

# ASTM New Engine Oil Gelation Test (EOGT) WK86363 Update

EOFT and EOWTT Surveillance Panel Meeting  
September 25, 2023

Yong-Li McFarland, Chair



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# EOFT and EOWTT Surveillance Panel Membership

## 20 members

Beth Schwab, Afton Chemical

Michael Kunselman, Center for Quality Assurance

Robert Stockwell, Chevron Oronite

Dennis Gaal, Exxonmobil

Michael Deegan, Ford

Ron Shah, 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: 2 drafts (large volume (600g) and small volume (200 g)) uploaded on ASTM Collaboration Area, email Jared with procedure questions
  - Oils: **11** potential reference oils offered; 17 oils received at TMC
  - Screening Tests, Pilot Study, and ILS: Reviewing Screening Test results, wait on 1 lab result
  - Timing: Pilot Study tests run by November, ILS tests to be run by March, and final method ballot in May or June 2024



# Oil Matrix

Participants	Potential Reference Oils Offered	Oil Sample Received at TMC	Comments
Ford	2 oils (low and high known performance oils) - eligible to be reference oils	2 oil samples received	
Toyota	2 oils - not eligible to be reference oil	2 oil samples received	Offer 2 field samples for later testing; Awaiting some Physical and Chemical data
Afton	4 oils– eligible to be reference oils	4 oil samples received	
Lubrizol	4 oils – eligible to be reference oils	4 oil samples received	
Infineum	1 oil – eligible to be reference oil	1 oil sample received	
Oronite	3 oils –not eligible to be reference oils	3 oil samples received	Awaiting Physical and Chemical data
Subaru	1 oil – not eligible to be reference oil	1 oil sample received	Offer 1 field sample for later testing
<b>Total Oils</b>	<b><u>11 potential reference oils confirmed</u></b>	<b><u>17 oils received</u></b>	

John Loop to manage Sample Information



# Testing Status – updated Sept 22 [EOGT report form Rev 6](#)

Test Phase	Description	Status	Comments
1. Screening Tests	<p>-4 tests; 2 oils: low performance oil in duplicate, high performance oil in duplicate; 6 labs</p> <p>-Run LV method</p> <p>-Intent: check labs can run test as set up</p>	-Valvoline: complete tests by end Sept, send data by end Sept	Run SOT & 14 day EOT only. <b>-REVIEW initial data</b>
2. Pilot Study	<p>-? Tests; ? Oils; 4 labs</p> <p>-Run SV and LV methods, all intervals</p> <p>-Intent: determine samples, method, and intervals for procedure and ILS</p>	<p>Waiting to determine samples:</p> <p>-Plan to include either 6 or 10 oils including 2 performance oils, and then each of the other oil participants select 1 or 2 “borderline” oil for total of 6 or 10 oils to run. “Borderline” is something that would fall in-between the 2 performance oils (less Ca than Oil F?)</p> <p>-Pros/cons: 6 oils – shorter to run, but may not find a borderline reference and may need another Pilot run; 10 oils-longer to run, but more likely to find a borderline reference</p>	<b>Group to decide as we move forward</b>
3. Interlaboratory Study (ILS)	<p>-? Tests; ? Oils; 6 labs</p> <p>-Run _ method</p> <p>-Intent: generate repeatability and reproducibility data on samples, determine at least 2 reference oils</p>	Waiting to determine samples	

# Screening Tests Results review

- Insufficient information on Condenser size and type, CO2 vessel size, type, shape, and dimensions, Water type, CO2 COA/purity, and Storage container max volume, lid lining, and # containers from different labs, missing photos- **Labs please update by Thursday Sept 28, lab meeting Oct 2 or 3?**
- Observed differences: different condenser sizes, CO2 vessel sizes, water type, filter batches, storage container material and size and #containers
- Heating and CO2 SOT times: labs listed same times for starting heating and CO2 flow, need to update that CO2 flow starts when sample at temperature, and confirm how long CO2 flow is run for
- Is Lab G homogenizing sample or not prior to filtration? Response is unclear
- ICP: Results across labs are consistent at different intervals, Ca and Mg on 2 EOT samples do show discrimination
- KV40: are all labs taking sample before homogenizing? Is this run manually or auto instrument? Are labs making sure sample is homogenous before running KV?
- Flow times are not consistent across labs on New Oils. See large range in flow times and small differences in time (seconds) make large impact on Change in Flow Rate
- Should expect to see large Change in Flow Rate compared to EOFT and EOWT with more water added
- Some Change in Filter Rates incorrect based on calculations – Include calculations in Report Form, Labs please check reported results are correct
- 1<sup>st</sup> Proposal to look at filterability of just bottom layer (sediment) of interval/EOT sample instead of homogenized full sample. The bottom layer would be a condensed layer (more likely to show larger difference in filter rate)-Need procedure and unsure if can be done or shows difference
- 2<sup>nd</sup> Proposal to include a 0hr (Oil with water, no heat or CO2 flow) filterability as a baseline
- 3<sup>rd</sup> Proposal to include 1 existing EOWT/EOFT reference oil (oil 79) in study to see if test modifications make difference (increased water %, CO2 bubbling)
  
- Next steps: Collect additional info, Send out additional samples, Run next set of Screening Tests (specific instructions undetermined)
  - Previous LV shipment was 1750 g per container: **TMC to send out 2 samples each of 2 performances to all 6 labs.**
  - **Yongli to set up additional meetings regarding next steps to share needed info (Afton), please email Yongli if needed.**
  - **Yongli to set up labs only meeting to review additional data and make suggestions to group on next test conditions**
  
- Group to decide:
  - 1. Do we want to include B and Mo results for New oil, 0hr, EOT as there was a drop in these elements? If so, are oil participants ok with reporting this? **Yes tentatively pending oil participants response. Oil participants can let John know if ok or not, either way.**
  - 2. Continue with any of Proposals 1-3? **Is all the sediment/gel the same made across all labs? Undetermined currently.**
  - 3. Conditions for next Screening Tests?



# Proposals

## ■ Proposal 2:

### 10. Procedure

10.1 Run each new oil and test oil for ICP by D5185 or D4951 for all elements including Sulfur. The Test oil should be sampled from the middle of the oil layer of the unhomogenized test sample. See Fig.3 for example.

10.2 Homogenize each sample and determine kinematic viscosity by D445 at 40°C. Run fresh oil kinematic viscosity at 40°C.

10.3 Prepare a zero hour sample using  $(100 \pm 1.0)$  g of new oil blended with  $(4.0 \pm .1)$  g deionized water and test for kinematic viscosity, elements, and filterability.

10.4 Assemble apparatus as shown in Fig. 1 with filter installed in proper orientation (25 $\mu$ m smooth side up).

10.5 Determine the new oil flow rate by placing a sample of the new oil in the burette. Pressurize the system and force at least 10 mL of oil through the filter to saturate the filter with oil and remove any air bubbles. Disconnect the air line and fill the burette with the new oil to a level (1 to 2) cm above the 0ml mark. Pressurize the system to  $(69 \pm 2)$  kPa, open the stopcock, and measure the flow time for each successive 5 mL of oil between the (0 and 25) mL graduations.

10.6 To determine the 0hr, 72hrs, 168hrs, 240hrs and 336hrs test oil flow rate, the flow times of the new oil are first determined in accordance with 10.5. Using the same filter disc, filter holder, and burette, reduce the new oil level in the burette to the lowest level that allows no air bubbles below the stopcock. Disconnect the air line and fill the burette with a homogenized sample of test oil to a level (1 to 2) cm above the 0ml mark. Pressurize the system to  $(69 \pm 2)$  kPa, open the stopcock, and measure the flow time for each successive 5 mL of oil between the (0 and 25) mL graduations. Test may be stopped once 100% flow increase has been observed.



# Pilot Study Matrix

## 6 Samples

Note: Order to be randomized

Screening Test Oils are "Sample 1" and "Sample 2"

Test Number	Lab A	Lab B	Lab C	Lab D
1	Sample 1 (LV)	Sample 1 (SV)	Sample 1 (LV)	Sample 1 (SV)
2	Sample 2 (LV)	Sample 2 (SV)	Sample 2 (LV)	Sample 2 (SV)
3	Sample 3 (LV)	Sample 3 (SV)	Sample 3 (LV)	Sample 3 (SV)
4	Sample 4 (LV)	Sample 4 (SV)	Sample 4 (LV)	Sample 4 (SV)
5	Sample 5 (LV)	Sample 5 (SV)	Sample 5 (LV)	Sample 5 (SV)
6	Sample 6 (LV)	Sample 6 (SV)	Sample 6 (LV)	Sample 6 (SV)
7	Sample 1 (SV)	Sample 1 (LV)	Sample 4 (SV)	Sample 4 (LV)
8	Sample 2 (SV)	Sample 2 (LV)	Sample 5 (SV)	Sample 5 (LV)
9	Sample 3 (SV)	Sample 3 (LV)	Sample 6 (SV)	Sample 6 (LV)
10	Sample 1 (LV)	Sample 2 (LV)	Sample 1 (LV)	Sample 2 (LV)
11	Sample 1 (SV)	Sample 2 (SV)	Sample 1 (SV)	Sample 2 (SV)
12	Sample 3 (LV)	Sample 4 (SV)	Sample 5 (LV)	Sample 6 (SV)

Total LV	8	4	8	4
Total SV	4	8	4	8

### Total Sample Runs

4 per volume, 8 total

## 10 Samples

Note: Order to be randomized

Screening Test Oils are "Sample 1" and "Sample 2"

Test Number	Lab A	Lab B	Lab C	Lab D
1	Sample 1 (LV)	Sample 1 (SV)	Sample 1 (LV)	Sample 1 (SV)
2	Sample 2 (LV)	Sample 2 (SV)	Sample 2 (LV)	Sample 2 (SV)
3	Sample 3 (LV)	Sample 3 (SV)	Sample 3 (LV)	Sample 3 (SV)
4	Sample 4 (LV)	Sample 4 (SV)	Sample 4 (LV)	Sample 4 (SV)
5	Sample 5 (LV)	Sample 5 (SV)	Sample 5 (LV)	Sample 5 (SV)
6	Sample 6 (LV)	Sample 6 (SV)	Sample 6 (LV)	Sample 6 (SV)
7	Sample 7 (LV)	Sample 7 (SV)	Sample 7 (LV)	Sample 7 (SV)
8	Sample 8 (LV)	Sample 8 (SV)	Sample 8 (LV)	Sample 8 (SV)
9	Sample 9 (LV)	Sample 9 (SV)	Sample 9 (LV)	Sample 9 (SV)
10	Sample 10 (LV)	Sample 10 (SV)	Sample 10 (LV)	Sample 10 (SV)
11	Sample 1 (SV)	Sample 1 (LV)	Sample 6 (SV)	Sample 6 (LV)
12	Sample 2 (SV)	Sample 2 (LV)	Sample 7 (SV)	Sample 7 (LV)
13	Sample 3 (SV)	Sample 3 (LV)	Sample 8 (SV)	Sample 8 (LV)
14	Sample 4 (SV)	Sample 4 (LV)	Sample 9 (SV)	Sample 9 (LV)
15	Sample 5 (SV)	Sample 5 (LV)	Sample 10 (SV)	Sample 10 (LV)
16	Sample 1 (LV)	Sample 1 (SV)	Sample 6 (LV)	Sample 6 (SV)
17	Sample 2 (LV)	Sample 2 (SV)	Sample 7 (LV)	Sample 7 (SV)
18	Sample 3 (LV)	Sample 3 (SV)	Sample 8 (LV)	Sample 8 (SV)
19	Sample 4 (SV)	Sample 4 (LV)	Sample 9 (SV)	Sample 9 (LV)
20	Sample 5 (SV)	Sample 5 (LV)	Sample 10 (SV)	Sample 10 (LV)

Total LV	13	7	13	7
Total SV	7	13	7	13

### Total Sample Runs

4 per volume, 8 total



# Next Steps

- Remaining lab run Screening tests (LV tests on high and low performance oils).
- Group to review Screening Test data and understand why the 2 oils are not discriminating for all labs and make suggestions of what to do before starting Pilot Study
- **Plan out additional samples and conditions for labs to run for additional Screening Tests**
- On Hold-Determine Pilot Study samples (# and which samples, and # repeats), and method (LV, SV, all intervals)
- On Hold- Send out Pilot Study samples to Pilot Study labs
- On Hold- Labs run Pilot Study





# Action Items and Next Meeting

- Remaining lab to run Screening Tests and send Excel Report TMC (John Loop) ASAP.
  - All labs to review and update submitted Data Report Form to John Loop with additional fields and any missing or clarifying information. **Please submit missing info and photos.** Please follow Lab A in providing as much detail as possible.
  - **Labs to send back data by Thursday Sept 28.**
  - **Oil participants let John know if ok or not to include B and Mo info on their oils, either way.**
  - All participants to review Screening Test data and Lab group to make suggestions on procedure for likely Screening Test reruns.
  - **John to send out next set of Screening Test samples to all 6 labs.**
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- Next Meeting: Monday October 9 at 8:30AM CDT and every 2 weeks



# Thank you for your support!

Participants		
Method Development	Oil Donations	Testing Labs
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 (Screening, Pilot, and ILS) Intertek (Screening, Pilot, and ILS) ISP (Screening, Pilot, and ILS) Savant (Screening and ILS) SwRI (Screening, Pilot, and ILS) TMC (monitoring system only) Valvoline (Screening and ILS)

