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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

April 04th, 2013

Reply to:
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ASTM D02.B0.03 L-37-1 Next Generation Hardware Task Force
Members and Guests:

Attached for your review and comment are the unconfirmed minutes of the:

- **April 03rd , 2013 Next Generation Hardware Task Force Meeting (Teleconference)**

Please direct any corrections or comments to my attention.

Sincerely,

Date: 2013.04.04 09:08:14 -04'00'

Chris Prengaman, Chairman
L-37-1 Hardware Taskforce Chairman

Report of Meeting
L-37-1 Hardware Task Force Meeting
Teleconference
April 04th, 2013

Attendees:
Voting Members in **BOLD**
Gottwald, Thomas – Afton Chemical
Koglin, Cory – Afton Chemical
Gropp, Jerry – Lubrizol
Guzikowski, Joe – Dana
Koehler, Brian – Southwest Research Institute
McGlone, Bruce – Meritor
Prengaman, Chris – Lubrizol
Green, Galen - BASF
Smith, Dale – Intertek Automotive Research
Marsh, Greg – American Axle
Chen, Jui –American Axle

The meeting was called to order at 10:10 am EST.

1.0 Agenda Review

2.0 Review Break-In Proposal

B. Koehler updated the group that the 1B Non Lubrited Run was expected to start later today, and a rater from SwRI will send out comments later in the week to the group.

3.0 ASTM Procedure

C. Prengaman shared that the ASTM procedure draft is progressing and the intent at this time will be to pull a new D# procedure. This allows the current D6121 to stay an active procedure at the same time. With a new D#, the test method will need a different title than the current D6121.

The following is proposed, and if it was requested that if anyone comes up with anything better, to please let the group know.

Current Title (L-37 / D6121)
"Evaluation of Load-Carrying Capacity of Lubricants under conditions of Low Speed and High Torque Used for Final Hypoid Drive Axles"
New Title (L-37-1 / DXXXX)
"Evaluation of Load-Carrying Capacity of Lubricants Used in Final Hypoid Drive Axles Operated under Low-Speed and High-Torque Conditions"

Units:
The goal in the new procedure will be to use SI units (C° and Nm), the group was asked if anyone thought this would be an issue.

J. Guzikowski – Nearly all designs are in metric now, so he did not see an issue from the LRI prospective.
J. Gropp – reports / paperwork tends to have the specs right next to the values, so units aren't as important as long as you can tell if it is in spec or not.
B. McGlone – Does not see an issue with this – a pass / fail will still be a pass / fail.

B. Koehler – shared that typically there is a tendency to round units after they are converted from the standard units to something nice, so we just need to be on the same page when this happens.

4.0 New Business

No new business.

5.0 Adjournment

Motion to adjourn .

Respectfully Submitted

Chris Prengaman

L-37-1 Task Force Meeting

April 04th, 2013
10:00 am –11:00 pm EST
Teleconference

Agenda

1) Call to order/Agenda review

2) Review Break-In test progress

3) ASTM Procedure

   a) Units

   b) Draft Title:

   c) Current Title (L-37 / D6121)
      "Evaluation of Load-Carrying Capacity of Lubricants under conditions of Low Speed and High Torque Used for Final Hypoid Drive Axles"
   d) New Title (L-37-1 / DXXXX)
      "Evaluation of Load-Carrying Capacity of Lubricants Used in Final Hypoid Drive Axles Operated under Low-Speed and High-Torque Conditions"

4) New business

5) Adjournment

Call in number → **216-706-7052 code 324160**

SwRI offered to propose a modified break-in procedure and offer one test on oil 1B, at standard temps, 950 ml oil charge, Non-lubrited axle, using the modified break-in listed below.

Some comments:

1. This axle currently has a limited slip diff. so we can keep the dynos in synch related to RPM without differential RPM control (as long as our torque differential is not too large). This is different than the Dana model 60.
2. The variable speed drives and electric drive motors give us break-in options that we did not have with the fired engines. The motors do a great job of speed control over a large and changing range of loads.
3. I am not a gear engineer but axle break-in does relate directly to the change of contact pattern which relates to elastic gear tooth deflection which relates to load.
4. Oil temp and gear tooth surface temp spikes significantly while the tooth surface modification is in process and then drops as it is completed.
5. The current L-37-1, at SwRI, is showing a significant amount of heat generation during the first 20 to 40 minutes of on test time (after the one step break-in).
6. The industry made the test significantly milder by independently 1. Forcing the outer housing temp (and bulk oil temp) to a lower value. 2. Adding more oil to the sump.

How SwRI currently runs the L-37-1 test (prior to 3-28-13):
Ramp pinion rpm to 2352.9 in 90 seconds with no load on dynos.
Take dynos from no load condition to 350 lb-ft each in 2 minutes (both ramp together).
Ramp load to 375 lb-ft each in 1 minute (This two step approach was originally set up to prevent torque overshoot but that has not been seen as a problem)
Stabilize speed and load for 45 seconds
Start break-in time and run for 65 minutes.
Ramp load down to 100 lb-ft on each dyno over 1 minute period.
Stabilize speed and load for 20 seconds.
Ramp pinion rpm down to 427.8 rpm over 2 minute period.
Stabilize speed and load for 30 seconds.
Ramp load to 1600 lb-ft over 2 minutes.
Ramp load to 1650 lb-ft over 40 seconds.
Stabilize for 65 seconds.
Wait for oil temp to be in spec.
Run for 11 hours.
Ramp load down to 100 lb.-ft. in 1 minute.
Ramp pinion speed to zero rpm in 1 minute.
Test over.

SwRI proposed way to run the test (modified Break-in for use after 3-27-13):
Ramp pinion rpm to 2352.9 in 90 seconds with no load on dynos. (at speed, the SwRI dynos will have about 20 to 30 lb-ft of torque displayed.)
Stabilize speed for 60 seconds while also ramping both dynos to 50 lb-ft load. (allows speed control to catch up, assures both dynos ramp load together in next step).
Take dynos from 50 lb-ft of torque to 375 lb-ft each in 20 minutes. (Both ramp together) Include this as break-in time.
Run steady state for 1 minute at 100 Hz data logging (Include as break-in time).

Run steady state for an additional 44 minutes while logging once each 10 seconds. (Include as break-in time).
Ramp load down to 100 lb-ft on each dyno over 1 minute period.
Stabilize speed and load for 20 seconds.
Ramp pinion rpm down to 427.8 rpm over 2 minute period.
Stabilize speed and load for 60 seconds (allows speed control to catch up).
Ramp load on each dyno from 100 lb-ft to 1650 lb-ft over 1 hour period. (Count this as additional break-in time?)
Wait for oil temp to be in spec. (it will be)
Run steady state for 1 minute at 100 Hz data logging. (Count as test time)
Run for 10 hours and 59 minutes while logging once each 10 seconds. (Count as test time)
Ramp load down to 100 lb.-ft. in 1 minute.
Ramp pinion speed to zero rpm in 1 minute.
Test over.

Oil temp set point control strategy will be unchanged and will follow the L-37 method.

Data logging while the axle is turning will be once each 10 seconds unless otherwise stated above.

Load and speed tuning will be fast enough to follow the ramps but not aggressive enough to cause oscillations.

When I list “ramp load” I am talking about a linear ramp of the control set point from the existing process condition at the start of the step to the target we are going to achieve.

Other future issues would be outlier calculations, plotting of data, data statistical summaries, unscheduled shutdowns during extended ramping, etc. I have not concerned myself with those yet.

Regards,
Brian P. Koehler
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