

Minutes of the Sequence VIF Task Force teleconference call

September 02, 2015 08:00 CDT

The second meeting of the Sequence VIF Task Force was called to order by Chairman Dan Worcester. The meeting Agenda is included as Attachment 1. The attendance roster is included as Attachment 2. Mark Adams of Tribology Testing and Guy Stubbs of Southwest Research Institute were added to the roster.

The minutes from the August 27, 2015 meeting were approved without changes.

Hiranosan from Toyota briefly reviewed the concept of "Sense Check" and Precision Matrix testing noting that at our last meeting the group wanted a better definition of what would be needed to constitute acceptable "Sense Check" testing. Toyota's original concept was taken, studied and modified somewhat by the Statistician Task Force. Hiranosan expressed appreciation of the work of the Statistician Group which led to a review of their work.

Ms. Jo Martinez presented the work of the Statistician Task Force. This is included as Attachment 3. Slides 3 and 4 are unchanged from the original Toyota presentation made to the VIF Task Force. Slide 5 details an Alternative VIF Matrix design. The design allows for repeat tests to get a sense of replication. Initial testing would be in two engines followed by additional testing in those two and two more engines. No change was made to Slide 6. Slide 7 details what would constitute an acceptable Sense Check. Oil 400 (Toyota designation) is expected to be better or equal to TMC 1011 and TMC 1011 is expected to be better than TMC 542. Assumptions needed to be made for the expected precision of the VIF; VID standard deviations were used. The Alternative Sense Check proposal would have a detectable difference of 0.56 with a Significance level of 0.10. Slide 8 shows a Stage Gate process that could define the running of the Sense Check and Precision Matrix testing. Following the initial eight tests in the Alternative Design, there would be a decision point. Slides 9 and 10 were unchanged from previous presentation.

Dan Worcester moved, and Terry Kowalski seconded that the Sequence VIF Task Force accept the Alternate Design as detailed in Statistician Group Task Force report (Attachment 3) for the Sense Check testing. The motion passed 13-0-1. Summary of the voting by affiliation is included in Attachment 2.

Mr. Richard Grundza of the ASTM-TMC updated the group on the oils selected. The suppliers of oil 400 and RO 542-3 have been in contact with the TMC. Richard felt that oils could be in the labs by October 19. Efforts will be made to shorten this time, if possible. Discussion concerning which version of 542 would be used resulted in the group in concurrence that RO 542-2 would be the best choice. Supply is sufficient for about the next two years and there was concern using 542-3 as it would be somewhat unknown.

Dan Worcester noted that SwRI has started a "VIF" test with RO 542-2 as the first test following new engine break-in. Data from that evaluation should be available for the next call on September 9, 2015 at 08:00 CDT.

Having now further business, the meeting was adjourned.

Respectfully submitted,

David L. Glaenzer

Afton Chemical Corporation

GF-6B Sequence VIF Task Force

Toll-free dial-in number (U.S. and Canada):

(866) 588-1857

International dial-in number:

(678) 373-4882

Conference code:

2894131

Scope

The ASTM Sequence VI Surveillance Panel requested a Task Force be formed to determine if the Sequence VIE could be used for OW 16 oils. The TF will look at development of the VIF test using 100 °C oil temperature and 94 °C coolant temperature for stages 1, 3, 4, and 6.

Objective

Review the Toyota proposal attached and work on selection of reference oils, stands to support testing, and running the Sense Check and test matrices.

The agenda for this meeting is shown below, if you have any additions please send them to me and Cc this distribution.

- 1.0 Chairman's Comments
- 2.0 Roll Call
- 3.0 Approval of Minutes from Meeting 08.27.2015

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencevi/minutes/VIFTaskForceMinutes20150827.pdf>

- 4.0 Meetings will be every Wednesday morning at 8:00 AM Central Time.
- 5.0 Review of the Toyota matrix. Review of Stat Group matrix design 09.02.15.
- 6.0 Review of Option # 3 selected in first meeting. 542 Blend and 400 as reference oils for the matrix.
- 7.0 Next call September 09, 2015 at 8:00 AM Central Time.

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

08/27/15		09/02/15	
Vote on Option#3		Vote on Alt. Sense	
P	Y		
	Y	P	Y
P	W	P	W
		P	Y
P			
P	Y	P	Y
P		P	
P	W	P	Y
P			
P		P	
P			
P		P	
		P	
P	W	P	Y
P	Y	P	Y
P		P	
P	Y	P	Y
P	Y		Y
		P	
P	Y	P	Y
P		P	
P		P	
P		P	
P		P	
P			
P	W	P	Y
		P	
		P	Y
P		P	
P		P	
P	Y	P	Y
P			
P	W		
P			
P			Y

8-0-5

13-0-1

ATTACHMENT 3
(5 PAGES)

GF-6 VIF PRECISION MATRIX

Statisticians Task Force

Sep. 2, 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

3

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

4

Toyota's Proposed Seq VIF Matrix Design

Run	EOT Hour	Engine 11	Engine 12	Engine 21	Engine 22
1	350	TMC1011	Oil 400	TMC542	TMC1011
2	550	Oil 400	TMC542	TMC1011	TMC542
3	750	TMC542	TMC1011	Oil 400	Oil 400
4	950	Oil 400	TMC542	TMC1011	Oil 400
5	1150	TMC1011	Oil 400	Oil 400	TMC542
6	1350	TMC542	TMC1011	TMC542	TMC1011
7	1550	TMC1011	TMC542	TMC1011	Oil 400
8	1750	Oil 400		TMC542	

Sense Check Runs

5

Alternative VIF Design

Run	EOT Hour	Engine 11	Engine 12	Engine 21	Engine 22
1	350	Oil 400	TMC1011	TMC542	TMC1011
2	550	TMC542	TMC542	Oil 400	Oil 400
3	750	TMC542	TMC1011	Oil 400	TMC1011
4	950	Oil 400	Oil 400	TMC542	TMC542
5	1150	TMC1011	Oil 400	TMC1011	TMC542
6	1350	Oil 400	TMC1011	Oil 400	TMC1011
7	1550	TMC542	TMC542	TMC1011	Oil 400
8	1750	TMC1011		TMC542	

Stage 1 Sense Check Runs will be tested in 2 engines/2 labs

Stage 2 Sense Check Runs will be tested in the other 2 engines/2 labs

6

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

7

Sense Check Evaluation

- Oil Ranking (Based on VID Data in Appendix 2)
 - Oil 400 ≥ TMC1011 > TMC542
- Precision, ≥
 - VID Prove Out Estimate of s
 - FEI1=0.22
 - FEI2=0.26
- Effect Size, s

Matrices	VIF Sense Check Proposed	VIF Sense Check Alternative	VIF Sense Check Alternative
No. of Stands	3	2	2
No. of Labs	2	2	2
No. of Oils	3	2	2
Total No. of Tests	9	8	8
No. of Tests/Oil	3,3,3	4,4	4,4
Significance level (α)	0.10	0.10	0.20
Detectable Difference in s of variable and using t	2.72	2.17	1.75
Detectable Difference in s of variable and MC	3.85		
Detectable Difference Assuming FEI2 s=0.26	1.00	0.56	0.45
Degrees of Freedom			
Oil	2	1	1
Stand(Lab)	1		
Lab	1	1	1
Engine Hour	1	1	1
Mean	1	1	1
Error	3	4	4
Total	9	8	8

8

Recommendation

- Use Alternative Design
- Run in Stage Gate Process

```

    graph TD
      A[Run Stage 1 Sense Check n=8] --> B{Good?}
      B -- Yes --> D[Proceed with the PM runs]
      B -- No --> C{Need More Data?}
      C -- No --> E[STOP]
      C -- Yes --> F[Run Stage 2 Sense Check* n=16]
      F --> G{Good?}
      G -- Yes --> D
      G -- No --> H[STOP]
  
```

*Stage 2 Sense Check can be re-designed based on the outcome of Stage 1 Sense Check

9

Appendix 1

Sequence VIF Test Development
TOYOTA

• REO Selection Options

	Oil A	Oil B (OW-16)	Oil C (OW-20)	Pros	Cons
Option 1	TMC1011 (Tech1 OW-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 :

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

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

August 2015, 2015
Prepared for Sequence VIF Test Dev
9

10

Appendix 2

Sequence VIF Test Development
TOYOTA

• Reference Info

	VID FE1 Sum	VID FE12	Source
TMC542 (OW-20)	2.29 (1.49 + 0.80)	0.80	LTMS (Aug-2015)
Oil 400 (OW-16)	2.87	1.51	Average of VID Matrix Data
Oil 401 (OW-20)	2.69	1.32	Average of VID Matrix Data
Oil 201 (OW-20)	2.60	0.96	Average of VID Matrix Data

August 2015, 2015
Prepared for Sequence VIF Test Dev
10