

May 15, 2008

Mr. Jerry Wang, Chair
ASTM PCEOCP MDF Subgroup

Dear Mr. Wang,

Your letter to me dated April 7, 2008 requested information on four specific items related to the ongoing work by the Consortium developing the Sequence VID Test. The purpose of this letter is to respond to your specific requests. As you noted, since your subgroup is working under ASTM rules, any information I provide to you is considered public knowledge. For reference, your requests are included, in *italics*.

First, please advise when a final recommendation can be made to the public for further review. This impacts all subsequent industry activities and will help this Sub-group establish a meaningful timeline accordingly.

The timeline for the Sequence VID development called for completion of the final phase of the test development, the Prove-Out Matrix, to be completed during the month of May. However, some additional testing was added to the program which has caused a delay in the Prove-Out Matrix testing. The new expected completion date for the Prove-Out Matrix is the end of June or early July. Therefore the Consortium would expect to be able to make a final recommendation in July. The Consortium is planning to review in detail the completed test development work at the PCEOCP meeting during the ASTM meeting in Vancouver in mid-June. A draft Research Report is near completion, and will be released to the PCEOCP prior to the meeting in Vancouver.

Second, please disclose the final test procedure in sufficient detail as soon as possible. This is necessary to enable laboratories outside of the Consortium assess their capability to participate in the upcoming matrix testing as well as test cost. We understand the Consortium is operating under a confidentiality agreement. However, it may not be necessary to disclose the whole test procedure which may not have been finalized. The key information will be those pertinent to lab setup and test operation.

The Consortium will release the draft test procedure by May 5, 2008. This draft Procedure will include sufficient detail such that a non-Consortium entity should be able to set up a Sequence VID test stand. Information will include specific recommendations or requirements for hardware and instrumentation, and sources of said hardware and instrumentation. The draft Procedure will not include the details of the actual test conditions and sequences, since at this time those portions of the Procedure have not been finalized.

Third, please provide additional information regarding the reference oils currently used in the Consortium. The 10 consortium reference oils have been previously described in ASTM PCEOCP meetings as part of the progress update. However, the Sub-group will need to know if these oils can be categorized as based on current or prototype GF-5 technologies so the Sub-group can decide whether to use them as the basis to design the matrix. It is also important to know if these oils will be available in sufficient quantities for matrix testing.

The Consortium used a Matrix of ten test oils, in addition to a baseline oil (BL) and a flushing oil (FO) throughout the Sequence VID Test development including the vehicle FTP testing. The complete group of oils was selected, after considerable discussion, by the ILSAC/Oil-formed ILSAC GF-5 Fuel Economy Task Force. The process of oil selection was based upon the primary objective of developing a new test for determining the engine oil effect on fuel economy which was responsive to both viscosity effects and friction modifier effects. Thus, the suppliers of the test oils were requested to formulate oils of different viscosity grades with the expectation that viscosity differences could demonstrate fuel efficiency differences, and to also formulate oils using friction modifiers varying in both type of friction modifier and treat level of friction modifier, with the expectation that friction modifier differences could also demonstrate fuel efficiency differences. It was also requested that the oils submitted for inclusion in the test oil Matrix be ILSAC GF-4 capable, meaning the oils would be expected to be able to meet the performance requirements of ILSAC GF-4. The ten oils selected are shown below in Table 1. The oils came from three sources and represented three Detergent-Inhibitor technologies referred to as DI-1, DI-2, and DI-3. The ten oils cover a range of viscosity grades and several types and treat levels of friction modifiers. Since the primary objective was to develop a test capable of demonstrating viscosity and friction modifier effects, the oils were formulated to separate these two effects. Therefore, to eliminate a confounding of effects, oils from DI-1 and DI-2 formulated for showing viscosity effects did not contain any friction modifiers, and within a DI technology group, friction modifiers were only included in the formulation of one viscosity grade. Because of this, while the oils from DI-1 and DI-2 were formulated to be GF-4 capable, they probably would not have represented a typical GF-4 oil. The two oils using DI-3 technology (supplied by JAMA) were fully-formulated GF-4 oils.

Oils A, B, C, D, and E were formulated to be GF-4 capable, again as noted above, with the restraint that Oil B would contain only organic friction modifier and no Molybdenum-containing components, and Oil C would contain only Molybdenum-containing friction modifiers and no organic friction modifiers. All of the oils using DI-1, including the baseline oil (BL) and the flush oil (FO) have a finished phosphorus level of 0.05%, which does not meet the chemical limits of GF-4, but at the time of formulating of these oils and the subsequent approval by the GF-5 Fuel Economy Task Force, may have represented what the anticipated phosphorus level was for the proposed ILSAC GF-5 category. Oils A, B, C, D, and E are available in sufficient quantities from the ASTM TMC for precision matrix testing.

Oils G, H, and I were derived from a holistically formulated DI core technology (DI-2) that met ILSAC GF-4 performance for SAE 5W-30 in Group II base stock. However, as noted above, organic friction modifiers and/or Molybdenum-containing components in the core DI had to be removed and/or modified to achieve desired friction modifier types and coefficient of friction targets. Oils G, H, and I are available in sufficient quantities from the ASTM TMC for precision matrix testing.

Oils J and K, formulated using DI-3, are available in sufficient quantities from the ASTM TMC for precision matrix testing.

The baseline oil, BL, and the flush oil, FO, will be available in sufficient quantity for precision matrix testing and for up to five years of anticipated candidate testing.

Table 1
Sequence VID Development Matrix Oils

Oil Code	DI Package	SAE Viscosity Grade	Friction Modifier	KV40, cSt	KV100, cSt	HTHS at 100°C, cP	HTHS at 150°C, cP	CCS, cP
VID-A	1	5W-20	none	45.29	8.06	5.82	2.53	5760 (-30°C)
VID-B	1	5W-20	Organic	44.33	7.92	5.74	2.51	6360 (-30°C)
VID-C	1	5W-20	Mo-containing	45.06	8.11	5.84	2.54	6000 (-30°C)
VID-D	1	5W-30	none	56.07	9.59	6.37	2.88	5790 (-30°C)
VID-E	1	10W-30	none	71.40	10.83	7.53	3.21	5920 (-25°C)
VID-G	2	5W-30	none	61.14	10.55	6.84	3.05	5420 (-30°C)
VID-H	2	5W-30	Organic	61.42	10.47	6.84	3.03	5410 (-30°C)
VID-I	2	5W-30	Mo-containing	61.54	10.59	6.73	3.06	2980 (-25°C)
VID-J	3	0W-20	Mo-containing	41.14	9.36	5.39	2.51	5140 (-35°C)
VID-K	3	5W-20	Mo-containing	41.84	8.66	5.66	2.59	4050 (-30°C)
VID-BL	1	20W-30 (No VM)	none	102.00	12.06	9.88	3.70	6530 (-15°C)
VID-FO	1 + 5X Detergent	20W-40 (No VM)	none	114.70	13.26	10.70	4.10	7100 (-15°C)

Finally, the Sub-group would like to remind the Consortium that data showing proper discrimination of the final VID procedure using reference oils representing current or prototype GF-5 technology are required before any ASTM matrix testing can start. This usually requires a minimum of three (3) oils for discrimination, and must have a minimum of two (2) valid test results for each oil in the latest test procedure. In addition, there needs to be sufficient supply of critical test parts and critical test fuel used in the matrix in post-matrix testing beyond one reference cycle.

The Consortium is planning for a comprehensive Prove-Out Matrix that will include at least three oils from the ten oils used in the Sequence VID development described above. The Prove-Out Matrix will include multiple tests of each oil and will be run using the final test procedure. Critical test parts, including pre-built test engines, will be available

from the Central Parts Distributor, OH Technologies, Inc. The test fuel for the Sequence VID Test is commercially available Haltermann HF-003, and is expected to be available for the foreseeable future.

Jim Linden, Chair
Sequence VID Consortium