



A Program of ASTM International

## Test Monitoring Center

@ Carnegie Mellon University  
6555 Penn Avenue, Pittsburgh, PA 15206, USA

<http://astmtmc.cmu.edu>  
412-365-1000

MEMORANDUM: 16-029

DATE: September 19, 2016

TO: D02.B0.07 EOV D5800 Mailing List

FROM: Tom Schofield

SUBJECT: D5800 Technical Memo: New D5800 Calibration Monitoring Requirements  
Effective October 19, 2016

Attached is the new D5800 Volatility by Noack Test LTMS Requirements document as approved by the D5800 surveillance panel on August 9, 2016. The new monitoring requirements include an exponentially weighted moving average (EWMA) evaluation and continuous severity adjustments (SA's) by instrument.

The attached monitoring protocol is effective October 19, 2016, coincident with the D5800 report packet revision version 200160919 effective date.

It is important to note that the SA's in the attached protocol apply to non-reference tests; TMC calibration tests must be reported with an SA of zero.

TMS/tms

Attachment

c: TMC: Jeff Clark, Frank Farber, Mike Kasimirsky  
<ftp://ftp.astmtmc.cmu.edu/docs/bench/d5800/memos/mem16-029.pdf>

Distribution: Email

D5800 Volatility by Noack Test LTMS Requirements Revision 20160917

The following are the specific D5800 Volatility by Noack Test calibration requirements.

A. Reference Oils and Critical Parameter

The critical parameter is Sample Evaporation Loss, Mass %. The reference oils required for test stand and test laboratory calibration are reference oils accepted by the D02.B0.07 Volatility Surveillance Panel. The means and standard deviations for the current reference oils for the critical parameter are presented below.

SAMPLE EVAPORATION LOSS

Unit of Measure: mass %

Reference Oil	Mean	Standard Deviation
VOLC12	14.19	0.73*
VOLD12	12.52	
VOLE12	16.74	

\*Value utilized for standard deviation to be periodically reevaluated by the D02.B0.07 Volatility Surveillance Panel

B. Acceptance Criteria

1. New Test Instrument

- a. Test Instrument that has never previously calibrated
  - A minimum of two (2) operationally valid calibration tests and/or matrix tests, with no Level 3 e<sub>j</sub> alarms must be conducted in a new instrument on any approved reference oils.
  - Note that industry matrix runs may be included, as well as reference runs, at the discretion of the surveillance panel.
  - Following the necessary tests, check the status of the control charts and follow the prescribed actions
- b. Test Instrument for which a lapse in calibration is greater than nine weeks
  - A minimum of two (2) operationally valid calibration tests and/or matrix tests, with no Level 3 e<sub>j</sub> alarms must be conducted in a new instrument on any approved reference oils.
  - The instrument would be treated as a new instrument and historical data for the stand would not be included for instrument charting going forward.
  - Following the necessary tests, check the status of the control charts and follow the prescribed actions

## 2. Existing Test Instrument

- Instrument has previously been accepted into the system by meeting the requirements defined in this section.

## 3. Transitioning Instruments

- From the first day of implementation of this LTMS system, an instrument that had been calibrated in the “old” (Shewhart Chart) system will have up to 30 days to complete an operationally valid calibration test. This calibration test shall be analyzed in conjunction with historical calibration data from the same instrument to establish acceptance into the system.

## 4. Calibration Test Requirements and Reference Oil Assignments

After test instruments have been accepted into the system, continuing calibration requires a reference oil assignment be obtained from TMC, and a calibration test performed, when either of the following occur:

- 30 days have passed since the last successful (“in control”) calibration test, OR
- the instrument has been retrofitted with a new thermocouple or new pump, or has received updated firmware.

100% of the scheduled calibration tests should be conducted on reference oils VOLC12, VOLD12 and VOLE12 or subsequent approved reblends. All operationally valid calibration tests must be charted to determine if the test instrument is currently “in control” as defined by the control charts defined in B.6.

## 5. Mandatory Daily QC Check Sample and Data Submittal

To maintain calibrated status, all TMC-monitored instruments must utilize the TMC daily quality control check fluid, VOLD14, in order to comply with the daily QC check requirement defined in the current revision of ASTM D5800. The results from *all* daily QC checks (passes and fails, whether operationally valid or invalid) since the *last operationally-valid calibration attempt* must be included in the flat file submittal (report form) for each calibration run. The data required for each daily QC check shall include unique cup and lid identifiers, among other mandatory data as defined on the TMC-maintained template. Daily QC sample data is not used to determine calibration status of an instrument, but it may be utilized on an ad-hoc basis as an indicator of the ongoing effectiveness of the D5800 LTMS system.

The current pass/fail limits for VOLD14 are documented in TMC Memorandum 15-005, and are included below for reference. As indicated in this memorandum, these pass/fail limits may be periodically re-evaluated by the ASTM D02.B.07 Volatility Surveillance Panel.

					<b>95% Acceptance Limits*</b>	
<b>Oil Code</b>	<b>Parameter</b>	<b>N</b>	<b>Mean</b>	<b>sR</b>	<b>Lower</b>	<b>Upper</b>
VOLD14	Mass % evaporation loss	33	12.99	0.62	11.8	14.2

\*95% Acceptance Limits = Mean +/- (1.96 sR)

## 6. Control Charts

In Section 1, the construction of the control charts that constitute the Lubricant Test Monitoring System is outlined. For the D5800,  $Z_0 = \text{Mean } Y_i$  of first two operationally valid tests for the instrument. The constants used for the construction of the control charts for the D5800 Volatility by Noack Test, and the response necessary in the case of control chart limit alarms, are depicted below.

LUBRICANT TEST MONITORING SYSTEM CONSTANTS

		EWMA Chart		Instrument Prediction Error	
Chart Level	Limit Type	Lambda*	Alarm*	Limit Type	Limit*
Instrument	Level 1	0.3	0.000	Level 2	$\pm 1.734$
	Level 2		$\pm 1.800$	Level 3	$\pm 2.066$
Industry	Level 1	0.2	0.775	--	--
	Level 2		$\pm 0.859$	--	--

\*Values for Lambda and alarm limits to be periodically reevaluated by the D02.B.07 Volatility Surveillance Panel

The following are the steps that must be taken in the case of exceeding control chart limits. The steps are listed in order of priority, although charts should be studied simultaneously to determine the cause(s) of a problem. In the case of multiple alarms, contact the TMC for guidance. The laboratory always has the option of removing any instrument from the system.

- Exceed Instrument chart of Prediction Error ( $e_i$ )

Level 3:

- Immediately conduct one additional reference test on the instrument that triggered the alarm. Do not update the control charts until the follow up reference test is completed and the Excessive Influence analysis (refer to Section 1.A.5) has been performed.

Level 2:

- The Level 2 limit applies in situations that have been pre-determined by the surveillance panel to have a potential impact on test results. These situations may include the introduction of new critical parts, reference oil reblends, or other test components. When these conditions have been met and a Level 2 alarm is triggered, immediately conduct one additional reference test in the instrument that triggered the alarm.

Level 1:

- The Level 1 limit does not apply for the D5800.
- Exceed Instrument EWMA of Standardized Test Result ( $Z_i$ )

Level 2:

- Immediately conduct one additional reference test in the instrument that triggered the alarm. The instrument that triggered the alarm is not qualified for non-reference tests until the Level 2 alarm is cleared.
- In instances where surveillance panel has deemed that industry-wide circumstances are impacting the Level 2 alarm, the TMC may be asked to review instrument calibration status in accordance with the surveillance panel's findings.

Level 1:

- Calculate the instrument SA as follows and confirm the calculation with the TMC:

Sample Evaporation Loss:  $SA = (-Z_i) \times \text{Standard Deviation}$

Standard Deviation (D5800) = 0.73\*

\*Value utilized for standard deviation to be periodically reevaluated by the D02.B0.07 Volatility Surveillance Panel

- Exceed Industry EWMA of Standardized Test Result ( $Z_i$ )

Level 2:

- TMC informs the surveillance panel that the limit has been exceeded. The surveillance panel then investigates and pursues resolution of the alarm.

Level 1:

- The TMC investigates whether severity adjustments are adequately addressing the trend, investigates the possible causes, and communicates as appropriate with industry.