Minutes of the Sequence VIF Task Force teleconference call

August 27, 2015 14:00 CDT

Chairman Dan Worcester opened the meeting with some general comments as to the scope of the Task Force and that this group is replacing the group which Charlie Leverett chaired. The goal of the group is to define the Sequence VIF test, a test similar to the Sequence VIE with lower operating temperatures for engine coolant and oil gallery during Stages 1, 3, 4 & 6. Temperatures are reduced by 15° C. The group is to look at the options for testing and meet weekly.

The meeting started with a review of the Toyota presentation, slightly modified for this meeting from the original presentation made to the Sequence VI SP. Several members expressed concern with running two matrices concurrently, the VIE and the VIF. The two independent labs are working on adjusting stand availability to accommodate. Much discussion was centered about the choice of the three oils for the Sense Check and Matrix testing. Slide 9 of the Toyota presentation details their assessment of oil selection. Oils not currently in use by the TMC will have to go through there for distribution to the labs. TMC oils 1011 and 542-2 are readily available. There will be a re-blend of 542 forthcoming but will probably not be available for the VIF testing. The group agreed that oils 1011 and 542 would be used. Oil 400 (as designated in last winter's Toyota VID matrix), 0W-16, was proposed. It was questioned if oils 400 and 542 are from different suppliers. An Option 4 was proposed using oils 1011, 542 and 542 blended as a 0W-16. After much discussion, Option 4 was dismissed and a motion made.

Motion by Oronite: Proceed with Toyota Option 3 as detailed on Slide 9 of the presentation. Second by Toyota. Vote by organization was held. Affirmative 8, Negative 0, Waive 5. Motion carried.

TMC has requested Toyota put them in touch with supplier of oil 400 so it may be secured.

Having decided on the three oils, the discussion moved to Jo Martinez's a review of the Stats Group presentation. Following a review of the presentation, discussion centered on Slide 4 "Sense Check" testing. The testing proposed was using three oils in three engines with no replication. The Stats Group prefers an alternative shown on Slide 5 which would allow some replicate data; however, all three oils would not be tested in each engine. There was much discussion as to the desired outcome of the "Sense Check" testing. It was generally agreed that oil 400 should produce better results than oil 542. If not, perhaps a re-design would be warranted. The Stats Group questioned what measure of difference might be applied.

At this time, Task Force members were asked to try and determine within their organizations what level of differences in results would constitute a change in their opinion.

Having questions that the Task Force was unable to answer, Chairman Dan Worcester moved the meeting close and reconvene on Wednesday, September 2 at 08:00 CDT and every Wednesday thereafter to continue discussions. Meeting Adjourned at 15:25 CDT.

Respectfully submitted,

David L Glaenzer

Afton Chemical Corporation

Name	Affiliation	08/27/15	08/27/15 Vote on Option#3	09/02/15
Adrian Alfonso	Intertek	P	Y	
Amol C Savant	Ashland		Y	
Andrew Ritchie	Infineum	P	W	
Charlie Leverett	Intertek			
Chris Castanien	Nesteoil			
Cliff Salvensen	ExxonMobil	P		
Cole Hudson	SwRI	P	Y	
Dan Worcester Jr.	Chairman, SwRI	P		
David Glaenzer	Secretary, Afton Chemical	P	W	
Denny Gaal		P		
Doyle Boese	Infineum	P		
Eric Liu	SwRI	P		
Gordon Farnsworth	Infineum	P		
Jason Bowden	OH Technologies	P	W	
Jim Linden	Toyota	P	Y	
Jo Martinez	Chevron	P		
Kaustav Sinha	Chevron	P	Y	
Kevin OMalley	Lubrizol	P	Y	
Mark Mosher	ExxonMobil	P	Y	
Martin Chadwick	Intertek			
Matthew Bowden	OH Technologies	P		
Michael Conrad	Lubrizol	P		
Mike McMillan	Infineum	P		
Nathaniel Moles	Lubrizol	P		
Patrick Lang	SwRI			
Ray Burn	ExxonMobil	P		
Rich Grundza	ASTM Test Monitoring	P	W	
Robert Stockwell	Chevron			
Ron Romano	Ford Motor Company			
Satoshi Hirano	Toyota	P		
Teri Kowalski	Toyota	P		
Timothy Cushing	General Motors	P	Y	
Todd Dvorak	Afton Chemical	P		
Tracy King	Haltermann	P	W	
Valerie Lieu	Chevron	P		
William Buscher	Intertek	P		
			8-0-5	

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Proposal of Sequence VIF Development Plan

Prepared for
Sequence VIF Taskforce
August 27th, 2015
Toyota Motor Corporation

Current Status of Sequence VIE and VIF

TOYOTA

- It was decided that Sequence VIE would be proceeded to the Precision Matrix for ILSAC GF-6A
- Sequence VI Surveillance Panel decided to form a taskforce to develop Sequence VIF for ILSAC GF-6B
  - Dan Worcester of SwRI is new chair
- In order to proceed the Sequence VIF development to meet the ILSAC GF-6 introduction timing, the work should be started as soon as possible
  - Matrix Design to be finalized
  - REO Selection to be decided

Needs of Sequence VIF Test Development

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- To maintain ILSAC GF-6A and GF-6B Timing
  - Seq VIF Matrix needs to be completed in parallel to the Seq VIE Precision Matrix.
    - VIF matrix will provide data to establish the LTMS targets
- To Mitigate Shortage of Seq VID Availability
  - Ballot for the addition of VID for API SN/RC xW-16 is in process in the API LC.
  - Once approved, xW-16 test demand is certainly expected.
  - Need to establish equivalent P/F criteria in the new FE tests, i.e., Seq VIF for xW-16, and Seq VIE for xW-20 and xW-30.

Sequence VIF Test Development

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- Proposed Test Conditions
  - Oil and Coolant Temperatures at Stage 1, 3, 4, and 6 are 15°C lower than those of Sequence VIE
  - No Change in Aging Conditions

Sequence VIF

Test Stage	1	2	3	4	5	6
Speed, RPM	2000	2000	1500	695	695	695
Torque , Nm	105	105	105	20	20	40
Oil Temp, °C	**100**	65	**100**	**100**	35	**100**
Coolant Temp, °C	**94**	65	**94**	**94**	35	**94**
Stage Weighting (%)	30	3.2	31	17.4	1.1	17.2

Aging condition: 2250 RPM, 110 Nm, 120 °C

Sequence VIF Test Development

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- Project Plan
  - Utilize existing data and information as much as possible
    - Sequence VIE development data
    - Toyota Sequence VID Matrix work for 0W-16
    - Reference Oil
    - Etc.
  - Conduct the Seq VIF test development by the same methodology as the Seq VID test development
    - 30 test matrix to establish test conditions with minimum number of test laboratories and test stands
    - Additional REO tests at other test laboratories to enlarge the REO database to establish the LTMS target

Sequence VIF Test Development

TOYOTA

- Project Plan

	Description	Design	Test Laboratories	Sponsors
Step 1	Sense Check Runs	9 Tests with Latin Square (3 factors x 3 levels)	SwRI Intertek	Toyota + 2 companies
Analyze data and decide to proceed to the step 2 at Seq VI SP and TF				
Step 2	Remaining Runs of 30 Test Matrix	Complete matrix consists of step 1 and step 2	SwRI Intertek	Remaining 7 companies
Finalize test conditions and test procedure as Sequence VIF Establish engine hour correction equation				
Step 3	Enlarge REO database to establish LTMS target as industry	To be determined	Other test laboratories	Test laboratories
Analyze entire database and establish initial set of LTMS targets				

Sequence VIF Test Development

TOYOTA

- Proposed Matrix Design for Step 1 plus Step 2
  - 2 Laboratories
  - 2 Engines per Lab
  - 3 Reference Oils
  - Total 30 test runs
    - 10 Sponsors x 3 Tests / Sponsor = Total 30 Tests
  - Stepwise Execution
    - Step 1 : Sense Check Run with 9 tests (Latin Square Design)
    - Step 2 : Remaining Test to complete the Matrix
  - Test Sponsorship
    - 10 Companies plan to sponsor each 3 tests
    - Not based on the MOA funding

Sequence VIF Test Development

TOYOTA

- Proposed Matrix Design

Run	EOT Hour	Engine 11	Engine 21	Engine 12	Engine 22
1	350	TMC1011	Oil B (0W-16)	Oil C (0W-20)	TMC1011
2	550	Oil B (0W-16)	Oil C (0W-20)	TMC1011	Oil C (0W-20)
3	750	Oil C (0W-20)	TMC1011	Oil B (0W-16)	Oil B (0W-16)
4	950	Oil B (0W-16)	Oil C (0W-20)	TMC1011	Oil B (0W-16)
5	1150	TMC1011	Oil B (0W-16)	Oil B (0W-16)	Oil C (0W-20)
6	1350	Oil C (0W-20)	TMC1011	Oil C (0W-20)	TMC1011
7	1550	TMC1011	Oil C (0W-20)	TMC1011	Oil B (0W-16)
8	1750	Oil B (0W-16)		Oil C (0W-20)	

Sense Check Runs

Sequence VIF Test Development

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- REO Selection Options

	Oil A	Oil B (0W-16)	Oil C (0W-20)	Pros	Cons
Option 1	TMC1011 (Tech1 0W-16)	Oil 400 of VID Matrix	Oil 401 of VID Matrix	• Evaluate viscosity effect directly	• Only 2 technologies
Option 2	TMC1011	Oil 400	Oil 201	• 3 technologies • Expect more separation btwn B and C	• No direct viscosity comparison
Option 3	TMC1011	Oil 400	TMC542 (VID/VIE REO)	• 3 technologies • Better tie back to VID • Expect more separation btwn B and C • Compare VIE and VIF	• No direct viscosity comparison

Remarks :

a) Oil 400 showed best result in the Toyota VID matrix.
b) Oil 201 showed worse result than Oil 401 in the VID matrix, then can expect more separation between 0W-16 and 0W-20.
c) TMC542 has comparable level of VID target in LTMS.

-> Option 3 seems the best choice : Toyota's recommendation

Sequence VIF Test Development

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- Reference Info

	VID FEI Sum	VID FEI2	Source
TMC542 (0W-20)	2.29 (1.49 + 0.80)	0.80	LTMS (Aug-2015)
Oil 400 (0W-16)	2.87	1.51	Average of VID Matrix Data
Oil 401 (0W-20)	2.69	1.32	Average of VID Matrix Data
Oil 201 (0W-20)	2.60	0.96	Average of VID Matrix Data

Sequence VIF Test Development Action Plan

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	Action Item	Action by	Target Timing
1	Finalize the SP/TF proposal of the test plan to the AOAP and the PCEOCP for approval	Seq VI SP Seq VIF TF	Aug 25th Aug 27th
2	Report the proposal and ask approval at the AOAP and PCEOCP meetings (Circulate the material in advance)	Seq VI SP/VIF TF	September 10th
3	Blend and deliver REO samples to labs	Toyota / TF	Mid ~ Late Sept
4	Choose 3 sponsors for the sense check matrix (Toyota and other 2 companies)	Toyota / TF	Early Sept
5	Allocate test engines/stands for the VIF	TF / Labs	Early Sept ?
6	Process documentations to start testing (RFQ and Purchase Order)	Sponsors and Labs	Mid Sept
7	Execute the sense check tests	Labs / TF	Late Sept ~ Mid Oct
8	Analyze the Sense Check Matrix and Decide to proceed to the Step 2	TF and SP	Late Oct
9	Process documentations to prepare the Step 2	Sponsors and Labs	Late Sept ~ Late Oct
10	Execute the Step 2	Labs / TF	Nov ~ Dec
11	Analyze and Finalize the VIF Test Procedure	TF and SP	Jan 2016 ?
12	Execute Step 3	SP and Test Labs	Feb ~ Mar ? 2016
13	Analyze and Establish the initial LTMS target	SP	Apr 2016 ?

GF-6 VIF PRECISION MATRIX

Statisticians Task Force

August 26, 2015

GF-6 PM Design Statisticians Task Force

- Doyle Boese, Infineum
- Kevin O'Malley, Lubrizol
- Todd Dvorak, Afton Chemical
- Jo Martinez, Chevron Oronite
- Ricardo Affinito, Chevron Oronite
- Arthur Andrews, Exxon Mobil
- Martin Chadwick, Intertek
- Eric Liu, SwRI
- Rich Grundza, TMC

Toyota's Proposed Matrix for Seq VIF

- 2 Laboratories
- 2 Engines per Lab
- 3 Reference Oils
- Total 30 test runs
  - 10 Sponsors x 3 Tests / Sponsor = Total 30 Tests
- Stepwise Execution
  - Step 1 : Sense Check Run with 9 tests (Latin Square Design)
  - Step 2 : Remaining Test to complete the Matrix

Toyota's Proposed Seq VIF Matrix Design

Run	EOT Hour	Engine 11	Engine 12	Engine 21	Engine 22
1	350	TMC1011	Oil B (0W-16)	Oil C (0W-20)	TMC1011
2	550	Oil B (0W-16)	Oil C (0W-20)	TMC1011	Oil C (0W-20)
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8	1750	Oil B (0W-16)		Oil C (0W-20)	

Sense Check Runs

Alternative VIF Design

Run	EOT Hour	Engine 11	Engine 12	Engine 21	Engine 22
1	350	Oil B (0W-16)	TMC1011	Oil C (0W-20)	TMC1011
2	550	Oil C (0W-20)	Oil C (0W-20)	Oil B (0W-16)	Oil B (0W-16)
3	750	Oil C (0W-20)	TMC1011	Oil B (0W-16)	TMC1011
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8	1750	TMC1011		Oil C (0W-20)	

Sense Check Runs will be tested in 2 engines/2 labs

Concerns

- Matrix Oils
  - If Option 3 was chosen, there's no direct Vis Grade comparison since 3 PM oils have different DIs
- Sense Check Runs
  - Proposed design doesn't include replicates within an engine
  - Neither design yields a high statistical power to detect differences

Appendix

Sequence VIF Test Development

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- REO Selection Options

	Oil A	Oil B (0W-16)	Oil C (0W-20)	Pros	Cons
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