Nordstef Consulting

Clark Downhole Tool
Field Trial Testing

Well:	NLSD 6-13-61-6W4
Rig:	Aurora # 69
AFE #:	TR-001-2020, TR-002-2020
CDHT Job #:	Trial # 1, Trial # 2
Dates In Hole:	Jan 23rd and Feb 24 2020
NCR #:	N/A
NCR Title:	N/A
BHA #:	1
Tool Run #:	1
Effect to Client:	Positive affirmation
Total NPT: **(Date and Time from Diagnosis to Resolution)**	N/A

50068 Range Road 233 Leduc County, AB, Canada

1. Scope

This document details the results encountered on the fore mentioned job as well as the resolutions and analysis.

2. Description Of Trial And Equipment Used

The purpose of this trial was to test the newly engineered parts and confirm their viability on a commercial level. The reason for testing was due to an underperforming trial run in India with ONGC (see ONGC Trial #1 LNW-177 document). We were to install the tool in 7” casing using 2 7/8 tubing with 7/8 sucker rod to a depth of 120Md. Fresh water was used in all tests. The tubing was circulated through a return line back into the annulus creating a closed loop system. A digital flow meter and pressure transducer were used to capture the well data. The rig was a Crown WTD-00350 Mobile Free -Standing Single Class II Description. The well was under the control of Clark Downhole Tools (CDHT). Multiple days were spent on location performing a various array of testing.

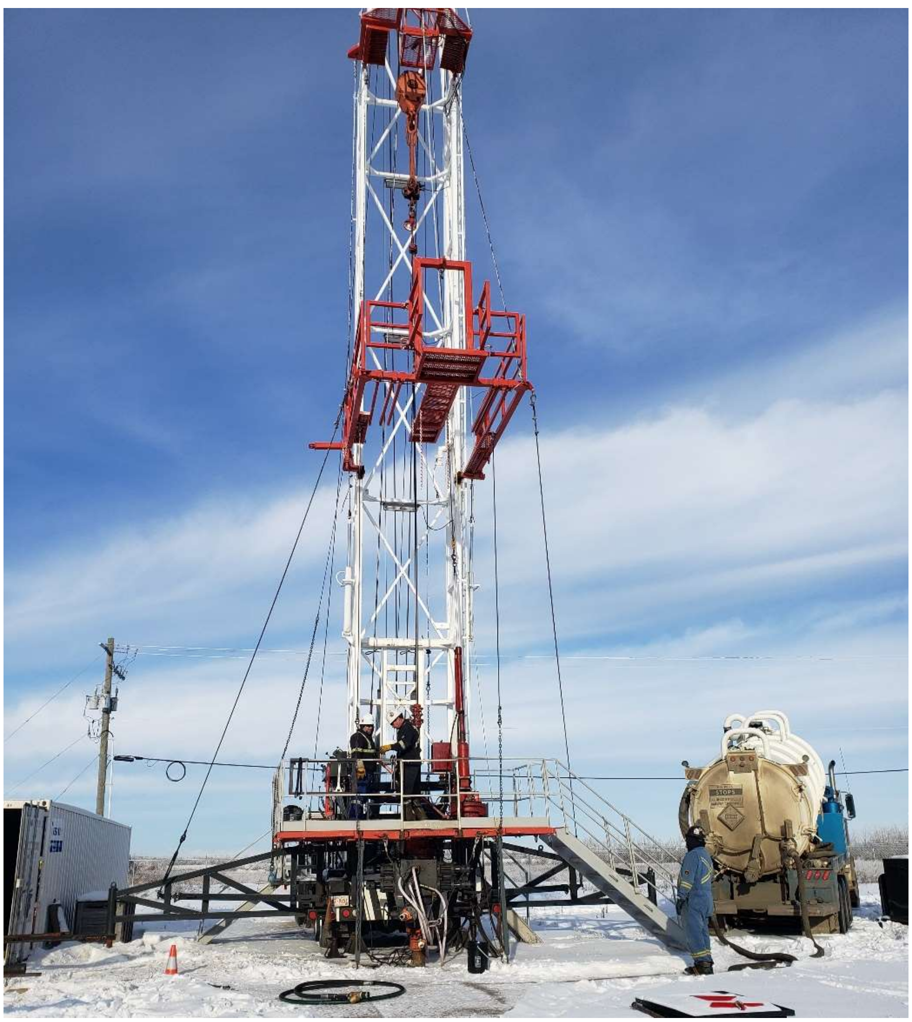

Figure 2.1 – Worksite showing the rig and related services.

Figure 2.2 – Digital flow meter and pressure transducer installed on flow line.

Figure 2.3 – Stuffing box installed on tubing with 1 ½ polish rod.

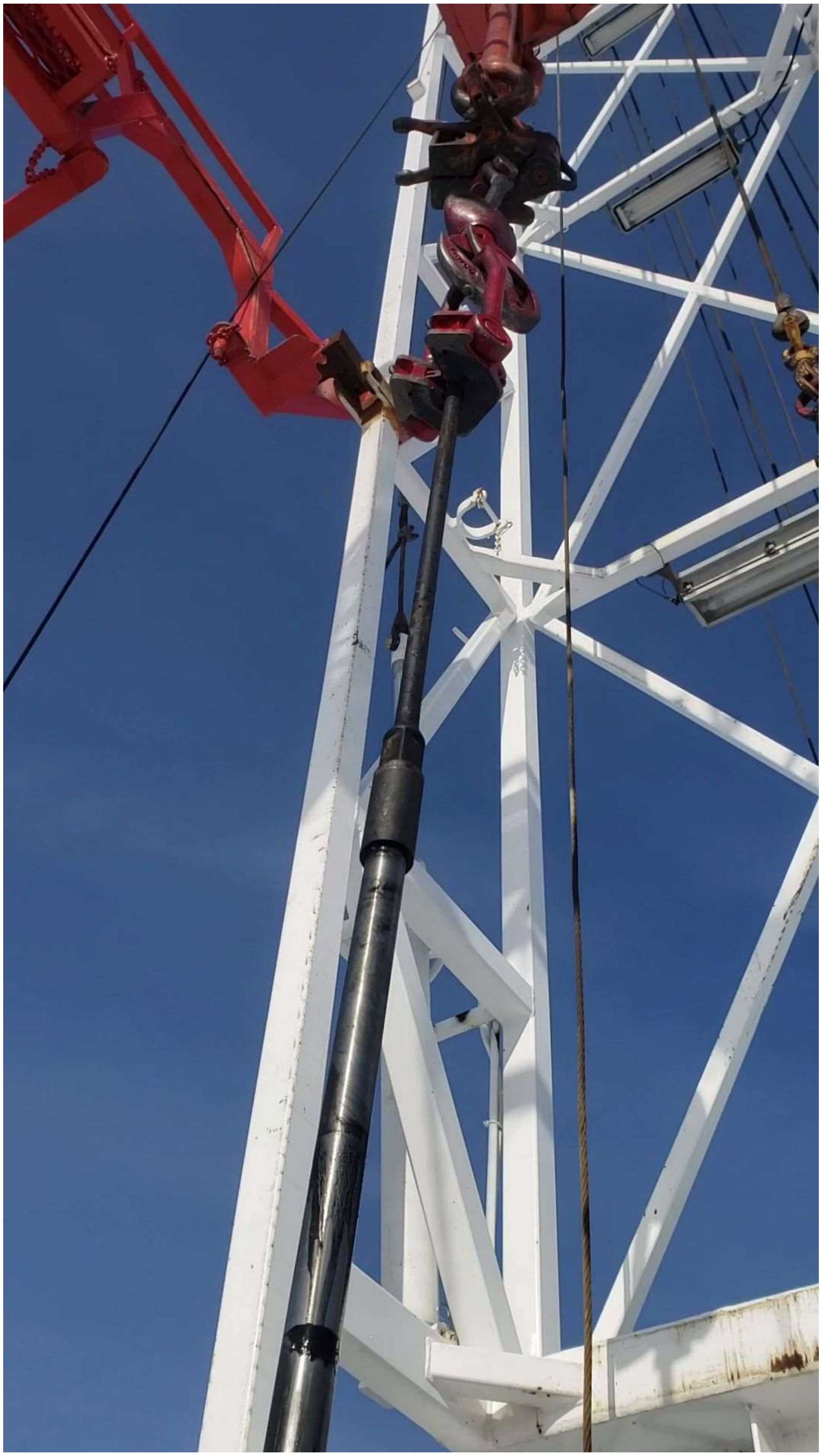

Figure 2.4 – Traveling block with rod hook and elevators stroking the pump.

Figure 2.5 – Tubing set in air slips with power tongs over top.

3. Results

The results from the test confirmed what we had suspected after using hydraulic fluid modeling software using the new components. The revised design was working very well.

Once we had installed the rods and reverse circulated the tubing to fill it, we stroked the pump and immediately had fluid coming out the end of the test line. We stroked the tool five times to rid the well of any trapped air and collected the fluid in 5-gallon pails for observation purposes.

After removing the air from the well, the hose was hooked up to the BOP stack on the annulus side for re-circulation. The tool was then set through a series of tests using a benchmark set of testing procedures over a 20 stroke timeframe. The results from the testing are as follows: On 20 strokes using water at 10 strokes per min the tool produced 80.15 gal to surface. A test using 20 strokes with water at a rate of 5 strokes per min yielded 80.08 gal to surface. Both tests showed similar pressures.

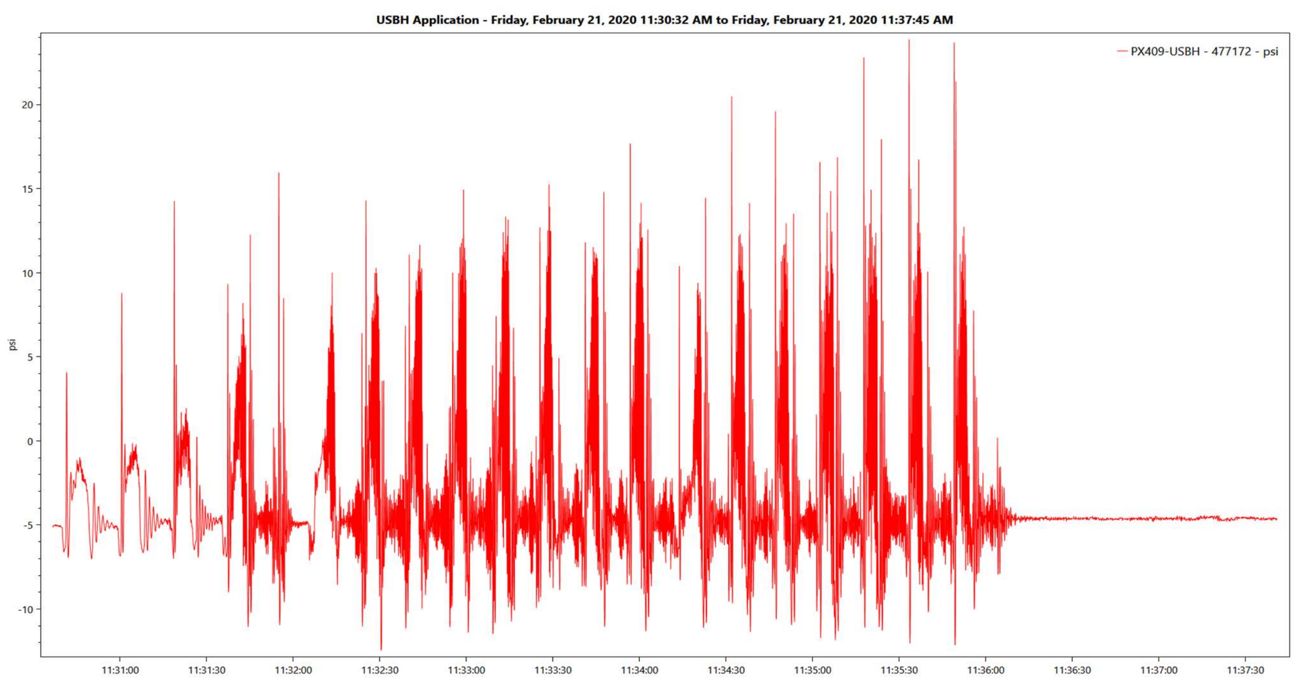

Figure 3.1 - Test # 1 Pressure Transducer output @ 10 strokes /min with 16' stroke.

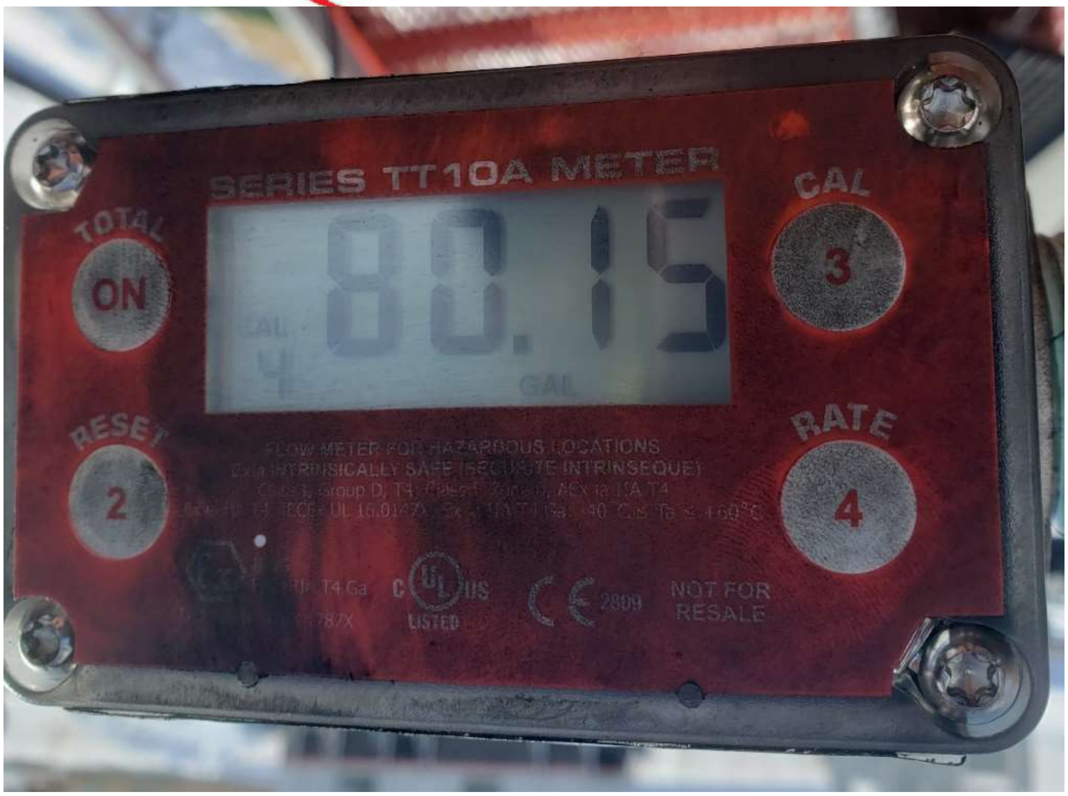

Figure 3.2 – Test # 1 Digital flow meter read out after 20 strokes @ 10 strokes /min with 16' stroke.

Figure 3.3 – Bleeding air out of the lines prior to circulating a closed loop. Hose size is 1 1/2".

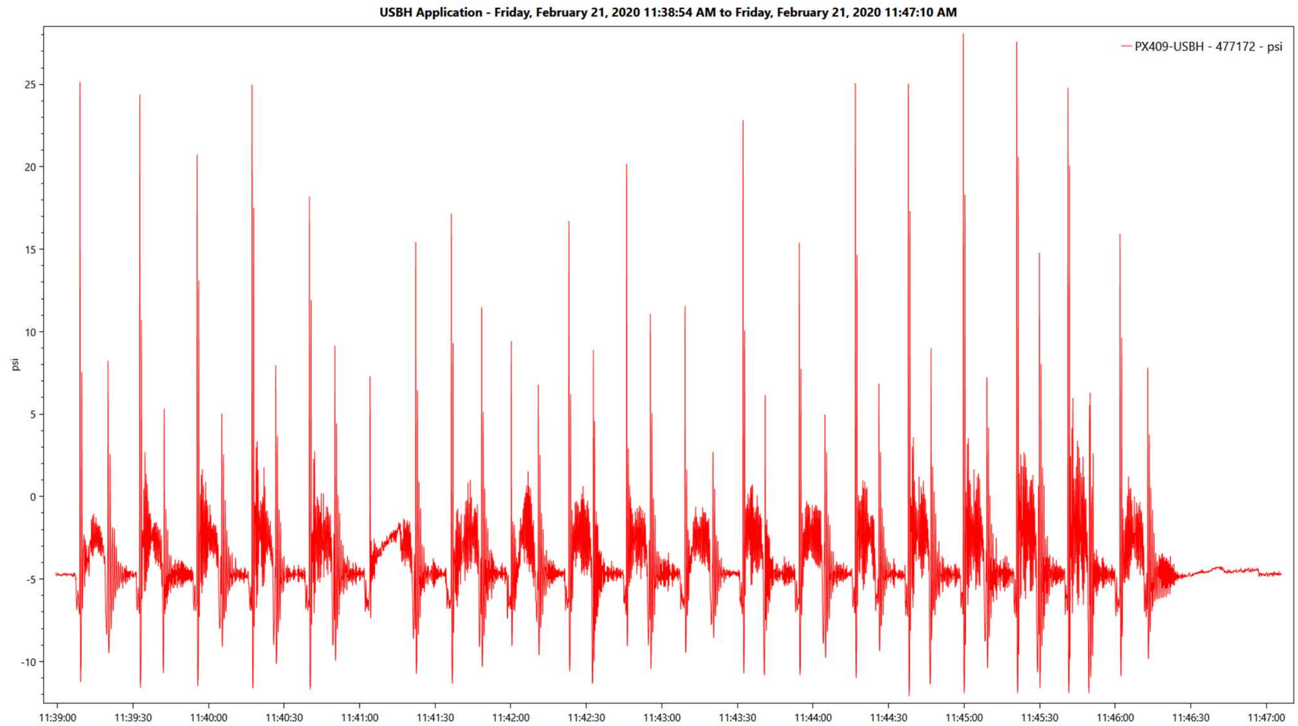

Figure 3.4 – Test # 2 Pressure Transducer output @ 5 strokes /min with 16’ stroke.

Figure 3.5 - Test # 2 Digital flow meter read out after 20 strokes @ 5 strokes /min with 16’ stroke.

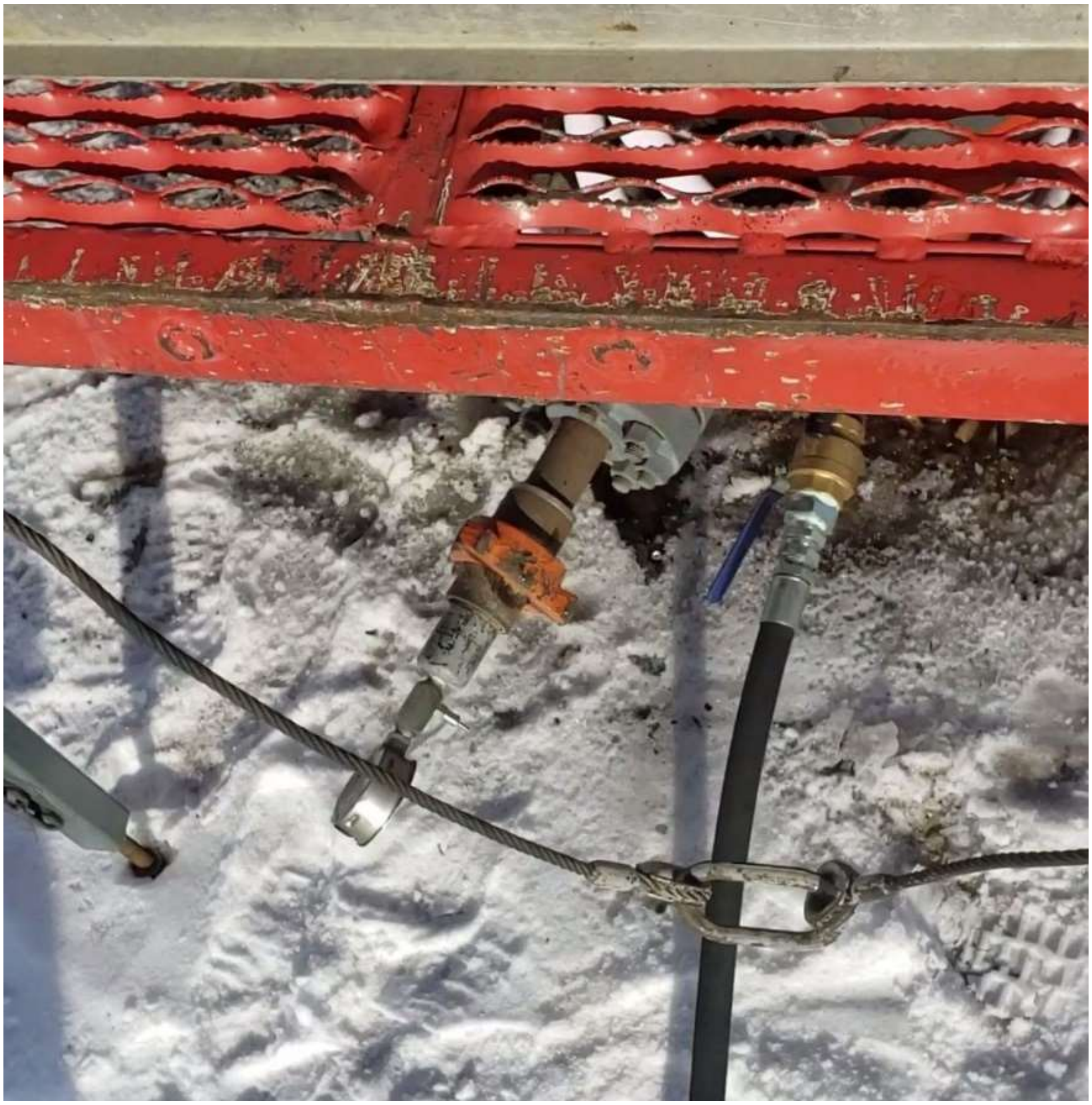

Figure 3.6 – Flow line tied into the annulus to create a closed loop system.

4. Review

After taking what we learned from the India trial and doing an engineering re-design to the upper piston component of the tool we were able to take the tool from 25% efficient to over 95% efficient.

The output values that were recorded match to the theoretical values for displacement outputs. This confirmed without a doubt that the new design is ready for production.

The following charts and graphs show the actual velocities created during the test scenario that prove the functionality of the newly designed components.

	Side Port Open/Closed	Flow Up gpm	Flow out ports each - gpm	Max Flow Velocity in/s	Theoretical Flow gpm
5 strokes per minute	Closed	19.4	0.2	55	20

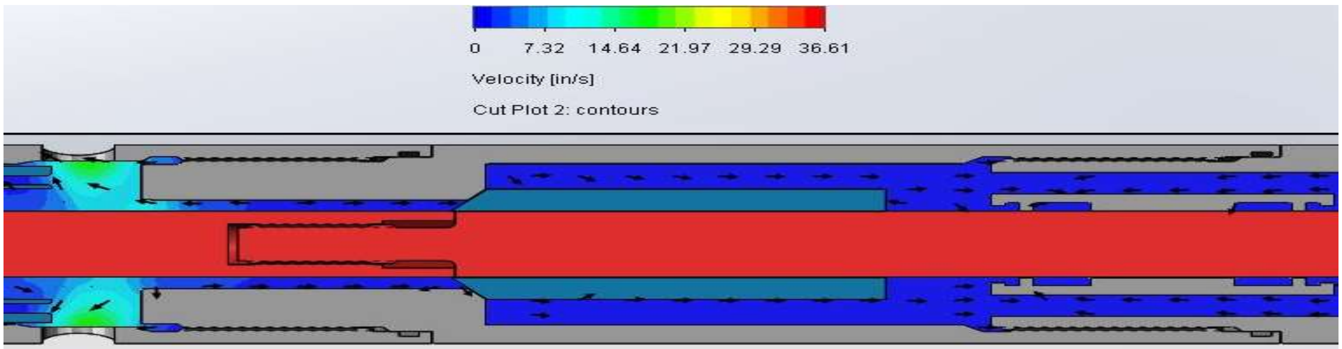

Figure 4.1 - Intake Holes Open – 5 spm – Flow Velocities

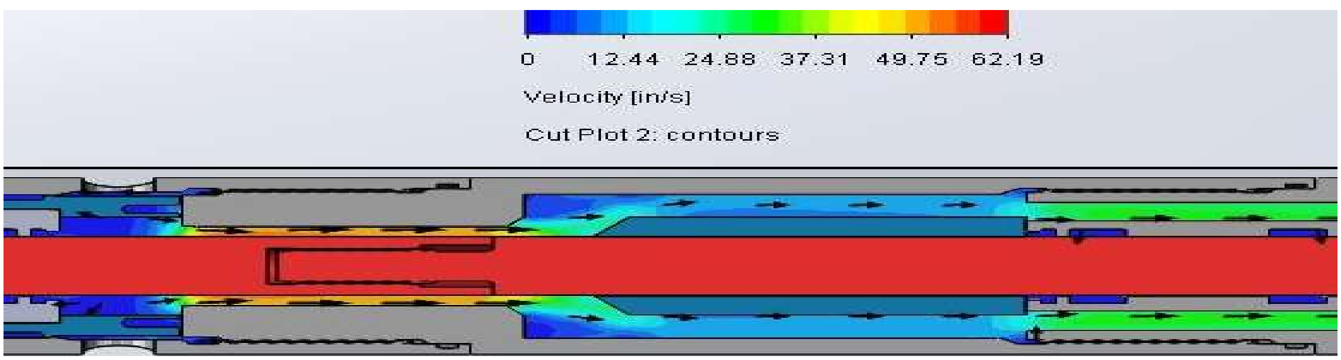

Figure 4.2 – Intake Holes Blocked – 5 spm – Flow Velocities

	Side Port Open/Closed	Flow Up gpm	Flow out ports each - gpm	Max Flow Velocity in/s	Theoretical Flow gpm
10 strokes per minute	Closed	38	0.5	55	40

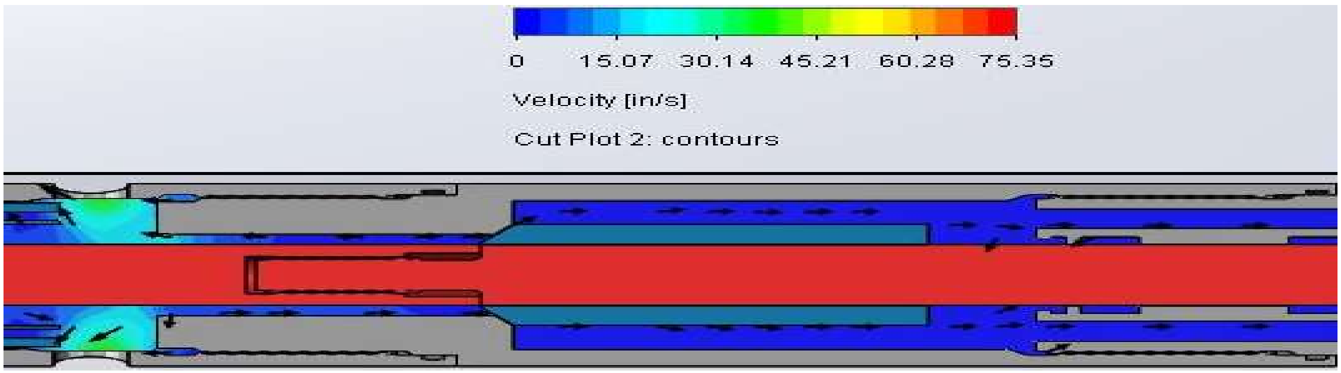

Figure 4.3 – Intake Holes Open – 10 spm – Flow Velocities

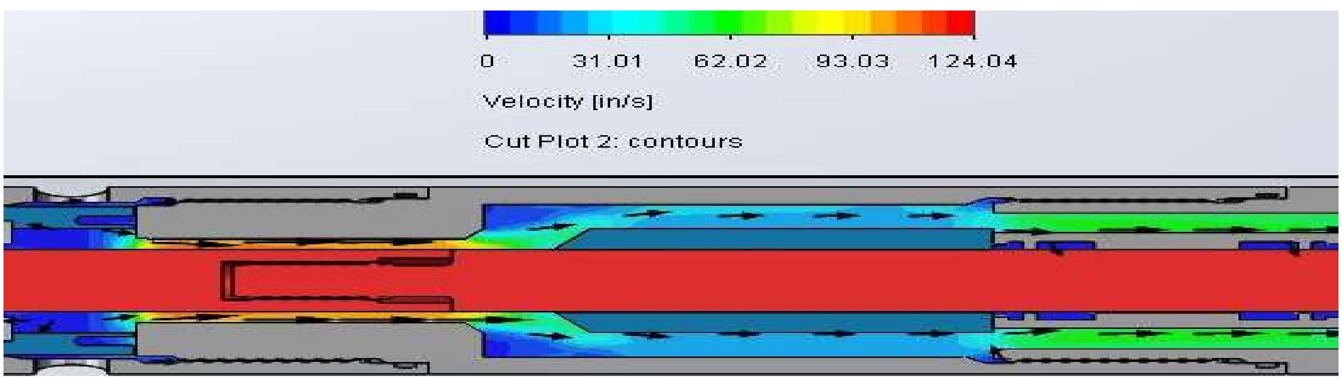

Figure 4.4 – Intake Holes Blocked – 10 spm – Flow Velocities

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February 28, 2020

Attention: **Clark Downhole Tools Inc.**

RE: **Mechanical Compliance Testing**

At the request of Clark Downhole Tools Inc, a series of component examinations and mechanical compliance tests were carried out to confirm, with real time data in a live well scenario, the functional reliability of its design.

Based on the component drawings, the data collected during the mechanical compliance test is in line with the data from the component examinations using simulation software.

The theoretical outputs calculated using the design software match the actual values that are represented in the two tests. The numbers posted in the tests are the as pumped values and show 95% of actual.

Yours Truly,

X

Steve Nordhagen P.Eng.
Nordstef Consulting