



Cummins ISM Test Concerns HDEOCP

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Crosshead Wear

- **Correction factors were implemented for IAS and CWL for tests that completed on or after June 28, 2007**
- **Factors are +19.1 mg for IAS and +1.7 mg for CWL**
- **Data is trending severe for CWL**
 - **Not statistically significant for reference**
 - **Reference – TMC 830-2**
 - **Carried forward from CI-4 / M11-EGR**
 - **Very strong performance in crosshead weight loss**
 - **Valid registered candidate data at independent labs is trending severe compared to pre-correction factor candidate tests**
- **Data shown on registered candidate data from two laboratories**
- **Correction factor does not seem to affect P/F rates for IAS wear.**
 - **However, IAS correction “unbalances” ISM merit calculation**
- **Recent testing with new filter batch shows severe OFDP results**

TESTKEY	LTMSL	LTMSDATE	VAL	IND	ENKIT	Merits pre ICF	Merits w/ICF	ACWL	ACWLCF	CWL	Merit (pre)	Merit (DB)	SAIAS	SAIASCF	IAS	Merit (pre)	Merit (DB)	FPD	FDP Merit	ASR	AS Merit
47644	D	20040901	AC	830-2	ISM-012	1442	1442	5.7	0	5.7	350	350	19.4	0	19.4	592	592	9	250	9.2	250
50224	A	20040903	AC	830-2	ISM-010	1215	1215	4.6	0	4.6	625	625	35.5	0	35.5	215	215	10	225	9	150
51799	G	20040905	AC	830-2	ISM-013	1300	1300	4.4	0	4.4	675	675	33.3	0	33.3	250	250	12	175	9.1	200
52996	B	20041002	AC	830-2	ISM-016	1535	1535	2.4	0	2.4	700	700	25.9	0	25.9	385	385	7	300	9	150
52997	D	20041126	AC	830-2	ISM-025	800	800	7	0	7	25	25	26.2	0	26.2	375	375	11	200	9.1	200
54195	B	20041219	AC	830-2	ISM-026	1265	1265	4.7	0	4.7	600	600	29.2	0	29.2	315	315	13	150	9.1	200
54204	G	20041226	AC	830-2	ISM-031	537	537	4.9	0	4.9	550	550	40.4	0	40.4	137	137	27	-200	8.8	50
50226	A	20050709	AC	830-2	ISM-073	1224	771	6.4	0	6.4	175	175	17.6	19.1	36.7	649	196	6	300	8.9	100
55570	A	20050716	AC	830-2	ISM-069	1125	753	7.1	0	7.1	0	0	9.3	19.1	28.4	700	328	8	275	9	150
55571	A	20050730	AC	830-2	ISM-070	1175	815	6.1	0	6.1	250	250	8.5	19.1	27.6	700	340	10	225	8.7	0
52791	B	20060131	AC	830-2	ISM-099	1800	1244	3.5	1.7	5.2	700	475	7.3	19.1	26.4	700	369	11	200	9.1	200
55568	G	20060409	AC	830-2	ISM-143	1575	1041	3	1.7	4.7	700	600	13.2	19.1	32.3	700	266	14	125	8.8	50
54189	D	20060502	AC	830-2	ISM-083	1573	808	4	1.7	5.7	700	350	20	19.1	39.1	573	158	11	200	8.9	100
56718	A	20060612	AC	830-2	ISM-150	1643	768	4.6	1.7	6.3	625	200	17.8	19.1	36.9	643	193	12	175	9.1	200
56719	A	20060806	AC	830-2	ISM-162	1675	1226	2.9	1.7	4.6	700	625	9.4	19.1	28.5	700	326	10	225	8.8	50
55572	B	20070228	OC	830-2	ISM-131	1625	1367	1	1.7	2.7	700	700	5	19.1	24.1	700	442	20	-25	9.2	250
55573	B	20070311	AC	830-2	ISM-132	1775	1099	3.7	1.7	5.4	700	425	11.1	19.1	30.2	700	299	12	175	9.1	200
55574	D	20070429	AC	830-2	ISM-220	1475	698	4.9	1.7	6.6	550	125	8	19.1	27.1	700	348	14	125	8.9	100
55569	G	20070509	OC	830-2	ISM-217	1675	1471	0.7	1.7	2.4	700	700	3.3	19.1	22.4	700	496	10	225	8.8	50
61892	C	20070615	AC	830-2	ISM-201	1625	1351	2	1.7	3.7	700	700	5.5	19.1	24.6	700	426	20	-25	9.2	250
54577	A	20070705	AC	830-2	ISM-205	1425	723	5.9	1.7	7.6	300	-125	5.6	19.1	24.7	700	423	8	275	9	150
63706	C	20070810	AC	830-2	ISM-146	1375	493	6.1	1.7	7.8	250	-175	14.6	19.1	33.7	700	243	10	225	9.1	200
54576	A	20070816	AC	830-2	ISM-177	1850	1494	2.5	1.7	4.2	700	700	8.3	19.1	27.4	700	344	7	300	9	150
54578	A	20070826	AC	830-2	ISM-239	1850	1529	2.2	1.7	3.9	700	700	7	19.1	26.1	700	379	6	300	9	150
63288	G	20070906	AC	830-2	ISM-237	1700	1139	3	1.7	4.7	700	600	14.9	19.1	34	700	239	13	150	9	150
63226	D	20080203	AC	830-2	ISM-267	1525	1102	2.4	1.7	4.1	700	700	12.5	19.1	31.6	700	277	16	75	8.8	50
62504	B	20080324	AC	830-2	ISM-229	1700	1449	2	1.7	3.7	700	700	4.8	19.1	23.9	700	449	15	100	9.1	200
56721	A	20080912	OC	830-2	ISM-298	950	62	7.2	1.7	8.9	-25	-450	15	19.1	34.1	700	237	10	225	8.8	50
64411	G	20081013	AC	830-2	ISM-301	1386	514	4.4	1.7	6.1	675	250	18	19.1	37.1	636	189	18	25	8.8	50
68200	A	20081025	AC	830-2	ISM-300	1625	974	4.8	1.7	6.5	575	150	4	19.1	23.1	700	474	7	300	8.8	50
63707	C	20081114	AC	830-2	ISM-275	1800	1095	3.6	1.7	5.3	700	450	14.5	19.1	33.6	700	245	13	150	9.2	250
66132	D	20090303	AC	830-2	ISM-292	1825	1551	2.5	1.7	4.2	700	700	5.5	19.1	24.6	700	426	8	275	9	150
62999	B	20090316	AC	830-2	ISM-297	1875	1173	4.4	1.7	6.1	675	250	5.6	19.1	24.7	700	423	6	300	9.1	200
68201	A	20090419	AC	830-2	ISM-299	1525	852	5.6	1.7	7.3	375	-50	4.7	19.1	23.8	700	452	6	300	9	150
68649	G	20090723	AC	830-2	ISM-360	1800	968	4.5	1.7	6.2	650	225	11.5	19.1	30.6	700	293	7	300	9	150
70663	A	20090807	AC	830-2	ISM-351	1850	1672	1.7	1.7	3.4	700	700	2.5	19.1	21.6	700	522	7	300	9	150

Official Merits	Pre CF (21)		Post CF (15)		Avg	Max	Min	Std Dev	Pre	Post	563	346	192	143
	Avg	1404	1071	Avg										
	Max	1800	1672	Max	700	700	700	522	300	250				
	Min	537	62	Min	0	-450	137	189	-200	0				
	Std Dev	318	453	Std Dev	238	374	194	107	113	70				

pre ICF 170 145
post ICF 222 140

Average Merits for TMC 830-2 -- treated as candidate oil

	Total	CWL	IAS	FDP	ASR
Pre (21 tests)	1404.0	525.0	563.5	170.2	145.2
Post (15 tests)	1071.1	363.3	346.1	221.7	140.0
	-332.9	-161.7	-217.4	51.4	-5.2

-332.885

Lab A Data

	Pre-correction 05/2005 - 03/2007		Post-correction 11/2007 - 09/2009		Post-correction Uncorrected Results	
Grade	N Size	CWL P/F	N Size	CWL P/F	N Size	CWL P/F
20W-50	0	N/A	1	0%	1	100%
15W-40	7	100%	4	0%	4	50%
10W-40	3	33.3%	1	0%	1	0%
10W-30	4	100%	1	0%	1	100%
5W-40	2	100%	0	N/A	0	N/A
5W-30	1	100%	13	7.7%	13	61.5%
Total	17	88.2%	20	5.0%	20	60%
Mean	N/A	5.16	N/A	8.91	N/A	7.21
Std. Dev.	N/A	1.75	N/A	1.66	N/A	1.67

- Registered candidate tests
- Large shift in candidate P/F on CWL comparing pre and post-correction data.
- Uncorrected results for post-correction factor data show similar P/F rates to candidate data pre-correction factor.
- Only 1 candidate pass out of 20 since correction factor!

Lab B Data

Grade	Pre-correction				Post-correction				Post-correction Uncorrected Results			
	N Size	CWL P/F	Mean	Std. Dev.	N Size	CWL P/F	Mean	Std. Dev.	N Size	CWL P/F	Mean	Std. Dev.
0W-30	1	0%	/	/	0	/	/	/	0	/	/	/
5W-30	5	40%	7.04	1.79	11	9%	10.44	2.64	11	36%	8.74	2.64
10W-30	3	67%	/	/	1	0%	/	/	1	1%	/	/
0W-40	1	100%	/	/	0	/	/	/	0	/	/	/
5W-40	3	100%	/	/	4	0%	/	/	4	25%	/	/
10W-40	5	20%	8.16	1.37	5	20%	9.42	2.48	5	20%	7.72	2.48
15W-40	33	76%	5.83	1.87	11	18%	8.32	2.92	11	64%	6.62	2.92
Total	51	67%			32	13%			32	44%		
Mean	N/A	6.29			N/A	9.43			N/A	7.73		
Std. Dev.	N/A	1.9			N/A	2.59			N/A	2.59		

- Registered candidate tests
- Lab B data shows higher P/F rates for most viscosity grades before implementation of correction factor
- 15W-40 P/F went from 76% to 18% after correction factor. Without the correction factor, the 15W-40 P/F rate would have been 64%.
- Supports Lab A data for severity of CLW parameter in Cummins ISM

ISM Data – Pre & Post Industry Correction Factors

	Lab (Year)	Filter Type	Official Result	Test Results				Merit Calculation				
				Xhead	ASWL	OFDP	AS	Xhead	ASWL	OFDP	AS	Total
				7.1 max	49 max	19 max	87 min	-	-	-	-	1000 min
15W-40 CJ-4 Prototype	1 (2005)	Old	Yes	4.1	30.1	2	9.2	700.0	300.7	300.0	250.0	1550.7
(with ICF)			No	5.8	49.2	2	9.2	325.0	-32	300.0	250.0	871.8
15W-40 CJ-4 Prototype	1 (2009)	New	No	3.4	24.6	44	9.1	700.0	426.4	-625.0	200.0	701.4
(with ICF)			Yes	5.1	43.7	44	9.1	500.0	84.3	-625.0	200.0	159.3
10W-30 CJ-4 Prototype	1 (2005)	Old	Yes	4.9	36	1	9.1	550.0	206.8	300.0	200.0	1256.8
(with ICF)			No	6.6	55.1	1	9.1	125.0	-97.0	300.0	200.0	528.0
10W-30 CJ-4 Prototype	2 (2009)	Old	No	7.6	9.5	0	9.1	-125.0	700.0	300.0	200.0	1075.0
(with ICF)			Yes	9.3	28.6	0	9.1	-550.0	324.5	300.0	200.0	274.5

Summary

- Registered candidate P/F rates at independent labs indicates that the correction factor for CLW has increased test severity higher than severity before implementation of correction factor
- All other test parameters for P/F appear to be in line with historical test severity
- Merit calculation needs to be revised to re-center the available merits for IAS
- New filter batch is more severe on OFDP than original batch
- Filter severity shift appears to be accentuated with candidate tests for older quality levels such as API CH-4

