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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

Issued: July 16, 2010
Reply to: Dan Worcester
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The unapproved minutes of the 05.13.2009 Sequence VI Surveillance Panel meeting held in San Antonio, Texas.

The meeting was called to order at 1:00 PM by Chairman Charlie Leverett.

Agenda

The Agenda is the included as Attachment 1.

Roll Call

The Attendance list is Attachment 2.

Minutes

The minutes from the previous meeting were accepted unanimously

Motion – Accept the minutes from the previous meeting on 11.18.2009.

Rich Grundza / Dave Glaenzer / Passed Unanimously 12-0-0

1.0 Action Items

1.1 Time response has been completed for all labs.

1.2 MAP is being included on Break-In traces supplied to TMC to date.

1.3 There was an editorial change required for the procedure, Section 6.6.5.3.

1.4 There was an editorial change required for the procedure, Section 6.5.12. Both will be covered by Information Letter 09-2.

1.5 There is now a replacement pressure transducer from Rosemount.

Motion – Modify VID test procedure to allow the 3051 pressure transducer as an acceptable alternative to the 1151 pressure transducer.

Dan Worcester / Dave Glaenzer / Passed Unanimously 12-0-0

1.6 The LTMS TF Statistics Sub-Group has generated Version 2 that should be reviewed for implementation on the VID test.

Motion – Form a task force to develop a recommendation to the surveillance panel for adopting LTMS 2nd Edition to the Sequence VID. Task force to report to surveillance panel within six weeks of today's meeting.

Dwight Bowden / Ed Altman / Passed Unanimously 12-0-0

2.0 Old Business

2.1 Break-In ramps and traces. George Szappanos gave a presentation included as Attachment 3.

2.1.1 Data has been provided by three labs.
2.1.2 It will be difficult to prove equivalent operation.
2.1.3 Data will be needed from all labs. This will be tabled for now.

Motion – Add MAP data requirement, the same as engine speed and torque data requirement, to a minimum of three break-in transitions.

George Szappanos / Rich Grundza / Passed Unanimously 12-0-0

Action Item – Once sufficient MAP data from engine break-in transitions is available, determine a break-in MAP specification.

2.2 System response time data had been gathered.
- 2.2.1 There were questions on how the data was gathered.
- 2.2.2 One lab had all minimums.
- 2.2.3 Here is that data.

Min	Max	Parameter
0.1	1.3	Speed
0.2	1.1	Torque
0.6	4.5	Oil Gallery Temp
0.6	4.3	Coolant inlet temp
0.2	2.5	Exhaust Backpressure
0.6	4.4	Intake air temp
0.5	4.7	Fuel Rail Temperature

Action Item – Refine the procedure for the system time response measurement, add MAP, and repeat at the laboratories.

2.3 There was discussion on load cell power supplies and temperature variations.
- 2.3.1 Data for the labs was supplied.
- 2.3.2 That data is not meaningful.

Action Item – Laboratories to provide their dyno excitation power supply temperature coefficient specification for each VID test stand.

Action Item – George Szappanos and Rich Grundza to work on the dyno excitation power supply issue and report to the surveillance panel.

<u>3.0 New Business</u>

3.1 Per procedure, Section 6.3 fans are not allowed to blow on the VID engine.

3.2 Afton has been using the IVA style fan to cool the wiring on the Crank Sensor.

3.3 Guy Stubbs noted the oxygen sensor wiring can also melt due to its mounting location.

Motion – Modify section 6.3 of the VID test procedure to allow for fans, less than 75 cfm, to blow across the crank position sensor and oxygen sensors.

Dave Glaenzer / Mark Mosher / Passed Unanimously 12-0-0

3.4 There was a question on how labs monitor CEL or EMC problems. OHT has agreed to modify new wiring harness units with the CEL activated.

Action Item – Dave Glaenzer will supply information on the software package to monitor the GM 3.6L engine sensors.

Action Item – George Szappanos will supply information on wiring in the "check engine" light.

3.5 BL-3 has been blended and distributed. SwRI needs to complete their matrix run to compare BL-2 and BL-3.

3.6 There was a question on VID engine life. In particular oil consumption tends to end the life of a VID engine. OHT supplies a chart of engine usage, includes as Attachment 4. All labs should be holding used VID engines. A rebuild may include honing and new rings at a minimum.

Action Item – OHT to report VID engine usage and expected depletion date at all surveillance panel meetings.

Action Item – Sid Clark to inquire with GM if information on GM's and SwRI's opinions on oil consumption of the VID engine can be shared with the surveillance panel.

3.7 The load cell specification in the procedure is incorrect.

Action Item – Correct sourcing information for the load cell in appendix of the VID test procedure.

3.8 Two new 5W-20 reference oils have been made available.

Motion – Accept both potential reference oils as GF-5 category reference oils. Select oil # 2 (FEI SUM = 2.79%, FEI 2 = 1.41%) for use in the Sequence VID.

NOTE: Oil # 2 is Ron Romano's 5W-20 oil.

3.9 There was a brief statement made regarding some VID reference tests conducted with the coolant thermocouples reversed. The issue was addressed and resolved by the Test Monitoring Center.

The meeting adjourned at 2:30 PM.

The next meeting will be for LTMS Version 2 review in 6 weeks.

Sequence VI Surveillance Panel
May 13, 2010 @ SwRI
1:00 – * 5:00

**** I expect we will use all the allotted time for this meeting and may even go past 5:00 if we are close to a finish of the agenda.***

1.) Roll Call and attendance list, any <u>membership changes or voting proxies</u>?

2.) Approval of minutes from last conference call 01/19/10.

3.) Review of Action Items

4.) Old Business
4.1 Break-in Traces
Comments from George:
Thanks Rich. Here's my expectation down the road...

* it will be difficult to systematically characterize these ramps, especially given that some labs are providing their "data" as chart images.

* there will be a significant amount of variability in the shape of the transitions (length of time to transition, the linearity/quality of the ramp, coordination of speed & load control, etc)

* what IS provided will reveal a manifold pressure spike during both ramps (upward during accel, downward during decel)

Based on all that, my own simplistic assessment would be comprised of identifying what those peak values are and at what engine speed they occur. It's crude, but those numbers are indicative of the true load on the engine during the transition. It's a reasonable first cut, and a more indepth analysis would require substantially more effort.

Just my "too sense".

4.2 System Response times, summary from Rich:
Here are the system response min and max from the 18 stands that have been or are calibrated.

Min	Max	Parameter
0.1	1.3	Speed
0.2	1.1	Torque
0.6	4.5	Oil Gallery Temp

0.6	4.3	Coolant inlet temp
0.2	2.5	Exhaust Backpressure
0.6	4.4	Intake air temp
0.5	4.7	Fuel Rail Temperature

4.3 Temperature Excursion in Power Supply

I (George) suppose since I was the one who prompted the capture of all this data it's probably my obligation to attempt to analyze it!

Here's my thoughts:

- It appears that within the entire data set, there is about a 25 deg C temperature excursion in power supply temperatures (max of all maxes – min of all mins); that seems like a lot, but it covers all labs, all tests
- what's important is the max temperature excursion during a given test (just like load cell temp)
- This needs to be lab specific since each lab has their own power supply with associated accuracy
- Labs should supply this data, and the data should be recrunched as the product of the accuracy spec * temp delta

My suggestion going forward is that we should review the new calculation, determine reasonable limits, and if it still makes sense, create a new reported parameter to capture it (and delete the voltage and temp delta params). Labs would be responsible for determining the temperature sensitivity spec from their supplier's documentation, and then utilizing that value in combination with the temperature delta value to calculate the value for the new parameter.

The intention with all this is to not make life more difficult, but a) identify when the load cell output could be compromised, and b) insure that labs select power supplies appropriate for their test cell conditions.

Geo.

5.) New Business

5.1 Use of fans, there was a question if the following section should be omitted from the VID procedure, this was implemented in most all tests types but may not pertain to the VID?

> *6.3 Laboratory Ambient Conditions—Do not permit air from fans or ventilation systems to blow directly on the engine. The ambient laboratory atmosphere shall be relatively free of dirt, dust, or other*

contaminants as required by good laboratory standards and practices

5.2 Detecting Sensor Failures – General discussion on how Labs detect sensor failures.

5.3 BL Blend 3 Verification Review

5.4 LTMS Review

6.) Next Meeting

7.) Adjournment

ASTM SEQUENCE VI SURVEILLANCE PANEL

May 13, 2010

Name	Address	Phone/Fax/Email	Attendance
Bowden, Dwight Voting Member	OH Technologies, Inc. P.O. Box 5039 Mentor, OH 44061-5039	Phone: 440-354-7007 Fax: 440-354-7080 dhbowden@ohtech.com	
Bruce Matthews Voting Member	GM Powertrain Engine Oil Group Mail Code: 483-730-472 823 Joslyn Rd	Pontiac, MI 48340: 248-830-9197 bruce.matthews@gm.com	
Andy Ritchie Voting Member	Infineum 1900 East Linden Ave. Linden, NJ 07036-0735	Phone: 908-474- Fax: 908-474-3637	
Ron Romano Voting Member	Ford Motor Company 21500 Oakwood Blvd POEE Bldg Rm DR 167 MD 44 Dearborn, MI 48121-2053	Phone: 313-845-4068 rromano@ford.com	
John Rosenbaum Voting member	Chevron Global Lubricants	Phone:	
Leverett, Charlie Voting Member	Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238	Phone: 210-647-9422 Fax: 210-523-4607 charlie.leverett@intertek.com	
Grundza, Rich Voting Member	ASTM TMC 6555 Penn Ave. Pittsburgh, PA 15206-4489	Phone: 412-365-1034 Fax: 412-365-1047 Dml@tmc.astm.cmri.cmu.edu	
Miranda, Timothy Voting Member	BP Castrol Lubricants USA 1500 Valley Road Wayne, NJ 07470	Phone: 973-305-3334 Timothy.Miranda@bp.com	
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Tracey King Voting Member	Chrysler	Phone: Fax: tek1@chrysler.com	
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Robert Stockwell Voting Member	ConocoPhillips Lubricants R&D Passenger Car Engine Oil	office 580-767-6894 Robert.T.Stockwell@conocophillips.com	
Teri Kowalski Voting Member	Toyota	Phone: 734-995-4032 teri.kowalski@tema.toyota.com	

ASTM SEQUENCE VI SURVEILLANCE PANEL

May 13, 2010

Name	Address	Phone/Fax/Email	Attendance

Guest Present at meeting

Jeff Clark, TMC

Al Lopez, Intertek

Jerry Brys LZ

Chris Castanien LZ

Jason H. Bowden OHT

Guy Stubbs SwRI

Jim Carter Haltermann

Art Andrews ExxonMobil

Bill Maxwell ExxonMobil

Jo Martinez Oronite

Ed Altman Afton

Todd Dvorak Afton Chemical

Doyle Boese Infineum

Bill Buscher SwRI

Proposal

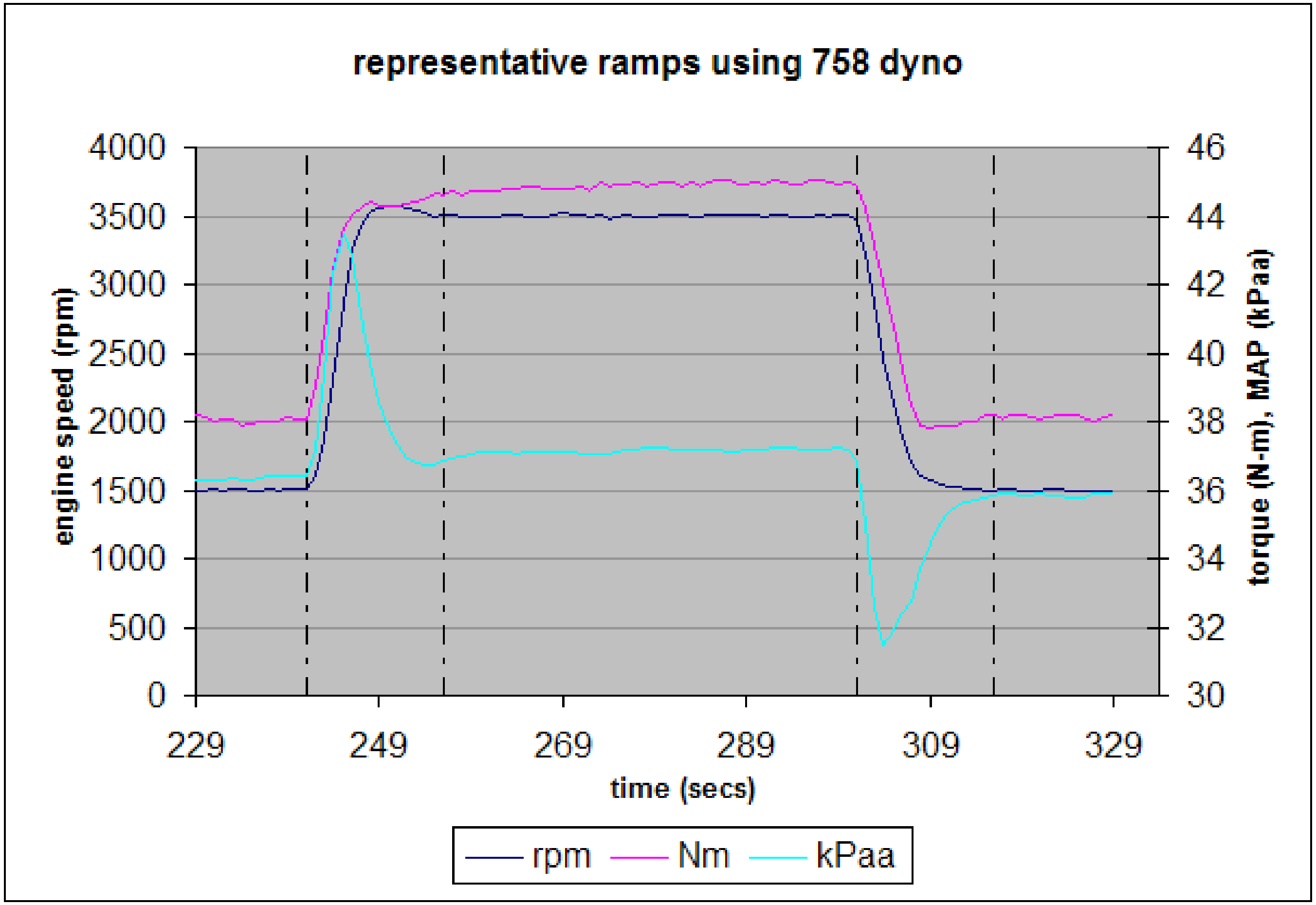
- VID procedure to allow use of alternate dynos for break-in
- Ramp specifications to be amended to specify manifold pressure targets midway through ramps
- Targets to be developed by comparison of industry labs’ data

background

- Procedure states that the break-in is to be performed using Midwest 758 dyno
- The break-in cycle is dynamic and includes an accel and decel every 5 minutes
- The torque the engine produces during that time is the sum of what’s measured and absorbed by the dyno, <u>plus the torque to accelerate the inertia of the dyno, driveshaft, and engine</u>
- The issue with dynos other than the 758 is that they are different inertias, and therefore would provide for a different effective load on the engine

Typical Ramps

- Ramping must be completed in 15 sec
- Note manifold pressure peaks halfway through ramp



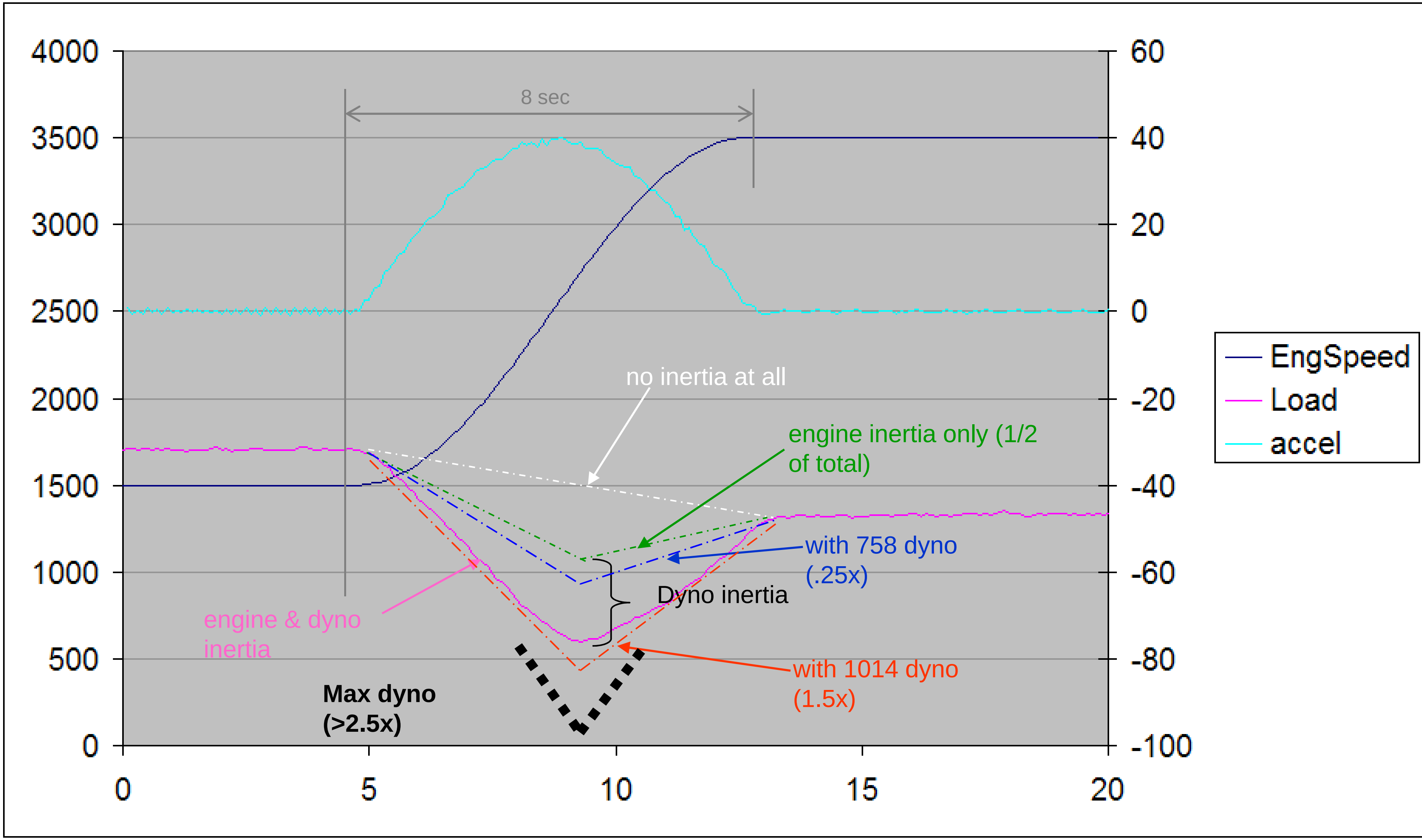
Concerns:

1. Different dynos will not provide the same load to the engine
2. It will be difficult to establish consistency between labs for how breakins are conducted
3. The effectiveness of breakins will be different

1. Dynos of larger inertia

- The choice will be to use a larger dyno than a 758, such as a 1014 (6x larger)
- Can such a large dyno provide the same load to the engine?
- Manifold pressure, not dyno torque is the true indicator of engine load due to the impact of engine and dyno inertia.
- How big is too big?

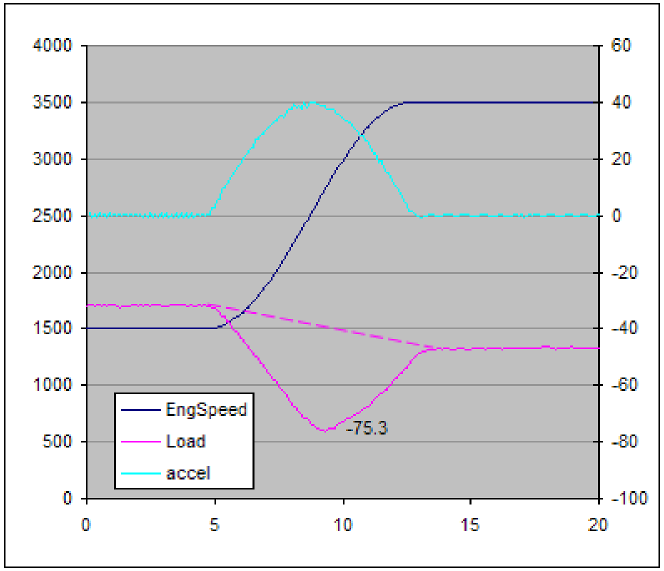
VID engine and 150hp dyno motored from break-in stage A to stage B with **ignition OFF**



The maximum dyno size that will still provide the same load to the engine is approx 10x bigger than a Midwest 758 (all engine torque channeled into inertia, with no dyno excitation required)

	Motoring requirement (Nm)
no inertia	-40
LZ dyno & engine	-75

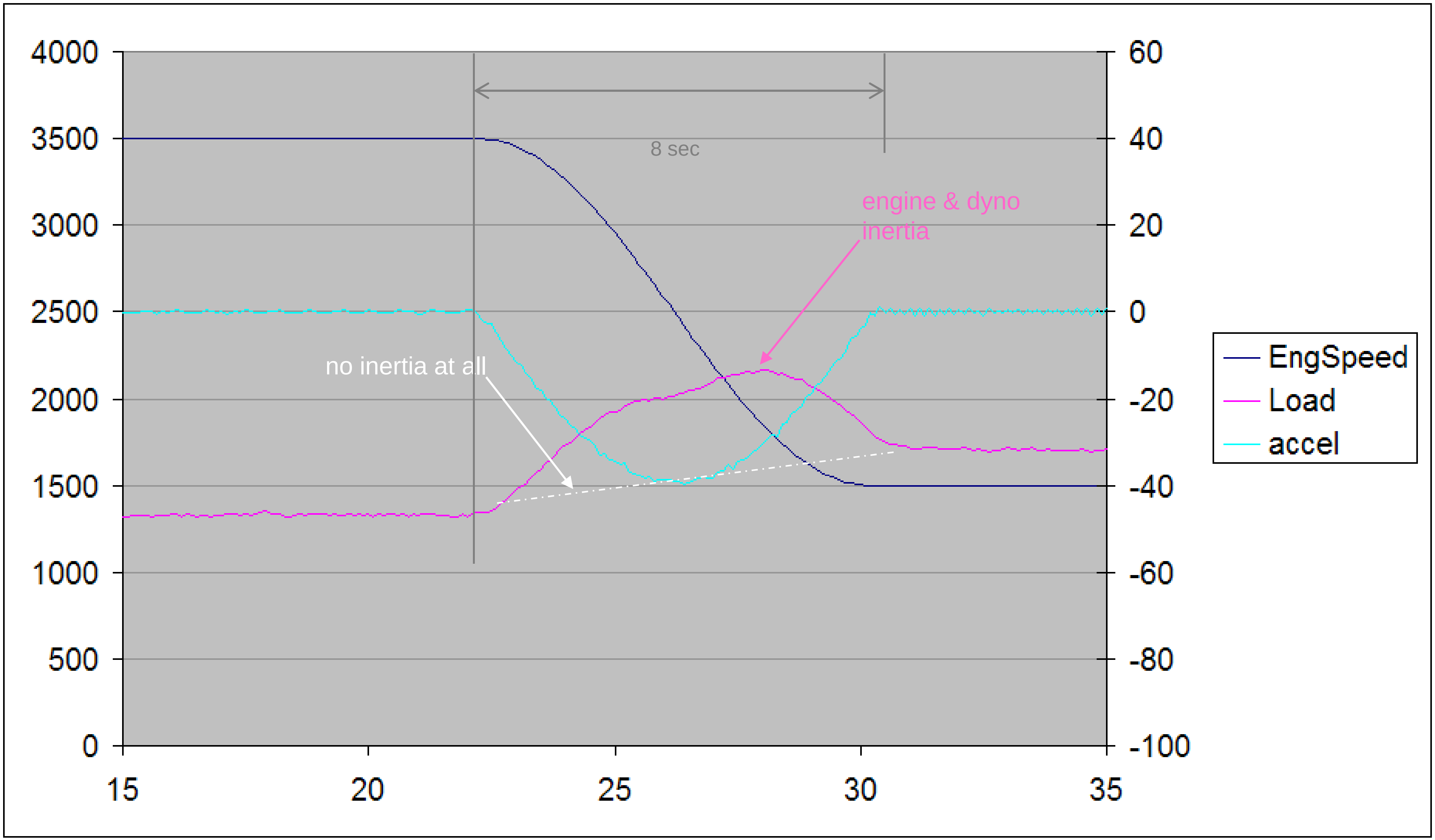
Component	Inertial torque
LZ dyno & engine	35
Engine only (52%)	18
Dyno only	17



Dyno	Inertia (lb-ft²)	Ratio (to LZ dyno)	Dyno Inertial torque	+ engine inertia
LZ dyno	0.43	1	17	35
758	0.11	0.25	4	22
1014	0.66	1.5	26	44
Max	**1.14**	**2.7**	**45**	**63***

** Actual Torque produced by engine when in middle of ramp, determined by operating engine at steady state at the condition that represents that point*

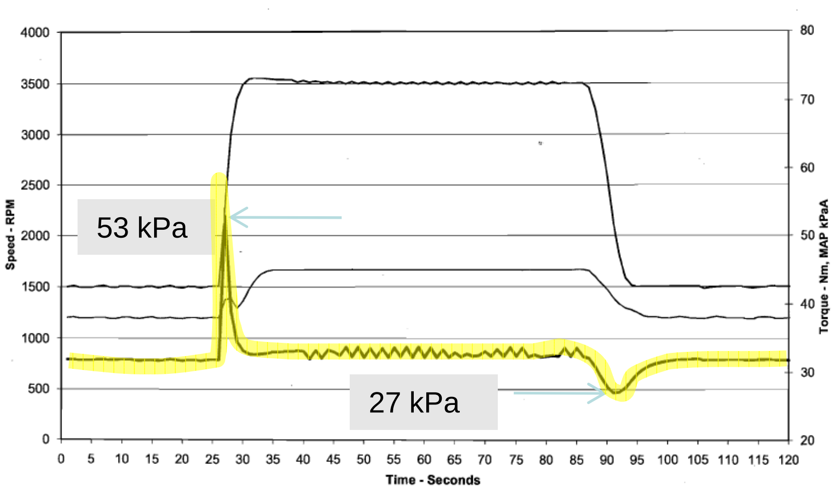
Motored from stg B to stg A. Note that approx 30 Nm is required to decelerate this system which is ~50% heavier than a 758. The presumption is that larger dynos will have no issue with accommodating their correspondingly higher torque requirements.

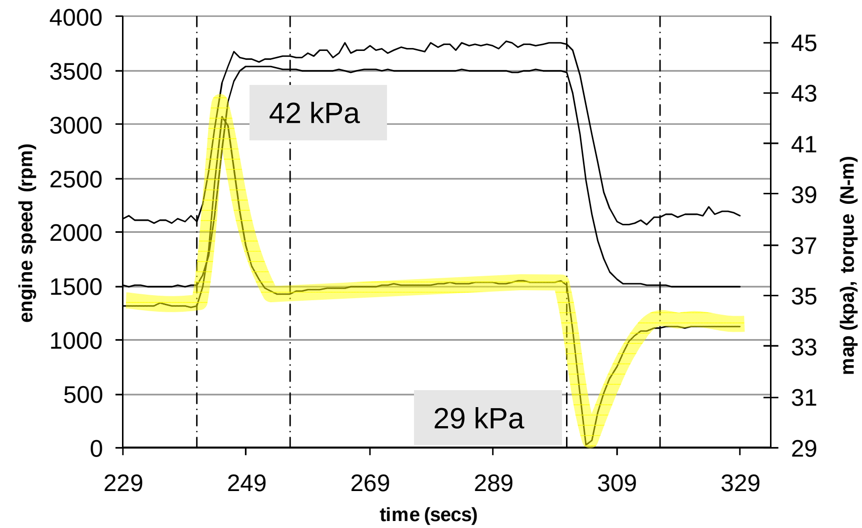


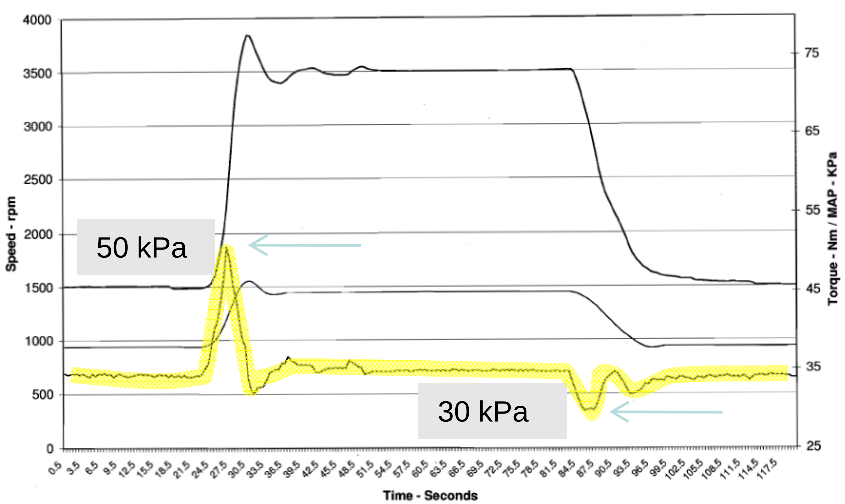
2. Ramp consistency

- Manifold pressure should be the target during ramping.
- Must pass through window (±Y kPa abs) halfway through ramp
- Torque is still setpoint during steady state

Only three labs have provided MAP data







	Up ramp	Down ramp
Min	42	27
Max	53	30

3. Consistency in engines

- Completeness of breakin is still judgment call by engineer
- New engine must be triple referenced before candidate runs (~450 hrs)
- Any intra-test change in engine is nullified by the BLA.

Revision to Draft procedure:

- 11.5.4 The engine break-in shall be done on a test stand that has a Midwest or Eaton 37 kW Model 758 dry gap dynamometer (see X1.4) and meets the specifications shown in Table 2. Alternative dynamometers may be used provided they meet the manifold pressure criteria shown in Table 2 during condition ramping.
- 11.5.5 Record speed, load, and manifold pressure at a minimum of one second intervals.
- Table 2:

	Cycle A	Cycle B
Time at Each Step, min	4	1
Time to Decel. to Step A, s		15 max
Time to Accel. to Step B, s	15 max	
Speed, r/min	1500 ± 50	3500 ± 50
Power, kW	6.0	16.5
Load, N·m	38.00 ± 5	45.00 ± 5
MAP, kPa at mid ramp	31 ± 2	42 ± 2

TBD → (MAP, kPa at mid ramp)

Next steps

- Develop a complete analysis of MAP data for all industry labs so as to finalize the MAP setpoints
- Specify a max time constant for MAP

Appendix: inertia calcs:

Total Inertia -

$$T = I * \alpha$$

$$40 \cdot Nm = I_T * 400 \cdot \frac{rev}{\min} / \sec$$

$$I_T = \frac{40}{400} * \frac{Nm}{rev} * \sec * \frac{rev}{2\pi * rad} * \min * \frac{60 \sec}{\min}$$

$$I_T = 0.90 \cdot Nm \cdot \sec^2$$

The 40 Nm is the difference between the white “no inertia” line and the pink measured “total inertia” line.

Dyno Inertia -

$$I_D = (10.2 \cdot lb \cdot ft^2) * \frac{1.356 \cdot Nm}{ft \cdot lb} * \frac{\sec^2}{32.2 \cdot ft}$$

$$I_D = 0.43 \cdot Nm \cdot \sec^2$$

Engine Inertia -

$$I_T = I_D + I_E$$

$$I_E = 0.90 - 0.43$$

$$I_E = 0.47 \cdot Nm \cdot \sec^2$$

VID Engine Consumption by Year