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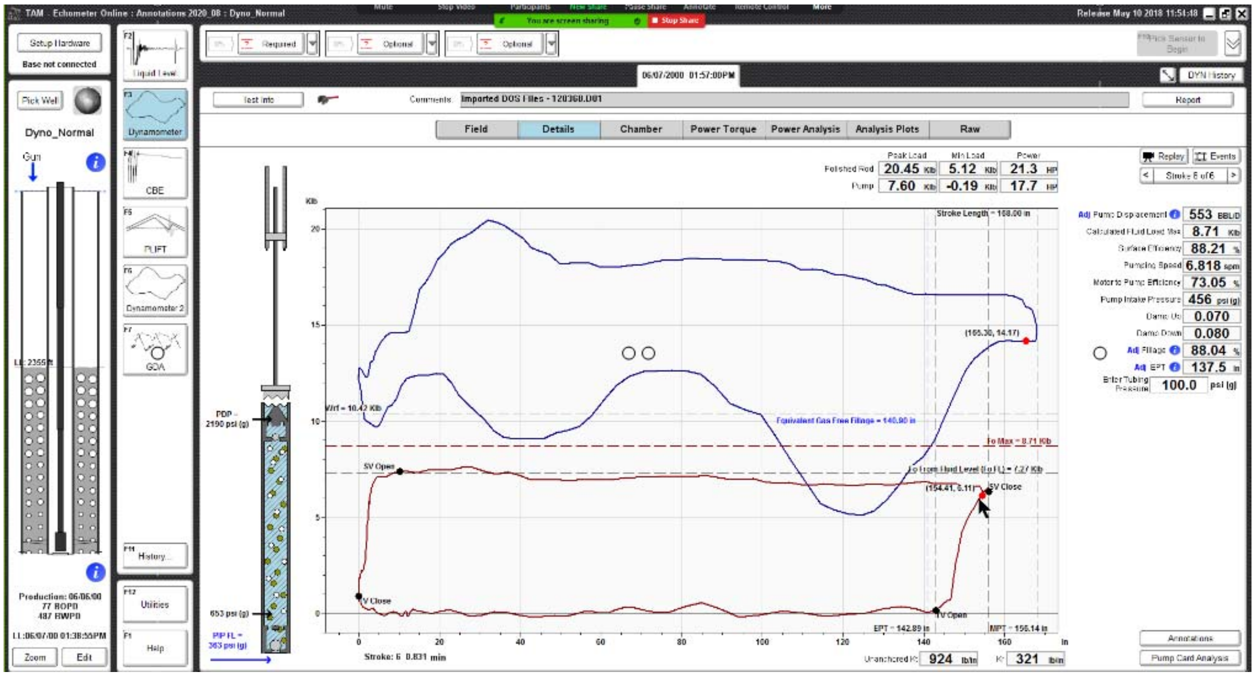
Q & A Session 8 – July 8 2020

Troubleshoot and Analyze Sucker Rod Wells with Reference Load Lines and Pressure Annotations

<u>What do you look at when you analyze the perf. of the d/h gas separator?</u>
Question answered at time: 1:02:27

This is a question for gas interference. If you look at the TAM example:



The shape on the downstroke (arrow) is gas compression. The difference between the EPT and Gas Free Pump Fillage line is the free gas in the pump when the traveling valve opens. And the length from the Gas Free Pump Fillage line to the MPT line represents how much free gas entered the pump chamber. So you see a compression curve if you have incomplete pump fillage on the right hand side of the pump card.

With respect to the perforations, if you have an unconventional well, it’s very difficult to set the pump below the perfs on a horizontal well. With vertical wells it is much simpler because the gas will go up and the liquid will fall down and the pump would be full of liquid. In a horizontal well, you don’t have that option. You have to worry about gas interference and you have to run a downhole gas separator.

Regarding “performance” rather than “perforations” we will talk about that in the future. There is a paper on gas separation and we have an upcoming session planned to cover downhole gas separator performance.

Is there any way to account for the frictional force due to the well deviation when using the wave equation to calculate pump load?

Question answered at time: 1:04:47

When you enter the deviation survey into the software, we only include the true vertical weight of the rodstring. If there was no mechanical friction, and your rodstring wasn't vertical, then the pump card still should sit on the zero load line. The mechanical friction is going to cause the pump card to plot below zero when there's mechanical friction that's not handled by the wave equation and it's going to show the pump card to go above the Fo from the Fluid Level if there's mechanical friction on the upstroke. So the answer would be, you'll see the pump card outside the limits of the Zero Load Line and the Fo from Fluid Level Line if there's mechanical friction present.

Is the wave equation in TWM and TAM the same one developed by Sam Gibbs or is it a modified version? And if it was modified, what was considered for that correction?

Question answered at time: 1:05:52

The wave equation is the same equation. But the way it is solved inside TWM and TAM is with finite differences. Sam Gibbs uses a different method to solve the wave equation than using finite differences. That's a simple answer but it's really more complicated than that.

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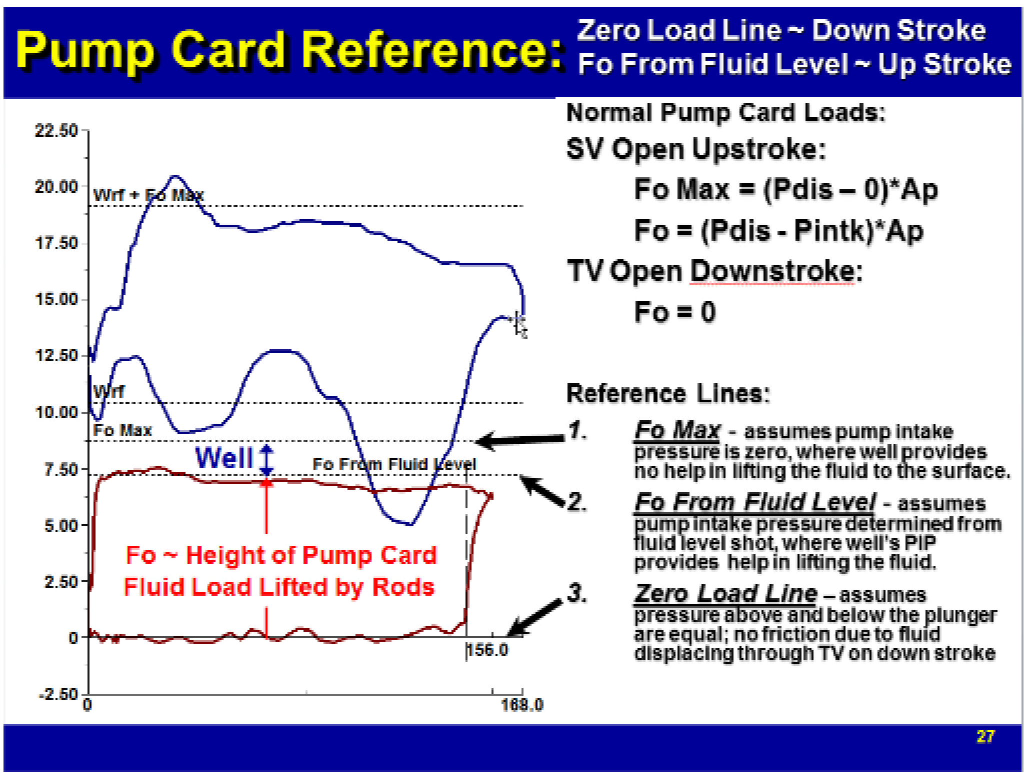
<u>Hi Lynn. Given that the wave through the rod string is speed dependent, if you ran the pump slow enough would it be possible to dampen the wave enough to get a flat surface card where the top lines up with Wrf + Fo and the bottom lines up with Wrf?</u>

Question answered at time: 1:07:00

On Slide 27, this is a vertical well. And since there’s no mechanical friction, the card plots on the Zero Load Line because we’ve measured the surface card information on the downstroke with a load cell. Then we used the wave equation to subtract out the fluid dampening on the rods along with the weight of rods and fluids and we treated the rodstring as a giant spring.



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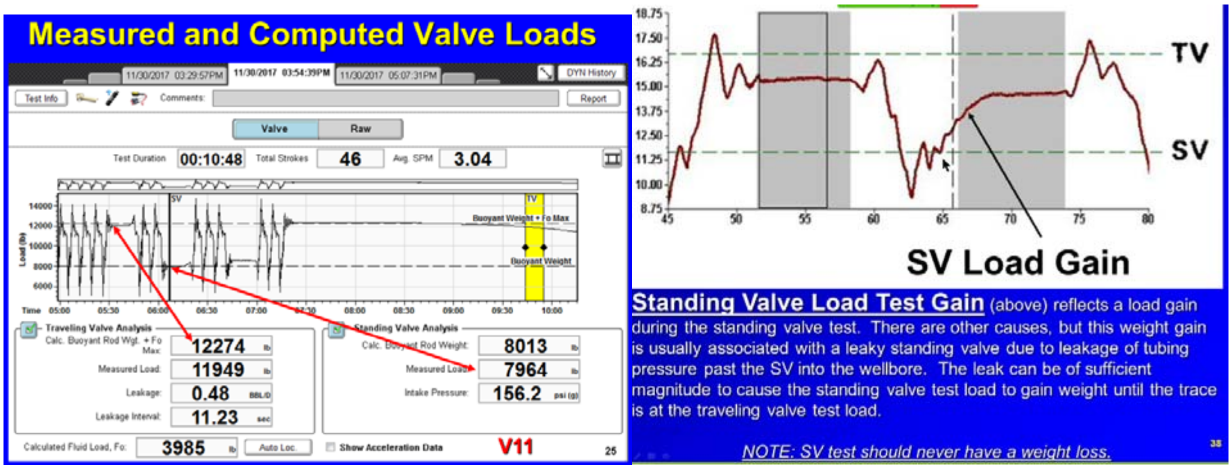
Hi, Lynn, why do we not see the SV leak from the test? Can we measure SV leakage?

Question answered at time: 1:12:05



We don’t calculate it in TWM or TAM. Slide 38 shows a leaky standing valve. The change in load vs. time represents how fast the rods unstretch. If rods stretch due to the load changing we COULD calculate it, we just don’t.

Hello Lynn, many of our dynos we run, whether on the drive or with TAMs, shows the angles on the side of the pump card. Its very rare that we actually have unanchored tubing (they confirm the tubing is anchored 30’-50’ from the pump) when the well is serviced. Why do we see these lines?

Question answered at time: 1:08:45

Pump slippage due to pump clearances. Visual description/explanation comparing slippage to unanchored tubing on a pump card in the session recording.

Valve check question: is there any difference between a shallow well and a deep well when we do a valve check? Is the load decline trace similar? Is it correct?

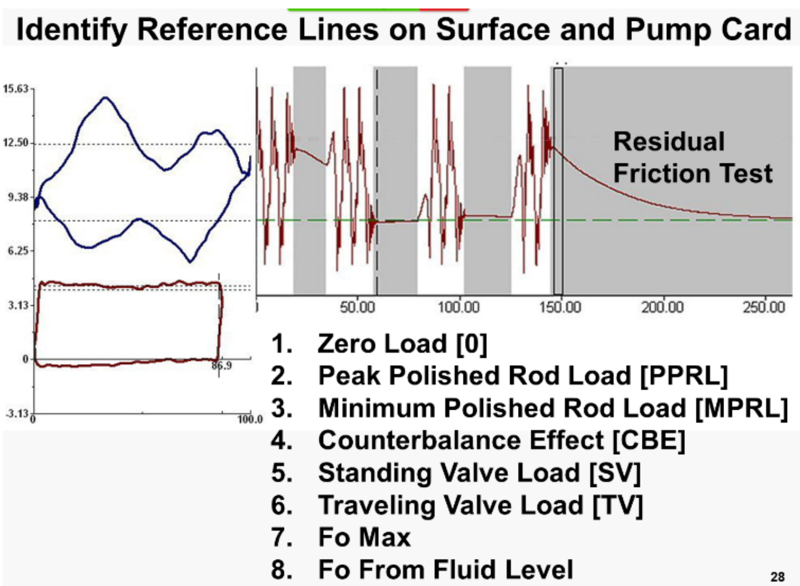
Question answered at time: 1:13:19

When you have a shallow well you are usually pumping faster, you have a short stroke, and it's pretty hard to stop it on the upstroke because you're going fast. The faster the well pumps the harder it is to stop, and the shorter the stroke is the harder it is to stop.

Yes it is the same procedure. You need a good brake on the unit, and you just need to practice.

On slide 28, it looks like the second standing valve test stabilized at a load a little higher than the previous one. Wondering what causes this?

Question answered at time: 1:14:29



The unit was probably not stopped as well on the second test. If you jerk the brake and stop it too fast then some of the traveling valve load is picked up. This is actually fluid load on the downstroke on the rodstring because the traveling valve moved down, and picked up some load and then it leaks off. You can see it drops slightly on the second test. If we had let it sit longer it would have dropped off to the same level.

The recommendation is to stop the unit smoothly.

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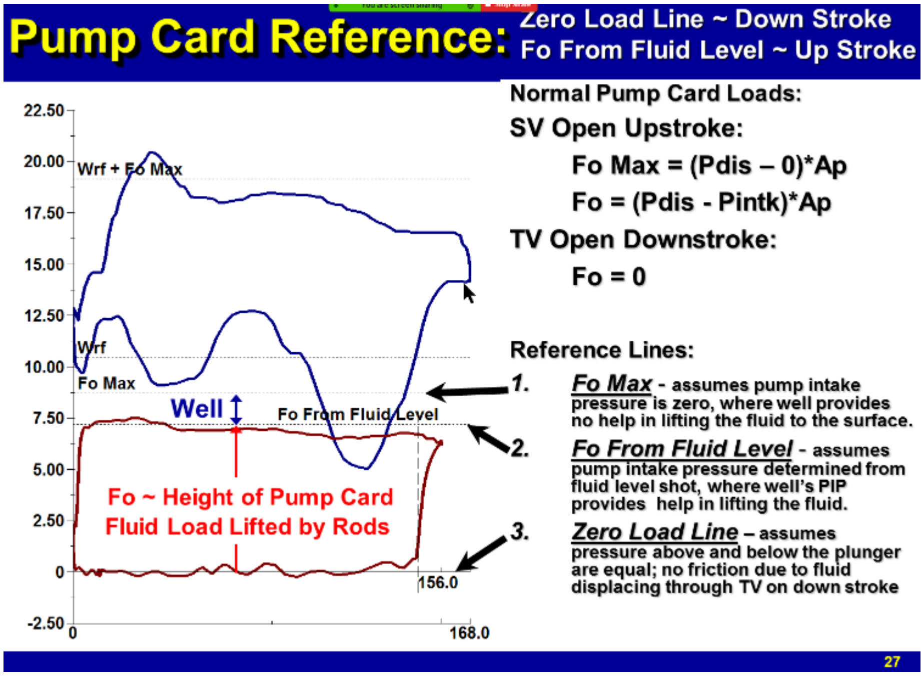
<u>Looking at the polished rod stroke length vs the plunger stroke length what factors affect the difference in length?</u>

Question answered at time: 1:16:09

The pumping speed and the fluid load. Consider Slide 27:



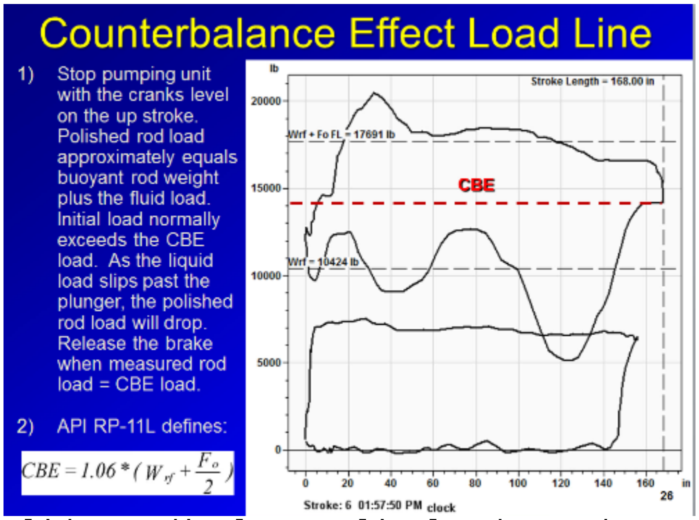
The surface stroke is 168 inches, and the pump stroke is 156 inches. The pump stroke length is less due to the stretch from picking up the fluid load.

Increasing the pumping speed will create more acceleration and will tend to cause the pump stroke to get longer. The faster you pump, the more Overtravel you get.

The more load (or more mechanical friction) you have the shorter the load (less downhole stroke) you get because there’s more rod stretch.

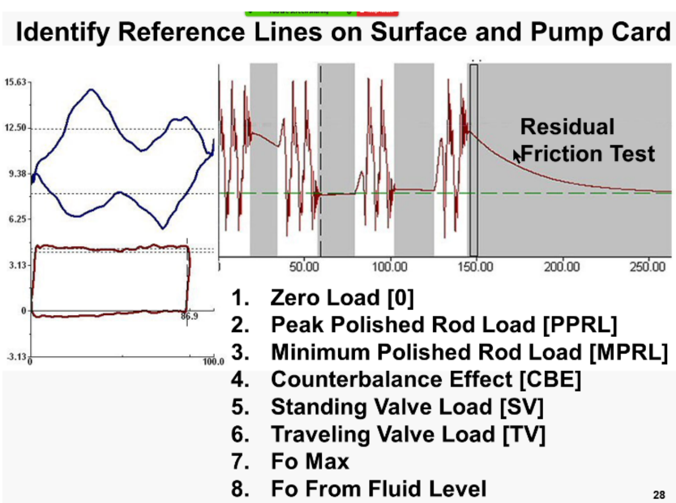
Can you review the Counterbalance Effect and how to measure it?

Question answered at time: 1:19:10



Slide 26 displays a little about the procedure.

When you perform a CBE test, you’re going to try to measure the effect of the weights and cranks with your loadcell (not the PRT). That means you’re going to try to weigh the weights and the crank at the polished rod. To do this, you balance the weight of the rodstring and fluid against the weight of the crank and the weights. At the balance point, when you release the brake, the crank stays level.



During the time when the fluid load is dropping off from the TV load to the SV load, as shown in the final TV test on slide 28, at some point along that time when performing the CBE test, when you release the brake the loads won’t move up or down. That is the point that describes the effect of the weights and the crank because the loads will be in balance.

Please TAM → Help → CBE Features or visit www.echometer.com and visit the Support page for How-To videos on CBE tests.