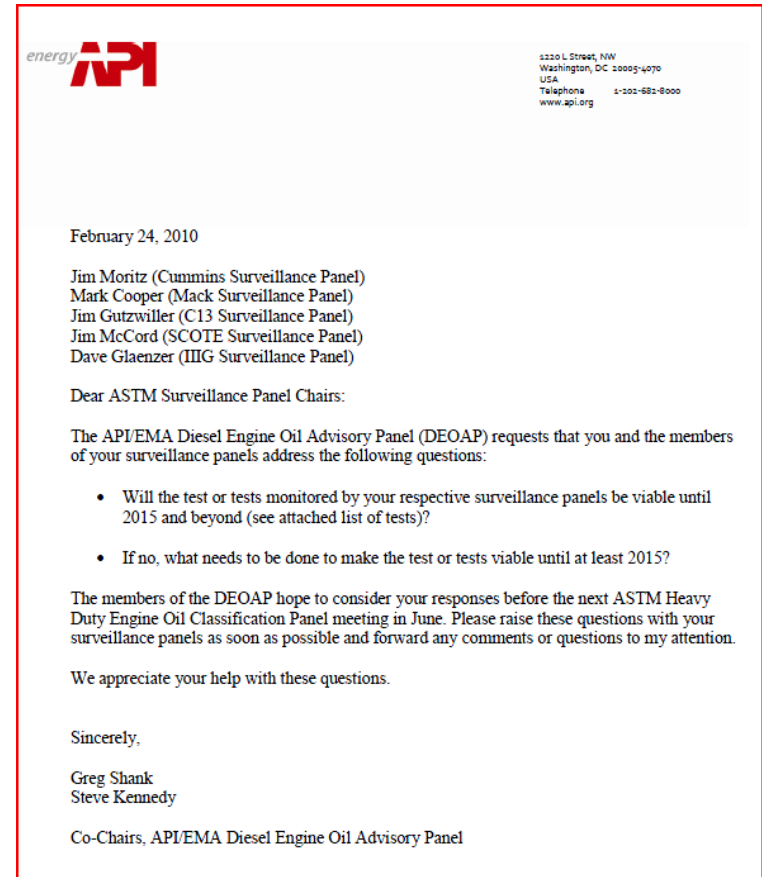


Projected Life of Engine Lubricant Tests in API 'C' Categories

**Mark Cooper
June 29, 2010**

Requests Concerning Life of API 'C' Engine Lubricant Tests

- **February 24, 2010 Letter from DEOAP**
 - Plan to make CJ-4 engine tests available through 2015
- **Recent request to project availability beyond 2015**
- **Summary of all current API 'C' Category engine lubricant tests included**
- **Thanks to numerous people who provided supporting information**



API 'C' Category Engine Lubricant Tests

Engine Test	Fuel	Active?	Cal Stands	CJ-4	CI-4 PLUS	CI-4	CH-4	Issues
Cat 1K	0.4% S	Y	5			X	X	
Cat 1N	PC-9	Y	5	X				
Cat 1P	PC-9	Y	4				X	
Cat 1R	PC-9	Y	1			X		
Cat C13	ULSD	Y	2	X				
Cummins M11-HST		N					X	
Cummins M11-EGR		N				X		
Cummins ISM	PC-9	Y	5	X		M11-EGR alt	M11-HST alt	OFDP, Wear severity
Cummins ISB	ULSD	Y	3	X				Engine to be replaced
Mack T-8/E	PC-9	Y	3			X	X	
Mack T-11	PC-9	Y	3	X	X			
Mack T-9		N					X	
Mack T-10		N				X		
Mack T-10A	PC-9	N (a)				X		Alternate being evaluated
Mack T-12	ULSD	Y	4	X		T-10 alt	T-9 alt	New hardware pending
RFWT	PC-9	Y	2	X		X	X	
EOAT	PC-9	Y	1	X		X	X	EMA concern w/severity
Seq III F/G	--	Y		X		X	X	Tied to light duty specs

June 29, 2010

Projected Life of API "C" Category Engine Lubricant Tests
HDEOCP / DEOAP

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Caterpillar Tests

Test	Engine	Supported through 2015	Supported past 2015
1K / 1N	1Y540	Yes*	?
1P / 1R**	1Y3700	Yes	?
C13	C13	Yes	Yes***

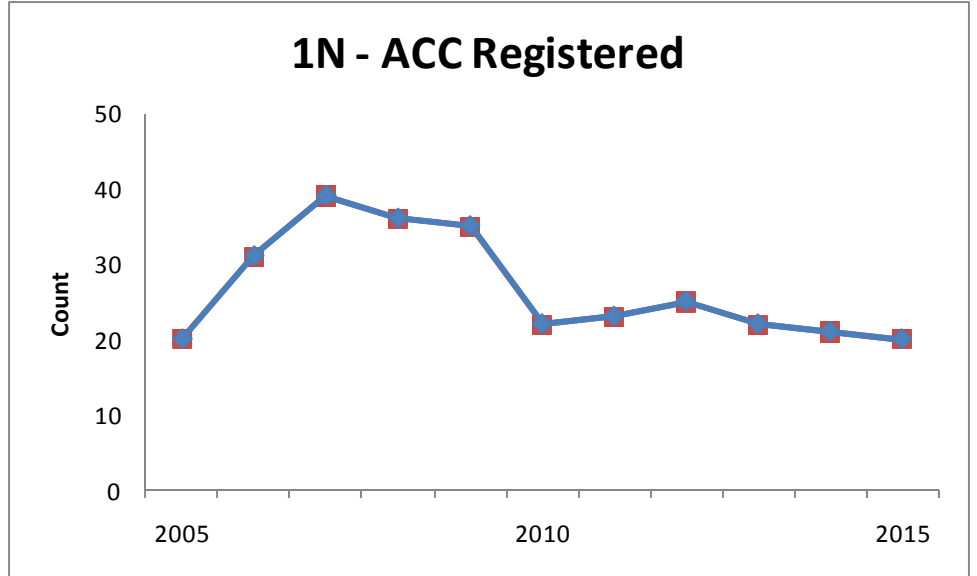
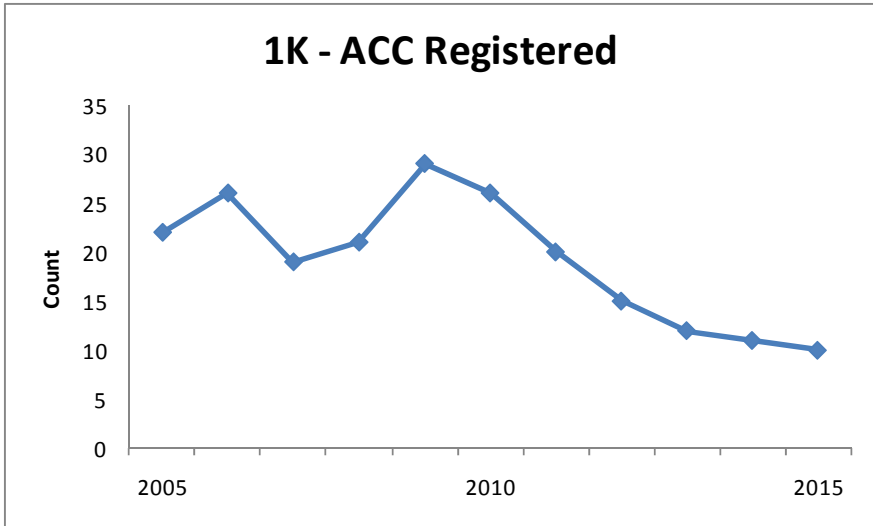
Notes:

* Current issues with oil pumps and coolant heat exchangers

** Different pistons and rings used in 1P and 1R.

*** C13 is production engine – end date of production?

Cat 1Y540

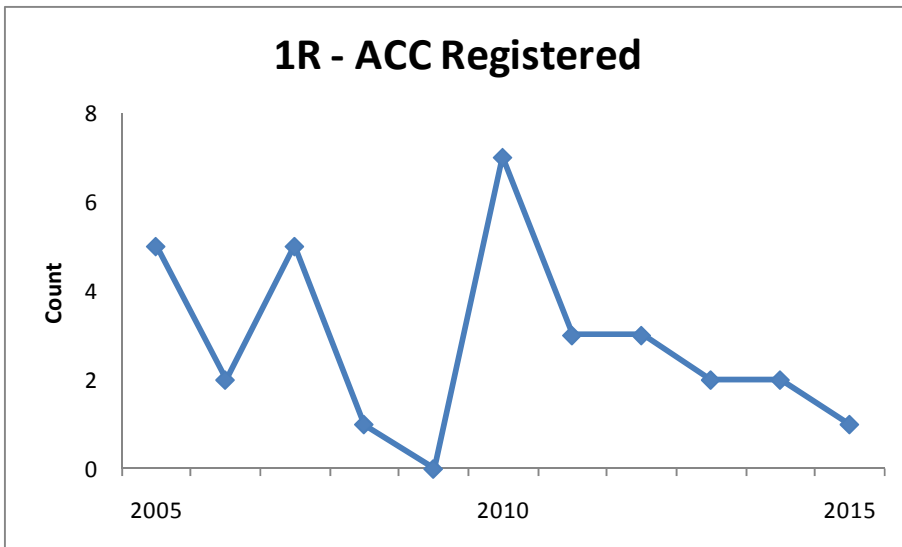
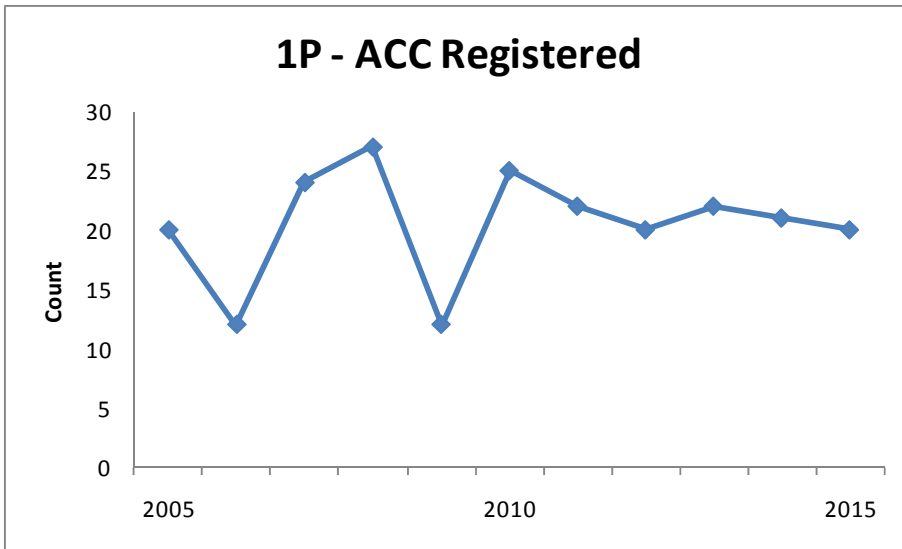


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Projected Life of API "C" Category Engine Lubricant Tests
HDEOCP / DEOAP

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Cat 1Y3700

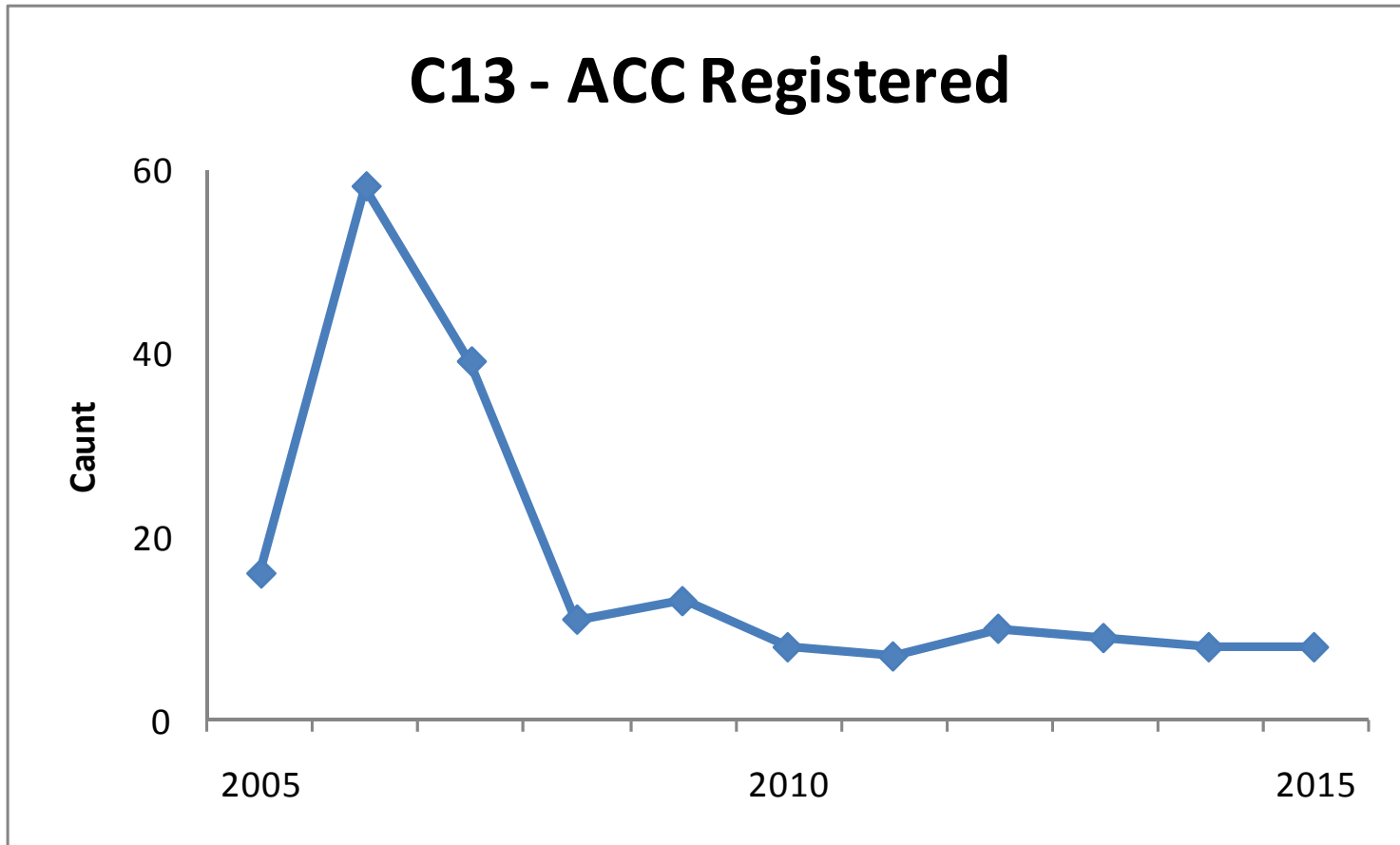


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Projected Life of API "C" Category Engine Lubricant Tests
HDEOCP / DEOAP

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C13



Cummins ISB and ISM

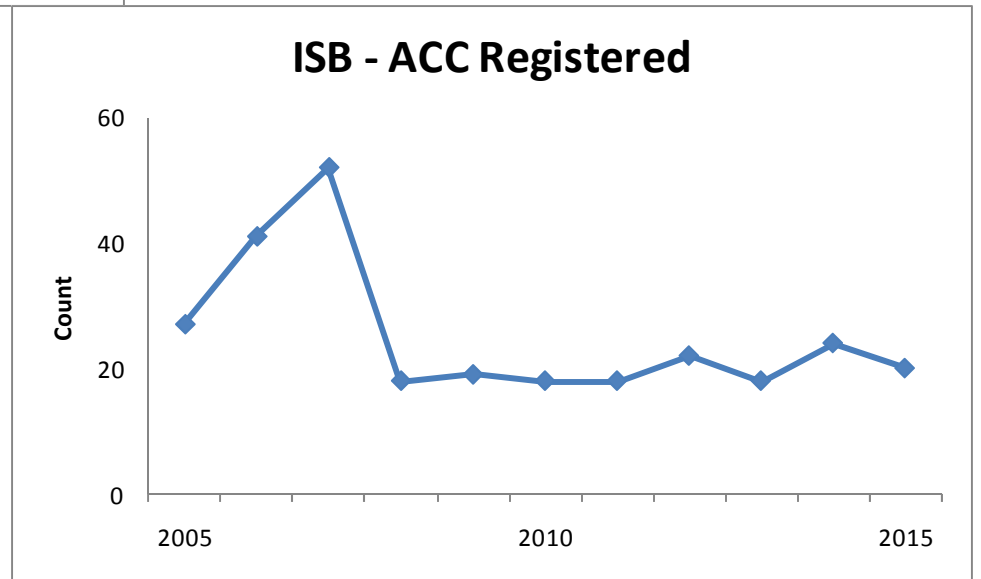
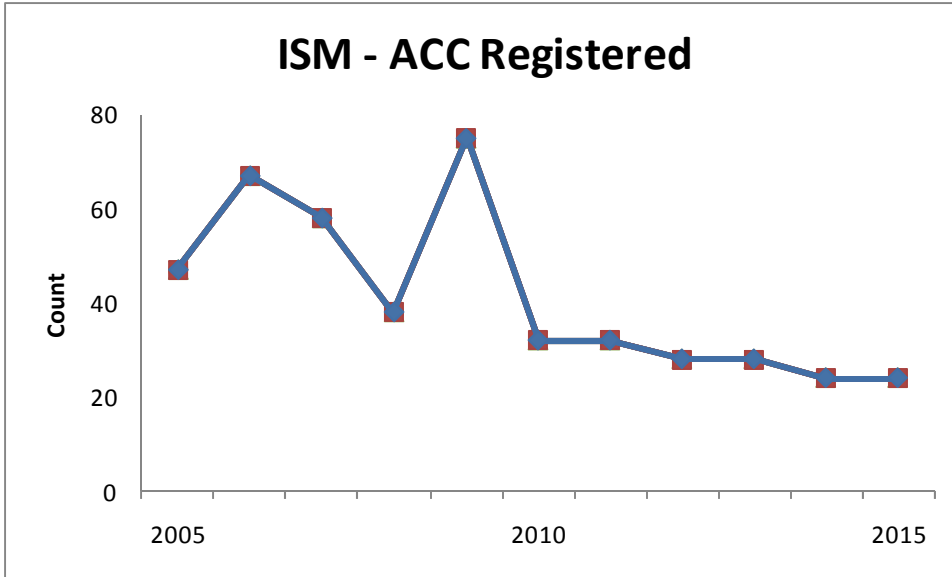
- **ISM**

- Evolution of 1994 M-11 engine
- Engine produced in Jamestown facility for foreseeable future
- ISM can be supported through 2015, possibly longer
- Large batch of crossheads and oil filters secured in March 2010

- **ISB**

- Evolution of 1997 ISB 5.9 L engine
- Production ISB engine upgraded to 6.7 L in 2007
- ISB can be supported with current hardware for foreseeable future
- Transition from 5.9 L to 6.7 L after 5.9 L inventory is used up

Cummins ISB and ISM



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Projected Life of API "C" Category Engine Lubricant Tests
HDEOCP / DEOAP

Engine Oil Aeration Test (EOAT)

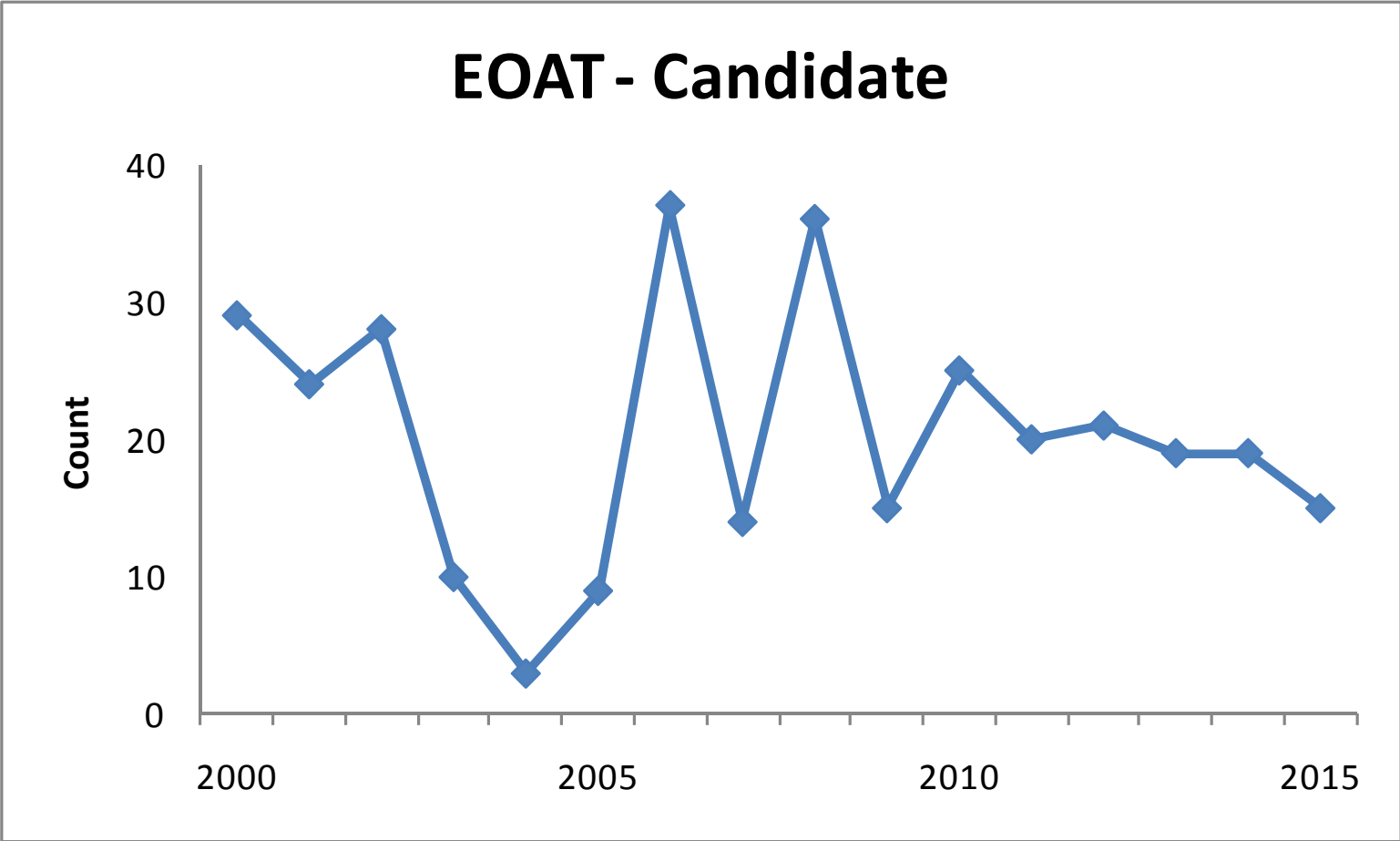
1 referenced lab

- **Base Engine – 1994 7.3L Ford Power Stroke**
 - Engine designed by Navistar
 - Uses HEUI injection system
- **Engine Components Critical to Severity**
 - Engine block – must be SN 201680 or previous
 - Oil pan
 - Front cover
 - Oil suction tube

Current design of these components reduces aeration

- **Availability of Critical Engine Components**
 - Lab currently has one engine block, oil pan, front cover, and oil suction tube that produce correct severity
 - Still determining availability of critical components at reman contacts
 - Other rebuild components available as service parts

EOAT



Mack T-8, T-11, and T-12

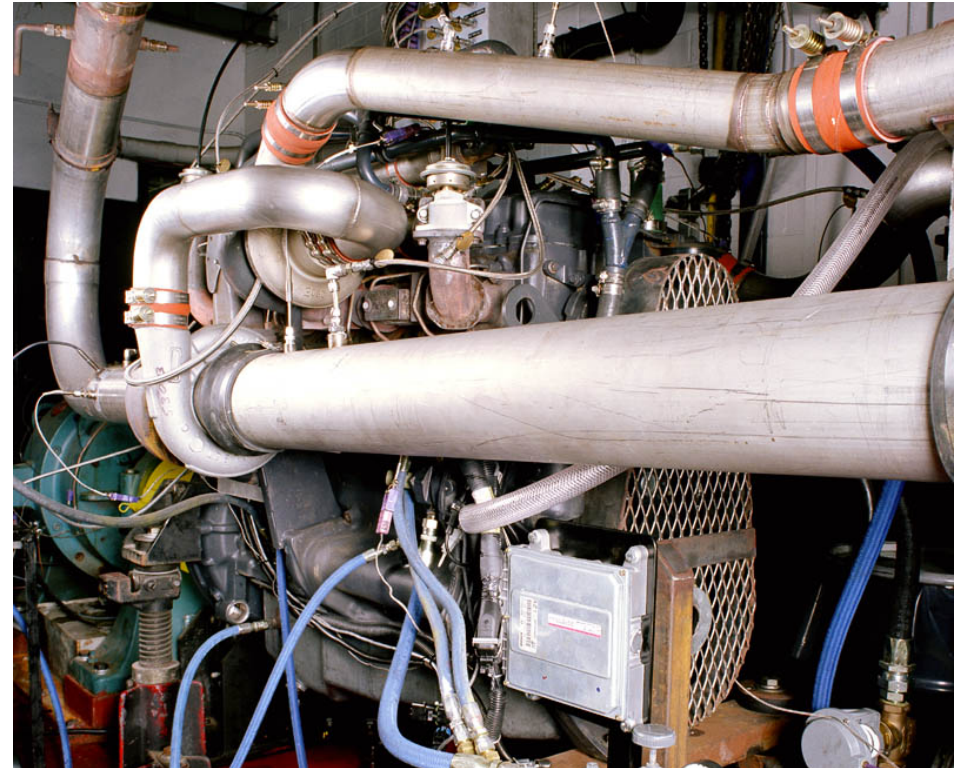
- **T- 8**
 - 1989 E7 12 L engine
 - originally production engine
- **T-11 – T-12**
 - 1998 based on E7 E Tech with Bosch EUP
 - Non-production, emissions mapping configuration

Notes:

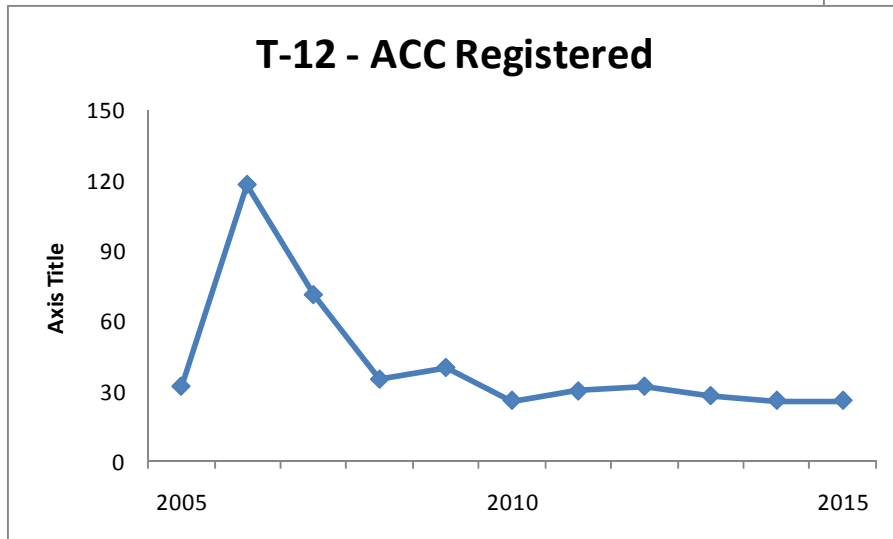
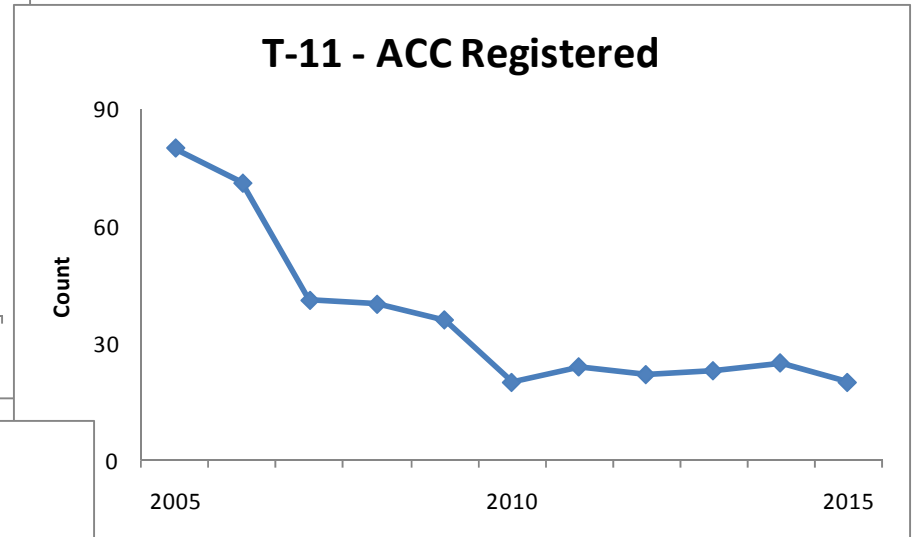
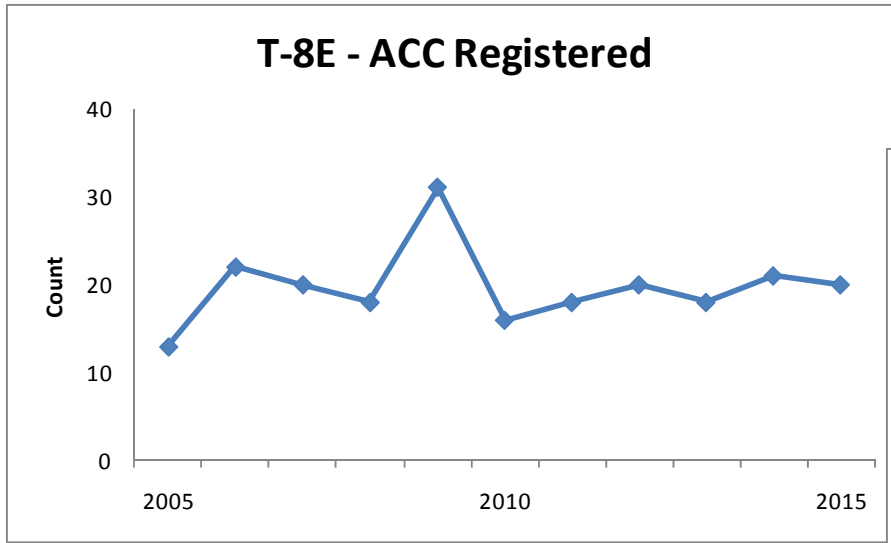
E7 and E Tech no longer in production

Sufficient pistons, rings, liners and bearings to support usage through 2015+

Other components supported through service parts



Mack Test Usage



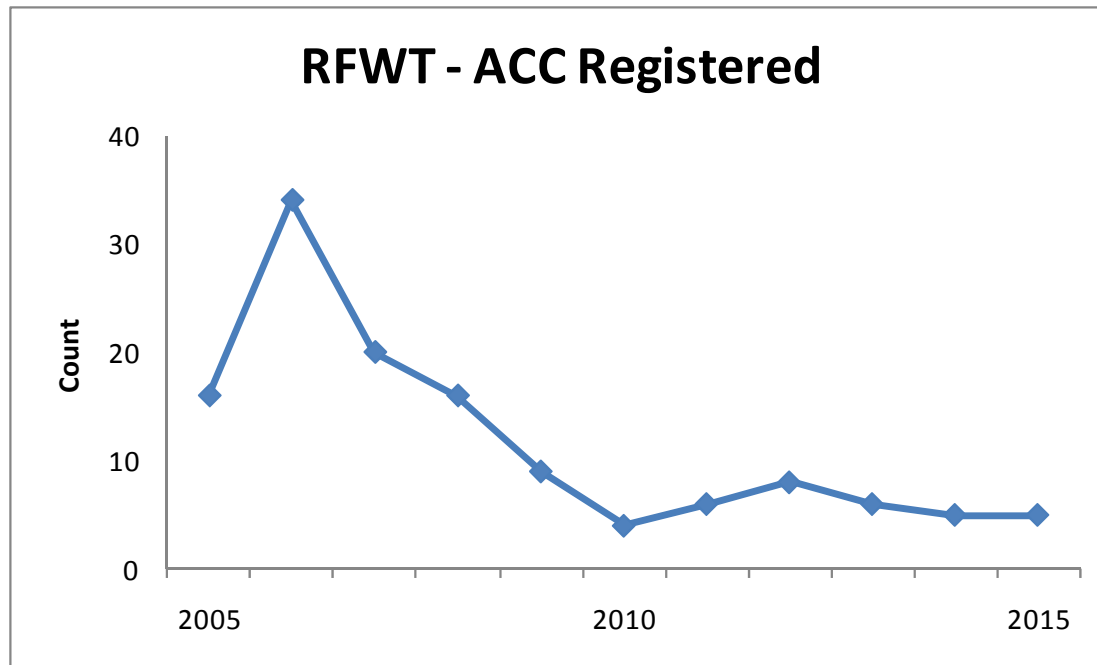
June 29, 2010

Projected Life of API "C" Category Engine Lubricant Tests
HDEOCP / DEOAP

13

Roller Follower Wear Test

- **Base Engine – 1992 6.5L GM Diesel V-8**
 - Original engine 6.2L GM diesel (1982-1992)
 - Changed to 6.5 L (6.5 L in production 1992 -2000)
 - Mechanical injection pump, variant of Stanadyne DB-2 pump
 - Flush and run test, but engine / injection pump replaced every 15 runs



RFWT Critical Parts Inventory

Engine Components	Availability
6.5 L Engine Long Engine Block (PN 88894130)	Currently available
Injection Pump K8-DB2831-5437 (PN 12561384)	Available at dealer Discontinued?
Injection Pump (in RFWT test procedure) (PN 10154615)	Unable to confirm
Fuel Injector Nozzle (PN 12458122)	Currently available

Roller Follower Inventory at CPD	Quantity
Assembled Roller Followers	575
Components (Bearing & Shafts)	7413
Total Roller Follower Availability**	7988

Notes:

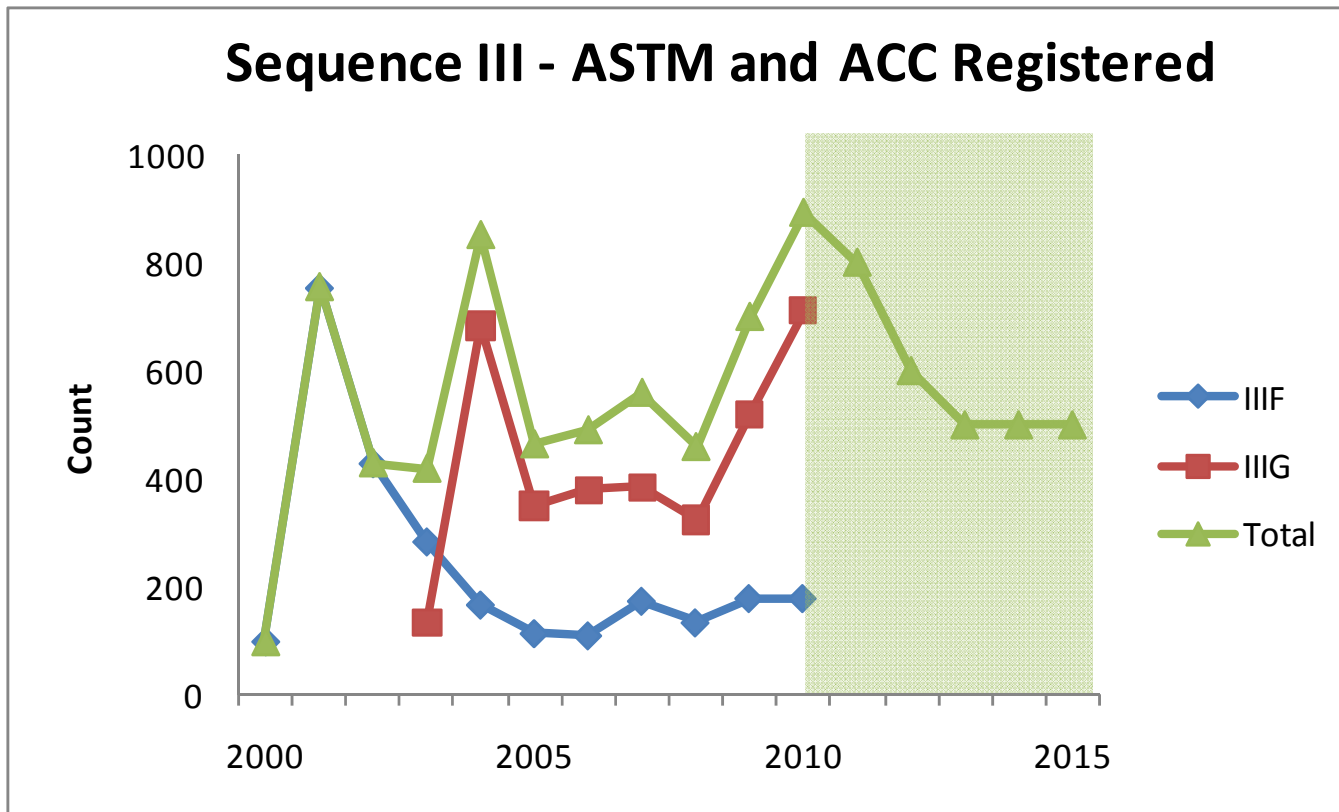
Engine components outside of ten-year warranty requirement supply.

Engine components will only be supported if dictated by sufficient volume.

Injection system upgraded to electronic rotary pump in 1994.

A version of this engine still produced by AM General, General Engine Products (GEP).

Sequence III



Projected 3800 runs 2010-2015

Sequence III Critical Parts Inventory

Component	GM Racing	Test Labs	Total
Connecting Rods (PN 12593374)	21,758	1172	22,930 (3821 runs)
Crankshaft (PN 24502168)	584	50	634 (3804 runs)
Engine Block (PN 24502286)	570	36	606 (3636 runs)
Cylinder Head (PN 24502260B)	6200	555	6755 (3377 runs)

Notes:

Other parts, e.g. parts supplied by CPD will remain available.

Potential shortages of small items will be dealt with as they arise.

May be excess components at the projected end of GF-5 in 2015.

May be forced to re-use cylinder heads.

Sequence III SP feels they are “in good shape”.

Summary

Test	Availability through 2015	Availability beyond 2015	Notes
Cat 1K	No issues	Possibly	Oil pump and coolant heat exchanger
Cat 1N	No issues	Possibly	Oil pump and coolant heat exchanger
Cat 1P	No issues	No issues	CH-4 life?
Cat 1R	No issues	No issues	
Cat C13	No issues	Probably	Production engine for some time
Cummins ISM	No issues	Probably	Production engine for some time
Cummins ISB	No issues	Probably	Production engine for some time
EOAT	?	?	Critical engine parts supply?
Mack T-8E	No issues	Possibly	Depends on usage rate until 2015
Mack T-11	No issues	Possibly	Depends on usage rate until 2015
Mack T-12	No issues	Possibly	Depends on usage rate until 2015
RFWT	?	?	Injection pump supply?
Seq III	No issues	?	Not projected past 2015 – GF5