

All,

I wanted to inform this group of the result of a recent 1N hardware test that we ran as a part of our continuing investigation into the TGF issues we discussed earlier last year. We ran a reference test on oil 811 in our stand 605. If the group recalls, 811 was supposedly the oil that was trending severe and our stand 605 was also supposedly a severe stand. We ran the recent reference test using a piston, rings, and liner from Southwest who had some older parts on hand and, as you might guess, we drastically shifted our results and went very mild with TGF as you can see in the plot below. Before running the test, we analyzed the Southwest parts and compared them against a set from Lubrizol. We found what we believe to be significant differentiation of the top ring face surface finish, as displayed in the second graphic below (the “Minus Major Asperity” values or those that discount a large valley in the Southwest ring). I believe this new information warrants further discussion and should probably be brought up again at a surveillance panel call. If there are any questions or comments, please let me know.

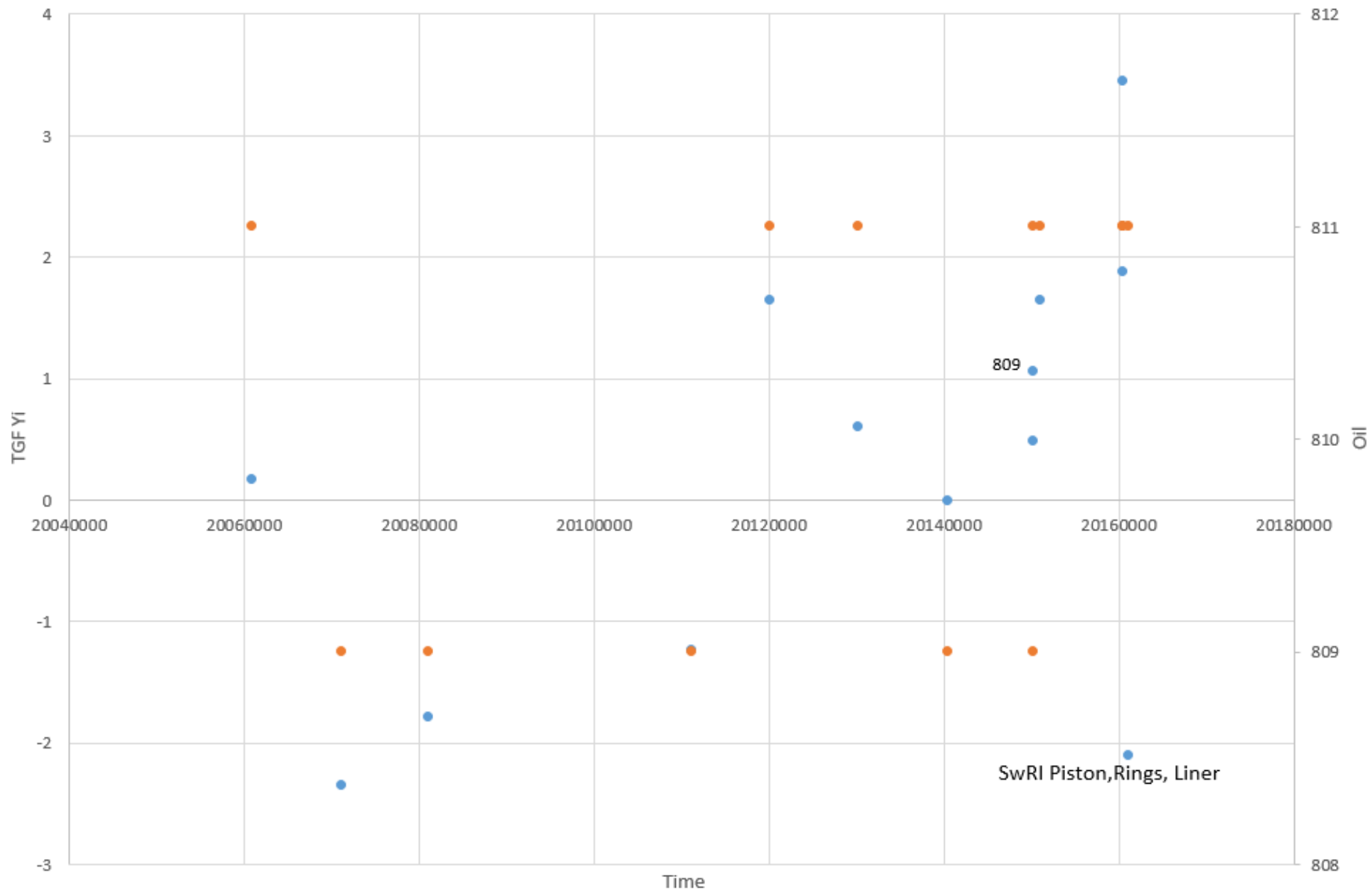
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The Lubrizol Corporation

Pos 605 Reference TGF Current Performance

● TGF Yi ● Oil



LZ					SwRI			
Top Ring Face, 180°					Top Ring Face, 180°			
Measurement	Entire Trace Values	Minus Major Asperity Values	Units		Measurement	Entire Trace Values	Minus Major Asperity Values	Units
Ra	0.173	0.128	μm		Ra	0.885	0.798	μm
Rq	0.386	0.218	μm		Rq	1.18	0.936	μm
Rp	0.96	0.434	μm		Rp	3.708	1.947	μm
Rv	4.51	2.598	μm		Rv	10.03	4.084	μm
Rt	5.47	3.032	μm		Rt	13.738	6.031	μm
Rpm	0.43	0.311	μm		Rpm	2.066	1.699	μm
Rmax	5.47	2.894	μm		Rmax	13.738	5.947	μm
Rz	1.953	1.658	μm		Rz	5.087	3.921	μm
Rsk	-6.587	-4.391			Rsk	-1.398	-0.087	
Rku	64.18	36.26			Rku	11.083	2.338	
RSm	36.077	27.073	μm		RSm	12.939	12.59	μm
Pc	50.11	57.49	/mm		Pc	79.33	81.48	/mm
RΔa	0.101	0.1	μm/μm		RΔa	0.414	0.416	μm/μm
RΔq	0.153	0.153	μm/μm		RΔq	0.5	0.496	μm/μm

Definitions	
Parameter	Explanation
Ra	Average Roughness
Rq	Root mean square roughness
Rp	Highest peak over profile
Rv	Deepest valley over profile
Rt	Vertical distance from deepest valley to highest peak
Rpm	Trace broken into unit lengths: total average over entire trace of each Rp within a unit length
Rmax	Trace broken into unit lengths: Greatest Rt of any one of the unit lengths
Rz	Average of 5 highest peaks and 5 deepest valleys
Rsk	Skewness: (-) means profile is skewed towards valleys, (+) means skewed towards peaks
Rku	Kurtosis: Intensity of peaks about mean line, >3 means sharp peaks, < 3 means not sharp peaks
RSm	Mean value of spacing between profile irregularities
Pc	Peak Count (# of peak in a unit length)
RΔa	Average wavelength
RΔq	RMS average wavelength