

# ASTM Engine Oil Gelation Test (EOGT) WK86363 Update

EOFT and EOWTT Surveillance Panel Meeting  
September 30, 2024

Yong-Li McFarland, Chair



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# EOFT and EOWTT Surveillance Panel Membership

## 21 members

Beth Schwab, Afton Chemical

Michael Kunselman, Center for Quality Assurance

Robert Stockwell, Chevron Oronite

Quanchang Li, ExxonMobil

Michael Deegan, Ford

Melissa Chu, Infineum

Angela Willis, Infineum

Joe Franklin, Intertek

Karina Gil, Intertek

Michael Johnscher, ISP

Litchi Xie, Lubrizol Additive (Zhuhai) Co., Ltd.

Victoria Fein, Lubrizol

Jason Bowden, OH Technologies Inc

Greg Miiller, Savant Group

Maggie Smerdon, Savant Labs

Sean Alston, SGS North America

Jared Cavaliere, SwRI

Becky Grinfield, SwRI

Yong-Li McFarland\*, SwRI

John Loop, TMC

Amy Ross, Valvoline

\*Chair



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# New EOGT WK86363, ILS# 1854

- Ford request for a new Engine Oil Gelation Test (EOGT): request to add a new test filterability test to better screen oils for field issues
- Current status:
  - Method: 3 drafts (large volume (600g), small volume (200 g), and Afton method) uploaded on ASTM Collaboration Area
  - Oils: 11 potential reference oils offered; 17 oils received at TMC
  - Screening Tests and ILS: Screening Test and additional tests ongoing
  - Timing: ILS tests to be run by November, and final method ballot in February 2025



# Afton Method and Original EOGT Results

- Savant update
- SwRI update
- Afton update
- ISP update
- Intertek update
- Valvoline update



# Savant updates

■ As far as recommendations:

1. Pass/fail request as termed below.

**1. Calculation:**

1. If one or both (candidate) sample gels, record as “gel”

2. If one sample does not gel, repeat steps ...

~~3. If one candidate sample gels and one does not. Repeat testing. If the 3<sup>rd</sup> result gels, record as “gel”~~

2. The protocol, as simple as possible, on the homogenizer. Maybe even automating it.

3. Recommend stirring for 10 minutes, Heating in Oven at 45 ° for 1 hour, Stirring for 10 more minutes and then store for 24 hours.

Notes 9-26-24: Group discussed the above (but without Savant) and made some changes to the recommendations. Consider TMC referencing section wording on running a reference with each candidate sample. Define “gel” or “gelling”. Let’s include all EOT results and then get feedback from ILS on what final method should state. Keep qualitative report result.

# Afton Method suggestions

## Sample Prep

- Candidate samples to be prepped in duplicate.

## Testing

- First candidate sample is tested
- If candidate sample gel, second sample DOES NOT need to be run
- If Sample does not gel, second sample DOES need to be run
- Define gel: “less than 0.1 ml/s flow”



S 25 N - 18 G - ST  
Dispersing tool

PRICE  
USD 2,695.00

Ident. No. 0004447300



S 25 KD - 18 G Dispersing  
tool

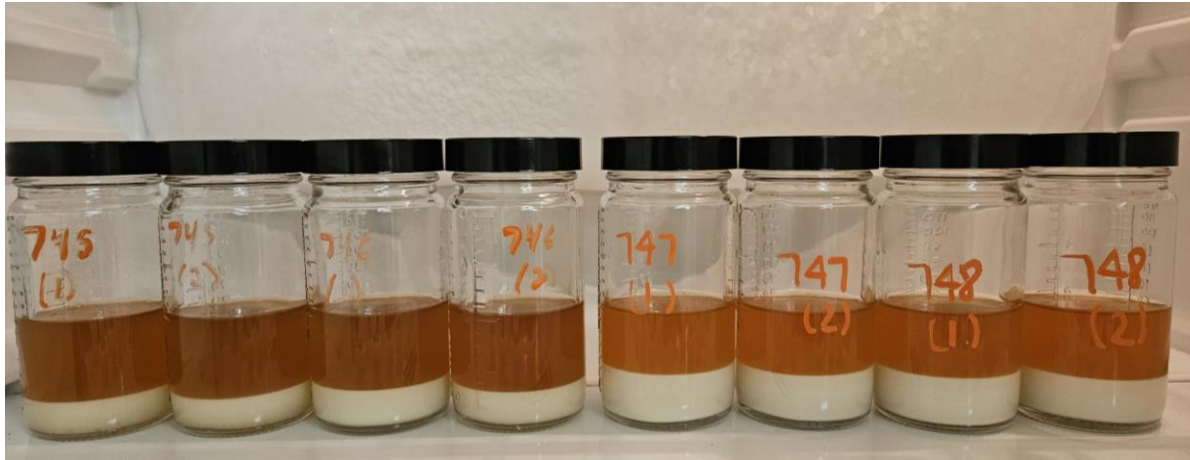
PRICE  
USD 2,950.00

Ident. No. 0020002971

Volume range min. (H2O)	0.01 l	0.01 l
Volume range max. (H2O)	1.5 l	1.5 l
Stator diameter	18 mm	18 mm
Rotor diameter	13.4 mm	12.7 mm
Gap between rotor and stator	0.25 mm	0.3 mm
allowable Speed max.	25000 rpm	25000 rpm
Circumferential speed max.	17.5 m/s	16.6 m/s
Immersion depth min.	40 mm	40 mm
Immersion depth max.	165 mm	185 mm
Shaft length	194 mm	194 mm
Material in contact with medium	PTFE, AISI 316L	AISI 316L / PTFE / FPPM
pH min.	2	2
pH max.	13	13

# SwRI updates

## Samples F & K during 24 hr storage



### Notes 9-26-24:

- Sample starts to gel but then breaks down. Consider rate of revolving jar
- Savant, SwRI, Afton to share videos of blending steps
- In-person workshop in San Antonio next month? Labs to respond?
- Afton and Savant to request recent aliquot of oil K and F from TMC and rerun Afton method.
- Keep mixing temp at 45C +/- 5C.



Sample F (gelled) EOT

# TBN Results Sept 30

Lab	Method	Sample	TBN D4739 SOT	TBN D4739 EOT (homogenous sample)
Afton	Afton	F (gel)	7.61	4.4
		K	5.6	3.23
ISP	Original	F (clog or gel)	7.4, 7.6, 7.5	6.3, 6.2, 6.0 (Hand mixed to be homogenous)
		K	5.5, 5.7, 5.7	5.1, 5.1, 5.0
ISP	Afton	F (no gel)	7.4	4.3
		K	5.5	3.2
Savant	Afton	F (gel?)	7.546	3.91, 3.72
SwRI	Afton	F (gel)	7.48	2.71, 4.46
		F (no gel)	7.39, 7.58, 7.67	4.39, 4.36, 4.48, 4.50
		K	5.68, 5.75, 5.66, 5.57	3.29, 3.44, 3.28, 3.32, 3.19
Intertek	Original + 11 months storage + 1 wk cold storage	F (clog or gel)	6.89, 6.95	6.19, 6.18
		K	5.30, 5.41	1.02, 1.79
Valvoline	Original	F (no gel)		8.21
		K		0.75

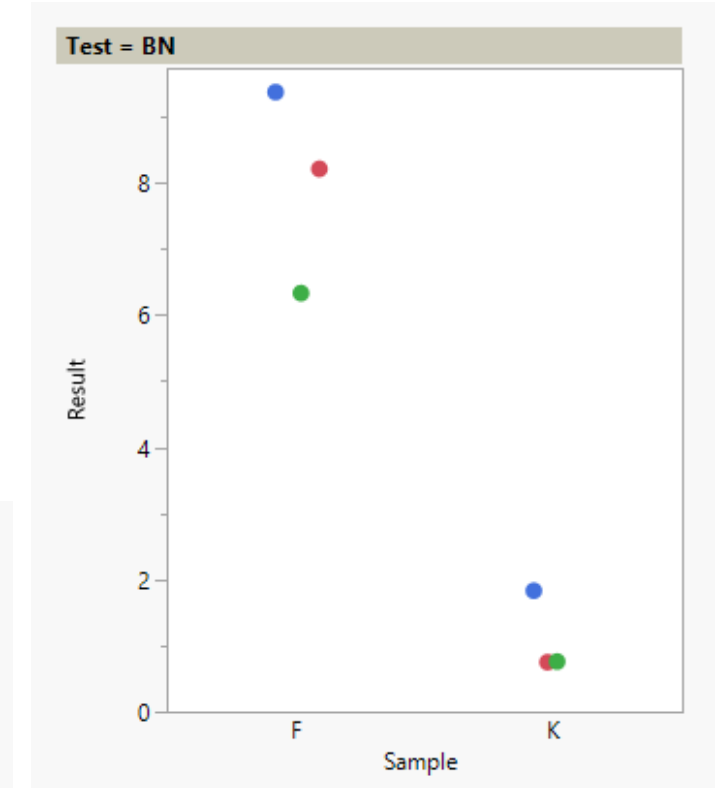
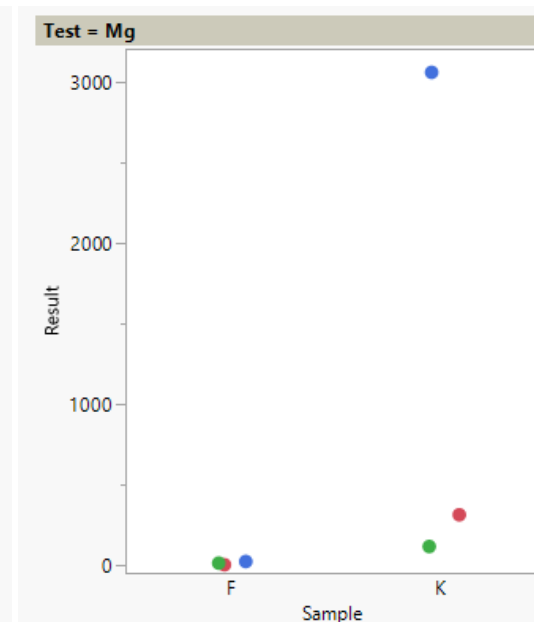
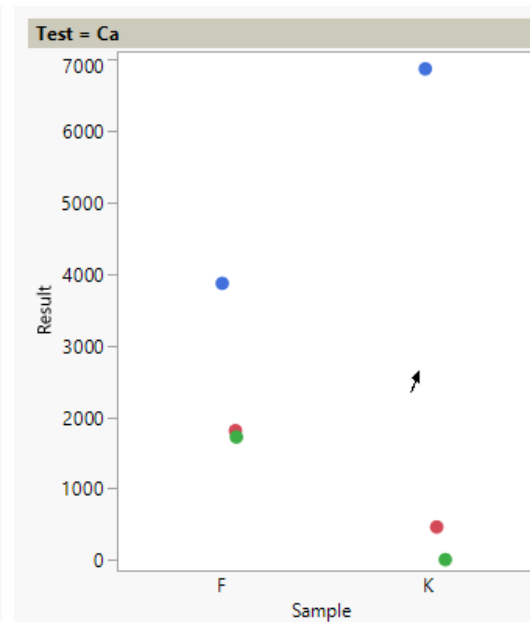
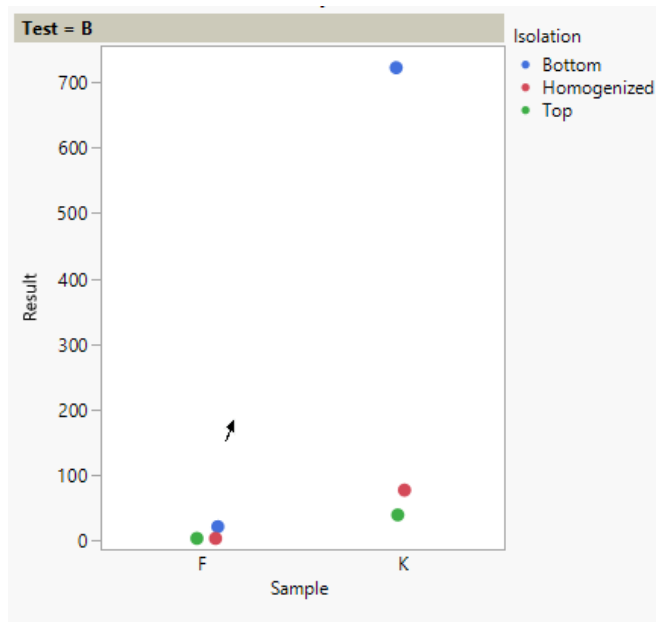


# Valvoline EOGT Root Cause – Follow-up BN analyses 20240917

Sample	Isolation	BN	B	Ca	Mg	P	Zn
182155+182156 (K)	Top	0.76	38	9	119	694	635
182155+182156 (K)	Bottom	1.83	723	6862	3062	561	1670
182155+182156 (K)	Homogenized	0.75	76	464	316	711	729

Sample	Isolation	BN	B	Ca	Mg	P	Zn
182157+182158 (F)	Top	6.33	2	1720	16	850	984
182157+182158 (F)	Bottom	9.37	20	3866	26	591	709
182157+182158 (F)	Homogenized	8.21	2	1810	6	817	929

Notes 9-30-24: to verify sample ID, also provide SOT TBN results



- BN differentiation observed between fluids
- Oil K bottom isolations consistently showed significantly higher amounts of detergent/dispersant analytes (B, Ca, Mg) than top/homogenized samples

# API comments on EOGT available for GF7 industry use

- 1. EOGT can correlate to the field issue of Engine Oil Gelation as described by Ford.
  - 2. EOGT must have an established test method with documented repeatability and reproducibility supported by statistical analysis.
  - 3. EOGT must be an ASTM Test Procedure.
  - 4. The EOGT Surveillance Panel would support API and AOAP in developing the Precision and BOI/VGRA Testing with Reference Oils to aid in Precision and BOI/VGRA testing.
  - 5. The AOAP would need to review and approve data from the EOGT Precision and BOI/VGRA testing.
  - 6. The EOGT Surveillance Panel exists as a functioning task force or surveillance panel to coordinate activities and analyze test data.
  - 7. The EOGT Surveillance Panel must provide a method for referencing and/or calibrating each bench test.
  - 8. EOGT shall be monitored by the TMC (or equivalent).
- Included Test Readiness Document from ACC comments that are relevant. Laura mentioned there will be an email from ACC email to Yongli on their comments.



# ACC PAPTG response on Test Readiness and Availability

ACC PAPTG notes that test ‘readiness’ is also important and test developers are encouraged to use the Engine Test Development Readiness Template to help ensure tests are founded on technical and statistically valid principles and processes are in place to maintain these characteristics over time. While this template was drafted with engine tests in mind, the practices it lists can also apply to bench tests. Additionally, it is important that:

1. Test development group has demonstrated that the procedure is applicable to the field issue observed and shown discrimination between known good and bad performing oils.
  2. A test referencing procedure has been agreed to.
- [Engine Test Development Readiness Template](#)

ACC PAPTG has previously shared our considerations for test availability with the AOAP and NCDT as it relates to the start of the Technology Demonstration period. The ACC PAPTG requirements are:

1. All tests proposed for the category are available. Available is defined as the following:
  - a. Test procedure is established and cannot change.
  - b. Test is able to be scheduled at an independent lab with all of the final test-procedure-defined materials and sufficient test capacity is available.
2. Proposed targets for all performance criteria of the test is/are known and provided.



# ILS Planning (If time)

- Criteria for Afton method to moving forward to ILS: Root cause group to finalize method, specifically on shearing details; Ford to give recommendation to move forward
- Sample volume: 120 mL for duplicate run per oil – Afton to confirm
- Labs participating: Afton, Intertek, ISP?, Savant, Southwest Research Institute, Valvoline, Infineum?
  - Others?



# ILS Planning

Notes: 9-30-24: Concern on labs being picked for ILS who can gel Oil F; consider results with partially gelling samples; collect flow time volumes with partially gelling samples

- Goals: Establish precision (repeatability and reproducibility) statement with different levels of performance
- ILS: Assume 6 labs, 6 oils, each lab runs 12 tests total (each oil run twice, consider more repeats?)
- We have 11 oils eligible as reference oils and 6 additional oils at TMC
  - Ask oil participants to select down to 6 fluids total. Optimal: 2 good, 2 bad, 2 borderline oils.
  - Consider send out 17 offered oils to 3 labs to run 1 test each and determine if there's any borderline fluids to include in ILS. Propose each lab to run Oil F and 5 samples and then group to select down to 2 good, 2 fail, 2 borderline (if possible). There will be some lab bias.
- Travis to come up final test matrix once oils are determined
- Procedure:
  - All labs should prove they can gel (2?) poor oils before being included in ILS
  - Take sample and report every 15 sec volume up to 180 sec and then determine what to report
  - Include range of Vis grade samples, check with TMC on info supplied
  - Consider combine ILS with BOI-VGRA matrix



# Draft Timeline – updated Sept 30, 2024

Task	Date										
	5-6 2023	7-8 2023	9-10 2023	11- 12 2023	1-2 2024	3-4 2024	May-Jun 2024	Jul-Aug 2024	Sept-Oct 2024	Nov-Dec 2024	Jan-Feb 2025
Develop test procedure and ILS report form	█										
Collect and prepare donated oil samples (18 oils)	█	█									
Screening samples shipped to labs (6 labs)		█									
Screening labs run 4 tests			█	█							
Data analysis for Screening and Proposal tests			█	█	█	█	█	█	█	█	
ILS samples shipped to ILS labs (6 labs)									█		
ILS Labs run tests									█	█	
Data analysis for ILS, generate Research Report (RR) & Precision										█	█
Ballot test procedure and RR											█
<b>Test available for industry use</b>											█



# EOFT D6795 and EOWT D6794 Method Review

- WK91396 opened to revise D6795: Current Subcommittee B ballot due by Oct 28, 2024
- WK91397 opened to revise D6794: Current Subcommittee B ballot due by Oct 28, 2024



# Action Items and Next Meeting

- Root Cause group to consider if pH was root cause for lack of differentiation in original EOGT method; ask labs to run pH or TBN on fresh EOT sample (ISP, Intertek)
- TMC supply of Oils F and K (John to provide estimate of how much remaining and estimate if additional oil is needed). Oil F has 7.085 gallons remaining (from 25 gallons initially provided). Oil K has 2.925 gallons remaining (from 20 gallons initially provided).
  
- Group to review TBN results on fresh and EOT samples.
- Sample size: 120 mL? Jacob Z to let us know if adequate to run duplicates (as written in method)
- Any other labs wanting to participate in ILS, please let Yong-Li know.
- Jacob/ Afton to update Afton Method with suggested wording in slides 3 and 4
- Afton and Savant to request new Oil F and K from TMC and repeat Afton method
- Afton to run Afton Method with non-serrated tool
- SwRI to run additional Afton Method tests with mixing temp at 45C and collect flow time volumes
- SwRI to verify 2.71 TBN EOT Oil F result
- Savant, SwRI, Afton to share videos of blending step, starting after water addition
- Savant, SwRI, Afton, Intertek, Valvoline, ISP and other interested parties to let Yong-Li know of the possibility to attend an in-person workshop in San Antonio in October to review Afton Method.
- Valvoline to provide fresh Oil F and K TBN results
- Group to review TBN results
  
- Next Meeting: Tuesday Oct 15 at 9:00 AM CDT for 1 hr



# Thank you for your support!

Participants		
Method Development (11)	Oil Donations (9)	Testing Labs (7)
Afton ExxonMobil Ford Infineum Intertek ISP Lubrizol Oronite Savant SwRI TMC	Afton Ford Infineum Lubrizol OH Technologies (donate filters only) Oronite Subaru TMC (collection, shipping only) Toyota	Afton Intertek ISP Savant SwRI TMC (monitoring system only) Valvoline

