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Sequence VI, Webex call

Date: 17 Mar 21

ATTENDANCE

SWRI	Mike Lochte, Pat Lang, Dan Engstrom, Travis Kostan
INTERTEK	Adrian Alfonso
CHEVRON	
LUBRIZOL	Andrew Stevens
AFTON	Todd Dvorak, Christian Porter, Ben Maddock
ORONITE	Robert Stockwell
INFINEUM	Andy Ritchie, Doyle Boese
TMC	Rich Grundza, Scott Parke
FORD	
EXXON	Paul Rubas
GM	Aleise Gauer, Mike Raney
SHELL	Jeff Hsu
VALVOLINE	
HALTERMAN	Prasad Tumati
CP CHEM	Jon VanScoyoc
TMC	Scott Parke
GAGE PRODUCTS	Jim Carter
HALTERMANN	Izabela Gabrel
CARLESS	

Item 1: Meeting minutes from 01/14/21

- ➔ Andrew Stevens motioned to approve meeting minutes from previous meeting (01/14/21)
  - Seconded by Adrian
  - Motion passes, minutes approved

Item 2: Analytical data from conversion of BL to FO

- ➔ Scott Parke presented data from Batch 5 oils and compared to data from converted batch of BL to FO oil (see attachment 1)
- ➔ ICP analysis of the converted batch, as well as a sample of the Batch 5 oil, was run at the same time
- ➔ Analysis results showed Zn and P were lower than historical values
- ➔ No knobs were available to turn to increase Zn and P
  - Detergent additive does not have any Zn or P in it
  - Possible dilution effect of adding detergent to oil
- ➔ Si and Mg specs also did not match up to results seen historically
  - Potential need to adjust specification for future
- ➔ Proposed adjustments to oil spec based on historical data from batch 5 oil
- ➔ **Two questions came out of this data review:**
  - **Does -1 batch of FO (converted batch) look acceptable for use?**
  - **Should the oil specification for ICP be altered to capture what has been seen historically on FO and BL for the next batch that is made?**
- ➔ Andy Ritchie: While this is just FO, the integrity of the batch has to be checked. To convert BL to FO, it's roughly a 90%/10% blend to add Ca detergent. The addition of 10% detergent dilutes the rest of the additive in the BL oil, so a ~10% decrease in Zn and P are expected. There could also be some instrumentation bias due to such high levels of Ca in FO.
- ➔ Scott Parke: Agreed with Andy that there could be influence in the ICP measurements from the Ca levels
- ➔ Aleise Gauer: Also confirmed ICP is always off by a little. "<1" instead of 0 should be included in spec to make it more accurate.
- ➔ Andy: Since the Ca level is correct, the proper amount of Ca detergent was added. We want to prevent the blender of the next batch of oil from falling into the same trap.
- ➔ Scott: The proposed new spec for Zn was not altered based on the -1 blend. It was altered to capture the original values from batch 5.
- ➔ Robert Stockwell: We added 8.5% detergent, and P and Zn decreased by 8.1% and 8.2%, respectively
- ➔ Adrian: Asked about ICP analysis from previous batches of fuel. What values have been seen historically?
- ➔ Scott: Looked at this previously. The altered spec was based off of data from batch 5 only. Did not look to expand the spec based on previous batches. This is a more conservative approach, but can change based on panel direction.
- ➔ Andrew: Batch 5 goes back to 2016, so it's a good starting point with a few years of history
- ➔ Adrian: If we look at previous batches and there are larger deviations from spec, we can have more confidence that those changes don't impact the test.
- ➔ Andrew: Requested to find/send out ICP data from older batches for panel review. Relevant data is mg and Si. No concern for converted batch to be used for now, but asked if the panel is okay with Scott's suggested changes to spec.
- ➔ Jeff Hsu: Since this is FO oil, its purpose is to minimize carryover effect and flush out components in candidate oil. Zn and P are needed for anti-wear, but other components minimal.
- ➔ Scott Parke: Presented ICP analysis going back to batch 2. The data is from the initial intake of the oils at labs A, B, and the TMC
- ➔ Adrian: The analysis shifts smalls amounts between batches → provides confidence for -1 batch and future blends

- ➔ Andy: Would like to accept Scott's request of approving the blended/converted -1 batch.
- ➔ Scott: Suggested the panel be cautious and only reference batch 5 when altering specification, but can make additional changes if requested otherwise. **The specification targets will stay where they are, but will bump the edges of envelope on certain elements based on what was the historic data shows.**
- ➔ Andrew: Would like to take an email ballot for the limits and specification. There seemed to be good agreement from the panel that Scott's changes are acceptable.
- ➔ There was no objection to Andrew's request for an email ballot.
- ➔ **Action 1: Scott to mark-up BL/FO specification with historical consideration of analytical data**
- ➔ **Action 2: Andrew will send out email ballot to vote on suggested changes to the spec**
- ➔ Meeting adjourned.

Attachment 1. Flush oil analytical results from VIE BL/FO5 and VIE FO5-1

VIEFO5-1 Analyticals

Table 1 shows a sampling of elementals for VIEBL/FO5 taken over the past several years.
This gives an idea of the variability seen in repeated measures of the same fluid.

Table 1

	VIEBL5					
ASTM D5185	Date Sampled	10/26/2016	11/1/2017	10/24/2018	11/1/20119	10/29/2020
	Boron, ppm	<1	<1	<1	2	2
	Calcium, ppm	1979	2096	2049	1994	2019
	Magnesium, ppm	10	11	11	11	11
	Molybdenum, ppm	<1	<1	<1	<1	<1
	Phosphorus, ppm	489	492	489	488	488
	Silicon, ppm	9	8	6	6	5
	Zinc, ppm	556	569	567	558	555

	VIEFO5					
ASTM D5185	Date Sampled	10/26/2016	11/2/2017	10/24/2018	11/1/2019	10/29/2020
	Boron, ppm	<1	<1	<1	1	2
	Calcium, ppm	12210	11810		12000	12400
	Magnesium, ppm	34	35	34	34	32
	Molybdenum, ppm	<1	<1	<1	<1	<1
	Phosphorus, ppm	493	486	494	501	488
	Silicon, ppm	34	31	29	29	27
	Zinc, ppm	558	559	570	563	548

Table 2 shows analytical results for VIEFO5-1 and a VIEFO5 sample run along with it.
The VIEFO5-1 was produced from the VIEBL5 shown at the left and a newly-obtained sample of detergent additive. These results were confirmed with a repeated run.

Table 2

ASTM METHOD	PROPERTY	UNITS	TMC DATA	
			VIEFO5-1	VIEFO5 20160111B
D445	Kinematic Viscosity			
	40°C	cSt	111.5	112.5
	100°C	cSt	12.90	12.72
D1298	Density by Hydrometer, 60°F	lbs/gallon	7.48	-----
D4683	HTHS at 150°	cP	3.86	3.90
D4684*	MRV at -20°C/Yield Stress	cP/Pa	16900 <35	16400 <35 (from initial QA not run concurrently)
D4739	TBN Inflection Pt/Buffer Pt	mgKOH/g	24.21/22.63	27.08/24.99
D5185*	Elemental Analysis - ICP			
	Boron	ppm	2	4
	Calcium	ppm	11653	11780
	Magnesium	ppm	38	33
	Phosphorous	ppm	451	491
	Sulfur	ppm	2923	3068
	Silicon	ppm	24	24
	Zinc	ppm	502	546
D5293	CCS at -15°C	cP	7736	7942
	FTIR, Ref Spectrum ID		21327	21330

Table 3

Specifications

		Baseline Oil (VIEBL6)			Flush Oil (VIEFO6)		
	Method	Minimum	Maximum	Target	Minimum	Maximum	Target
B, ppm	D4951	<2 (0)	<2 (0)	<2 (0)	<2 (0)	<2 (0)	<2 (0)
Ca, ppm	D5185	1979 (1987)	2281	2134	11,170	12,820	11,990
Mg, ppm	D4951	4	11 (4)	4	18	35 (21)	19
Mo, ppm	D4951	<1 (0)	<1 (0)	<1 (0)	<1 (0)	<1 (0)	<1 (0)
P, ppm	D4951	462	537	500	462	537	500
Si, ppm	D4951	3	9 (4)	4	3	34 (4)	4
Zn, ppm	D4951	517	583	550	517	583	550
Kin.Vis. 100°C, sCt	D445	9.3	12.5	12.2	12.5	16.3	13.3
CCS -15°C, cP	D5293			6530			7100
HTHS150C, cP	D4683			3.71			4.07

Specs are shown in Table 3.
Shown in red are the adjustments that would be necessary to encompass all the Batch 5 elementals shown in Table 1. Existing specs are shown in (parenthesis). Only the min or max are adjusted. No adjustment is made to re-center the target.