



Committee D-2 ON PETROLEUM PRODUCTS AND LUBRICANTS

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UNAPPROVED MINUTES

OF THE

T-10 OPERATIONS AND HARDWARE

TASK FORCE MEETING #5

San Antonio, TX

Chairman Jim Collum convened the fifth meeting of the T-10 Operations and Hardware Task Force at 1:00 p.m. at PerkinElmer in San Antonio, TX.

ATTENDANCE

Perry Grosch – SwRI	Jim Gutzwiller – Infineum	Jeff Clark – TMC
Greg Shank – Mack	Riccardo Conti – ExxonMobil	Warren Totten – Cummins
Ken Goshorn – Mack	Scott Richards – SwRI	Bob Campbell – Ethyl
Andy Broff – SwRI	Bill Larch – Lubrizol	Jim Collum – PerkinElmer
Gary Tietze – TEI	John Haegelin – PerkinElmer	Mark Cooper – Oronite

****NOTE****

These minutes also contain all the issues that were discussed as part of the T-10 lab visitations to both SwRI and PerkinElmer.

PARTS AND HARDWARE

Ken Goshorn stated that cylinder rebuild kits will, hopefully, be available for shipment by mid-July, or later if the old design cylinder liners (w/ crevice seal) will be the ones used for testing. After discussion, a motion (Goshorn, Richards) to move to the new cylinder liners (no crevice seal) passed unanimously. This issue will also need to be brought before the Mack Surveillance Panel for approval in T-9 testing. In an effort to speed up the delivery process for the new rebuild kits, Ken stated that he would try to get a partial shipment of rings and liners to TEI in advance so that they may start taking the necessary parts measurements. The remainder of the rebuild kits will be shipped to TEI when the piston crowns are available. The group made note that the next batch of parts should be ordered a few months earlier than would normally be the case.

POST MEETING NOTE

Ken was informed that some rings and liners should be available by late June. He is trying to direct shipment of these parts to TEI. The mid-July timeframe for availability of piston crowns remains unchanged.

Gary Tietze stated that TEI is working on the EGR rig hardware. Stainless steel piping will be used, and the exhaust manifold will be included as part of the rigging. TEI will build a prototype, confirm with the San Antonio labs that it fits, and then they will build two more. All three will be used in verification testing. If the design proves out, then all labs will need to have the standard EGR rigs in place prior to the start of the matrix.

Ken Goshorn said that Mack will supply TEI with the venturis, EGR coolers, and small turbos. Cummins will supply the large turbos, and Warren Totten said that this should not be a problem.

Ken Goshorn will handle oxygen sensor replacement as needed. He is also looking into new sensors that are closer to production (oxygen only) but does not want to change any of the electronics associated with the sensor.

OIL COOLER DELTA P

The oil cooler delta p spec will be removed from the procedure.

EGR COOLANT FLOW

Three labs return EGR coolant to the engine coolant-in, and two labs return it to the engine coolant out. A motion (Collum, Campbell) was made to standardize on returning the EGR coolant to the hose attached to the adapter block at the coolant pump inlet, with the coolant-in t/c located anywhere between the heat exchanger and the coolant pump inlet. This motion passed unanimously. It was also noted that SR will supply the oil cooler adapter blocks and hardware.

OIL CONSUMPTION CALCULATION / AUXILIARY OIL SYSTEM

Oil consumption is a possible pass/fail parameter for the T-10. The group agreed that there are two steps that are necessary: 1) standardize the oil system and collect data; 2) use the data to develop a calculation method. It is premature to address the second step, but to accomplish the first step the following were agreed to:

1. Require 6 min. data acquisition on the oil weigh scale.
2. Suction line location on oil pan: exhaust side, 4.75" down from oil pan rail, and 7" back from the front of the pan. This location is directly above the oil sump t/c location.
3. Return line location: intake side at side drain plug.
4. No specs on line length, however, the size specs from the T-8/T-9 must be used (#8 suction, #6 return, and #8 minimum vent).
5. The vent line is to be connected to the oil scale bucket and the dipstick tube. Crankcase pressure may be taken anywhere in the vent line.
6. Auxiliary oil pumps: a motion (Collum, Richards) to standardize on the pumps used by SR passed unanimously. SR provided the pump specs (Viking Pump Model SG053514), pump speed is specified as 1725 rpm.
7. The oil weight is to be recorded before and after any force oil drains.

START-UP / SHUTDOWN / RAMP PROCEDURES

SR will provide the standard start-up, shutdown and stage change ramping procedures.

FUEL INJECTION PUMP ISSUES

The electronic unit pumps and injector nozzles can be changed at anytime, using the procedure specified in the Service Manual (note: enter into the ECU the four-digit CAL code from the label of the EUP). Mack recommends the injector nozzles be check or serviced every 300 hours. The electronic unit pumps are not to be serviced, only replaced.

Ken was asked to see if the ECU can be re-programmed with fixed timings at all conditions except Phase I.

****POST MEETING NOTE****

Ken forwarded the following response to the ECU issue: ‘The short answer is no. Because the “normal” timing circuit uses a number of different inputs to arrive at its conclusion of the correct timing for a given speed and load, and those have been zeroed out to allow the present “adjustable” timing circuit to rule, a lot of programming (and not even a clear path) would be required to go to a “split” system. No one at Mack will invest the resources to tackle this. We must continue to pay close attention to the test, and set the timing according to the conditions desired, using the present system.’

COMPRESSOR DISCHARGE PRESSURE

Compressor discharge pressure is to be measured within 6” of the second turbo’s discharge. Both SwRI and PerkinElmer need to move their pressure taps to comply.

EGR COOLER INLET TEMPERATURE

Distinct EGR cooler in temperatures are not necessary. The exhaust pre-turbine temperatures are to be used instead.

FUEL-IN TEMPERATURE

PerkinElmer needs to move their fuel-in t/c from the top of the secondary filter to the outlet of the fuel transfer pump.

PRE-TURBINE EXHAUST PRESSURE

PerkinElmer takes this pressure measurement of the exhaust ports for cylinders 2 and 5. They agreed to move it to the turbo inlet, similar to SwRI. Note, unlike the T-8 and T-9, there is not enough room for a tee at the turbo inlet to take both temp and pressure. The pressure tap will need to be separate and upstream from the t/c.

COOLANT SYSTEM PRESSURE

This was dropped as a validity requirement, and data acquisition is not necessary.

OIL GALLERY TEMPERATURE AND PRESSURE MEASUREMENTS

Oil gallery temp is to be measured at the center port on the oil filter housing. Insertion depth is 3.875”. Oil gallery pressure (aka after-filter oil p) is to be taken from the left port. A photo will be put in the procedure to show these locations.

OXYGEN SENSOR LOCATATION

In addition to the already specified distance from the turbo (14” – 17”) the radial location is specified as 12 o’clock. Ethyl will provide the spec for insertion depth, which is derived from counter-sinking the sensor so that the threads are flush with the inside of the pipe.

EGR AND INTAKE MANIFOLD CLEANING

The EGR coolers and intake manifold are to be cleaned before every test. The coolers are to be solvent flushed, and air-dried. The intake manifold is to be scrubbed using solvent and a nylon brush and then also washed using a parts cleaner (dish washer). TEI will look into the possibility and cost of anodizing the intake manifolds.

CENTRIFUGAL FILTER VENT

The part number for the jiggle cap vent is 541KB23. These are available from any Mack dealer.

HUMIDITY

It was agreed that there would be no conditioning of intake air downstream of the humidity sensor.

AIR FLOW MEASUREMENT

After some discussion, it was agreed that air flow measurement would be dropped as an issue for the O&H group.

EGR GASKET MATERIAL

Bill Larch of Lubrizol will provide TEI the information on the EGR rig gasket material in case it ends up being needed in the standardized rig.

QUALITY INDEX

It will not be necessary to calculate and report QI numbers during the matrix. Please note that matrix operational data files will need to be sent to the TMC similar to the PC-7 matrix.

CENTRIFUGAL OIL FILTER

A new, thinner spindle was introduced to get speed and efficiency back up. After some discussion, the group decided to stay with the current part and not switch to the new spindle.

BLOWBY

Blowby measurements are to be taken at a minimum frequency of every 6 minutes.

REMAINING LAB VISIT ITEMS

The labs were reminded that the data acquisition checklist needs to be completed and returned to the TMC before the start of the matrix. Similar to PC-7, the labs will need to provide the operational data for matrix tests to the TMC.