

24. ISM LTMS Requirements

The following are the specific ISM calibration test requirements.

A. Reference Oils and Parameters

The critical parameters are Crosshead Wear at 3.9 % Soot, Oil Filter  $\Delta P$ , and Average Sludge Rating. Injector Adjusting Screw Wear at 3.9% Soot is a non-critical parameter. The reference oils required for test stand and test laboratory calibration are reference oils accepted by the ASTM Cummins Surveillance Panel. The mean and standard deviation for the current reference oils for critical and non-critical parameters are presented below.

## CROSSHEAD WEAR AT 3.9% SOOT

Unit of Measure: Milligrams  
CRITICAL PARAMETER

Reference Oil	Mean	Standard Deviation
830-2	5.1	1.5
830-3	5.1	1.5

OIL FILTER  $\Delta P$ 

Unit of Measure: LN(O FDP+1)  
CRITICAL PARAMETER

Reference Oil	Mean	Standard Deviation
830-2	2.5209	0.3274
830-3	2.9653	0.3274

## AVERAGE SLUDGE RATING

Unit of Measure: Merit Rating  
CRITICAL PARAMETER

Reference Oil	Mean	Standard Deviation
830-2	9.00	0.15
830-3	8.45	0.65

## INJECTOR ADJUSTING SCREW WEAR AT 3.9% SOOT

Unit of Measure: Milligrams  
NON-CRITICAL PARAMETER

Reference Oil	Mean	Standard Deviation
830-2	29.5	5.7
830-3	29.5	5.7

ISM Reference Oil Targets											
Oil	n	Effective Dates		X-Head Wear @ 3.9% Soot		OFDP <sup>1</sup>		Average Sludge		Injector Adj. Screw Wear @ 3.9% Soot	
		From	To <sup>2</sup>	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s
830-2	7	9-1-04	11-30-05	4.8	1.4	2.5430	0.3936	9.04	0.20	30.0	7.0
	10	12-1-05	8-6-07	5.3	1.4	2.4342	0.3813	8.99	0.15	24.5	10.7
	21	8-7-07	***	5.1	1.5	2.5209	0.3274	9.00	0.15	29.5	5.7
830-3	5	4-16-20	4-9-25	5.1	1.5	2.9653	0.3274	8.24 <sup>3</sup>	0.50 <sup>3</sup>	29.5	5.7
	5	4-16-20	***	5.1	1.5	2.9653	0.3274	8.45 <sup>3</sup>	0.65 <sup>3</sup>	29.5	5.7

- 1 Transformation for OFDP is  $\ln(\text{OFDP}+1)$
- 2 \*\*\* = currently in effect
- 3 New targets were back-applied to all tests

L-33-1 Reference Oil Targets						
Oil	Gear Version	n	Effective Dates		Rust	
			From <sup>1</sup>	To	$\bar{X}$	s
121	V94.1	12 <sup>2</sup>	6-5-96	4-19-00	9.370 <sup>2</sup>	0.280 <sup>2</sup>
	V95.1	12 <sup>2</sup>	6-5-96	4-19-00	9.370 <sup>2</sup>	0.280 <sup>2</sup>
121-1	V94.1	--	1-19-98	4-29-99	9.370 <sup>3</sup>	0.280 <sup>3</sup>
	V94.1	45 <sup>2</sup>	4-30-99	11-17-00	9.390 <sup>2</sup>	0.218 <sup>2</sup>
	V95.1	--	1-19-98	4-29-99	9.370 <sup>3</sup>	0.280 <sup>3</sup>
	V95.1	45 <sup>2</sup>	4-30-99	11-17-00	9.390 <sup>2</sup>	0.218 <sup>2</sup>
	V99.1	8	4-20-00	11-17-00	9.830	0.260 <sup>4</sup>
121-2	V94.1	--	12-14-99	11-17-00	9.390 <sup>5</sup>	0.218 <sup>5</sup>
	V95.1	--	12-14-99	11-17-00	9.390 <sup>5</sup>	0.218 <sup>5</sup>
	V99.1	--	4-20-00	11-17-00	9.830 <sup>6</sup>	0.260 <sup>4</sup>
123	V94.1	54 <sup>2</sup>	5-5-95	4-19-00	9.000 <sup>2</sup>	0.330 <sup>2</sup>
	V95.1	54 <sup>2</sup>	5-5-95	4-19-00	9.000 <sup>2</sup>	0.330 <sup>2</sup>
	V99.1	12	6-11-02	8-24-04	8.430	0.390
	V01.1	--	11-25-02	8-24-04	8.430 <sup>10</sup>	0.390 <sup>10</sup>
	V99.1 & V01.1	30	8-25-04	***	8.560	0.230
123-1	V94.1	13 <sup>7</sup>	4-20-00	11-17-00	8.240 <sup>7</sup>	0.330 <sup>8</sup>
	V95.1	--	12-14-99	4-19-00	9.000 <sup>9</sup>	0.330 <sup>9</sup>
	V95.1	13 <sup>7</sup>	4-20-00	11-17-00	8.240 <sup>7</sup>	0.330 <sup>8</sup>
	V99.1	13 <sup>7</sup>	4-20-00	11-17-00	8.240 <sup>7</sup>	0.330 <sup>8</sup>
123-2	V99.1	--	11-25-02	8-24-04	8.430 <sup>10</sup>	0.390 <sup>10</sup>
	V99.1 & V01.1	--	8-25-04	6-1-06	8.560 <sup>9</sup>	0.230 <sup>9</sup>
	V99.1 & V01.1	15	6-2-06	***	8.740	0.260
	AAM K2XX	10	6-24-16	06-28-17	8.05	0.43
	AAM K2XX	19	6-29-17	11-07-17	8.09	0.41
	AAM K2XX	22	11-08-17	0-01-20	8.12	0.38
	AAM K2XX	19	01-02-20	08-31-20	8.37	0.39
	K2XX & T1XX T1T11T	37	09-01-20	***	8.51	0.35
126	T1XX	6	02-22-23	***	8.90	0.27
	31XX	--	12-24-25	***	8.90	0.27
151-3	V99.1	13	6-11-02	8-24-04	9.690	0.350
	V01.1	--	11-25-02	8-24-04	9.690 <sup>11</sup>	0.350 <sup>11</sup>
	V99.1 & V01.1	30	8-25-04	***	9.640	0.250
155	V99.1 & V01.1	--	6-2-06	---	9.580	0.250 <sup>12</sup>
155-1	V99.1 & V01.1	--	4-4-12	---	9.580	0.250 <sup>12</sup>
	AAM K2XX	9	6-24-16	06-28-17	9.26	0.12
	AAM K2XX	20	6-29-17	11-07-17	9.24	0.19
	AAM K2XX	23	11-08-17	01-01-20	9.25	0.22
	AAM K2XX	20	01-02-20	08-31-20	9.47	0.13
	K2XX & T1XX	42	09-01-20	***	9.47	0.16
155-2	K2XX, T1XX & 31XX	-	08-25-21	***	9.47	0.16

1 Effective for all tests completed on or after this date.

2 Based on V94.1 & V95.1 data.

3 Based on oil 121 data.

4 Based on lab pooled s of V94.1 & V95.1 data (all blends of oil 121).

5 Based on oil 121-1 data.

6 Based on V99.1 data on oil 121-1.

7 Based on V99.1 and V95.1 data.

8 Based on lab pooled s of V94.1 & V95.1 data (all blends of oil 123).

9 Based on oil 123 data.

10 Based on V99.1 data on oil 123.

11 Based on V99.1 data on oil 151-3.

12 Based on V99.1 & V01.1 data on oil 151-3.