Mack / Volvo Surveillance Panel Meeting

April 22, 2024

David Brass (chair)

Agenda

- Volvo T-13 Oil Consumption Discussion
- Volvo T-13 Parts Analysis
- Reference Oil 823-1 Testing Plan
- New Reference Oil Matrix
- AOB

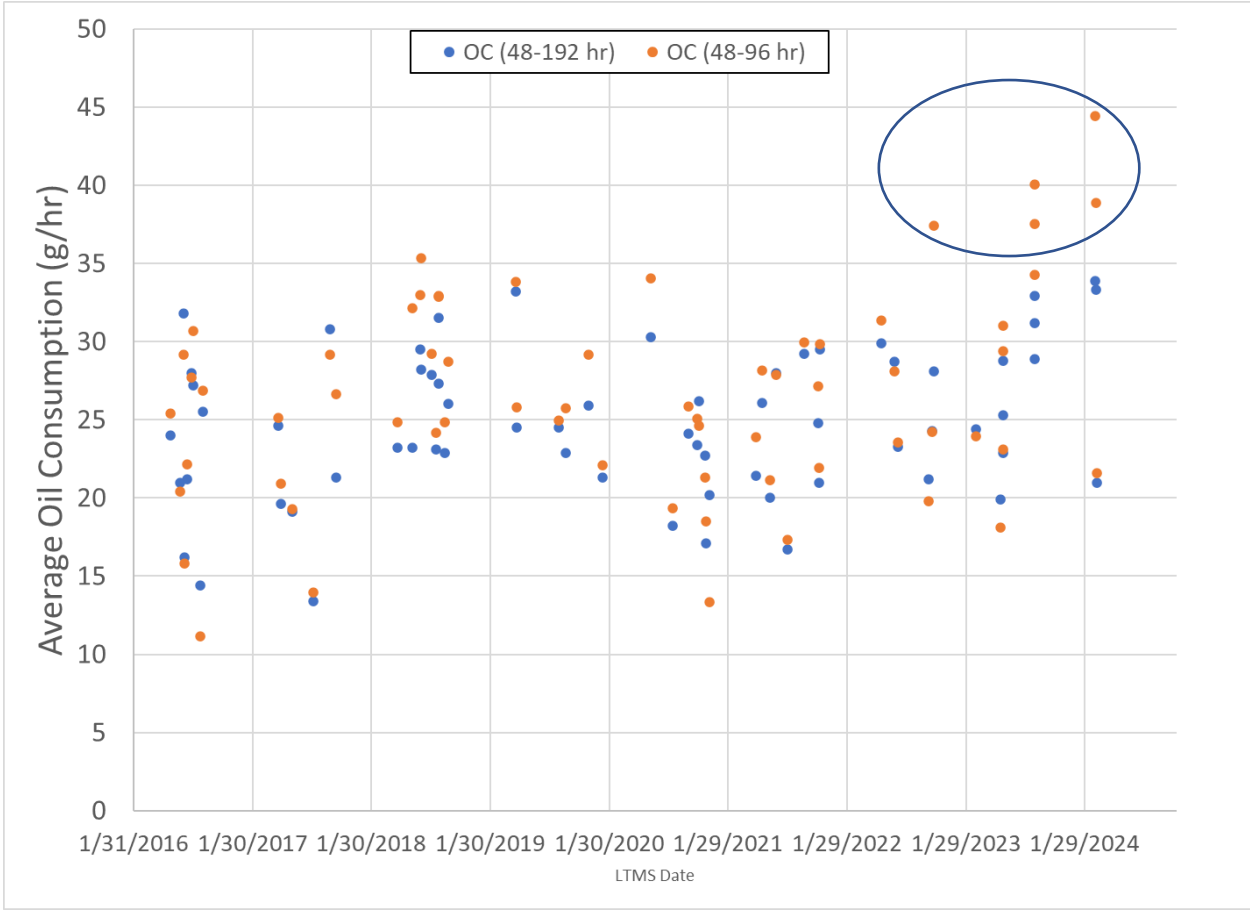
Oil Consumption Concern
Testing of RO 823 and 823-1

In recent tests the oil consumption measured during the first 96 hours of the test has been much higher than historical tests. The reference oil 823 & 823-1 is a 10W-30 (2.9-3.2 cP) viscosity oil.

- For tests that had oil consumption higher than 40 g/hr in the first 96 hours the external weight bucket was dry prior to 360 hrs.
- Tests > 45 g/hr for extended time will not complete the 360 hr test
- This level of oil consumption is occurring in both reference and candidate tests.

Historical Average (N=65), 48-96 hr = 26.5
Historical Average (N=65), 48-192 hr = 24.8

Historical Average includes only tests on 823 & 823-1 since humidity control was implemented



Oil Consumption appears to be affected by the rings

- Test Lab G ran testing to understand the effect of the rings

	Reference Test	Run 1	Run 2	Run 3
Pistons	**Kit 866**	Kit 939	Kit 939	Kit 939
Rings	**Kit 866**	Kit 939	**Kit 866**	Kit 939
Liners	**Kit 866**	Kit 939	Kit 939	Kit 939
Oil Consumption (48-96 hr, g/hr)	29.4	44.4	26.9	36.2
Oil Consumption (48-192 hrs, g/hr)	25.3			

- Fresh 832-1 oil was added for each test. Engine was run through initial break-in cycle before each run.

	866	939
Piston Date Codes	0822	0123
Top Ring Stamp	903k – 934k	1017k
2nd Ring Stamp	897k – 934k	998k – 1020k
Oil Ring Stamp	900k – 945k	950k – 974k

Oil Consumption appears to be affected by the pistons

CMIR	Stand	Oil Consumption (48-192 hr)	Oil Consumption (48-96 hr)	Kit #	Piston Date 1	Piston Date 2	Piston Date 3	Piston Date 4	Piston Date 5	Piston Date 6
172877*	A2	19.9	18.1	853	0522 1218	0522 1328	0522 1324	0522 1330	0522 1224	0522 1335
179973	A2	21.0	21.6	917	0822 2311	0922 1307	0822 2306	0822 2309	0821 1500	0722 0623
177777	B3	22.9	23.1	795	0421 1644	0421 0819	0521 0015	0521 0016	0521 2355	0521 2354
	G		26.9	939/866						
177774	G1	25.3	29.4	866	0822 1829	0822 1814	0822 0316	0822 0043	0822 1859	0822 1814
177776	A4	28.8	31	860	0522 1331	0522 1338	0522 1337	0522 1337	0522 1339	0522 1330
180631	G2	28.9	34.3	907	0822 0013	0922 0509	0922 0501	0922 0837	0922 1117	0922 1307
177775	D2	32.9	37.5	856	0522 1331	0522 1341	0522 1341	0522 1321	0522 1307	0522 1325
185298	D1	33.3	38.9	929	0223 0635	0223 0637	1022 0413	1022 0432	1222 1008	1022 0411
179972	A8	31.2	40.1	887	0922 0844	0922 0921	0922 2212	0922 0841	0922 0822	0922 2228
	G		44.4 36.2 repeat	939	0123 1218	0123 1304	0123 1305	0123 1322	0123 1302	0123 1302

*RO823

< 30

30 ≤ x < 35

35 ≤ x

0922 and later

- Pistons after a certain date appear to be affecting Oil Consumption

Parts Combinations

CMIR	Stand	Oil Consumption (48-192 hr)	Oil Consumption (48-96 hr)	Kit #	Liner Batch	Piston Date 1	Top Ring Stamping
172877*	A2	19.9	18.1	853	C	0522	5x 681k-808k, 1x 934k
179973	A2	21.0	21.6	917	D	0821, 0722, 3x 0822, 0922	1x 903k, 5x 939k
177777	B3	22.9	23.1	795	C	2x 0421, 4x 0521	
	G		26.9	939/866	D	0123	1x 903k, 1x 914k, 4x 934k
177774	G1	25.3	29.4	866	C	0822	1x 903k, 1x 914k, 4x 934k
177776	A4	28.8	31	860	C	0522	3x 903k, 3x 934k
180631	G2	28.9	34.3	907	C	0822, 5x 0922	
177775	D2	32.9	37.5	856	D	0522	4x 914k, 2x 925k
185298	D1	33.3	38.9	929	D	3x 1022, 1x 1222, 2x 0223	6x 1000k
179972	A8	31.2	40.1	887	D	0922	5x 939k, 1x 968k
	G		44.4 36.2 repeat	939	D	0123	6x 1017k

*RO823

< 30

30 ≤ x < 35

35 ≤ x

0922 and later

>934k

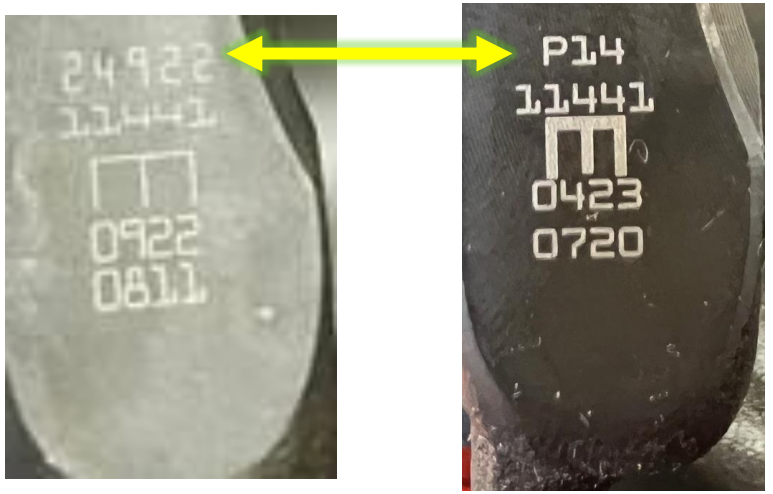
Piston Coloration Difference

It appears that there is a difference in the coatings on the pistons that are being received

Based on the picture which includes 16 pistons

- All those that look black are date coded 2019-2020
- All those that look green are date coded 2022-2023

- All of the 2019, 2020, 2022 pistons in this picture have Julian Date Codes dddyy stamped above the M. All 0423 pistons have a P14 stamped above the M.



823-1 Results – Sorted by Oil Consumption

CMIR	Stand	FTIR Peak Height	Delta KV40 (300-360)	Oil Consumption (48-192)	Oil Consumption (48-96)
179973	A2	115.9	64.2	21	21.6
177777	B3	124.3	78.2	22.9	23.1
177774	G1	103.3	61.2	25.3	29.4
177776	A4	102.6	52.8	28.8	31
180631	G2	95.2	57.7	28.9	34.3
177775	D2	104.9	59.6	32.9	37.5
185298	D1	121.6	68.8	33.3	38.9
179972	A8	113	63.5	31.2	40.1
Target		109.3	$(8.139)^2 = 66.2$		

Oil Consumption may not affect test results. Repeated results not available on a stand to help confirm.

Piston/Ring Analysis

- External Slides from Lubrizol

TEI Parts

- The following parts are in hand at TEI (approximate)

Pistons	Quantity	Rings
0119	5	500k
0619	1	500k
0819	2	500k
1120	1	600k
0722	6	
0922	14	
1022	3	
1122	2	
0223	37	>900k
0423	51	>1000k

- Liner Batch D. Only 1 Batch C liner kit remains.

RO 823-1 Testing Plan

1. Lab D is running a test using pistons all date coded 0423, top rings stamped 1017729 and D batch Liners. (These are the latest stamped materials in hand)

What other tests would the Surveillance Panel like to test to better understand how to rectify the situation.

SP agreed to have Lab B test XX19 pistons with >1000k piston rings and D liners.

Volvo T-13 Reference Oil Matrix Testing

Lab A / Stand 1	Lab B / Stand 1	Lab D / Stand 1	Lab G / Stand 1
New Reference Oil	New Reference Oil	New Reference Oil	New Reference Oil
New Reference Oil	New Reference Oil	New Reference Oil	New Reference Oil

Both tests must be conducted in the same stand and run consecutively (no candidates in between)

Current Reference Status

All labs have stands that recently came off calibration status.

Lab	Stand	Date Reference Expires
A	2	4/18/25
A	4	3/23/24
A	8	6/17/24
B	3	3/23/24
D	1	1/3/25
D	2	3/23/24
G	1	3/23/24
G	2	5/22/24
G	3	8/16/23