

## L-42-1 Task Force Meeting Minutes

Virtual Meeting – Webex

July 22, 2020

### **Attendees:**

D. Beck (TMC)

M. Sangpeal (Afton/C)

R. Warden (SwRI)

J. Clark (TMC)

D. Schwenk (Afton)

A. Zyski (Dana)

A. Goyal (BASF)

R. Slocum (LZ)

A. Lange (Intertek)

W. Venhoff (LZ)

### **Call to Order**

### **Review of Agenda**

The meeting agenda is attached.

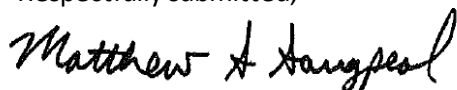
### **L-42-1 Development**

A Webex conference was held to discuss L-42-1 development. M. Sangpeal compiled and presented all previous development efforts to date. After reviewing that information, it was decided that the next logical step would be to investigate performance of an electric input motor driving a standard L-42 test stand with spring plates and Eddy Current dynos. R. Warden volunteered to use SwRI's test stand that is already built with this configuration. The group also agreed to use the current Dana 44 hardware for this effort, and then explore other options once performance is satisfactory. Afton, Intertek, and LZ will donate left-over hardware to be used for this testing. Those three labs will check what they have available, and report quantities at the August SP meeting. The quantity of available hardware will be used to help determine the test plan. Initial testing will investigate the impact of each phase of the L-42 test method on EOT scoring.

### **Membership Review**

### **Adjournment**

Respectfully submitted,



Matt Sangpeal

L-42 Surveillance Panel Chairman



# L-42-1 Development Task Force Meeting








Virtual Meeting

July 22, 2020

10:00 am - 11:00 am EST

Passion for Solutions™

# Agenda

-  **Call to Order**
-  **Agenda**
-  **Purpose**
-  **L-42-1 Development History**
-  **Next Steps**
-  **Task Force Members**
-  **Adjournment**

# Situation

## **L-42 test is aging, technology has progressed**

- ▲ Current controls hardware is un-supported
- ▲ Discontinued drivetrain/engine parts

## **Desire to move away from fired engine testing**

- ▲ Move to electrically driven stand

## **Previous development efforts (beginning 2014)**

- ▲ Summary of what has been done to date (snips of SP meeting minutes)

# Aug. 13, 2014

## L-42-1 Design Scope

Three “must haves” were noted; (1.) New test needs to maintain severity and historical performance with TMC reference oils and commercial fluids, (2.) New test needs to use hypoid gear set, and (3.) New test needs approval of OEM’s.

If a path similar to L-37-1 is chosen, convert the stand from fired engine to electric input motor first (using current Dana hardware), once this data lines up with historical results, focus could be moved to changing the hardware.

It was suggested to approach the committee as well as the OEM’s for wants, needs and ideas concerning L-42-1.

The group agreed an L-42-1 Taskforce was needed. Volunteers (see below) from the group will begin holding taskforce teleconferences to better define proposals. A separate meeting will be held at the November LRI for L-42-1 Taskforce.

J. Dharte (AAM)  
L. Hamilton (Lz)  
R. Warden (SwRI)  
D. Smith (Intertek)  
J. Gropp (Lz)

M. Keisler (Afton)  
A. Trader (Intertek)  
M. Umerley (Lz)  
J. Zakarian (CVX)  
J. Chalkley (Afton)

Aug. 13, 2014

## L-42-1 Design Scope

### **Must have**

- ▲ Maintains severity and historical performance with TMC reference oils and commercial fluids.

### **Nice to have**

- ▲ A stand that requires less tuning to reference
- ▲ Less expensive hardware to reduce test costs
- ▲ More consistent batch to batch
- ▲ Less inventory storage space required

### **Focus on electric stand or hardware first? Parallel path?**

# Nov. 12, 2014 Meeting Minutes

## L-42-1 Design Scope

Spare L-42 stand donated and will be modified to fit electric stand. Initial testing will utilize standard spring plates to assist with recreating current test conditions.

## L-42-1 Update

### **Main focus is to duplicate test using electric motor**

- ▲ Thanks to Intertek for spare stand
- ▲ Received better drawings from TMC & Intertek

# Feb. 18, 2015 Meeting Minutes

## L-42-1 Update

### **Our first step is to duplicate test using electric motor**

- ▲ 3232 Dynos on the outputs
- ▲ Modified L-42 stand to include spring plates
- ▲ Will be using test axle initially to replicate stages
- ▲ Plan to run test axle before May LRI

### **No official results reported from this effort**



# Nov. 4, 2015 Meeting Minutes

In the interest of time the group decided it best to focus on possible parallel paths:

- Finding a way to run current hardware in an electric stand
- Finding new hardware to run on the fired stand

In the end, all parties want to find a solution that reduces the overall size of the stand and hardware, to ideally merge both VALIDATED paths into an all-electric bench style test.

Regular meetings will be set up at a later date to continue discussion with the Task Force.

## L-42-1

- ▲ One attempt was made on an electric stand (L-37-1 stand)
- ▲ Needs more direction and development
- ▲ Ideas?

# Feb. 10, 2016 Meeting Minutes

## L-42-1 Development Update

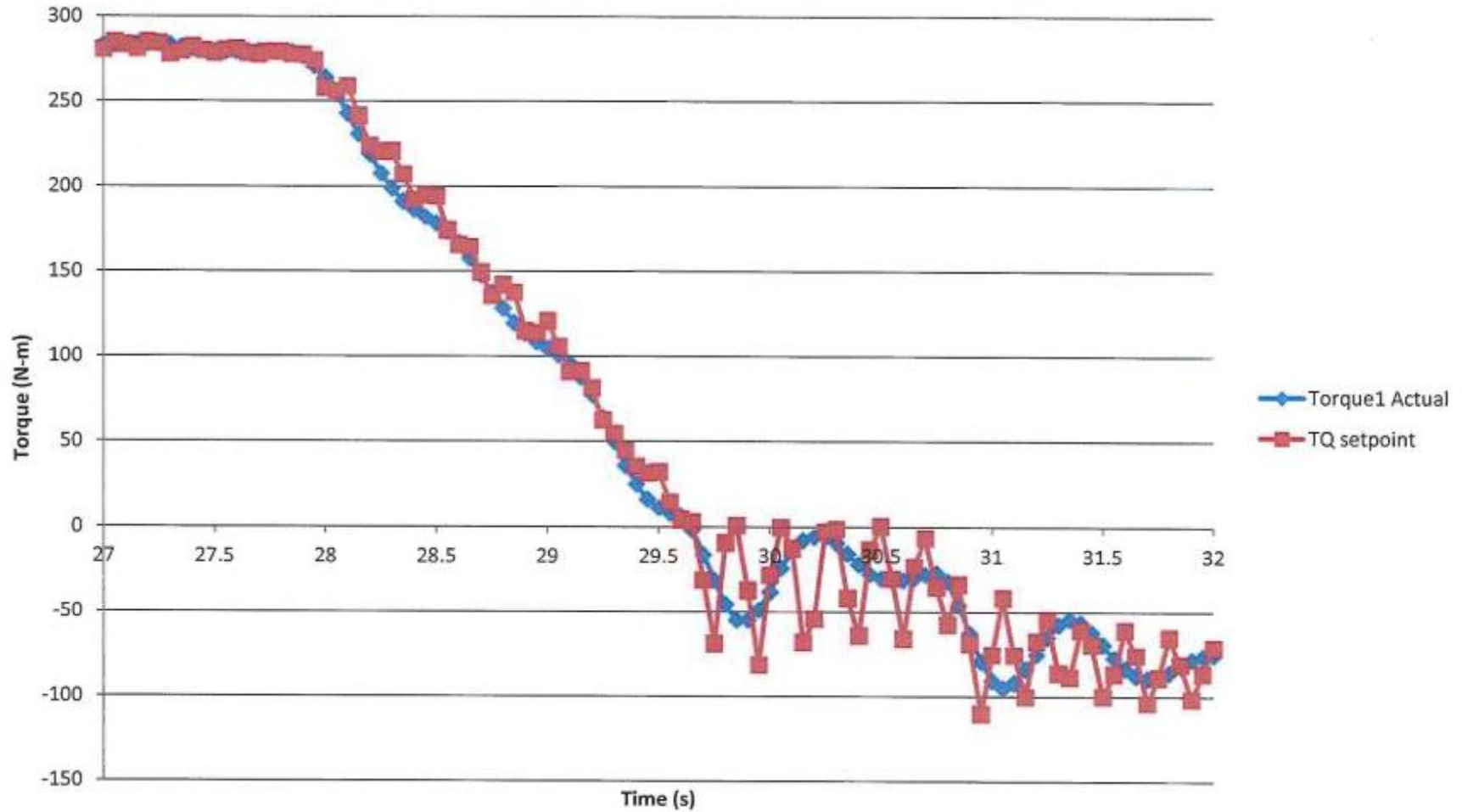
E. Donovan described Afton attempts to run the L-42 test on an all-electric T rig. The test utilized an L-42 Dana 44 mounted without springs and used actual L-42 data as setpoints. The goal is to tune the rig so it runs the test mimicking a regular L-42 and then run portions of Shock 2 to determine the origin of scoring. The first shakedown tests showed promise but more drive tuning is needed to achieve the desired system response.

## L-42-1 Development

- ▲ **Electric T-rig (input and outputs)**
- ▲ **Dana 44 mounted without springs**
- ▲ **Data from L-42 run was used to create 20 Hz setpoints for initial L-42-1 testing**
- ▲ **Goal is to have the rig follow L-42 setpoints first then use mathematical model for setpoints**

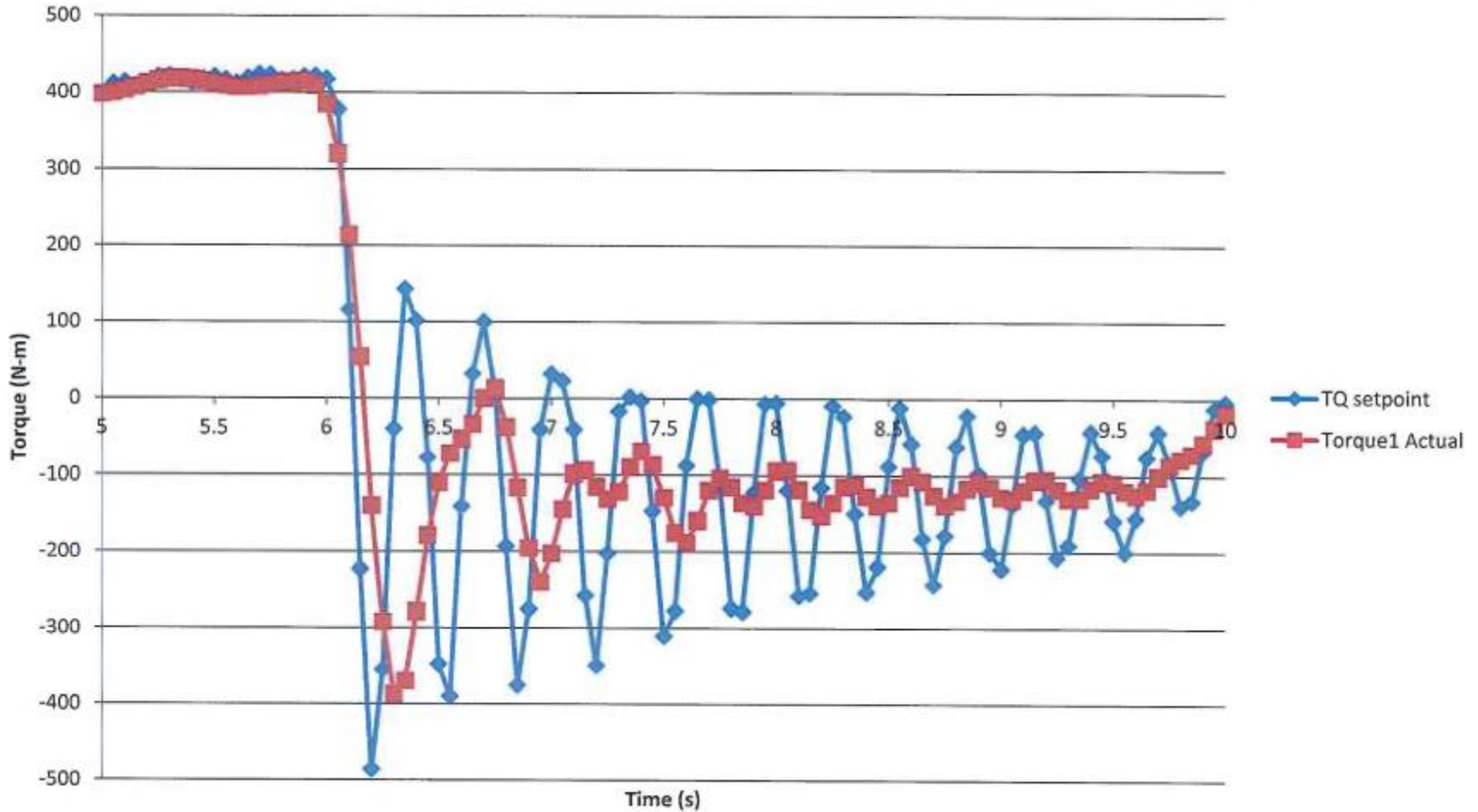
# Feb. 10, 2016 Meeting Minutes

## L42-1 Shock 1 - Input Torque Comparison



# Feb. 10, 2016 Meeting Minutes

## L42-1 Shock 2 - Input Torque Comparison









# Feb. 10, 2016 Meeting Minutes

## L-42-1 Task Force

E. Donovan to set up L-42-1 Task Force meeting at a later date to continue discussions of test development.

## L-42-1 Task Force

-  Eric Donovan
-  Allen Comfort
-  Matt Umerley
-  Rebecca Warden
-  Angela Trader
-  Dale Smith

# Feb. 10, 2016 Meeting Minutes

## New/Open Issues

R. Warden raised concerns over hardware cost; desire to search for a new hardware option while developing L-42-1 electric test before the current batch of hardware runs out. Discussion was held about banjo style axles such as Nissan or Toyota Tacoma axles with a removable center section allowing the housing to remain in the stand. Possibly use an AAM axle of similar dimensions if available.

# May 11, 2016 Meeting Minutes

## **L-42-1 Development Update**

Afton has continued to further develop L-42-1 testing using an all-electric motor test rig with current Dana hardware mounted without springs. A Siemens engineer visited Afton to assist in development and further drive tuning. This service was provided free of charge as a way for Siemens to show their support and further their own knowledge. Adjustments were made to input torque control which showed very positive results in the system response matching the setpoints. The next steps are to continue fine tuning of the test rig and begin initial testing with reference oils and new Dana hardware.

# May 11, 2016 Meeting Minutes

## L-42-1 Development

- ▲ Electric T-rig (input and outputs)

- ▲ Dana 44 mounted without springs




- ▲ Data from L-42 run was used to create 100 Hz setpoints for initial L-42-1 testing

- ▲ Goal is to have the rig follow L-42 setpoints first then use mathematical model for setpoints



# May 11, 2016 Meeting Minutes

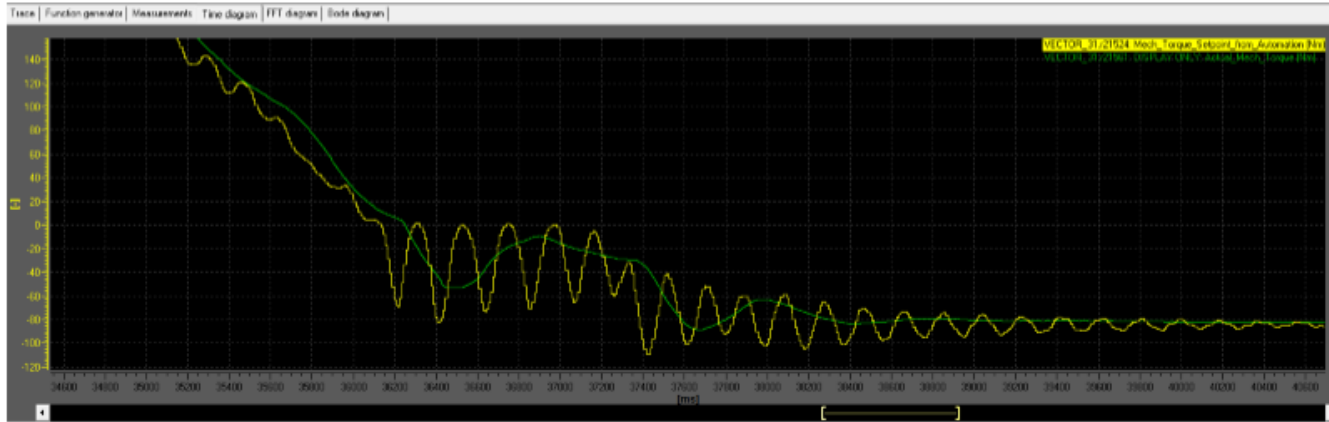
## L-42-1 Development – April 2016

-  **Afton worked with a Siemens Applications Engineer to tune the rig for a dynamic test**
-  **Input torque control parameters were adjusted**
-  **Very positive results after two days with minor tuning still remaining**

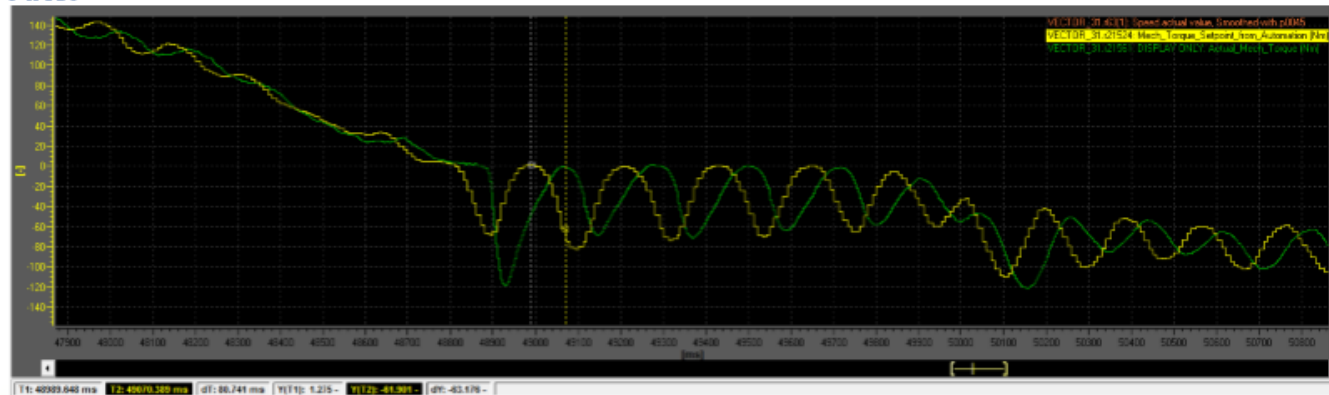
# May 11, 2016 Meeting Minutes

## L-42-1 Development – April 2016

Before

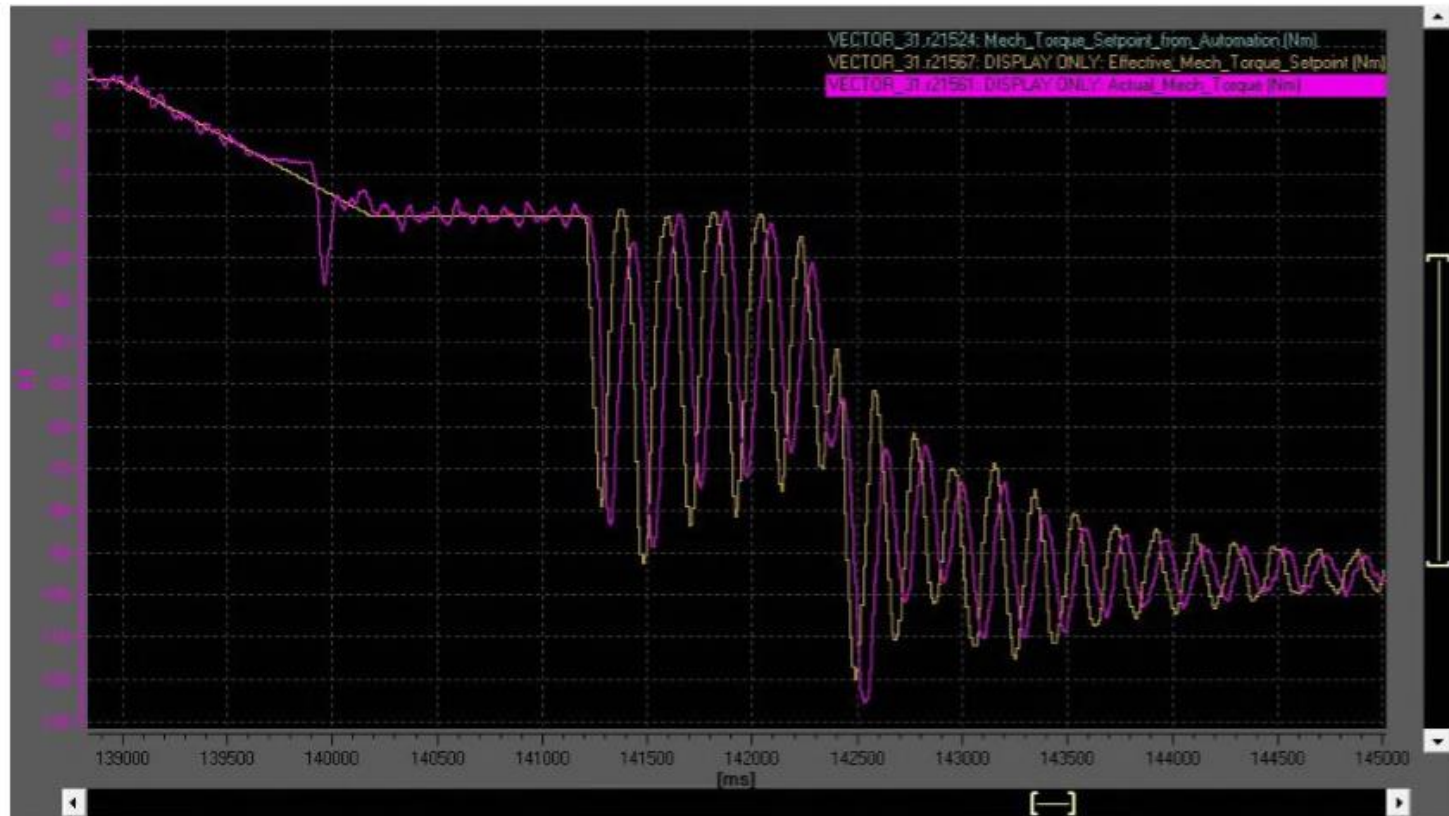


After



# May 11, 2016 Meeting Minutes

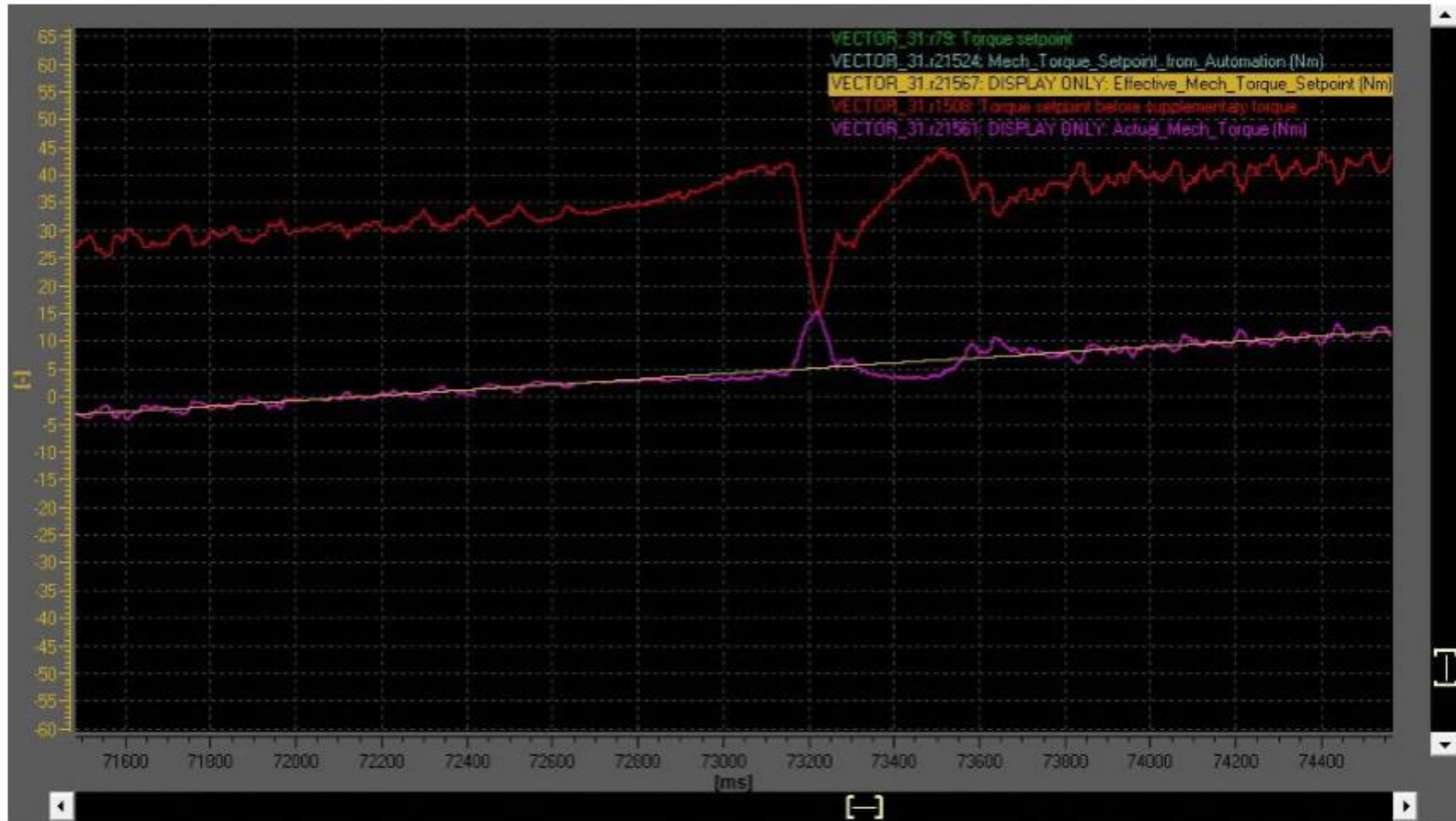
## L-42-1 Development – April 2016



# May 11, 2016 Meeting Minutes

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## L-42-1 Development – April 2016



# Aug. 10, 2016 Meeting Minutes

## **L-42-1 Development**

E. Donovan described Afton's first two L-42-1 runs, one passing and one failing reference oil run. Data from a recent L-42 reference run was used for setpoints as previously stated for L-42-1 shakedown runs. Shock 2 torques were lower than what they should have been but the final scoring rating for each run fell in line with the L-42 reference runs considering the torque difference.

Continued discussion was had about simplifying the test profile now that the fired engine and springs are removed from the apparatus. Afton to continue research and testing when rig time is available.

# Aug. 10, 2016 Meeting Minutes

## L-42-1– Run 4-236 (TMC 117)

**Test Method D7452  
L-42  
Form 1  
Test Result Summary**

Lab: EV	Stand No.: 4	Stand Run No.: 236	TMC Oil Code (reference only): 117
Oil Code: 112374			Lab Oil Code: EV 449

Test Date Started	Test Date Completed	Drive Side Scoring (%)		Coast Side Scoring (%)			Coast Side Torque (lbf-ft)	
		EOT Pinion	EOT Ring	EOT Pinion	EOT Ring	Shock Series 1 Ring	Shock Series 1 (Average)	Shock Series 2 (Average)
20160526	20160526	0	0	18	8	0	-75.3	-231.5
Conditioning 2 Test Time: 3.2		Conditioning 4 Test Time: 2.4		End of Test Time: 15:07		Total Test Minutes: 71		
Ring Batch: P8AD078X		Pinion Batch: C1L925		Latest Information Letter Run Against:			15-2	

Stand Reference Oil Test History In Chronological Order												
	Test Date Started	Test Date Completed	Stand Run No.	CMIR No.	TMC Oil No.	Drive Side Scoring (%)		Coast Side Scoring (%)			Coast Side Torque (lbf-ft)	
						EOT Pinion	EOT Ring	EOT Pinion	EOT Ring	Shock Series 1 Ring	Shock Series 1 (Average)	Shock Series 2 (Average)
Discrimination <sup>A</sup>												
Calibration Sequence Passing Tests Only <sup>B</sup>	20160506	20160506	2A-1642	112373	117	0	0	24	14	0	-80.2	-338.2
	<b>Passing Reference Oil Test Average</b>						24	14	0	-80.2	-338.2	

# Aug. 10, 2016 Meeting Minutes

## L-42-1– Run 4-236 (TMC 117)

Test Number:	236	Date Completed:	20160602
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# Aug. 10, 2016 Meeting Minutes

## L-42-1– Run 4-237 (TMC 113)

**Test Method D7452  
L-42  
Form 1  
Test Result Summary**

Lab: EV	Stand No.: 4	Stand Run No.: 237	TMC Oil Code (reference only): 113
Oil Code: 109023			Lab Oil Code: EV 448

Test Date Started	Test Date Completed	Drive Side Scoring (%)		Coast Side Scoring (%)			Coast Side Torque (lbf-ft)	
		EOT Pinion	EOT Ring	EOT Pinion	EOT Ring	Shock Series 1 Ring	Shock Series 1 (Average)	Shock Series 2 (Average)
20160531	20160531	0	0	64	47	0	-75.5	-225.0
Conditioning 2 Test Time: 3.2		Conditioning 4 Test Time: 2.4		End of Test Time: 16:56		Total Test Minutes: 69		
Ring Batch: P8AD078X		Pinion Batch: C1L925		Latest Information Letter Run Against:			15-2	

Stand Reference Oil Test History In Chronological Order												
	Test Date Started	Test Date Completed	Stand Run No.	CMIR No.	TMC Oil No.	Drive Side Scoring (%)		Coast Side Scoring (%)			Coast Side Torque (lbf-ft)	
						EOT Pinion	EOT Ring	EOT Pinion	EOT Ring	Shock Series 1 Ring	Shock Series 1 (Average)	Shock Series 2 (Average)
Discrimination <sup>A</sup>												
Calibration Sequence Passing Tests Only <sup>B</sup>	20160506	20160506	2A-1642	112373	117	0	0	24	14	0	-80.2	-338.2
<b>Passing Reference Oil Test Average</b>								24	14	0	-80.2	-338.2



# Aug. 10, 2016 Meeting Minutes

## L-42-1– Run 4-237 (TMC 113)

Test Number:	237	Date Completed:	20160602
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# Aug. 10, 2016 Meeting Minutes

## L-42-1 Hardware – Thinking Ahead

- 📅 **May 2016 – the group agreed the best idea is to continue with Dana hardware until L-42-1 is complete**

# May 3, 2017 Meeting Minutes

## L-42-1 Development Update

Due to rig availability, no further development has occurred at Afton. More development runs will happen as the rig becomes available in the near future.

Due to lack of rig and resource availability, E. Donovan suggested involving a 3<sup>rd</sup> party to help develop the test and possibly design a test rig that all labs would purchase to run L-42-1 and also have performance to run L-37-1. Cost is a major concern as is determining the exact test profile needed for the next generation test. The panel agreed that more development is needed before being able to move forward with a 3<sup>rd</sup> party such as testing only one (1) shock or part of a shock to see how that effects the gear tooth surface. The labs will continue to attempt development as rig and resource availability allows.

# Summary

- ▶ **Initial efforts were made to retrofit electric input motor onto existing L-42 stand**
  - ▶ More development time needed
- ▶ **Afton ran pass/fail reference fluids on fully electric AC Motor T-Rig w/solid mounts**
  - ▶ Promising results, more tuning and tweaking needed
  - ▶ Expensive rig to build
- ▶ **Current Dana 44 hardware has been used for all L-42-1 development efforts to date**

**Anything else to add?**

# Where to go next?

## Which path to follow?

- ▲ New Hardware Investigation
- ▲ Electric Input Motor Retrofit
- ▲ Complete Test Rig Re-design (i.e. AC T-Rig Development)
- ▲ Test Method Modification (which portion impacts scoring?)
- ▲ Parallel Paths

# Where to go next?

## Hardware

- ▶ Continue development on current Dana 44 hardware?
- ▶ Other options?

## Test Rig

- ▶ More development on AC T-Rig?
  - Afton is willing and able to run more testing on their rig
- ▶ Retrofit current fired-engine stand with AC Input Motor?
  - Do any labs have this configuration in place now?
    - Availability?
      - » Time, hardware

## Test Method

- ▶ Investigate running individual portion of the existing test?
- ▶ Entirely new method?

# Task Force Members

-  D. Beck (TMC)
-  J. Clark (TMC)
-  A. Comfort (Army)
-  A. Goyal (BASF)
-  A. Lange (Intertek)
-  M. Sangpeal (Afton)
-  D. Schwenk (Afton)
-  R. Slocum (LZ)
-  W. Venhoff (LZ)
-  R. Warden (SwRI)
-  A. Zyski (Dana)

**Thanks everyone!**



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