

To: API Lubricants Group
Cc: Lubricants Group Mailing List
API

Ballot to Update EOWTT Read Across text in API 1509, Annex E and Annex F

On June 29, 2022, Eric Kalber Chair BOI/VGRA gave a presentation reviewing the Engine Oil Water Tolerance Test (EOWTT) and the text describing BOI/VGRA. (Attachment 1) An issue was raised about the EOWTT wording used for more than 20 years in the BOI and VGRA guidelines (Annex E and Annex F). The BOI/VGRA Task Force determined that:

- Annex F wording appears to all read across to other base oils
- Annex E wording indicates requirements for each base oil interchange.

After discussion it was clear there are different interpretations of the wording used for EOWTT BOI/VGRA. As a result, a call for data to be brought forward was made. Oronite, Lubrizol, and Afton each provided data that would support clarification of the BOI/VGRA language in both Annex E and Annex F. (Attachment 2)

The EOWTT data presented supports base oil interchange and viscosity grade read across directionally from the highest additive and highest VM treat rate to the same or lower additive and the same or lower VM treat rates. After the data technical review, the BOI/VGRA TF proposed that the Lubricants Group adopt the following language into API 1509, Annex E and Annex F.

Proposed update for API 1509 Annex E.4.2.4

- Current Language Annex E.4.2.4.1:
 - The Engine Oil Water Tolerance Test (EOWTT) ASTM D 6794 [formerly GM 9099P Filterability (Modified Method for ILSAC GF-2/GF-3)] for each base oil interchange is required only in the viscosity grade with the highest additive (DI/VM) combination.
- *Proposed Language Annex E.4.2.4.1:*
 - *The engine oil water tolerance test [EOWTT] ASTM D6794 is required only in the viscosity grade with the highest additive concentrations in combination (DI/VM). Results are then read across to all other base oils/viscosity grades using the same or lower concentration of the identical additive DI and using the same or lower concentration of the identical additive VM. Each different [DI/VM] combination must be tested.*

Proposed Update for API 1509 Annex F.4.2

- Current Language Annex F 4.2:
 - The Engine Oil Water Tolerance Test [EOWTT (ASTM D6794)] must be run on the formulation with the highest additive (DI/VM) combination. Results are then read-across to all other base oil/viscosity grade formulations using the same or lower concentration of the identical additive (DI/VM) combination. Each different (DI/VM) combination must be tested.
- *Proposed Language Annex F.4.2:*
 - *The engine oil water tolerance test [EOWTT] ASTM D6794 is required only in the viscosity grade with the highest additive concentrations in combination (DI/VM). Results are then read across to all other base oils/viscosity grades using the same or lower concentration of the identical additive DI and using the same or lower concentration of the identical additive VM. Each different [DI/VM] combination must be tested.*

After the BOI/VGRA Task Force presentation the Lubricants Group discussed the proposed updated EOWTT text. As a result the following motion was made.

Move that Lubricants Group ballot the proposed update for EOWTT BOI/VGRA for inclusion in API 1509, Annex E and Annex F.

By a Show of Hands Vote the Lubricants Group agreed to issue a written ballot on update to the EOWTT BOI/VGRA.in API 1509.

Lubricants Group Members should use the API Ballot System to cast their vote and make comments. The Ballot Link is: <http://Ballots.api.org>. The Lubricants Group Member votes will be counted, and all received comments reviewed and considered to determine if the ballot is passed.

Non-Lubricants Group Members may comment using the API Ballot system. The Ballot Link is: <http://Ballots.api.org> .

This Ballot will close on August 19, 2022. All votes on the Ballot to Update EOWTT Read Across text in API 1509, Annex E and Annex F must be received by that date.

Attachment 1
Recommendation to Revise
the EOWTT BOI and VGRA Guidelines.

API BOI-VGRA TF Update

June 28,2022 API LG Meeting

Seattle, WA

Recommendation to Revise the EOWTT BOI and VGRA Guidelines.

ASTM D6794-20: Engine Oil Water Tolerance Test

- A standard test method for measuring the effect on filterability of engine oils after treatment with various amounts of water and a long (6h) heating time.
- Also known as EOWTT

Background

- An issue was raised within the BOI/VGRA Task force about the agreement of wording withing both the BOI and VGRA guidelines in Annex E and Annex F for the EOWTT.
- Annex F wording appears to all read across to other base oils
- Annex E wording indicates requirements for each base oil interchange.
- After some discussion it was clear different interpretations of the wording could be used and a call for data to be brought forward was made.
 - Current wording adopted more than 20 years ago and accompanying support needed to change.
- Supporting data was provided by 3 different Additive Companies for further review by the task force.
- Recommendation now made to LG to ballot new language for API 1509.

Data Reviewed

- Oronite, Lubrizol, and Afton each provided data that would support further relaxing of the language in both Annex E and Annex F.
- The data presented supports base oil interchange and viscosity grade read across directionally from the highest additive and highest VM treat rate to the same or lower additive and the same or lower VM treat rates.
- The following language is proposed by the API BOI/VGRA TF for adoption into API 1509.

Proposed Language for Annex E

- **Proposed update for API 1509 Annex E.4.2.4**
- *Current Language:*
- E.4.2.4.1 The Engine Oil Water Tolerance Test (EOWTT) ASTM D 6794 [formerly GM 9099P Filterability (Modified Method for ILSAC GF-2/GF-3)] for each base oil interchange is required only in the viscosity grade with the highest additive (DI/VM) combination.
- *Proposed Language:*
- The engine oil water tolerance test [EOWTT] ASTM D6794 is required only in the viscosity grade with the highest additive concentrations in combination (DI/VM). Results are then read across to all other base oils/viscosity grades using the same or lower concentration of the identical additive DI and using the same or lower concentration of the identical additive VM. Each different [DI/VM] combination must be tested.

Proposed Language for Annex F

- **Proposed Update for API 1509 Annex F.4.2**
- *Current Language:*
- The Engine Oil Water Tolerance Test [EOWTT (ASTM D6794)] must be run on the formulation with the highest additive (DI/VM) combination. Results are then read-across to all other base oil/viscosity grade formulations using the same or lower concentration of the identical additive (DI/VM) combination. Each different (DI/VM) combination must be tested.
- *Proposed Language:*
- The engine oil water tolerance test [EOWTT] ASTM D6794 is required only in the viscosity grade with the highest additive concentrations in combination (DI/VM). Results are then read across to all other base oils/viscosity grades using the same or lower concentration of the identical additive DI and using the same or lower concentration of the identical additive VM. Each different [DI/VM] combination must be tested.

Ballot for both Annex E and Annex F

- The following language shall replace the existing language in Annex E.4.2.4.1:
 - The engine oil water tolerance test [EOWTT] ASTM D6794 is required only in the viscosity grade with the highest additive concentrations in combination (DI/VM). Results are then read across to all other base oils/viscosity grades using the same or lower concentration of the identical additive DI and using the same or lower concentration of the identical additive VM. Each different [DI/VM] combination must be tested.
- The following language shall replace the existing language in Annex F.4.2
 - The engine oil water tolerance test [EOWTT] ASTM D6794 is required only in the viscosity grade with the highest additive concentrations in combination (DI/VM). Results are then read across to all other base oils/viscosity grades using the same or lower concentration of the identical additive DI and using the same or lower concentration of the identical additive VM. Each different [DI/VM] combination must be tested.

Attachment 2
Data Supporting Revised
EOWTT BOI and VGRA Guidelines.



Oronite

Engine Oil Water Tolerance Test Base Oil Interchange

**Laura Birnbaumer
Jo Martinez**

**API Base Oil Interchange/Viscosity Grade Read Across Task Force
August 3, 2021**

Data

- 64 EOWTT tests
- 1 technology
 - 1 DI/VM/PPD
 - 2 treat rates (Low, High)
- 3 Base Oil Types
 - 6 Group II base stock slates
 - 5 Group III base stock slates
 - 4 Group II/Group III mixes

Treat	Group	N
Low	II	25
	II/III	6
	III	9
High	II/III	22
	III	2

- 15 Base Oils

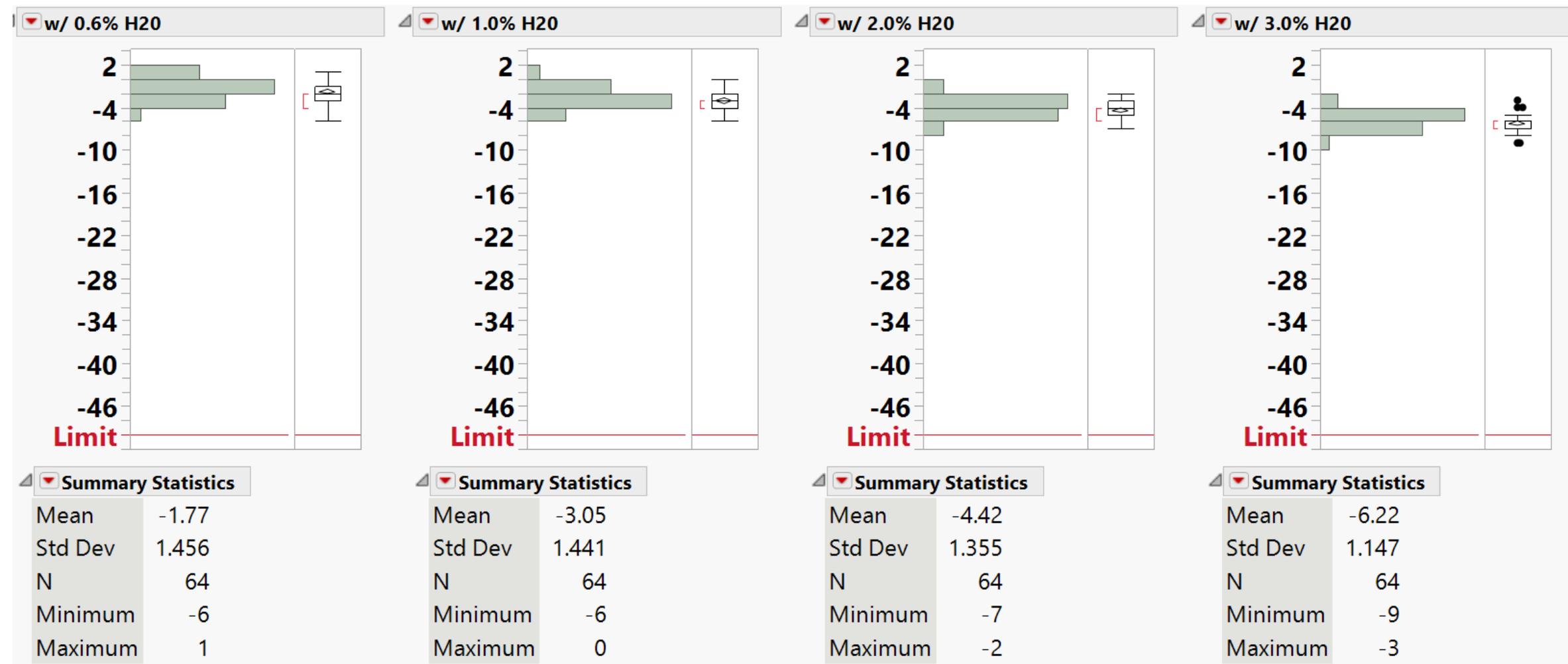
Treat	BS Slates	N
Low	IIA	10
	IIB	1
	IIB/IIIJ	1
	IIC	4
	IIC/IIIH	3
	IID	3
	IIE	6
	IIE/IIIH	2
	IIF	1
	IIID	2
	IIIG	2
	IIIJ	4
	IIIK	1
	High	IIA/IIIH
IIC/IIIH		8
IIE/IIIH		8
	IIIH	2

- 8 Viscosity Grades

Treat	Visgrade	N	
Low	0W20	4	
	0W40	2	
	5W20	6	
	5W30	7	
	5W40	3	
	10W30	5	
	10W40	6	
	20W50	7	
	High	0W20	3
		5W20	6
5W30		7	
10W30		5	
	20W50	3	

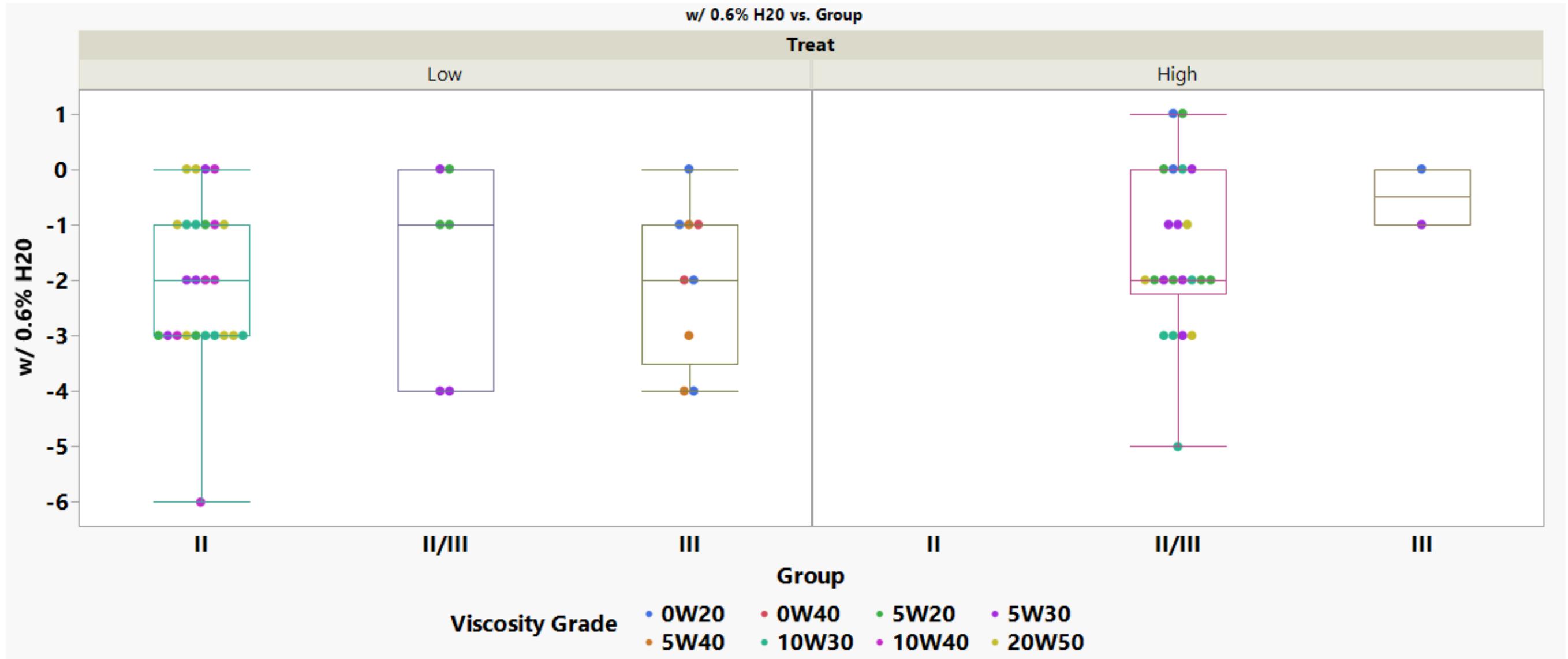
Change in Flow Rate (%) Distribution

- All 64 change in flow rate (%) data are strong passes against the minimum limit of -50%.
- The overall mean is at -4% and an overall range from -9% to 1%.



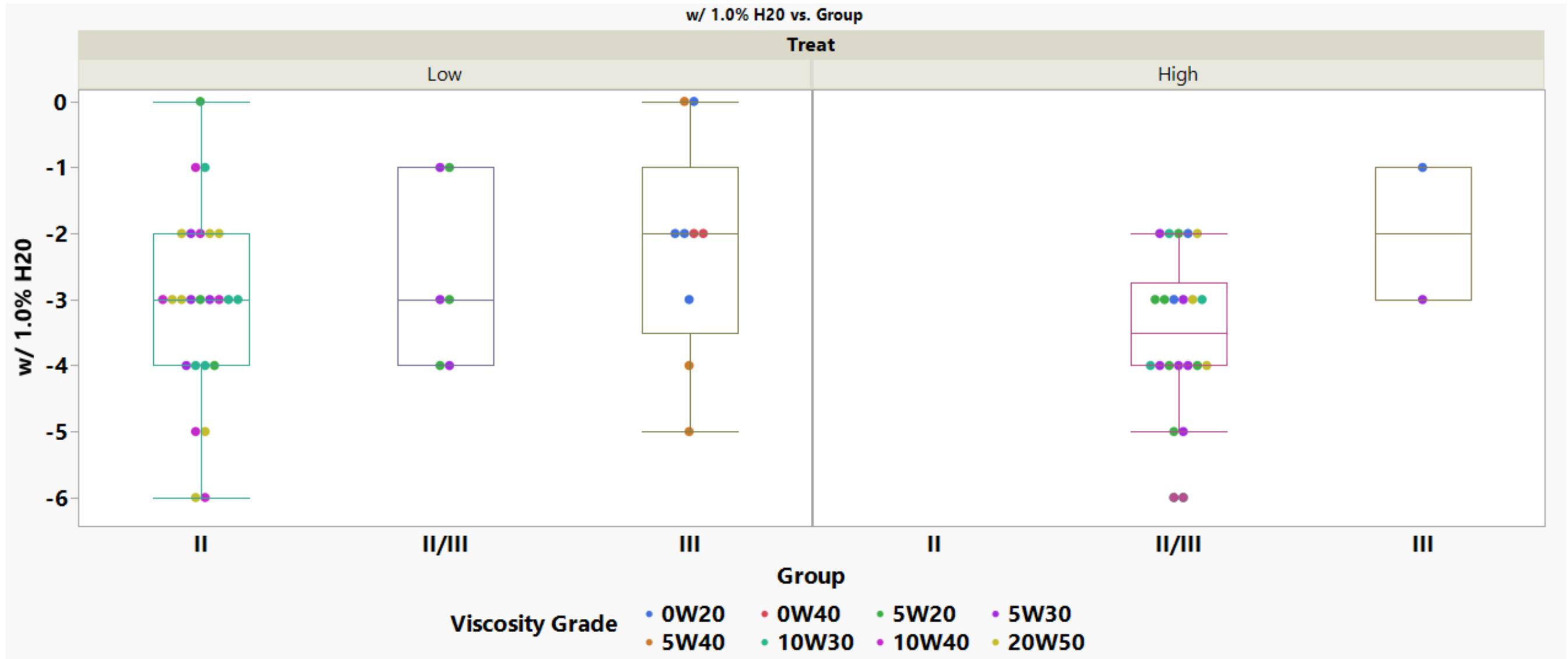
No significant Base Oil Group differences within Technology

%Change in Flow Rate with 0.6% H₂O



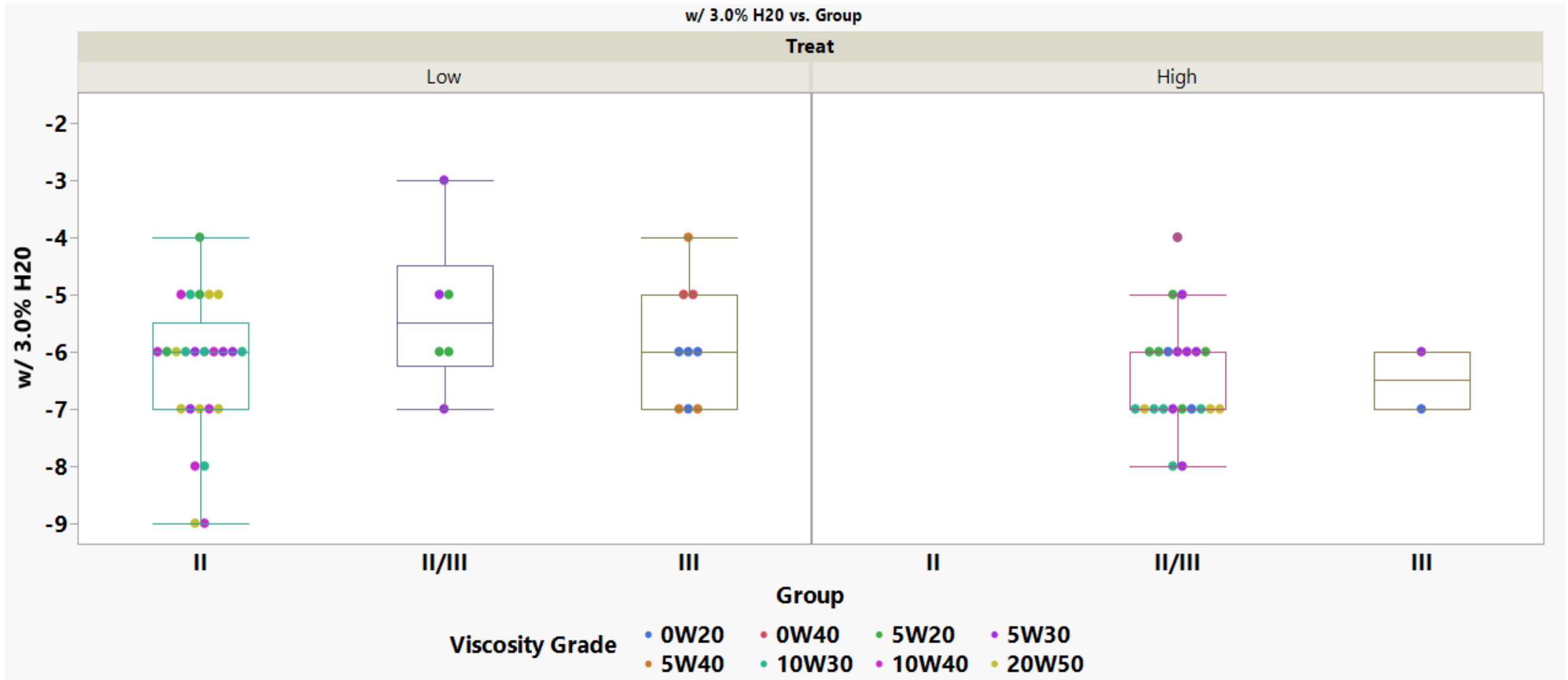
No significant Base Oil Group differences within Technology

%Change in Flow Rate with 1.0% H₂O



No significant Base Oil Group differences within Technology

%Change in Flow Rate with 3.0% H₂O



Making API 1509 Consistent with Regard to D6794 Base Oil Interchange

With the EOWTT BOI data that has been brought forward, Oronite moves to change E.4.2.4 to the following:

E.4.2.4 Engine Oil Water Tolerance Test (EOWTT) ASTM D6794

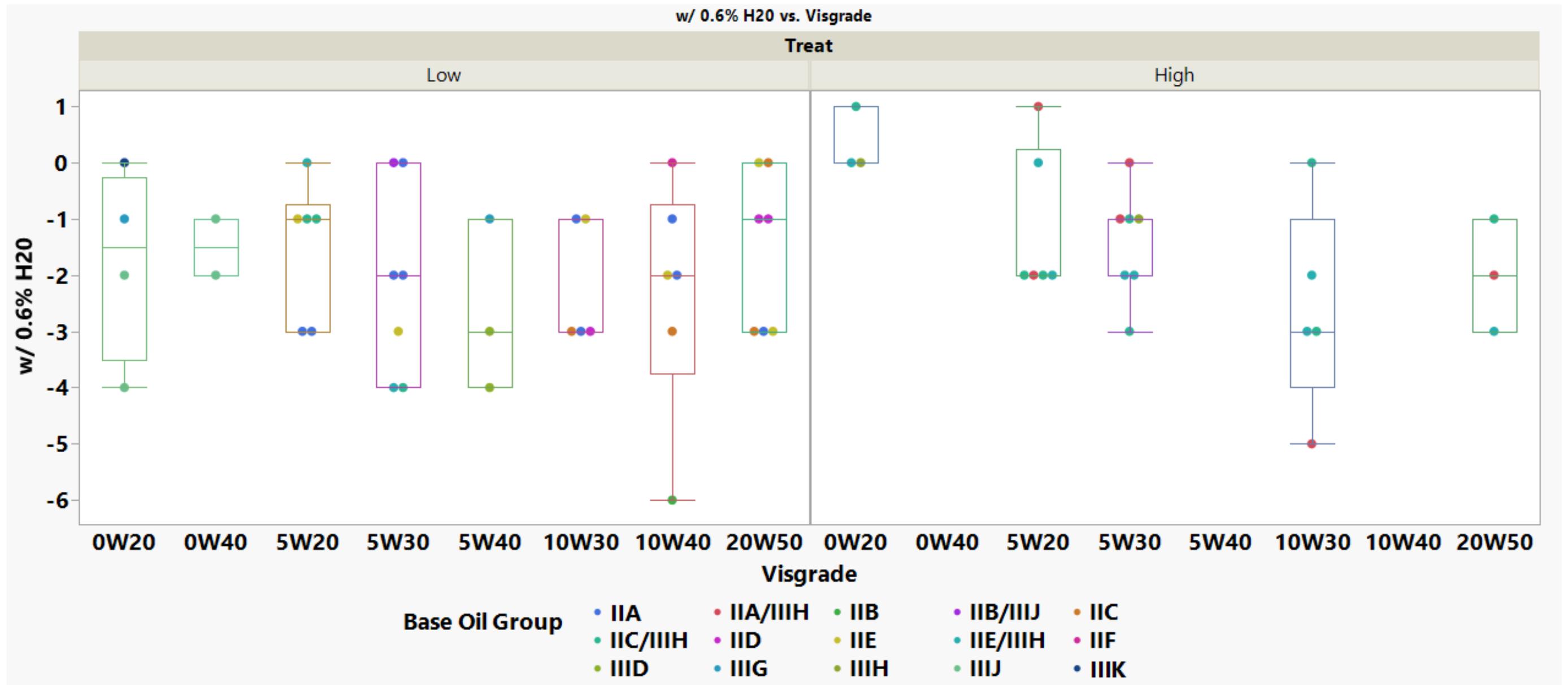
E.4.2.4.1 The Engine Oil Water Tolerance Test (EOWTT) ASTM D 6794 [~~formerly GM 9099P Filterability (Modified Method for ILSAC GF-2/GF-3)] for each base oil interchange~~ is required only in the viscosity grade with the highest additive (DI/VM) combination. Results are then read-across to all other base oil/viscosity grade formulations using the same or lower concentration of the identical additive (DI/VM) combination. Each different (DI/VM) combination must be tested.

F.4.2 EOWTT (ASTM D6794)

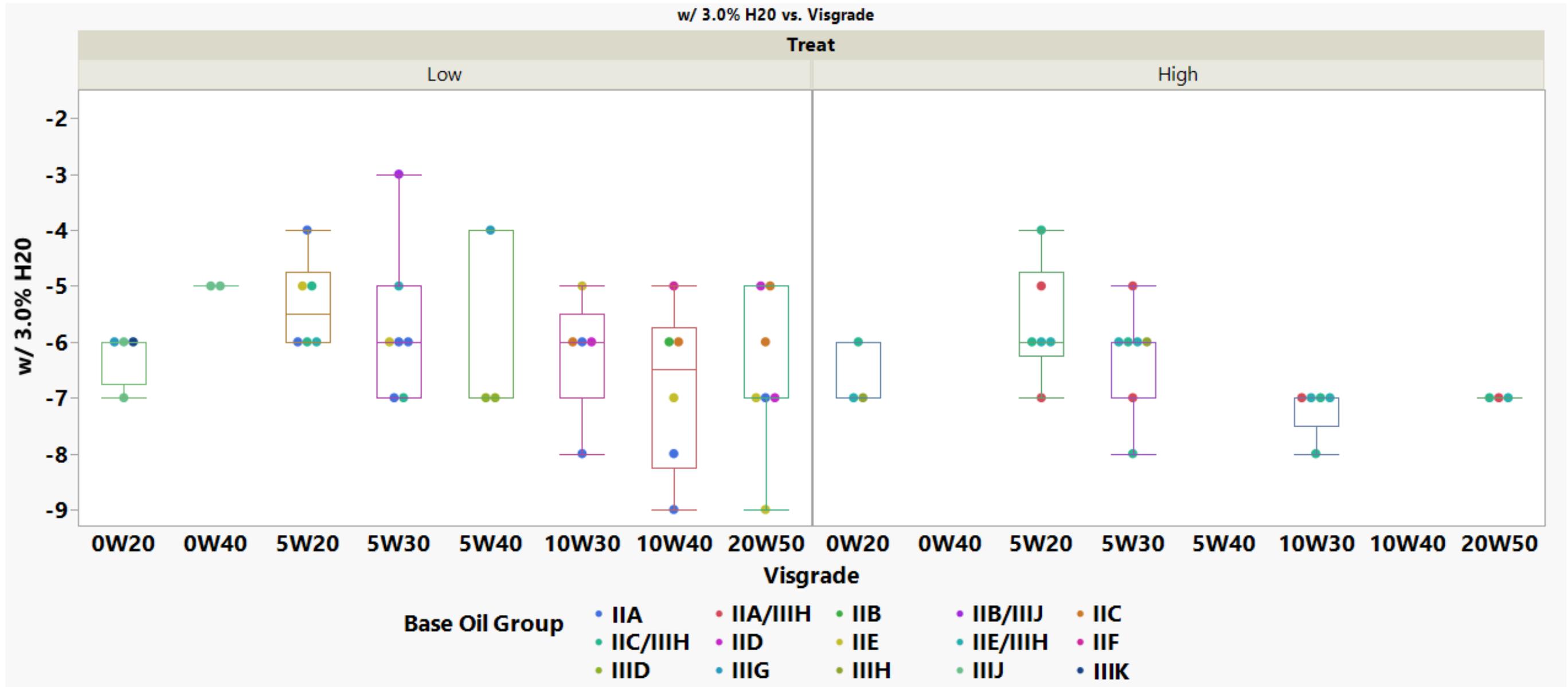
The Engine Oil Water Tolerance Test [EOWTT (ASTM D6794)] must be run on the formulation with the highest additive (DI/VM) combination. Results are then read-across to all other base oil/viscosity grade formulations using the same or lower concentration of the identical additive (DI/VM) combination. Each different (DI/VM) combination must be tested.

Appendix

% Change in Flow Rate by Viscosity Grade with 0.6% H2O



% Change in Flow Rate by Viscosity Grade with 3.0% H2O





**ASTM D 6794
EOWTT
Summary to
BOI/VGRA**

August 2021

MOVE CLEANER
CREATE SMARTER
LIVE BETTER

EOWTT Base Oil Interchange Support

Lubrizol has run several thousand complete, valid, and non-reference Engine Oil Water Tolerance Tests (ASTM D 6794 EOWTT)

Passing rate (all four water level results) for those thousands of complete, valid, and non-reference tests is extremely high: > 95%

Most of these tests would have been on final formulations, but some were experimental formulations

Data includes multiple (DI/VM) technologies in 5W-30, 10W-30, 10W-40 and 15W-40 Viscosity Grades

EOWTT Base Oil Interchange Support

Lubrizol provided data API to support the addition of BOI rules for EOWTT

Multiple data pairs support these reads:

Group I & Group I

Group II & Group II

Group III & Group III

Group II & Group III

Other data pairs support these reads:

Group I & Group II

Group I & Group III

Group II & Group IV

Group III & Group IV

EOWTT Base Oil Interchange Support

Current Annex E (BOI) & Annex F (VGRA) rules for EOWTT as written in API 1509

BOI E.4.2.4 Engine Oil Water Tolerance Test (EOWTT) ASTM D 6794

E.4.2.4.1 The Engine Oil Water Tolerance Test (EOWTT) ASTM D 6794 [formerly GM 9099P Filterability (Modified Method for ILSAC GF-2/GF-3)] for each base oil interchange is required only in the viscosity grade with the highest additive (DI/VM) combination.

VGRA F.4.2 EOWTT (ASTM D6794)

The Engine Oil Water Tolerance Test [EOWTT (ASTM D6794)] must be run on the formulation with the highest additive (DI/VM) combination. Results are then read-across to all other base oil/viscosity grade formulations using the same or lower concentration of the identical additive (DI/VM) combination. Each different (DI/VM) combination must be tested.

Lubrizol supports revising the BOI & VGRA statements into one unified statement where one passing EOWTT result would support a specific additive (DI/VM) combination for all Base Stocks and Viscosity Grades with the same identical additive combination (DI/VM) at the same or lower total treat rate.



MOVE CLEANER



CREATE SMARTER



LIVE BETTER





EOWTT, ASTM D 6794
Data in Support of BOI

Beth Schwab
Todd Dvorak
August 9, 2021

Passion for Solutions®

Data in Support of BOI for EOWTT

EOWTT is a technology test

- ▲ Data indicates it is not sensitive to base oils

Review of Afton database from 9/2014 through 7/2021

- ▲ 1884 candidate results
- ▲ 1881 passes, 3 fails
- ▲ 3 fails are outliers
 - 3 different technologies that have multiple base oil and vis grade passes
 - Repeats pass

Technology 1 -Data in Support of BOI for EOWTT

Technology 1 (API SN Plus)								
% wt.	Base Oil A Grp III			Base Oil B Grp II			Base Oil C Grp II	
	0W-20	5W-30	5W-30	5W-30	10W-40	15W-50	5W-30	10W-40
Light Neutral, LN	64.5	39.6	64.4	63.8	12.4	12.4	80.7	12.5
Medium Neutral, MN	35.5	60.4	0.0	36.2	87.6	87.6	19.3	87.5
Heavy Neutral, HN	0.0	0.0	35.6	0.0	0.0	0.0	0.0	0.0
VM1	0.7X	X	X	X	1.3X	1.3X	X	1.3X
Base Oil Blend Properties								
BOV 100C, cSt	4.899	5.234	5.189	4.990	6.100	6.100	4.880	6.133
BO VI	137	139	139	115	113	113	115	109
BO Saturates D2007, %	96.8	97.2	97.3	98.4	98.3	98.3	97.4	97.0
BO Sulfur, % m	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.001
D6794 EOWTT, % Flow Reduction								
with 0.6% H ₂ O	6.63	18.58	-10.58	9.38	0.00	10.37	2.28	-2.50
with 1.0% H ₂ O	11.03	14.56	-5.84	4.41	3.74	0.36	3.82	5.15
with 2.0% H ₂ O	3.39	15.30	8.71	-2.05	1.17	14.54	0.00	-1.19
with 3.0% H ₂ O	2.51	14.99	10.12	-0.81	-6.29	12.20	-0.02	-1.14
Technology 1 (API SN Plus)								
% wt.	Base Oil D Grp II		Base Oil E Grp III		Base Oil F Grp II		Base Oil G Grp III	Base Oil H Grp III
	5W-30	10W-40	5W-30	5W-30	5W-30	10W-40	5W-30	5W-30
Light Neutral, LN	60.2	11.1	63.6	75.9	100.0	25.0	63.9	63.5
Medium Neutral, MN	39.8	88.9	36.4	0.0	0.0	75.0	36.1	36.5
Heavy Neutral, HN	0.0	0.0	0.0	24.1	0.0	0.0	0.0	0.0
VM1	X	1.4X	X	0.9X	X	0.9X	X	X
Base Oil Blend Properties								
BOV 100C, cSt	5.023	5.907	4.974	5.177	4.771	6.308	5.099	4.879
BO VI	113	106	130	132	113	117	133	130
BO Saturates D2007, %	98.0	98.4	98.4	96.4	95.7	94.5	98.8	98.8
BO Sulfur, % m	0.001	0.000	0.000	0.000	0.001	0.002	0.000	0.000
D6794 EOWTT, % Flow Reduction								
with 0.6% H ₂ O	1.43	4.60	2.67	11.79	3.75	2.64	2.58	2.49
with 1.0% H ₂ O	0.74	-0.18	4.82	9.26	3.72	2.38	-0.02	1.96
with 2.0% H ₂ O	0.74	0.00	1.85	15.92	1.52	-0.03	-2.5	-0.65
with 3.0% H ₂ O	-2.2	-1.22	-1.41	-4.33	-2.05	-0.07	-2.53	-1.82

Technology 2 -Data in Support of BOI for EOWTT

Technology 2 (API SL)				
	Base Oil I Grp I	Base Oil J Grp I		Base Oil K Grp I
% wt.	15W-40	20W-40	20W-50	15W-40
Light Neutral, LN	6.0	11.2	16.4	16.3
Medium Neutral, MN	94.0	0.0	0.0	83.7
Heavy Neutral, HN	0.0	88.8	83.6	0.0
VM2	X	X	1.5X	X
Base Oil Blend Properties				
BOV 100C, cSt	6.402	9.484	10.02	6.609
BO VI	100	97	99	98
BO Saturates D2007, %	72.0	64.0	69.5	85.0
BO Sulfur, % m	0.542	0.766	0.675	0.093
D6794 EOWTT, % Flow Reduction				
with 0.6% H ₂ O	-6.80	-6.57	-2.38	-6.26
with 1.0% H ₂ O	-11.47	-6.26	-15.00	-4.50
with 2.0% H ₂ O	-13.77	-11.00	-28.05	-8.23
with 3.0% H ₂ O	-10.40	-12.90	-15.84	-7.55

Technology 3 -Data in Support of BOI for EOWTT

Technology 3 (API SP)								
	Base Oil A Grp III	Base Oil L Grp II	Base Oil N Grp II, G Grp III		Base Oil D Grp II	Base Oil O Grp II	Base Oil F/O mix Grp II	
% wt.	0W-30	10W-40	5W-30	10W-40	10W-40	10W-40	10W-30	20W-50
Light Neutral, LN	87.5	55.2	58.4 (N/G mix)	15.1 (N)	8.1	7.5	17.1 (F)	0.0
Medium Neutral, MN	12.5	0.0	41.6 (N)	84.9 (N)	91.9	92.5	82.9 (O)	35.9 (F)
Heavy Neutral, HN	0.0	44.8	0.0	0.0	0.0	0.0	0.0	64.1 (O)
VM3	X	X	X	1.3X	X	X	X	1.6X
Base Oil Blend Properties								
BOV 100C, cSt	4.522	6.740	5.003	6.051	6.147	6.410	6.101	9.912
BO VI	132	116	112	105	110	107	109	104
BO Saturates D2007, %	95.9	91.5	95.8	95.2	94.7	94.6	95.4	93.2
BO Sulfur, % m	132	116	112	105	110	107	109	104
D6794 EOWTT, % Flow Reduction								
with 0.6% H ₂ O	22.67	21.46	10.96	26.92	12.70	21.19	19.71	19.46
with 1.0% H ₂ O	26.42	19.87	16.47	17.16	20.00	21.82	12.82	16.51
with 2.0% H ₂ O	18.0	18.01	15.12	17.50	18.47	24.34	15.89	25.55
with 3.0% H ₂ O	12.2	14.42	8.11	10.87	1.70	9.20	11.67	13.26

Summary

- ▲ Afton has presented EOWTT data from three technologies across multiple base oils
- ▲ Afton data indicates that the test is not sensitive to base oil
- ▲ Afton recommends adopting BOI for the EOWTT

▲ Suggested wording for Annex E.4.2.4.1

- ▲ If there is one passing Engine Oil Water Tolerance Test (EOWTT) ASTM D 6794 [formerly GM 9099P Filterability (Modified Method for ILSAC GF-2/GF-3)] in the viscosity grade with the highest additive (DI/VM) combination, read across is allowed to all other viscosity grades and base oil slates.