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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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August 15th, 2023

Reply to:
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ASTM D02.B0.03 L-42 Surveillance Panel
Members and Guests:

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

August 9, 2023 L-42 Surveillance Panel Meeting (PRI Headquarters, Warrendale, PA and Virtual Meeting – Microsoft Teams)

Please direct any corrections or comments to my attention.

Very Respectfully,

Matthew A Sangpeal

Matt Sangpeal, Chairman
L-42 Surveillance Panel

L-42 Surveillance Panel Meeting Minutes

PRI Headquarters, Warrendale, PA and Virtual Meeting – Microsoft Teams

August 9, 2023

Attendees: voting members in **bold,** * indicates virtual attendance

N. Ariemma (Lubrizol)
R. Banas (Exxon-Mobil)
D. Bell (Afton)
T. Bender (Fuchs)
M. Caridi (BASF)
J. Carter (Cummins-Meritor)
A. Comfort (US Army)
A. Goyle (BASF)*
A. Jackson (Chevron Oronite)
B. Jordan (Shell)*
P. Kanga (Retired)*
A. Lange (Intertek)
J. Morris (Navistar)
S. Moyer (TMC)
C. Mueller (SwRI)
T. Muransky (AAM)
M. Sangpeal (Afton/C)
E. Sattler (US Army)
N. Schaup (LZ)
D. Uy (Shell)*
R. Warden (Chevron Oronite)*
F. Yucebilgic (Fuchs)
G. Zarins (AAM)*
A. Zyski (Dana)

Call to Order

Review of Agenda
The meeting agenda is attached.

Review of Membership
No changes required.

Approval of Meeting Minutes
Meeting minutes for approval:

- "20230510_SP" → May 10, 2023 – Surveillance Panel Meeting – Plymouth, MI

A motion was made to approve the meeting minutes as presented.
Motion: N. Schaup
Second: A. Comfort
All in favor, no objections, no abstentions.

L-42-1 Development
C. Mueller gave an update on SwRI's progress on electric L-42-1 test development. Several changes to the procedure were investigated. Details can be found in the attached presentation.

The group was polled for suggestions for next steps. R. Warden suggested to increase Conditioning 4 severity to promote more discrimination.

Action Item: SwRI will generate data using a more severe Conditioning 4 test method.

Future development will be done using the 2023 batch of hardware. Two additional axles from batch C1L446/P8AD132 are needed for comparison.

Action Item: Afton and Lubrizol will each send one more C1L446/P8AD132 axle to SwRI.

M. Sangpeal shared that Afton will run L-42-1 shakedown testing on an AC Regen T-Rig. One concern is that test severity could be very different compared to an Eddy Current load absorber. Data is needed to perform a comparison.

Action Item: Afton will generate L-42-1 data and share with SP at November meeting.

A new L-42-1 Taskforce is needed to continue test development. Emphasis will be placed on defining a new ASTM test method in parallel to generating more data on electric test rigs. All labs are interested in moving development forward.

Action Item: M. Sangpeal will setup a new L-42-1 Taskforce.

2023 Hardware Order

M. Sangpeal gave an update on Dana's progress with the next hardware order (details can be found in the attached presentation). The group has requested that partial shipments go out to all three labs as soon as any axles are ready.

Action Item: A. Zyski will inquire why problems are occurring with assembly at Dana. A list of contacts at Dana who are involved with the order was provided.

New/Open Issues

N. Schaup noted that section 10.2.1.3 of D7452-22 states Conditioning 1 pinion torque must be 60 lbf-ft ± 20 lbf-ft, yet Figure FIG. A6.15 shows pinion torque must be 60 lbf-ft ± 10 lbf-ft. Section 10.2.3.2 states Conditioning 3 pinion torque must be 70 lbf-ft ± 20 lbf-ft, yet Figure FIG. A6.16 shows pinion torque must be 70 lbf-ft ± 10 lbf-ft. TMC confirmed that the specification for both sections should be ± 20 lbf-ft.

Action Item: M. Sangpeal will work with TMC to correct FIG. A6.15 and FIG. A6.16 to show ± 20 lbf-ft.

Adjournment

A motion was made to adjourn.
Motion: N. Schaup
Second: A. Comfort
All in favor, no objections, no abstentions.

Meeting adjourned.

Respectfully submitted,

Matthew A Sangpeal

Matt Sangpeal
L-42 Surveillance Panel Chairman

L-42 Surveillance Panel Meeting

ASTM D7452

PRI Headquarters

Warrendale, PA

August 9, 2023

12:30 – 1:30 PM EST

Passion for Solutions™

Agenda

- **Call to Order**
- **Agenda**
- **Membership Review & Update**
- **Approval of Meeting Minutes**
  - 20230510 SP Meeting – Intertek AR: Plymouth, MI
- **L-42-1 Development Updates**
  - Update from SwRI
  - Update from Afton
- **2023 Hardware Order**
- **New Issues**
- **Adjournment**

L-42 SP Voting Members

- **Rob Banas:** Exxon Mobil
- **Dylan Beck:** TMC
- **Allen Comfort:** US Army
- **Arjun Goyal:** BASF
- **Troy Muransky:** AAM
- **Jason Carter:** Cummins-Meritor
- **Matt Sangpeal:** Afton Chemical (Chair)
- **Nick Schaup:** Lubrizol
- **Anthony Lange:** Intertek
- **Caroline Mueller:** SwRI
- **Amy Zyski:** Dana
- **Rebecca Warden:** Chevron Oronite

Approval of Meeting Minutes

SP Meeting Minutes

- "20230510_SP" → May 10, 2023 – Surveillance Panel Meeting – Intertek AR, Plymouth, MI and Virtual Meeting via Microsoft Teams

L-42-1 Development Update

- **Update from SwRI on progress**

L-42-1 Development Update - Afton

- **Afton ran L-42-1 testing on AC motor T-Rig in 2016**
  - Solid axle mounts (no spring plates)
  - Torque and Speed traces from L-42 Fired Engine Rig reference run @20 Hz were used as setpoints for Electric T-Rig
  - Scoring performance was comparable to Fired Engine Rig
    - Good discrimination between TMC 113 and TMC 117
- **Afton plans to run another round of L-42-1 testing on the same T-Rig by November SP meeting**
  - Gathering parts to install Dana 44 L-42 axle on LDT rig in Ashland, VA
  - Shakedown testing to begin in 2-3 weeks
- **Do all labs have desire to officially create L-42-1 method?**

2023 Hardware Order: Recap

- **Three labs will purchase hardware in 2023**
- **$3266 each (~35% increase from 2020)**
- **650 total axles ordered**
- **8-month lead time from receipt of POs**
- **Dana will be using a different steel supplier and a different forge facility**
  - Dana has worked with both suppliers in the past, just not with L-42 hardware
  - Same team within Dana will be managing order

2023 Hardware Order: Recap

02/06/2023 Update Conference Call

- Weekly meetings w/in Dana to keep project moving forward
- Steel for forgings located, due to arrive at Dana Ft. Wayne plant May 1
- Tubing due to arrive at Dana Lafayette plant May 1
- All material expected at Dana Lugoff by June 1
  - Assembly to begin June 5
  - ~2 working weeks to build axles
  - All other assembly will halt during build process
- Build and ship by end of June
  - Pilot batch of 10 will go to one lab
  - Need to decide which one
  - Set up overnight shipment to validate hardware
- Dana will continue to monitor steel shipments and update as needed
- Next update meeting in ~2 months

2023 Hardware Order: Recap

05/05/2023 Update Conference Call

- 2-3 internal meetings per week to monitor progress
- Material continues to be delivered to assembly plant in Lugoff, SC
  - Still waiting for R&Ps and housing tubes
- Target Pilot Batch Assembly Completion Date: June 9
- Assembly line will be shut down until Pilot performance approval is granted

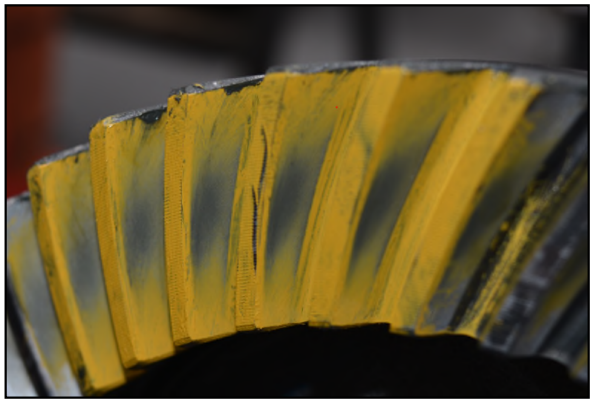
Panel must decide how Pilot Axles will be tested

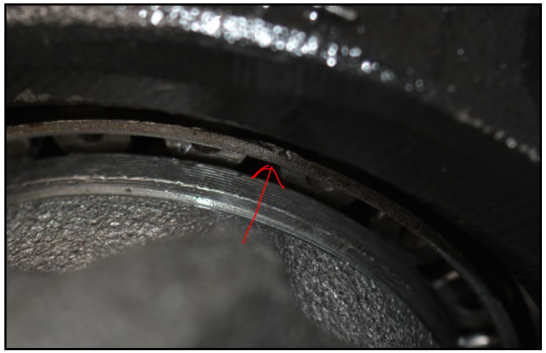
- All 10 to one lab or split between 3 labs?
- Historically, one lab would perform all Pilot testing
- Dana prefers that one lab do all testing, but is willing to split up if deemed necessary

2023 Hardware Order:

Pilot Batch #1

- 5 axles each sent to SwRI and IAR, Received 6/22/23
- Both labs noted serious quality concerns with assembly
  - Inconsistent and undesirable contact patterns
  - Rust inside axle tubes
  - Damage on bearing cages
  - Little to no carrier bearing pre-load



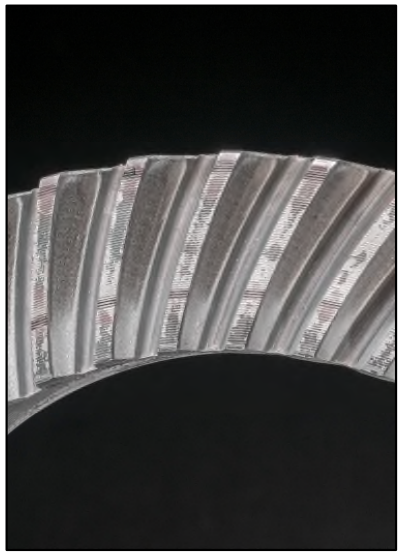
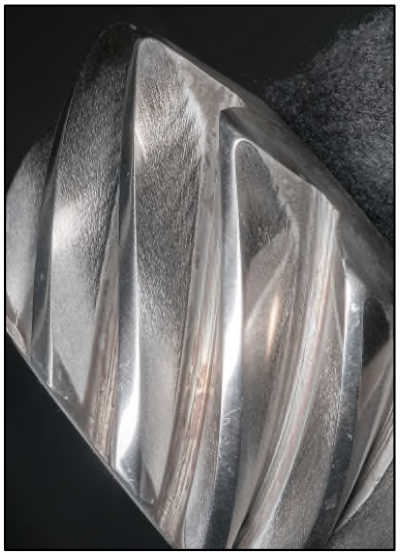


2023 Hardware Order:

Pilot Batch #1, Cont.

- Poor contact patterns led to uneven distress on teeth post-test



2023 Hardware Order:

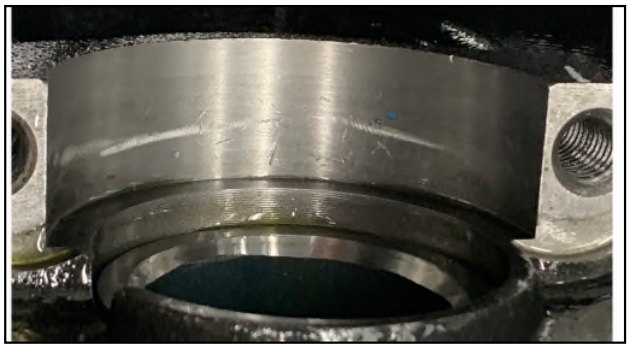
Pilot Batch #1, Cont.

- Scoring performance inconsistent with Reference Oils
  - One lab showed some discrimination between Hi and Low Reference Oil
  - One lab showed no discrimination whatsoever
- Conference Call w/Dana on 6/29/23
  - Shared detailed description of problems
  - ASTM SP rejected first Pilot Batch because of quality concerns
  - Dana agreed to build 6 more Pilot axles

2023 Hardware Order:

Pilot Batch #2

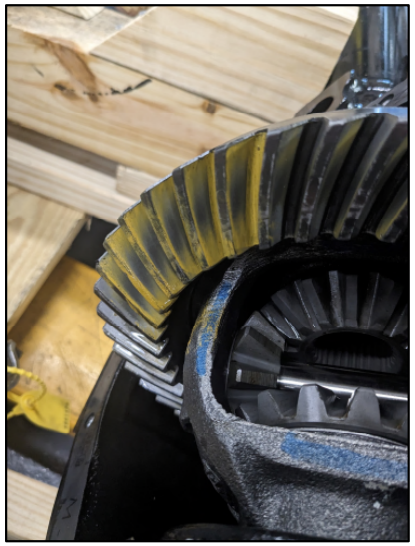
- 3 axles each sent to SwRI and IAR, Received 7/20/23
  - Contact patterns much more consistent and desirable
  - Carrier bearings had appropriate pre-load
  - Several quality concerns around assembly still present
    - Nicks in rings and pinions
    - Damaged bearings
    - Metal chips in housing



2023 Hardware Order:

Pilot Batch #2, Cont.

- Scoring performance more in line with historical levels
  - Both labs showed discrimination between Hi and Low Reference Oils
- Conference Call w/Dana on 7/28/23
  - Dana rebuilt each axle numerous times to achieve desired pattern/preload
  - ASTM SP accepted Pilot Batch #2 w/stipulation that all noted quality concerns with assembly be addressed



2023 Hardware Order:

- **Dana has removed the ASTM order from their assembly line to fulfill an OE order that is due**
- **L-42 assembly will resume 8/21**
  - Partial shipments possible if needed
  - ETA mid to late September for entire order

New Issues

- ?

Thanks!

L-42-1 Development Update August 2023

SOUTHWEST RESEARCH INSTITUTE®

Caroline Mueller

8/9/2023

Where we left off…

- 12 severity runs completed to November 2022
- Major outcomes:
  - No drive side scoring on any run
  - No Shock 1 scoring since very early runs → all scoring contributed by Shock 2
  - All runs are 'on the board', no complete reference sequences yet
  - Electric stand is generally more severe than engine-driven stand
  - Discrimination is primary issue
    - Converging TMC-117 and TMC-113/119 runs
- Action items from last L-42-1 discussion were to reduce Shock 2 severity overall
  - Last two results
    - TMC-117: 35 pinion/23 ring
    - TMC-119: 60 pinion/48 ring

Data Summary

Test Number	Oil Code	Scoring %, Pinion	Scoring %, Ring	Notes
0013	TMC 117	16	11	S2 dyno setpoint raised from 70 ft-lbs to 100 ft-lbs (Eddy current dynos)
0014	TMC 119	28	18	0013/0014 mild, just shy of discriminating
0015	TMC 117	25	16	S2 has 12 cycles instead of 10
0016	TMC 119	38	28	0015/0016 appropriately severe, well shy of discriminating
0017	TMC 117	24	16	0017/0018 eliminate Conditioning 4 phase, S2 has 10 cycles
0018	TMC 119	35	26	

Targets for pinion scoring % on TMC 117: *14-32*
correction factor +6 pinion, +4 ring
Targets for pinion scoring % on TMC 119: *2x most recent 117 run, including correction*

Discussion & Next Steps

- Increasing dyno setpoint for S2 has bounced severity from high to low
- Discrimination is slightly better
  - Actual discrimination oil scoring has not changed much
  - Targets for discrimination oil have moved due to lower % scoring on high reference oil
- Severity appears driven almost exclusively by S2

- New L-42 batch is on the way. Previous development was all done on 2020 batch
- I suggest switching L-42-1 development to the new batch
  - Run fixed set of conditions on 2x old batch axles (1x TMC-117, 1x TMC-119)
  - Run same fixed set of conditions on 4x new batch axles (2x TMC-117, 2x TMC-119)

Operational Data 0013-0018

Test 01-0013

Summary Data—Conditioning 01-0013

Conditioning 1			
Input Torque [ft-lb]		**Input Speed [rpm]**	
Target	*60 ± 5*	*Target*	*2363*
Avg	59.8	Avg	2360
Min	59.0	Min	2357
Max	61.2	Max	2363

Conditioning 2							
Peak Input Torque Drive [ft-lb]		**Peak Input Torque Coast [ft-lb]**		**Maximum Input Speed [rpm]**		**Minimum Input Speed [rpm]**	
Target		*Target*		*Target*	*2363*	*Target*	*1562*
Avg	113.2	Avg	-61.7	Avg	2366	Avg	1581
Min	112.7	Min	-65.3	Min	2366	Min	1580
Max	113.6	Max	-57.8	Max	2367	Max	1581

Conditioning 3			
Input Torque [ft-lb]		**Input Speed [rpm]**	
Target	*70 ± 5*	*Target*	*3350*
Avg	70.0	Avg	3346
Min	52.6	Min	3343
Max	85.8	Max	3349

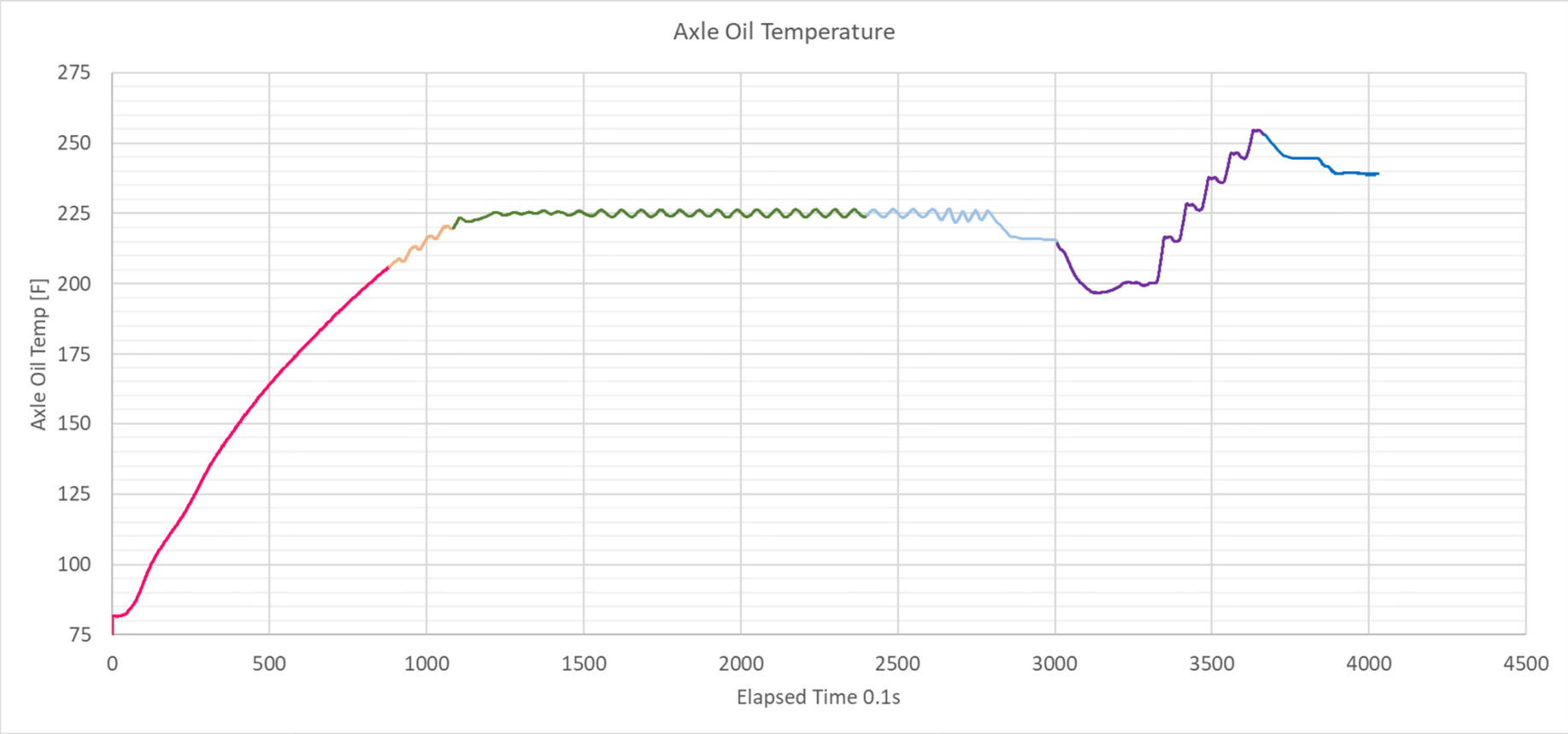
Conditioning 4							
Peak Input Torque Drive [ft-lb]		**Peak Input Torque Coast [ft-lb]**		**Maximum Input Speed [rpm]**		**Minimum Input Speed [rpm]**	
Target		*Target*		*Target*	*3350*	*Target*	*2754*
Avg	114.9	Avg	-67.4	Avg	3351	Avg	2753
Min	114.1	Min	-72.0	Min	3351	Min	2752
Max	115.0	Max	-59.4	Max	3352	Max	2754

Summary Data—Shocks 01-0013

Shock 1							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*4316*	*Target*	*2178*
Avg	242.0	Avg	-55.8	Avg	4350	Avg	2191
Min	240.0	Min	-59.2	Min	4349	Min	2174
Max	243.4	Max	-52.2	Max	4352	Max	2196

Shock 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3083*	*Target*	*2178*
Avg	233.7	Avg	-225.5	Avg	2599	Avg	2191
Min	224.6	Min	-229.9	Min	2596	Min	2172
Max	245.5	Max	-203.0	Max	2602	Max	2200

Temperature Data—01-0013



Test 01-0014

Summary Data—Conditioning 01-0014

Conditioning 1			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*60 ± 5*	*Target*	*2363*
Avg	59.7	Avg	2360
Min	58.4	Min	2357
Max	61.3	Max	2363

Conditioning 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*2363*	*Target*	*1562*
Avg	112.0	Avg	-55.4	Avg	2367	Avg	1581
Min	111.7	Min	-57.1	Min	2366	Min	1581
Max	112.2	Max	-54.5	Max	2368	Max	1582

Conditioning 3			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*70 ± 5*	*Target*	*3350*
Avg	70.0	Avg	3345
Min	65.9	Min	3343
Max	76.7	Max	3348

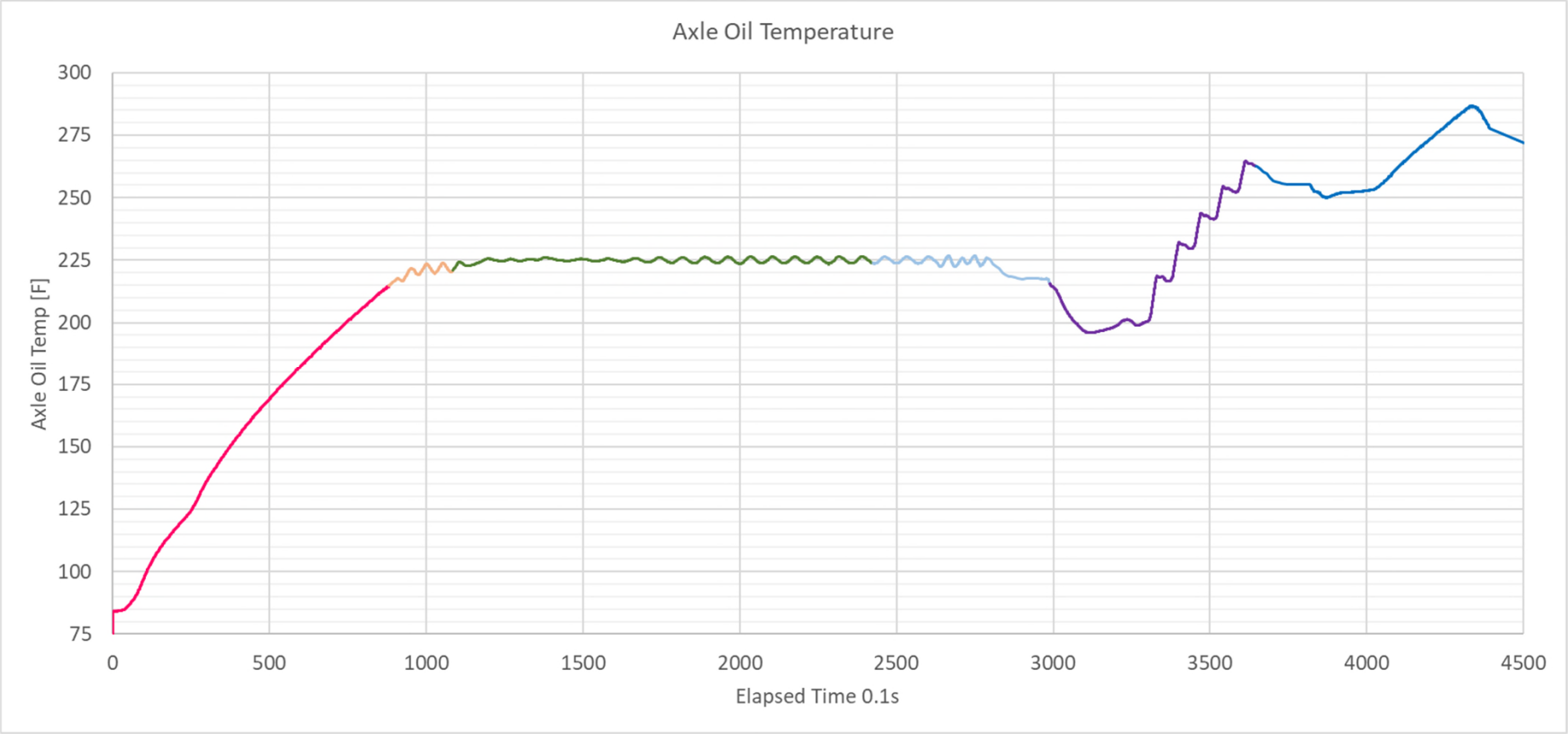
Conditioning 4							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3350*	*Target*	*2754*
Avg	113.8	Avg	-67.0	Avg	3243	Avg	2753
Min	113.3	Min	-75.7	Min	2915	Min	2753
Max	114.5	Max	-54.6	Max	3354	Max	2754

Summary Data—Shocks 01-0014

Shock 1							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*4316*	*Target*	*2178*
Avg	242.2	Avg	-56.4	Avg	4351	Avg	2190
Min	241.1	Min	-61.6	Min	4349	Min	2173
Max	243.8	Max	-53.8	Max	4354	Max	2196

Shock 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3083*	*Target*	*2178*
Avg	237.1	Avg	-219.8	Avg	2600	Avg	2192
Min	227.6	Min	-226.1	Min	2597	Min	2170
Max	247.6	Max	-198.1	Max	2602	Max	2205

Temperature Data—01-0014



Test 01-0015

Summary Data—Conditioning 01-0015

Conditioning 1			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*60 ± 5*	*Target*	*2363*
Avg	59.8	Avg	2360
Min	58.9	Min	2357
Max	64.0	Max	2363

Conditioning 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*2363*	*Target*	*1562*
Avg	112.1	Avg	-56.6	Avg	2366	Avg	1581
Min	111.6	Min	-58.9	Min	2365	Min	1580
Max	112.3	Max	-55.5	Max	2366	Max	1582

Conditioning 3			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*70 ± 5*	*Target*	*3350*
Avg	69.9	Avg	3346
Min	49.6	Min	3343
Max	83.8	Max	3350

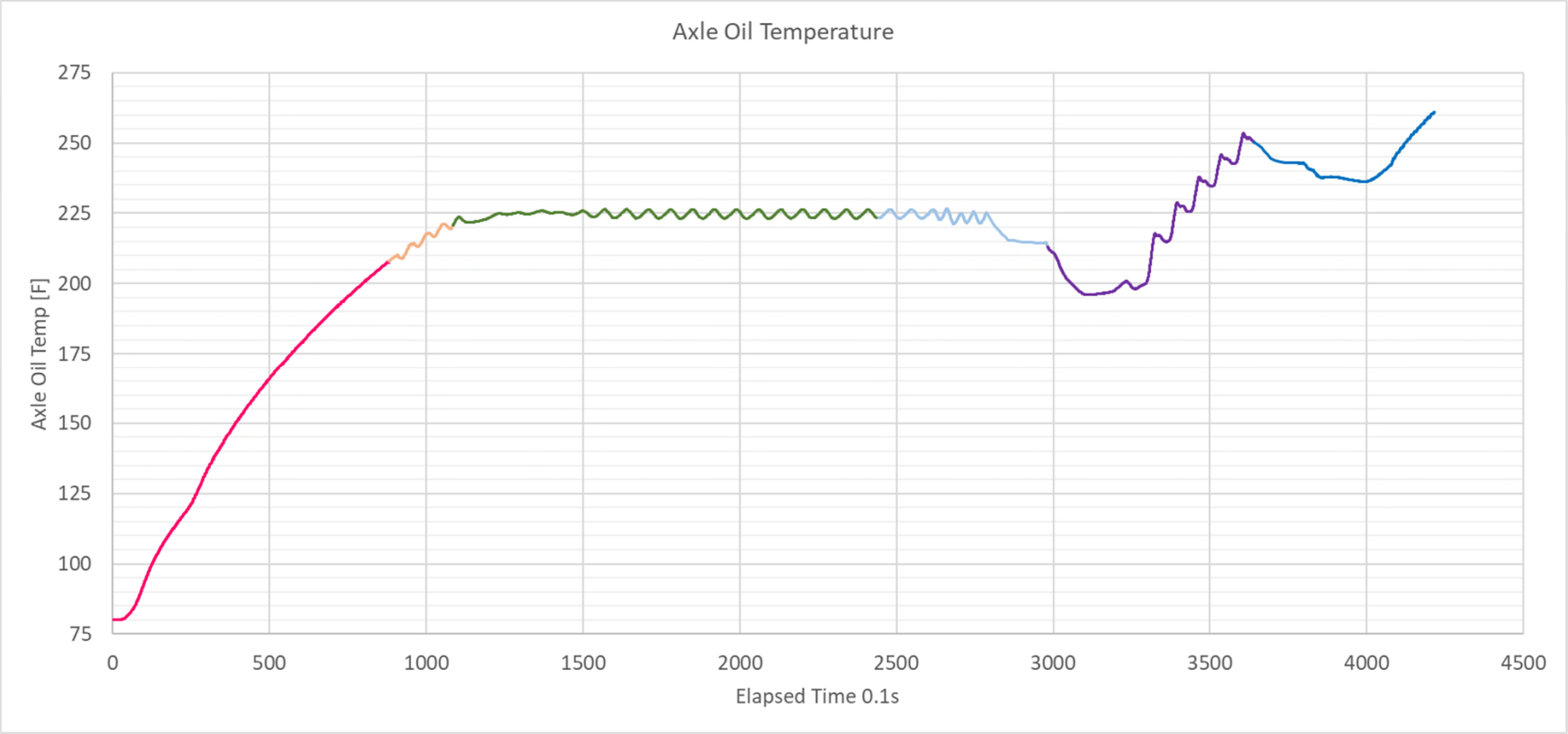
Conditioning 4							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3350*	*Target*	*2754*
Avg	115.5	Avg	-63.1	Avg	3350	Avg	2752
Min	114.4	Min	-68.8	Min	3346	Min	2751
Max	116.2	Max	-57.8	Max	3352	Max	2754

Summary Data—Shocks 01-0015

Shock 1							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*4316*	*Target*	*2178*
Avg	242.0	Avg	-57.2	Avg	4349	Avg	2192
Min	240.4	Min	-59.9	Min	4348	Min	2174
Max	243.5	Max	-53.7	Max	4351	Max	2197

Shock 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3083*	*Target*	*2178*
Avg	241.0	Avg	-226.7	Avg	2600	Avg	2192
Min	227.7	Min	-232.0	Min	2597	Min	2172
Max	264.4	Max	-199.9	Max	2603	Max	2202

Temperature Data—01-0015



Test 01-0016

Summary Data—Conditioning 01-0016

Conditioning 1			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*60 ± 5*	*Target*	*2363*
Avg	59.9	Avg	2360
Min	48.4	Min	2357
Max	70.7	Max	2365

Conditioning 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*2363*	*Target*	*1562*
Avg	112.2	Avg	-57.6	Avg	2366	Avg	1581
Min	110.6	Min	-61.0	Min	2365	Min	1580
Max	112.9	Max	-56	Max	2366	Max	1582

Conditioning 3			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*70 ± 5*	*Target*	*3350*
Avg	69.7	Avg	3348
Min	50.0	Min	3343
Max	90.8	Max	3351

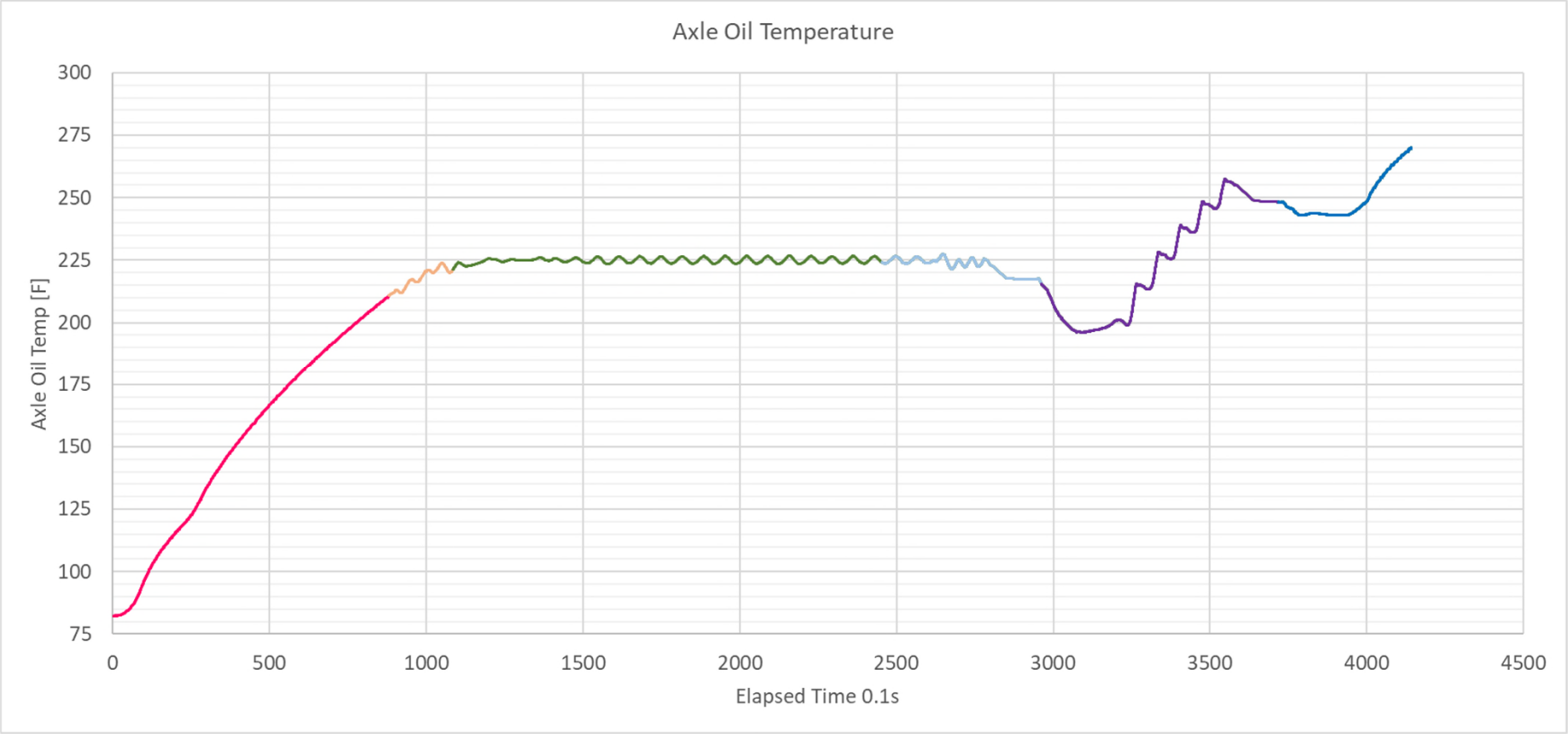
Conditioning 4							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3350*	*Target*	*2754*
Avg	113.7	Avg	-67.4	Avg	3351	Avg	2752
Min	113.1	Min	-73.6	Min	3346	Min	2751
Max	114.1	Max	-61.0	Max	3354	Max	2754

Summary Data—Shocks 01-0016

Shock 1							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*4316*	*Target*	*2178*
Avg	241.4	Avg	-57.2	Avg	4351	Avg	2118
Min	239.9	Min	-65.7	Min	4349	Min	1826
Max	243.2	Max	-53.3	Max	4354	Max	2197

Shock 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3083*	*Target*	*2178*
Avg	235.8	Avg	-220.5	Avg	2600	Avg	2193
Min	227.3	Min	-227.7	Min	2597	Min	2172
Max	250.2	Max	-197.4	Max	2602	Max	2201

Temperature Data—01-0016



Test 01-0017

Summary Data—Conditioning 01-0017

Conditioning 1			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*60 ± 5*	*Target*	*2363*
Avg	59.7	Avg	2360
Min	58.0	Min	2357
Max	61.2	Max	2365

Conditioning 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*2363*	*Target*	*1562*
Avg	113.4	Avg	-56.9	Avg	2367	Avg	1581
Min	112.2	Min	-59.2	Min	2366	Min	1579
Max	114.4	Max	-54.2	Max	2367	Max	1582

Conditioning 3			
Input Torque [ft-lb]		Input Speed [rpm]	
Target	*70 ± 5*	*Target*	*3350*
Avg	70.0	Avg	3346
Min	65.7	Min	3342
Max	76.0	Max	3350

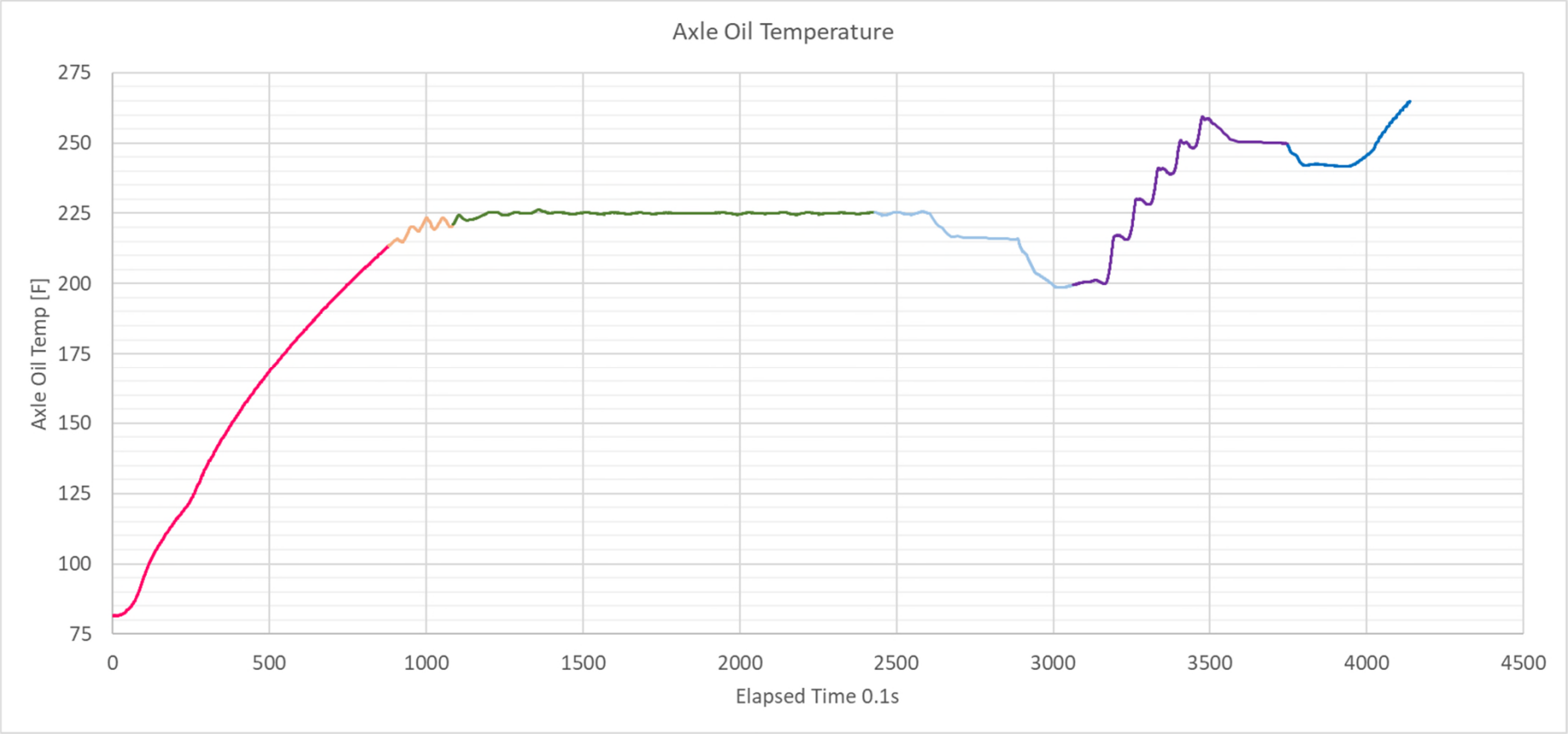
Conditioning 4							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3350*	*Target*	*2754*
Avg	#N/A	Avg	#N/A	Avg	#N/A	Avg	#N/A
Min	#N/A	Min	#N/A	Min	#N/A	Min	#N/A
Max	#N/A	Max	#N/A	Max	#N/A	Max	#N/A

Summary Data—Shocks 01-0017

Shock 1							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*4316*	*Target*	*2178*
Avg	234.9	Avg	-65.9	Avg	4350	Avg	2190
Min	233.5	Min	-69.7	Min	4348	Min	2176
Max	236.9	Max	-60.2	Max	4353	Max	2195

Shock 2							
Peak Input Torque Drive [ft-lb]		Peak Input Torque Coast [ft-lb]		Maximum Input Speed [rpm]		Minimum Input Speed [rpm]	
Target		*Target*		*Target*	*3083*	*Target*	*2178*
Avg	234.7	Avg	-225.4	Avg	2601	Avg	2192
Min	228.5	Min	-231.3	Min	2598	Min	2171
Max	246.9	Max	-200.9	Max	2603	Max	2202

Temperature Data—01-0017



Test 01-0018

Summary Data—Conditioning 01-0018

Summary Data—Shocks 01-0018

Temperature Data—01-0018

Reference: all ratings to date

Test Number	Oil Code	EOT Date	Final Pinion Rating (Adjusted)	Final Ring Rating (Adjusted)	On L-42 Target?
01-0003	TMC 117 (High Ref)	4/22/22	22%	15%	Y
01-0004	TMC 113 (Disc. Oil)	4/25/22	52%	42%	Y
01-0005	TMC 117 (High Ref)	6/16/22	30%	18%	Y
01-0006	TMC 113 (Disc. Oil)	6/17/22	46%	36%	N
01-0007	TMC 117 (High Ref)	6/20/22	30%	20%	Y
01-0008	TMC 113 (Disc. Oil)	6/20/22	43%	33%	N
01-0009	TMC 117 (High Ref)	9/27/22	33%	18%	N
01-0010	TMC 113 (Disc. Oil)	9/28/22	61%	49%	N
01-0012	TMC 117 (High Ref)	10/19/22	35%	23%	N
01-0011	TMC 113 (Disc. Oil)	10/19/22	60%	48%	N

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August 9, 2023

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NA	Ariemma, Nick	NV	The Lubrizol Corporation	Phone:	
			29400 Lakeland Boulevard Wickliffe, OH 44092	E-mail:	Nick.Ariemma@Lubrizol.com
RAB	Banas, Rob	V	ExxonMobil Product Solutions	Phone:	770-833-5920 ~~678-493-3930~~
			535 Thomas Lane Waleska, GA 30183	E-mail:	rob.a.banas@exxonmobil.com
	Beck, Dylan	V	ASTM Test Monitoring Center	Phone:	724-355-1854
			203 Armstrong Drive Freeport, PA 16229	E-mail:	djb@astmtmc.org
DB	Bell, Don	NV	Afton Chemical	Phone:	804-788-6332
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			2000 Town Center, Suite 1160 Southfield, MI 48075	E-mail:	dan.horvath@aftonchemical.com
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	Mueller, Caroline	V	Southwest Research Institute	Phone:	210-522-2671
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	Muransky, Troy	V	AAM	Phone:	734-564-8406
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	Schaup, Nick	V	The Lubrizol Corporation	Phone:	
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FY	Yucebilgic, Fatih	NV	Fuchs Lubricants	Phone:	708-539-0252
			17050 Lathrop Ave Harvey, IL 60426	E-mail:	fatih.yucebilgic@fuchs.com
Virtual	Zarins, George	NV	AAM	Phone:	586-854-8810
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	Moyer, Sean	Proxy V For Dylan Belt	TMC	Phone:	412-365-1035
			203 Armstrong Dr Freeport, PA 16229	E-mail:	sam@ASTMTMC.org
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				Phone:	
				E-mail:	

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