

## MEETING MINUTES: ROBO SURVEILLANCE PANEL

**Meeting:** ROBO SP Meeting

**Date:** August 13, 2020

**Location:** MS Teams (virtual)

**Minutes by:** Justin Mills – SP Chair

**Actions:**

1. Tom Schofield to send 436 samples for those labs wishing to participate in round robin.
  - a. All labs able to participate should contact Tom.
2. Tom to update LTMS and issue information letter to cover approved changes to Section 9 of D7528 method.
3. Justin Mills, Matt Schlaff, Tom Schofield, Alan Flamberg to continue to work on dilute NO2 procedure/method.
4. Justin Mills to tentatively schedule the next ROBO SP meeting for October 8, 2020.

**Membership and Attendance:**

Ace Glass	Dave Lawrence, *Tom Petrocella
Afton	Shelia Thompson, Jeff Yang, Todd Dvorak
ASTM TMC	*Tom Schofield
Chevron Oronite	Man Hon Tsang, *Robert Stockwell
ExxonMobil	Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	*Joe Franklin, *Matt Schlaff
Lubrizol	Mike Faile, *Aimee Shinhearl
PetroChina	Li Shaohui , Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	*Justin Mills, *Bruce Zweitzig, *Justin Kontra, Gabriel Walkup
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 Miller, Ted Selby
General Interest	*Alan Flamberg

\* Denotes attendance

## MEETING MINUTES: ROBO SURVEILLANCE PANEL

### Summary:

- Meeting convened at 10:32EST on August 13, 2020
- No modifications to agenda
- ASTM Antitrust and Recording Policy reviewed
- Membership review and update
  - Greg Lentz of Lubrizol removed - retired
  - Rachel Stone of Intertek added
- Meeting minutes from June 4, 2020 SP meeting were accepted
- Actions from the June 4<sup>th</sup> meeting were reviewed. Outstanding actions include:
  - Justin Mills, Matt Schlaff, Tom Schofield to update ASTM D7528 to include dilute NO<sub>2</sub>.
- ROBO industry statistics
  - The current semester, 2020OCT (4/01/20 – 9/30/20), is in progress. As of July 27, there were 59 datapoints. It is running with mild bias ( $Y_i = -0.71$ ) but closer to target precision than previous semester; pooled  $s = 0.2221$ .
- API Provisional Licensing
  - API provisional licensing for the ROBO test began April 1, 2020 and ended August 1, 2020
- TMC reference oils
  - As of August 3<sup>rd</sup>, there are only 16 valid results available for 434-3. Will revisit final limit setting once >20 results are available.
    - TMC still has 20-40 samples of 434-2 in inventory so full usage of 434-3 will not occur until this supply is depleted.
  - Tom Schofield confirmed that ROBO could get access  $\geq 1$  drum of TMC 436. The SP is interested in investigating this reference oil as a potential replacement for one of our current reference oils (likely 438-2) or as a 4<sup>th</sup> reference oil.
    - To support this investigation, it was requested that labs donate 436 runs – Intertek and Evonik both volunteered. Any additional labs able to participate should contact TMC and Tom will include 436 samples in their regular oil replenishment. All donated runs will be tracked in the LTMS database. Given the ample supply of our 3 current reference oils, there is no rush for this request and data can be gathered over next several months.
  - Some discussion regarding 438 and subsequent reblends also took place. Alan commented that the original 438 was intended to be a mild oil; however, if the conditions of the test are too severe this oil could perform very poorly. This sensitivity to change made it an ideal reference oil. Unfortunately the reblend (TMC 438-2) has significantly broader standard deviation (438-2 s.d. = 0.2596 vs 438 s.d. = 0.2037). In last semester the precision of 438-2 was 0.3634.
- Calibration requirements
  - LTMS
    - Current calibration requirements in LTMS only distinguish between New Laboratory/Test Stand(s) and Existing Laboratory/Test Stand(s). - No distinction between new test stand(s) at new labs or existing labs.
    - Proposal was made to clarify calibration requirements by adding a third category and modifying requirements. A General summary of the changes is provided below, but full proposal can be found in **Appendix A:**
      - New Laboratory/New Test Stand(s) - Will be required to run all 3 (unblind) reference oils prior to requesting 2 (blind) reference oils.
      - Existing Laboratory/New Test Stand(s) - Will not be required to run 3 (unblind) reference oils prior to requesting 2 (blind) reference oils. Instead new test stands at existing labs can just run 2 (blind) reference oils after their own internal shakedown.
      - Existing Laboratory/Existing Test Stand(s) - No changes to requirements
    - After reviewing the proposal some discussion took place. In general, it seemed that all SP members want to ensure new rigs are properly vetted and agreed that it is good practice to do “shakedown” runs prior to requesting the double-blind calibration oils from the TMC. Some labs utilize an internal standard for setting up new rigs, making the 3-unblind references redundant. In the end it seems that the 2-test calibration should be sufficient to keep “bad” ROBO units out of the system and it is up to

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individual labs to identify their own best practice for vetting their rigs prior to requesting the double-blind calibration oils from the TMC.

- Joe Franklin made a motion to approve the new acceptance criteria for the LTMS as proposed (see **Appendix A**). The motion was seconded by Matt Schlaff and vote took place with one vote allowed per company:

Affirmative	Negative	Abstain
Matt Schlaff (Intertek)	Alan Flamborg (general interest)	Tom Schofield (TMC)
Aimee Shinheart (Lubrizol)		Tom Petrocella (Ace Glass)
Mike Birke (SwRI)		Robert Stockwell (Oronite)

- By majority vote, the motion carried. Alan Flamborg withdrew his negative after additional discussion.
- ASTM D7528-17a
  - Corresponding changes to the D7528-17a method were also reviewed. Primary changes included adding “9.2 New Test Stand at Existing Laboratory Calibration” as well as updating the TMC LTMS reference in Footnote 11. The proposal for Section 9 changes can be found in **Appendix B**.
  - Joe Franklin made a motion to produce an information letter detailing changes to Section 9 as proposed in **Appendix B**. The motion was seconded by Alan Flamborg and a vote took place:

Affirmative	Negative	Abstain
Matt Schlaff (Intertek)		
Aimee Shinheart (Lubrizol)		
Mike Birke (SwRI)		
Robert Stockwell (Oronite)		
Tom Schofield (TMC)		
Tom Petrocella (Ace Glass)		
Alan Flamborg (general interest)		

- By majority vote, the motion carried. An information letter will be issued with an effective date of 30 days.

- Dilute nitrogen dioxide
  - Due to timing, this topic was not covered in detail. Instead Justin will work with a smaller workgroup to determine tolerances for dilute NO<sub>2</sub> (concentration, duration, flow rate). Work group likely to include Justin Mills, Alan Flamborg, Matt Schlaff, and Tom Schofield; however, it is open to anyone that would like to participate. Recommendations will then be shared with entire SP at future meeting.
- Calibration and reporting
  - The LTMS and D7528 method do not explicitly state whether a test needs to start or finish by end of calibration date to be considered valid. Consensus from SP is that test just needs to start before end of calibration date.
  - Tom proposed the following language to be added to the D7528 method: “Qualified Non-Reference Test Runs On Calibrated Test Stands—A non-reference test is considered to be run on a calibrated test stand if started at least one-hour before the calibration expiration period, and is within the allowed number of runs between calibrations specified by the LTMS calibration requirements.”
    - General consensus is that this wording should be sufficient; however due to timing no vote was taken and this topic will be revisited at next meeting.
- Next meeting tentatively scheduled on October 8, 2020. Date may be postponed if no progress is made on agenda items.
- Meeting adjourned at 12:10

-End report-

## Appendix A: Changes to Section 42.B in LTMS

**Proposed Version**

## B. Acceptance Criteria

1. New Laboratory/**New** Test Stand(s)

- a. The TMC calibration auditing system calibrates individual test stands at individual laboratories. There are no requirements to bring a lab into TMC calibrated status, there are only requirements to bring individual test stands into TMC calibrated status, as follows:
  - b. **Prior to obtaining calibration test oils from the TMC, new laboratories introducing a test stand must demonstrate their stand can successfully run all three (3) current TMC calibration oils within the TMC acceptance bands. Upon acceptance of these results by the TMC, the lab may request the two test calibration.**
- c. A minimum of two (2) operationally valid calibration tests which fall within the acceptance bands for the oils assigned are required to calibrate a stand for the first time. These must be back-to-back consecutive runs on the same test stand, though exceptions can be made at the sole discretion of the TMC for operational fails for reasons that would be considered to have had no bearing on the operational performance of the test stand for subsequent tests (for example, a power failure)
- d. Passing two back-to-back consecutive TMC calibrations places the new test stand in TMC calibrated status. Both tests must pass on operational and statistical criteria.
- e. TMC calibrated status of a test stand is valid for no more than 50 days from date completed of a valid TMC calibration (that is, the end of the test's 40-hour oil oxidation heating cycle), or no more than 15 subsequent test starts on the stand (as counted sequentially by run number; see Item 3), whichever comes first. To renew the calibration at the end of the calibration period, see Item 2 for Existing Laboratory/Test Stand(s).

2. Existing Laboratory/**New** Test Stand(s)

- a. The TMC calibration auditing system calibrates individual test stands at individual laboratories. There are no requirements to bring a lab into TMC calibrated status, there are only requirements to bring individual test stands into TMC calibrated status, as follows:
  - b. A minimum of two (2) operationally valid calibration tests which fall within the acceptance bands for the oils assigned are required to calibrate a stand for the first time. These must be back-to-back consecutive runs on the same test stand, though exceptions can be made at the sole discretion of the TMC for operational fails for reasons that would be considered to have had no bearing on the operational performance of the test stand for subsequent tests (for example, a power failure)
- c. Passing two back-to-back consecutive TMC calibrations places the new test stand in TMC calibrated status. Both tests must pass on operational and statistical criteria.
- d. TMC calibrated status of a test stand is valid for no more than 50 days from date completed of a valid TMC calibration (that is, the end of the test's 40-hour oil oxidation heating cycle), or no more than 15 subsequent test starts on the stand (as counted sequentially by run number; see Item 3), whichever comes first. To renew the calibration at the end of the calibration period, see Item 2 for Existing Laboratory/Test Stand(s).

3. Existing Laboratory/**Existing** Test Stand(s)

- a. An existing TMC calibrated test stand, or one where the TMC calibrated status had expired within the past 150 days, can renew its TMC calibrated status by demonstrating a successful calibration on another single TMC blind calibration audit. The test must pass on both operational and statistical criteria.
- b. TMC calibrated status of an existing test stand is valid for no more than 50 days from date completed of a valid TMC calibration (that is, the end of the test's 40-hour oil oxidation heating cycle), or no more than 15 subsequent test starts (as counted sequentially by run number) on the stand, whichever comes first. Test stands that exceed these time/run specifications are considered to be out of calibration for TMC monitoring purposes.

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- c. A stand that has been out of TMC calibration for more than 150 days from the prior TMC calibration expiration date will require New Test Stand calibration as listed in B.2.b through B.2.d. of this document.
- d. A stand must pass the TMC calibration within two operationally valid test runs. If a stand cannot produce a calibration test that falls into the acceptance bands for the assigned oil within two operationally valid runs. Renewing calibration on that stand will require the two test calibration as listed in B.2.b through B.2.d.
- e. Changing the vacuum control valve set point, exchanging the reactor vessel or the vacuum pump, or changing the heating voltage setting by more than  $\pm 1$  volt on a stand for any reason voids any current TMC calibrated status. Renewing calibration on that stand will require the two test calibration as listed in B.2.b through B.2.d.

## Appendix B: Changes to Section 9 in D7528-17a

**9. New and Existing Test Stand Calibration**

9.1 Set up qualifying test runs for a new ROBO apparatus test stand at new test laboratory. For new ROBO apparatus at existing laboratory, proceed to 9.2. For existing ROBO apparatus test stands, proceed to 9.3.

9.1.1 Obtain the required, current reference oils from the TMC for the purpose of setting up a new ROBO apparatus stand.<sup>2</sup> (See 7.7.2 and Annex A2 for conditions of use for the TMC reference oils.)

9.1.2 Test the assigned reference oils according to the procedure described in Section 10.

9.1.2.1 It is imperative that the vacuum control valve (VCV) set position be set on the first set-up test and not changed again for subsequent set-up qualifying runs.

9.1.2.2 If the VCV set position is changed by more than  $\pm 0.125$  revolutions after the start of the first qualifying set-up test run, all previous tests in the set-up test sequence are void; repeat the test stand setup runs from 9.1.1 – 9.1.4.

9.1.3 Determine the viscometric properties of the aged reference oils as described in Section 12 and report according to Section 13.

9.1.4 Report test results to the TMC using the standardized reporting protocols (see 9.3.2 and Section 13). Be sure to include all required operational parameters as defined in the reporting protocol data dictionary.

9.1.5 Review all initial set-up results on new instruments and receive approval from the TMC.

9.1.5.1 Test results will be posted to the TMC website. Lab identification will be coded by the TMC for confidentiality of the testing laboratory.

9.1.6 If all the required test stand set-up runs meet the current, approved ROBO TMC calibration requirements<sup>11</sup> (both operationally and statistically), the TMC will notify the laboratory that it can proceed with calibrating the test stand per 9.3.

9.1.7 If the TMC's review determines that the required test stand set-up runs do not collectively meet the approved requirements (both operationally and statistically), the TMC will notify the laboratory that additional adjustments need to be made to the test stand and one or more of the set-up runs will have to be repeated.

9.2 New Test Stand at Existing Laboratory Calibration

9.2.1 Laboratory can proceed with calibrating the test stand per 9.3.

9.3 Existing Test Stand Calibration:

9.3.1 *Reference Oil Test Frequency*—The TMC requires test stands to pass periodic calibration verification with reference oils supplied by the TMC. These calibration verification runs are typically run on blind-coded reference oil samples.

9.3.1.1 Prior to conducting a TMC reference oil test for the purpose of stand calibration, procure a supply of reference oil directly from the TMC. (See 7.7.2 and Annex A2 for conditions of use for the TMC reference oils.) The reference oils are usually supplied directly to a testing laboratory with blind-coded identification numbers to ensure that the laboratory is not influenced by prior knowledge of a reference oil's acceptable performance results in assessing the test results. The TMC will determine which specific reference oil or oils the laboratory shall test in accordance with the calibration requirements.

9.3.1.2 Initial calibration verification of a new test stand or repeated consecutive unacceptable calibration verifications on a test stand requires passing two consecutive TMC reference oil tests.

9.3.1.3 Certain operational changes to the test stand, as specified in the TMC calibration requirements,<sup>11</sup> voids the TMC test stand calibration status and requires passing two consecutive TMC reference oil tests to re-verify the calibration status of the modified test stand.

9.3.1.4 During the time of conducting a reference oil test on one test stand, non-reference oil tests may be conducted on other previously calibrated stands.

9.3.2 *Test Numbering*:

9.3.2.1 The test number shall follow the format AAA-BB-CCCC. AAA represents the test stand identification. BB represents the number of tests since last reference. CCCC represents the total number of tests on the stand. As an example, 6-10-175 represents the 175 test on Stand 6 and the tenth test since the last reference. Consecutively number all tests on a given stand.

<sup>11</sup> The ROBO TMC Calibration Requirements document is available at:

[http://www.astmtmc.cmu.edu/ftp/docs/bench/robo/procedure\\_and\\_ils/20170713\\_ROBO\\_TMC\\_Calibration\\_Requirements.pdf](http://www.astmtmc.cmu.edu/ftp/docs/bench/robo/procedure_and_ils/20170713_ROBO_TMC_Calibration_Requirements.pdf)

<http://www.astmtmc.cmu.edu/ftp/docs/ltms/ltms.pdf>

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9.3.3 *Reporting of Reference Oil Test Results*—Report the results of all reference oil tests to the TMC according to the following instructions:

9.3.3.1 Transmit results according to the ROBO Standardized Report Forms and Data Dictionary<sup>12</sup> to the TMC within five days of test completion via electronic data transfer protocol as outlined in the Data Communication Committee, Electronic Test Report Transmission Model (ETRTM).<sup>13</sup>

NOTE 4—Be sure to collect data on all the required parameters defined in the ROBO Standardized Data Dictionary<sup>12</sup> (see Section 13). Validity evaluation of test results cannot be made if critical evaluation parameters are missing.

9.3.4 *Evaluation of Reference Oil Test Results*—The TMC evaluates the reference oil test results for both operational validity and statistical acceptability. The TMC may consult with the test laboratory in case of difficulty, as follows:

9.3.4.1 Upon receipt of the reference oil test results from the test laboratory, the TMC evaluates the laboratory's reported operational parameters for compliance with the current test method. For operationally valid tests, the TMC then evaluates the pass/fail parameters for statistical validity. The TMC sends a test confirmation report to the test laboratory indicating the overall validity of the calibration test results, and disclosing the non-blind industry reference oil code.

9.3.4.2 In the event the reference oil test is unacceptable, the test laboratory shall provide an explanation of the problem relating to the failure. If the problem is not obvious, carry out operational re-checks (instrumentations, settings, and procedures). Following the re-checks, the TMC assigns another reference oil for testing by the laboratory. If this reference oil test is unacceptable, a reassessment of the stand setup as described in 9.1 or 9.2 may be necessary.

9.3.4.3 It is recognized that a certain percentage of calibration tests will fall outside the acceptance limits because of the application of statistics in the development of the acceptance limits. The TMC decides, with consultation as needed with industry experts (testing laboratories, members of the ASTM Technical Guidance Committee, the surveillance panel, and so forth), whether the reason for any failure of a reference oil test is a false alarm, testing apparatus, testing laboratory, or industry-related problem. The ROBO surveillance panel adjudicates all industry problems.

9.3.5 *Reference Oil Accountability:*

9.3.5.1 Laboratories conducting calibration tests are required to provide a full accounting of the identification and quantities of all reference oils used.

9.3.5.2 With the exception of analysis required in this test method, no additional physical or chemical analysis of new or used reference oils is permitted without the express permission of the TMC. (See 7.7.2 and Annex A2 for conditions of use for the TMC reference oils.)

# ASTM D7528: Bench Oxidation of Engine Oils by ROBO Apparatus

ROBO Surveillance Panel Meeting

August 13, 2020

Justin Mills



# Agenda

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- Welcome, ASTM statement
- Review membership of surveillance panel
- Review and approve minutes from previous meetings (see attachment)
- Review and follow-up on actions from June 4<sup>th</sup> meeting
- Current status of ROBO including statistics and API provisional licensing update
- Reference oil update including TMC 436
- Calibration requirements for new rigs
- Dilute nitrogen dioxide update
- Additional topics, if any
- Set next meeting

# ASTM Antitrust and Recording Policy

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ASTM International is a not-for-profit organization and developer of voluntary consensus standards. ASTM's leadership in international standards development is driven by the contributions of its members: more than 30,000 technical experts and business professionals representing 135 countries.

The purpose of antitrust laws is to preserve economic competition in the marketplace by prohibiting, among other things, unreasonable restraints of trade. In ASTM activities, it is important to recognize that participants often represent competitive interests. Antitrust laws require that all competition be open and unrestricted.

It is ASTM's policy, and the policy of each of its committees and subcommittees, to conduct all business and activity in full compliance with international, federal and state antitrust and competition laws. The ASTM Board of Directors has adopted an antitrust policy which is found in Section 19 of ASTM Regulations Governing Technical Committees. All members need to be aware of and compliant with this policy. The Regulations are accessible on the ASTM website (<http://www.astm.org/COMMIT/Regs.pdf>).

Electronic recording of ASTM meetings is prohibited.

# Membership

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Ace Glass	Dave Lawrence, <b>Tom Petrocella</b>
Afton	Shelia Thompson, Jeff Yang, Todd Dvorak
ASTM TMC	<b>Tom Schofield</b>
Chevron Oronite	Man Hon Tsang, <b>Robert Stockwell</b>
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Koehler Instruments	Raj Shah, Vincent Colantuini
Tannas/Savant	Greg Miller, Ted Selby
General Interest	<b>Alan Flamberg</b>

## Summary of changes:

1. Joan Souchik of Evonik removed (retired)
2. Greg Lentz of Lubrizol added but to be removed in July following retirement
3. Rick Hartman to be removed
4. BASF removed from list (no longer have any members on list)

# Motion to accept June 4, 2020 meeting minutes

## MEETING MINUTES: ROBO SURVEILLANCE PANEL

Meeting: ROBO SP Meeting  
 Date: June 4, 2020  
 Location: MS Teams (virtual)  
 Minutes by: Justin Mills – SP Chair

### Actions:

1. Tom Schofield to confirm that 436 could be made available for ROBO.
2. Justin Mills, Matt Schlaff, Tom Schofield, Alan Flamberg to continue to work on dilute NO2 procedure/method.
3. Justin Mills to schedule the next ROBO SP meeting in July 23, 2020.

### Membership and Attendance:

Ace Glass	Dave Lawrence, *Tom Petrocella
Afton	Shelia Thompson, Jeff Yang, *Todd Dvorak
ASTM TMC	*Tom Schofield
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General Interest	*Alan Flamberg

\* Denotes attendance

ASTM D7528 ROBO SP Meeting June 4, 2020

## MEETING MINUTES: ROBO SURVEILLANCE PANEL

### Summary:

- Meeting convened at 10:03EST on June 4, 2020
- No modifications to agenda
- ASTM Antitrust and Recording Policy reviewed
- Membership review and update
  - Joan Souchik of Evonik removed (retired)
  - Greg Lentz of Lubrizol added.
  - Rick Hartman to be removed
  - BASF removed from list (no longer have any members on list)
- Meeting minutes from October 24, 2019 SP meeting were accepted
- Actions from the October 24<sup>th</sup> meeting were reviewed. Outstanding actions include:
  - Justin Mills to revisit TMC 436 as a potential reference oil for ROBO.
  - Justin Mills, Matt Schlaff, Tom Schofield to update ASTM D7528 to include dilute NO2 (likely in early-2020).
- ROBO industry statistics
  - The 2020MAR (10/01/19 – 3/31/20) semester ended with a slight mild trend;  $Y_i = -0.10$ . Precision was worse than target but better than previous semester; Pooled  $s = 0.2723$ .
  - In current semester there are only 41 data points with indication that test continues to trend mild.
- API Provisional Licensing
  - In response to long backlogs at independent test labs, API invoked provisional licensing on April 1, 2020 for ROBO. Provisional licensing is expected to end August 1, 2020 assuming backlog improves.
  - SP believes queue is just a result of surge in demand, not a test issue. ROBO test continues to be available at 2 independent labs and 3+ dependent labs.
- TMC reference oils
  - Interim limits for 434-3 were set in October 2019. To date, there are only 14 valid results available for 434-3. SP will revisit final limit setting once >20 results are available.
  - At the October 2019 SP meeting it was requested to revisit the potential of using TMC 436 as a reference oil. Justin Mills shared a limited dataset provided by Evonik with only 4 datapoints indicating it runs mild – like the original 438. Before going further with additional screening, the SP needs to confirm how much 436 could be made available for ROBO.
- Dilute nitrogen dioxide
  - Work on alternative procedure for dilute NO2 continues to move at a slow pace; however significant progress has been made thanks to Alan Flamberg and his attempt to write the initial draft. Significant amount of work still required before draft is considered ready for publication/distribution.
- Method housekeeping
  - A number of method housekeeping items need to be included in next revision of the method. To date the following were collected:
    - Section 9.1.6: If all the required test stand set-up runs meet the current, approved ROBO TMC calibration requirements 11 (both operationally and statistically), the TMC will notify the laboratory that it can proceed with calibrating the test stand per 9.2.
      - Footnote 11 needs to be updated: \*11 The ROBO TMC Calibration Requirements document is available at: [http://www.astmtmc.cmu.edu/ftp/docs/bench/robo/procedure\\_and\\_tls/20170713\\_ROBO\\_TMC\\_Calibration\\_Requirements.pdf](http://www.astmtmc.cmu.edu/ftp/docs/bench/robo/procedure_and_tls/20170713_ROBO_TMC_Calibration_Requirements.pdf)
      - Recommendation: Should reference TMC's LTMS instead.
    - Section 10.8.2: Volatility calculation makes reference to Note 8.
      - NOTE 8—The significance of the % volatiles parameter is under investigation.
      - Recommendation: Remove note. No longer under investigation.
    - Annex A.2.2.1: ...It is a laboratory's responsibility to keep the on-site reference oil inventory at or above the minimum level specified by the TMC test engineers.
      - Recommendation: Update or remove statement to reflect that TMC manages the inventory.
    - Section 6.11, 10.4, Annex A13.2, A13.4.1. Clarify vacuum measurement methodology.
      - Currently reported as vacuum pressure of 61 kpa. Is it clearer to report as gauge pressure of -61 kPa?

ASTM D7528 ROBO SP Meeting June 4, 2020

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- Upcoming ASTM D02.B0.07
  - Justin shared the slide he intends to present at upcoming D02.B0.07

### ASTM D7528: ROBO Summary for D02.B0.07

Status	Test Aspect	Comments
✓	Method	Test method is in good standing <ul style="list-style-type: none"> <li>ASTM D7528-17a was published in October 2017. Revision planned for 2020.</li> <li>Monitored by the TMC</li> </ul>
✓	Parts Availability	All ROBO hardware and test materials are available <ul style="list-style-type: none"> <li>Nitrogen dioxide, the primary catalyst for ROBO, is available from multiple suppliers</li> <li>Alternative with dilute nitrogen dioxide expected to be approved in 2020 as well.</li> </ul>
✓	Reference Oils	All current reference oils are in good supply at TMC <ul style="list-style-type: none"> <li>In last semester, limits were finalized for TMC 438-2 and interim limits were set for TMC 434-3</li> </ul>
⚠	Test Availability	In response to long backlogs at independent test labs, API invoked provisional licensing on April 1, 2020 for ROBO <ul style="list-style-type: none"> <li>Queue is a result of high utilization</li> <li>ROBO test is available at 2 independent labs and 3+ dependent labs</li> </ul>
✓	Severity and Precision	In last semester (Oct 2019 – Mar 2020) precision was slightly worse than target and test ran with a slight mild bias (-0.10) <ul style="list-style-type: none"> <li>In current semester (test 1) precision is on target, but test is running mild (-0.58)</li> </ul>

- Next meeting tentatively scheduled on July 23, 2020. Date may be postponed if no progress is made on agenda items.
- Meeting adjourned

-End report-

ASTM D7528 ROBO SP Meeting June 4, 2020

## Actions from June 4<sup>th</sup> meeting

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- Tom Schofield to confirm that 436 could be made available for ROBO
- Justin Mills, Alan Flamberg, Matt Schlaff, Tom Schofield to continue to work on dilute NO2 procedure/method
  - Need input from SP before we can proceed.
- Justin Mills to schedule the next ROBO SP for July 23.

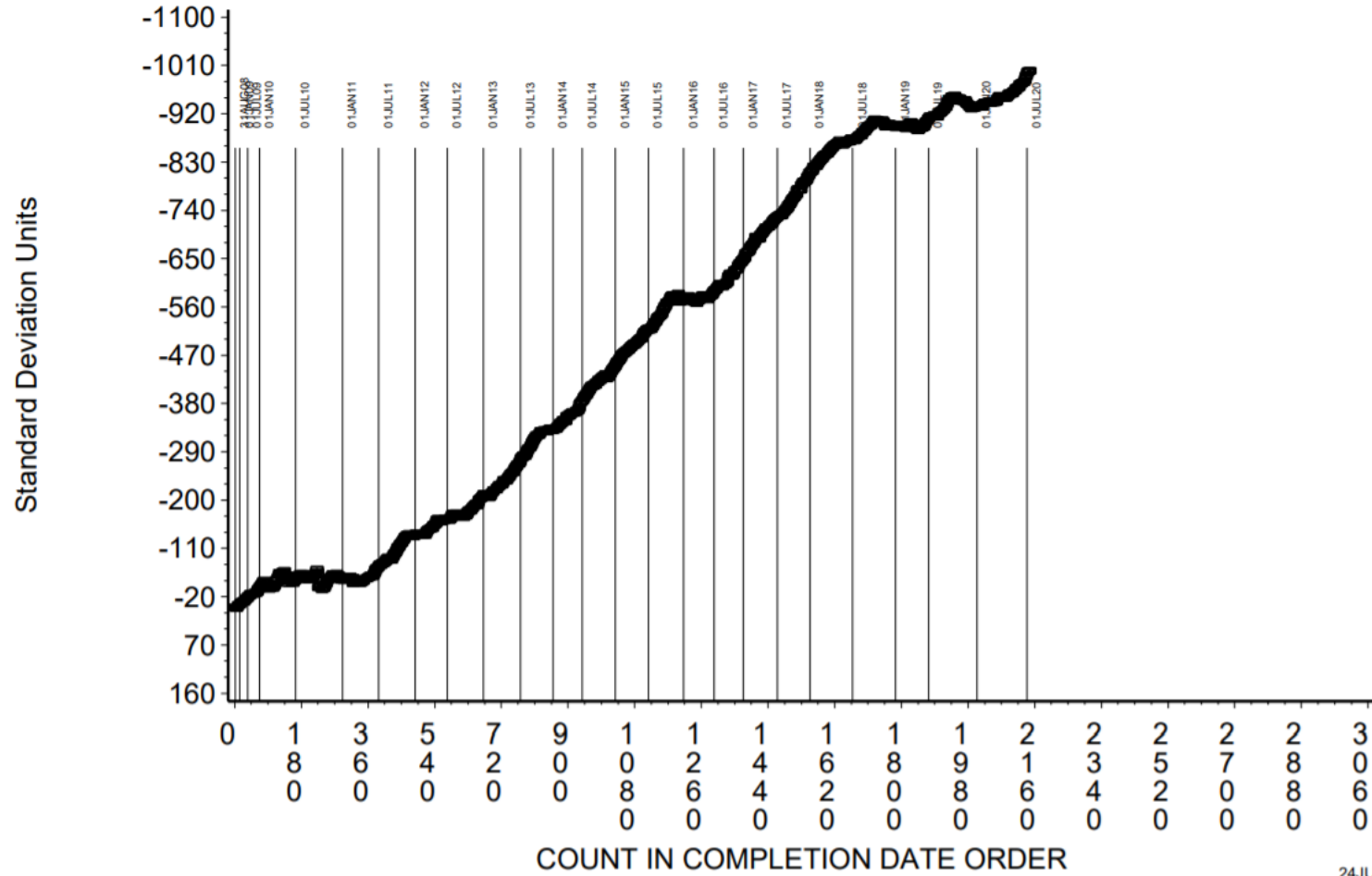
# Current status of ROBO

# ROBO Industry Statistics

Period	N-size	Degrees of Freedom	Pooled s	Mean $\Delta/s$	Comments
Current Targets	49	46	0.1945	-----	
10/1/16 through 3/31/17	78	75	0.2771	-0.91	
4/1/17 through 9/30/17	99	95	0.2220	-0.76	
10/1/17 through 3/31/18**	90	86	0.2376	-0.91	Period statistics with and without seven suspect results from two rigs
10/1/17 through 3/31/18**	83	79	0.2076	-0.74	
4/1/18 through 9/30/18	126	122	0.2184	-0.49	Period statistics with and without one extreme result included
4/1/18 through 9/30/18	125	121	0.1958	-0.53	
10/1/18 through 3/31/19	100	96	0.2738	0.04	
4/1/19 through 9/30/19	95	91	0.2492	-0.32	
10/1/19 through 3/31/20	158	153	0.2723	-0.10	
4/1/20 through 9/30/20	59	54	0.2221	-0.71	

Source: <http://www.astmtmc.cmu.edu/ftp/refdata/bench/robo/data/statistics.txt> (7/27/2020)

# CUSUM severity analysis



24JUL20:08:44

Source: <http://www.astmtmc.cmu.edu/ftp/refdata/bench/robo/plots/mrv%20INDUSTRY.pdf> (7/24/20)



## API Provisional Licensing

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- In response to long backlogs at independent test labs, API invoked provisional licensing on April 1, 2020 for ROBO.
- Provisional licensing closed August 1, 2020

# Reference oils

# TMC reference oils

## Current limits

Oil	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa's Min <sup>1</sup>	95% band in mPa's Max <sup>1</sup>	95% Bands Min (ln)	95% Bands Max (ln)
434-1	13	10.6599	42,612	0.1672	30,706	59,136	10.3322	10.9876
434-2	36	<sup>2</sup> 10.9284	<sup>2</sup> 55,737	0.1551	<sup>2</sup> 41,126	<sup>2</sup> 76,008	<sup>2</sup> 10.6244	<sup>2</sup> 11.2386
434-3	13	<sup>2</sup> 10.8411	<sup>2</sup> 51,078	0.1342	<sup>2</sup> 39,265	<sup>2</sup> 66,443	<sup>2</sup> 10.5781	<sup>2</sup> 11.1041
435	15	11.4895	97,685	0.2952	<sup>3</sup> 60,000	173,546	<sup>3</sup> 11.0021	12.0642
435-1	22	11.0416	62,420	0.20295	<sup>4</sup> 44,570	92,910	<sup>4</sup> 10.7048	11.4394
438	14	10.2676	28,785	0.2037	19,308	42,912	9.8683	10.6669
438-2	19	<sup>2</sup> 10.5404	<sup>2</sup> 37,813	0.2596	<sup>2</sup> 22,734	<sup>2</sup> 62,894	<sup>2</sup> 10.0316	<sup>2</sup> 11.0492

<sup>1</sup> 95% bands in mPa's are listed for information purposes only, the transformed values will be used to judge acceptance in all cases.

<sup>2</sup> A bias adjustment has been applied to the mean of reference oils 434-2, 434-3 and 438-2 to account for biases observed in the TMC reference data during the periods that each oil target dataset was generated. The 95% confidence range reflects the inclusion of the bias adjustments.

<sup>3</sup> The minimum value for Reference oil 435 is fixed at 60,000 (11.0021 in transformed units) and not a true 95% minimum as calculated from the statistics.

<sup>4</sup> The minimum value for reference oil 435-1 is based on -1.66 standard deviations from the target mean (to match the range previously approved for oil 435 min), so is not actually a 95% confidence range. A 95% confidence range would use 1.96 standard deviations from target mean.

- At the October 2019 SP meeting we voted on final limits for 438-2 and interim limits for 434-3
- To date (August 3), there are only 16 valid results available for 434-3. Will revisit final limit setting once >20 results are available.

## TMC 436 as alternative to current reference oils

- Limited dataset from Evonik suggests that it is mild, similar to original 438

IND	APPARATS	PVIS	MRVTEMP	MRVYSEOT	MRV
436	AM3	71.5	-30	<35	25,900
436	AM4	70.7	-30	<35	28,200
436	AM4	92.1	-30	<35	26,200
436	AM3	95.1	-30	<35	16,000

- TMC 436 could be used reference oil replacement, likely for 438-2. Current limits for TMC 438-2 are 22,734-62,894, much broader than original 438 limits 19,308-42,912.
- **Since our last meeting, Tom has confirmed that we get access to  $\geq 1$  drum**

Only 4 datapoints available for 436 from Evonik. Should we evaluate further? Potential replacement for TMC 438-2 or as a 4<sup>th</sup> reference oil.

# Calibration requirements

# Calibration requirements



Method changes



LTMS changes

- Current calibration requirements in LTMS only distinguish between New Laboratory/Test Stand(s) and Existing Laboratory/Test Stand(s). → No distinction between new test stand(s) at new labs or existing labs.
- Propose to clarify calibration requirements by adding a third category and modifying requirements.
  - New Laboratory/**New** Test Stand(s) → Will be required to run all 3 (unblind) reference oils prior to requesting 2 (blind) reference oils.
  - Existing Laboratory/**New** Test Stand(s) → Will not be required to run 3 (unblind) reference oils prior to requesting 2 (blind) reference oils. Instead new test stands at existing labs can just run 2 (blind) reference oils after their own internal shakedown.
  - Existing Laboratory/**Existing** Test Stand(s) → No changes to requirements
- Section 9 of D7528 would also need to be updated to reflect changes.

Proposed changes to method and LTMS were included in meeting invite.

Dilute NO<sub>2</sub>

# Dilute nitrogen dioxide

## Next steps

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Path forward to implement dilute NO<sub>2</sub> as an alternative to pure NO<sub>2</sub> is the following:

- 1) **Demonstrate equivalence to the SP** → Based on the available data, SP feels confident that dilute NO<sub>2</sub> and concentrated NO<sub>2</sub> yield comparable results?
- 2) Develop a procedure for dilute NO<sub>2</sub> → Initial draft completed, but now still requires further review editing. Many thanks to Alan for preparing first draft.
- 3) Approve by SP → Seek approval after procedure is written.
- 4) Issue information letter allowing use of dilute NO<sub>2</sub> as an alternative
- 5) Ballot the recommended changes at ASTM



## For the method

	Concentrated	Dilute	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Proposal
NO2 pure, ml	2.0ml +/- 0.1ml (5%)						
NO2 in air, %		1.13	1.19 (+5%)	1.13	1.19 (+5%)	1.07 (-5%)	1.13 +/- ?
NO2 duration, hours	12 +/- 1 hour	12	12	13 (+1hr)	13 (+1hr)	11 (-1hr)	12 +/- ? 15min
Dry air, ml/min	185 ml +/- ?	185	185	185	203 (+10%)	167 (-10%)	185 +/- ?
NO2 "liquid equivalent"	1.9 – 2.1	1.98	2.08	2.14	2.47	1.55	

- In current method for concentrated NO2, the maximum range for NO2 is 1.9 – 2.1ml.
- With dilute NO2 the concentration, feed rate, and duration will all affect the amount of NO2 introduced.
  - See above for examples.
  - How should we specify tolerances?

**Any Additional Topics?**

## Calibration end date

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- Do tests not to start or finish by end of calibration expiration date?
  - Method does not specify
  - LTMS includes following statement:

c. TMC calibrated status of a test stand is valid for no more than 50 days from date completed of a valid TMC calibration (that is, the end of the test's 40-hour oil oxidation heating cycle), or no more than 15 subsequent test starts on the stand (as counted sequentially by run number; see Item 3), whichever comes first. To renew the calibration at the end of the calibration period, see Item 2 for Existing Laboratory/Test Stand(s).

- XX Qualified Non-Reference Test Runs On Calibrated Test Stands—A non-reference test is considered to be run on a calibrated test stand if started at least one-hour before the calibration expiration period, and is within the allowed number of runs between calibrations specified by the LTMS calibration requirements.

What is the consensus of the SP?

# Next Meeting

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- Suggestions for next SP meeting?
  - **October 8, 2020?**

A calendar for October 2020. The days of the week are listed at the top: Su, Mo, Tu, We, Th, Fr, Sa. The dates are arranged in a grid. The date 8 is highlighted with a red rectangular border. The calendar also shows dates from the previous month (27-31) and the following month (1-7).

October 2020							^	v
Su	Mo	Tu	We	Th	Fr	Sa		
27	28	29	30	1	2	3		
4	5	6	7	8	9	10		
11	12	13	14	15	16	17		
18	19	20	21	22	23	24		
25	26	27	28	29	30	31		
1	2	3	4	5	6	7		