Sequence X Surveillance Panel Meeting Agenda/Minutes 11/20/19

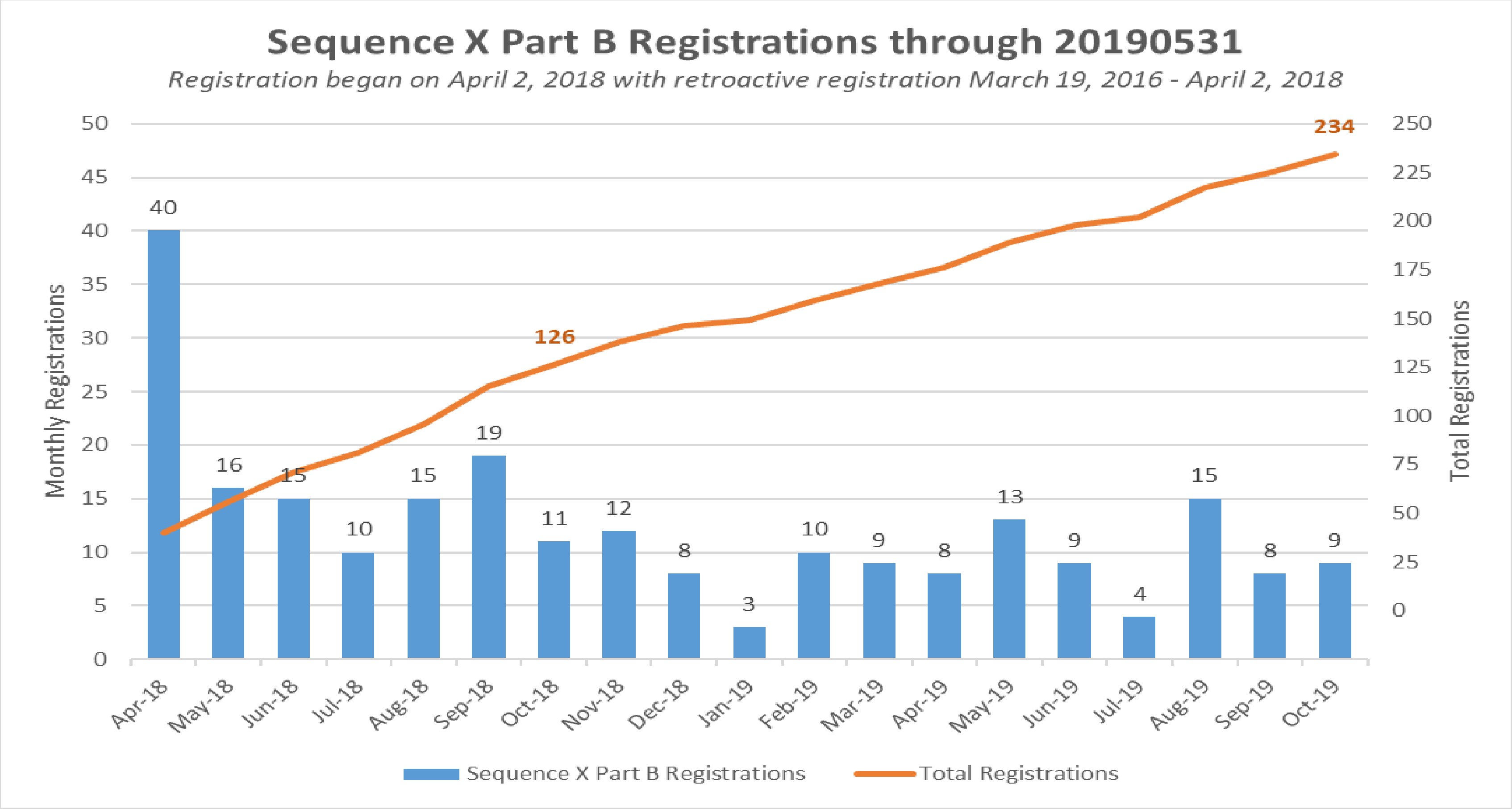
- Motion to accept the minutes from 06/19/19
  - Motioner: Al Lopez
  - Second: Christian
  - Vote: Passed with no negatives
- Dual Purpose Stand for Aging Oil E-ballot
    - E-ballot Closed on 10/07/19 with no negatives
    - TMC Memorandum 19-043
    - Dual Purpose Stand for Oil aging and Calibrated CW
- Test Status / Candidate Activity / TMC Report
- Blowby Measurement – Christine Eickstead
- Procedure Updates – George Szappanos
- Dual Calibration Proposal – George Szappanos
- Report to B – ASTM Number D8279
- Next meeting December 4th – Task force to review CAN data and Dual Calibration proposal

Sequence X
Ford Chainwear Test
Presentation to Subcommittee D02.B

December 9, 2019

Prepared By: Alfonso Lopez, S.P. Chairman

Sequence X S.P. Report
Candidate Test Activity



Sequence X TMC Activity

April 2019 to September 30, 2019

Summary of Calibration Activities Since October 2018

- 5 results from 2 labs, all resulted in calibration
- Precision in line with historic levels
- Industry Control charts show test in control.
- Sufficient quantities of reference oils available for the foreseeable future.

Sequence X Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	6
Statistically Unacceptable Calibration Test	OC	1
Aborted Calibration Test	XC	2
Total Number of Tests		**9**

Sequence X - Failed Tests

Test Status	Number of Tests
CHST Ei Level 3 alarm	1
Total	**1**

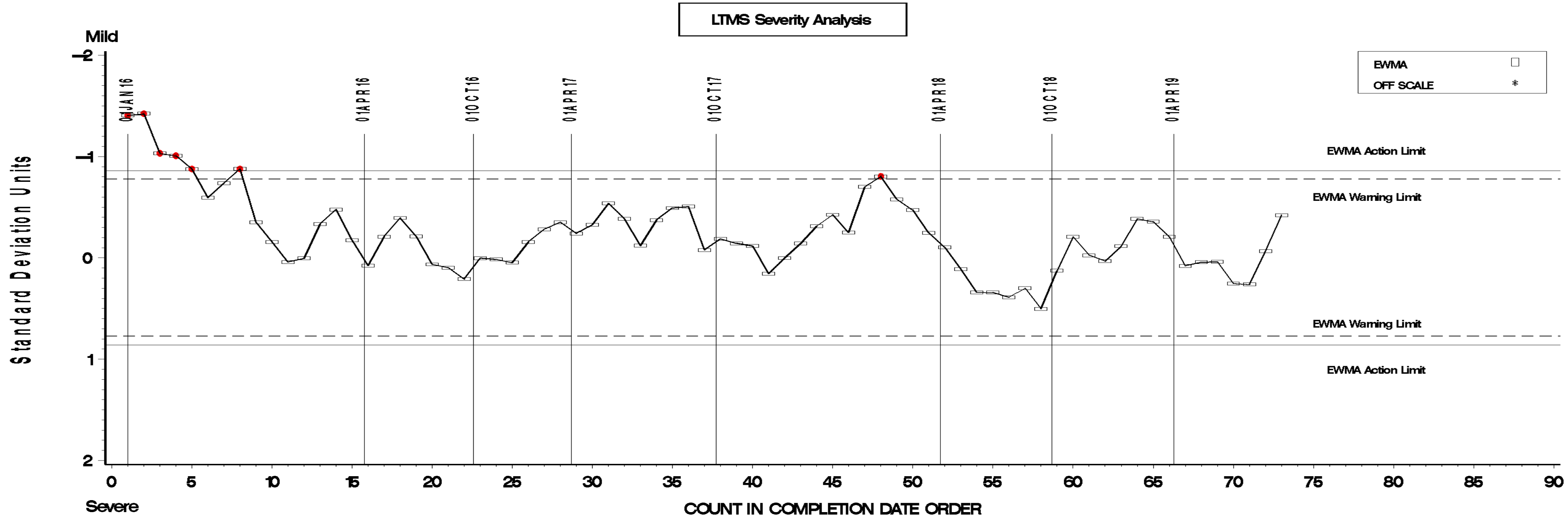
Sequence X - Lost Tests*

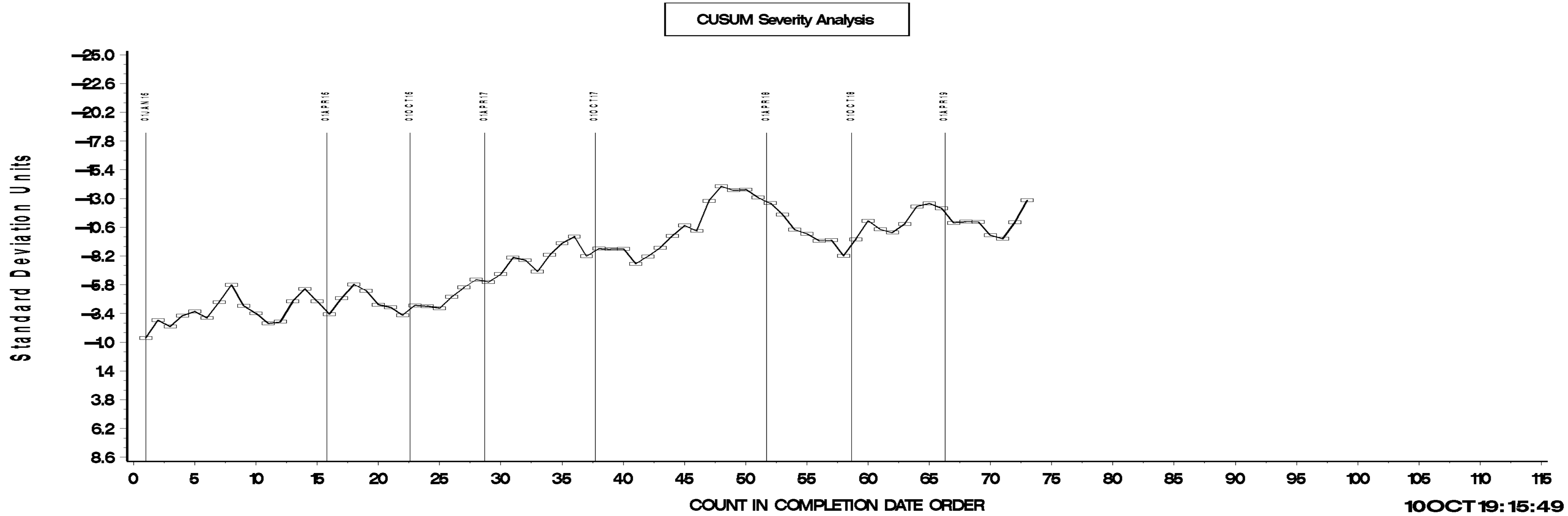
Test Status	Cause	#
Aborted	Oil Loss due to Venting	1
Aborted	Oil loss during rework	1
Totals		2

*Invalid and aborted tests

SEQUENCE X INDUSTRY OPERATIONALLY VALID DATA

END OF TEST CHAIN WEAR FINAL RESULT





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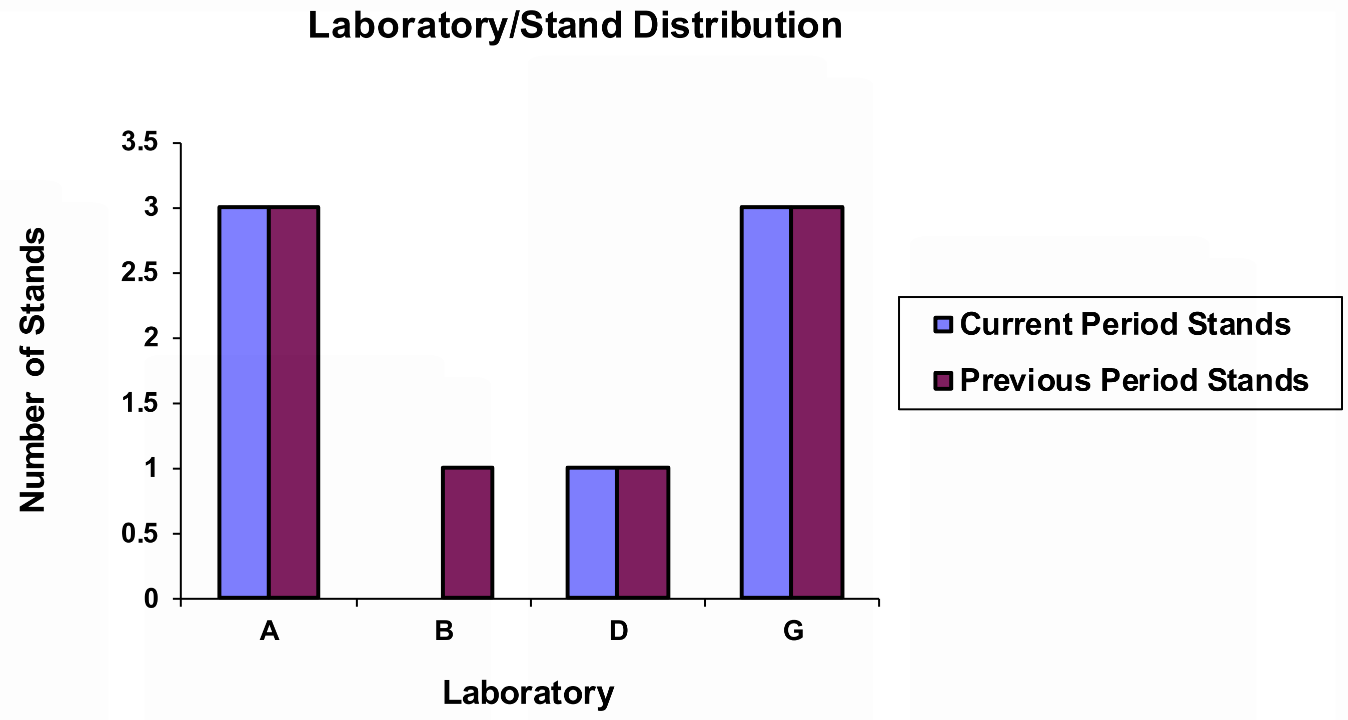
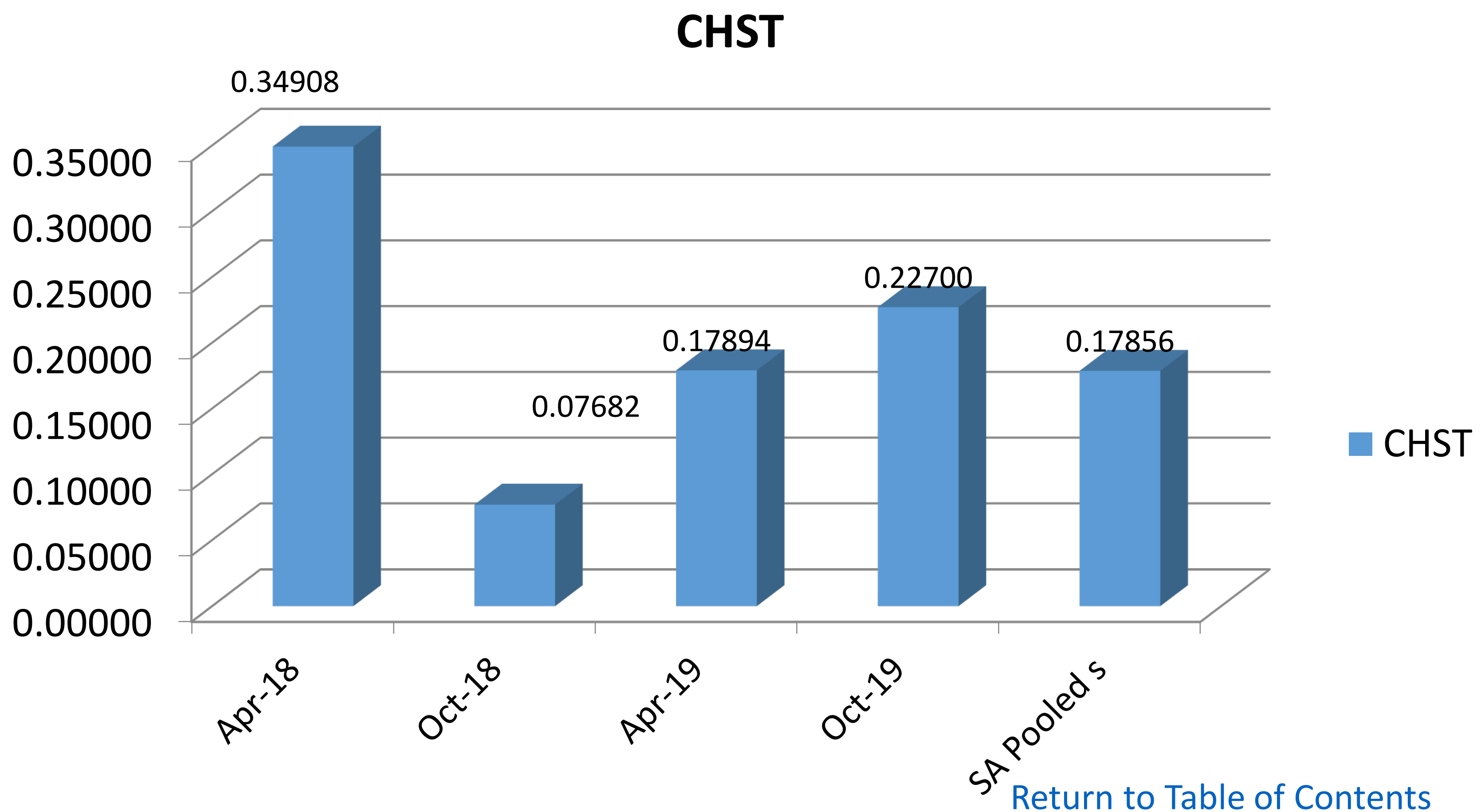
Sequence X S.P. Report

LTMS Laboratory/Stand Distribution

	Reporting Data	Calibrated as of 9/30/19
Number of Laboratories	3	3
Number of Stands	7	7



Sequence X Precision Estimates



Return to Table of Contents

Sequence X S.P. Report
Reference Oils Status

- 271 SAE 5W-30 passing reference oil (5yr)
- 1011 SAE 0W-16 (1yr)
- 270 SAE 5W-30 failing reference oil (5yr)

Blowby Measurement Procedure – Christine Eickstead

8.26.2.1 **<u>When using the cart apparatus</u>**, maintain crankcase pressure during operation of the system at 0.0 Pa +/- 25 Pa to minimize the potential for crankcase leakage.

8.26.2 The measurement system routes the blowby into the atmosphere through an external, sharp-edged orifice in the case of the cart apparatus or through a J-TEC flowmeter VF563AA.[42,7]

8.26.2.1 Maintain crankcase pressure during operation of the system at 0.0 Pa ± 25 Pa to minimize the potential for crankcase leakage.

8.26.2.2 Mount the orifice plate or the J-TEC flowmeter in a vertical position.

8.26.2.3 In the case of the cart system:

Procedure Changes – George Szappanos

- Motion to accept changes to the procedure as indicated in attachment file (CWT procedure revisions 11-20-19.pdf)
  - Motion Made by George Szappanos, Seconded by Al Lopez, passed with no objections. Effective 10/20/19
  - CAN data collection was removed for the motion list. Further discussion is needed to implement any CAN data collection and implementation into the data dictionary. The Sequence X task force will take this as an action item.

Dual Calibration

- See Attachment file (Ford 2L multicalibration proposal.pdf)
- George Szappanos decided to postpone the discussion for a meeting on the 4th of December.

Sequence X History

Sequence X Milestones	
1/1/2012	**Start of Chain Wear Test Development**
12/7/2017	**AOAP Approval for GF6**
4/2/2018	**Live Registration (03/19/16 – 04/02/18 Retro - Registration)**
2/20/2019	**Surveillance Panel Procedure Acceptance Vote**
4/4/2019	**Subcommittee B Ballot**
6/16/2019	**Main Committee D02 Ballot - ASTM Procedure D8279**
11/07/19	**Memorandum 19-043 Use of Sequence x Stand to Generate Used Oil Samples for Seq IX (LSPI) est**

Attendance List

Sequence X Surveillance Panel Meeting

Novenber 20, 2019

	Attendance
Porter, Christian <Christian.Porter@AftonChemical.com>	y
OMalley, Kevin <Kevin.OMalley@lubrizol.com>	
Rieth, Ryan <Ryan.Rieth@Infineum.com>	
Todd Dvorak <Todd.Dvorak@AftonChemical.com>	
Martin Chadwick Intertek <martin.chadwick@intertek.com>	
Dan Lanctot <DLanctot@tei-net.com>	y
Romano, Ron (R.) <rromano@ford.com>	y
Jason Bowden <jhbowden@OHTech.com>	
'Rich Grundza' (reg@astmtmc.cmu.edu)	y
Mahboob.Hosseini@chevron.com	
Jason Soto Intertek <jason.soto@intertek.com>	y
doyle.boese@infineum.com	y
Martinez, Jo G. (jogm) <JoMartinez@chevron.com>	y
J.Hsu@shell.com	
Gleason, Joseph <Joseph.Gleason@lubrizol.com>	
Dingwell, Lisa (Lisa.Dingwell@AftonChemical.com)	
Kostan, Travis G. <travis.kostan@swri.org>	y
ptumati@jhaltermann.com	y
Salvi, Luca <luca.salvi@exxonmobil.com>	
doug.deckman@exxonmobil.com	
'Chris Castanien (Chris.Castanien@nesteoil.com)'	
Jim Linden <lindenjim@hotmail.com>	
Overaker, Mark <mhoveraker@jhaltermann.com>	
Charlie Leverett <charlie.leverett@yahoo.com>	y
Amol C Savant <ACSavant@valvoline.com>	
Eickstead, Christine M. <christine.eickstead@swri.org>	
Brys, Jerome <Jerome.Brys@lubrizol.com>	
Salvesen, Clifford R <clifford.r.salvesen@exxonmobil.com>	y
'Bob.Campbell@aftonchemical.com'	
Patrick M. Lang <patrick.lang@swri.org>	
Stockwell, Robert T (Robert.Stockwell@chevron.com)	
Bill Buscher Intertek <william.buscher@intertek.com>	
Ritchie, Andrew <Andrew.Ritchie@Infineum.com>	
Rais, Khaled <khaled.rais@swri.org>	
Stevens, Andrew <Andrew.Stevens@Lubrizol.com>	
Matthews, Tim <Tim.Matthews@uk.bp.com>	
Terry Bates <batesterryw@aol.com>	
Lopez, Alfonso <al.lopez@intertek.com>	y
Deegan, Michael (M.D.) <mdeegan@ford.com>	
Lochte, Michael D. <michael.lochte@swri.org>	
joshua cooley valvoline	
George Szappanos	y

Seq X (CWT) ASTM D8279

Suggested test procedure revisions

11/20/2019

1. Driveshaft specification

- The shaft identified is specific to only a single supplier.
- LSPI procedure includes functional specification regarding stiffness, and allows flexibility in length (17-1/2” to 31”); the length of the currently specified shaft is 22”
- MSI has stated that the difference in torsional stiffness in the length range is negligible
- Motion: adopt the wording of the LSPI test procedure section 7.6.5 for section 6.8.2 of the CWT procedure (450 to 790 mm)

<u>CWT</u>

6.8 *Driveline:*

6.8.1 Use the flywheel, clutch, pressure plate, bell housing, and clutch spacer listed in Table A5.7 (see also X1.24).

6.8.2 Use the driveshaft listed in Table A5.7.

TABLE A5.7 Special Parts List

Part Number[A,B]	Description
OHTVH-002-1	PAN, OIL MODIFIED, ASSY. (INCLUDING DIPST
VH002-2	TUBE, PICK UP
OHTVH-005-1	HOUSING, FLYWHEEL
M-6026-23BSBP	Ford Racing Balance Shaft Delete Kit
MSI-41/55S-22	MSI Driveshaft

[A] OHT denotes OH Technologies, 9300 Progress Pkwy., Mentor, OH 44060.
[B] MSI denotes Machine Services Inc., 1000 Ashwaubenon St., Green Bay, WI 54304.

<u>LSPI</u>

7.6.5 *Driveline*—Grease the driveline every test. The driveline specifications are as follows:

a) Driveline angle degree: 1.5° ± 0.5°;

b) Installed length from flange to flange: 450 mm to 610 mm;

c) 1410 series flanges; 1550 joints;

d) Driveshaft stiffness: 0.1° to 0.3°/136 N•m (100 ft•lbf). Part number MSI-41/55S-22 from Machine Services Inc. has been found to be a suitable driveshaft.

2. Engine oil temperature parameter

- Oil temperature gallery is identified as "Engine-Oil Inlet" in section 8.23.2.3
- All other references to this temperature are "oil gallery" (11 instances)
- Motion: change 8.23.2.3 to *Engine – Oil Gallery*

8.23.2.3 *Engine-Oil Inlet*—Install the tip of the sensor at the center of the flow stream in the external oil-filter adapter (see Fig. A9.16) through the hole for the oil-pressure switch (not used). Install a tee to accept this temperature sensor and attach the oil-pressure line.

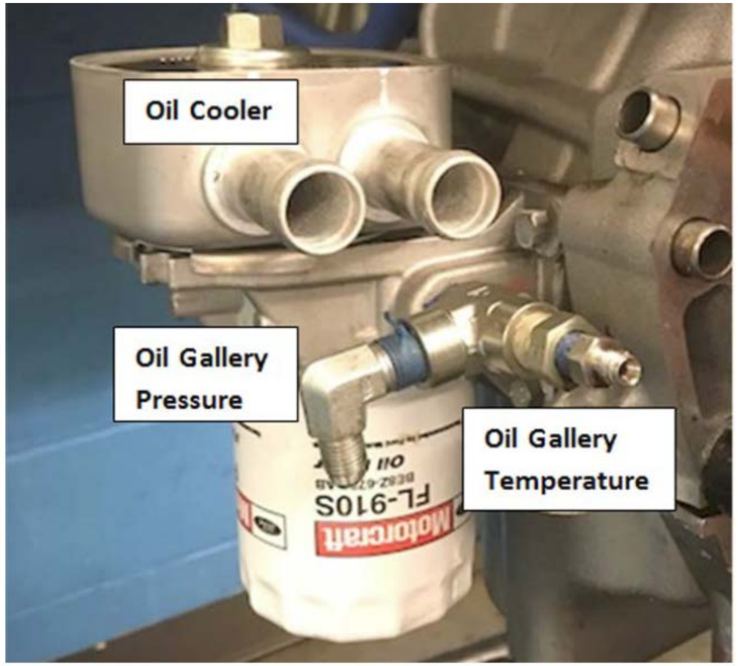


FIG. A9.16 Oil Cooler Showing Temperature and Pressure Measurement Locations

3. Fuel temperature

- Fuel temp is not controlled. Table 3 shows fuel temperature as controlled.
- Section 8.22.3.4 states "Maintain the fuel temperature to the fuel rail below 50°C". (note, there is no setpoint in the procedure)
- Motion: remove fuel temp from Table 3 (but added to non-controlled parameters)

	Parameter	Units	QI Threshold	EOT QI	Target		
					Stage 1	Stage 2	S
Controlled Parameters	Speed	r/min	0.000	QRPM	1550	2500	
	Torque	N·m	0.000	QTORQUE	50	128	AT
	Oil Gallery	°C	0.000	QOILIN	50	100	A
	Coolant Out	°C	0.000	QCOOLOH	45	85	AC
	Coolant System	kPa	0.000	QCOOLPR	70	70	AC
	Blowby Outlet Temperature	°C			23	78	AI
	Engine Coolant Flow	L/min	0.000	QENGFLO	40	70	AI
	Intake Air Humidity	g/kg	0.000	QAIRHUM	11.4	11.4	AA
	Intake Air Pressure	kPa	0.000	QINAIRP	0.05	0.05	A
	Exhaust Back Pressure	kPa	0.000	QEXHBP	104	107	A
	Intake Air Temperature	°C	0.000	QINAIRT	32	32	A
	Air Charge Temperature	°C	0.000	QAIRCHT	30	30	A
	Lambda	λ	0.000	QLAMBDA	0.78	1	AI

	Parameter	Units	Target		
			Stage 1	Stage 2	St
Non-controlled Parameters	Ambient Cell	°C	27	27	CEL
	Fuel Flow	kg/h	Record	Record	AFU
	Ignition Voltage	V	13	13	AIG

TABLE 3 Parameter Logging

Test Point	Units
Controlled	
Engine speed	r/min
Engine torque	N·m
Coolant-out temperature	°C
Oil-gallery temperature	°C
Air-charge temperature	°C
Inlet-air temperature	°C
Inlet-air pressure (gauge)	kPa
Exhaust back pressure (absolute)	kPa
Fuel temperature	°C
Humidity	g/kg

8.22.3.3 Deliver the fuel to a high-pressure, engine-driven pump that boosts the pressure and supplies the fuel to the fuel rail.

8.22.3.4 Maintain the fuel temperature to the fuel rail below 50 °C.

8.22.3.5 To ensure good supply to the high-pressure fuel pump, maintain the fuel pressure to the fuel pump above

4. Blowby system coolant flowrate (1)

- Section 8.25.2.2 describes the measurement of the blowby system coolant flowrate. There is no specification on the rate and flow is not controlled.
- Measurement of heat exchanger flow offers questionable value in the interpretation or validation of test results.
- Motion: Section 8.25.2.2 to be removed, and blowby heat exchanger coolant flowrate removed from Table 3

8.25.2.2 *Blowby Heat Exchanger Coolant*—Measure the total volumetric coolant flowrate through the blowby heat exchanger system as shown in Fig. A9.11. A suitable heat

Monitored	
Fuel flowrate	kg/h
Manifold absolute pressure (MAP)	kPa
Boost pressure (absolute)	kPa
Barometric pressure (absolute)	kPa
Oil-gallery pressure (gauge)	kPa
Oil-head pressure (gauge)	kPa
Oil-filter-in temperature	°C
Exhaust temperature	°C
Crankcase pressure (gauge)	kPa
Fuel pressure (gauge)	kPa
Power	kW
Pre-intercooler air pressure (absolute)	kPa
Ambient temperature	°C
Coolant-in temperature	°C
Coolant pressure (gauge)	kPa
Coolant flowrate	L/m
Blowby heat exchanger coolant flowrate	L/m
Lambda (λ)	unitless

4. Blowby system coolant flowrate (2)

- Fig A9.18 showing the blowby cooling system shows a coolant circulation pump that does not correspond to a valid pump
- Motion: change wording of item (11) in FigA9.18 to “coolant circulation pump”;
- Labs are free to choose whatever pump allows them to achieve the required blowby temperatures

NOTE 1—Legend:
(1) Vented reservoir cap
(2) Coolant reservoir (fabricated)
(3) Pressure control valve (optional)
(4) Chilled process water control valve
(5) System heat exchanger
(6) F and P Co. flowrator tube, FF-1-35-G- 10/448D053U06
(7) CCV Heat Exchanger
(8) Inlet temperature sensor
(9) Flow control valve
(10) External heat source
(11) Electric coolant pump DAYTON 6K581A
(12) ABB Kent-Taylor flow element, 1330LZ08000-8375A

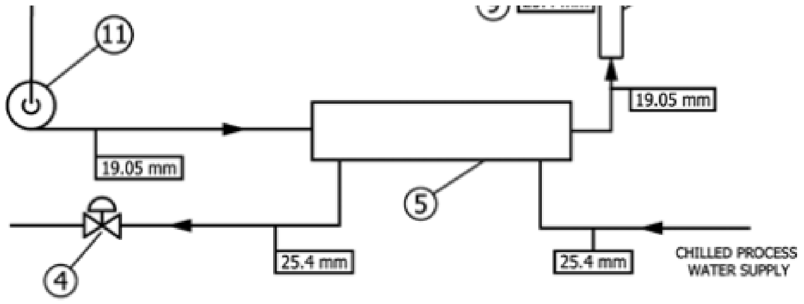


FIG. A9.18 Typical Characterized Control Valve (CCV) Heat Exchanger Heating and Cooling System

4. Blowby system coolant flowrate (3)

- Section 8.25.3.1 requires that the blowby heat exchanger flowrate be calibrated prior to a reference test.
- As a non-critical parameter, it is unnecessary to calibrate
- Motion: Section 8.25.3.1 should be removed.

8.25.3 *Calibration of Flowrate Devices:*

8.25.3.1 Calibrate the flow meters used in the measurement of fuel flowrate, the engine-coolant flowrate and blowby heat exchanger coolant flowrate prior to a reference oil test. Calibrate as installed in the system at the test stand with the test fluid. Calibrate with a turbine flow meter or by a volume/time method at Stage 1 and 2 operating conditions.

5. Corrections: Hose length (1)

- 20" = 50.8 cm
- Motion: Section 8.26.1.1 (b) length should be 50.8 cm (not 5.8)

(b) The hose used to connect the valve cover vent port to the heat exchanger shall have ID of ¾ in. with a length of 5.8 cm ± 7.6 cm (20 in. ± 3 in.). No part of this hose shall be lower than the valve cover vent, and there shall be no sags or dips in the hose that can retain fluid.

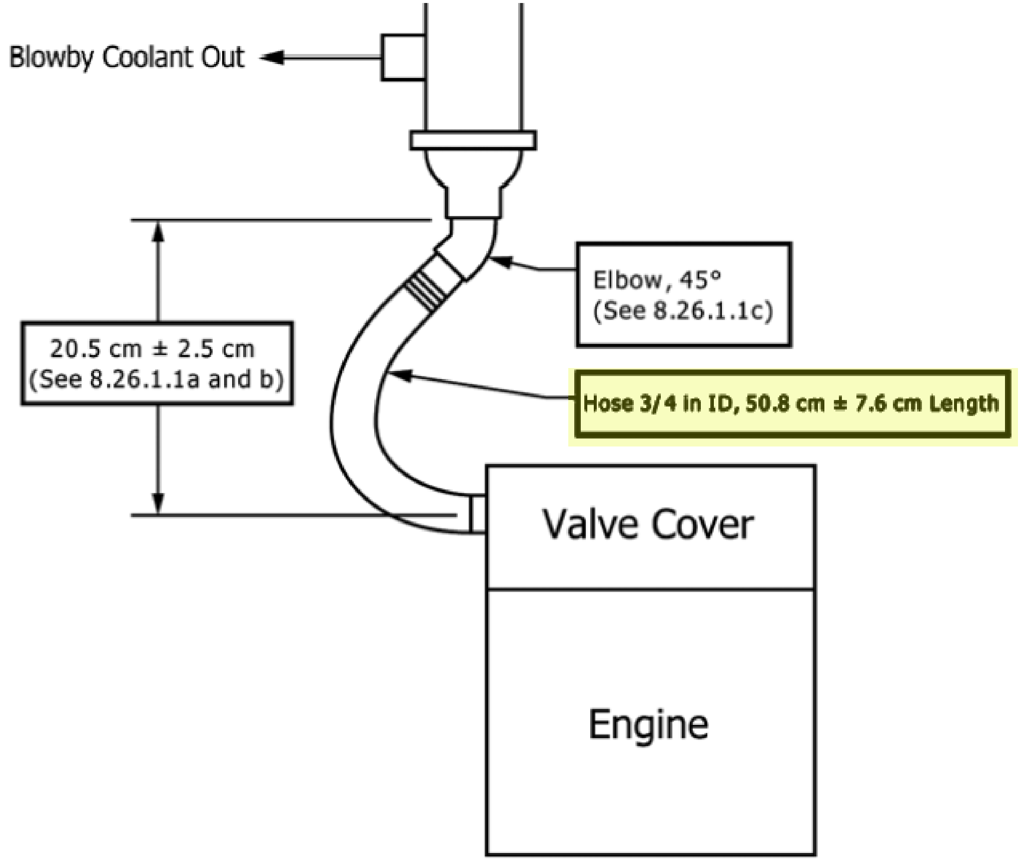


FIG. 4 Crankcase Ventilation System and Blowby Conditioning Critical Dimensions

5. Corrections: Blowby temp ramp (2)

- Fig A9.28 blowby temperature ramp charts should be in minutes, not seconds.
- Motion: change fig A9.28 to minutes

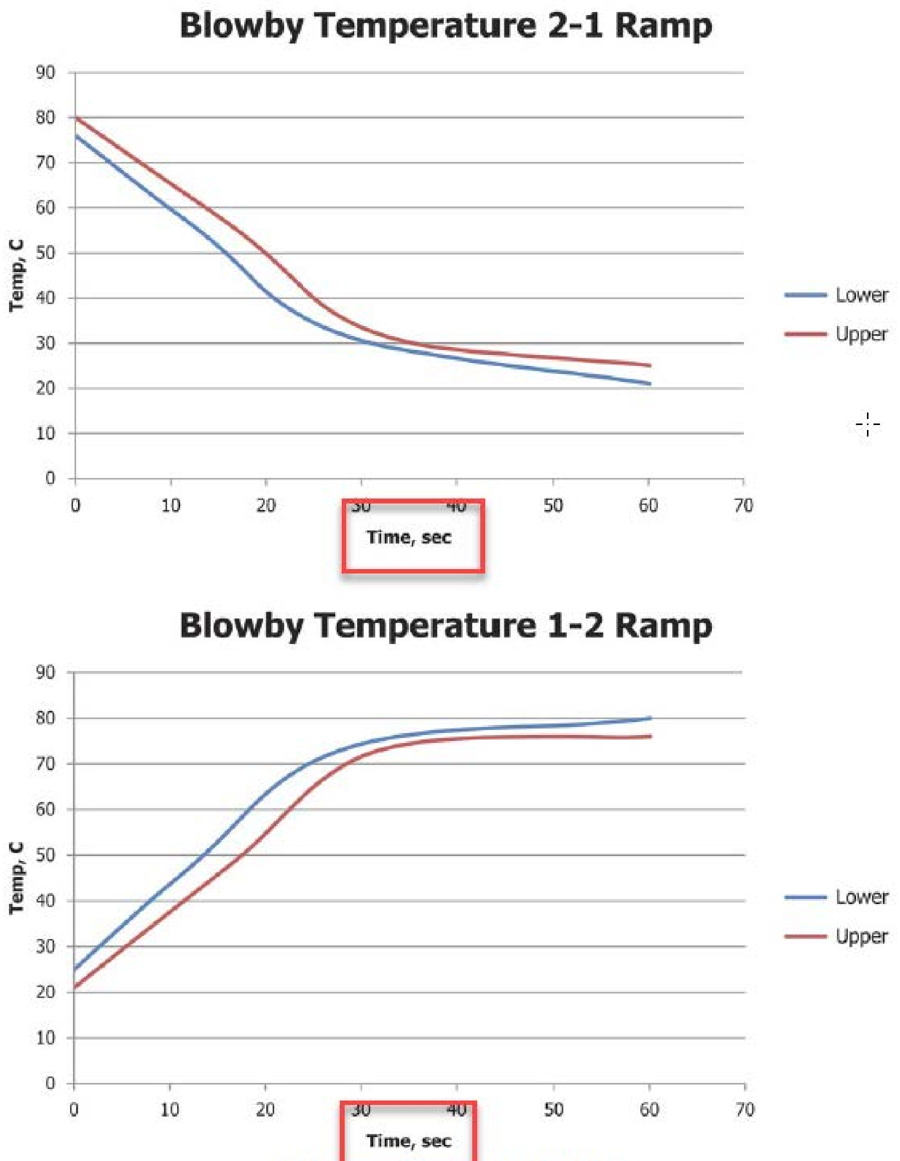


FIG. A9.28 Typical Blowby Temperature Ramps

TABLE 7 Stages Order and Ramp Description

Stage 1 to 2 blowby temperature ramp	Ramp from 23 °C to 73 °C: Reach 49 °C by 15 min ± 2 min, reach 73 °C by 30 min ± 2 min. Ramp from 73 °C to 78 °C: reach 78 °C ± 2 °C by 60 min. (30 min of this ramp is run during Stage 2.)
Stage 2 to 1 blowby temperature ramp	Reach 55 °C by 15 min ± 2 min. Reach 32 °C by 30 min ± 2 min. Reach 23 °C ± 2 °C by 60 min. (30 min of this ramp is run during Stage 1.)

5. Corrections: Qi values (3)

- Table A10.2 includes several typos
- Motion: correct Table A10.2 typos

Stage 1 and 2 should be reversed

Stage 1 and 2 (not 3) should be reversed

Stage 2 should be 126 and 130 (128±2 from Table 2)

TABLE A10.2 L and U Constants and Over- and Under-Range Values

Quantity, unit	Stages	L	U	Over-Range	Under-Range
Coolant flowrate, L/min	1	38	42	267	0
	2	68	72	267	0
Coolant-out temperature, °C	1	84.5	85.5	134	0
	2	45.5	44.5	134	0
Exhaust back pressure, kPa	1	102	106	304	0
	2	105	109	304	0
Humidity, g/kg	1, 2	10.4	12.4	109.9	0
Inlet-air pressure, kPa	1, 2	0.03	0.07	2	−1.9
Inlet-air temperature, °C	1, 2	31.5	32.5	81.2	0
Oil gallery temperature, °C	1	99.5	100.5	149.2	0.8
	2	49.5	50.5	149.2	0.8
Engine speed, r/min	1	2505	2495	2992	1058
	3	1555	1545	2992	1058
Torque, N·m	1	48	52	325	0
	2	128	132	325	0
Coolant pressure, kPa	1, 2	68	72	267	0
Air-charge temperature	1, 2	29.5	30.5	79.2	0
Lambda	1	0.73	0.83	5.9	0
	2	0.95	1.05	5.9	0

6. Chain elongation terminology

- Technically speaking, "stretch" refers to plastic deformation (movement of material). In the case of the chain wear test, it is wear (material removal) that causes the chain to become longer.
- (note, the term stretch is not used anywhere in the procedure)
- Motion: "stretch" should be replaced with "elongation" in form 4 of the Test Report.

Pass/Fail Results

PARAMETER	% Change
End of Test Chain Stretch	EOTCHAIN
Transformed End of Test Chain Stretch	TEOTCHST
End of Test Chain Stretch, Industry Correction Factor	CHAIN_CF
Transformed Corrected Test Chain Stretch	CHAINCOR
End of Test Chain Stretch, Laboratory SA	CHAIN_SA
Final Transformed Result	TCHAINFL
End of Test Chain Stretch, Final Result	CHAINFNL

7. Parameters to add

- There are 3 temperatures, 8 pressures, ~~and 16 CAN parameters~~ defined in the procedure that are not reported or included in the data dictionary.
- Listed on following slide
- Motion: add fields for the 11 missing analog (non CAN) parameters to Seq X data dictionary and test report form 5 as non-controlled parameters.
- Motion: remove "Target" columns from non-controlled parameter table (the target values are not identified as such in the procedure)

	Parameter	Units	QI Threshold	EOT QI	Target		
					Stage 1	Stage 2	S
Controlled Parameters	Speed	r/min	0.000	QRPM	1550	2500	A
	Torque	N·m	0.000	QTORQUE	50	128	AT
	Oil Gallery	°C	0.000	QOILIN	50	100	A
	Coolant Out	°C	0.000	QCOOLO	45	85	AC
	Coolant System	kPa	0.000	QCOOLP	70	70	AC
	Blowby Outlet Temperature	°C			23	78	AB
	Engine Coolant Flow	L/min	0.000	QENGFLO	40	70	AE
	Intake Air Humidity	g/kg	0.000	QAIRHUM	11.4	11.4	AA
	Intake Air Pressure	kPa	0.000	QINAIRP	0.05	0.05	AI
	Exhaust Back Pressure	kPa	0.000	QEXHBP	104	107	AE
	Intake Air Temperature	°C	0.000	QINAIRT	32	32	AI
	Air Charge Temperature	°C	0.000	QAIRCHT	30	30	AA
	Lambda	λ	0.000	QLAMBD	0.78	1	AL

	Parameter	Units	Target		
			Stage 1	Stage 2	Sta
Non-controlled Parameters	Ambient Cell	°C	27	27	CELA
	Fuel Flow	kg/h	Record	Record	AFUE
	Ignition Voltage	V	13	13	AIGN

7. Parameters to add

Monitored	**PCM CAN BUS Channels**
Manifold absolute pressure (MAP) kPa	~~Ignition timing advance for #1 cylinder ° CA~~
Boost pressure (absolute) kPa	~~Absolute throttle position %~~
Barometric pressure (absolute) kPa	~~Engine-coolant temperature °C~~
Oil-gallery pressure (gauge) kPa	~~Inlet-air temperature °C~~
Oil-head pressure (gauge) kPa	~~Equivalence ratio (lambda) unitless~~
Oil-filter-in temperature °C	~~Absolute torque value %~~
Exhaust temperature °C	~~Intake-manifold absolute pressure kPa~~
Crankcase pressure (gauge) kPa	~~Fuel-rail pressure (gauge) kPa~~
Fuel pressure (gauge) kPa	~~Accelerator pedal position %~~
Fuel temperature °C	~~Boost absolute pressure – raw value kPa~~
~~Power kW (controlled, via torque and speed)~~	~~Turbocharger wastegate duty cycle %~~
Pre-intercooler air pressure (absolute) kPa	~~Actual Intake (A) camshaft position °~~
Coolant-in temperature °C	~~Actual exhaust (B) camshaft position °~~
~~Coolant pressure (gauge) kPa (controlled)~~	~~Intake (A) camshaft position actuator duty cycle %~~
~~Coolant flowrate L/m (controlled)~~	~~Exhaust (B) camshaft position actuator duty cycle %~~
~~Blowby heat exchanger coolant flowrate L/m~~	~~Charge air cooler temperature °C~~
~~Lambda (λ) unitless (controlled)~~	

Section 8.22

- Reconcile 8.21.14.3 and 8.24.2.8, and diagram

8.22.14.1 Intercooler Tubing

(1) Fabricate the intake air system with 51 mm ID stainless steel tubing from the turbocharger to the intercooler and 64 mm ID stainless steel tubing from the intercooler to the throttle body.

(2) The tubing length is not specified but should be the appropriate length to achieve the required air charge temperature and system pressure loss.

(3) Locate the MAPT sensor 305 mm ± 25 mm from the intake surface of the throttle body and the intake air charge temperature thermocouple 25 mm downstream from the MAPT sensor.

(4) The post-intercooler turbo boost pressure measurement probe should be placed a minimum of ~~25.4~~ 305 mm (12 in.) upstream from the MAPT sensor.

(5) The pre- intercooler turbo boost pressure measurement probe should be placed a minimum of ~~25.4~~ 130 mm (~~12~~ 5 in.) downstream from the turbocharger outlet.

(6) Typical installation is shown in Fig. 12, the measurements can be seen in Fig. A2.13.

JTEC blowby measurement

- Remove requirement to set 0 Pa crankcase pressure

Multi-test calibration for Ford 2.0L Ecoboost tests

Proposal to allow simultaneous calibration status on a single test stand for LSPI, Cam Chain Wear, and LSPI Oil Aging test

11/15/2019

George Szappanos, Lubrizol

Differences in 2.0L Ford test types

	Chain wear test	LSPI test	LPSI oil aging
Engine	**modified to provide high blowby**	**modified to accept cyl press transducers**	**CWT build, stock pan**
Unique stand equipment	Temperature controlled blowby	Cylinder pressure analysis equipment	None
Test duration, hrs	216	20	72
Engine life	One per test	Flush and run test; 500+ hrs	
Calibration requirement, new stand	2 tests	2 tests	
Calibration requirement, new engine	None	2 tests	
Calibration period, # tests	15	5	
Calibration period, days	180	90	
Instrument calibration frequency	Every reference test	Every 3 months	
Calibration requirement if engine is removed (LTMS)	Non-applicable	**2 tests**	Non-applicable
Test numbering	Stand# - runs on calibration - **runs on stand**	Stand# **- runs on stand** – engine# - runs on engine	Stand# - runs on calibration **- runs on stand**

Motivation

- Improve the versatility and stand utilization efficiency
- Some test types are more heavily needed than others (while others sit idle)
- In the case of the Ford 2L, three different test types can be accommodated with little difference in configuration

Fundamental concerns with test swapping

General test severity concern	resolution
Test severity change due to **instrumentation / measurement drift**	Addressed by defining a reasonable time-based instrumentation calibration interval or checking critical instrumentation prior to test start (ex: load cell)
Switching between test types introduces opportunities for **configuration error**	Addressed by sufficiently capturing operational data that validates correct test operation
Test severity change due to **engine removal and re-installation** (LSPI)	Addressed by requiring a calibration test after re-installation.

Precedents

- Seq IIIF and IIIG
  - Slightly different engine build
  - Different load, oil temperature, and test duration
- Seq VG and VH
  - Different engine hardware, and fuel
- HDD: Cat 1K & 1N
  - Different fuel

} no re-calibration required when switching between test types

- Chain Wear Test and LOA (LSPI oil aging) – can share same stand and running LOA does not impact calibration status of CWT (mem19-043.reg.pdf)
- LSPI test - engines could be removed and reinstalled, and stand recalibrated with a single test, for purpose of evaluating BC pistons (mem19-024.reg.pdf)

Proposal

- Each test type has its own numbering system and does not change the test number count for the others (and thus does not reduce available candidate test count).
- When swapping to LSPI test type, the most recently calibrated engine may be reinstalled with <u>1 reference test</u>; The calibration period is defined as currently (90 days). Otherwise, a minimum of two are required.
- When swapping to CWT or LOA test type, <u>no re-calibration is required</u> as long as the respective calibration period has not expired.

Necessary procedure and LTMS revisions…

- modifications in following slides
- additions or modifications are highlighted in yellow

Stand mods, section 9.4, CWT (and LOA)

- 9.4 *Stand Modification and Calibration Status*—Stand calibration status will be invalidated by conducting any nonstandard test or modification of the test and control systems, or both. A non-standard test is any test conducted under a modified procedure, or using non-procedural hardware, or using controller-set-point modifications, or any combination thereof. Any such changes terminate the current calibration period. A reference test is required before restarting the current calibration period (see A2.2.2). If changes are contemplated, contact the TMC beforehand to ascertain the effect on the calibration status. Exempt are standard test types that are currently calibrated on the stand.

The implication is that only the Ford 2.0L based engine tests would ever successfully calibrate on a single test stand.

The legitimacy of the stand remains protected because modifications to the stand are restricted following successful calibration.

Stand mods, Section 10.4, LSPI

- 10.4 *Test Stand Modifications*—A nonstandard test includes any test completed under a modified procedure requiring hardware or controller modifications to the test stand. The TMC determines whether another calibration test is necessary after the modifications have been completed.
- 10.5.3 Re-reference the engine once removed from the test stand and re-installed, even if the test number and time criteria are met by the engine.

Since a calibration test is required based on this proposal, this requirement does not need modification.

Test Numbering System

Seq IX, 10.5.1 *Acceptable Tests*—The test number shall follow the format *AAA-BB-CCCC-DDD* where *AAA* represents the test stand number, *BB* represents the number of Sequence IX tests on the stand, *CCCC* represents the engine number, and *DDD* represents of tests on the engine.

Seq X, 9.5.1 *Test-Numbering System*—The test number shall follow the format AAA-BB-CCC where *AAA* represents the test stand number, *BB* represents the number of tests since last reference, and *CCC* represents the total number of Sequence X tests on the stand.

This is the convention used in Seq IIIF and IIIG ASTM procedures. LOA would follow equivalent wording.

appendix 2.2.2 amendment

- A2.2.2 Test Stands Used for Non-Standard Tests—If a non-standard test is conducted on a previously calibrated test stand, the laboratory shall conduct a reference oil test on that stand to demonstrate that it continues to be calibrated, prior to running standard tests.
- A2.2.3 Test Stands Used for multi-calibrated Tests - Once calibrated on a particular test type, candidate testing is permitted if the maximum number of tests of that test type have not been exceeded, and the calibration period has not expired.

This addition clears up any ambiguity between calibrated-standard and non-standard tests.

Seq IX LTMS, Removal of Test Stand~~/Engines~~ from the **System**

The laboratory must notify the TMC and the ACC Monitoring Agency when removing a stand~~/engine~~ from the system. No reference oil data shall be removed from the control charts from test stand~~/engine~~ that have been used for registered candidate oil testing. Reintroduction of a stand~~/engine~~ into the system requires completion of new stand/engine acceptance requirements [two tests]. In all instances of stand~~/engine~~ removal, stand~~/engine~~ renumbering can occur only if the stand~~/engine~~ undergoes a significant rebuild, as agreed upon by the laboratory and the TMC.

Engine removal and reinstallation is covered by section 10.4 of the Seq IX procedure. The LTMS is revised to specifically address the maintenance of control chart data and test numbering that are specific to the stand.