85 or greater. An example is provided below.

Correlation Coefficients

	Parameter A	Parameter B	Parameter C	Parameter D
Parameter A	1.00	0.91	0.23	0.02
Parameter B	0.91	1.00	0.19	-0.01
Parameter C	0.23	0.19	1.00	0.56
Parameter D	0.02	-0.01	0.56	1.00

Comments:

B. Severity and Precision Control Charting

Requirements

B.1 Is an LTMS for reference oil tests in place which is consistent with CMA Code Appendix A? __C__

B.2 Are appropriate data transforms applied to test results? __C__

Comments:

C. Interpretation of Multiple Tests

Requirements

C.1 Is a suitable system in place to handle repeat tests on a candidate oil? __C__

Type: MTAC Tiered Limits Other

C.2 Has a method for the determination and handling of outlier results been defined? __C__

Comments:

D. Action Plan

D.1 Reference Oils

Do the majority of reference oils represent current technology? __B__

Are the majority of reference oils of passing or borderline pass/fail performance? __B__

Recommended Approaches

D.1.1 Is reference oil supply and distribution handled through an independent organization? __C__

D.1.2 Is a quality control plan defined and in place? __B__

D.1.3 Is a turnover plan defined/in place to ensure uninterrupted supply of reference oil and an orderly transition to reblends? __C__

D.1.4 Is a process for introducing replacement reference oils defined and in place? __C__

D.1.5 Are oils blended in a homogeneous quantity to last 5 years? __C__

Comments:

D.2 Test Parts

Are all critical parts identified? __B__

Is a system defined/in place to maintain uniform hardware? __A__

Is there a system for engineering support and test parts supply? __A__

Recommended Approaches

D.2.1 Are critical parts distributed through a Central Parts Distributor (CPD)? __A__

D.2.2 Are critical parts serialized, and their use documented in test report? __B__

D.2.3 Are all parts used on a first in/first out basis? __A__

RATING SCALE: A - Completed; B - In Progress; C - Planned; D - No Action

D.2.4 Are all rejected critical parts accounted for and returned to the CPD? __A__

D.2.5 Does the CPD make status reports to the test surveillance body at least semi-annually? __A__

D.2.6 Is there a QC and turnover plan in place for critical test parts, including identification and measurement of key part attributes, a system for parts quality accountability, a turnover plan in place for simultaneous industry-wide use of new parts or supply sources? __B__

D.2.7 Is the CPD active in industry surveillance panel/group, and in industry sponsored test matrices? __A__

Comments:

D.3 Test Fuel

Recommended Approaches

D.3.1 Is the fuel specified and the supplier(s) identified? __A__

Is a process in place to monitor fuel stability over time? __A_

Are approval guidelines in place for fuel certification? __A__

D.3.2 If the test fuel is treated as a critical part of the test procedure: Is an approval plan and severity monitoring plan for each fuel batch in place? __A__

Is a quality control plan defined and in place to assure long term quality of the fuel? __A__

Is a turnover plan defined, in place and demonstrated to ensure uninterrupted supply of fuel? __A__

Comments:

RATING SCALE: A - Completed; B - In Progress; C - Planned; D - No Action

D.4 Test Procedure

Recommended Approaches

D.4.1 Is a technical report published documenting, per ASTM FlowPlan:
Test precision for reference oils? __C__

Field correlation? __C__

Test development history? __C__

D.4.2 Are test preparation and operation clearly documented in a standard format, e.g., ASTM, CEC __B__

D.4.3 Are test stand configuration requirements documented and Standardized? __B__

D.4.4 Are milestones for precision improvements established __B__

D.4.5 Are routine engine builder workshops planned / conducted? __C_

Comments:

D.5 Rating and Reporting of Results

Recommended Approaches

D.5.1 Are the reported ratings from single raters (i.e. not averages from various raters)? __B__

D.5.2 Is a suitable severity adjustment system in place? __C__

D.5.3 Is each pass / fail parameter unique and have a significant purpose for judging engine oil performance? __C__

D.5.4 Do all rate and report parameters judge operational validity, help in test interpretation or judge engine oil performance? __C__

D.5.5 Are routine rater workshops conducted / planned? __C__

Comments:

RATING SCALE: A - Completed; B - In Progress; C - Planned; D - No Action

D.6 Calibration, Monitoring and Surveillance

Recommended Approaches

D.6. Is a process in place for independent monitoring of severity and precision with an action plan for maintaining calibration of all laboratories? __A__

D.6.2 Are stand, lab, and industry reference oil control charts of all pass / fail criteria parameters used to judge calibration status? __C__

D.6.3 Does the specified calibration test interval allow no more than 15 non-reference oil test between successful calibration tests? __D__

D.6.4 Is an industry surveillance panel in place? __B__

Comments:

D.7 Guidelines for Read Across

Recommended Approaches

D.7.1 Is a plan defined to establish data for development of BOI and VGRA? __B_

D.7.2 Has VGRA and BOI data been summarized and included in the technical report in D.4.1? __C__

Comments:

Rating Scale: A - Completed; B - In Progress; C - Planned; D - No Action