

L-42 Surveillance Panel Meeting Minutes

Intertek IAR, Plymouth Township, MI and Virtual Meeting – Microsoft Teams

November 13, 2024

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

N. Ariemma (Lubrizol)	A. Goyal (BASF)	E. Sattler (US Army)
R. Banas (Exxon Mobil)	D. Horvath (Afton)	N. Schaup (IZ)
D. Beck (TMC)	A. Jackson (Chevron Oronite)*	A. Schweitzer (Shell)
D. Bell (Afton)	A. Lange (Intertek)	A. Stone (Afton)*
T. Bender (Fuchs)	J. Morris (International Motors)	D. Uy (Shell)
B. Campbell (Afton)	D. Mosher (BASF)	C. Vacher Wal (Daimler)
M. Caridi (BASF)	C. Mueller (SwRI)	W. Venhoff (TMC)
J. Carowick (Cummins)	T. Muransky (AAM)	R. Warden (Chevron Oronite)
H. Catania (Cummins)	L. Pappademos (Dana)*	E. Wulf (Dana)*
A. Comfort (US Army)	M. Sangpeal (Afton/C)*	K. Zreik (GM)*
E. Fry (Daimler)		A. Zyski (Dana)

Call to Order

Review of Agenda

The meeting agenda is attached.

Review of Membership

Wes Venhoff is now with TMC. Wes will replace Dylan Beck as voting member.

Approval of Meeting Minutes

Meeting minutes for approval:

~ “20240807_SP” à August 7, 2024 – Surveillance Panel Meeting – Warrendale, PA

A motion was made to approve the meeting minutes as presented.

Motion: A. Lange

Second: A. Goyal

All in favor, no objections, no abstentions.

Action Item Review

Two open action items remain from August SP meeting:

- **IAR to donate three axles from MSPLO/P2AD01 batch to SwRI for development efforts.**
- **IAR to investigate installing L-42 axle on their Efficiency T-Rig.**

Next Hardware Batch Order

The order for the next hardware batch has been placed with Dana. Individual lab quantities:

SwRI: 300

IAR: 250 325

Afton: 200 300

Lubrizol: 100 125

PO Status:

SwRI: Complete

IAR: Pending

Afton: Complete

Lubrizol: Pending

No features on the axle housing were identified that could be eliminated to save cost. The decision was made to keep the housings the same.

Future of L-42 Test Hardware

E. Wulf and L. Pappademos from Dana presented on the future of L-42 test hardware. The current hardware is produced on a two-axis gear cutting machine that will be put out of service in Q2 2025. They proposed a more modern three axis cutting method. Current gears are face-milled. New gears will be face-hobbed.

Dana will match gear tooth topography as closely as possible (macro and micro geometry). Sliding velocity at the pitch line will be closely matched.

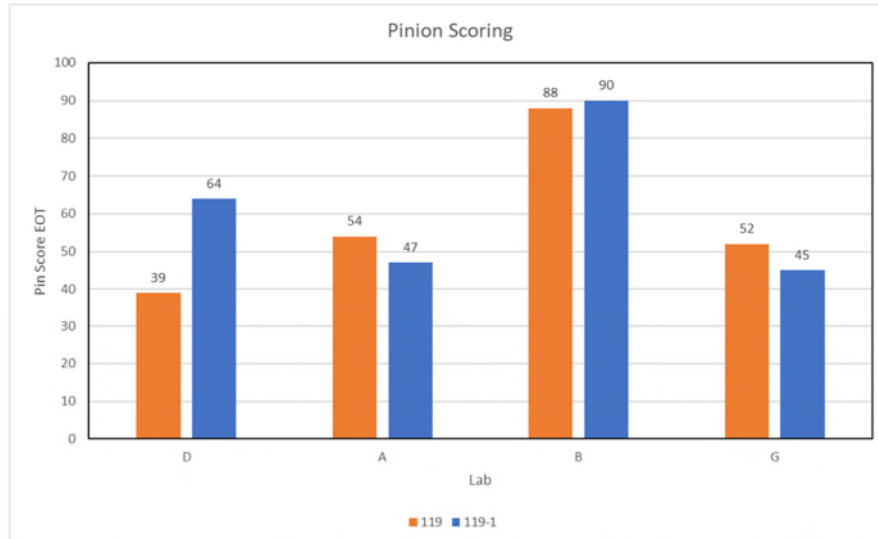
Dana plans to cut all currently in-stock forgings (2000-3000) on 2-axis machine before it's taken out of service. This should be enough to fulfill the current order and one additional order (likely 4-5 years of testing).

Preliminary plan: Dana to produce ~5 axle assemblies to be tested on a currently referenced L-42 test stand at one lab.

Action Item: Afton to set up call with SP to discuss and identify process for new gear approval.

TMC 119-1 Reference Oil

All labs have completed acceptance testing of TMC 119-1. Results are as follows:



Lab	CMIR	Oil	Hardware	Pin Score EOT	Ring Score EOT	S1 Score Ring	S1 Tq [ft-lb]	S2 Tq [ft-lb]
D	184769	119	MSPLO/P2AD01	39	29	0	-75.1	-353.2
D	188628	119-1	MSPLO/P2AD01	64	47	0	-77.1	-356.9
A	183550	119	MSPLO/P2AD01	54	45	35	-102.7	-407.7
A	188630	119-1	MSPLO/P2AD01	47	37	25	-98.5	-411
B	158148	119	C1L446/P8AD132	88	67	0	-81.2	-344.9
B	188624	119-1	C1L446/P8AD132	90	75	0	-98.3	-374.5
G	184370	119	MSPLO/P2AD01	52	33	0	-82.9	-351.1
*G	188626	119-1	MSPLO/P2AD01	45	50	0	-87.4	-356.2

*S2 Tq >10% of Ref. Avg

Avg Pin Score 119	Avg Ring Score 119
60	47
Avg Pin Score 119-1	Avg Ring Score 119-1
67	53

No concerns with the results were noted.

A motion was made to approve TMC 119-1 for testing. No additional TMC 119 will be assigned for reference testing. Remaining inventory at TMC and individual labs will be retained in case of future performance issues with TMC 119-1.

Motion: T. Muransky

Second: A. Goyal

All in favor, no objections, no abstentions.

L-42-1 Development

C. Mueller presented data from two runs with the SwRI electric L-42 stand:

§ Operational differences from D7452:

- Shock 2 peak torque (avg) -243 ft lbs

§ Results:

- 117: 16/9
- 119: 25/12

Action Item: SwRI to run two additional tests on TMC 117 and TMC 119 with a target peak torque of -250 to -255 ft-lbs in Shock II.

New/Open Issues

None.

Adjournment

A motion was made to adjourn.

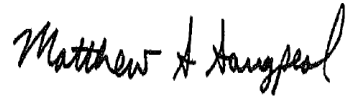
Motion: A. Goyal

Second: A. Lange

All in favor, no objections, no abstentions.

Meeting adjourned.

Respectfully submitted,

A handwritten signature in black ink that reads "Matthew A. Sangpeal". The signature is written in a cursive style with a large, stylized initial 'M'.

Matt Sangpeal

L-42 Surveillance Panel Chairman



L-42 Surveillance Panel Meeting

ASTM D7452

Intertek PSI

Plymouth Township, MI

November 13, 2024

10:30 – 11:30 AM EST

Passion for Solutions™

Agenda

- 📈 Call to Order
- 📈 Agenda
- 📈 Membership Review & Update
- 📈 Approval of Meeting Minutes
 - ~ “20240807 SP” – PRI Headquarters, Warrendale, PA
- 📈 Action Item Review
- 📈 Next Hardware Batch Order Update
- 📈 Future of L-42 Test Hardware (presentation by Dana)
- 📈 TMC 119-1 Reference Oil Qualification Test Results
- 📈 L-42-1 Development Updates
- 📈 New Issues
- 📈 Adjournment

L-42 SP Voting Members

 Rob Banas:	Exxon Mobil
 Dylan Beck:	TMC *Replace with Wes Venhoff
 Allen Comfort:	US Army
 Arjun Goyal:	BASF
 Troy Muransky:	AAM
 Jessica Carowick:	Cummins
 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

- ~ “20240807 SP” à August 7, 2024 – Surveillance Panel Meeting - PRI Headquarters, Warrendale, PA and Virtual Meeting via Microsoft Teams

Motion to Approve Meeting Minutes as they stand?

Action Item Review

- ▲ **M. Sangpeal to set up call with Dana, lab engineers, and A. Zyski within two weeks (next hardware batch order discussion)**
 - ~ Status: Complete (more details later in presentation)
- ▲ **SwRI will run additional testing with increased Shock 2 torque, Cond. 4 and Shock 2 repetitions as defined in D7452, and rigid axle mounts**
 - ~ Status: Complete (more details later in presentation)
- ▲ **IAR to donate three axles from MSPLO/P2AD01 batch to SwRI for development efforts.**
 - ~ Status?
- ▲ **IAR to investigate installing L-42 axle on their Efficiency T-Rig.**
 - ~ Status?

Next Hardware Batch Order

Orders have been placed with Dana. Quantities by lab:

- ~ SwRI: 300
- ~ IAR: 250 325
- ~ Afton: 200 300
- ~ Lubrizol: 100 125

Dana requested pictures of the axle in the test stand

- ~ May be able to reduce cost / complexity
 - No features were identified that would save significant cost
 - Decision was made to keep axles the same

PO Status:

- ~ Afton: Complete
- ~ SwRI: Complete
- ~ IAR: ?
- ~ Lubrizol:?

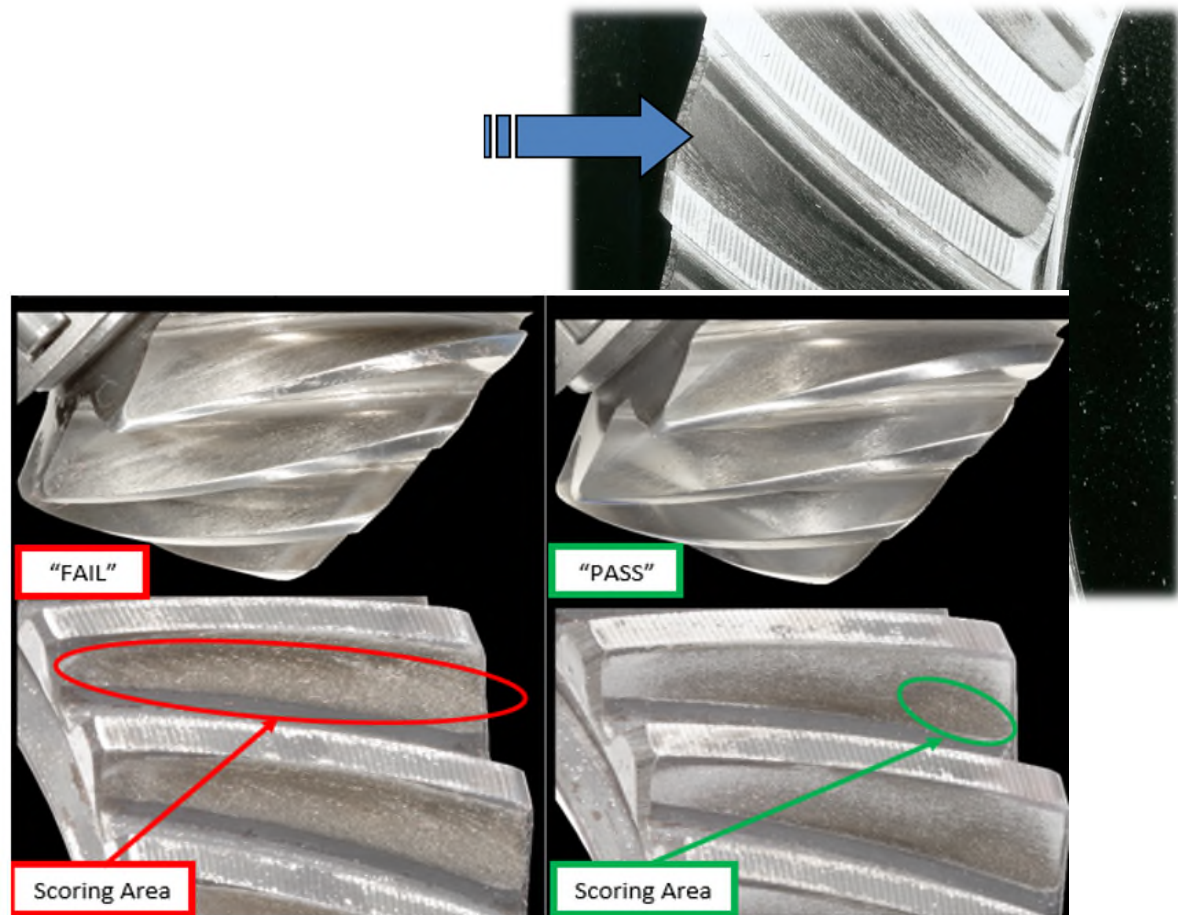


ASTM 2 axis gearing

People Finding A Better Way[®]

ASTM L42 Test

- § Dana 44 axle
- § Coast side scoring test
- § Uses an old 2 axis (FACE MILLING) process



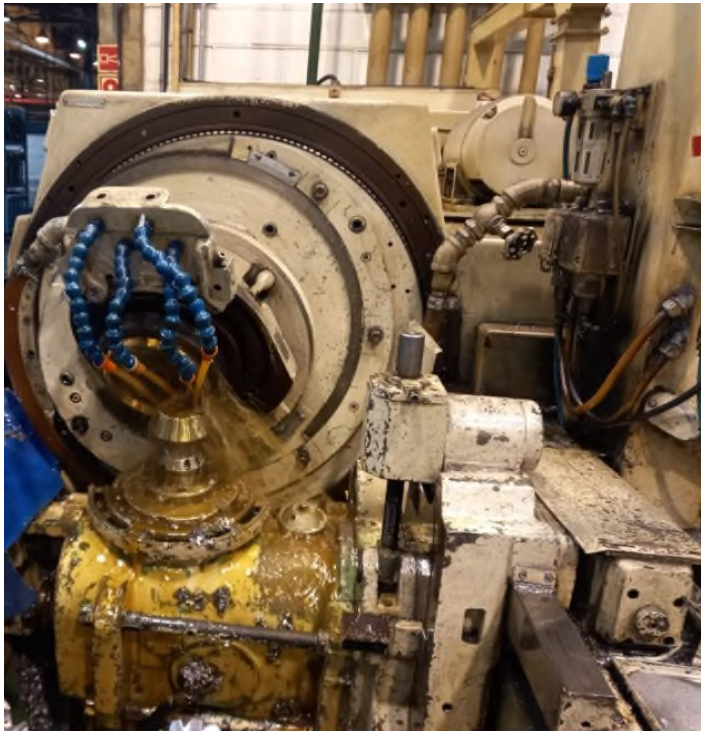


Burning Platform

- § Dana Ft. Wayne Currently produces the 2 axis gears on old, manual machines
- § Machines are no longer serviceable and training available for this position is becoming a challenge
- § **Industry has moved to 3 axis gear geometry**
- § Dana Ft. Wayne will be exiting the 2 axis gear cutting process in early 2025
- § Secured last time cut for 2-3,000 pcs of gears from Dana Ft. Wayne in 1Q2025
 - Material secured and forgings to be made in October 2024

Machine Examples

GLEASON #606 / 607
Manual 2-AXIS machines



5 cut method with multiple cells

OERLIKON C50 AND GLEASON 450HC
CUTTING MACHINES



1 cut

Options

1. Discontinue the gear sets (not preferred)
2. Move production to Dana Brazil
 - Potential to continue production for 5-10 years MAX
 - Keep US material and forging supply base
 - Lead time increases and increased freight costs
 - Increased complexity
3. Move from 2 axis to 3 axis design
 - Multiple iterations required
 - (40) pcs generally used to develop a gear set
 - (15) weeks from design to prototype
 - Feasibility Study with ASTM required
 - Can the data be translated to new design?



Next Steps – Option 3 – Long term

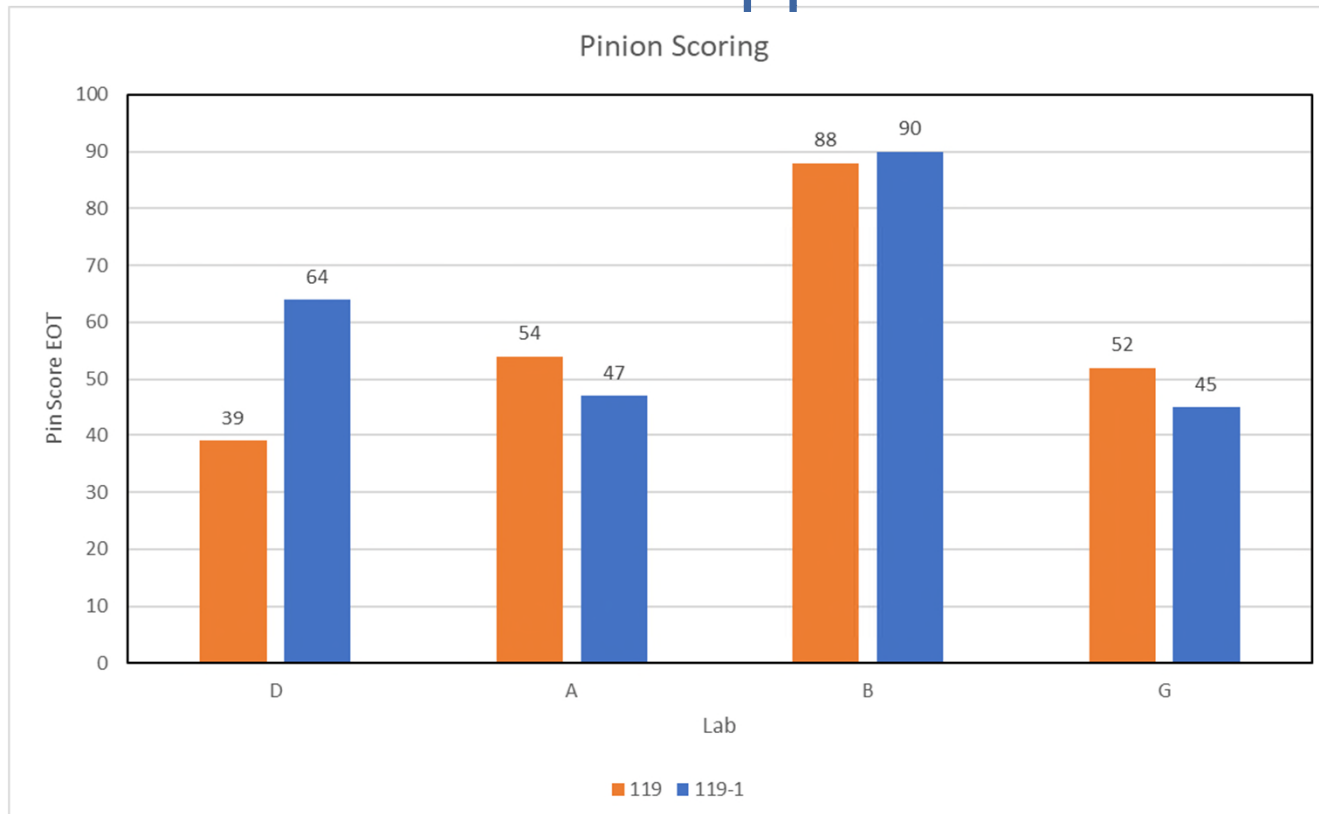
1. ASTM test lab initial feedback
2. Feasibility study
 1. Can Dana duplicate an ASTM test?
 1. Dana Testing team to review the Gas-fired test and determine replication feasibility
 2. Alignment with ASTM test facilities on scoring methodology
 2. Plan for prototyping
 1. Initiate internal inquiry to set a program number
 2. Gear engineering to determine design and forging needs
 3. Planning to build several units with new design in the next batch – 2Q2025
 4. Alignment with above testing and correlation with ASTM

TMC 119-1 Reference Oil Approval - Process

Approval Process

- ~ Each lab will run one test with 119 and one test with 119-1 back-to-back on a referenced stand
- ~ Labs have two choices on how the tests will be recorded:
 - Two tests will be added to the 20-test reference period
 - One test with 119 will be used as the low reference run in a four-test calibration sequence and one test will be added to the 20-test reference period (for the 119-1 test run)
- ~ Due date to submit data: August SP meeting (August 7, 2024)

TMC 119-1 Reference Oil Approval - Results



Lab	CMIR	Oil	Hardware	Pin Score EOT	Ring Score EOT	S1 Score Ring	S1 Tq [ft-lb]	S2 Tq [ft-lb]
D	184769	119	MSPLO/P2AD01	39	29	0	-75.1	-353.2
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L-42-1 Update ASTM/LRI 215

SOUTHWEST RESEARCH INSTITUTE®

11/13/24

Caroline Louis



FUELS & LUBRICANTS RESEARCH

Background

§ Southwest and Afton agreed to:

- Bring number of cycles and torque setpoints back to D7452 standard
- Target -250 ft lbs on Shock 2
- Compare results



Results

August 2024

§ Operational differences from D7452:

- 10 cycles conditioning 4
- 15 cycles Shock 2
- Dyno setpoint of 100 ft-lb Shock 2
- Shock 2 peak torque (avg) -223 ft lbs

§ Results:

- 117 (Avg): 15/10
- 119: 34/24

November 2024

§ Operational differences from D7452:

- Shock 2 peak torque (avg) -243 ft lbs

§ Results:

- 117: 16/9
- 119: 25/12



Next Steps

- § Southwest can push Shock 2 down a little further, between -250 and -255
 - Conditioning 4 and Shock 1 can change a little more while staying inside specification boundaries
- § 1 more run each on 117 and 119



New Issues



Thanks!



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