PC-10 Matrix Funding & Design TF

ASTM HDEOCP Meeting

November 11, 2004

Chicago, IL

PC-10 Engine Test Matrix

Funding Group

- **Preliminary plan to fund the PC-10 matrix established at the October 20 meeting**
  - **ACC & API each contribute $1MM in cash**
  - **EMA to provide $350M in cash and >$650M in-kind**
- **Trade association funding ($2.35MM) plus stand calibration testing likely to allow acceptable designs**
  - **Projected overall cost** — **$4.2MM to $4.5MM**
  - **Stand calibration tests** — **$1.89MM to $2.14MM**
  - **Industry funded tests** — **$2.33MM**
- **Final approval for funding pending**
  - **ACC to confirm support for the proposal**
  - **API LC endorsed the plan pending AAC decision**

PC-10 Engine Test Matrix

Matrix Design Task Force

- **Preliminary designs that meet criteria below identified**

		Cat C13	Cummis ISB	Mack T-12
Matrix Outputs	Precision	Yes	Yes	Yes
	BOI	Yes	No	No
Number ot Tests		26	14 to 16	14 to 16
Calibration		12	6 to 8	6 to 8
Funded		14	8	8
Number of Stands		7	4	4
Number of Labs		5	2 to 4	2 to 4
Runs / Stand	First Stands	4	4	4
	Second Stands	3	3	3

- **Final matrix selection to be based on additional criteria**
  - **Readiness / willingness of individual labs and stands**
  - **Agreed distribution across labs and test costs to industry**
- **PC-10 MDTF will remain in place to see if additional input is needed**

PC-10 Engine Test Matrix

Next Steps

- **Industry agreement on the plan to limit BOI to the Cat C13; precision only for the Cummins ISB & Mack T-12**

- **Finalize selection of oils for the matrix**
  - **EMA to choose 2 PC-10 technologies for Cat C-13; select base oils**
  - **Identify & accept matrix oils for the Cummins ISB & Mack T-12**
  - **Matrix oil blending**

- **Trade association confirmation of the plan to fund matrix testing; complete MOA before testing starts**

- **Selection of specific matrix designs**

PC-10 Engine Test Matrix

Preliminary Matrix Designs

Engine Test	Cat C-13	Cummins ISB / Mack T-12		
		Case 1	Case 2	Case 3
Matrix Type	Precision / BOI	Precision Only		
No. of Stands	7	4	4	4
No. of Labs	5	2	3	4
No. of Oils	6	2	2	2
Total No. of Tests	26	14	15	16
No. of Tests/Oil	6,4,3	7	7,8	8
Detectable Difference in s of variable and using t	3.02	1.95	1.86	1.78
Detectable Difference in s of variable and MC	4.22	1.95	1.86	1.78
Comparing reference oils only	2.81			
No. of Tests/Stand	4,3,4,3,4,4,4	4,3,4,3	4,3,4,4	4,4,4,4
Detectable Difference in s of variable and using t	2.67	2.78	2.75	2.52
Detectable Difference in s of variable taking the multiple comparison into account for several sample size combinations	3.85 3.57 4.12	3.63 3.36 3.88	3.55 3.29	3.23
No. of Tests/ Lab	7,7,4,4,4	7,7	7,4,4	4,4,4,4
Detectable Difference in s of variable and using t	2.19	1.95	2.26	2.52
Detectable Difference in s of variable taking the multiple comparison into account for several sample size combinations	2.93 2.50 3.30	1.95	2.66 3.00	3.23
Degrees of Freedom				
Oil	5	1	1	1
Stand (Lab)	2	2	1	0
Lab	4	1	2	3
Mean	1	1	1	1
Error	14	9	10	11
Total	26	14	15	16
95% CI for Sigma, Width^	0.84	1.14	1.06	0.99

PC-10 Engine Test Matrix

Matrix Cost Calculator

- Enter assumptions in cells with blue text
- Sheet will display the number and cost for individual PC-10 matrices and the total test cost

Inputs	Cat C13	Cummis ISB	Mack T-12	
Number ot Tests	26	14	14	
$1,000 per Test	95	50	75	
No. of Labs / First Stands	5	2	2	
No. of Calibrations per 1st Stand	2	2	2	
No. of Second Stands	2	2	2	
No. Calibrations per 2nd Stand	1	1	1	
Outputs	**Cat C13**	**Cummis ISB**	**Mack T-12**	
Labs	5	2	2	
Stands	7	4	4	
No. of Tests				
Total	26	14	14	
Calibration	12	6	6	
Funded	14	8	8	**Total Cost**
Cost ($1,000)				
Total	2,470	700	1,050	4,220
Calibration (Labs)	1,140	300	450	1,890
Funded (Trade Assoc)	1,330	400	600	2,330

	Cash	In-Kind	Contrib.
EMA	350	657	1007
ACC	1000	--	1000
API	1000	--	1000
Total Trade Association	2350	657	3007