



COMMITTEE D02 on PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS

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SEQUENCE IX SURVELLANCE PANEL

Date: 16 Nov 22

ATTENDANCE

SWRI	Christine Eickstead, Khaled Rais, Travis Kostan, Pat Lang, Mike Lochte, Mike Van Hecke
INTERTEK	Al Lopez, Jason Soto, Bill Buscher
LUBRIZOL	George Szappanos, Tony Catanese
AFTON	Ben Maddock, Bob Campbell, Andrew Rohlfing, Joe Hoehn
ORONITE	Robert Stockwell, Ricardo Affninito
INFINEUM	Doyle Boese, Andy Ritchie
TMC	Rich Grundza
OHT	Jason Bowden
TEI	Dan Lanctot
FORD	Mike Deegan, Rob Zdrowski
VALVOLINE	Amol Savant
HALTERMAN CARLESS	Izabela Gabrel
EXXON MOBIL	Paul Rubas
IMTS	Dave Passmore
SHELL	Jeff Hsu

ATTACHMENTS:

- ➔ A: Meeting Agenda
- ➔ B: Rich Grundza's State-of-the-Test Presentation
- ➔ C: Rich Grundza's RO 221 presentation

MEETING:

1. **Attendance. See table above.**
2. **Chairman's Comments, Khaled.**
3. **Review and Acceptance of Minutes**
 - a. Last IX SP meeting was 16 June 22.

MOTION 1: Approve meeting minutes from last meeting

Proposed: Khaled Rais

Second: Bill Buscher

Discussion: None

Questions: None

Votes: *Waive:* 0

Negative: 0

Approve: N/A

Outcome: Motion passes unanimously

4. **Review Action Item List, Khaled.**

Will be discussed as we get to the individual topics in old business.

5. **TMC Report, Rich Grundza.**

Rich presents, see attachment B.

6. **Fuel Performance Update**

No one available for fuel update, skipped item.

7. **Pistons**

The machined pistons (modified 2019 BBs), had good results. Received a matrix from stats group. There is concern with the possible variability of the cast surface.

Deegan to look into producing a new batch of pistons with IMTS. Deegan has a meeting with them on 28th Nov. to discuss timing, and prints. Will make small amount for testing. Have had discussions with labs to make sure can they duplicate piston design.

Deegan – what is SwRI going to do with the machined pistons? Khaled – all labs except Lubrizol have a set of machined pistons. SwRI – waiting on other labs to try the pistons.

SwRI has enough BBs to wait for the new batch. Other labs?

Pat – we’ve shown the machining process works, but this needs to be proven at other labs. But if a new batch is coming soon, should we wait for that instead?

Rich – yes, results on machined pistons were fairly encouraging. 221 provided avg of 9 (slightly mild), 224 provided an avg of 3.25 (slightly severe), so probably would have calibrated if these runs had been intended as references.

Doyle - were the pistons in a new engine? Khaled – no, not a new engine. Jason – were new rings or used rings used to break engine in? Khaled – think new rings.

George – what made the difference? Compression ratio? Feature on crown? Khaled – probably more the crown features. Tried a head gasket early on– didn’t make a difference. Pat – there is contour difference with new pistons. Once we mapped the old BBs onto the new pistons, were able to see results. Only one degree of freedom – to remove material. Sharp edge vs cast edge.

Pat – need to decide this today. Don’t know everyone’s inventory levels, but suspect they are low across the board.

George – which piston batches are suitable for modification and how many do we have? Pat – 2019 BBs, total order?

Jason – Ford has a grade 3 piston which is identical. 2019 problem – they are bigger. So SwRI hand-picked a few to machine. Khaled – measured 40, very few rejected if pick bore and piston together.

Jason – IAR has hardware to last for quite some time. Would like to proceed with running machined pistons, as long as the runs count towards something. Believe they will work at all labs, but wait for new pistons to be manufactured instead?

Lochte – we can machine the necessary amount of pistons in house, no problem.

George – preference to move forward with the machined pistons, more robust way forward.

Christine – what assurance do we have that new batch will be more in line with what we need? Will we be in the same place again with pistons that don’t match the print?

IMTS – been to the facility, talked to them, reviewed piston with them, 100% confident they can duplicate it.

George – forged or cast? IMTS – forged, but externally machined. George – OEM piston is cast. So... difference.

Christine – does everyone else have hardware? Lubrizol and Afton – yes.

Deegan – so what is the timeline to make the decision?

George – have an engine that is getting old. Can build an engine with the machined pistons, with the understanding that if it passes, it will calibrate.

Khaled – but would need four tests, as the matrix was designed vs. bringing them in on a reference

Pat – don’t need huge number of pistons to complete category. Say... 30 runs per set? But as we know, this test is extremely sensitive to pistons. We have a ton of 2019 BB, but having to cherry pick because of the fitment problem, so don’t know how many will eventually be good to be machined.

Lochte – machine shop can do this before they machine pistons to ensure they will fit.

Khaled – Lubrizol and IAR – okay starting machined piston matrix. Afton? Ben – have the machined pistons. Khaled – preference? Will run if can bring them in on a reference, not matrix.

Pat – hold up. Don't need to pursue both paths. Back to the forged issue. George - A forged piston will need more clearance.

Deegan – tentative date of January to have new pistons made. Probably kick off production on 28th.

Khaled – Ford opinion? Deegan - sounds like everyone wants to try machined first. Don't know how long those will cover us.

Christine – so we will need a matrix either way.

Doyle – have brought in hardware on references before, but might have difference in response per oil, and 2 refs would not detect that.

Andy – but both ROs weighted equally in matrix. Would like to see 220 first. Labs don't report breaking 220 iterations, but could.

Khaled – so all labs would like to pursue machined pistons. So questions is do we need a matrix at all? Afton – have to run both ROs to calibrate anyway, and need a ref every 5 tests. So comfort level high with just bringing them in on a reference run

Doyle – the original matrix for failed pistons – would they have passed if coming in on a ref? Rich – can't say for certain, will have to look.

Bowden – how introduced? When labs exhaust current supply? Pat – yes. So question is do we machine them all now? Pat – given the fitment issue, don't know how many will be machined. But industry bought enough for life of test.

Pat – this is all complicated by RO 221. Travis – there are ways to deal with that in the matrix. Travis – opinion, need matrix for machined pistons. Need to establish upfront that these are good. And four tests is not that much more than two. Often three tests are needed to ref anyway. Matrix – four tests per stand.

Pat – grade 3 – how many of these are out there?

Deegan – would like to see a matrix with machined pistons, if use machined pistons.

Khaled – leaning towards a motion for machined pistons. Travis – if run through matrix and all “pass”, those stands are then calibrated. Rich – would there be a data analysis portion before cal status? Travis – need to coordinate so that all labs run at same time. Al – so if calibrate on machined pistons, would then be using old and new hardware at the same time? If calibrate, use that engine, then go back to old hardware and exhaust that, then move to new machined pistons.

Pat – if we move to machined pistons, do we need to pursue new pistons being made? Jason – key is the timeline on this matrix.

Jason – could commit to running machined matrix in Jan. SwRI can do it now. George – once run 4 tests, then remove engine to keep running. Then how bring machined piston engine back in?

George – with the LSPI-CW dual stand, only require one test to recalibrate.

Pat – so if we do the machined pistons matrix, hold off on new pistons until we know the result. So it will be January either way.

Khaled – so can we delay the new pistons until after matrix?

Pat – the fact that the new pistons are forged instead of case – didn't know that – puts a new variable into the mix. This bothers me.

Christine - So, we are into January either way for either matrix. Machined pistons “safer” bet at this point. Run that first and see where we land.

Deegan – do we have a way to measure the pistons after machining to ensure that they are good? Lochte – could put back in 3D scan, but how close is close enough?

Bowden – so, if run machined pistons now, consider those the same batch as the next machined ones? Lochte – could probably machine a large batch at one time. Bowden – would the matrix cover the “new” machined pistons or just the ones already sent to the labs?

Bowden – the CNC program is same for every piston. So the main variable is the height of piston.

Pat – not necessarily the height, there is a lot of contour on top of piston. So how to have a metric for that?

Pat – could do post-machining scan, but not sure what that would do. Khaled – if we do scanning, how much variation is okay? How much did original BBs have?

Pat – need to nail this down before we vote on a matrix – we don't want to run a matrix and then change the whole process. Pat – can go back and discuss with machine shop, but not sure how we're going to be able to make this happen.

Jason – do you have drawings of each set at the labs? Khaled – no. Jason – maybe scan the matrix pistons, then scan every 50 of large machined batch? Lochte – then, how much variation is too much, how to quantify this?

Khaled – maybe get all pistons back, scan them, then if matrix is acceptable, set the variation level at what was present in the matrix sets?

Lochte – make plastic mold to test each one after machining? Christine – a go/no go gage.

Khaled – action to look into establishing acceptance criteria before matrix. Talk to machine shop, metrology, etc. what metric to use to measure consistency. Will need to check sets in labs already against whatever the criteria is.

Deegan – can look into internal quality checks to see what we do. We control as well. What is our internal process, if there is one.

Travis – can we complete this in time for January matrix start? Khaled - should still be on target for mid-January matrix start

Should have another meeting after Thanksgiving, before ASTM meeting. Pat and Lochte – need more time. Khaled – try to update by next Friday.

Motion tabled for now.

8. RO 221

Rich: we see more mild failures with 221 with older engines than with newer engines. See CUSUMS on old vs. new engines. Shift in 2019 – after shift, losing response with this oil sooner.

Doyle – could it be that we are running the engines longer? Age wise?

Rich - Dilemma – is the engine really going mild? Or is 224 highlighting that 221 is going mild?

Andy – 221 is a useful as it is a failing oil that should not be on the market. So, if we are getting close to passing the oil, that is a problem. 224 – even if 224 is a bit more severe, it's still on the “right” side of the limit.

Can the SAs remedy this? No, because if an SA is set with 224, it would make 221's result even worse, for the test/market.

Rich – pulled samples of RO 221 and nothing has changed. Well, nothing in our analyticals.

Doyle – when 224 was brought in, did we use new or used engines? Did we set the wrong targets?

Bowden – when we used to set targets, we would review the limits every so often. Where did that go?

Rich – back then, didn't have the emphasis on SAs that we do now. If we change targets, it could change the test pass limit for the Industry.

Christine – describes situation with new engine at SwRI. Passed 221 (barely), then failed 221, then passed 224. This is a brand new engine.

Rich – this is the dilemma, is 224 telling us that 221 is bad? Or is 221 telling us that the engine is bad and 224 can't detect that?

224 approval matrix engine run numbers: 11, 3, 18, 10, 4, 11, 7, 3, 16, 12

Christine – so nothing higher than 18, engine run wise. We run up to 30-38 now; we didn't capture any of that engine life in the matrix

Travis – don't know if we can really come up with a solution without a full stats group meeting – go through engine hours, etc. and determine exactly what is going on.

Rich – don't have the reblend of 224 ready yet. Andy – 224 reblend has been a bugger. Hasn't been able to get it to TMC. 400 gallons are in Pittsburg, another 600 will be there in about a week's time. Rich – don't think there are 400 gallons there yet....

Rich – would like to get 1000 gallons, homogenize it, then issue to labs. Rich – this will take a month (ICPs, dump into one batch, retest, etc.)

One lab doesn't have any 224 on site. Others have 2 or 3, maybe redistribute to other lab?

Al – we're burning through hardware that is precious failing references just because of this one oil. Just get rid of the oil.

Andy – bad bad bad idea. This would give bad oils a chance of passing the test.

Travis – if the ROs are going in different directions, the SAs are probably not doing what they are supposed to. Even so, if you remove one RO, you change the way the SAs affect the test.

Doyle – need to do a deep dive before make any decisions.

Khaled – will formally request that the Stats group analyze this.

Christine – in the meantime, what do we reference on? We have no more 224. Al – extend reference period?

George – so... we are going to have to sort this out before we do the piston matrices. Group – yep.

What are we looking for in the ICP? Just a comparison to the manufacturer's spec. Just verifying the formulation.

Rich – option to cobble together retains and run 224 from those?

Christine – action to quantify 224 retains on site.

9. RO 224-1 blend

224-1 blend – hopefully January if all the tests come back okay.

Next meeting: want to give some time to check measurement of pistons... 15th? Christine - Stats group – good by then or need more time? Travis – we can try. If we have something to propose... but there are a lot of things that have to work out nicely.

10. New Business

Rich – will bring up some minor procedure issues during next meeting. But enough for today.

Al – can any ADCOS offer a replacement RO? Khaled – we'd have to set new targets, etc. That would take a long time anyway.

11. Meeting adjourned.

Sequence IX



October 2022

Test Monitoring Center
<https://www.astmtmc.org>



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Sequence IX Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	26
Statistically Unacceptable Calibration Test	OC	6
Aborted Calibration Test	XC	1
Not for Industry Statistics Test, Alternate Fuel	NN	2
Not for Industry Statistics Test, Fresh oil Test on API02 (UOLSPI oil)	NI	2
Engine removed from stand, did not calibrate	MC	1
Total		38

Sequence IX – Failed Tests

Test Status	Number of Tests
Ei Level 3 alarm (mild direction)	5
Exceeded Maximum Number of Pre-ignition Limit	1
Total	6

Sequence IX – Lost Tests*

Test Status	Cause	#
Terminated	Engine damage	1
Totals		1

*Invalid and aborted tests

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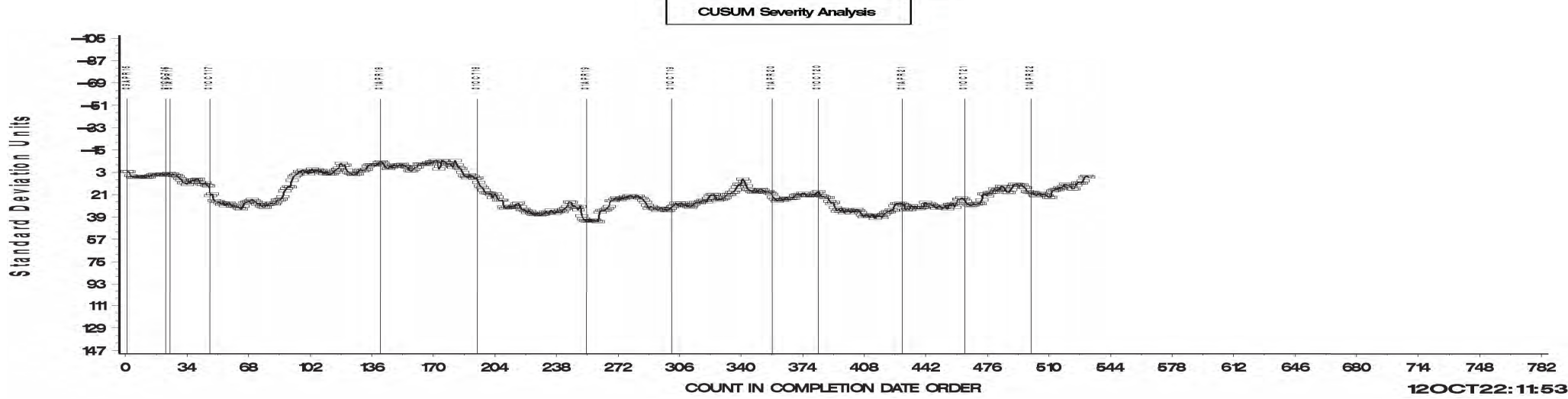
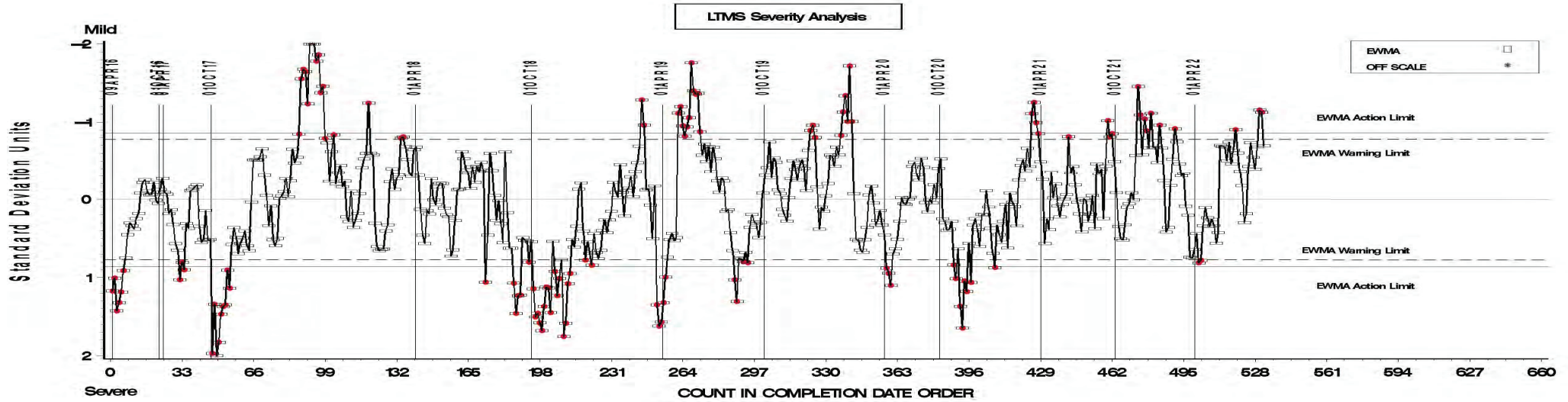
Sequence IX Test Severity

- Average number of Pre-ignitions in control.
(currently near severity warning alarm)

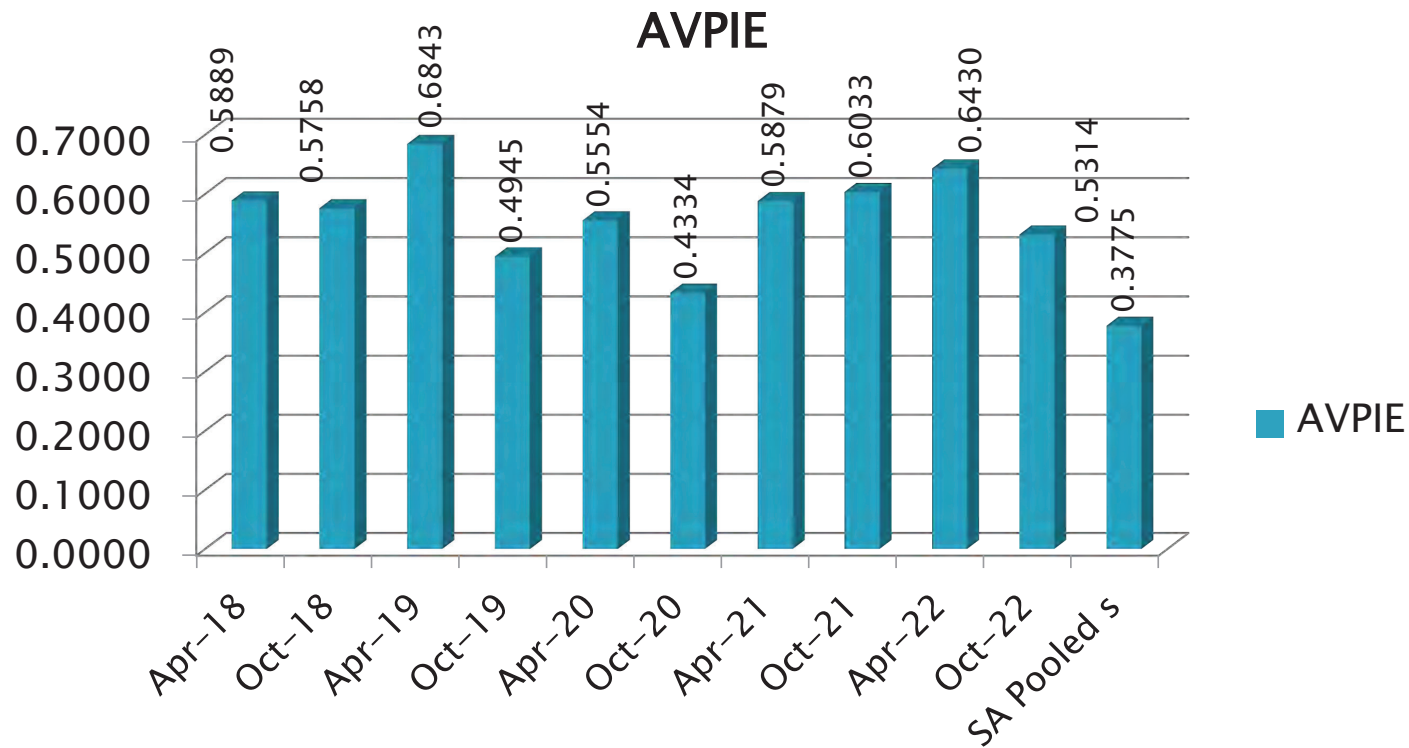
SEQUENCE IX INDUSTRY OPERATIONALLY VALID DATA



AVERAGE NUMBER OF PREIGNITIONS FROM VALID ITERATIONS



Sequence IX Precision Estimates

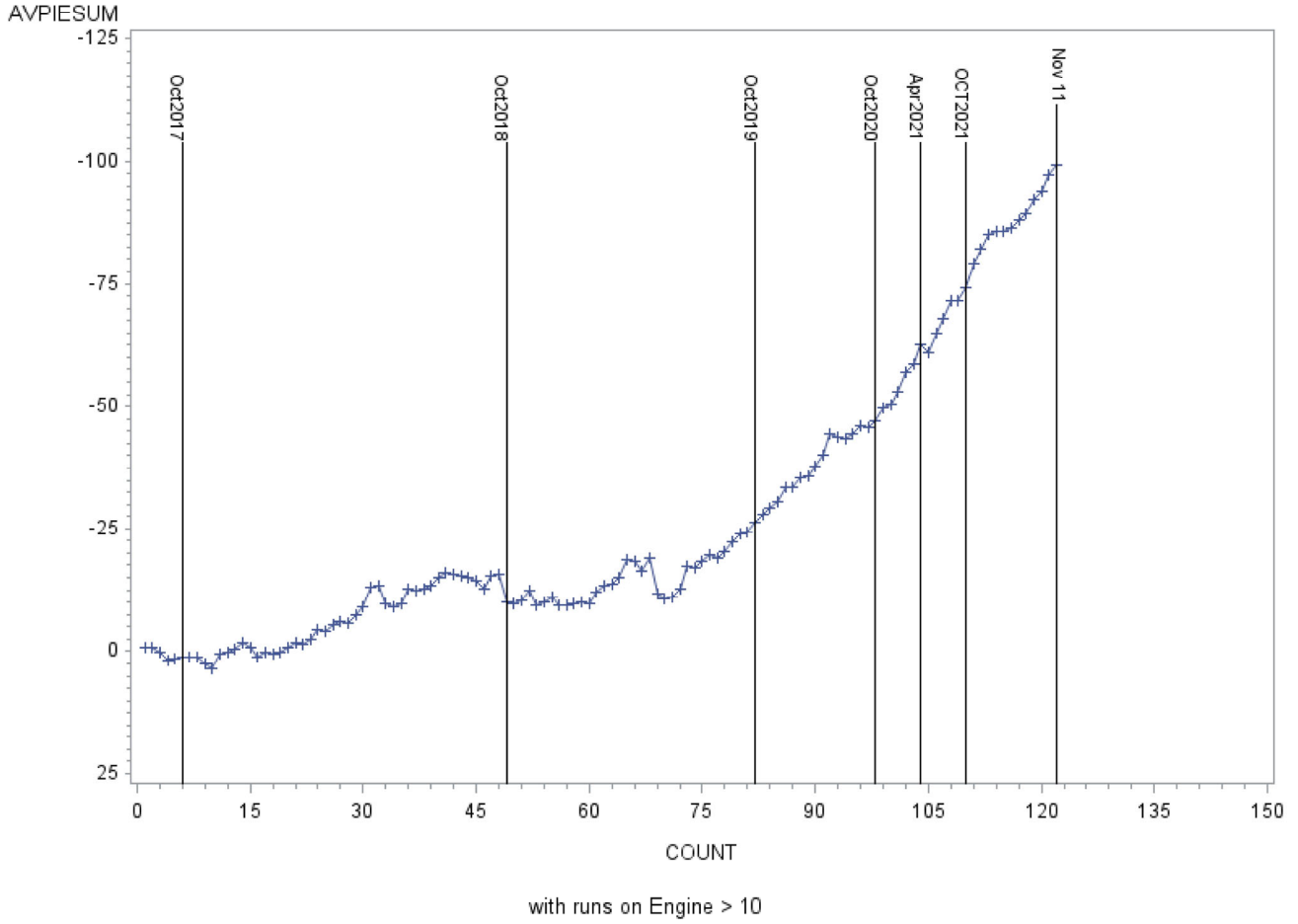


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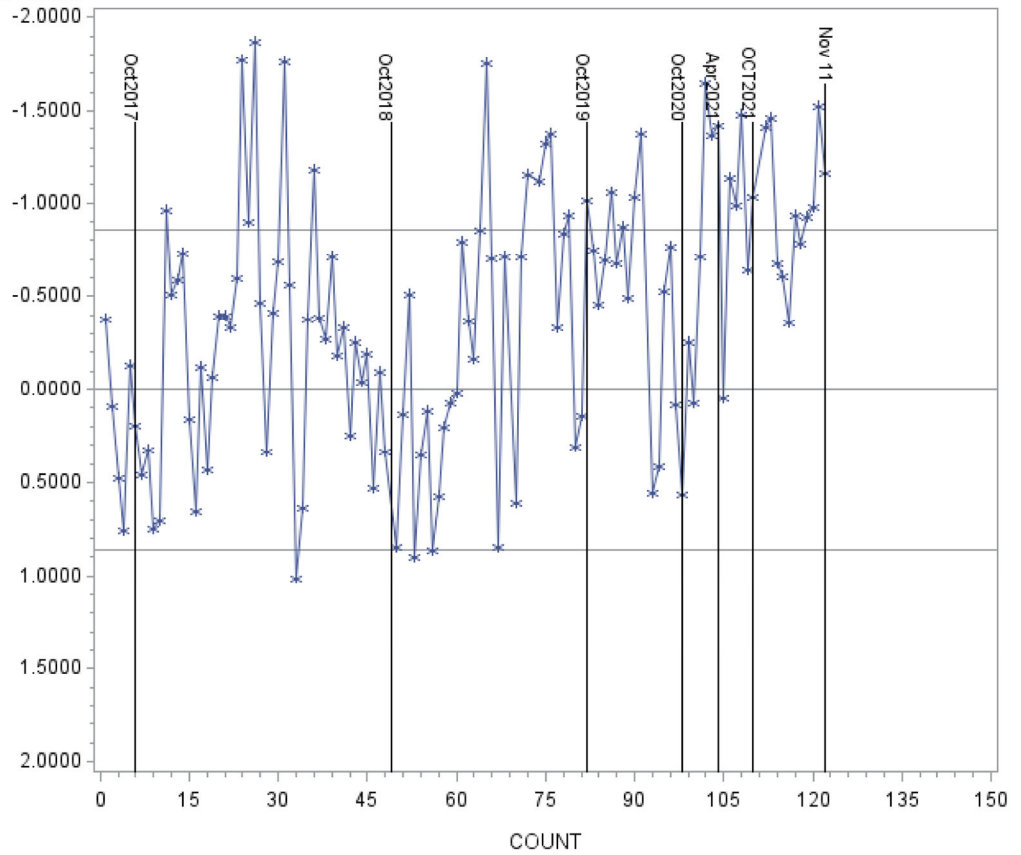


Sequence IX Cusum RO 221 only Older engines



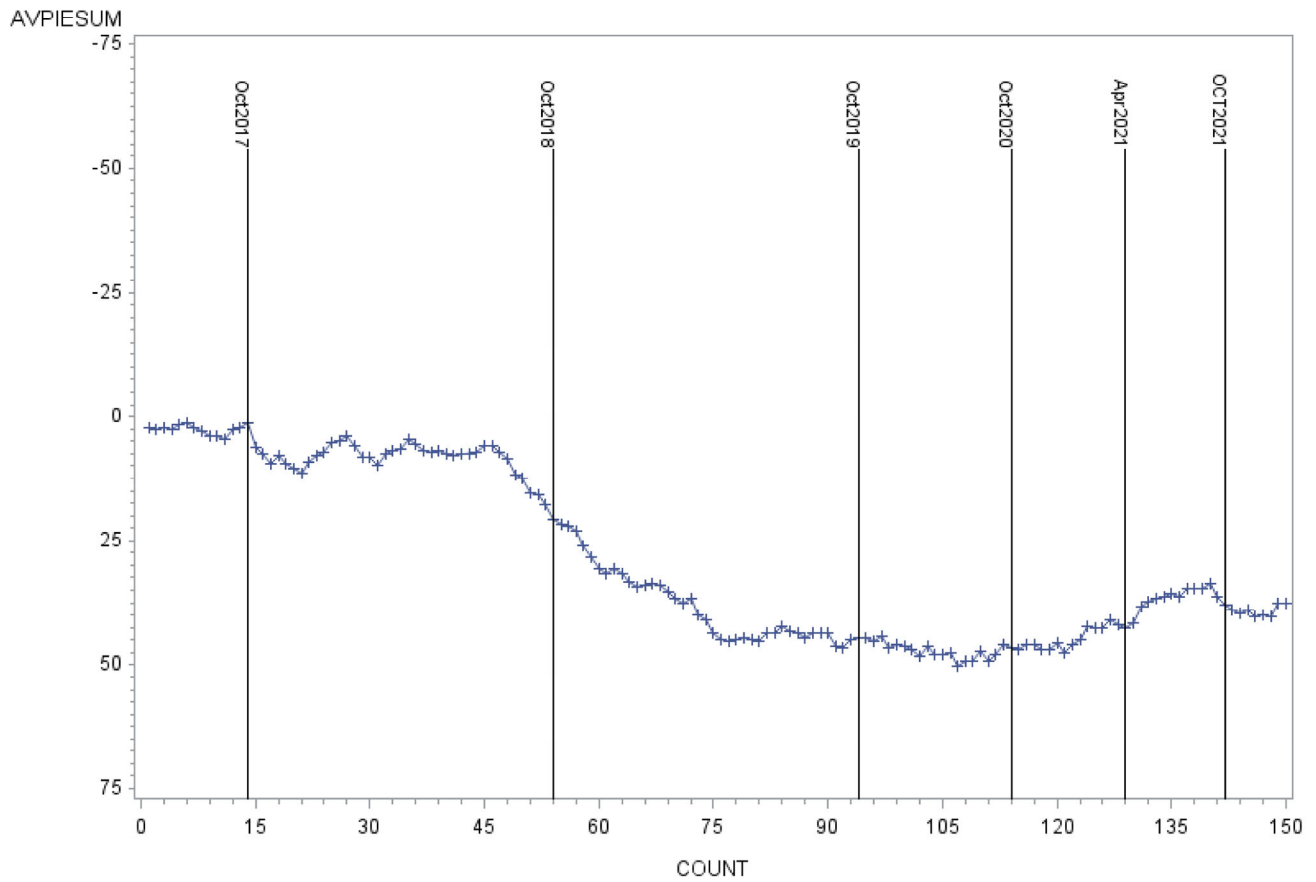
Sequence IX RO 221 EWMA with Older Engines

zi Value of Average Pre-ignition Events



with Runs on engine > 10

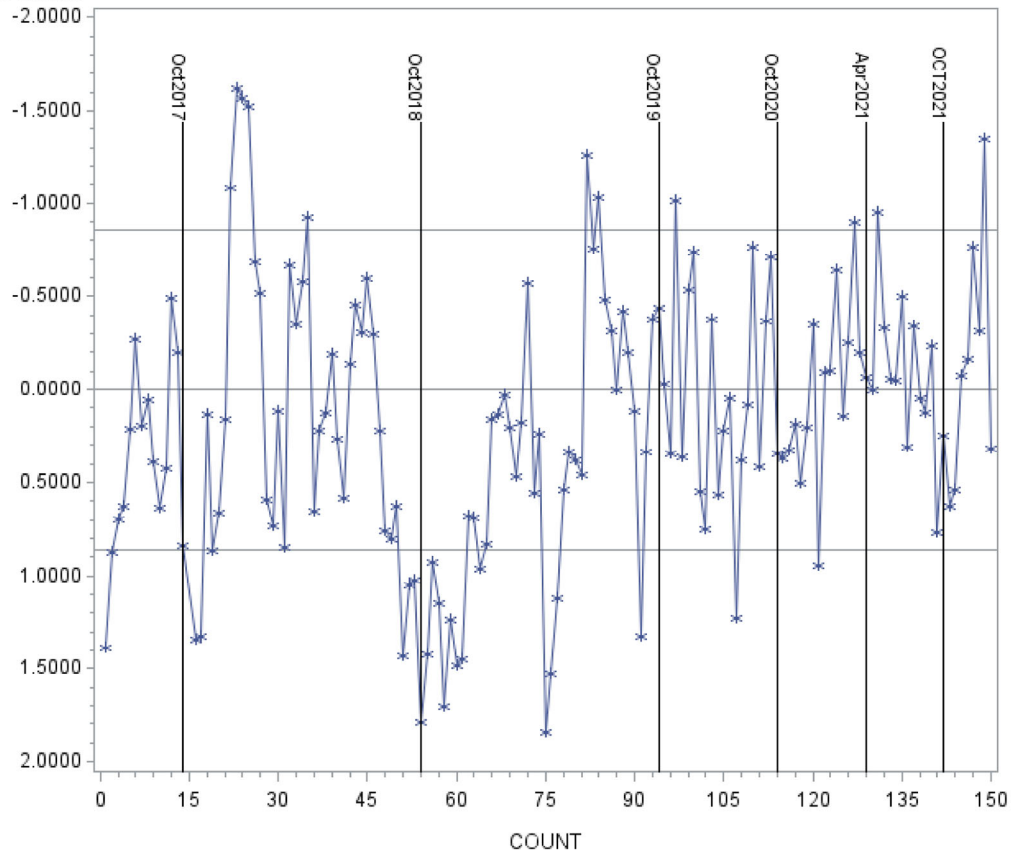
Sequence IX Cusum RO 221 only Newer engines



with runs on Engine < 10

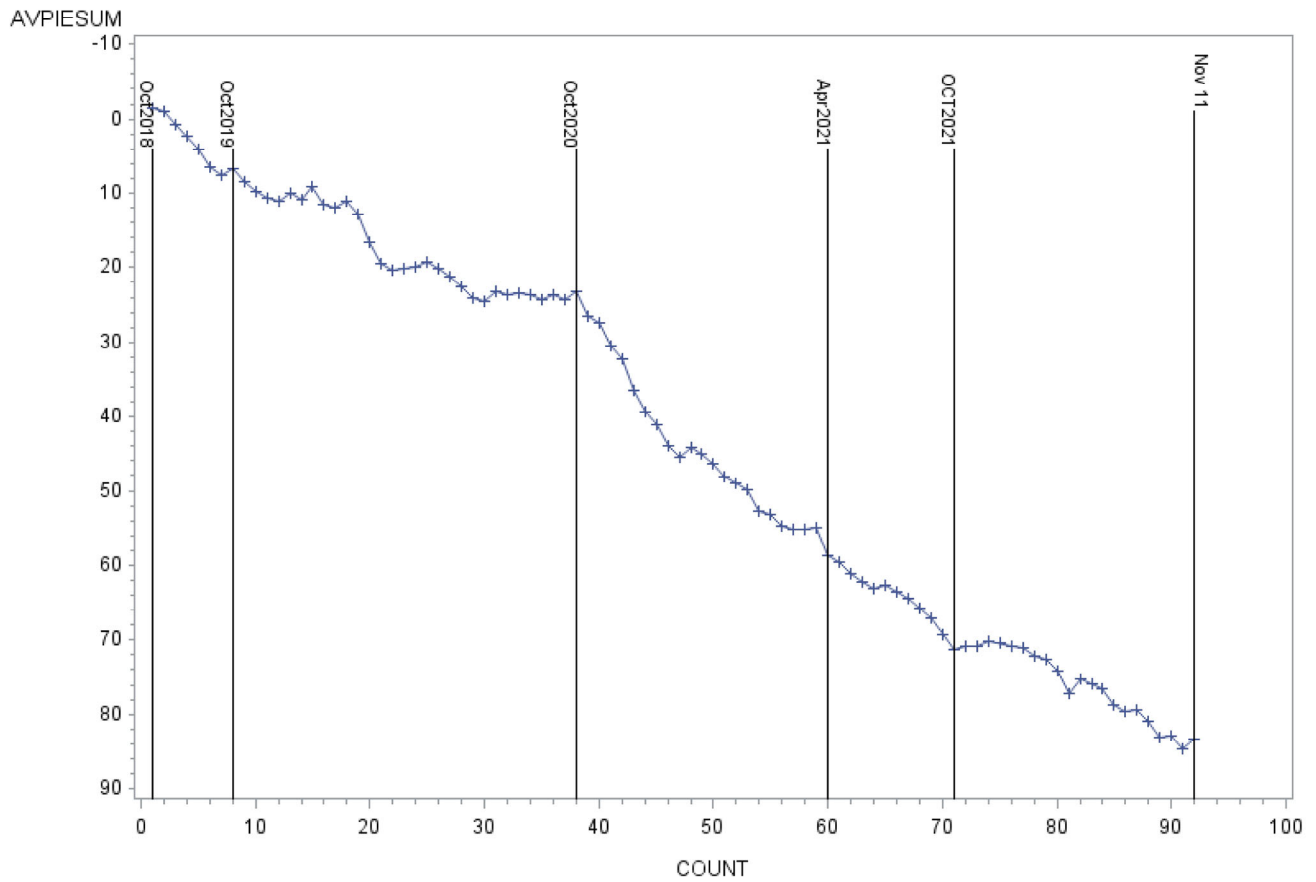
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with Runs on engine < 10

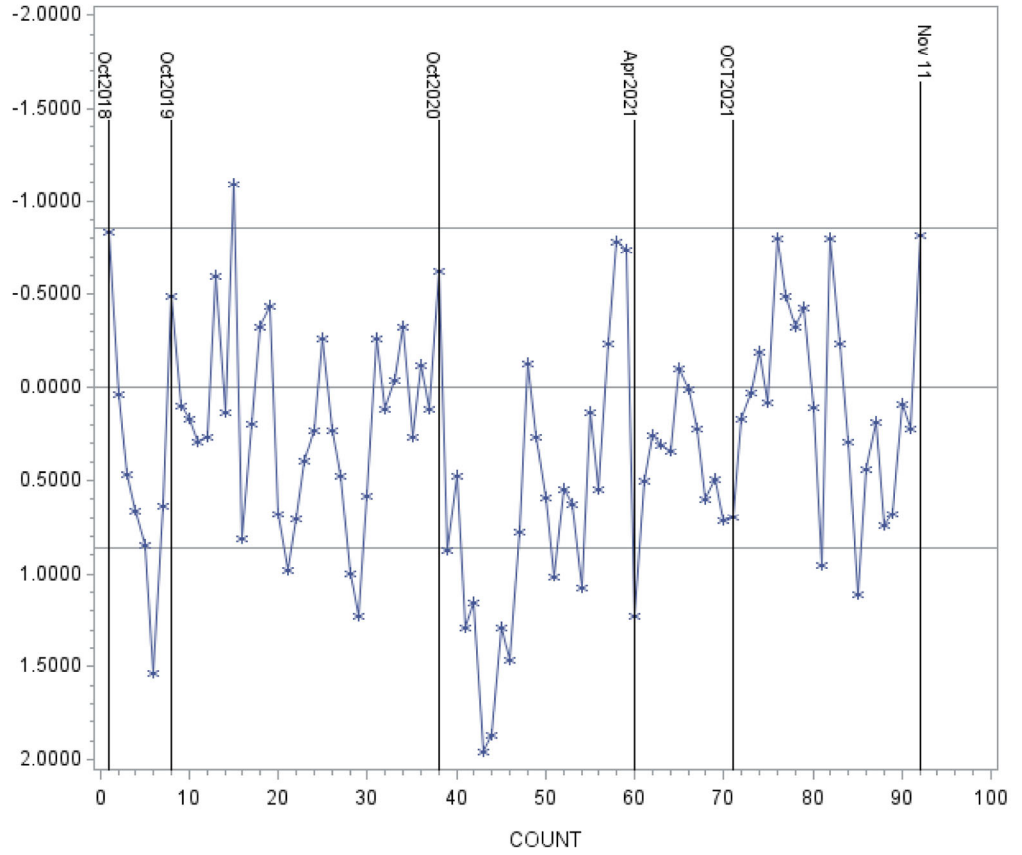
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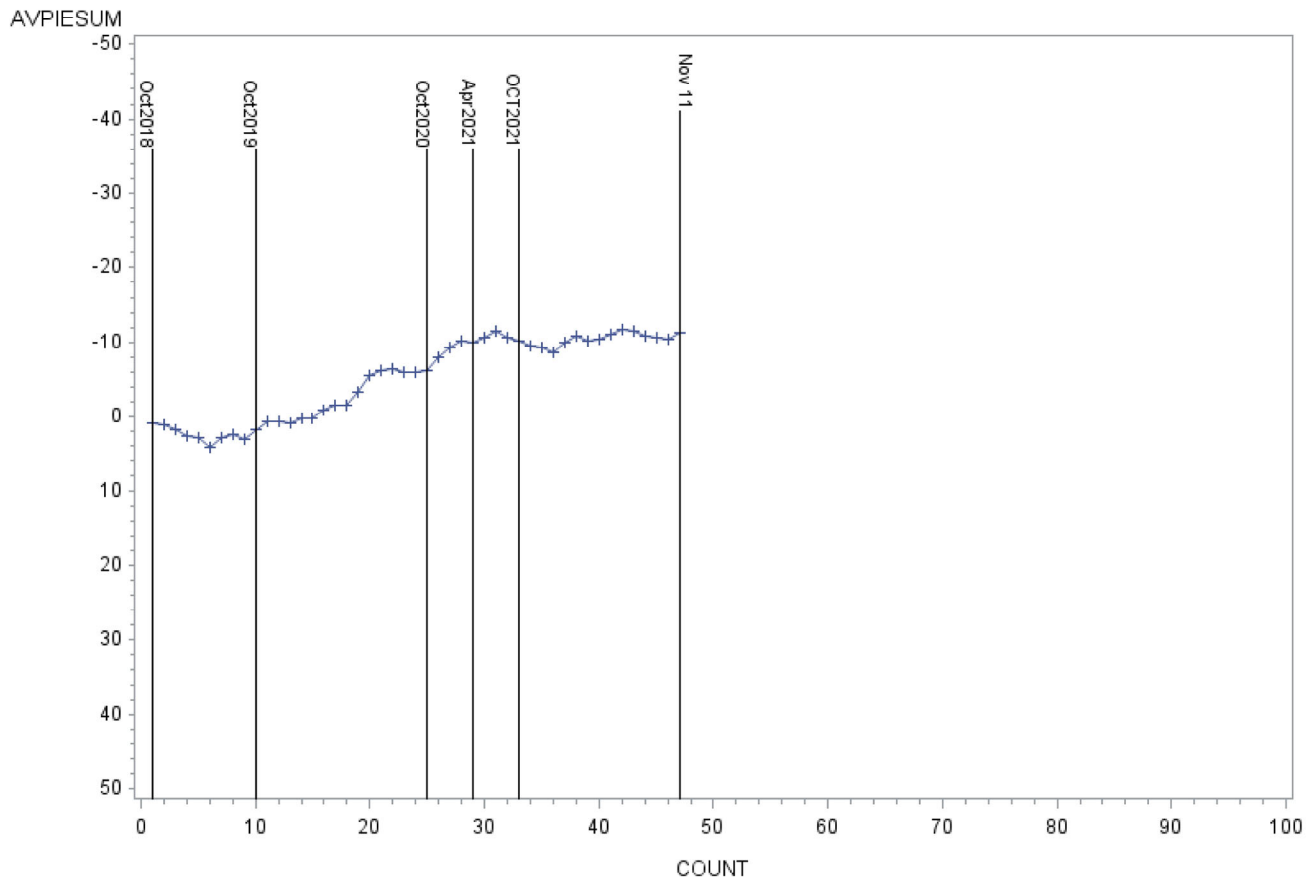
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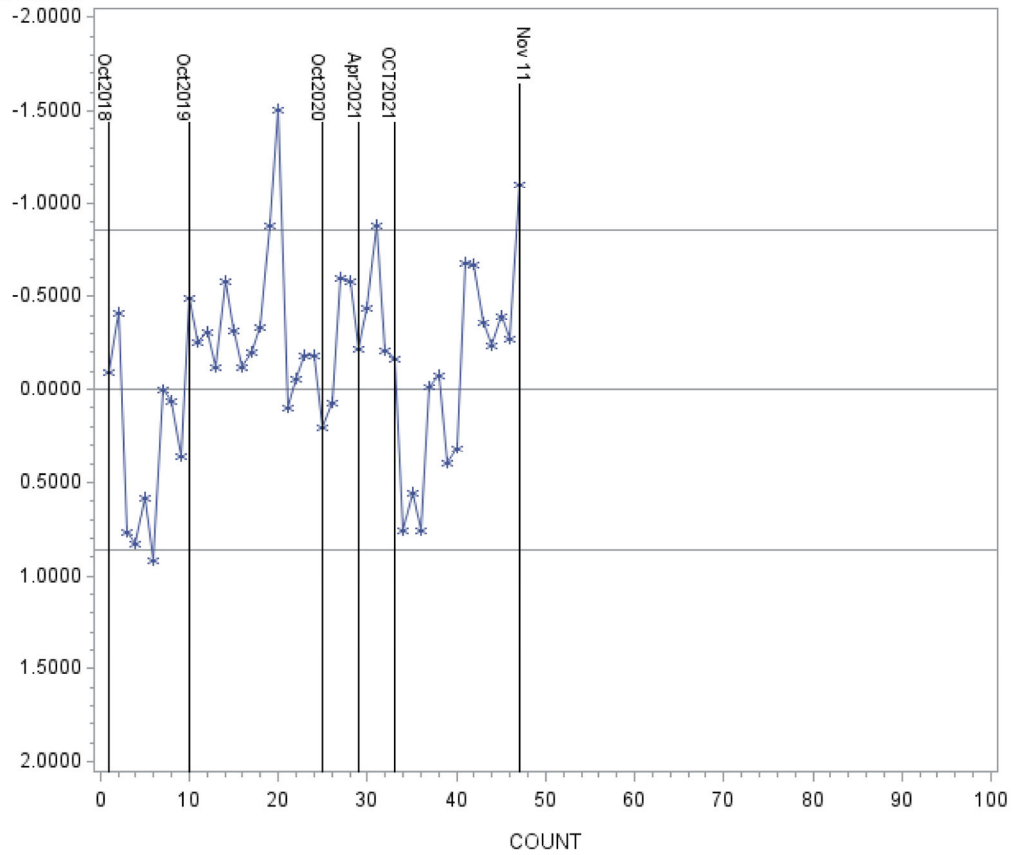
Sequence IX Cusum RO 224 only Older engines



with runs on Engine > 10

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