

From: [Salgueiro, Bob](#)
To: [Alessi, Michael \(michael.l.alessi@exxonmobil.com\)](#); [Bishop, Zack](#); [Boese, Doyle](#); [Mark Sutherland](#); [Campbell, Bob \(Bob.Campbell@AftonChemical.com\)](#); [Cauley, Chris](#); [Jeff Clark](#); [Conrad, Michael \(Michael.Conrad@Lubrizol.com\)](#); [Conti, Ricardo \(riccardo.conti@exxonmobil.com\)](#); [Garcia, Luiz \(luiz.garcia@intertek.com\)](#); [Rich Grundza](#); [Gutzwiller, James](#); [Johnson, Kurt D. \[kurt.johnson@swri.org\]](#); [Kennedy, Steve \(steven.kennedy@exxonmobil.com\)](#); [Lanctot, Dan \(dlanctot@tei-net.com\)](#); [Matasic, Jim \(james.matasic@lubrizol.com\)](#); [McCord, James F. \(jmccord\) \(SwRI\)](#); [Moritz, Jim \(Intertek\)](#); [Sean A. Moyer](#); [OMalley, Kevin Kevin \(OMalley@lubrizol.com\)](#); [Ritchie, Andrew](#); [Rutherford, Jim \(JARU\)](#); [Santos, Elisa](#); [Secue, Nick \(Nicholas.Secue@Lubrizol.com\)](#); [Shank, Greg \(greg.shank@volvo.com\)](#); [Sutherland, Mark \[msutherland@tei-net.com\]](#); [VanScoyoc, Jonathan \(vanscj@cpchem.com\)](#); [Warden, Robert W. \(robert.warden@swri.org\)](#); [Juan Vega Intertek \(juan.vega@intertek.com\)](#); [Booth, James E. \(James.Booth@chevron.com\)](#); [Cooper, Mark \(MAWC\)](#); [Salvesen, Clifford R \(clifford.r.salvesen@exxonmobil.com\)](#); [raymond.g.burns@exxonmobil.com](#); [Juan Vega Intertek](#); [Chris.Taylor@VPRacingFuels.com](#); [Mlochte@swri.org](#)
Cc: [Kostan, Travis G. \(travis.kostan@swri.org\)](#)
Subject: Updated: Mack Surveillance Panel Meeting Minutes - May 4, 2016
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Corrected meeting date from May 5th to May 4th.

Everyone,

The following are the unconfirmed minutes of the Mack Surveillance Panel Meeting held on May 4, 2016 at Southwest Research Institute, San Antonio, TX. Please feel free to let me know if there are any changes or revisions needed. Thanks.

Call Participants:

Afton - Bob Campbell, Abaigeal Ritzenthaler
ExxonMobil – Cliff Salvesen
Infineum - Bob Salgueiro (Secretary), Elisa Santos, Jim Gutzwiller
Intertek - Jim Moritz, Luiz Garcia, Juan Vega
Lubrizol - Jim Matasic, Nick Secue, Kevin O'Malley, John Loop
Oronite - Mark Cooper (Chairman), Jim Rutherford
SwRI – Jim McCord, Robert Warden, Travis Kostan, Mike Lochte,
TEI - Mark Sutherland
TMC - Sean Moyer
Volvo/Mack - Greg Shank
VP Racing Fuels – Chris Taylor

Mack Surveillance Panel Meeting

The Mack Surveillance Panel meeting was called to order at 8:35 AM Central, by Mark Cooper, Chairman of the Surveillance Panel. The agenda topics are listed below, with discussions and actions following.

Agenda:

- **Words of Appreciation – Mark Cooper & Greg Shank**

Mark Cooper acknowledged the many contributions to the HDD Industry, of several people who had recently passed away. Ron Buck, was a key contributor to the research reports for some of the Mack tests, Scott Johnson was involved with the Mack T-6 and Mack T-7 engine test developments. Pat Fetterman was the Secretary of the Mack Surveillance Panel for at least 20 years and very active in the HDD Industry.

- **CPD Report – Mark Sutherland**

Mack T-8/T-11/T-12 – Volvo currently has 53 Mack E7 blocks, but won't release them as they still want to sell them as whole engines. T-8 blocks are not purchased through TEI, so availability is in question. The T-8 test procedure needs to be checked to see if states that blocks must be purchased new from Volvo. No one has been asking TEI for blocks. Greg will ask for 5 to be released to TEI as just bare blocks.

Mack T-12 parts batches were also reviewed (See attached CPD report for details). T-12 will need top and 2nd rings. For Top ring, batch assignment will skip batch "V" as that was a special batch from Federal Mogul, next top ring batch will be "W".

Mack T-13 – TEI reported that recently the rejection rates for T-13 pistons has been higher due to pistons arriving "dinged up".

Noncritical parts inventory – Current inventory is sufficient for all the Mack tests. T-12 oil pumps are in stock at TEI, but TEI needs to buy the special number tooth gears, which TEI has pressed on for the oil pump.

Bob Warden (SwRI) commented that there had been some issues recently with the new **Mack T-12 head gaskets** not holding together well. It doesn't torque like they used to, causing a blowout into the coolant passage. Bob Campbell (Afton) had tried to re-torque the head bolts after break-in but it doesn't help this problem. Bob Campbell suggested allowing the Surveillance Panel to go to aftermarket T-12 head gaskets or seek a manufacturer who builds high performance head gaskets. Greg confirmed that there was a change to the gasket material.

Bob Warden shared a photo of a recent blown out T-12 head gasket. Volvo will look into the issue.

Mack T-13 Rod bearings batch has changed, earlier than expected, due to 75% of the old batch being rejected due to rust.

- **Other Hardware Issues**

Broken **T-13 intake/exhaust valves** still seem to be popping up occasionally as an issue.

Wrong T-13 Turbo – After a recent turbo failure and replacement, ExxonMobil had noted the turbo was operating over speed (116600 RPM) and they were low vs targeted torque (~2000 Nm). The cause was the remanufactured turbo was an US07 turbo with a US10 part number. The turbos are easily identifiable. The

US07 turbo uses an 85mm compressor wheel with a 12 bladed turbine wheel (“B” turbine wheel). The US10 turbo uses a 92mm compressor wheel with an 11 bladed turbine wheel (“D” turbine wheel). Greg had asked for a corrective action at Volvo to address the issue immediately.

	<u>Compressor Wheel</u>	<u>Turbine Wheel</u>	<u>No. of Blades</u>
US07 Turbo	85mm	“B” wheel	12 bladed
US10 Turbo	92mm	“D” wheel	11 bladed

Crank thrust washers had changed (it was reported at last Surveillance Panel meeting) but no problems have been reported.

- **T-13 Humidity Discussions**

ExxonMobil shared fuel flow controlled reference data run in Sept/Oct 2015 which looked at the impact of Humidity on T-13 results. The reference data shared showed an effect of humidity at 20C vs 10C dew point, between two reference runs. Humidity control was added at ExxonMobil’s lab after the T-13 test development so matrix testing was not run with the humidity controlled. Dew point was measured about 2 feet prior to the air filter.

Lubrizol then shared a presentation on their analysis of humidity effect on T-13 results. Lubrizol had observed a seasonal shift in T-13 results which they traced back to the effect of Humidity. They ran the same oil in two stands, one with humidity control and the other without. Air is normally conditioned to 22C, then its raised to 30C (set point of test) but has no humidity control. The controlled humidity test had a target dew point of 16C, the other test averaged at 3.19C but varied with weather. Dew point was considered not the best measure as it does not take into account the effect of pressure. The non-humidity controlled test had more severe T-13 Oxidation and Kinematic Viscosity at 40C % Increase results than the one controlled. Additional affects were: used oil Iron, Pb levels, higher EGR position, Exhaust NOx and Soot. A 16C dew point was also selected since that what Passenger Car tests target.

SwRI looked at LTMS data and the impact of dew point from Precision matrix through Feb 20th 2016. The precision matrix was conducted in the last quarter of 2014 so because it was done during a short time period, maybe there was just not enough data collected to see a seasonality effect. Yi’s vs Dew point seems to confirm there is a trend. SwRI looked at a possible correction for dew point. X-intercept was set at 13.2C, then a correction was calculated for each T-13 parameter. A 15.3C dew point was the average dew point of the data SwRI used. SwRI acknowledged there were other options as well. Afton mentioned that some of the dew points reported for their matrix results may have been off, since the reported dew point measurements were variable but they control humidity to a 16C dew point.

There was discussion around the need to align on where the labs are measuring dew point/humidity for the T-13.

Adding humidity was something that all the labs felt they could do. Getting rid

of humidity (drying it out) would be very difficult below 15C dew point. A question was raised around if the labs should be targeting a value, or should they be operating in a tight range, and then applying a correction. A lengthy discussion ensued on what course of action to take. The basis for humidity control was lab capability.

The overall T-13 precision/BOI Matrix data Median dew point was 12.2C but it was run in a 3 month period of time, was torque controlled, and the labs were not measuring it in all the same place, back then. Reference data has been between 9C to 24C dew point with median of 13C.

Dew point of 16.1C = 11.4g/kg moisture content.

Bob Campbell moved that for next T-13 tests, the labs should target a moisture content of 11.4 g/kg, measured after intake air humidity controls.

On June 1st, report back the results on their capability to control to that target moisture content and then work to add upper and lower control limits. The pressure at dew point measurement and moisture content will be added to the test procedure and test report. The motion was Seconded by Jim Moritz.

Votes: YES 10, NO 0, WAIVE 0

The motion carried.

- **Low T-13 oil pressures**

New T-13 engines ordered and put into service seem to have low oil pressure. It was observed during matrix testing that lower oil jet pressure affected the test. Greg Shank (Volvo) said there have been a couple of changes to increase oil pressure on new production engines. Afton suggested checking the main bearing clearances. Volvo will follow up with any possible explanation. There remains a wide spread in oil jet pressure across the labs.

Old/New Business

- **Should a non-critical measurement make a test invalid?**

Jim Moritz (Intertek) shared that ACC monitoring agency asked to monitor test reports for exceptions like oil samples getting missed. A recent test was invalidated for a missed oil sample which was supposed to be taken for information only. The test procedure doesn't currently allow for any engineering judgement for these issues. Jim proposed we add a subsection to A3.3 for procedural requirements and results that have no impact on the outcome of the test, will get an engineering review. This would allow checking of box 2, that confirms the procedure was fully followed, on the procedure test report form. Wording will be developed to be included in the minutes. Any issues that come up during this interim period, until the wording is in place, should not invalidate a test if the intent of the procedure was met. It was suggested this be brought up to the ASTM Technical Guidance Committee (TGC) as is would apply to all other engine test procedures as well.

Other Business

- None

Next Meetings

- **June 1st Teleconference 10:30AM Eastern**

The Mack Surveillance Panel adjourned at 1:11PM.

Respectfully submitted,

Bob Salgueiro

Industry Liaison Advisor

Infineum USA L.P. 1900 East Linden Avenue Linden NJ 07036 USA

Office: 908-474-2492 Fax: 908-474-3637 Mobile: 908-358-8742 E-mail: Bob.Salgueiro@Infineum.com



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