MEETING MINUTES: ROBO SURVEILLANCE PANEL

Meeting: ROBO SP Meeting

Date: June 14, 2018

Location: Skype meeting

Minutes by: Justin Mills

Actions:

1. Bruce Zweitzig to provide contact at Airgas for dilute NO2 – Done
    a. Evonik is using Airgas for their dilute NO2. The contact is Harry Spring (cell: 215-498-5598, email: harry.spring@airgas.com)
2. Justin Mills to review old notes and workshop minutes to determine if SP previously developed metrics to exclude ROBO units from statistics that fail consecutive calibration attempts.
3. Justin Mills to consult with Todd Dvorack (or alternative ASTM statistician) to assess validity of our TMC 434-2 statistics
4. Justin Mills to schedule next SP meeting – Tentatively July 19th, but dependent on having Stats Group review our TMC 434-2 limits.

Membership and Attendance:

Ace Glass	Dave Lawrence
Afton	*Shelia Thompson, Jeff Yang
ASTM TMC	*Tom Schofield
BASF	Mary Dery, Bridgett Rakestraw
Chevron Oronite	Man Hon Tsang, *Robert Stockwell
ExxonMobil	Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	Joe Franklin, *Matt Schlaff
Kuwait Petroleum	Leen Poot
Lubrizol	Mike Faile, Aimee Shinhearl, Rick Hartman
PetroChina	Li Shaohui , Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	*Justin Mills, *Bruce Zweitzig, *Joan Souchik, *John Maxwell, *Elizabeth Wagoner
Vanderbilt Chemicals	*Al Filho, Ron Hiza
SwRI	Becky Grinfield, Joe De La Cruz, *Mike Birke, *Young-Li McFarland
Valvoline	*Amol Savant, Kevin Figgatt, *Steve Lazzara
Koehler Instruments	Raj Shah, Vincent Colantuini
Tannas/Savant	Greg Miiller, Ted Selby

*** Denotes attendance**

MEETING MINUTES: ROBO SURVEILLANCE PANEL

Summary:

- Meeting convened at 10:03EST on June 14, 2018
- Agenda accepted by SP without any modifications
- ASTM Antitrust and Recording Policy reviewed
- Membership review and update – no additional changes were made to membership
- Meeting minutes from March SP meeting were accepted – Motion to accept minutes was made by Justin Mills and seconded by Mike Birke and there was no further discussion or objections.
- API Provisional licensing for ROBO statement was reviewed – no additional discussion or questions
- Update on nitrogen dioxide supply
    - NO2 remains discontinued at Sigma-Aldrich
    - Electronic Fluorocarbons and SpecGas are known suppliers for >99.5% purity NO2. No one on SP has identified additional suppliers.
    - Aside from longer lead times, there are no known supply issues with dilute NO2 (1.13% NO2 in air). Longer lead time may be related to this being a custom gas mix or special order bottle sizes.
        - Evonik is using Airgas for their dilute NO2. The contact is Harry Spring (cell: 215-498-5598, email: harry.spring@airgas.com)
- Setting Permanent Limits for TMC 434-2
    - Proposed limits for TMC 434-2 were reviewed but no clear consensus was reached. There were some concerns over the methodology used to calculate the limits. The Tukey Box Plot methodology (Remove data points <Q1 - 1.5*IQR or >Q3 + 1.5*IQR) seemed to detect and remove suspect datapoints, but was a deviation from how we may have calculated limits in the past. For that reason it was suggested that we run the proposals by an ASTM statistician.
    - It was agreed by SP to hold off voting until we received input on our proposed 434-2 limits from a statistician.
- Statistics
    - ROBO test continues to run mild. For 10/1/17 through 3/31/18 period the bias (mean Δ/s) reached -0.91, but seems to be improving in current period – currently at -0.47.
- Summary of meeting with ASTM Stats Group - On June 7, 2018 Jo Martinez hosted a Webex to discuss a path forward for addressing the persistent mild trend that exists in the ROBO test. Participants included Justin Mills (ROBO SP chair), Tom Scholfield (ASTM TMC), and ASTM's statistics group.
    - Stats Group suggested that addressing this "bad" units is out of the scope of the stats group. Instead this is better handled administratively. The surveillance panel can develop criteria to exclude this units from LTMS statistics.
    - Statistical Analysis will be difficult for ROBO since it is more complex that other bench tests.
    - All labs should harmonize their naming nomenclature or at the very least be consistent within their own flatfiles.
    - MRV results (significant figures) should be in agreement with ASTM D 4684.
    - Unresolved issue regarding MRV yield stress. Currently TMC's calibration requirements only evaluates MRV viscosity and do not consider yield stress as a pass/fail criteria.
    - No clear timeline. There is not an urgent need to address the mild trend in ROBO. The test is operational and "bad" units are being excluded from running candidate samples by TMC's calibration requirements.
- Additional topics – none were discussed
- Next meeting tentatively July 19th from 10:00AM EST to 11:30AM EST.
- Meeting adjourned

ROBO Surveillance Panel Meeting

June 14, 2018

Justin Mills | June 2018

Agenda

- Welcome, ASTM statement
- Review membership of SP
- Review and approve minutes from previous meetings
- Provisional licensing for API SN Plus for ROBO test
- Update on NO2 concentrate supply – any issues from the SP?
- TMC 434-2 limits – setting permanent limits
- Bias review – the charter for the stats group was approved at the last meeting, so what is next?
- Next meeting

ASTM Antitrust and Recording Policy

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Electronic recording of ASTM meetings is prohibited.

Membership – Updated 6/13/18

Ace Glass	Dave Lawrence
Afton	Shelia Thompson, Jeff Yang
ASTM TMC	Tom Schofield
BASF	Mary Dery, Bridgett Rakestraw
Chevron Oronite	Man Hon Tsang, Robert Stockwell
ExxonMobil	Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	Joe Franklin, Matt Schlaff
Kuwait Petroleum	Leen Poot
Lubrizol	Mike Faile, Aimee Shinhearl, Rick Hartman
PetroChina	Li Shaohui , Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	Justin Mills, Bruce Zweitzig, Joan Souchik, John Maxwell, Elizabeth Wagoner
Vanderbilt Chemicals	Al Filho, Ron Hiza
SwRI	Becky Grinfield, Joe De La Cruz, Mike Birke, Young-Li McFarland
Valvoline	Amol Savant, Kevin Figgatt, Steve Lazzara
Koehler Instruments	Raj Shah, Vincent Colantuini
Tannas/Savant	Greg Miiller, Ted Selby

Summary of changes:

Ace Glass – Membership transferred from John Ross to Dave Lawrence

Chevron Oronite – Membership transferred from Kaustav Sinha to Man Hon Tsang

Evonik – John Maxwell added as member, Alan Flamberg has retired - Elizabeth Wagoner added as his replacement.

Vanderbilt Chemicals – Simon Tung removed. Name changed from RT Vanderbilt to Vanderbilt Chemicals.

Motion to Accept March 2017 minutes

ROBO SP Meeting Minutes

March 7, 2018

Actions:

- Justin Mills to revisit minutes from last ROBO Workshop and determine if thermocouple positioning was addressed or if there was any consensus
- Justin Mills to update membership list - **complete**
- Justin Mills and Alan Flamberg to recalculate statistical limits for TMC 434-2 and distribute to SP for review
- Justin Mills to schedule next SP meeting for Thursday, April 26 - **complete**
- Justin Mills to send approved charter for Statistical Task Group to Tom Schofield - **complete**
- Tom Schofield to determine path forward for seeking Stats Group support from ASTM - **complete**

Membership and Attendees:

Ace Glass	*Dave Lawrence
Afton	*Shelia Thompson, Jeff Yang
ASTM TMC	*Tom Schofield
BASF	Mary Dery, Bridgett Rakestraw
Chevron Oronite	Man Hon Tsang, Robert Stockwell
ExxonMobil	*Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	*Joe Franklin, *Matt Schlaff
Kuwait Petroleum	Leen Poot
Lubrizol	*Mike Faile, *Aimee Shinhearl, Rick Hartman
PetroChina	Li Shaohui , Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	*Alan Flamberg, *Justin Mills, *Bruce Zweitzig, Joan Souchik, *John Maxwell, *Andre Dawson
RT Vanderbilt	Al Filho, Ron Hiza, Simon Tung
SwRI	Becky Grinfield, Joe De La Cruz, *Mike Birke, Young-Li McFarland
Valvoline	*Amol Savant, Kevin Figgatt, Steve Lazzara
Koehler Instruments	Raj Shah, Vincent Colantuini
Tannas/Savant	*Greg Miiller, Ted Selby

*** Denotes attendance**

Summary:

- Meeting began at 10:05EST on March 7, 2018
- Agenda accepted by panel
- ASTM Antitrust and Recording Policy reviewed
- Membership review and update
  - ACE Glass removed John Ross and added Dave Lawrence
  - Evonik Oil Additives added John Maxwell
  - Chevron Oronite removed Kaustav Sinha and added Man Hon Tsang
- ASTM D7528-017a approved. Changes included:
  - Introduction section revised.
    - ASTM TMC monitoring is necessary/mandatory for ASTM D7528: ROBO. The SP believes it is critical to calibrate ROBO stands using TMC reference oils
  - Subsection 5.4 added, clarifying test validity requirements.
  - Subsection 6.6, corrected length of steel rod from 30 mm to 300 mm.
  - Subsection 7.7 revised, deleting specific numbered reference oils.
  - Section 9, Test Stand Calibration, completely revised; the existing section replaced with new wording.
  - New Annex A1 – Annex A4 added, explaining role of the Test Monitoring Center.
- Update on NO2 concentrate supply – any issues from the SP?
  - Sigma-Aldrich has once again discontinued NO2
  - Known alternative suppliers include Electronic Fluorocarbons and SpecGas
    - According to Bruce Zweitzig, shipping from Electronic Fluorocrabons is ~$2,500 per order
  - Current supply/stock of NO2
    - Evonik estimates they have 1-2year supply
    - Lubrizol estimates they have a 1 year supply
    - SWRI estimates they have a 1 year supply
- Test Oil Status
  - 434-2 implemented in 2017. It has 24.3 gallons allocated to ROBO – 6+ year supply
  - 435-1 has 435 gallons allocated to ROBO – 36 year supply
  - 438 has 5 gallons allocated to ROBO – 1.25 year supply, but additional 25 gallons may be available from IIIG allocation. There is also the option to use a reblend.
    - Tom Schofield is able to get 5 gallon allotments of 438 for ROBO from Sequence IIIG's allocation.
    - Based on Evonik's observations, TMC 438-1 is comparable to TMC 438.
- TMC 434-2 limits – setting permanent limits
  - Temporary limits set in July 2017 were reviewed. The temporary limits used the current average of TMC 434-2 and added a bias correction (see slide #8 for further detail)
  - Several proposals for setting final limits were reviewed
    - There was some debate over whether or not we should continue to add a bias correction or just use the data as-is
    - No clear resolution was reached
    - Agreed to keep as an agenda item for next SP meeting
- ROBO data dictionary
  - A motion was made to expand the ROBO data dictionary field CCSVEOT (CCS result on oxidized oil) to 10 characters
    - Motion made by Matt Schlaff – seconded by Alan Flamberg – no additional discussion
- Update on NO2 in air alternative and path forward
  - Dilute NO2 workgroup met in September 2017
  - Evonik has completed 4 runs with dilute NO2 – no change in severity with dilute NO2 was observed
    - Work at Evonik temporarily placed on hold due to demand from API SN Plus
  - More work is needed to develop dilute NO2 method, but timeline is unclear due to high ROBO utilization related to API SN Plus
  - For development work, labs can use decoded TMC oils. Tom Schofield asks that labs use TMC 435-1 because TMC has a large volume of this test oil.
- Capacity Concerns – Is there enough ROBO capacity for API SN Plus?
  - Labs are experiencing a backlog of samples (likely due to API SN Plus).
  - To address capacity concerns, some labs are adding additional ROBO capacity.
- Bias review – what we need to do next
  - Within the ROBO SP, there was an outstanding action to develop a project charter so that we may get support from ASTM stats group
  - The following Statistical Group Charter was accepted by the SP (motion to accept the charter was made by Matt Schlaff – seconded by Mike Faile – no further discussion)
    - Scope:
      - Use TMC ROBO reference results to investigate alternative or additional statistical applications for TMC test monitoring of the ROBO test given the overall and persistent mild industry performance of the test, and prior periods of high imprecision compared to target performance.
    - Objectives:
      - Analyze whether a log transform of the MRV results still applicable.
      - Analyze test results overall, by lab and by instrument and by oil to determine the most critical level of bias, and how that bias changes over time.
      - Propose a statistically justified correction of the bias where operational corrections cannot be achieved, with a focus on either an industry-wide correction factor, or severity adjustments at the lab or rig levels, as is most appropriate.
      - Evaluate whether exclusion of exceptionally biased and/or imprecise labs or rigs is justified, and propose a statistical mechanism for doing so.
- Next meeting
  - Next meeting will be April 26, 2018

Provisional licensing for API SN Plus for ROBO test

Kevin Ferrick
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March 29, 2018

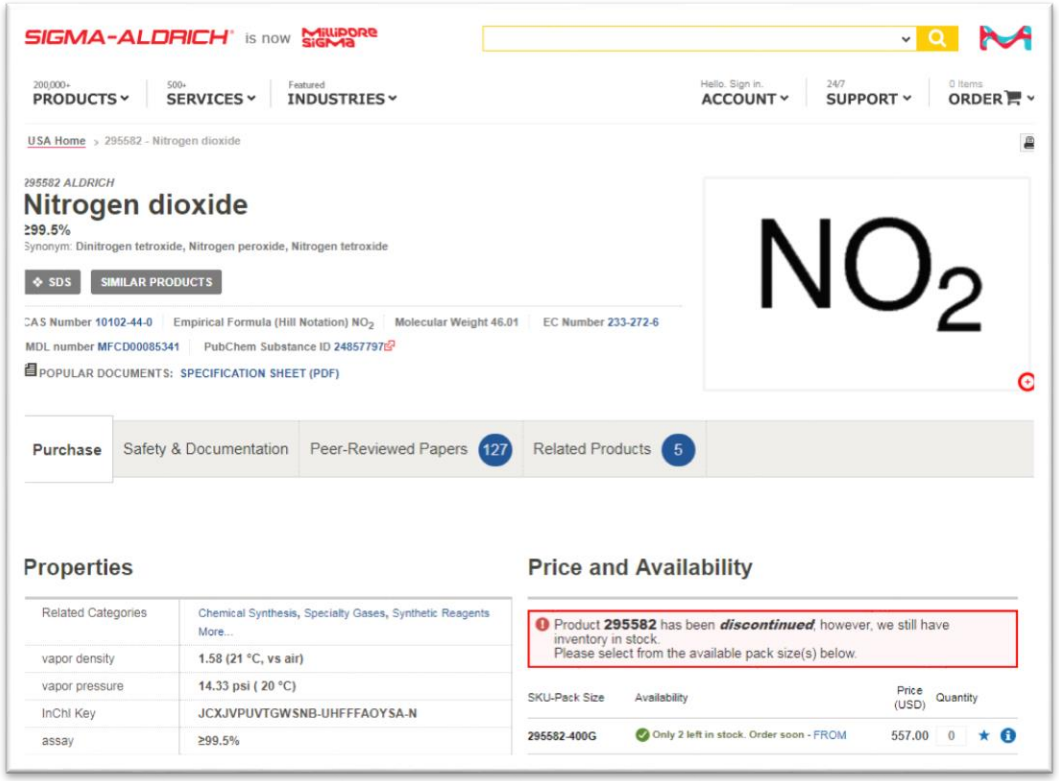
TO: API Engine Oil Licensing and Certification System (EOLCS) Licensees
API Lubricants Group
Other Interested Parties

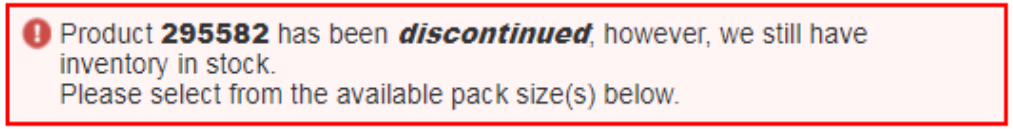
SUBJECT: Provisional Licensing for ILSAC GF-5, API SN with Resource Conserving, API SN with Resource Conserving and SN PLUS, API SN with SN PLUS, and API SN

The ASTM ROBO Surveillance Panel Chair has informed API that high demand for the ASTM D7528 ("ROBO") test has resulted in a backlog at Intertek Automotive Research and Southwest Research Institute. The ROBO measures an oil's ability to maintain low temperature viscosity after aging. In response to this notification, API's Engine Oil Licensing and Certification System (EOLCS) has invoked Provisional Licensing in accordance with paragraph 6.7 of API 1509. Provisional Licensing applies to oil marketers that need to run the ROBO test to qualify a formulation as ILSAC GF-5, API SN with Resource Conserving, API SN with Resource Conserving and SN PLUS, API SN with SN PLUS, and API SN. The requirements and application instructions for Provisional Licensing are provided below:

Update on NO2 concentrate supply – any issues from the SP?

- NO_2 remains discontinued at Sigma-Aldrich
- Known alternative suppliers include:
  - Electronic Fluorcarbons
  - SpecGas
  - Have any other suppliers been identified?
- There are no known supply issues for dilute NO_2





TMC 434-2: Setting Permanent Limits

All charted data through May 30th

- Eliminate outliers via:
  - Apply Robust Mean Methodology (Remove data points >3σ)
  - Or Tukey Box Plot (Remove data points <Q1 - 1.5*IQR or >Q3 + 1.5*IQR)
- Eliminate Unit G6 from dataset due to multiple failed calibration attempts based on current TMC limits.

All Data Included			No bias correction (data as-is)					Adjusted for bias via correction factor to mean				
	TMC 434-2	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max
	No data excluded	44	10.7351	45,940	0.2449	28,427	74,974	10.8924	53,766	0.2449	33,270	87,746
	Robust Mean (one outlier excluded)	43	10.7537	46,803	0.2143	30,752	71,847	10.911	54,776	0.2143	35,990	84,086
	Tukey Box Plot (three outliers excluded)	41	10.756	46,911	0.1559	34,558	64,074	10.9133	54,902	0.1559	40,445	74,989

All charted data through May 30th except G6

- Eliminate Unit G6 from dataset due to multiple failed calibration attempts based on current TMC limits.
- Eliminate outliers via:
  - Apply Robust Mean Methodology (Remove data points >3σ)
  - Or Tukey Box Plot (Remove data points <Q1 - 1.5*IQR or >Q3 + 1.5*IQR)

			No bias correction (data as-is)					Adjusted for bias via correction factor to mean				
Without G6	**TMC 434-2**	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max
	No data excluded	39	10.7465	46,467	0.2551	28,184	77,397	10.9038	54,383	0.2551	32,985	90,581
	Robust Mean (one outlier excluded)	38	10.7678	47,467	0.2207	30,798	73,806	10.925	55,548	0.2207	36,041	86,370
	Tukey Box Plot (three outliers excluded)	36	10.7712	47,629	0.1551	35,144	64,952	10.9284	55,737	0.1551	41,126	76,008

By SP Consensus, which is the appropriate set of limits

			No bias correction (data as-is)					Adjusted for bias via correction factor to mean (-0.1573)				
	TMC 434-2	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max
All Data	Robust Mean (one outlier excluded)	43	10.7537	46,803	0.2143	30,752	71,847	10.911	54,776	0.2143	35,990	84,086
	Tukey Box Plot (three outliers excluded)	41	10.756	46,911	0.1559	34,558	64,074	10.9133	54,902	0.1559	40,445	74,989
Without G6	Robust Mean (one outlier excluded)	38	10.7678	47,467	0.2207	30,798	73,806	10.925	55,548	0.2207	36,041	86,370
	Tukey Box Plot (three outliers excluded)	36	10.7712	47,629	0.1551	35,144	64,952	10.9284	55,737	0.1551	41,126	76,008

- Current limits for TMC 434-2 are 10.6133 – 11.2687 (40,672 – 78,331mPa*s)
  - The current limits also include a bias correction factor.

Statistics

ROBO Industry Statistics Based Upon LTMS Data Sets through May 30th

Parameter	Period	N-size	Average Yi	Degrees of Freedom	Pooled s
MRV	2008OCT	10	-0.3595	7	0.2769
MRV	2009APR	12	-0.5696	9	0.2229
MRV	2009OCT	25	-0.6238	22	0.1855
MRV	2010APR	61	-0.2386	58	0.3941
MRV	2010OCT	115	-0.2630	111	0.5113
MRV	2011APR	120	0.2044	117	0.6888
MRV	2011OCT	97	-0.6775	83	0.2587
MRV	2012APR	93	-0.3892	80	0.2068
MRV	2012OCT	86	-0.2933	83	0.2975
MRV	2013APR	109	-0.5789	106	0.2684
MRV	2013OCT	90	-0.9423	87	0.2368
MRV	2014APR	85	-0.4308	82	0.2715
MRV	2014OCT	83	-0.7778	80	0.2535
MRV	2015APR	96	-0.7245	93	0.3004
MRV	2015OCT	85	-0.8995	82	0.2363
MRV	2016APR	92	-0.0995	89	0.4115
MRV	2016OCT	74	-0.5317	71	0.3152
MRV	2017APR	78	-0.9096	75	0.2771
MRV	2017OCT	99	-0.7643	95	0.2220
MRV	2018APR	90	-0.9060	86	0.2376
MRV	2018OCT	48	-0.4749	44	0.2444

- ROBO test is actively ran at 7 labs (2 independent and 5 dependent)
- ROBO test has very good precision, but appears to be biased mild
- ROBO workshops have been effective to improve bias, but effects are short term (6-12 months)

ASTM D02.B0.07 D7528-17a (ROBO) Statistical Task Group

Scope:

- Use TMC ROBO reference results to investigate alternative or additional statistical applications for TMC test monitoring of the ROBO test given the overall and persistent mild industry performance of the test, and prior periods of high imprecision compared to target performance.

Objectives:

- Analyze whether a log transform of the MRV results is still applicable.
- Analyze test results overall, by lab and by instrument and by oil to determine the most critical level of bias, and how that bias changes over time.
- Propose a statistically justified correction of the bias where operational corrections cannot be achieved, with a focus on either an industry-wide correction factor, or severity adjustments at the lab or rig levels, as is most appropriate.
- Evaluate whether exclusion of exceptionally biased and/or imprecise labs or rigs is justified, and propose a statistical mechanism for doing so.

Motion to approve project charter was made by Matt Schlaff – seconded by Mike Faile – no further discussion

APPROVED

Highlights from meeting with Stats Group on June 7, 2018

On June 7, 2018 Jo Martinez hosted a Webex to discuss a path forward for addressing the persistent mild trend that exists in the ROBO test. Participants included Justin Mills (ROBO SP chair), Tom Scholfield (ASTM TMC), and ASTM's statistics group.

- ***Exclusion of "Bad" ROBO units***
  - Within the group of TMC monitored ROBO stands, there are sometimes "bad" units. These are units that either fail to calibrate after multiple attempts or have poor precision, causing a negative impact to the test's pooled s and average Yi. **It was suggested that addressing this type of issue is out of the scope of the stats group. Instead this is more or less an administrative task. The surveillance panel can develop criteria to exclude this units from LTMS statistics.** It is important to note that ROBO's calibration requirements are effective in keeping "bad" units out of service. The robust calibration requirements prevent these units from running candidate samples.
- ***Statistical Analysis***
  - The ROBO test is more complex than most other bench tests. As such, there are many more variables to consider when conducting a statistical analysis. In addition to the operational variables, things such as workshops, method changes, reference oil changes, equipment changes may have an impact on the statistical analysis. **An action was taken to develop a timeline of changes to the ROBO test.**
  - It was pointed out that not all labs are reporting to the same number of significant figures. For example some labs report MRV as XX,XXX while others report as XX,X00. Also some labs are changing their naming nomenclature of reaction flasks or vacuum pumps between calibrations. **It was suggested that reporting units and number of significant figures be harmonized in the reporting of results.**
  - Currently TMC's **calibration requirements only address MRV viscosity and do not consider yield stress as a pass/fail criteria**. MRV yield stress is reported and tracked on ROBO's LTMS.
- ***Timeline***
  - There is not an urgent need to address the mild trend in ROBO. The test is operational and "bad" units are being excluded from running candidate samples by TMC's calibration requirements. With that said, the ROBO SP would still like a rough estimate on how long the analysis will take.

Actions and next steps

- SP to review calibration requirements and assess criteria for LTMS charting
- SP to harmonize reporting units and number of significant figures, as well naming nomenclature for critical parts
  - i.e. for MRV, please follow reporting as defined in ASTM D 4684.
- SP to discuss and decide whether or not MRV yield stress should be included as a pass/fail criteria for calibration – currently TMC only considers MRV viscosity
- Justin Mills to send the following items to Jo Martinez for distribution: Presentation, TMC calibration requirements, Link to ROBO section on TMC's website.
- Tom Scholfield and Justin Mills to develop ROBO test timeline with critical dates for the following: method changes, workshop dates, introduction of new reference oils, limit setting for reference oils
- Stats Group to determine path forward at their next meeting

Other Topics?

Next Meeting

- Justin Mills will provide an update to D02.B0.07 Bench Tests Surveillance on our SP behalf at ASTM meeting on Monday, June 25th in Phoenix, AZ.

- Suggestions for next SP meeting?