

Proposed Cummins ISM Merit Rating System
presented to
Cummins Surveillance Panel

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Merit Rating System Terms

- Anchor – if an oil averaged exactly at the anchor for each criterion, it would be a borderline oil
- Maximum – limit of acceptable performance for an individual criterion
- Minimum – best possible performance for an individual criterion, or better number gives no better performance
- Weight -- relative contribution of individual criterion to total merit

Proposed Merit Rating System

- A result at or below the anchors for all five criteria would pass the test.
- If any of the five criteria results is above the maximum, the test fails.
- If results are below the maximums for all five criteria but one or more results is above the anchors, a mathematical system determines whether marginal numbers above the anchors are compensated by better than anchor results on other criteria.

Straw Man Parameters

Criterion	Crosshead Weight Loss	Top Ring Weight Loss	Oil Filter Delta P	Adjusting Screw Weight Loss	Sludge
Weight	225	150	250	225	150
Maximum	6.5	90	25	45	8.6
Anchor	5.0	65	12	30	9.0
Minimum	3.5	40	5	15	9.5

Multiple Test Acceptance Procedure

- Multiple test evaluation would consist of averaging the five individual criteria across multiple tests. The Cummins ISM Merit Rating System would be applied to the averages for the criteria.

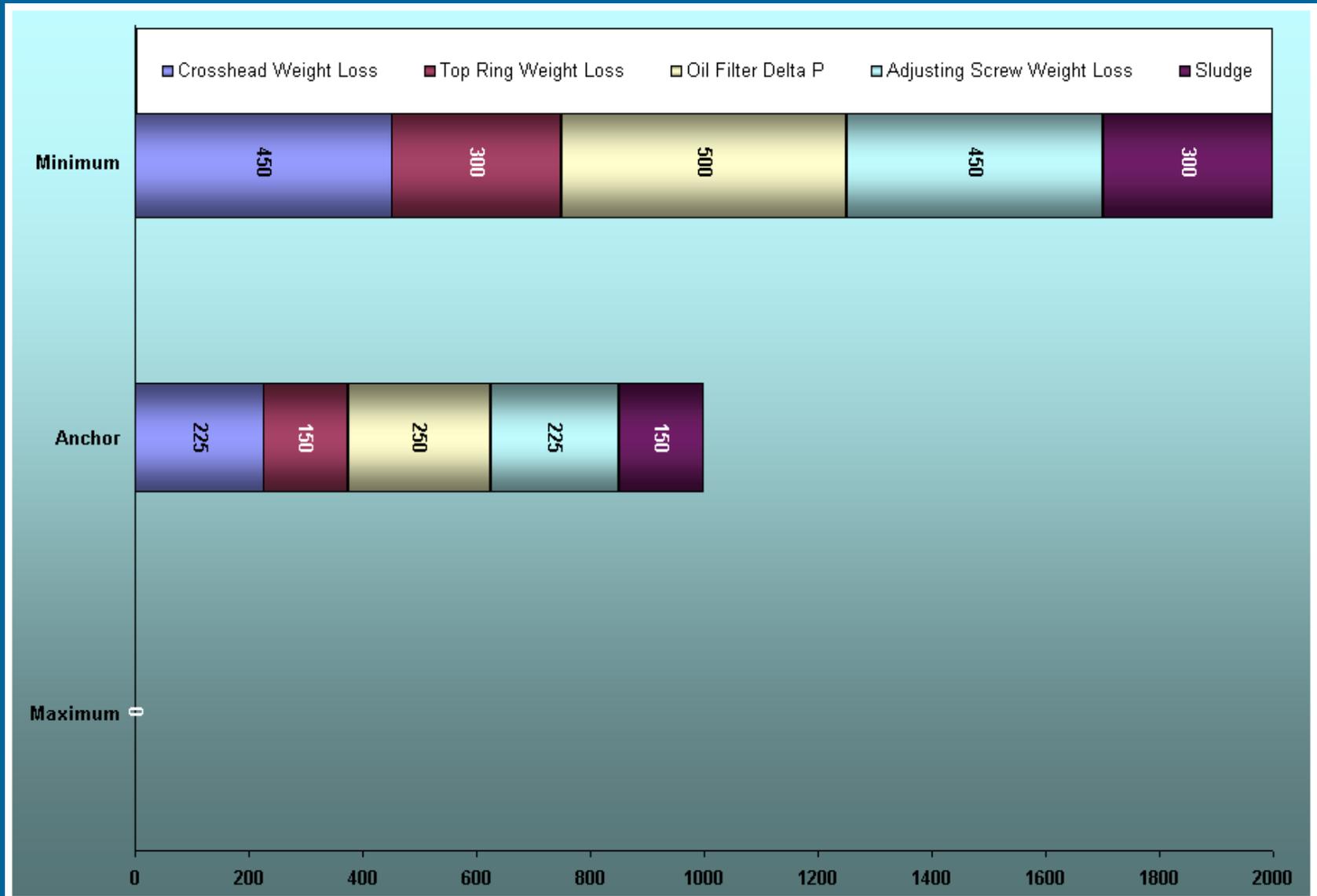
Examples Using Hypothetical Test Results

	Crosshead Weight Loss	Top Ring Weight Loss	Oil Filter Delta P	Adjusting Screw Weight Loss	Sludge	Calculated Merit	Final Merit
On the border	5.0	65	12	30	9.0	1000	1000
Borderline Failures	6.6	65	12	30	9.0	760	Fail
	5.0	91	12	30	9.0	844	Fail
	5.0	65	26	30	9.0	731	Fail
	5.0	65	12	46	9.0	760	Fail
	5.0	65	12	30	8.5	813	Fail
One parameter can make up for another	6.0	40	12	30	9.0	1000	1000
	5.0	70	10	30	9.0	1041	1041
	5.0	65	15	20	9.0	1092	1092
	5.0	65	12	35	9.3	1015	1015
	4.0	65	12	30	8.8	1075	1075
Beyond Limit Failure	6.6	40	5	15	9.5	1535	Fail
	3.5	91	5	15	9.5	1694	Fail
	3.5	40	26	15	9.5	1481	Fail
	3.5	40	5	46	9.5	1535	Fail
	3.5	40	5	15	8.5	1663	Fail

Values for Matrix Oil Tests

		Crosshead Weight Loss	Top Ring Weight Loss	Oil Filter Delta P	Adjusting Screw Weight Loss	Sludge	Calculated Merit	Final Merit
28402	1004-3	8.3	61	35	139	9.0	-1558	Fail
30048	1004-3	7.4	72	238	155	9.0	-5618	Fail
35313	1004-3	9.4	62	24	138	9.0	-1483	Fail
43672	1004-3	7.8	64	110	59	8.9	-1764	Fail
50254	1004-3	8.0	53	126	191	9.1	-3952	Fail
51225	1004-3	8.5	46	75	44	7.9	-1242	Fail
47644	830-2	5.7	57	9	20	9.2	1253	1253
50224	830-2	4.6	44	10	38	9.0	1134	1134
51799	830-2	4.4	56	12	34	9.1	1123	1123
52996	830-2	2.4	68	7	24	9.0	1470	1470
52997	830-2	7.0	34	11	25	9.1	988	Fail
54195	830-2	4.7	40	13	27	9.1	1245	1245
54204	830-2	4.9	78	27	41	8.8	397	Fail
50769	ISMA	5.9	76	10	137	8.6	-874	Fail
51224	ISMA	5.9	44	3	43	9.1	1087	1087

Potential Criteria Contributions



Benefits of Merit System

- More cost effective testing
- Consistent with reducing the time between ASTM acceptance and first date of API licensing
- Allows test developer to weight individual criteria
- Adds incentive for improved performance
- Flexibility in setting up system
- Easier to gain consensus on limits