

Backward Compatibility of ISM to M11 for API CH-4

Do they correlate?

Test Comparison

	M11 HST	ISM
% Soot	5.0%	6.5%
EGR	No	Yes
Oil Filter Media	Microglass media Remay polyester and nylon overlay	Stratapore polyester media Remay polyester overlay
OFDP Hours	200	150
Bypass in Oil Filter Head	Open	Blocked

TMC 1004 Test Comparison

	M11 HST		ISM	
	TMC 1004	CH-4 Limit	TMC 1004	Proposed Limit
Xhd Wt. Loss	20.5 mgs	6.5 mgs	8.6 mgs	7.5 mgs
OFDP	83 kPa	79 kPa	56 kPa	79 kPa
Sludge	8.75	8.7	8.97	8.1
n size	4		3	

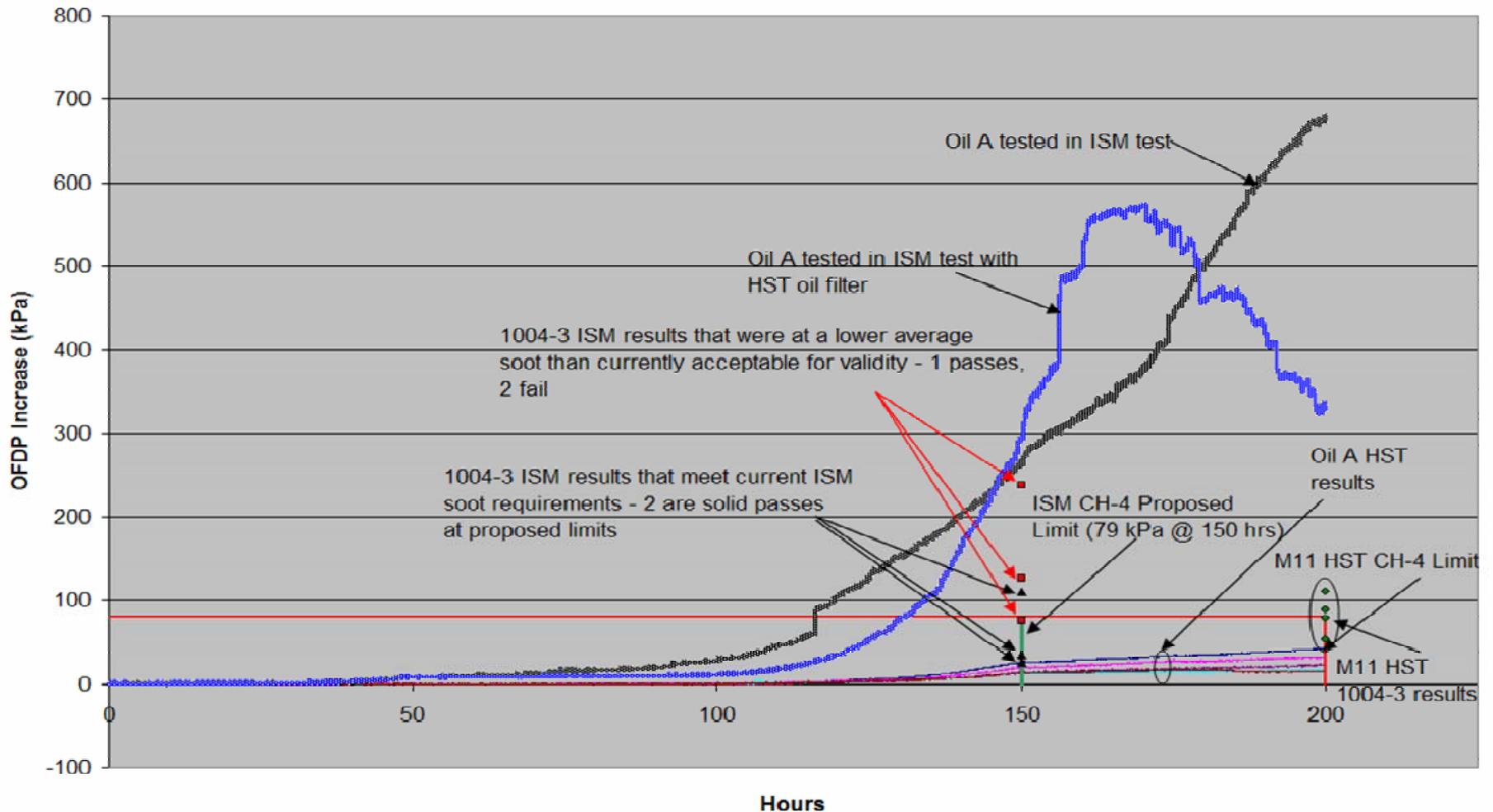
-  OFDP performance changes from borderline fail to solid pass
 -  2 of 3 ISM results less than half of pass limit (24, 35, 110)
-  Sludge performance changes from borderline pass to solid pass

Oil A Test Comparison

	M11 HST		ISM	
	Oil A	CH-4 Limit	Oil A	Proposed Limit
Xhd Wt. Loss	6.5 mgs	6.5 mgs	5.8 mgs	7.5 mgs
OFDP	42 kPa	79 kPa	265 kPa	79 kPa
Sludge	8.8	8.7	8.2	8.1

- OFDP performance changes from solid pass to very high fail
- Other parameters compare favorably to limits

Oil A and TMC 1004-3 OFDP Comparison ISM and HST data



TMC 1005 Test Comparison

TMC 1005 is M11 HST Reference Oil

	M11 HST		ISM	
	TMC 1005	CH-4 Limit	TMC 1005	Proposed Limit
Xhd Wt. Loss	4.53 mgs	6.5 mgs	?	7.5 mgs
OFDP	122 kPa	79 kPa	?	79 kPa
Sludge	8.4	8.7	?	8.1
n size	Ref Oil Targets			

Qualitative Summary

	1004			Oil A			1005	
	HST	ISM		HST	ISM		HST	ISM
Xhd Wear	Solid Fail	Fail		Borderline Pass	Pass		Solid Pass	?
OFDP	Borderline Fail	Solid Pass		Solid Pass	Solid Fail		Solid Fail	?
Sludge	Borderline Pass	Solid Pass		Borderline Pass	Borderline Pass		Solid Fail	?

Conclusion

- Comparison of TMC 1004 and Oil A data suggest ISM and M11 HST do NOT correlate on sludge and OFDP parameters.
 - ▲ Limits appropriate for one are not appropriate for the other

- CH-4 oils were designed for 4.5% - 5% fuel soot, not 6.5%. Perhaps this data suggests that when subjected to higher soot levels, or different types of soot (EGR vs non-EGR), oil performance may vary.

- When defining replacement tests, the integrity of the category must remain unchanged...ie. no decrease or increase in performance.

Proposed Path Forward

- ▲ Afton has agreed to run one ISM test on TMC 1005 (M11 HST reference oil) to generate data from a 3rd oil.
 - ▲ All data should be used by Cummins SP to either generate appropriate targets (if they exist) or deem the tests (or specific parameters) non-comparable.
 - ▲ If proposed limits are correct, 1005 should have clearly failing OFDP, clearly passing Xhd wear and failing sludge.
- ▲ Cummins SP recommends (6-0-2) that HDEOCP hold off on exit ballot limits until Afton runs 1005 and the SP reviews all data to propose limits (estimated completion ~ end of September 2007). Technical goal is to maintain backward compatibility without changing category performance.