

ISB Cam and Tappet Test

Presentation to HDEOCP



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Precision Summary

	Repeatability s (Within Stand)	Reproducibility s (Between Stand)	Reproducibility s (Between Lab)
Tappet Wear (mg) Soot Adj	8.1645 Ep=1.84	16.8574 Ep=0.89	16.9092 Ep=0.89
Camshaft Wear (um)	4.7021 Ep=3.19	7.1512 Ep=2.10	7.1512 Ep=2.10
XHead Wear (mg) Soot Adj	0.3817 Ep=1.96	0.3817 Ep=1.96	0.5221 Ep=1.44
Torque Adjstd Cam Wear (um)	5.0833 Ep=2.95	5.0833 Ep=2.95	6.3063 Ep=2.38

Target Summary

	Oil 830-2	PC10B	PC10E
Tappet Wear (mg) Soot Adj	LS Mean = 88.23 Mean = 85.8167 S = 16.1416	LS Mean = 93.47 Mean = 88.6833 S = 15.8176	LS Mean = 67.54 Mean = 57.86 S = 9.4796
Camshaft Wear (um)	LS Mean = 40.20 Mean = 40.2667 S = 9.2058	LS Mean = 44.85 Mean = 41.9833 S = 5.6722	LS Mean = 36.86 Mean = 34.14 S = 5.0093
XHead Wear (mg) Soot Adj	LS Mean = 2.072 Mean = 2.0833 S = 0.5345	LS Mean = 2.057 Mean = 2.0667 S = 0.4367	LS Mean = 1.940 Mean = 2.0000 S = 0.4743
Torque Adjstd Cam Wear (um)	LS Mean = 40.86 Mean = 40.86 S = 6.8895	LS Mean = 42.29 Mean = 42.2984 S = 4.7694	LS Mean = 33.94 Mean = 33.0695 S = 6.0193

ISB Balloted Limits

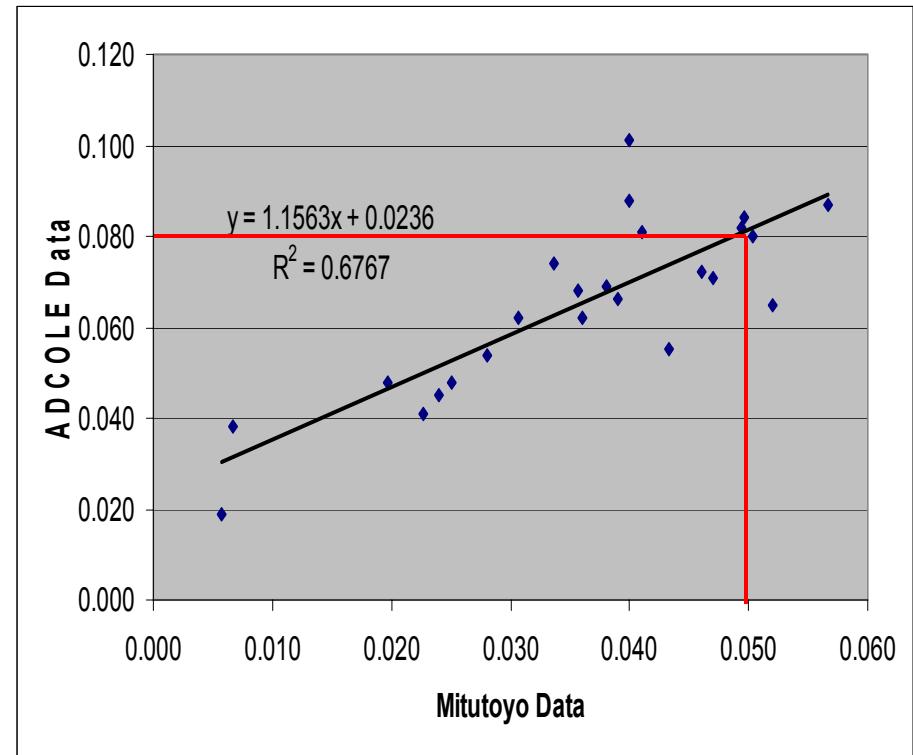
- **Tappet wear limit**
 - Target limit 75 mg weight loss. MTAC limits are: 75/83.1/86.7 for 1/2/3 tests
- **Cam wear limit**
 - Target limit 30 μm wear by Mitutoyo snap gauge. MTAC limits are: 30/33.4/35
- **Viscosity limit: Viscosity@100C less than or equal to 16.3 cSt at 100 hr**

Concerns Expressed in Exit Ballot

- **Viscosity control should not be measured in ISB**
- **Cummins and Mack have agreed to add viscosity parameter to T-11 @ 3.5% Soot:**
 - **Ie. Min. 3.5% soot @ 4cSt over sheared Vis.**
- **Tappet and Cam Limits too restrictive to reflect the acceptable performance of 830-2 and PC 10-B**
- **Cams were evaluated @ Cummins and better correlation with Mitutoyo established**
- **Tappet limit re-evaluated to reflect performance of 830-2 and PC 10-B**

Camshaft Wear

- A 2.0 Cummins visual rating is deemed acceptable for end of test requirements in the ISB test
- 2.0 visual is equivalent to 80 μm with the ADCOLE.
- Based upon correlation data using the historical ratings and the PC-10 matrix cam ratings a camshaft wear limit of 50 μm as determined by a Mitutoyo snap gauge is proposed.
- This limit fails one PC-10 matrix test in TMC 830-2



Tappet Wear

- **Based upon rating and evaluation the proposed limit is 100 mg of wear.**
- **This limit fails one test on TMC 830-2 and two on PC-10B.**

Limits

- **The following limits are being proposed for ballot**
 - **Tappet weight loss – 100 mg**
 - **Camshaft wear – 50 μm**
 - **Crosshead weight loss – record,**
 - **use ISM methodology for screening**
 - **Soot / Viscosity Control – Measure in Mack T-11**

Estimated MTAC Limits

- **Tappet wear limit**
 - Target limit **100 mg weight loss.**
 - **MTAC limits are: 100 / 108 / 112 mg for 1/2/3 tests**
- **Cam wear limit**
 - Target limit **50 μm wear by Mitutoyo snap gauge.**
 - **MTAC limits are: 50 / 54 / 56 μm for 1/2/3 tests**
- **Statisticians need to verify MTAC Limits.**